CALIFORNIA
HIGHWAYS AND PUBLIC WORKS

JANUARY-FEBRU

California Highways and Public Works

Official Journal of the Division of Highways, Department of Public Works, State of California

Vol. 37 January-February, 1958 Nos. 1-2

FRONT COVER

A rotary snowplow, dwarfed by the snow-blanketed landscape, puts the finishing touch on a cleanup job along a section of US 40 at Donner Summit. Donner Lake and the crest of the Sierra Nevada range lie beyond, to the east. *—Photo by Robert Munroe*

BACK COVER

California contrast is provided by this winter scene of the Mojave Desert region east of Victorville. Two school busses drive along a section of State Sign Route 18 toward a community in Lucerne Valley.
—Photo by Robert Munroe

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Published in the interest of highway development in California. Editors of newspapers and others are invited to use matter contained herein and to request photographs or engravings.

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Aerial photo looking north along a completed section of the Harbor Freeway from above Manchester Avenue

Freeway System Taking Shape In Greater Los Angeles Area

Report from District VII

By EDWARD T. TELFORD
Assistant State Highway Engineer

DISTRICT VII of the State Division of Highways includes the three counties of Los Angeles, Orange, and Ventura, within which are 87 incorporated cities. Here there reside over 6,000,000 people who operate more than 3,000,000 motor vehicles, roughly 45 percent of the State's total motor vehicle registration. Of the total population of the district, approximately 40 percent live within the City of Los Angeles. The existing State Highway System in District VII includes approximately 1,400 miles of traversable routes, with another 100 miles, more or less, in routes which have been included in the system by the Legislature with the understanding that the State would not be called upon to maintain these routes until constructed on final alignment. Approximately 326 miles of U. S. interstate routes are in the system.

The pressure of population and traffic in this area brought about consideration of freeway development at an early date. The first actual freeway construction was a six-mile length on the Arroyo Seco Parkway, now known as the Pasadena Freeway, which was completed and opened to traffic December 30, 1940. Considerable planning was done on other freeways during the early years in addition to the Pasadena Freeway; however, there was no comprehensive financial program which would permit an adequate rate of progress until the enactment of the Collier-Burns Act in June of 1947. The results of this 1947 legislation were helpful in that some increase in progress was possible, but the rate was still much less than desirable. In 1953 the California Legislature increased funds available for highway construction, and then the passage of the 1956 Federal Aid Highway Act by the Congress of the United States made further substantial increases, principally by adding the financing of the Interstate Highway System to the previously existing federal aid program. The accelerated construction program resulting from these upward steps in financing is shown by the following tabulation of expenditures, contract obligations and budgeted projects for the period 1947 through the 1957-58 Fiscal Year, for construction, rights of way, and engineering:

July 1, 1947, to June 30, 1952

Los Angeles County	$143,672,371
Orange County	14,615,486
Ventura County	7,945,354
Total for five years	$166,233,211

July 1, 1952, to June 30, 1955

Los Angeles County	$169,146,220
Orange County	22,634,489
Ventura County	14,441,750
Total for three years	$206,222,459

. . . *Continued on page 2*

Public Works Building
Twelfth and N Streets
Sacramento

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DISTRICT VII

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July 1, 1955, to June 30, 1958

Los Angeles County	$258,393,000
Orange County	51,200,000
Ventura County	18,688,000
Total for three years	$328,281,000
GRAND TOTAL	$700,736,670

The rate of expansion of this program is graphically indicated on the two accompanying maps of District VII freeways. One of these, dated March of 1953, indicates progress as of that time, and the other indicates the status as of January 1, 1958, including projects budgeted for the 1958-59 Fiscal Year. The abrupt changes in the financial picture that have taken place from time to time can best be indicated by considering certain of the District VII annual budgets:

1952-53 Fiscal Year	$44,263,000
1953-54 Fiscal Year	$77,232,000
1956-57 Fiscal Year Budget was increased by revenue from Federal Aid Act of 1956 from about $86,000,000 to $119,000,000	
1958-59 Fiscal Year	$115,064,000

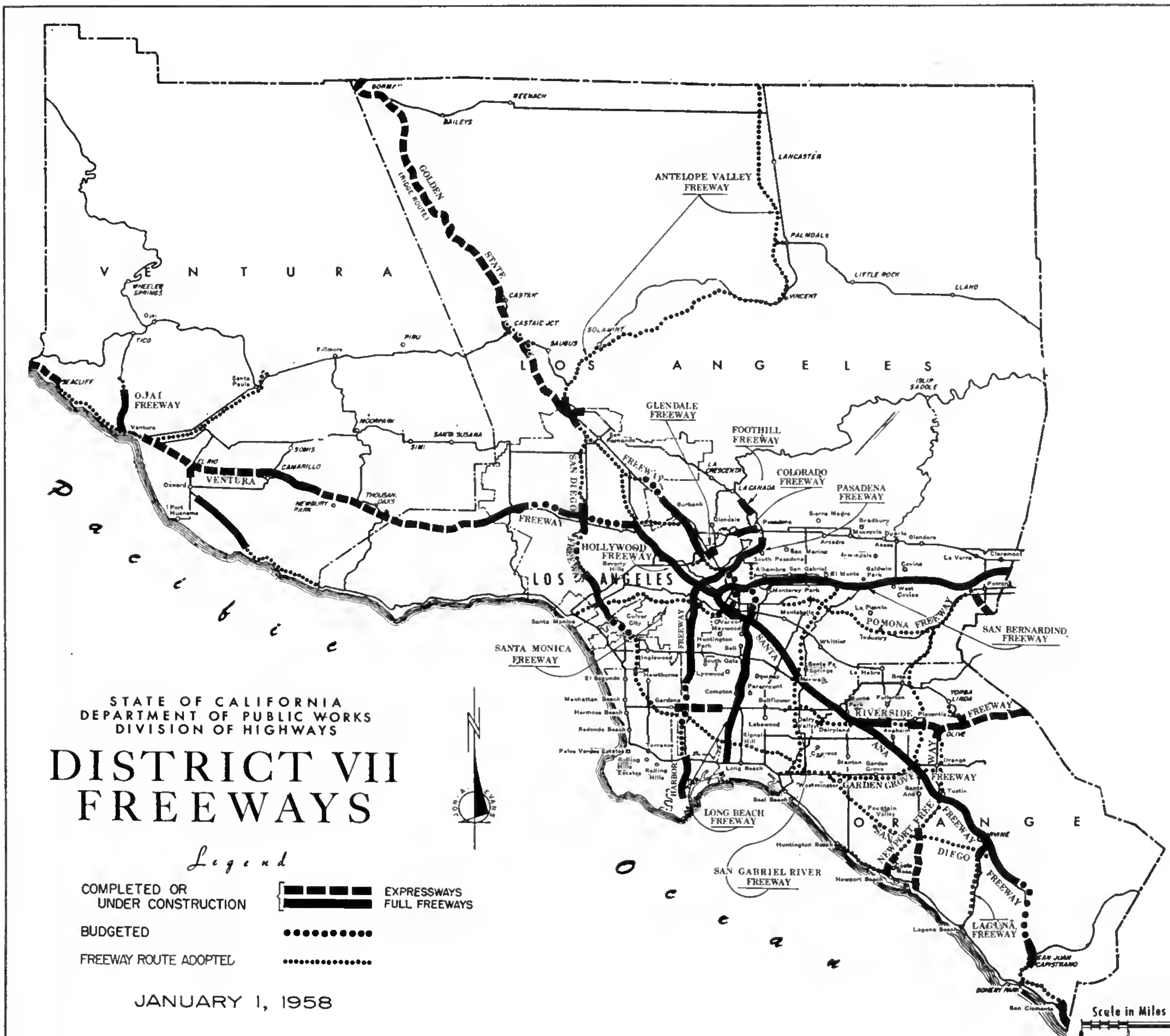
Freeway Progress to January 1, 1958

	Miles
Routes adopted as freeways	647.0
Constructed or under construction	
Freeways	180.4
Expressways	107.2
Budgeted (including 1958-59 Fiscal Year) Freeways	32.7
Total value freeway contracts under way	$79,508,934

An examination of the District VII Freeways Map for January 1, 1958, indicates that we now are beginning to have a sufficient mileage of connected freeways and expressways in operation so that we are justified in referring to it as a "freeway system." Three important freeways, the Pasadena, the Hollywood, and the San Bernardino, have been completed within the district, and gaps are now being closed where necessary to connect our freeways in the so-called Los Angeles Metropolitan Area with the expressways in the outlying areas for Los Angeles, Ventura, and Orange Counties.

One System

When it is considered that on all of the freeway routings in District VII the extreme distance between the Los Angeles Civic Center and the outlying



boundaries of the district is less than 100 miles, and that in time they can easily be traveled in less than 2½ hours, it is certainly now in order to speak of the District VII freeways as being the "*Greater Los Angeles Freeway System.*"

This is perhaps a better descriptive title than the previously used "Los Angeles Metropolitan Freeway System" which at best makes it necessary to define a vague area originally considered to be the coastal plain occupied by the City of Los Angeles and other cities in Los Angeles County between the mountains and the Pacific Ocean.

Later thinking has indicated the reasonableness of including a considerable portion of Orange County in the so-called "Los Angeles Metropolitan Area." In their thinking now, the people of this area are definitely inclined to get away from consideration of county boundaries and recognize the importance of the freeways being built for their use in outlying areas of the three counties, as well as those that are close in.

From the standpoint of offering vitally needed traffic service in the movement of people and goods, who can say that the Golden State Freeway over the Ridge Route is not as important as any of the freeways in the central Los Angeles area? Therefore, it is perhaps not out of line to suggest that the District VII freeways be called "*The Greater Los Angeles Freeway System.*"

Interstate Highways

The general location of the national system of interstate highways was designated in September, 1955, by the Bureau of Public Roads of the U. S. Department of Commerce. Included in this national system are seven important state highway routes in District VII that are being developed as freeways. These interstate freeways constitute an important part of the District VII Freeway System. These freeways are: the Golden State, the Santa Monica (previously called the Olympic), the San Diego, the Santa Ana, the San Gabriel River, the San Bernardino, and the Foothill. The first six of these freeways are in various stages of design, right-of-way acquisition, construction and completion, as will hereinafter be described.

The only interstate route for which the California Highway Commission has not yet made an actual route adoption and freeway declaration throughout its entire length is the Foothill Freeway.

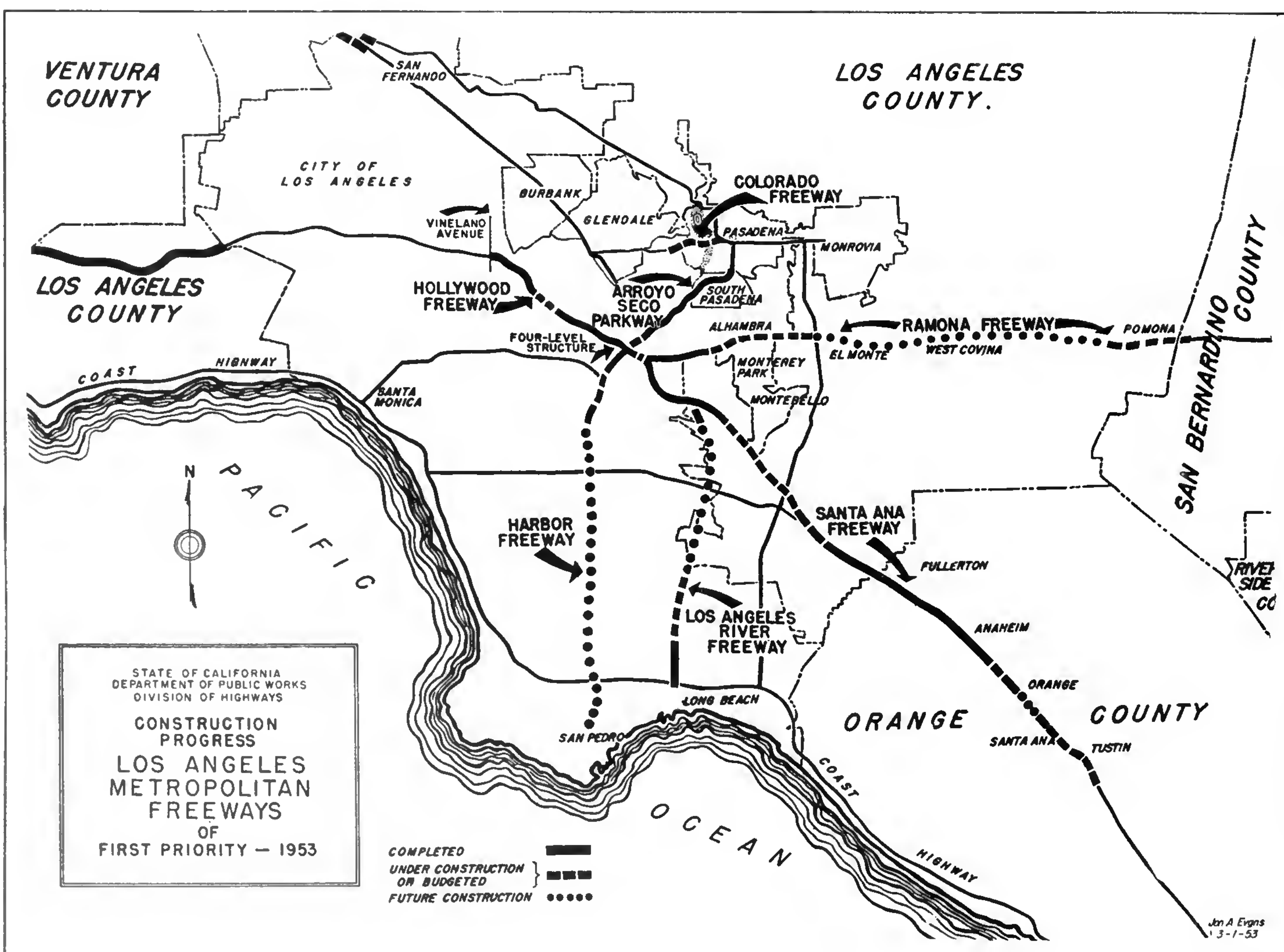
Important sections of freeways in District VII were completed and opened to public traffic during 1957 as follows:

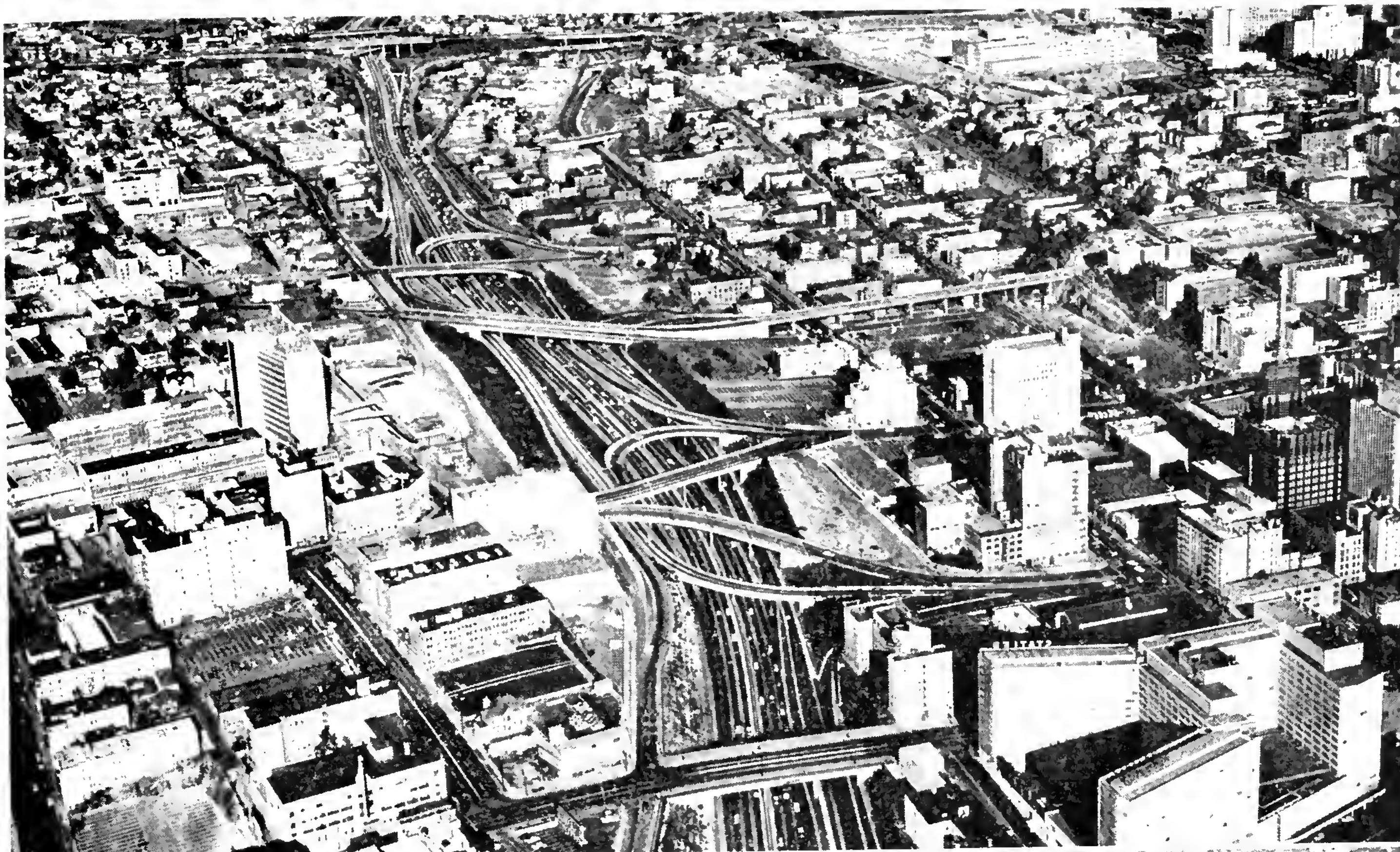
	Miles
Santa Ana Freeway Broadway to Lewis Street in Santa Ana	2.5
San Bernardino Freeway Azusa Avenue in West Covina to Ganesha Boulevard in Pomona	8.2
Harbor Freeway From Santa Barbara Avenue to 88th Place in the City of Los Angeles	3.8
Long Beach Freeway From Atlantic Boulevard to Firestone Boulevard in East Los Angeles area	3.2
Golden State Freeway From Glendale Boulevard in Los Angeles to Ash Street in Burbank	4.7
San Diego Freeway Casiano Road to Ohio Street in West Los Angeles area	2.1
Pacific Coast Freeway From Calleguas Creek to Date Street in the City of Oxnard	7.2
Total	31.7

Traffic Counts

G. T. McCoy, State Highway Engineer, recently made public the 1957 Statewide Traffic Count figures. As he says, "The annual statewide traffic count taken on Sunday and Monday, July 14 and 15, 1957, showed an increase of 4.44 percent over the previous annual count of July, 1956. Gains were generally well distributed over all routes and regions. Among the major routes, a very substantial increase was shown on Route 26. Opening of several miles of full freeway on the heavily traveled portions of this route near Los Angeles probably contributed to this increase."

The freeway to which McCoy refers is the San Bernardino Freeway that is now completed throughout its entire length in Los Angeles County of 30.7 miles. On this freeway the av-





UPPER—Looking north along the Harbor Freeway in the City of Los Angeles showing the Wilshire Boulevard Bridge crossing the freeway in the foreground and the Four-level Traffic Interchange, hub of four major freeways, in the background. LOWER—Looking north along construction in progress on the Harbor Freeway from above 124th Street. Figueroa Street is to the left, Broadway to the right.

erage daily traffic at Soto Street two miles out from the Los Angeles Civic Center is 93,000. Ten miles out at Rosemead Boulevard the average daily traffic is 90,200. Fifteen miles out at the easterly city limits of El Monte the average daily traffic is 78,400. Twenty-four miles out at Kellogg Hill the average daily traffic is 50,200. This shows the extensive use which traffic is making of this new freeway facility throughout its entire length.

The 1957 traffic counts on District VII freeways indicate that in certain cases perhaps the maximum capacity has been reached with the result that some of the motorists, for short, close-in trips, are going back to existing surface streets which are being made more attractive due to efforts of local jurisdictions.

The average daily traffic volumes on major freeways in this area for the past four years is shown by the following:

Location	*1954*	*1955*	*1956*	*1957*
Hollywood Freeway (4-level Westerly)	168,000	180,000	185,000	192,000
Pasadena Freeway (Elysian Park)	110,000	112,000	114,000	109,000
Santa Ana Freeway (Soto Street)	90,000	113,000	145,000	145,000
San Bernardino Freeway (Soto Street)	80,000	88,000	96,000	93,000
Harbor Freeway (4-level Southerly)	125,000	160,000	175,000	190,000
Colorado Freeway (Linda Vista)	30,000	27,000	29,000	23,000
Long Beach Freeway (Pacific Coast Highway)	10,000	31,000	37,000	35,000
Using 4-level interchange	242,000	280,000	300,000	318,000

In this connection attention is directed to a "driving-time study" that was made in the Los Angeles area recently.

During the month of June, 1957, the Engineering Department of the Automobile Club of Southern California undertook to make a between home and work driving-time study embracing an area of metropolitan Los Angeles within a circle having a radius of 20 miles. The selection of routes was based on normal travel by Auto Club employees coming to work from suburban residential areas, and returning to their homes. Referring back to similar studies this organization had made previously during the year 1936, it was possible for them to work out travel time comparisons for the 21-year interval. These results have proven so interesting that Table III from this driving study report is reproduced here:

Los Angeles—Travel Time Comparisons

(All times given in minutes)

FROM Seventh St. and Broadway TO:	*1936 off-peak periods*	*1957 a.m. and p.m. rush hours*	*1957 off-peak periods*
Woodland Hills	57	64	----
San Fernando	43	50	
South Pasadena	26	21	15
Whittier	35	44	----
Torrance	34	31	----
Playa del Rey	37	37	----
Venice	40	30	----
Monterey Park	25	----	21
Pasadena	31	----	21
San Marino	30	----	22
Sierra Madre	40	----	34
El Monte	31	----	26

Vehicle registration in Los Angeles County in 1936 was 967,981; in 1956 it was 2,741,422.

The conclusion of this report presents important findings of great value in obtaining an understanding of the transportation problems in this area, and is herewith quoted:

"The overall average speed of 24 miles per hour accomplished during the heaviest congested periods of the day revealed that Los Angeles has a good transportation system when compared with other major cities.

"In comparison of freeway versus surface street travel, in no case did we find any surface street route to be faster than its freeway alternate nor even any five-mile increment of surface street travel to be faster than the corresponding five miles via freeway.

"A review of the study reveals that travel time, as might be expected during today's peak hours, is in some cases slower than travel time obtained during off-peak periods recorded in the earlier studies. Several subsequent test runs revealed that travel time during the off-peak periods from Seventh Street and Broadway in Los Angeles to various outlying suburban communities has been reduced, however.

"It appears that we have been able to better than hold our own during the last 20-year period in spite of a three-fold increase in motor vehicle registration. We anticipate that with the expected increase in availability of construction money for highway improvements in the future we will begin to make significant gains in the years to come.

"It is our belief that the primary reasons for our ability to travel as well as we do are the following:

"1. Freeway construction.

"2. Traffic engineering:
   (a) Synchronization of traffic signals.
   (b) Rush-hour turning prohibition.
   (c) Rush-hour parking restriction.
   (d) Channelization of problem intersections.
   (e) One-way streets.

"3. Improved construction of motor vehicles:
   (a) Better brakes and steering.
   (b) More rapid acceleration—automatic transmission.
   (c) Large rear windows, permitting greater visibility for motorist to observe sudden stops as many as five vehicles ahead.

"4. Experienced drivers who handle their cars in such a manner as to increase efficiency, particularly on freeways."

During the calendar year 1957, the California Highway Commission passed resolutions adopting five very important District VII freeway routings. On January 23, 1957, the commission passed a resolution adopting a freeway routing for U. S. Highway 399, State Highway Route 138, in the City of Ventura from the Ventura Freeway near River Street to the existing Ojai Freeway near Mission Street. This route adoption was for the purpose of connecting the completed section of the Ojai Freeway with the proposed Ventura Freeway. On this same date the commission also adopted a routing in Orange County for Route 182, State Sign Route 22, now called the Garden Grove Freeway, from the Santa Ana Freeway easterly to Route 43, which the Highway Commission has recently officially named the "Newport Freeway."

On November 25, 1957, the commission adopted resolutions affecting three District VII freeways. Two of these adoptions applied to portions of Route 23, U. S. Highway 6, from the

LEFT—Looking north along Colorado Boulevard connection with Golden State Freeway. RIGHT—Looking northwest along Golden State Freeway in Griffith Park, now under construction. Los Feliz Boulevard Interchange in foreground.

Santa Clara River to a point one mile north of the Angeles Forest Highway, and from Neenach Road northerly to the Kern county line. These two freeway route adoptions now fix the location of the Antelope Valley Freeway location in District VII from junction with U. S. Highway 99, the Golden State Freeway at the north city limits of Los Angeles to the Kern county line. On November 25, 1957, the commission also adopted a freeway routing for a section of the Golden State Freeway, U. S. Highway 99, at Castaic Junction. This routing extended from a point one mile south of Route 79, State Sign Route 126, to a point 0.7 of a mile north of Route 79.

The year 1957 has been one of significant accomplishment from the standpoint of major District VII freeway construction contracts that have been advertised and awarded. These contracts, in chronological order of bid openings, are as follows:

	Miles
Santa Ana, San Diego, and Laguna Freeways — Between Niguel Road and Laguna Canyon Road in Orange County	6.6
San Bernardino Freeway — Overcrossing for Barranca Street in West Covina	...
Glendale Freeway — Between Los Angeles River and Eagle Rock Boulevard in City of Los Angeles	1.5
Long Beach Freeway — From Atlantic Avenue to Rosecrans Avenue in Los Angeles County	1.4
Ventura Freeway — Between Conejo Grade Summit and Fifth Street in Camarillo in Ventura County	5.0
San Diego Freeway — Between San Mateo Creek in San Diego County and Avenida Cadiz in San Clemente	2.3
Riverside Freeway — From Santa Ana Freeway in Orange County south of the City of Buena Park to US 101 in Fullerton	3.6
Santa Monica Freeway (formerly called Olympic Freeway) — Bridge substructure across the Los Angeles River in the City of Los Angeles	.
Santa Ana Freeway — Between 10th Street in the City of Buena Park and Palmer Avenue in Anaheim	1.7
San Diego Freeway — From Trabuco Creek southerly through San Juan Capistrano in Orange County	4.1
Santa Ana Freeway — Two additional lanes between Brookhurst Avenue in Orange County and Euclid Avenue in City of Anaheim	...
Temescal Freeway — Between Fifth Street in the City of Pomona and 0.9 mile south of Riverside Drive in San Bernardino County	3.7
Hollywood Freeway — Ventura Freeway from Moorpark Street to Laurel Canyon Boulevard in the City of Los Angeles	2.0
San Diego Freeway — From Ohio Avenue in the City of Los Angeles to Venice Boulevard in Culver City	3.6
Golden State Freeway — Between Alameda Avenue and Burbank Boulevard in the City of Burbank	1.6
Total	37.1

Pasadena Freeway

The Pasadena Freeway is 8.2 miles in length, extending from the four-level structure near the Los Angeles Civic Center to Glenarm Street in Pasadena. The first unit was completed and opened to traffic on De-

Looking north showing cloverleaf interchange for Golden State Freeway and Western Avenue in Glendale cember 30, 1940. The last unit of construction on this freeway was completed and opened to traffic on September 22, 1953. The total cost of this freeway was $11,444,000.

The southerly two miles of this freeway that is referred to as the Elysian Park section is an eight-lane freeway and it is now carrying, according to the 1957 traffic count, a total of 109,000 vehicles per day.

Hollywood Freeway

The Hollywood Freeway extends for 16.8 miles from Spring Street in the Los Angeles Civic Center northwesterly to junction with the Golden State Freeway.

It is divided into two sections. The southerly section is 10 miles in length, from Spring Street through Cahuenga Pass to Vineland Avenue, and was completed and opened to public traffic throughout its entire length on August 5, 1954. The total cost of this 10-mile unit was $55,000,000, not including the current construction contract for widening and other necessary improvements that is now in progress between Highland Avenue and Lankershim Boulevard. This construction is being carried out by the Tomei Construction Company at a cost of $1,193,000, and is scheduled for completion in February, 1958.

The northerly unit of the Hollywood Freeway is known as the Hollywood Freeway Extension. This joins the Cahuenga Pass portion of the Hollywood Freeway near the intersection with Lankershim Boulevard and extends northerly therefrom for seven miles to the proposed Golden State Freeway near Wentworth Avenue.

Currently under construction on this unit with date of completion being set for February, 1958, is the Griffith Company contract for building 1.1 miles of the Hollywood Freeway Extension from Lankershim Boulevard to Moorpark Street. The construction allotment is $2,325,000. Work is also now under way on a second Griffith Company contract for constructing two miles of the Hollywood Freeway Extension and adjoining Ventura Freeway between Moorpark Street and Laurel Canyon Boulevard. This contract carries an allotment of $4,467,000, and is scheduled for completion in December, 1958.

The remainder of the Hollywood Freeway Extension is now in process of planning and designing, and in some areas negotiations are under way with property owners for acquisition of rights of way.

Santa Ana Freeway

The Santa Ana Freeway extends from the easterly terminus of the Hollywood Freeway at Spring Street in the Los Angeles Civic Center in a generally southeasterly direction for total length of 42.9 miles through the Cities of Buena Park, Anaheim, Santa Ana, and Tustin to a junction with the San Diego Freeway near the Town of El Toro. This freeway, following as it does a northwesterly-southeasterly direction generally paralleling the Pacific Ocean coastline, makes it of great strategic value because so many of the other important traffic arteries in this part of the State have been established in a generally northerly-southerly or easterly-westerly direction.

The entire 42.9 miles of this freeway are now either fully completed, under construction, or financed. By the end of 1958 it will be entirely


LEFT—Looking southeast on Santa Ana Freeway; Euclid Avenue Interchange in foreground. RIGHT—Looking east on Riverside Freeway near Brookhurst Avenue.

completed to full freeway standards. The total cost is $76,419,000.

Current construction on the Santa Ana Freeway is described in detail in this issue of *California Highways and Public Works by* Basil N. Frykland, District VII Construction Engineer.

The 1958-59 Fiscal Year budget contains an item for widening existing Santa Ana Freeway from four lanes to six lanes from Norwalk to Buena Park, 2.9 miles, $1,420,000.

San Bernardino Freeway

A four-mile section of the San Bernardino Freeway from Azusa Avenue to Barranca Street was opened to public traffic on January 18, 1957, and another of approximately the same length from Barranca Street to Ganesha Boulevard was completed and opened to traffic on April 19, 1957. The entire 30.7 miles of the San Bernardino Freeway from Aliso Street near the Los Angeles River easterly to the San Bernardino county line at Claremont is now completed. The total cost of this freeway including right-of-way acquisition costs, as well as construction costs, is $53,888,000.

Traffic counts taken in 1957 on this freeway in the City of Los Angeles at Soto Street indicate an average daily traffic of 93,000 vehicles.

Harbor Freeway

The Harbor Freeway is 22.2 miles in length, extending from the four-level traffic interchange structure to San Pedro. On April 24, 1957, a four-mile length of the Harbor Freeway was completed between 42d Street and 88th Place. This four-mile unit had a total cost for right-of-way acquisition and construction of $22,000,000.

On December 4, 1956, a contract was awarded to the Guy F. Atkinson Company for constructing a 2.5-mile section of the Harbor Freeway from 88th Place to 124th Street. The contract allotment for this construction is $5,902,500. The construction is now 60 percent along toward completion, with a completion date being September, 1958. The contract is well ahead of schedule.

Including previous completed sections of the Harbor Freeway, there is now open to public traffic 10.6 miles. The total amount expended for construction to date is about $86,000,000. The section of the Harbor Freeway just south of the four-level structure is now carrying an average daily traffic of 190,000 vehicles.

Looking west along Ventura Freeway construction showing Conejo Grade in the foreground

In the budget for the 1958-59 Fiscal Year is the item for constructing the Harbor Freeway from 124th Street southerly 4.9 miles to 190th Street in the amount of $6,000,000 (total estimate $8,700,000, with $2,700,000 to be financed in the 1959-60 Fiscal Year Budget.) Construction will be started on this unit during 1958.

On the remaining six-mile section of the freeway plans and right-of-way acquisition are substantially completed and start of construction is dependent upon financing.

Long Beach Freeway

The Long Beach Freeway is one of the newer freeway developments. Ground-breaking ceremonies at the southerly terminus of this freeway at Pacific Coast Highway in the City of Long Beach were held on June 27, 1951. However, since that time there has been steady progress in constructing this important freeway in the East Los Angeles area.

The total length of the Long Beach Freeway from Pacific Coast Highway (Route 60) in Long Beach to Huntington Drive in East Los Angeles approaching the City of Alhambra is 21.7 miles. As of the present time, seven miles of the Long Beach Freeway at the south end have been completed from the Pacific Coast Highway northerly to the crossing of Atlantic Boulevard east of the City of Compton, and 4.8 miles have been completed at the northerly end from Verona Street north of the Santa Ana Freeway southerly to Firestone Boulevard near the City of South Gate.

Three construction contracts are now under way to complete the gap on the Long Beach Freeway from Firestone Boulevard to Atlantic Avenue. This current construction covers a distance of five miles and the contract allotments total $8,755,000. All construction work under these three contracts is expected to be completed in April, 1958, and at that time public traffic will have the use of 17 miles of completed freeway from Long Beach to junction with the Santa Ana Freeway. To date there has been expended for right-of-way acquisition and construction on the Long Beach Freeway a total of $48,000,000.

In the budget for the 1958-59 Fiscal Year as adopted by the California Highway Commission on October 25, 1957, there are three items for construction work on the Long Beach Freeway, as follows:

At Del Amo Boulevard for grading and paving ramp	$180,000
For major construction from the Santa Ana Freeway northerly for 3.6 miles to the San Bernardino Freeway	6,150,000
For landscaping between Sheila Avenue and Olympic Boulevard	85,000

These three contracts will be advertised during 1958.

Golden State Freeway

The Golden State Freeway extends 73.2 miles from the southerly terminus at the junction with the Santa Monica and Santa Ana Freeways near Soto Street in Los Angeles northerly to Kern county line. The total spent and obligated on the freeway is close to $80,000,000.

The portion of the Golden State Freeway, U. S. Highway 99, locally known as the "Ridge Route" between Tunnel Station and the Kern county line, 45.2 miles in District VII, has been converted to a four-lane expressway. The total cost of this reconstruction, completed February, 1953, was $13,500,000. Southerly from Tunnel Station for 27.5 miles the Golden State Freeway is to be carried out to full freeway standards to its southerly terminus at junction with the Santa Ana Freeway. Of this portion the northerly three miles from Tunnel Station southerly to Sepulveda Boulevard was completed as a four-lane expressway at a cost of $3,200,000 on August 25, 1955.

Two very important contracts on the Golden State Freeway were under way during 1957 and are now completed. The contractor on this five miles of construction, extending from Glendale Boulevard in the City of Los Angeles to Ash Street in the City of Burbank, is Vinnell Co., Inc., and Vinnell Constructors. The sum of the two contract allotments is $9,799,000.

Right-of-way acquisition is under way for acquiring rights-of-way needed for the Golden State Freeway to complete it throughout its entire length. The 1958-59 Fiscal Year Budget of the Highway Commission contained items totaling over $10,000,000 for continuing right-of-way acquisition on the Golden State Freeway.

Financed from the 1957-58 Fiscal Year Budget, a contract was awarded by the Director of Public Works on November 18, 1957, for 1.3 miles of this freeway between Alameda Avenue and Burbank Boulevard in Burbank. The contractor is Ukropina, Polich & Kral, and the contract allotment is for $4,878,900.

Also in the 1957-58 Budget is an item of $8,900,000 for 3.1 miles of this freeway from Sixth Street to Mission Road in the City of Los Angeles. This latter project includes the traffic interchange facilities with the San Bernardino Freeway. Construction on this unit is expected to start early in 1958.

The freeway agreement for the last-remaining unit of the Golden State Freeway from the north city limits of Burbank to junction with San Fernando Road near intersection with Sepulveda Boulevard was approved by the Los Angeles City Board of Public Works and was executed February 13, 1957, by the city council. This covers an 11.8-mile length of freeway and is the longest continuous stretch of freeway that has yet been presented to the Los Angeles city officials for freeway agreement.

For the Golden State Freeway the budget for the 1958-59 Fiscal Year contains four construction items, as follows:

From Mission Road to Pasadena Avenue, 1.1 miles	$4,600,000
Landscaping, from Glendale Boulevard to Los Angeles River, with freeway connection to San Fernando Road	246,000
Landscaping, Los Angeles River to Ash Street in Burbank	84,000
From Burbank Boulevard to Roscoe Boulevard, 3.9 miles	6,000,000
(Total estimate $7,648,000, with $1,648,000 to be financed in the 1959-60 Fiscal Year Budget).	

Also in the 1958-59 Fiscal Year Budget are allocations for right-of-way acquisition on the Golden State Freeway totaling $10,000,000.

Ventura Freeway

The Ventura Freeway extends from the Golden State Freeway in Griffith Park to the Santa Barbara County line, a distance of 75.4 miles. Of this mileage, 37.7 have been completed at a construction cost of $13,923,000 to provide four-lane divided highway or expressway standards. This completed construction is all westerly of the west city limits of Los Angeles at Calabasas.

The Highway Commission on May 18, 1955, adopted a freeway routing to carry the Coast Highway (US 101) through the City of Ventura. Plans are now in progress so that construction can go forward whenever financing can be arranged for this entire 5.5 miles through the City of Ventura. The budget for the 1958-59 Fiscal Year contains an item of $2,880,000 for right-of-way acquisition on this section.

The budget for the 1957-58 Fiscal Year contained an item of $3,400,000 to convert to full freeway status the existing two- and three-lane undivided section over the Conejo Grade. This is five miles in length, extending from Conejo Grade Summit to Fifth Street in Camarillo. Contract was awarded for this construction by the Director of Public Works on April 29, 1957, to J. E. Haddock, Ltd. The construction

UPPER LEFT Looking north along a completed section of the Long Beach Freeway showing Florence Avenue Interchange in the foreground. UPPER RIGHT Looking north along the Long Beach Freeway showing portion of Artesia Avenue cloverleaf. LOWER LEFT– Looking north along the San Diego Freeway with Wilshire Boulevard in foreground and Sunset Boulevard in background. LOWER RIGHT Looking northwest, showing Long Beach Freeway crossing Santa Ana Freeway is now 50 percent complete, and the scheduled finish date is in late 1958.

Within the City of Los Angeles two major freeway construction contracts are now in progress on sections of the Ventura Freeway. These extend from Sepulveda Boulevard to Encino Avenue, a length of three miles, and from Kelvin Avenue to Calabasas, a length of 3.6 miles. The value of this current construction is $9,779,000.

In the 1958-59 Fiscal Year Budget are two items for continuing construction on the Ventura Freeway, as follows:

From Laurel Canyon Boulevard to San Diego Freeway, 4.1 miles	$6,248,000
(Total estimate $11,100,000 with $4,852,000 to be budgeted in the 1959-60 Fiscal Year Budget.)	
From Encino Avenue to Kelvin Avenue, 3.9 miles	6,000,000
(Total estimate $7,300,000, with $1,300,000 to be financed from the 1959-60 Fiscal Year Budget.)	

San Diego Freeway

The San Diego Freeway is 90.5 miles in length in District VII. It extends southerly from junction with the Golden State Freeway near the City of San Fernando in close vicinity to existing Sepulveda Boulevard over the Santa Monica Mountains through the West Los Angeles area and along the easterly side of the Los Angeles International Airport. Then it swings easterly, passing to the south of the Long Beach Municipal Airport and then southeasterly into Orange County to a junction with the Santa Ana Freeway at El Toro. Then it proceeds in close vicinity to existing US 101 through San Juan Capistrano and San Clemente to the Orange-San Diego county line.

In many locations, advance right-of-way acquisition funds, frequently called "Chapter 20 money," have been utilized in the purchase of vacant lands to forestall construction of private improvements which, if allowed to proceed, would have made future right-of-way cost many times greater. On December 11, 1956, a contract was awarded to Oberg Brothers for construction at the crossing of the San Diego and Ventura Freeways. This in-

UPPER—Looking east along Ventura Freeway construction near Calabasas showing Mulholland Drive Bridge in foreground. LOWER—Looking east along Ventura Freeway construction in the Woodland Hills area.

Looking northwest along Hollywood Freeway Extension. Traffic artery in center is Moorpark Street.

cluded 1.3 miles of the San Diego Freeway from Valley Vista Boulevard to Burbank Boulevard, estimated to cost $2,500,000. Work is 75 percent completed.

There are three units of construction on the San Diego Freeway in Orange County upon which work is proceeding under State Division of Highways contracts. This construction is located at San Clemente, at San Juan Capistrano, and from Niguel Road northerly for two miles near El Toro. In all, 8.4 miles of the San Diego Freeway in Orange County are now under construction, for which the construction cost is $7,300,000.

On March 29, 1957, a 2.1-mile length of this freeway between Ohio Avenue and Casiano Road in West Los Angeles, valued at $10,000,000, was opened to public traffic. On August 12, 1957, Guy F. Atkinson Company of South San Francisco was awarded contract on the low bid of $5,748,745 for 3.5 miles of construction on this freeway from Ohio Avenue to Venice Boulevard. A substantial start on construction has been made.

In the budget for the 1958-59 Fiscal Year are three major construction items, as follows:

San Diego Freeway in Los Angeles County, from Jefferson Avenue to Venice Boulevard, 2.5 miles	$6,000,000
(Total estimate $7,500,000, of which $1,500,000 is to be budgeted in the 1959-60 Fiscal Year Budget).	
San Diego Freeway in Los Angeles County, Mulholland Drive relocation	1,100,000
San Diego Freeway in Orange County, from Trabuco Creek to El Toro, 7.9 miles	5,530,000

In the 1958-59 Fiscal Year Budget are also allocations totaling $13,200,000 for continuing right-of-way acquisition negotiations on the San Diego Freeway.

Colorado Freeway

As adopted by the California Highway Commission the Colorado Freeway routing is 2.3 miles in length extending from Eagle Vista Drive in Eagle Rock to Holly Street in Pasadena. The last unit of construction on the Colorado Freeway from Eagle Vista Drive to Avenue 64 was completed July 28, 1955. This freeway unit extends both easterly and westerly from the new Pasadena Pioneer's Bridge over the Arroyo Seco, and as a major traffic artery leading into Pasadena from the west it is of vital importance. The total expenditure on this freeway to date has been $8,500,000.

Foothill Freeway

From Hampton Road to Montana Street in the Flintridge area, a 1.8-mile unit of the Foothill Freeway including crossing of the Arroyo Seco at Devil's Gate Dam was completed October 28, 1955. This construction was enthusiastically welcomed by the people of Pasadena, Flintridge, and Altadena because it corrected an exasperating traffic congestion problem at Devil's Gate Dam. The total cost was $2,675,000.

The Foothill Freeway is the only interstate route in District VII for which the California Highway Commission has not as yet passed a resolution adopting a freeway route for the entire length. We are now engaged in preliminary engineering studies and are conferring with engineering departments and planning commissions of Los Angeles County and of the various cities that will be passed through by this freeway, in order to obtain the most economical route to provide the greatest possible traffic service.

Glendale Freeway

As adopted by the California Highway Commission, the Glendale Freeway is 2.6 miles in length from Glendale Boulevard to Avenue 36 near Eagle Rock Boulevard.

On this freeway a contract was awarded on February 8, 1957, to the Thompson Construction Company of Inglewood for the construction of a one-mile length between the Los Angeles River and Avenue 36 near Eagle Rock Boulevard. The contract allotment is for $2,832,200. Construction includes a grade separation bridge over Taylor Yard tracks of the Southern Pacific Railroad. This contract is now 50 percent completed. The budget for the 1958-59 Fiscal Year contains an allocation of $2,105,000 for continuing right-of-way acquisition on the Glendale Freeway.

Artesia Freeway

This freeway takes its name locally from Artesia Street along which it follows for considerable distance in Los Angeles County. It is a part of State Highway Legislative Route 175 (State Sign Route 14) that extends from the Coast Highway (Route 60) in Redondo Beach westerly into Orange County.

The State Highway Commission has adopted two portions of this route as freeway. One of these extends from Normandie Avenue to Santa Fe Avenue, and the other from Palo Verde Avenue to Santa Ana Freeway. The total mileage of freeway adoption is 12.4 miles. Of this, 4.9 miles have been constructed to expressway standards at a cost of $2,453,000. The extension of this route in Orange County easterly of the Santa Ana Freeway has recently been named the "Riverside Freeway."

Riverside Freeway

On October 25, 1957, the California Highway Commission announced the official naming of the freeway route for State Sign Route 14 that had formerly been called locally the "Houston Freeway," and State Sign Route 18 (U. S. Highway 91) that had formerly been called the "Santa Ana Canyon Freeway." Thus the Riverside Freeway now extends from the Santa Ana Freeway easterly to near the Town of Olive where it joins the freeway through Santa Ana Canyon and follows along it to the Riverside county line. The total length from the Santa Ana Freeway to the Riverside county line is 20.4 miles. From Cypress Avenue near Placentia, easterly through the Santa Ana Canyon to the Riverside county line, it has been completed to expressway standards. Construction contract is now in progress with Griffith Company for completion to full freeway standards of a section 3.5 miles in length, extending from the Santa Ana Freeway, easterly through Anaheim and Fullerton to Spadra Road (State Highway Route 2). The construction allotment for this contract is $3,500,000. It is 40 percent completed and the date for final completion is September, 1958.

Ojai Freeway

The total length of freeway adoption for the Ojai Freeway is six miles. A contract was awarded June 29, 1955, for four miles of the Ojai Freeway in Ventura County, extending from the junction with West Main Street in the

Looking northwest along Hollywood Freeway Extension. Lankershim Boulevard is in foreground. During construction traffic uses inbound lanes of Hollywood Freeway and Venturo Boulevard to left.

STATUS OF DISTRICT VII FREEWAY PROJECTS—JANUARY 1, 1958

Freeway name	Total miles	Completed projects		Under construction		Right-of-way costs	Total obligated costs to date
		Miles	Construction costs	Miles	Estimated construction cost		
Pasadena Freeway 4-Level Structure to Glenarm St., Pasadena	8.2	8.2	$10,435,078	......	....	$1,009,100	$11,444,178
Hollywood Freeway Spring St. via Cahuenga Pass to Junction on Golden State Freeway Near Wentworth St.	16.8	9.9	30,016,344	1.7	$4,649,600	32,662,000	67,327,944
*Santa Ana Freeway Spring St. (Los Angeles) to Junction of San Diego Freeway Near El Toro	42.9	29.0	43,417,974	13.9	14,031,207	18,970,000	76,419,181
*San Bernardino Freeway Santa Ana Freeway Near Los Angeles River to San Bernardino County Line in Claremont	30.7	30.7	36,027,862	......	....	17,860,000	53,887,862
Harbor Freeway 4-Level Structure to San Pedro	22.2	10.6	28,338,347	2.5	6,118,800	50,948,000	85,405,147
Long Beach Freeway Pacific Coast Highway in Long Beach to Huntington Dr. in South Pasadena	21.7	10.7	17,678,550	5.7	8,755,000	21,700,000	48,133,550
*Golden State Freeway Junction of Olympic and Santa Ana Freeway Near Soto St. to Kern County Line	73.2	51.2	26,249,481	1.3	4,878,927	48,596,000	79,724,408
Ventura Freeway Golden State Freeway to Santa Barbara County Line	75.4	37.7	13,922,874	12.8	16,355,200	29,468,000	59,746,074
*San Diego Freeway Golden State Freeway Near San Fernando Reservoir to San Diego County Line	90.5	2.5	5,776,011	12.5	16,502,800	39,677,000	61,955,811
Colorado Freeway Eagle Vista Dr. in Eagle Rock to Holly St. in Pasadena	2.3	2.3	6,209,405	......	....	2,295,000	8,504,405
*Foothill Freeway Hampton Rd. to Montana St. in Flintridge	1.8	1.8	2,054,436	......	....	624,000	2,678,436
Glendale Freeway Glendale Blvd. to Ave. 36, Near Eagle Rock Blvd.	2.6	......	....	1.0	2,832,200	4,057,000	6,889,200
Artesia Freeway Normandie Ave. to Santa Fe Ave. and Palo Verde Ave. to Santa Ana Freeway	12.4	4.9	2,452,500	......	....	2,844,000	5,296,500
Riverside Freeway Santa Ana Freeway to Riverside County Line	20.4	13.7	4,022,066	3.5	3,500,000	5,169,000	12,691,066
Ojai Freeway West Main St. in Ventura to 0.4 mi. North of Foster Park	6.0	4.0	2,084,353	......	....	1,167,000	3,251,353
*Santa Monica Freeway Santa Ana Freeway Near Soto St. to Lincoln Blvd. in Santa Monica	14.9	......	....	......	466,600	30,118,000	30,584,600
Pacific Coast Freeway Oxnard to Los Angeles County Line and Huntington Beach to Newport Beach	22.1	7.2	2,519,000	......	....	1,961,000	4,480,000
Other Freeways Covered by Resolution of Adoption by Highway Commission	182.9	3.3	1,171,300	5.0	1,418,600	9,529,000	12,118,900
Total	647.0	227.7	$232,375,581	59.9	$79,508,934	$318,654,100	$630,538,615

* Interstate Highways

City of Ventura northerly to Mills schools. This contract was completed and opened to public traffic on December 3, 1956. Total expended to date is $3,251,000.

Santa Monica Freeway

By action of the California Highway Commission in 1956, a freeway routing was established for the Santa Monica Freeway (previously called the Olympic Freeway) throughout its entire length of 14.9 miles from junction with the Santa Ana Freeway in East Los Angeles to Lincoln Boulevard in the City of Santa Monica.

A start was made in the actual construction of this freeway at groundbreaking ceremonies on June 9, 1957, when Jones Brothers Construction Corporation commenced work on the substructure portion of the bridge to carry the Santa Monica Freeway over the Los Angeles River, a project which was financed in the 1957-58 Fiscal Year budget.

The contract allotment for this work is $466,000. In the 1957-58 Fiscal Year budget there is a total allocation for Santa Monica Freeway construction of $8,400,000. Bids were opened January 9, 1958, on part of the 4.2-mile unit of the Santa Monica Freeway between Hoover Street and the Santa Ana Freeway that involves long lengths of viaduct to carry the

Santa Monica Freeway over the southeast business and industrial section of the City of Los Angeles. The total cost of right-of-way acquisition and construction for this unit is estimated at $66,000,000.

In the 1958-59 Fiscal Year budget of the California Highway Commission, there is a total of $13,600,000 set up for continuing right-of-way acquisition on the Santa Monica Freeway. The work of planning, design and right-of-way acquisition on this important freeway is proceeding at a satisfactory rate to insure construction and ultimate completion at the earliest possible date, consistent with problems of financing.

Pacific Coast Freeway

The Highway Commission has adopted as the Pacific Coast Freeway, two sections of Route 60, Pacific Coast Highway; one at Ventura County and one in Orange County. The portion in Ventura County, 17.4 miles long, extends from Ventura Freeway to the Los Angeles county line, and of this, 7.2 miles from Date Street, Oxnard, to Calleguas Creek was under construction during 1956-57.

The contractor was Peter Kiewit Sons Company, and the contract allotment was for $2,320,000. Work under this contract was completed November 15, 1957.

The other portion of this freeway in Orange County is 5.6 miles in length, with one section 4.6 miles long, extending from Huntington Beach to Newport Beach, and the other section, one mile long, being in the San Juan Creek area.

Other Freeways

In the summary of District VII freeway projects printed herein, the last item is entitled "Other Freeways." This is what might be termed a "catch-all" to include all of the freeway routes that have been covered by resolution of adoption by the California Highway Commission, but upon which extensive construction has not as yet been carried out. This is not meant as any reflection upon the importance of those freeways that are all vital to the overall system. On all of these other freeways which now total 182.9 miles, considerable advance planning work, some detailed designing, and some right-of-way acquisition have been carried out, and this work is continuing. There are two freeways included in this category, concerning which special mention should perhaps be made.

On the Temescal Freeway from Fifth Street in the City of Pomona southeasterly for 3.2 miles into San Bernardino County to a point one mile south of Riverside Drive, construction is in progress under a state highway contract with Eric L. Peterson. The contract allotment is for $765,000, the construction work is 50 percent completed, and the estimated date of completion is April, 1958. The construction is on the basis of providing a four-lane expressway.

Included in this classification of "other freeways" is one in Orange County that should be given special mention. On October 25, 1957, the California Highway Commission announced the official naming of the new freeway routing for State Sign Route 55 between the City of Newport Beach and the Town of Olive as the "Newport Freeway." The existing state highway route follows along Newport Boulevard through the City of Costa Mesa and along Tustin Avenue through the City of Tustin and the City of Orange.

The freeway routing was adopted by resolutions of the California Highway Commission in two sections, on March 17, 1944, for the southerly portion to Dyer Road, and on July 20, 1954, for the northerly portion. The total length of the Newport Freeway is 17.5 miles.

Cities Concur

The District VII Office of the State Division of Highways is now actively engaged in design of this freeway. Freeway agreements have been consummated with the City of Tustin and the City of Orange, and through these cities, design details are now being prepared for grade separations and traffic interchange facilities at important cross streets. Freeway agreements are under negotiation with the County of Orange and with the City of Costa Mesa. We are now negotiating with the City of Costa Mesa relative to proceeding at an early date with an interim program of construction for frontage roads through this city from 20th Street to Palisades Road. Details for construction in county areas cannot be fully designed until the County of Orange and the State have executed the freeway agreement that is now under discussion.

The Newport Freeway is being designed on the basis of an ultimate six-lane freeway with initial construction to be for four lanes. There are no funds as yet available for construction. Good progress is being made on right-of-way acquisition for this freeway. To date, 44 parcels have been acquired at a total cost of about $1,000,000. Additional funds for right-of-way acquisition are now available, and negotiations are proceeding as design details and appraisals are completed.

The budget for the 1958-59 Fiscal Year contains an item of $1,300,000 for continuing right-of-way acquisition on this freeway.

Outlook Good

Speaking of the immediate future, it would appear that the calendar year 1958 is about to break all previous records for completing District VII freeway construction projects within any one-year period. A review of the record of going contracts on January 1, 1958, indicates that during the present calendar year we will complete and open to traffic 18 major freeway construction contracts. These 18 contracts will make available to the motorists an additional 55 miles of freeways for which the total construction cost is $70,000,000.

As to the long-range picture, we estimate that approximately $1,000,000,000 will be required to complete the 647 miles of District VII freeways presently adopted by the California Highway Commission.

Further studies are being made and correlated with local planning groups, and the results will be embodied in the department's report on Senate Concurrent Resolution No. 26 that will provide for correction of highway transportation deficiencies on a statewide basis and result in the establishment of a complete and comprehensive freeway system for the State of California.

Operations and Activities of Materials and Research Department

PART V—FOUNDATION SECTION

By A. W. ROOT

This, the fourth of a series of articles describing the activities of the Materials and Research Department of the California Division of Highways, will describe the operation and activities of the Foundation Section. As explained previously, this section is one of the five major subdivisions of the Materials and Research Department.

The Foundation Section of the Materials and Research Department, in addition to performing routine tests on all aggregates submitted to headquarters laboratory, performs numerous services when requested by a district or by one of the Headquarters Departments. These services include: investigation of foundations for highway embankments; locating, sampling and testing potential sources of construction materials; investigation of potential or active landslides; obtaining field data and making recommendations pertaining to design of cut slopes; planning and installing horizontal drains; assisting the districts in controlling compaction, measuring fill settlement, and evaluating construction compacting equipment.

The Foundation Section also assists in preparation of specifications pertaining to aggregates and earthwork, and performs research work directed toward improving test procedures, methods and materials pertaining to these phases of highway design and construction.

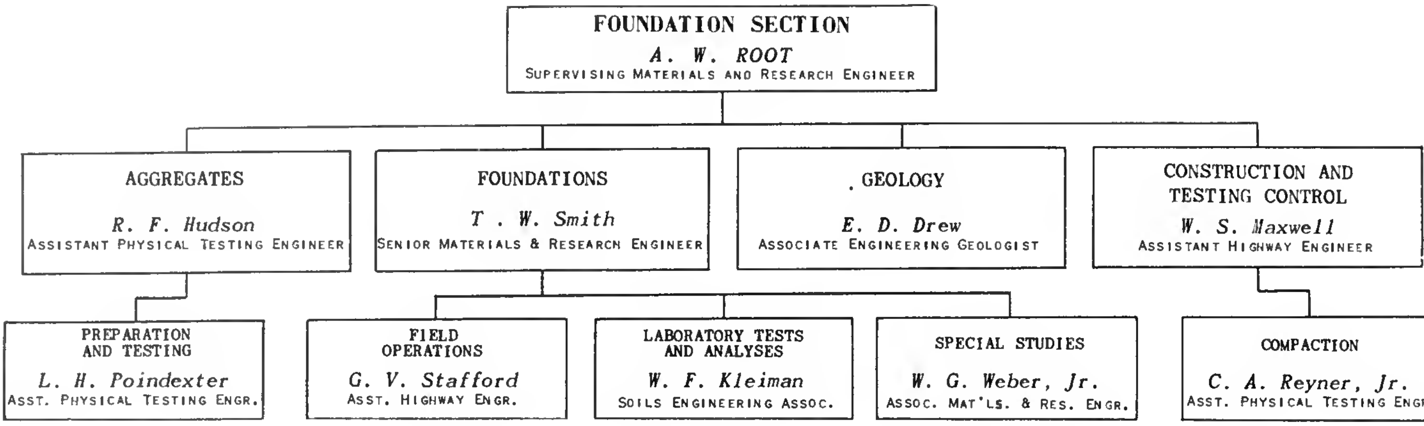
For organizational purposes the section is divided into four units or subsections: Aggregates, Foundations, Geology and Construction Control. Following is a more detailed description of the functions and activities of the four units.

Aggregate Subsection

In most cases the layman attaches little importance to rocks, sand, silt, clay and the like. To the engineers, however, they are his chief building material, and many of them fall under the heading of mineral aggregates, or more popularly, just aggregates. The term of course implies that a piece of stone or a sand grain is an aggregation of one or more minerals.

It is frequently said among engineers that no two aggregates are exactly alike. This statement might well be considered the hallmark of aggregates; for they vary in almost every conceivable way. The particles differ from one another in size, shape, texture and color. They vary in mineral composition and structure. In the case of gravels, the aggregates also vary in the relative proportions of the various particle types.

Large drill rig in position for making deep borings in a landslide area. Undisturbed samples can be obtained with this equipment with a drive-type sampler or a rotary type core barrel. Cores have been taken with this machine from depths in excess of 300 feet.



Obviously these variables have a significant effect on the physical characteristics of the individual particles and on the mixtures of particles; these variations, in fact, make aggregates a versatile construction material. The engineer must ascertain which properties an aggregate should have for a particular use, and then measure those properties, either directly or indirectly. It is the function of the aggregate section of the Materials and Research Department to perform many of the tests to determine the suitability of aggregates for the purpose intended.

Sieves Used

The simplest of these tests is the sieve analysis, used to measure directly the relative proportions of aggregate particles of various sizes. This is done by sieving the aggregate over a series of sieves with the opening of each successive sieve smaller than in the sieve above. By scrutiny of the particle size distribution obtained from the sieve analysis, it is possible to estimate other properties such as porosity, surface area, and workability of concrete mixes made of the aggregate.

Hardness and resistance to impact and abrasion are important in aggregates intended for many uses. The objection to excessively soft and weak particles in aggregates for concrete and pavement wearing surfaces, for example, is obvious. The test most frequently used to measure these properties is the "Abrasion by use of the Los Angeles Machine," commonly referred to as the "Rattler Test." Where it is desired to measure the resistance to abrasion in the presence of water, the older "Deval Machine" or "Wet Shot Test" is used. In both tests steel balls are tumbled and rolled together with the aggregate sample in rotating cylinders under specified control conditions. Breakage, wear and particle loss are determined by sieving.

Specific Gravity Test

Another test performed in this section is the specific gravity determination, usually performed separately on the coarse and fine portions of the aggregate. Knowledge of the specific gravity or density of the individual particles makes it possible to translate proportions by weight into volume relationships. The final design of both asphaltic and portland cement concrete mixtures is based on absolute volumes rather than weight. The absorption of water by the aggregate is determined concurrently with the specific gravity test. This is indicative of the porosity of the mineral particles and is used directly in concrete mix design to compute water requirements.

The "soundness" of aggregate—that is, the resistance to frost action and weathering—is evaluated by the sodium sulfate soundness test, a form of accelerated weathering test. In this test the aggregate is subjected to five cycles of alternate oven drying followed by immersion in a concentrated sodium sulfate salt solution, after which the degree of disintegration is measured. Sodium sulfate crystals expand in the pores of the stone much as does water upon freezing. This test is used primarily for aggregates proposed for use in portland cement concrete.

Test for Clay

The suitability of aggregates for many purposes is affected by the quantity and character of the dust or claylike material present, either as coatings on coarse aggregates or as discrete particles in the mixture. Clay coatings on aggregate particles may inhibit bonding of an asphalt binder; excessive fines may cause increased water demand in portland cement concrete, or cause excessive volume change with resultant reductions in quality of the concrete. By means of a sedimentation type of test the cleanness of coarse aggregate is measured.

The amount of claylike materials contained in fine aggregates is determined by the sand equivalent test, which is performed on mineral aggregate for bituminous mixtures, sand for portland cement concrete, and on base and subbase materials. This simple test, which can be performed quickly in either field or laboratory, indicates the amount of those fines which affect the quality of the aggregate. A relatively small quantity of clay, for example, can greatly reduce the stability of a graded aggregate, whereas a similar quantity of silt might have negligible effect.

Aids Districts

In the above paragraphs mention has been made of some of the properties of aggregates that are investigated by laboratory tests. The Aggregate Section performs all of the tests noted, and numerous others as an aid to the 11 highway districts and other departments in controlling materials going into highway jobs.

In this respect, the Aggregate Section's testing frequently supplements the well established testing programs of the districts, and often is for "referee" purposes. Perhaps of greater importance than the direct determinations themselves is the constant attention the section gives to the adequacy of the standard procedures themselves. All sections of the Materials and Research Department, in fact, give considerable attention to this phase of materials work.

In addition to the work outlined above, the aggregate section is actively engaged in research and special investigations. The improvement of test procedures and the development of new tests generally requires considerable research. Unless these efforts are made, test procedures may become out dated and fail to keep up with the fast pace set by modern construction equipment. The heavy pounding of modern vehicles in ever-increasing numbers is making greater demands for uniformly high quality of road materials. The study of degradation and weathering of aggregates, and the development of test procedures for accurately predicting aggregate durability are examples of important research projects now underway in the Aggregate Section.

Foundations Research

The work of the Foundations Unit consists of three primary activities: field operations, which comprises the exploratory drilling and sampling and the installation of horizontal drains; laboratory tests and analyses, which includes the laboratory testing of samples obtained in the field operations, and the interpretation of the test data; special studies, which consists of various control and research installations.

Soils engineers and geologists contribute to the sound and economical design of our state highways. Not many years ago, most earthwork design was by rule of thumb, arbitrary rules being used for establishing designs. Many designs by these methods were adequate, but no one really knew how adequate, or inadequate, unless the structure failed. Nowadays most engineers working with soil supplement their experience and judgment with factual information about the depth and characer of the formations encountered in a project. They know that natural deposits may vary greatly from point to point in their strength, density, and other properties; however, they attempt to secure representative samples and perform laboratory tests to evaluate the important properties. Engineering calculations are made to establish basic design features, such as steepness of slopes and amount of settlement to be expected.

Disassembling 2-inch California sampler to remove soil samples which are contained in 4-inch-long brass tube liners

Assists Other Engineers

An important part of this work consists of the mechanics of obtaining the engineering data. The Foundation Section of the Materials and Research Department assists the engineers in the various districts in solving special foundation problems where they exist or are suspected. The section maintains several drill rigs which are manned by experienced personnel. One of the larger drills is capable of drilling and obtaining undisturbed soil samples and rock cores to depths of several hundred feet. Samples from critical locations are tested and analyzed in the laboratory. The drill holes also provide a means of making ground water observations. Most of the work of these crews is performed for the Division of Highways; however, investigations are sometimes made for other state departments, such as the Division of Architecture in connection with their work on state buildings, and for other governmental agencies.

Before recommendations are made for the solution of particular foundation problems samples of soil or rock are examined and tested in the laboratories and the basic properties determined. The problems are then analyzed in the light of the field and laboratory data obtained.

Slow to Admit Need

Although earth and rock are the oldest of construction materials, less has been known of their properties than of man-made materials such as steel and concrete. Engineers and builders of the past have readily recognized the need for measuring the tensile strength of steel and the compressive strength of concrete, but have been slower to admit the need for basic knowledge of the properties of earth and rock. They have wanted to know accurately the strength of steel and concrete, and have insisted upon liberal factors of safety in the use of these materials. In dealing with earth and rock many have been willing to use the most meager basic information and have been satisfied with unbelievably small margins of safety.

In spite of the complexity and variable nature of most natural soil deposits, much progress has been made in soil engineering during the past two or three decades. Development of improved and standardized testing equipment and modern soil mechanics have done much to eliminate the guesswork on earthwork.

Some of the mechanics of obtaining field data have been discussed. Having programed the field explorations, the engineer plans laboratory tests and analyses to help him answer such questions as: What is the strength of the soil? What is its allowable bearing capacity? How much settlement can be expected? How much settlement will occur after the job is completed? In obtaining soils data for the study of these questions the engineer employs modern testing methods such as the Triaxial Shear Test, the Consolidation Test, the Unconfined Compression Test and many others. He studies factors such as cohesion, permeability, compressibility, time factors, and plots the data on time-consolidation curves, pressure-void ratio curves, Mohr diagrams, and other useful charts and diagrams. He analyzes the data and makes engineering calculations to verify the adequacy of a proposed design or to establish features for a new project.

Foundation Problems

Engineers in the Soils Testing and Analyses Unit do the things outlined above. They evaluate the properties of many types of soil. Experience has shown that sandy soils and stiff clays usually do not present serious foundation problems to the highway engineer. Sandy soils consolidate rapidly under applied loads, and stiff clays are relatively incompressible under moderate loads. Consequently this unit does most of its work on soft compressible clays, peaty clays, and peat which are prevalent in the San Francisco Bay area and Delta regions along the lower San Joaquin and Sacramento Rivers. On some projects the settlement of compressible soils has been controlled by use of vertical sand drains, embankment overloads, and controlled rates of construction.

Completed horizontal drain in foreground and boring being made for another drain on a recently completed horizontal drain installation in San Luis Obispo County

Although the testing of foundation soils has become quite routine along well established lines, the engineering calculations frequently are complicated by the difficulty of properly evaluating the many factors entering into the calculations. Much field and laboratory experience is needed for rational interpretation of the laboratory test results. Ground water levels, the horizontal and vertical extent of soil masses, and other important field conditions must be taken into consideration in a logical analysis of a problem.

Special Studies

Most of the work described above is of a more-or-less routine or standard type. The Foundations Unit also does a great deal of nonstandard work that may be classed under special studies. Much of this work is done upon request by the districts of the Division of Highways, for the Division of Architecture, and other public agencies. It may be grouped roughly into two categories: investigations and studies to correlate predicted and actual performance; research and the development of new processes and methods.

A major item of the correlation and control work consists of construction control for embankments and fills. Generally stability and settlement are of prime interest. This work utilizes such devices as settlement platforms, piezometers, heave stakes, etc. The installation of these special devices, and soil sampling generally are done by Materials and Research Department personnel. Observation and recording of engineering data generally are done jointly by District and Materials and

Research Department personnel during construction. The department also assists the districts in interpreting the readings. In this work, Materials and Research Department personnel are made available to the districts upon their request. When the districts desire, the department makes the complete installation, records the data, and furnishes the information to the District Engineer for his use.

Co-operation With Districts

In addition to the type of work just described, the department works with the districts during the design of projects. Special studies at this time frequently relate to drainage in depressed cuts for grade separations or permeability studies of soft foundations possibly requiring special treatment.

As in other phases of materials and research activity, constant research is in progress. Studies are made of testing procedures and their results to determine their adaptability to problems encountered in highway construction. By way of example, a new *in place* method of determining strengths of soils is being investigated. A method of measuring the field permeability of foundation soils has been developed by the department and is now being used for estimating rates of settlement of foundation soils. At present, an *in place* method of determining soil moisture and density is being studied to determine its applicability to highway construction.

Horizontal Drains

Most landslides are caused or aggravated by the presence of subsurface water. Horizontal drains are two-inch perforated metal pipe drains installed in holes drilled horizontally, or on slight plus grades, into the slide area to reduce the driving forces causing sliding by drawing down the water table or tapping impounded ground water.

A few of the outstanding examples of success in stabilizing slide areas by the installation of horizontal drains are at the following locations: Piercy Slide near Piercy in District I; Baxter Slipout near Baxter in District III; Orinda Slide west of the Orinda Crossroads in District IV; and at several locations on Cuesta Grade in District V. It was on Cuesta Grade in 1939 that this department installed the first horizontal drains on the State Highway System. A recent installation at this location has produced some of the most spectacular flows ever recorded. Several of these drains were estimated to have each produced maximum flows of one-half to one million gallons per day.

Equipment Modified

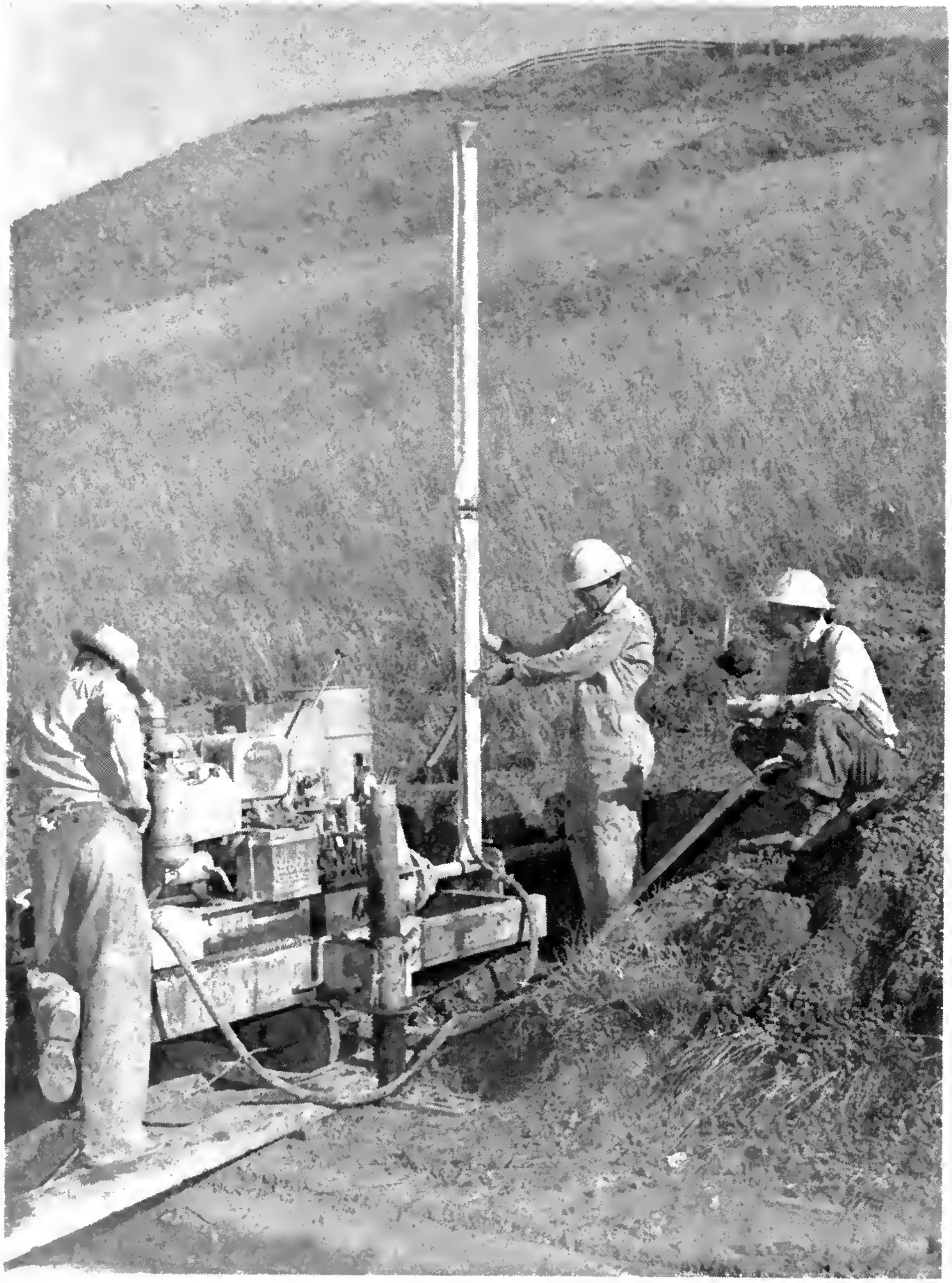
Light, portable, air-powered drilling machines were first utilized to install horizontal drains. This original equipment, purchased in 1939, was modified during the ensuing years until the quest for more depth and greater drilling speed exceeded the structural capacity of the machine. A heavier machine designed to use continuous flight helical augers was purchased in 1950 and was later adapted to rotary drilling. This rig was more effective but had some definite operational limitations.

Since no drill rig was commercially available which exactly fitted our needs the Materials and Research Department in co-operation with the Highway Equipment Department designed and built a unit exclusively for installing horizontal drains. This original design has been continually developed and improved upon and we now feel we have evolved a very efficient machine, although additional improvements are already contemplated.

It is now possible to install horizontal drains consistently to depths of 150 to 300 feet in most formations and drilling speed has been increased to more than keep pace with rising operational expenses.

Reading settlement of ground beneath the weight of a fill by means of California designed settlement measuring device

Reading spring-loaded consolidometers to obtain test data used for estimating settlement



Technicians work in the field with a horizontal drill designed and constructed by the Division of Highways

Geology Unit

The late Dr. Charles P. Berkey, the dean of engineering geologists, once stated: "To make suitable field inspection, to indicate what important questions are still unsettled, to suggest how to secure more complete or more reliable data, and to determine what they mean is the task of the geologist. If he can do these things successfully and can transmit this information in usable form to the designing engineer and the construction staff, he is then by that token an engineering geologist."

The California Division of Highways has for many years utilized the services of engineering geologists in varied phases of highway engineering including: location, design, construction, materials, foundations, landslides, ground water and many others.

Con Request Survey

When relocation or reconstruction of a portion of highway is proposed, the highway district in which the project is located may request that the Materials and Research Department make a geological survey of the route, especially if the route traverses rugged or unstable terrain. Such a geologic study will locate areas where structural conditions are adverse or where subsurface exploration will be required; also, possible sources of construction materials will be located. The geologic study may involve the use of various techniques, such as airphoto analysis, geophysical exploration, geologic mapping, and the old reliable method of plodding the route on foot.

The department is frequently asked to make recommendations on the design of cut slopes for roadway excavation on proposed construction projects. The geology subsection is called upon to determine the structural attitude and character of the rock formations, and this information is used in deriving the most economical cut slope design. In areas which are inaccessible to drilling equipment, and in which there are no existing cut slopes for guidance, the design of the cut slopes must be based largely on geology. Excessively steep slopes may cause disastrous landslides, while unnecessarily flat slopes will result in waste of construction funds for excess excavation. Knowledge of the rock type, hardness, bedding, jointing, weathering and other geologic features helps to determine the probable stability of the proposed excavation slopes.

The Materials and Research Department often assists the districts in locating satisfactory sources of construction materials, such as mineral aggregate, base materials, and rock for riprap. The geology unit may use geologic maps, airphoto interpretation or geophysical exploration in locating potential sources of construction materials. Photogeology, one of the new tools of the geologist, is being used to eliminate much arduous fieldwork, with a resultant saving in cost. The geology unit is equipped with a 12-channel seismograph and the most modern resistivity apparatus for geophysical exploration. These methods often provide valuable information to supplement the data obtained by borings, and may effect a saving in cost by reducing the amount of more costly boring exploration.

Construction Control

The construction control subsection of the Foundation Section is concerned with control tests and devices utilized during the actual construction stage of the earthwork portion of the roadway. In the early days of highway building fills were formed by simply dumping successive loads of dirt over the area until the desired height of fill was attained, and the mass was then allowed to settle over a period of time before placing the final surfacing or pavement. As highway designers progressed in their efforts to improve curvature and reduce steep grades, deeper cuts and higher fills were required and settlement became a major consideration. Paving of the road could no longer be deferred until these massive fills had settled and the need for compaction of the soil as it was being placed was apparent. While it was a relatively simple matter to draft specifications requiring layer construction and the use of compacting rollers, control of the work to assure compliance with the specifications and a satisfactory finished product posed a considerably more difficult problem. California pioneered in the field of compaction in 1929 and devised the first highway compaction control test. Following the general pattern initiated by California the majority of road building agencies throughout the United States and in many foreign countries now require all earthwork to be compacted during construction and control their work by compaction tests.

Critical Soils Problem

The compaction of soils requires the forcing together of the individual particles of aggregations into a dense mass by means of rollers or tamping devices. Water in the mass is essential to act as a lubricant between the particles and facilitate their movement. While all types of soils have a certain water content which provides the highest degree of compaction for the particular soil and compacting equipment concerned, some soils are especially critical to an exact amount of water and to the uniform distribution of it throughout the mass. To complicate life for the road building personnel, these critical soils often resist the penetration of applied water and special mixing devices must be employed by the contractor constructing the highway. Soil as excavated from the native ground generally requires additional water for satisfactory compaction, and California requires pressure type water distributors to assist in securing uniform coverage and distribution. Should the soil as excavated be too wet for proper processing, it is necessary to aerate the material to dry it to the correct water content. In addition to determining relative compaction, the compaction test also indicates the approximate water content needed for each soil.

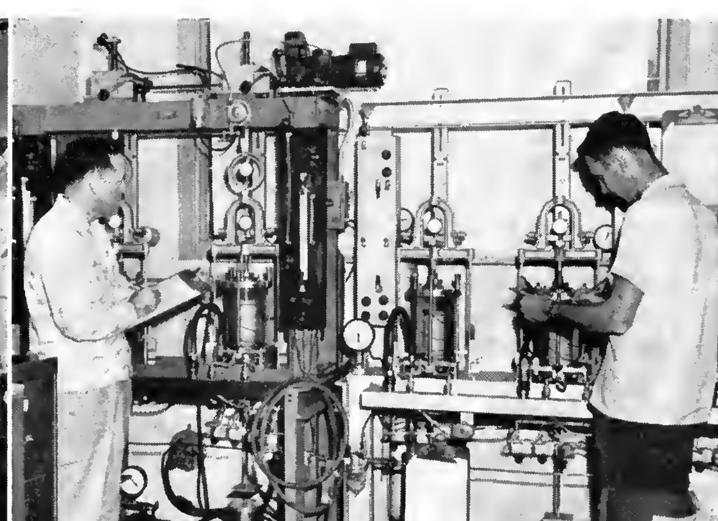
Check Compaction

Specifications stipulate that the fill must be placed and compacted in layers and that each layer must be compacted to the specified relative compaction prior to placing subsequent layers. Field testing personnel check the compaction frequently to disclose any areas not meeting specification requirements.

During the past eight years, compaction equipment manufacturers have produced a wide variety of new design compactors intended to increase production and lower unit costs. The new units are often demonstrated before state representatives and contractors prior to full-scale sales promotion and a series of tests are performed to appraise the effectiveness of the machine. These evaluations are conducted by representatives of the Materials and Research Department under practical working conditions in co-operation with the Construction Department.

Roadbed Sagging

Notwithstanding all efforts to eliminate settlement by rigid compaction control, sags continue to occur occasionally in roadbeds constructed over high fills and raise a question as to whether the fill is compressing within itself or whether the native ground on which it was built is sink-



LEFT—Lever type loading device with consolidometers in place. Data from consolidation test are used in estimating settlement under an applied load, such as embankment. RIGHT—Triaxial compression test for determining shear strength of soils. At left, soil specimen being tested. In chambers on right specimens being consolidated to simulate field loading before testing.

ing under the weight of the embankment. This condition is usually not discernible until several years after construction and long-range studies are necessary to reveal the basic cause of the movement. Such studies have been in progress for the past four years and are presently being expanded to include a wide range of conditions believed to contribute to settlement problems. Obviously, the native ground surface is not accessible for direct observations or measurements of movement after the fill is completed and a remote control type of apparatus is required to indicate any change in the original elevation. A fluid level device has been designed by the Materials and Research Department for this purpose. The standpipe unit is installed on the surface of the existing ground prior to the starting of embankment construction and in such location that it will eventually be under the maximum height and weight of the fill. The indicating unit installed outside of the limits of the fill is connected to the standpipe unit with a copper tube and the system is filled with water. Because it is placed directly on the native ground surface, the standpipe unit will settle exactly the same amount as does this surface and this amount will in turn be denoted by a corresponding lowering of the fluid level in the sight tube of the indicating unit.

Compaction Control Difficult

Construction of modern freeways with wider roadbeds and higher standard of alignment necessitates deeper cuts and higher fills than in the past. Economical construction and safe uninterrupted operation of these freeways make it imperative that the cut slopes and embankments be designed for stability and economy. This can be accomplished only by thorough exploration, analysis, and judicious application of the principles of soil mechanics. Improper design may result in closure of a heavily traveled freeway by landslides or embankment failures.

Continuous development of larger and more efficient earth-moving equipment has resulted in greater construction speed and lower excavation costs.

Unconfined compression apparatus for obtaining the unconfined compressive strength of clay soil

This greater speed has, however, made the control of campaction more difficult. Because present compaction test methods are slow and tedious, sufficient tests are not always made to assure thorough compaction. Embankment settlement due to improper compaction causes distortion of the roadbed, damage to the pavement and possibly failure of the embankment. All possible methods are being investigated to develop a more rapid and simple compaction test procedure.

Due to degradation of aggregates during placement and also after completion of the pavement, pavement failures may occur due to deterioration of aggregates, even though the material conformed to specifications when sampled at the point of delivery. Research studies are in progress to develop better test procedures for evaluating the durability of aggregates, and to identify those which may degrade due to action of traffic, weathering and moisture.

These and numerous other problems are being studied by the Foundation Section. In Materials Engineering, merely to maintain the status quo is to retrogress, and every effort is being devoted to research and development which will produce design methods, control tests and materials specifications necessary to keep pace with the ever-increasing demands on our roads and freeways.

Robert E. McClure Again Named to CHC

Governor Goodwin J. Knight has announced the reappointment of Robert E. McClure of West Los Angeles, publisher of the Santa Monica Evening Outlook, to the California Highway Commission, for a new term ending January 15, 1962.

McClure, a native of Ohio, has lived in California since 1922, and has been connected with the Santa Monica

Commissioner McClure busies himself with document signing at a recent commission meeting

Evening Outlook since 1937. He is widely known in the southern part of the State as a newspaper editor and publisher, novelist and civic leader. McClure has long taken an interest in the highway problems of his section of the State, campaigning actively for more highways to serve the western section of Los Angeles County and for a freeway to the coast. He has been active on the Highway Committee of the Santa Monica-Ocean Park Chamber of Commerce. He is a graduate of Yale University and a veteran of World War I. He originally was appointed to the Highway Commission on January 15, 1954.

California Highways . . . 1957

> *The report which appears on Pages 25 through 40 basically covers the 1956-57 Fiscal Year, but has been revised to include important developments extending to December 31, 1957. Copies of this report may be obtained upon request.*

An Annual Report

By G. T. McCOY, State Highway Engineer

THE CALIFORNIA way of life and the future of the State's expanding economy are closely tied to motor transportation and a modern system of roads, streets and highways.

With more cars and trucks than any other state, California's need for bigger and better highways touches the daily life of every citizen—and the need becomes more critical as the population and traffic increase.

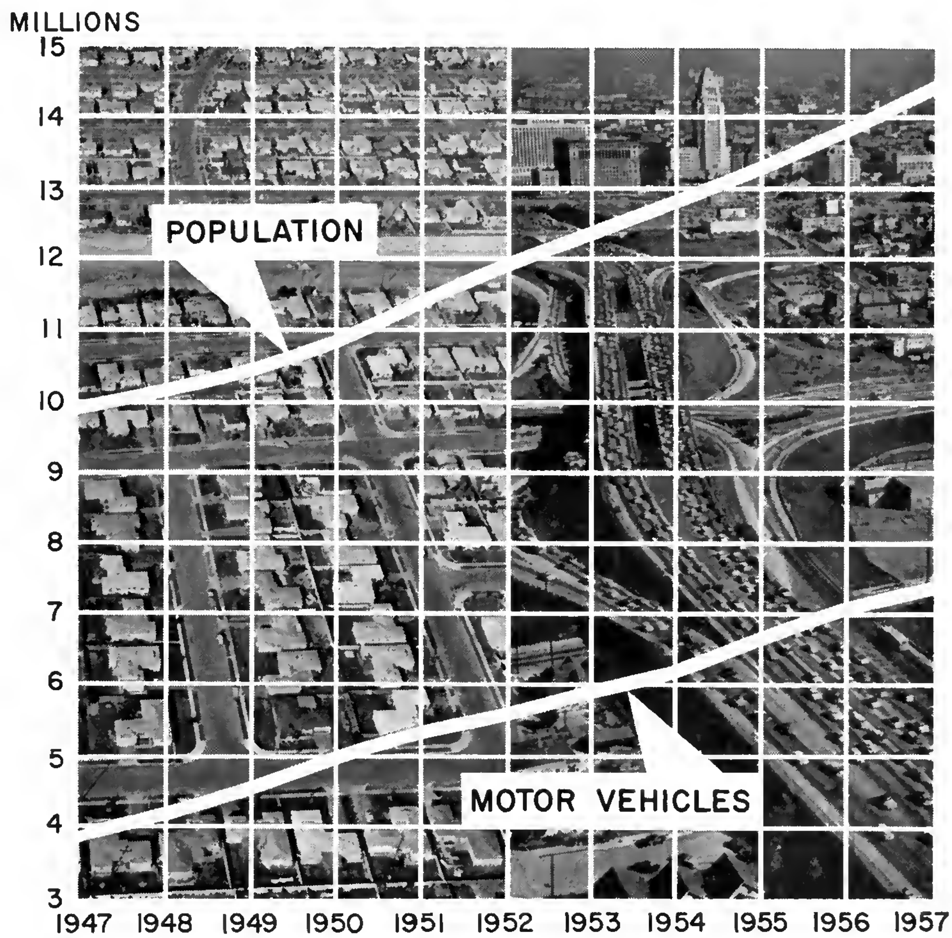
Today, California has 14,445,000 residents and nearly 7,500,000 motor vehicles. The population is expected to be 16,000,000 by 1960 and 20,000,000 by 1970. A corresponding, if not greater, increase in the number of motor vehicles is also expected.

To meet the challenge of this soaring growth, Californians are engaged in an extensive and carefully planned program of highway improvement which has already resulted in major advances.

California now has the greatest mileage of toll-free multilane divided highway in the United States, and its entire network of state highways has been described by competent observers of the national scene as "the best in the Country."

A favorable political and fiscal atmosphere has been provided by the California Legislature to make this progress possible.

The Legislature, on the basis of various studies, has provided financing through highway user taxes to help meet the increasing needs. At the same time it has continued to delegate to the California Highway Commission the authority and responsibility to determine highway routings and to allocate construction funds, the latter subject to certain statutory geographical controls.



These time-tested legislative policies, not enjoyed in many other states, have permitted orderly, steady progress in state highway development—"advance planning and continuity of fiscal policy," as the Legislature expressed it in the Streets and Highways Code.

The day-to-day and year-to-year administration of the state highway program and related functions is carried on by the California Division of Highways, a unit of the State Department of Public Works. Activities of the division cover the whole broad area of highway work from spectacular new freeway construction to routine maintenance.

State highway development and operation during the fiscal year ending June 30, 1957, are recorded in the Eleventh Annual Report to the Governor by the Director of Public Works. The report contains detailed financial tabulations, construction contract statistics and other data. (Some of the material in that report, together with other more recent data, is included here.)

Notable progress was made during the year toward the still distant goal of an adequate highway system for California—for example, by the end of 1957, 2,180 miles, or about 15 percent of the State Highway System, were completed, under construction or advertised for bids as multilane divided highway.

Travel in California amounted to a total of about 60,000,000,000 vehicle miles in 1957 on the approximately 136,000 miles of roads and streets in the State. About 45 percent of this travel was on the 14,000 miles of state highways.

Ever-increasing traffic volumes have resulted in serious deficiencies on many of these streets and roads, including state highways.

Traffic congestion and accidents are the principal villains, with many problems involved:

Thousands of miles of two-lane roads should have four or more lanes and dividing strips; alignment of many routes is antiquated and unsuitable for today's vehicles; maintenance cost is excessive on some older sections; bridges and traffic lanes in numerous instances are too narrow, and dangerous cross traffic chokes travel throughout the State.

This aerial photograph, taken just east of Los Angeles Civic Center, shows recent, current and coming freeway construction in one view. Traffic on the Santa Ana Freeway moves along smoothly under the bridges which carry the Long Beach Freeway. The section of the Long Beach Freeway extending upward (south) from the interchange was recently opened to traffic, while construction is scheduled to start in 1958 on the northward extension for which preparation is evident at bottom left.

Construction Expenditure, 1956-57

A total of $336,501,116 was allocated for construction and rights of way on state highways in the 1956-57 Fiscal Year. Comparable amounts are being expended in the current (1957-58) fiscal year, and the State Highway Budget for 1958-59 provides $337,000,000 for construction and right-of-way purposes. Even greater expenditures are needed in the future if California is to keep from losing ground in its battle against mounting highway deficiencies.

Californians pay 9 cents a gallon in gasoline taxes, of which three cents is a federal tax. Four cents per gallon goes for state highways, one and three-eighths cents for county roads, and five-eighths of a cent for city streets. This tax is the main source of revenue. Other user taxes include use fuel (diesel) taxes, transportation taxes and miscellaneous motor vehicle and registration and weight fees. (Revenue sources and distribution for road purposes are depicted in the accompanying charts.)

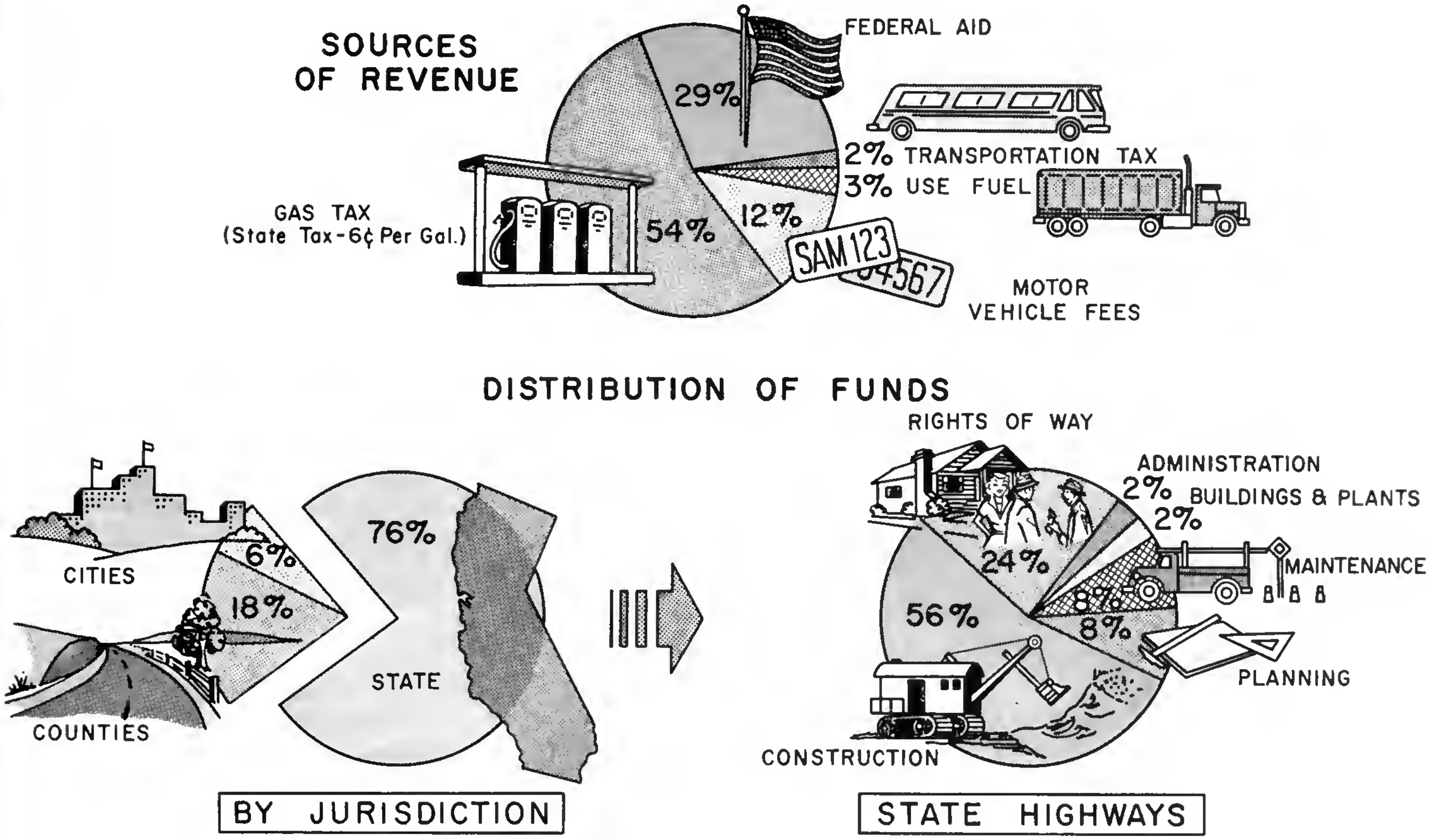
Federal apportionments to California for state highways were sharply increased by the Federal Highway Act of 1956. A total of $102,000,000

THE ENGINEER'S ANSWER

With motor vehicle registration now over 7,000,000 in California, it has been estimated that by 1975 our roads will be used by more than double the present number of cars and trucks. So we must build highways not only for the traffic we now have, but we must also anticipate the huge numbers of vehicle movements on our highways in the years ahead.

The engineer's answer to the problem of moving all of this traffic is the "FREE-way." That is to say, free of oncoming traffic, free of crossing traffic, free of traffic moving at random onto the highway from the side of the road. A full freeway can do these things because it allows no left turn movements, and it limits access to strategic points where traffic can enter it or leave it safely. Intersecting roads are carried over or under the main highway.

THE STREET, ROAD AND HIGHWAY DOLLAR IN CALIFORNIA



was allocated in 1956-57, $134,000,000 for 1957-58, and $153,000,000 for 1958-59. In addition to these amounts for state highways, federal funds also were allocated each year for roads included in the Federal Aid Secondary System. Under California law, nearly all F. A. S. funds are expended on county roads.

According to the statutes, 55 percent of the state highway construction money available in any fiscal year must be allocated to the 13 southern counties, with the remaining 45 percent going to the northern 45-county group. A further provision guarantees each county a minimum percentage of construction funds, during a specified period of years.

The California Highway Commission allocates funds for highway projects in the two groups of counties after considering all available data, including studies of traffic volumes, accidents, population changes and road conditions and other factors to determine the most needed improvements.

Highway Construction

California's 1956-57 record of highway construction and development was impressive. Improvements of various types, from new freeway construction to spot corrections, covered a record total of 2,317 centerline miles.

Broken down, this total represents approximately 1,640 miles of paving and surfacing, 640 miles of seal coating, and 30 miles of grading, as well as numerous bridge, traffic signal and illumination and other miscellaneous projects.

In 1947 there were about 480 miles of divided highway with four or more lanes. Ten years later, on June 30, 1957, there were 1,728 miles of this type of highway, including both freeways and expressways, and an additional 383 miles under construction. By the end of the calendar year the totals were 1,810 miles in operation and 358 under construction.

The heavy emphasis in recent years has been on freeways because of their proved ability to handle more traffic with greater safety than any other type of highway facility. This is possible through the control of access, the elimination of cross traffic and left turns at grade, and the separation of opposing traffic.

A total of 467 miles of full freeway was in operation at the end of 1957 with 215 miles under construction. In addition, most of the State's 926 miles of expressways, which have some intersections at grade, are designed for future conversion to freeway status. Also constructed in recent years have been a number of miles of "two-lane freeways" on which two lanes are built initially, with access control, right-of-way, and design provisions made for an ultimate freeway.

In 1957, as during the 10 preceding years, the state highway construction program resulted in improvements which are readily evident in all areas of California.

Except for a few short sections, U. S. Highway 99 is now four-lane divided highway over the 360 miles between San Fernando and Sacramento. Projects among those completed in 1957 on this route include freeway sections in rural portions of Kern and Tulare Counties and through the Fresno and Atwater urban areas.

On US 99 north of Sacramento current and recently completed construction will provide almost 13 miles of continuous expressway in the Sacramento River Canyon north of Shasta Lake.

North of San Francisco U. S. Highway 101 was completed as a divided highway between the Golden Gate Bridge and Santa Rosa, and further north construction began in 1957 on the first unit of the long-anticipated Redwood Freeway in Humboldt County.

In the San Francisco region large scale advances have been made in the major cities and on freeway arteries serving adjacent population centers.

Construction completed or under way in 1957 on the Eastshore Freeway, together with projects budgeted for 1958-59, will mean completion of this important freeway between Vallejo and Los Gatos, a distance of 75 miles.

Recently completed in the City of Oakland was the Cypress Street Viaduct, a 1.3-mile double-deck structure with separate levels for opposing freeway traffic. It is California's first double-deck freeway.

In San Francisco construction is proceeding on the elevated Central Freeway and on the double-deck structure which will carry the Embarcadero Freeway along the waterfront.

Traffic on the Bayshore Highway now has the use of 27 continuous miles of freeway as a result of the 1957 completion of the link between Candlestick Point in San Francisco and Sierra Point in San Mateo County. This new freeway section is built on a large earth fill across the open water. Current and budgeted projects will carry the Bayshore Freeway well into Santa Clara County.

Particularly rapid progress is being made toward the development of U. S. Highway 40 to freeway standards between Oakland and the Nevada state line.

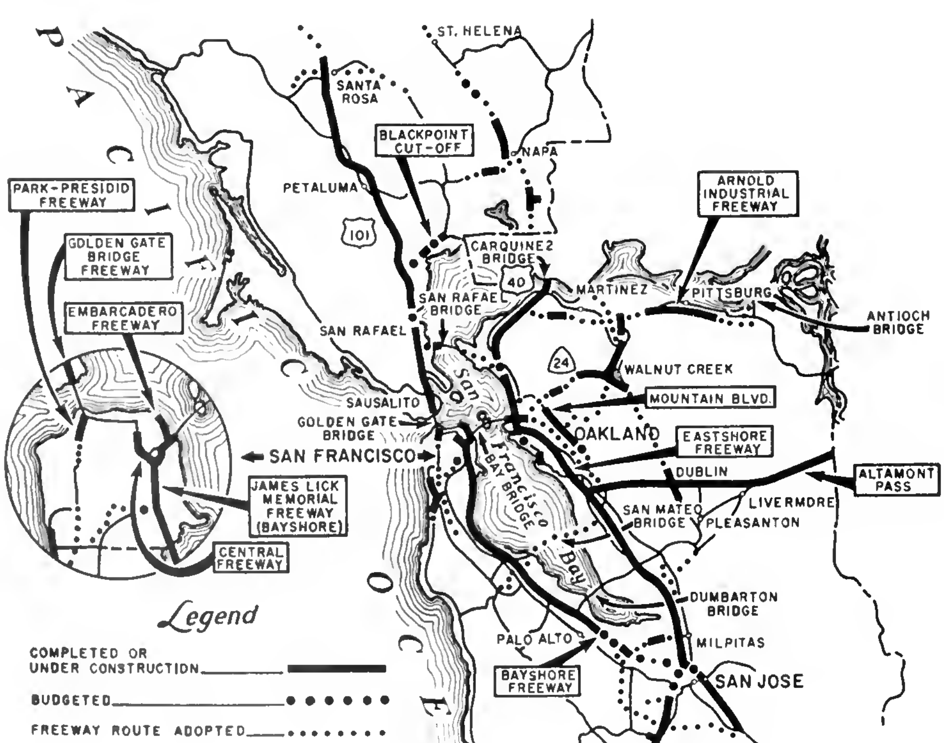
Now under construction on this route is the parallel Carquinez Bridge, with freeway approaches in Contra Costa and Solano Counties. This toll project, due to be completed in late 1958, will eliminate a series of traffic bottlenecks north of San Francisco.

East of Sacramento, particularly in the rugged terrain of the Sierra Nevada Mountains, construction is in progress or budgeted on nine major freeway and expressway projects on US 40. Five projects, with an estimated total cost of $34,650,000 are contained in the 1958-59 State Highway Budget. When these current and budgeted projects are finished, there will be about 83 miles of freeway or expressway in operation on the 117 miles of US 40 between Sacramento and the Nevada state line.

On US 101 between San Francisco and Los Angeles, several new sections of freeway and expressway were completed and others placed under contract, particularly in Monterey, San Luis Obispo and Santa Barbara Counties.

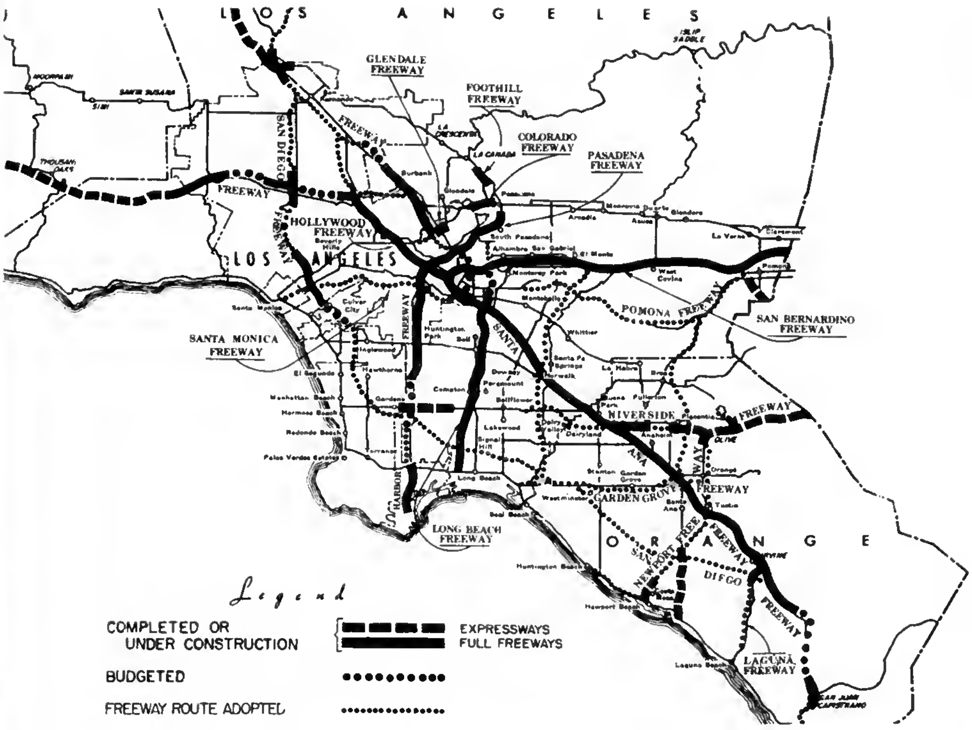
In the Los Angeles area 24.5 miles of freeway were completed in 1957, and nearly 60 miles were under construction at the end of the year. The 1958-59 State Highway Budget provides for additional advances in the continuing Greater Los Angeles freeway development program.

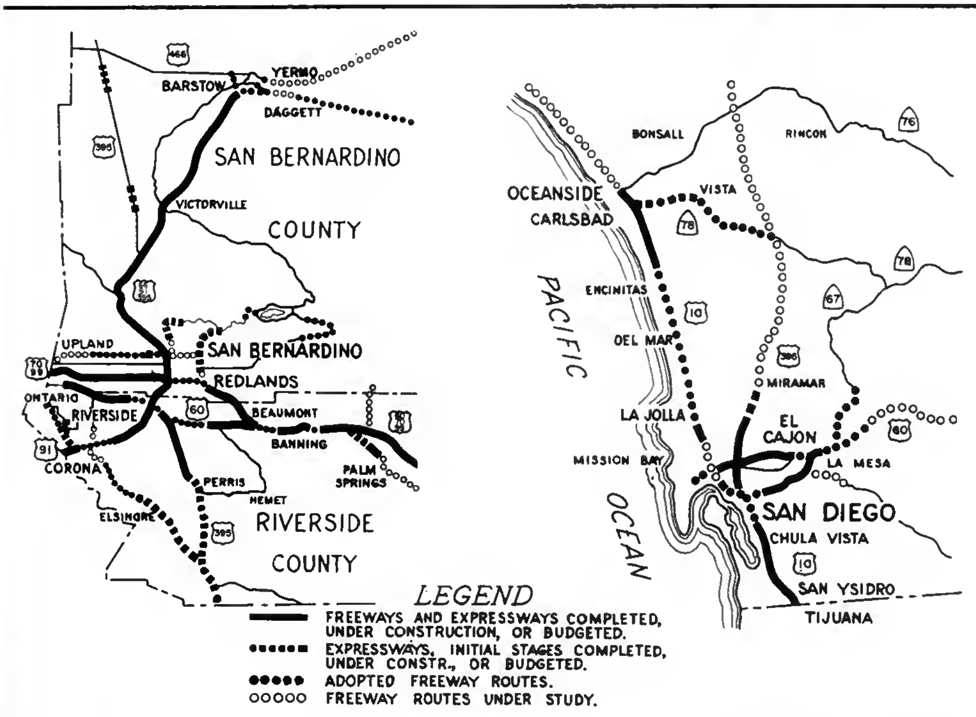
During 1957 the last gap was closed in the San Bernardino Freeway (US 70-99) between Los Angeles and east of Ontario, and to the east further freeway construction and conversion of the existing expressway to full freeway are continuing.

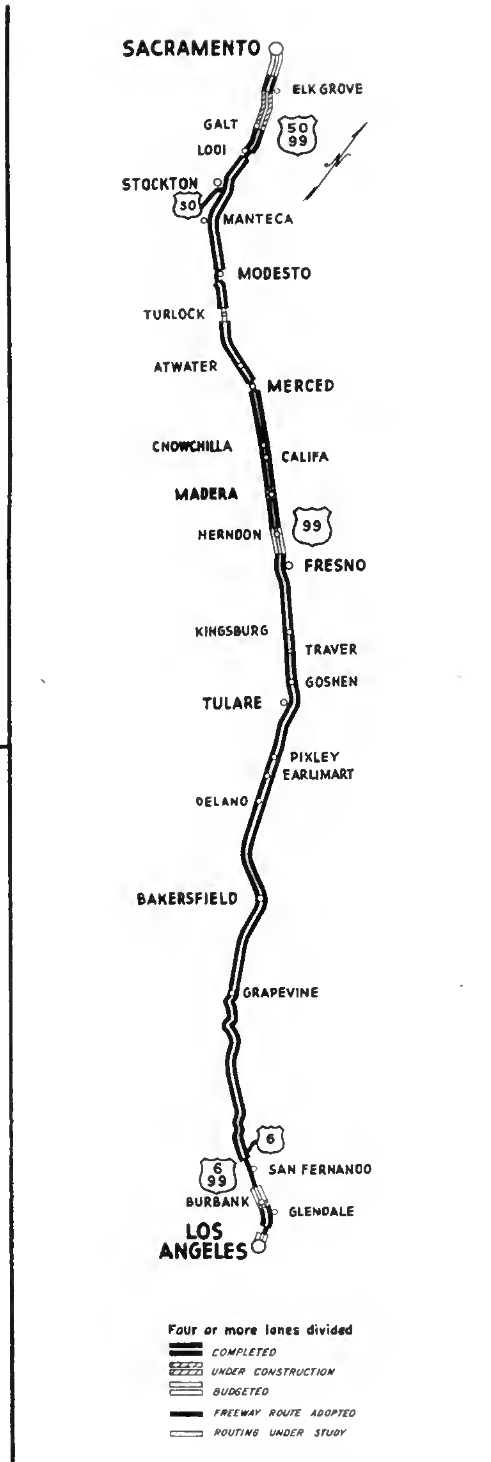


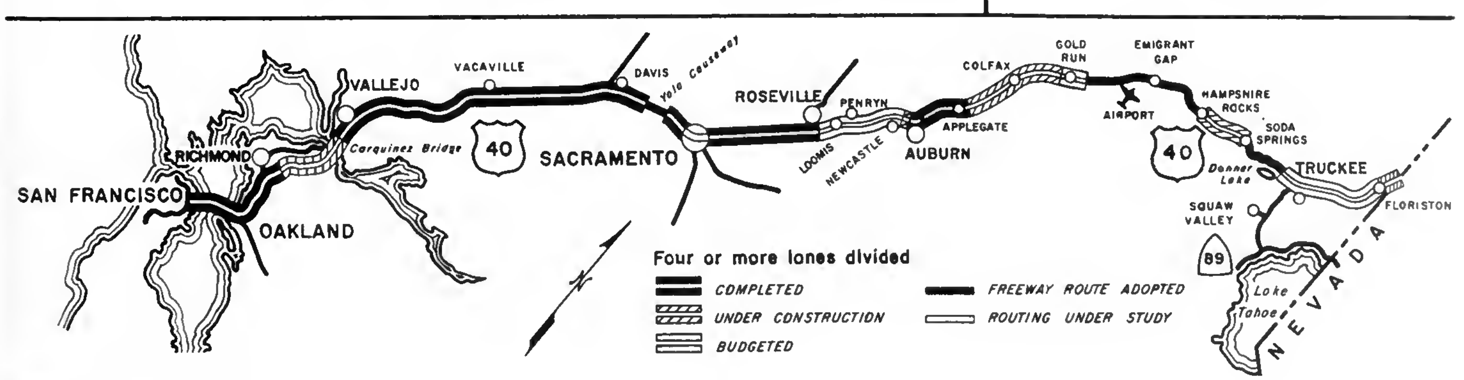
FREEWAY NETWORKS

The maps on these pages illustrate the expanding freeway and expressway networks in the San Francisco, Los Angeles, San Bernardino-Riverside and San Diego areas as well as the status of two important routes, US Highway 99 between Los Angeles and Sacramento, and US Highway 40 from the San Francisco Bay area to the Nevada state line. Progress on these and other routes is following a long-range plan of orderly development tailored to priority of needs and availability of funds.


LOS ANGELES
GLENDALE FREEWAY
FOOTHILL FREEWAY
COLORADO FREEWAY
PASADENA FREEWAY
HOLLYWOOD FREEWAY
SAN DIEGO
LOS ANGELES
POMONA FREEWAY
SAN BERNARDINO FREEWAY
SANTA MONICA FREEWAY
SANTA ANA
RIVERSIDE FREEWAY
GARDEN GROVE FREEWAY
HARBOR
LONG BEACH FREEWAY
ORANGE
NEWPORT FREEWAY
SAN DIEGO FREEWAY
LAGUNA FREEWAY
Legend
COMPLETED OR UNDER CONSTRUCTION
EXPRESSWAYS
FULL FREEWAYS
BUDGETED
FREEWAY ROUTE ADOPTED


BARSTOW
YERMO
DAGGETT
SAN BERNARDINO COUNTY
VICTORVILLE
UPLAND
SAN BERNARDINO
REDLANDS
ONTARIO
RIVERSIDE
BEAUMONT
BANNING
CORONA
PERRIS
HEMET
PALM SPRINGS
ELSINORE
RIVERSIDE COUNTY
BONSALL
RINCON
OCEANSIDE
CARLSBAD
VISTA
ENCINITAS
PACIFIC
DEL MAR
MIRAMAR
LA JOLLA
EL CAJON
MISSION BAY
LA MESA
OCEAN
SAN DIEGO
CHULA VISTA
SAN YSIDRO
TIJUANA
LEGEND
FREEWAYS AND EXPRESSWAYS COMPLETED, UNDER CONSTRUCTION, OR BUDGETED.
EXPRESSWAYS, INITIAL STAGES COMPLETED, UNDER CONSTR., OR BUDGETED.
ADOPTED FREEWAY ROUTES.
FREEWAY ROUTES UNDER STUDY.


SACRAMENTO
ELK GROVE
GALT
LODI
STOCKTON
MANTECA
MODESTO
TURLOCK
ATWATER
MERCED
CHOWCHILLA
CALIFA
MADERA
HERNDON
FRESNO
KINGSBURG
TRAVER
GOSHEN
TULARE
PIXLEY
EARLIMART
DELANO
BAKERSFIELD
GRAPEVINE
SAN FERNANDO
BURBANK
GLENDALE
LOS ANGELES
Four or more lanes divided
COMPLETED
UNDER CONSTRUCTION
BUDGETED
FREEWAY ROUTE ADOPTED
ROUTING UNDER STUDY


VALLEJO
VACAVILLE
DAVIS
Yolo Causeway
ROSEVILLE
PENRYN
COLFAX
GOLD RUN
EMIGRANT GAP
HAMPSHIRE ROCKS
SODA SPRINGS
AIRPORT
APPLEGATE
AUBURN
LOOMIS
NEWCASTLE
RICHMOND
Carquinez Bridge
SACRAMENTO
SAN FRANCISCO
OAKLAND
Donner Lake
TRUCKEE
FLORISTON
SQUAW VALLEY
Lake Tahoe
NEVADA
Four or more lanes divided
COMPLETED
UNDER CONSTRUCTION
BUDGETED
FREEWAY ROUTE ADOPTED
ROUTING UNDER STUDY

Contracts which were under way in 1957 on the Long Beach Freeway will complete this route from the Santa Ana Freeway to the Pacific Coast Highway in Long Beach.

Additional mileage also was completed in 1957 on the Harbor Freeway. When current and budgeted projects on this route are finished, there will be only six miles still to be constructed.

The 1958-59 State Highway Budget provides funds for the extension of the Golden State Freeway (US 6-99) through and north of Burbank. This freeway job will connect with current construction which in turn connects with the section between the Los Angeles River and Alameda Avenue opened in 1957.

The 1958-59 budget also provides funds to close the present gaps in the Ventura Freeway (US 101) west of North Hollywood.

This work on the Ventura Freeway, together with other current, budgeted and completed freeway projects on US 101 to the south (Santa Ana and San Diego Freeways) will mean 80 miles of continuous full freeway from Calabasas, through the City of Los Angeles, to San Juan Capistrano.

The projects referred to in the preceding paragraphs represent only a small portion of the work which has recently been completed or which is now budgeted or under construction.

Not covered is extensive construction on less-traveled highways which are nevertheless important arteries in rural and scenic areas. Work on these routes during the year resulted in many miles of new highway, completed reconstruction, realignment and other improvements throughout the State.

All these projects, whether minor spot corrections, improvements on conventional two-lane routes, or major freeway construction, are contributing to relief from congestion and hazard in the face of rapidly growing traffic volumes.

STATE HIGHWAYS

The State Highway System includes all roads which have been designated "state highways" by the Legislature or by constitutional amendment. The first state highway, designated in 1895, was the Lake Tahoe Wagon Road from Placerville over the Sierra.

The Highway Bond Act of 1909 provided for 3,082 miles. Periodic additions brought the total to 7,300 miles in 1932. The 1933 Legislature practically doubled the mileage, making the total nearly 14,000, a figure which has since remained relatively constant.

Legislative designation of state highways usually consists of naming only the termini, with possibly a few intermediate points. Adopting the general location is one of the duties of the California Highway Commission.

Planning

The division's planning department prepares plans and estimates on projects in advance of the time when construction funds actually become available.

This advance planning program has enabled the Highway Commission to put to immediate use all money made available for state highway purposes.

Rapid utilization of funds has meant huge savings to Californians due to early completion of projects in an era of rising construction costs. It also has meant savings in fuel and upkeep to the motorists who enjoy early use of the improved highways, and savings in life and limb as well.

An example of the prompt use of funds is provided by the Commission's record of committing federal highway aid to specific projects.

The Bayshore Freeway link between Candlestick Point in San Francisco and Sierra Point in San Mateo County was placed in operation in 1957. The new freeway section (left) is built on an earth fill across open water at the edge of San Francisco Bay. Below is a photograph taken in 1954 during an early stage of the project.

In 1956 the Federal Highway Act of that year increased California's share of federal aid by about $62,000,000. Thanks to a backlog of planned and designed projects, the entire amount was promptly placed under contract.

Even more impressive, California was the first of all the states to commit its 1957-58 federal apportionment. This $134,000,000 allotment was translated into specific projects by June, 1957, before the fiscal year had even started. The $153,000,000 federal apportionment for state highways for the 1958-59 Fiscal Year was made in August, 1957; by the end of the calendar year 55 percent of it had already been programed on specific approved projects, with additional projects pending approval which would more than take up the remaining 45 percent.

Local citizens view maps, query engineers and discuss proposed route alternates at public meetings called by the Division of Highways. Full public discussion of proposed freeway routes is a long-standing policy of the California Highway Commission and the State Highway Engineer.

Freeway Raute Discussions

One big reason for the effectiveness of California's planning program is the early determination of freeway routes by the Highway Commission. In most instances routings are adopted several years before construction funds are available.

Freeway routes are adopted by the commission only after long and extensive studies by Division of Highways engineers and after public meetings at which local views are offered and thoroughly discussed, and later considered by the division in its recommendations and by the commission in its determinations. A booklet entitled "Freeway Facts," distributed at these meetings, explains the route selection procedure. (Copies of this booklet are available on request).

The Cypress Street Viaduct in Oakland, first double-deck freeway in the State, was completed and opened to traffic in 1957. It is a unit of the Eastshore Freeway.

Full public discussion of proposed freeway routes is a long-established policy of the Legislature, the Highway Commission and the State Highway Engineer.

Special emphasis was given this phase in 1956-57. Ninety formal public meetings regarding routings were held by the Division of Highways. In addition, there were several hundred preliminary informational meetings and map displays.

The Highway Commission frequently holds full-scale, official public hearings in the vicinities where new freeway routes are being considered. These hearings were scheduled either at the request of local authorities or on the Commission's own initiative.

Freeway routes covering 551 miles were adopted during the fiscal year, and the total mileage of declared freeways on the State Highway System was 3,894 on June 30, 1957. By the end of the calendar year, it was 4,205 miles.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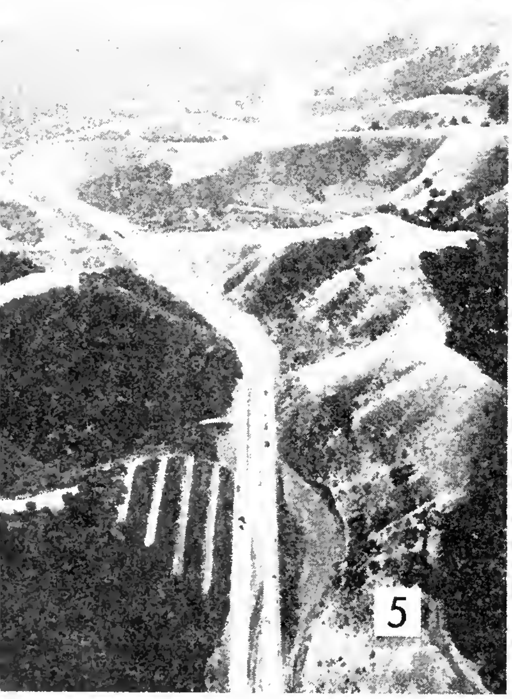
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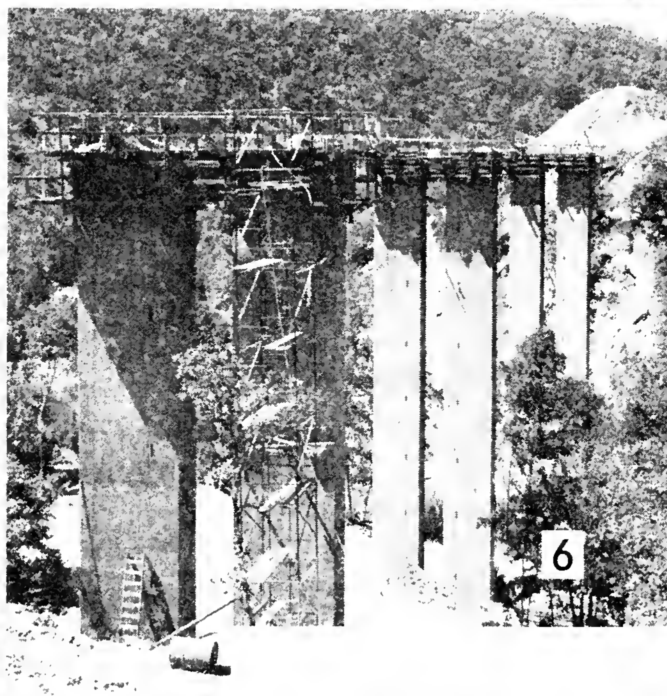
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1. Victorville Bypass on US
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2. New section of San Dieg
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4. US 99 now carries traffi
Valley center, on a full fr
5. New section through Du
lanes Oakland to Tracy.
6. Piers for bridge across E
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7. At Dyerville on US 101
contractor used donkey e
8. Alto interchange on US
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9. Cypress Street double-lev
Freeway with S. F.-Oakl
10. Construction near Colfax
making US 40 a divided
11. Newest section of Gold
Western Avenue Intercha
12. On east side of Sierra N
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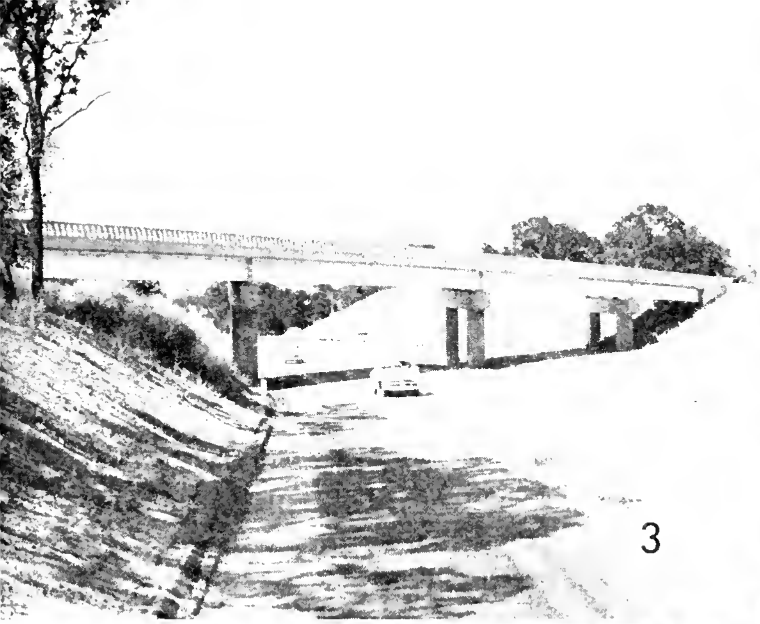

h grading in progress for ex-
ve Desert to Barstow.

ay extending southward from
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elocation of US 101 south of
y.

Fresno, major San Joaquin

yan makes US 50 now four

of Russian River on Highway
reservoir, Mendocino County.

d Highway freeway project,
d cables to pull earth movers.

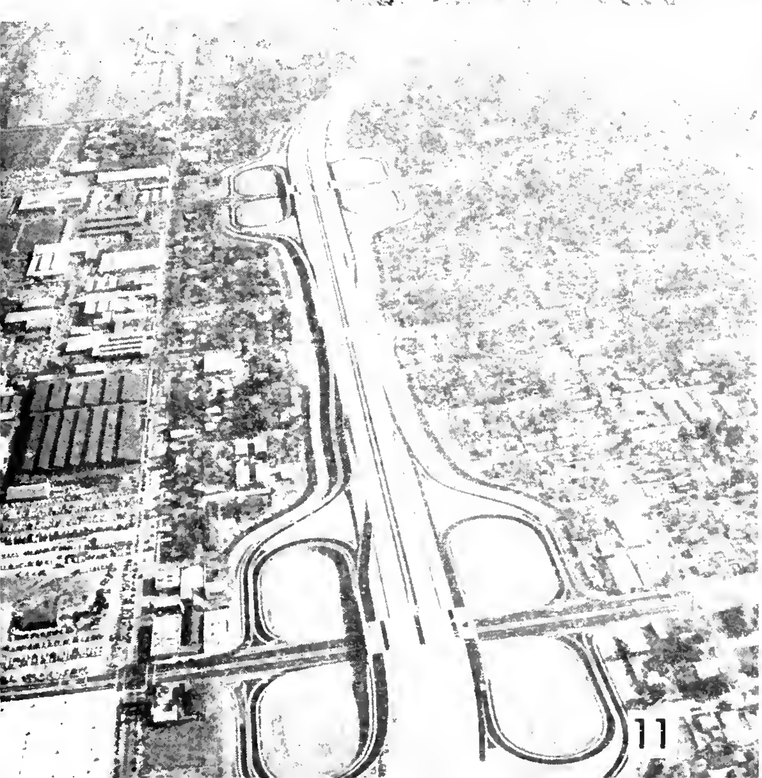
of San Rafael; new Richard-

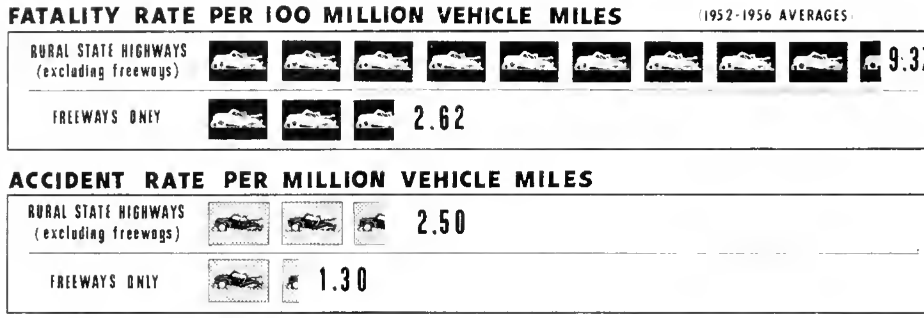
ay viaduct connects Eastshore
Bridge Distribution Structure.

County; another step toward
across Sierra Nevada.

Freeway in Glendale above
ing toward Griffith Park.

Sherwin Grade section of US
n canyon in lower right.





Improved Methods

The stepped-up program of highway construction in California has been carried on successfully despite a nationwide shortage of engineers. This shortage has been overcome in large measure in this State through the use of new and improved methods, procedures and equipment.

Utilization of such improved techniques and equipment was increased in 1956-57.

Electronic computers were put to greater use in the tabulation of traffic data and other statistics, in the calculation of traverses in surveying, in the computation of earthwork quantities, and in making structural calculations in bridge design.

California also has expanded its use of aerial photography in connection with highway location, planning and design. Most preliminary surveys are now carried on by this timesaving photogrammetry method, with ground survey crews required only for establishing aerial control points and for checking.

Long-range Planning and Surveys

Several long-range surveys were in progress or completed during 1956-57 for incorporation in broad areas of highway planning.

Five major studies of this type were required by the Federal Aid Highway Act of 1956. These covered cost estimates for interstate highway needs; data on vehicle sizes and weights; possible reimbursement for previously constructed interstate highways; highway safety; and various phases of federal highway taxation.

Data developed in another long-range survey will be used in formulating a statewide system of freeways and expressways without regard to State, city or county jurisdictions. This study was required by Senate Concurrent Resolution 26, adopted by the State Legislature in 1957.

Traffic Flow—Accidents

The value of the modern freeway in saving life and limb, as well as in carrying large volumes of traffic, is once more demonstrated by the latest accident record figures.

The overall accident rate on rural state highways for the calendar year of 1956 was 2.60 per million vehicle miles; on full freeways, the rate was 1.25, despite the fact that the average daily traffic on freeways was more than 10 times higher. The average accident rates for the five-year period from 1952-1956, inclusive, were 2.50 per million vehicle miles on conventional highways and only 1.30 on full freeways.

Comparative rates on fatal accidents are even more impressive in favor of freeways. In 1956 the fatality rate on rural state highways was 9.47 killed per 100 million vehicle miles of travel; on full freeways the rate was 3.06. According to this record, the life of a motorist on a modern freeway is more than three times as safe per mile of vehicle travel as on conventional highways. The fatality averages for the 1952-56 period were 9.37 per 100 million vehicle miles on conventional highways and 2.62 on full freeways.

LEFT—Applying traffic stripes in connection with tests of various paints, part of the continuous program in materials research. RIGHT—The Equipment Department often modifies or adapts equipment to meet special requirements. This self-loader was installed on the truck by Highways Shop personnel for use in roadside cleanup work.

The average daily traffic on rural state highways in 1956 was 3,804 vehicles. Traffic on rural and urban freeways in operation during 1956 averaged 44,150 vehicles a day.

Heaviest travel in the State was recorded on a section of the Hollywood Freeway in downtown Los Angeles, which carried more than 190,000 vehicles a day.

Snow removal in the passes of the Sierra Nevada Mountains is a difficult job handled each winter by the division's maintenance men. Here a rotary plow chews into a high snow bank on US Highway 40 near Donner Summit and deposits the snow on the far side.

Roadside Development and Erosion Control

During 1956-57 plans were prepared on 32 roadside development, landscaping or functional planting projects. In addition, on all construction contracts for projects situated in erosive soil areas plans were developed for basic erosion control planting.

Large quantities of various kinds of plants, shrubs and trees were used, including approximately 8,500 trees, 145,000 shrubs and more than 5,000,000 ground cover plants.

In 1957 the Highway Commission, in response to expressions of the Legislature, adopted a new policy calling for a moderate increase in freeway landscaping in the future. The budget for 1958-59 provides approximately $3,000,000 for both landscaping and functional planting projects.

Maintenance

Maintenance is an important and constant part of the work of the division, and California's varying climate and topography dictate a program of wide scope.

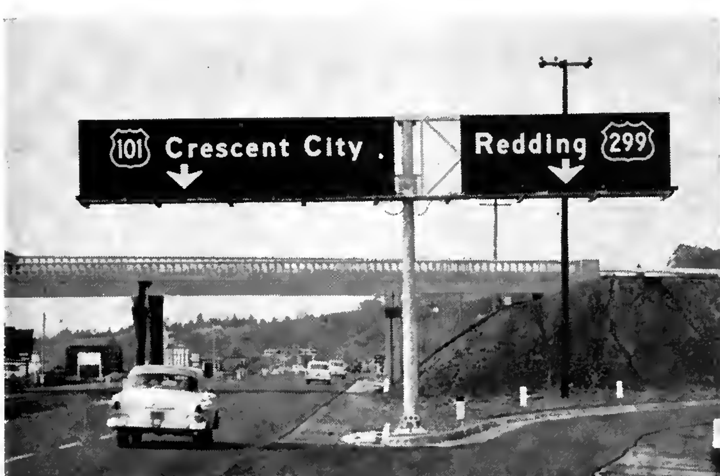
Equipment and personnel are required for diverse tasks ranging from difficult winter snow removal in the high Sierra to the regulation of electronic traffic signals in many cities.

Cleanup and repair after winter storms is an annual maintenance chore. Care of roadside trees and landscaped highway sections is another duty. No small task, also, is picking up after litterbugs.

These jobs, together with constant patching, sealing, painting, spraying, shoulder maintenance, and various specialized tasks such as posting of warning and directional signs, make up much of the work of the division's maintenance crews.

To better co-ordinate its broad, statewide activities and keep up-to-the-minute tab on road conditions, the maintenance department has developed a system of radio communication which at the end of the fiscal year included 159 radio stations, 13 microwave stations and 700 mobile units throughout the State.

Weather, a dominant factor in the maintenance of highways, favored the operations of the maintenance organi-



Traffic engineers strive for maximum legibility in all types of traffic signs. Illuminated overhead signs such as the one pictured during the day (left) and at night (right), are used extensively on highways throughout the State.

zation during 1956-57. Road closures due to storms and other disruptions, such as forest fires and earthquakes, were held to a minimum. The total expenditure for maintenance work during the year was $27,240,234.

Equipment

Equipment maintained by the Division of Highways ranges from passenger cars and highway striping devices to motor graders and a fleet of 40 rotary snowplow units mounted on four-wheel-drive trucks.

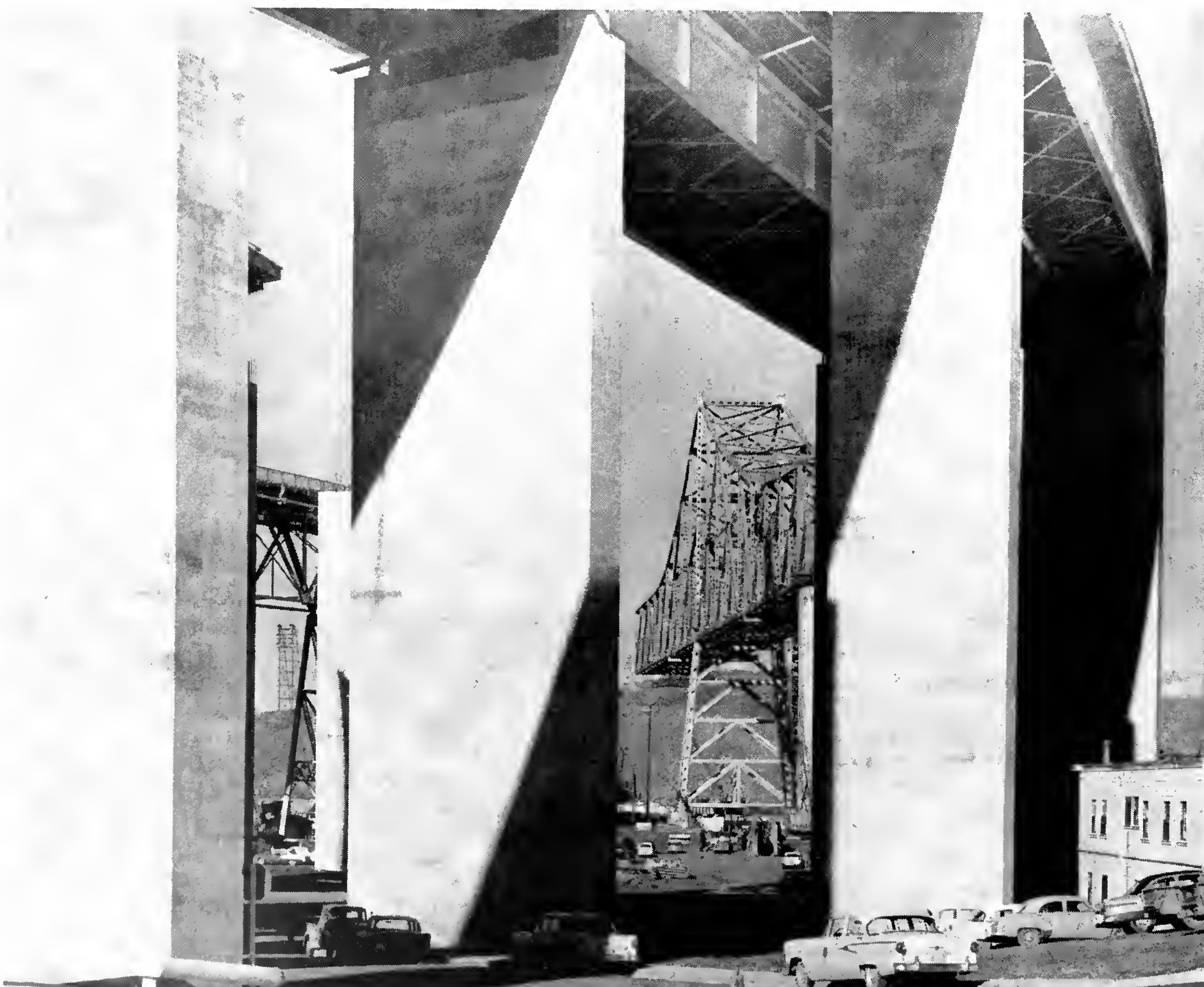
The accelerated highway program has resulted in increases in the Equipment Department's regular activities involving the procurement, repair and administration of major equipment used for highway maintenance. It also has meant increases in other activities such as the construction of experimental equipment to fill special needs and the modification of standard units to better meet specific requirements.

Most of the district shops have been enlarged in the past five years, and new shops, incorporating modern repair facilities, were completed during the fiscal year in Bishop, Fresno, and San Luis Obispo. Improvements also were made at the Eureka and San Diego shops.

Materials and Research

Two of the principal phases of Materials and Research Department activity are the testing of materials to be used in highway construction, and research aimed at developing improved use of materials and better construction methods.

This work is divided between the Headquarters Laboratory in Sacramento, four branch laboratories located in Los Angeles, Berkeley, Santa Maria and Bakersfield, and individual laboratories in each of the 11 state highway districts.



Construction is progressing on the parallel Carquinez Bridge which will connect with freeway sections now being built on US Highway 40 northeast of Oakland and through Vallejo. The bridge is one of several major projects which are under construction or budgeted on this interstate route between Oakland and the Nevada State Line. In view (center) between the giant piers which support approach roadways is a portion of the superstructure of the new bridge.

The district and branch laboratories for the most part are equipped to inspect and test various highway construction materials and carry on required special investigations. Additional testing, plus research and development work, is carried on at the Headquarters Laboratory in Sacramento.

Studies and research of the department involve investigations of such subjects as the design of roadways on soft foundation soils, the fatigue resistance of bituminous pavements, the resiliency of soils, volume changes in concrete, traffic paints and protective coatings, and the properties of prestressing steel and prestressed concrete.

Work on a new Division of Highways Materials and Research Laboratory Building is now under way in Sacramento and is expected to be completed in the spring of 1958. The new building will centralize the Headquarters Laboratory activities which are now carried on at four locations in the city.

Bridges

The Bridge Department, with its own facilities for design, construction, operation and maintenance, is responsible for all structures on state highways.

These include elevated freeways, traffic interchanges, overcrossings and undercrossings, and highway-railroad separations, as well as bridges over rivers, streams and other bodies of water.

The Bridge Department also supervises the operation of the state-owned toll bridges. Largest of these is the San Francisco-Oakland Bay Bridge, which carried a total of 33,751,448 vehicles in 1956-57.

The 1956-57 budget contained funds for construction, widening or strengthening of structures on the State Highway System at an estimated cost of $56,552,000.

Most spectacular of the current bridge projects is the Carquinez Bridge in Contra Costa and Solano Counties. This large scale project is financed by a $46,000,000 bond issue authorized by the California Toll Bridge Authority.

Construction of a freeway approach to the bridge in Contra Costa County involves the largest known highway cut in the history of road construction. The "Big Cut" will require the excavation of more than 9 million cubic yards of earth. By June 30, 1957, the contractor had completed excavation of nearly 7 million cubic yards.

At the end of the year nearly all phases of the bridge and approach construction were up to expected schedules. Provided normal weather and other factors prevail, the estimated date for opening the new bridge to traffic is December, 1958.

Federal aid secondary county road projects are planned by the county and in most instances constructed with county supervision following review and approval by the Division of Highways. One large-scale 1957 FAS project was this improvement and interchange on the Alfred Harrell Highway near Bakersfield, Kern County.

Right-of-way

A total of 9,391 right-of-way transactions were concluded in 1956-57. Of these, 97.16 percent were negotiated settlements with property owners; in only 2.84 percent of the cases was it necessary to complete court proceedings in eminent domain. Money expended for rights-of-way, including administration, amounted to $130,416,963.

One reason for this success in concluding amicable negotiations is the division's policy of paying fair market value for required property. In dealings with right-of-way personnel owners can expect to receive the same amount for their holdings as they would from any other buyer under normal market conditions.

The methods and policies of the right-of-way department are outlined and explained in the booklet "14 Million People Want My Property," which is mailed to affected property owners before their property is appraised. (Copies of this booklet are available on request.)

Acquisition of rights-of-way in California is expedited in some cases by a special fund which has been authorized by the Legislature.

This $30,000,000 revolving fund has been set up for the advance purchase of rights-of-way on which costly improvements are slated. Expenditures from the fund are repaid from regular revenue when the construction period is reached for each project. The effect of this legislation is to make sufficient funds available to purchase land before improvements are made, even though actual highway construction may be some years in the future.

By making early purchases with revolving fund money it is estimated that a $164,000,000 reduction in rights-of-way acquisition costs has been made in the five years since the fund was established.

A contractor's paving train at work on a freeway section of US Highway 101 now nearing completion in the vicinity of Paso Robles

Federal Aid Secondary Projects

Out of the 68,000 miles of county roads in California, a total of 6,780 are on the Federal Aid Secondary System. For the most part, these roads are next in importance to state highways in terms of traffic volume and economic service. They are often referred to as "feeder roads" or "farm-to-market roads."

Federal money apportioned to the counties in 1956-57 for use in improving roads on the F. A. S. System amounted to $7,705,681. State highway funds made available to the counties for use in matching their federal allocations totaled $4,034,515.

Two changes in highway laws by the 1957 Legislature have meant an increase in county F. A. S. funds for 1957-58 and a corresponding decrease in the amount available for state highways.

Contractors' bids on highway construction projects are carefully checked as a part of the bid opening procedure

One change was increasing from $100,000 to $200,000 the yearly maximum to be provided to a county as matching money from state funds. The other was increasing from 87½ percent to 98½ percent the amount of the State's F. A. S. apportionment which must be made available to the counties. Previously, the State retained 11 percent to improve state highways on the F. A. S. System. The State continues to use 1½ percent for long range planning. For 1958-59 the federal apportionment available for these county roads is $9,615,571; the state matching funds will amount to $6,002,924.

Projects on federal aid secondary routes are planned and in most instances constructed under the direct supervision of the county involved. The Division of Highways, under federal regulations, has the responsibility for reviewing and approving these county projects. The division also assists in other phases when requested by the counties.

The largest source of revenue for all county road purposes is the 1⅜ cents share of the State's six cents a gallon gasoline tax. These funds are distributed directly to the counties by the State Controller, and are administered by local boards of supervisors. Apportionments are made according to law on the basis of proportionate motor vehicle registration and mileages of county maintained roads. For 1956-57 the counties received as their share of the gasoline tax, along with a portion of vehicle registration fees, a total of $72,682,437.

City Projects

The Division of Highways administers the allocation of the five-eighths of a cent gasoline tax revenue which goes to incorporated cities and reviews and approves city street improvements financed with these funds.

In addition, it also allocates engineering and administrative funds to the cities. These range from $1,000 for cities with a population of less than 5,000 to $20,000 for cities of more than 500,000 population.

During the year the total gas tax and engineering apportionment to cities was $29,219,480. City street construction and improvement projects approved by the division numbered 486.

Rising Costs

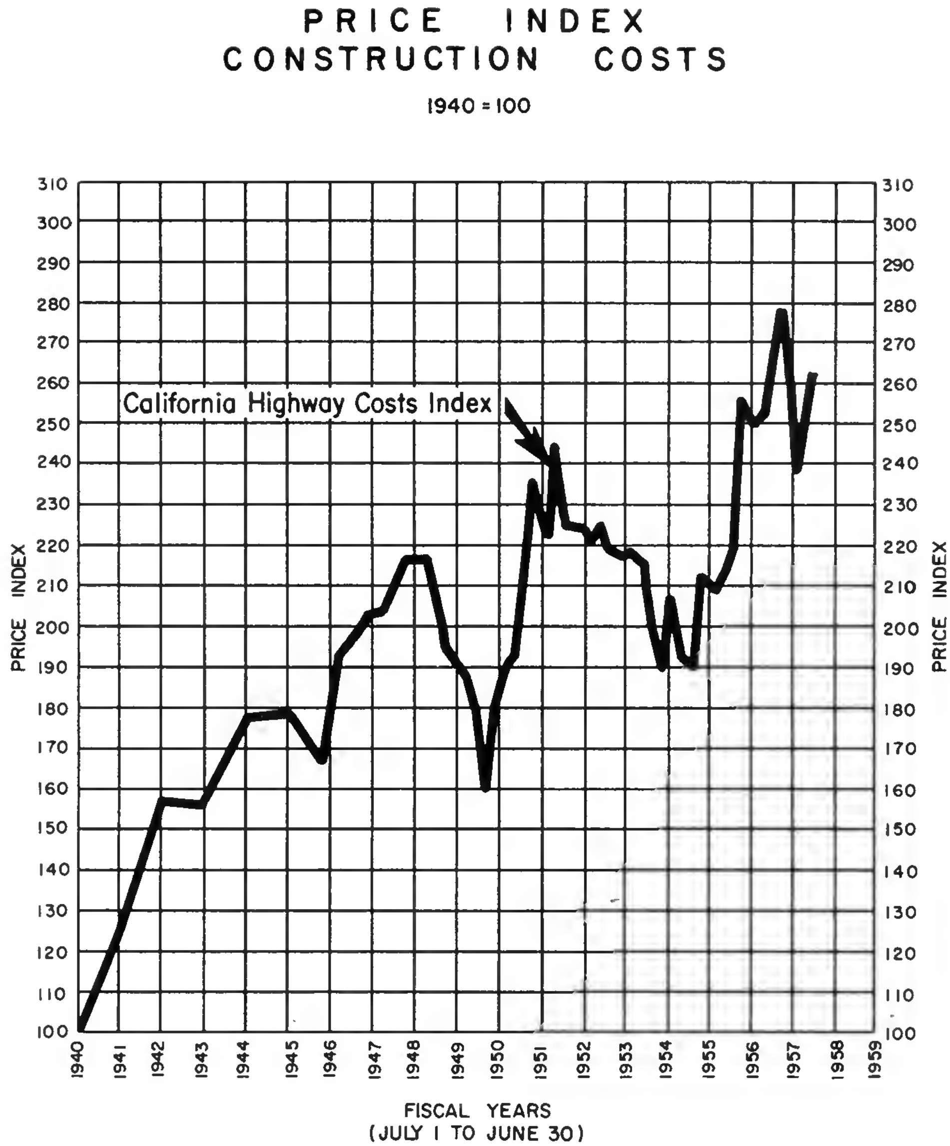
A constant problem in planning and financing highway improvements is the upward trend of construction costs. These increases have resulted from rising costs of labor and material, which were not fully offset by improved efficiency in construction machinery and operations.

The construction cost index maintained by the division reached a record high in the first quarter of 1957. After dropping slightly in the second and third quarters, the index again showed a rise in the final quarter. Costs at the end of the year were approximately 30 percent higher than in 1947.

The average cost per parcel in right-of-way transactions also climbed. In 1955 this average was $9,789, and in 1956 it had risen to $14,430. A slight decrease to $14,128 was recorded in 1957, probably because fewer high-priced parcels in downtown areas were required.

Construction Contracts

Construction is performed by contract under competitive bidding, to insure that the public receives the greatest value for its highway tax dollar.



Contractors who desire to bid on state highway projects estimated to cost more than $15,000 are required to be prequalified by the division. Each contractor's financial capabilities, experience and resources are studied in determining the type and size jobs he is qualified to handle.

On June 30, 1957, there were 992 contractors, with varying prequalification ratings, eligible for bidding on state highway projects. Total bidding capacity of these contractors was approximately $1,800,000,000.

Construction projects are advertised for bids by the Division of Highways after the Director of Public Works, on the division's recommendation, has approved the plans, specifications and estimates. Contracts are awarded by the Director of Public Works, also on the division's recommendation.

The California Highway Commission

As indicated earlier, responsibility for highway route adoptions rests not with the Division of Highways, but with the California Highway Commission, which is a nontechnical, nonsalaried board of business and professional men representing the people of the State at large. Commissioners are appointed by the Governor, and the appointments are confirmed by the State Senate. The commission is a seven-man body with the State Director of Public Works as ex officio chairman. The other six members serve four-year staggered terms.

Present commissioners are Robert L. Bishop of Santa Rosa; H. Stephen

Chase, San Francisco; James A. Guthrie, San Bernardino; Robert E. McClure, Santa Monica; Fred W. Speers, Escondido; Chester H. Warlow, Fresno, and C. M. Gilliss, chairman and Director of Public Works. Frank B. Durkee retired as commission chairman and Director of Public Works on December 31, 1957.

In addition to administering highway finances and adopting freeway routes, the commission also approves county primary road systems and authorizes the execution of deeds, condemnation proceedings, and right-of-way abandonments.

The Division of Highways

Chief of the Division of Highways is State Highway Engineer G. T. McCoy. He directs the work of the division in planning, constructing, maintaining and operating the State Highway System and acquiring rights-of-way.

The State Highway Engineer has a headquarters staff in Sacramento composed of two deputy state highway engineers, four assistant state highway engineers, a chief right-of-way agent, and a comptroller. Each of the assistant state highway engineers is in charge of a group of specialized units.

For localized administration of the highway program, the State has been divided into 11 state highway districts. These districts have approximately equivalent state highway mileage. A district engineer is in charge of each district except that in the San Francisco and Los Angeles areas an assistant state highway engineer is in charge.

The district engineer is responsible for all phases of the highway program in his district. Information concerning local highway matters is most readily obtained at his office.

District offices are in these cities:

District I
Eureka
430 West Wabash Avenue
Sam Helwer, District Engineer

District II
Redding
1657 Riverside Drive
H. S. Miles, District Engineer

District III
Marysville
703 B Street
Alan S. Hart, District Engineer

District IV
San Francisco
150 Oak Street
B. W. Booker, Assistant State Highway Engineer

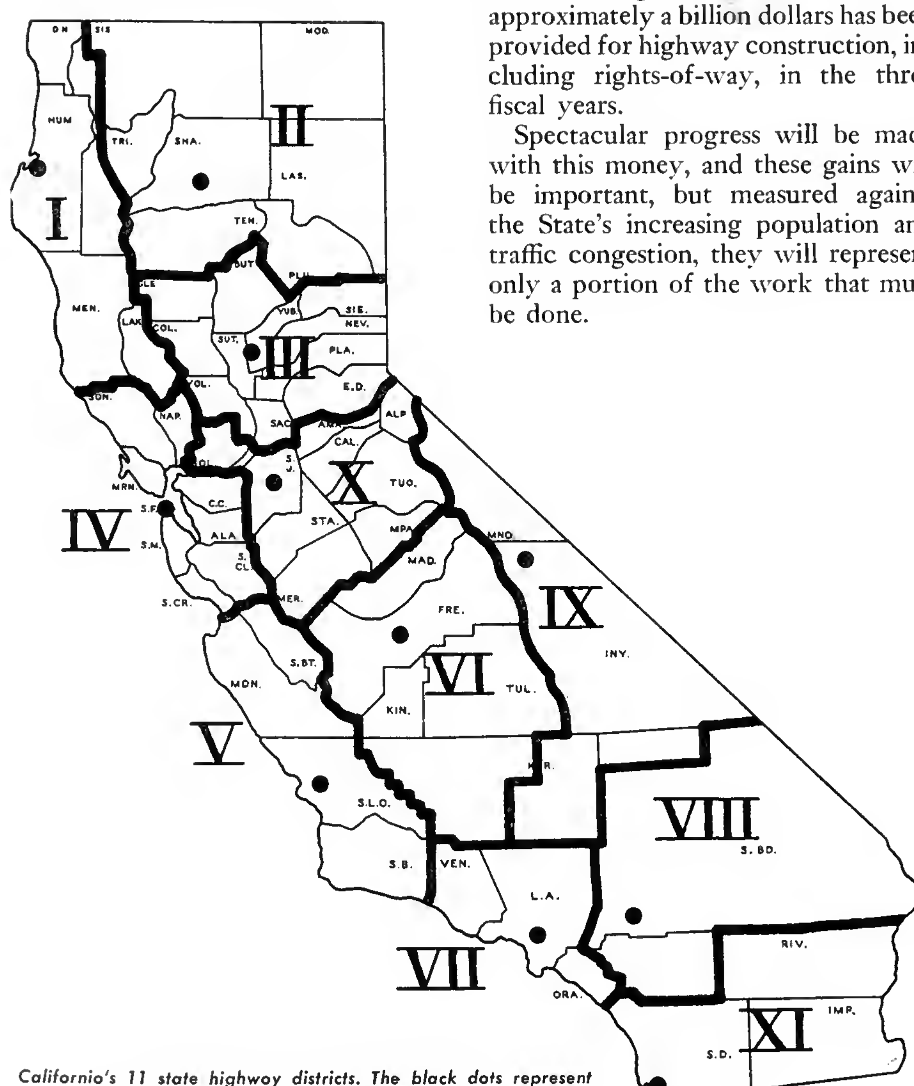
District V
San Luis Obispo
50 Higuera Street
A. M. Nash, District Engineer

District VI
Fresno
1352 West Olive Avenue
W. L. Welch, District Engineer

District VII
Los Angeles
120 South Spring Street
E. T. Telford, Assistant State Highway Engineer

District VIII
San Bernardino
247 Third Street
C. V. Kane, District Engineer

District IX
Bishop
South Main Street
E. R. Foley, District Engineer



California's 11 state highway districts. The black dots represent cities in which district offices are located.

District X
Stockton
1976 East Charter Way
J. G. Meyer, District Engineer

District XI
San Diego
4075 Taylor Street
J. Dekema, District Engineer

A Look at the Future

All highway improvements, whether resurfacing, minor realignments or new freeways, mean added convenience and safety for California motorists.

Completed projects, which alleviate acute local traffic problems, take on added significance as part of the continuing, long range program of highway development.

Thus, the improvements of 1956-57 will be enhanced by those financed in the current 1957-58 State Highway Budget and the already adopted 1958-59 Budget. A combined total of approximately a billion dollars has been provided for highway construction, including rights-of-way, in the three fiscal years.

Spectacular progress will be made with this money, and these gains will be important, but measured against the State's increasing population and traffic congestion, they will represent only a portion of the work that must be done.

Durkee Retires; Gilliss Named

31-year Career in State Service Comes to Close

Frank B. Durkee, Director of the California State Department of Public Works since 1951, closed a 31-year career in the service of the State by retiring December 31, 1957.

He chose the end of the month in which he reached his 65th birthday to retire as departmental director, as Chairman of the California Highway Commission, and as Member of the California Toll Bridge Authority and other state boards, commissions and committees.

Many paid tribute to Durkee.

Governor Goodwin J. Knight said:

"Mr. Durkee has faithfully served the people of California for more than three decades and no one is more deserving of relief from the heavy burden of responsibility than he.

"The achievements of the Department of Public Works during the past six years reflect great credit upon his administration."

Lauded for Progress

Resolutions of local governmental groups and chambers of commerce lauded Durkee for the "outstanding contributions" he made to the progress of California public works and for the "devotion he gave to the highway system for more than 30 years."

"His outstanding ability, tact and judgment have added lustre to the state office in which he served," said a resolution of the Golden Gate Bridge and Highway District.

Typical of the resolutions of governmental bodies was one adopted by the City of Redding. It commended Durkee "for his long and faithful service to the people of the State of California in the many activities to which he has contributed and the offices he has held."

Honored by Commission

The California Highway Commission adjourned its December meeting to honor Durkee. Chester H. Warlow, a commission member for 14 years,

FRANK B. DURKEE

C. M. GILLISS

spoke for his fellows in paying tribute to the man who has been commission chairman for the past six years.

"Frank Durkee has served the State magnificently," Warlow said, "from

. . . Continued on page 42

Deputy Promoted to Head Public Works Department

C. M. Gilliss, public works executive, engineer and accountant, became Director of the California State Department of Public Works and Chairman of the California Highway Commission on January 1st.

He was appointed by Governor Goodwin J. Knight to succeed the retiring director, Frank B. Durkee.

Gilliss has been a highway and public works administrator for a decade and has been in the State Department of Public Works for the past five years.

The Governor's appointments name him to the California Toll Bridge Authority, State Public Works Board, and State Allocation Board, as well as to the directorship of the Public Works Department and the chairmanship of the Highway Commission.

On Governor's Staff

Gilliss has been Deputy Director of the Department of Public Works since September 23, 1955, except for the period January 3 to September 16, 1957, when he was a secretary on Governor Knight's staff assigned to legislative duties.

Born and reared in Oklahoma, Gilliss attended Riverside Junior College, Riverside, California; Oklahoma A. and M. College, and the University of California at Los Angeles where he majored in business administration and engineering.

He began his business career at Riverside in 1937 as an accountant for a private corporation and later became chief of its central accounting systems. He became associated with the International Business Machines Company in 1940 as an engineer and later was an engineering instructor and sales representative in New York, Seattle, and Los Angeles.

Becomes Highways Administrator

In November, 1946, he entered public service for the first time as a systems

. . . Continued on page 61

DURKEE RETIRES

Continued from page 41 . . .

the bottom of the ladder up to the top.

"He has given the people of the State dedicated service, coming from his heart and soul. He has done much toward building the California Highway System up to where it stands the envy of the Nation."

Warlow told Durkee that the commissioners and Public Works Department employees "have every hope you will stay young in retirement and will keep busy doing the things you want to do."

Durkee briefly reviewed his directorship in his letter to Governor Knight, announcing his intention of retiring.

"It has been an honor," the letter said, "to have served as Director of Public Works during your administration and that of Governor Earl Warren. During this period of California's great growth, the Department of Public Works, through its Divisions of Architecture and Highways, has administered the greatest construction program in the State's history.

"In relinquishing my duties and responsibilities, it is a source of great pride to me that the highway organization of this department has been recognized as being outstanding among the highway departments of the Country, and that the Division of Architecture has become the largest such organization in any state."

Durkee is an attorney and was a newspaperman and a chamber of commerce executive before going into state service. He was born in Oregon on December 3, 1892.

His first state post, which he took in November, 1923, was as editor of *California Highways and Public Works* and public relations representative of the California Highway Commission.

He became a member of the legal staff of the Department of Public Works in 1927 as a general right-of-way agent. His first assignment in this position was the planning of a rights-of-way organization for the Division of Highways.

He resigned in 1928 but returned again to state service in February, 1931, moving up through the legal staff of the department to the position of principal attorney in the Division of Contracts and Rights-of-Way. In May, 1948, he was selected as deputy director of public works, a position he held until his appointment as director by Governor Warren.

In 1927 Durkee served on a committee to draft plans for the formation of an organization of state employees. Out of the work of the committee grew the present-day California State Employees' Association. He is a charter member of Sacramento Chapter No. 2 of the C. S. E. A.

Durkee spent most of his boyhood in Chico, Butte County, where he was later manager of the chamber of commerce for several years. He is a graduate of Chico High School and studied law at the University of Southern California.

He is a long-time resident of Sacramento. Mrs. Durkee is the Secretary and Treasurer of Natomas Company. They have two sons, Frank B., Jr., who is with the Division of Architecture, and Travers E., an administrative analyst with Los Angeles County.

Through his many years of association with the Department of Public Works, Durkee is familiar with, and has worked on, legal and administrative phases of many major highways, water resources, architectural and bridge projects of the State of California.

He is a member of the Commonwealth Club, and a charter member in Sacramento of the American Society for Public Administration. He is also a Rotarian and a member of the Grandfathers' Club of Sacramento.

Latest Highway Statistics Given

The Division of Highways had under way 242 contracts with a total value of $382,243,800 on January 1, 1958.

The length of freeways, expressways and other multilane divided highways on the State Highway System either completed or under construction on the same date was 2,180 miles.

Forty highway contracts totaling $24,367,800 were completed during December, 1957.

Twenty-three highway contracts totaling $6,707,900 were awarded during December, 1957. On January 2d, an additional five contracts totaling $3,854,100 were awarded from the 1958-59 Budget.

Retirement Ends 34-year Service

Mrs. Jessie Hillery Steen of District X retired on January 1, 1958, after having served with the State of California for some 34 years.

Mrs. Steen was born in New York City. She was educated in a private school, started her business career as a stenographer, and moved to California in December of 1920, settling in Sacramento where she was employed by an automobile concern.

MRS. JESSIE STEEN

Mrs. Steen was given an appointment as stenographer in Governor Stephen's office in the fall of 1921. At the expiration of Governor Stephen's term, she again went to work for private industry and later was appointed as stenographer in the Board of Control, Department of Finance.

In June, 1928, she went to work for District X of the Division of Highways as a clerk. When headquarters office was moved to Stockton in 1933, Mrs. Steen transferred with many of the other "old timers." Since then she has been employed as switchboard operator and receptionist.

Mrs. Steen is a member of Rhodora Club, the Business and Professional Women's Club and El Toyon Chapter of Daughters of the American Revolution. She expects to be busy with activities in connection with these clubs, as well as with her church work. She is especially fond of history and is planning to devote considerable time to reading on the subject.

Governor Officiates at Ground Breaking for New State Building

Ground breaking ceremonies were held in Los Angeles January 3d for a new state office building designed to be California's most adaptable structure of its kind.

The new building will have interior partitions, lights, heating, cooling, and even the number of elevators adjustable to the needs of 4,000 employees of 25 state agencies who will occupy the building in 1960.

Governor Goodwin J. Knight was the principal speaker at the ceremony, which took place on the construction site in Los Angeles' Civic Center.

"The project for which we break ground today," Governor Knight said, "will be a notable addition to the magnificence of this city and to the perpetuation of efficient government for all California.

"There is no better example of how much the world is changing than that provided by the unprecedented expansion of the State of California. It may well be that Los Angeles itself is the scene of the most unrelenting development to be observed anywhere in the world."

Legislators and other state officials were guests at the ceremony along with city and county officials and business and labor leaders. They were introduced by C. M. Gilliss, Director of the State Department of Public Works, who presided.

The new office building will cost $8,500,000; an adjacent garage and a tunnel under the Broadway-First Street intersection, connecting with the existing State Office Building, will bring the total project cost up to $12,000,000. The new building will have 550,000 square feet of space which may be partitioned and rearranged as required. In addition to movable partitions throughout there will be movable ceiling light panels and heating and refrigerated air conditioning adjustable to provide the temperatures desired in different zones or offices of the building. Space will be provided for later additions of elevators and installation of escalators when they are needed.

Governor Goodwin J. Knight, heading a group of state legislators and other state and local leaders, spoke at the ground breaking for the State's newest and most adaptable office building. The artist's sketch shows how the building will appear.

Provision has been made in the plans for the seven-story, 900-car state garage to be built next to the office building so that two additional stories may be added in the future when needed.

A food service facility will be constructed on the second floor and will include an outdoor eating area. A 400-seat auditorium and nine conference rooms will be built on the first floor.

The main lobby of the building will be on the Broadway side. A second lobby, opening onto First Street, will be for the primary use of the Department of Employment. A third lobby on the Hill Street side will serve the Departments of Corrections and Youth Authority.

Another new feature of the building will be sets of tracks around the exterior supporting wheeled trucks or spiders for the use of window washers and repair men.

Design, planning and construction of the entire project are under the supervision of the Division of Architecture of the Department of Public Works. The department contracted with a private architect, J. E. Stanton of Los Angeles, for the buildings.

The two new structures will occupy the northern three-quarters of the block bounded by Broadway, Hill and First and Second Streets. The office buildings will be built on 1½ acres and the garage will occupy about three-fourths of an acre.

Cost Index

Costs Resume Upward Trend In Fourth Quarter of 1957

By J. P. MURPHY, Assistant State Highway Engineer
H. C. McCARTY, Office Engineer
LLOYD B. REYNOLDS, Assistant Office Engineer

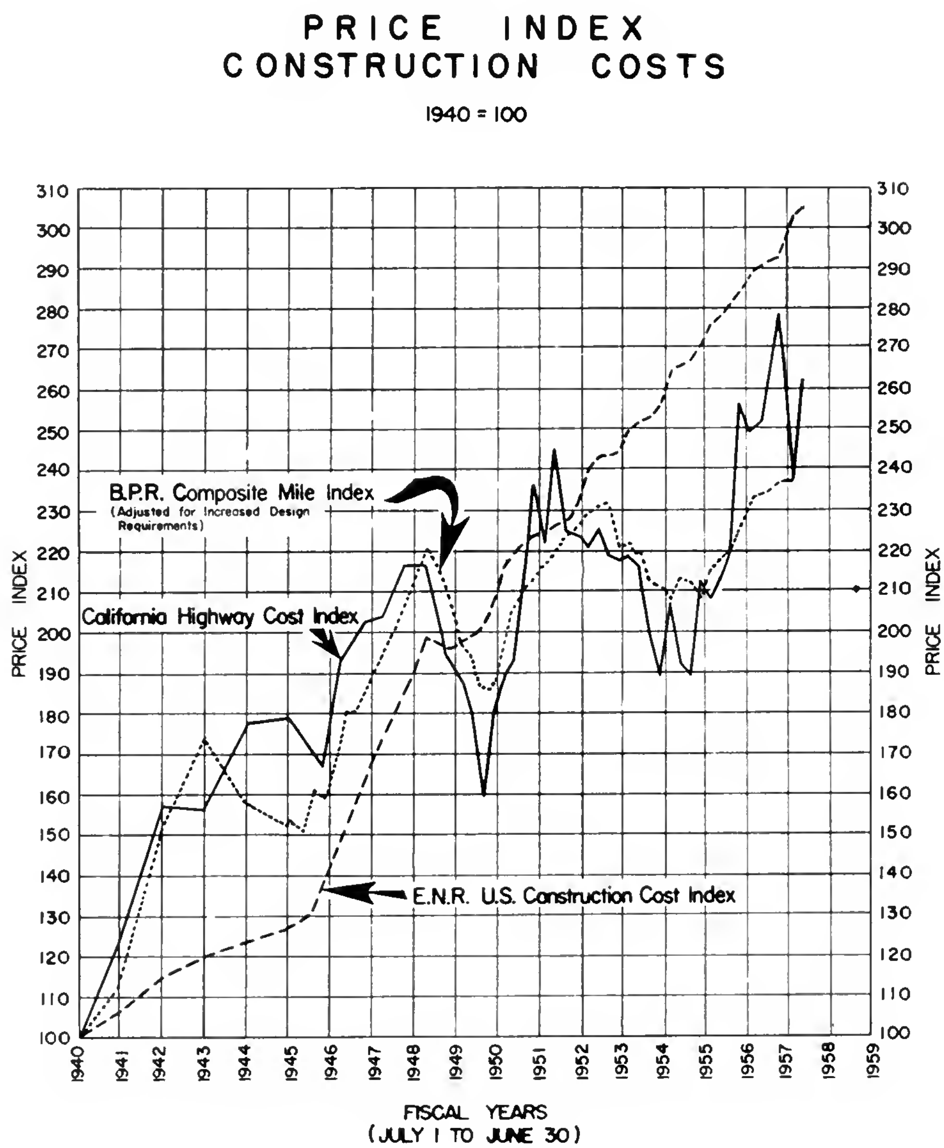
THE CALIFORNIA Highway Construction Cost Index returned to an upward course in the fourth quarter of 1957 after successively following a downward direction in the second and third quarters. The Index now stands at 262.1 (1940 = 100) which is 24.6 index points or 10.4 percent above the third quarter. It is 10 points or 4 percent above the fourth quarter a year ago.

Projects for which bids were opened during this quarter were smaller in number than prevailed last year. The percentage of multimillion-dollar freeway projects was about equal in the two periods but the value of smaller projects was considerably less this year. This has had the tendency of excluding the item values of small projects from exercising an influencing effect on the overall index behavior.

The increase in the Index standing during this period is, in great part, caused by bid prices received for roadway excavation in connection with two major freeway projects. These projects are situated on US 40 at high elevations in the Sierra Nevada range of mountains where almost solid granite formations are encountered. The short construction season of less than seven months as well as the difficult excavation to be encountered undoubtedly had an effect on the bid prices for these high altitude projects.

In addition to the effect of the roadway excavation price on the Index, the prices of the plant-mixed surfacing and portland cement concrete for both pavement and structures on the same projects had considerable influence. The mountain location of these projects is such that aggregate production and transportation costs for aggregates, cement and asphalt are all considerably greater than are generally required.

Portland cement concrete pavement to be used on these projects will consist of a six-sack mix. Data for this Index was adjusted to compare on the same basis with other projects where five-sack mixes were required. Pavement using five sacks of cement per cubic yard is standard in California but in these special instances because of severe winter weather conditions coupled with heavy traffic volumes a higher cement content was specified.



Four of the seven items used in this Index show increases in varying amounts while the remaining three items represent decreases.

Roadway excavation averaged $0.68 per cubic yard, increased from $0.42 prevailing in the third quarter. Reasons for the increase are explained above.

Untreated rock base dropped to $1.78 per ton from last quarter's price of $2.34 establishing a new low. It appears that project location and supply of this material are the cause of the reduction.

Asphaltic and bituminous mixes with higher price averages in previous quarters rose from $5.10 per ton to $5.45 in this period. The previous $5.10 per ton price was attributed to a large project favorable to lower costs and the large resurfacing program in progress during the early part of the third period. These conditions did not prevail in this quarter and with the explanation above, a price increase was to be expected.

Portland cement concrete pavement with a previous standing of $14.34 per cubic yard rose to $16.88 which price was adjusted for two projects requiring six sacks per cubic yard.

Class "A" portland cement concrete, structures, increased $0.92 to $59.76 in this period. The price, while higher, is almost identical to the average for the same period last year.

Bar reinforcing steel shows a negligible decrease of $0.001 to $0.129 this quarter.

Structural steel dropped from the previous average of $0.200 to $0.177 in this quarter. The decrease is substantial and it would indicate that advances previously included in steel bid prices to allow for delivery delays are no longer a consideration.

At the right is a tabulation showing average unit prices upon which this index has been computed since 1940.

Data for preparation of this quarter's index was provided by 95 projects of which 52.6 percent were under $50,000; 7.4 percent ranged from $50,000 to $100,000; 17.8 percent ranged from $100,000 to $250,000; 7.4 percent ranged from $250,000 to $500,000; 5.3 percent ranged from $500,000 to $1,000,000 and 9.5 percent were over $1,000,000. The total bid value of these projects amounted to $40,045,400 and the projects under $50,000 accounted for 2.1 percent of the total; between $50,000 and $100,000 was 1.4 percent; between $100,000 and $250,000 was 7.0 percent; between $250,000 and $500,000 was 6.0 percent; between $500,000 and $1,000,000 was 7.9 percent and over $1,000,000 was 75.6 percent.

Bidder competition was extremely good during this quarter showing an average of 8.8 bidders per project. The average for the third quarter was 6.2, and was 5.1 for the fourth quarter of 1956. An average of 5.1 was obtained for the fiscal year ending June 30, 1957. The accompanying table shows in detail the number of

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CALIFORNIA DIVISION OF HIGHWAYS AVERAGE CONTRACT PRICES

	Roadway excavation, per cu. yd.	Untreated rock base, per ton	Plant-mixed surfacing, per ton	Asphalt concrete pavement, per ton	Asphaltic and bituminous mixes, per ton	PCC pavement, per cu. yd.	PCC structures, per cu. yd.	Bar reinforcing steel, per lb.	Structural steel, per lb.
1940	$0.22	$1.64	$2.19	$2.97	--	$7.68	$18.33	$0.040	$0.083
1941	0.25	2.31	2.84	3.18	--	7.64	23.31	0.063	0.107
1942	0.36	2.81	4.02	4.15	--	9.62	29.48	0.073	0.103
1943	0.42	2.26	3.71	4.76	--	11.48	31.76	0.069	0.080
1944	0.50	2.45	4.10	4.50	--	10.46	31.99	0.064	0.132
1945	0.51	2.42	4.20	4.88	--	10.90	37.20	0.059	0.102
1946	0.41	2.46	4.00	4.68	--	9.48	37.38	0.060	0.099
1947	0.46	2.42	4.32	5.38	--	12.38	48.44	0.080	0.138
1948	0.55	2.43	4.30	5.38	--	13.04	49.86	0.092	0.125
1949	0.49	2.57	4.57	4.64	--	12.28	48.67	0.096	0.117
1950	0.40	2.25	4.26	3.76	--	11.11	43.45	0.079	0.094
1951	0.49	2.52	4.34	5.00	--	12.21	47.22	0.102	0.169
1952	0.56	2.99	5.00	4.38	--	13.42	48.08	0.098	0.150
1953	0.51	2.14[1]	5.31	4.68	--	12.74	50.69	0.093	0.133
1954	0.45	2.13	4.50	4.86	--	14.41	48.42	0.094	0.124
1955	0.39	2.22	4.93	--	--	13.36	45.72	0.096	0.142
1st quarter 1956	0.40	2.08	5.40	6.60	--	14.05	52.51	0.105	0.166
2d quarter 1956	0.51	2.06	5.27	--	--	14.64	57.13	0.113	0.219
3d quarter 1956	0.52	2.27	6.12	--	--	15.67	56.32	0.121	0.178
4th quarter 1956	0.52	2.21	--[2]	--[2]	$5.93[2]	14.95	59.63	0.112	0.197
1st quarter 1957	0.53	2.10	--	--	5.94	17.28	61.14	0.129	0.236
2d quarter 1957	0.53	2.10	--	--	6.18	15.59	58.61	0.119	0.204
3d quarter 1957	0.42	2.34	--	--	5.10	14.34	58.68	0.130	0.200
4th quarter 1957	0.58	1.78	--	--	5.45	16.88[3]	59.76	0.129	0.177

[1] The item of crusher run base was used before 1953.
[2] Asphalt concrete pavement combined with plant-mix surfacing in fourth quarter 1956, and will be identified as asphaltic and bituminous mixes in the future.
[3] Two projects with six-sack mix adjusted to five-sack basis.

NUMBER AND SIZE OF PROJECTS, TOTAL BID VALUES AND AVERAGE NUMBER OF BIDDERS (July 1, 1957, to December 31, 1957)

Project volume	Up to $50,000	$50,000 to $100,000	$100,000 to $250,000	$250,000 to $500,000	$500,000 to $1,000,000	Over $1,000,000	All projects
Road projects							
No. of projects	95	24	30	12	7	2	171
Total value*	$1,630,100	$1,831,306	$4,920,950	$4,071,504	$4,603,119	$2,731,297	$19,788,275
Avg. No. bidders	5.5	7.3	8.6	10.4	9.1	10.0	6.9
Structure projects							
No. of projects	22	2	11	2	----------	4	41
Total value*	$444,988	$136,720	$1,856,778	$526,298	----------	$15,102,275	$18,066,060
Avg. No. bidders	6.5	8.0	12.1	10.0	----------	8.5	8.4
Combination projects							
No. of projects	----------	----------	----------	----------	----------	11	11
Total value*	----------	----------	----------	----------	----------	$41,285,240	$41,285,240
Avg. No. bidders	----------	----------	----------	----------	----------	10.0	10.0
Summary							
No. of projects	118	25	41	14	7	17	223
Total value*	$2,075,088	$1,968,026	$6,776,728	$4,597,802	$4,603,119	$59,118,813	$79,139,675
Avg. No. bidders	5.7	7.3	9.5	10.4	9.1	9.6	7.3

* Bid items only.

Total Average Bidders by Months

	July	August	September	October	November	December	Average for six months
1957	6.2	6.3	5.7	8.2	9.2	9.5	7.3
1956	3.8	3.7	3.7	4.2	5.3	6.1	4.3

Atwater Bypass

Further Progress Made on US 99 Freeway Construction

By ROBERT W. GILLISPIE, Resident Engineer

ANOTHER traffic bottleneck on U. S. Highway 99 has been eliminated by the opening of the Atwater Bypass. The 4.5 miles of full freeway was dedicated by the Mayor of Atwater and opened to traffic on October 14, 1957. Work was completed approximately one month later.

The $2,500,000 project was awarded to Gordon H. Ball Company and Erickson, Phillips and Weisberg as a joint venture in July of 1956. Their work was finished well ahead of the scheduled completion date of December 12, 1957.

The City of Atwater is a farming community located in the Central Valley area and is the home of many personnel stationed at nearby Castle Air Force Base. The former Highway 99 through Atwater is a narrow two-lane road with two sharp reversing curves at each end of the business district. Due to restricted sight distance and the interference of local traffic, speed zones of 45, 35 and 25 miles per hour were in effect in the four-mile stretch. A portion of the old highway was reconstructed to serve as a frontage road serving Atwater and also used as an on and off ramp to the freeway for traffic entering and leaving the city. This portion of US 99 was taken into the State Highway System in 1912 and was declared a freeway in 1955. Part of the reconstruction work done on old US 99 was over old concrete pavement on which no surfacing had ever been placed since it was constructed in 1926.

Local traffic is served by four interchanges and almost continuous frontage roads providing short travel time to every area of the community. Erickson, Phillips and Weisberg constructed seven structures of which two are of reinforced concrete girder construction and five are welded steel girder bridges. Five of the bridges cross the Southern Pacific Railroad tracks which roughly parallel old US 99.

The Buhach Road interchange consists of two bridges, one a reinforced concrete girder structure carrying northbound traffic over the southbound ramps and one of steel construction which carries local traffic over the four-lane divided highway and the railroad. This interchange is unique in that the southbound acceleration and deceleration lanes are to the left of traffic and approximately

. . . *Continued on page 61*

An aerial view looking northwest along the new US 99 Bypass of Atwater. In the foreground is the East Atwater overhead and the Broadway frontage road. The dark road in the center of the picture extending from foreground to background and paralleling the railroad tracks is old US 99.

Orange County

Freeway Construction Program Moves Ahead

By BASIL N. FRYKLAND, Construction Engineer, District VII

The completion of the Santa Ana-San Diego Freeway in its entirety through Orange County will provide that fast-growing important area of California, now having more than 584,000 population, with one of the most modern and efficient highway facilities yet engineered. In addition to handling a large part of the county's registered vehicles (242,640 out of a total of 7,212,642 for the entire State) it will provide a through portal for transportation of people and goods from metropolitan Los Angeles southeasterly. Greatly benefited will be Orange County's 135 nationally known manufacturers and the thousands of travelers in and about the area.

BASIL N. FRYKLAND

The southbound traveler using the Santa Ana Freeway route in Orange County through the Cities of Buena Park, Anaheim, Santa Ana and Tustin is struck by the homes, industries and businesses along this great traffic artery. As he continues south of Santa Ana, after passing beyond El Toro, industry and business gives place to sprawling ranch lands and truck farms, walnut and citrus groves, eucalyptus windbreaks, olive trees, California oaks, tomato farms, sheep and cattle pastureland.

Irvine Ranch Longest

The freeway here bisects the vast terrain known for the past 90 years as the Irvine ranch, one of the most fertile regions in California, lying between the Santa Ana Mountains and the Pacific Ocean. The Irvine ranch, one of the largest in California, is 22 miles long by nine miles wide, extending over an acreage in excess of 80,000 acres. It entirely surrounds the El Toro Marine Corps air base, the site for which was carved from the Irvine ranch. In 1957 the acreage was used for crops as follows: barley, 6,000 acres; lima beans, 7,000; persimmons, 100; oranges, 3,450; walnuts, 1,000. The ranch also raises avocados, grapefruit, lemons, blackeye beans, sugar beets, and vegetables. Grazing over the 48,000 acres of hilly pasture are 2,500 head of range cattle.

The landscape is hillier farther south, approaching the coastal area of San Juan Capistrano and San Clemente. Here the existing highway proceeds along a canyonlike defile, through orange and avocado groves and the surrounding hills—green pasture lands in the rainy season—until it opens onto the coast at Capistrano Beach. The existing highway then follows along the base of the cliffs through the City of San Clemente where it crosses the line into San Diego County.

Construction in Progress

The southernmost construction on the Santa Ana-San Diego Freeway is the beach city of San Clemente, a section 2.3 miles in length, between San Mateo Creek and 0.1 of a mile south of Avenida Cadiz. Robert M. Innis, Resident Engineer, reported that the $2,724,400 job is progressing as scheduled with an anticipated completion date of September 18, 1958. The contractors are J. E. Haddock, Ltd., and Cox Bros. One of the principal problems at the construction site is the necessity of relocating existing utilities at an estimated cost of $300,000. Workmen also have the further problem of excavating beside a high pressure gas line—a pipe 14 inches in diameter carrying gas at 400 pounds of pressure per square inch—throughout the length of the job. An important additional feature is the installation of 22,000 feet of storm drain to provide water runoff, and construction of a 172-foot-span steel girder bridge at a cost of $250,000. Construction is continuing normally with excellent cooperation from utility personnel and local city officials.

Not far distant to the north of San Clemente, at the junction of U. S. Highway 101 and 101 Alternate on the rocky shelf of the Pacific, is Dana Point, which has taken its name from Richard Henry Dana, author of the autobiographical novel *Two Years Before the Mast.* In 1834-36 Dana shipped aboard the brig *Pilgrim* and came to the coast at San Juan Capistrano, where he helped gather cargoes of steer hides, then a flourishing business there. The hides were brought by cart from the mission to the seaside and pitched from the cliff to the beach below.

Will Erect Bridges

Inland from Dana Point, northwesterly of San Clemente, is San Juan Capistrano where another link of the San Diego Freeway is now under construction. This portion of the freeway is located between 2.2 miles south of Route 64 and Trabuco Creek, a distance of 4.1 miles, and is scheduled for completion in September, 1958, at a total cost of $4,233,000. Peter Kiewit Sons Co., is the contractor, and the resident engineer is James L. Needham. Two bridges will be erected over San Juan Creek—both steel girder structures 600 feet in length and costing a total of $1,000,000. The contractor has been faced with the serious complication of pumping excess ground water at the bridge site prior to driving, piling and constructing bridge footings. The path of this freeway link through San Juan Capistrano and around the Mission was designed from aerial surveys and, as such, is unique in District VII freeway development.

The San Diego Freeway at San Juan Capistrano traverses a colorful

Looking northwest along Santa Ana Freeway under construction between City of Anaheim in foreground and City of Buena Park in background. In center is Broadway-Anaheim shopping center.

bit of California rich in history and local lore. It was here in November, 1776 that under the direction of Franciscan Father Junipero Serra the seventh mission of a total of 21 in California, stretching from San Diego to Sonoma was founded and called San Juan Capistrano. Styled as "the jewel of the missions," it today attracts tourists from everywhere who come to look at the mission corridors, arches, gardens, fountained courts and famous colony of swallows.

Murietta's Tree

A northerly access road to the San Diego Freeway through San Juan Capistrano passes a massive 300-year-old sycamore, said to have been a trysting place of the early Californian bandit Joaquin Murietta. The meeting of this ancient landmark with the modern freeway was discussed by a local paper, the *Coastline Dispatch*, on August 8 and August 15, 1957.

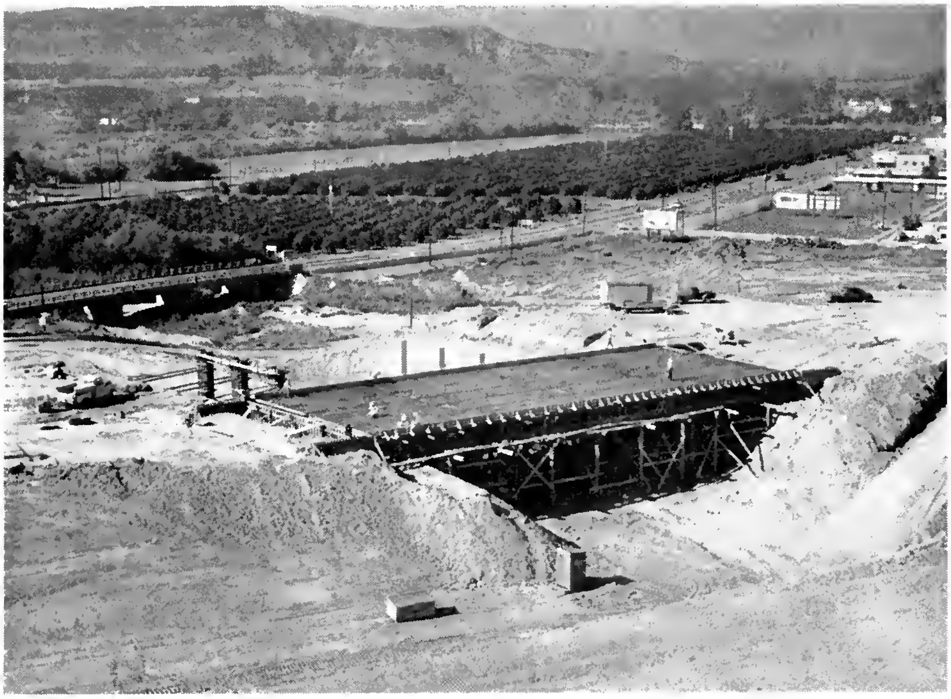
"The large sycamore at one time had Murietta's name carved in its base, but it has gradually been obscured by the growing giant, until only a scar remains. It is more than 170 feet high and covers the better part of an acre. It was probably a landmark as far back as Padre Serra's day. The tree is located approximately one-half mile north of Mission San Juan Capistrano and is about 200 yards from Highway 101. * * * An example of the State Highway Department interest in maintaining historical sites, is (the) certainly favorable decision on rerouting an access road on former Buchheim property to bypass a landmark tree."

Northwesterly of San Juan Capistrano, along the old U. S. Highway 101 there is no new construction until reaching Niguel Road intersection at El Toro. Construction is in progress from Niguel Road to Laguna Road on a section 6.6 miles in length. This link will cost $2,420,200 and is scheduled for completion in September, 1958. The resident engineer is James D. Hetherington, and the contractors J. E. Haddock, Ltd., and Cox Bros.

Big Drainage Problem

The next in line, constructionwise, along the San Diego-Santa Ana Freeway is a Winston Bros. contract, 5.7 miles in length, between 0.2 mile south of Laguna Canyon Road and 0.3 mile north of Browning Avenue, costing $3,614,000. This portion of the freeway is scheduled for completion in June, 1958. The resident engineer is Chas. J. McCullough. In order to handle the considerable drainage problem, airblown mortar is being used in the runoff channels, which range from the two-foot, round-bottom type to the 15-foot V bottom. This drainage facility is the longest in the district, requiring 42,000 square yards of mortar at a cost of $200,000.

By far the most complex system of interlacing roadways on this freeway is in the Anaheim area at the junction of the Santa Ana Freeway and the Route 175 Freeway, locally called the "Houston Freeway." A 6.5-mile length of the Santa Ana Freeway is being constructed in this area under three separate contracts held by J. E. Haddock, Ltd., and R. M. Price Company, of Pasadena. These contracts extend from Coyote Creek in Los Angeles County, a short distance northerly of the Orange county line, to Ball Road in the City of Anaheim. A single contract on



Overcrossing on the San Diego Freeway. This section of the freeway passes through San Juan Copistrano. It is 4.1 miles long and will be completed sometime during the fall of 1958 at a cost of $4,223,000.

the Houston Freeway, held by Griffith Company of Los Angeles, extends from the Santa Ana Freeway easterly to Spadra Road in the City of Fullerton, a distance of 3.61 miles. Twenty-five bridges are included in the four contracts. Seven are under construction to provide traffic interchange at the junction of the two freeways. Six additional bridges will be required when the Houston Freeway is extended to the west at some future date.

Cars Make Problem

Construction of the Santa Ana Freeway in this area is characterized by the very heavy traffic to be carried through and around the work. Average daily traffic is approximately 50,000 cars and as many as seven separate detours have been necessary at a single intersection to enable traffic to move freely through construction. Throughout the work on the Santa Ana Freeway the number of traffic lanes available to freeway traffic has been maintained equal to that which existed prior to construction. The fact that these contracts have continued to smoothly move ahead on schedule is a tribute to the ingenuity and co-operative attitude of the contractors. Contracts in this area are scheduled to be completed by summer of 1958 with the bulk of the work on the Santa Ana Freeway to be completed by January, 1958.

Contracts on the Santa Ana Freeway, in the Buena Park and Anaheim area, total value of which is $8,921,377, are under the supervision of O. V. Janeway, C. C. French, R. D. Seifried, resident engineers, and H. O. Will, Bridge Department representative. The contract on the Houston Freeway is under Peter Varvis, resident engineer, and W. B. James, Bridge Department representative. Construction engineer for these projects is C. W. Ford.

Through the years past, including the Fiscal Year 1957-58, a total of $88,450,000 has been expended by the State Division of Highways on construction, rights-of-way acquisition and engineering on freeways in Orange County. The recently budgeted funds covering freeways in Orange County for the Fiscal Year 1958-59 will swell the previous total by an additional $11,821,000. The Santa Ana Freeway contracts now under construction will be fully completed by the close of next year, at which time the Santa Ana Freeway will be opened uninterruptedly to through traffic for a distance of 42.8 miles, from the Los Angeles Civic Center to a junction with the San Diego Freeway at El Toro.

Looking southeast along construction of Santa Ana Freeway through City of Anaheim. In foreground, Broadway-Anaheim shopping center.

1957 ANNUAL TRAFFIC COUNT

By G. T. McCOY, State Highway Engineer

The annual statewide traffic count taken on Sunday and Monday, July 14 and 15, 1957, showed an increase of 4.44 percent over the previous annual count of July, 1956. Gains were generally well distributed over all routes and regions. Among the major routes, a very substantial increase was shown on Route 26. Opening of several miles of full freeway on the heavily traveled portions of this route near Los Angeles probably contributed to this increase.

For the fifth consecutive year, monthly traffic counts show freight vehicles increasing at a substantially faster rate than passenger vehicles. Also, for the sixth time in the last seven years, Sunday traffic shows appreciably less gain than Monday traffic.

One major change was made in the classification of vehicles. Counting out-of-state passenger cars separately from California passenger cars was eliminated and, instead, passenger cars are classified as those without trailers and those towing heavy trailers, such as house trailers. More directional counts have been included because of the expanding traffic volumes on multilane facilities. Actual recording covers the 16-hour period from 6 a.m. to 10 p.m. for both Sunday and Monday. At selected representative stations, counts are continued for the entire 24-hour period and are extended to record each of the seven days of the week. Traffic is segregated into the following classifications: Passenger cars without trailer, passenger cars with trailer, buses, pickups, 2-axle commercial units, 3-axle units, 4-axle units, 5-axle units, and 6-or-more-axle units.

Each year some minor changes in the census become necessary, such as the relocation, addition or discontinuance of individual stations; but in every instance these are excluded in determining comparison with the previous year, only those stations that were identical during both years being taken into consideration.

Because of the growth of the State, many routes have become multipurpose and it is no longer practicable to classify them into meaningful groups by primary use as has been done in the past. Hence, the tabulation of groups is omitted.

The gain and loss of traffic volume for the various state highway routes are shown in the tabulation below. For the first time, all routes on which counts were made are included in the summary. The very large percentage changes shown on some of the minor routes may not be significant because the total number of vehicles counted was quite small.

		Percent gain or loss for 1957 count as compared with 1956			
		Sunday		Monday	
Route	Termini	Gain	Loss	Gain	Loss
1.	San Francisco-Oregon Line	2.12		2.95	
2.	Mexico Line-San Francisco	1.59		4.52	
3.	Sacramento-Oregon Line	4.74		4.29	
4.	Los Angeles-Sacramento	0.28		0.55	
5.	Santa Cruz-Junction Route 65 near Mokelumne Hill	0.62		0.33	
6.	Napa-Sacramento via Winters	4.34		3.15	
7.	Route 69, Albany-Route 3 near Red Bluff	1.35		2.03	
8.	Ignacio-Cordelia via Napa	2.38		1.67	
9.	Route 2 near Montalvo-San Bernardino		12.20		2.08
10.	Route 2 at San Lucas-Sequoia National Park		3.47		0.60
11.	Route 75 near Antioch-Nevada Line via Placerville		2.40	1.32	
12.	San Diego-El Centro		2.88		1.69
13.	Route 4 at Salida-Route 23 at Sonora Junction		11.48		7.89
14.	Oakland to Route 7, Richmond	No count		No count	
15.	Route 56 near Fort Bragg to Route 37 near Emigrant Gap		0.28	4.82	
16.	Hopland-Lakeport	2.82			1.42
17.	Route 3 at Roseville-Route 15, Nevada City		0.08	0.49	
18.	Route 4 at Merced-Yosemite National Park	0.59		0.32	
19.	Route 2 at Fullerton-Route 26 at Beaumont		5.92	2.41	
20.	Route 1 near Arcata-Route 83 at Park Boundary	5.08		5.27	
21.	Route 3 near Richvale-Route 29 near Chats via Quincy	7.78		9.20	
22.	Route 56, Castroville-Route 32 via Hollister		5.43	4.10	
23.	Route 4 at Tunnel Station-Route 11, Alpine Junction	2.87		5.88	
24.	Route 4 near Lodi-Nevada State Line		7.85		2.50
25.	Route 37 at Colfax-Route 83 near Sattley		6.65		10.02
26.	Los Angeles-Mexico via San Bernardino	26.78		24.44	
27.	El Centro-Yuma		5.47		1.33
28.	Redding-Nevada Line via Alturas		2.55		5.98
29.	Peanut-Nevada Line near Purdy's	0.75		0.24	
31.	Colton-Nevada State Line	2.01		4.96	
32.	Route 56, Watsonville-Route 4 near Califa	0.57		2.94	
33.	Route 56 near Cambria-Route 4 near Famosa		3.66	2.66	
34.	Route 4 at Galt-Route 23 at Pickett's Junction	7.22		2.65	
35.	Route 1 at Alton-Route 20 at Douglas City	3.51		6.31	
37.	Auburn-Truckee	1.65		3.35	
38.	Route 11 at Mays-Nevada Line via Truckee River	26.18		33.41	
39.	Route 38 at Tahoe City-Nevada State Line	1.82		7.21	
40.	Route 13 near Montezuma to Nevada State Line	39.02			5.33
41.	Route 5 near Tracy-Kings River Canyon via Fresno	0.72			0.16
42.	Redwood Park-Los Gatos		7.94		4.10
43.	Route 60 at Newport Beach-Route 31 near Victorville		3.76	0.26	
44.	Boulder Creek-Redwood Park	8.46		1.62	
45.	Route 7, Willows-Route 3 near Biggs	17.56		10.05	
46.	Route 1 near Klamath-Route 3 near Cray		22.48		20.98
47.	Route 7, Orland-Route 29 near Morgan	1.40		0.24	
48.	Route 1 north of Cloverdale-Route 56 at mouth of Navarro River		1.85		3.90
49.	Napa-Route 15 near Sweet Hollow Summit		2.24	4.50	
50.	Sacramento-Route 15 near Wilbur Springs		0.01		2.22
51.	Route 8 at Shellville-Sebastopol	5.86			0.53
52.	Alto-Tiburon	21.68		17.38	
53.	Route 7 at Fairfield-Route 4 near Lodi via Rio Vista		9.45		3.84
54.	Route 11 at Perkins-Route 65 at Central House	0.37		15.60	
55.	Route 5 near Glenwood-San Francisco	18.93		15.82	
56.	Route 2 at Las Cruces-Route 1 near Fernbridge	11.41		7.06	

TRAFFIC COUNT

Continued from page 50 . . .

Percent gain or loss for 1957 count as compared with 1956

Route	Termini	Sunday Gain	Sunday Loss	Monday Gain	Monday Loss
57.	Route 2 near Santa Maria-Route 23 near Freeman via Bakersfield	6.89		4.00	
58.	Route 2 near Santa Margarita-Arizona Line near Topock via Mojave and Barstow	2.14		3.44	
59.	Route 4 at Gorman-Route 43 at Lake Arrowhead	2.38		9.92	
60.	Route 2 at Serra-Route 2 at El Rio	5.34		8.42	
61.	Route 4 south of Glendale to Route 59 near Cajon Pass	0.91		1.74	
62.	Route 171 near Buena Park-Route 61 near Crystal Lake	18.91		19.98	
63.	Big Pine-Nevada State Line		0.32		35.04
64.	Route 2 at San Juan Capistrano-Blythe		7.17		1.59
65.	Route 18 near Mariposa-Auburn		0.12	5.90	
66.	Route 5 near Mossdale-Route 13 near Oakdale		0.20		2.76
67.	Watsonville to Route 2 near San Benito River Bridge		8.69		1.40
68.	San Jose-San Francisco	6.76		9.22	
69.	Route 68 at San Jose-Route 1, San Rafael	13.21		12.19	
70.	Ukiah-Talmage		5.41	12.96	
71.	Crescent City-Oregon Line		11.65	4.64	
72.	Weed-Oregon Line	1.75			3.05
73.	Route 29 near Johnstonville-Oregon Line		12.29		1.64
74.	Napa Wye-Cordelia via Vallejo and Benicia	3.29			1.68
75.	Oakland-Junction 65 at Altaville		7.39		6.64
76.	Route 125 north of Fresno to Huntington Lake and Camp Sabrina	8.91		7.05	
77.	San Diego-Los Angeles via Pomona		3.12	5.38	
78.	Route 12 near Descanso-Route 19 near March Field		1.08	7.24	
79.	Route 2 at Ventura to Route 23 via Saugus	8.14		11.60	
80.	Route 151, Rincon Creek-Route 2 near Zaca		1.37	15.59	
81.	Route 1 near Hiouchi Bridge to Route 71 near Smith River		40.99		0.93
82.	Etna Mills to Montague via Yreka		21.92		21.04
83.	Route 38 at Truckee to Route 3 near Mt. Shasta City		8.08		5.64
84.	Route 20 near Willow Creek to Route 46 near Weitchpec		25.46	9.04	
85.	Route 1 near McKinleyville to Route 20 north of Mad River	28.71		18.76	
86.	Route 29 near Mineral to Route 83 near Park Boundary		11.42		1.58
87.	Woodland to Route 3 near Chico via Oroville		2.62		0.12
88.	Route 87 at Knights Landing to Route 47 at Hamilton City		2.39		11.98
89.	Route 49 at Middletown to Route 15 at Upper Lake		6.81		1.26
90.	Route 7 near Vacaville to Route 7 near Dunnigan via Winters		4.16	4.75	
91.	Route 3 at Lincoln to Route 17 at Newcastle		2.09		13.81
93.	Route 65 at Placerville to Route 65 at Cool via Georgetown	7.18		1.90	
94.	Route 38 at Tallac to Fallen Leaf Lake	16.83		3.05	
95.	Route 23 to Nevada State Line via Coleville		23.13	0.00	
96.	Bridgeport to Nevada State Line	51.59		47.13	
97.	Route 4 near Stockton to Route 54 near Waites Station	5.00			1.75
98.	Route 4 at Sacramento to Route 3, Arden Way	8.99		19.76	
99.	Route 53 near Rio Vista to Route 6 near Sacramento	1.04		4.12	
100.	Route 99 west of Ryde to Route 11 at Ryde	8.83		2.49	
101.	Route 53 west of Rio Vista to Route 7 at Dixon		13.35		10.02
102.	Route 49 at Rutherford to Route 6 near Monticello	19.98		37.03	
103.	Route 49 near Calistoga to Route 1 near Geyserville	3.44		2.89	
104.	Route 56 near Jenner to Route 8 near Shellville	12.82		5.54	
105.	Route 56 near Half Moon Bay to Route 5 near Hayward	8.22		7.10	
106.	Route 7 near Hercules to Route 75 north of Concord		11.53		10.24
107.	Route 55 at La Honda Pass to Route 75 near Walnut Creek via Woodside and Redwood City		3.76	0.68	
108.	Route 5 at Mission San Jose to Route 5 east of Livermore	1.74		2.65	
109.	Route 4 at Modesto to Route 13 near Salida		12.85		2.95
110.	Route 5 near Tracy to Route 65 near Coulterville		3.96		3.78
111.	Route 23 at June Lake Junction to Route 23 near Rush Creek	21.96		21.41	
112.	Lake Mary to Junction Route 23	10.73		18.07	
113.	Route 2 near Mountain View to Route 5 at Milpitas	4.85		25.81	
114.	Route 42 at Saratoga to Route 68 near Sunnyvale	8.38		11.62	
115.	San Jose to Mt. Hamilton	2.86		0.22	
116.	Route 56 at Santa Cruz to Route 42 at Waterman Gap	1.06		3.41	
117.	Monterey to Route 2 at Salinas	20.88		8.95	
118.	Route 2 at Salinas to Route 56 at Castroville	9.60			3.89
119.	Route 10 in Peachtree Valley to Route 2 at Carnadero Creek		5.29	12.99	
120.	Route 2 near Soledad to Route 119		14.80		3.21
121.	Route 32 west of Los Banos to Route 41 at Centinella	23.43		16.28	
122.	Route 41 at Gustine to Route 4 at Merced via John C. Fremont Ford Road		10.87		0.56
123.	Route 32 near Madera-Merced County Line to Snelling	8.34		9.94	
124.	Route 32 west of Califa to Route 4 at Chowchilla		4.67	10.42	
125.	Route 56 near Morro Bay to Yosemite National Park via Fresno		0.50	9.77	
126.	Route 41 near Kerman to Route 125 six miles south of Bates Station via Madera	8.82		10.22	
127.	Route 4 near Tipton to Route 31 near Baker via Lone Pine		2.97		3.09
128.	Death Valley Junction to Nevada State Line	19.12		32.14	

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Merit Award Board Winners Announced

Employees of the Department of Public Works receiving certificates of commendation and cash awards since the last list was published in the magazine are:

Marlowe E. Hardin, Division of Highways, San Francisco. $100 for designing a project check sheet to be used by design squad leaders to prevent costly omissions, revisions and delays due to oversights.

J. D. Groff and Mr. John H. Smith, Division of Highways, Los Angeles. $150, to be divided equally, for recommending a spray boom to be used to spray and control weed growth along highways.

Albert S. L. Hewes and Steve J. Zvara, Division of Highways, Los Angeles. Certificates of commendation for recommending a remodification of an auxiliary GPT timer.

Jack Roy, Division of Architecture, Los Angeles. Certificate of commendation for recommending the use of a check-out system for sepia transparency sheets.

Tommie C. Hanner, Division of Architecture, Sacramento. Certificate of commendation for recommending the placing of road maps in state cars.

William E. Weeks, Highways, San Francisco. $50 for preparing a design squad manual to be used by the division employees.

James H. Coan, Highways, Sacramento. $25 for designing and building a device to facilitate the removal of cement and cement mortar test bars from the double molds in laboratory.

Alden R. Strople, Highways, Altadena. Certificate of commendation for recommending that manhole hooks be supplied to survey parties as a safety device.

Henry S. Smith, Highways, Colton. Certificate of commendation for recommending the use of thin ozalids or autopositives by the Bridge Department in lieu of ozalid prints.

Evelyn L. Bradley, Highways, North Hollywood. Certificate of commendation for designing a plastic ruler to be used by the clerical personnel working on Form S-14, Equipment Time Record to increase the efficiency of the checking operation.

James L. Johnson, Highways, San Luis Obispo. Certificate of commendation for recommending the purchase and use of 11-inch wide ozalid paper for project reports in lieu of the 12-inch which had to be trimmed.

Andrew B. Schoellkopf, Highways, Sacramento. $150 for recommending legislation to appoint the State Treasurer as trustee for all counties in condemnation proceedings instituted by all agencies of the State.

Leroy R. Eglin, Highways, Oakland. $15 for recommending that check identification forms be made up in duplicate and in book form.

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Fred J. Grumm

Fred J. Grumm, who retired in 1950 as Deputy State Highway Engineer of the California Division of Highways, died of a heart attack at his home in Sacramento January 8th. He was 72 years of age.

During his retirement he took an active interest in civic affairs in Sacramento and at the time of his death was Chairman of the Sacramento Redevelopment Agency, a position he had held since 1953. He became a member of the agency on its inception in 1950.

Grumm, a native of Iowa who came to California in 1907, joined the Division of Highways in 1922 after holding engineering positions with San Diego County and the San Diego and Arizona Railroad.

Associates credited him with an important part in meeting the challenge of the growth of the State and development of California highways.

After attention was first drawn in the Biennial Report of 1936 to the advantages of controlled access, the forerunner of the freeway principle in California, Grumm carried out further studies which contributed to the adoption by the Legislature of the California Freeway Act of 1939.

Grumm was a member of a number of professional societies and of the Commonwealth Club and Sutter Club.

He leaves his wife and two sons, Gunther S. Grumm of Marysville, an employee of the Right of Way Department, Division of Highways; and Watson J. Grumm of San Mateo, an engineer with the Standard Oil Company.

AWARD WINNERS

Continued from page 51 . . .

Heber G. Player, Highways, Sacramento. $50 for suggesting the insertion of hardened steel bushings in the Snogo fan spider and hub, where the shear bolts go through, which will reduce the repair work now required when the hub and shear bolt holes become damaged.

Miss Lucille H. Forrest, Highways, Nevada City. Certificate of commendation for suggesting a revision of Form A-99, Stock Card.

John A. McCrea, Highways, Niles. Certificate of commendation for suggesting an improved hook for removing metal guide posts that have been damaged or broken off.

TRAFFIC COUNT

Continued from page 51 . . .

Route	Termini	Sunday Gain	Sunday Loss	Monday Gain	Monday Loss
		Percent gain or loss for 1957 count as compared with 1956			
129.	Route 4 near Bakersfield to Route 41 near General Grant National Park		1.78	2.07	
130.	Route 132 at Orosi to Route 129 near Cottonwood Creek	25.26			19.64
131.	Route 4 at Kingsburg to Route 10 near Lemon Cove		2.46		6.87
132.	Route 134 near Tulare to Orange Cove		3.70		2.23
133.	Visalia to Route 129 at Woodlake	4.79		1.02	
134.	Route 135 at Corcoran to Route 129 at Lindsay		0.14	3.82	
135.	Routes 33 and 139 at Wasco to Route 10 at Hanford		10.07		3.32
136.	Route 4 at Delano to Route 129		3.98	2.19	
137.	Route 58 near Santa Margarita to Route 125 near Creston		23.53	29.73	
138.	Route 2 at Ventura to Route 41 at Mendota		2.33	3.07	
139.	Route 140 south of Kern River to Route 33 at Wasco	5.25		6.45	
140.	Route 138 at Taft to Route 58 near Caliente		8.71	0.13	
141.	Bakersfield Junction Route 4 near Brundage Lane to Junction Route 4 near Beardsley School	1.12		0.63	
142.	Bakersfield to Route 57 at Isabella		9.91		11.85
143.	Route 140 at Weed Patch to Route 57 at Loma Park	8.03			0.83
144.	State Institution for Men to Junction Route 58 near Old Town	6.81			0.92
145.	Route 31 near Adalanto to Route 23 near Brown	6.77		12.57	
146.	Imperial County Line near Palo Verde to Nevada State Line via Needles	2.26			3.11
147.	Route 2 at Arroyo Grande to Route 2 at San Luis Obispo	1.55		13.18	
148.	Sisquoc to Route 56 near Guadalupe		2.03		4.66
149.	Surf to Route 80 at Santa Ynez	1.55		7.49	
150.	Route 2 near Santa Barbara to Route 2 at Hollister Underpass	19.99		24.24	
151.	Route 2 near Carpinteria to Route 79 at Santa Paula		5.69	11.40	
153.	Hueneme to Route 9 near Somis	4.18		7.54	
154.	Route 2 at El Rio to Route 79 near Saticoy	6.27		7.12	
155.	Route 60 at Decker Road to Route 79 at Fillmore		0.87	19.91	
156.	Route 60 at Topanga Canyon to Route 9 near Chatsworth	6.68		23.39	
157.	Route 9 near San Fernando to Route 4 near Tunnel Station	3.91		3.30	
158.	Route 60 near El Segundo to Route 4 north of San Fernando		0.35	2.69	
159.	Route 2 north of Hollywood to Route 4 south of San Fernando	2.03		6.01	
160.	Route 162 south of Hollywood to Route 2 at Hollywood		7.24		0.90
161.	Route 2 near Vineland Avenue to Route 9 near Monrovia		10.19		0.17
162.	Route 60 at Santa Monica to Route 161 at Eagle Rock		2.26	0.54	
164.	Route 60 at Hawthorne Avenue to Route 158 at Centinela Ave.	8.23		7.71	
165.	San Pedro to Route 9 at Altadena	20.36		21.65	
166.	Route 172 at Downey Road to Route 174 near Norwalk		3.63		1.20
167.	Long Beach to Route 26 near Monterey Park	1.10		6.04	
168.	Route 60 near Long Beach to Route 9 at Pasadena		9.05		7.13
170.	Route 60 near Seal Beach to Route 26 near West Covina		0.94	1.87	
171.	Route 60 near Huntington Beach to Route 2 at Whittier	4.60		3.29	
172.	Route 2, Fourth and Boyle, Los Angeles, to Route 19 near Walnut Station	1.19		1.47	
173.	Route 60 in Santa Monica to Route 2 near Soto Street		1.36	2.75	
174.	Route 60 west of Inglewood to Route 2 south of Orange		7.88		1.20
175.	Route 60 near Hermosa Beach to Route 43 in Santa Ana Canyon	7.19		7.14	
176.	Route 62 near La Habra to Route 43 in Santa Ana Canyon		29.85		13.77
177.	Route 176 near Loftus Station to Route 77 south of Chino		5.87	9.80	
178.	Route 168 near Lakewood to Route 174 near Anaheim		4.08	6.54	
179.	Route 60 near Long Beach to Route 43 near Orange	0.74		1.79	
180.	Route 2 north of Chapman Avenue to Route 175 via Placentia Avenue		27.98		27.87
182.	Route 2 near Orange to Orange County Park		2.62		13.13
184.	Route 60 near Corona del Mar to Route 2 at Santa Ana		5.10		2.17
185.	Route 60 at Laguna Beach to Route 2 near Irvine		41.22		43.15
187.	Route 202 at Bonds Corner to Morongo		1.19		0.60
188.	Route 43 near Mt. Anderson to Route 59 near Cedar Springs	4.01		8.25	
189.	Route 43 near Squirrel Inn to Route 59 at Lake Arrowhead	22.63		12.46	
190.	Route 9 near San Dimas to Route 43 at Big Bear Lake	1.97		7.50	
191.	Junction Route 31 at Verdemont to San Bernardino	17.91		5.18	
192.	Route 77 to Route 190 in Upland		1.16	5.24	
193.	Route 43 at Corona to Route 19 northwest of Mira Loma	2.40		9.89	
194.	Route 78 near Aguanga to Route 19 west end of Moreno Grade		7.26		4.68
195.	Oceanside to Route 78 near Lake Henshaw		10.20		15.55
196.	Route 2 at Oceanside to Route 77 at Vista	12.93		9.82	
197.	Route 198 at Ramona to Route 77 at Escondido		20.18	17.96	
198.	Route 200 near La Mesa to Route 26 near Kane Springs		4.43	13.52	
199.	Route 2 near Otay to Coronado	11.00		8.40	
200.	San Diego to Route 12 at White Star	17.19		31.21	
201.	Route 26 near Heber to Route 187 at Calipatria		2.15		0.57
202.	Route 12 near Coyote Wells to Route 27 at Midway Wells	21.08			2.54

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Eastshore Opening

Jackson Street to Beard Road Section Now Open

By WEBSTER C. HITE, Resident Engineer

On November 14, 1957, after a short but colorful ceremony, the third from last unit of the Eastshore Freeway between Richmond and San Jose, was opened to traffic. The last unit to the south is now under construction.

This latest 5.8-mile project for which the opening ceremonies were held, is located in Washington Township in Alameda County and extends the completed freeway from Jackson Street in Hayward on new location to the intersection with the old highway at Beard Road, just north of Centerville. Construction work was performed as a joint venture by the contracting firm of Gordon H. Ball and Ball & Simpson at a cost of approximately $4,600,000.

Completion of this project is another step toward the soon-to-be-realized freeway system following the shoreline of San Francisco Bay, giving easy access to the many communities that have developed over the years along this general route.

Two other units remain to be completed: a 10-mile section from Warm Springs to San Jose which will be completed in the fall of 1958, and a 1.6-mile section in Oakland between Fallon and Market Streets which will be completed in the winter of 1958.

The completed section between Jackson Street and Beard Road bears testimony to the phenomenal growth of the area and the awesome changes in our very way of life over a relatively short period of time.

Two opening ceremonies were observed for this latest unit, one at each end of the project. The ribbon was cut for the southbound lanes at Jackson Street in Hayward by Supervisor Francis Dunn of Alameda County. The ceremonies were then moved to Beard Road at the south end of the project where Chester E. Stanley, chairman of the Alameda County Highway Advisory Committee, cut the ribbon sym-

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UPPER—Giant scissors cut a ribbon and open to traffic the most recently completed section of the Eastshore Freeway. LOWER—The Jackson Street separation shortly after the freeway was opened to traffic.

San Diego's US 80

Historic Highway Sees Improvement

By C. WIGGINTON, District Administrative Assistant

OLD MAN EUCLID of geometry fame once casually remarked that a straight line is the shortest distance between two points. He not only qualified to be one of the front starters for a place in history as a charter member in the Mathematicians' Union, but he laid out the ground rules for modern freeway design. US 80, beginning in San Diego, the birthplace of California, and ending in Savannah, Georgia, aptly qualifies as a straight line highway from coast to coast, and under the impetus of the federal interstate program, is to be constructed to freeway standards from the Pacific to the Atlantic Ocean. Truly a tribute to Euclid and his mathematics and the highway designers of the eight states through which it passes.

This article deals with plans for US 80 in San Diego. Present planning provides for an ultimate eight-lane full freeway from US 101 in San Diego to the eastern outskirts of the City of El Cajon, with frontage roads as necessary, lighting, illuminated signs, and all of the highway design features common to modern freeway practices. Studies are in progress from El Cajon easterly; however, this article will be limited to discussion of the metropolitan areas.

Existing Bridges Replaced

Construction of additions to the US 80-US 395 Interchange should be under way before the end of this year, with bids to be opened November 7, 1957. This one-mile project includes provision for five new bridges and necessary roadwork to completely modernize a very essential facility. The existing bridges which have been laboring valiantly to handle overwhelming traffic will remain in place with minor modifications to fit them into the traffic pattern.

Fall of 1958 should see the three-and-a-half-mile portion of US 80 under construction from the US 80-US 395 Interchange to one-tenth mile west of Fairmount Avenue. This multimillion-dollar project provides for the East Cabrillo, the Texas Street, and the Ward Road overcrossings and a new bridge over the San Diego River at Ward Road. A frontage road presently parallels existing US 80 on the south through this area and where possible, this road has been incorporated into the design.

Highway Relocated

In order to make room for an interchange, plans at Ward Road provide for a complete relocation of the road to the west of its present position and erection of a new bridge across the river. This is an extremely important artery providing access between east San Diego and booming developments on Kearny Mesa. The road also provides access to old Mission San Diego de Alcala, one of the many historic monuments in the San Diego area.

The interchange at US 80 and Fairmount Avenue is at present being constructed by the Griffith Company. The bid price of $1,695,500 includes provision for grade separation structures at three locations, together with frontage roads and approaches. Fairmount Avenue ties into Mission Gorge Road leading past the old Mission Dam and thence to Santee. Work on this project should be completed by the fall of 1958.

Extensive Residential Areas

Design for the 2.2-mile section of US 80 from Fairmount Interchange to 70th Street in La Mesa is being prosecuted rapidly. San Diego State College lies on the south side of this section and US 80 provides access to this rapidly expanding educational institution. On either side of this section are extensive residential developments depending on US 80 for transportation. This project is included in the 1958-59 Fiscal Year budget.

At 70th Street, the Griffith Company is constructing another interchange to serve the La Mesa-Lake Murray area. This project, involving a bridge over the freeway with entrance and exit ramps, has a bid price of $1,229,800 with completion expected near the first of the year. Completion of this contract will provide full freeway from the interchange to the recently constructed Baltimore Drive Interchange near La Mesa's industrial area along El Cajon Boulevard.

Traffic Relief Provided

Although design is in progress for a revision of the section from the Baltimore Drive Interchange to Grossmont Summit on the eastern outskirts of La Mesa, no timing is yet available. This portion has been improved rather recently to limited access standards and has served faithfully considering the growing traffic demands of the La Mesa-El Cajon area. The most recently completed project is the Jackson Boulevard Undercrossing of US 80 sponsored by the City of La Mesa. This provided relief for north-south traffic from downtown La Mesa to the industrial area and to recently completed Fletcher Parkway, a Federal Aid Secondary project of the County of San Diego. This Parkway connects with US 80 at Baltimore Drive and extends through Fletcher Hills, connecting with State Sign Route 67 along Magnolia Avenue and Broadway in El Cajon.

Contractors Kenneth Golden, M. H. Golden, E. C. Young, and Young & Arrieta are busy with the $3,594,000 project from Grossmont Summit in La Mesa to Chase Avenue in El Cajon. This two-mile project features a multibridge interchange with State Sign Route 67 and La Mesa Boulevard, as well as a bridge at Fuerte

Drive and a pedestrian overcrossing for Grossmont High School. This portion should be completed and carrying traffic by fall of 1958.

Six-lane Freeway

A freeway agreement is in effect with the City of El Cajon to provide a relocation of US 80 through El Cajon from Chase Avenue to Tunnel Hill east of the city. This project is in the design stage with considerable rights-of-way already acquired. Construction on this section will provide six lanes of traveled way with major interchanges at Main Street, Magnolia Avenue, Mollison Avenue, Second Street, existing Highway 80 at Third Street, and Greenfield Drive. Other bridges will be provided at Marshall Avenue, Johnson Avenue, Ballantyne Lane, First Street, Broadway and a pedestrian overcrossing at Grape Street. A bridge at the connection to the existing highway at Tunnel Hill will provide access with safety until the next section is ready to go.

So ends our first project report on accomplishments to date for US 80. Many miles of highway design and many headaches are in prospect before the ultimate goal at the Colorado River is reached. Studies are under way for the balance of the line, taking advantage of the newest fields of automation in order to gain valuable engineering time. Aerial photos are providing survey information previously gathered by weary surveyors, patiently plodding through the brush of the mountains and the sands of the desert. Electronic machines click the answers for traverses and roadway excavation quantities.

But electronic machines, even of the most advanced design, are not able to think. They are only able to supply lightning-fast answers to problems submitted to them by trained personnel. The skill of submission and interpretation of data still must be accomplished by engineers using the very basic science of mathematics pondered over and developed by pioneers of the past.

Our modern freeway is a memorial to men of the stature of Pythagoras, Archimedes, and Euclid—mental masters of the ages.

UPPER—View looking east on US 80 with Baltimore Driving Overcrossing in foreground and City of La Mesa beyond. CENTER—Looking east on US 80 showing Lake Murray Boulevard Overcrossing during construction.—LOWER—Looking west on US 80 showing construction of US 80—State Sign Route 67 interchange in the foreground.

US 66 Project

New Type Bridges Used In Job Near Needles

By K. B. STONE, Resident Engineer, and
E. M. RIKER, Bridge Department Representative

On October 15, 1957, more than eight miles of new construction on US 66 were opened to traffic. The project was on entirely new alignment, extending south from the City of Needles, and was reported to be the first completely new highway in the Needles area in 45 years. The construction consisted of two lanes of what will later become a four-lane freeway, and featured novel methods of bridge construction in crossing eight large desert washes.

This improvement of heavily traveled US 66 is on new alignment, from the south city limits of Needles to three miles north of Topock. This project provides two lanes of ultimate four-lane freeway. The highway has eliminated many sharp curves and dips with new alignment and eight modern precast, prestressed concrete bridges and smaller culverts which provide drainage facilities to eliminate bottlenecks caused by the frequent summer desert storms.

This project was located and designed from the beginning by aerial photography. Aerial survey was flown by Pafford, Jones and White under contract in 1955. They furnished one set of contact prints and a contour map with a scale of 1″ = 50′, and a contour interval of two feet.

From these aerial maps the Division of Highways completed plans and specifications for the highway. It was let to contract December 24, 1956, under a joint venture consisting of E. L. Yeager, Yeager Construction Company, Bert C. Altfillisch, Altfillisch Construction Company and Lowe and Watson. The contractors finished the contract October 23, 1957, one month ahead of schedule.

New Type Bridges

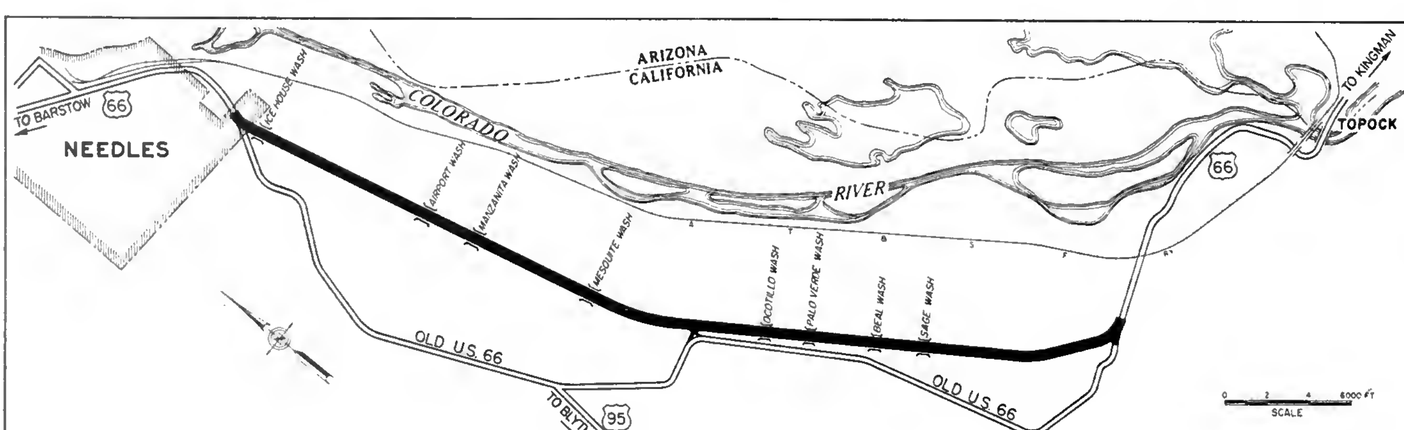
There are eight precast, prestressed, reinforced concrete slab bridges on this project, with each bridge crossing a major desert wash. All of the bridges have precast, prestressed concrete decks, with plant-mixed surfacing. Two of the bridges have conventional closed type abutments using cast-in-place reinforced concrete; the remaining structures have precast, prestressed, reinforced concrete abutments, wingwalls and piers. Bridge lengths vary from 30 feet to 183 feet. Bridge widths are a nominal 40 feet, which includes two 12-foot lanes and adjacent shoulders. Deck spans are of standardized design in lengths of 30 and 40 feet. The designs of the precast abutments, piers and wingwalls are standardized as much as possible. The bridges are on straight alignment with bridge skews varying from zero to 28 degrees. The total cost of the eight bridges was approximately $515,000. All bridges are supported on reinforced cast-in-place concrete footings and piling.

All precast, prestressed, reinforced concrete bridge members were cast by the Concrete Conduit Company, subcontractors, at their casting yard at Azusa, California. The members were transported by truck to the construction site at Needles, a distance of about 250 miles. The largest precast unit was a 40-foot deck unit which weighed 16 tons. There was a total of 477 units transported by 225 truck loads.

Prestressing is used to reduce the size and weight of concrete structural members. It consists of applying high tension stresses to the steel reinforcement and releasing them to react on the concrete after the concrete has hardened. For this purpose high-strength steel wires or cable are usually used instead of the ordinary reinforcing bars.

Pretensioning

The prestressing may be done by tensioning (stretching) the wires and pouring the concrete around them. Adhesion of the hardened concrete to



the wires thereafter retains most of the tensile stress. This is called pretensioning. Another method, called posttensioning, consists of stretching the steel after the concrete is hardened, through holes left in the concrete when it is cast. The tensile stress is then held by end ties which bear against the hardened concrete at the ends of the member.

All deck units were pretensioned longitudinally at the casting yard and posttensioned transversely after erection. Both pretensioning and posttensioning were performed using high-strength ⅜-inch-diameter, stress-relieved, seven-wire strand.

All precast substructure members were of conventional reinforced concrete. The precast substructure members were secured to the footings with steel dowel bars and anchor bolts. After erection, the substructure units were posttensioned transversely. The purpose of all transverse posttensioning was to tie all adjacent members together, thereby causing them to act under load as a completely integrated unit.

County Supervisor Magda Lawson cuts ribbon opening new section of US 66 south of Needles. Others present included, left to right: Clyde V. Kane, District Engineer for the Division of Highways; W. H. Hirschmann, H. L. Smith, Mrs. Boyd C. Cunningham, P. C. Griswold, D. N. Baker, President, Needles Chamber of Commerce; Capt. A. G. Strom, California Highway Patrol, and Kent B. Stone, Resident Engineer. (Photo by San Bernardino Daily Sun.)

Precast Beams Used

Erection procedures in general consisted of erecting and aligning the precast members, grouting the joints between adjacent members, inserting the posttensioning strand through the transverse posttensioning ducts in each adjacent member, stressing the strand, and pressure-grouting each posttensioning duct.

Erection of the precast substructure units was complicated somewhat by vertical field adjustments, necessary to obtain perfect alignment of the transverse posttensioning ducts.

Grouting the joints between the precast members without plugging the transverse posttensioning ducts was accomplished by placing a one-inch pipe completely through the duct. The pipe was rotated frequently to prevent it from bonding to the grout. After grouting, the pipe was removed from the duct. The posttensioning strand was inserted into the duct immediately after the pipe was removed.

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LEFT—Workers place heel planks on wingwall units of a bridge. RIGHT—Tensioning the transverse reinforcement on an abutment.

Harry D. Johnson Retirement Marked

Harry D. Johnson, highway superintendent for the Division of Highways District VII Office in Los Angeles, has retired after 30 years of service.

Johnson first worked for the State Division of Highways in 1922 in surveys as a rodman, a chainman, and a transitman. Later he joined construction as a junior highway engineer. In 1947 he took over the position of prison camp superintendent at Angeles Crest and was in charge of all convict labor to the time of his retirement on December 1, 1957.

HARRY D. JOHNSON

A roadbuilder and an inventor to boot, Johnson is well known today for his invention in 1937 of the "Johnson Float" (a concrete finishing machine), now a common sight in paving operations on highway construction. The machine is now in use in 11 western states and Alaska. Johnson's innovations resulted in a method of delayed finishing which allowed workmen to finish a thousand feet distant from the mixer.

Another Johnson invention which was in service for a number of years was an expansion joint end-clip, designed to prevent the concrete from spreading to the end of the expansion joint filler.

Johnson was a construction superintendent on the Angeles Crest Highway job. The Angeles Crest Highway across the San Gabriel Mountains through the Angeles National Forest was almost 50 years in the making, cost approximately $10,000,000, and stretches 55 miles into the Big Pines recreational area. Ten years of Johnson's life was spent in this rocky, mountainous country, at the head of a convict gang working on the highway. In the daytime he worked them on construction and in the evening returned them again to the prison officials at the detention camp. Johnson today says: "I found them in every way as fit as others doing the same work someplace else."

Johnson's work in the years past has been mainly connected with paving, but he had a hand in most everything in construction on the Ridge Route in 1933-34.

Born in San Bernardino and raised in Riverside, Johnson attended Riverside Polytechnic High School and later enrolled in correspondence courses to further his education in civil engineering. He is an army veteran of World War I, 1916-1918. He is also a navy veteran of World War II, serving with the Seabees in Samoa until 1945.

Johnson is married and has a son and a daughter.

Johnson owns a 27-foot sailboat in Santa Barbara, with which he intends to cruise the coast of Mexico. He also intends to tour Mexico inland.

Vincent J. Preston

Vincent J. Preston, right-of-way agent for the Division of Highways in Los Angeles, died on November 11th following a heart attack.

Preston was born in Jersey City, New Jersey, on March 5, 1914. He served in World War II as a storekeeper 1/C U. S. N. R. After this war service, he completed his education at Seton Hall College, New Jersey, where he received his B.S. degree in 1947.

In 1947 he came to California to accept employment as Supervising Property and Supply Clerk for the U. S. Navy Bureau of Yards and Docks at Port Hueneme. He began work for District VII of the State Division of Highways in 1949 as a right-of-way agent.

During recent years his right-of-way acquisition activities were largely in Orange County. He brought to a successful conclusion some of the complex right-of-way problems connected with development of the Santa Ana Freeway. He was an active member of Chapter 1 of the American Right of Way Association.

A total of 7,118,862 drivers' licenses were outstanding in California on August 31, 1957, as compared with 6,783,746 a year before.

Lloyd Dunbar Craig

A 32-year career with the State Division of Highways came to a close October 19, 1957, with the sudden passing of Lloyd Dunbar Craig, Service and Supply Co-ordinator for Northern California.

Craig, who was 61, joined the ranks of civil service in 1925 as a laborer. The following year he rose to maintenance foreman. By 1931 he had become maintenance superintendent on Highway 40 projects in the Sierras during which time he initiated snow removal operations on Donner Pass.

He was maintenance superintendent in the Quincy and Red Bluff areas from 1932 until 1947, when he joined Headquarters staff in Sacramento as co-ordinator-troubleshooter for the Service and Supply Department.

Craig was born in Garden City, Kansas, on December 19, 1895. He served in the U. S. Army from May, 1917, until July, 1919. After his discharge, he managed his own ranch for a few years before coming to work for the State.

He was a past master of the Plumas Lodge No. 60 of the Free and Accepted Masons in Quincy, Plumas County, and a past patron of the Vesper Chapter No. 20 of the Order of the Eastern Star in Red Bluff, Tehama County.

Surviving are his wife, Alta Mae; his son, Eldon Lewis Craig, of Sacramento; grandchildren, Alisa Dene and Brian Dunbar Craig; sisters and a brother, Mrs. Walter E. Hunzeker and C. F. Craig of Gridley, Butte County, and Mrs. Russell Mills of Carlsbad, New Mexico.

Highway 'Danger Red' Finds Another Use

Remnants from Division of Highway red warning flags are used at Merritt Hospital in Oakland to wrap sterilized equipment used for emergency treatment of heart stoppage.

The bright red wrappings enable hospital personnel to identify the emergency trays among other equipment kept in the hospital's emergency room, surgery, and central supply area.

'Equity for State,' Governor Reports

Governor Goodwin J. Knight expressed satisfaction with California's position in federal developments concerning the National System of Interstate and Defense Highways when he returned in mid-January from a visit to Washington, D. C.

The estimated cost of completing the 2,135 miles of the interstate system in California is $3,266,360,000, which represents 10.162 percent of the total cost of the program nationwide. These cost estimates will be used as the basis for apportioning funds authorized for the Fiscal Years 1960, 1961, and 1962. The program is financed with 90 percent federal funds, matched by 10 percent state funds.

In view of the fact that California motorists contribute approximately 10 percent to the Federal Treasury in highway user taxes, the allocation of approximately 10 percent of federal funds to California for the Interstate and Defense Highway System brings about an interesting coincidence in equity, the Governor said.

Governor Knight commended California's Highway Division for the record made thus far in putting funds to work in the development of the National Highway System. California leads the states in meeting the challenge of the expanded highway program and has been able to match funds and award contracts as rapidly as federal funds have been made available. California has to date utilized available federal interstate funds through the 1958-59 Fiscal Year, amounting to approximately $250,000,000.

Although Washington reported cost estimates had increased over those in the 1956 Highway Act, Governor Knight said there was no indication that there will be an increase in federal highway user taxes.

Basic reasons for the increased costs were explained as: (1) nationwide traffic forecasts for 1975 are 15 percent higher than previous forecasts, resulting in a need for more traffic lanes and other facilities, with additional construction required on the interstate system to handle this additional traffic; (2) higher design standards to serve local needs will require more highway grade separations, interchanges and other structures, and additional frontage roads; (3) miscellaneous items such as utility adjustments, lighting, signing, etc.; (4) increased highway construction costs.

EASTSHORE OPENING

Continued from page 53 . . .

bolizing the opening of the northbound lanes. Following the two ribbon cuttings and a tour of the job, the official caravan proceeded to Niles where a reception and luncheon were held at the International Kitchen, sponsored by the Alameda County Highway Advisory Committee.

The recently completed unit was under the immediate supervision of G. L. Beckwith, district construction engineer. W. C. Hite was resident engineer in charge, with R. C. Colley as Bridge Department representative.

The construction forces of the contractor, Gordon H. Ball and Ball & Simpson, were under the direction of R. G. Webster, superintendent.

Separation structures such as this on the Eastshore Freeway are typical of the State's freeway construction program

William R. Cobb Ends 26 Years With State

William R. Cobb retired from state service on November 30, 1957.

Cobb came to California in 1889 from his birthplace in Grafton, North Dakota, when he was only two years old. After graduating from Mission High School in San Francisco, he entered Stanford University.

WILLIAM R. COBB

His education at Stanford was interrupted by the 1906 earthquake which partially destroyed the campus. He completed his engineering studies at the University of California at Berkeley in 1912.

From 1912 to 1916 he was employed as a party chief by the Board of State Harbor Commissioners, then engaged in varied waterfront projects including the Fort Mason Tunnel.

As a Lieutenant (JG) in the Naval Reserve he was called to active duty at the start of World War I in 1917, and after a year of sea duty he was ordered to Naval Aviation. He won his wings as Naval Aviator, becoming a member of a small group of pioneers who founded the air arm of the Navy.

Upon termination of his naval duty Cobb entered private industry, both in business and in engineering. In 1931 he joined the Division of Highways. He has been with District IV in all the intervening years except for a short tour of duty with the San Francisco-Oakland Bay Bridge. At the end of World War II he became Assistant District Engineer, Traffic, of District IV, in 1948 and has so served since that date.

Cobb is married and has two daughters and three grandchildren.

A total of 83,770 vehicles on the San Francisco-Oakland Bay Bridge were supplied gasoline and miscellaneous services by the Highway Division from the time the bridge opened through September, 1957.

National Honors Accorded State Engineers

The annual award for the best paper presented to the Highway Research Board in 1957 is being accepted by George M. Webb (left), Traffic Engineer of the California Division of Highways, from Rex M. Whitton, Chief Engineer of the Missouri State Highway Department and chairman of the HRB. At right is Karl Moskowitz, Assistant Traffic Engineer, and coauthor of the winning paper on "California Freeway Capacity, 1956." Moskowitz received a similar certificate.

A California Division of Highways traffic research project won national honors in the highway engineering field at the annual meeting of the Highway Research Board held in Washington, D. C., early in January.

The study, entitled "California Freeway Capacity Study, 1956," made by George M. Webb, traffic engineer, and Karl Moskowitz, assistant traffic engineer of the State Division of Highways, was accorded the Highway Research Board annual award for the best paper presented at the board's 1957 meeting.

The Webb-Moskowitz research, an analysis of the operating characteristics of high-volume freeways, has been in demand among highway planners and designers all over the Country since it was published a year ago. The facts which this study discloses are being applied in the planning of many new freeways on the National Interstate System.

The 105-page study includes photographs and charts showing and interpreting the movements of traffic on the Hollywood, Harbor and other freeways in the Los Angeles area, the Bayshore and Eastshore Freeways in the San Francisco Bay area and the North Sacramento Freeway. Some of the data were also used in an article entitled "Freeway Traffic Flow" which appeared in the July-August, 1956, issue of *California Highways and Public Works*. Another result of the research was a motion picture which has been widely shown to highway engineers throughout the Nation.

Selection of the California paper from among the hundreds presented annually at the scientific meeting was made by a special executive committee on awards.

The papers from among which the winner was chosen covered not only traffic studies, but also research in all phases of highway engineering, including soils, materials, design, economics, urban problems, and maintenance.

The last time a California Division of Highways paper was similarly honored was in 1949. The winner then was a study entitled "The Factors Underlying the Rational Design of Pavements," written by Francis N. Hveem, materials and research engineer, and Robert M. Carmany, assistant engineer of design.

Hveem has also been the recipient of the other annual award made by the Highway Research Board, the Roy W. Crum Distinguished Service Award. This honor, conferred for continuing distinguished contributions to highway research, was presented to Hveem for 1956. A previous California winner of this award was Ralph A. Moyer of the Institute of Transportation and Traffic Engineering, University of California.

TRAFFIC COUNT

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Percent gain or loss for 1957 count as compared with 1956

Route	Termini	Sunday Gain	Sunday Loss	Monday Gain	Monday Loss
203.	Route 26 near Oasis to Route 204 west of Mecca		19.76		9.63
204.	Route 26 Bendels Corner to Mecca via Avenue 66	3.22			4.75
205.	Pasadena Freeway		6.14		0.40
206.	Route 69 Eastshore Highway to Route 75 via Ashby Avenue	5.53		4.24	
207.	Route 190 near Highland to Route 43 at Running Springs	2.59		7.15	
208.	Sears Point to Vallejo		8.52		8.57
209.	Route 3 to Shasta Summit near Summit City		4.54		6.66
210.	Route 28 near Canby to the Oregon Line	13.62		18.04	
212.	Nevada and California State Line to Route 23 near Freeman	6.28		2.95	
224.	Route 2 near Lombard Street to the San Francisco-Oakland Bay Bridge Approach	No count		No count	
226.	Route 69 in San Leandro to Posey Tube	25.05		39.34	
227.	Route 75 in Oakland to Route 5 near San Leandro		12.27		12.73
228.	Route 5 to Route 69 near San Lorenzo	No count		No count	
230.	Route 172 to Route 173 via Indiana Street		6.32		15.17
232.	Sacramento to Marysville	No count		No count	
233.	Sierraville to Vinton via Loyalton	No count		No count	
235.	Route 69 near 42d Avenue to Route 5 near High Street in Oakland	No count		No count	
237.	Route 56 to Daly City to San Bruno	No count		No count	
All routes		2.26		4.80	

COST INDEX

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projects, the project values and the average number of bidders arranged by value brackets for the period July 1, 1957 to December 31, 1957.

The California Highway Construction Cost Index, the Engineering News-Record Construction Cost Index and the United States Bureau of Public Roads Composite Mile Index, all reduced to the base 1940=100 are shown on the accompanying graph. The latter two indexes are based on nationwide construction costs.

The Engineering News-Record Cost Index which now stands at 304.8 again shows a rise but at a lower rate of increase than in the third quarter of 1957. It is up 1.6 index points or 0.5 percent from the second quarter.

The Bureau of Public Roads Composite Mile Index for the third quarter of 1957 at the level of 237.3 which is the latest available, was up 0.1 index point or 0.05 percent over the second quarter of 1957.

Faced with a general round of wage increases and the possibility of an expanded federal defense program, a rising tendency in the cost index can be anticipated. However, this will be offset to some extent by strong competition for contracts, and it is expected that the next quarter will show a level tendency or perhaps a slight increase.

THE CALIFORNIA HIGHWAY CONSTRUCTION COST INDEX

Year	Cost index
1940	100.0
1941	125.0
1942	157.5
1943	156.4
1944	177.8
1945	179.5
1946	179.7
1947	203.3
1948	216.6
1949	190.7
1950	181.2
(1st Quarter 1950—160.6)	
1951	225.0
(4th Quarter 1951—245.4)	
1952	225.9
1953	215.2
1954	193.5
(2d Quarter 1954—189.0)	
1955 (1st Quarter)	189.3
1955 (2d Quarter)	212.4
1955 (3d Quarter)	208.6
1955 (4th Quarter)	212.6
1956 (1st Quarter)	219.5
1956 (2d Quarter)	255.9
1956 (3d Quarter)	249.1
1956 (4th Quarter)	252.1
1957 (1st Quarter)	277.7
1957 (2d Quarter)	266.9
1957 (3d Quarter)	237.5
1957 (4th Quarter)	262.1

ATWATER BYPASS

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one-quarter mile from the northbound acceleration and deceleration ramps. The Applegate Interchange serves local traffic and is a four-quadrant cloverleaf constructed in two quadrants. The East and West Atwater Overheads consist of two parallel steel bridges spanning the railroad and old US 99.

The Gordon H. Ball Company started imported borrow operations in September of 1956 and reached a daily production of 16,000 tons placed in a nine-hour day. The borrow material consisted of Atwater sand, a sandy silt material with a very high "R" (resistance) value. One million tons were placed in approximately four months of good weather. Many compaction devices were experimented with, including a grid roller, vibratory compactors, and a vibratory roller. Two 50-ton pneumatic rollers were found to be the most satisfactory in handling the large borrow output.

Normally, drainage of a project of this magnitude in the flat valley lands represents a major undertaking; however, the "Atwater Sand" over which this project passed is a free-draining sandy-silt and by constructing drainage sumps to serve as settling basins the drainage problem has been solved. Other drainage facilities consisted of various sizes of reinforced concrete boxes and corrugated metal pipes.

Because of the high "R" value of the subbase material, a standard structural section of four inches of cement treated subgrade under the portland cement concrete pavement was all that was required. A cement content of 7 percent was used in order to arrive at a compressive strength of 650 psi. The cement and top four inches of subgrade were mixed with a self-propropelled mixer. The frontage road structural section consisted of six to eight inches of untreated base under two to three inches of plant-mixed surfacing.

Extensive fencing was placed; both six-foot chain link in the populated areas and field fence in the remaining areas.

Outstanding results were obtained in the placing of the portland cement concrete. A "bump meter" reading of four inches per mile was recorded, one of the finest ever obtained in this district. Due to the hardness of the Merced River agregate used in the concrete sawing of the 30-foot joints was discontinued and paper joints were substituted.

This project was under the supervision of District Enginer J. G. Meyer, Operations Engineers Sam Helwer and E. L. Tinney and Construction Engineer W. L. Hurd. The Bridge Department was represented by Don Nance and later by Charles Negus.

GILLISS NAMED

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expert for Riverside County and chief of its central accounting system. In 1947 he was named Riverside County assistant road commissioner and highways administrator.

Gilliss was appointed special representative of the State Department of Public Works December 1, 1952; assistant deputy director of the department in August, 1953, and deputy director September 23, 1955.

The new director is a member of the American Road Builders Association, American Right of Way Association, National Institute of Traffic Engineers, American Society for Public Administration, Western Governmental Research Association, Inland Association for Personnel Administrators, Inland Society of Public Administration, International Accountants Society, Toastmasters International, and State Men's Club. He holds a public accountant's license in California.

Gilliss is married and has two daughters, Charlene, 15, and Donna, 13. His home is in Sacramento.

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US 66 PROJECT

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Stressing of the posttensioning strand was performed with a hydraulic jack with an adapter which allowed stressing of one complete duct (four to six strands) in one operation.

Pressure grouting was performed with a grouting machine capable of producing 100 psi at the far end of the duct. Pressure grouting material consisted of cement and water mixed to the consistency of thick paint.

Wingwall Design

The design of the precast wingwalls deserves special mention. The wingwalls were of the counterfort type and had precast face panels, counterforts and heel planks set on a cast-in-place footing. The counterforts had flanged bases which were fastened to anchor bolts set in the footing. Face panels set between the counterforts were provided to transfer the horizontal thrust to the counterforts. These face panels were secured by grouted keys and horizontal posttensioned strands. The heel planks spanned between adjacent counterfort units and transferred the vertical load of the backfill to the counterforts for the necessary stability.

The roadway embankment areas were protected by ditch and dike sections adjacent to bridges and culverts, supplemented by light stone riprap on the dikes.

There was a total of 12,700 cubic yards of structure excavation, with 7,600 yards of structure backfill. The ditches and dikes required 46,200 yards of excavation and embankment quantities. There were 11,600 tons of light stone riprap placed on the dike sections.

Overhaul Reduced

The contractor found excellent materials for both the embankment and imported base materials. Due to the excellent side borrows the contractor elected to waste approximately 175,000 cubic yards of roadway excavation, thereby reducing the overhaul from the original estimated quantity of 22,700,000 station yards overhaul to 3,769,900 station yards.

The contractor was paid for 567,800 yards of roadway excavation. The project required 226,000 pounds of steel, 1,201 cubic yards of concrete (not including precast bridge members), 65,700 tons of imported base material, and 7,230 lineal feet of corrugated metal pipe varying in size from 8 inches to 84 inches.

The roadbed was completed with 36,780 tons of plant-mixed surfacing, 3 inches in depth, placed on 6 inches of imported base material.

Charles K. Benedict

Charles K. Benedict, Right-of-way Agent in District III of the Division of Highways, Marysville, died on November 21, 1957, of a heart attack.

Benedict was in charge of one of the appraisal sections in the Right-of-way Department. He had supervision of many of the appraisals made on right-of-way required in converting US 40 from Sacramento to the Nevada state line to full freeway standards as part of the Interstate Highway System. Prior to this time he had been in charge of the Condemnation Section in which he handled the many varied legal matters required in connection with the filing and prosecution of lawsuits when it became necessary for the State to acquire rights-of-way under eminent domain. Earlier he was in charge of the District Right-of-way Clearance Section dealing with utility and railroad companies in the relocation of their facilities required by highway construction.

Benedict was born in New York City on March 28, 1905. His family moved to the West Coast when he was seven years old. He graduated from Palo Alto High School and received a B.A. degree from Stanford University with a major in chemistry in 1928.

In 1931, he enlisted as a naval aviation cadet. He was released to inactive duty in 1933 as an ensign in the U. S. Naval Reserve.

From 1933 to 1941 he worked in retail selling, personnel management and fire and casualty insurance in Oakland and in San Francisco.

On the outbreak of World War II he resumed his active status in the U. S. Navy and was assigned as flight instructor in the aviation cadet training program. He rose to the rank of commander, and served in many areas.

Benedict entered state service in March, 1947.

He was a member of the American Right-of-way Association and an associate member of the Society of Residential Appraisers. He was a commander in the U. S. Naval Reserve and at the time of his death was Assistant Training Officer, Electronics Division 1218. He was also quite active in civic affairs.

He is survived by his wife, Barbara, daughters, Susan, Martha and Nancy, and a brother, Howard Courtney, of Chico.

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GOODWIN J. KNIGHT
Governor of California

CALIFORNIA HIGHWAY COMMISSION

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FRED W. SPEERS	Escondido
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A. H. HENDERSON	Deputy Director
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JOHN STANFORD	Management Analyst
S. ALAN WHITE	Departmental Personnel Officer
RICHARD WINN	Departmental Information Officer

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CHAS. E. WAITE	Deputy State Highway Engineer
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F. W. PANHORST	Assistant State Highway Engineer
J. C. WOMACK	Assistant State Highway Engineer
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G. M. WEBB	Traffic Engineer
MILTON HARRIS	Construction Engineer
H. B. LA FORGE	Engineer of Federal Secondary Roads
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I. O. JAHLSTROM	Bridge Engineer—Operations
R. R. ROWE	Bridge Engineer—Special Studies
J. E. McMAHON	Bridge Engineer—Southern Area
L. C. HOLLISTER	Projects Engineer—Carquinez
E. R. HIGGINS	Comptroller

Right-of-Way

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E. F. WAGNER	Deputy Chief Right-of-Way Agent
RUDOLPH HESS	Assistant Chief
R. S. J. PIANEZZI	Assistant Chief
E. M. MacDONALD	Assistant Chief

District IV

B. W. BOOKER	Assistant State Highway Engineer

District VII

E. T. TELFORD	Assistant State Highway Engineer

District Engineers

SAM HELWER	District I, Eureka
H. S. MILES	District II, Redding
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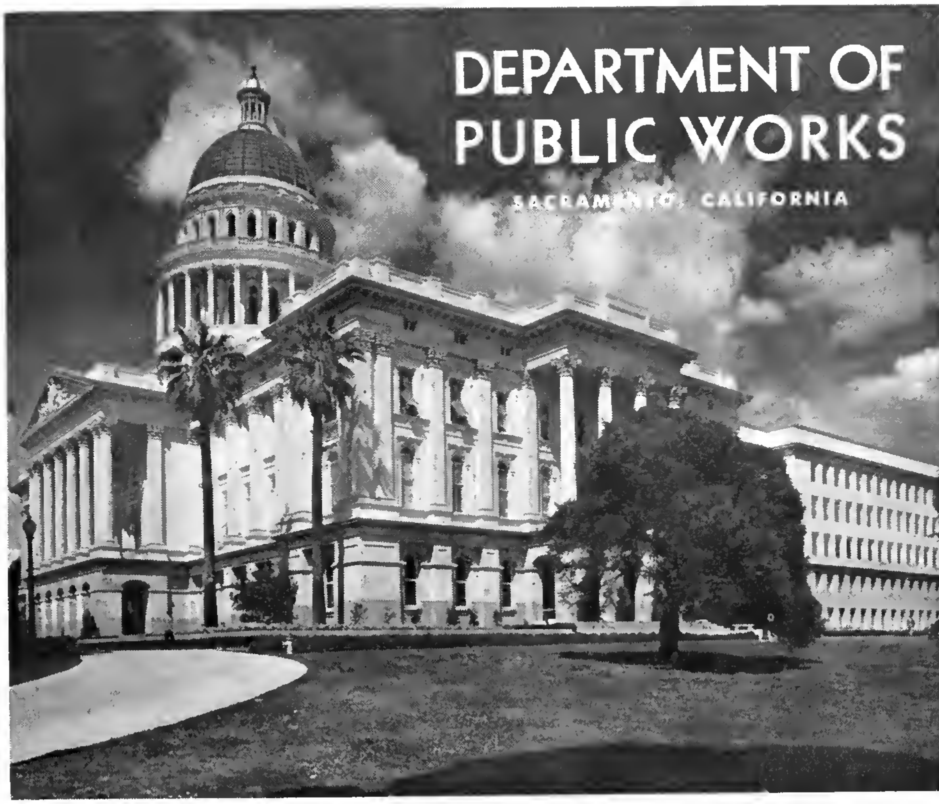
J. P. SINCLAIR	District IV, San Francisco
L. A. WEYMOUTH	District IV, San Francisco
R. A. HAYLER	District IV, San Francisco
A. M. NASH	District V, San Luis Obispo
W. L. WELCH	District VI, Fresno
A. L. HIMELHOCH	District VII, Los Angeles
LYMAN R. GILLIS	District VII, Los Angeles
C. V. KANE	District VIII, San Bernardino
E. R. FOLEY	District IX, Bishop
JOHN G. MEYER	District X, Stockton
J. DEKEMA	District XI, San Diego
HOWARD C. WOOD	Bridge Engineer State-owned Toll Bridges



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GEORGE C. HADLEY	Assistant Chief
HOLLOWAY JONES	Assistant Chief
HARRY S. FENTON	Assistant Chief

DIVISION OF SAN FRANCISCO BAY TOLL CROSSINGS

NORMAN C. RAAB	Chief of Division
BEN BALALA	Principal Bridge Engineer

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HUBERT S. HUNTER	Deputy Chief of Division
ROBERT W. FORMHALS	Administrative Assistant to State Architect
FRANK B. DURKEE, JR.	Information Officer

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HENRY R. CROWLE	Fiscal Officer
THOMAS MERET	Construction Budgets Architect
WADE O. HALSTEAD	Principal Estimator of Building Construction
STANTON WILLARD	Principal Architect, Standards
LEAVITT M. POWERS	Accounting Officer
W. F. PARKS	Supervisor of Office Services

Design and Planning Service

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ROBERT M. LANDRUM	Chief Architectural Coordinator
ARTHUR F. DUDMAN	Principal Architect, Sacramento
JAMES A. GILLEM	Principal Architect, Los Angeles
CHARLES PETERSON	Principal Structural Engineer, Los Angeles
CARL A. HENDERLONG	Principal Mechanical and Electrical Engineer
CLIFFORD L. IVERSON	Chief Architectural Draftsman, Sacramento
RAYMOND CHEESMAN	Chief Architectural Draftsman, Los Angeles
GUSTAV B. VEHN	Chief Specifications Writer

Construction Service

CHARLES M. HERD	Chief Construction Engineer
CHARLES H. BOCKMAN	Assistant to Chief Construction Engineer

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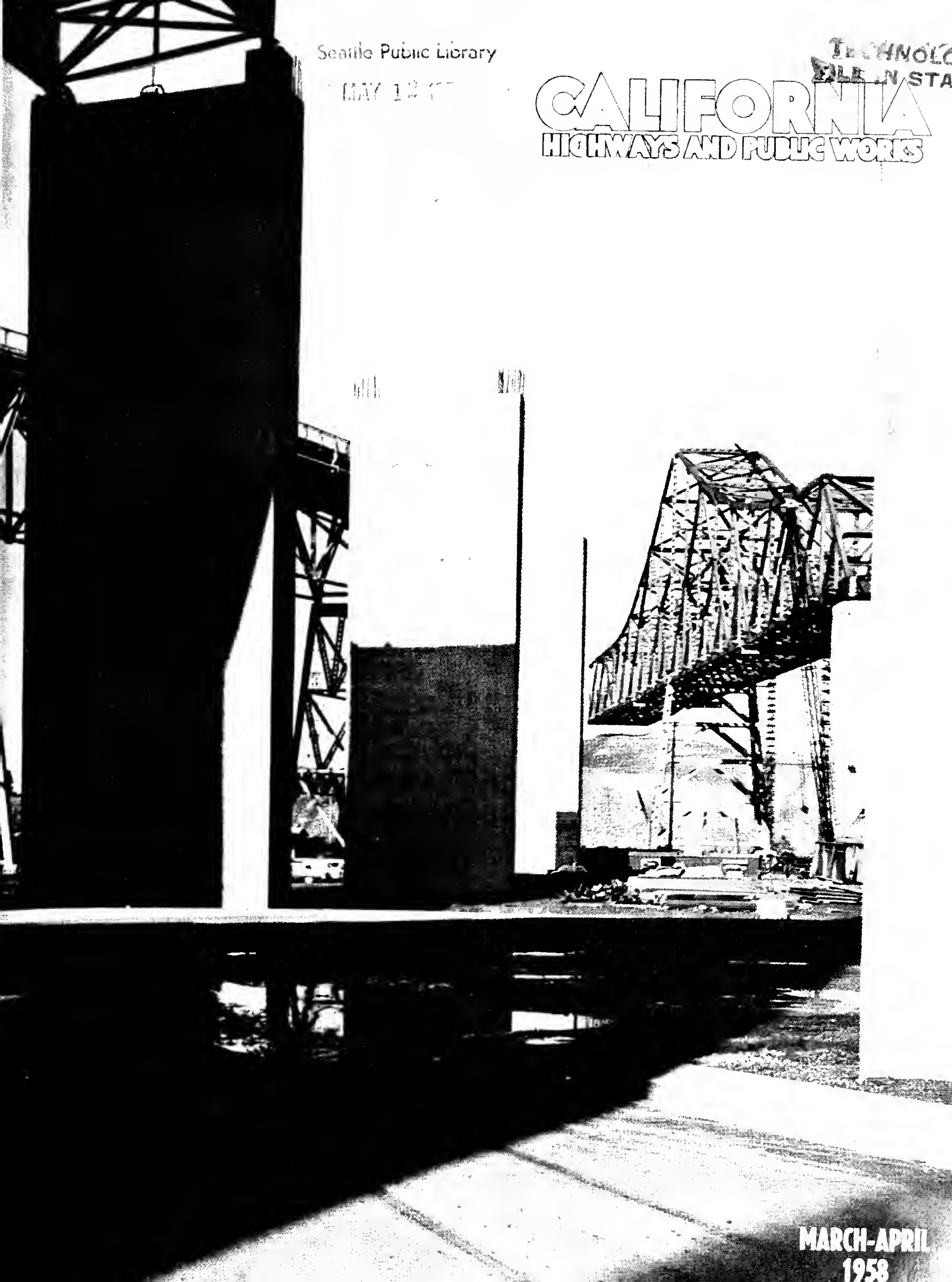
printed in CALIFORNIA STATE PRINTING OFFICE 68274 1-58 53M

CALIFORNIA
HIGHWAYS AND PUBLIC WORKS



MARCH-APRIL
1958

California Highways and Public Works

Official Journal of the Division of Highways, Department of Public Works, State of California

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Vol. 37 | March-April, 1958 | Nos. 3-4

FRONT COVER

The steel superstructure of the new parallel Carquinez Bridge is viewed through the concrete piers of the south approach. The curved ramp of the old bridge can be seen behind the piers to the right.
—Photo by Bill Ruland

BACK COVER

The San Francisco-Oakland Bay Bridge, shown here in a view from Yerba Buena Island looking toward Oakland, was cited as one of the seven "civil engineering wonders of the U. S." *—Photo by William Chaney*

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Published in the interest of highway development in California. Editors are invited to use information contained herein and to request prints of any black and white photographs.

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Report From District IV

Pushed Toward Completion Bay Area Freeway Network

By B. W. BOOKER
Assistant State Highway Engineer

The population of the nine counties in District IV (Sonoma, Napa, Marin, San Francisco, Contra Costa, Alameda, San Mateo, Santa Clara and Santa Cruz) has increased from 2,500,000 in 1947 to 3,200,000 in 1957. It is expected that by 1970 the population of the area will increase to nearly 5,000,000. During the past 10 years automobile registration has increased over 80 percent. The ratio of persons per vehicle has been steadily declining to a present 2.3 persons per vehicle within the metropolitan area and less within the rural areas.

Many new areas, both residential and commercial have been developed; new cities have been formed and others will be required in the future. The growth in population and automobiles in the nine counties has introduced many problems, not the least of which is transportation.

The task of providing a transportation system to serve the needs of the dynamic increases in population and area development is a tremendous one. It requires the development of all forms of transportation which contribute to the solution of the problem.

It is the State Highway's responsibility to provide the network of freeways and major highways which are an essential component of the integrated transportation system required to serve this area.

District IV freeway system planning has been based on comprehensive traffic information as well as collection of planning data, future population projection and probable land use changes. This has been done through public meetings, by discussions with those engaged in planning, public works, and pertinent operations in the cities and counties, as well as with the utility and industrial organizations and others who are similarly engaged in area development.

Photos at Top of Page. LEFT—A newly completed section of the Bayshore Freeway in southern San Mateo County. CENTER—A freeway section of U. S. 40 recently opened to traffic in Contra Costa County. RIGHT—The Richardson Bay Bridge on U. S. 101 in Marin County.

Progress Cited

Since funds for the expanded program of street and highway development were made available in 1947, we have made substantial progress. It may be too easy to forget the previous traffic conditions existing along our conventional highway and city street routes prior to improvements as freeways. There may be a tendency to neglect to appraise the situation which would have prevailed if the tremendous increases in traffic still had to be served by conventional facilities along these routes. In spite of this progress there is a great deal left to be accomplished. In District IV, there are a

. . . Continued on page 2

Public Works Building
Twelfth and N Streets
Sacramento

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DISTRICT IV

Continued from page 1 . . .

total of 1,381 miles of state highway. Of this, approximately 1,000 miles are to be developed as freeways and routings for 537 miles have been adopted. Since 1947, 242 miles of freeway have been constructed, another 47 miles are under construction and 30 miles are scheduled for construction in the 1958-59 Fiscal Year.

The decade has witnessed the virtual completion of a basic network of the freeway system extending from the metropolitan Bay area in all directions. By the end of 1958, continuous freeways and expressways will be in service or under construction extending from Los Gatos to San Jose then via the Eastshore through Oakland to Sacramento; from Oakland to Tracy; from San Francisco to Moffett Field south of Palo Alto; and from San Francisco to Santa Rosa (with the exception of the portion through Novato). Other important routes are being progressively planned and constructed.

We are well advanced in development of the first stage of our planned construction along the heaviest routes of travel. Other areas must be afforded relief from present inadequacies and provision must be made for traffic demands of the future. One freeway alone could never serve heavily developed areas near large centers of population. Other freeways radiating from the metropolitan hubs to areas not served by present freeways must be provided if present unsatisfactory conditions of traffic congestion are to be eliminated.

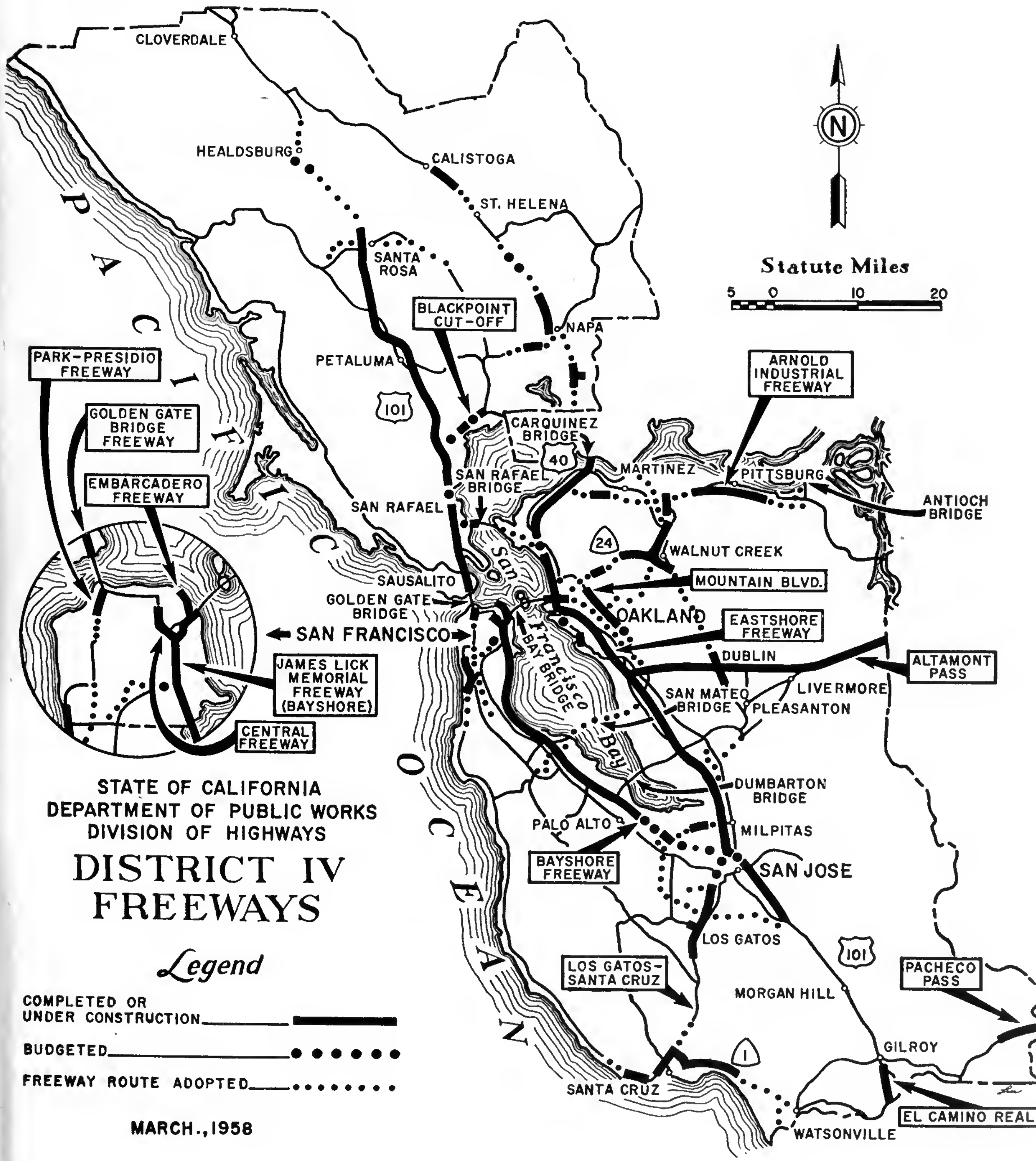
As is proper, the rights of the individual must be weighed along with the need of the many, and the highlight of the present picture of highways development is the democratic processes of discussion and deliberation by all parties concerned with the purpose of obtaining agreement upon the routes which will provide the greatest public benefit with the least private injury.

Let us review the accomplishments of the past year, as they fit into the existing pattern and as they project into the plans for the future.

US 101 and US 101 Bypass

Development to higher standards and extension of the freeway portions is continuing along these major north-south routes in District IV which extend from San Francisco to the north boundary of the district at the Mendocino county line, and to the south boundary of the district at the San Benito county line.

At the present time, the main activities, construction-wise, are concentrated along the US 101 Bypass (Bayshore Freeway) south of San Francisco from San Carlos to Palo



The double-deck Cypress Street structure on the Eastshore Freeway in Oakland. The southbound off-ramp to 14th Street is at the lower left.

Alto and further extensions are budgeted for 1958-59. The completion of these going jobs early this year will provide a continuous freeway for the 35 miles between the San Francisco-Oakland Bay Bridge approach (US 40) and Palo Alto.

Continued development of the freeway south to San Jose is assured with projects included in the 1958-59 Fiscal Year Budget. In this budget are projects extending from Palo Alto to the completed interim interchange at Moffett Field, as well as an interchange at the Mountain View-Alviso Road intersection and the extension of the freeway north of San Jose from Taylor Street to Brokaw Road. From Taylor Street south, there is now in existence a four-lane facility to the San Benito county line, portions of which are expressways.

Also being continued is the improvement of US 101 north of San Francisco. Major projects budgeted for this next year along this section amount to $4,617,000. The entire portion between the Golden Gate Bridge and just north of Santa Rosa is now in service as a four-lane, or better, divided facility. Most of it is now a freeway or expressway. Freeway construction is now under way immediately south of San Rafael and other projects, which will be started soon, will further improve sections of this highway.

US 101-101 Bypass in San Francisco

In San Francisco, US 101 follows the routing of the Southern Freeway to its connection with the James Lick Freeway (Bayshore) at the Alemany interchange. It then proceeds along James Lick Freeway to the Central Freeway connection at 13th Street and along the Central Freeway to Van Ness Avenue and to the Golden Gate Bridge and points north.

US 101 Bypass is that portion of the James Lick (Bayshore) Freeway southerly of the Alemany interchange to the peninsula and points south.

Much of these freeways through the City of San Francisco have now been completed or are under construction or budgeted. The James Lick (Bayshore) Freeway is completed from the Central Freeway to the south city limits of San Francisco.

Northerly, the Central Freeway is completed to South Van Ness Avenue. This portion of the Central Freeway was opened to traffic in 1955 as a single-level elevated structure and, along with the elevated portion of the James Lick (Bayshore) Freeway, is often referred to as the "Skyway." The remainder of James Lick Freeway from the Central Freeway at 13th Street to the San Francisco-Oakland Bay Bridge is a part of US 40 and will be covered under that route.

Under construction at this time is a 1.3-mile-long extension of the Central Freeway from South Van Ness Avenue to Turk Street. Completion of this $7,725,000 project is expected during the summer of 1959. This portion of the skyway will be a two-level elevated viaduct with the three southbound lanes carried above the three northbound lanes and both directions of travel will be elevated over the city streets, leaving them clear to handle the cross traffic movements. Shoulders for emergency parking aside of the through traffic lanes are being constructed on each level of this facility. Contractor on this project is the Peter Kiewit Sons Company.

As a portion of the future Golden Gate Freeway, design is underway for a 1.3-mile-long project extending between the Park Presidio Freeway and the Marina approach to the Golden Gate Bridge. This project will widen the present freeway to eight lanes and revise the interchange at the junction of US 101 and State Sign Route 1. Estimated construction cost is $5,700,000.

Within San Francisco the James Lick (Bayshore) Freeway is now complete. Continuation of landscaping, ground cover and erosion control work along this freeway will proceed. Funds totaling $75,000 for this work between Fifth Street and 17th Street are included in the 1958-59 Fiscal Year Construction Program. During the past year a double steel post guard rail was constructed in the median separating opposing traffic between 17th Street and Army Street with guide posts southerly to Third Street. This work approximated $46,900 in cost and was done by J. Henry Harris, contractor. Results of this installation in minimizing the number of and severity of spectacular accidents through this section are being carefully observed.

The double-deck Cypress Street traffic viaduct on the Eastshore Freeway through Oakland. Note the local service roads on each side.

With completion of the James Lick Memorial Freeway (Bayshore) in San Francisco, and as the major traffic distribution units of the Embarcadero and Central Freeways are now under construction, planning has been advancing toward other segments of the much-needed integrated San Francisco Freeway System.

Planning studies on the Southern Freeway have been completed and a route adopted for an eight-lane freeway following generally along the old Southern Pacific Railroad locations and Alemany Boulevard between Orizaba Avenue, near the south city limits of San Francisco, and the James Lick Memorial Freeway (Bayshore). Route location west of Orizaba Avenue is dependent on future location of the Junipero Serra Freeway. Studies and hearings for that freeway have been under way for some time.

Rights-of-way acquisition is well advanced with $8,685,000 appropriated in the 1957-58 Fiscal Year. An additional $1,400,000 has been budgeted for rights-of-way in 1958-59. Overall construction costs on the entire 4.3 miles of this freeway are estimated at $18,000,000.

Early construction of the first unit of this freeway is assured—$4,730,000 of the estimated $6,900,000 construction cost of the first unit is included in the 1958-59 Fiscal Year construction budget. The remaining cost is to be financed in the 1959-60 Budget. This first unit consists principally of an interchange with the James Lick Freeway (Bayshore) at Alemany Boulevard together with freeway construction for approximately 0.5 mile to the west where it will reconnect to Alemany Boulevard. Grading will be continued to Trumbull Street. The City of San Francisco has plans for the easterly extension of this freeway from James Lick to connect with Southern Crossing Freeway approach, planning for which is now being made by the Division of Bay Toll Crossings. Neither of the latter two extensions are presently a part of the State Highway System.

San Francisco to Palo Alto

Recently completed at the south city limits of San Francisco between Third Street and Butler Road in San Mateo County, was the last contract for freeway construction over the "open water fill" project across an arm of the bay between Candlestick Point and Sierra Point. As a direct result of this relocation, there is an estimated 20 minutes saving in travel time through this area during peak hours and a saving of 0.4 mile in distance. Construction work was performed by a total of seven contracts amounting to $7,710,000. Contractor on the final project, involving drainage and paving, was L. C. Smith and construction cost of this project was $1,563,000.

Funds in the amount of $246,000 are budgeted this next year for landscaping on this freeway, between Third Street and Butler Road.

From the south end of the open water project at South San Francisco to Bransten Road, just north of Redwood City, the freeway has been completed and in operation for some time. This work started in 1946 and was finished with the completion of the southernmost contract in 1955.

The remaining eight miles from Bransten Road to the Santa Clara county line has been under construction as four separate projects. The first of these was the Willow Road interchange which was finished in 1956. This project was selected for first construction to eliminate a very congested intersection as early as possible and prior to the time when the freeway could be constructed in its entirety to this point.

The second contract to be completed extends from Willow Road to 0.5 mile south of the Santa Clara county line and includes frontage roads on both sides southerly to Embarcadero Road in Palo Alto. It is expected to be finished during March, 1958. Included in this project is a major interchange at University Avenue. Construction cost on this 2.2-mile section approximates $1,900,000. Work was performed by Charles L. Harney, Inc.

The third contract is scheduled for completion by April. This two-mile project extends to north of Marsh Road including an interchange there. Charles L. Harney is the contractor on this $1,770,000 project. Provided in this contract, as well as in the other three, will be an initial six-lane, ultimate eight-lane freeway.

Construction is well under way on the remaining project which will link the above projects and the completed freeway to the north. This project is a 3.8-mile relocation from Bransten Road to 0.4 mile north of Marsh Road. The $5,550,000 contract is being performed as a joint venture by Piombo Construction Co., M & K Corporation, and Connoly and Pacific Co. The expected date of completion is the summer of 1958. Full use of the 35-mile continuous freeway facility will then be in effect between Palo Alto and the San Francisco-Oakland Bay Bridge.

Additional improvements are contemplated during this next year on already completed portions of the freeway. These include, in addition to the landscaping project on the "open water fill," a bus stop at the Third Avenue Interchange in San Mateo, a revision of the East Hillsdale Boulevard Interchange, and landscaping improvements between Peninsular Avenue and 16th Avenue in San Mateo.

Palo Alto to North of San Jose

Improvement is being continued this year throughout most of this section. Included in the 1958-59 budget is $11,540,000 for several major projects.

In the budgeted items is the extension of the freeway through Palo Alto to Stevens Creek near Moffett Field. This project will complete the freeway southerly to the completed Moffett Boulevard Interchange. Design of this 4.4-mile connecting link was based on the need for initial six lanes with provision made for eight lanes in the future when needed. Budgeted this fiscal year are funds in the amount of $3,265,000 for this $5,150,000 project. Construction is expected to start in the summer of 1958.

Completed in January of this year was the 1.1-mile section of freeway and interchange near Moffett Field at a cost of $1,031,000. Four lanes of this ultimate eight-lane freeway were constructed at this time along with a full four-quadrant cloverleaf with bus stop facilities at Moffett Boulevard. Contractor for this work was the firm of L. C. Smith Co.

By early summer, 1958, an interchange will be under construction at the intersection of the Mountain View-Alviso Road. Funds in the amount of $1,290,000 are included in the 1958-59 budget for this purpose.

Design studies are well advanced on the remaining sections of freeway to Brokaw Road, just north of San Jose, that the not already financed and which will eventually provide a continuous freeway to south of San Jose. It is anticipated that further improvements of this major freeway will be continued as rapidly as availability of funds and priority of other worthwhile projects will permit.

San Jose to San Benito County Line

Completed in 1957 was a four-lane, future six-lane freeway in the City of San Jose extending from north of Taylor Street to Santa Clara Street. This project eliminated the last of the three-lane portions on the route. Contractor on this 1.6-mile-long freeway was Lew Jones and Leo F. Piazza. Construction cost was $1,681,000.

Budgeted in 1958-59 Fiscal Year is $5,100,000 for a four-lane, future six-lane freeway from 0.5 mile north of Brokaw Road to Taylor Street. A major interchange at the intersection of the Eastshore and Bayshore Freeways is included in this project as well as the extension of Sign Route 17 from this interchange to First Street in San Jose where it connects with another budgeted project completing the Sign Route 17 Los Gatos-San Jose Freeway development in this area.

South of Santa Clara Street to Ford Road, an expressway has been in operation since 1947. Eventually it is expected that intersections at grade will be replaced by interchanges and planning has proceeded accordingly.

From Ford Road to south of Gilroy, the last of the three-lane width through this area was eliminated by expanding to a four-lane section, between Ford Road and Llagas Creek in 1956. Location studies are still under way for a freeway routing.

South of Gilroy to the San Benito county line, 5.8 miles of four-lane expressway (future six-lane freeway) have been in operation since early 1951.

El Camino Real—San Francisco to San Jose

As the work of extending the US 101 Bypass (Bayshore) Freeway toward San Jose progresses, improvement of portions of El Camino Real (US 101) has also been under way. At numerous locations along this route, traffic signals, channelizations, and widening to four- and six-lane, divided or undivided, conventional city street boulevard standards have been constructed.

Completed in 1957 in the City of San Mateo was a 2.9-mile-long widening project extending between 31st Avenue and Poplar Avenue which widened the street to six lanes. This $505,000 project was performed as a co-operative project between the City of San Mateo and the State, with the city providing an estimated $112,000 of the funds required. Contractor on this project was Lowrie Paving Co. and Lord & Bishop.

Budgeted this next year (1958-59) is $1,455,000 for additional work along this route which will be accomplished in four contracts. The major project among these covers the 3.8 miles between San Tomas Aquino Creek in the City of Santa Clara and State Sign Route 9 in Sunnyvale at an estimated cost of $1,170,000. Work will consist of the grading and surfacing necessary to widen the highway to four lanes. It is anticipated that a start will be made on this work in the near future.

Additional widening work will be performed in the City of Millbrae where the highway will be expanded to six lanes at a cost of $150,000 for a distance of 0.6 of a mile. The city is contemplating additional work in conjunction with this project, including curbs, gutters, and parking lanes.

The other two contracts will involve signals and channelizations in San Jose, one of which will be at the intersection of Alma Avenue and the other at Cottle Road. Both of these are co-operative projects with the City of San Jose, and the city will provide $21,700 toward the expected cost of $156,700 for these projects.

US 101—Golden Gate Bridge to Mendocino

Continued progress was made in 1957 toward the completion of US 101 as a freeway. Funds are provided in the 1958-59 budget for additional work on this route.

Work was completed early in 1956 over the Waldo approach from the northern end of the Golden Gate Bridge to just south of the Richardson Bay Bridge. This improvement converted the inadequate four-lane undivided facility to a full six-lane freeway. It was dedicated and opened to

LEFT—This section of U. S. 40 in Contra Costa County was opened to traffic in February. The scene is looking northeast toward Oleum in the left background. RIGHT—Another photo of U. S. 40 Freeway in Contra Costa County looking south toward Richmond. The interchange nearest the camera is San Pablo Dam Road.

traffic on March 20, 1956. Construction and rights-of-way were financed jointly by the Golden Gate Bridge and Highway District and the Division of Highways.

Proceeding northerly and extending for a distance of 5.8 miles between Manzanita to just south of the Greenbrae intersection, freeway construction is now complete. Included in this section is the new six-lane bridge over Richardson Bay which was opened to traffic in the fall of 1956.

Other recent additions to the freeway include the portion completed and opened to traffic in the summer of 1957. This is the $1,480,000 project between the Richardson Bay Bridge and 0.3 mile north of Alto. Dan Caputo Company and Dan Caputo & Edward Keeble were the contractors on this initial six-lane, ultimate eight-lane section of freeway.

North and immediately adjacent to the above project, the freeway was also extended in 1957 to 0.6 mile north of the Greenbrae Intersection, a distance of 3.5 miles. Peter Kiewit Sons Company was the contractor on this $2,924,000 project.

Budgeted this year at the Greenbrae Intersection is the third construction stage of this important interchange. Funds are provided in the amount of $1,800,000 for the northbound bridge which, when finished, will complete the traffic separation at this point. The existing bridge at this location is now being used for one-way traffic, northbound, and this traffic presently continues to pass through the traffic signals at the junction of Sir Francis Drake Boulevard. After completion of the interchange, the existing bridge will serve as a part of the off-ramp and the signals will be utilized to control local traffic at the intersection only.

Under way at this time and expected to be completed in the spring of 1959 is a project extending 1.4 miles from the Greenbrae Interchange to 0.5 mile north of the California Park Overhead. This is the last link for freeway construction on this route south of San Rafael. Work consists of grading, paving and structures for a six-lane freeway at an estimated cost of $1,919,000. Twin three-lane bridges will replace the existing wooden structure over the Northwestern Pacific Railroad at California Park. Contractor on this work is the Frederickson and Watson Construction Co.

From 0.5 mile north of California Park to the north city limits of San Rafael, the freeway has been completed and in use for some time. Northerly of this point, as far as the entrance to Terra Linda, the highway has been declared a freeway and although left turns are physically prohibited, it has not been constructed to full freeway standards whereby access from immediate properties are controlled. Two hundred thirty-two thousand dollars is budgeted in the 1958-59 Fiscal Year for three more projects along US 101 in Marin County. These are $125,000 for the addition of a southbound truck lane over Puerto Suelo Hill, just north of San Rafael which will minimize congestion on through lanes due to slow moving vehicles on this sustained grade; $60,000 for the relocation of a truck scale at Gallinas Creek; and $47,000 for a reconstruction of the southbound lanes between Manuel Freitas Parkway and Miller Creek.

Completed in 1957 was a new Forbes Station Overhead Bridge. New twin bridges for an initial six-lane, future eight-lane freeway over the Northwestern Pacific Railroad were constructed. Contractor on this $500,000 project was Charles L. Harney, Inc.

From Forbes Overhead to south of Petaluma, a distance of 18.9 miles, the existing facility is an expressway except within the Town of Novato. Planning studies are now well advanced for the future development of this entire distance into full freeway standards with no at-grade intersections.

Now complete as a freeway is the 18.5-mile length extending from south of Petaluma to the south city limits of Santa Rosa. Construction was performed on five contracts, the first of which was a bridge at Petaluma Creek and abutment fills.

Within the above section, work was finished in December, 1956, on the 8.6-mile Petaluma Bypass between 1.4 miles south of Petaluma Creek and Railroad Avenue north of Petaluma. The project provided a complete freeway to Denman Flat and grading to Railroad Avenue. Work was performed by Parish Bros. & Carl N. Swenson Co., Inc., at a cost of $3,709,000. Thirty thousand dollars is included in the 1958-59 budget for landscaping on the 5.8-mile portion south of Denman Flat.

Two additional projects were completed in 1957 on this section of freeway. The first of these projects extended from Denman Flat to three miles north of Cotati at Wilfred, a distance of 7.9 miles. Work was performed by Parish Bros., Inc., and Parish Bros. & Carl N. Swenson Company, Inc., at an estimated construction cost of $2,700,000.

The other contract extended the freeway from three miles north of Cotati to a connection with the existing expressway through Santa Rosa. Construction cost was $2,869,000 and Guy F. Atkinson was the contractor on this 5.1-mile-long project.

North of Santa Rosa to the Mendocino county line the highway is not as yet constructed as a freeway. Route adoption for the future freeway location has been accomplished as far north at Lytton and a 1.4-mile portion of this section is budgeted for construction this year. This project will provide a four-lane freeway between Grant School, south of Healdsburg, and the Guerneville Road at an estimated cost of $2,480,000.

Design for the other portions of the freeway northerly of Santa Rosa to Lytton is under way and is well advanced. Initial construction as a four-lane facility, partially expressway, and partially full freeway, is planned.

From Lytton to the Mendocino county line, studies for future freeway development are under way.

Embarcadera Freeway

Work was completed in 1957 on the first two contracts of this multi-lane, elevated freeway which distributes traffic to and from downtown San Francisco. Freeway service is now provided from the on and off ramps at Beale and Main Streets, near Mission Street, to the Skyway as well as to the San Francisco-Oakland Bay Bridge.

Construction on the new parallel Carquinez Bridge looking north from above the Big Cut. Crockett Interchange is in the foreground.

Construction was started on the first of these contracts in May of 1955 by MacDonald, Young and Nelson, Inc., and Morrison-Knudsen. Construction cost of this 0.9-mile-long single- and double-decked project was $5,407,000. Second stage construction was performed by Charles L. Harney, Inc., at a cost of $1,921,000. This project provided a two-lane single-level structure for Oakland-bound traffic and the extension of the freeway to Howard Street as a four- and six-lane, two-level structure.

Under construction at this time is the third link in this freeway system extending it 1.2 miles from Howard Street, past the Ferry Building to Broadway and Sansome Streets. Completion of this $7,800,000 contract is expected during the summer of 1959. Charles L. Harney, Inc., is also the contractor on this two-level freeway. Extensive reconstruction work is required along this latest project including the relocation of portions of both the State Belt and Southern Pacific Railroad tracks and channelization of the Embarcadero alongside the freeway.

Western and Park Presidio Freeways

Preliminary studies are under way for the proposed Western Freeway from the intersection of Junipero Serra Boulevard, near Alemany Boulevard, north and east to a junction with the Central Freeway in the vicinity of Oak and Octavia Streets. Studies also include locations for a connection of the Park Presidio Freeway to the Golden Gate Bridge. A recent report of consultants hired by the City of San Francisco confirms the need for the freeways and a future report by them will discuss the routings.

Junipero Serra Freeway

In July, 1956, Joint Highway District 10 was dissolved and the Legislature designated the constructed portion of this route as State Highway Route 237. The Highway Commission adopted the existing facility from State Sign Route 1 in Daly City to Crystal Springs Road in San Bruno, and declared it to be a freeway. Subsequently, a portion of this four-lane divided expressway was repaved in 1957 and the major intersection at Hickey Boulevard was signalized and channelized. Construction cost was $195,000. Lowrie Paving Company was the contractor. It is anticipated that this route will be developed to full freeway standards in the future and planning is advancing accordingly.

In February, 1957, the Legislature designated Route 239 as being from a point on Route 56 (SSR 1) near Daly City to Route 2 (US 101) near San Jose. A short section along Moorpark Avenue in San Jose from Saratoga Avenue to new Sign Route 17 was adopted in November, 1957.

In addition to the short section above, the location for another portion of Route 239 was adopted by the Highway Commission on November 25, 1957. This portion extends between US 101 south of Ford Road and the new Sign Route 17, near Vasona Junction. Design studies are under way.

On the remainder of this new route, many meetings have been held with local authorities and the public concerning various possible locations and at the time of this writing, analysis of the results of the various meetings and studies is in progress.

Skyline Freeway-Sign Route 5

In December, 1954, a 2.3-mile portion of expressway on Skyline Boulevard between Edgemar Road and Alemany Boulevard was placed in service.

Continuation of the expressway northerly of Alemany Boulevard 1.3 miles to the south city limits of San Francisco was completed in March, 1956. Concurrently, the City of San Francisco completed the 1.0-mile portion north of the city limits to Lake Merced Boulevard, also as an expressway.

Sign Route 1 Freeway

Scheduled for completion in March, 1958, is the $1,378,000 link between Edgemar on the coast route (Sign Route 1) and Skyline Boulevard at Edgemar Road. This 2.2-mile link included grading, surfacing and structures to provide a four-lane expressway. Contractor was the McCammon-Wunderlich Co. and the Wunderlich Contracting Co.

This project replaces the two-lane coastal road along the bluffs north of Edgemar which has been subjected in the past to numerous closures due to wet weather slides. Maintenance problems encountered have been difficult and costly and are being eliminated by this project.

Improvement of other portions of this highway to multilane standards at some time in the future is contemplated and in various stages of planning. The routing for a portion of this work, extending from a connection with the expressway now under construction at Manor Drive in Edgemar to Pedro Valley, was adopted as a freeway by the Highway Commission in January, 1958.

19th Avenue Freeway-San Mateo

Planning studies are complete for the 19th Avenue Freeway in the City of San Mateo. In March, 1957, the State Highway Commission adopted the route for this freeway extending from Sign Route 5 (Skyline Boulevard) west of San Mateo, to the Alameda county line at the San Mateo Bridge, a total distance of 7.2 miles. Design studies on this four-lane facility are well advanced and rights-of-way acquisitions are in progress. A freeway routing was previously adopted from the county line to the Eastshore Freeway by action of the Highway Commission in August, 1952.

US 40—San Francisco to East Bay

US 40 starts at the James Lick Skyway and Central Freeway Interchange (US 101) at 13th Street in San Francisco and proceeds across the Bay Bridge (US 40 and 50) and northerly via the Eastshore Freeway to the El Cerrito Overhead thence through Richmond and northerly.

From US 101 to the Eastshore Freeway, the freeway has been completed including connections to the Embarcadero Freeway just west of the Bay Bridge. The portion in San Francisco is referred to as the James Lick Skyway.

Faster service during peak hours has been obtained at the toll plaza on the east approach to the Bay Bridge as a result of the increased number of toll booths and drivers-side toll collections. Cost of this construction, amounting to $2,200,000, was financed by toll bridge funds and included widening and sur-

Construction on the Central Freeway (U. S. 101) in San Francisco. The piers will support a double-deck traffic structure. Right-of-way needed is reduced to a minimum by double-deck design.

facing the toll plaza area and construction of new toll collection booths. Construction was completed in March of 1957.

From the distribution structure to south of the El Cerrito Overhead, US 40 is also SSR 17. This portion is complete and is an eight-lane freeway. The last portion of this freeway was completed in November of 1956 and extended 1.9 miles from south of University Avenue to the El Cerrito Overhead. Funds are included in the 1958-59 Budget in the amount of $235,000 for landscaping work along this section.

Completion of a freeway routing for US 40 mostly on new alignment between the El Cerrito Overhead and the Solano county line is now contemplated in the foreseeable future. This 13.6-mile freeway is now in use, under construction, or budgeted for its entire length. There remains only the 1.8-mile section from south of El Cerrito Overhead to south of Jefferson Avenue in Richmond. The design for this remaining portion is completed. The project includes an additional structure at El Cerrito Overhead and diamond interchanges at Central Avenue and Carlson Boulevard. Funds are budgeted in the amount of $4,300,000 in the 1958-59 Fiscal Year for this $6,250,000 project. Construction is expected to be under way in the spring of 1958.

Immediately to the north of the above budgeted project, the six-lane freeway extending to just south of Hilltop Drive has been completed and open to traffic since early 1957. Construction work on this 4.8-mile project was done by the combine of Fredrickson and Watson Construction Co. and M & K Corporation at a cost of $5,621,000.

On February 6, 1958, the 4.9-mile project, from Hilltop Drive to Hercules was opened to northbound traffic and subsequently southbound traffic has also been routed over this completed section. In keeping with the Division of Highways policy of opening completed portions of improvements to serve traffic as soon as possible, a temporary connection from the freeway to the old highway just south of Rodeo was constructed in order to effect this early service. Contractors on this $7,383,000 job were McCammon-

Wunderlich & Wunderlich Contracting Co.

North of the Arnold Industrial Freeway (Sign Route 4) the freeway is being financed by special toll bridge bonds as an approach to the new Carquinez Bridge. These projects will result in an initial six-lane, future eight-lane, freeway. A new bridge is being constructed easterly of and parallel to the existing bridge across the Carquinez Strait. The new bridge will carry four lanes of northbound traffic. The existing bridge will carry three southbound lanes and can be widened in the future to four lanes when justified. Completion of all work and opening to traffic is expected by the end of 1958.

The toll financed projects in this district, including the bridge, a portion of which is in District X, are as follows:

Contracts Under Way *Description*	*Estimated completion cost*
(1) N. of N.C.L., Hercules to Crockett Road—2.9 miles ... The project contains the largest highway cut in U. S.: 9,500,000 cubic yards; 3,000 feet long, 1,370 feet wide at top and 350 feet deep. Contractors—Ferry Bros., John M. Ferry, Peter L. Ferry, L. A. and R. S. Crow.	$7,591,453
(2) Carquinez Bridge superstructure ...	9,972,565

Contracts Completed *Description*	*Estimated construction cost*
(1) Crockett Interchange and approach ramps ... Contractors—Peter Kiewit Sons Co.	$5,089,573
(2) Carquinez Bridge substructure ... Contractors—Mason & Hanger, Silas Mason Co., Inc., and F. S. Rolandi, Jr.	5,942,364

In addition to the foregoing there are two contracts for mechanical, electrical and toll plaza equipment amounting to approximately $500,000. Prior to completion of the project an additional contract for the Crockett approach ramp connection and modification of the present bridge amounting to approximately $600,000 will be required.

US 50—Bay Bridge to San Joaquin County

The entire 15.3 miles of the future MacArthur Freeway routing between the distribution structure and Castro Valley has now been adopted by the California Highway Commission. Design studies are under way for this development, being more advanced on the western extremities from the distribution structure to Park Boulevard within which limits will be the first construction projects. A total of $28,655,000 has been expended or budgeted for rights-of-way acquisition on this route including $10,800,000 in the 1958-59 Fiscal Year. Design studies are being based on the need for eight lanes on the freeway proper, both initially and ultimately.

Now in full service is the combined freeway-expressway between Castro Valley and the City of Tracy on US 50. Completion of the last section in the fall of 1957 provided a 51-mile-long uninterrupted, combined freeway and expressway facility, between Oakland and Tracy via portions of the Eastshore Freeway (SSR 17), and the Route 228 connection at Castro Valley and US 50.

The project completed this last fall was the last link extending between 0.3 mile west of Center Street in Castro Valley and the previously completed freeway, 2.3 miles west of Dublin. Contractor on this $4,528,000 project was the Peter Kiewit Sons Company. Constructed was an initial four-lane, ultimate six-lane, freeway which eliminated the last of the former hazardous two- and three-lane road over Boehmer Hill.

Additional funds are budgeted in the amount of $25,000 for landscaping work this year, a portion of which is on US 50. This project will extend from the Eastshore Freeway via Route 228 to east of Center Street in Castro Valley, a distance of 3.8 miles. In addition, planning and design is now

Central Freeway (U. S. 101) in San Francisco showing ramps under construction

New expressway is being constructed on State Sign Route 1 between Pacifica and Skyline Boulevard just south of San Francisco. Note the old highway on the left which is benched into the bluffs to the north.

under way for the future development of portions of this freeway which were constructed on an initial expressway basis to full freeways eliminating intersections at grade and with access at grade-separated interchange points only.

State Sign Route 17

Studies are under way and in various stages for the future freeway development of Sign Route 17 between Santa Cruz and Los Gatos. Design studies for a four-six-lane freeway are well advanced on the 6.2-mile portion between the junction of Sign Routes 1 and 17 in Santa Cruz and north of Granite Creek. North of Granite Creek Road to Los Gatos the route now is a four-lane conventional highway.

A source of serious congestion was eliminated with the opening to traffic in November, 1956, of the 2.1-mile-long Los Gatos business district bypass and a 0.6-mile connection between the freeway easterly to a junction with San Jose Avenue at Charles Street was completed in 1957. The contractor on this portion of the work was the Lew Jones Construction Company and Leo F. Piazza Paving Company. The cost of this connection was $294,000. Work was done as a co-operative project with the City of Los Gatos participating to the extent of $80,000.

Construction on the 8.8-mile relocation project extending between the junction of the Saratoga-Los Gatos Highway in Los Gatos and Bascom Avenue in San Jose, started in July of 1957 and is expected to be finished early in 1959. This four-lane, future six-lane, freeway on relocation is expected to cost approximately $5,836,000. Alignment of this section lies approximately midway between the Santa Clara-Los Gatos Road and the San Jose-Los Gatos Road (existing Sign Route 17). The contractors are Gordon H. Ball, Ball and Simpson, and Lew Jones.

Eastshore Freeway from San Jose North

Completion of the 33.7-mile freeway between Bascom Avenue in San Jose and the south city limits of Oakland is contemplated in the near future. There remains to be finished only two budgeted projects (1958-59) through the city areas of San Jose, and one project under construction north of Warm Springs to place this entire facility in full use.

One of the projects budgeted will provide a major interchange at the intersection of the Bayshore Freeway (US 101 Bypass) and the Eastshore Freeway (SSR 17). This 3.9-mile-long construction project will extend from 0.5 mile north of Brokaw Road to Taylor Street on the Bayshore Freeway and from First Street to 0.3 mile north of the existing Bayshore Highway on Sign Route 17. Funds are provided in the amount of $5,100,000 and it is expected that work will be under way by early summer. Initial construction will be four-lane divided with the future addition of two lanes contemplated when needed.

Also included in the 1958-59 budget are funds amounting to $3,310,000 for completing the freeway connection in San Jose between the foregoing construction and the project now under way south of Bascom Avenue. This 2.5-mile project will be from North Fourth Street to Bascom Avenue, and will complete a four-lane divided highway through the City of San Jose.

North of the Bayshore Freeway, the freeway has been opened for some time as far as Warm Springs Junction and also from Jackson Street in Hayward to Oakland. The 5.8-mile section extending south from Jackson Street in Hayward to Beard Road was completed in 1957 reducing the gap to one project. Estimated construction cost of this initial four-lane, ultimate six-lane facility is estimated at $4,620,000. Contractors were Gordon H. Ball and Ball and Simpson.

Immediately to the south of the above project, the freeway is being

The Eastshore Freeway (Sign Route 17) looking north from the Alvarado-Niles Road Interchange

continued to Warm Springs Junction and a junction with the completed freeway by the contractors Gordon H. Ball and Ball and Simpson. This project when finished will complete the freeway between San Jose and Oakland and is scheduled to be opened in the fall of 1958. Four lanes are being constructed with provision made for the addition of two more lanes when required. Construction costs on this final link are estimated as $6,764,000.

Other recent construction along this freeway has included the widening from four to six lanes between the Route 228 connection at Hayward and High Street in Oakland. The additional lanes were required to handle the increased flow of traffic resulting from the completion in 1956, of the four-lane freeway connection tying US 50 and Foothill Boulevard into the Eastshore Freeway at Lewelling Boulevard.

Eastshore Freeway—Oakland to US 40

At the end of this year, or by early 1959, the last undeveloped portion of the Eastshore Freeway in Oakland will be completed to freeway standards and opened to traffic. From the south city limits of Oakland to the distribution structure, near the east approach to the San Francisco-Oakland Bay Bridge, the freeway is complete except for one short stretch now under construction extending north from Fallon Street to Market Street in Oakland. Contractors on this 1.6-mile project are Johnson-Drake and Piper, Inc., and it is expected that they will complete their work late this year. Construction cost of this eight-lane elevated freeway is expected to be $5,234,000. This project will provide 46 miles of continuous freeway between San Jose and the El Cerrito Overhead.

North of this overhead structure at Market Street, completed in 1955, to the distribution structure, two contracts were completed in 1957, providing 2.1 miles of elevated, double-decked freeway structure through this commercial and industrial area of Oakland along Cypress Street. Opposing traffic travels on separate levels of this viaduct. Four lanes are provided for each direction of travel, and in addition, the former highway (Cypress Street) has been reconstructed at surface level along both sides of the freeway, thereby supplying a divided arterial street for use of local traffic. Work on both contracts was performed by the firm of Grove, Sheppard, Wilson and Kruge of California, Inc., at an estimated cost of $8,551,000 for construction. Landscaping of the entire portion of this freeway between Sixth Street and the distribution structure is contemplated and $40,000 is included in the 1958-59 budget for such work.

North of the distribution structure to the El Cerrito Overhead, Sign Route 17 is combined with US 40 and extends along the east side of the Bay. This section is also in service as a full eight-lane freeway.

Connection With US 101 in San Rafael

During 1957, State Sign Route 17 was extended to connect Eastshore Freeway (US 40) with US 101 south of San Rafael at the San Quentin Wye via the new Richmond-San Rafael Bridge. The double-deck six-lane bridge is now complete and both three-lane decks are open to traffic. The bridge was constructed by the Division of Bay Toll Crossings through bond financing. Freeway approaches have been and are being constructed at the San Rafael end by the Division of Highways with gas tax funds.

Completed by the Division of Bay Toll Crossings are the east approaches of the bridge extending to Marine Street in Richmond, all to modern, multilane expressway standards. The route for the future connection between these approaches and the Eastshore Freeway, near the El Cerrito Overhead, has been adopted in its entirety by the Highway Commission and traverses generally along Hoffman Boulevard. Preliminary design is under way for this future freeway. It is planned that initial construction will be six lanes between the above limits with provisions for eight lanes in the future between 32d Street and Marine Street. Miscellaneous interim projects including channelization of various intersections and drainage improvements have been completed along the present Hoffman Boulevard routing to allow more efficient interim use of the existing facilities.

The west approach of the Richmond-San Rafael Bridge is now in operation as a part of the future freeway that will eventually connect the bridge to US 101 at the San Quentin Wye in San Rafael. This Division of Highways work was completed in 1957. The contractor was Ball and Simpson and the project included grading work over the entire distance from the bridge to US 101 and paving and structures to Sir Francis Drake Boulevard. Construction cost of this 2.1-mile, four-lane project approximated $1,216,000.

Included in the 1958-59 budget are funds in the amount of $850,000 to complete this freeway to US 101, a distance of 1.5 miles. This portion of the freeway will also be constructed as a four-lane facility.

Sign Routes 9 and 21

Planning of this future Interstate Freeway is in various stages. From Warm Springs to Mission San Jose, preliminary planning is now completed and after public meetings were held, the route for the freeway was adopted on new location. Design is now in progress.

From Mission San Jose, for 4.9 miles, across Mission Pass to Sunol, the route was adopted and declared a freeway on January 18, 1956. Location will be along the general location of the existing highway with substantial reductions in grade over Mission Pass. Design studies are now well advanced.

From Sunol to US 50 at Dublin, preliminary route location studies are now in progress. Public meetings and hearings will be held in the local area prior to recommendation for route adoption.

From US 50 to the Contra Costa county line, a distance of 1.8 miles, the initial two lanes of a future freeway and an interchange at US 50 were constructed in 1955. North of this project to Walnut Creek a new routing for the freeway has been adopted and preliminary design studies are under way.

Included in the 1958-59 budget is $1,100,000 for rights-of-way acquisition between Danville and Walnut Creek.

LEFT—Beard Road Interchange on the Eastshore Freeway. The section under construction will complete the freeway south of Oakland. RIGHT—Eastshore Freeway, looking north from Warm Springs.

LEFT—The completed Carte Madera Interchange on U. S. 101 in Marin County. The interchange at Greenbrae can be seen at the upper right. RIGHT—Also on U. S. 101 in Marin County, the Forbes Overhead twin structures at the northwestern Pacific Railroad in the center.

From Rudgear Road south of Walnut Creek to a junction with Sign Route 24 near Oakland Boulevard and thence to the recently completed freeway north of Walnut Creek, the freeway is now under construction by Charles L. Harney. This 4.2-mile project, started in June of 1957, will also provide a part of Sign Route 24 from Walnut Creek to the completed freeway east of Lafayette. Cost of the project is estimated at $8,547,000 for construction.

Northerly of Walnut Creek from Oakland Boulevard to 0.3 mile north of Monument, a $2,900,000 unit of the freeway was placed in service in January of 1957. This 2.8-mile section was built by Stolte, Inc., and Gallagher & Burk, Inc.

Preliminary studies have been completed and design is well advanced for the freeway extension from Monument to the future Martinez-Benicia Bridge and the bridge itself. The financing of the bridge and immediate approaches in conjunction with the Carquinez Toll Bridge project was authorized by the Legislature in 1952.

South of Escobar Street in Martinez, the proposed facility will be financed from regular state highway funds. The route for this facility between Monument north of Walnut Creek and the Solano county line was adopted by the Highway Commission in March of 1956.

This future interstate freeway will cross Arnold Industrial Freeway a short distance easterly of the existing Pacheco Highway intersection and lies just east of the extensive Shell Oil Company development in Martinez. It will cross the strait via a new high level bridge immediately west of the existing Southern Pacific Railroad Bridge.

State Sign Route 24

Hearing proceedings preliminary to freeway route adoptions are presently under way covering the future location for the Sign Route 24 freeway extending from the Eastshore Freeway in Oakland to east of the Contra Costa county line and the Broadway Tunnel.

Extending east from the East Portal of the Broadway Tunnel to Orinda, design is well advanced on a future eight-lane freeway. As an interim measure an additional lane between Orinda and the Broadway Tunnel was constructed in 1956. This lane enables slow moving vehicles to stay to the right over this sustained grade, thus permitting the normal two westbound lanes to serve faster traffic more safely and effectively.

In April, 1955, the Orinda Interchange was completed and has resulted in the elimination of a serious bottleneck and accident site. East of this interchange, design is complete and rights-of-way acquired for an initial six-lane, ultimate eight-lane freeway extending to the completed Lafayette Bypass.

Elimination of the severest congestion on this highway was removed with the construction of the 2.6-mile section of freeway, bypassing Lafayette. Completed in 1957, the project extends between west of Sunnybrook Drive and west of Pleasant Hill Road. Work was performed by the contractor, Gordon H. Ball, at a cost of $3,300,000. Realignment of this portion of the road leaves the present highway as a high standard, uncongested local arterial servicing the rapidly growing community of Lafayette. A landscaping project will be started this year between Hodges Road and Grant Lane east of Lafayette. Cost is expected to approximate $76,000.

Immediately to the east of this bypass is the completed interchange at Pleasant Hill Road. This two-quadrant cloverleaf was completed in December, 1956, and serves as a connection between the state freeway and Pleasant Hill Road, an important county expressway. In the future it will also be a connection to the Shepherd Canyon Freeway, Route 235 from Oakland. Work was performed by Stolte, Inc., and Gallagher & Burk, Inc., at a cost of $1,300,000.

Now under way is the interchange at Walnut Creek which will connect this portion of the freeway to the completed section of SSR 21 and 24 to the north as well as providing a new connection to SSR 21 to the south. This project and the other work as far north as the Monument Intersection is covered under SSR 21.

Shepherd Canyon Freeway

Preliminary studies were completed in 1956 covering the location for this future freeway. On December 19, 1956, after various public meetings and a hearing before the Highway Commission, the last gap in the route was adopted and declared a freeway. This future facility will consist of initially four lanes, future six lanes, and starting at the Mountain Boulevard Freeway in Oakland, will traverse Shepherd Canyon and tunnel some 1,400 feet through the Oakland hills. It will span the Redwood Canyon in Contra Costa County and traverse the range of hills easterly thereof entering and crossing the Moraga Valley just north of the present town site. It traverses close to St. Mary's College and terminates at a junction with Sign Route 24 at Pleasant Hill Road. Design studies are in the preliminary stages.

Sign Routes 24 and 4—Monument to County Line

Design is nearly completed for extending the freeway now terminating at Monument through Concord to a connection with the Arnold Industrial Freeway. Two lanes of this future freeway were constructed in 1947 between Concord and Arnold Industrial. An interim project is budgeted this year on Amador Avenue in Concord between the South City Limits and the Willow Pass Road. This co-operative project with the City of Concord will widen the existing highway at a cost of $48,000, the State's share being $35,000.

Further east, a four-lane expressway has been completed between Willow Pass Road and A Street in Antioch. Provisions have been made for the future development of this portion into a full freeway. Route adoption and freeway declaration has been accomplished as far east as Nerolly Road, formerly referred to as Bridgehead Avenue, which is directly south of the Antioch Bridge.

Recently adopted and declared to be a freeway was that portion of Sign Route 24 north of the above freeway location at Nerolly Road to the Antioch Bridge. Design is nearly completed. East of this point on SSR 4, location studies are under way to the San Joaquin county line. Preliminary public meetings have been held and after studies have been completed further public meetings and hearings will be held toward adoption of a routing.

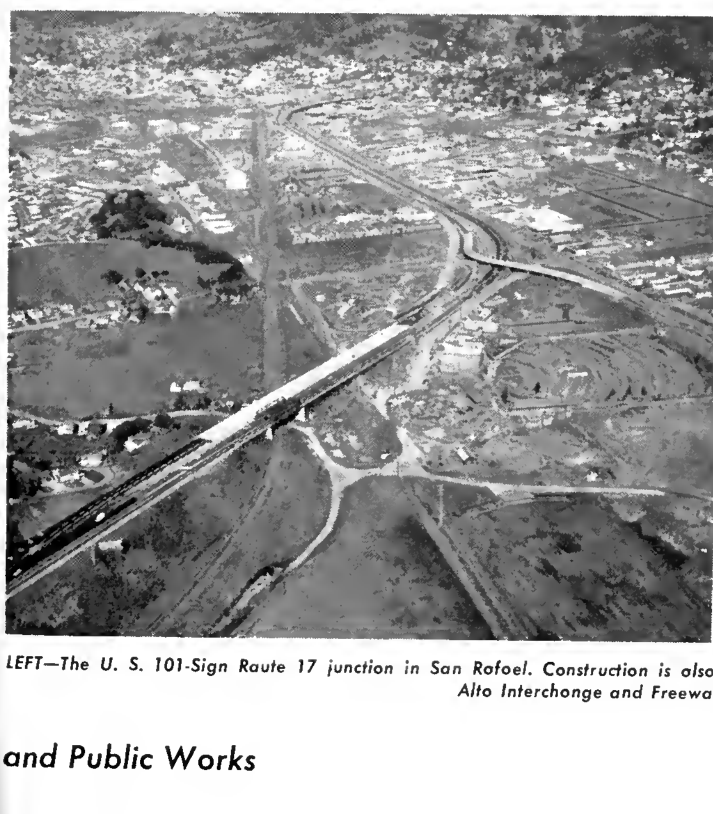
Arnold Industrial Freeway

From Hercules to a junction with Sign Route 24 north of Concord at Willow Pass Road, planning is in various stages. A short relocation is being provided at the Hercules end in conjunction with the US 40 freeway relocation. Preliminary studies are now under way for the determination of future freeway development along the entire route.

Warren Boulevard (Mountain Boulevard)

This improvement in the City of Oakland, when completed, will provide 5.6 miles of freeway from Sign Route 24 near Lake Temescal following the general route of Mountain Boulevard to a connection with the future MacArthur Freeway near Mills College (Calaveras Street.)

Joint Highway District No. 26 originally formed to develop this route was dissolved in July of 1954 but the County of Alameda and the City of Oakland have agreed to continue to



LEFT—The U. S. 101-Sign Route 17 junction in San Rafael. Construction is also under way on the California Park Overhead. RIGHT—The recently completed Alto Interchange and Freeway on U. S. 101 in Marin County.

finance a total of $300,000 per year, matching a like contribution by the State, toward the continued improvement of this freeway through the Oakland hills.

One project was finished in October, 1956, supplementing the previously completed 2.3-mile portion which extends from north of Broadway Terrace to south of the Moraga-Thornhill intersection. Charles L. Harney completed work on the second section (1.3 miles in length) between Thornhill Drive and Ascot Drive at a cost of $1,300,000. Construction was for four lanes with provision made for six lanes in the future. Included in this contract was the Park Boulevard interchange which is designed as a future connection to the Shepherd Canyon Freeway (Route 235) through the Oakland hills into the Moraga Valley in Contra Costa County.

Included in the 1958-1959 Budget is the amount of $123,000 for landscaping work on the portion of this freeway between Tunnel Road and Park Boulevard.

The 1.4-mile extension of the freeway from Park Boulevard to 0.6 mile south of Lincoln Avenue, also to be four lanes initially is now under contract at an estimated cost of $1,290,000. Contractor is Gallagher & Burk, Inc., and it is expected that work will be finished this spring.

The Lincoln Avenue separation was constructed in 1955 under a separate contract for $130,000.

A major project for construction on this route is budgeted for this year. This latest project will extend from Lincoln Avenue separation south to Anderson Avenue, a distance of 1.1 miles, and is estimated to cost approximately $1,400,000. Continuation of construction of this freeway to the south is contemplated as rapidly as availability of state, county and city contributions will permit.

UPPER—Freeway construction on the Bayshore Freeway looking north from the San Mateo-Santa Clara County line. LOWER—Construction on the Bayshore Freeway in Redwood City. The present highway is on the right. The Whipple Avenue Interchange is on the new freeway to the left.

Route 226—Oakland to Alameda

Further progress has been made toward the alleviation of the Oakland-Alameda traffic problem this last year with first steps toward the future construction of another tube connecting these cities along Webster Street. Rights-of-way requirements at the southern portal necessitated negotiations with the Federal Government, which are now complete, and funds in the amount of $750,000 have been allocated in the 1958-59 budget for site preparation.

Another project on this route will be performed at Doolittle Drive and Davis Street in San Leandro. Budgeted at this location is $37,000 in state funds for this co-operative project which will provide channelization and signals.

Various other improvements have been made along this route including traffic signals and channelizations as well as a new bridge at Bay Farm Island.

OTHER SOUTHERN COUNTY FREEWAYS

Design studies for the development of a cross-county freeway from Sign Route 17 north of Los Gatos to the Bayshore Freeway near Mountain View are now in progress. A new routing for this future freeway location was adopted on October 18, 1956, by the Highway Commission extending from Bayshore Freeway north of Moffett Field to the existing Sign Route 9 north of Azule, and generally following Stevens Creek. In addition, the routing was extended southerly following along the Southern Pacific Railroad to new State Sign Route 17 near Vasona Junction. This routing was adopted by the California Highway Commission on November 25, 1957.

Mountain View-Milpitas Area

Studies are now in progress toward future route adoption proceedings for the westerly extension of Sign Route 9 from its present junction with the Bayshore Freeway at the Mountain View-Alviso Road intersection to the cross-county freeway mentioned above.

A freeway routing along the Mountain View-Alviso Road from Bayshore Freeway to the Eastshore Freeway at Milpitas was adopted on December 15, 1954, and design is in progress. Between Lawrence Station Road east of Bayshore Freeway and 0.2 miles east of the San Jose-Alviso Road, a bypass of the Town of Alviso was completed in 1957. This 2.1-mile bypass is the initial construction of two lanes of a future freeway on new alignment and above flood and tidewater level. The project is through a section of the Santa Clara Valley, subject to continuous area subsidence resulting in continuous maintenance problems during wet weather. Construction cost of this project was $981,000. Contractor was the Frederickson and Watson Construction Co.

Budgeted in this fiscal year is $202,000 for widening on the route from 0.2 mile east of Lawrence Station Road to 0.2 mile east of Bayshore Highway. This two-lane project is 2.5 miles long and should be under way in the early spring.

Pacheco Pass

In use for many years has been the 2.5-mile portion of four-lane freeway over Pacheco Pass on Sign Route 152. This four-lane section was constructed in 1951 as a part of the 5.3-mile freeway route, adopted on May 18, 1949, which extends between one mile east of Bell's Station and the Merced county line. The remaining 2.8 miles of this section was constructed as a two-lane facility in 1939.

Santa Cruz Area

In Santa Cruz a new freeway entrance to the city was completed in December, 1956, from existing Sign Route 17 at the north city limits to Mission Street. This project facilitates a much-needed traffic distribution in the Santa Cruz recreational area. An-

UPPER—The new freeway under construction between San Jose and Los Gatos (Sign Route 17). Saratoga Avenue Interchange in Los Gatos is in the foreground. LOWER—Sign Route 29 north of Napa. Construction of an additional two lanes converted this section into a four-lane expressway between Union Station and Orchard Avenue.

STATUS OF DISTRICT IV FREEWAY PROJECTS

MARCH 1958

Description	Total miles	Completed projects		Under contract		Budgeted		Right of way expended and budgeted
		Miles	Construction cost	Miles	Construction cost	Miles	Construction cost	
Bayshore and James Lick Freeway; Bay Bridge to Ford Road south of San Jose	56.6	35.9	$48,970,000	5.8	$7,399,000	7.6	$8,376,000	$36,699,000
Central Freeway; James Lick Freeway to Turk Street	1.8	1.0	4,122,000	0.8	7,725,000			8,537,000
Embarcadero Freeway; Bay Bridge to Broadway	1.5	0.4	7,328,000	1.1	7,634,000			11,337,000
Golden Gate Freeway; Lyon Street to Route 56	1.1							123,000
Park Presidio Freeway; Golden Gate Bridge to Fulton Street	2.1	1.2	1,448,000					3,000
Southern Freeway; Route 56 near south city limits of San Francisco to Route 68 (Bayshore)	4.7						4,730,000	15,625,000
Coast and Skyline Blvd. Freeway; Edgemar to Lake Merced Blvd. in San Francisco	5.4	3.9	1,376,000	1.5	1,378,000			781,000
Redwood Freeway; Golden Gate Bridge to Lytton	66.6	49.1	*32,342,000	1.4	1,919,000	2.1	4,435,000	9,153,000
Sonoma Valley Freeway; Route 104 to 0.6 mile south of Kenwood	17.7							300,000
Napa-Ignacio Freeway; from Redwood Freeway at Ignacio to Napa (ptns)	13.4	0.8	1,607,000	0.3	2,433,000	6.1	2,444,000	792,000
San Quentin Freeway; Route 1 to Richmond-San Rafael Bridge	2.4	1.0	1,216,000			1.4	850,000	1,092,000
Napa Valley and Napa-Vallejo Freeway; Solano County line to Calistoga	31.8	19.3	3,264,000			2.9	735,000	302,000
Richmond-Carquinez Freeway; El Cerrito O.H. to Carquinez Bridge	13.6	4.7	†17,045,000	6.6	‡25,467,000	2.3	4,453,000	7,542,000
Arnold Industrial Freeway; Hercules to Bridgehead Ave.	32.0	14.7	4,728,000				76,000	1,603,000
Monument-Martinez Freeway; Monument to Solano County line	7.4							868,000
Mt. Diablo Freeway; US 50 in Oakland to Arnold Industrial Freeway near Concord	19.8	9.8	9,217,000	2.4	6,200,000			12,469,000
Shepherd Canyon Freeway; Warren Blvd. Freeway to Mt. Diablo Freeway	10.3							271,000
Warren (Mountain) Blvd. Freeway; Mt. Diablo Freeway near Lake Temescal to San Leandro	9.3	2.4	§3,175,000	1.3	§1,292,000	1.1	§723,000	3,689,000
MacArthur Freeway; Distribution Structure to Route 228	15.3							28,655,000
Bay Farm Island Bridge and approaches	0.6	0.6	2,187,000					2,252,000
Webster Street Tube (ptn)	0.8						750,000	
Eastshore Freeway; Richmond-San Rafael Bridge to Bayshore Freeway at San Jose	52.7	35.2	52,191,000	10.6	11,999,000		325,000	25,528,000
Route 107; US 50 to Walnut Creek (ptns)	10.1	2.1	550,000	1.4	2,347,000			4,464,000
Altamont Pass; San Lorenzo to San Joaquin County line	33.6	33.6	14,327,000					6,466,000
Routes 5 and 108; Warm Springs to Scott's Corner	9.7							101,000
Pacheco Pass; 1 mile east of Bell's Station to Merced County line	5.3	5.3	1,286,000					12,000
El Camino Real; Ford Road south of San Jose to San Benito County line (ptns)	5.8	5.8	1,095,000					546,000
Watsonville to 4 miles south of Davenport	21.0	8.4	4,110,000	4.6	2,221,000			2,885,000
Santa Cruz to San Jose (ptns)	19.9	4.2	3,376,000	8.8	5,836,000	3.4	4,910,000	8,932,000
19th Avenue Freeway; San Mateo-Hayward Bridge to Route 55	8.0							1,325,000
Route 114; Route 5 to Route 68 at Mountain View	13.4							126,000
Mountain View-Alviso Freeway; Bayshore Freeway to Eastshore Freeway	8.0	2.1	980,000			2.5	202,000	397,000
Junipero Serra Freeway; Route 2 south of San Jose to Route 5	10.0							
Junipero Serra Freeway; Route 5 to Saratoga Avenue	1.9							
TOTALS	513.6	241.5	$215,940,000	46.6	$83,850,000	29.4	$33,009,000	$192,875,000

* Includes total of $5,000,000 by Golden Gate Bridge and Highway District.
† $11,033,000 Toll Bridge Funds in this amount.
‡ $18,084,000 Toll Bridge Funds in this amount.
§ Includes City of Oakland and Alameda County contributions.

other project, under construction, extends from the junction of Sign Routes 1 and 17 to 0.3 mile east of Morrissey Avenue. When completed in the fall of 1958, a circumferential freeway around Santa Cruz will provide area wide distribution. Contractor on this 2.1-mile initial four-lane, future six-lane, project is Dan Caputo and Dan Caputo & Edward Keeble. Construction cost is estimated to be $1,830,000.

Also under way on State Sign Route 1 is the first project on the northerly side of the city that will eventually provide a four-lane expressway. The first two lanes of this expressway on new alignment are being constructed between 0.2 mile east of Swift Street in Santa Cruz and Wilder Creek,

. . . Continued on page 54

Right-of-Way Clearance

District VII Program Moves Ahead Steadily

By HAROLD W. LEONARD
Metropolitan District Right-of-Way Agent

The Division of Highways has received from time to time laudatory press coverage on the progress in the construction of the freeway system in the rapidly growing Los Angeles metropolitan area. Without the freeways traffic would be hopelessly snarled on the conventional city streets. While the motoring public comprehends the magnitude of the freeway system and fully appreciates the inherent functional beauty in the design of the freeways and bridges by the engineers, other than knowing that the properties in the rights-of-way had to be appraised and acquired, few probably have given much thought to the fact that after the acquisition of these rights-of-way they had to be cleared and made available for construction.

The clearance of rights-of-way in the Los Angeles area is a program of considerable magnitude. Tenants occupying buildings must be evicted and the buildings sold to be removed from the site or contracts awarded for their demolition. Utility facilities, both overhead and underground, have to be removed and relocated. These utilities include telephone, electric, gas, water, and sewer lines. Also oil and irrigation pipelines and canals. The work also includes the reconstruction and the moving and relocating of buildings. The work functions involved are performed by various subsections within the Right-of-Way Department.

Bond Required

The building sales section appraises the salvage value, advertises and conducts the sale of buildings to be removed. The buildings sold by this section are those which conform to the present building codes and are suitable for relocation in another area. The sale is conducted on the premises and is by auction or sealed bid. The notice of sale states that the sale is for cash within five days and specifies the amount of deposit required at time of sale on each item. The successful bidder is required to supply a bond in the amount of $1,000, guaranteeing the removal of the improvements in the time specified, and the cleaning of the site. It is the buyer's responsibility to ascertain if the building is movable and whether or not the city or county authorities will permit the building to be relocated in a particular neighborhood and to secure all permits. In clearing industrial sites, equipment, acquired as a part of the realty by reason of having been designed for industrial purposes and installed for use in a fixed location, is sold separately. After the equipment has been removed the building is sold or demolished under contract. This procedure results in greater return to the State by dealing directly with the two separate types of buyers. With modern house moving equipment brick and concrete block buildings, as well as wood frame structures, are moved successfully, the width of the streets over which they are to be moved being practically the only limitation. Many fine homes have been saved by moving them to a new location. Usually after the rehabilitation they are in better condition and appearance than they were prior to moving and are a credit to their new neighborhood. While the salvage and sale of these buildings is a byproduct to the main right-of-way function of acquiring rights-of-way it is still big business. In the past five years over 6,000 buildings were sold to be moved for a return of approximately 8½ million dollars. In the light of the steady stream of buildings being removed from the freeway rights-of-way a number of people have entered into the buying and selling of these buildings as their business even to the extent of establishing used house lots where buildings are stored, displayed, and resold.

Some Buildings Destroyed

Buildings not salable are turned over to the demolition section for their advertising and awarding of contracts for their demolition. Proposals to bid are also mailed to approximately 60 contractors on our mailing list. Bids, to be acceptable, must be submitted by a licensed contractor and the State License Board further requires that the contractor have a C-21 class license for house moving and building wrecking. Some buildings contain salvage value material, such as used brick, large timbers, steel beams, or corrugated metal. Where this occurs the proposal will provide for a plus bid where the contractor pays the State to remove the building. The demand for used brick in contemporary construction has resulted in many old brick buildings being removed without cost to the State, the salvage value of the brick offsetting the labor expended in the demolition of the building. The bricks are easily separated from the lime mortar used in old construction and are slid down chutes to trucks with minimum breakage. The contractor must furnish a faithful performance bond and the site must be clean before the work is accepted and the bond released. The methods used in demolishing improvements vary with the type of construction. Hand labor is usually used in the wrecking of old brick buildings and corrugated metal buildings. Some frame buildings, wherein there is considerable salvage of heavy timbers, are also torn down by hand; however, manual labor is generally too costly to be practical as a method of removal. Concrete and concrete brick buildings are demolished by suspending a heavy iron ball from the boom of a large crane and swinging it against the building, knocking out huge chunks of concrete which are then pulverized by dropping the ball on them. The debris is picked up with a power scoop, loaded into a truck, and hauled away. Wood frame and wood frame-stucco buildings are usually demolished by biting off large chunks of the buildings with a large crane and clam shell and loading directly into trucks. This giant termite chews up a normal sized house in a very few minutes. The burning of combustible material is not permitted on the premises and all debris must be hauled to a dump. In the past five years approximately 650 demolition contracts were awarded in the district at a cost of over $600,000 to the State. There were about 30 contracts where the salvage exceeded the cost of removal wherein the State received approximately $15,000.

A 3,700-pound weight on the end of a long crane boom demolishes a concrete building to make way for a new freeway through downtown Los Angeles

Agreements With Owners

Where the right-of-way takes a portion of the property and the taking affects the improvements, agreements

A fire station in the City of Los Angeles is relocated to clear right-of-way for the Hollywood Freeway. LEFT—Shows the building blocked up just before being moved. RIGHT—Shows the same building after it had been re-established and placed in use by the Los Angeles Fire Department in its new location.

are entered into with the property owners wherein he will cut off the building and reconstruct or move the building back clear of the right-of-way. Estimates for the work are secured and the agreed amount is included in the agreement and paid after the right-of-way has been cleared. Sometimes an owner prefers that the State handle the relocation or reconstruction of the improvements and the agreement will so specify. In these cases the relocation section prepares the plans and specifications, advertises for bids, awards the contract and inspects the work. This work includes relocating irrigation and oil pipelines, replacing water wells, cutting off and constructing new fronts on commercial buildings, moving buildings back and resetting them. Pipelines bisected by a freeway are sometimes relocated to pass overhead on a bridge structure or on a separate structure designed to carry the pipelines only. Sometimes special concrete boxes with pipe racks are constructed to carry the pipes under the freeways. This work is performed with the least amount of interrupted use of the facilities as possible. As part consideration for the right-of-way through the Sawtelle Veterans Hospital the relocation section designed and constructed two new residences for resident physicians. At the Point Mugu Naval Air Missile Test Center this section relocated and constructed a large electric switch station outside the freeway right-of-way. Another interesting job was that of raising a two-story brick fire station about 15 feet, turning it through 90 degrees and relocating it a block away. Being of brick construction the raising and moving had to be done very evenly and carefully so as not to cause any jars or strains. The building was raised on hydraulic jacks and rolled on railroad rails. Sometimes a building has to be moved twice for one project like the railroad station at Camarillo. It first had to be moved out of the right-of-way area to a temporary location until the construction was completed, then moved and reset in its permanent location in an area that had been used for a temporary detour during construction. This relocation phase of the clearance work involved an expenditure of nearly two million dollars during the past five years. In addition this section prepared plans and specifications for a large volume of work performed by the highway construction contractor.

Close Liaison Essential

The highway program requires close liaison between the Division of Highways and the various public utility companies. The work of relocation of public utilities, both publicly and pri-

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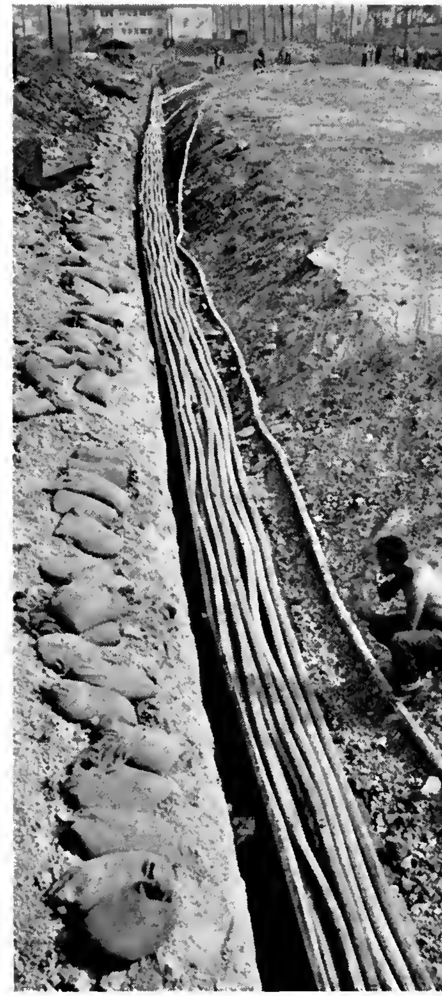
A high voltage line tower is being raised to put an additional section underneath to allow sufficient clearance for freeway construction.



ABOVE—Skilled workmen splice one of the more complex telephone cables. RIGHT—Shows temporary relocation of telephone cables during the construction of the Hollywood Freeway at Vermont Avenue.

vately owned, is handled by the utilities section of the Right-of-Way Department. It is their responsibility to determine, in accordance with the Collier-Burns Act and other state laws, when the State will pay for the cost of utility relocation, when it will share in the cost of relocation, and when said relocation is the financial responsibility of the utility company alone. In cases that the State is to pay for the relocation or a share of the cost, relocation agreements must be made with companies, and in all cases relocation plans must be approved by the Division of Highways. Almost without exception the relocation work is actually done by the utility company being affected and the design of the freeways is planned to affect utilities as little as possible. The wholehearted co-operation of the utility companies with the Division of Highways has resulted in satisfactory solutions to the utility relocation problems.

Telephone Cables Moved

Telephone lines present a very complicated relocation problem. Within the City of Los Angeles the largest telephone cables used are cables which have 2,100 pairs of telephone lines within them. If these lines must be relocated outside the right-of-way area needed for construction it necessitates a splicing of the telephone cables. On the surface this does not sound like much of a project, but a double splice is required to lengthen the cable. This means that each pair of wires on each end of this extension must be matched with pairs in the original cable so as to result in a continuous line for each pair. If this were not done there would be a scramble of some 2,000 telephones in the city. To complete such a splice requires a period of time of approximately four months. In order to preclude the splicing of such a cable on the Golden State Freeway the bridge at North Broadway has been so designed that the underground ducts and cables can be raised out of the way until the bridge is partially constructed, then lowered to cells within the bridge structure and construction of the bridge completed.

Power Lines Raised

High-tension electrical wires and towers are frequently disturbed by freeway projects. Recently it was necessary for towers belonging to the City of Los Angeles Department of Water and Power to be raised 25 feet to provide adequate clearance for the freeway project. The city department engineered the construction of a tower extension which was attached to the bottom legs of the tower. The power lines were slackened to allow the tower to be raised and the tower was then picked up with a crane having an extra long boom and raised 25 feet. The placement of the crane was so critical in this lift that it took approximately three hours to get the crane strategically located to the precise point necessary for the lift.

Railroads are another utility that frequently need relocation. Sometimes a main line must be moved for construction purposes but more often it is only necessary to construct shoo-flys around proposed grade separations. On the Glendale Freeway, presently under construction, one of the main lines of the Southern Pacific had to be relocated to provide room for footings for a bridge. In Ventura County over a mile of main line track of the Southern Pacific was relocated

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Petaluma Creek

High-level Bridge Will Replace Old Drawspan

By M. H. JACOBS, Resident Engineer and BILL ZENONI, Assistant Highway Engineer

On September 13, 1948, the California Highway Commission adopted State Route 8 in Marin and Sonoma Counties between State Route 1 and the junction of Routes 8 and 208, as a freeway.

The existing Route 8 was originally constructed in 1916-1917 with a variable depth gravel base, and was surfaced in 1923 with an 18-foot-wide by 6-inch-thick asphaltic concrete pavement. In 1943, the roadbed was widened to 22 feet by a 0.20-foot plant-mixed surface over the existing pavement.

A contract completed in January, 1951, realigned the original road at Black Point, eliminating sharp curvature and providing improved approaches to the existing Petaluma Creek Drawbridge. Also under the same contract, excavations and embankments were constructed to provide for future expansion of the existing two-lane facility to a four-lane divided freeway. The embankments were constructed with a surcharge to allow for consolidation and settlement in this tideland area.

Looking east over the Petaluma Creek project. The partially completed fill in the foreground will be finished after two lanes of the new bridge are opened to traffic.

Original Trestle Replaced

The existing Petaluma Creek Drawbridge was originally constructed in 1917 under Contract No. 163. It is of interest to note that Ben C. Gerwick, Sr., one of the present contractors, was the resident engineer for the State on this project at the time. The existing structure consisted of two 80-foot spans of steel trusses encased in concrete, one 150-foot single-leaf bascule span, and 43 27-foot timber trestle spans. Over the years repairs and changes have been made including the replacement of the original trestle deck to a steel I-beam and reinforced concrete slab. It has become necessary to replace the structure mainly due to its substandard 21-foot clearance between curbs and its trestle timber piles which are near the end of their useful life.

On January 23, 1957, a contract was awarded to Ben C. Gerwick, Inc., and J. H. Pomeroy & Co., Inc., of San Francisco for the construction of a new high-level fixed bridge across Petaluma Creek at Black Point with necessary approaches. The low bid was $2,309,498.

Ship Channel Widened

The new structure will be 2,200 feet long and 75 feet above mean sea level. It was necessary at the east end to construct an extra long structure with a low abutment since the original ground is a virtual mudflat and cannot sustain a fill of over a few feet. A 140-foot-wide ship channel, complete with protective fenders, will be provided with 70-foot minimum vertical clearance. This clearance is in line with previously established clearance on the US 101 bridges over Petaluma Creek at Petaluma, constructed in 1955.

The bridge has a total of 29 spans: 24 of precast prestressed girders, 4 feet 6 inches deep and 80 feet long; 4 of precast reinforced girders for tower bents, 25 feet long; and one of 160-foot steel plate girders for the crossing of the ship channel. All girders are supported on five-foot by five-foot reinforced concrete caps, two four-foot round columns strutted at midheight, five-foot by six-foot reinforced concrete pile caps and from five to eight 200-ton pilings. The west abutment is supported on 10-inch H-piles driven through holes drilled into a 60-foot fill. The next four bents are supported on spread footings founded in good conglomerate. From here on heavy pile sections are used since the bedrock drops off very rapidly.

Earthquake Resistant

An unusual feature of design is the use of tower bents which are used to resist longitudinal seismic forces. Since most of the structure is over water in marshy tideland it would have been very expensive to design each bent to resist these forces. The tower bent is actually two bents spaced 25 feet apart and tied together with struts and a monolithic footing. Three to four spans on either side are tied to it and all move as one unit. Adjacent units are isolated by using expansion rocker bearings.

Foundations presented a problem to both design and construction. Bedrock is easily reached anywhere on the west shore but drops off rapidly toward the east where at the ship channel it is 80 feet below sea level and at the east abutment it has reached a low of 200 feet. Piling necessarily had to be extremely long and at the same time stout enough to withstand column action in the soft bay mud. A column consisting of a 14-inch-wide flange beam weighing 184 pounds per lineal foot section was designed and an option was provided for protection above the mud line using either a prestress pile or concrete encasement of a full-length steel pile. The contractor chose the prestress option. The section was 26 inches square with a 12-inch void; it was limited to 70 feet in length and had to have at least six feet of a steel pile stub protruding from the concrete to insure adequate penetration of the bedrock. Any length of steel pile could be welded to the stub as needed. Thirty-four high tensile strength strands are used with a working load of 394,000 pounds and seven-sack concrete was used to insure quick stripping and early driving. For those piles driven on land, steel sections up to 135 feet were welded together in jigs on the ground and then driven in place. The prestress section was trucked direct to the driving site and was picked off by the driver and an auxiliary crane and positioned in the leads. After being lined up with the bottom section and plumbed, it was worked on by three welders who, in two hours time, completed a full beveled butt weld splice on it. X-rays were used to spot check the welds. The longest pile driven was 205 feet.

Barges Carry Piles

For the water work all piles were cased and spliced in the Ben C. Gerwick Petaluma Yard and were brought to the site in barges. The longest of these piles was 137 feet and weighed 28 tons. It required great care and skill to handle such large sections; however, once set into position and plumbed they could be held true while driving. A pile hammer with a rated energy of 36,000 foot-pounds was used to drive the 26-inch piles. Difficult driving was done on these large sections to get the ultimate 200-ton bearing capacity.

The use of prestressed girders at this site is ideal. Falsework for any type of cast-in-place concrete would be expensive since it would have to be high above the water and penetrate deep into the bay mud. Maintenance cost becomes an important factor in considering the use of structural steel in this salt water location. The site is within a 15-mile radius of three of the leading bay area manufacturers of precast, prestressed concrete products. The girders used are the new state standard "T" section with a 4½-foot depth. They were constructed in the contractor's Petaluma Yard and were barged or trucked to the job.

Prestressed Girders Cast

Four new special prestressing beds were built side by side which can handle any unit up to 105 feet in length. This side-by-side setup was used rather than the conventional continuous line so that a steel gantry straddling the beds can be used to place reinforcing steel, lift forms, pour concrete, transport steam curing hoods, and transport completed girders into adjacent storage area or direct to the barges. The girders were cast in all-metal forms which were continuous over the full length of the girder and were hinged at the bottom for quick forming and stripping. All prestressing was done by the pretensioning of 36 7/16-inch, seven-wire strands to a working load of 532,000 pounds. The strand is taken from reels, cut roughly to length, then placed in anchorages and each is preloaded to 1,000 pounds with a portable dynamometer. In this manner all start out with the same tension. Hydraulic jacks then pull half of the strands in the bottom of the beam

This photo of the new construction shows 80-foot, precast, prestressed girders in place on the west approach to the new bridge

This view, taken from the west abutment fill, shows a crane with a 120-foot boom setting one of the 12-ton, 25-foot-long girders in place

to full tensioning load. The remaining 18 strands follow a 2½-foot parabolic path. These are first partially tensioned in a straight line by the jacks and then "hogged" down into final position by strand "hold-downs" located at the center and quarter points of the girder. The additional elongation caused by the hogging brings the strand tension to full load. The contractor has developed a very efficient organization for this type of construction. Using an eight-sack dry concrete and 150-degree steam curing for a period of 20 hours he is producing an average of seven girders on the four beds in a 40-hour workweek.

After all the girders have been set at the bridge cast in place closures will be made between girder diaphragms and the "T" beam flanges which form the deck. A two-inch plant-mix surfacing course will be added to smooth out any irregularities and the structure will be ready for traffic.

Future Freeway Construction

Construction of the new approaches required a 70,000-cubic-yard, 60-foot-high abutment fill on the west end of the structure. Material was obtained from a 100-foot sliver cut adjacent to the existing traveled way which changes the old alignment, moving it south, and provides a 3 percent grade up to the bridge abutment. The roadway section on this contract was constructed only half of the ultimate width and will carry only two lanes of traffic when the bridge is first put into operation. This split was necessary in order to keep the fill slope from encroaching on the existing approach to the drawbridge. Included in the 1958-59 Fiscal Year construction program is the development to four-lane freeway standards of the 6.1 miles between State Route 1 (US 101) and the Junction of Routes 8 and 208 (Sign Routes 37 and 48) at Sears Point. By this time, traffic will have been routed off the existing drawbridge onto the new structure and work can begin on widening the present fill to its ultimate width. By the fall of 1959 a four-lane freeway should be completed over the seven miles to Sears Point.

All cut slopes on the present contract were made at 1:1 and fill slopes at 2:1 except for the north slope of the abutment fill which has a 1:¼ slope to prevent crowding the existing traveled way.

As a guide to costs on the project a few of the major unit prices are as follows:

Roadway excavation	\$0.50 per c. y.
Class "A" concrete (bridge)	66.18 per c. y.
Furnish precast prestressed girders	2,305.00 ea.
Erect precast prestressed girders	200.00 ea.
Furnish 200-ton bearing piles	18.00 per l. f.
Drive 200-ton bearing piles	700.00 ea.

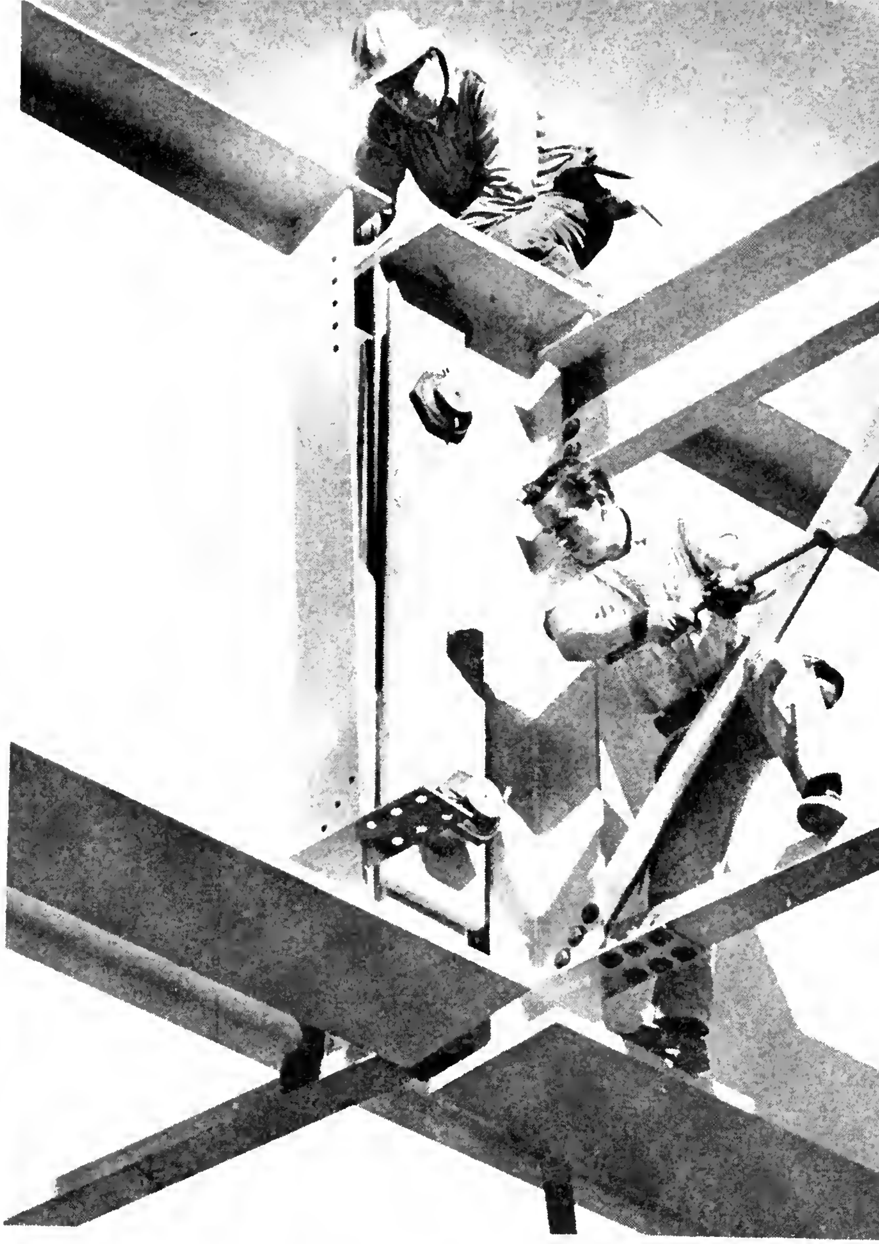
Superintendent for Ben C. Gerwick, Inc., and J. H. Pomeroy & Co., Inc., was John Ford, assisted by Chuck Lochtefeld.

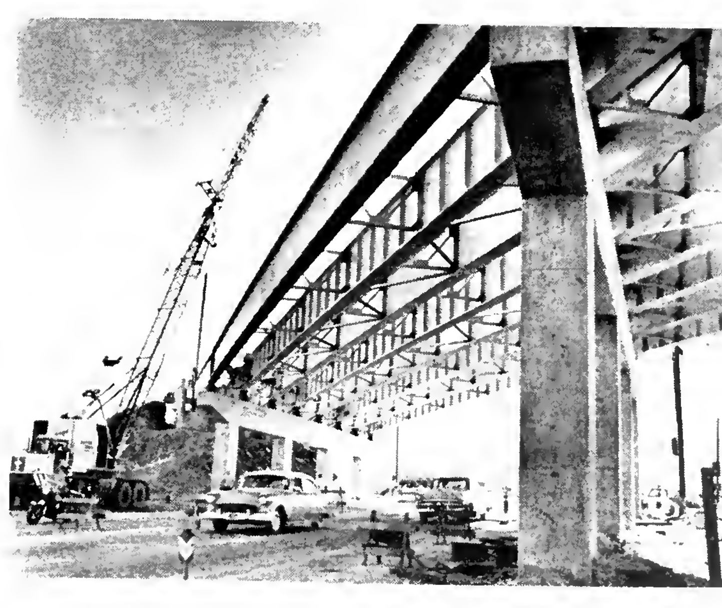
The contract is under the administration of the Bridge Department of the Division of Highways, F. W. Panhorst, Assistant State Highway Engineer—Bridges; I. O. Jahlstrom, Operations Engineer. Design was by Carl F. Stewart of the Bridge Department and Chief Designer George D. Gilbert.

American motorists traveled more than half a trillion miles in 1957.

Strength and Beauty

Man, in assembling his materials to build the things that serve him, is guided by basic geometric patterns which lend his creations beauty as well as strength. Captured in these photos of construction now under way on the Santa Ana Freeway and the new Carquinez Bridge, is some of the harmony of perspective and design inherent in the science of engineering. *Freeway photos below and extreme right by John Malmin, Los Angeles Times; bridge photo upper center by American Bridge Division.*





Conejo Grade

Ventura Freeway Construction Extended Over Conejo Summit

By K. D. LEWIS, Resident Engineer

SOUTHLANDERS and visiting tourists will soon be using a link of the Ventura Freeway that was once traveled by coach, oxen, dog and goat teams of the Old West as they came east from Santa Barbara, Ventura, Camarillo, Hueneme or west from Los Angeles, Agoura and Thousand Oaks. Old rancho lands that once covered thousands of acres in any direction, as the crow chose to fly, now resound to the blast of tons of dynamite and the scrape of metallic earth-moving monsters as they plow a multilane furrow through the hard-rock passes of the Conejo Grade just outside of the town of Camarillo. The old ribbonlike roadways that connected the summit of the Conejo Pass to the fertile valley around Camarillo is now a relic of the past, a scarcely visible cowpath tortuously winding around massive fills that will provide the concrete pavement of the super state highway now under construction. The five miles of freeway under construction by the State Division of Highways west from Conejo Summit to Fifth Street in Camarillo will cost close to $4,000,000 and is under contract to J. E. Haddock, Limited. The estimated completion date is October, 1958.

K. D. LEWIS

Improved in 1937

The Conejo Grade highway was first realigned to three-lane standards in 1937, supplanting the old two-lane sharply curving Conejo Grade road in use since 1914. The 1937 road building specifications—adequate for those days—called for an overall graded width of 46 feet, with two 10-foot strips of pavement and a 10-foot center lane for passing. The entire project cost $570,000. By way of contrast, the new Ventura Freeway through Conejo Pass is being built to modern standards, with four 12-foot pavement lanes and a 22-foot center dividing strip. The plans provide for a two-quadrant cloverleaf traffic interchange at Camarillo County Park Road, a three-quadrant interchange at Calleguas Road, and a bridge over Conejo Creek. Neighboring farm areas will have the use of four miles of new access roads. The job starts at the Conejo Grade summit and proceeds down the northern slope of Conejo Mountain, more or less paralleling the existing alignment, to the Pleasant Valley plain, where it ends just easterly of the Calleguas Creek Bridge and makes connection with the previously completed (1953-1954) Ventura Freeway through Camarillo.

Historic Area

The urbanite traveler is hardly aware of the history of the countryside through which he passes in his busy schedule, whether he commutes from Ventura to Thousand Oaks or from Woodland Hills to Newbury Park or simply passes through. He will be curious to learn that there was, years ago, a gold rush in this area, when seekers in rigs and afoot flocked to the Russell Ranch to establish claims on sites that were said to be rich in gold deposits, but which

LEFT—A drill operator works away at a large rock left over from primary blasting in order to reduce it to pieces small enough for equipment to handle. RIGHT—A crew is engaged in secondary blasting operations on a rock not broken up small enough by the primary blast.

proved to be empty despite samples showing plenty of "color." He is not likely to know that west from Agoura

A unique breed of "sidewalk superintendent" was encountered by the construction crews working on the Conejo Summit job in the form of rare California condors whose native habitat is the area through which the work is going on.

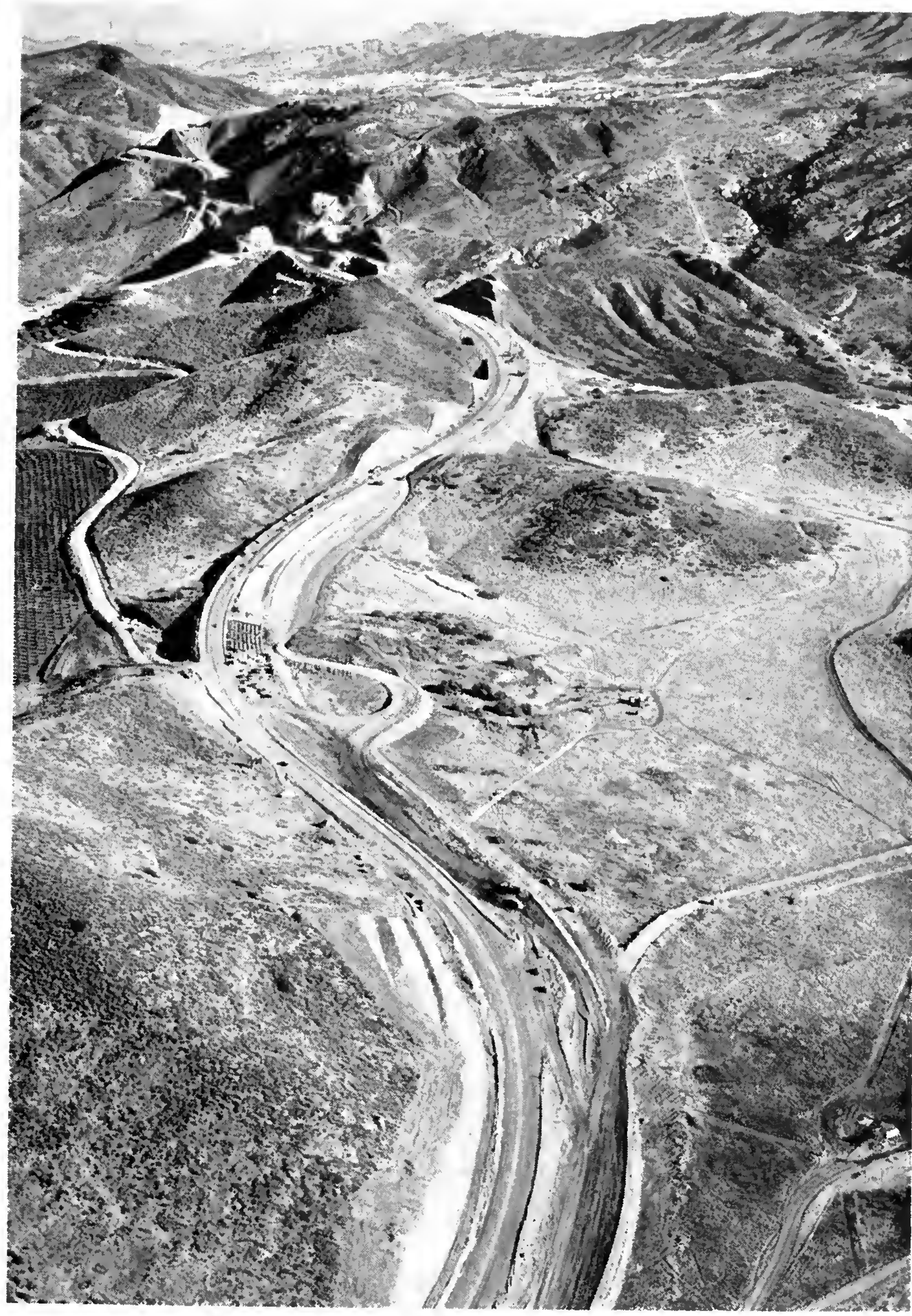
The California condor or vulture is a large, carrion-eating bird with a wing span of up to 10 feet and a body weight of approximately 20 pounds. It has a life expectancy of from 80 to 100 years and is considered as a form of life surviving from the Pleistocene Age.

Once numerous, the birds are now protected in a Los Padres National Forest Sanctuary, where they live and nest in rocky fissures. The great, orange-headed birds are excellent flyers and range as far as the foothills of the Sierras and the coastal islands of the Pacific. They were once seen as far north as the Columbia River and their skeletal remains have been found as far east as Florida. The total condor population today may reach 60 birds of which only 8 to 12 are mating pairs, since long inbreeding has resulted in a high incidence of sterility. According to Ed N. Harrison, an authority on the condor, the bird is gradually disappearing because of the inability to reproduce in number and because of encroaching civilization.

Modern agriculture and farming methods have reduced the condor's supply of food which consists chiefly of the carcasses of cattle, sheep, ground squirrels, deer and horses. The condor has also been known to feed on whale meat, mussels, fish and even house cats.

The principal roosts of the condor in Ventura County are located in Big Sespe Canyon, at Sulphur Peak and in Hopper Canyon. Some also roost in Santa Paula and Piru Canyons. They range over the wild areas of Ventura County and are seen around the Conejo Summit area.

to the outskirts of Thousand Oaks he is speeding through Russell Valley, which takes its name from the pioneer family whose members still work the land there and remember when the rare California condor fed in numbers on cow carcasses on the range.



An aerial view looking east along Ventura Freeway construction on Conejo Grade. The partially completed undercrossing in the center of the picture will serve Camarillo Grove Park.

Missions Established

This sometimes mountainous country of sunny skies and equable temperatures is rich in history and tradition which began with the visit of the Portuguese navigator, Juan Rodriguez Cabrillo, to the shores of California at Point Mugu, just a few miles seaward from Camarillo and Ventura, in 1542. Another explorer, the Spaniard Gaspar de Portolá, on his way with an expeditionary force from San Diego to Monterey, coming along El Camino Real, visited the area around Ventura in 1769. The missionaries then followed under the indefatigable Majorcan Fra Junipero Serra, who established Mis-

UPPER—Heavy equipment moves blasted material from a cut. LOWER—Grading operations in progress near the summit. The embankment under construction in the foreground will contain a total of half a million cubic yards of material when completed.

sion San Buenaventura in 1782 on the present site of the city of Ventura (shortened from San Buenaventura, meaning "Good Fortune"). In the pioneer years following, Spanish cattle barons founded vast estates on the fertile grasslands of present Ventura County, which was originally a land grant shared by two ranchero interests, the brothers Pico and Ygnacio Rodriguez, and José Polanco.

The later tumultuous years saw California become a Mexican possession, then a territory of the United States, then a state, and so the ranchero days gave way to modern times and beginning in 1860 the cattle kingdoms were divided and subdivided. The pastoral period, beautiful as it was, had come to an end.

Good Ranching Area

The scenic route along the Ventura Freeway from the recently completed portion through Woodland Hills is a panorama of plains and mountains, ranch and stock ranges, dotted with the California evergreen live oak and the white oak, gnarled trees sometimes two and three hundred years old. The purple looming mountains, stolid boulder-faced crags, stand ageless sentries over the Russell and Conejo Valleys and eventually give way to the far-flung plains west of the Conejo Grade. Ranching varies from stock or beef-raising to horse pasture, lemon, avocado and walnut groves, lima bean acreage, truck-gardening, dairying. Four miles south from the Ventura Freeway along Triunfo Road near Thousand Oaks is gemlike Lake Sherwood, a cottage-fringed manmade lake. Traveling west there is the small town of Thousand Oaks, a rapidly growing community of 1,500, site of Jungleland, a menagerie of trained animals that perform daily before visiting sightseers and before Hollywood cameras. Ten miles away, in Newbury Park, an old hostelry stands fully restored, looking much as it did in 1876, when it was built by James Hammel as a coach stage stop and hotel. The Seventh Day Adventist boarding academy—a 700-acre farm—for boys and girls stands in the foothills at the top of Conejo Grade. South and across the freeway is the Borchard Ranch, 400 acres of grain, walnuts, peppers, Angus and Hereford cattle, established in circa 1879. Down the grade and into the Camarillo plain is the 232-acre Hartman lemon and avocado ranch, acreage purchased from the Camarillo holdings.

Freeway Construction Started

Construction on the Conejo Grade portion of the Ventura Freeway was formally begun with a bid opening on April 11, 1957, and an award of contract on April 29, 1957. Actual construction got under way on May 8th of that year.

The design and preparation of plans for the freeway were executed in the

Los Angeles office of the State Division of Highways under Assistant District Engineer Ralph V. Chase, with E. H. McBroom, Senior Highway Engineer, in direct charge. The plans provide for 5.0 miles of full freeway of which 2.2 miles are of six-lane and 2.8 miles are of four-lane (ultimate six-lane) width. 1.2 miles of the four-lane full freeway is accomplished by adding frontage roads and closing off access to existing four-lane divided expressway. The 2.2 miles of six-lane freeway is on a 7 percent grade and replaces the previously existing three-lane highway. With the exception of increasing the minimum radius of curvature from 1,200 feet to 1,500 feet, the alignment remains approximately the same.

The State is represented on construction by K. D. Lewis, Resident Engineer, who is responsible to District Construction Engineer H. E. Belford, Assistant District Engineer Frank B. Cressy, and A. L. Himelhoch, District Engineer—Operations. The contractor is J. E. Haddock, Limited, with Superintendent Neal Saul in charge. Counting all hands, some 120 state and contractor's men are actively engaged on the project.

Large Fills Needed

Excavation and embankment operations on the Conejo Grade job have been on a major scale. Near the summit of the grade, the top fill required 230,000 cubic yards of material, a second fill below it required 490,000 cubic yards. In all, the job calls for 1,225,000 cubic yards of roadway excavation to be moved into roadway embankment. Heavy duty machinery used in the earthwork includes Northwest shovels Model 6 and 80, 10-ton rock trucks, heavy track laying tractors equipped with new heavy-duty rippers (an important factor reducing the use of blasting powder), and DW-21 scrapers for dirt and rubble work. A breakdown of major quantities on the job indicates the following: 22,500,000 station yards overhaul in connection with placement of material in the fills; 92,000 cubic yards of imported subbase material from Conejo Creek; 70,000 tons of treated base material in the roadbed section obtained from local commercial rock

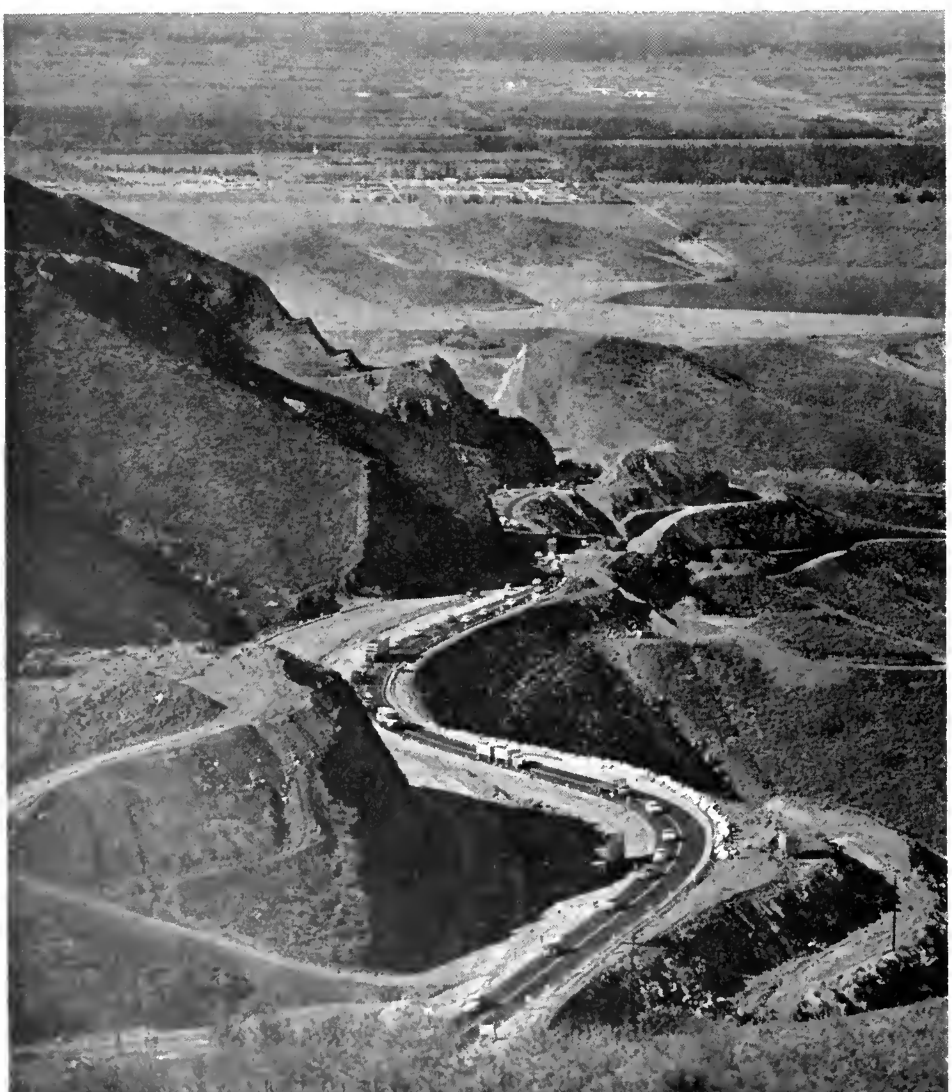
UPPER—Section of a cut taken just after a blast. The larger boulders will have to undergo secondary blasting operations before they can be hauled away. LOWER—A tractor clears boulders from the roadway shortly after a blast.

producing plants on the Ventura River; 25,000 cubic yards of Class B concrete pavement; and 25,000 cubic yards of plant-mixed resurfacing and plant-mix shoulder dikes throughout the length of construction.

Water for compaction and dust control are obtained by an electric turbine-driven water pump from a drilled well in the Camarillo Oak Park ravine up a 1,000-foot embankment to a 25,000-gallon storage tank, whence the water is piped to fill locations.

Traffic Problems

Considered to be one of the heavier grading contracts to be let in District VII for some time, construction on the Conejo has been complicated by the traffic problem, inasmuch as there are no practicable detours in the vicinity and public traffic must be carried through construction with a minimum of inconvenience and delay. Traffic has been routed through the rough grading operations along two lanes of existing pavement or two lanes of paved detour signed for a 35-mile speed limit. Passing lanes are permitted at safe locations within the area. Some delays of short duration have resulted as a consequence of blasting, but the overall flow of traffic has not been seriously impeded or the public subjected to any undue hazard. Advance notice of blasting operations are relayed to all state, county and local agencies concerned.



Looking west from the top of Conejo Grade showing construction in progress on the Ventura Freeway. Traffic through the construction area is being handled on a temporary detour.

Construction on the Conejo Grade has been spectacular because of the precipitous, rugged terrain and the extensive dynamiting through a series of volcanic flows ranging from well-weathered basalt to a resistant volcanic breccia. Two types of powder have been used with excellent results. These are the stick and the bag, the latter of which requires a stick powder primer. Up to five tons of powder is used in some shots. The biggest shot to date, occurring on January 8, 1958, was a 14,500-pound charge that brought down 18,000 cubic yards of fractured rock. In blast preparation, drillers penetrate to a depth up to 50 feet, boring holes of a two-, three- or six-inch diameter, using air-driven waterless equipment including jackhammers, Airtrack drills, and the wheel-mounted drills. In an eight-hour shift, the Drillmaster can bore 200 feet and the Airtrack 500 feet.

Extensive Blasting

As of this writing, 325,000 pounds of powder has been exploded of a total anticipated amount of 450,000 to 500,000 pounds, a figure considerably under the 850,000 pounds estimated before drilling started. The economy of the blasting operation is explained by the efficiency of the new giant ripper and the scientific methods of the powder crew, who drill and space their holes for carefully timed charges that disintegrate the maximum amount of material in the minimum space of the desired area.

The conclusion of the Conejo Grade construction project this fall means completion of another link in the development of U. S. Highway 101, to expressway and freeway standards throughout its entire length. This unit will close the gap in the 38 miles of freeway and expressway between the Santa Clara River in Ventura County and Woodland Hills approaching the San Fernando Valley section of the City of Los Angeles. Freeway construction by the State Division of Highways is a continuing program carried out as expeditiously as funds can be made available.

During February, 1958, the Division of Highways awarded 17 contracts totaling $4,419,000. Another 20 contracts totaling $19,064,100 were completed.

Guided Tour

Governor Meets Editors In San Fernando Area

Governor Goodwin J. Knight led San Fernando Valley newspaper publishers and editors on a tour of San Fernando Valley freeways in late January.

The trip to see recently completed construction, construction in progress, and clearing of right of way was under the auspices of the Valley-wide Committee on Streets and Highways.

C. M. Gilliss, State Director of Public Works and Chairman of the California Highway Commission, and Robert E. McClure of Santa Monica, commission member, accompanied Governor Knight on the inspection.

Members of the Valley-wide Committee on Streets and Highways who were on the tour were: Frank W. Pine, Vice Chairman; John Cawlfield, John J. Tuttle, DeWitt McCann, John Haas and Earl M. Watson.

Newspaper executives and staff members who were a part of the nearly two-hour automobile trip were: Russell A. Quisenberry, publisher, *Valley Times;* Gordon MacLean, publisher, West Valley Newspapers; Lamont Odett, publisher, San Fernando *Sun;* Walter L. Scratch, assistant to the editor, Hollywood *Citizen-News;* Ferdinand Mendenhall, publisher, Van Nuys *News & Green Sheet;* Sue Ressler, editor, Valley Publications; Glen Ingles, managing editor, West Valley Newspapers; Charles S. Ryan, Valley *News & Green Sheet;* Art Ryon and Bill Murphy, Los Angeles *Times;* Charles Ridgway, Los Angeles *Mirror-News;* Charles L. Page and Bob Lindsey, Los Angeles *Herald-Express;* and Ralph Samuels, *Valley News.*

Begin Inspection

The caravan entered the Hollywood Freeway at Cahuenga Pass and saw widening and reconstruction in progress by the Tomei Construction Co. between Highland Avenue and Lankershim Boulevard. This work, for which the contract allotment was $1,192,600, was scheduled for completion in early March.

The Governor's car and the following automobiles were next led over a Griffith Co. contract on Hollywood Freeway Extension from Lankershim Boulevard to Moorpark Street, which was completed and opened to two-way traffic a few days after the tour.

Governor's party halts on contractor's haul road to inspect work. The road is normally traveled by heavy equipment used in construction of the Ventura Freeway-San Diego Freeway interchange.

Contract allotment for this one-mile length of eight-lane freeway was $2,324,800.

Beyond Moorpark Street, the visitors saw the progress of construction on a $4,466,400 contract—also to the Griffith Co.—for 1.3 miles of Ventura Freeway westerly to Laurel Canyon Boulevard. This work is expected to be completed during December, 1958.

From Laurel Canyon Boulevard westerly for 4.1 miles to Sepulveda Boulevard right-of-way has been cleared in anticipation of starting construction this spring. This section of Ventura Freeway is estimated to cost $11,100,000, of which $6,248,000 is financed in the 1958-59 Fiscal Year budget and the remainder is to be financed in 1959-60.

Then the caravan went under a new bridge over Ventura Boulevard west of Sepulveda Boulevard, turned right and traveled over construction in progress on an Oberg Bros. $7,733,000 contract at the intersection of the San Diego and Ventura Freeways. This will complete in July, 1958, 1.3 miles of San Diego Freeway from Valley Vista Boulevard to Burbank Boulevard and three miles of Ventura Freeway from Sepulveda Boulevard to Encino Avenue.

Governor Knight and the rest of the party saw right-of-way clearing, substantially completed, for the Ventura Freeway between Encino Avenue and Kelvin Avenue. Constructoin cost for this 3.9 miles is estimated at $7,300,000. Bids for this work are expected to be called for in late spring. The 1958-59 Fiscal Year Budget provides $6,000,000 of the construction cost; the remainder is to be financed in Fiscal Year 1959-60.

E. T. Telford, Assistant State Highway Engineer, explained the freeway progress in San Fernando Valley and the background of progress in District VII of the Division of Highways. He said:

"In the San Fernando Valley between July 1, 1953, and July 1, 1957, there was expended approximately $50,000,000 for right-of-way. In addition, the 1957-58 Fiscal Year Budget has provided about $9,000,000 for this purpose, and in the 1958-59 Fiscal Year beginning July 1st next we have nearly $13,000,000 provided for anticipated right-of-way expenditures. This gives us a total of nearly $72,000,000 either expended or budgeted for right-of-way on freeways in the San Fernando Valley since July 1, 1953.

Governor Knight looks over construction plans with other members of the party; left to right, Frank Pine, vice chairman of the Valley Wide Committee; Russell Quisenberry, publisher of the Valley News; Knight; and Robert E. McClure, member of the California Highway Commission

"As to construction, we have either completed or under construction work with a total value of $35,000,000, and projects with a total estimated cost of $27,148,000 which will be placed under contract this year. In order to accomplish this, the department has taken advantage of a recent act of the Legislature which makes it possible to obligate funds in succeeding fiscal years for projects on which contract time will run beyond the fiscal year in which the work goes to contract. It is presently estimated that projects in the San Fernando Valley going under contract this year will obligate the 1959-60 Fiscal Year to the extent of approximately $7,800,000. It is in this manner that we have been able to arrange for the earlier starting of several very important projects.

Roadside Development Planned

"In addition to the major projects, funds have been provided for planting the slopes of recently completed projects. This matter of planting and landscaping has been the subject of a great deal of consideration. It is expensive, both to install and to maintain, but it is important for two reasons: one, it of course prevents the erosion of cut and fill slopes; and two, it tends to preserve the appearance of the neighborhood. It is becoming of continually greater importance that we make every effort to have our planting consistent with the type of development in the neighborhood, but limited to those types of planting which will require the least maintenance.

"Now, as to the future, it appears that it will require approximately $98,000,000 to complete the presently adopted freeway routes in the San Fernando Valley. This estimate is split $23,500,000 for right-of-way and $74,500,000 for construction. Of the total of $74,500,000 for construction, $7,800,000 is presently obligated from the 1959-60 Fiscal Year Budget for projects to be placed under contract in the 1958-59 Fiscal Year. Thus we can see that projects which will be placed under construction after the 1958-59 Fiscal Year have an estimated total construction cost of approximately $67,000,000."

Oakland Progress

Construction Moves Ahead On Bancroft Avenue Freeway

By JAMES E. McCARTY and WELTON E. FOLLETT
Supervising City Engineers, City of Oakland

THE CITY OF OAKLAND is currently engaged in a co-operative project constructing Bancroft Avenue Parkway with financing from State Gas Tax Major City Street Funds and Gas Tax Funds from the County of Alameda. This street will extend from Bancroft Avenue at 107th Avenue to East 14th Street at 46th Avenue, with another connection to the East Shore Freeway via 42d Avenue. The improvement will cost approximately $4,500,000 for right-of-way and construction and is slated for completion sometime in 1962 if present financing is continued.

The project will convert Bancroft Avenue from a rundown noncontinuous street and railroad right-of-way to a major intercity thoroughfare and railroad parkway. This transformation involves problems which have been overcome by engineering planning of city, county, state, railroad, utility and contracting agencies. Many of the problems are unique, but basically the major concern was to convert this disconnected dedication into a useful arterial serving both rail and automotive vehicles without materially changing the general residential character of the neighborhood.

Needed Relief Provided

The need for this arterial was foreseen as early as 1927 when the major street plan of the City of Oakland was formulated. Uncontrolled subdivision in East Oakland in the early history of the city had left a large area with no provision for the important east-west movement. The development of Bancroft Avenue will serve this area and provide the much needed relief of Foothill Boulevard, MacArthur Boulevard and East 14th Street, as well as a direct connection to an existing major city street, Bancroft Avenue in San Leandro. Studies for this thoroughfare were commenced in 1941 and protection of the right-of-way started. With the Engineering Department, Planning Commission, Park Department, and Recreation Board participating, the general policy of a parkway with the railroad located in a wide median strip was formulated. The Park Department and Recreation Board are to make maximum use of surplus properties for park and playground facilities, and the Planning Commission agreed to co-ordinate the zoning so as to maintain the present land-use. With this general policy set, detailed planning was undertaken by the Engineering Department under the direction of John A. Morin, City Engineer, to tackle the specific problems.

Design Problems

What can be done with a railroad spur track on a major street? The railroad is the chief transportation link for major industries that are located in this area. The railroad was located partly in city street under spur track permit and partly in private rights-of-way. These private rights-of-way resulted in a noncontinuous street dedication. After much study and negotiation with railroad officials a satisfactory solution was reached. The city purchased all of the existing railroad rights-of-way and under a spur track permit the railroad moved the track into the center of the new street alignment. A wide median strip was provided which will not only afford a landscaped right-of-way but also make room for ample left-turn lanes at all intersections. This wide right-of-way will also provide for an additional two traffic lanes if required. A study of the traffic circulation in this area established which crossings of the railroad and thoroughfare were necessary. Those not needed were closed with the resulting fewer crossings making the railroad operation and the parkway use much safer. The agreement between the city and railroad on the division of costs for the relocation of the railroad removed the major block in way of the Bancroft Avenue Parkway.

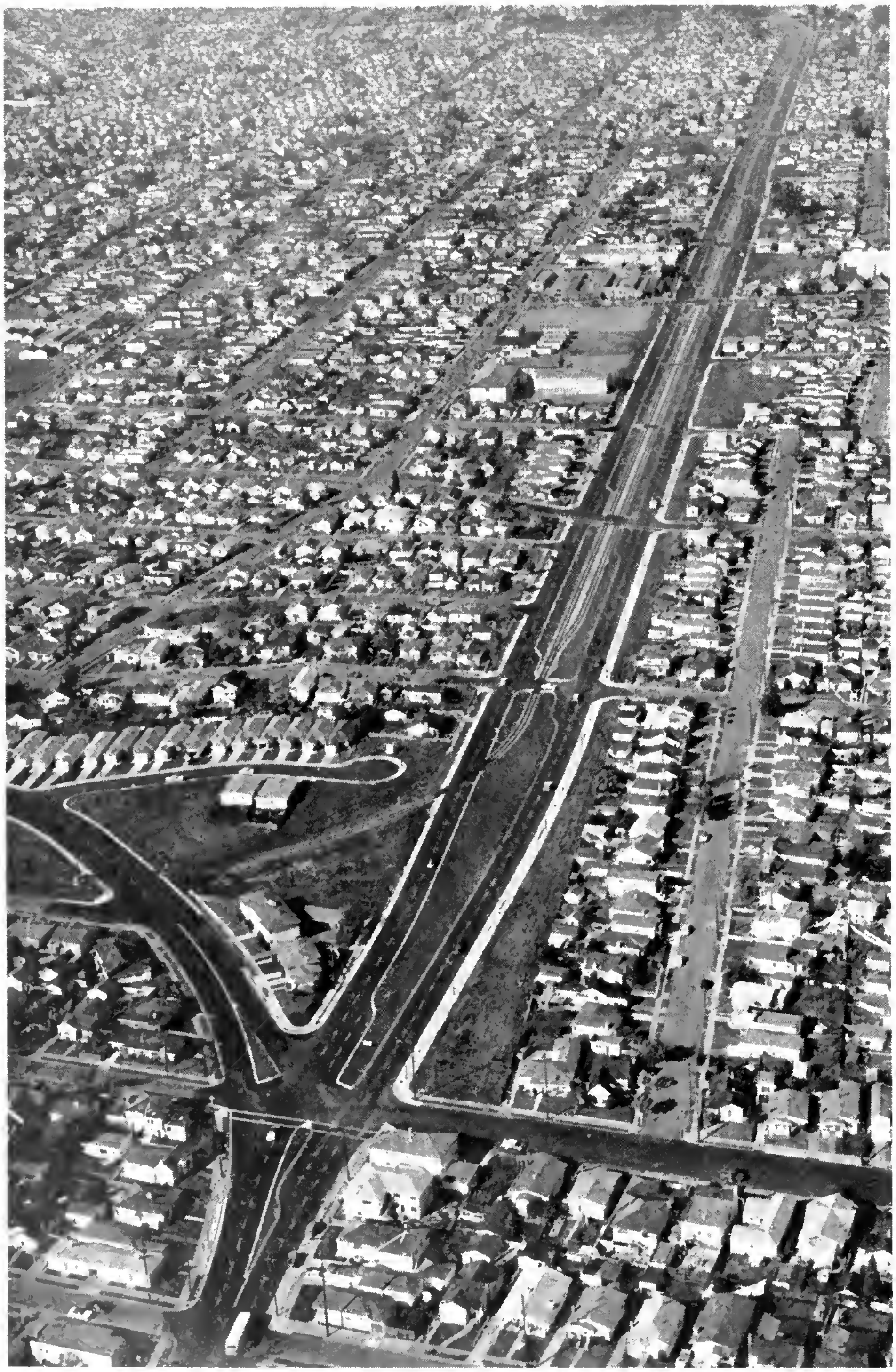
Povement Design

With the removal of this obstruction and the planning initiated for the required utility rearrangements, the remaining design problems were considered. The typical section of the Bancroft Avenue Parkway is planned as two 12-foot moving lanes in each direction, a parking lane eight feet wide, and the previously mentioned left-turn lanes which are also 12 feet wide. This section is made up of a concrete curb and six-foot-wide concrete gutter in the parking lane, 25 feet of pavement and a concrete curb with one-foot-wide concrete gutter at the median strip. There are sidewalk crossings of the median strip at each intersection and a sidewalk area is provided for five-foot sidewalk next to the curb.

Tests on the subgrade indicated a poor foundation material of heavy clay. To support the anticipated loads on this heavy clay subgrade a pavement thickness of 18 inches was designed. This pavement section consists of four inches of selected material subbase, eight inches of crusher-run base and six inches of asphaltic concrete surfacing, of which the top two inches was open-graded mix.

Co-operotive Finoncing

With the location and planning well established, the financing of the project was undertaken. Inasmuch as this was a major city street, the project was eligible for state gas-tax funds; however, inasmuch as the parkway was an intercity thoroughfare serving San Leandro traffic as well as Oakland, county aid was also solicited. These negotiations resulted in the use of Alameda County gas-tax funds allocated to the City of Oakland under the mayors' formula (an administrative agreement worked out by Oakland Mayor Clifford E. Rishell, the mayors of other cities of Alameda County, and the Alameda County Board of Supervisors relative to redistribution for city use of state



An aerial view of the recently completed Bancroft Avenue Freeway in Oakland. A noncontinuous street and railroad right-of-way was converted to a major thoroughfare and railroad parkway.

gas-tax funds allocated to the county) for construction of the first two units of the parkway. It is anticipated that the remaining portions not under contract now will be similarly financed.

With design and financing completed, the purchase of rights-of-way was accomplished. A total of $1,313,800 has been spent acquiring rights-of-way for the project. This has been financed by state gas tax funds allocated to the City of Oakland for major city streets. As these properties were acquired, contracts were awarded for clearing of all existing improvements. With the clearing completed, construction operations could be commenced after co-ordinating the relocation of the railroad, the gas, electricity, and water lines, the sewers and the storm conduits with all agencies involved.

The contract for the first unit of the project from 107th Avenue to 90th Avenue was awarded November 1, 1956, by the Oakland City Council to Lee Construction Company of San Leandro and was completed on October 2, 1957, at a cost of $414,860.

The contract for the second unit of the parkway was awarded by the Oakland City Council June 25, 1957, to Gallagher and Burk, Inc., of Oakland, and at present is under construction. The contractor's bid for this unit was $359,603.

Future Construction

The third unit is presently in the design stage, with a tentative construction date set for spring of 1958, at an estimated construction cost of $450,000. Following this unit, which will run to Havenscourt Boulevard, the parkway will follow the present alignment of Bond Street. The improvement in this area will involve the reconstruction of the existing pavement, construction of new pavement in areas where Bond Street is not presently improved (small previously nondedicated stretches which were purchased when commuter trains were discontinued). The estimated cost for construction and right-of-way for the portion from Havenscourt Boulevard westerly is $2,000,000. The eventual terminous of this project will be at East 14th Street at 46th Avenue, with another leg to tie into the Eastshore Freeway via State Route 235.

In this manner funds presently available are being used to culminate 30 years of engineering planning. Major problems involving right-of-way acquisition, railroad location, utility co-operation and other construction difficulties are being surmounted to provide the citizens of Oakland, San Leandro and Alameda County with a new parkway to relieve existing congested major streets and provide the required connections to the planned future freeways in Metropolitan Oakland.

OPERATIONS AND ACTIVITIES OF MATERIALS AND RESEARCH DEPARTMENT

PART VI—Administration and Services Section

By HARRY R. CEDERGREN, Senior Materials and Research Engineer

In the May-June, 1957, issue of *California Highways and Public Works* Francis N. Hveem, Materials and Research Engineer, presented an outline of the general operations and activities of the Materials and Research Department. Each of the subsequent issues has contained an article giving a review of the work of one of the four testing sections—Pavement, Technical, Structural Materials, and Foundation. This article, covering the operations of the Administration and Services Section, concludes the six-part series outlining the activities of the Materials and Research Department.

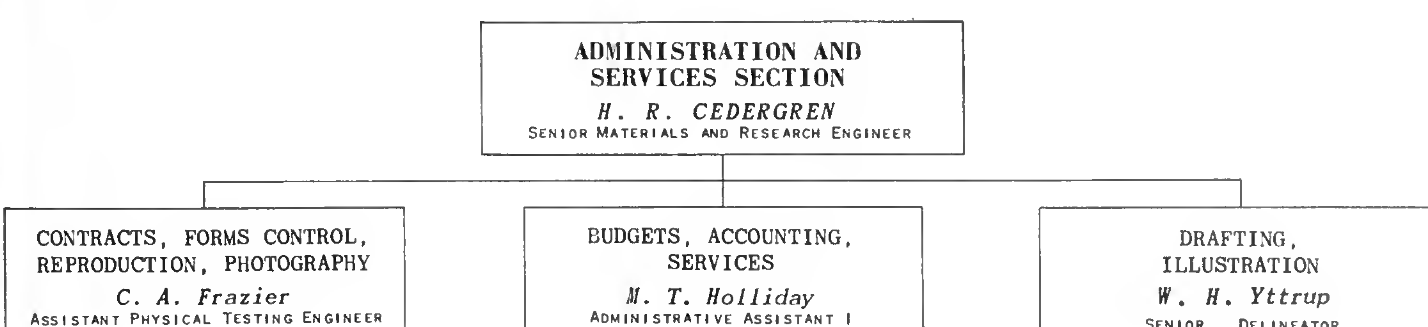
The five preceding articles about the Materials and Research Department have related a great diversity of activities performed in the various sections. The department conducts research and makes investigations on anything needed for the construction and maintenance of highways, including such widely differing materials as asphalt, latex, timber, paint, cement, steel, concrete, soil, rock, survey tapes, traffic lights, etc. In the past, much of the work of the laboratories was directed toward verifying the quality of materials being used in highway work. The present trend places increased emphasis on research and special investigations.

For many years the Materials and Research Department has believed that careful study and research in the properties and usage of materials can pay substantial dividends. Many of the employees of the four testing sections are engaged directly in a wide variety of interesting and sometimes spectacular testing and research activities that are aimed toward this goal. Needless to say, much hard work is required of other individuals who indirectly contribute to the work. The broad scope of work in the different laboratories creates demands for many stock items of tools, supplies, materials and other services that are more or less common to all. This concluding article discusses the activities of the Administration and Services Section, in furnishing services needed by all sections of the department.

Scope of Activities

The Administration and Services Section provides a variety of services, and co-ordinates miscellaneous activities that are required for the smooth and orderly operation of all working units. The section operates a drafting room, and a photographic and reproduction unit that prepares illustrative material of various kinds for reports originating in the other sections. An accounting office maintains nonrental equipment inventory and budget control, service agreement and purchase files, renders bills for work and services performed for other highway and governmental agencies, maintains cost and revenue records, and performs accounting studies. The section prepares reports, maintains records, and furnishes miscellaneous services such as mail distribution, telephone switchboard, messenger service, building upkeep and maintenance, car pool, shipping and receiving and related activities. It makes periodic analyses of payroll and other expenditures to enable the Materials and Research Engineer and his staff to keep abreast of financial matters.

The section compiles various reports—for example, the department's contribution for the Annual Report to the Governor—from material furnished by the various sections. It edits the department's monthly newssheet "Random Samples" and prepares general information booklets, such as one for orientation of new employees. It works with the clerical staff in the sections to prepare and maintain Manuals of Office Procedures. The section handles interviews with prospective new employees and conducts exit interviews for individuals leaving the department. It arranges laboratory safety meetings and supplies safety information to employees. It is developing a program of standardization of laboratory weights and balances. An employee of the section has studied modern practices in forms design and usage and assists all sections in making laboratory report forms clear, efficient and as uniform as possible. All forms used are scrutinized and referred to the Standard Forms Manual. The section co-ordinates or manages miscellaneous employee activities such as approved charity drives, etc.



Numerous office activities are needed for the operation of the department. LEFT—The Administrative Assistant discusses billing procedure for charges on a contract. RIGHT—Vital to every section's activities is the mail desk in the "Front Office."

A small personnel office handles local personnel matters for the department including the maintenance of official personnel records, the processing of official personnel documents, the submission of payroll data and distribution of paychecks. The section maintains active files on preliminary and current contract records for the convenience of all sections. The section supervisor prepares training schedules to fill the needs of trainees and visitors from the districts and other Division of Highways departments, students, visitors from other states and other countries, and other people interested in methods, apparatus, and ideas that have originated in the department. Some of the major activities of the section will be discussed in the following paragraphs:

Many Operations Unusual

Many of the operations of the Materials and Research Department are "one time" affairs—each one new, different, and unusual. Others are standardized or repeated day after day. "Unusual" projects appear so often that they are commonplace. Nevertheless, the procuring of special testing apparatus and supplies that are needed for these enterprises keeps the accounting unit on its toes much of the time. Budget control, nonrental inventory of various testing devices, and other accounting procedures are routine activities of this unit.

This group handles all details in connection with the approval and "follow through" of approximately 2,500 purchase requests a year, covering specialized laboratory and field equipment and supplies. The work includes the editing of requests submitted by the several laboratory sections, conferences with persons submitting the requests, checking for budget encumbrance, posting of account records, etc. Purchase orders issued by the Department of Finance are registered, receiving documents are checked, and vendors' invoices audited for payment. Approximately 1,000 Subpurchase Orders for emergency buying are issued each year, and 100 current service agreements maintained for special services.

Cost Records Kept

Highway districts and departments, state and federal agencies, and cities and counties are billed for services rendered by this department in accordance with published schedules. Cost account records and revenue analyses are kept on a monthly basis so that the Materials and Research Engineer may be fully informed on fiscal operations of the department.

Nonrental inventory records on laboratory equipment valued at more than $500,000 are maintained in accordance with standardized procedures. Work routines are studied for possible improvement, facts and data are accumulated, and special investigations conducted when requested by management personnel.

During the 44 years of its existence the Materials and Research Department has developed dozens of new testing devices and ideas. We have also not hesitated to borrow good ideas from others. The department is well-known for its work with the alkali aggregate reaction test for concrete, horizontal drains, development of economical traffic paint, epoxy adhesives, improvement in welding techniques, and researches in asphalt and bituminous paving technology, just to mention a few items.

New Manual

Many new research and special investigation projects requiring highly specialized apparatus and supplies are begun on short notice and are of such urgency that engineers directly concerned are unable to request the ordering of necessary items far enough in advance to allow for routine purchase. Securing earliest possible delivery of required items then becomes the problem of the employees handling purchase requests. These people are continually being faced with the necessity of trying to expedite delivery by working within the many rules and

A photographer in the Materials and Research Department has many and varied duties. Here he uses a high speed camera in a study of the behavior of soils during compaction.

requirements covering purchase procedures and at the same time maintaining the good will and co-operation of other agency employees who handle the documents. The new "Manual of Instructions" prepared by the Service and Supply Department outlines in some detail the procedures that are to be followed in procuring supplies and services and is an excellent reference on this subject.

Seldom does the Materials and Research Department request the purchase of foreign-made devices or materials; however, upon occasion no domestic item will do the job satisfactorily, and a foreign-made item is known to be available. Transactions for such purchases require unusual care in processing to avoid conflict with state and national laws and policies. An item of this sort was a soniscope, available only from a firm in Canada. Clearance eventually was obtained and the order was placed by the Finance Purchasing Division. After long delay, notice was received from the United States Customs Office that the shipment had arrived at the Canadian border, and a substantial payment would be required in order to secure clearance. Much appreciated co-operation of District IV accounting office and several headquarters employees, including the highway disbursing officer, finally secured delivery of the soniscope.

Early Delivery Important

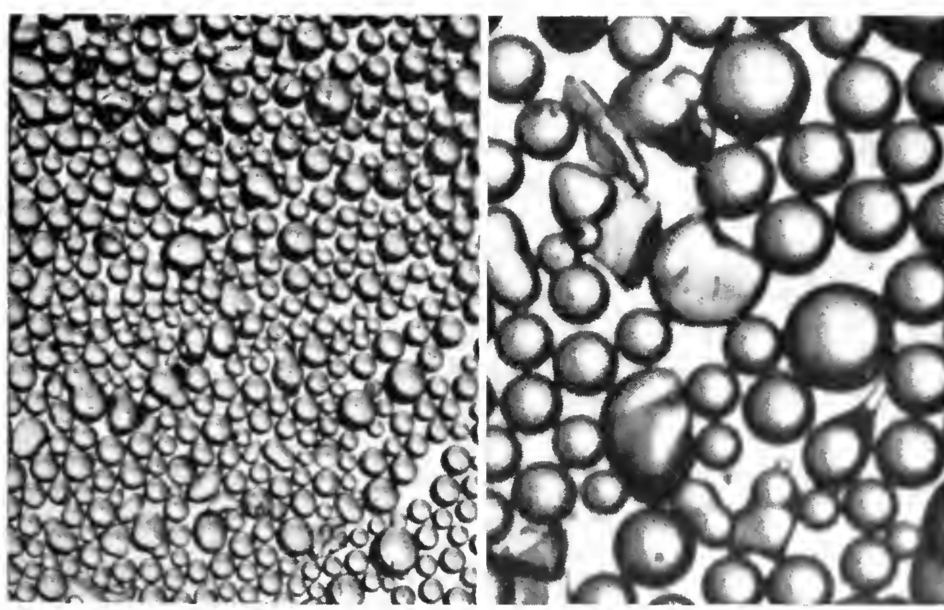
Fortunately, most purchase requirements of the department do not cause so many complications and the problem is more often one of getting things delivered in the shortest possible time.

All bills must be carefully audited prior to approval for payment. Some require detailed handling that is far more time-consuming than the small amounts of money involved might imply. Bills for demurrage charged by the vendors on oxygen and acetylene gas cylinder containers held beyond a 30-day "free" period are an excellent example:

Though each cylinder has an identifying serial number, the vendors' bills show calculation of demurrage only by the totals on hand, without further identification. Since the vendors also bill for "lost" cylinders, it has been necessary to use an especially designed work sheet form that provides for listing all cylinders received and returned by serial number in order to accomplish positive audit when discrepancies occur.

Return of Cylinders

Gases are used in several of the laboratory sections, and in addition, cylinders continually are being returned and picked up by our field personnel at the vendors' various out-of-town locations. The employee who signs each tag is responsible for recording serial numbers of the cylinders received and returned. When the employee "forgets," additional time



Macro-camera shows details of small objects. This picture shows typical glass "beads" used in traffic paint: Left, magnified 10 times; right, magnified 30 times.

must be spent by the Accounting Personnel in "riding herd."

Cost records maintained by this department for the materials and research engineer's information require detailed posting. Our accounting office is small, and laboratory technicians are no more meticulous than any other variety of engineer when it comes to forwarding packing slips and delivery tags, etc.

The administration of a staff of a couple of hundred people requires a surprisingly large variety of personnel transactions. While basic transactions of all Division of Highways personnel are supervised by "Headquarters Personnel Office," the actual preparation of documents and the filing of personnel data for our employees are carried out by our own personnel office. One experienced personnel clerk with the part-time help of another has been able to take care of this work. Our personnel office is one of the smallest units of the department but at times just about the most important. On payday everyone welcomes the girl with the pay warrants. A good personnel clerk is a real asset to any department. She must be accurate in the preparation of documents, willing to listen to employees' personal problems with a sympathetic ear, and is expected to handle all personnel transactions in a strictly confidential manner.

A draftsman for the Materials and Research Department must be versatile. Engineering details of structures, maps, machine drawing, architectural design and the illustrative arts are all in the day's work.

Photographic Section

An essential part of any research project or special investigation is the report outlining the scope of the work and summarizing the findings. Personnel in the photographic, reproduction and drafting units are charged with the job of helping the technical staffs express their ideas on printed pages or before audiences. They may be called upon to prepare almost any kind of illustrative material from large posters such as the 7-foot by 12-foot chart illustrated in the opening article by F. N. Hveem to complete sets of working drawings for an original testing device, or photographs and charts for technical reports. Some of the engineers and specialists of the various sections frequently are asked to represent the Division of Highways at conferences and technical meetings throughout the United States. Employees of the illustrative unit prepare for the speakers charts, graphs, slides, and color illustrations of various types. They also prepare illustrative material for reproduction in *California Highways and Public Works.*

Technical reports and papers originating in the department usually are illustrated with photographs. When photographs are needed they usually show an operation in progress in one of the laboratories or in the field. When feasible, the Service and Supply Department has assigned their photographers to special projects such as the bridge barrier curb investigations made for the Bridge Department. Since a project may require only a few pictures, taken on comparatively short notice, the Materials and Research Department has placed on its staff a photographer who can be assigned immediately to projects as they arise. He has a small darkroom and the basic photographic equipment needed for this work. He has become familiar with the jargon of the engineers and technicians and understands basically what they are trying to show photographically. Most of his work is rather specialized. For example, a high-speed motion picture camera is used to slow down certain operations that are not visible to the naked eye. By speeding up this camera he can reduce the speed of a projected action to one one-hundredth of its actual speed. Pictures have been taken with this camera as part of the study of events that take place during the compaction of laboratory specimens and for detailed sequences of mechanical operations. A slow-motion study of one device showed with remarkable clarity actions that were not even suspected to be taking place. Some simple changes in design eliminated serious vibrations that were causing trouble.

Color Prints Useful

In general, photographic illustrations for reports prepared by the various sections are made in black and white; however, color prints have been found useful for many purposes such as depicting the corrosion of metals and other actions that are largely lost in black and white pictures. In addition to its work in the preparation of illustrative material for technical reports and papers, the photographic unit develops a record of the progress of technical investigations. Pictorial records have been found to be an irreplaceable supplement to physical observations and tests. The photographer also prepares photographic copies of forms, charts, reports, and other material being reproduced by the offset method, and maintains and indexes a central laboratory negative file.

Many testing devices have been invented or improved upon by the Materials and Research Department. Frequently, a new apparatus has been developed by close contact between a man with an idea and an instrument maker. Ideas may be worked out with the aid of rough sketches; however, after a device has been developed, detailed drawings generally are prepared. Some of this work has been done by people in the Structural Materials Section; however, the drafting unit has prepared working drawings of numerous new instruments. Complete mechanical drawings have been prepared for many original pieces of equipment such as the following:

1. The asphalt extractor.
2. Mechanical compactor for soils and bituminous mixes.
3. Hveem stabilometer.
4. Sand volume apparatus.
5. Modified Benkelman beam apparatus.
6. 60-inch I. D. sphere photometer.
7. California type soil samplers.
8. Unconfined compression machine.
9. Reflux moisture test apparatus.
10. Kelly penetration apparatus.
11. Abrasion test equipment.
12. California impact compaction apparatus.
13. Cohesiometer.
14. Expansion pressure apparatus.
15. Fatigue testing machine.

The drafting unit prepares illustrative material needed by the testing sections of the laboratory. They regularly prepare drawings showing the results of investigations performed by the Foundation Section. They delineate the underground rock and soil conditions as determined from samples taken by the field crews, and other physical conditions. They present details of the installation of horizontal drains for the control or prevention of slides. The drafting unit also maintains a central file of engineering tracings for all sections of the department. A close affiliation between the drafting and illustration personnel and the research staff is essential in the development of useful illustrative material.

After all of the various illustrative material has been prepared for reproduction, reports for distribution usually are printed by the offset method. A multilith operator prints most of the reports that are written by the department. The artwork for the current series of articles was developed by the illustrative unit.

Miscellaneous Services

In addition to its work in accounting, personnel, drafting and reproduction as outlined above, the section provides numerous general services needed for the operation of all units of the department. These services include general building upkeep and maintenance, the operation of a car pool, shipping and receiving, telephone switchboard, messenger service and mail distribution, etc. The Administration and Services Section also maintains files on all active highway construction from the "project report" stage through the completion of each contract or work order. These files enable employees of all sections to quickly locate pertinent data, design information, contract specifications, test results and materials reports.

The work of the Materials and Research Department has brought about the development of a sizable number of forms. An employee of the Administration and Services Section has made a study of modern trends in forms design. He has aided all sections in the design of new forms and has improved existing forms when necessary before submittal for reprints. Attention to the design and control of forms has made possible the saving of time of people in all sections.

One of the newest additions to the work of the Administration and Services Section is the preparation of a program to develop standards of accuracy of laboratory weights and balances. Each of the testing sections has done its own standardization work in the past. A consolidated effort to co-ordinate the standardizing activities of all sections is underway.

Training Programs

Many different kinds of skills are required for the accomplishment of the work of the Materials and Research

Standardization of weights and balances assures that laboratory work will be accurate and precise

Engineers and other specialists from foreign countries are a common sight in Materials and Research laboratories. Picture shows Dr. B. G. Singh of Trinidad (left) being shown a California test method.

generally have an excellent technical background and a good command of the English language. A mutual exchange of ideas is beneficial to them and to us. In general, our instructors have little difficulty from the standpoint of a language barrier; however, upon occasion visitors are received who scarcely understand what is being said to them. The language problem strains the abilities of our engineers to the limit. Sometimes we look among our staff desperately for an interpreter. Recently one of our Spanish-speaking employees helped ease conversation with a group of Mexican engineering students. Another of our employees who speaks a little Japanese spent a couple of days acting as interpreter for an official from Japan. All situations that have arisen in the past have been handled with reasonable satisfaction. However, we wouldn't know what to do if a group suddenly descended upon us from Siberia. We speak no Russian.

The views of some of our visitors are typified by the statement of a recent engineer from Pakistan who said, "California is a great state, the Division of Highways has the most beautiful highways in the world, and the Materials and Research Department is—," but then he begins to sound just like a native son of California so we won't quote him any further.

Department. Anyone who becomes experienced in a specific activity is likely to be on the way toward becoming a specialist. Once a man has become expert in a particular kind of work, there is a tendency for him to continue indefinitely in that work. To a degree this specialization is necessary; however, the department is attempting to broaden the scope of work of its employees by job rotation whenever feasible. To accomplish this objective, proper training programs have been developed to fit individual needs.

The Materials and Research Department, being a segment of a modern engineering organization, receives many visitors from foreign countries and other parts of the United States. Training programs are developed to meet the needs of many such individuals who visit our department each year. The laboratories are open to anyone in the districts or another state department who wishes either a short tour or an extensive training. Recently one of the districts sent about 14 construction and materials men to our laboratories for a few days observation of our methods. This group was interested primarily in highway pavements and earth foundations. Schedules were developed with the bulk of their time in the Pavement Section and the Foundation Section. Other visitors have been primarily interested in concrete, traffic paint, welded structures, horizontal drains or other specialized activities. Groups of students from local schools may wish to tour the laboratories in an hour or two. Engineers and officials from foreign countries sometimes wish to remain in the department as long as three or four months for detailed study of certain phases of our work. Some of these visitors learn our methods by actually carrying them out. Whatever the desires of our visitors and trainees, programs are developed to meet their individual needs.

Foreign Visitors

Our department receives numerous foreign visitors who are referred to us by the U. S. Bureau of Public Roads or the Department of State. More than 300 engineers and other officials from 33 foreign countries have registered in the Materials and Research Engineer's guest book. While these people come to us mainly to study our methods, our people derive considerable pleasure and benefit from their contacts with these visitors. Foreign visitors

Demands Are Continual

In the above paragraphs we have outlined some of the activities of the Administration and Services Section that are necessary for the smooth and orderly functioning of the working units. We have mentioned some of the problems of keeping the research and testing units supplied with the articles and materials of their trade. We have mentioned the work of our illustration and reproduction unit in helping the technical staffs get their ideas down on printed pages. We have touched upon the continual demands for developing training programs for engineers from other units of the Division of Highways and from other lands and states of our own Country. These activities go on behind the scenes and appear less spectacular than

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Ribbon Cutting

Chico-Hog Springs Section Of Sign Route 32 Improved

In a traditional ceremony on January 9th, F. W. Tarr of the Statewide Highway Committee of the State Chamber of Commerce cut the ribbon to signal the opening of the recently completed highway improvement on State Sign Route 32 between Chico and Hog Springs. This ceremony marked the culmination of two separate but adjoining projects representing an expenditure of over a million dollars: one to widen Eighth and Ninth Streets in Chico from Main Street to near Fir Street and the other to construct the 5.4-mile length of highway from near Fir Street to Hog Springs, a combined length of about six and one-half miles.

In addition to Tarr, other speakers at the well-attended opening were: Claude Alexander, Chairman of the Butte County Board of Supervisors; Dr. Vern M. Bartram, President of the Chamber of Commerce; Andrew R. Morrison, Chamber Secretary-Manager; Chico Mayor Theodore Meriam; State Senator Paul L. Byrne, and Alan S. Hart, District Engineer of Division of Highways District.

F. W. Tarr, longtime member of the Statewide Highway Committee of the California State Chamber of Commerce, cuts the ribbon to place in service on improved section of State Sign Route 32. Assisting are (left to right): Dr. Vern M. Bartram, President of the Chico Chamber of Commerce; State Senator Paul L. Byrne of Butte County; Tarr; Theodore Meriam, Mayor of Chico; Alan S. Hart, District Engineer, Marysville; and Claude Alexander, Chairman, Butte County Board of Supervisors. (Chico Record-Enterprise Photo)

Two Contracts

Lester L. Rice and Sons, Inc., of Yuba City had the $176,284 contract to widen and surface Eighth and Ninth Streets in Chico. Earl R. Horn was resident engineer.

The adjoining project was constructed by A. Teichert and Son, Inc., of Sacramento at a cost of $872,773. Right-of-way was purchased during 1955 and 1956 at a cost of approximately $130,000. One of the features of this project was the relocation of Little Chico Creek and the diversion of Dead Horse Slough which necessitated the removal of approximately 60,000 cubic yards of material. Grading for the roadway required excavation of about 100,000 cubic yards. Forty-two thousand tons of rock base was placed under 20,000 tons of plant-mixed surfacing to complete the roadway. Two reinforced concrete bridges were constructed across the diversion channel of Dead Horse Slough, requiring 325 cubic yards of concrete and 90,000 pounds of steel. M. E. Ryan, Sr., represented the Division of Highways as resident engineer.

The road is principally a recreation route for summer vacationists and is a shortcut to Lassen Park and Lake Almanor for travelers coming from the west and south of Chico as well as those from the immediate vicinity of Chico.

Historic Road

Frank B. Durkee, former Director of Public Works, in his brochure entitled "Deer Creek Highway," as this portion of the route is known locally, has this to say about the early history of the route:

"From the time the early pioneers settled in California the need was evident for a direct highway from Chico toward Susanville and the country north and east of there.

"Although used by Peter Lassen prior to 1855, the development of such a route really started in 1863 when the gold rush had ebbed in California and the miners sought the shortest way to the Idaho mines. This earliest development was meager—only a toll trail—for 'saddle trains' along what was to become the Humboldt Road. The first saddle train is recorded as having left Chico on April 3, 1865. Accommodations for 'passengers' consisted of a mule or horse to straddle, a blanket roll, and food along the way."

Alvarado-Niles Road

Unique Method Builds Bridge

By OLOF E. ANDERSON, County Surveyor and Road Commissioner

ALAMEDA COUNTY, in co-operation with the United States Bureau of Public Roads and the California Division of Highways, recently completed the newly reconstructed Alvarado-Niles Road between Alquire and Decoto Roads. The 2.4-mile project was constructed at a total cost of $200,000 (exclusive of engineering) utilizing federal, state and county funds under the federal-aid secondary highway program. The new road intersects the recently completed section of the Eastshore Freeway (State Highway Route 69) between Jackson Street and Beard Road.

The Alvarado-Niles Road serves an area devoted primarily to truck farming; however, easterly of the road are located several industrial developments that have access to this route and utilize it extensively for employee access. In addition, the trend of residential growth is toward this area as is evidenced by the fact that the local school district has purchased 46 acres fronting on the Alvarado-Niles Road for a high school site. Before improvement, the road showed evidence of surface failure due to the thin bituminous-treated surfacing and inadequate cover over the native material. High annual maintenance costs resulted.

Traffic studies indicated that the Alvarado-Niles Road would be the primary east-west feeder into the freeway system and the estimated future average daily traffic further indicated that a four-lane facility would ultimately be necessary. However, the construction of a four-lane facility was not warranted at this time, but the acquisition of the necessary additional right-of-way for the four lanes was considered economically practicable. On this basis, the current improvement is one-half of a two-stage development plan, or the construction of two lanes of an ultimate four-lane divided highway. With minor exceptions, the additional right-of-way acquired was all on one side of the existing road. The alignment of the present improvement followed the existing roadway.

Pavement Widened

Structurally, the section for the current improvement was designed on the basis of a traffic index of 6.54 and a minimum resistance value ("*R*") of 30 for the basement soils. On this basis, the following section was adopted: three inches of plant-mixed asphaltic surfacing; six inches of Class "B" cement-treated base; and six inches of imported subbase material. The pavement width is 40 feet, consisting of two 12-foot moving lanes and two eight-foot shoulders delineated by a fine seal coat. There were approximately 10,000 cubic yards of waste excavation in the contract to be disposed of by the contractor.

A local disposal site was not specified in the contract. The architect for the aforementioned proposed high school, however, met with representatives of Alameda County to determine whether surplus excavated material would be available to the school district. The architect was referred to the contractor and an agreement was made whereby the waste material would be stock piled on the school property. Thus the contractor was able to waste the material locally without double handling, which resulted in a saving for both parties to the agreement.

Plant Mix Used

The special provisions provided for either plant-mixing or road-mixing the cement-treated base material. For various reasons the contractor elected to plant-mix the material. Chief among those reasons was the availability of materials from a commercial plant in the area and the traffic hazards that would have resulted through road-mixing. The material was hauled eight miles from the plant to the job with end dumps and placed on the grade with two windrow spreader boxes side by side. The operation thereby progressed for the full width of the roadway.

A unique feature of the contract was the construction of the Dry Creek crossing, consisting of a reinforced concrete cored-slab bridge of one span, supported on concrete piles. Built in 1910 and consisting of a double-span reinforced concrete slab, the existing structure was deficient in roadway width and hydraulic properties not complying with channel improvements proposed by the flood control district.

No Falsework Necessary

In lieu of conventional timber falsework, the contractor elected to cast the slab on a compacted fill. His primary reason for selecting this method being the large falsework members required to support the heavy dead load of a structure of this type. The material used for the fill was waste excavation from the roadway and consisted of a granular clay-loam material which compacted very satisfactorily. This material was brought up to within one foot of finished grade. Sand was used for the final lift. Double 2-inch by 4-inch deck forms were securely staked to the fill to the desired elevation, after which sand was brought up flush with the top of the forms and the plywood panels fastened. If the plywood panels did not have a firm supporting base, the weight of the concrete would "dish" the panels from support to support and the effect would be reflected in the finished structure. However, by carefully placing the fill, panel by panel, and with the use of a vibrating compactor, the contractor was able to provide a stable base which resulted in a neat appearing surface when stripped.

The Sonovoid tubes were supported by semicircular snap-tie cradles which in turn were anchored to the 2-inch by 4-inch deck forms. The tubes were

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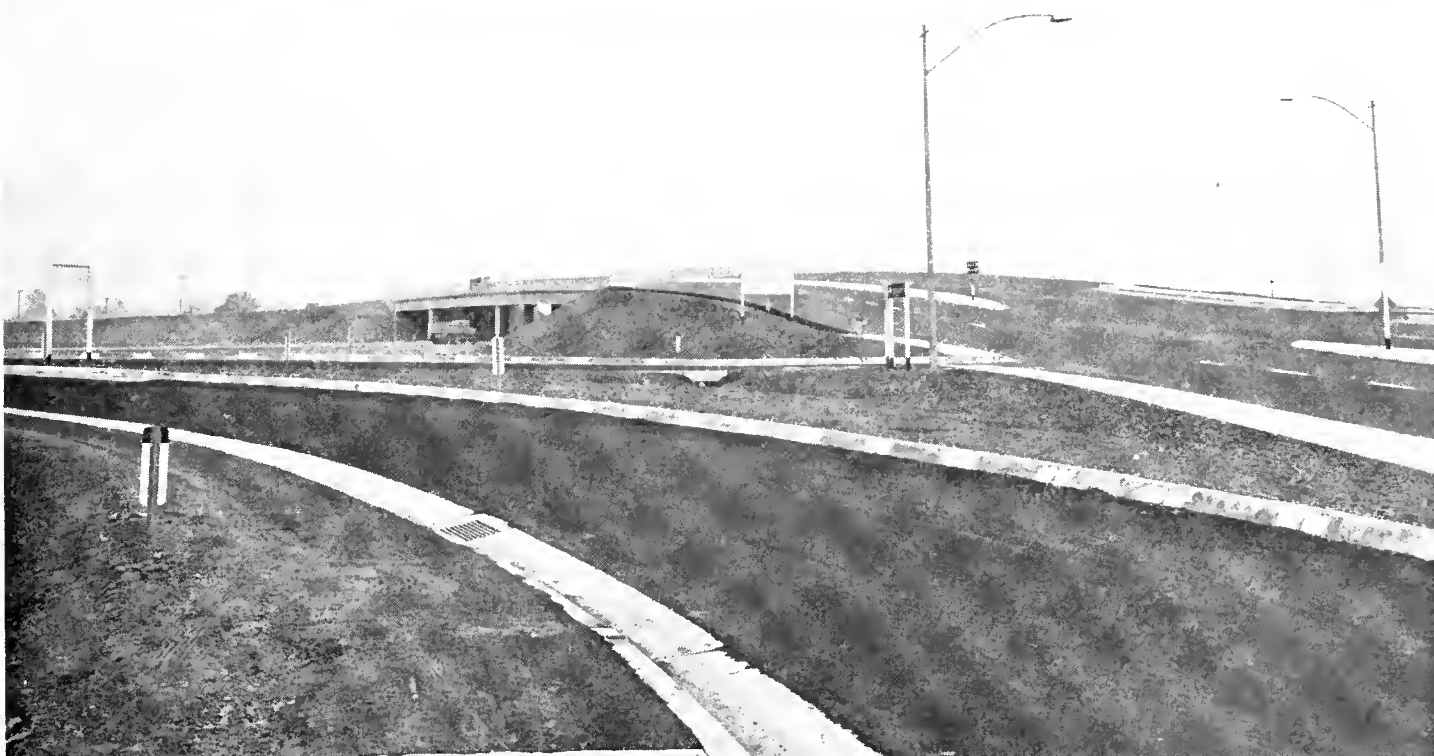


UPPER—An unusual method was used in the construction of this Alameda County Federal Aid Secondary bridge. The bridge deck was built on a compacted earth fill just as though it were a section of concrete pavement. The channel was excavated after the concrete had set. LOWER—The Alvarado-Niles Road Overcrossing at the Eastshore Freeway.

San Miguel

Bypass of Historic Mission Town on US 101 Completed

By J. W ROBERTSON, Resident Engineer

Another link in the four-lane construction of US 101 has been completed and was opened to public traffic late in November of 1957.

Recently completed at a cost of approximately $1,184,000 is 3.1 miles of US 101 between two miles south of San Miguel and the south boundary of Camp Roberts. Located near the north boundary of San Luis Obispo County, this full freeway facility bypasses the unincorporated community of San Miguel.

The town of San Miguel, located approximately three miles south of Camp Roberts is primarily a farming and ranching community. The principal attraction for tourists and the historical minded public is Mission San Miguel Arcángel, which was founded in 1797, and located "one day's journey" between Mission San Luis Obispo and Mission San Antonio. Mission San Miguel was the sixteenth link in Padre Junipero Serra's chain of 21 original California missions.

The new freeway, constructed on new alignment throughout its length, lies westerly of the town of San Miguel and generally parallels old US 101, which is to be relinquished to the County of San Luis Obispo. The beginning of the project is contiguous to the four-lane expressway completed in 1954 between the City of Paso Robles and two miles south of San Miguel.

Local Material Used

The typical structural section of the mainline consisted of 0.67 foot of portland cement concrete and 0.33 foot of cement-treated subgrade on 1.0 foot of selected subbase material for a total cover thickness of 2.0 feet.

The roadway excavation between Stations 443 and 454 was of suitable quality to permit its use as selected subbase material in lieu of the more usual practice of providing imported subbase and imported base.

Selected material was hauled to the grade in two-axle scrapers. Since the material contained approximately 5 percent of oversize, the contractor equipped two continuous belt loaders with grizzly attachments to move the oversize before loading and delivering to the grade. This procedure enabled him to load out a scraper in approximately 90 seconds.

As some difficulty was experienced during the early stages of placing the selected subbase due to lack of fine material, it was considered advisable to provide a Class "C" cement treatment to the upper 0.50 foot under the

The north end of the San Miguel Bypass looking toward Camp Roberts in the left background. Traffic entering San Miguel uses the ramp curving under the freeway in the middleground.

PMS surfaced main line shoulders and frontage roads.

The work of mixing, spreading and compacting the cement treated material was performed at force account, since no contract items had been provided for this work. The final cost for cement treatment was approximately 15 cents per square yard.

Ramp construction consisted of 0.25 foot of Type "B" plant-mixed surfacing and 0.50 foot of Class "B" cement treated base over 0.50 foot of selected subbase material.

Three Large Cuts

Roadway excavation for the project was obtained from three principal cuts. Total roadway excavation exclusive of rehandling stockpiled materials was approximately 690,000 cubic yards. This included approximately 80,000 cubic yards of selected material which was hauled and placed throughout the freeway facility.

Two of the three principal cuts were approximately 160 feet and 100 feet in height, respectively, and were of a sidehill nature. The natural ground lying on approximately a 1½:1 slope required the contractor to develop long, easy haul routes for accommodation of large earthmoving equipment. All cuts greater than 40 feet in height were constructed with 1:1 slopes and 20-foot benches provided at 50-foot elevation increments to reduce slide potentialities.

Except for the selected material, the excavated material consisted principally of sandy silts and silty clays, together with terrace sands and gravels. The material was loosened by scarifying and was hauled in conventional two- and three-axle pneumatic-tired scrapers, supplemented by push dozers. Compaction was obtained with sheepsfoot rollers supplemented by segmented steel wheel rollers. Except for the selected subbase material, the production rate for roadway excavation was between 12,000 and 18,000 cubic yards per day.

Traffic Diverted

Portland cement concrete pavement operations were started May 16, 1957, and continued until June 11, 1957, at which time it was necessary for the contractor to divert traffic to the

Local traffic entering or leaving the bypass between the northern and southern ends does so at this interchange located west of the city

newly constructed left lanes in order to complete the earthwork at the south terminus of the project.

Material for use as mineral aggregate for P. C. C. pavement was manufactured by the contractor at a granite quarry located approximately 28 miles south of the project.

The contractor elected to erect his P. C. C. batch plant at the city of Paso Robles for serving both this project and a state highway project being constructed concurrently in the City of Paso Robles. This constituted a haul of approximately eight miles from the batch plant to the project. Production rates were approximately 960 cubic yards per day.

Metal strips (16-gauge) were used as weakened plane joints at 60-foot intervals on the initial lanes of pavement. Corresponding strips were placed adjacent on the companion lanes including all working joints. All other weakened plane joints were formed by sawing. This method of operation proved highly successful as only four random cracks developed during construction despite daily temperature variations of between 20 and 40 degrees.

Three reinforced concrete bridges were consrructed to serve as interchanges at each end of the project and at 10th Street. These interchanges will provide ingress and egress to the town of San Miguel without interruption.

The prime contractor was the Madonna Construction Company of San Luis Obispo, represented by superintendents R. W. Osborne and R. E. Chafin. Major subcontractors were Statewide Steel Erection Co. for placing bar reinforcing steel, P & Z Co., Inc., for furnishing and driving piles, and Valley Electric Company for the highway lighting system.

The work was performed under the general supervision of Mr. A. M. Nash, District Engineer. R. S. Samuelson and John Pettine were the Bridge Department representatives with the author as resident engineer.

It is common these days to speak of billion-dollar road programs. How much is a billion dollars? If a man started playing the stock market with a billion dollars for a stake, he could lose $1,000 a day for 26 centuries.

Carl S. Hamilton

Carl S. Hamilton, Supervising Bridge Engineer on state-owned toll bridges, died suddenly on December 19, 1957, at his home in Oakland.

Hamilton was born on March 24, 1897, at Northport, Washington, and spent his early years in that state and in British Columbia. During World War I he served with the Canadian Army, attaining the rank of captain. He was wounded in action three times.

Following the war he studied engineering at the University of British Columbia. In 1922 he moved to the San Francisco Bay area where he pursued his engineering career on several projects, including the Posey Tube. This was followed by two years on bridge construction with the Bureau of Public Roads.

Hamilton's service with the State of California began in August, 1929, when he went to work for the Bridge Department as resident engineer on bridge and subway construction. In May, 1933, he was transferred to the construction engineering staff of the San Francisco-Oakland Bay Bridge where he was assigned responsibility for caisson construction in the fabricating shipyards. His next assignment, in May, 1937, was to the permanent operating and maintenance staff of the Bay Bridge. In this position, which he held until his death, he was in direct charge of all maintenance activities on the several toll bridges, and after 1938 served also as second in charge of the entire operating and maintenance organization.

Hamilton was recognized as a leading West Coast expert on paints and protective coatings.

Hamilton is survived by his widow, Isabelle; his son, William C. Hamilton; his daughter, Mrs. Isabelle E. Dunlap, and seven grandchildren.

During the 1956-57 Fiscal Year, Division of Highways maintenance crews painted traffic lines and other pavement markings on more than 10,700 miles of rural state highways.

Warlow Is Elected CHC Vice Chairman

Chester H. Warlow, of Fresno, has been elected Vice Chairman of the California Highway Commission, succeeding James A. Guthrie, of San Bernardino.

Warlow has served on the commission since his appointment by former Governor Earl Warren in 1943. He was reappointed by Warren in 1945, 1949 and 1953, and by Governor Goodwin J. Knight in 1957. He previously served as commission vice chairman in 1954 and 1956.

A retired lawyer, banker and oil company executive, Warlow has been active in promoting the planning and construction of an adequate highway system in California since he became a member of the Roads and Resorts Committee of the Fresno County Chamber of Commerce in 1927.

He was educated in Fresno public schools and graduated from Stanford University in 1911 where he also completed his law studies. He was admitted to the California bar in 1913.

During World War I, Warlow served as a first lieutenant in the U. S. Air Service. He is a 33d Degree Mason and a past Grand Master of Masons in California.

Ted Jain

Ted Jain, 57, former District III City and County Projects Engineer in Marysville, died of a heart attack February 11, 1958, in Yuba City.

A veteran of 25 years with the Division of Highways, Jain retired in 1955.

Jain was born in Boulder, Colorado, and attended grade school in Boulder and high school in Greybull, Wyoming. He studied at San Diego State College after arriving in California in 1924.

From 1927 to 1930 he was an engineering draftsman for the San Diego city engineer. He went to work for the Division of Highways in San Bernardino in 1930. Following a short assignment in San Luis Obispo, he transferred to Marysville in 1934.

Jain had charge of the squad that designed the North Sacramento Freeway. He was appointed District III City Project Engineer in 1949, and in 1950 also assumed the duties of administering the federal aid secondary county road program for the district.

During World War II he was a Navy officer, serving in the Pacific area with the Seabees. He is survived by his wife, Georgia.

Highway Commission Names Laguna Freeway

The California Highway Commission has assigned the name Laguna Freeway to the adopted freeway route for State Highway Route 185 in Orange County from U. S. Highway 101 in the vicinity of Irvine to a point near the City of Laguna Beach.

A freeway route for State Highway Route 185 was adopted by the commission in November, 1954. The freeway route provides for some relocation of the present highway, known as Laguna Canyon Road, on a more direct line.

The commission's action in naming the Laguna Freeway was taken pursuant to a resolution from the Orange County Board of Supervisors and a subsequent study and report by two of the commission members, Vice Chairman James A. Guthrie of San Bernardino and Robert E. McClure of Santa Monica.

Three other freeway routes in Orange County were assigned names in October. They are the Newport Freeway, Garden Grove Freeway and Riverside Freeway.

MICHIGAN STATE HIGHWAY DEPARTMENT

November 15, 1957

Editor, California Highways and Public Works

Sir: I would like to express my sincere appreciation for receiving your excellent magazine.

Your editorial and pictorial coverage is so complete that one can readily understand the popularity of your magazine.

In Michigan, we look forward to every issue of your publication.

Sincerely,

Harold N. Brunornd
Co-ordinating and Scheduling Engineer

John O. Bronson Named to Highway Commission

Governor Goodwin J. Knight announced the appointment of John O. Bronson, Sacramento, to the California Highway Commission succeeding H. Stephen Chase, Sacramento, resigned, for a term ending January 15, 1959. The appointment requires confirmation by the State Senate.

JOHN O. BRONSON

Bronson was born in Sacramento September 18, 1903, and was educated in the public schools of Sacramento, Los Angeles and Santa Monica. He attended the University of California at Davis. From 1924 to 1940 he was a produce buyer for the California Fruit Exchange and other companies in the Sacramento Valley. Subsequent to that time he had been in the general insurance business in Sacramento, operating under the name of John O. Bronson Company with a branch office at Al Tahoe, El Dorado County.

Bronson has been active in highway matters for the past 10 years, serving as a member of the California State Chamber of Commerce State Highway Committee, the Collier Joint Interim Factfinding Committee, the Sacramento City Planning Commission, and various other subcommittees and regional committees of the State Chamber of Commerce, as well as being chairman of the Sacramento City-County Chamber of Commerce Highway Committee. He is treasurer of the Greater Broadway Association of Sacramento, a member of the Native Sons of the Golden West and the Elks Lodge.

Bronson is married and has one daughter, a student at McClatchy High School.

Chase has served on the commission since October, 1951. He was reappointed in 1955 for a term to run until January 15, 1959.

The former district manager of the American Trust Company in Sacramento, he was promoted in 1955 to senior vice president and transferred to San Francisco.

Chase said that his duties as a bank official made it impossible for him to find adequate time to fully carry out his responsibilities as a member of the commission.

NEW DEVICE SPEEDS DISTANCE MEASUREMENT

A NEW AND UNIQUE surveying tool designed to provide quick and accurate measurements of long distances is now being used on an experimental basis by the Division of Highways.

The device, an electronic distance measuring meter, was obtained by the division some three months ago. Since then it has proved to be consistently reliable in on-the-job use at several locations in the State.

The unusual instrument is used primarily in determining long distances which are difficult to measure by conventional surveying methods, and it is expected to speed the early planning of lengthy highway developments.

With this device it is possible to supplement existing geodetic survey data in less time, with fewer men, and at reduced expense. New survey base points and check points, specifically suited to highway construction needs, can be set without encountering many of the problems normally faced in establishing these data.

Basically the instrument works like this:

The meter box shoots a beam of pulsating light at the distant reflector which contains seven precisely ground prisms made of high quality optical glass. The pulsating beam is reflected back to a photo tube at the light source. The time lag in sending and receiving the light pulses is converted by the instrument into units of distance.

Light pulses, from a small 15-watt bulb, are dispatched 1,500,000 times a second. Because of the precise design of the reflector, the light from even an ordinary pen flashlight has been picked up from as far away as six miles.

Under ideal atmospheric and visibility conditions, the instrument is effective over distances up to 20 miles with a maximum error of only four inches. Longest distance covered thus far by Division of Highways operators was 14 miles.

Although the usual survey crew contains from four to seven men, only two are required to operate this instrument. Total weight of the meter box and mechanism, the reflector, and a small generator to supply necessary power is about 150 pounds.

SANTA ROSA, CALIF.

Editor, California Highways and Public Works

SIR: Having traveled the length and breadth of our State for many years on all kinds of highways from the early days to the present time, I want to congratulate the California Highway Department for the fine progress and excellent highways and freeways they are bringing to the traveling public. Just another example of the high caliber of personnel, from the bottom to the top, we have working for us in the department.

Wishing you continued success for your publication, I am

Cordially yours,

FRED H. CLARK

In 1895 there were only four registered motor vehicles in the United States. By 1900 there were 8,000. That figure has jumped to more than 60 million vehicles on the road today.

Redwood Highway

Four-lane Construction Requires Traffic Control

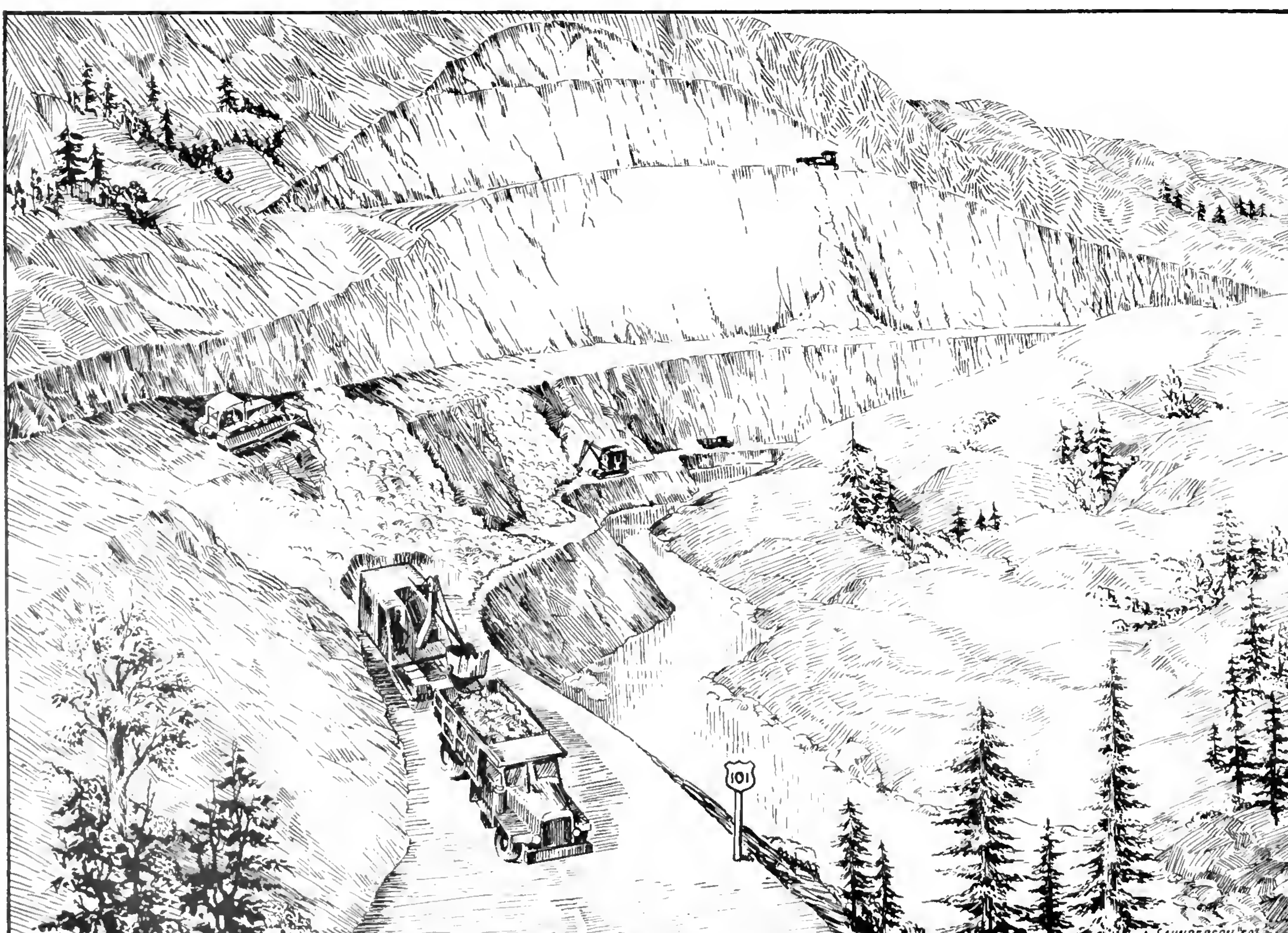
By R. BERGROTH, District Office Engineer

THE 1958 CONSTRUCTION season in District I will see considerable continued activity in the program of converting the world-famous Redwood Highway to four-lane freeway or expressway standards.

Of particular note is a 2.8-mile project in Mendocino County about 12 miles north of Laytonville. The exact project limits extend from 0.2 mile north of Farmhouse Inn to one mile north of Tan Oak Park.

This project, for which bids were opened on February 26, 1958, provides for the construction of a four-lane expressway in a narrow canyon already containing the old existing highway and meandering Rattlesnake Creek. The contract was awarded to Ball and Simpson, of Berkeley, California, on a low bid of $1,814,527.60.

The new highway alignment, with its easy curves, is crisscrossed by the existing traveled way whose alignment is of 1914 standards. As in the case of most highways of that vintage, the old highway is narrow and crooked, having been constructed generally parallel to the meandering course of Rattlesnake Creek. The new and old grades are also at variance and, in general, construction of new cuts and fills will necessarily be carried on through and immediately adjacent to the existing pavement. About 775,000 cubic yards of roadway excavation are involved. This situation, with no practical detour available, poses a



This sketch by Larry Saunderson of the District I staff, illustrating the heavy excavation necessary in the canyon of Rattlesnake Creek on U. S. 101 in northern Mendocino County, will be featured this summer in a leaflet to be handed to motorists who are delayed by the construction problem in carrying traffic through the work, as well as permitting construction operations to proceed during the relatively short construction season in this area.

As design of the project progressed, it became obvious that there was no alternative but to place regularly scheduled controls on public traffic movements through the work for specified periods of time. This is essential for the safety of traffic, as well as to permit the contractor to work economically to complete the project within a reasonable period of time.

The contract provisions, therefore, specifically permit the contractor to close the highway for two regularly scheduled four-hour periods daily. Opening and closing schedules will be publicized widely so that all concerned may plan accordingly and so that unavoidable delays will be held to a minimum.

The contractor will be permitted to close the project to all public traffic during grading and earth-moving operations for two four-hour periods during the night. This situation may exist for a period up to 50 consecutive working days as selected by the contractor. Actual closing time will be from 9 p.m. to 1 a.m., and from 2 a.m. to 6 a.m., except on weekends and holidays. On weekends and holidays, the contractor will be required to provide two traffic lanes at all times between 6 a.m. Saturday and 6 a.m. Monday, or between 6 p.m. of the day preceding a legal holiday until 6 a.m. of the day following the holiday.

During all other working hours the road may not be closed to traffic for a period greater than 30 minutes at any one time. School busses and regularly scheduled public transportation busses will not be delayed more than 10 minutes. The necessity of providing for emergency equipment, such as fire fighting, ambulances, etc., will be recognized, and immediate action will be taken to open the road in the shortest possible time during any such emergency.

To keep the public informed of road closure schedules, appropriate signs four feet by eight feet in size will be placed and maintained at five strategic locations along US 101 between Ukiah on the south and Arcata in the north. Near established delay points at each end of the project, comfort stations and pay telephones will be maintained for public convenience. Pamphlets explaining the scope of the work and reasons for delay will be distributed to the public at these locations.

The project, in general, consists of constructing a four-lane roadway with plant-mixed surfacing on cement-treated base. The roadway will be 60 feet wide, and will provide four 12-foot traffic lanes with a four-foot division strip and four-foot shoulders.

Rattlesnake Creek has prior rights in the confines of its narrow canyon and its flow, therefore, must be maintained. The construction of a modern four-lane roadway within this limited area requires channel changes where embankments infringe on the natural creek channel. To protect the embankments from the erosive action of the stream will require rock slope protection and heavy stone riprap. At one location where Rattlesnake Creek makes a horseshoe bend around a 200-foot-high solid rock promontory, the new roadway embankment encroaches into the streambed up to this promontory. An open channel change through this rock point was not economically feasible. Therefore, as a prelude to actual construction of the new highway, a tunnel was designed and built under the direction of the Bridge Department in 1956. The unlined tunnel is 136 feet long, 23 feet high, and 20 feet wide. It was constructed under contract by Mercer, Fraser Company, of Eureka, at a cost of $39,000, and involved 1,719 cubic yards of tunnel excavation.

The completion of this project will fulfill a long-felt need by eliminating a particularly substandard section of highway. The old, narrow, and crooked roadway has long been inadequate; and the shady and frosty conditions generally prevalent during the winters aggravated this situation and created hazardous traveling conditions.

Americans spend almost 22 billion dollars a year for domestic travel, counting only those trips involving overnight stops. Of these trips, 85 percent are made by car.

Harold Byroads Ends 40-Year Career

Harold Byroads, District XI Maintenance Superintendent at Escondido since 1950, retired March 1 after nearly 40 years with the Division of Highways.

HAROLD BYROADS

His retirement closed out a career that began when he went to work setting headerboard stakes on a highway project near Turlock in 1918.

From 1920 to 1923 he worked on construction jobs in Tracy, Marysville, Wheatland and Hamilton City. In 1923 he was transferred to the Maintenance Department at Stockton. From 1924 to 1926 he was an equipment operator on the Big Oak Flat Road. In 1926 he was again transferred to Stockton where he served for 12 years and was advanced to foreman. He was appointed maintenance superintendent at Indio in 1938 and served there until he moved to Escondido in 1950.

Byroads and his wife, Vera, were married in Modesto in 1922. They have three children, Vyrll of San Mateo, Melvin of San Carlos, and Adrienne, who attends college in Los Angeles.

The Byroads have lived in Vista for seven years, but now plan to move to Santa Barbara. They also plan to spend the first months of his retirement in traveling through the midwestern and northern United States.

City of San Rafael

Editor, California Highways and Public Works

Sir: I wish to congratulate you and your staff on the excellent job in making the *California Highways and Public Works* magazine such an interesting and informative publication.

Very truly yours,

W. C. Cornwell
Assistant City Clerk

REPORT FROM DISTRICT IV

Continued from page 20 . . .

north of the city limits. This project is being financed jointly by the State and Joint Highway District No. 9. The State is budgeting $419,000 toward the $729,000 cost of construction. Contractor is the Granite Construction Company.

South of the city, Sign Route 1 has been operating as an expressway for some time to the Rob Roy Junction. Planning studies are now under way for further multilane improvement of Sign Routes 1 and 152 past Watsonville in co-operation with studies in Monterey County by District V.

OTHER NORTH BAY COUNTY FREEWAYS

Work is now under way on State Sign Route 37 for the replacement of the existing Petaluma Creek Bridge by Ben C. Gerwick, Inc., and J. H. Pomeroy & Co., Inc. The new bridge itself will be a single structure, 2,200 feet long, having four lanes and will cost $2,433,000 including abutment fills. Provision is made for possible future widening to six lanes on this route. Replacement of the existing substandard two-lane bridge is required because it is structurally and geometrically deficient.

The above project is the third stage of a four-lane freeway extending from Ignacio Wye to Sears Point. The last stage completed was the construction in 1951 of two lanes of this future freeway and a graded four-lane roadbed from Petaluma Creek to Tolay Creek.

Budgeted this next year is $2,444,000 for completing the entire facility as a four-lane, future six-lane, expressway between US 101 and 0.5 mile west of the junction of State Sign Route 48 in Sonoma County.

Sonoma Valley Freeway

A new freeway route was adopted on January 24, 1957, connecting Sebastopol through Santa Rosa to Kenwood. This 17.4-mile route follows the existing highway from the east city limits of Sebastopol to the vicinity of Wright Road, then traverses just north of the present route and adjacent to the Petaluma and Santa Rosa Railroad to the vicinity of US Highway 101 in Santa Rosa. The route then continues on a generally direct northeasterly course to rejoin the present highway near Los Alamos Road east of Melita and follows the present highway routing to south of Kenwood. Surveys and design studies for details are now under way.

An interim project on this route has been recently completed in Santa Rosa. Work extended between US 101 and 0.17 mile east of Farmers Lane. College Avenue and Fourth Street were widened to four lanes and channelized. This project was a co-operative one with the City of Santa Rosa.

Napa Valley Freeway

A 3.8-mile section of two-lane, future four-lane, expressway was finished in December, 1956, between four miles north of St. Helena and Calistoga. The contractor on this $550,000 project was Huntington Bros.

Work is continuing on this route in 1958-59 with $735,000 in the budget for the initial two lanes of a future four-lane expressway extending from 0.9 mile south to two miles north of Yountville. Work should commence on this 2.9-mile project by early summer.

Napa Area—Sign Routes 12, 29 and 37

In 1957 a contract was completed by Lee J. Immel for the addition of two lanes to Sign Route 29 north of the City of Napa. The project extended between Union Station and Orchard Avenue. Addition of the lanes converts the 2.3-mile stretch into a four-lane expressway and provides a faster and safer facility. Cost of construction was $474,000.

In 1955, the initial two lanes of a future four-lane freeway were constructed from a point two miles east of the Sonoma-Napa county line for a distance of 2.7 miles.

Southerly of Napa on Sign Routes 12 to 20 to the Sonoma county line, the present routes have been operating as expressways for many years although access rights have not been fully acquired. It is expected that at some future period, when justified, development will be to freeway standards.

ALVARADO-NILES ROAD

Continued from page 46 . . .

anchored to the snap-tie cradles by metal bundling straps and were quite successful as there was no apparent evidence of uplift in the tubes. Horizontal displacement was prevented by pouring the deck in vertical stages, which in turn facilitated vibration between and beneath the tubes.

Channel Improvement

Excavation of the channel beneath the bridge was complicated due to the limited headroom of eight feet. The flood control district, however, has plans now in progress to improve the channel in the near future with a channel elevation two feet lower than that existing. The contractor was allowed to excavate to the future channel depth in order to provide work room for his excavating equipment. A D-6 loader was used to rough out to bottom width and a motor grader was used for final sloping. The two feet of overexcavation was then backfilled and compacted to the existing stream line.

Design and construction engineering for the project were provided at county expense and by personnel operating under the direction of Olof E. Anderson, County Surveyor and Road Commissioner of Alameda County. The contract for the project was let by the Department of Public Works, Division of Highways, to Eugene G. Alves Construction Company, Inc., of Pittsburg, California, on June 24, 1957. Work was begun on July 10th and continued until completion on November 15th, under the direction of Mr. Dale Marr as representative for the contractor and general supervision by engineering personnel from District IV, Division of Highways. Ronald F. Sorensen was Resident Engineer for Alameda County on the project.

How big a job is road sign maintenance on California's highway system?

State highway maintenance crews installed more than 14,000 new traffic signs during the 1956-57 Fiscal Year. They also replaced 7,000 more, washed and cleaned another 38,000, repaired 20,000, straightened 5,000, relocated 11,000, removed 4,000 and painted more than 30,000 signposts.

CHC Hearings

Commission Revises Freeway Route Adoption Procedure

THE CALIFORNIA Highway Commission has revised its freeway route adoption procedure "to provide additional guarantees that local views will be fully heard and carefully considered."

C. M. Gilliss, Director of the State Department of Public Works and Chairman of the Commission, explained that the revised procedure "is in line with the continuing efforts of the California Highway Commission and the State Highway Engineer to improve freeway location procedures to meet changing conditions."

"The changes," Gilliss said, "provide additional guarantees that local views will be fully heard and carefully considered before any conclusions or recommendations as to specific routes are made.

"They are also designed to provide for frequent consultation between local officials and state highway officials from the initiation of route studies to the adoption of a route by the commission—that is, right from the beginning up until the decision is made.

"In adopting the revisions, the commission recognized the desirability of making changes and improvements from time to time as circumstances and changes in federal law might warrant, just as did the California Legislature in Senate Concurrent Resolution No. 90, Session of 1957.

"The commission does not contemplate that the procedure as revised need be inflexible; rather the commission considers its procedure to be always open to improvement as it may appear desirable or necessary."

The text of the revised resolution, amending and superseding one adopted February 18, 1955, is as follows:

"*Resolved, by the California Highway Commission,* That the following procedure shall be followed in the adoption of freeway locations on the State Highway System:

"1. When it is proposed to locate or relocate any portion of a state highway as a freeway, the State Highway Engineer, or his authorized representative, shall:

"(a) At the initiation of the studies necessary to determine the possible locations to be presented to the commission for consideration, and from time to time thereafter, confer with the appropriate local governing bodies, and other agencies that may be affected thereby and with their technical and planning personnel, obtaining where available any master or general plan of the area;

"(b) Call to the attention of the appropriate local governing body, in writing, the provisions of Section 75.5 of the Streets and Highways Code;

"(c) When sufficient information has been accumulated to permit intelligent discussion, publicize and hold such public meeting, or meetings, as may be reasonably necessary to acquaint interested individuals, officials and civic or other groups with the studies made and the information developed, and to obtain their views with respect thereto.

"In conducting any such meetings where major controversy appears probable, the State Highway Engineer may arrange for a Division of Highways employee, not employed in the district office involved, to act as presiding officer.

"2. The State Highway Engineer shall submit to the commission a written report, covering the results of such conferences and meetings, the relationship between all proposed locations and any master or general plans of the affected local agency or agencies, any information submitted pursuant to Section 75.5 of the Streets and Highways Code, the studies made, and a recommendation as to the location of the freeway.

"3. When authorized so to do by the commission, the State Highway Engineer shall notify the appropriate local governing body, which notice shall be publicized, of the intention of the commission to consider the location of the freeway. Such notification shall include a statement that the commission or designated members thereof will hold a public hearing on the proposal, if requested to do so by the local legislative body within thirty (30) days after the first regular meeting of such body following receipt of such written notification; provided, however, that if, prior to receipt of such notification from the commission, the local legislative body or bodies shall have, by resolution, declared that no public hearing by the commission is necessary, then the notification by the State Highway Engineer shall advise such local body only of the intention of the commission to consider the matter.

"4. If any such legislative body requests such hearing, the commission, or a designated member or members thereof, will hold, a hearing, after public notice given in such manner as the commission may determine, at which time and place all persons, and official bodies and other organizations interested in the matter, shall be afforded an opportunity to be heard. The commission may also, on its own motion, call a public meeting or hold such hearings, as it may deem appropriate.

"5. After the expiration of such period of thirty (30) days, if no hearing is requested, or after such meetings or hearings as the commission may hold, the commission will adopt a location for the freeway between the limits under consideration.

"6. The authorization referred to in numbered paragraph 3 of this resolution, to give public notice of the commission's intention to hold a hearing, shall be by resolution of the commission relating to each specific freeway location proposed to be considered. In all other respects, this resolution authorizes the State Highway Engineer, without further resolution or order of this commission, to do such things and take such action as may appear to him to be necessary or proper to comply with the above specified procedure.

"7. At any public meetings held by the State Highway Engineer, or his authorized representative, any material transmitted by an affected city or county pursuant to Section 75.5 of the Streets and Highways Code shall be presented at the meeting by the person conducting the meeting or hearing, if so requested by the affected city or county, or shall be received in such manner as the affected city or county requests.

"8. It is recognized that, in addition to the foregoing, the State Highway Engineer, through his representatives, may hold any additional meetings or hearings required to qualify any highway project for the use of federal funds pursuant to any federal statute or rule or regulation promulgated thereunder.

"9. The resolution of the commission regarding the subject matter hereof, adopted on February 18, 1955, is hereby rescinded."

CABRAMATTA, AUSTRALIA

Editor, California Highways and Public Works

SIR: Since last year I regularly receive your magnificent publication.

The article in September-October issue "Public Relations" made quite an impression. Your magazine contains a wealth of information on design and possibilities in alignment and pavement of highways.

H. KARMAN, Surveyor

RIGHT-OF-WAY CLEARANCE

Continued from page 24 . . .

in new right-of-way acquired by the State for them in exchange for their right-of-way needed for the freeway along the coast.

The acquisition of operating property from railroads, property of other public utility companies, and oil companies' pipeline rights-of-way, is inherently integrated with the operation of the facility; the acquiring of these rights-of-way is handled by a negotiating group of right-of-way agents specializing in this function. Most of the major utility and oil companies have a similar organization contacting the State's Right-of-Way Department and this close liaison has resulted in being able to award highway construction contracts on schedule.

Cost Basis Established

Pursuant to legislative authority, agreements referred to as "Master Contracts" have been entered into with several of the major utility companies in California establishing the basis for portioning utility costs on freeways with these respective utility companies. These contracts have virtually eliminated disagreements in the determination of liability between company and State, and have in effect greatly expedited utility relocation with these companies.

Other than the Collier-Burns provisions the basis test in determining who pays the cost of relocating utility facilities is whether or not the utility holds an easement prior to State's ownership. Generally speaking, if the utility is located in the freeway under permit, utility assumes the relocation costs. An analysis of these facts determines the extent to which the utility company is entitled to reimbursement for relocation of utility facilities. In old established areas where the State superseded a city in interest by declaring a city street a state highway it has been necessary to dig into the archives of the city to determine the rights of the parties. By co-ordinating the work of the utility companies with the highway program, uninterrupted utility service to the public has been achieved and the public benefited from the orderly progress of the freeway construction. In the past five years this district expended approximately $7\frac{1}{2}$ million dollars for the relocation of public utilities.

The total expenditures by the State in the past five years in the Los Angeles District in clearing rights of way total about 10 million dollars. In this same period the district received approximately $8\frac{1}{2}$ million dollars from the sale of buildings to be removed from the rights-of-way and in addition to this revenue the State collected over 7 million dollars in rentals in the past five years from buildings during the period between the time of their acquisition and when they had to be removed to clear the rights-of-way.

John A. Stein Ends 29 Years With State

John A. Stein, Equipment Superintendent at Shop 10, Stockton, retired from state service on February 28, 1958.

Born in Lodi, Stein attended Lodi schools. He first became interested in a mechanical career in watching the operations of the early Central Valley canneries, and started his working career setting up food manufacturing equipment for these canneries. This part of his career was followed by five years as an engineering officer aboard various merchant vessels, traveling the world. Later he became an early-day automobile enthusiast.

JOHN A. STEIN

In 1925 Stein joined the Division of Highways. However, in 1929, he left to become the service manager at a Stockton garage. The State called him back in 1933, when he was appointed Superintendent of Equipment at Shop 9 in Bishop, where he stayed until 1942. He was then transferred to Shop 1, Eureka, and later in the same year the Division of Highways lent him to the U. S. Public Roads Administration as a general consultant on the Alcan Highway in Alaska, where he made appraisals and surveys of equipment and repair shops.

Late in 1943, when the Alcan Highway assignment was completed, Stein came to Shop 10 as the superintendent of equipment, remaining until his retirement.

John Stein is a member of many organizations, including Kerak Temple of Reno, Stockton Commandery No. 8, Knights Templar, and Owens Valley Chapter 124, Royal Arch Masons.

He is a Past President of both the Bishop Chapter of C. S. E. A., and the Native Sons of Lodi.

Highway Conference Held at COP Campus

Director of Public Works C. M. Gilliss was one of the principal speakers at the First Annual Highway Conference held on the College of the Pacific Campus at Stockton on March 3d, 4th, and 5th.

Members of the Division of Highways staff who participated in discussion panels held during the three days were Assistant State Highway Engineers F. W. Panhorst and J. W. Trask, District Engineer J. G. Meyer and Assistant District Engineer Bruno Dentino from Stockton; and F. E. Baxter, Maintenance Engineers; Dale Downing, Senior Bridge Engineer; and George Sherman, Senior Materials and Research Engineer, from Sacramento.

MATERIALS AND RESEARCH

Continued from page 44 . . .

the countless research activities and investigations going on in the working units. Knowing that our department is making progress in the ever-changing highway materials scene and that we are a part of this work gives us a feeling of participation and accomplishment.

Some of the ideas presented in the above article were developed upon suggestions of Bill Yttrup, Senior Delineator; Minor Holliday, Administrative Assistant I; and Charles Frazier, Assistant Physical Testing Engineer, all having supervisory responsibilities in the Administration and Services Unit.

GOODWIN J. KNIGHT
Governor of California

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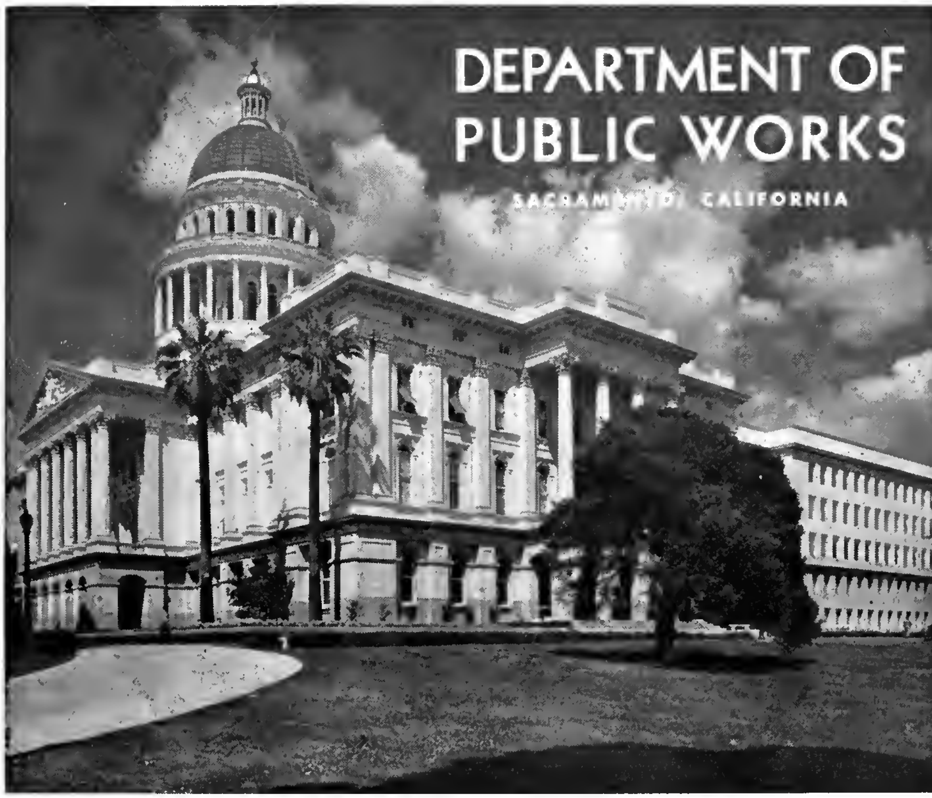

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printed in CALIFORNIA STATE PRINTING OFFICE 71950 3-58 53M

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CALIFORNIA
HIGHWAYS AND PUBLIC WORKS

MAY-JUNE 1958

California Highways and Public Works

Official Journal of the Division of Highways, Department of Public Works, State of California

Vol. 37 May-June, 1958 Nos. 4-5

FRONT COVER

The rich foliage of the redwoods frames a section of US 101 at Bridges Creek in northern Mendocino County. The highway runs through miles of the stately trees, many of which were already 10 centuries old when Julius Caesar ruled in Rome.

—*Photo by Robert Munroe*

BACK COVER

US 40 Alternate follows a picturesque path beside the turbulent waters of the Feather River in Plumas County. Elephant Butte Tunnel is in the foreground.

—*Photo by Robert Munroe*

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Published in the interest of highway development in California. Editors are invited to use information contained herein and to request prints of any black and white photographs.

Address communications to

CALIFORNIA HIGHWAYS AND PUBLIC WORKS
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SACRAMENTO, CALIFORNIA

More Highways Less Paper

By
JOHN H. STANFORD
Management Analyst

Headquarters Records Center showing low-cost storage of semiactive records which have not yet reached date for disposal

IMAGINE a row of 5,800 five-drawer filing cabinets full of administrative records. The row would be over 1¼ miles long. It would contain about 87,000,000 pieces of paper—correspondence, reports, legal documents, accounts, requisitions, authorizations, hundreds of different kinds of records.

Now imagine that you have to plan and organize the contents of these 29,000 file drawers * for an organization with 13,000 employees and an annual budget of more than $450,000,000, operating through a Sacramento headquarters office and 11 district offices from San Diego to Eureka, so that:

(1) Anyone can get information he needs from the records when he needs it;

(2) New records are added promptly, in the right places;

(3) Old records are kept as long as they are needed, but no longer; and

(4) All of this is done at the least possible cost for personnel, equipment and space.

This is the recordkeeping job of the California Division of Highways. It is a big job, and getting bigger as our statewide traffic problem grows and the division's work grows with it. Fortunately, however, it is a job to which the Division of Highways is applying the same modern tools of records management that are proving effective in other large-scale business and government enterprises.

Rapid Progress

Here are the encouraging first results of the intensified records management program launched by the State Highway Engineer in 1957. They show that Headquarters Departments and District Offices throughout the division are making rapid progress in reducing and bringing under better control their administrative records (records other than maps and plans) through this co-ordinated effort.

The contents of about 5,000 file drawers, more than one-sixth of those 29,000 file drawers, are being destroyed or sold as waste paper because they are no longer necessary. Nearly half of these already have been discarded and the balance soon will be. This is eliminating about 15,000,000

. . . Continued on page 2

* Not all of these records, of course, are kept in file drawers. The term "file drawers" is used throughout this article to indicate quantities of records in an easily visualized measure. It means 1½ cubic feet of records or about 3,000 pieces of paper, regardless of how they are stored.

Public Works Building
Twelfth and N Streets
Sacramento

CONTENTS

MORE HIGHWAYS

Continued from page 1 . . .

pieces of paper and cutting nearly one-quarter mile off that theoretical row of five-drawer file cabinets.

About 5,400 file drawers of other records are being moved from high-cost office space to low-cost record center type storage because, although necessary, they are used infrequently. Nearly 4,500 of these have already been moved.

In summary, 10,400 file drawers or 35 percent of all division records other than maps and plans (which are excluded from all of these figures and which will be the subject of a separate study) are being transferred or destroyed, including 2,400 file drawers already destroyed and 4,500 drawers already moved out of offices.

The value to the Division of Highways of this breakthrough in the battle against unnecessary paper is about $180,000 a year, as explained later in this report.

How was this program developed? By what methods have these results been obtained?

The answer starts several years back, for the Division of Highways has for some time been concerned with the problem of controlling the growth of records which has naturally accompanied the growth of the highway program. Large quantities of records, particularly field accounting records and duplicate records in districts and field offices, have for some time been destroyed each year.

Joint Survey

In 1954, the Service and Supply Department and the Accounting Department jointly undertook a survey of the storage and use of records in all division offices. By 1956, this work had progressed to the point where it was decided to call in a private consulting firm of records management specialists to make a broader study of paperwork problems and to develop an overall records management program proposal.

The division contracted with the National Records Management Council for this work and provided several employees from Service and Supply Department to assist. During 1956, this group inventoried records in Headquarters Office and in District III (Marysville) and District VII (Los Angeles), and submitted proposed schedules for the retention and disposal of records in these offices. During this period the Service and Supply Department, with the advice of the council, established a Records Center at the Sacramento Warehouse location for more efficient and lower-cost storage of inactive records.

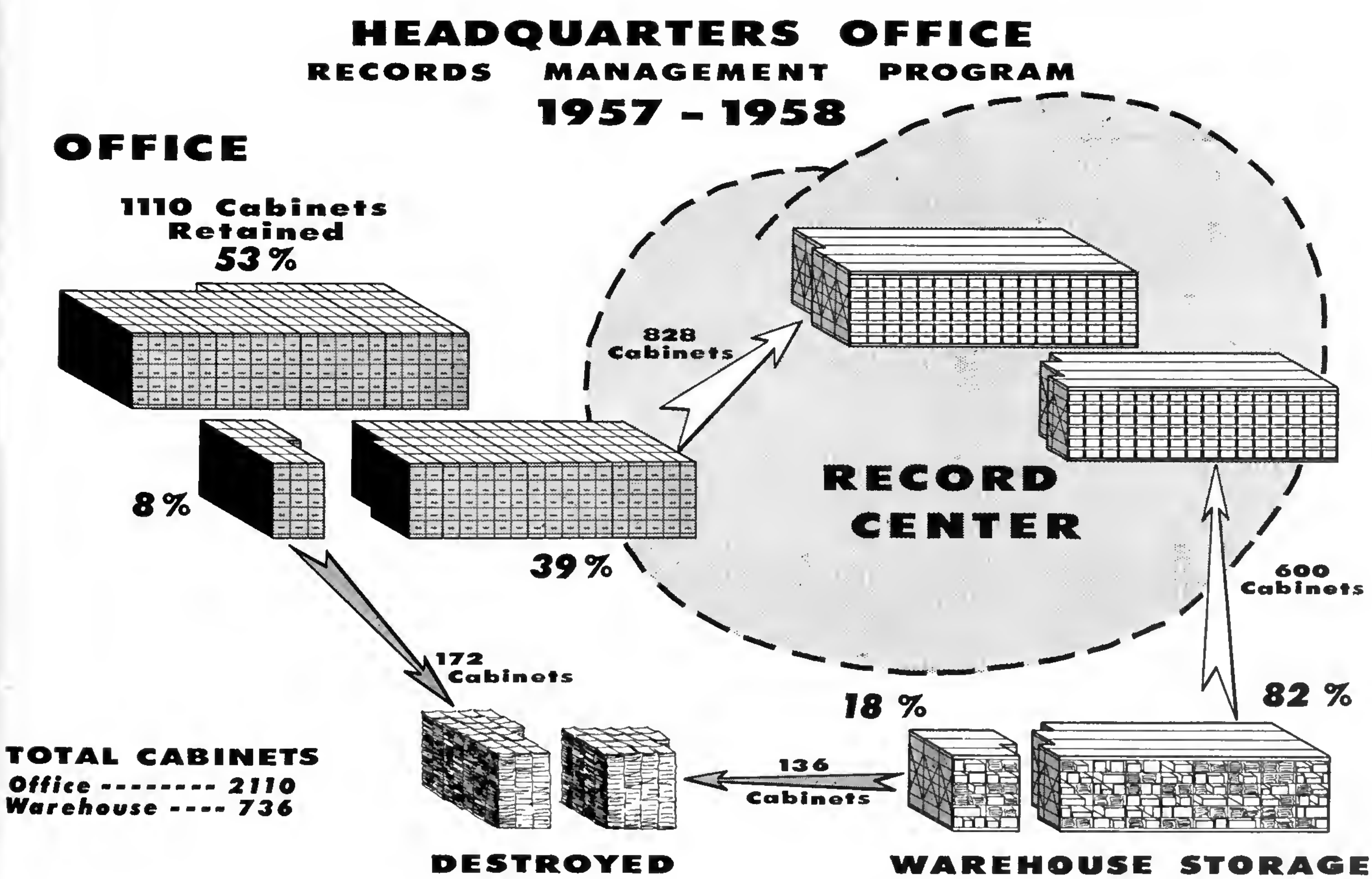
Report Submitted

In March, 1957, the NRMC survey group submitted its report, including a proposed program of comprehensive paperwork analysis and records management. In addition to a division-wide survey program to apply the tentative schedules for the retention, transfer, and disposal of records in the offices covered and to develop schedules for all other offices, the council outlined programs for developing an improved filing plan and file classification system, an improved circular letter system, a vital and historical records protection program, a forms and reports analysis program, and a correspondence simplification program.

> The Management Section discussed in the accompanying article was established in July, 1957. John H. Stanford, Management Analyst for the Department of Public Works, was assigned at the request of the State Highway Engineer to serve as Division Management Analyst and to organize, develop, and direct the Management Section.
>
> The purpose of the section is to help division officials by making assigned studies, developing recommendations, and providing advisory services on administrative and management problems, both in Headquarters and in the districts. The first major project assigned the section was to help carry out the records management recommendations submitted by the National Records Management Council after its survey for the Division of Highways.

In July, 1957, the State Highway Engineer approved this long-range program. The task of planning, coordination, and assistance was assigned to the newly established Management Section. The Service and Supply Department continued to operate the Records Center facility. Four division employees who had worked with the council on the survey were transferred to the Management Section. Two administrative analysts were later added to the Management Section.

The plan and procedures established were designed both to expedite disposal of records no longer needed and to guard against unauthorized or ill-advised destruction of essential records. The most basic feature is that each department, section, and office initially reviews its own specific records and on the basis of its own direct knowledge and needs proposes for each record series the length of time the record will be needed in the office, needed in storage, and the period after which it may be discarded. Some general guides, developed in Headquarters Office and in similar offices, are made available, but are not mandatory.



Obsolete Records Destroyed

Once the schedule has been developed for the retention and disposal of all records, office by office, no further authorizations are necessary. Both continuing authority and continuing responsibility are delegated to departments and districts for application of the schedules in the future. Records can be destroyed as they become obsolete, unless some change in the schedule should be needed.

Each District Engineer has designated a records officer to review and approve on his behalf all requests from district offices for authority to destroy records. In the Headquarters Office all such requests are reviewed by the Comptroller and by the department concerned with the subject matter. They are given final approval by the Assistant State Highway Engineer, Administration, who is records officer for the Division of Highways. He is responsible for obtaining necessary clearances from the Department of Finance and the Secretary of State's Office.

Since July, 1957, first the Headquarters Departments and then each of the district offices have been engaged in an initial "housecleaning" program to place all administrative records on the systematic plan of scheduled retention, transfer, and disposal, and to apply approved schedules to accumulated records. All offices have schedules completely in effect, submitted for approval, or actively in preparation.

Following are some highlights of the results obtained by various offices so far:

Headquarters Office. 5,000 file drawers of records moved out of office space—47 percent of the records which were in offices. In addition, 18 percent of the records in warehouse storage were destroyed, the remaining 82 percent being transferred to the records center. (The accompanying chart shows these results graphically and in more detail.)

District III (Marysville). 23 percent of all records transferred or destroyed, a total of 203 file drawers.

District IV (San Francisco). 484 drawers destroyed and 298 moved from office space, totaling 31 percent of district records. Improved district record center facilities established.

District X (Stockton). 25 percent of records discarded, mostly from basement storage. Improved district record center facilities established.

Bridge Department—Bay Bridges. Retention schedules submitted. 72 percent of office records will be moved (249 drawers transferred and 158 drawers destroyed) when new schedules are approved. In addition, 75 percent (322 drawers) of records now in storage will be destroyed. Total of 73 percent of all records to be transferred or destroyed.

District II (Redding). Schedules submitted. Of a total of 953 drawers of records, 41 percent will be discarded and 12 percent will move into storage.

District V (San Luis Obispo). Schedules submitted. Of a total of 1,048 drawers of records, 31 percent

Headquarters Records Center showing a portion of the tons of records marked for disposal as a result of applied schedules

The white lines sketched on this photo of the Headquarters General Files Office represent the "ghosts" of former filing cabinets. The records once occupying the delineated space have been transferred or disposed of in accordance with a regular schedule under the Records Management Program, making space available for two workers' desks.

will be discarded, mostly from basement storage.

District VI (Fresno). Schedules submitted. Of a total of 972 drawers of records, 21 percent will be discarded. Improved district record center facilities have been established.

District VII (Los Angeles). Schedules submitted. 368 drawers will be destroyed and 235 drawers moved from office space, totaling 19 percent of district records. Record center being established at Southern Warehouse by Service and Supply Department, primarily to serve District VII.

Districts I, VIII, IX, XI. Inventory of records in progress. Schedules being developed. Results expected to be similar to those in other districts.

The disposal and transfer of records already completed benefits the Division of Highways by an estimated $133,000 a year from now on. An additional $47,000 may be expected from work now under way in the districts, which will bring the total benefits to $180,000 a year.

This estimate is based upon generally accepted estimates that it costs about $25 a year to maintain a drawer of records in the office (personnel, space, and equipment) and about $1.50 a year to keep the same quantity in record center storage. Estimating $25 a year per file drawer destroyed from the office, $23.50 a year per file drawer moved from the office to storage, and $1.50 a year per drawer destroyed from storage gives the above rough estimates, which are considered conservative.

With the first or "housecleaning" phase of the records management program well on its way to completion attention is being given to other phases of the long-range records management program.

In the field of filing systems review, representatives of each Headquarters Department who are directly responsible for departmental files met in March and April, 1958, for six weekly training conferences, including description and analysis of filing systems, under the leadership of Mrs. Doris Weaver of the Management Section staff. A six-month statistical study has been made of the sources and uses of Headquarters General Files material. The circular letter system has been studied. Preliminary data on vital records have been collected. Each of these subjects and others will in the future receive further attention as the division records management program moves ahead.

Report From District II

North Area Builds First Section of Full Freeway

By H. S. MILES
District Engineer

THE SEVEN counties of northeastern California that comprise District II, Lassen, Modoc, Plumas, Shasta, Siskiyou, Tehama and Trinity, occupy 27,500 square miles. Highway transportation is provided for this area principally through a network of 1,438 miles of state highways supplemented by a feeder system of 740 miles of federal aid secondary routes under county jurisdiction.

The population density is relatively low as the result of having little more than 1 percent of the State's population with 17.5 percent of the total area. Nevertheless, progressive improvement of the road systems is of vital importance to the economy of the area and to the general welfare of the State as a whole.

Access to areas that otherwise would have remained inaccessible was spurred a full century ago by extensive mining operations, supplemented by lumbering. While mining has dropped to a relatively minor role in recent years, lumber production is now the leading industry with the seven counties in this district accounting for 30 percent of the entire output of the State.

Changes in the lumber industry have added to highway transportation needs. Improved management of lands and the cutting of saw logs on a sustained yield basis have expanded the zone of operations from small concentrations to large areas. The progress that has been made in converting into useful pulp or pressed board products the 50 percent of the tree that was previously wasted is resulting in a similar trend. Logs are now hauled greater distances to integrated processing centers or sawmill waste is transported as a raw material to manufacturing plants.

Use of recreational resources in this northeastern county area is directly related to highway transportation. Because of the scenic, climatic and other natural attractions recreational activity has become second in importance in the local economy. Highway routes which traverse six national forests afford access to mountain scenery and a variety of weekend and vacation pastimes, including winter sports. The many rivers and streams add to the multiplicity of resources that encourage travel.

In recent years boating has gained in popularity as a form of recreation and today it heads the list. The rivers and lakes of the area attract many pleasure boats because of the accessibility through the use of boat trailers. For example, during one weekend last summer it was estimated that 5,000 boats were in use on Shasta Lake alone. With the completion of Trinity Dam which is now under construction, there will be a further increase of boat trailer travel on the highways of this area.

Increased travel coupled with growth of population in the larger communities has caused congestion at

PHOTOS AT TOP OF PAGE. *LEFT—West approach to Cedar Pass (US 299) between Alturas and Cedarville in Modoc County. RIGHT—Completed expressway north of Dunsmuir on US 99. Mt. Shasta in the background.*

NIGHT AND DAY. Two photos taken from the same location showing the median island and four-lane construction at the north entrance to Redding on US 99

locations where lack of traffic capacity was relatively minor a few years ago. Expressways and freeways already constructed, under construction, or now being planned will remedy this and other deficiencies in our highway network.

The designation of Route US 99W and its northerly continuation, US 99, as a part of the interstate system will result in this main line artery being developed as a multiple-lane freeway. On the lateral routes construction of the initial two lanes of an ultimate four-lane expressway makes it possible to provide improved service for low volumes of present traffic.

The résumé that follows covers projects recently completed in District II as well as current activity.

US 99W and US 99

Route US 99W enters District II at the Glenn-Tehama county line about 8.5 miles south of Corning and extends northerly to Red Bluff. It then continues northward as Route US 99 through Tehama, Shasta and Siskiyou Counties to the Oregon border about 21.5 miles north of Yreka.

The last major work on this route in Tehama County was a relocation from six miles north of Red Bluff to the Shasta county line, a distance of 7.12 miles completed in 1947.

In Shasta County practically all of this route has been realigned or relocated or is in the planning stage for construction in the near future.

In 1949 a modern two-lane highway was completed from the Shasta county line to Anderson, a distance of five miles. In 1950 a four-lane expressway was constructed from Anderson to Clear Creek, a distance of 5.78 miles,

A section of new expressway on US 99 in Siskiyou County. Castle Crags are in the background.

The Antler Bridge on US 99 spans the Sacramento River arm of Shasta Lake. The Southern Pacific Railroad Bridge is in the background. The connection to the U. S. Forest Service Antler Campground is in the lower right.

Beautiful views of the new Shasta Lake are visible along this route and the Pit River arm is crossed by a two-level bridge 3,588 feet in length. This bridge carries the Southern Pacific tracks on the lower level and a four-lane highway on the upper level. The Shasta Dam can be reached from a highway taking off from US 99 at Project City. Thousands of visitors view this dam yearly and most visitors take an interesting conducted tour through the dam. Numerous campgrounds have been built along the lake by the United States Forest Service.

Construction of the long-planned four-lane divided highway through the Sacramento Canyon north of Shasta Lake is well under way. Two road contracts and one bridge contract totaling 6.1 miles in length were completed in 1956 between Crespos and 0.5 mile north of La Moine at a cost of $5,300,000. The two road contractors were Piombo Construction Company of San Carlos and Guy F. Atkinson Company of South San Francisco. The bridge contractor was Ukropina, Polich, Kral & Ukropina of San Gabriel. A contract for 6.9 miles between 0.5 mile north of La Moine and 0.8 mile north of Shotgun Creek is now under way and should connecting with a four-lane expressway already completed into Redding.

North of Redding, under several contracts between 1952 and 1956, a four-lane expressway has been completed from the bottom of Sulphur Creek Hill to Bass Hill, a distance of 11.8 miles. The contractors were Fredrickson and Watson Construction Company of Oakland and Rice Brothers of Marysville. The cost was $3,500,000. At present a contract is under way to extend the four-lane highway southerly to the Sacramento River Bridge and to construct a one-way street couplet in Redding—Contractor W. H. Darrough & Sons, Yuba City.

From Bass Hill to Crespos, a distance of 16 miles, this highway was relocated in the early 1940s to bypass the lake resulting from the building of Shasta Dam on the Sacramento River.

An improved section of US 40 Alternate in Plumas County a few miles west of Spring Garden. In the center is the Williams Loop on the Western Pacific Railroad Feather River Route with an overhead crossing in the foreground.

be completed this year. The cost is about $6,000,000 and the contractor is Gibbons and Reed, Salt Lake City, Utah.

First Full Freeway

The first section of full four-lane freeway with separations and interchanges to be built in District II will be opened for bids this spring. It will extend from 1.0 mile south of the Shasta-Siskiyou county line to the Sacramento River bridge in Dunsmuir, a distance of 3.7 miles. The budget allocation for construction is $4,600,000.

For the 10.3-mile gap between 0.8 mile north of Shotgun Creek and 1.0 mile south of the Shasta-Siskiyou county line, plans are being completed and right-of-way is being acquired.

Beginning at the Sacramento River bridge in Dunsmuir and extending five miles north to Big Canyon, contracts were completed in 1954 for widening the bridge to four lanes and constructing a four-lane divided expressway for about 3.5 miles to the north then two-lane for 0.8 mile. The roadway cost was $2,100,000 and the bridge cost was $700,000. The bridge contractor was Charles MacCloskey, San Francisco, and the road contractor A. Teichert & Son, Inc., Sacramento.

From Dunsmuir on, Mt. Shasta, which reaches a height of 14,162 feet, comes prominently into view. At Mt. Shasta City the Everitt Memorial Highway leads from US 99 along a newly built scenic route up the mountain to a ski lift and a lodge which will be ready for use this next winter. This is expected to become a very popular ski resort as it has so many natural advantages for the enjoyment of this winter sport. At Weed the highway skirts the base of Mt. Shasta.

From Big Canyon north to the Oregon state line the only recent construction other than resurfacing was completed at the following locations:

From Spring Hill north of Mt. Shasta to Weed, a distance of 8.0 miles, a modern two-lane highway with an overhead over the Southern Pacific tracks was completed in 1951. The construction cost was $882,000. The contractors were Harms Brothers and F. Fredenburg of Sacramento and Rand Construction Company of Bakersfield.

UPPER—Adin Summit on US 299 in Modoc County. Note the damage to the sign which has evidently served as a rifle target for vandals. LOWER—New construction on US 299 in Trinity County with the Trinity River on the right and the old highwoy on the left.

From 4.7 miles south of Yreka to Jefferson Street in Yreka, a distance of 4.7 miles, the initial two lanes of a future four-lane expressway were completed in 1957 under two contracts at a total cost of $1,082,000. The contractor was M. W. Brown of Redding.

Between Camp Lowe and Bailey Hill, a distance of 7.8 miles, a modern two-lane highway realignment was completed in 1949 at a construction cost of $1,013,000. The contractor on the grading was Fredrickson and

An improved section of US 299 east of Weaverville in Trinity County. A section of the old highway can be seen in the right foreground.

Watson Construction Company, Oakland, and the contractor on the base and surfacing was A. Teichert & Son, Sacramento.

US 99E

US 99E enters District II at the Tehama-Butte county line about 12.5 miles north of Chico and joins US 99 at Red Bluff.

Since 1947 all this route has been reconstructed to a modern two-lane standard partially on old alignment and partially on new alignment. A number of bridges have been widened and a number of new bridges have been built. Total cost of these projects was $1,700,000 for the roadway and $1,000,000 for the bridges.

The two latest contracts were completed in 1954 and 1955. Fredrickson and Watson Construction Company of Oakland completed the section between Los Molinos and Mill Race Creek in 1954 and Clements and Company of Centerville completed the section between the Butte county line and Mill Race Creek. The bridge widenings had been completed previously by the bridge department.

US 40-Alternate

US 40-Alternate leaves District III and enters District II in Butte County about six miles southwest of Pulga, passes through the scenic Feather River Canyon and joins US 395 about eight miles east of the Nevada line. Two major realignment projects on this route have been constructed in recent years. A forest highway project was completed under the jurisdiction of the Bureau of Public Roads in October, 1956, from plans furnished by the Division of Highways for 2.6 miles of two-lane highway between seven miles east of Quincy and 0.7 mile west of Spring Garden with an overhead over the Western Pacific Railroad tracks. Contractor Carl M. Halvorson, Inc., of Portland, Oregon, constructed this project at a cost of $800,000.

An adjoining 5.2-mile unit from 0.7 mile west of Spring Garden to Sloat is now under contract and should be completed this year. This project is for the initial two lanes of a four-lane expressway. The estimated construction cost is $1,200,000 and the contractor is O. K. Mittry & Sons, Gardena.

Plans are under way for the section between Sloat and Blairsden.

US 97

US 97 begins at Weed in Siskiyou County, branching off from US 99, and leads in a northwesterly direction toward Klamath Falls, Oregon, leaving California about three miles north of Dorris. Wonderful views of Mt. Shasta are seen from this highway as it skirts the base of the mountain on the north side. This route has become a popular route to northern Oregon and Washington as it is shorter than US 99 and traverses fewer cities.

The only major realignment project on this route in recent years is the completion in 1954 of a realignment from Dorris to the Oregon state line, a distance of three miles. Clements and Company of Hayward was the contractor and the cost was $410,000.

Work has been started by Dorman Construction Company on a heavy-duty asphalt pavement on the 17.2-mile section between Juniper Station and 0.1 mile north of Dorris. Also resurfacing with plant mix is under way between 8.3 miles north of Weed and Grass Lake, a distance of about 13 miles. M. W. Brown is the contractor.

US 299

US 299 enters District II from District I along the Trinity River about 26 miles west of Weaverville, passes through Weaverville, Redding, Burney and Fall River Mills, and ends at Alturas.

There has been no recent construction on this route west of Weaverville except for storm damage restoration and resurfacing.

From Weaverville to Douglas City under a number of contracts between 1950 and 1957, the entire section has been reconstructed to a modern two-lane standard with greatly improved alignment and new bridges, the cost being about $1,600,000. A new 0.2-mile approach to the Trinity River Bridge is to be contracted this year.

From Vitzthums, which is 2.6 miles east of the bridge, to 1.0 mile east of

A new section of US 395 south of Ravendale in Lassen County presents an interesting study in perspective for the cameraman

Tom Lang Gulch, a distance of three miles, a contract was completed in 1957 for a relocation of a narrow, winding stretch of mountain road. Plans are being prepared for further relocation to the summit of Buckhorn Mountain.

In Shasta County between 1947 and 1949, 9.9 miles of highway were relocated between Tower House and Shasta. The building of the dams for the Trinity River development will create a lake in the neighborhood of Whiskeytown which will necessitate an extensive relocation of this highway.

From just east of the west Redding city limits to the Southern Pacific overhead, a contract was completed in 1956 for a four-lane highway and street. The work was performed by Fredrickson and Watson Construction Company of Oakland at a cost of $312,000. A contract has been let to Stolte, Inc., Oakland, for a new four-lane overhead over the railroad. This should be completed by late fall.

On Market Street in Redding this route coincides with US 99 to the top of Sulphur Creek Hill then proceeds in a northeasterly direction to Alturas.

Contracts were completed in 1955 on a relocation of a four-mile stretch of highway between Montgomery Creek and 0.2 mile east of Hillcrest and on a realignment of a 3.6-mile stretch between Deb's Place and Hatchet Mountain Summit. The contractor on the former was Eaton and Smith of San Francisco and on the latter was Fredrickson and Watson Construction Company of Oakland. The cost for the two projects was $1,700,000.

Work is scheduled to start this year on a construction job that will include completing the 1.4-mile gap between the above projects as well as a 3.9-mile relocation on the east slope of Hatchet Mountain. This is covered by a budget allocation of $1,450.000.

Recent work on this route in Lassen County consists of extensive resurfacing. In Modoc County, realignment between 1.0 mile east of Canby and Chambers Ranch was completed in 1954 at a cost of $500,000. The contractor was Peter Kiewit Sons' Company of San Francisco.

US 395 five miles east of Alturas at the junction with Route 28 to Cedarville

This highway extends from Alturas to the Nevada state line as Legislative Route 28. It follows US Route 395 north of Alturas for a distance of six miles then branches to the east over Cedar Pass and through Cedarville to the Nevada state line.

Honor Camp forces in 1955 and 1956 graded a section 7.9 miles in length from the junction of US 395 east, at a cost of $330,000. In 1957 a plant-mixed surfacing was placed on this section at a cost of $130,000. The contractor was Clements and Company of Centerville.

In 1951 a realignment of an 8.9-mile section between Toms Creek and Cedarville and going over Cedar Pass was completed to a modern two-lane standard at a cost of $1,100,000.

US 395

US 395 enters the State in Sierra County about 16 miles northwest of Reno and traverses Lassen and Modoc Counties to the Oregon border about 40 miles north of Alturas. Alturas is the only city through which it passes.

In Sierra County and south of Johnstonville in Lassen County no construction has been done in recent years except for surfacing.

North of Johnstonville since 1953, contracts have been completed by the Division of Highways and by the Bureau of Public Roads which have made the major portion of this route in Lassen County an adequate, modern two-lane highway. The main contractors were Harms Brothers of Sacramento and A. Teichert & Son, Inc., of Sacramento. The cost was $2,300,000. With the completion of a surfacing contract this year between Ravendale and Madeline the traveling public will have a smooth, wide two-lane highway through Lassen County.

Between Alturas and the Oregon state line in Modoc County the complete distance of 38.4 miles was graded by Honor Camp forces between the years 1946 and 1956. The cost was $2,500,000. In 1957 a surfacing contract was completed over this stretch of highway. The cost was $600,000 and the contractor was J. C. Compton of McMinnville, Oregon.

State Sign Route 89

State Sign Route 89 enters District II at the Sierra-Plumas county line and runs north 8.7 miles to a junction with US 40-Alternate about 8.9 miles west of Portola. It follows along US 40-Alternate to a point about 11 miles north of Quincy; branches to the right through Crescent Mills and around the west side of Lake Almanor to a junction with State Sign Route 36 about three miles southwest of Chester. It follows along Route 36 to a point four miles west of Morgan Springs; branches to the right to the

UPPER LEFT—Route 82 entering the City of Fort Jones from the south. UPPER RIGHT—The section of US 99 in the Sacramento River Canyon near Castella scheduled for reconstruction soon. LOWER LEFT—The Pit River Bridge across Shasta Lake on US 99. LOWER RIGHT An aerial view of the new Scott Valley highway (Route 82) in Siskiyou County southwest of Yreka. Sections of the old winding road it replaced can be seen in the foreground.

south entrance of Lassen Volcanic National Park.

Through the park is a scenic park road which passes hot springs and reaches the height of 8,512 feet from which it is an easy climb to the top of Mt. Lassen at 10,453 feet. The road runs through the devastated area from the last eruption in 1915 and skirts trout-filled lakes.

From the north entrance of Lassen Park Route 89 continues north at times along a beautiful trout stream, Hat Creek, and crosses US 299 about five miles east of Burney. 5.5 miles north of the junction on the left is the entrance to the McArthur-Burney Falls State Park, which has an awe-inspiring falls that attracts many visitors. Camping facilities are available. The route now turns to the northwest and passes through McCloud and ends at a junction with US 99 about two miles south of Mt. Shasta City. It is from this route that the new ski lift road up Mt. Shasta begins.

Recent work on this route south of US 40-Alternate includes the building of bridges with approaches over Sulphur Creek, Frazier Creek, Graeagle Creek and the Middle Fork of the Feather River. The cost was $435,000.

Between US 40-Alternate and State Sign Route 36 improvements have been made at Greenville and Almanor Dam.

In Shasta and Siskiyou Counties, $244,000 is budgeted for the replacement this year of a bridge across Hat Creek and six other minor structures.

State Sign Route 32

State Sign Route 32 enters District II in Butte County about 22 miles northeast of Chico and ends at a junction with State Sign Route 36 about 13 miles west of Chester in Tehama County. This route is a shortcut from the south to the Lassen Volcanic National Park and for trout fishing areas.

The only recent work on this route was a contract completed in 1952 for a bridge and approaches over Deer Creek about 48 miles northeast of Chico. Contractor R. E. Hertel of Sacramento performed the work at a cost of $95,000.

State Sign Route 36

State Sign Route 36 enters District II at Peanut in Trinity County, touches a corner of Shasta County near Beegum, traverses Tehama County through Red Bluff and over Morgan Summit, crosses a small portion of northern Plumas County and ends at the junction with US 395 east of Susanville in Lassen County. Near Mineral, State Sign Route 89 connects this route to the southern entrance of Lassen Volcanic National Park.

In the vicinity of the Trinity-Shasta county line a five-mile section of this route was relocated on improved alignment by the Bureau of Public Roads under the Forest Highway Program.

In Tehama County west of Red Bluff plans are in progress for improvement of the most deficient sections. A critical section between Tedoc Road and Dry Creek has been realigned for a distance of 8.8 miles under two contracts, one in 1954 and the other in 1957. The contractors were Eaton and Smith of San Francisco and Jess Harrison of San Ardo. The cost was $930,000.

East of Red Bluff from 1.5 miles east of Lassen Camp to Mineral, work on a contract for 4.9 miles of the initial two lanes of an ultimate four-lane freeway will be completed this fall. The contractor is Stolte, Inc., of Oakland with a construction cost of $1,-300,000.

A typical scene on Sign Route 89 between Burney and the Lassen Park boundary

The new highway over Scott Mountain between Yreka and Fort Jones (State Route 82)

In Plumas and Lassen Counties several recent resurfacing projects have improved the riding qualities of this route.

It might be interesting to note that at one time during last winter this route over Morgan Summit was the only Northern California east-west route that remained open while Routes 40, 50 and 40-Alternate were blocked by slides and snow.

State Sign Route 44

State Sign Route 44 extends from the junction of Route US 99 in Redding to the north entrance of Lassen Volcanic National Park. The park containing the only mountain in the United States which has had an active volcano eruption in recent years attracts a great many visitors yearly.

In the City of Redding a new bridge was built across the Sacramento River and the road improved from the junction of US 99 to 1.5 miles east. The cost of these improvements was $1,100,000. Other recent work includes the construction of several bridges west of Millville. This year replacement of two bridges across Churn Creek is scheduled with a budget allocation of $164,000.

State Sign Route 96

State Sign Route 96 enters District II in Siskiyou County about 18.5 miles southwest of Happy Camp and follows the Klamath River to a junction with US 99 about nine miles north of Yreka.

Honor Camp No. 41 was established eight miles southwest of Happy Camp in 1956 for the purpose of grading all of the stretch between the district boundary and the Town of Happy Camp. A budget of $491,000 is allotted to the camp each year.

The Bureau of Public Roads last year completed a two-lane highway for a distance of 6.4 miles between Happy Camp and the foot of Cade Mountain for a cost of $884,000, under the forest highway program.

In 1957 the Division of Highways completed a contract for 4.5 miles to 5.4 miles east of Hamburg at a cost of $150,000. The contractor was Peter Kiewit Sons' Company of Portland, Oregon.

In addition to many recent minor improvements that have been made along this route, last year an improved connection with US 99 also was constructed.

State Sign Route 139

State Sign Route 139 starts at the junction with US 299 at Canby and runs northwesterly through Tulelake to the Oregon border about 27 miles southeast of Klamath Falls. Two roads lead off this route to the Lava Beds National Monument which is noted for the spectacular lava flows and also as a historical monument commemorating battles of the Modoc Indian War.

Recent work on this route includes major resurfacing and the reconstruction of the Perez Overhead 21 miles southeast of Tulelake.

Legislative Route 35

Legislative Route 35 enters District II at Peanut in Trinity County and runs through Hayfork to a junction with US 299 at the south end of the Trinity River Bridge near Douglas City.

The Bureau of Public Roads since 1949 has completed to a modern two-lane standard the 24.7 miles of highway between 1.0 mile south of Hayfork and Douglas City as a Forest Highway improvement.

Legislative Route 82

Legislative Route 82 extends from Etna in Siskiyou County through Ft. Jones and over Forest Mountain to a junction with US 99 about two miles south of Yreka; follows along US 99 to Yreka and then branches to a terminus at Montague.

Between 1954 and 1957 contracts were completed for a modern two-lane highway under four contracts for 13.1 miles between 0.4 mile south of Kidder Creek to 1.0 mile east of Forest Mountain Summit. The cost was $2,650,000. The contractors were Eaton and Smith of San Francisco, Peter Kiewit Sons' Company of Portland, Oregon (two contracts), and Clements and Company of Hayward. A gap of 2.9 miles between Greenview and 1.8 miles east of Ft. Jones will be let to contract this year.

The section between Yreka and Montague, a distance of 5.9 miles, was completed in 1953. The cost was $277,-000 and the contractor was Harms Brothers of Sacramento.

This leaves only two stretches not yet budgeted for building to modern standards; a 5.5-mile stretch from Etna to 0.4 mile south of Kidder Creek and a 5.5-mile stretch from 1.0 mile east of Forest Mountain Summit to the junction of US 99. Preparation of plans and acquisition of right-of-way is in progress for these remaining sections.

Since the Collier-Burns Highway Act was passed by the Legislature in 1947, substantial improvements have been completed on our road network. This progress has benefited highway users in the form of added safety and convenience. It is now commonplace to measure distance by the length of time required to travel between two points. In this northeastern area of the State where mileage to destinations is generally large for most of the trips, distances have been shortened notable amounts.

On the lateral routes where two lanes provide sufficient capacity for present traffic the construction of a single roadway of a future divided espressway has been followed. This provides a means of progressing with an orderly program with assurance that the current investment in the highway plan will continue to serve the public in the ultimate development. Recent provision that has been made for building a system of interstate highways has given impetus to freeway construction in this area. While much remains to be done, we can look ahead to the day when the main north-south route, which is the economic life line of this region, will be completed to freeway standards.

An artist's drawing superimposed on this photograph shows the future interstate freeway location through the City of Dunsmuir. The interchange in the foreground will connect the new freeway with the present US 99 which is also the main street of the city.

Loleta Bypass

Redwood Highway Improvement Continues in Humboldt County

By H. A. DAVIS, Resident Engineer

COMPLETION of a 4.6-mile section of expressway between Fernbridge and Beatrice, and passing easterly of Loleta, marks another milestone in the program to modernize US 101, the Redwood Highway, in Humboldt County.

The new expressway replaces a 5.1-mile section of substandard two-lane highway over Loleta Hill, also referred to as Table Bluff Hill, approximately 10 miles to 15 miles south of Eureka.

The new facility is the first unit in a planned development of 13.5 miles of the Redwood Highway between the north city limits of Fortuna and Elk River, just south of Eureka.

Of the section of the old highway that was replaced, two miles were constructed in 1927, with the remaining 3.1 miles being constructed in 1930-31. The average daily traffic and accident rate for the past four years is shown in the table on the following page.

A number of these accidents occurred at an underpass of the NWPRR at Loleta where highway alignment is a 400-foot to 1,000-foot radius (doglegged) reverse curve, having clearance of 28 feet between concrete piers.

Many Slow Trucks

Proceeding northerly over the section known locally as Loleta Hill to Table Bluff Summit, steep grades and substandard alignment caused a definite bottleneck to traffic movements as a result of the large number of slow-moving trucks common to this stretch of highway.

As the new expressway is on completely new alignment, this superseded section of highway will be maintained as a county road.

The new expressway is a four-lane divided section having a 22-foot median. Surfacing is plant-mix with open graded seal, all on cement treated base. At two locations where terrain features made it necessary to go to 6 per-

An aerial view looking north along the newly completed bypass. The road crossing in the foreground connects the new expressway with Loleta to the left.

cent grades, the 10-foot-wide shoulders were reinforced with cement treated base to provide for slow-moving trucks, which frequently use the shoulders.

The design provides for an ultimate full freeway and the only two initial grade intersections will be replaced by traffic interchanges at some later date. Lighting of the intersection serving the Town of Loleta was necessary as the sight distance at the intersection is often restricted by very dense fog.

The new facility results in a considerable saving of time to the daily user and, in addition, due to its location on high lands above Loleta, adds further to the scenic splendor of the Redwood Highway by providing a panoramic view of the Eel River as it snakes through the bottom land and empties into the Pacific Ocean.

Two-stage Construction

This unit was constructed in two stages. The first stage, consisting of grading, structures, and drainage, was described in H. W. Benedict's article in the March-April, 1957, issue of *California Highways and Public Works*.

The second-stage contract consisting of surfacing and subgrade drainage was awarded to Mercer, Fraser Company, Inc., and Mercer, Fraser Gas Company, Inc., of Eureka on a low bid of $659,028.50.

The subgrade drainage consisted of installation of 20,400 lineal feet of 8″ perforated metal pipe placed longitudinally along the low side of the roadbed, in the cut sections, in "V" ditches having a depth of two feet below subgrade. The entire roadbed in the cut sections received a one-foot blanket of type "C" filter material. In addition to the filter material, the typical section consists of 0.50 foot of imported subbase material, 0.83 foot of base (0.67 foot of which is cement-treated under the traveled lanes), 0.25 foot of type "B" PMS, and 0.05 foot of open-graded PMS on the traveled lanes.

An aerial view taken at the north end of the Loleta Bypass. The road extending southward to the right of the new freeway is the old highway.

Survey Conducted

Before placing the base materials, E. Dewing, Senior Highway Engineer of Headquarters Materials and Research Department, conducted a survey of deflections of the subgrade as recorded by the Benkleman beam deflection tester. Areas showing excessive deflection were recorded and additional base was added. Successive tests were made at various levels of the base with the final test on the completed surface showing deflections well below the maximum allowable for type "B" plant-mixed surfacing. This is the first project where the Benkleman beam test was conducted from the subgrade through the completed surfacing. Analysis of the data gathered by this survey will be a definite asset in determining required thicknesses of base materials for future projects.

Although the grading contract was not completed until September 30, 1957, the surfacing contractor was able to start on the completed portions on July 24, 1957.

The surfacing contractor made excellent progress, and completed the project on February 3, 1958, utilizing only 70% of the contract time allotted.

The structures of Unit II of the freeway development program southerly from Unit I to Fortuna are now under construction with the grading and surfacing scheduled to be completed during the 1958-59 season.

The project was under the supervision of District Engineer Sam Helwer, Operations Engineer C. P. Sweet, and Construction Engineer M. O. Clemens. The writer was resident engineer on the project, and the superintendent for contractor Mercer, Fraser Company was Fred O. Bott.

Daily Traffic and Accident Rate

Year	Number of Accidents: Property Damage	Injury	Fatal	Total	Accident rate MVM	A.D.T.
1954	17	10	2	29	2.60	6400
1955	21	14	0	35	2.92	6900
1956	26	11	3	40	3.06	7500
1957	20	12	4	36	2.65	7800

Pacifica Freeway

New Section Bypasses Old Coastal Highway

By LESLIE M. PETERSEN, District Design Engineer

THE CITIZENS of the new City of Pacifica on the Pacific coast south of San Francisco will celebrate this spring the opening of the new freeway from Skyline Boulevard to Manor Drive near the south end of their city. This project bypasses the old state highway along Thornton Bluffs, which has been one of the most difficult sections of state highway to keep open.

The old state highway along Thornton Bluffs was constructed in 1936. It was established generally along the location of the abandoned Oceanshore Railroad and for the most part consisted of a bench section along the face of a precipitous slope about 150 feet above the ocean. The aerial photograph included with this article shows the situation much more clearly than words can tell. The continued slipouts resulting from erosive wave action along the base of the bluffs and slides from the unstable slopes above made the maintenance of the road progressively more difficult and costly over the years.

Many Closures

The road was closed a total of 17 times during the seven winters between 1950 and 1957. These closures ranged from a period of one hour to a period of 120 days. The road was closed a total of 174 days during this time. During these periods of closure, the two county roads leading from Sharp Park and Edgemar to Skyline Boulevard served as detours. A third, Manor Drive, was extended to Skyline Boulevard in 1956. The closures resulted in considerable inconvenience and delay to the motorists involved.

The cost of correcting the slides and slipouts during this seven-year period was about $425,000 or an average of about $60,000 per year. This cost is in addition to normal maintenance expenses.

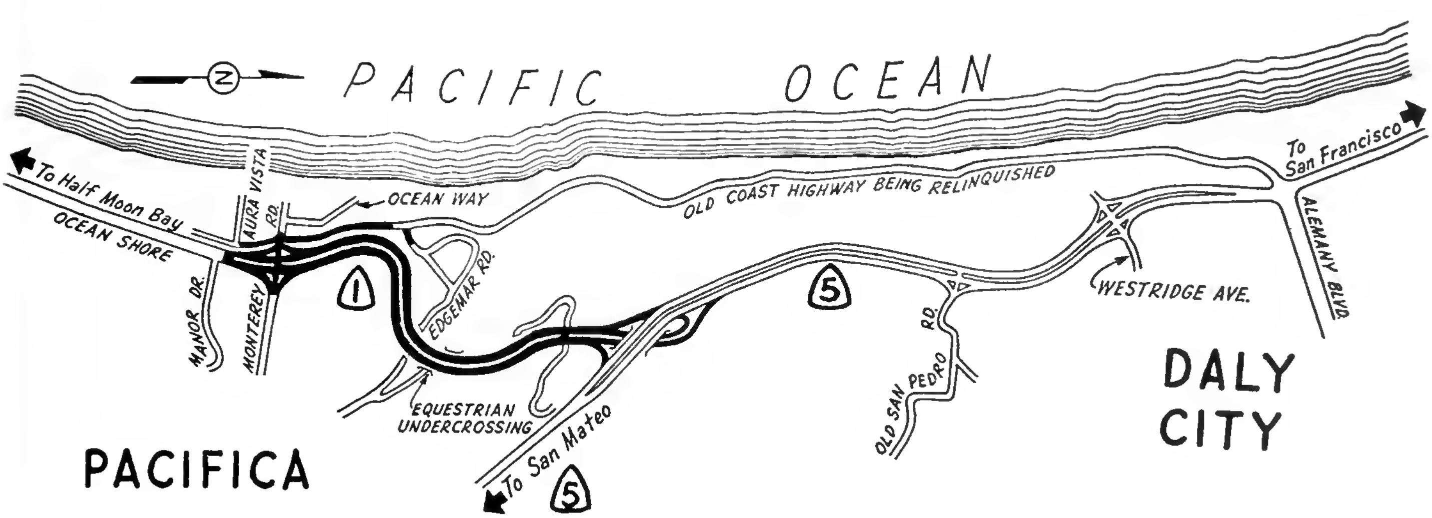
In addition to maintenance difficulties, it was obvious many years ago that the road along Thornton Bluffs would soon be deficient from a traffic standpoint. A four-lane roadway would soon be needed to accommodate the traffic to the fast-growing communities along the coast. The close proximity to San Francisco and the scenic beauty of the area have been attractions to thousands of prospective homeowners. Because of rugged terrain the area, until recent years, has been sparsely settled. The increased demand for housing has made it economically feasible to do the large-scale grading necessary to develop the hill areas into residential subdivisions.

New Road Built

The State Highway Commission adopted a new route bypassing this section on November 17, 1952. Construction of Route 55 on Skyline Boulevard between Edgemar Road and Alemany Boulevard was completed in December, 1954, at a cost of $630,000. This was constructed as a four-lane expressway with provisions for six lanes. Edward Keeble of San Jose was the contractor.

The contract for the section nearing completion was awarded to McCammon, Wunderlich & Wunderlich Contracting Company of Palo Alto on May 3, 1957. Their low bid was $1,-291,659.

This project was principally an earth-moving job with over 1,000,000 yards of roadway excavation required. The deepest cut was about 140 feet and the highest fill was about 100 feet. There were two bridges constructed as part of the interchange at Skyline Boulevard and an equestrian crossing was constructed near the center of the



This aerial view shows the interchange under construction connecting the new freeway with Skyline Boulevard (State Sign Route 5) job to provide for a State Beaches and Parks horse trail.

This project was constructed as a four-lane divided expressway. The typical section consisted of four 12-foot lanes with a 10-foot dividing median and two eight-foot shoulders. An interchange was constructed with Skyline Boulevard and two channelized public road grade crossings were provided. Private access was restricted to new frontage roads or existing local roads.

The area traversed was largely undeveloped, and right-of-way problems were minor with one exception. A portion of the Globe Wireless overseas transmitting antennas had to be relocated. This was financed through right-of-way negotiations and relocated by the Globe Wireless Company.

Fault Area

This project is almost entirely within the San Andreas fault zone. The principal faultline appears to be in the draw about the center of the job on which the highest fill was placed. After a geological investigation, it was decided the only provision that need be made for seismic conditions was to provide flatter slopes on the fill across the main fault and provide extra material near this faultline to provide correction for future vertical or horizontal shift.

The principal design problem was to make the 530-foot difference in elevation from the top of the hill at Skyline Boulevard down to the beach area at Edgemar. A sustained 7 percent grade and reversing 750-foot radius curves were used to provide enough distance to make the difference in elevation.

The superintendent for contractors McCammon, Wunderlich & Wunderlich was Elmo Campbell. The Division of Highways was represented by Resident Engineer E. L. Raymond with J. W. Beck as Bridge Department representative.

The State Highway Commission adopted a 4.8-mile southerly extension of this freeway through the new City of Pacifica to Pedro Valley on January 22, 1958. Design of this section is now under way.

UPPER—An aerial view of the south end of the new freeway. The old road parallels the new freeway on the left before taking out around the Thornton Bluffs in the distance. LOWER—Looking south over part of the Thornton Bluffs showing the old highway (middle foreground) and the new freeway curving up the slope to the left.

County Highway

Three-mile Section Improved Along Tuolumne-Sonora Road

By CHARLES D. HOF, Road Commissioner

A RECENTLY completed project in District X is a three-mile section of the Tuolumne-Sonora Road, which is Tuolumne County Federal-aid Secondary Route 954. This route begins approximately two miles easterly of Sonora, on State Sign Route 108 and ends at Tuolumne, a total length of 7.20 miles.

FAS Route 954 is the main artery between the City of Sonora and the Town of Tuolumne. The road serves an area devoted to stock and turkey farms, dairies, and apple orchards in addition to the mills of the West Side Lumber Company at Tuolumne and the Pickering Lumber Corporation at Standard, both of which are large operations that involve trucking of logs and finished lumber products over this road.

The original road was constructed about 1928 and consisted of asphaltic concrete approximately 15 feet in width retained by redwood header boards. As far as it may be determined, little or no base was provided under the surfacing. Since the original construction, county forces widened the surface by asphalt penetration of the shoulders and improved some of the curves. By present-day standards, with a traffic count of 1,200 vehicles per day, the old road was very inadequate.

The completed three miles was designed by the county and constructed under a Division of Highways contract as a part of the federal-aid secondary highway program in co-operation with the U. S. Bureau of Public Roads. The new construction has a 32-foot-wide all-paved roadway with 1,150-foot minimum radius curves. Maximum grades are 6 percent and sight distances on vertical curves have been greatly improved. All engineering work, except construction staking and construction inspection, was performed by county forces under the direction of Mr. Howard Emrich, assistant road commissioner. Mr. Emrich also completed all right-of-way negotiations.

With crushed aggregates being costly in mountainous areas it was determined that the most economical material available was a decomposed granite located at Standard, California. This granite was used for imported base material and as mineral aggregate for the cement-treated base. The contractor, M. J. Ruddy & Son, hauled the plant-mixed surfacing a distance of approximately 30 miles from a plant near Oakdale, California.

Total construction cost was $196,000, financed from federal, state and county funds.

Plans are presently in process for the next two and one-half miles of this route. The new project is located in a more mountainous area with an existing 12 percent grade to overcome and a switchback to correct with improved alignment.

A section of the recently completed Tuolumne County Federal Aid Secondary project shows the Wards Ferry Road connection on the left

Still Tops

Bay Bridge Wins ASCE 'Seven Wonders' Award

A PLAQUE citing the San Francisco-Oakland Bay Bridge as one of the "seven civil engineering wonders of the United States" was presented to the State of California on March 17th.

C. M. Gilliss, State Director of Public Works, received the plaque on behalf of Governor Goodwin J. Knight at a luncheon held in San Francisco by the American Society of Civil Engineers.

Louis R. Howson of Chicago, president of the society, presented Gilliss with the bronze plate which is the symbol of the society's designation of the San Francisco-Oakland Bay Bridge as "a unique overwater steel structure."

The California State Department of Public Works built the Bay Bridge and operates it.

After the luncheon presentation of the plaque, Gilliss and Howson were joined by other ASCE and state officials in a brief ceremony at the Bridge Toll Plaza. A permanent display of the plaque will be arranged later, probably at the toll plaza.

The seven civil engineering wonders selected by the society included the Grand Coulee-Columbia Basin development, the Empire State Building, the Colorado River-Los Angeles Aqueduct, the Panama Canal, the Hoover Dam, the Southwest Sewage Treatment Plant of the City of Chicago, and the San Francisco-Oakland Bay Bridge.

Unique Features Considered

The San Francisco-Oakland Bay Bridge was selected as the greatest among the many fine suspension bridges of the country, primarily because its construction included unique features not found elsewhere. It was cited as outstanding due to its total length of steel over water, about 6 miles, its twin suspension spans built end to end, each 2,310 feet in length, and the exceptional appeal of its graceful lines.

State Director of Public Works C. M. Gilliss accepts a bronze plaque from Louis R. Howson of Chicago, National President of the American Society of Civil Engineers, designating the San Francisco-Oakland Bay Bridge as one of the "Seven Civil Engineering Wonders of the United States"

The society also referred to the great center anchorage pier between the twin suspension spans which it called one of the most remarkable examples of foundation and pier construction the world has ever seen. Praising the unique construction methods involved, Howson said, "The foundation was carried to the unprecedented depth of 240 feet below the water surface. The huge caisson for this pier (the largest ever used—92′ x 197′) was floated into position and sunk in a hundred feet of water in an area subjected to swift tidal currents. In order to avoid difficulties experienced in keeping smaller caissons in a vertical position an ingenious plan of providing buoyance was adopted by which the 55 dredging wells were used either for excavation or as air chambers as needed. Thus the huge cellular box was held in a level position while being sunk to sound material 140 feet below the bottom of the bay.

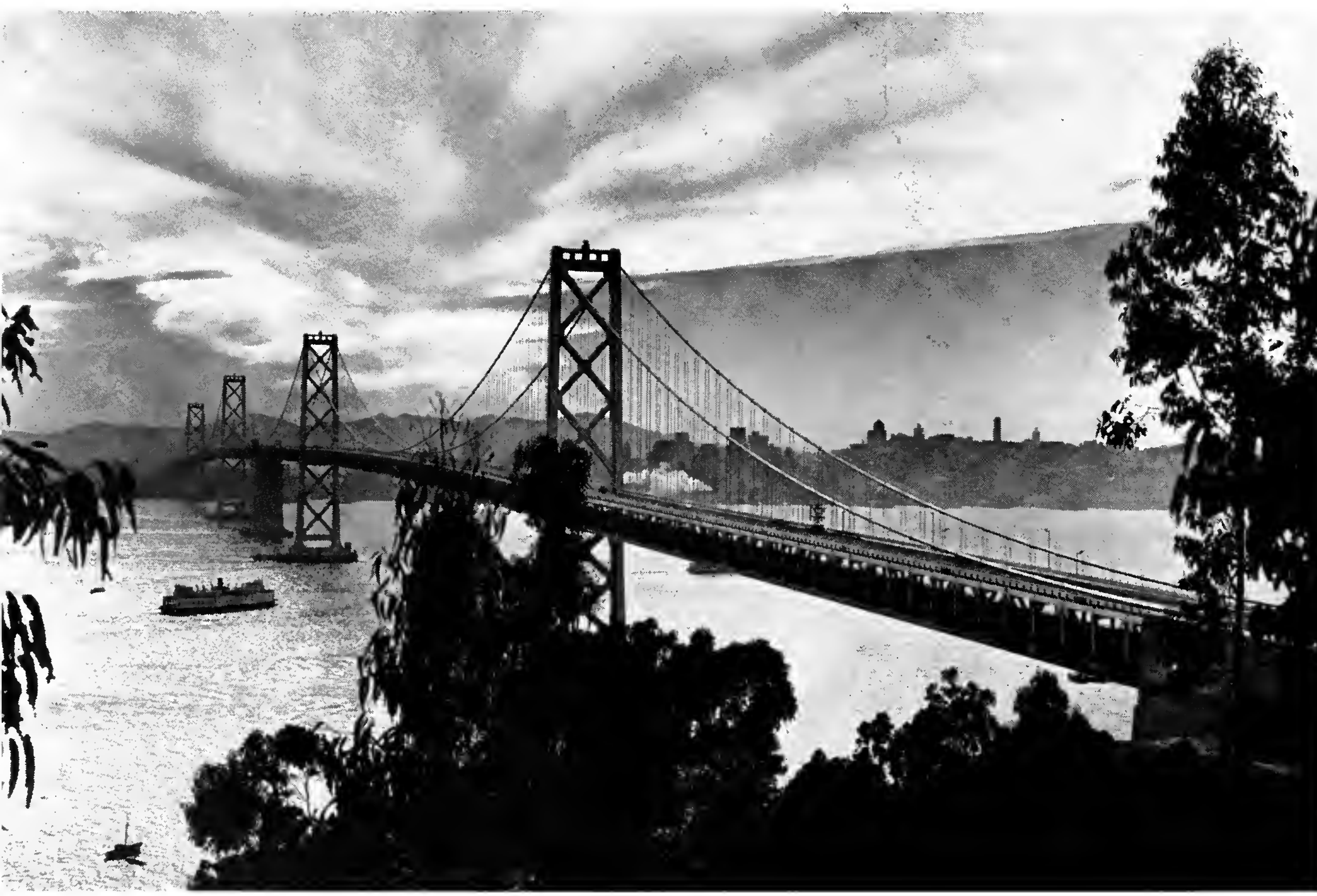
Notable Features

"The San Francisco-Oakland Bay Bridge superstructure can always be seen and admired but only the top of great central pier, which determined the selection of this bridge from many others as the greatest suspension bridge of our country, is visible to remind us of one of the most notable features of its construction.

"The boldness of conception of the great center anchorage pier, the ingenuity with which the work was carried out, and the success with which this most difficult undertaking was done attest to the careful planning of civil engineers and those associated with them in the work."

Howson said that the society began its study to determine the "seven civil engineering wonders of the United States" about two years ago.

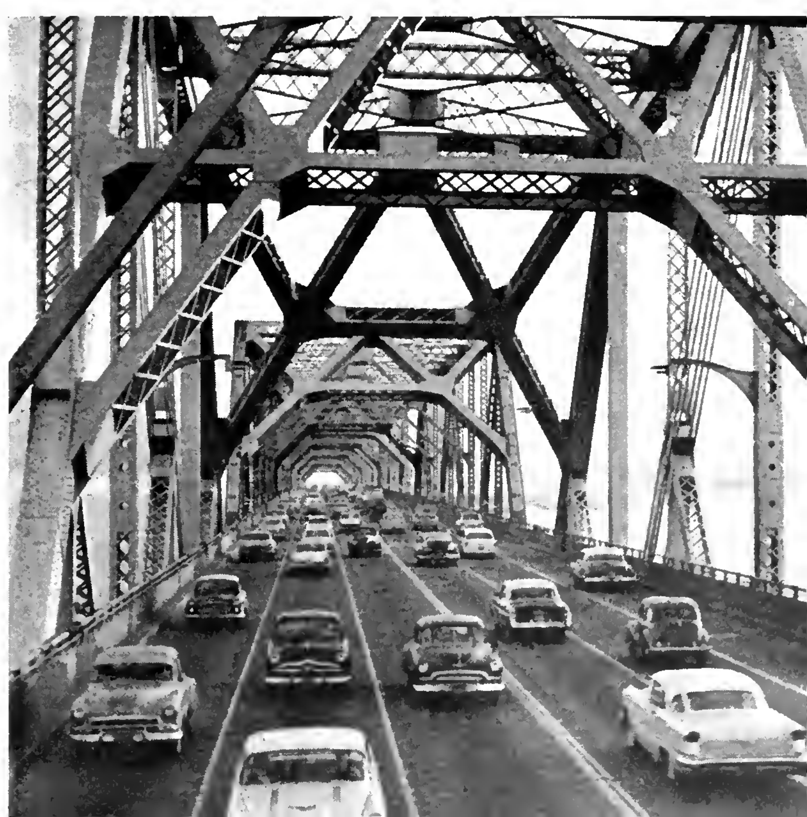
The Seventh Wonder



". . . its spans and foundations, the elevation of its towers, the dimensions of its cables and their composition are staggering . . . The assembly of these materials into this beautiful structure which contributes so much to human welfare is a civil engineering feat of the first magnitude."

—LOUIS R. HOWSON, National President of the American Society of Civil Engineers, San Francisco, March 17, 1958.

Included among the "seven civil engineering wonders of the United States" chosen by the American Society of Civil Engineers is California's own San Francisco-Oakland Bay Bridge. Here she is, captured in some of her moods over the past 22 years by Division of Highways cameramen.



Restoration

Old Capitol at Benicia Becomes State Monument

The State Capitol at Benicia, reconstructed to its grandeur of a century ago, was accepted as a historical monument in the State Park System on April 15th at official ceremonies attended by many notables including Governor and Mrs. Goodwin J. Knight and Members of the Legislature.

Lieutenant Governor Harold J. Powers, members of the State Park Commission, state department chiefs and local officials were among the estimated 2,500 people who took part in the dedication ceremonies.

Many of those present, including the Governor and his wife, were in period dress of one hundred years ago.

After opening ceremonies, the Legislature convened briefly in the old Capitol.

The restoration was supervised by the State Division of Architecture. The Division of Beaches and Parks maintains the monument.

During the past century the old Capitol has been used for many local functions and for various civic activities. At times it has been the Benicia city hall, a church, a school, a theater, a dancehall, a skating rink, the city library and the police station.

The building was in a deplorable condition before restoration; neglected and timeworn, its second story had become a home for pigeons. An engineer of the Division of Architecture reported in 1953 that "There may be buildings in use for human occupancy in as poor structural shape as this building, but in my experience I have seen no worse. The building has been so weakened by neglect that very little factor of safety remains."

Such was the problem that confronted the Division of Architecture; namely, to make the building structurally safe and strong by present-day standards and, at the same time, to preserve its original appearance of more than a century ago.

Governor and Mrs. Goodwin J. Knight and State Park Commissioner Leo Carrillo (left) headed a large group of notables taking part in the dedication ceremonies of the old Capitol at Benicia

Authenticity Preserved

One of the most difficult things of any restoration work is to resist the strong tendency toward "make believe." The preservation of authenticity—making sure that the work is honest and genuine—is a prime essential. True restoration work always demands subordination of individual imagination to correctness of design. This can be achieved only through scholarly research and the study of tangible, on-the-job evidences discovered during restoration.

The division's sources of information in working on the Benicia Capitol project were (1) printed and pictorial records found in libraries and archives; (2) reports of old-time residents of Benicia who were able to give firsthand accounts or data handed down from previous generations; and (3) evidence discovered throughout the structure and within the building frame as the work progressed. Important evidence was also gathered through careful study of other buildings erected in the 1850's at Benicia.

Research disclosed that, as the building was variously occupied after March, 1854, additions and many alterations to the original structure were made. There was also evidence of extensive alteration to the original design due to maintenance repairs over the years. Most of this work differed greatly from the original and had to be completely done over. Damaged original materials were restored with like materials where practicable. To guide the division's construction forces, 21 large sheets of blueprints were carefully prepared to secure exactness of the construction details. Many of these details were drawn as the work progressed and new data was revealed to the architects.

Reinforcing Concealed

The exterior brick walls of the building are constructed of underburned brick, called salmon brick. In restoring the building, these walls were reinforced from the inside with concrete, leaving the exterior brickwork as originally laid in 1852. The foundations were similarly backed and underpinned with reinforced concrete. The new concrete frame and foundations support the building by transferring the building weight from the weakened brick walls.

The method of reinforcing old structures in this way was devised by the Division of Architecture and first used several years ago in restoring the Wells-Fargo Building at Columbia, Tuolumne County, for the Beaches and Parks Division. At both buildings, it was possible to preserve the texture of the brickwork in its original state and in all its charm. Also, a layer of exterior plaster was removed from the foundations in order to expose the original stonework.

The roof of the building had been replaced several times during the past 100 years and had to be removed entirely during restoration. Rebuilt with new roof trusses, the roof has a standing seam tin roof covering that conforms to the original. This detail was determined by examination of a painting of the building made in 1860. The so-called "tin" roof is actually made of sheet iron plates coated with a composition mixture of lead and tin. In the early days this metal was a product of Wales and was called "terneplate."

The original floor joists throughout the structure are mortised, hand-squared crossbeams. These timbers were found to be in as good condition as the day the carpenters first set them, free from rot or other defects. The interior wood columns are original and were made from hand-shaped masts of abandoned sailing vessels.

The floors are laid with new random width floor planks that faithfully reproduce the original pattern of flooring. All rooms were reconstructed during restoration to follow the floor plans of the building when it was built in 1852.

Stairs Reconstructed

The inside stairways adjacent to the main entrance are authentically reproduced to coincide with trace marks of the original winding stairs found on the plaster lathing.

Doors and windows are restored and are authentically designed as reproductions of the original work.

Cornice moldings are mostly hand-shaped. Cut "square" nails instead of wire nails were used throughout the restoration work, as in the old days.

The hardware in the building consists of original items secured from other buildings of the period. The front door lock and key, however, are the original and were donated to the State.

The lighting fixtures include a number of midcentury oil lamps, procured after long search up and down the State. The more elaborate fixtures in the legislative chambers, however, could not be found and replacements were specially designed for the building from documented information.

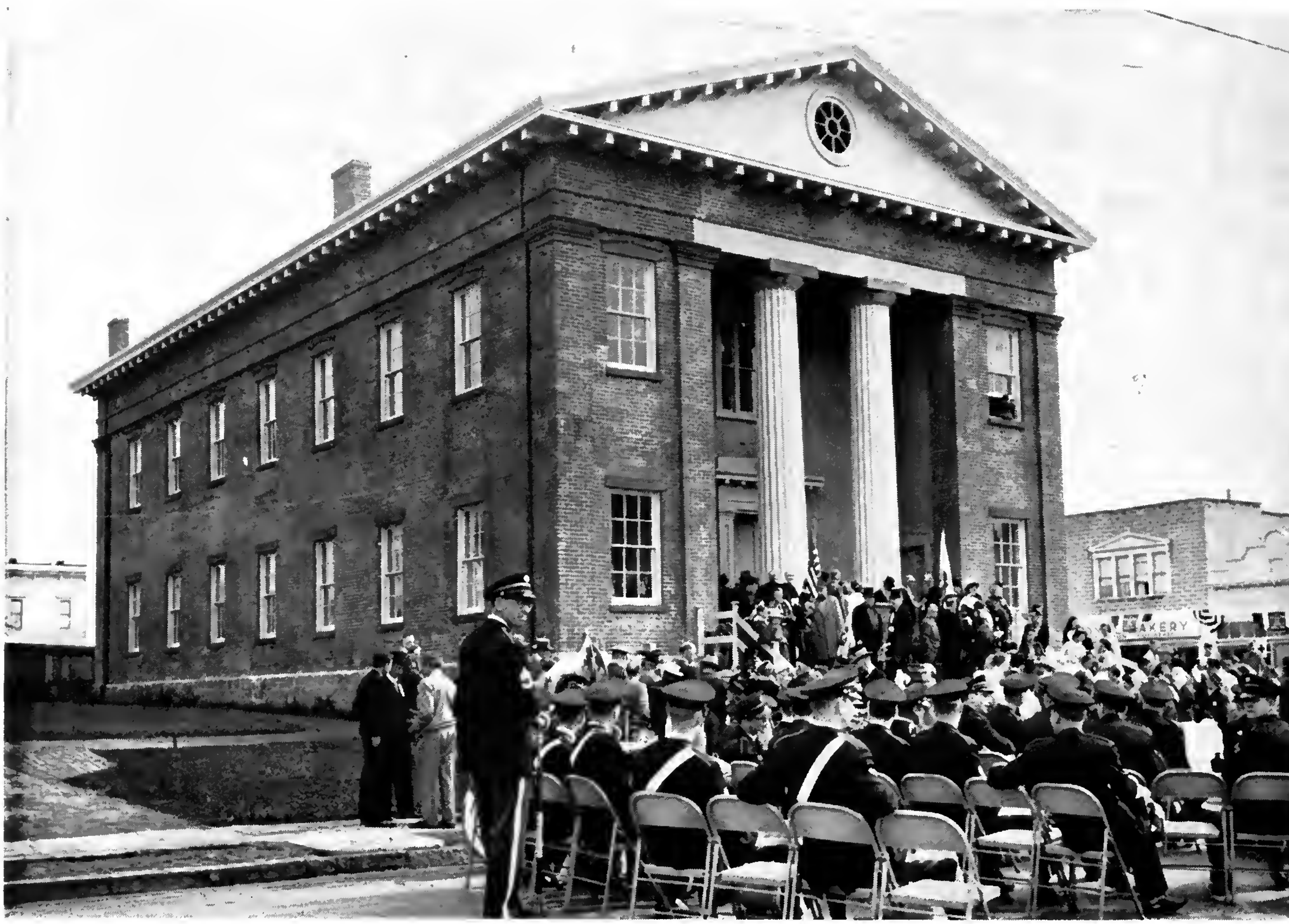
Interior paint colors were determined by analysis of the paint found on original surfaces, the many layers of newer paint having been removed down to the first color.

The architecture of the Benicia Capitol has that quality that lifts it out of the class of the ordinary building. The grace and charm of this art work set it apart from other buildings of the era. Early photographs show that the Benicia Capitol was entirely of a different quality than its neighboring buildings of the growing town of Benicia.

It has often been asked, "How, in the early days of 1852, in a frontier settlement, does a work of architecture such as this come about?" The answer is found in the local carpenter-architects' study of books such as Lefevre's 1833 "Modern Builder's Guide." These books were used much the same as house plan books are used at the present time. Ideas, source material and "how-to-do-it" information were all in the books.

Greek Temple Effect

The builders of the Capitol chose the simplest design that would give the effect of a Greek temple—getting the "mostest for the leastest." The carpenter-architect was not concerned with the imaginative development of space utilization, nor had he come in contact with ideas relating to the climate of creative living. He chose the Greek temple form solely because it was the fashion of the time in capitol structures, a trend started by Thomas Jefferson in 1789 when he designed the Virginia State Capitol at Richmond in the form of a classical temple. The



Visitors, some of them in period dress of a century ago, throng the steps of the reconstructed Capitol. Renovation of the building required extensive research by the staff of the State Division of Architecture and Division of Beaches and Parks to insure that it would be an exact replica of the structure as it appeared just after its completion in 1853.

vogue for domed capitols came later with the completion of the dome of the National Capitol during Civil War days. Thus, the Benicia Capitol has its place in historical lineage.

Architecturally, the building is described as a distyle temple with *portico in antis:* a temple form with a two-column porch set flush with the front elevation of the building instead of projecting.

The builders of the Capitol were Rider and Houghton, who contracted for construction of the building based on their low bid of $24,800. The structure was erected in a great hurry in order to be ready for the 1853 Session of the Legislature. Three months of actual building time sufficed. This was possible because the time-consuming installation of modern-day plumbing, heating, ventilating and lighting was not required. Then, too, there was no eight-hour day for anyone working on the project. The underburned brick was used because there wasn't time to bake it longer.

LAHORE, WEST PAKISTAN

Editor, California Highways and Public Works

SIR: I acknowledge with thanks receipt of the August and October issues of your excellent publication and have enjoyed them through and through. These issues have been read with great interest by all the research and materials engineers working in this laboratory. The articles on "Operations and Activities of the Materials and Research Department" were found to be very informative, educational and enlightening.

Having worked for one month in the Sacramento Laboratory and in District IV of the Highway Division I particularly feel attached to the persons and places mentioned in these magazines.

I will be looking forward to your subsequent issues and thank you again for your courtesy in transmitting these magazines to us.

Yours truly,

MIAN M. HANIF
Assistant Research Officer
Buildings and Roads
Research Laboratory

Accident Study

Types of Collisions Made Subject of Special Research

By G. M. WEBB, Traffic Engineer

GREATER traffic safety is being achieved through modern engineering as the Division of Highways moves ahead in its extensive statewide program of highway construction and improvement.

Consistent and often spectacular reductions in accident rates are resulting as new highways and freeways are constructed, trouble spots are revised and modernized, and design is constantly improved.

These reductions are recorded from accident reports which are received from the California Highway Patrol and from some of the cities through which state highways pass. The reports are plotted and coded so that before-and-after comparisons can be made, points of high accident frequency determined, and patterns of recurring accident types isolated.

An important use of these data is in designing revisions and improvements for locations which show a large number of accidents. Some 300 spot improvements of this type are completed by the division each year.

One of these trouble spots, for example, was a sharp curve on State Sign Route 20 at Woodruff Lane in Yuba County, between Marysville and Grass Valley. A 25-month record of accidents at this location revealed a total of 20 accidents—16 property damage and four injury. Most of these mishaps resulted from vehicles failing to negotiate the curve. A correction might consist of more warning signs or an easier curve. In this case, it was possible to construct an easier curve.

As a result, not one accident was reported at this location in the 25 months following the improvement. *(See before-and-after collision diagrams of this location.)*

Left-turn Accidents

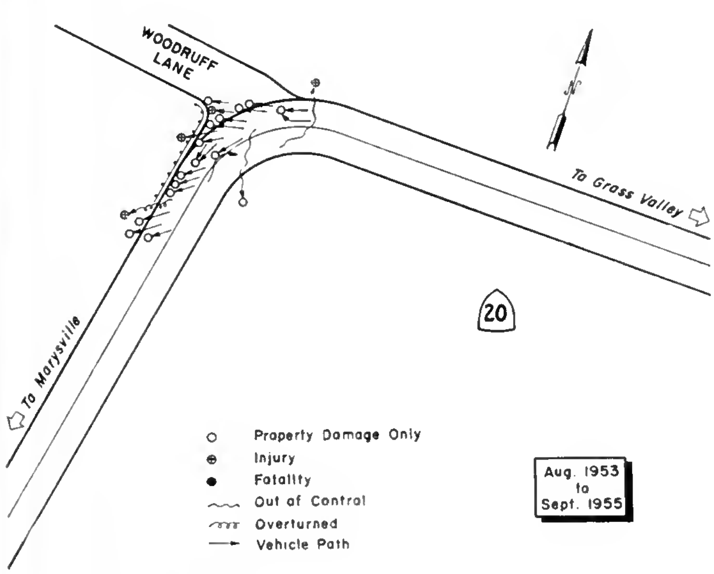
Another of these problem locations was on Sign Route 29 at the intersection with Rio Del Mar in Napa County. Here reports listed a total of six accidents in a year—five property damage and one injury. According to collision diagrams, vehicles that stopped to make left turns were involved. To remedy the situation, the dividing strip opening was widened, a left-turn lane constructed, and signs installed.

In the year following the improvement not one accident was reported. *(See before-and-after collision diagrams.)*

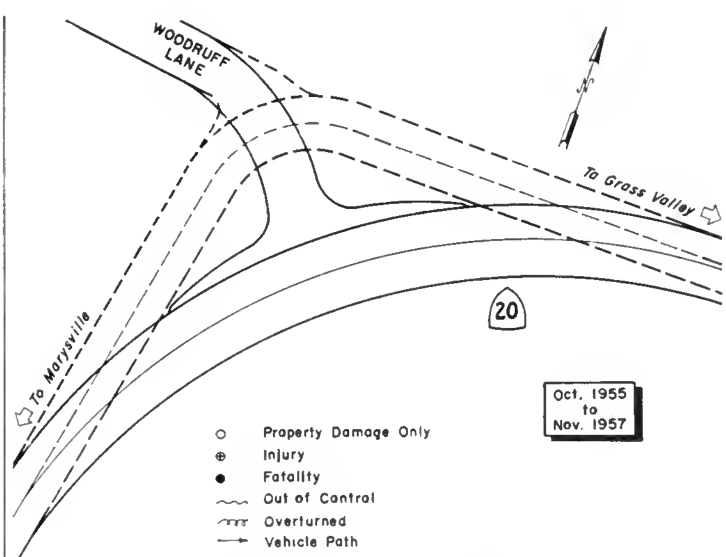
These examples show the benefit derived from the study of specific accident locations. Such corrections contribute very substantially to statewide traffic safety.

Going beyond these accident concentration points to take a look at the State Highway System as a whole, an overall analysis shows that accidents arise from many causes, but the pattern will generally fit one of the following categories:

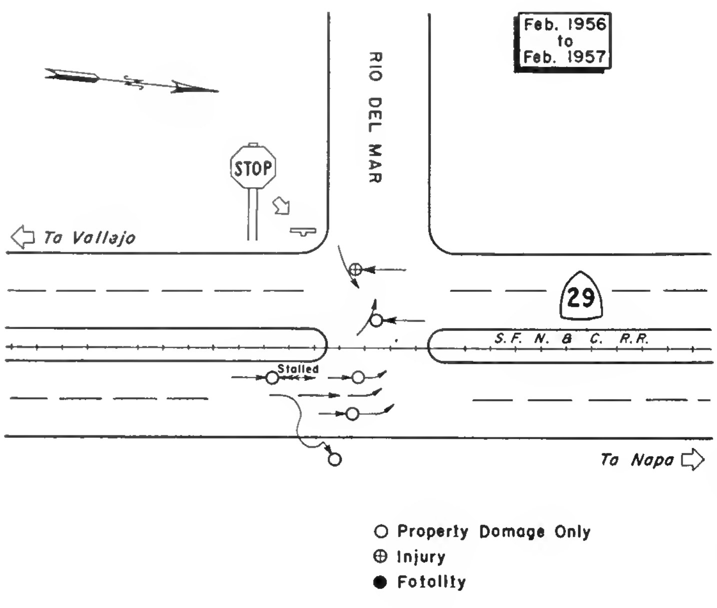
1. Conflict between vehicles traveling in opposite directions.
2. Conflict between vehicles traveling in the same direction.
3. Conflict between vehicles at intersections.



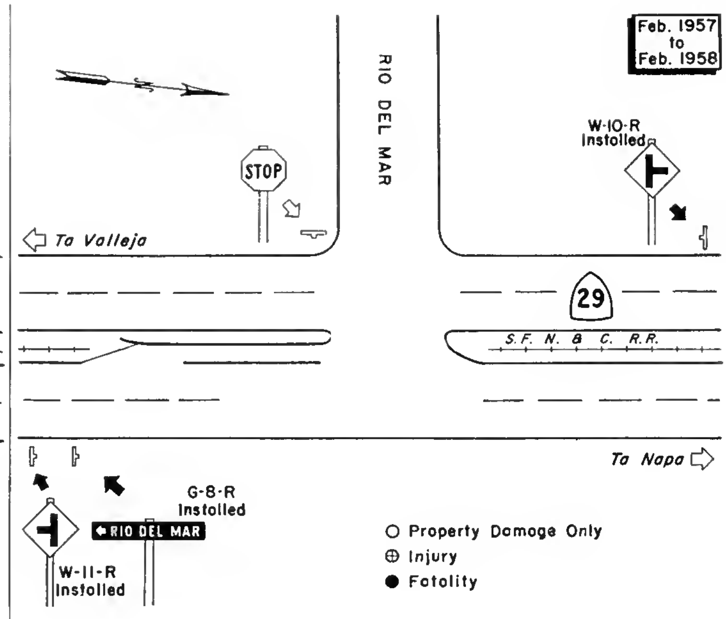
State Sign Route 20 Collision Diagram (Before Improvement)



State Sign Route 20 Collision Diagram (After Improvement)



State Sign Route 29 Collision Diagram (Before Improvement)



State Sign Route 29 Collision Diagram (After Improvement)

4. Side conflict or conflict between vehicles entering or leaving the roadway from parking spaces or driveways.
5. Vehicles striking fixed objects, running off the roadway or overturning.
6. Conflict between vehicles and pedestrians.

As traffic volumes increased over the years and the need developed for highways with more than two lanes, these conflicts became greater. One of the first of these probelms to receive attention was the conflict between vehicles traveling in opposite directions.

Medians Effective

This conflict, which frequently resulted in head-on collisions, was reduced by the construction of divided highways; that is, highways with a median or neutral area separating the opposing lanes of travel. This design proved effective, but did not entirely eliminate occasional spectacular and severe accidents resulting from vehicles crossing the divider, particularly on the high-volume highways.

These cross-median accidents have been the subject of intensified study by the Division of Highways for many years. The number of accidents of this type is not large; however, they are of particular concern to the division because of their severity and the fact that they occur on the safest and best highways—full freeways.

One of the earliest attempts to solve this problem was the construction of a median barrier on the Grapevine Grade on U. S. Highway 99 south of Bakersfield, where the divider was quite narrow and there was a high rate of approach-type accidents.

The results were very disappointing in that accidents of all degrees of seriousness increased sharply after the barrier was installed.

Primarily, this increase resulted from cars and trucks striking the barrier and from rear-end collisions. The barrier restricted the freedom of the motorist in maneuvering to avoid trouble.

Four-lane Study

Since this indicated that a barrier would not be satisfactory under all conditions, an extensive study of the safety record of all four-lane divided highways in existence in 1947 was initiated.

The study showed, at least for the lower-volume roads of that time, that highways with medians free from physical obstructions had better safety records than those with median barriers or other physical features to prevent crossing.

However, there was also an indication that on higher-volume roads barriers might prove beneficial. In line with this indication, a barrier of back-to-back metal plate guard railing was installed on a section of the San Bernardino Freeway which had an unfavorable record of cross-median accidents. A similar installation was later made on the Bayshore Freeway in San Francisco.

Results of a before-and-after study covering the San Bernardino Freeway installation were also disappointing.

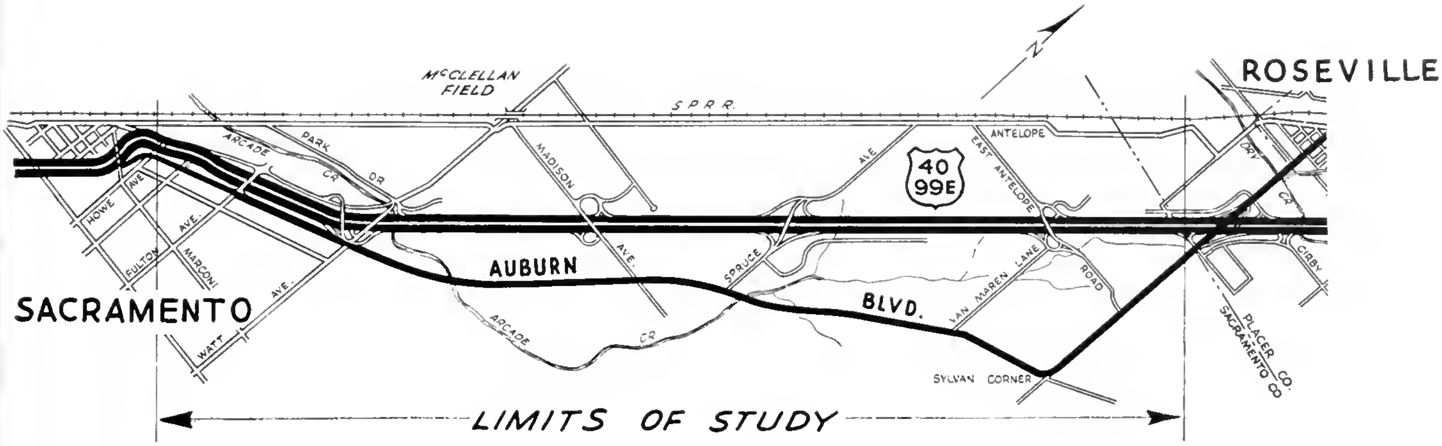
During the "after" period, the total accident rate increased three-fourths and the total casualty rate doubled. That the seriousness of accidents was not reduced was indicated by an increase of 10 percent in the number of vehicles involved per accident, and an increase of 30 percent in the number of casualities per accident.

Although the traffic volume climbed from 65,000 to 86,000 vehicles a day during the four-year study, congestion was not a factor in the accident rate increase. The accident rate for the peak hours of travel actually went down.

A similar study of the Bayshore Freeway barrier installation is being made.

Extensive Survey

In accordance with a long-standing practice of analysis and research to improve highway design, an extensive



statewide survey of highways with various types of medians is now in progress. This study covers about 280 miles of highway with traffic volumes of more than 15,000 vehicles a day, including 45 miles where barriers are in place.

Even though barriers have not yet proven effective in the promotion of overall safety at the locations where they have been installed, the division will continue its investigations of their safety possibilities. Barriers will be constructed where engineering studies and judgment indicate that they will bring about an improvement in the accident picture.

At present, about 16 miles of barriers are budgeted or under construction with an additional 15 miles under consideration. Each of the barrier segments will be carefully studied to determine the influence of the barrier on safety.

In addition, full-scale crash tests will soon be made, using radio-controlled cars and dummy occupants to determine the most effective barrier design.

Although divided highways have greatly reduced the danger of cross-median accidents, they are a direct attack on only one of the accident-producing traffic conflicts. To show an even better safety benefit, a highway must reduce all types of these conflicts.

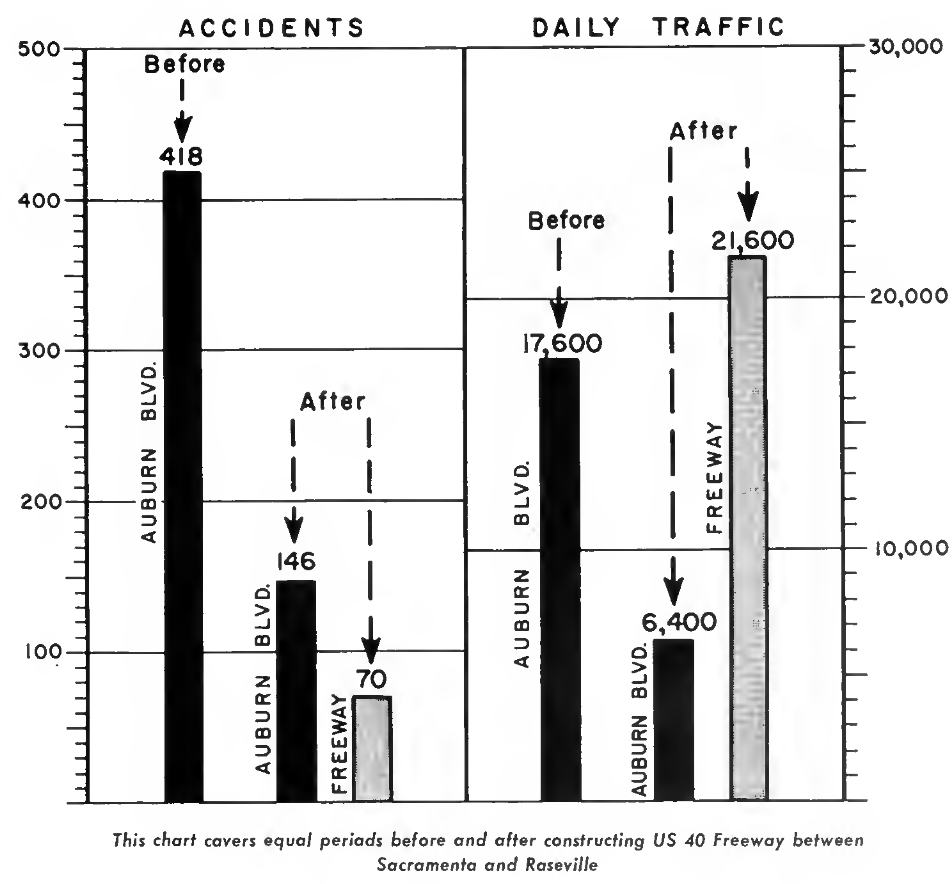
Accident Rate Reduced

This is successfully accomplished by modern, properly designed freeways. That freeways are effective can be seen by the fact that the freeway accident rate is about one-half the rate for conventional highways, and the fatality rate is about one-third the conventional highway figure.

The superiority of freeways over conventional highways is illustrated by the effect of construction of a 10.5-mile freeway between Sacramento and Roseville.

In a 22-month period immediately preceding the opening of the freeway, there were 418 accidents. Only 70 accidents were reported during an equal period after the freeway was opened, even though the traffic volume increased from 17,600 to 21,600 vehicles a day. (*See location map and chart of accidents.*)

In addition, the combined volume of traffic on the old road and the freeway was 60 percent greater than the volume prior to the opening of the



This chart covers equal periods before and after constructing US 40 Freeway between Sacramento and Roseville freeway. Even with this increase, the combined accident total on the old road and the freeway in the "after" period was about half the number that occurred on the old road before the freeway was completed.

This is another striking example of added traffic safety through engineering.

Highways Improved

California now has a full 500 miles of freeways in operation with another 209 miles under construction. In addition, most of the State's 916 miles of expressways, which have some intersections at grade, are designed for future conversion to freeway status. Also constructed in recent years have been a number of miles of "two-lane freeways," planned-access highways with two lanes initially and with design and right-of-way provisions included for an ultimate multilane freeway.

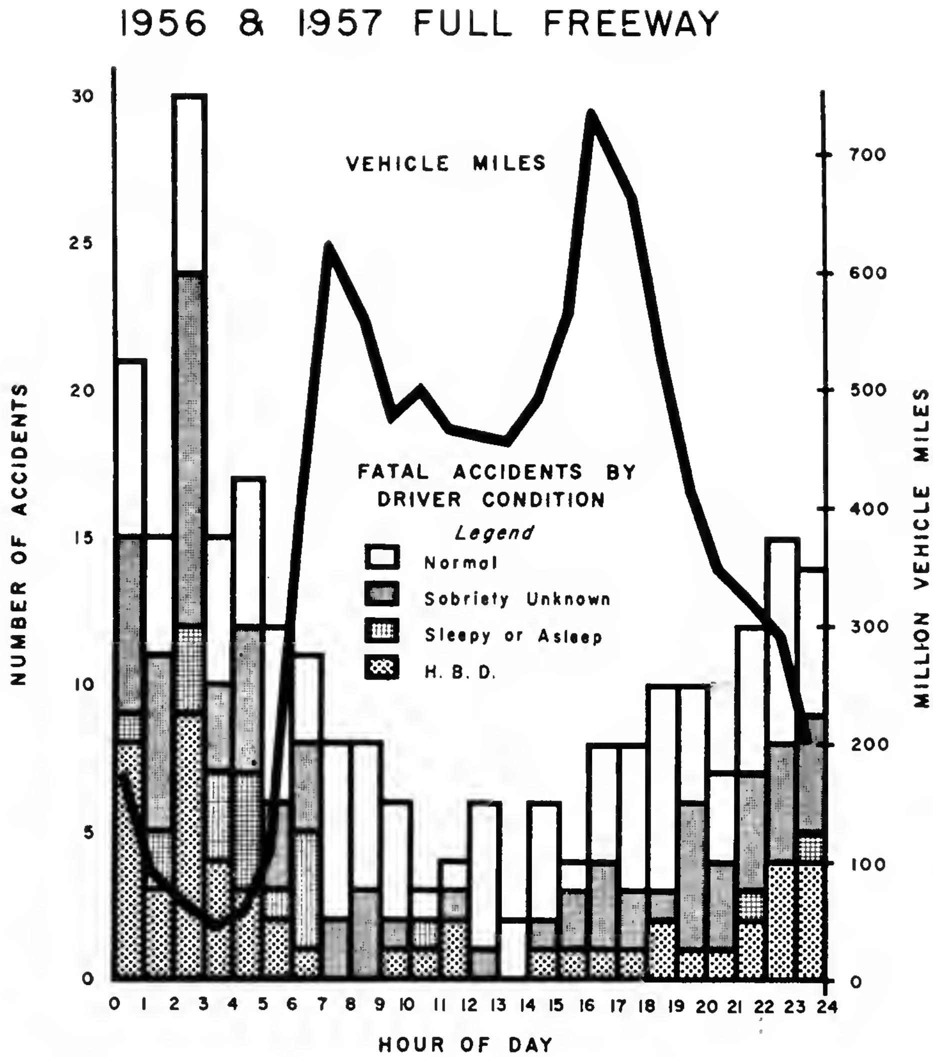
Successful spot revisions and low accident rates on freeways are the bright side of the picture, but what about the accidents that do occur?

In an attempt to find answers to this problem, a study was made of fatal accidents on freeways in 1956 and 1957. (*See chart showing accident frequency and traffic flow by hours.*)

One finding of significance was that the hours from midnight to 5 a.m. produce 40 percent of the fatal accidents while accounting for only 5 percent of the traffic. A large number of the drivers involved in these early-morning crashes, it was found, had been drinking, were fatigued or asleep. In many cases the condition of the driver was unknown, but could have been a contributing factor.

An overall review of fatal accidents on freeways confirms the general observation that driver condition or attitude is an important factor in a very large number of accidents. In fact, during 1956 a traffic violation or the condition of the driver were contributing factors in 90 percent of all accidents on rural state highways. Drinking was reported in 28 percent of the fatal accidents.

This points to a means of improving highway safety which goes beyond engineering; that is, developing a safety-minded attitude and a feeling of



responsibility on the part of drivers. The division will continue to make available engineering experience and knowledge to any group attempting to deal with this phase of the problem.

From an engineering standpoint, the extensive statewide program of highway construction and improvement will be pushed ahead as rapidly as possible, according to a long-range plan of orderly development based on priority of needs and availability of funds.

Meanwhile, there appears to be an acute need for a similarly effective approach to the social and psychological problems, the human failings, that play such a tragically important role in the great majority of traffic accidents.

SANTA BARBARA, CALIFORNIA

State Division of Highways
Maintenance Station
Buellton, Calif.

SIRS: During the past season of rain, fog, wind, and occasionally snow, I, like many others from this area, have had to drive over the San Marcos Pass regardless of weather, and often late at night.

Although it was frequently necessary to use great caution in driving due to slippery mud and falling rocks, I always drove with confidence, knowing that the staff from the Maintenance Station were working day and night to keep the road as safe as was humanly possible. They put in long hours of hard labor against heavy odds and did a wonderful job.

Yours very truly,

MRS. GEORGE A. YARNELL

California Bridges

Costs Hit Peak and Decline

By H. K. MAUZY, Senior Bridge Engineer, and W. J. YUSAVAGE, Assistant Research Technician

BRIDGE construction costs rose to an unprecedented index value of 292 during the first quarter of 1957 and then declined to a value of 281 at the conclusion of the calendar year. The index value, 292, represents a 10 percent increase over the average level of costs during the year 1956 and the year's end index value of 281 represents a 4 percent decrease from the cost level of the first quarter of 1957.

In terms of average annual index values, the cost level has risen for the third consecutive year. Bridge construction costs hit a low point of 219 in the recession year 1954 and then in the subsequent years of 1955, 1956, and 1957 rose to the successively higher values of 228, 265, and 283. The values represent successive annual increments of 4.1 percent, 16.2 percent, 6.8 percent, or an overall increase for the three-year period of 33.3 percent. During the same three years, the Bureau of Public Roads Cost Index for structures shows an overall increase of about 17 percent, a rate which suggests that economic conditions in California are more volatile than those in most of the other states.

The level of costs for successive periods is presented graphically in the accompanying chart which summarizes the course of California bridge construction costs since 1934.

Bridge Construction

Bridge construction activity continued at the high rate established in 1954, the year the additional increase to the state highway budget voted by the State Legislature took effect. During the past three years, the rate has been about 10 times that of the base (1939-40) period in terms of current dollars and just under four times that of the base period in terms of constant (1939-40) dollars. The differences in the two rates, 10 to 4, is accounted for by the rise in bridge construction costs since 1939-40.

TABLE 1

INDEXES RELATING TO CALIFORNIA BRIDGE CONSTRUCTION AND PERIODIC DOLLAR VALUES OF LOW BIDS ON CALIFORNIA BRIDGE CONSTRUCTION

I Year	II Quarter	III Index of the cost of California bridge construction (1939-1940—100)	IV Index of the value of California bridge construction (1939-1940—100)	V Index of the volume of California bridge construction (1939-1940—100)	VI Dollar value of low bids on California bridge construction (in millions of dollars)
1934.....	..	94	*60	*64	3.1
1935.....	..	88	*138	*157	7.1
1936.....	..	98	*72	*73	3.7
1937.....	..	114	*60	*53	3.1
1938.....	..	99	*78	*79	4.0
1939.....	..	101	*99	*98	5.1
1940.....	..	99	*101	*102	5.2
1941.....	..	122	*78	*64	4.0
1942.....	..	158	*80	*50	4.1
1943.....	..	165	*16	*9	.8
1944.....	..	153	*29	*19	1.5
1945.....	..	167	*109	*65	5.6
1946.....	..	182	*247	*133	12.7
1947.....	..	215	*443	*202	22.8
1948.....	..	229	*307	*134	15.8
1949.....	..	201	*233	*117	12.0
1950.....	..	202	*262	*129	13.5
1951.....	..	248	*617	*247	31.8
1952.....	1st	239	396	166	5.1
1952.....	2d	236	1,017	431	13.1
1952.....	3d	*235 239	*561 652	*237 273	28.9 8.4
1952.....	4th	223	179	80	2.3
1953.....	1st	243	140	58	1.8
1953.....	2d	224	707	315	9.1
1953.....	3d	*229 231	*522 893	*227 387	26.9 11.5
1953.....	4th	235	350	149	4.5
1954.....	1st	221	691	313	8.9
1954.....	2d	217	1,196	551	15.4
1954.....	3d	*219 220	*870 1,002	*399 455	44.8 12.9
1954.....	4th	213	590	277	7.6
1955.....	1st	217	1,039	477	13.3
1955.....	2d	237	500	211	6.4
1955.....	3d	*228 228	*930 1,047	*408 461	47.9 13.4
1955.....	4th	237	1,148	484	14.7
1956.....	1st	245	833	715	25.1
1956.....	2d	284	1,083	232	7.8
1956.....	3d	*265 260	*1,117 604	*422 381	57.5 13.9
1956.....	4th	273	1,952	213	10.7
1957.....	1st	292	680	232	8.8
1957.....	2d	283	2,007	709	25.8
1957.....	3d	*283 275	*972 460	*343 167	48.0 5.9
1957.....	4th	281	740	263	9.5

* Average annual information.

The indexes are designated as value and volume indexes in the accompanying charts where the course of the rates are given for all periods since 1934.

General economic trends are roughly reflected in the changing patterns of bidder activity. When the economy is running at a high level, the average number of bidders per project is four or five; as the economy becomes depressed, the average number of bidders per project rises. In the depressed year of 1954, an average of 9.9 contracting firms submitted bids for bridge projects.

For state projects which included bridge work, the average number of bidders per project was 9.9, 6.7, 5.3, and 7.7 for the years 1954, 1955, 1956, and 1957, respectively. The data clearly reflect the depressed economic level of 1954, the rising level through 1955 and 1956, and the recessive trend which was evident in the last three quarters of 1957. Bidder activity was high during January of 1958, indicating that the recessive economic trend is continuing.

Unit Prices Trends

Unit prices for the various bridge items follow the general trend of the summary index of bridge construction costs; certain of the items may rise or fall faster than others but in the long run these differences are canceled and all items show roughly the same proportionate relationship to base year prices.

Three major items, Class A portland cement concrete, bar reinforcing steel, and structural steel, account for about 75 percent of the total value expended for bridge construction. The changes in the unit prices of these items exert a preponderant influence on the general trend of costs.

The average unit price for Class A portland cement concrete is currently running at about $58 per cubic yard or at a rate of about 4 percent below that of the first quarter of 1957. Bar reinforcing steel costs continue at a high average level of $0.127 per pound. The unit price for structural steel (plate girder) fell off sharply from the average price of $0.234 per pound of the first quarter of 1957 to an average price per pound of $0.176 in the fourth quarter of 1957, or a reduction of 25 percent. The reduction is counterbalanced by the increase in the cost of plate girder steel from an average price of $0.176 per pound in the third quarter of 1956 to the peak price of $0.234 in the first quarter of 1957.

The dramatic fluctuations in the price of structural steel is indicative of the fast-changing demand for this item. Steel plates were in relatively short supply and in heavy demand during 1955, 1956, and the first half of 1957. The coupling of the two factors of short supply and heavy demand gave rise to a price spiral which reached a climax in the first quarter of 1957. In the third quarter of 1957, demand apparently fell off sharply and steel prices receded to a substantially lower level.

This article is the sixth of an annual series dealing with California bridge construction costs. The most recent article appeared in the March-April, 1957, issue.

Overall highway construction costs in California are given in the article entitled "Cost Index" on page 37 of this issue. These articles appear regularly in *California Highways and Public Works*.

Prices received for projects let to bids in January, 1958, suggest that unit prices will stabilize at somewhat lower levels than those reached in the latter part of 1957.

Cost Outlook

The foregoing analysis has taken into consideration the economic trend from the previously depressed period of 1954 to the recessive period which began in the second quarter of 1957 and which shows signs of continuing into the forthcoming year. The recession from the peak first quarter costs of 1957 appears to be mild; it is, however, somewhat clouded by a change in the pattern of allocation of project funds due to the emphasis placed upon the completion of major portions of Highway 40 in time for the 1960 Olympic Games at Squaw Valley.

Prior to the fourth quarter of 1957, the major portion of the total value of all projects was allocated to the relatively low-cost metropolitan and urban areas and only about 10 percent of the project funds were allocated to the relatively high-cost remote loca-

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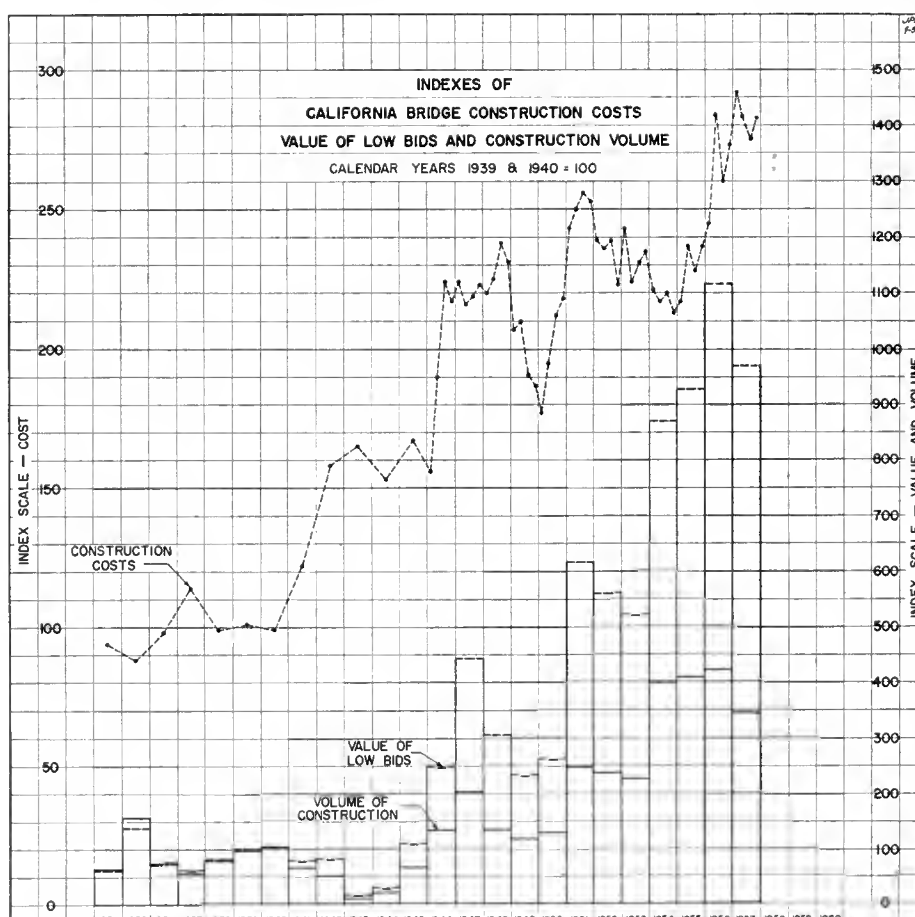


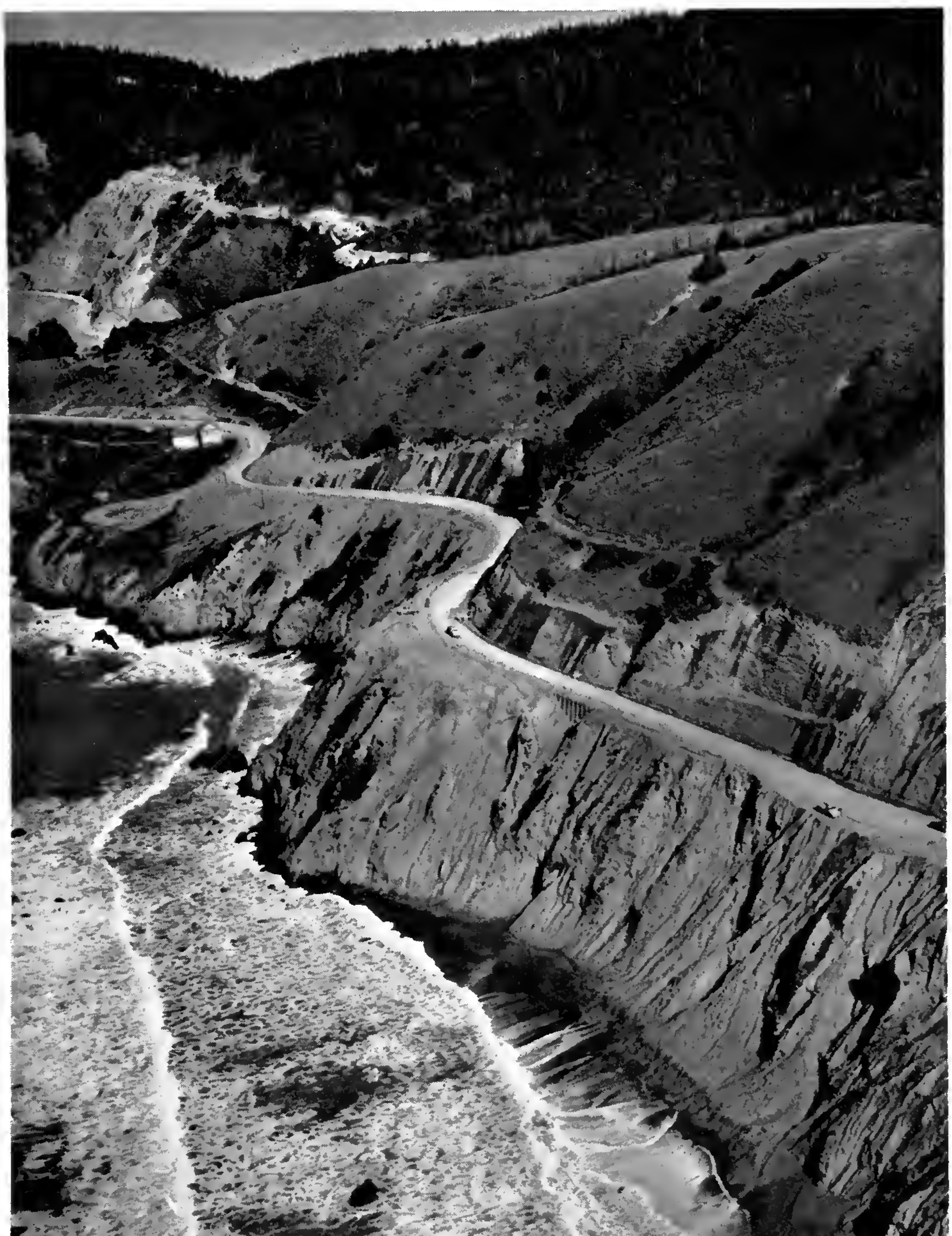
Mendocino Coast

F. A. S. Highway Project Features Large Cuts

By J. K. RICHARDSON, Mendocino County Surveyor

A RECENTLY completed federal-aid secondary highway project in Mendocino County offered several interesting sidelights and features never before encountered on F. A. S. projects in this county.

The project was located on the Westport-Leggett Valley Road, F. A. S. Route 504, now State Highway Route 56 and State Sign Route 1, between one mile south of Juan Creek and Hardy Creek, a distance of one and one-half miles, and is generally referred to as the "Juan Creek Bluffs."



This view looks north along the reconstructed portion of State Sign Route 1 between Westport and Leggett Valley in Mendocino County. The Juan Creek Bluffs are in the left background.

In the fall of 1955 steps were taken by the county to include this project in its federal-aid secondary highway construction program being conducted in co-operation with the United States Bureau of Public Roads and the California Division of Highways.

Aerial Survey Used

The route traverses the rugged and scenic coastline of Mendocino County and the terrain in this area made it particularly adaptable to aerial surveying, so on December 5, 1955, the board of supervisors entered into a contract with C. O. Greenwood, civil engineer in Sacramento, to prepare aerial maps to a scale of $1'' = 50'$ with a contour interval of five feet for a total cost of $4,400.

In January, 1956, the first work sheets were ready and on March 26th the last contour map was completed. Since this was Mendocino County's first experience in designing from aerial contour maps, the District I F. A. S. projects engineer worked closely with county personnel whenever requested.

Design work proceeded through the summer and winter of 1956, slowed somewhat by the numerous flood damage projects resulting from the "Big Storm" of 1955-56. In April, 1957, the plans and preliminary report were completed.

Many Bids Received

On May 31, 1957, the project for grading and draining was advertised by the State Department of Public Works, and on June 26th 14 bids were received. Rockport Redwood Company, the low bidder, was awarded the contract for $344,394 on July 24, 1957, and work began the following day.

This aerial view of State Sign Route 1 in Mendocino County shows the giant cuts made in the Juan Creek Bluffs as part of the reconstruction of the highway by the county under the Federal-aid Secondary Highway Program

Although the Legislature had designated this route as a state highway several years ago, it was with the condition that the State would not be required to maintain it until the road had been constructed to state highway standards. During the past few years the county completed numerous betterment projects using its own forces and equipment, and in the spring of 1957 the State Highway Commission passed a resolution requesting the Department of Public Works, Division of Highways, to assume the maintenance of this portion of State Highway Route 56, effective July 1, 1957.

Even though it was known that this route would be a state highway before the contract was awarded, the county

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Cost Index

Construction Costs Down in First Quarter of 1958

By J. P. MURPHY, Assistant State Highway Engineer
H. C. McCARTY, Office Engineer
LLOYD B. REYNOLDS, Assistant Office Engineer

THE CALIFORNIA highway construction cost index resumed the downward course started in the second quarter of 1957 after a 1957 fourth quarter interruption when a sharp rise was experienced. The index now stands at 241.8 (1940 = 100), which is 20.3 index points or 7.7 percent below the fourth quarter of 1957. It is also 35.9 index points or 12.9 percent below the alltime high established in the similar period last year.

The items of roadway excavation and Class "A" concrete (structures) were the principal items in lowering the index during this quarter. The average unit price of roadway excavation for this quarter is $0.52 per cubic yard, compared to $0.68 for the fourth quarter of 1957. The average unit price of Class "A" Concrete (structures) is $55.21 per cubic yard, compared to $59.76 for the fourth quarter of 1957.

Bidder competition during the quarter had its effect upon lowering the index figure. The average number of bidders per project stands at 9.3, while the previous quarter average stood at 8.8, with 7.0 for the same period last year. The average number of bidders per project exceeded 10 for three of the brackets. In several instances more than 20 bidders submitted proposals for individual projects during this period.

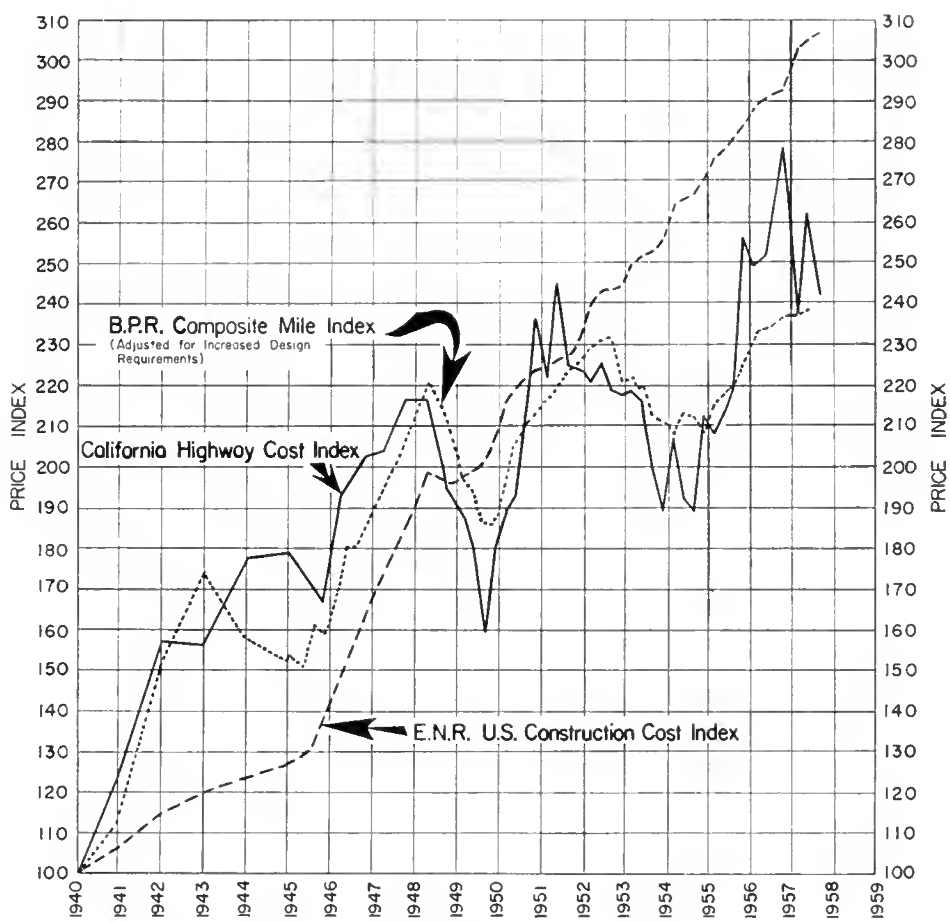
The 88 representative statewide projects for which bids were opened during this quarter and which provide the data for preparation of this quarter's index are distributed as shown in opposite columns.

The total value of the above projects is $49,776,894.

Four of the seven items used in the preparation of the index show lower average prices than the fourth quarter of 1957, two items were slightly higher and one item was equal in

PRICE INDEX
CONSTRUCTION COSTS

1940 = 100



FISCAL YEARS
(JULY 1 TO JUNE 30)

Range	Number of projects	Value of projects
Under $50,000	35—40.0%	$805,315— 1.6%
$50,000 to $100,000	15—16.9%	1,076,785— 2.2%
100,000 to 250,000	15—16.9%	2,501,832— 5.0%
250,000 to 500,000	5— 5.7%	1,933,957— 3.9%
500,000 to 1,000,000	7— 8.0%	5,520,220—11.1%
1,000,000 to 2,500,000	5— 5.7%	8,111,404—16.3%
2,500,000 to 5,000,000	3— 3.4%	10,174,644—20.4%
Over $5,000,000	3— 3.4%	19,652,737—39.5%

value. The four items with lower average prices are roadway excavation; portland cement concrete pavement; class "A" concrete, structures; and bar reinforcing steel. The two items showing an increase are untreated rock base and structural steel. The average price for asphaltic and bituminous mixes remains unchanged. The following table shows average unit prices for the items used in the preparation of the index.

Unit prices received for roadway excavation ranged from $0.21 to $0.88 per cubic yard for the major projects during the quarter. A few small projects having little effect upon the index value were bid at prices above $1 per cubic yard. The several large projects for which excavation prices under $0.50 per cubic yard were received are situated in areas subject to a minimum of traffic interference due to construction on new alignment. Two large projects situated high in the Sierra Nevada furnished prices in the 80-90-cent range, but their effect upon the quarterly average was offset by two large freeway projects in the Los Angeles area where prices below $0.50 per cubic yard were received. During the last three quarters the number of projects in progress has gradually decreased while the total contract value has remained at a high level. There is reason to believe that the winter reduction in going projects has contributed to the lowering of excavation prices because of idle equipment being immediately available for use.

NUMBER AND SIZE OF PROJECTS, TOTAL BID VALUES AND AVERAGE NUMBER OF BIDDERS
(January 1, 1958, to March 31, 1958)

Project volume	Up to $50,000	$50,000 to $100,000	$100,000 to $250,000	$250,000 to $500,000	$500,000 to $1,000,000	Over $1,000,000	All projects
Road projects							
No. of projects	33	13	13	5	6	3	73
Total value*	$720,326	$910,102	$2,130,634	$1,933,957	$4,678,699	$6,693,687	$16,967,206
Avg. No. bidders	7.5	7.5	11.1	16.2	11.0	10.3	9.1
Structure projects							
No. of projects	2	2	2			3	9
Total value*	$84,989	$166,683	$371,198			$4,684,993	$5,307,863
Avg. No. bidders	9.5	8.0	16.0			8.7	10.1
Combination projects							
No. of projects					1	5	6
Total value*					$941,621	$26,560,205	$27,501,826
Avg. No. bidders					14.0	10.2	10.8
Summary							
No. of projects	35	15	15	5	7	11	88
Total value*	$805,315	$1,076,785	$2,501,832	$1,933,957	$5,520,220	$37,938,785	$49,776,894
Avg. No. bidders	7.6	7.6	11.6	16.2	11.4	9.8	9.3

* Bid items only.

Total Average Bidders by Months

	January	February	March	Average for first quarter
1958	11.4	9.2	7.6	9.3
1957	7.1	7.3	6.7	7.0

The increase in average price for untreated rock base in this quarter amount to only $0.07 per ton.

Quantities of asphaltic and bituminous mixes required during this period are about normal and the project distribution is such that little or no change in average price was to be expected.

Bid prices for portland cement concrete pavement ranged between $12.35 and $19.36 per cubic yard. It is believed that the low bid prices for some of the projects are the result of construction on new alignment without interfering traffic and also aggregate costs favorable to low unit prices.

The average unit price for Class "A" concrete structures changed from $59.76 to $55.21 per cubic yard. This is the lowest quarterly average since the first quarter of 1956 but monthly averages determined during some of the recent months have approached

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CALIFORNIA DIVISION OF HIGHWAYS AVERAGE CONTRACT PRICES

	Roadway excavation, per cu. yd.	Untreated rock base, per ton	Plant-mixed surfacing, per ton	Asphalt concrete pavement, per ton	Asphaltic and bituminous mixes, per ton	PCC pavement, per cu. yd.	PCC structures, per cu. yd.	Bar reinforcing steel, per lb.	Structural steel, per lb.
1940	$0.22	$1.54	$2.19	$2.97	--	$7.68	$18.33	$0.040	$0.083
1941	0.26	2.31	2.84	3.18	--	7.64	23.31	0.063	0.107
1942	0.35	2.81	4.02	4.16	--	9.52	29.48	0.073	0.103
1943	0.42	2.26	3.71	4.76	--	11.48	31.76	0.059	0.080
1944	0.50	2.45	4.10	4.50	--	10.46	31.99	0.054	0.132
1945	0.51	2.42	4.20	4.88	--	10.90	37.20	0.059	0.102
1946	0.41	2.45	4.00	4.68	--	9.48	37.38	0.060	0.099
1947	0.46	2.42	4.32	5.38	--	12.38	48.44	0.080	0.138
1948	0.56	2.43	4.30	5.38	--	13.04	49.85	0.092	0.126
1949	0.49	2.67	4.67	4.64	--	12.28	48.67	0.096	0.117
1950	0.40	2.25	4.25	3.76	--	11.11	43.45	0.079	0.094
1951	0.49	2.62	4.34	5.00	--	12.21	47.22	0.102	0.169
1952	0.56	2.99	5.00	4.38	--	13.42	48.08	0.098	0.150
1953	0.51	2.14[1]	5.31	4.58	--	12.74	50.59	0.093	0.133
1954	0.46	2.13	4.50	4.86	--	14.41	48.42	0.094	0.124
1955	0.39	2.32	4.93	--	--	13.35	46.72	0.096	0.142
1st quarter 1956	0.40	2.08	5.40	5.50	--	14.05	52.51	0.105	0.166
2d quarter 1956	0.51	2.06	6.27	--	--	14.64	57.13	0.113	0.219
3d quarter 1956	0.52	2.27	6.12	--	--	15.57	56.32	0.121	0.178
4th quarter 1956	0.52	2.21	--[2]	--[2]	$5.93[2]	14.95	59.63	0.112	0.197
1st quarter 1957	0.63	2.10	--	--	5.94	17.28	61.14	0.129	0.235
2d quarter 1957	0.63	2.10	--	--	6.18	16.59	58.61	0.119	0.304
3d quarter 1957	0.42	2.34	--	--	5.10	14.34	58.68	0.130	0.200
4th quarter 1957	0.68	1.78	--	--	5.45	16.88[3]	59.76	0.129	0.177
1st quarter 1958	0.62	1.86	--	--	5.45	14.96	55.21	0.118	0.192

[1] The item of crusher run base was used before 1953.
[2] Asphalt concrete pavement combined with plant-mix surfacing in fourth quarter 1956, and will be identified as asphaltic and bituminous mixes in the future.
[3] Two projects with six-sack mix adjusted to five-sack basis.

US 101 North

Work Progress Detailed on First Unit of Redwood Bypass

By NORMAN G. LARSEN, Project Designer

In the September-October, 1957, issue of *California Highways and Public Works*, H. W. Benedict, Resident Engineer on the first unit of the Redwood Freeway on the Redwood Highway at Dyerville in Humboldt County, told the story of the problems on this rather spectacular project relative to the construction of a 480-foot-high cut.

The start of construction on this eventual 47 miles of the Redwood Freeway is the consummation of a number of studies dating back to the early thirties. The new freeway route has been adopted so as to pass through the region of the Redwood Groves with the least possible disturbance to these last remaining extensive groves of the old and stately trees.

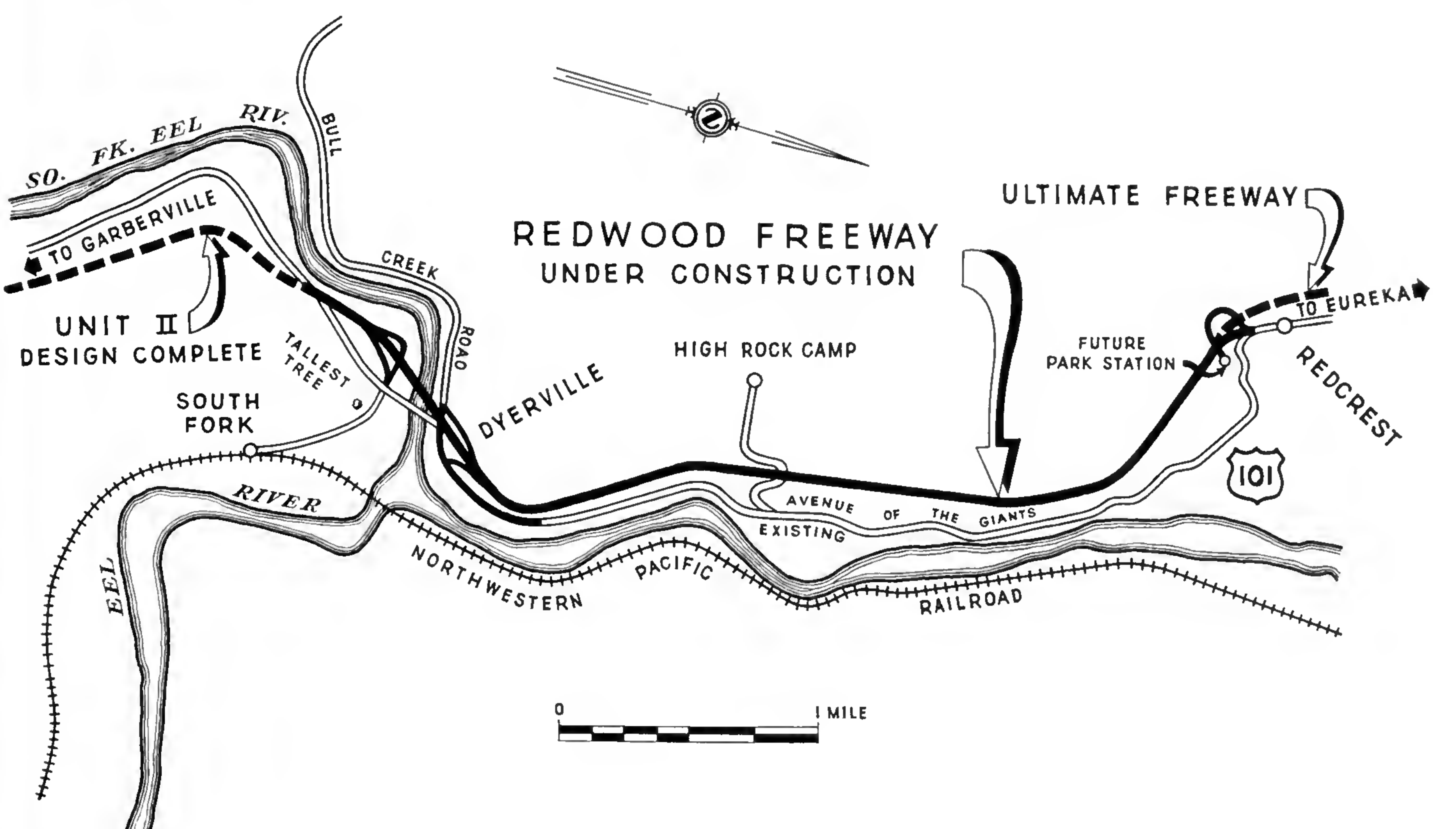
Past studies indicated the complex problems in determining routing and design details, even for the provision of a modern two-lane facility in the redwood groves area. This was amplified when the recent routing studies were undertaken on a four-lane freeway basis, and detailed design work started.

It is thought that the story of the design work will prove to be of interest to the people directly connected with highway construction and all who have traveled or will travel the Redwood Highway.

Follows Eel River

A project report providing for full freeway construction of US 101, the Redwood Highway, between the Mendocino county line and Jordan Creek, about four miles south of Scotia, in Humboldt County, was approved in January of 1956. This area includes approximately 50 miles of highway of varying degree of obsolescence as US 101 follows the meandering South Fork of the Eel River through some rugged mountain country and peaceful redwood groves.

This section of US 101 has undergone limited improvement since initial construction in the 1920's; largely because of the restricting influence of the redwood groves. It was necessary to chop away portions of some redwoods at the edges of the traveled way to provide even 18 feet of roadway during initial construction. Limited funds available for construction



The first unit of the Redwood Freeway is now under construction between one mile south of Dyerville and the Englewood Park Station. The highest cut in the history of California road building is located at the southern end of the project where the new route crosses existing US 101.

This existing bridge spanning the South Fork of the Eel River at Dyerville will become part of a future interchange. The proposed new structure is rising from the gravel bar right of the limits of this picture to cross the existing road near the left extremity of this picture. US 101 disappears into the Redwoods at the site of the Founder's Tree, tallest tree in the world. The tree cannot be detected because its neighbors are only a few feet short of the record 364 feet.

have prevented serious consideration of any major relocation projects, although, as previously stated, studies have been undertaken at various times in years past.

Immediately upon approval of the project report, the first construction unit was selected. The portion between one mile south of Dyerville and Englewood was chosen because it includes some of the least desirable combinations of alignment and grade on US 101, and bypasses some of the prime redwood groves of the world. Both the "Avenue of the Giants" and Founder's Grove, which contain the world's tallest tree, are included within the 4.4 miles of this project.

The route, as adopted by the Highway Commission on March 21, 1956, was designed to avoid the flatter terrain, the location of the redwood groves. This forced the new route to utilize the higher, less stable, partially logged-over country. A ground survey was initiated immediately, as it was recognized that the ground cover would limit the use of aerial photography in achieving the desired results in the time permitted, if a contract was to be let within a year.

Eight days after the route was approved, the entire design chain of command met with representatives of the Division of Beaches and Parks and Headquarters Design Section from Sacramento to review the preliminary survey line on the ground.

Key to Fast Design

This meeting proved to be the key to successful completion of the surveying, design, and advertising stages within one year. The first few hundred feet of preliminary line covered by the review party presented a pretty dark outlook for all concerned. The line was located on steep sidehill country where even a 1½:1 fill slope would wipe out a beautiful stand of redwood. A section designed all in cut or cribbed on one side would indeed be expensive. The party scattered and literally "took to the hills" with a "there must be a way attitude." A little pass that was completely concealed by redwoods was discovered. It afforded access to a higher, flatter, partially logged-over route. When the Beaches and Parks' representatives were assured that the line would be relocated, a co-operative atmosphere was established that prevailed throughout the design period.

This co-operation was essential, since the Division of Beaches and Parks has responsible charge of the state park lands traversed, and will develop existing US 101 as a park road for visitors to the groves.

Advance Site Maps

On May 11, 1956, an advance site map for the crossing of the south fork of the Eel River at Dyerville was submitted to the Bridge Department. The district specified only an approximate line and grade, and requested the Bridge Department to submit its desired line and grade with the preliminary report. Since long spans would obviously prove most economical, only tangent alignment free of vertical curves and super transitions was considered.

The suggested bridge line forced an "off" ramp into an unstable mountain, with prospects of creating a 700-foot-high sliver cut to obtain a suitable slope. Two retaining walls with a maximum height of 30 feet proved to be more economical than forcing the new four-lane structure to cross over the existing two-lane span. The existing span had to be retained to carry park traffic and to function as an integral part of a split diamond interchange serving communities of South Fork and Bull Creek and extensive redwood groves in the State Park System.

Big Cut Required

With the Bridge Department working on the project's major structure, district attention was focused about one-half mile southerly where existing US 101 was only a 20-foot niche in the side of a mountain reaching over 500 feet upward from the South Fork of the Eel River on a 1⅓:1 slope. The situation was further complicated because the river channel in this area was constricted to a minimum area and was bordered on the opposite bank by 300-foot redwoods. The project report anticipated a causeway type of structure along the easterly bank, but the disastrous flood of December, 1955, coupled with further analysis of the economics, resulted in the decision to take a 480-foot cut.

With river discharges and velocities, such as were demonstrated in December, 1955, an elaborate and costly drift protection system was indicated as necessary to be included in the design of any structure to protect the piers from the destructive efforts of the river, debris, and drift logs traveling at 20 m.p.h. All factors considered and a final economic analysis made, the big cut with the slide potential was favored, although these things defy exact analysis.

The cut was designed to provide a four-lane, 60-foot all-paved freeway, and a 30-foot roadbed for park and local traffic. A design slope of 1:1 with 20-foot benches at 60-foot vertical intervals, was agreed upon by all concerned. Headquarters Materials Department brought in the equipment necessary to bore 150-foot vertical exploration holes from the top and horizontal holes of the same depth from halfway down the face. An investigation of this type was considered

The South Fork of the Eel River shows none of the fury it unleashed in December, 1955, when it rose from elevation 110 feet to about 168 feet, overtopping existing US 101 in the right-hand portion of this picture. The projected cut failed to "catch" short of the top at elevation 650 feet.

Equipment at work on the Big Cut. Steepness of the slope made it necessary to draw equipment to the top by the use of steel cable and winches.

necessary to determine the bedding planes and slide potential of the proposed cut. Although the 1,400,000 cubic yards of excavation involved may not be a record, it is understood that the height of 480 feet is a record for California highway construction.

Cut Material Used

Once the decision to take the cut was made, the problem of what to do with 1,400,000 cubic yards of material was solved by using half to construct a fill with grade line above the high water of the '55 flood along the east bank of the South Fork channel northerly of the "Big Cut." Here the channel is wide enough to permit this type of construction and still leave sufficient waterway for the maximum anticipated discharge. The remainder was designed to be hauled across the South Fork to be used as fill for the freeway proper, two ramps, and the park road, which are adjacent to the westerly bank of the formidable Eel River. Needless to say, considerable bank protection was involved in this "man versus rivers" phase of the project. Combinations of heavy stone riprap, grouted rock, slope paving, and timber pile jetties were designed to protect new fills and turn back the rivers at points of impingement.

Remainder Is Routine

When the problems of the South Fork-Main Eel River confluence area were solved to the mutual satisfaction of Highways and Parks representatives, the rest of the job settled down to concentrated effort on the part of the Materials Department to complete its report. A design crew worked as much as 12 hours a day completing the $1'' = 50'$ contour maps and preparing sufficient projections to allow for all of the anticipated difficulties the materials report might point out. In spots that were recognized as "trouble" on numerous field expeditions, as many as three lines were carried through the calculation stage and held ready for use.

When the materials report was submitted on October 8th, it indicated that what the "oldtimers" say is probably true: "Where you find the redwoods, you find water, lots of it." The proposed 140-foot centerline fill near the center of the project was approved without a hitch, but the

. . . Continued on page 47

Letter Explains Britain's Highway Program

Traffic on the Great North Road through Stamford

BRITISH ROAD FEDERATION
LIMITED
26 Manchester Square, London W1

Editor, *California Highways and Public Works*

SIR: In your excellent publication, which you very kindly send us, I was intrigued to see the illustration on page 61 in the current issue of the "Great" North Road where it passes through Stamford in Lincolnshire. The situation depicted is as it is today except that the street stalls are only there on market days, not that it could make the position much worse if they were there every day!

In view of your interest I thought you might like to have the enclosed photograph [reproduced herewith—*Ed.*] of Stamford to add to your collection. This is the town which has a notice on the highway when you approach from either direction which reads "This Is Stamford—Stay Awhile Amidst Its Ancient Charm." It is somewhat superfluous as you frequently have no choice!

However, I would not like you and your readers to form the impression that nothing is being done to provide proper highways.

The government has a road programme under which road schemes which will cost some $1.2 billion (£430 million) will be authorized by 1962. Included in the projects will be about 415 miles of freeways.

Further, there are a number of major cross river schemes including a suspension bridge with a span of 3,300 feet across the Firth of Forth, tunnels under the Rivers Thames, Clyde and Tyne. In addition to these works a great number of others are to be carried out throughout the whole country in the form of bypasses, removal of bottlenecks, grade separations and improvement generally.

I would like you to know that I look forward to receiving your publication. I make a practice of showing the breathtaking, to me, illustrations of your road schemes whenever an appropriate occasion arises. What impresses me is the objective way in which you tackle your problems and the results which follow from this approach. I can only say I am green with envy.

Yours sincerely,

M. FRANCIS

MENDOCINO COAST

Continued from page 36 . . .

agreed that it would perform the construction engineering under state supervision.

Traffic Problems

The big problem facing the contractor was maintaining traffic through that portion of the job between Juan and Hardy Creeks, where within a distance of 3,000 feet it was necessary to excavate 700,000 cubic yards of earth and rock or about 79 percent of the project total. The depth of the cuts in this area ranged up to 326 feet with six benches running a length of approximately 1,000 feet. The contractor solved this problem by reconstructing the original county road over the top of the bluff area, into an acceptable detour.

With the traffic problem thus solved, the contractor put eight huge tractors on the benched area and soon had this difficult section down to grade.

No detour was available for the remainder of the project and the contractor was required to maintain a published schedule of openings for the convenience of the traveling public.

Rapid Completion

The contract was completed in 77 working days (60 percent of the allotted time) and accepted by the Director of Public Works on November 27, 1957.

Of the $395,262.91 total payment to the contractor, $347,310.60 was for 890,540 yards of roadway excavation at $0.39 per yard. This final pay quantity was based on cross sections taken by county personnel while slope-staking the project prior to the start of work.

Contractor's personnel on the project were Jack Douglass, General Superintendent, Construction Division, Rockport Redwood Company; Frank Gibbs, Project Superintendent; assisted by Ray Wallace and Dick Gunningham, Grading Foremen.

The county was represented by W. B. Severance, Road Commissioner; J. K. Richardson, County Surveyor, and D. M. Yttreness, Resident Engineer, working in close co-operation with Sam Helwer, District Engineer, and B. D. Van Zandt, District F. A. S. Engineer. Close co-operation between all personnel involved allowed the job to progress smoothly to a satisfactory completion.

Not only has this been Mendocino County's first job designed from aerial photography, it is also its largest F. A. S. project to date. Since the inception of the program following the end of World War II, Mendocino County has completed over $2,000,000 worth of federal-aid secondary projects, and preliminary work is under way on two more estimated to cost in the vicinity of $700,000.

NEW BRIDGE RECORD

The record for a single day's traffic on the San Francisco-Oakland Bay Bridge now is 113,433.

The new traffic total was reached on Friday, May 2d, exceeding the previous high by nearly 1,000 vehicles. The old record was 112,575, set on the day after Thanksgiving last year.

No difficulty in handling the record traffic load was reported to the State Department of Public Works.

A. A. Lernhart Ends Long State Service

Albert A. Lernhart, veteran Bridge Department engineer, retired on April 30, 1958, after almost 35 years state service. He was one of the few employees remaining of the 24 in the "expanded Bridge Department of 1924.


ALBERT A. LERNHART

Lernhart was born in Virginia City, Nevada, in 1897, raised in Napa, California, studied civil engineering at Stanford University and served in the U. S. Navy during World War I. After release from the service he was a bridge design draftsman and a highway construction inspector in the Napa County Road Department for over three years. Next there followed employment with several private firms and the U. S. Bureau of Public Roads as estimator and surveyor. He went to work for District III of the California Division of Highways as a draftsman on October 16, 1923.

Lernhart transferred to the Bridge Department in Sacramento on March 4, 1924, when the Bridge Department was authorized to supervise construction as well as to design state highway bridges. This accounted for the "big" expansion to a total of 24 employees.

Lernhart worked alternately as a bridge designer and resident engineer on bridge construction projects in Northern California. He was one of the original bridge resident engineers assigned to construction projects. The Van Duzen River concrete arch bridge on the Redwood Highway and the Feather River steel arch span at Pulga were two of the major structures built under his supervision.

He has been with the Bridge Maintenance Section as an associate bridge engineer since that unit was formed in 1934.

Lernhart has maintained his home in Napa and will retire there with his wife where he will now be able to devote more time to his ranch. He is an ardent trout fisherman and deer hunter.

COST INDEX

Continued from page 38 . . .

the current figure. Several large projects on new alignment free from traffic interference affected the lowered cost of this item. It is possible that lower aggregate costs have contributed to the reduction in average prices. The replacement of timber falsework by tubular steel, together with construction of forms permitting repeated use, is contributing to the trend toward lower structure concrete prices.

The decrease of $0.011 per pound for bar reinforcing steel in this quarter is the direct result of one project requiring an extremely large quantity of reinforcement at a bid price of $0.106 per pound. Otherwise an increase in average price would have occurred in this period.

The upward change of $0.015 per pound in the average price for structural steel during this quarter results from requirements being to a great extent confined to isolated regions.

The California Highway Construction Cost Index may continue its downward trend into the next quarter but increased seasonal construction activity and the basic controls of labor and material costs make it doubtful that the trend would continue throughout the second quarter. On the contrary a moderate increase in the cost index would be anticipated.

The California Highway Construction Cost Index, the Engineering News-Record Construction Cost Index, and the United States Bureau of Public Roads Composite Mile Index, all reduced to the base 1940 = 100, are shown on the accompanying graph. The latter two indexes are based on nationwide construction costs.

The Engineering News-Record Cost Index, which now stands at 307.4, again shows a rise over the fourth quarter of 1957. It is up 2.6 index points or 0.9 percent from the fourth quarter.

The Bureau of Public Roads Composite Mile Index for the fourth quarter of 1957 at the level of 238.3, which is the latest available, was up 1.0 index point or 0.42 percent over the third quarter of 1957.

THE CALIFORNIA HIGHWAY CONSTRUCTION COST INDEX

Year	Cost index
1940	100.0
1941	125.0
1942	157.5
1943	156.4
1944	177.8
1945	179.5
1946	179.7
1947	203.3
1948	216.6
1949	190.7
1950	181.2
(1st quarter 1950—160.6)	
1951	225.0
(4th quarter 1951—245.4)	
1952	225.9
1953	215.2
1954	193.5
(2d quarter 1954—189.0)	
1955 (1st quarter)	189.3
1955 (2d quarter)	212.4
1955 (3d quarter)	208.6
1955 (4th quarter)	212.6
1956 (1st quarter)	219.5
1956 (2d quarter)	255.9
1956 (3d quarter)	249.1
1956 (4th quarter)	252.1
1957 (1st quarter)	277.7
1957 (2d quarter)	266.9
1957 (3d quarter)	237.5
1957 (4th quarter)	262.1
1958 (1st quarter)	241.8

OUR ERROR; WE'RE SORRY

BEVERLY HILLS, CALIFORNIA

Editor, California Highways and Public Works

SIR: We would like to congratulate you upon the fine color photograph on the back cover of your January-February, 1958, edition. The fine warm colors and sharpness of the reproduction certainly capture the feeling of the high California desert.

However, we would like to remark that the description is slightly in error. The photo was taken in the heart of Apple Valley, 15 miles distant from the Lucerne Valley.

As representatives of Apple Valley we would appreciate anything you could do to clarify this inaccurate caption.

Sincerely,

SHERMAN MULLE

P. T. Poage Concludes Long Career With State

P. T. Poage, whose third of a century as Assistant State Architect saw state building construction under his charge mount to a total of $1,000,000,000, will retire this summer.

His decision to retire effective August 1st was announced today by C. M. Gilliss, State Director of Public Works.

P. T. POAGE

Poage has worked in the Division of Architecture of the State Department of Public Works for 36 years. After his first four years in architectural designing positions, he became Assistant State Architect in charge of design and planning, a title he has retained since 1926.

Gilliss said that Poage "during his years supervising California's building program, developed better and less expensive ways of building the State's different correctional and mental institutions, office facilities, colleges, and fairs, as well as lesser works."

Poage was also credited by Gilliss with "a big share in establishing the techniques California now uses in determining the scope of building projects, in programing space requirements, and in controlling costs of planning and building."

Projects which make up the billion-dollar total Poage has supervised have ranged from building a bleacher for an athletic field to developing a $20,000,000 new plant for a state institution.

Poage was born in Bolivar, Missouri, January 28, 1896, and came to California in 1907. He received his bachelor of arts degree in architecture at the University of California at Berkeley in 1918.

After a short period in the Army, he did architectural work in Oakland, San Francisco, and Hawaii before joining the State's Division of Architecture.

Poage was married to Marguerite Bennett in Berkeley in 1923. They have a daughter, Mrs. Ellen Doermer of Sacramento, and a son, Bennett Poage, who is associated with a Sacramento paving and grading firm.

After retirement, Poage plans to move his home from Sacramento to an oceanside area near Fort Bragg. He plans then to add geology and oceanography to his hobby interests, which now include old clocks, furniture, branding irons, early churches, books, and people.

Poage's fellow employees will honor him at a farewell dinner June 4th in the Empire Room of the Hotel Senator. He will leave his desk June 6th for nearly two months' terminal leave.

No successor to Poage has been named.

TWENTY-FIVE-YEAR AWARDS

Employees who received twenty-five-year awards since those listed in the November-December, 1957, issue of California Highways and Public Works.

District I
Mills, Odell

District II
Cardoza, Wallace P.
Delano, Edward R.
Gould, Cyril B.
Huck, Ray

District III
Davis, Elbert B.
Haskell, Arthur S.

District IV
Cowgill, Paul
Dale, Roy H.
Evans, Sylvester
Freitas, Reuben E.
Hartley, Dave
MacKenzie, Hugh F.
Pimentel, George
Russell, Wilfred W.
Sinclair, Joseph P.

District V
Perdew, Harlan
Permasse, Jean M.

District VI
Stewart, Joseph M.
Stewart, Walter P.

District VII
Beebe, John Edward, Sr.
Hileman, Joe B.
Kleinhen, Russell
Lander, Guy A.
May, Howard D.
Nauslar, Jack L.
Oberg, Donald
Robinson, Van D.
Royal, Harry

District IX
Compton, W. Earl
Fischer, Merle E.
Goforth, P. A.
McGee, James W.

District X
Atherstone, Harold E.
Barrett, Clifford
Fairbanks, Earl L.
Greenwood, Clinton D.
Picollo, Ernest J.
Sola, James T.
Stewart, Donald M., Jr.
Treganza, Gage

District XI
Elder, Dick
Parker, James N.
Portis, Laurin

Bridge Department
Kay, Alton F.
Woodridge, C. J.

Headquarters Shop
Cardona, Thomas S.
Peck, Emory Earl
Todd, Clarence T.

Shop 3
Clifton, Eugene R.

Shop 7
Tracy, Charles W.

Nearly 27 percent of United States drivers involved in 1957 traffic fatalities were under 25 years of age.

Federal Aid

Moneys From New 1958 Act Put to Work Without Delay

SIXTEEN highway projects estimated to cost a total of more than $20,000,000, all of them scheduled for an early start and for completion within 18 months, have been added to the 1958-59 State Highway Budget by the California Highway Commission at its April meeting.

Financing of the new jobs came chiefly from the additional money provided in the recently enacted Federal Highway Act of 1958 and partly from savings on recent projects where contractors' bids ran below budget estimates, according to Director of Public Works C. M. Gilliss, chairman of the commission.

The new federal law included additional 1958-59 apportionments to California of $11,600,000 for interstate system highways and $21,900,000 for other federal aid highways. This amounted to an increase of about 10 percent in the State's highway construction budget.

Gilliss said the additional interstate funds would be used for acquisition of additional rights-of-way in preparation for a further augmentation of interstate construction in the 1959-60 Fiscal Year as also provided for in the 1958 federal measure.

The $21,900,000 earmarked for immediate construction on other federal aid routes included approximately $4,500,000 for eligible projects on county federal aid secondary roads. The commission combined the remainder of this added federal apportionment with available state funds to add the 16 projects to the 1958-59 budget.

The principal criterion which the newly budgeted projects had to meet was that they be under contract by December 1, 1958, and completed by December 1, 1959. This requirement was contained in the "antirecession" features of the 1958 federal act, which provided special financing arrangements for such projects.

"In other words," Gilliss said, "on these jobs the plans and specifications are ready to go and the right-of-way has been acquired and cleared, so that they can be advertised for bids very soon. We expect all these projects to be under contract this summer. Also, this means that motorists will be using these new sections of highway or other improvements within the next 18 months."

The new projects in the 1958-59 budget and their estimated costs are as follows:

COLUSA COUNTY, State Sign Route 20, between five miles west of Williams and U. S. 99W in Williams, grade, surface and structures (widening), 5.9 miles, $400,000.

CONTRA COSTA COUNTY, State Sign Route 24, Orinda Road to Sunnybrook Drive, grade, pave and structures for six-lane freeway, 2.1 miles, $4,000,000. (Completion of this project will mean continuous full freeway from Orinda to north of Walnut Creek).

ORANGE COUNTY, State Sign Route 14 (Riverside Freeway), from 0.4 mile west of Spadra Road to 0.2 mile east of Placentia Avenue, grade, pave, and structures for four-lane freeway, 2.7 miles, $3,300,000. (This project will connect with previously constructed expressway on the east and current freeway construction on the west.)

ORANGE COUNTY, U. S. 91-State Sign Route 18 (Lincoln Avenue), from State Sign Route 39 (Stanton Avenue) to the Santa Ana Freeway, grade, pave and structures for four-lane divided highway, 3.4 miles, $900,000.

SACRAMENTO COUNTY, U. S. 50-99, from 1.8 miles south of the Cosumnes River to two miles south of Elk Grove Road, grade, pave and structures to reconstruct the southbond lanes of a four-lane freeway, 5.6 miles, $1,100,000.

SACRAMENTO COUNTY, State Sign Route 12, from junction of State Sign Route 24 at east end of Rio Vista Bridge to the Mokelumne River, grade and surface for relocation across Andrus Island, 5.5 miles, $1,000,000.

SAN BENITO COUNTY, US 101 and State Sign Route 156, from 0.5 mile south of Little Merrill Road to 0.3 mile south of Anzar Road, grade, surface and structures to provide interchange at San Juan Bautista Intersection plus related work, 2.5 miles, $425,000.

SAN BERNARDINO COUNTY, State Sign Route 71, from Junction of Route 192 (Euclid Avenue) to Merrill Avenue (near Chino), grade, pave and structures for initial two lanes of future four-lane freeway, 5.3 miles, $1,100,000.

SAN DIEGO COUNTY, State Sign Route 94, 0.1 mile west of 56th Street to College Avenue, revise freeway ramps, $95,000.

SAN JOAQUIN COUNTY, US 99, between 0.2 mile south of Mariposa Road and 0.2 mile north of Farmington Road (portions), three interchange structures to convert southerly portion of Stockton Bypass from expressway to full freeway, 0.9 mile, $1,000,000.

SAN LUIS OBISPO COUNTY, State Sign Route 41, two continuous projects extending from two miles east of Estrella River to 0.4 mile west of Lucy Brown Road and from there to Palo Prieto Road, grade and surface for initial two lanes of future four-lane expressway, 11.2 miles, $1,850,000.

SAN LUIS OBISPO COUNTY, US 466, from Junction of State Sign Route 41 to Kern county line, grade and surface for initial two lanes of future four-lane expressway, six miles, $1,100,000.

SANTA BARBARA COUNTY, US 101, from Ortega Hill to Miramar Avenue in Montecito and from Park Place to Salsipuedes Overhead in Santa Barbara, grade, pave and structures to convert four-lane highway and four-lane expressway sections to full freeway, 2.5 miles, $1,340,000.

SANTA BARBARA COUNTY, State Sign Route 1, from 1.8 miles north of Ytias Creek to Jalama Road (south of Lompoc), grade and surface (realignment), 2.9 miles, $1,080,000.

SHASTA COUNTY, US 299, between 0.2 mile east of Hillcrest and three miles west of Burney (portions), grade and surface for initial two lanes of future four-lane expressway (completes realignment over Hatchet Mountain), 5.3 miles, $1,450,000.

The Division of Highways reports that the regular traffic counts for April, 1958, show a decrease of 5.9 percent under April, 1957, and an increase of 3.4 percent over March, 1958. Comparing April, 1958, with April, 1957, passenger vehicles show a decrease of 6.9 percent and freight vehicles show a decrease of 0.6 percent. Freight vehicles represented 17.3 percent of the total weekday traffic.

Vaughn O. Sheff

DEATH TOOK Vaughn O. Sheff, highway superintendent, March 31, 1958, as he and a state highway maintenance crew worked around the clock to clear a slide at Santa Monica Canyon and US 101 - Alternate. Sheff was caught in one of the landslides.

A scholarship in memory of Sheff has been established at Los Angeles State College by Highway Chapter 101 of the California State Employees' Association. The Sheff Memorial Scholarship will be awarded to students in engineering and business administration who meet requirements established by Chapter 101 and the scholarship and loan committee of Los Angeles State College.

Sheff was born in Cloquet, Minnesota, August 18, 1900, and educated in the Cloquet public schools.

He served with the 1st U. S. Engineers during World War I with the Army of Occupation in Germany.

Sheff went to the State Division of Highways February 1, 1929, from the Los Angeles County Flood Control District.

His experience with the Maintenance Department started in February, 1948, when he was assigned as assistant to E. A. Penrose, superintendent of the Venice maintenance territory. Sheff worked as his assistant until December, 1952, when he transferred to District I in Eureka as maintenance superintendent. He remained in District I for approximately five months, at which time he returned to District VII to succeed Penrose. He was considered one of the outstanding superintendents in District VII, the only one holding a California license as civil engineer.

He is survived by his wife, Ruby, who lives at 3655 Colonial Street, Venice; a stepdaughter, Mrs. Opal Pink; two grandsons, Robert and Gary; and five sisters and four brothers.

Passenger cars were involved in over 78 percent of all United States traffic fatalities in 1957, and in 86 percent of traffic injuries.

Pioneer State Highway Economist Retires

KENNETH A. MACLACHLAN, highway economist and a pioneer in the adaptation of tabulating and computing machines for highway engineering purposes, retired on May 1, 1958, after 28 years of service with the Division of Highways.

KENNETH A. MacLACHLAN

MacLachlan was born in New Haven, Connecticut, and obtained his education in England and at the University of California, graduating with a B.S. degree in 1921. He served with the Navy in World War I and then with the U. S. Bureau of Public Roads.

Early in his state career MacLachlan was one of the group who formulated a definite highway signing policy as the first step toward California's present well-defined system of warning, regulatory, and directional signs.

Soon afterward he was assigned supervision over the California Highway Transportation Survey of 1934. He was instrumental in initiating the use of punched card equipment for tabulating and analyzing the vast amount of information produced by the survey. The Division of Highways' order for supplying and later processing 6,000,000 cards was the largest single order of its kind placed up to that time with the leading business machine concern involved.

In 1936 MacLachlan was given responsibility for organizing the California Highway Planning Survey, at that time under the direction of Maintenance Engineer T. H. Dennis. He continued as a member of the planning survey staff, now a part of the Planning Department, until his retirement.

Under his supervision the Division of Highways was the first agency of its kind to use punched card equipment to analyze highway accidents and detect problem locations; to use the co-ordinate system of analysis for traffic data; to depict the results of origin and destination surveys in the form of "trip desire line" contours; and to adapt gyroscopic equipment for highway survey purposes by means of a specially equipped vehicle.

MacLachlan is a member of the American Statistical Association, Henry Morris Stephens Lodge of the Masons, and the Institute of Traffic Engineers; and has been a member of the Highway Research Board committees on Origin and Destination Studies and on Speed Studies in Urban Areas.

He and his wife, Florence, will continue to live at their home in Sacramento.

US 101 NORTH

Continued from page 42 . . .

stabilization work for the project was going to cost in the neighborhood of $600,000. That is quite a neighborhood, even for a project in District I where plenty of water falls, and most of it collects below ground to plague highway engineers.

Unusual Project

The rest is history now. Design under the general supervision of Mr. Alan S. Hart, then District Engineer of District I, was completed on schedule and forwarded to Headquarters in early December. When the bids were opened, it was obvious that contractors had a million dollars more respect for the project than anticipated. Coupled with another "unusually tough" job on US 40, the cost index got quite a jolt when a contract was awarded to the Guy F. Atkinson Co. for an estimated final cost of $6,800,000.

Since then, a man has died hauling material down off the "Big Cut," and one construction season has changed the face of the country considerably. It has been demonstrated that, with a lot of co-operation, there is a way to move mountains, rivers, and some of the redwoods to provide a full freeway through some of the most scenic country in the world, and still preserve the natural beauty of the redwood groves.

Fifty-three thousand Americans were injured in car-bicycle mishaps in 1957.

Freeman C. Witt

Freeman C. Witt, Highway Superintendent for the State Division of Highways in Imperial County for the past 17 years, died March 19 following a serious illness.

Witt, who was born in Poway, California, November 11, 1890, moved to Escondido when he was 15 years old. Subsequent to his graduation from the University of California and while in business as a civil engineer, he was quite active in civic affairs, serving as a member of the city council and as mayor of Escondido.

Witt first became associated with the State Division of Highways in 1935 and had been continuously in the State's employ in Escondido and the Imperial Valley. Witt was a registered engineer as well as a licensed surveyor in the State of California.

Survivors include his widow, Frances; a son and daughter, Eugene and Margaret; a brother, Mark; and six grandchildren.

CALIFORNIA BRIDGES

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tions. This pattern was changed in the fourth quarter of 1957, however, when between 20 and 25 percent of the total value of bridge projects was allocated to the high-cost areas of Highway 40. This shift to the high-cost areas raised the normal level of bridge costs by a small but indeterminate amount. A more reasonable estimate of the reduction of costs from the first to the fourth quarter of 1957 is therefore probably closer to 6 percent rather than to the 4 percent given by the indexes.

Bids received in January, 1958, indicate that the recessive trend is continuing into 1958. Bidders per job are running at an average of 10-12 and unit prices for bridge items are generally lower than were those during most periods of the past three years.

The ultimate trend of costs for the coming year, however, is obscured by the uncertainties which exist on the national level. The current trend for business in general is downward and it is reasonable to assume that this trend will be maintained during at least the first half of 1958. The actions of Congress during the present session will undoubtedly bear heavily on the degree and duration of the current recession but since some time will be required before legislative enactments take effect, it is likely that the current trend will continue into the third quarter and then return to some as yet unpredictable level. In the interval, however, the State of California may realize a substantial saving in bridge construction costs.

Toll Authority Orders South Crossing Report

An informational report on all San Francisco Bay Southern Crossing studies to date was ordered by the California Toll Bridge Authority at its April 30th meeting in Sacramento.

The State Department of Public Works will make the report public as soon as it is completed, Public Works Director C. M. Gilliss told the authority, "* * * so that when the authority meets again on this subject we'll have the benefit of advice of an informed citizenry."

The report will form a basis for further studies which the authority is expected to order after late July, when survey funds voted by the special session of the Legislature become available.

Gilliss explained that the informational report will "bring together the essentials of all the studies made on possible crossings south of the present San Francisco-Oakland Bay Bridge, so that the authority may know which direction to go later for further study."

A companion report, giving details of the status of financing of all of the authority's bay bridges, will be made to the authority by the Department of Public Works.

The department also was asked by the authority to comment, in its report, on the request of the San Francisco Bay Area Rapid Transit District that the authority give first consideration to an underwater tube near the Bay Bridge in determining the nature and location of the next crossing to be built.

C. W. W. Abbott

Clinton W. W. Abbott, Associate Bridge Engineer who had served nearly 20 years in the Division of Highways, died on March 17th, in Sacramento.

Abbott began his state service as an engineering aide with Division of Highways in District IX at Bishop in 1937. After a few months in Bishop he moved to the Bay Bridge where he served as chief of party laying out control points for the intricate East Bay structures.

In April, 1938, he was transferred to the Bridge Department in Sacramento where he served as a surveyor in the preliminary surveys. In 1954 he transferred to the Bridge Research Section where he was working at the time of his death.

He was born in Washington, D. C., in 1905, and lived in South Dakota during his early years. Later he moved to Hollywood, California, where he attended high school. He studied civil engineering at Oregon State College.

He began his engineering career as a surveyor with the City of Los Angeles on powerline surveys in Owens Valley. He was active in the Sacramento Camp Fire Girls as a board member and chairman of the camp committee, the Sacramento Photographers Club, Sacramento Junior Museum, and folk dancing clubs for a number of years. He was a member of the American Society of Civil Engineers, American Geophysical Union, American Congress of Surveyors and Mappers, and a registered civil engineer.

He is survived by his wife, Nancy, of Sacramento, two daughters, Virginia Todd and Jo, a brother, John G. Abbott of San Leandro, and a sister, Kay Barnett of Los Angeles.

Weekends are the most dangerous time to be on United States highways. In 1957, more than 55 percent of all fatalities occurred on Fridays, Saturdays, and Sundays.

During 1957, there were 1,300 fewer highway traffic fatalities than in the previous year.

GOODWIN J. KNIGHT
Governor of California

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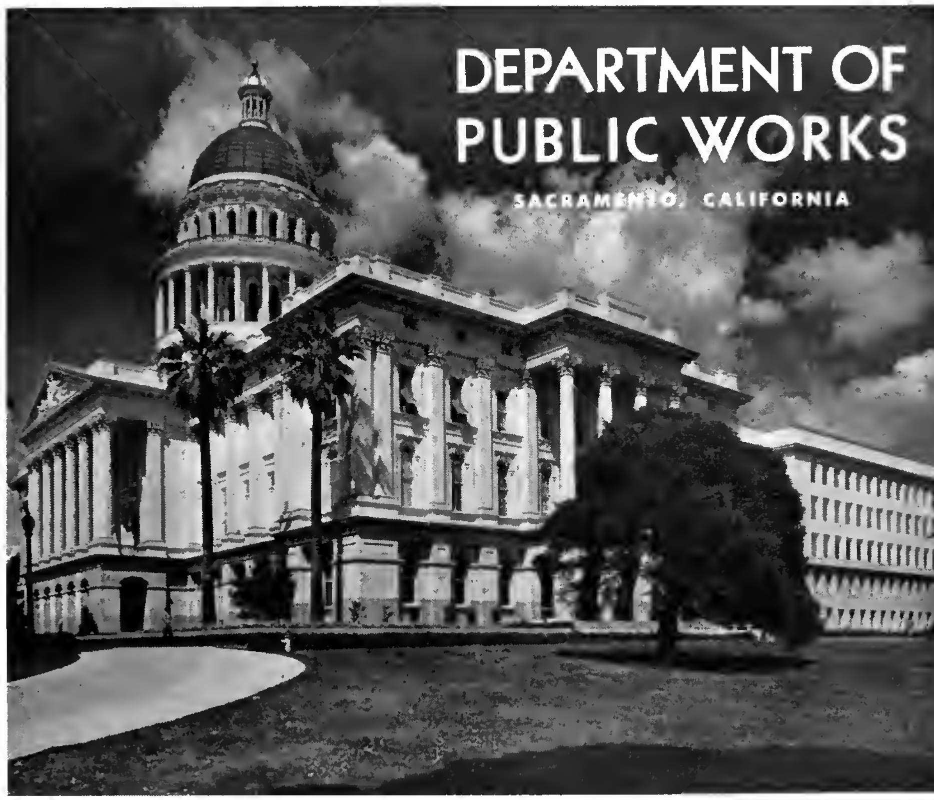

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printed in CALIFORNIA STATE PRINTING OFFICE 75050 5-58 53M

California Highways and Public Works
DIVISION OF HIGHWAYS
P. O. Box 1499
SACRAMENTO, CALIFORNIA

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CALIFORNIA
HIGHWAYS AND PUBLIC WORKS

California Highways and Public Works

Official Journal of the Division of Highways, Department of Public Works, State of California

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Vol. 37 July-August, 1958 Nos. 7-8

FRONT COVER

Broom in bloom. State Route 93 winds its way through patches of this colorful and prolific import from Scotland. This scene near Georgetown is typical of a wide area of the Sierra foothills in the spring.

—Photo by Bill Ruland

BACK COVER

The Mother Lode Highway (State Route 49) crosses the Stanislaus River over this bridge located at the Calaveras-Tuolumne county line between Sonora and Angels Camp.

—Photo by Robert Rose

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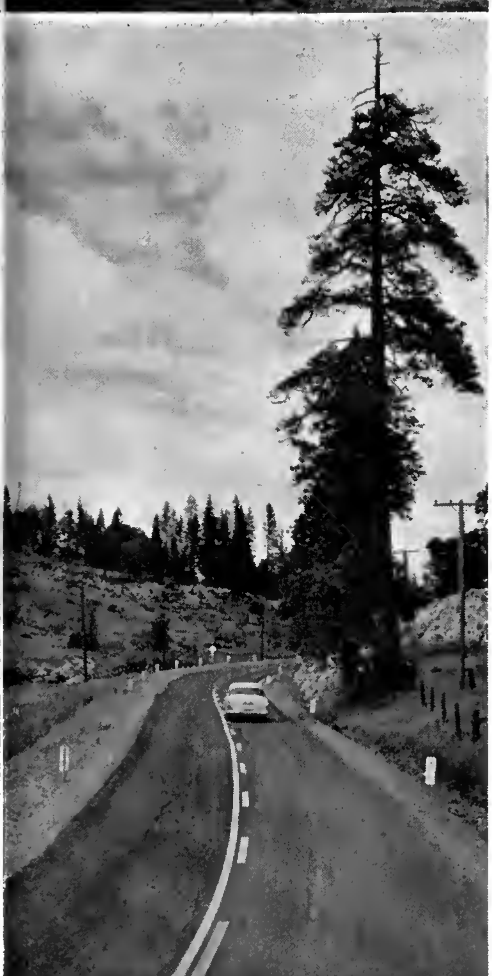

Report From District III

By ALAN S. HART
District Engineer

District III is composed of 11 counties (Butte, Colusa, El Dorado, Glenn, Nevada, Placer, Sacramento, Sierra, Sutter, Yolo, and Yuba) lying in the northern portion of the Great Valley of California and in the Sierra Nevada region north and south of Lake Tahoe. It contains 12,688 square miles which is serviced by 1,374 miles of state highways.

The district is faced with every type of planning and construction problem, except a desert, found anywhere in the State. It contains metropolitan areas and small villages, rugged mountains and marshy lowlands, regions of extreme cold and regions of subtropical climate, large rivers (the largest in the State) and dry washes (that can become raging torrents in a matter of hours), and, above all, it has demands for increased highway capacity on its highways, caused by an unprecedented population growth in the past decade.

Major Routes Listed

The state highway network provides two major north-south routes and three east-west routes that cross the Sierra Nevada Mountains within the district. A fourth such trans-Sierran route passes through the district and crosses the mountain chain just to the north in District II. One north-south and one east-west route have been designated as a part of the Federal Interstate Highway System. A short section of a second north-south interstate route is also within the district.

The main north-south interstate route in the district enters the district at the Sacramento-San Joaquin county line and proceeds northward through Sacramento to Woodland and then generally parallels the present Highway US 99W until it leaves the district at the Glenn-Tehama county line. The second north-south interstate route referred to connects the east-west interstate route near Vacaville with the north-south interstate route near Dunnigan. This connection is to provide a more direct connection for traffic between the Bay area and the Pacific Northwest.

UPPER—The Camino Bypass on US 50 in El Dorado County. LOWER—State Route 93 in the vicinity of Georgetown, El Dorado County.

Planning for the improvement of the many miles of highway in the district, many of which will never be graced with the title of freeway, is progressing satisfactorily. However, major emphasis in planning matters is being directed to the two interstate routes.

US 40 Progress

Primary emphasis has been placed in the past year, and is still being placed, on the east-west interstate route, Highway US 40. This highway enters the district at the Sacramento-Solano county line and leaves the district in Sierra County on the eastern slope of the Sierra Nevada Mountains at the Nevada state line. In addition to being an integral part of the Interstate Highway System, this route will also be required to service the many thousands of motorists that plan to attend the 1960 Winter Olympic Games to be held in Squaw Valley, near Truckee. Every effort is being made, with financing available, to convert as many miles of this highway as possible to a four-lane freeway prior to February, 1960. It is realized that all of the route

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Public Works Building
Twelfth and N Streets
Sacramento

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REPORT FROM DISTRICT III

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cannot be completed by this time and that gaps will exist from one-half mile west of Monte Vista to Hampshire Rocks and from Soda Springs to the east end of Donner Lake. All projects—there are nine of them now under construction or advertised for bid during the 1958 construction season—will be placed in service prior to the games.

Contracts presently under construction, or offered for bid, and certain of completion before the end of the 1959 construction season, will provide 61 miles of uninterrupted four-lane divided highway (most of it to freeway standards) from Sacramento to one-half mile west of Monte Vista. The major gaps in the route occur in the next 40 miles where only six miles of freeway is currently under construction (Hampshire Rocks to Soda Springs). Twenty-one continuous miles of four-lane freeway will be available from the east end of Donner Lake to the Nevada state line with the completion of the contracts now under way. These nine contracts with the addition of the construction of two major detours, call for the expenditure of approximately $48,500,000.

Freeway Completed

Four of the nine contracts will be completed this construction season. Two of these were opened to traffic on June 24, 1957, and were the first full freeways to be completed in Northern California under the Federal Highway Act of 1956. One is the 3.6-mile section from one mile east of Newcastle to Elm Avenue in Auburn. The road was opened to traffic with appropriate ceremonies under the sponsorship of the Auburn Area Chamber of Commerce. Baldwin Contracting Company and H. Earl Parker, Incorporated, of Marysville were the joint contractors on the project which cost approximately $2,570,000.

The second contract completed on this date was a 6.1-mile section from Heather Glen to Colfax. The Colfax Chamber of Commerce held a dedicatory ceremony for the opening of this section the afternoon of June 24th. Portions of this section were already being used by traffic prior to completion of the entire project. McCammon-Wunderlich Company and Wunderlich Construction Company of Palo Alto are the joint venture contractors for this $3,842,000 project.

The 5.8-mile section of freeway from Colfax to the Magra Overhead crossing of the Southern Pacific east of Colfax, is planned for use by the traveling public some time in October of this year. Fredrickson and Watson Construction Company and Ransome Company of Oakland are the joint contractors for the project. The final construction cost for this portion of the route will be approximately $4,035,000. Starting with this project, and continuing for the remainder of the route over the mountains the traveled way is to be of Portland cement concrete.

The fourth project to be completed on Highway US 40 this year will be from near Floriston to the Nevada state line. When completed in August, this section will provide 5.4 miles of four-lane freeway through the Truckee River Canyon. Gibbons and Reed Company of Salt Lake City are the prime contractors for this project that will cost approximately $5,420,000. Careful planning by the contractor and the Resident Engineer for the Division of Highways avoided the anticipated long delays to traffic in the narrow canyon.

Detours Constructed

To avoid other anticipated major delays to traffic through particularly rugged terrain on this major transcontinental route during future freeway construction, two extensive detours were constructed. The first of these, from near Monte Vista to Alta, was completed in 1957 by Fredrickson and Watson Construction Company of Oakland at a cost of $422,000. The second such detour, from near Boca to near Floriston, in the Truckee River Canyon has just been completed. H. Earl Parker, Incorporated, of Marysville is the contractor for this project which will cost approximately $564,000.

Five contracts to construct sections of this route to freeway standards were provided for in the 1958-59 Budget. All of these contracts have been let or advertised, at the present time, and are expected to be completed by the end of the 1959 construction season.

This section of freeway on US 99-50 south of Sacramento will be completed this summer. The Elk Grove Road Interchange is in the foreground; the City of Sacramento on the horizon.

The last of the five contracts, calling for the construction of 11.1 miles of freeway south of the existing highway between Roseville and Newcastle is now advertised and bids are to be opened on July 16th. This section will provide 12 structures, seven of which will provide for the interchange of traffic, and one that will be an underpass at the Southern Pacific Railroad in Newcastle.

Bids were opened late in May for the construction of an additional 4.5 miles of freeway in the vicinity of Gold Run. The low bidder for this work was a joint venture of Fredrickson and Watson Construction Company and Ransome Company of Oakland with an offer that will cost approximately $2,880,000. This section will join the portion now under con-

This photo shows paving operations in progress on the US 40 freeway in the Truckee River Canyon between Floriston and the Nevada state line. It is scheduled for completion this summer.

struction between Colfax and the Magra Overhead. The first structure on the new contract, the Alpine Interchange, will actually extend into the limits of the previous contract, but is being done at this time, rather than at a future date as originally planned, to insure there will be no crossings at grade between Illinoistown, west of Colfax, and the Nevada state line.

Snow Delays Work

A six-mile section is now under construction between Hampshire Rocks and Soda Springs at a cost of about $5,392,000. The heavy snow of the past winter has delayed the start of work until this time. The contracting on the project is again a joint venture composed of Clyde L. Wood, Incorporated, Kirst Construction Company and Alwood Corporation or North Hollywood.

The two remaining interstate projects under way are east of the crest of the Sierra Nevada Mountains. One, from the east end of Donner Lake to near Boca, east of Truckee, will provide 8.8 miles of freeway at an approximate cost of $8,136,000. Fredrickson and Watson Construction Company and Ransome Company of Oakland are again the contractors. The contract calls for the construction of structures in 11 locations, a truck scalehouse, and preliminary work for the ultimate construction of an agricultural inspection station.

The other contract will complete the 21 miles of freeway east of the Sierra Nevada from Donner Lake to the Nevada state line. This section from near Boca to near Floriston, a distance of 6.7 miles, is being constructed as a joint venture by Isbell Construction Company of Reno in conjunction with Granite Construction Company of Watsonville, and Gordon H. Ball and Gordon H. Ball, Incorporated, of Danville. The approximate cost will be $7,420,000.

Plans are being prepared for the remaining 34 miles of this route between Sacramento and the Nevada state line that will permit construction when financing is made available. The estimated cost to complete the conversion of the entire 122 miles of the route to a four-lane facility is $48,000,000.

Other Routes

Closely allied to the development of Highway US 40 and to the 1960 Olympic Games is the widening of State Sign Route 89 from 0.2 mile south of Squaw Valley Road to the Donner Creek Railroad Underpass. When completed, this project will provide a 40-foot all-paved roadway from 8.3 miles. This widened section of highway, together with the anticipated traffic controls at the time, is planned to handle the tremendous volume of traffic during the periods when visitors are entering and leaving the games site at Squaw Valley. Fredrickson and Watson Construction Company and Ransome Company are the prime contractors for this $1,400,000 improvement that is scheduled for completion in December of this year.

West of Sacramento, plans for the improvement of US 40 are being prepared. These plans include interchanges for Davis and County Road 104 and a new causeway over the Yolo Bypass.

Work on the north-south interstate route is only beginning. The first actual construction on this route was completed in August, 1957, and provides four lanes of freeway on US 99W from High School Road through Arbuckle to Salt Creek. This required the depressing of the highway through Arbuckle to provide for grade separation at Hall Street. The 1.6-mile section was constructed by Fredrickson and Watson Construction Company of Oakland at a cost of approximately $1,324,000.

Public meetings have been held, and the freeway route adopted, for the 23-mile section from two miles south of Willows to the Tehama county line.

On the short section of interstate highway in the district south of Dunnigan, a contract was let this year to a contracting group consisting of Gordon H. Ball, Gordon H. Ball, Incorporated, and Ball and Simpson of Danville to grade, place base material, and erect the necessary structures for two lanes of an ultimate six-lane freeway from the Solano county line to near Madison, a distance of 13.4 miles. Surfacing and the construction of the additional lanes will be done under later contracts. This new route lies east of the present State Route 90, the more commonly known Vacaville-Dunnigan Cutoff. This stage of the construction is scheduled for completion by the end of December.

This view eastward shows the four-lane interim improvement on US 50 between Sacramento and Alder Creek. Nimbus Dam and Reservoir is to the right.

Freeway Resolution Adopted

Two lanes of expressway have been constructed on this route through a four-mile section between 2.7 and 6.7 miles north of Madison. A freeway resolution has been adopted for the remaining five miles of this route to its junction with Highway US 99W, the other north-south interstate route in the district.

The conversion of Highway US 99-50 to full freeway standards from the San Joaquin county line north to Sacramento is rapidly approaching the ultimate development as presently planned. A. Teichert and Son, Sacramento contracting firm, plan to finish two contracts on this route during the month of August. One project calls for the construction of four lanes of full freeway from 0.7 mile south of Galt to 1.6 miles south of the Cosumnes River at the approximate cost of $2,800,000. The second project will provide the northbound lanes of a full freeway from 1.8 miles south of the Cosumnes River to 0.2 mile south of Elk Grove Road. This work will cost about $2,000,000.

Two contracts that will bring closer the day that this route will meet freeway standards are being let this year. The bids on the first are to be opened June 25th and will provide for the construction of structures, approaches and highway lighting facilities from 1.8 miles south of Florin Road to Broadway in Sacramento. This section, known as the South Sacramento Freeway is on completely new alignment. Subsequent contracts will provide for surfacing and other work necessary to put the route in operation. It is estimated the initial work will cost approximately $2,250,000.

Additional Funds Provided

The second contract on this route, the reconstruction of the existing highway from 1.8 miles south of the Cosumnes River to 0.2 mile south of Elk Grove Road to freeway standards, was made possible by additional funds included in the 1958 Federal Highway Act. These additional funds were provided to start projects prior to December, 1958, that would not be financed under the existing financial schedule. The bids for this contract are to be opened July 16th. Additional funds amounting to $1,100,000 were added to the 1958-59 Budget by the Highway Commission for this work.

In, and near Sacramento, State Sign Route 24 (Freeport Boulevard) from Florin Road to Sutterville Road was widened to a four-lane divided street in the past year. This project, which included signalization and lighting, was constructed by McGillivray Construction Company of Sacramento at a cost of approximately $552,200.

The improvement of Highway US 50 from Sacramento easterly over the Sierra Nevada has progressed during the past year, and plans are being made for the conversion of the entire route to full freeway standards at a future date. In the Sacramento area, the existing route was widened to four lanes, as an interim improvement, pending the construction of a freeway on new alignment, from near the Sacramento city limit to Alder Creek. This work was necessary to ease the traffic pressure built up by the tremendous industrial, aviation, and residential growth in the area east of the state capital. This project, costing approximately $1,000,000 was done by A. Teichert and Son of Sacramento and was accepted as completed in March of this year.

Lane Signals Installed

The conversion of this route to four lanes created a problem at the Brighton Underpass which provides only three lanes for traffic. A contract was let to Collins Electrical Company, Incorporated, of Stockton for $21,000 to install lane control signals through this structure. This signalization will make possible the use of the middle lane for eastbound traffic only during the morning hours, and for westbound traffic only during the evening hours. During other times the lane will not be used for the movement of traffic. The installation of this system required the relocation of Redding Avenue to give property owners in the area satisfactory ingress and egress from Highway 50. A. Teichert and Son submitted a low bid of $21,849 for this work early in June.

In November, 1957, a $1,000,000 project was completed to bypass the community of Camino with a four-lane expressway. A joint venture of John Delphia and Fred J. Early, Jr., Company of Patterson constructed this improvement.

US 50 Improved

Public meetings are being held, and plans being prepared, to convert US 50 to a freeway route from Sacramento to the Nevada state line. Freeway resolutions have been adopted from Brighton to Alder Creek, from near Perks Corner to the west city limit of Placerville, between Washington Street in Placerville and two miles to the east, and between Fresh Pond and Riverton. Action is well under way to secure such a resolution from Camino to Pollock Pines.

A portion of this route, from Al Tahoe to the Nevada state line, was widened in 1957 to provide a 64-foot street section. This work together with reconstruction between Mays and Al Tahoe was done by Baun Construction Company of Fresno at an approximate cost of $340,000. Plans are being prepared for the future extension of this work to the west when financing is available.

Near Echo Summit, two projects to increase traffic safety were accomplished. Six truck turnout lanes were constructed by Harms Brothers Construction Company of Sacramento at a cost of $157,000 that permit the passing of trucks moving slowly upgrade by the faster passenger traffic. Metal plate guardrails were installed

An aerial view of the freeway through the Town of Arbuckle on US 99W. The separation structure in the center of the picture is the Hall Street Overcrossing.

in nine locations by Wulfert Company of San Leandro.

Work was also done to improve the intersections of county roads with this transcontinental route. During the past year, two such intersection improvements were completed, both in the Placerville area, one at El Dorado Road and the other at Missouri Flat Road.

The Bureau of Public Roads is improving a section of the route between Fresh Pond and Riverton, the so-called "cliff" section, to a four-lane expressway. The first contract on this work is nearing completion, and a second contract is planned for advertising this summer.

The bureau is also improving and realigning a portion of State Sign Route 89, referred to as the Luther Pass Route, that connects Highway US 50 and State Sign Route 88. The 7.1-mile section being improved is from US 50 to Grass Lake.

Relocation Necessary

The proposed construction of a major dam on the Feather River above Oroville made necessary the relocation of a portion of the Feather River Highway, Highway US 40 Alternate, from Oroville to Jarbo Gap. This relocation, to be done under several contracts, presently is requiring the construction of 13.7 miles of roadway, on new alignment, from near Wicks Corner to Jarbo Gap. This work, costing approximately $9,500,000, is being done by McCammon-Wunderlich Construction Company of Palo Alto. Other features of this relocation, a dual purpose bridge over the West Branch of the Feather River to accommodate the highway and the Western Pacific Railroad and the extension of the relocation from Wicks Corner to Oroville with a new bridge over the Feather River at Oroville, are contingent upon appropriations by the State Legislature.

South of Oroville, Baldwin Contracting Company of Marysville has a contract for $580,000 to relocate US 40 Alternate from the Union High School to a point near Adelaide. This work is the initial two lanes of an ultimate four-lane expressway. This contract also includes the widening of the existing highway from the end of the

UPPER—Relocation of US 40 Alternate along the Feather River between Wicks Corner and Jarbo Gap. A dual-purpose bridge carrying the highway and railroad over the West Branch of the Feather River, which extends from left to right across the center of the picture, will connect the two visible construction areas. LOWER—An aerial view eastward of the State Sign Route 32 improvement between Chico and Hog Springs. A portion of the one-way couplet in Chico shows in the foreground.

UPPER—A ground view of the improvement on State Sign Route 32 east of Chico. See the March-April issue of California Highways and Public Works for an article on the opening of this section of highway. LOWER—An improved section of the Mother Lode Highway (State Sign Route 49) in Sierra County west of Downieville.

relocation to the junction of the Oroville-Richvale Road. It is anticipated this improved facility will be available for public use late in September of this year.

Highway Relocated

In the northern end of the district, in Glenn and Butte Counties, work is being done to improve State Sign Route 32. Work was completed in the past year to relocate this route from Main Street in Chico to Hog Springs to the east. This work was done from Fir Street in Chico to Hog Springs by A. Teichert and Son of Sacramento, and the one-way couplet between Main and Fir Streets on Eighth and Ninth Streets was completed by Lester L. Rice and Sons of Yuba City. This 6.5 mile improvement cost approximately $1,061,000. The route has been adopted as a freeway, although only two lanes of the ultimate expressway have been constructed, and the route, and freeway resolution, has been adopted from Hog Springs to Lomo.

A portion of this same route is presently being widened between Orland and 1.6 miles east of the Sacramento River. This work is being done under a contract to Baun Construction Company of Fresno and also includes the widening of two portions of the Hamilton City-Glenn Highway and a section of the Willows-Butte City Highway. This same construction firm has a second contract that extends the limits of the widening of the Willows-Butte City Road to Codora Four Corners and calls for the replacement of the Sheppards Slough Bridge between Willows and Glenn. These two projects will call for the expenditure of approximately $868,000.

Interim Improvement

After considerable discussion a freeway agreement has been approved by the City Council of Chico, and the Butte County Board of Supervisors, for the construction of a freeway along the so-called Sheridan Avenue route in Chico. Until financing of this route is possible, it is necessary to improve the present route through Chico on an interim basis. To this end, Main and Broadway will become a

. . . Continued on page 50

Freeway construction on US 40 near Floriston in Sierra County. The section from Floriston to the Nevada state line will be completed this summer.

Grapevine

Historic Canyon Section of US 99 Will Be Eight-laned

By A. G. FLUTER, District Design Engineer

Motorists on US Route 99 between Los Angeles and Bakersfield will find a refreshing improvement in the passage through Grapevine Canyon when a new $7,000,000 interstate highway contract recently awarded to the Guy F. Atkinson Company is completed.

The development of the original state highway through Grapevine Canyon was the direct result of the passage of the State Highway Act of 1909. Construction was completed with a portion of the $18,000,000 raised from bonds sold as authorized by the Highway Act.

In commenting on the original Ridge Route construction, which was a complete new road between Bakersfield and Los Angeles, the Bulletin of the Highway Commission dated July, 1916, stated in part, "The route was explored by W. Lewis Clark, the Division Engineer at Los Angeles, and his findings dissipated all doubt as to its feasibility and on January 25, 1912, surveys were ordered."

Construction was started in 1914 and travelers were soon using portions of the road.

A comment of 1916 reads: "The Ridge Route has already become a great and powerful influence in promoting the unity and integrity of heretofore divided sections of the State and in discouraging state division agitation. The new road entirely does away with the old 30 percent grades which took the stamina out of a motor on the Midway Route" (via Tehachapi, Mojave, Palmdale, Newhall and Los Angeles).

The reconstruction of the Ridge Route in 1933-1934 reflected an increasing awareness on the part of the Division of Highways of the vast monetary savings accruing to the public by reducing the traveling time and mileage by better alignment. Deep cuts and high fills not previously considered because of high initial cost were constructed, together with the then new concept of three traveling lanes on the roadbed to facilitate the passing maneuver.

A comment of 1933 describes the rebuilding as "the last word in modern highway design with the roadway carried through deep cuts and over deep fills and meandering streams to secure the most feasible direct route."

At the dedication ceremony in 1933, it was stated that the completion of the reconstruction was truly "the greatest blow to sectionalism in California since the construction of the original Ridge Route in 1915."

The following table shows the comparison of the various routes to Los Angeles:

	Previous to 1914 (county road)	*1914 state highway*	*1933 state highway*	*1958 state highway*
Length (Bakersfield to Los Angeles)	170 mi.	124 mi.	117 mi.	117 mi.
Total curvature (Grapevine Station to Castaic Junction)	Unknown	38,571°	3,062°	2,928°
Maximum elevation	4,233	4,234	4,183	4,183
Minimum curve radius	Unknown	70 ft.	1,000 ft.	1,300 ft.
Maximum grade	30%	6%	6%	6%

History

Recorded travel by Europeans through this historic pass began with Don Pedro Fages, who used this route while pursuing deserters from the Spanish Army in 1727. Kit Carson in his two trips to California in 1824 and 1854 used this route to Los Angeles.

Early Spanish settlers even before the year 1800 traveled to San Francisco and the Northern California missions and ranchos from Southern California by way of the famed "El Camino Viejo a Los Angeles," a trail that used the arid west side of the San Joaquin Valley. A modern note to this route shows that in many locations the future interstate freeway (Route 238) will occupy almost the exact site of this road, including the use of Grapevine Canyon and the northerly slopes of Wheeler Ridge.

Fort Tejon

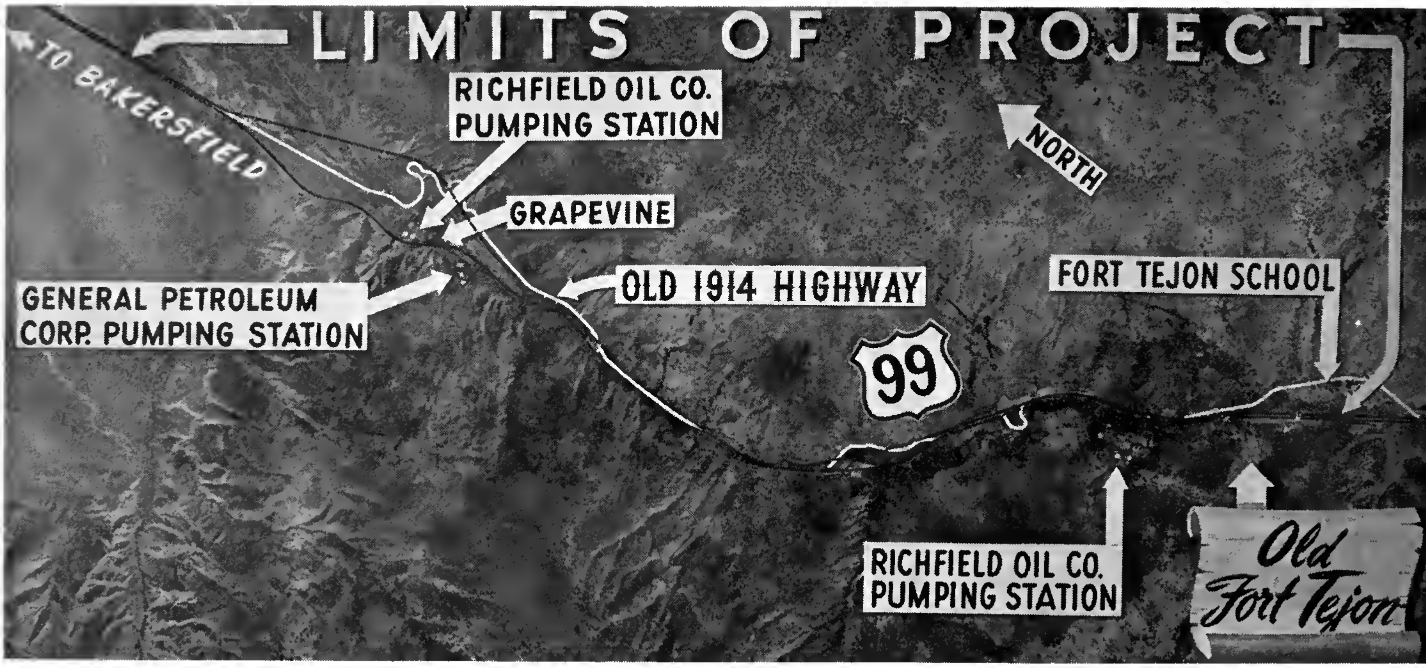
Because of the use of Grapevine Canyon by horse and cattle thieves, and because of its convenient location to the Sebastian Indian Reservation, General Edward Fitzgerald Beale, Commissioner of Indian Affairs for California and Nevada, persuaded the U. S. Army to establish Fort Tejon near the top of the canyon at a site with abundant water. The construction on the fort began August 10, 1854. During its active years the fort was the center of social activity for the area, and was notable in other ways. For example, Fort Tejon was the western headquarters for the U. S. Army Camel Corps, established by direction of Secretary of War Jefferson Davis in 1857. The first camels arrived at Fort Tejon in November, 1857, and were stationed here in varying numbers until the fort was abandoned in 1861.

An important milestone for the fort was the establishment here of a Butterfield Overland Mail Station. The first mail stage from St. Louis stopped here October 8, 1858, on its way to San Francisco. From that date on, the stage line was on a regular schedule with the travel time between Los Angeles and Fort Tejon listed as 32½ hours. The trip today takes less than two hours at an easy pace.

Another historic user of Grapevine Canyon was Phineas Banning who established a stage line to the gold fields on the Kern River and to the frontier town of Havilah.

. . . Continued on page 12

A dramatic shot of the Grapevine Grade showing the present highway (right) heading southward up into the canyon and the old 1914 highway twisting its way up the grade on the left. The present highway is seven miles shorter than the old 1914 road.



The black lines superimposed on this aerial of the Grapevine Canyon show the planned location of the northbound and southbound roadways after the new freeway is completed in 1960. Some 13,000 vehicles a day now pass along this section of US 99.

GRAPEVINE

Continued from page 10 . . .

Drainage Problems

Grapevine Canyon is a narrow defile with steep, rocky slopes, so narrow that in order to provide the width needed for a divided highway of eight lanes, it will require, for a distance of approximately two miles, cutting back the slopes on both walls.

Grapevine Creek, also needing passage in the canyon, is to be placed in a closed conduit for 9,000 feet of its course. The calculations and considerations necessary to determine the size to use for the conduit constituted one of the major problems of the project.

After consideration of the many factors involved, such as possibility of a true cloudburst storm, possible recurrence of an intense rain similar to the record flood of 1914, possible flood on Cuddy Creek when Lake Castaic is full, the discharge finally adopted for design was 3,000 cubic feet per second. This is the equivalent of a storm of rare cloudburst intensity. An allowance for six cubic yards per second of debris load is made.

The usual economics of "estimating the damage likely to be caused by greater floods," and computing the annual cost thereof, which "should just equal the allowable annual cost of additional capital investment to provide waterway for the greater floods," and comparing the cost of possible alternate conduits, was performed. From the above calculations a rectangular culvert 10 feet by 8 feet was chosen in which to place Grapevine Creek.

Construction

With 9,700 passenger cars and 3,300 trucks passing through this canyon on an average day, the problems of construction take on special significance in regard to public safety.

The California Highway Patrol, the contractor, G. F. Atkinson & Co., and the Division of Highways are all concerned with the problems of making a safe passage.

The order of work for the contract was developed to minimize the disruption and inconvenience to public travel, and after many trials, was set as follows:

1. Construct sufficient detours to allow the building of necessary portions of permanent pavement on the uphill lanes to place all traffic on the west side of the canyon. During this operation 2,300,000 vehicles will pass through the work.

2. Construct all downhill lanes and place traffic on them. An estimated 4,600,000 vehicles will pass during this time.

3. Reconstruct the gaps not constrcted under paragraph No. 1 (2,300,000 vehicles will pass).

4. Open completed highway to traffic.

At the contract prices, the cost of the work will be divided as follows:

Grading	$2,700,000
Paving	1,970,000
Grapevine Creek Conduit	1,240,000
Other drainage	400,000
Bridges	380,000
Miscellaneous	260,000
Total	$6,950,000

NEW CONTRACT TOTAL

The State Division of Highways reports that, as of June 30, 1958, it had 355 contracts under way totaling $405,525,900.

Completion of these projects will bring the total length of freeways, expressways and other multilane, divided highways within the State to 2,315 miles.

There have been 50 interstate projects totaling $179,179,800 awarded since July 1, 1956. Five more interstate projects totaling some $20,000,000 are pending award or have been advertised for bids.

Snow Removal

Motor Grader Units Prove Worth During Past Winter

By A. C. DILDINE, Senior Equipment Engineer

THE MAIN east-west highway link in the northern part of California is through the Sierra. This highway system had its beginning in 1895 when the Placerville-Lake Tahoe wagon road was taken over by the State. This was followed in 1909 by the completion of state acquisition of the road which connected Auburn, Donner Lake, Truckee and Lake Tahoe. In 1919 a state road was authorized between Truckee and Verde on the California-Nevada line. These were the beginnings of the modern state highway system over the Sierra. The necessity of keeping these roads open was also the start of the snow removal problem.

In the winter months ground transportation in the Sierra is continually hampered by heavy snowfall. In early days transportation stopped. Today too much depends on this transportation to allow the roads to be choked with snow for any long periods of time.

With the construction of the modern highway system maintenance has become increasingly important. And with increased dependency on the main east-west routes over the Sierra, it has become important to keep them open the year around. Winter usage of the highways requires dependable high-powered snow removal equipment.

More Power

Snow removal equipment has progressed from crude wooden plows mounted across the front of trucks to modern push plows and rotary snow removal units. The push plows displace the snow from one location to another immediately adjacent to the trailing edge of the plow. To move snow completely out of the way necessitates a machine capable of picking it up and throwing it to a location off the road. Such a machine requires power to handle the loads imposed on it. The most common snow removal units operating in the mountains at present are the auger-type rotary snowplows which are mounted on large heavy-duty four-wheel-drive trucks.

Until this past winter the Division of Highways had a fleet of 42 auger-type rotary units operating in the various mountain areas of the State.

In recent years, with the increasing capacity and use of mountain high-

One of the auger-type rotary units mounted on a heavy-duty four-wheel-drive motor grader used by the Division of Highways in snow removal last winter

One of the heavy new motor grader units in action last winter. Increased weight of the unit resulted in better traction, the Equipment Department reported.

ways, it was seen that heavier units would be advantageous under certain conditions of rough going. A heavier unit with a longer wheelbase and larger tires would have better traction and stability when cutting into dense snow. This would aid materially in the speed of clearing a choked highway. Consequently, two years ago the Equipment Department began investigating other methods of mounting and operating rotary plows where increased weight, which results in better traction, could be obtained.

The result of this investigation was the purchase and operation of three auger-type rotary units mounted on large heavy-duty four-wheel-drive motor graders. Two of the units are in District III (Marysville) and the third is in District IX (Bishop). The auger box is relatively the same as that mounted on the trucks, but there the similarity ends.

The common rotary unit consists of steel cutting edges and three horizontal augers that bite into the snow and move it to a fan which discharges it to one side in a steady stream. The cutting edges and augers are capable of loosening snow of any consistency, even ice, and feeding the loosened material to the discharge fan.

In the motor-grader-mounted units the auger-type rotary mechanism is powered by two diesel engines mounted on each side of the motor grader forward of the cab. These two engines provide a total of 270 h.p. to operate the augers and fan. This is 70 h.p. more than is available on the truck-mounted units. The same model engine powers the motor grader. This makes the procurement of spare parts and repairs simplified by the standardization of the engines.

The engines are equipped with safety devices to automatically stop them in case of low oil pressure or extreme water temperature. They are also equipped with hourmeters, thermostatically controlled shutters, and electric tachometers. Power is transmitted from each engine through clutches to a common drive shaft. The clutches allow single engine operation under emergency conditions.

The new combination of the auger-type rotary unit and motor grader weighs approximately 33,000 pounds, which is 8,000 pounds more than the truck unit. The wheelbase is approximately three feet longer than the wheelbase of the truck units. This additional weight and wheelbase, plus larger tires, provides better stability and traction for crowding under rough going.

The new motor grader rotary snowplow combinations are rigidly built for continuous hard usage. The past winter's usage has proven their ability to remove heavy hard-packed snow, under severe conditions. The motor grader units will not completely replace the truck units but their capability for long heavy-duty continuous snow removal operations makes them a necessary additional tool to aid in the snow removal problem.

Fred Jacobson Named To Public Works Job

Fred Jacobson, long associated with chambers of commerce in California, took office June 16th as special representative of the State Department of Public Works.

C. M. Gilliss, State Director of Public Works and chairman of the California Highway Commission, said, in announcing Jacobson's appointment:

"We are doing all we can to keep the department and the California Highway Commission in close touch with the citizens of California. One part of our program for better communications was to restore this long-vacant position to the department.

"Fred Jacobson's particular background and experience will help the department maintain and improve liaison with local governing bodies and civic organizations."

Jacobson was manager of the Retail Merchants Association of Sacramento in 1955 and 1956, and for five years before that was Central Coast District Manager of the California State Chamber of Commerce.

From 1943 to 1950, he was assistant manager of the Sacramento Chamber of Commerce. He was with the Bank of America from 1930 to 1943, his last post with the bank being assistant cashier in Yuba City.

Jacobson has made his home in Alameda recently and has been with a Bay area container manufacturing firm. He studied in Alameda schools and graduated from the Western Institute of Commercial and Trade Executives at the University of Oregon. He is past president of the California Association of Chamber of Commerce Managers.

New Highway Lab

Commissioners Attend Laying of Cornerstone

THE MATERIALS and Research Department of the Division of Highways has moved into its new $1,377,000 Headquarters Laboratory at 5900 Folsom Boulevard.

Completion of the new building was marked formally by a cornerstone laying ceremony on May 21st which was attended by members of the California Highway Commission and other state officials.

Director of Public Works C. M. Gilliss, who is also chairman of the Highway Commission, stressed the important role the Materials and Research Department has played in developing and improving highway construction methods not only in California but nationally and internationally as well.

"We spend a lot of money for highways and most of it is spent for materials to build roads and bridges," Gilliss said. "All divisions of the Department of Public Works are aware of the great responsibility involved in the large expenditures of public money. The principle of competitive bidding assures the taxpayer that the work will be performed at the lowest cost commensurate with adequate quality. It is important that the State is able to check the quality of the materials. This is one of the important missions of the laboratory."

Harmer E. Davis, Director of the Institute of Transportation and Traffic Engineering at the University of California in Berkeley, said:

"The list of honors and awards by national organizations to members of this Materials and Research group for outstanding contributions is impressive, as is the list of important committee posts held in technical and professional societies."

After the ceremonies, the commissioners and guests toured the new laboratory where the various uses of the equipment were explained by engineers of the Materials and Research Department.

Commissioner Chester H. Worlow trowels mortar while Director of Public Works C. M. Gilliss (left) and members of the Highway Laboratory staff look on

The new laboratory, which provides 65,000 square feet of space for a wide range of research and testing equipment, was designed by the Division of Architecture.

The work of the Materials and Research Department is divided into two main categories—research to develop better highway construction methods and materials, and testing to make sure the State gets its money's worth from every highway construction dollar.

When it first began operations in 1912, the department had one geologist and one testing engineer. Its laboratory was a small wooden building at the State Fairgrounds. In 1922 the Headquarters Laboratory was moved to 3435 Serra Way.

As the State's highway program has grown, the department has faced an increasingly acute need for added space. In recent years its Sacramento activities have been conducted at sev-

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Report From District X

By J. G. MEYER, District Engineer

District X of the Division of Highways has made considerable progress since the enactment of the Collier-Burns Act in 1947 in providing improved highway facilities for the motoring public. This overall report has been prepared to inform Californians of this progress.

District X, which has its headquarters in Stockton, extends over a large portion of Central California. It includes 1,400 miles of state highways in nine counties with diverse terrain, ranging from the flat San Joaquin Valley to the rugged Sierra Nevada range.

The economic importance of this great area hinges to a large extent on its agricultural pursuit, on its recreational area, and on its military establishments, all of which in turn depend upon its automotive transportation system.

PHOTOS AT TOP OF PAGE. *Construction of separation structures on US 40 through Vallejo such as the one at Laurel Street (left) will do away with the traffic slowdown at present encountered at signalized intersections such as the one at Tennessee Street (right).*

The flat, fertile San Joaquin Valley with its highly developed irrigation systems produces a wealth of crops each year. Agriculture and food processing activities demand an extensive road net to accommodate the trucking of harvests to the markets, canneries and mills. The mountain counties produce timber, minerals and livestock which are hauled to market by motor vehicles. Stockton is a focal point for a large movement of raw materials, food products, supplies and equipment for domestic and foreign markets, due to its central location with a deep water port and rail facilities of three major railroads.

Many Attractions

That portion of the Sierra Nevada mountains within the boundaries of District X contains recreation areas of worldwide interest. Yosemite National Park, Calaveras Big Trees and other parks attract thousands of tourists and vacationers each year. Ski resorts, hunting, fishing, camping and hiking appeal to many others who travel our highways in cars and busses.

There are in District X, because of its strategic location, a large number of Army, Navy and Air Force bases. Major installations of the Department of Defense include historic Benicia Arsenal, founded over 100 years ago, the U. S. Naval Shipyard at Mare Island, Travis Air Force Base near Fairfield, the Naval Supply Annex and Sharpe General Depot in Stockton, and Castle Air Force Base near Merced.

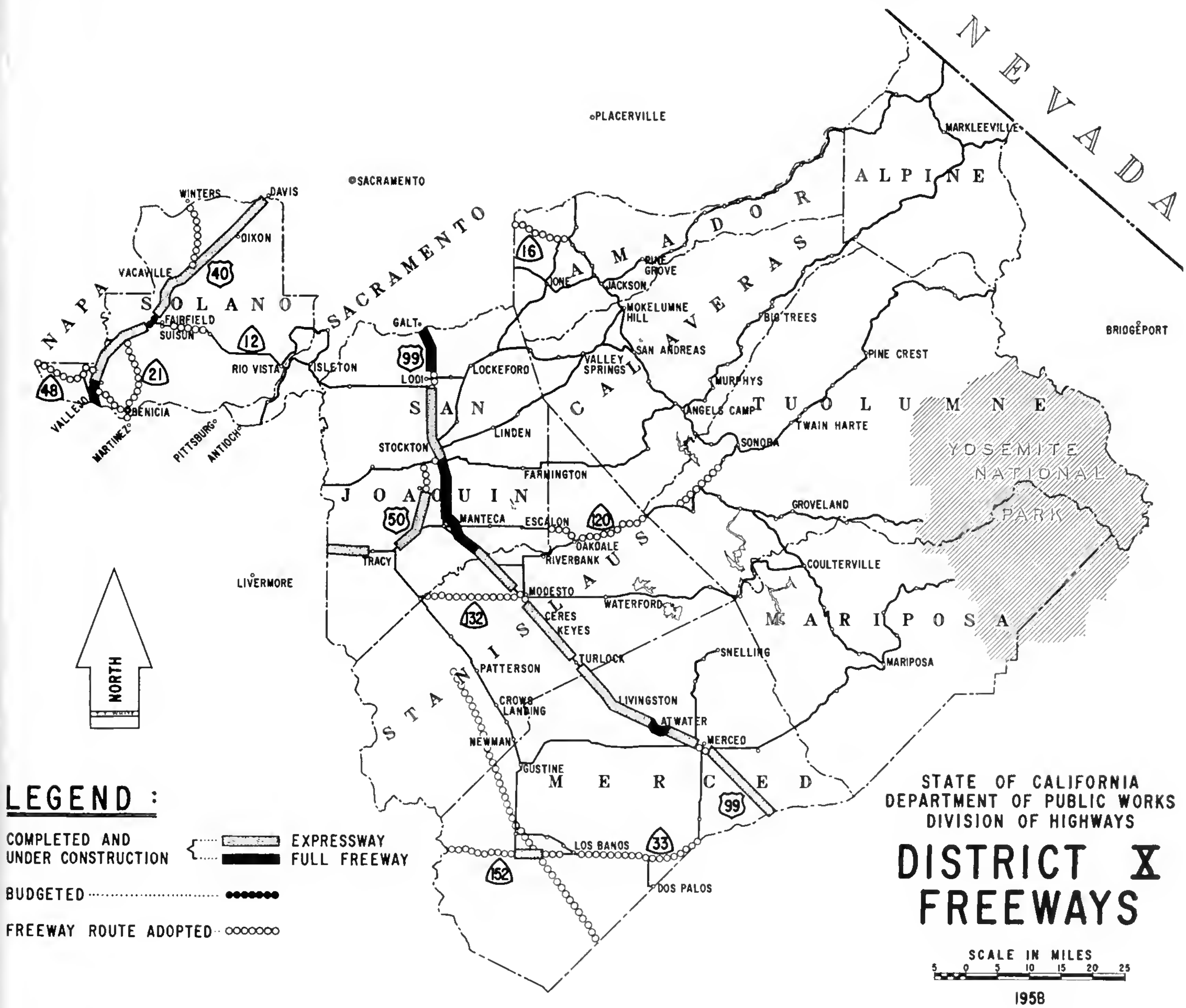
In District X, as in any highway district, the backbone of the road network is the rapidly developing system of freeways which have been constructed since World War II. The emphasis on freeway construction in the past has been primarily along the three U. S. sign routes which traverse the district. These are US 40 in the northwest area of the district, US 50 through the north-central area, and US 99, the major north-south artery. Increased traffic demands and the need to integrate some of the state highways with the National Interstate Highway System program which Congress authorized in 1956 have made it necessary to extend the district's freeway planning efforts. As a result, portions of Sign Routes 12, 16, 21, 48, 120, 132 and 152 have been adopted as freeways. Supplementing the freeway system throughout the district is an important secondary network of feeder routes and connecting laterals. This includes Sign Route 49, a foothill route on the western slopes of the Sierra Nevada; Sign Route 88, Carson Pass Highway; Sign Route 4, which connects Stockton with the industrial area around Carquinez Strait and continues east from Stockton over Ebbetts and Monitor Passes; Sign Route 108, Sonora Pass; and Sign Route 140, the all-year highway into Yosemite.

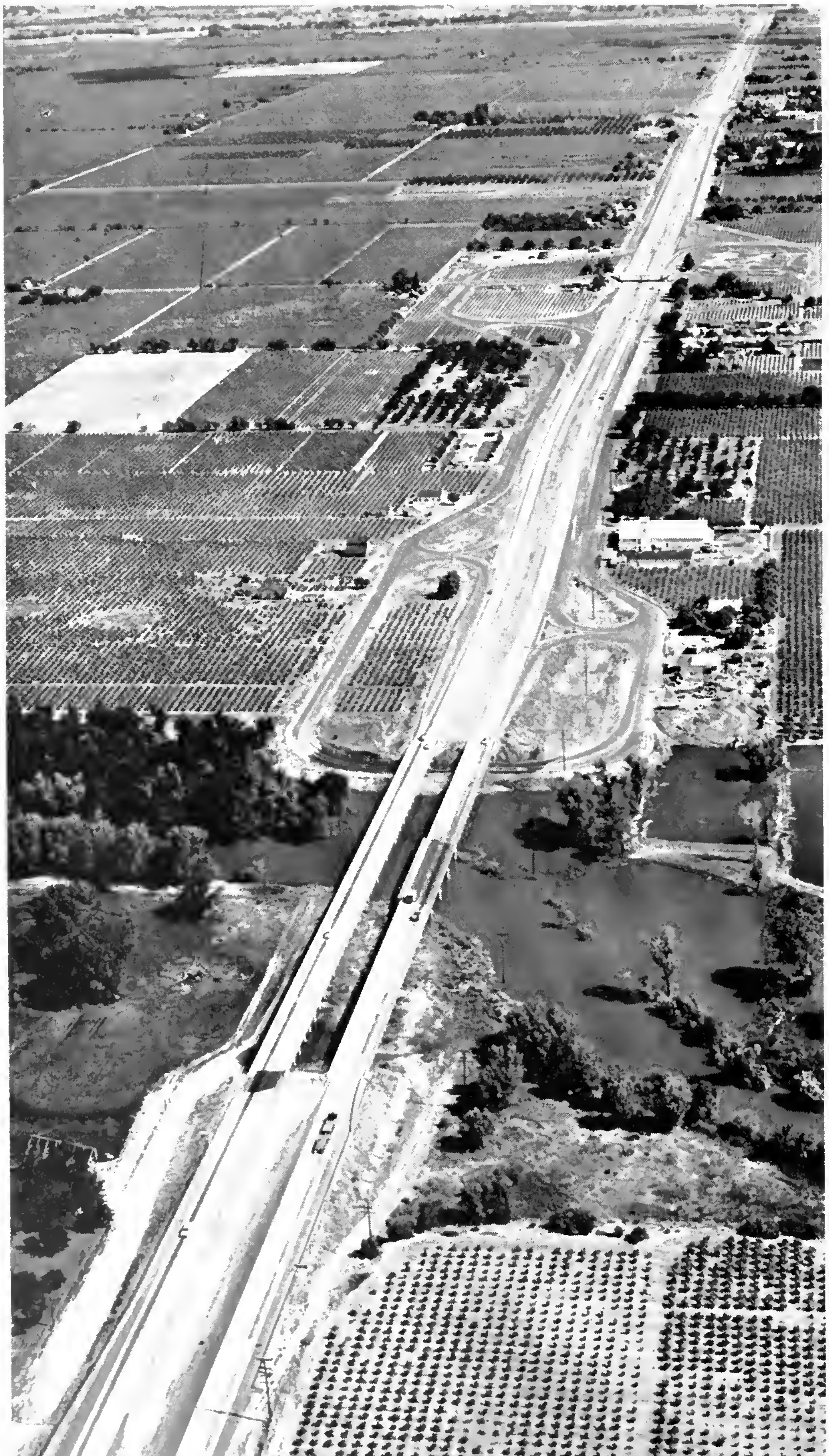
Interstate System

Approximately 190 miles of existing or proposed highways in the district have been included in the Federal Interstate Highway System which is proposed for rapid development as indicated by the Federal Highway Act of 1956.

Portions of the interstate system in this district on which routes have been adopted and design studies under way include 44 miles of US 40 in Solano and Napa Counties, between the Carquinez Bridge and the Yolo county line; 11 miles of State Route 90 in Solano County from US 40 near Vacaville to the Yolo county line; approximately 6.6 miles on State Routes 74 and 75, between the Martinez-Benicia Bridge and US 40 in Vallejo. The Martinez-Benicia Bridge was authorized by the 1955 Session of the California Legislature in combination with the Carquinez Bridge. Negotiations are under way with the U. S. Government for rights-of-way for approximately three miles of road construction within the limits of the Benicia Arsenal. It is anticipated that this right-of-way transaction will be completed by October 1st. Construction of the Martinez-Benicia Bridge is scheduled to begin April, 1959.

Portions of the interstate system that have not been adopted included 110 miles of Westside Freeway and connecting links between the Alameda





An aerial view of US 99 in San Joaquin County showing the twin spans across the Mokelumne River with frontage road passing under the north end of the bridges

county line and a junction with the proposed Westside Freeway (State Route 238) east of Tracy and a connection from west of Tracy to Stockton.

Westside Freeway

In 1957 the State Legislature, in Chapter 26, Statutes of 1957, declared that Route 238 "is hereby added to the State Highway System, to extend from a point on Route 4 south of Bakersfield to a point on Route 7 near Woodland, on a route along the westerly side of the San Joaquin Valley to be selected by the California Highway Commission, which route may include all or portions of any existing state highway route or routes."

The portion within the limits of District X comprises about 110 miles of the route. The portion between the Fresno county line and west of Patterson has been the subject of public meetings and a definite route for this portion of the freeway was adopted by the California Highway Commission in June, 1958.

The portion between west of Patterson and south of Stockton, including the connection of legislative Route 110 and all of legislative Route 5 (US 50), has been the subject of public meetings, but no recommendations have been made as yet. Public meetings will be scheduled for the balance of the route in the near future.

A great deal of construction work has been in progress in District X. A brief résumé which has been grouped according to sign route designation, follows below:

US 40

The District X portion of this highway runs from Carquinez Bridge through Solano County to the Yolo county line.

In December of 1957 work was completed on 1¼ miles of eight-lane freeway from the Carquinez Bridge to one-half mile north of the Vallejo Wye. The work was performed by Fredrickson and Watson Construction Company and Ransome Company and required approximately 18 months to complete.

This contract, which was a part of the conversion of US 40 to full freeway status, included facilities for a connection to the new parallel Carquinez Bridge.

The work was financed from Carquinez Strait Bridge construction funds, Chapter 960, Statutes of 1955 Bond Resolution adopted by the California Toll Bridge Authority October 4, 1955.

Closely allied with this project are several Bridge Department contracts amounting to approximately $1,500,000 for bridge administration buildings, toll collecting systems, and bridge maintenance shops.

A second highway contract is currently in progress between 0.2 mile north of the Vallejo Wye and one-half mile north of Redwood Street under which the existing four-lane highway is being converted to a six-lane freeway.

Work includes the construction of seven bridges, the Laurel Street Overcrossing, the Route 7-74 Separation, Benicia Road Overcrossing, Georgia Street Overcrossing, Springs Road Overcrossing, Tennessee Street Overcrossing, and the Redwood Street Overcrossing.

Harms Bros., C. M. Syar and Erickson, Philips and Weisberg are the contractors. (The estimated cost is $4,500,000, and the project is expected to be completed in December, 1958.) Under an already completed contract, the Magazine Street Overcrossing and the frontage roads between Sequoia and Alhambra Streets were constructed by Harms Bros., contractor.

US 50

US 50 enters District X through Altamont Pass, joins US 99 at Stockton and continues north to the Sacramento county line.

Approximately 15½ miles of US 50 between Tracy Overhead and Stockton are under improvement at a total cost of $3,558,000. From Tracy to Kasson Road (better known as Grant Line Road), a 3½-mile interim proj-

Construction on the Yosemite All-year Highway (Sign Route 140) eight miles north of Mariposa is improving this important recreation route ect is under construction, widening the existing two-lane highway to four lanes. Work on 6¾ miles of four-lane divided highway between Mossdale at the San Joaquin River and Richards Avenue south of French Camp is nearing completion. The project involves a railroad separation and an interchange with State Sign Route 120 near Mossdale. From Richards Avenue to Charter Way in Stockton, an interim project consisting of two bridges and 5¼ miles of four-lane undivided highway is nearing completion.

The interim projects on US 50 near Tracy and Stockton have been dictated by the need for added traffic capacity prior to completion of the Westside Freeway.

US 99

US 99, a heavily traveled and extremely important highway from north to south. Ultimately, a portion of its traffic will be diverted by the proposed Westside Freeway.

Two projects, totaling $4,626,000, added 9¼ miles of full freeway to US 99 during the year. The first project included 4½ miles of full freeway with interchange and frontage roads from Canal Creek to Grove Avenue at Atwater, in Merced County. The second project is in San Joaquin County from Lodi north city limits to one-half mile north of Jahant Road. The latter project included a number of structures such as the Mokelumne River Bridge, Woodbridge Road Overcrossing, Acampo Road Overcrossing, Peltier Road Overcrossing, and the Jahant Road Overcrossing. Frontage roads were provided on both sides throughout the project.

The project in San Joaquin County was completed in September of 1957 and the Merced County project in November of the same year.

Bids were opened on July 2, 1958 for a third freeway project on US 99. The project proposes to convert a portion of the Stockton Bypass between Mariposa Road and Route 75 to full freeway status. Included in the $1,000,000 project are the Mariposa Road Interchange, South Stockton Overcrossing and Route 4-75 (Farmington Road) separation with a system of frontage roads.

An aerial view eastward on Sign Route 120 in Stanislaus County showing relocation of the highway at Jones Curve, east of Oakdale. The old highway is to the left.

Sign Route 12

Highway 12 runs from the west boundary of Solano County through Jamison Canyon to U. S. Route 40 near Cordelia. It continues from Fairfield through Solano, Sacramento and San Joaquin Counties to US 99 near Lodi. From Lodi it continues east into Calaveras County to Sign Route 49 at San Andreas.

A bridge and approach contract at the Rio Vista Bridge across the Sacramento River will replace a narrow antiquated concrete bridge and bascule span and provide a separation structure at the intersection of legislative Route 99, the West Sacramento-Rio Vista Road, and Sign Route 12. This project will be completed in 1960 and the total cost is estimated at $3,-310,000.

Bids were opened in July for a 5½-mile improvement on Sign Route 12 from the east end of the Sacramento River bridge at Rio Vista to the Mokelumne River bridge. The project follows a direct route replacing a narrow, tortuous levee road. A number of engineering problems are presented by the relocation due to the unstable peat soil necessitating the installation of 38,400 lineal feet of 18-inch sand drains to assist in draining the underlying mass by providing an escape route for the water being compressed, and by so doing it speeds up the rate of consolidation to the point that ultimately the underlying soils will be stable under the superimposed fill load. It is anticipated work will be completed concurrently with the Sacramento River bridge project.

January, 1958, 6¾ miles of Sign Route 12 were improved with the completion of a roadway on new alignment around the extended limits of Travis Air Force Base. Work was accomplished between 2½ miles east of Suisun and one-half mile east of Denverton. Fredrickson Bros. was the contractor, and the cost of the work was $1,018,750.

Sign Route 49

One major improvement on Sign Route 49, the Mother Lode Highway, was completed in October, 1957. A

The US 50-Sign Route 120 interchange at Mossdale is nearing completion. The river in the background is the San Joaquin.

relocation project near Mokelumne Hill replaced 2½ miles of winding, narrow grade with an all-paved 32-foot roadway at a cost of $327,000.

A second project between three and four miles northwest of Sonora, involving grading and surfacing, for a total cost of $131,000, is nearly completed.

Sign Route 88

The Carson Pass Highway, Sign Route 88, starts at Stockton and traverses Carson Pass at an elevation of 8,600 feet and continues to the Nevada state line near Minden. It passes through Jackson, historic community which dates back before the Gold Rush. Two famous gold mines were located near Jackson, the Argonaut and Kennedy Mines, from which millions of dollars were taken in the early days.

A section of Sign Route 88 in Alpine County was completed in October, 1957. This improvement which is 5¾ miles in length is between Red Lake and a point 1½ miles east of Blue Lake Road. The final cost was $729,550.

A second project on Sign Route 88 in Amador County is currently in progress. A portion amounting to 7¾ miles between Lancha Plana Road and Martell is being graded and surfaced at a cost of approximately $1,040,000. It is estimated that work will be completed by September, 1958.

Also of interest is the construction project now underway at Peddler Hill under the supervision of the Federal Bureau of Public Roads. This work is an extension of two previously completed projects by the bureau. The contractor is H. E. Parker.

Sign Route 108

The Sonora Pass Highway crosses Sonora Pass at an elevation of 9,600 feet. It follows the same route as Sign Route 49 between Yosemite Junction and Sonora.

Four miles of Sign Route 108 is under construction from one mile west of Yosemite Junction to Montezuma Road in Tuolumne County. The project involves grading and surfacing on improved alignment at a cost of $606,650. It is estimated that work will be completed by September, 1958. The contractor is the Rockport Redwood Company.

Sign Route 140

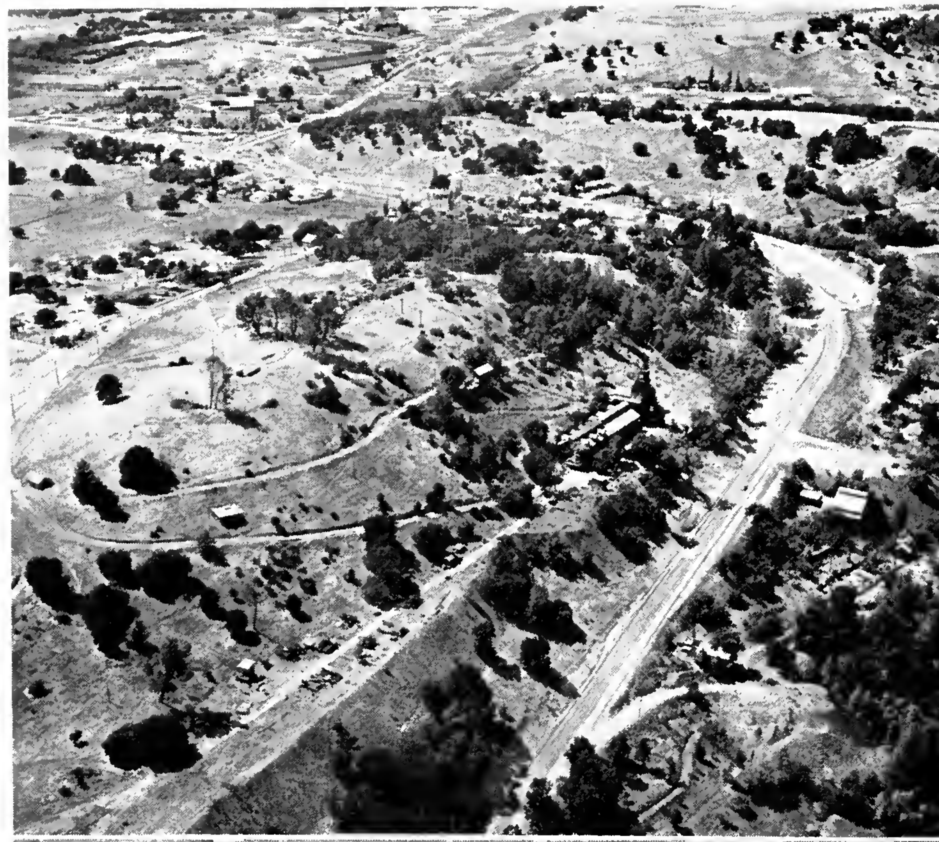
This route is known as the All-year Highway from Merced to Yosemite Park, inasmuch as it is not closed during the winter months as are other routes into the park. It passes through the Town of Mariposa, a community dating back to Gold Rush days, which is the southern terminus of the Mother Lode Highway.

Work was completed in December, 1957, on a five-mile realignment of Sign Route 140 in Mariposa County between Acorn Inn and King Solomon's Mine. The cost of the work was $1,106,300. The project improved an important segment of the All-year Highway into Yosemite National Park. A second project, between Briceburg and Crane Flat, was completed in July, 1957. This project involved line changes, restoration of embankment protection along the Merced River, bridges and surfacing at a total cost of $828,200.

Various other contracts have been completed on this route in recent years so that now the motorist has the advantage of nearly a continuous 32-foot all-paved roadway from Mariposa county line to Briceburg.

By the end of 1958 approximately 22 miles of full freeway will have been completed by current projects in District X. Interim projects will add

... Continued on page 48



UPPER—This section of Sign Route 88 in Amador County near Jackson is being improved. The Town of Martell is in the distance. LOWER—An aerial showing the newly constructed southbound lanes to the right on US 50 in San Joaquin County.

Irvine-El Toro

New Santa Ana Freeway Section Completed in Orange County

By J. D. HETHERINGTON, Resident Engineer

To THE motorist who remembers the narrow substandard over-hill-and-dale section of US 101 in Orange County between El Toro-Niguel Road and Laguna Canyon Road, news of the completion of this four miles to full freeway standards will be welcome.

The $2,400,000 contract for construction was awarded to Cox Bros. Construction Co. and J. E. Haddock Ltd., a joint venture, on January 30, 1957. Construction work started the first week of February, 1957, and was continuous except for time lost due to inclement weather until completion on April 21, 1958, approximately eight months ahead of the expiration of contract time.

In addition to the construction on US 101, a two-mile section of relocation of State Route 185 (Laguna Canyon Road) was included in the contract. This work was included primarily to provide a source of fill material needed for the freeway construction; however, construction of this section has provided the motorist with a two-lane highway constructed to present-day standards with provision made for ultimate improvement to a four-lane divided freeway section when traffic warrants.

At one time the quantities of material and work involved in a contract of this nature would have been quite impressive. However, with present-day construction equipment, the movement of huge amounts of material has become commonplace. Converting the more than one-half million yards of roadway excavation involved to smaller units, such as the quantity a man could haul in a garden wheelbarrow, will perhaps give a better picture of the work required in changing this farm and pasture land to a modern freeway. It would take one wheelbarrow trip each by half of the 14,445,000 population of California to move this quantity of earth. Each of these wheelbarrow trips would have to be almost a mile long.

Looking west along Laguna Canyon Road showing a considerable portion of the two miles of new roadway.

In actuality, the earthmoving was done using tractors and carryalls for short hauls and tractor and scraper units for the long hauls. To speed up loading of the scrapers, tractor push cats were used in tandem. Due to the hardness of the sandstone encountered in the excavation on the new alignment of Laguna Road, it was found necessary to use ripper-equipped tractors to break up the material prior to loading.

Due to the substandard width and alignment of the old highway, no attempt was made to salvage any of it other than utilizing a portion for subbase for the new construction. In contrast to the old narrow two-lane highway, the motorist now has the use of two 12-foot concrete lanes in each direction with a paved shoulder to his right and a wide median between opposing traffic. Provision has also been made to add an additional lane in each direction when needed for future increased traffic.

Since access is not permitted to the freeway, it was necessary to construct frontage roads from El Toro-Niguel Road to provide access to the Irvine Ranch and other holdings in this area. In addition to the frontage roads, an undercrossing and an overcrossing were constructed to provide access across the freeway for farm equipment.

In addition to structures needed for access across the new freeway the contract also provided for an interchange for the new Laguna Canyon Road and the freeway.

J. E. Haddock Ltd. was represented on the contract by Superintendent George Wiggers. Duncan Manning was superintendent for Cox Bros. Construction Company with the author as resident engineer.

(Other photos on next page.)

UPPER—This photo, taken from the new Laguna Canyon Road traffic separation structure, shows the new section of the Santa Ana Freeway looking south toward San Juan Capistrano. LOWER—The new traffic separation connecting Laguno Canyon Road with the Santa Ana Freeway. (Story on previous page.)

Monterey County

King City-North County Line Section of US 101 Improved

By A. M. NASH, District Engineer

TODAY'S many modern business and pleasure travelers who drive on US 101 in Monterey County travel in increasing comfort, ease and safety as they visit the many scenic resorts and other fascinating points of historical interest that abound in the county, or in making the many truck and passenger trips required to keep pace with the ever-expanding industry and agriculture much in evidence throughout the area.

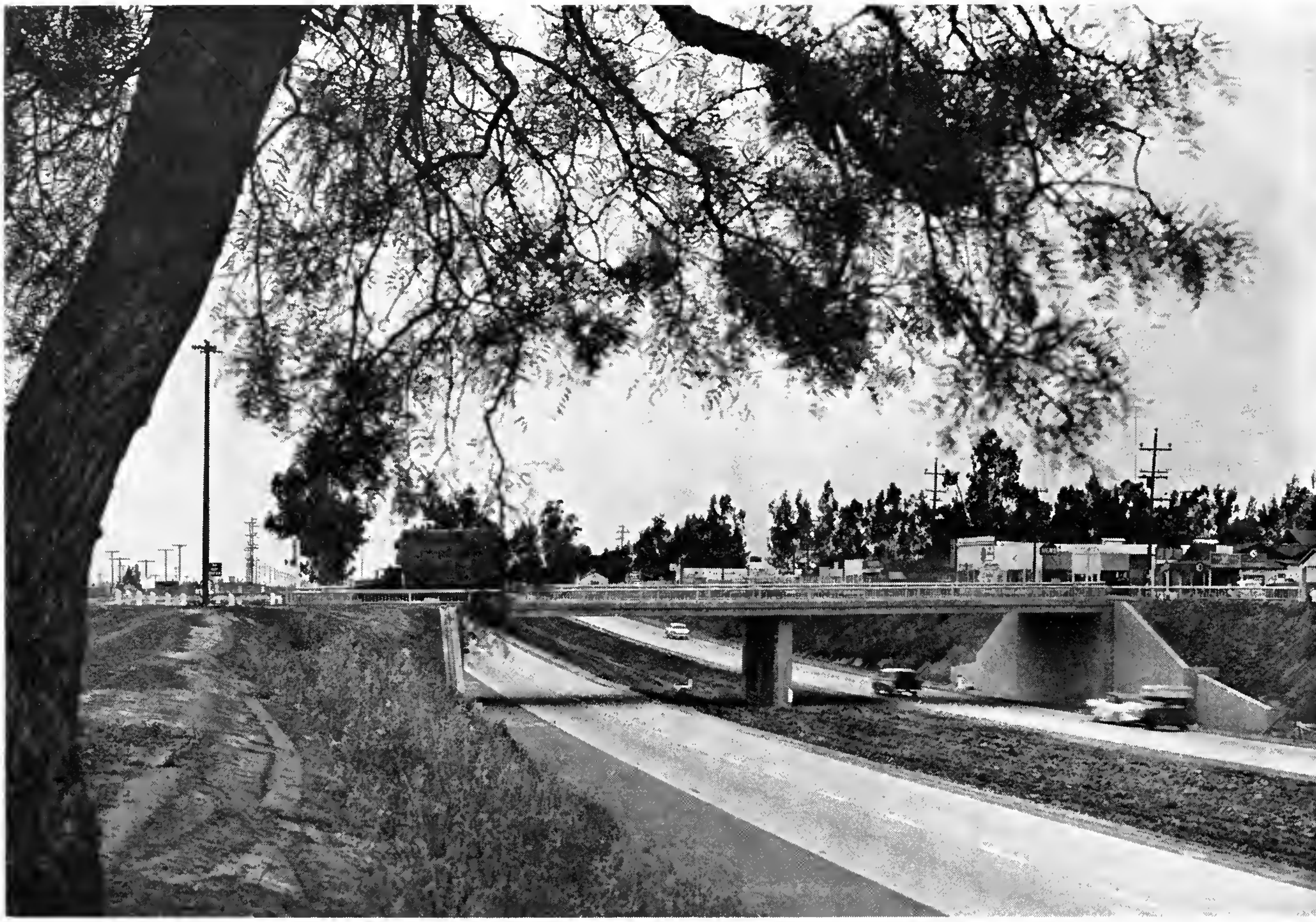
US 101 in Monterey County is rapidly changing from a heavily traveled, two-lane country road into a modern well-planned divided four-lane expressway or freeway. Much improvement has been made, as will be seen, but there is still much to do to provide the traveling public with the modern highways they need.

To see what has been done and will be done, let us take an imaginary trip down historic El Camino Real from the county line north of Salinas to King City, since this section of US 101 has been receiving preferred attention for the elimination of its deficiencies during the last several years.

Entering Salinas Valley from the north we travel over a divided four-lane highway constructed in 1943 but no longer adequate. Plans are well under way for a full freeway development westerly of the existing highway which will bypass the business and residential development that has been built up on both sides of the existing highway, causing much of the traffic congestion. Right-of-way is presently being acquired for this freeway project which will be constructed as soon as funds can be made available.

After passing the Salinas Rodeo grounds to our left, we notice on our right a sign directing us to a ramp leading us onto the Salinas freeway. We are leaving North Main Street and we shall now travel a distance of 6.2 miles skirting the easterly edge of busy Salinas. The first section of this full freeway from North Main Street to South Market Street was opened for traffic in 1954 and eliminated a great deal of the congestion at the intersection of Main and Market in the Salinas business district as well as reducing the heavy volume of traffic on North Main Street. The second section from Market Street to Spence Underpass and Hartnell Road was completed and this entire six-mile Salinas freeway was opened to traffic in 1956, considerably easing the local traffic problems throughout the City of Salinas, as well as facilitating and benefiting traffic to and from Los Angeles and San Francisco.

The Salinas Bypass on US 101 in Monterey County. As the directional sign indicates, the interchange ahead connects US 101 with State Route 117 to the Monterey Peninsula.



A view of the depressed section of the US 101 freeway through Chualar and the Main Street overcrossing. The old highway is on the upper level to the right along the line of buildings.

Separation structures were constructed at sufficient intervals to allow free flow of crosstown traffic and provide access to State Route 117 which leads westerly from this point to historic and scenic old Monterey, the original capital of California, as well as to the resort city of Carmel, the communities of Seaside and Del Rey Oaks, and the large army facility at Fort Ord, north of Monterey.

For details of construction of this freeway, one may refer to the July-August 1953 and March-April 1954 issues of *California Highways and Public Works*.

As we travel south on the Salinas freeway we see to the southeast rising sharply from the green valley floor the steep, craggy Santa Lucia Mountains. Looking across the valley to the east we see the green of the Salinas Valley merging into the dry, brown rolling hills of the Gabilan (Hawk) Range that separates the Salinas Valley from the valleys farther east. We are actually entering a huge trough between these mountain ranges, a great, green plain from 10 to 20 miles wide and a hundred miles long.

Rich Croplands

Here we see under intense cultivation and irrigation all types of vegetables with lettuce obviously king of them all. Local people refer to the Salinas Valley as the "Lettuce Bowl of America" and as we travel south seeing the endless rows of vegetable and forage crops it is evident that the Salinas Valley is one of the most productive agricultural valleys in the United States.

Driving effortlessly we have quickly passed the southerly terminus of the Salinas Freeway at Spence Underpass and Hartnell Road. Many road names honor original Spanish, Mexican, and "Anglo" colonists who first settled in this rich valley. These particular road names honor two British citizens who were, after the padres, among the first settlers here.

David Spence came to California from Scotland in 1824 to salt meat and hides for shipment to Peru and other Latin American countries. He prospered, married Adelaida Estrada, daughter of the commandant of Monterey, and settled down to developing the Rancho Buena Vista south of the present-day Salinas. Don William Hartnell, originally a young Lancashire man, became a prosperous trader in Monterey, married Teresa de la Guerra, a high-caste Spanish maiden from Santa Barbara, and later owned and operated the Alisal Rancho. He established a private college which eventually failed due to depression times but which has been re-established as a two-year college in Salinas named, in his memory, Hartnell College.

Heavy Harvest Traffic

South of Hartnell Road we are traveling on a divided four-lane expressway built in 1952 for a distance of 5.5 miles to the northern outskirts of the little town of Chualar. This section of expressway was constructed prior to other sections in this area to facilitate the flow of agricultural produce from the surrounding fields to the market and shipping center in Salinas. The old two-lane highway previously in existence was so congested with large, slow vegetable produce trucks during the summer harvest seasons that all vehicle traffic was forced to travel at greatly reduced speeds.

A one-mile freeway section through the Town of Chualar has just been completed. Completion of this freeway has eliminated an annoying two-lane traffic bottleneck which formerly existed between the divided four-lane expressway north of town, over which we have just traveled, and the divided four-lane expressway from the southerly limits of Chualar to two miles north of Gonzales, some 3.8 miles away, which was completed in July, 1954.

Old Spanish Rancho

Chualar is an unincorporated community approximately 10 miles south of Salinas on El Camino Real approximately two miles east of the Salinas River, lying in the center of a level agricultural plain some 110 feet above sea level. The town varies from 300 population in off agricultural seasons to 800 during peak harvest periods as imported farm laborers crowd the labor camps as they harvest the vegetable crops produced in the rich land for many miles around.

The land on which these crops are grown lies in the yet distinct boundaries of the old Chualar Rancho. This 8,890-acre rancho, an original land grant from the King of Spain to an old Peruvian trader named Juan Malarin, passed into the hands of a Scotsman named David Jacks in 1850 when Juan's son, Mariano Malarin, could not repay Jacks a loan on his rancho of $3,000 which he had borrowed in a vain attempt to save his cattle operations during a long drought. The rancho is still owned by the David Jacks Corporation, which he established before his death.

M. J. B. Construction Company and Lord and Bishop, Inc., of Stockton worked on this project as a joint venture with Lord and Bishop, Inc., doing the structure work.

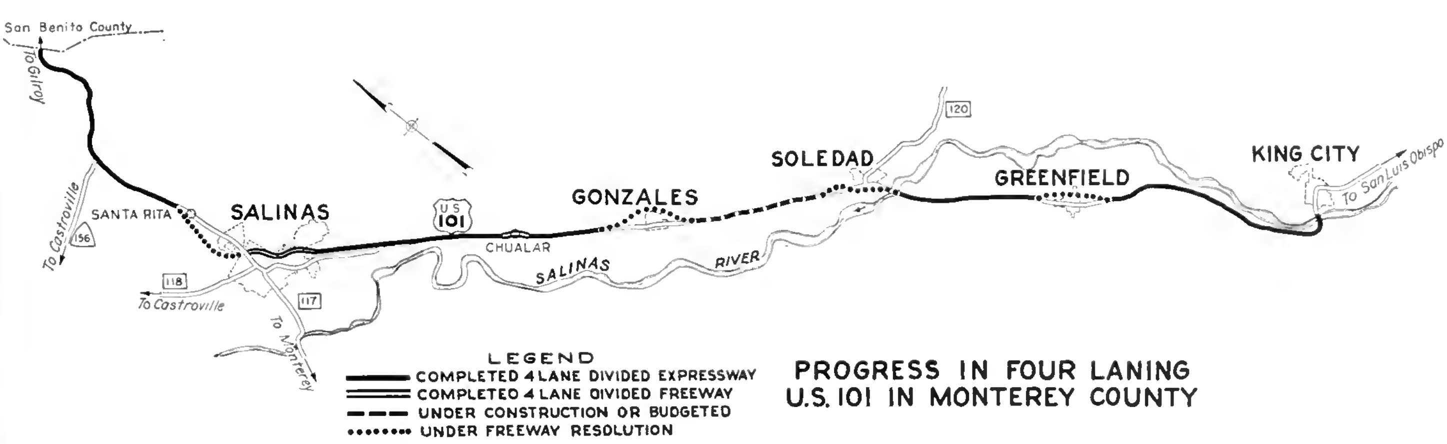
Work started in April 1957 and was completed approximately one year thereafter. The project consisted of constructing 1.5 miles of four-lane divided freeway with a depressed mainline section through Chualar, and a diamond-type interchange with an overcrossing at Main Street. The new alignment runs between and parallel to the old highway and the Southern Pacific Railroad. The old highway through Chualar became a frontage road. An existing county road which intersected the highway just south of Chualar was realigned to connect to the Main Street interchange.

Since construction of this section of highway parallels the existing highway, and overlaps the existing four-lane divided expressways to the north and south, it was necessary to detour traffic at various stages of construction, when the existing traveled way became involved in the construction procedures. Detouring was complicated by a time element resulting from construction of the prestressed concrete overcrossing at Main Street. Setting up safe detours proved to be quite a problem since traffic approached the project from the north and the south on long level sections of high-speed divided expressway. One troublesome spot was greatly improved by erecting an oversize 8-by-8-foot advance "SLOW" sign to warn oncoming high-speed traffic.

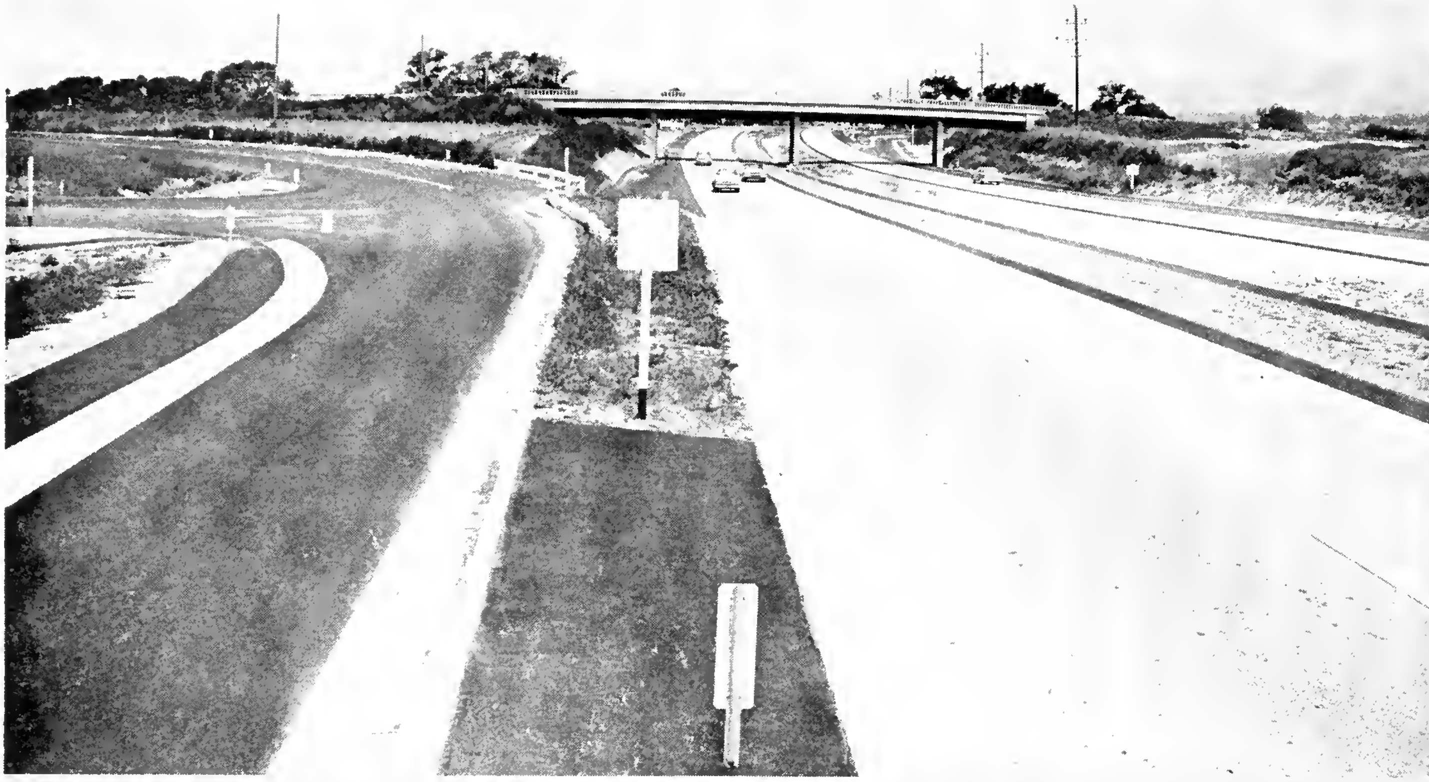
Soil Problem

Excavated material encountered within the roadway area proved to be expansive. Generally, a moisture content of 20 percent was required to obtain "no shrink, no swell" moisture requirements. Subgrade samples were taken early during the grading operations. From tests on these samples, the laboratory recommended that the structural section for the base materials and pavement be increased from two feet to three feet to prevent detrimental swell of the underlying basement soils. This was done.

Construction of the depressed section resulted in a surplus of excavation of approximately 75,000 cubic yards out of a total of 124,000 cubic yards. This surplus was disposed of in areas outside of the right-of-way, some of which were selected by the State and others by the contractor. Most of this



PROGRESS IN FOUR LANING U.S. 101 IN MONTEREY COUNTY



The section of US 101 expressway between Soledad and Greenfield (upper) showing the Arroyo Seco overhead and frontage roads left and right is typical of the new divided, multilane construction replacing such sections as the existing highway through Soledad (lower) with its slow-moving traffic

A view southward of the Salinas Bypass from the John Street overcrossing showing industrial development in the zoned area to the right

disposal material was moved by the use of two-axle pneumatic-tired scrapers and was hauled across the railroad tracks which paralleled the job to the west. Considerable excitement occurred on two different occasions when a scraper accidentally hooked into the rails and pulled the Southern Pacific tracks out of line. Trains were able to detour via an existing siding without much delay. Part of the work under this contract consisted of constructing some fills for a Southern Pacific Railroad siding relocation necessitated by the new highway construction.

The flat terrain in this area made it necessary to set up two storm drain systems to drain the project. First of all, the depressed freeway section, which is 15 feet below the surrounding area, is being drained by a gravity storm drain. The depressed area storm drain consisted of an intricate system of small box culverts which drain into a 30-inch reinforced concrete pipe which runs into a reservoir approximately 1,100 feet west of the project. The 30-inch reinforced concrete pipe was laid on a 0.3 percent grade and 92 feet of it was jacked under the Southern Pacific Railroad tracks.

The second storm drain runs along the old highway which will become the frontage road through Chualar. This storm drain picks up the water from the streets of Chualar and carries it out the north end of the project. It is on a 0.3 percent to 0.4 percent grade and starts out with a 30-inch reinforced concrete pipe increasing to a 36-inch reinforced concrete pipe. All new pipe culverts on the project are of reinforced concrete pipe.

Prestressed Concrete

To meet limited clearances at the Main Street overcrossing it was necessary to construct a bridge with a minimum structural depth. A two-span continuous prestressed slab, 18 inches thick, was constructed providing two 14-foot lanes and one five-foot sidewalk.

Ninety-one 1⅛-inch diameter rods were used in the construction of this prestressed slap. The rods were post-tensioned to 12,000 pounds per square inch and then grouted with a cement grout. The entire stressing operation, including grouting, was completed in three days.

A borrow pit located 1½ mile south of the project suitable for imported base and subbase materials was set up in the special provisions, and the contractor elected to use this pit.

All aggregates used were obtained from commercial plants. Materials for the concrete pavement were batched at a commercial plant in Salinas. Plant-mixed surfacing was obtained from a commercial plant 29 miles north of the project.

The prime contractors were represented by Superintendent M. L. Purser. Wayne Louderback was Bridge Department representative and Al Jorge was Resident Engineer on the project.

With the elimination of the Chualar bottleneck the motorist can now drive on divided four-lane highways from the Santa Clara county line to a point two miles north of Gonzales, a distance of 35 miles.

All too soon, after a brief 3.5 miles of travel south of the new Chualar Freeway, the wide expressway ends, and we enter a section of two-lane highway extending from two miles north of Gonzales to 0.3 mile south of the Salinas River.

Deficiencies Recognized

It should be noted that our design engineers are even now completing plans for a 5.6 mile freeway to bypass to the east the stretch of two-lane highway we now have to travel from a point two miles north of Gonzales southerly.

Our planning engineers have long recognized the deficiencies of the existing two-lane highway in and on either side of Gonzales with its high accident rate, congestion and ribbon development through Gonzales complicated by lack of access control. Congestion has always been acute in the summer months when produce hauling from the adjacent farms to packing and shipping points in Salinas results in a high percentage of slow-moving produce truck traffic. This congestion has resulted in considerable unsafe use of shoulders for passing purposes.

The new four-lane divided freeway facility now under design will veer off easterly from the terminus of the present expressway north of Gonzales with an interchange approximately 2,000 feet south of the project point of beginning to provide access to Gonzales on the existing two-lane highway for local traffic.

Veering east, the new alignment roughly parallels the easterly city limits of Gonzales, skirting the new subdivision areas lying within the city limits.

An overpass with north and south on and off ramps will be constructed at Johnson Canyon County Road that merges into Fifth Street within the city limits and roughly crosses in east-west direction the center of town.

Bypass Planned

From Johnson Canyon Road the new alignment will veer westerly, meeting the existing highway approximately one mile south of town by means of an interchange. At the southern end of this interchange the proposed bypass freeway will merge with the existing highway again.

Right-of-way acquisition has been started on this project. Construction is estimated to cost $2,200,000 exclusive of right-of-way and will be started as soon as funds can be made available.

An intricately related part of this project is the next section directly south tying in with the above project at approximately one mile south of Gonzales. This project on which construction has just begun is designed to remove the deficiencies of the existing two-lane highway from this point to a point 0.8 mile north of Soledad. Deficiencies here are the same as cited around Gonzales and are generally

This is US 101 north of Soledad at the entrance to Soledad State Prison as it looked before the contractor began operations in June. New highway lanes will be constructed on the right, parallel to the existing roadway.

true throughout the rich agricultural portion of the Salinas Valley.

This project is a part of the California Highway Commission's route adoption between Salinas River and two miles north of Gonzales in August, 1955, which was immediately followed by freeway agreement with the County of Monterey in October, 1955. The Board of Supervisors of Monterey County have been cognizant of the great need for freeway development on this highway and have been very helpful and most co-operative in working out the many problems encountered by the state engineers in developing the necessary freeway agreements.

Wark Will Begin

This construction project initially develops a four-lane divided freeway for its entire length of 5.7 miles which will be graded and paved with plant-mixed surfacing or cement-treated base with two grade separations structures to be constructed at the entrance to Soledad State Prison and at Camphora railroad station and Gloria County Road. Approximately $1,780,000 has been budgeted by the California Highway Commission for construction.

Yet these projects in themselves do not solve our critical traffic problems in this area. We must consider two other projects presently being designed and readied for construction.

The major of these two is the Soledad bypass freeway beginning at the terminus of the project just discussed one mile north of Soledad. It is proposed to construct a four-lane freeway on new alignment 2.8 miles in length bypassing the City of Soledad on the west, through cultivated portion of the old San Vicente Rancho.

The existing highway will be used for 750 feet at the northern end of the project in making the transition to new alignment. A grade separation structure will be constructed over the existing highway and Southern Pacific Railroad approximately one-third mile north of town. An off-ramp farther north will allow traffic access to town from the freeway.

Existing Highway Used

The new alignment parallels the railroad and westerly city limits until it merges with the existing highway just south of the existing highway railroad underpass by means of an interchange. The existing highway will be used for the southerly 700 feet of the project as the freeway merges into existing alignment at the Salinas River Bridge, south of Soledad. As part of this project a second bridge over the Salinas River will be constructed directly west of and parallel to the existing bridge. Right-of-way is presently being acquired and construction is scheduled as soon as funds become available.

As we cross the bridge over Salinas River south of Soledad we can see on both sides of the highway groves of old oak trees that once provided shade fot Don Gaspar de Portolá, Padre Junípero Serra and their band of 20 weary men as they camped here on their historic journey of exploration from San Diego to find a land route to the Bay of Monterey, a route which with slight deviation we now refer to as El Camino Real.

Within the oak grove on our right lies an old long rectangular adobe and wood siding building that was once the ranch headquarters of Feliciano Soberanes, a retired soldier of the King of Spain who received the surrounding Los Coches Rancho as a land grant from the King in appreciation of his long and loyal service.

Later the old adobe became a populare stagecoach stop at the intersection of the well-traveled El Camino Real and Paraiso Hot Springs Road.

As with the Chualar Rancho, the Los Coches Rancho passed into the hands of David Jacks. The very productive Los Coches Rancho is still owned by the David Jacks Corporation, who lease the land for vegetable growing and dairy operations, and one of the tenants on the rancho still lives today in this old adobe.

New Interchange

Across the highway from this old adobe a new interchange has just been constructed as part of a four-lane expressway project between the Salinas River and one mile north of Greenfield.

This overcrossing at the north end of the project diverts traffic to the Arroyo Seco district over the freeway lanes on a two-way reinforced concrete, open beam bridge.

Grading was light over most of this 5.6-mile expressway project, with only 273,000 cubic yards of roadway excavation.

The contractor was hampered during his grading operations by high-velocity winds that blew almost daily from the north, creating a tremendous dust nuisance because of the fine, silty, sandy quality of the local soils. It became necessary to keep seven or eight water trucks steadily sprinkling the graded roadway 10 hours a day, seven days a week, using three different sources of water. When grading was completed and the left lanes paved, dust palliatives were applied on an experimental basis by our Materials and Research Department with considerable success, and the contractor was able to considerably reduce his water application operations.

Base material was manufactured from a pit in the nearby Arroyo Seco River, located at midpoint of the job. Aggregates were trucked approximately 60 miles by bottom dump truck and trailers from Aromas. Fortunately, the necessary sand was obtained from Metz, a short eight miles from the batch plant, and plant-mixed surfacing was produced from an old existing plant set up in the Arroyo Seco River just south of the base pit.

Detour Necessary

Traffic was maintained on the old lanes and around the overcrossing site by a 2,000-foot detour until the new left lanes had been completed. Traffic was then placed two-way on the new concrete lanes and the existing two-lane roadway was completely resurfaced. Two locations on the existing lanes were reconstructed to meet the high present-day highway design standards.

The only real traffic problem on the project was handling the flow of traffic to the Arroyo Seco and Mission districts which had to pass through the overcrossing construction area. The problem was solved by dividing

The detour at the beginning of the freeway project between King City and Greenfield during construction. Effective barricades such as this get traffic moving over the detour without delays. Some 9,000 vehicles a day use this section of US 101.

the main area of work into three stages of construction, meanwhile leaving a 200-foot gap in construction to allow traffic through.

The contractor was the Granite Construction Co., who was awarded the contract in April, 1957. The Bridge Department representative was William H. Schooler, and the resident engineer was R. S. Scamara. Cost of the work was $1,145,000.

Once again we revert to two-lane highway as we enter the Town of Greenfield. This section too, through Greenfield, is included in plans for four-laning US 101 in Monterey County.

Farm Traffic

Generally we shall follow the same overall plan developed for bypassing the Towns of Gonzales and Soledad with a four-lane freeway bypassing Greenfield, this time to the east, some three blocks from the existing highway which passes through the business district. The present traffic congestion occurring through this area during the summer months also results largely from produce hauling on adjacent farms to packing and shipping centers in Salinas.

An added traffic hazard in Greenfield that will be eliminated in this proposed freeway construction stems from the Greenfield Grammar School which lies adjacent to the existing highway, generating a considerable volume of pedestrian traffic across the existing highway during school hours.

Beginning a mile north of the city the project will make a transition from the recently completed project to the north, veering slightly east and paralleling the existing highway through town joining with the new expressway project nearing completion approximately 1.5 miles south of Greenfield.

Interchanges are proposed at each end of the Greenfield city limits, at Walnut Avenue near the middle of town, and a separation at Elm Avenue the main east-west county road which actually connects the Gabilan and the Santa Lucia Mountain Ranges. Present estimated cost of construction of this 3.7-mile freeway section, including structures, is approximately 1.5 million dollars with an additional expenditure of $500,000 required for acquisition of rights-of-way. Construction will be scheduled on this project as soon as the necessary funds become available.

Bridge Completed

On leaving town we see ahead another newly completed link in our chain of freeway projects in Monterey County. This particular expressway project joins on the south with the short expressway section completed in 1956 which included the new bridge across the Salinas River at King City.

Even though the expressway on which we are now traveling has recently been completed we have already nearly forgotten that the previous highway from Greenfield to King City, bounded on the east by the Salinas River, and on the west by

. . . Continued on page 53

Crestmore Bridge

F. A. S. Project Completed Near City of Riverside

By DOUGLAS POWELL, Assistant Road Commissioner, Riverside County

In May, 1958, a final field inspection was made by the State Division of Highways and the Riverside County Road Department to accept the Crestmore Bridge, Federal-aid Secondary Project S-1177(3). There were no ribbon-cutting ceremonies, no applauding civic groups, and no speeches, but the event did culminate some 7½ years of effort and the expenditure of some $650,000 on behalf of the State, the Federal Government, and the county in the realization of a new northwest access route to the downtown area of the City of Riverside.

The Santa Ana River crosses the northwesterly corner of the county adjacent to the Riverside city limits. It drains an area of approximately 790 square miles, much of which lies in the rugged San Gabriel and San Bernardino Mountains. The stream rises in the mountains and is fed by nu-

An aerial view of the new Crestmore Road and Bridge with the City of Riverside in the distance. The bridge was lengthened by Riverside County under the Federal-aid Secondary program. The river is the Santa Ana.

merous small tributaries as it runs to the Pacific Ocean at a point just south of Huntington Beach.

In Riverside County, most of the river is deceptive in appearance, as its flow is mostly through subterranean placer gravels, and it is rarely a visible watercourse. This part of Southern California has undergone a protracted dry cycle since the early forties and most of the extensive population influx since World War II has never had an opportunity to see the river in flood stage.

Runoff Problem

However, due to the size of the drainage basin, the steep and barren slopes of the semidesert mountains, and the magnitude of the possible storms, an accumulated runoff in excess of 100,000 second-feet is readily realized, and such flows pose a considerable problem in planning and financing any bridge crossings.

Prior to the completion of the present structure, there were only five crossings of the river inside Riverside County with the average distance between them over five miles, and basically only one bridge, the Rubidoux Bridge on U. S. Route 60, serving the City of Riverside. Needless to say, this was an inadequate arrangement from both the civilian and military standpoint, and had received considerable criticism from various public groups for several years.

Late in 1950, the county road department undertook a study of the feasibility of providing an additional crossing some two miles northerly of US 60 at a point which had formerly carried a trestle bridge on the long-since abandoned Pacific Electric Railway. A low-type road crossing at stream level had been maintained by both the city and the county at this point for some years, and in spite of its impassibility during wet weather showed an average daily use of nearly 500 vehicles.

In the preliminary review, extensive information was obtained from a report prepared in 1943 by the Corps of Engineers on a proposed flood control project for the entire Santa Ana River from its source to the ocean.

An aerial of the recently constructed channel for the Santa Ana River and the Crestmore Bridge located northwest of the City of Riverside

Land Use Studies

This report had been submitted to Congress in 1943, and had lain dormant in the ensuing seven years in spite of repeated efforts on behalf of the county and the flood control district to revive it.

Planning commission studies gave information on current and projected population and land use for the residential and industrial areas north and west of Riverside that such a new route would serve and a further incentive was added by the completion of the San Bernardino Freeway through Bloomington which provided an interchange connection to serve the proposed Crestmore Road traffic bound for the metropolitan areas.

After completing this preliminary planning, the county road department submitted the following recommendations to the board of supervisors:

(1) That the initial construction be on the basis of providing for the northbound set of lanes of an eventual four-lane divided facility, but that right-of-way be acquired immediately for the ultimate construction, and that it be acquired with full access control.

(2) That the first stage of the work consist of the construction of a 600-foot plate-girder bridge so designed that eventual extension to double this length could

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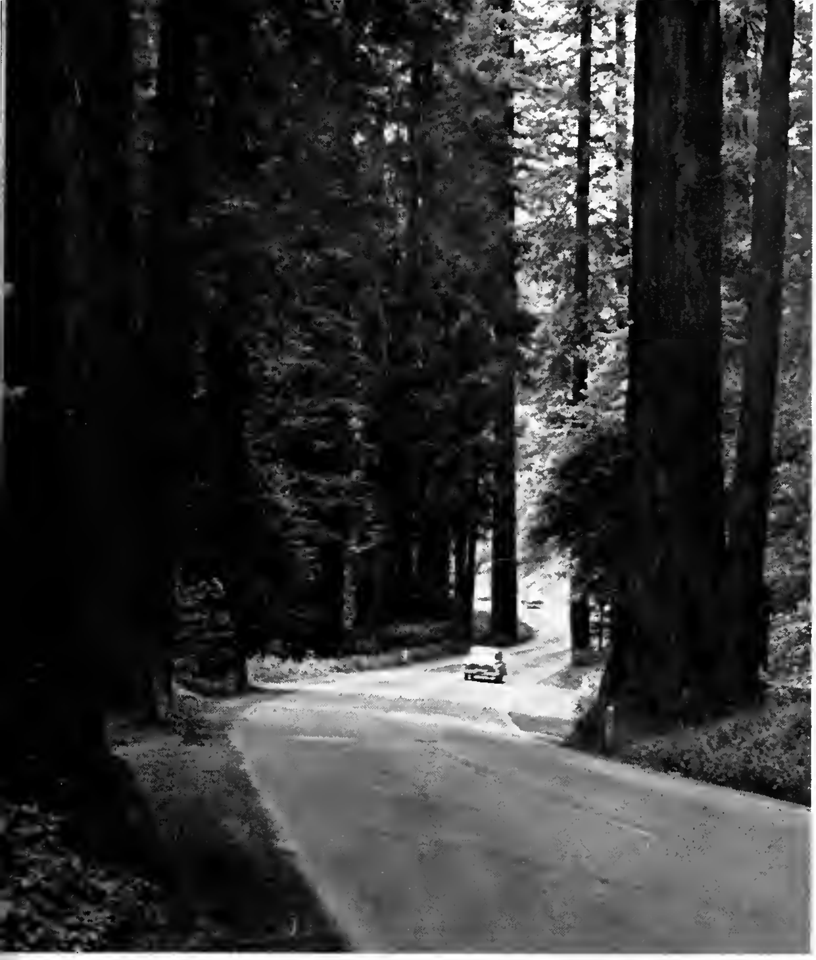

Report From District I

By SAM HELWER
District Engineer

In the first biennial report of the California Highway Commission for years 1917-18, which accompanied the sixth biennial report of the Department of Engineering, we find the opening introductory paragraph: "In 1910 the people of the State of California adopted the 'State Highways Act' providing for the issuance of bonds to the amount of $18,000,000 for the construction and acquisition of a system of state highways."

As a result of that forward step by the people of the State of California, the record shows that Contract No. 2 was located in Mendocino County in District I. This contract provided for grading a 12.6-mile section of highway between the Sonoma-Mendocino county line and Hopland.

The contract, dated July 23, 1912, was with the General Construction Corporation and work was completed at a cost of $93,280, plus $2,675 for engineering, or a total of $95,955.

PHOTO ABOVE—*US 101 between Phillipsville and Arden in Humboldt County, a scene typical of the Redwood country in District I*

Other contracts followed in District I and throughout the State, and it probably appeared that a sound highway development program was well under way, promising California an adequate highway system commensurate with the thinking of the times.

The people of California had vision, but who could visualize the tremendous development of the "horseless carriage" and its utilization coupled with all developments—population, industry, etc.—would result in the present transportation and highway problems?

In District I, the "main line" is US 101, more commonly referred to and known worldwide as the Redwood Highway. In Del Norte County the Redwood Highway changes to US 199, connecting Crescent City and Grants Pass, Oregon, while US 101 continues northerly along the coast.

Vacation Traffic

It is doubtful if the early roadbuilders in District I, as they embarked on the ambitious program in 1912, realized that they were constructing a highway which would become internationally known as the "Redwood Highway." The cathedral-like groves of ancient trees have continued to attract tourists in ever-increasing numbers from the four corners of the world. This has generated travel through and into the area to the extent that the tourist and vacationist expenditures have become an important segment of the area's economy.

The early construction of the Redwood Highway for many miles was entirely remote from the wagon or stage roads that served the areas. Such places as Sherwood, Bell Springs, Harris, Alderpoint were way stations on the original stage roads from the south and into Eureka. The groves of virgin redwoods as traversed by the present Redwood Highway were in a virgin state, sparsely settled.

After initiation of the California state highway development program, there was an orderly and constant development of the state highways within District I. However, it became obvious, as result of continuing advancement of automobile design as to speed, roadability, and power coupled with increasing traffic volumes, that the development of highways was lagging. In the late twenties and early thirties highway projects under way were still replacing portions of the original wagon or stage routes that had become part of the Redwood Highway. This constant development was on a two-lane basis commensurate with stringently limited funds.

Modernization Begins

Many notable projects were completed in the late twenties and thirties undoubtedly inducing greater traffic volumes to the Redwood Highway as its fame became more pronounced. Growth of the area in turn generated additional volume in the form of commercial and industrial traffic.

The old Cloverdale-Hopland Grade, a portion of which was that old Contract No. 2, was eliminated by the construction of an entirely new water level grade along the Russian River between Cloverdale and Hopland. The highway between Hopland and Ukiah was also modernized. The old Oil Well Hill grade north of Willits was reconstructed to adequate standards of the time and appeared to be the fulfillment of needs long into the future. North of Laytonville, the old road was replaced with new and modern line and grade. Especially noteworthy was new construction from old Pepperwood School over Rattlesnake Summit to Farmhouse Inn. This reconstruction replaced a portion of the tortuous and narrow road over Rattlesnake Summit and in the canyon of Rattlesnake Creek.

New bridges and considerable realignment were constructed at Big Dann and Cedar Creeks. New bridge and realignment was constructed at the South Fork of Eel River at Dyerville. The old highway between Fortuna and Eureka was completely reconstructed with a new relocation over Table Bluff and across Beatrice Flats.

Old Road Replaced

North of Eureka the same pattern prevailed, with many miles of then old substandard road being replaced by modern two-lane facility in accordance with acceptable design standards of the times. Trinidad northerly, Orick to the county line, Last Chance Slide to Flanagans south of Crescent City, were names of projects that resulted in vast improvements to the Redwood Highway.

We have been discussing the "main line," or US 101, but improvements during this era were by no means confined to that route. Other routes in the district were receiving attention wherein the most deficient sections or bridges were being reconstructed or replaced, again commensurate with the availability of funds.

This continuing development was, of course, interrupted by World War II, when maintenance and strengthening of pavement structure were the major activities.

During the war period, demands for lumber instigated development of the vast, virtually untouched, fir timber resources in Humboldt, Del Norte, and Mendocino Counties. The heretofore long-established redwood industry was being supplemented to a

Old bridges on Sign Route 1 on the Mendocino coast have been replaced by modern structures such as this one across Salmon Creek

Heavy grading operations on the first unit of the Redwood Freeway. This aerial view southward was taken over High Rock Hill. The river in the upper left is the Eel.

rapidly increasing extent by the fir industry.

This spectacular expansion of the lumber industry within District I resulted in a somewhat suddenly added importance of the highways and roads in the counties.

Lumber Industry Expands

The long-established redwood industry generally utilized logging railroads for their forest-to-mill transport, and used railroad and water for transport of finished products to market. Logging techniques changed with the accelerated development of the fir industry. New areas were opened and mills of all sizes and production capacities were developed in areas only served by state and county highways. The logging and lumber trucks became an important segment of the traffic stream. The necessary services to these far-flung timber enterprises and immigration of people to man the expanding industry gave impetus to the importance of highways, and made the deficiencies more glaring. The Redwood Highway with recreational and tourist traffic consistently recording the high traffic volumes during the summer months, had suddenly changed to a more important adjunct to the economy of the area, by servicing this greatly expanded lumber industry throughout the year.

As we all know, the postwar "boom" started in the late forties at termination of World War II and went into the fifties. The demand for timber products went to unprecedented heights, resulting in a similar expansion of the lumber industry in the area. Since the counties in District I contained one of the major stands of timber in the United States, Humboldt County became the largest lumber producing county in the United States. Douglas Fir production, which comprised approximately 11 percent of the county's timber production prior to 1940, increased to more than 60 percent of the total after 1948.

In 1941 Humboldt County had 24 lumber mills with a "rough green" value of production amounting to about $16,000,000. In 1952 the county had 262 mills with a "rough green" value of the timber cut being about $86,000,000. This same change in proportionate amounts took place in Mendocino and Del Norte Counties.

Population Growth

The population of Humboldt County went from 45,812 in 1940 to an estimated 89,000 in 1955, and estimated at 90,000 to 100,000 at present, also indicative of the population growth throughout the District I area.

It is obvious that with such growth the transportation of people, goods, and services became a problem of greater magnitude, and highway obsolescence was accelerated. Contributing further to the increasing traffic volumes were increased numbers of tourists and vacationists as a result of the tremendous population growth in California and the Pacific Coast States.

This whole problem, painfully manifest in terms of congestion and accidents, necessitated a complete new planning approach. It had already been assumed that US 101 in the Fortuna-Eureka-Arcata area would need four-laning, and planning and design was underway on that basis. Now it became necessary to revise the design standards upward for the entire length of the Redwood Highway in the district.

Design standards were set on a four-lane controlled access basis for all future improvements of the Redwood Highway from the Sonoma-Mendocino county line to Crescent City and northerly as justified by traffic demands. This new basis of design

The Scotia Freeway Bypass in Humboldt County. Buildings of the town are seen on the left.

standards, four-lane roadbed versus two-lane, posed entirely new problems throughout the district. Rugged and unstable terrain, tight location controls by streams and mountains, provision of adequate access to and from a four-lane freeway or expressway, and construction of these new facilities within reasonable economic limits posed problems to challenge the ingenuity and abilities of the highway engineers.

Early Expressways

Some of the first multilane construction in District I, although not to freeway or expressway standards, was completed before the full impact of the tremendous growth in "Redwood Land" was felt. These were within the Cities of Ukiah and Fortuna, and the unincorporated community of Rio Dell.

The first rural four-lane expressway construction in the district was undertaken in 1950 and completed in 1952. This project was in Humboldt County from Robinson Ferry Bridge just north of Scotia to Alton, a project length of 4.4 miles. This was a preview of the future improvements of the Redwood Highway within District I. Since that time, development has progressed to the full extent of available funds with better traffic movements and increased ease and safety as each project was completed.

Reconstruction has been on a logical basis, starting improvements on those sections of highway having the greatest degree of deficiencies, highest traffic volumes, and a consideration of all the factors essential to a proper planning program.

Rainfall a Problem

Improvements in the three counties of District I on the Redwood Highway have served to expedite traffic movements, in that modern standards with sight distance commensurate with design speed, four lanes, etc., permitted breaking up long lines of slow-moving traffic resulting from leading slow-moving vehicles.

The advent of four-lane design standards on the Redwood Highway multiplied the problem of providing a stable roadbed in an area of heavy rainfall and unstable rough terrain. The elimination of possible slides and slipouts is a major factor considered in design. These problems were of serious concern to the highway constructors on the Redwood Highway when originally constructing and then modernizing on a two-lane basis; higher four-lane roadbed standards have enlarged this problem. The prevalence of rugged and unstable terrain results in expansive highway construction costs, which decrease the length of improvements obtainable by the District I highway dollar.

Projects Reviewed

Starting at the southerly end of the district and proceeding northerly along the Redwood Highway, we might review the more recently completed improvements, those under way, and projects planned for the future.

In the Ukiah-Willits area the major improvements have been over the Ridgewood Summit. This relocation and improvement between 1.5 miles south of Forsythe Creek and 0.5 mile northerly of the Northwestern Pacific Railroad crossing has almost been continuous since 1950. The 5.2-mile improvement to two-lane expressway in 1950 at the southerly end of the Ridgewood Grade north of Calpella, was extended with a 4.9-mile section of four-lane expressway in 1954, which carried the modernization over Ridgewood Summit. The last remaining section of the originally constructed two-lane highway on this

At Freshwater Lagoon south of Orick, US 101 was rerouted along the sandspit section was eliminated in 1957, with extension of four-lane expressway from Ridgewood Summit to 0.5 mile northerly of the Northwestern Pacific Railroad crossing. This latter project included an overcrossing of the railroad eliminating a hazardous grade crossing of long standing.

In the City of Ukiah, the highway between Smith Street and Low Gap Road was widened to four lanes in 1951. This four-lane section was extended northerly from Low Gap Road to 0.2 mile north of Ford Road in 1956.

Design work is under way on a new freeway to skirt the Ukiah central area to the east. Plans are under way for such construction to extend from Crawford Ranch about seven miles south of Ukiah to just southerly of Forsythe Creek on the north. The total length of this planning is approximately 14 miles and in all probability when the project is financed, construction will be undertaken in three units.

Willits Bypass

Preliminary studies are also active in the planning of a freeway to bypass the central area of Willits. This future project will extend from the end of the recently completed four-lane improvement on the northerly slope of Ridgewood Summit to Reeves Creek north of Willits.

The old and very substandard section of the Redwood Highway between Reeves Creek and the old Sherwood Road south of Laytonville is being eliminated by a series of projects. A four-lane expressway project 2.1 miles in length between Reeves Creek and one mile north of Hilvilla was completed in 1955. A 4.2-mile extension northerly from Hilvilla to Irvine Lodge, north of Longvale, is currently under construction with completion scheduled for this summer. Plans are almost complete, and funds for some rights-of-way acquisition have been allocated for the remainder of the section through Long Valley Creek Canyon to old Sherwood Road south of Laytonville.

As we proceed northerly over Rattlesnake Summit north of Laytonville to Farmhouse Inn, about 12 miles north of Laytonville, work is under way on four-lane expressway construction between Farmhouse Inn and just north of Tan Oak Park, a distance of 2.8 miles. This work is transforming a portion of originally constructed highway to a modern four-lane facility. Ball and Simpson, of Berkeley, are the contractors with a low bid of $1,814,527. This four-lane project will connect with a job completed in 1953 at a cost of $570,000, which replaced an old timber bridge across Rattlesnake Creek with a large culvert and embankment.

Creek Diversion

Work was actually started on this section in 1956 when a tunnel was constructed through a rock point at Tan Oak Park to divert the course of Rattlesnake Creek where new highway embankment will infringe on the original creek channel. This 136-foot-long tunnel was constructed by Mercer-Fraser Company of Eureka at a cost of $39,000.

On the portion between Rattlesnake Creek and the Humboldt county line, studies have been initiated for replacement of this sinuous 25 miles of two-lane road with a four-lane controlled access facility.

A short length of four-lane facility was completed in 1955 at Red Mountain Creek when the old timber bridge at that crossing was replaced with a culvert and fill.

The outstanding recent event in the development of the Redwood Highway through the state redwood parks in southern Humboldt County, was the start of construction of the Redwood Freeway in 1957, in conformance with plans to provide a four-lane freeway through or near the world-famous redwood groves with minimum disturbance to the groves and park areas. Freeway routing has been officially adopted for a length of 43 miles from the Mendocino-Humboldt county line to Jordan Creek. The routing is approximately seven miles shorter than by existing highway.

The Big Cut

The first unit, 4.4 miles in length, now under construction, extends from one mile south of Dyerville to Englewood. Guy F. Atkinson, of South San Francisco, is the contractor on this unit, and final cost will closely approach $7,000,000. The story of the "Big Cut" on this project was given by H. W. Benedict, Resident Engineer, in the September-October, 1957, issue of the *California Highways and Public Works*. The problems of design were covered in an article in the

This four-lane structure over Outlet Creek and the Northwestern Pacific Railroad is part of the US 101 freeway construction north of Willits.

A four-lane fill between Patricks Point Park and the north shore of Big Lagoon will replace the 4,000-foot timber trestle (left)

May-June issue by Norman G. Larsen, Project Designer.

Work on the second unit between Myers and one mile south of Dyerville, a distance of 6.7 miles, is scheduled to start this summer under two separate contracts. One contract will provide for clearing the right-of-way and the other will be the construction of a 540-foot-long reinforced concrete arch culvert in Mowry Creek. The 1958-59 Budget provides $730,000 for this preliminary construction work on the second unit. Additional contracts will provide for grading and surfacing estimated to cost another $5,700,000.

The ultimate completion of this 43-mile length of Redwood Freeway promises to add to the renown of the Redwood Highway by adding new vistas to the traveler and providing greater safety, comfort, and convenience. In all probability, greater volumes of traffic will be induced as a result of the new spectacular and scenic freeway which will provide convenient connections to the old road remaining through the redwood groves where they may then be viewed and enjoyed at a leisurely pace.

Heavy Traffic Areas

Since 1950 the major expenditure of state highway funds in Humboldt County has been on that portion of the Redwood Highway between South Scotia Bridge and Mad River north of Arcata. This section of highway serves the Humboldt Bay metropolitan area, and records the highest traffic density in the district. The continuing program of development within these limits has resulted in the completion of many important projects.

On a sidehill location fringing Scotia to the east, 1.4 miles of four-lane expressway were completed in 1952. This improvement eliminated traffic congestion in Scotia as well as conflict between highway and local traffic since the former highway route was "Main Street" of Scotia. The four-lane expressway between Robinson Ferry bridge and Alton grade crossing, a distance of 4.5 miles, started serving the increasing traffic demands during the previous year.

From Alton grade crossing to the northerly city limits of Fortuna, four-lane freeway plans have almost been completed and some rights-of-way have been acquired.

From the northerly city limits of Fortuna to 0.4 mile north of Fernbridge, construction is in progress on a 3.2-mile length of four-lane freeway. Work is being done under two contracts, one providing for interchange structures and the other for grading and surfacing. This project connects with a recently completed project which provided a four-lane expressway from 0.4 mile north of Fernbridge to 0.7 mile north of Hookton Road on Beatrice Flat, a distance of 4.6 miles. The new expressway created consider-

UPPER In Lake County, Sign Route 53 is being constructed as a modern two-lane freeway. This aerial is looking southward toward Clearlake Highlands and Clear Lake (right background). LOWER Heavy sidehill construction in the canyon of the East Branch of the Russian River in Mendocino County featured the relocation of Sign Route 20 between Calpella and Potter Valley Road.

able interest in the area as it eliminated the old two-lane road over Table Bluff Hill near Loleta, which was a source of traffic delays and accidents.

From Beatrice Flat through Fields Landing and to Elk River just south of Eureka city limits, the freeway routing has been adopted and detailed planning is underway for a four-lane freeway.

One-way Couplet

In the Eureka area, 1956 saw the completion of improvements from 0.2 mile south of Elk River through Eureka and Arcata to the intersection of the Redwood Highway with US 299. The improvements resulted in multiple lanes for approximately 13½ miles, including a four-lane street section, a one-way couplet through Eureka, and four-lane divided expressway, the total investment being approximately $8,097,000.

The continuation of a four-lane expressway from the US 101—299 intersection to 0.3 mile north of Mad River is under construction with the first contract providing a parallel bridge and approaches at Mad River. Bids for grading and surfacing of this 1.5-mile improvement will be called for at an early date.

From Mad River to Trinidad the freeway route thas been adopted and detailed design work is underway. On the portion between Little River and Trinidad, rights-of-way are being acquired.

From Trinidad to Patricks Point State Park, preliminary studies have been started and aerial mapping has been completed.

Trestle Replaced

From Patricks Point State Park to 0.3 mile north of Big Lagoon, a four-lane expressway is being constructed at a construction cost of about $1,740,000. The work is being done under two contracts. Clearing and grading were done under the first contract, and the second contract provides for surfacing and construction of a 400-foot bridge across the Maple Creek outlet into Big Lagoon. This project eliminates the old 4,000-foot Big Lagoon timber trestle. Deterioration in this structure has required a speed limit for large trucks for quite some time.

Reconstruction of US 101 north of Arcata resulted in a new trumpet-type interchange connecting US 101 and US 299. This aerial is looking eastward along US 299.

In Del Norte County, from just south of the Humboldt-Del Norte county line to Minot Creek just northerly of Klamath, freeway routing has been adopted. This future project approximately nine miles long, will involve a new bridge across the Klamath River, and the eventual costs of providing a four-lane facility within these limits is estimated at $12,000,000.

Freeway routing has also been adopted from Minot Creek to one mile north of Wilson Creek, and two projects have been completed on the adopted line. New bridges and approaches were recently completed at Minot and High Prairie Creeks, replacing old timber structures. The new bridges were positioned to allow for future expansion of the route to four lanes.

Obsolete Highway

At Wilson Creek the year 1957 recorded completion of the first section of four-lane highway in Del Norte County. This 1.1-mile project includes a new four-lane bridge across Wilson Creek on new alignment. This portion of new highway has fulfilled a long-standing need by eliminating a stretch of obsolete highway with serious deficiencies in alignment and grade, coupled with a narrow bridge across Wilson Creek.

The old circuitous highway route through Crescent City will soon be a thing of the past. Construction is under way from 0.7 mile south of Elk Valley Road through Crescent City and to 0.4 mile north of Northcrest Drive, a distance of 2.1 miles. This new routing through Crescent City includes a one-way couplet, with L Street serving southbound traffic and M Street northbound traffic. The typical sections include improvement of two-lane existing highway, four-lane street section, and four-lane divided highway, together with channelized intersections. Work is being done by Mercer-Fraser Company, of Eureka, resulting from low bid of $529,955.

On the Redwood Highway (US 199) northeasterly of Crescent City in the Smith River Canyon, preliminary studies for relocation and improvement are progressing involving the portion of highway from Gasquet to Hazelview Summit. Anyone familiar with this area will realize that provision of a modern design highway in this mountainous country will pose some real engineering problems.

Other Routes Improved

During this period of development of the Redwood Highway, other routes have had improvements applied with resultant benefits to traffic and transportation needs of areas served by state highways.

In Lake County, in recognition of the importance of Sign Routes 29, 53, and 20 in the county's transportation picture, development of these routes has been a continuing effort for a number of years resulting in major expenditure of state highway funds.

In the St. Helena Canyon, Sign Route 53 south of Middletown has been reconstructed from the Napa county line down to the flat. Further improvement of the route on into Middletown is in the planning stage. This future project will eliminate a portion of substandard facility by relocation.

Farther north on Sign Route 53 between Putah Creek and Lower Lake, there remain several miles of old highway on which design work is under way, especially on the longer sections of old highway between Harris Creek and Lower Lake.

Sign Route 53 was relocated and reconstructed in 1953 between Lower Lake and Cache Creek. This relocation is currently being extended to the intersection with Sign Route 20 east of Clearlake Oaks by 6.3 miles of two-lane limited access facility. This $800,000 project will eliminate a seriously substandard section in Burns Valley, including the old Seven Creeks open fords.

In the Blue Lake-Upper Lake area, Sign Route 20 has been reconstructed and realigned for the entire distance between the Mendocino County line and Bachelor Valley Road just westerly of Upper Lake. The last project, completed in 1956, was a five-mile improvement at the Mendocino county line with the project partially in both counties.

In Mendocino County, Sign Route 20 between US 101 and Potter Valley Road has undergone a complete

This expressway section on US 101 is between Robinson Ferry Bridge and Alton. It was the first long section of four-lane, divided roadway to be constructed in District I.

US 101 in Arcata was reconstructed on a new routing east of the central business area. This view northward shows the Ninth and 14th Street overcrossings.

change. The Coyote Dam on the East Branch of Russian River will result in inundation of existing Sign Route 20 within the Coyote Valley reservoir area and necessitated rerouting the affected portion of the highway. Construction was completed in June on the new highway routing making it a modern two-lane expressway between a new connection with the Redwood Highway at Calpella and Potter Valley Road, a distance of 4.2 miles. This project was financed in the main by federal funds on a replacement basis. The Guy F. Atkinson Company, of South San Francisco, performed the work on the $3,081,000 project.

In 1957 an additional length of Sign Route 20 was included in the State Highway System. This section is between Sign Route 1 just south of Fort Bragg and Willits on the Redwood Highway, a distance of 33 miles. Prior to the inclusion of this section of highway into the State Highway System, it was improved considerably over its original condition by Mendocino County under the federal aid secondary program. To bring pavement markings, signing, and safety devices up to state highway standards, the route has been striped and a contract is under way providing signs, guide posts, and guard rail.

Bridges Replaced

On Sign Route 128 in Mendocino County there has been consistent improvement of the route between its terminus with Sign Route 1 and Dry Creek southeasterly of Boonville. Improvements have ranged from strengthening the pavement structure and resurfacing to relocation and bridge replacements. Emphasis was placed on replacing structurally deficient bridges. Old timber bridges at North Fork of Navarro River, Flynn Creek, Indian Creek, and Anderson Creek have been recently replaced by new structures and approaches. Further improvement of the route between Mill Creek and Boonville is in the planning stage, and an aerial mapping district has been completed.

In 1933, Sign Route 1 along the coast was taken into the State Highway System. In District I this included 80 miles of the route in Mendocino County between the Sonoma county line and Westport. Within the 80 miles there were 84 bridges, mostly timber structures in poor condition. Replacement of these deteriorated structures started almost immediately and has been a continuing program ever since, with only five of those original structures remaining in use at this writing.

This replacement of deficient structures is continuing, as evidenced by a current construction project for a new bridge and approaches across Gualala River at the Sonoma-Mendocino Counties line. The 1.1-mile project involving an expenditure of $565,000 will realign the highway routing and will result in a vastly improved section of Sign Route 1.

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Fair-bound Motorists Will See New Highways

The State Fair in Sacramento is a summer season highlight for thousands of Californians each year, and recent improvements on highways leading to the state capital will make this year's trip to the fair even more pleasant than in the past.

The 104th California State Fair and Exposition will open August 27th and continue through September 7th. Fair officials predict the 1958 event will be the "biggest and best ever" with new entertainment features added to the usual long list of topnotch attractions.

Motorists who make the trip to the fair this summer will find that every main state highway route to Sacramento has been improved in the past year, with new sections of freeway available in several places.

Between the San Francisco Bay area and Sacramento, US 40 is now nearly all freeway or expressway, with only short gaps remaining to be closed.

From the East Bay Distribution Structure to the Carquinez Strait, most of this route has been constructed as full freeway, including a 10-mile section recently opened through the hills between Richmond and Rodeo.

East of Rodeo work is entering its final phases on the "Big Cut" freeway approach to the new parallel Carquinez Bridge. The 2.9-mile freeway approach and the new bridge are both scheduled for completion in December.

Signals Eliminated

By the time the fair opens, construction crews will be into the final phases of converting the present four-lane divided stretch through Vallejo to a six-lane freeway. The traffic signals on that stretch will no longer be in operation. Work will be in progress on the two remaining lanes, but traffic will move smoothly through the area.

From Vallejo to Sacramento, US 40 is completed expressway, except for short four-lane undivided sections north of Vallejo and west of Sacramento (Yolo Causeway).

Another long stretch of freeway-expressway which will make a trip to

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DISTRICT III

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one-way couplet from 11th Street to Memorial Way, with attendant channelization and signalization, during the current budget year. Plans are being developed, pending available financing, for the improvement of the route along the Esplanade to provide four lanes in the northern section of Chico.

State Sign Route 16, extending northwest from Sacramento through Yolo and Colusa Counties, is being improved under several small contracts. This work is intended to correct the most critical deficiencies in the route. Four contracts are presently awarded on this route. They are: the surfacing of a levee relocation of a 1.4-mile section between the Sacramento Weir and Kiesel; the realignment of the route from the Yolo Bypass to one-half mile north of Kiesel and the widening of this route from Bryte to Broderick; the realignment at the Flyers Club west of Woodland; and the realignment from 0.8 mile south to 0.4 mile north of Rumsey. These projects represent a total expenditure of approximately $490,000. The contractors involved are A. Teichert and Son of Sacramento, Granite Construction Company of Watsonville, and Lange Brothers of Lakeport.

Another project for this route is included in the current budget. This calls for the realignment of the westerly approach to the I Street Bridge over the Sacramento River at Sacramento. The 1958-59 Budget contains $500,000 to make this improvement.

In 1957, a portion of Highway US 40 Alternate in Sutter County was widened from Knights Landing to north of Robbins. This 40-foot all-paved roadway, 5.9 miles in length, was constructed by Granite Construction Company of Watsonville at an approximate cost of $450,000.

Mother Lode Highway

The improvement of State Sign Route 49, the third trans-Sierran route within the district, has been overshadowed by work being done on the other such routes, but its value to the traveling public who use this route is very great. The largest project is the improvement of the route from the Placer county line to near Rattlesnake Creek in Nevada County and consists of the construction of two lanes of an ultimate four-lane expressway. This work has just been started by Isbell Construction Company of Reno under a $1,283,000 contract. This 7.3-mile section is scheduled for completion and public use in the latter part of December.

In Sierra County, a section of this route from the North Fork of the Yuba River to Ramshorn Creek is being widened and realigned. A portion of this work was completed in 1957 at a cost of $100,000. Bids were recently opened for the construction of a new bridge over Fiddle Creek in this section and the 1958-59 Budget contains funds for continuing the improvement of this portion of the route.

Another route being improved as rapidly as funds can be made available is the highway from Auburn through Georgetown to Placerville. Although this route is not subject to the traffic pressure of some of the other mountain routes, it is vitally important to the people of the area. In recent years its use by recreationists and the lumber industry has greatly increased. In 1957, Claude L. Youngs Construction Company of Sacramento completed a contract, at the cost of $184,000, to widen the road from Georgetown for 2.4 miles toward Auburn. As a part of a long range continuing program a total of 2.6 miles of the route between Georgetown and the top of Morgan Grade were improved at a cost of $112,500. Money for the further widening and realigning of the section of the route between Georgetown and Placerville is contained in the current budget.

New Highways Added

During the past year two sections of highway were added to the State Highway System within the district. The first of these is Route 232 between Sacramento and Marysville. This route, known as the Forty Mile Road to Sacramento, receiving oiling and sealcoat treatments on sections after its inclusion in the system and a $250,000 widening and surfacing project, is advertised for completion this summer. A public meeting is scheduled for July 1st to consider a change in alignment of the freeway routing between East Nicolaus and Highway US 99E previously adopted for this route. The presentation of the DeLeuw-Cather Report on transportation facility needs in and near Sacramento has now made possible the consideration of the remainder of the freeway routing to Sacramento.

The presentation of the DeLeuw-Cather Report has also permitted an

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Andrew J. Meehan

Andrew J. Meehan, Supervising Bridge Engineer, died suddenly on June 27, 1958, in Anchorage, Alaska, while on a vacation cruise with his wife, Anna.

Meehan had been with the Bridge Department of the Division of Highways for 37 years. He started in 1921 as a draftsman in the design section and had various assignments including resident engineer, designer on the San Francisco-Oakland Bay Bridge, bridge designer in the Sacramento office of the Bridge Department and for the last 10 years, in charge of design administration.

He was born on August 10, 1895, in Rochester, New York, where he attended school and was graduated from the Rochester Institute of Technology. After graduation he worked for several years as office and field engineer in various Eastern States. After a short period with the United States Bureau of Public Roads in Arkansas in 1918, he came to California where he worked as a structural draftsman for the Pacific Gas and Electric Company and later as assistant office engineer for the Bureau of Public Roads until he entered state service on August 1, 1921.

He was a registered civil engineer and registered structural engineer.

Survivors, in addition to his widow, are two sons, Dr. Carl W. Meehan, physician and surgeon, and John F. Meehan, structural engineer with the State Division of Architecture, both of Sacramento, and five grandchildren.

Merit Award Board Winners Announced

Employees of the Department of Public Works receiving certificates of commendation and cash awards since the last list was published in the magazine are:

Kenneth Y. Lee, Architecture, Los Angeles. Certificate of award and $10 for recommending the size of the original tracing sheet be printed on that sheet at the time the title block is printed.

Warren A. Johnston, Highways, Marysville. Certificate of award and $25 for recommending that tracing paper forms for plan sheets be supplied in "fadeout" grid paper as well as plain.

Gilbert E. Tolberg, Highways, Oakland. Certificate of award and $30 for recommending that sand pots, used by the painting crews on the bay bridges, be lowered 12 inches to reduce accident hazard of back and hand injuries.

George D. Mahlmeister, Highways. San Diego. Certificate of award and $25 for recommending that position markers be placed on rollback type buckets used on new TL-10-L loaders.

Miss Ramona S. Kaplan, Highways, Redding. Certificate of award and $10 for recommending discontinuance of the water service meter at the Cypress Street Yard.

Frank T. Myers, Highways, Sacramento. Certificate of award and $50 for recommending a positive mechanical locking device for use on highway dump body maintenance trucks.

Robert C. Warriner, *Frank C. Woehl*, and *David Hartley*, Highways, San Jose. Certificates of award and $150 to be divided equally for designing and building culvert invert paving sleds in three sizes to accommodate and pave the bottom of culvert pipes.

Ralph V. Bane, and *members of the Paint Striping Crew*, Highways, San Francisco. Certificate of commendation for recommending the use of grease on traffic stripes prior to seal-coating to serve as the pilot line for restriping after the seal coat has been placed

George E. Gray, Highways, San Bernardino. Certificate of commendation for recommending a drawing of culvert markers with reflectors be included on standard sheet A-51.

Mrs. Rosemary Lahey, Architecture, Sacramento. Certificate of award and $40 for recommending discontinuance of preparing supplemental agreements to construction contracts covering additional or deductional amounts in excess of $500.

Jack Roy, Architecture, Long Beach. Certificate of award and $25 for recommending that the specifications for construction contracts include a requirement that shop drawings must be adequately identified with

. . . *Continued on page 54*

CHC Vice Chairman Chester H. Warlow Cited for 'Years of Devoted Service'

Chester H. Warlow, Vice Chairman of the California Highway Commission, was honored in his home city of

CHESTER H. WARLOW

Fresno June 30th as "Mr. Highways of the San Joaquin Valley."

He was praised for his years of devotion to state highway problems and his decades of leadership in community activities by speakers at two ceremonies—the opening of Fresno's Stanislaus Street overpass and a testimonal luncheon.

Hundreds attended the two ceremonies. National and state leaders sent messages of greetings.

The occasion was Commissioner Warlow's sixty-ninth birthday. It was proclaimed "Chester H. Warlow Day" by both the City and County of Fresno.

Chief Justice Earl Warren of the United States Supreme Court telegraphed a message pointing to Warlow's "invaluable contribution to the development of California highways." Warren told Warlow that California's "tremendous growth * * * called for exceptional leadership such as yours to make certain growth meant progress."

Governor Goodwin J. Knight wrote in praise of Warlow's "notable devotion to the objectives of California's highway program" and his "dedication to the service of the people of California."

C. M. Gilliss, State Director of Public Works and Chairman of the California Highway Commission, sent a message crediting Warlow's "wisdom and judgment" with "great help to the commission in reaching sound decisions." Gilliss' message continued:

"So many have depended on you during your 15 years as commissioner—during the 15 years that have seen California's freeways grow from an adventurous innovation to an established system that is the envy of the world.

"Your contribution to California's highway program cannot be measured in prosaic terms—in dollars, or miles, or statistics. The best way to express the greatness of your continuing part in our highway program is to paraphrase the poet and say—

"You are truly a man to match our mountains!"

James A. Guthrie, only other member of the California Highway Commission beside Warlow to serve since 1943, told the luncheon audience that no commissioner could match Warlow's "record of familiarity with every mile of the California Highway System."

Officials of the City and County of Fresno, the Fresno County Bar Association, the Fresno Chamber of Commerce, and the Fresno Rotary Club paid tribute to Warlow, who entered law practice in Fresno in 1912, served as president of the Fresno Chamber of Commerce in 1922, and has been a director of the Rotary Club.

Commissioner Warlow, in a response to the praise, said he would accept approbation only "for what we of the community have done together."

"No man," he said, "accomplishes things by his own efforts. When something was achieved, it was not because of me, but because the goodness of the undertaking recommended itself to many men. * * * Circumstances have let me give more time than most."

DISTRICT III

Continued from page 46 . . .

acceleration in the plans for state highways to service this area. The route for the cross-city North-South Freeway has been adopted and will connect the work presently being done between Florin Road and Broadway and Highway US 40 in the northeast portion of the city. This route will lie between 29th and 30th Streets from Broadway to C Streets. Rights-of-way are being acquired in this area.

The exact routing of the East-West Freeway through Sacramento is being studied.

Other Routes Studied

Another interstate freeway route being studied at the present time is the proposed West Side Freeway from Woodland to the Grapevine, which will pass through Sacramento approximately paralleling the Sacramento River.

In addition to these major projects, many minor improvements were accomplished at intersections on the various routes, drainage problems were corrected, and channelization, signalization and lighting were provided at many locations.

The improvement of many miles of county roads in the Federal Aid Secondary System were also handled through the district office, as were the hundreds of thousands of dollars of storm damage repair projects that were the result of the severe storm of the 1955-56 winter.

Although much has been accomplished during the past year in our aim to provide the highway facilities that the traveling public wants, and needs, there is still a tremendous job ahead of the district. Industry will continue to come to this portion of California. The population will continue to grow. The number of motor vehicles will increase. With each year the demand for more adequate traffic facilities in even the most remote areas of the district will increase. We are preparing the plans to solve this eventuality. With the understanding help of the motoring public that we will do the most we can, with the financing that is available, eventually all these needs will be met.

Annual Bonneroo Awards Made in Los Angeles

Seven hundred highway construction men cheered at a Los Angeles banquet in May as honor was paid to contractors and resident engineers selected for the superiority of their workmanship on projects done in District VII of the Division of Highways during 1957.

The occasion was the seventh annual "Bonneroo," a program in which District VII rates its highway projects of a year on a basis of workmanship, job complexity, safety, and other factors. The contractor and the State's resident engineer on the 10 highest-rated jobs are honored at the annual banquet.

First place winners for 1957 were the Peter Kiewit Sons' Company, contractor, and T. L. Patterson, resident engineer, on a project on Pacific Coast Freeway, near Oxnard, between Date Street and Calleguas Creek.

C. M. Gilliss, State Director of Public Works and Chairman of the California Highway Commission, presented the winner's trophy to Alvin Galbreath, representing the Kiewit company. Patterson received his winner's trophy from Edward T. Telford, Assistant State Highway Engineer in charge of District VII.

Other winners were:

No. 2—Winston Brothers Construction Company, contractor; R. M. Innis, Resident Engineer; San Bernardino Freeway between Citrus Avenue and Ganesha Boulevard.

No. 3—Wonderly Construction Company, contractor; D. Frischer, Resident Engineer; Chambersburg Road, near Fillmore, between Guiberson Road and Santa Clara River.

No. 4—Sully-Miller Contracting Company, contractor; J. D. Hetherington, Resident Engineer; Riverside Freeway, Orange County, between Santiago Boulevard and Mohler Drive.

No. 5—J. E. Haddock, Ltd., contractor; R. D. Siefried, Resident Engineer; Lakewood Boulevard between Gardendale Street and Hall Road.

No. 6—Winston Brothers Construction Company, contractor; N. C. Brinkmeyer, Resident Engineer; San Bernardino Freeway between West Covina and Citrus Avenue.

The Peter Kiewit Sons' Company, contractor, represented by Alvin Galbreath (left), and T. L. Patterson (right) resident engineer, are the first-place winners in District VII's seventh annual Bonneroo.

No. 7—Guy F. Atkinson Company, contractor; R. A. Collins, M. L. Gould, and J. E. Kenan, Resident Engineers; Harbor Freeway between 92d Street and Gage Avenue.

No. 8—Griffith Company, contractor; J. Needham, Resident Engineer; Santa Ana Freeway between Lewis Street and Broadway.

No. 9—Ukropina, Polich, Kral and Ukropina, contractor; C. C. French, Resident Engineer; Long Beach Freeway between Southern Avenue and Atlantic Boulevard.

No. 10—J. E. Haddock, Ltd., contractor; L. W. Sixt, Resident Engineer; Whittier Boulevard between Washington Boulevard and Orange county line.

DISTRICT X

Continued from page 22 . . .

12 miles of expressway; a separation structure at Mossdale, where US 50 and Sign Route 120 meet near the San Joaquin River, will eliminate a major point of traffic friction; and in addition some 44 miles of outmoded and substandard two-lane highways will have been replaced or reconstructed. In addition, approximately 13 miles of federal-aid secondary roads were improved in several counties of the district during this past year.

Frank Balfour Given Right-of-way Award

For the first time in its 24-year history, the Board of Directors of the American Right of Way Association, a nationwide professional organization of right-of-way men, has awarded a testimonial certificate to a member of the profession for dedication to public service.

FRANK C. BALFOUR

Before approximately 600 right-of-way leaders from all parts of the Nation, Frank C. Balfour, Chief Right-of-Way Agent of the Division of Highways, was presented with a resolution paying tribute to his public service.

Balfour has been associated with the government of the State of California for approximately 27 years; he has been Chief Right-of-Way Agent since 1942. For 11 years Balfour served as Chairman, Committee on Right of Way, American Association of State Highway Officials; he has served as National Chairman of the Board of Directors, American Right of Way Association.

The resolution commends Balfour for "leading the cause of professionalism of right-of-way practices and procedures throughout the United States" and for his "major contributions to the outstanding success of the American Right of Way Association."

The tribute to Balfour highlighted the two-day national seminar sponsored in San Francisco May 28th and 29th by the American Right of Way Association.

NEW TRAFFIC RECORD

Another new traffic record on the San Francisco-Oakland Bay Bridge was set Friday, June 13th, with a total of 120,513 vehicles. The previous record was 118,001 vehicles, set on Friday, June 6th.

FAIR-BOUND MOTORISTS

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the fair more enjoyable is the 51-mile section from Oakland to Tracy. The final gap in this route (Nimitz Freeway, State Highway Route 228, and US Highway 50) was closed last fall with the completion of a section between Castro Valley and west of Dublin.

Between Tracy and Stockton three projects covering about 15 miles of US 50 are now under construction. One of these jobs, which will provide 6.8 miles of four-lane expressway between Mossdale and Richards Avenue, is scheduled to be open to traffic by fair time.

On US Highway 99-50 a 4½-mile stretch of freeway north of Lodi was completed last year. Slated for completion before the fair starts is 7.2 miles of new freeway now under construction between seven-tenths of a mile south of Galt and 1.6 miles south of the Cosumnes River. From there to south of Elk Grove Road new northbound freeway lanes, now being built, are also expected to be completed.

Motorists who take US Highway 40 or 50 to Sacramento from the mountain and foothill regions to the east will encounter new sections of freeway and improved highway at several locations.

Other Jobs Listed

On US 40 east of Sacramento two of the current series of nine major freeway projects will be completed. These two jobs will provide four-lane freeway for 6.1 miles between Heather Glen and Colfax, and 3.6 miles from Auburn to Newcastle.

Several major improvements will also serve fairgoers on US 50. The United States Bureau of Public Roads has completed the four-laning of a short section on this route between Pacific House and Riverton in El Dorado County. The Division of Highways last fall completed four miles of expressway near Camino.

From Nimbus to Brighton about 14 miles of US 50 have been widened to four lanes, relieving previous congestion on this section just east of Sacramento.

Motorists heading for the fair from points north of Sacramento will find that realignment, widening or resurfacing jobs have improved travel conditions on several routes.

On State Sign Route 16 four projects will be finished or near completion when the fair opens.

Realignment for 1.2 miles on this route through the Town of Rumsey is scheduled to be completed around the end of August. Another realignment job, eliminating sharp turns between Madison and US 99W, will also be nearing completion.

A new 1.4-mile stretch on a relocated levee section south of Kiesel, between Woodland and Sacramento, is expected to be available to fairgoers with the present detour no longer in use. Realignment and widening north of Kiesel and resurfacing and widening between Bryte and Broderick will be almost finished.

In addition, sections of US 99W north of Yolo and of US 99E north of Yuba City have recently been resurfaced.

GREMLIN CORNER

Editor, California Highways and Public Works

Sir: In the May-June issue of your magazine you have on the front cover a picture which you refer to as Bridges Creek. Actually, it is Bridge Creek in Humboldt County. There is a Bridges Creek in Mendocino County, but this is not it.

Also, on page 40 of the same issue, you have a picture of a bridge. This bridge is not across the South Fork of the Eel River at Dyerville, as you say. It is across the main Eel River at the old Robinson Ferry Crossing just north of Rio Dell on US 101.

I enjoy your magazine very much.

Very truly yours,

Robert W. Heflin

The photographer who took the back cover photo of the Feather River Highway on the May-June issue of the magazine was wrongly identified in the magazine. It was taken by Bill Ruland.—*The Editor.*

HIGHWAY LAB

Continued from page 15 . . .

eral different locations in the city, and its facilities have included nine temporary buildings and three trailer offices.

"The new building centralizes the department's work," said State Highway Engineer G. T. McCoy, "and makes possible substantial improvements in operating efficiency and economy."

The Folsom Boulevard structure is headquarters for a statewide research and testing organization which includes specialized branch laboratories at Los Angeles, Berkeley, Santa Maria and Bakersfield. The department also maintains technical control over laboratories in each of the 11 state highway districts.

About 60 civil service job classifications are required to cover the department's highly trained staff. These range from several types of engineering specialists and chemists to instrument makers and photographers.

Head of the department is Francis N. Hveem, internationally known authority on highway research. Hveem has been a Division of Highways employee since 1917, and was appointed Materials and Research Engineer in 1951, succeeding T. E. Stanton, who had headed the laboratory since 1928.

In addition to making sure the State's high standards for materials are being met, the department also checks on such things as the durability of paints, the stability of soils, the efficiency of highway lighting, the effect of temperature changes on pavements, the skid resistance of various pavements, and the durability of roadways under heavy traffic.

Work of this kind requires precise tools. Testing equipment and facilities used by the department include a giant press which can exert 440,000 pounds pressure, compression machines, refrigeration and humidity chambers, photometers, intricate measuring and weighing devices, and special cameras and magnifying equipment.

The new concrete and steel building has a level composition roof. Its interior walls are mostly concrete block with natural finish. Many of the structure's mechanical fixtures, such as ventilation equipment, were installed on the roof to reduce the need for expensive ductwork.

Louvered window boards and partitions add a modern touch to the exterior of the structure. A scale model of the building will be permanently displayed in the main entrance-lobby as a guide to visitors. This model was originally prepared by the materials and research staff in connection with the architectural design studies.

General contractor was Cal-Central Construction Company of Sacramento. Plumbing contractor was Luppen & Hawley, Inc., of Sacramento, and the electrical contractor was Collins Electrical Company, Inc., also of Sacramento. The Jackson-Hopkins Company of Bakersfield handled the heating, air conditioning and refrigeration work.

J. Frank Walsh

J. Frank Walsh, former senior right-of-way agent for the State Division of Highways, passed away on April 22, 1958, after a lengthy illness.

Walsh was born in Cottage Grove, Oregon, on August 9, 1899, and spent most of his youth in Salem, Oregon. He first came to work for the State Division of Highways as a title researcher in February, 1931, after having had seven years' previous experience in this field with the Title Insurance and Trust Company. Prior to that he had been with the State Department of the State of Oregon for 4½ years.

Walsh organized and developed the Title and Escrow Section of the Right-of-Way Department for District VII of the State Division of Highways and supervised its operation through the years to the time of his retirement from state service on April 10, 1956. He was a charter member of Chapter No. 1 of the American Right of Way Association and a former editor of the association's official magazine, *Right of Way*.

Walsh is survived by his brother, Leo Walsh of Los Angeles.

Lynn Latimer Retires; Joined State in 1938

A dinner was held in Los Angeles on May 15th to honor Lynn L. Latimer, Assistant Bridge Engineer, Bridge Department, Division of Highways, on the occasion of his retirement. Latimer was born on June 6, 1893, in Clear Lake, Iowa. He received his early engineering training with Cerro Gordo County.

LYNN L. LATIMER

Latimer moved to California shortly after returning from France at the close of World War I. During the next 15 years he worked with the Corps of Engineers, the County of Los Angeles, and the City of Los Angeles.

He joined the Bridge Department immediately after the flood of 1938 and worked on the investigation of bridge structures which were damaged by the flood.

He later worked on the four-level structure in Los Angeles, as well as on many major bridges on the San Bernardino and Harbor Freeways.

His plans after retirement include travel and deep sea fishing.

San Francisco

Editor, California Highways and Public Works

Dear Sir: I would like to take this occasion to commend the Highway Commission for their splendid work and continued progress in spite of the many protests and controversies which arise each time a new freeway is to be built.

Without these superhighways, transportation and life would be intolerable in a fast-growing State.

The public should realize that freeways are the main arteries through which life circulates and that they are absolutely essential for the development of the State of California.

Perhaps through your constant efforts and initiative, this ridiculous opposition will cease.

Sincerely yours,

J. L. Dalang

Edward S. Gripper

Edward S. Gripper died after a short illness on April 15, 1958. Gripper retired from state service on October 7, 1949, at which time he was City and County Co-operative Projects Engineer for District VII.

Gripper was born in Pasadena, March 3, 1884. His service with the State Division of Highways dated back to February 15, 1912, when his name appeared as the Chief of Survey Party No. 3 on the first payroll for Division VII, as it was then called. He spent considerable time in making surveys in San Diego County for the Coast Highway, the San Diego and El Centro Highway, and the old original Ridge Route in Los Angeles County. Although Gripper's service with the State was not continuous he did participate in all phases of the work, being at various times superintendent of day labor operations and resident engineer on important grading and paving projects.

In October, 1933, he was appointed District City and County Projects Engineer. He was in responsible charge of administering and co-ordinating the ¼-cent expenditure by cities from allocated state funds and also for the federal aid secondary projects as carried out by counties. At the time of his retirement Ned had responsibility for administering the state funds for 64 cities.

He is survived by his wife, Mrs. Ethel S. Gripper of Sierra Madre, his daughter, Eunice Pitzer, and a grandson, Edward Pitzer of Arcadia.

Basil Frykland Retirement Marked

Basil N. Frykland, District VII Construction Engineer for the California Division of Highways, retired on June 1st after 30 years in state service.

Basil Frykland was born of Swedish immigrant parents in Santa Cruz, California, on August 23, 1897. He attended public schools in Santa Cruz and studied engineering at Polytechnic College in Oakland and the University of California. He went to work as resident engineer with the Southern Pacific Railroad in 1925. In September of 1927 he entered state service in a classification equivalent to junior civil engineer. Until 1932 he worked in District II, after which he came to District VII, where he has been ever since.

BASIL N. FRYKLAND

Basil Frykland is a veteran of both World Wars. In World War I, 1918-1919, as a second lieutenant he gave instruction in pursuit flight. In 1942 he joined the Army and was stationed in Phoenix, Arizona, Washington, D. C., and Tucson, Arizona. He served as battalion commander of the 869th Aviation Engineering Battalion in the Philippines. He holds four combat stars and the Purple Heart.

Basil Frykland and Mrs. Frykland (nee Hazel Blewett) intend to travel, fish and relax after his retirement. He is homesteading a 40-acre ranch near Mt. Palomar.

San Mateo, Calif.

Editor, California Highways and Public Works

Sir: I have from time to time thought of writing to you and expressing my appreciation for the pleasure and information I derived from your magazine.

The last issue having had to do with Highway 101 therefore prompts these few lines.

I was reared in Eureka and make frequent trips back and forth over this highway, so can fully appreciate every bit of what you have to contend with in that area.

The information and pictures are outstanding and unless an opportunity presents itself to read this last issue, the motorist has not the slightest conception of what takes place to make his traveling comfortable and convenient.

Sincerely,

Russel Pettingill

Nine Current US 40 Freeway Jobs Listed

Four-laning of another 11 miles of US 40 in Placer County was scheduled to start in August, bringing to nine the number of current freeway jobs east of Sacramento on this interstate route.

This latest project involves grading and paving of 11.5 miles of four-lane, divided roadway and 12 bridges between one-half mile east of Roseville and a mile east of Newcastle.

Located on new alignment south of the present highway, the new route will bypass the Towns of Rocklin and Loomis. Interchanges and access connections will be provided for traffic service to these communities.

The Roseville-Newcastle project is one of five large-scale freeway projects on US Highway 40 east of Sacramento which are included in the 1958-59 State Highway Budget. It was the last of five to be advertised.

These 1958-59 projects, together with four other previously budgeted jobs, make a total of nine freeway projects under construction or advertised for bids on this portion of US 40. Estimated total construction cost of these projects is $48,500,000.

When these projects are completed there will be 88 miles of freeway and expressway on the 122 miles of US 40 from Sacramento to Nevada. This will include 61 continuous miles between Sacramento and east of Gold Run and 21 miles from the east end of Donner Lake to Nevada.

The freeway projects now under construction on US 40 east of Sacramento are as follows:

Newcastle to Auburn, 3.6 miles (to be completed this summer).

Heather Glen to Colfax, 6.1 miles (to be completed this summer).

Colfax to Magra (west of Gold Run), 5.8 miles (due for completion this fall).

Magra to west of Monte Vista (east of Gold Run), four miles.

Hampshire Rocks to Soda Springs, six miles.

East end of Donner Lake to Boca, nine miles.

Boca to Floriston, 6½ miles.

Floriston to state line, 5.4 miles (to be completed late this summer).

Twenty-five-year Awards Announced

Employees who received twenty-five-year awards since those listed in the May-June, 1958, edition of *California Highways and Public Works* are:

District I
Faulkner, Frank
Klein, Earl
Mitchell, Archie R.

District II
Eslinger, Rolin M.
Raymond, Charles R.

District III
Bernard, Paul E.
Robinson, Edwin E.
Schiffmann, Phillip C.
Wallace, Malion P.

District IV
DeLainey, Willis T.
Hayler, Richard Arthur
Welch, Elwood B.

District V
Dito, Peter L.
Franklin, Howard J.

District VII
Barnes, John E.
DeGroff, Ray E.

District X
Hull, Archie J.

District XI
Casey, Eugene A.

Headquarters Office
Israel, Rudolph J.

Bridge Department
Cordero, Fernando P.
Langenbach, W. O.

Materials and Research
Gates, Clyde G.

Shop 5
Duclo, Alma A.

Shop 11
Leisure, James R.

Headquarters Shop
Hatton, Arthur R.

I. T. E. Holds Annual Confab in Sacramento

Traffic engineers from 11 western states spent a week in Sacramento in mid-June at two professional gatherings, a freeway operations seminar and the eleventh annual meeting of the western section of the Institute of Traffic Engineers.

The magnitude of the challenge that faces traffic engineers was pointed to by the keynote speakers at both meetings.

C. M. Gilliss, California State Director of Public Works and Chairman of the California Highway Commission, and William A. Bugge, Director of Highways, State of Washington, both expressed assurance that the traffic engineers would meet the challenge.

"You have before you a big job," Gilliss said, "the problem of converting the thoughts of today and tomorrow into action, into a program that will achieve the results you want. Every one of you do well in your effort to continually better the service of highways, I am sure."

"Whether we meet the future successfully depends upon the traffic engineering profession," Bugge's keynote address said. It was read for him, in his absence, by Herbert C. Higgins, veteran engineer of Washington's highway department.

"The challenge is yours," Bugge's talk concluded. "I know that you will not fail to meet its demands."

Benicia-Martinez Bridge Construction Starts in April; Work to End in 1962

Construction of the Benicia-Martinez Bridge is scheduled to begin next April. The project is expected to be completed and open to traffic in March, 1962.

This tentative schedule of target dates was announced by C. M. Gilliss, State Director of Public Works and Secretary of the California Toll Bridge Authority.

Gilliss said the Department of Public Works expects to complete negotiations with the Federal Government for rights-of-way through the Army's Benicia Arsenal by October 1st. The tentative schedule calls for advertising the bridge construction work and the sale of the Bridge Authority's revenue bonds during the first two months of next year, and for sale of bonds and the award of the construction contract in April, 1959.

The bridge will be parallel to and just downstream from the railroad bridge across the Carquinez Strait. It will be operated as a toll bridge and will replace the state-owned Benicia-Martinez Ferry.

"These target dates are being announced," Gilliss said, "so that residents of the Benicia-Martinez area may be accurately informed as to current plans. The schedule is, of course, tentative and subject to revision as preconstruction planning and negotiations continue."

The bridge will be financed from a portion of the $80,000,000 in revenue bonds authorized by the California Legislature in 1955 for construction of the parallel Carquinez Bridge and approaches, now nearing completion, and the Benicia-Martinez Bridge and approaches. Of the total authorized amount $46,000,000 in bonds have already been sold to cover the Carquinez Bridge project.

The remaining $34,000,000 in revenue bonds will be available to finance the Benicia-Martinez Bridge and approaches, including the Escobar Street connection to Martinez.

The bonds will be redeemed from toll collections on the two bridges. The Toll Bridge Authority has set a 25-cent toll rate for passenger cars using the Carquinez Bridge. Collections will start on the Carquinez Bridge after the parallel bridge, due for completion in December, is opened to traffic.

Three-mile sections of freeway leading to either end of the Benicia-Martinez Bridge will be built with state highway funds. This state highway work will be timed for simultaneous completion with the bridge.

MONTEREY COUNTY

Continued from page 32 . . .

long rows of towering eucalyptus trees, consisted of two lanes, substandard in both horizontal and vertical alignment in many locations, and the deficiencies in sight distance that created a great deal of congestion as heavy truck traffic entered the highway from surrounding ranches at numerous locations because of the lack of access control.

Existing Road Converted

The project undertaken on this particular portion of US 101 was the conversion of the existing two-lane facility to a four-lane expressway and construction of nine crossovers at grade. (Right-of-way has been purchased for future expansion to full freeway, at which time the crossings will be separated by means of structures.)

The contract was awarded to the Granite Construction Co. of Watsonville, on February 5, 1957, and provided for the construction of 7.9 miles of highway between King City and Greenfield. The work started on February 15, 1957, and involved about 75 percent new construction and 25 percent resurfacing.

The structural section for the new construction was 0.67 foot of Class "B" cement-treated base over imported subbase material which ranged in thickness from 6 inches to 14 inches. This was paved with 0.33 foot of Type "A" plant-mixed surfacing and 0.06 foot of open graded plant-mixed surfacing.

The resurfacing consisted of placing 0.13 foot of Type A plant-mixed surfacing and 0.06 foot of open graded plant-mixed surfacing over the existing pavement.

The grading, which was relatively light, was completed early in the contract time. The contractor moved approximately 400,000 cubic yards in the first stage and 175,000 cubic yards in the second stage with an average production during heavy excavation of from 8,000 to 9,000 cubic yards per day. The roadway excavation was accomplished by using three-axle pneumatic-tired scrapers for the long haul material, and crawler tractor and scraper combinations for the short hauls. Compaction equipment consisted primarily of standard sheepsfoot rollers and occasionally a compactor or 50-ton pneumatic-tired roller. Satisfactory results have been obtained from all three types of compaction equipment.

Drainage Difficult

The majority of the drainage structures consisted of reinforced concrete pipe ranging in size from 18 inches to 60 inches. The only thing that approached a major structure on the project was the construction of an eight-foot concrete arch culvert which extended an existing concrete arch culvert.

On the north end of the project the land is uniformly flat and slopes slightly toward the Salinas River to the northeast. There is so little fall, however, that proper surface drainage is difficult. To eliminate the difficulty, vertical drains are being constructed at approximately 1,000-foot intervals to divert the surface drainage into porous subsurface strata which underlie the area.

The contract required 134,000 tons of imported base material and 81,000 tons of imported subbase material; the imported base material was used under shoulders, frontage roads, and as aggregate for cement-treated base. This material was produced by a portable crushing and screening plant located in the Arroyo Seco River approximately four miles from the project. Also produced in the Arroyo Seco was the mineral aggregate for the various types of plant-mixed surfacing (69,600 tons). The imported subbase material was obtained from a pit on the bank of the Salinas River adjacent to the project.

The horizontal alignment of the expressway lanes generally follows the existing alignment, although it does not parallel it. The existing lanes are being utilized as one pair of lanes throughout portions of the project, sometimes the left lane, and sometimes the right. This switch from left to right has been made at several locations to improve the horizontal alignment in the existing lanes and to clear various obstructions.

San Francisco Will Have AASHO Meeting

Plans and arrangements are well advanced for the Forty-fourth Annual Meeting of the American Association of State Highway Officials, which will take place in San Francisco December 1st through 5th.

An estimated 1,500 or more delegates and visitors will be housed at 10 hotels in downtown San Francisco.

This will mark the first year since 1946 that California has been the host state for the annual meeting of A. A. S. H. O. The association met in Los Angeles in 1946, and in San Francisco in 1936 and 1924.

The Host State Committee responsible for California's share of the arrangements is headed by Director of Public Works C. M. Gilliss as chairman, with State Highway Engineer G. T. McCoy, a past president of A. A. S. H. O., as vice chairman. This committee, assisted by a staff committee, is working in close collaboration with A. E. Johnson of Washington, D. C., Executive Secretary of A. A. S. H. O.

All sessions of the five-day meeting will be held in the Sheraton-Palace Hotel with the exception of an all-day field trip scheduled for December 3d. This trip will cover current and recent highway construction projects in the San Francisco Bay area.

The project was allotted 310 working days and was completed in March, 1958. D. E. Connelly was resident engineer.

Road Removal Necessary

As construction progressed approximately 50 percent of the existing highway was either removed or resurfaced. Therefore, it was not possible to route traffic continuously over the existing highway during the construction period. It was necessary to construct the job in two stages. Traffic was routed over a portion of the existing highway and first stage construction while second stage construction was in progress. We had to provide numerous detours to handle traffic. As many as six construction detours were in use at one time during second stage work.

. . . Continued on page 56

MERIT AWARD WINNERS

Continued from page 47 . . .

corresponding contract drawings, sections, and details.

John W. Maxwell, Architecture, South Pasadena. Certificate of commendation for recommending that a grid system be used on drawing sheets to assist in locating specific items shown thereon.

Gary L. Simms, Highways, San Luis Obispo. Certificate of award and $25 for recommending use of a three-center curve table and graph which he developed to supplement calculations done by I. B. M.

Herman R. Jantzen, Highways, Stockton. Certificate of award and $10 for recommending that Form R-24, Daily Extra Work Report, be made up in individual snap-out carbon sets.

Franklin L. Young, Highways, San Francisco. Certificate of commendation for recommending the use of a nonrepro pencil on original or master drawings that will not reproduce on copies run through a Bruning or Ozalid machine.

Orrin H. Rounds, Highways, Marysville. Certificate of commendation for recommending that an indicator needle be attached to the face of the hydraulic jack for cement testing.

Thomas Royce, Highways, Sacramento. Certificate of commendation for recommending a revision of the Bridge Department Photograph Form to include space for the job stamp.

Mrs. Josephine M. Andino, San Diego. Certificate of award and $15 for recommending the use of special folders with the "out" card front for use in the file room of the Right-of-Way Department.

Arthur K. Owen, San Luis Obispo. Certificate of award and $15 for recommending a revision of Form R-33, Daily Record of Platform Scale Weights, to include a larger column for the tare weights.

Gary E. Layton, Sacramento. Certificate of award and $150 for recommending the use of Diazo developed, enlarged, photographic film positives in the preparation of design and contract plans for traffic signal and highway lighting plans.

Alexis A. Shimonauff, Sacramento. Certificate of commendation for recommending use of a rubber stamp to hand stamp the contract number on "as-built" originals.

Warren A. Johnston, Marysville. Certificate of award and $15 for designing a special slope and scale triangle to be used for plotting cross sections.

Sylvester Evans, San Francisco. Certificate of award and $150 for designing and constructing a spray gun for applying high concentration, low volume soil sterilants.

Leroy R. Eglin, Point Richmond. Certificate of award and $15 for recommending the use of clear lucite covers in place of solid metal covers on Standard-Johnson coin separators and counting machines used on the bridges to permit immediate observation of money jamming in the coin boxes.

William J. Ziegler, Redding. Certificate of commendation for recommending use of one-half-inch drafttape instead of one inch in drafting rooms.

Vernon W. Messick, Division of Architecture, now of Spokane, Washington, who shared with Burton G. Beamer, an award, now a member of the Department of Finance. Certificate of award and $50, to be divided equally, were authorized for this suggestion which proposed a safety device to be installed on multiple-use crane booms to make it possible for the operator to know by visible inspection whether they are safe to operate.

Thomas E. Baumberger, Highways, San Luis Obispo. Certificate of award for recommending that in design projects developed from aerial survey contour maps, narrow sepias on standard 19-inch paper be made up instead of making full-size prints from 36-inch to 42-inch in width and 6 feet to 12 feet in length. An award of $100 was granted.

C. Roy Erickson and *Culmer F. Dickson*, San Bernardino, Highways. Certificates of award and $25 to be divided equally for developing a method whereby photostat machines could be converted into an effective photographic enlarger.

Edward W. Coble, Highways, San Francisco. Certificate of award and $40 for proposing a revision in the structure details of the horizontal reflector unit W61R as shown on highways standard sheet A-51, to facilitate removal of the posts when damaged or broken.

William C. Bastian, Highways, Fresno. Certificate of award and $25 for proposing a new method of cleaning sheet metal stencils used for pavement markings.

Miss Barbara J. Blair, Highways, Los Angeles. Certificate of award and $15 for recommending the use of a form as a front sheet for setting up appointments for prospective new tenants to inspent rental property of the division acquired in connection with the highway construction program.

George W. Havins, Highways, San Diego. Certificate of award and $10 for a revision in the method of determining if the termination of liability of a highway permit bond is satisfactory to all concerned.

Robert W. Apperson, Highways, San Diego. Certificate of commendation for designing and building an ice plant cutter from excess Allis-Chalmers parts.

Leonard R. Nelson, Highways, Sacramento. Certificate of commendation for proposing that a steel catch bin be placed on all sheetmetal shears to catch small pieces of steel that may have been cut from larger pieces.

Raymon E. Harden, Highways, Alhambra. Certificate of commendation for recommending a device which he designed to reduce or eliminate the possibility of inhaling fumes when making ethylene dichloride tests.

State, Five Cities Receive I. T. E. Awards

California and five of its cities were among 11 states and 53 cities recognized by the Institute of Traffic Engineers for traffic engineering performance during 1957.

Certificates recognizing these cities and states for achieving this high level of performance will be issued by the institute.

States recognized were: California, Connecticut, Delaware, Illinois, Maryland, Massachusetts, Michigan, Oregon, Texas, Virginia, and Washington.

California cities receiving recognition were: Modesto, Oakland, Pasadena, Riverside and Stockton.

Hall G. Williams

Hall G. Williams, Highway Engineering Associate in District XI of the State Division of Highways, died on June 11th after a brief illness.

Williams was born in East St. Louis, Illinois, February 23, 1911. After graduating from high school in 1928, he attended the Missouri School of Mines, and later completed his college training at Chicago Technical College.

On leaving college, Hall was employed as a surveyor on several construction projects and worked several years as manager of a chain grocery store. From 1934 to 1940 Williams was employed as a teamster in the stockyards of East St. Louis, when he quit to come to California for his wife's health.

For four years Hall was employed by a large San Diego lumber company, as a yard foreman. From there, Williams went to the Ryan Aeronautical Company as an engineering draftsman, working on one of the Country's first jet fighters. Shortly after the conclusion of World War II, in 1946, Williams became an employee of the California Division of Highways in District XI as a senior aid.

Williams is survived by his wife, two daughters, Mrs. Walter L. Hewitt of El Cajon and Mrs. W. D. King of La Mesa, and a brother, W. S. Williams of El Cajon.

CRESTMORE

Continued from page 34 . . .

be easily accomplished in the event the Corps of Engineers levee project were built. Grade and waterway clearances for the first stage bridge were to be established from the recommendations of the corps report.

(3) That the proposed road be established as a federal-aid secondary route, and that F. A. S. funds be used in its construction.

Following route adoption, the designation "FAS Route 1177" was established for Crestmore Road, and the first stage bridge plans (Project S-1177(1)) were prepared by the county road department with the assistance of the State Division of Highways Bridge Department in Sacramento.

The proposed structure was to consist of six spans of 100 feet each, a 28-foot-wide concrete deck; and a substructure of concrete piers on timber or concrete piles. Spans were to be riveted plate girders of 6½-foot depth. Design was conventional in all aspects except that the abutments were so formed as to be similar in outward appearance to the other piers following minor modification. This was done to provide for uniform appearance upon future extension of the structure.

This project was advertised in June, 1951, and seven bids were received, the low bidder being C. B. Tuttle of Long Beach, his bid being in the amount of $266,184.00.

Access Limited

Second stage work was designated Federal-aid Secondary Project S-1177(2) and was to consist of the construction of a two- and four-lane roadway extending from the bridge abutment north and west to an intersection with FAS Route 706, Bloomington Boulevard. Construction was to be on expressway standards with access limited to three points along the route. Nearly 1,800 feet of the alignment was to be approach fill for the bridge.

The project was advertised on March 13, 1953, and the low bidder was the E. L. Yeager Company and J. A. Payton of Riverside with a bid of $98,932.76. Work was completed on October 2, 1953. During the same period, the City of Riverside had also constructed the approaches and connection to Market Street, and the road was opened to through traffic immediately upon acceptance.

Public comment on the new route was most favorable and was reflected in the traffic usage which built up rapidly. A count made at the bridge one year after opening showed 4,600 vehicles per day were using the new road.

Late in 1955 the Corps of Engineers announced that allocations had been established which would allow it to proceed with the preparation of the final plans for the Riverside portion of the work. These plans were transmitted to the county in February, 1956, together with advice to the effect that the contract could be advertised in May. Extension of the Crestmore Bridge was not a part of the proposed work, and the county was requested to establish this as an independent project.

Extension Required

Review of the plans showed that a graded and lined channel with a bottom width of 930 feet was to pass through the present bridge site. Alignment was such that a skew length of 1,200 feet would be required to complete the crossing, and this would mean that a 600-foot extension of the structure would be necessary. The Corps of Engineers policy required a positive commitment from the local agency to instigate such concurrent construction before they would commence their own work on the levees.

In order to accommodate the new construction, it would be necessary to remove 600 feet of the west approach fill, and it was proposed that this be done by county forces prior to the start of the work.

Following completion of the bridge plans, they were transmitted to the district office of the Corps of Engineers for comment. The corps had meanwhile constructed a 1/120th scale hydraulic model of the entire channel project and from the observed results of its operation, they requested that the piers on the new portion of the bridge be skewed to coincide with their levee alignment rather than being made parallel with the existing piers. This resulted in a rather awkward "half-open venetian blind" appearance, but the model studies clearly demonstrated that erosion and flow characteristics under maximum flood conditions would be much improved.

These recommendations were accordingly incorporated in the final plans and the project was advertised on September 28, 1956.

Fifteen bids were received on October 25th, and Mr. C. B. Tuttle of Long Beach was again low with a bid of $221,810. Construction was started on December 3, 1956, and completed May 6, 1958.

Channel Work

Most of the operations required cooperation between the contractor and the prime contractor for the corps levee project, Matich Bros. of Colton, who were simultaneously engaged in the channel work above, below, and through the bridge site. This work was of considerable magnitude and involved extensive earthmoving operations. It was begun in April, 1957, and was completed in November, 1958.

Final cost of the original bridge and its extension, including extra work and construction engineering was $495,817. Crestmore Road and approaches cost $108,060 making a total for the county portion of the route $603,877 exclusive of right-of-way acquisition costs.

Construction engineering was done by the County of Riverside. Resident Engineer for the county on Projects S-1177(1) and S-1177(2) was Paul E. Stout, and on Project S-1177(3), Robert L. Wilson.

The completion of the third stage of improvements of FAS Route 1177 has provided an adequate connection for the present traffic; however, area development and the attendant highway user increase clearly indicate that such adequacy is only temporary. Latest traffic counts show vehicle counts in excess of 5,600 per day, and presage the not too distant day when development of the route to full four-lane status will be necessary.

DISTRICT I

Continued from page 45 . . .

Replacing Timber Bridges

In 1958-59 highway construction budget funds in the amount of $325,-000 are provided to replace another of the last remaining timber structures on Sign Route 1 on the Mendocino coast. This is the Pudding Creek Bridge at the north limits of Fort Bragg. It is expected that bids for this project will be issued this summer.

Another of these last remaining old structures, Big River Bridge just south of Mendocino, is receiving attention toward its eventual replacement. The U. S. Army Engineers have given approval of location and clearance of a new bridge crossing the navigable waters of Big River. Design work is progressing on the new structure and approaches.

In 1957 additional mileage of Sign Route 1 northerly from Westport to Leggett on the Redwood Highway was placed in the State Highway System. This addition, amounting to 28 miles, also included some bridges badly deteriorated to the extent that immediate action was taken. Old timber structures at Cottoneva Creek at Rockport and North Fork of Cottoneva Creek northerly of Rockport have already been replaced by modern concrete structures.

US 299 within District I, both in Humboldt and Trinity Counties, has been undergoing constant improvement since 1940. The routing for ultimate improvement of US 299 from its intersection with US 101 to Berry Summit has been adopted and an aerial survey, to provide maps for detailed study, is under way covering the portion between Mad River through Blue Lake and to North Fork of the Mad River.

Interchange Constructed

As a portion of the four-lane expressway development of the Redwood Highway, a new connection of US 101 and 299 resulted. A trumpet-type traffic interchange was constructed, and 299 between the intersection and Mad River was developed on a new routing providing four lanes.

Proceeding easterly on 299 there is a 0.9-mile project under way between 0.1 mile west of Essex Gulch Road and 0.2 mile east of Fieldbrook Road. This is a project to correct an especially deficient section of old highway as to line and grade. It will key in with the future development to four lanes, with this reconstructed portion of old highway serving as a frontage road.

In the Lord Ellis Summit-Redwood Creek area, construction activities are under way both by Honor Camp 42 and under contract.

In 1956 Honor Camp 36 at Burnt Ranch on US 299 in Trinity County was moved and re-established as Camp 42 at Preston Ranch near Lord Ellis Summit on 299 in Humboldt County. The honor camp forces are now working on the relocation and modernization of US 299 in Humboldt County with present efforts being expended on the portion easterly toward Redwood Summit, Green Point, and Redwood Creek. In connection with this activity, a concrete arch culvert is being constructed in Lupton Creek by Tom Hull, contractor of Eureka, on a low bid of $169,350.

Federal Funds Used

From Berry Summit 10 miles easterly to Willow Creek, the U. S. Bureau of Public Roads, under a series of contracts have completed all grading work and applied penetration treatment to the greater portion of the completed grade. Their planning program provides for placing a plant-mixed surfacing this summer. The completion of this work will provide a modern highway facility greatly enhancing highway travel in the area. Construction funds were from federal sources; the California Division of Highways purchased all rights-of-way for the 10.4-mile project.

From Willow Creek easterly through Del Loma and to Prairie Creek, the Districts I and II boundary, a distance of 36 miles, US 299 is now a modernized two-lane facility with some work done by several early contracts, but the greater portion of work was accomplished by honor camp forces. Subsequently, the greater length of the 36 miles has received plant-mixed surfacing under private contracts.

During this development period in District I, the occurrence of the catastrophic December, 1955, flood, resulted in the most extensive and serious damage ever suffered by the State Highway System. When floodwaters receded, it appeared that all gains were wiped out. Work costing in excess of $5,000,000 was necessary to make emergency and finally permanent repairs to flood-ravished District I highways. A series of flood damage repair contracts were completed along with the normal construction programs, and the last flood damage repair project was completed in 1957.

The district's highways also suffered damage from early 1958 storms and abnormally heavy rainfall. Damage was to the extent that seven repair contracts will be under way at an aggregate cost of about $1,538,000. Plans for this work are complete, and construction will be under way along with the regularly budgeted improvement program.

Much has been done since the completion of that old Contract No. 2 of 1912, and much remains to be accomplished to adequately fulfill the modern transportation needs of a growing area.

MONTEREY COUNTY

. . . Continued from page 53

Passing through this new addition to our expressways in Monterey County, we now travel on a project some 2.7 miles long completed in 1956 which will bring us into the city limits of King City.

This project originated early in planning for the four-laning of US 101 in Monterey County principally to improve the deficiencies of the narrow Salinas River Bridge and its substandard approaches. Inadequate lane capacity, severely restricted sight distance, particularly as it pertained to traffic coming from the Mission San Antonio and the Hunter Liggett reservation to US 101 north of the bridge were major deficiencies that required immediate correction. Now with the expressway, a second bridge over the Salinas used for the northbound lanes of expressway, and the addition of an interchange at Pine Canyon Road, the glaring highway deficiencies in this area have been corrected.

GOODWIN J. KNIGHT
Governor of California

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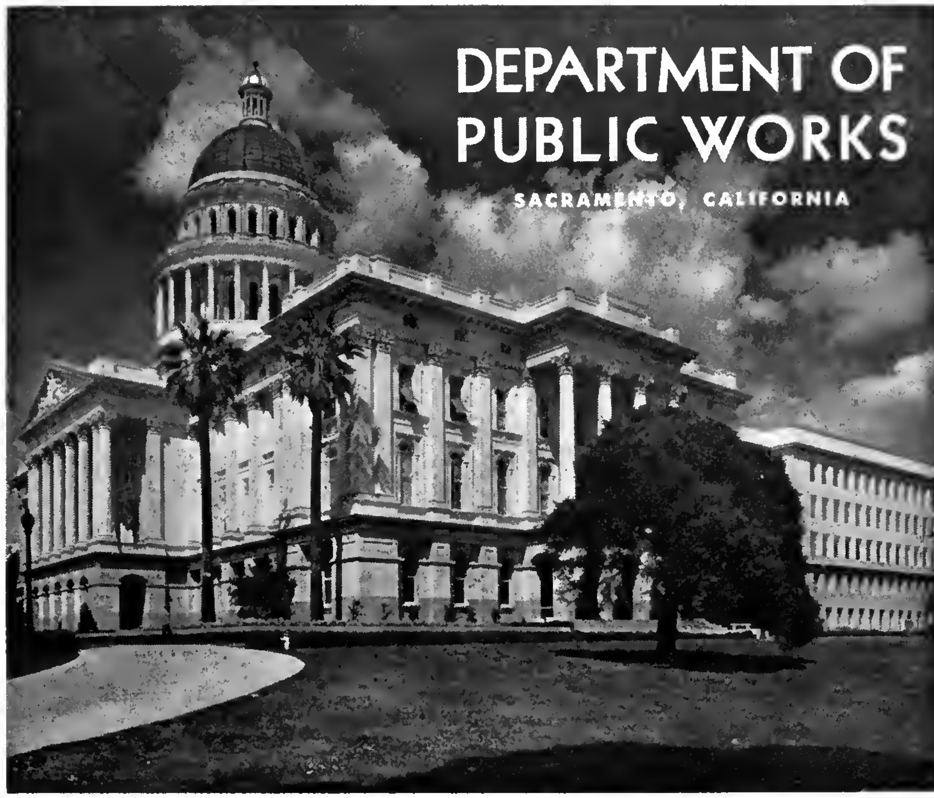

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printed in CALIFORNIA STATE PRINTING OFFICE 78250 7-58 46M

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CALIFORNIA
HIGHWAYS AND PUBLIC WORKS

SEPTEMBER-OCTOBER
1958

California Highways and Public Works

Official Journal of the Division of Highways, Department of Public Works, State of California

RICHARD WINN, *Editor*
HELEN HALSTED, *Assistant Editor*
STEWART MITCHELL, *Assistant Editor*
MERRITT R. NICKERSON, *Chief Photographer*

Vol. 37 | September-October | Nos. 9-10

FRONT COVER

The colorful walls of Red Rock Canyon rise above a foreground of cactus and sand along a section of U. S. Highway 6 in eastern Kern County.

—*Photo by William R. Chaney*

BACK COVER

This bridge over the Bixby Creek gorge on Sign Route 1 in Monterey County has long been a photographers' favorite. Built in 1932, the span rises 260 feet above the creek where it enters the Pacific Ocean.

—*Photo by Robert A. Munroe*

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Published in the interest of highway development in California. Editors are invited to use information contained herein and to request prints of any black and white photographs.

Address communications to

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SACRAMENTO, CALIFORNIA

SCR 26

Report on State's Freeway Needs Submitted to Joint Interim Committee

A MASTER PLAN on the grand scale for a California freeway system to be developed over the next two decades was submitted to the Legislature by the Department of Public Works, Division of Highways, on September 2, 1958.

The plan for "the California Freeway System" was prepared in compliance with Senate Concurrent Resolution No. 26 of the 1957 Legislature.

The first proposal of its kind and scope ever developed by any state highway organization, the freeway system envisaged in the study was described by Director of Public Works C. M. Gilliss in his presentation of it to the legislative Joint Interim Committee on Highway Problems as "such a monumental proposal that it is hard to realize its full significance at first glimpse."

When the presentation before the committee had been completed, its chairman, Senator Randolph Collier, observed that "the freeway system proposed in this report seems in general to have met our requirements." As expressed in SCR 26, what the Legislature wanted was:

"* * * a study which will provide a basis for an overall statewide plan of freeways and expressways for the State of California, such study not to be limited to state highways and such study to locate the potential freeway and expressway routes of the State and the necessary connections there to as nearly as is practicable in advance of detailed engineering design of projects."

Co-operation Cited

What the Legislature received in September, after 18 months of studies, was further described by Director Gilliss as follows:

"This highway study was more comprehensive than any ever made. The State worked closely with representatives of cities and counties. The city and county advisory group made an especially valuable contribution. In connection with the study, there were 23 separate meetings involving 730 county people and representatives of 280 cities. Special thanks are due also to the Automotive Safety Foundation and to the Institute of Transportation and Traffic Engineering.

"The California Freeway System suggested as a result of the study is such a monumental proposal that it is hard to realize its full significance at first glimpse.

"It would save lives, time and money.

"It would have a favorable highway user benefit ratio of 2 to 1, that is: 20 years' use of the California Freeway System would save the motoring public $20 billion, almost twice the cost of the system.

"It would serve every California city of 5,000 population—every city of the State which will grow to 5,000 by 1980—virtually every incorporated city and many communities not formally incorporated.

> Governor Goodwin J. Knight, in commenting on the SCR 26 report on the California Freeway System, said:
>
> "Providing adequate transportation facilities is of course one of the great needs of our State. Continuing increases in population bring a constantly growing number of vehicles both for private transportation and commerce. To meet the future needs of the State therefore it is essential that we have sound long-range planning.
>
> "This thorough exploration of our needs is significant to all Californians as an intelligent basis for planning to meet the highway development needs that lie ahead."

Presentation of the SCR 26 freeway report to the Joint Interim Committee on Highway Problems. Seated in the front row (backs to camera) are Assemblyman Lee Backstrand (left) and Senator Randolph Collier, cochairmen of the committee. Presenting the report is J. W. Vickrey, Deputy State Highway Engineer.

Public Works Building
Twelfth and N Streets
Sacramento

CONTENTS

"It would serve from one-half to three-fourths of all motor vehicle travel in California, everywhere in the State.

"It would cut the death rate among motorists using its full freeways by two-thirds to three-fourths.

"It would total nearly 12,250 miles in length, almost as extensive as the present State Highway System.

"All but approximately 1,500 miles of the proposed 12,250-mile California Freeway System are now included in the State Highway System.

"It would cost approximately $10½ billion.

"Its construction could be accomplished in 20 years.

"The final important point: Achievement of the California Freeway System outlined in the study would be possible without an increase in highway user tax rates."

Freeway Need Examined

The 36-page booklet which contains the report tells the story of the proposed California Freeway System in photographs, charts and maps, with the text relatively brief and in nontechnical language. A folded-in map showing the proposed freeway system for the entire State is attached to the inside back cover. Other maps show details of the proposed system, with route locations specified only as general in nature, for the Los Angeles, San Francisco, San Diego and Sacramento metropolitan areas.

The first part of the report is devoted to examining the *need* for a California freeway system. It contains a broad picture of the State's economy as it bears on motor vehicle travel—particularly *where* people travel, where the traffic originates and to and from what regions of the State it moves. Recreational travel is analyzed, and found to be widely spread throughout the State. Commercial vehicles carrying manufactured goods were found to outnumber those carrying agricultural, timber and other natural resource products in every region of the State.

Projecting highway needs into the future, the report envisages a population of 31 million in California in 1980, with 17 million motor vehicles and a staggering 200 *billion* vehicle-miles of total travel. This section of the report concludes:

"The development of a well-planned efficient highway transportation system for the future movement of people and exchange of goods is necessary to insure the future economy of California."

Study Methods Outlined

The second section of the report outlines the methods of study pursued by the Division of Highways and cooperating agencies in analyzing the statewide, regional and local motor vehicle transportation problem and in developing criteria for a freeway system. (See adjacent article.)

The third major section of the report contains the maps of the proposed freeway system, and an explanation of how it would serve traffic in general and the various segments of the State's economy.

Cost estimates for the proposed freeway system and a general statement on the financing picture, while not specifically called for by the Legislature in SCR 26, were prepared by the Division of Highways and were submitted to the Joint Interim Committee along with the report.

As explained to the committee by Deputy State Highway Engineer J. W. Vickrey, the approximate $10½ million cost of the system could be met on the basis of the existing revenue structure as it applies to federal, state and local financing.

. . . Continued on page 5

When Should a Road Be a Freeway?

The SCR 26 report established a "yardstick" made up of 10 criteria as a basis for selecting the proposed California Freeway System.

Ideally, as Deputy State Highway Engineer J. W. Vickrey pointed out in presenting the report to the Joint Interim Committee on Highway Problems, "everyone would be better off if every mile he traveled were on a freeway. His trip would be safer, cheaper, and quicker."

However, Vickrey went on, it is economically impossible to make every one of the approximately 120,000 miles of roads and streets in California a freeway, so the actual basic criterion is: What can the motorist afford?

He can afford, the report indicates, a freeway system which will meet all or most of the following criteria:

. . . Connect major centers of population.

. . . Connect primary centers of industrial activity and of natural resources with centers of supply of labor and material and with major shipping points.

. . . Provide access to important military installations and defense activities.

. . . Provide access to major recreational regions: national parks and monuments, and state beaches and parks; lakes; hunting and fishing areas; and to state institutions.

. . . Connect as many seats of county government as economically feasible.

. . . Provide for continuity of travel into, through, and around urban areas from rural freeway approaches.

. . . Provide for large traffic movements between population and industry within urban areas.

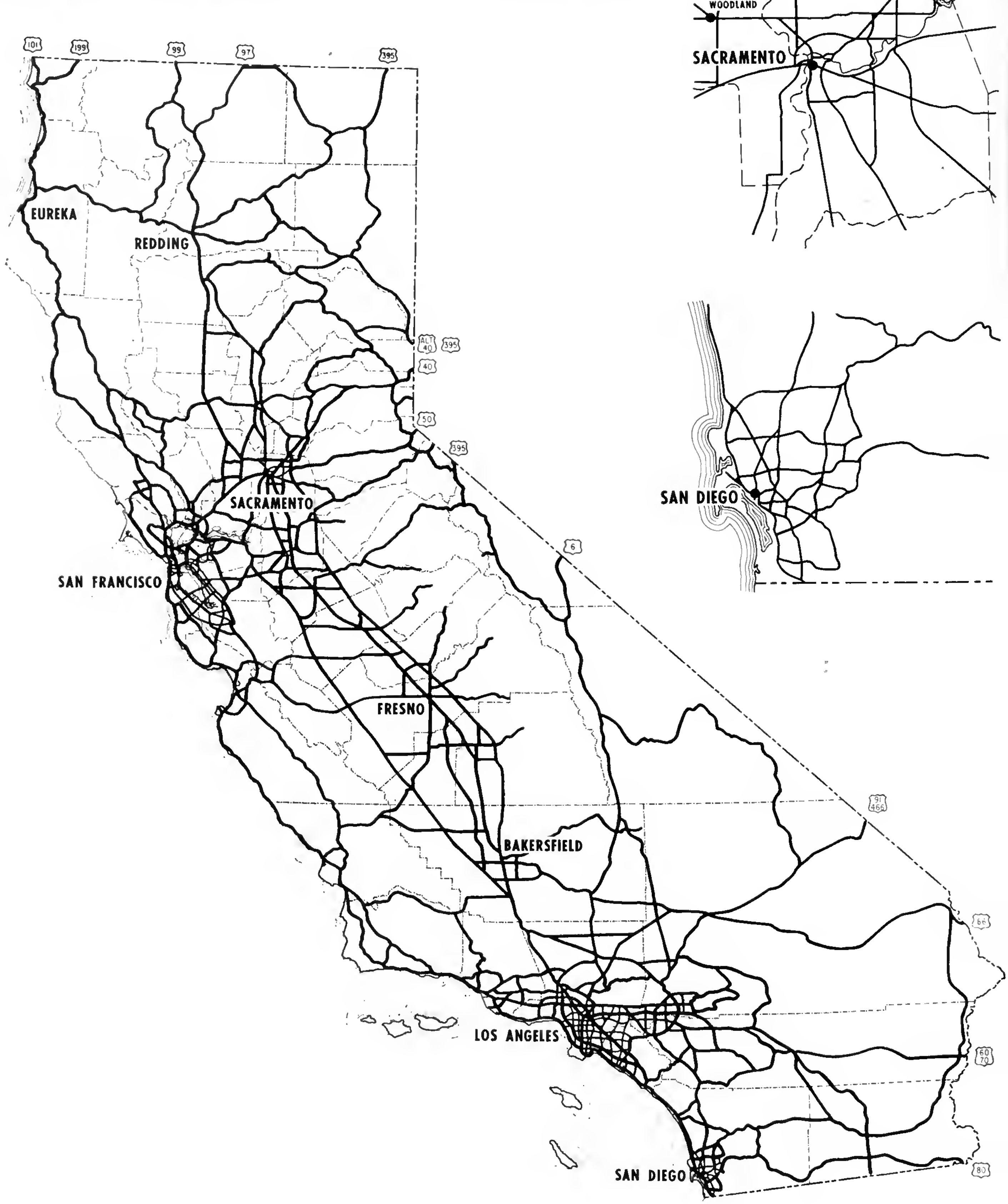
. . . Provide for needed capacity in the traffic corridors.

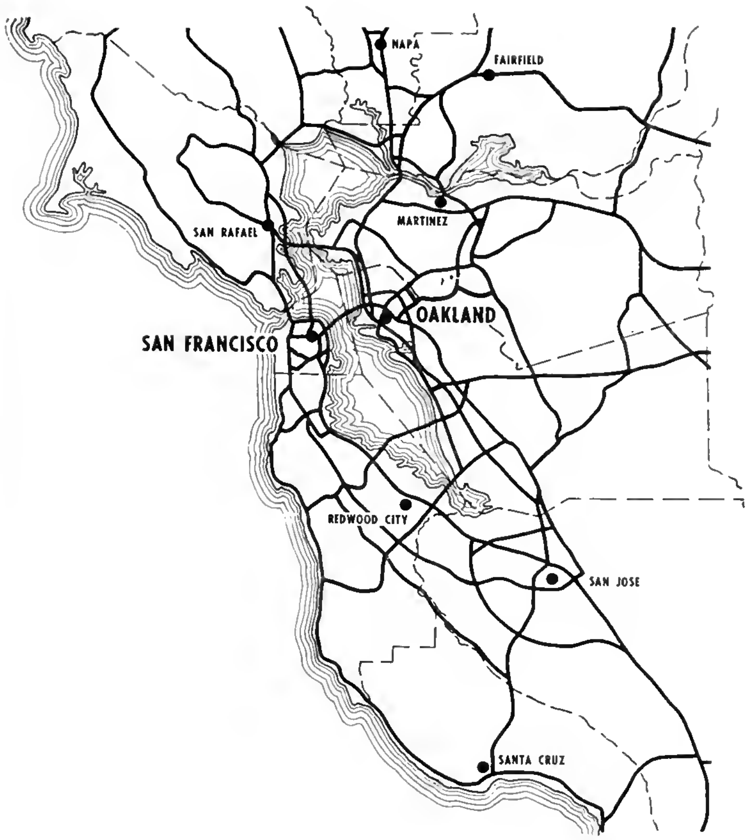
. . . Connect with major highways of adjacent states.

. . . Provide an integrated system, with a minimum of stubs or spurs, to permit general traffic circulation.

The SCR 26 Technical Advisory Committee is shown at one of its 11 meetings. Committee members seated around the conference table are (clockwise, beginning at left front): Victor W. Sauer, Road Commissioner, Contra Costa County; Jess Gilkerson, City Engineer, Long Beach; Edward W. Blom, Assistant City Manager, San Diego; Robert W. Cowden, City Manager, Redding; Richard M. Zettel, Research Economist, Institute of Transportation and Traffic Engineering, University of California; Sam R. Kennedy, Road Commissioner, County of Los Angeles, chairman; Harmer E. Davis, Director, I. T. T. E.; A. C. Keith, Road Commissioner, County of Riverside; John A. Morin, City Engineer, Oakland; E. A. Fairbairn, City Engineer, Sacramento, vice chairman; Lyall A. Pardee, City Engineer, Los Angeles; A. S. Koch, Road Commissioner, Orange County; E. R. Hanna, Road Commissioner, San Benito County. In the back row (left to right) are Mrs. Frances Reynolds and Assistant State Highway Engineer J. C. Womack of the Division of Highways. Committee members not present for this photograph were: E. J. Guidotti, Supervisor, Sonoma County; Road Commissioner Vernon G. Smith of Kern County and City Manager Jerome Keithley of Palo Alto, committee secretary. Former members of the committee include Supervisor Heinz Kaiser of Orange County (deceased) and City Manager O. W. Campbell of San Diego and Port Commissioner Dudley Frost of Oakland (resigned).

FREEWAY SYSTEM PROPOSED TO LEGISLATURE





SCR 26

Continued from page 3 . . .

For the period 1960-1980, Vickrey said, the present revenue basis would yield an estimated $23 billion from the following sources:

Federal aid	$3.9 billion
Local revenues	$4.8 billion
(City and county taxes for streets and roads, plus fines and forfeitures, etc.)	
State highway user tax revenues	$14.3 billion
(After deducting funds for Department of Motor Vehicles, Highway Patrol, and costs of collections.)	

Of this amount, $7 billion would be required for maintenance and administration (state, city and county), leaving $16 billion for rights-of-way and construction.

The $16 billion, again based on present legislation, would be distributed as follows:

County roads	$2.4 billion
City streets	$2.0 billion
Local grade crossing separation projects	$0.1 billion
State highways	$11.5 billion

The 12,241-mile freeway system proposed in the study consists of 10,722 miles which are now a part of the 14,000-mile State Highway System, plus 1,519 miles under city or county jurisdiction. Included in the 10,722 miles of present state highways proposed for the system are the 2,200 miles of national interstate routes.

Counties Consulted

Preparation of the report was assigned early in 1957 to the California Highway Planning Survey of the Division of Highways. One of its first steps was to arrange for consultation with the 58 counties and as many as possible of the 350 incorporated cities in the State. This approach was facilitated in three ways: first, SCR 26 itself called on the cities and counties to co-operate; second, it also provided for a technical advisory committee of 14 members, seven representing cities and seven representing counties; and third, the Division of Highways had already begun working with the cities and counties in compiling street, road and highway needs estimates in connection with a provision of Section 210 of the Federal Aid Highway Act of 1956. Some of the traffic estimates and other data compiled for the "210 study" were found to be applicable to the SCR 26 study.

Dozens of meetings were held throughout 1957 and the first half of 1958 with representatives of the cities and counties by members of the Division of Highways headquarters and district staffs. The full picture of local planning and local needs and problems was brought out at these meetings, to be presented to the Technical Advisory Committee for its review.

At the same time the Division of Highways was obtaining and correlating information from numerous state and federal government agencies and from regional intergovernmental organizations.

Several of the counties retained engineering consultants to make comprehensive traffic circulation studies, in which the State assisted financially. These studies were of particular value in developing the proposed freeway system in those areas.

The long-range significance of the study, extending beyond the proposed freeway system itself, was emphasized by legislators and others when the report was formally presented to the joint interim committee in the Senate Chamber of the State Capitol.

Report Praised

Assemblyman Lee Backstrand of Riverside County, vice chairman of the committee, termed the study a "pioneering step in more effective intergovernmental relations" in California.

Harmer E. Davis, Director of the Institute of Transportation and Traffic Engineering of the University of California and an adviser in the preparation of the report, described the study as an "excellent investment" for the people of California.

"Even if the Legislature doesn't 'buy' the proposed system," Davis said, "It has set in motion the kind of planning we need. This is a system which should be considered not in terms of mileages of road but in amount of traffic service."

The same note was touched on by Road Commissioner Sam R. Kennedy of Los Angeles County, who was chairman of the Technical Advisory Committee, and by Carl E. Fritts, vice president in charge of engineering of the Automotive Safety Foundation, consultants in the overall study. Fritts particularly praised the California Legislature as "outstanding in the Nation for its continuing and constructive interest in highways."

The report is now being taken by the committee to the people of California, in a series of public hearings conducted in all parts of the State.

"We are asking," Senator Collier said, "for constructive criticism from the people of the State, after they have had a chance to review the report. After we have heard their reaction, the committee will prepare its recommendations to the 1959 Session of the Legislature."

Continuing attention to the State's traffic problems is called for in the report itself.

"The system as planned for 1980," it emphasizes, "cannot be considered as the 'ultimate' freeways system. Continuous study will be given to changing conditions, with necessary additions or revisions made as far in advance as better estimates make possible. Nevertheless, the pattern set in this study should remain the backbone network."

I. T. T. E. Schedules Meet in January

The Eleventh California Street and Highway Conference will be held by the Institute of Transportation and Traffic Engineering of the University of California at Berkeley, January 28-30, 1959.

C. E. Waite, Deputy State Highway Engineer, will be chairman.

The annual I. T. T. E. conference covers subjects ranging from broad planning problems to latest developments in engineering and construction technique. It draws attendance from throughout the Country as well as from many parts of California.

Ben D. Martin Named Commission Secretary

Ben D. Martin, chamber of commerce executive and former newspaperman, has been appointed secretary of the California Highway Commission.

C. M. Gilliss, State Director of Public Works and chairman of the commission, announced the appointment which became effective August 18th. Martin succeeded C. A. Maghetti, who resigned "for personal reasons."

Martin was secretary-manager of the Chamber of Commerce of Bellflower. His home is at 12771 Leroy Circle, Garden Grove.

"Martin's background and experience," Gilliss said, "make him particularly well suited to serve the commission."

For more than a decade, Martin has been editor, managing editor and reporter on weekly, semiweekly and daily newspapers. He was on the editorial staff of the Long Beach *Press-Telegram* for five years, he worked with radio stations in Sacramento, Santa Ana and Long Beach, and he ran the monthly newspaper of the State Junior Chamber of Commerce.

A World War II veteran, Martin is 34 years old, married, and has one daughter.

In submitting his resignation to the commissioners, Maghetti explained: "I want to spend all of my time in my home town (Davis) in the interest of my personal affairs."

Maghetti had served as secretary since January, 1955.

He was editor and publisher of the Davis *Enterprise*, Yolo County weekly newspaper, for 20 years before his appointment to the commission post. He is a former postmaster in Davis and has been chairman of the Davis Housing Authority, director of the Yolo County Fair Board, and a director of the California Newspaper Publishers Association.

In 1957, there were over 370 persons killed while crossing at an intersection with signal. Remember, cross cautiously.

Report From District IX

By E. R. FOLEY, District Engineer

DISTRICT IX of the California Division of Highways encompasses most of the area of the State that lies east of the backbone of the Sierra Nevada Mountain Range. This sparsely populated area, which contains Mono, Inyo and eastern Kern Counties, is traversed by some 965 miles of state highways. These highways reach from the timberland, lakes and high passes of Mono County to the arid expanses of the Mojave Desert; from the highest point on the California State Highway System, Tioga Pass, at an elevation of 9,947 feet, to below sea level in the sink of Death Valley. Temperatures range from 40 degrees below zero in the north to a summertime high of 140 degrees F. in Death Valley.

PHOTO AT TOP OF PAGE—Typical of the country east of the Sierra Nevada included in District IX is this view southward along US 395 near Mono Lake. This section of the highway is being relocated and improved.

This land of extremes in climate and terrain poses many problems to the highway engineeer, be he concerned with planning, design, construction or maintenance. It also offers much to the tourist and vacationer who are visiting it in constantly increasing numbers. Recreational travel to enjoy summer camping, fishing, boating and hiking; the fall influx of deer hunters and the winter sports enthusiasts who flock to newly developing ski areas are bringing congestion to the highway system far beyond what a look at population figures would indicate. Military traffic to the Marine Cold Weather Training Station in Northern Mono County, to the Naval Ammunition Depot in neighboring Nevada, to the Naval Ordnance Test Station at China Lake and to Edwards Air Force Base in eastern Kern County add to the ever-increasing flow of vehicles which must be accommodated.

Important Route

The highway system which serves these many visitors in addition to the resident population has a long backbone which is Legislative Route 23. This enters District IX at the Los Angeles county line north of Lancaster as US 6 and proceeds northerly through Mojave, Red Rock Canyon and Indian Wells Valley where it is joined by US 395 near Inyokern. These two US routes then share Route 23 jointly for some 125 miles to Bishop where US 6 leaves it and US 395 continues on for another 140 miles to enter Nevada adjacent to Topaz Lake. En route it stays above 6,000-foot elevation for some 100 miles and crosses two summits above 8,000 feet, Deadman Summit, south of Mono Lake, at 8,041 feet, and Conway Summit, north of Mono Lake, at 8,138 feet, which is the highest point on US 395 from Mexico to the Canadian border.

This central backbone is crossed near its base at Mojave by US 466 which connects Bakersfield and the San Joaquin Valley with the Interstate System at Barstow. Many lateral offshoots which leave Route 23 at intervals provide access to the streams, lakes and back country of the eastern Sierra, to the mines and rangelands and to our sister state to the east. There are seven connections with the Nevada Highway System along the District IX border.

The first freeway adoption in District IX was in 1953 on a portion of State Route 212 between US 6 and the San Bernardino county line east of Ridgecrest. Additional routes which are planned for freeway development include US 466 from the District VI boundary at Bear Mountain Ranch to the District VIII boundary east of Boron, US 6 from the Los Angeles county line south of Mojave to the Nevada state line near Montgomery Pass and US 395 from Johannesburg to the Nevada line at Topaz Lake. This is a total of 460 miles to be developed initially as expressways with limited access and ultimately portions of these routes will become full freeways with no crossings at grade. To date public hearings have been held in affected communities and 156 miles have been formally adopted as freeways. Relocations of US 6 and US 466 in the Mojave area, which are now in the public meeting stage, will include an additional 26 miles and another 33 miles are in various stages of advance planning.

Initial Two-lane

Only a bare start has been made in constructing fragments of the planned freeway mileage to the initial expressway stage. In general, only two lanes of the ultimate four-lane section is planned initially. The few miles of 60-foot wide four-lane section which have been constructed are warranted because it has been more economical to construct passing lanes through rolling terrain than to make the heavier cuts and fills necessary to obtain safe passing sight distance on a two-lane section. US 6 has been likened to a long desert snake that has dined on numerous small rodents because of these four-lane bulges along its normally two-lane length.

Since 1955 District IX has had an annual construction expenditure of approximately two million dollars. Currently some $2,119,000 of construction work is under contract or advertised.

If you should enter via US 395 from the south the first modernized section traversed will be a five-mile length between Inyokern and a new junction with US 6 near Brady's. This was completed in February of 1958 by Schroeder and Company. It is a two-lane roadway with limited access control and has only one curve in its length. Next is a section along Haiwee Reservoir, where the Los Angeles aqueduct starts its long journey to the City of the Angels. This was surfaced to Olancha in 1955 over previous stage-construction widening to provide a 32-foot two-lane pavement, with some stretches of four-lane for passing. In 1958 this resurfacing was extended from Olancha along the west shore of Owens dry lake bed for 12 miles to join the portion reconstructed in 1955 to Diaz Lake south of Lone Pine. From here, past the World War II Japanese relocation camp at Manzanar, to the county seat at Independence, earlier construction has brought this portion up to acceptable modern standards.

Distance Shortened

North from Independence a realignment is programed for construction as soon as funds are available. This project will include the first four-lane divided section within District IX.

Proceeding northerly a six-mile section in the Fish Springs area south of Bigpine is currently under contract with I. L. Corft and Son. This construction will eliminate passing restrictions with a four-lane section and will shorten the distance by 0.3 mile by eliminating a "dogleg" in the old alignment.

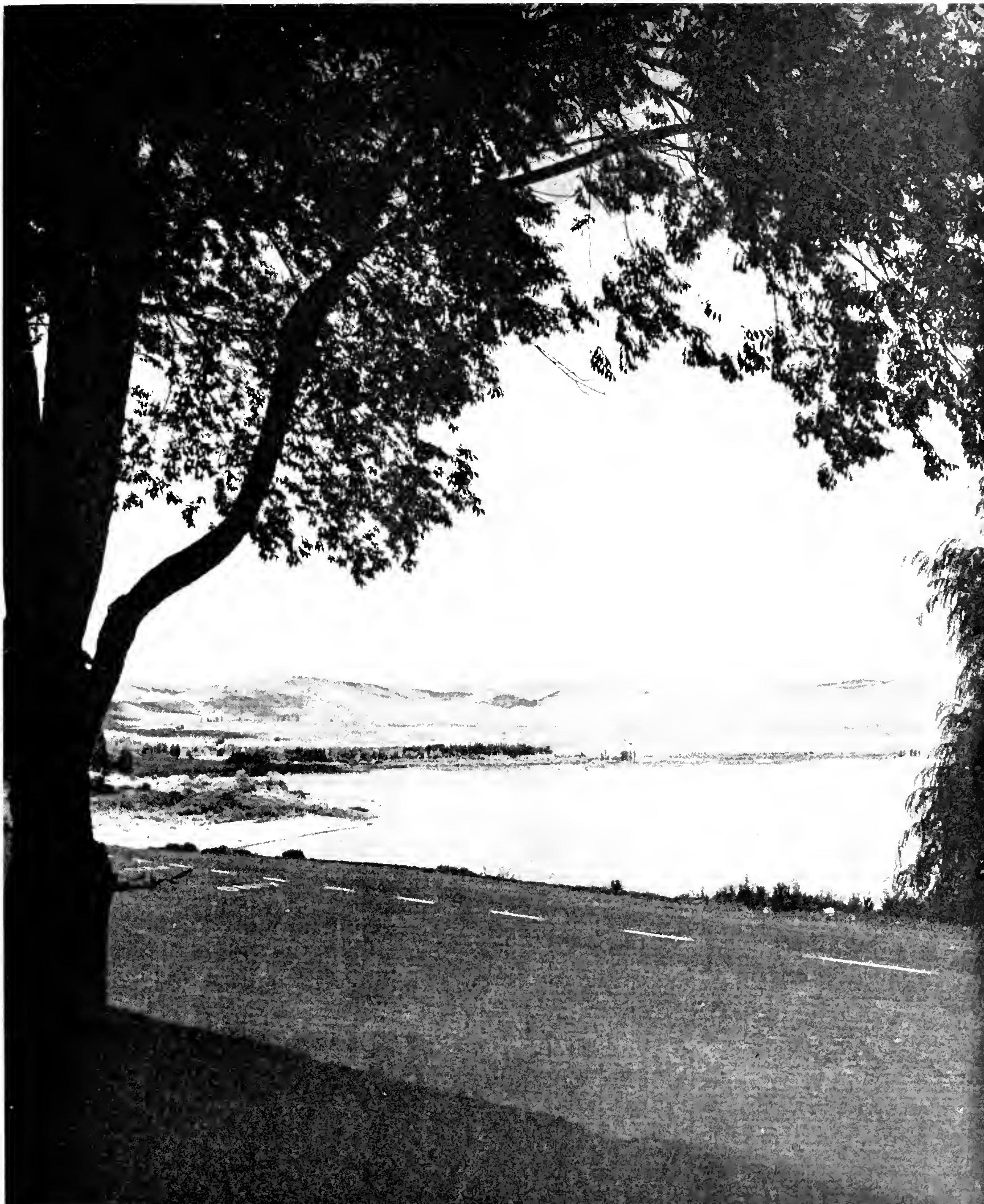
North from Bishop, 11.2 miles of US 395 were widened and resurfaced in 1957 to provide a 32-foot paved width connecting with the foot of the Sherwin Grade which was constructed on new alignment in 1956. The Sherwin Grade project eliminated one of the worst bottlenecks on this route and was the largest contract ever awarded in District IX.

Except for resurfacing at several locations, and widening from Crestview over Deadman Summit, no major construction has been done on US 395 north of the Sherwin project during recent years. However, the first of two projects which will eliminate hazards of the Conway Grade and its southerly approach is now under contract and construction operations were started this August. This job will provide a 32-foot two-lane section on new alignment from the Mono Inn for 4.2 miles to the foot of the grade. The second project, which will continue to Conway Summit, is now in the design stage and will be constructed as soon as financing can be provided. Portions south and north of Bridgeport are also in design stage and are proposed for early construction.

Resurfacing Completed

From the junction of the Sonora Pass Highway for a distance of 27 miles to the Nevada state line at Topaz Lake a resurfacing project is under contract which is expected to be completed this fall.

If you choose US 6 as your route into District IX from the south you will find the intersections with US 466 at each end of Mojave channelized by recent construction. Resurfacing through the Mojave business district and for a distance of six miles northerly was done this year and included these intersections. Proceeding northerly a four-mile section from Jawbone to Red Rock Canyon which was reconstructed to a four-lane width in 1954 is being extended one mile into the canyon under a current contract now nearing completion. This project involves heavy excavation in two rock points with cuts to a height of 185 feet to straighten the channel and make room for the widened roadway on improved alignment. This canyon, although normally dry, is subject to cloudburst floods and in the past has washed out this section of highway and caused serious disruption of transportation. A second project programed for early construction will bridge the main wash at the north end of the present project and climb out



US 395 follows the scenic shoreline of Mono Lake. The tortuous Conway Grade barely discernible in the left background will soon be replaced by a new highway

UPPER Looking west along Pole Line Road near the Nevada state line. This route connects US 395, which follows the base of the Sierra Nevada seen in the distance, with the Naval Depot at Hawthorne. LOWER This recently completed portion of US 6 north of Mojave is typical of the divided, four-lane pavements used for new expressways in District IX. Visible ahead is a continuation of this section now under construction through Red Rock Canyon.

UPPER—The recently improved junction of US 466, on the left, and US 6 at the north edge of Mojave. LOWER—A view eastward of the Walker Pass Road (Sign Route 178) near Weldon. The old highway curved along the base of the hills to the left.

New four-lane expressway construction in Red Rock Canyon north of Mojave on US 6. The high rock cut and channel excavation on the right were necessary to make room for the highway and flood channel in the canyon.

of the canyon on new alignment to join a completed section that was constructed in 1955. This extends to Little Dixie Wash. From here to the junction with State Route 212 north of the Walker Pass connection, the pavement which had previously been widened to 32 feet was resurfaced in 1956. A few miles farther north past Homestead and you will join US 395 to Bishop.

At Bishop US 6 leaves US 395, continues north to Benton and leaves California near Montgomery Pass. The first portion of this route north of Bishop was resurfaced to the Mono county line and the remainder received a seal of rock screenings and oil last year.

Three-mile Reconstruction

If your travels should take you east from the Bakersfield area to Barstow and points east, US 466 would be your route over the Tehachapi Pass and through the Mojave Desert. A three-mile portion of this route east of Tehachapi from Cameron Road to Cache Creek was reconstructed in 1957 to provide a 60-foot four-lane pavement. This relieved congestion that resulted from a large volume of heavy trucks where passing was restricted by lack of sight distance on a two-lane highway. This same condition has become acute on the long grade west of Tehachapi and a major project is in the design stage to reconstruct this portion as soon as financing can be obtained.

An interim project to serve traffic through Tehachapi and easterly to the Cameron section until the planned realignment in this area can be financed has been advertised for construction this fall.

Easterly from Mojave US 466 has been widened to a 32-foot paved section to the district boundary east of Boron. An eight-mile stretch through rolling hills easterly from the entrance to Edwards Air Force Base near Muroc was reconstructed in 1956 to eliminate sight distance restrictions and dips which were hazardous when flooded.

Steep Grades Eliminated

If you should leave US 466 at Baker for a look at Death Valley, or a destination in Nevada, you will find the steep grades and winding road at Ibex Pass superseded by three miles of newly constructed highway which has just been completed. Although approximately half of this distance is within District VIII the contract was administered by District IX and included improvement of sharp curves at four other locations north and south of Shoshone. This project is the only

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Final Link

Last Unit on Santa Ana Provides 42 Miles Continuous Freeway

By C. J. McCULLOUGH, Resident Engineer
R. F. BRITTON, Assistant Resident Engineer
C. R. HOLL, JR., Bridge Department Representative

On July 3, 1958, there was opened to public traffic a unit of construction on U. S. Highway 101 at the Irvine Grade Separation Overcrossing which marked the completion of the Santa Ana Freeway throughout its entire length of 42.6 miles from Spring Street in Los Angeles Civic Center to junction with the future San Diego Freeway near El Toro.

For the first time on that date public traffic using the Santa Ana Freeway was able to travel throughout its entire length on multiple divided roadways with no stops for traffic signals or interference with cross traffic of any kind. This does not mean that we can close the books on the Santa Ana Freeway and consider that there is nothing more needed to be done upon it. As a matter of fact, even at the present time, there is construction work now in progress.

In Orange County, at the junction of the Santa Ana Freeway with the Riverside Freeway, construction on traffic interchange facilities was completed in September. Also in progress in Los Angeles County is construction for a new and additional flood control channel for the north fork of Coyote Creek between Buena Park and Norwalk which requires detouring of freeway traffic around bridge construction on the freeway. This construction is scheduled for completion February 15, 1959. Also construction is under way in Los Angeles County to widen the existing four-lane Santa Ana Freeway between Buena Park and Norwalk to provide six lanes. This construction project is 3.8 miles in length, and the low bid received for this work on June 26, 1958, totaled $956,453.70. Thus, it is evident that even though the Santa Ana Freeway is completed to full freeway standards through its entire length, additional construction thereon as well as general maintenance may well be a continuing process.

PHOTO AT TOP OF PAGE—The completed Santa Ana Freeway as seen from the top of the Laguna Canyon Road separation bridge with the Santa Fe Railroad overpass in the distance

Last Contract

Of a total of 50 major units of construction on the Santa Ana Freeway the last completed that made it possible for the first time for this important traffic facility to be operated as a full freeway throughout its entire length of 42.6 miles was Contract No. 57-7VC45-F which was awarded to Winston Brothers of Monrovia on November 29, 1956. After completion of this contract there remained but a short half-section of freeway only a few hundred feet in length at the Irvine Grade Separation structure over the Santa Fe Railroad to be opened to public traffic on July 3, 1958. This was done without ribbon-cutting ceremony or fanfare of any kind.

The Winston Brothers' contract, 5.7 miles in length, between Browning Avenue and Laguna Canyon Road, carried a contract allotment of $3,000,-614. This section of freeway is entirely within the confines of the Irvine Ranch, one of the largest and most fertile in California with an area in excess of 80,000 acres. The newly completed freeway greatly improves the ingress and egress facilities for the air base.

The alignment, for the most part, followed along that of the old three-lane highway known as State Route 2, US Highway 101, and full advantage was taken of the capital investment in the roadbed and pavement which for long stretches was used for base by covering with plant-mixed surfacing of variable thickness. Due to the existing crown on the old two-lane pavement, it was necessary to place a variable thickness of plant-mixed surfacing ranging from a minimum of two inches to a maximum of six inches. The only portion of this project on entirely new alignment was through the Town of Irvine where the change in location created a considerable improvement in the standard of alignment approaching the Irvine Grade Separation over the Santa Fe Railroad. By adopting the new alignment, it was possible to leave undisturbed the business section of the Town of Irvine at the intersection of US Highway 101 with Central Avenue.

The present construction provided for a full freeway consisting of two roadways of two traffic lanes each with right-of-way being obtained and provisions being made for the constructing of additional traffic lanes on the inside of both roadways at some future time so that an ultimate six-lane freeway can be obtained.

Two Railroad Crossings

The Atchison, Topeka and Santa Fe Railroad crosses this project near the southerly and northerly ends. At the northerly end the plans called for constructing a 1,400 lineal foot shoofly while the south Tustin Underpass structure was being built. The contractor had the option of digging a "glory hole" to enable the construction of the underpass or excavating the entire underpass area with the exception of the shoofly "plug." He chose the latter method, and excavated and hauled the material by the use of four scrapers and several pusher tractors.

At the southerly end of the project the railroad crossed under the existing Irvine Overhead. Plans called for constructing a new northbound structure and raising the existing one to conform to the new established grades.

The contractor had agreements with the Irvine Ranch for the use of several borrow pits. He was able to excavate, by the use of a loader, all the imported borrow necessary for this contract within a distance of 2.5 miles from the freeway site. There were 120,000 cubic yards of imported subbase material required and this was obtained by use of a two-cubic-yard power shovel from pits located four miles from the freeway. The longest haul was from San Juan Capistrano where the contractor purchased the untreated rock base and hauled it to the project in nine-cubic-yard capacity trucks.

Settlement Platforms Used

At the Irvine Overhead, Central Avenue Undercrossing, Jeffrey Road Overcrossing, and the Culver Road Undercrossing approaches, embankments plus a 10-foot surcharge and at the Myford Road Undercrossing, embankments plus a four-foot surcharge were constructed with surcharge left in place for a period of 90 calendar days. Settlement platforms were installed at these sites and daily readings made to record the settlement as it occurred. After removal of fill and surcharge at the Central Ave-

The Laguna Canyon Road separation bridge as seen from the new section of freeway. The view is northwestward.

nue Undercrossing, it was found that the existing roadway had settled approximately two feet and this had to be reconstructed.

Prior to placing the fill and surcharge for the new Irvine Overhead, it was necessary to extend an existing 8′ x 8′ reinforced concrete box. After backfilling this box, placing the fills and surcharge and waiting the 90-day period, profiles were run in this culvert and its was found that it had settled in a sag curve with a maximum settlement of 1.8 foot. The District Design Department had anticipated this and in co-operation with the Bridge Department had designed expansion joints to allow this settlement to take place without structurally damaging the culvert. The plans called for the construction of a new invert after settling, and $1,000 was set up under supplemental funds to finance this work.

Another structure, which carries the flow from Hicks and Peters Canyons, had become inadequate to handle storm water during periods of heavy runoff, primarily because of land use developments in the tributary watershed. The difficulties were principally at the entrance to the culvert and at the junction of a lateral culvert carrying water from Trabuco Canyon. The work as completed on the most recent contract consisted of extending the existing 9′ x 9′ reinforced concrete boxes, adding two 6½′ x 8′ boxes and constructing a new 9′ x 9′ box to handle the Trabuco water. In addition to the boxes, inlet and outlet transitions and a broken concrete energy dissipator were constructed.

Other Drainage Features

Air-blown mortar paved channels intercept the runoff waters a considerable portion of the way along the northeasterly side of this project. They vary in size from two-foot round-bottom type to a 15-foot V-bottom section. Some difficulty was encountered while excavating these channels as the local ranchers and farmers do heavy irrigating every few months and if this was not anticipated correctly as the work progressed, flooding would be a certainty. Most of this work was completed with only

UPPER—A view southeast from Jeffrey Road toward the Town of Irvine along the newly completed section of the Santa Ana Freeway. LOWER—The Culver Road undercrossing on the new freeway. Culver Road connects with the county highway leading to the main entrance of the El Toro Marine Air Station.

Signing along the new freeway. Motorists are alerted to forthcoming separation structures where they may want to leave the freeway.

a small amount of damage resulting from uncontrolled irrigation waters.

The major bridge structure work on this contract consisted of one railroad underpass, one railroad overhead, one overcrossing, three undercrossings, one drainage bridge, and two pumping plants. The cost of these structures was $834,230.

The South Tustin Underpass consists of a riveted structural steel through plate girder bridge with a reinforced concrete deck. Two simple spans carry the Santa Fe Railroad over the depressed freeway to the small section south of the City of Tustin called Venta. A pumping plant was constructed in the below-ground surface of the freeway to provide removal of the surface runoff to the drainage ditch which terminates at the Orange County Flood Control Channel at Tustin Bridge.

Tustin Bridge is a reinforced concrete slab bridge spanning the Orange County Flood Control Channel. The flood control channel is an extension of the South Tustin Storm Drain which collects the water from the newly developed housing areas south of the City of Tustin. The new structure replaced the original bridge which had been rebuilt in 1938. The new bridge is approximately 50 feet longer than the existing bridge to provide for the new channel which was realigned and enlarged at the time of the existing bridge removal. The anticipated growth of the South Tustin area necessitated that the bridge be constructed with future channel widening provided. The existing reinforced concrete drop structure west of the bridge site was revised to accommodate the new channel section and the new bridge.

Drainage Water Removed

Myford Road Undercrossing is a reinforced concrete girder bridge spanning Myford Road, part of the Orange County Road System carrying farm-to-market traffic. A pumping plant was constructed at this site to provide removal of the drainage water in the cut section of Myford Road. The drainage water is pumped to an open ditch which terminates at the Orange County Flood Control Channel at Tustin Bridge.

Culver Road Undercrossing is a reinforced concrete girder bridge spanning Culver Road, part of the Orange County Road System and the main entrance to the El Toro Marine Base. This interchange structure permits freeway access for the heavy traffic to and from the marine base.

Jeffrey Road Overcrossing is a welded steel girder bridge with a reinforced concrete deck and provides access to the freeway for farm-to-market traffic. Jeffrey Road is part of the Orange County Road System.

Central Avenue Undercrossing is a reinforced concrete structure spanning Central Avenue in the Town of Irvine. The traffic to and from this community may gain access to the freeway at this structure.

Irvine Overhead as regarded consists of two parallel structures, one of which is new. These structures span the Santa Fe Railroad main line between Los Angeles and San Diego. The existing overhead structure was adjusted to the new freeway grade system by jacking the existing superstructure to the new grade and tilting the deck to obtain the required slope for superelevation. C. H. Bashore & Sons, a housemoving firm from Pasadena, provided the necessary equipment and crew to carry out the jacking operation. Approximately 70,000 board feet of 6 x 8 timbers, four feet long, were required to build the crib stacks used as a jacking platform to support the entire superstructure. Some 180 screw jacks and 57 hydraulic jacks were used to raise the 1,100 tons of bridge superstructure. The actual jacking operation consumed only five days after some six weeks of preliminary preparations. After completion of the raising, new bearings were placed under the girders and the deck was surfaced with plantmix to provide smooth riding qualities.

The completion of this 5.7 miles of four-lane freeway, replacing as it does a three-lane, 30-foot width of pavement, conventional type highway with many road intersections and one railroad grade crossing, provides the public with a much safer traffic facility. The many traffic tie-ups that used to occur on the old road on Sundays and holidays should now be a thing of the past. The 20,000 motorists per day (that figure being the present average daily traffic count) who drive this new freeway, on the basis of statewide accident statistics, will be three times safer than they were on the old superseded highway.

More than 95 percent of vehicles involved in fatal accidents on United States highways in 1957 were in apparently good condition.

Report From District V

By A. M. NASH
District Engineer

In the Counties of Monterey, San Benito, San Luis Obispo, and Santa Barbara that make up District V of the State Division of Highways, we have our share of the contrast and variety that is characteristic of our State. Along our wild coastline we have rocky mountains that fall abruptly into the sea. Farther inland lush green vegetable fields thrive adjacent to the arid, brown hills and the flatlands farther east. Busy modern factories spring up next to neat, peaceful-looking dairy ranches. Historic missions are spaced through the area in numbers, for here is the veritable heartland of the territory where Fra Junipero Serra and his fellow Franciscan missionaries labored so mightily.

District V has a relatively large area of 10,800 square miles, but a population of less than 400,000 with an average population density of 35 people per square mile.

ABOVE—This expressway now under construction west of Santa Barbara connects with completed expressway and freeway sections in the Gaviota Pass-Buellton area and will provide a long continuous stretch of divided, four-lane roadway for the heavy traffic using US 101

Population Growth

Yet, even in this predominantly rural area population is growing, particularly in such areas as Salinas, Monterey, San Luis Obispo, and Santa Barbara, bringing some of the same problems that concerns the large metropolitan centers.

Thus, as the population, development, and geography vary in the district so do the problems of developing suitable highways to serve these areas. We must be careful to plan for the inevitable growth of the future as well as for the immediate needs of the present, for experience has taught us that the two-lane highway of today may soon require a four- or six-lane freeway.

We must also give all possible attention to using every resource at our command to construct US 101, one of our State's main north-south arteries, to adequate freeway standards throughout our district to serve the heavy through traffic between San Francisco and Los Angeles while at the same time providing an adequate transportation system for local and agricultural traffic on which the livelihood of so many people in our district depends.

Such important lateral connections between US 101 and US 99 in the central valley as State Sign Route 41 between Paso Robles and Fresno also require attention in developing them to modern highway standards. So does State Sign Route 1, the Cabrillo Highway, which passes through such tourist attractions as Morro Bay, San Simeon, the scenic coastline leading to Big Sur State Park, Carmel and the Monterey Peninsula vacation lands.

Federal Program

As an illustration of the continuing efforts in solving these many difficult highway development problems facing us, let us review our accomplishments of the past year as well as project our plans for the immediate future.

A federal highway bill was passed this year by the Congress which, in addition to an augmented federal-aid allocation of funds for the interstate and regular Federal Highway System roads, also contained an emergency or antirecession allocation of 400 million dollars. The terms of the law specified that projects to be eligible for participation in these funds must be capable of being placed under construction before December 1, 1958, and must be completed by December 31, 1959.

Six projects in all were selected in this district for addition to the 1958-59 Fiscal Year Budget to be financed on the specified matching basis by these supplemental federal funds. The total estimated cost of the six projects was $5,795,000, which will materially accelerate the construction and completion to modern standards of six substandard sections of state highway in this district.

The specific allocation of these funds allows construction of the following highway projects.

In San Benito County, a grade separation structure, access ramps and connections will provide an interchange at the San Juan Bautista intersection of US 101 and State Sign Route 156. The 327-foot-long bridge structure will carry traffic on State Sign Route 156 over US 101. Some existing access openings from private properties to US 101 in this area will be closed and replaced by standard freeway frontage roads. Four hundred twenty-five thousand dollars was budgeted for construction of the project with minor right-of-way acquisition adding $66,000 to the project cost. When construction is completed on this project the present "at grade" crossing will be closed, thereby eliminating a serious traffic hazard and high accident rate location from our main coast highway.

Project Divided

Farther south in San Luis Obispo County, three construction projects were added on State Sign Route 41 and US 466, one of our main east-west laterals between Paso Robles and the San Joaquin Valley. For purpose of convenient design, budgeting, and construction, this highway development was split into three projects, the first one being an 8.7-mile section of two-lane conventional highway which begins two miles east of Estrella River near Paso Robles and extends to 0.4 mile west of Lucy Brown Road, east of the community of Shandon, bypassing this community on the north side. The second project extends from 0.4 mile west of Lucy Brown Road to Palo Prieto Road near the area known as Cholame. This is a comparatively small section of 2½ miles requiring an estimated $350,000 to construct.

The final project in this area involves the construction of approximately six miles of modern two-lane highway on US 466 between the junction of State Sign Route 41 and US 466 near Cholame and extends easterly to the Kern county line. Approximately $1,100,000 will be required for completion of this important project.

When completed, all three sections will provide the initial two lanes of a future four-lane expressway. Many winding curves and grade deficiencies will be eliminated in this new alignment which will run generally slightly north of the present route.

Improved Access

Farther south in Santa Barbara County a rough and tortuous section of State Sign Route 1 between Lompoc and Las Cruces on US 101 near the Gaviota Pass will be realigned for a distance of approximately three miles, between 1.8 miles north of Ytias Creek and Jalama Road. This project will provide greatly improved access from US 101 to the City of Lompoc and the fast-growing Cooke Air Force Base. This project will require the expenditure of approximately $1,000,000.

The remaining project resulting from these special federal aid funds is located between Santa Barbara and Carpinteria on US 101 and involves two separated sections of highway. The first or easterly section (this road runs east to west through Santa Barbara) is located at Ortega Hill replacing an existing four-lane undivided highway. Construction of an overcrossing structure at Sheffield Drive and frontage roads between Ortega Hill and Miramar Avenue in Montecito is included in the work on this section. The second or westerly section is located between Park Place and Salsipuedes railroad overhead and involves principally the construction of a complete interchange and separation structure at the existing Milpas Street-US 101 grade intersection.

Overall Picture Provided

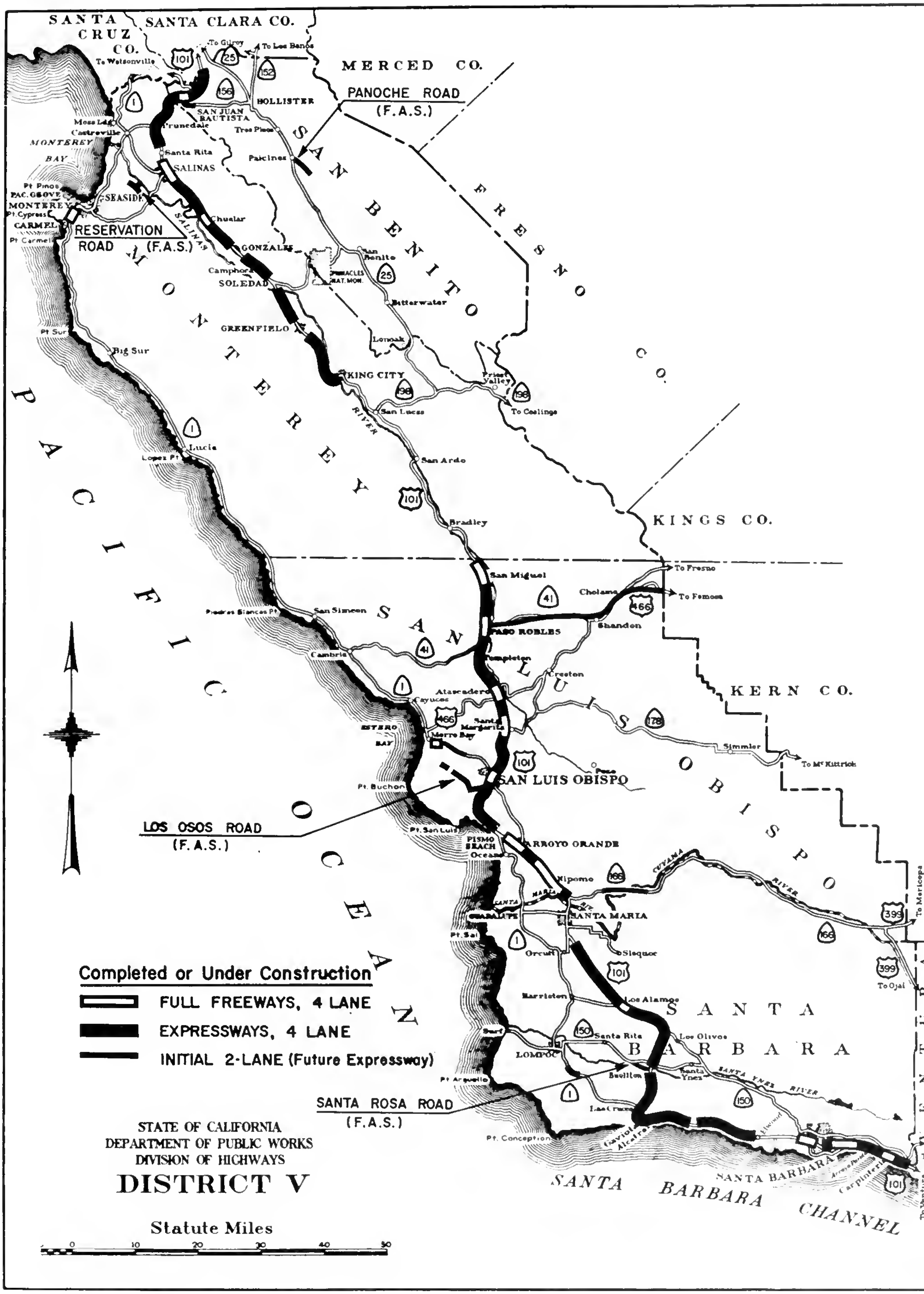
For a detailed account of our construction and planning activities for US 101 in the north section of District V, we refer to the article in the recent July-August issue of *California Highways and Public Works* magazine entitled "Monterey County." To provide an overall picture of this progress a brief summation is included here. Ten miles south of Salinas the two-lane bottleneck through the community of Chualar has now been eliminated, as a complete freeway for one mile in length was completed in May of 1958, providing continuous divided four-lane highways from the Santa Clara county line on the north to approximately 20 miles south of Salinas, just north of the City of Gonzales.

Farther south a new divided four-lane expressway project between the Salinas River south of Soledad and one mile north of Greenfield, 5.8 miles in length, was completed in March of this year at a cost of $1,145,000. This project included the Arroyo Seco grade separation structure at the northerly end, and provision was made in our design and right of way acquisition for construction of another grade separation structure at Hudson Lane at the southerly end of the project, along with necessary frontage roads to convert this expressway to a full freeway when traffic needs and available funds permit.

Traffic Convenience

Continuing south, we have just completed a divided four-lane highway eight miles in length between the Cities of Greenfield and King City, again with provisions for development to freeway standards when circumstances permit. All three of these projects have nearly eliminated the well-remembered bottleneck produced by the heavy summer truck traffic carrying vegetable produce from the intensely cultivated Salinas area to the City of Salinas for processing and distribution. Through traffic, as well as local traffic, will no longer suffer the inconvenience of following slowly for miles behind slow-moving, produce-carrying truck traffic as has been the case for so many years.

Much planning is being carried on as a prelude to construction of other



SANTA CRUZ CO.
SANTA CLARA CO.
MERCED CO.
PANOCHE ROAD (F.A.S.)
SAN BENITO
FRESNO CO.
MONTEREY
KINGS CO.
PACIFIC OCEAN
SAN LUIS OBISPO
KERN CO.
SANTA BARBARA
VENTURA
SANTA BARBARA CHANNEL
RESERVATION ROAD (F.A.S.)
LOS OSOS ROAD (F.A.S.)
SANTA ROSA ROAD (F.A.S.)
HOLLISTER
SALINAS
SEASIDE
MONTEREY
CARMEL
GONZALES
SOLEDAD
GREENFIELD
KING CITY
San Lucas
San Ardo
Bradley
San Miguel
PASO ROBLES
Cholame
Shandon
Templeton
Atascadero
Santa Margarita
Morro Bay
SAN LUIS OBISPO
ARROYO GRANDE
Nipomo
SANTA MARIA
GUADALUPE
Orcutt
Los Alamos
Los Olivos
Buellton
LOMPOC
Big Sur
Lucia
San Simeon
Cambria
Cayucos
Creston
Simmler
Pt. Conception
To Fresno
To Coalinga
To Ojai
To Ventura
Completed or Under Construction
FULL FREEWAYS, 4 LANE
EXPRESSWAYS, 4 LANE
INITIAL 2-LANE (Future Expressway)
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS
DISTRICT V
Statute Miles
0 10 20 30 40 50

vital sections of US 101 in Monterey County such as the bypasses of the Cities of Gonzales, Soledad and Greenfield, all of which are being carried forward in the plans and rights of way acquisition phases as fast as possible. Construction of several projects now awaits the availability of the necessary construction funds.

One such project for which fund allocation was made in the current budget is a 5.8-mile section of highway between the Cities of Soledad and Gonzales in the heart of the vegetable growing area on which construction is just beginning. The contractor has been allowed 275 working days in which to grade and surface this approximate six-mile section of highway and construct two grade separation structures to convey local traffic over the freeway. One structure will be at Camphora-Gloria Road north of Soledad. The second bridge will be constructed at the entrance of the Soledad Medium Security State Prison which will carry traffic to and from the prison from US 101.

New Freeway Opened

In the March-April issue of *California Highways and Public Works* magazine, there is a rather complete analysis of construction and use of the newly completed San Miguel Freeway on US 101 in San Luis Obispo County which was open to public traffic late in November, 1957. Briefly stated, this three-mile project between the south boundary of Camp Roberts and the expressway between Paso Robles and San Miguel provides additional traffic facilities for military transportation at Camp Roberts as well as benefiting the general traveling public.

Construction is virtually completed on the $3,340,000 Paso Robles bypass freeway project located at the intersection of the main north-south and east-west highways in our central coast area.

Serving Los Angeles-San Francisco traffic, US 101, now passing directly through the main business district of Paso Robles, will be relocated easterly when the project is open for public travel. Connecting existing four-lane divided highways north and south of Paso Robles, this five-mile relocation will carry traffic on four-lane divided concrete pavement from one mile south to one mile north of Paso Robles. The new alignment is located easterly of the present route, between the main business district and the Salinas River. The project will pass over the Southern Pacific Railroad at each end of the city by means of twin welded steel girder bridges with reinforced concrete decks. Within the city, at 13th Street, the freeway is depressed with local traffic being carried overhead by means of a prestressed concrete thin slab structure. Presence of ground water in this immediate area made construction of a thin slab overcrossing necessary in order to obtain the required vertical clearance.

Old Highway Replaced

This project will also improve State Sign Route 41 connecting the Fresno-Bakersfield area with Paso Robles and the central coast area by replacing approximately two miles of substandard highway between Paso Robles and recently completed projects eight miles in length further east. From that point on, the three projects described previously as part of the additional federal-aid allocation of 1958 will give us a complete modern two-lane alignment from Paso Robles to the easterly limits of San Luis Obispo County on this strategic east-west lateral with provision in the design and right of way width for future expansion to four-lane divided expressway.

Under construction since October, 1956, the Paso Robles bypass freeway has been considerably delayed by late delivery of the long sections of structural bridge steel without which the project could not progress. The structural steel was finally delivered in the middle of June, 1958, and the contractor, A. Madonna Construction Company, has been rushing the project to completion since that time.

Continuous Highway

Completion of the Paso Robles bypass freeway is an important accomplishment providing the traveling public with continuous divided four-lane highway on US 101 throughout San Luis Obispo County except for relatively short sections through the Cities of Pismo Beach and Arroyo Grande.

Design is nearly complete and right-of-way acquisition is well along on the 2.2-mile section through Pismo Beach. This planned project lies approximately one block east of the present four-lane highway through Pismo Beach and by means of on and off ramps will provide easy access to the existing highway for the benefit of local traffic. Existing divided four-lane expressways north and south of town will connect to this freeway.

Through the City of Arroyo Grande construction is presently in initial stages on a 1.3-mile four-lane divided freeway realigning US 101 westerly from the existing four-lane undivided highway extending from the south city limits of Arroyo Grande to about one-third mile south of Brisco Road just north of the city.

Main local traffic will be carried over the freeway by means of bridges at Grand Avenue and Valley Road.

During construction, traffic will continue to use the existing highway until the new freeway southbound lanes are completed at which time southbound traffic will be immediately routed onto these new lanes thus relieving some traffic congestion in the city prior to completion of the freeway.

Same Alignment Followed

Although not actually considered a freeway project, the present reconstruction in San Luis Obispo County of 3.1 miles of four-lane undivided highway on US 101 over the Cuesta Grade is of considerable importance from both an engineering and traffic point of view.

This project begins and is contiguous to a four-lane expressway completed in 1948 at Camp Fremont. The project ends at Cuesta Overhead which joins a four-lane expressway completed in 1949, and follows essentially the same alignment as the original roadbed which was constructed in 1937-38.

Adverse superelevation on many curves, extensive fill settlements, structural failure of the pavement and resulting high maintenance costs were the principal deficiencies which warranted the expenditure of approximately $550,000 on this project, for additional base reinforcement and a new surface.

UPPER—Completion of this new expressway between Greenfield and King City on US 101 in Monterey County has eliminated the congestion caused in the past by heavy local agricultural truck traffic. LOWER—Another scene on the new expressway between Greenfield and King City. The roadway follows the Salinas River (right).

Approximately 40 horizontal drains were placed in existing cut banks by Headquarters Materials and Research Department between 1952 and 1957. Such work was performed to relieve hydrostatic pressure which was responsible for much of the fill settlements and slide problems which had developed on this road. As the new roadbed is at an elevation greater than the outlet of these drains, it was necessary to collect the waters from these drains in a system of pipes, leading to and discharging into the natural drainage channels. In addition, approximately 6,000 feet of perforated metal pipe underdrains are being installed to prevent saturation of the roadbed in wet, unstable areas.

No Detour Available

It was necessary to carry the heavy traffic on this important road through the construction, since no detour was available. To accomplish this it was necessary to restrict the contractor's operation to half of the four-lane width, carrying traffic on the opposing two lanes and then switching traffic over to the completed two-lane portion while the other half was constructed. Minor traffic delays are inevitable on a long steep grade of the nature under these conditions due to the many slow-moving, heavy vehicles but every effort to shorten the time of inconvenience was made by pushing the construction operations in every way possible. Good progress has been made and the work has just been completed this month in accordance with the contract time allotments on the project.

Farther south in Santa Barbara County, construction of a new six-mile divided four-lane project bypassing the Town of Los Alamos south of Santa Maria has also just been completed.

This new expressway, passing through grain and flower seed farms, rolling hills and grazing lands, bypasses this community, a former stop on the old, now abandoned, narrow gauge Pacific Coast Railroad. The community presently serves the farms and cattle ranches throughout the surrounding area.

The south terminus of this project joins a five-mile length of expressway completed in April, 1955, and the north end of the project is contiguous to a nine-mile section of divided four-lane expressway leading to the outskirts of Santa Maria which was completed in 1956.

Further evidence of the development of divided four-lane highway on US 101 in Santa Barbara County can now be seen north of Buellton where full construction operations are under way to develop the existing two-lane highway from one mile north of Buellton to the old Pacific Coast Railroad station of Zaca near the turnoff to the San Marcos Pass on State Sign Route 150. This five-mile four-lane divided highway project is being presently graded and will be paved with portland cement concrete and plant-mixed surfacing. Work on this $940,000 project should be completed by March, 1959, providing divided four-lane highways through this central Santa Barbara County area from the southern outskirts of Santa Maria to Buellton.

Spectacular View

Passing southwest through the historic Gaviota Pass, the traveler is offered a spectacular combination of views of the Pacific Ocean, the Santa Barbara Channel Islands to the west, and the steep sandstone mountains to the east.

Construction was completed in January of this year on 2.3 miles of divided four-lane expressway along this scenic coast between Refugio Canyon and Refugio Beach Park and the railroad station point of Tajiguas some 20 miles west of Santa Barbara.

The easterly terminus of this project near Refugio Beach connects to an existing four-lane highway with a narrow median. This highway was constructed in 1942 and plans are being prepared to bring this section up to modern standards as soon as available funds permit. The westerly terminus of this newly constructed project joins a modern four-lane expressway which was completed in 1957. It leads to Gaviota Pass.

Popular With Tourists

Closer to Santa Barbara, a 9½-mile divided four-lane expressway project is now rapidly approaching completion between the station points of Elwood and Orella. This project begins about 10 miles west of Santa Barbara at what is locally referred to as the Elwood Wye and extends west between the Pacific Ocean and the foothills of the coast range. Completion of this project will provide a continuous four-lane divided highway from Elwood to the Santa Ynez River bridge at Buellton, a distance of approximately 34 miles.

This project follows the general alignment of the previous two-lane highway through this scenic coastal area. This area is also quite popular for recreation-seeking tourists as the El Capitan State Park and Refugio Beach County Park lie adjacent to the highway.

The project consists of constructing two new lanes for northbound traffic, as well as structural repairs to portions of the existing pavement, with two new lanes being constructed in the El Capitan area for southbound traffic. Three grade separations and five grade crossings have been completed, with the work being done to expressway standards. The largest separation structure is a 230-foot T-beam bridge across Dos Pueblos Creek. Local traffic moves beneath the highway at this point. There is also a 28-foot slab bridge at Las Llagas Canyon and twin T-beam bridges at El Capitan Canyon.

The terrain through which this expressway passes is quite rough, with a number of canyons or arroyos extending across the alignment. Seven arch culverts ranging in size from 9 to 17 feet in radius, as well as two large box culverts and a bridge were installed in the various canyons to handle the extensive cross drainage problems. The grading involved 1,750,000 cubic yards of roadway excavation, and 22,000,000 station yards of overhaul. Cuts ranged to 70 feet in depth and fills were up to 60 feet high.

Completion of this $3,144,000 project is expected in mid-October of this year.

Three-lane Highway Eliminated

Another vital link was added to the ever-expanding chain of divided four-lane highways with completion in November, 1957, of the freeway at the

Traffic was routed along the completed two-lane section during reconstruction of US 101 on the Cuesta Grade in San Luis Obispo County. The winding road on the slopes to the left is the pre-1937 highway.

west city limits of Santa Barbara on US 101.

Completion of this project eliminates approximately three miles of outmoded three- and two-lane highway which could no longer meet the demands required for traffic safety of increased vehicular volume. These deficiencies became extreme, partially as a result of greatly accelerated growth of the City of Santa Barbara itself.

Favorable weather during the fall and winter of 1956 and 1957 permitted excellent progress on the required work with a minimum inconvenience to the traveling public. A total of seven major structures represented a good portion of the project.

A pedestrian overpass, a precast reinforced concrete structure, was constructed at Junipero Street near the easterly end of the project primarily for the use of school children crossing the railroad and freeway at this point.

Large Interchange

The Las Positas overcrossing and the Las Positas overhead are two adjoining structures of reinforced concrete. They provide access to and from several residential sections extending over both the railroad and freeway lanes. The large State Street-Route 80 and Route 2 interchange structure was also of reinforced concrete while the structures at La Cumbre Road were reinforced decks on steel girders.

It is interesting to note that the State Street overcrossing has eliminated the first traffic-actuated signal in Santa Barbara County. This intersection, known locally as the Hollister Wye, was constructed in May, 1947. This new separation structure provides safe crossing over the freeway for Hollister Avenue-State Street traffic to and from the town of Goleta and the Santa Barbara Municipal Airport, and the newly constructed scenic campus of the University of California at Santa Barbara.

Close co-operation of the Southern Pacific Railroad was essential in the construction of all these structures and the railroad co-ordinated the movement of rail traffic through the construction area and co-operated in

This newly constructed county road between San Luis Obispo and Baywood Park on the coast serves the commuting traffic between these two communities as well as the farms and ranches along the route. Although the highway visible in the picture is absolutely straight, it curves in the distance and heads through the hills to the left.

This expressway under construction south of Santa Barbara is another link in the chain of improved sections on US 101. In this photo, the new lanes have been completed and are being used by traffic while the old roadway to the left is being reconstructed to expressway standards.

eliminating delay to railroad traffic and freeway construction progress.

Central Switchboard Used

The railroad company provided a central signal and communication control point. A central switchboard was provided at Los Positas Overhead and telephones were placed at the bridge construction sites. Warning lights were circuited into the central switchboard so that the telegraph operator could be warned of the approach of rail traffic several miles in advance. With this warning, construction crews could be properly alerted so that they could be clear of the tracks during the rail traffic movement. In an emergency, the telegraph operator could engage appropriate switches in the central switchboard which would turn outlying signal blocks "red," thus, stopping trains before they could enter the construction zone.

Total construction cost of this important freeway link amounted to $2,567,000, exclusive of landscaping and erosion control which is being completed this winter at an estimated cost of $116,000, thus beautifying the freeway entrance into this scenic city.

This discussion of the four-lane divided highway projects under way or completed may create the impression that the job of constructing divided four-lane highway on US 101 throughout the district is virtually completed. Actually, there is much to be done yet in achieving this worthwhile objective. Design plans are in various stages of development projected over a period of years to achieve this goal with several projects ready for construction as soon as funds become available.

Cuyama Road Relocated

Many other large and important projects have been under construction this year off US 101 on important lateral state highways. Probably one of the most exacting of these lateral construction projects is the complete relocation of eight miles of a two-lane narrow, twisting, substandard portion of State Sign Route 166 following along the Cuyama River and referred to locally as the Cuyama Road. This facility connects US 101 north of Santa Maria with the San Joaquin Valley in the vicinity of Maricopa. The new alignment roughly parallels the Cuyama River through the Santa Lucia Mountain Range in the Los Padres National Forest.

The reason for this relocation at this time was the construction of Twitchell Dam by the Bureau of Reclamation on the Cuyama River near its confluence with the Santa Maria River. The reservoir created by this dam will subject five miles of the existing crooked highway to intermittent inundation and thus requires complete relocation. The additional three miles of the job is being constructed as a part of the project to improve the substandard alignment of the present facility.

The new facility will have a 28-foot width roadbed in excavation and 34-foot width on embankment. The highway is designed for speeds of 50 miles per hour with maximum grades of 6 percent and minimum radius of curves of 850 feet. Anyone who has traveled on this road at any time will realize instantly what an immense improvement this will be over the existing alignment.

Welded Bridges Built

Construction involves an estimated 1,500,000 cubic yards of roadway excavation, over 34 million station yards of overhaul and 265,000 cubic yards of ditch and channel excavation in four major channel changes for the Cuyama River and Alamo Creek.

The new alignment crosses the Huasna River, Alamo Creek, and Cuyama River via composite welded bridges on reinforced concrete piers and abutments supported by steel piles and steel footings. The largest structure, the Huasna River bridge, consists of nine spans of a total length of 1,570 feet to be constructed on an 1,100-foot radius. Piers range in height from 60 to 136 feet. For this reason, the contractor has elected to use the slip-form method to construct the piers on the Huasna River and Alamo Creek bridges. Each pier will be poured continuously at a rate of one foot per hour. The pier forms are raised by means of a hydraulic jack which are supported by rods that are embedded in the pier. Under present plans, this project will be completed in the fall of 1959.

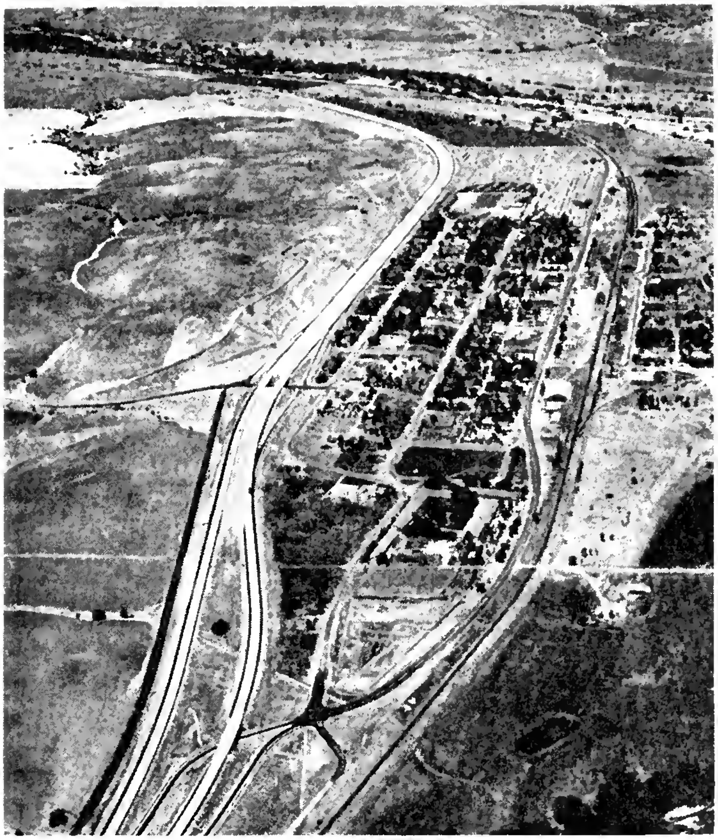
Construction of 3.1 miles of expressway on Sign Route 1 between Pennington Creek just west of Camp San Luis Obispo and the eastern edge of Morro Bay is now in the initial stages. When completed, the project will provide the initial two lanes of a future four-lane expressway to a point 0.2 mile west of the rural Banning School and a four-lane expressway from that point to the easterly edge of Morro Bay, where the project will be in transition to two lanes just east of Bay Street in that community. The new highway will be on improved alignment in the same general location on the existing route, but several dangerous curves will be eliminated and a wider traveled way will be provided. At several locations the existing highway will be available to motorists passing through the area until completed portions of the new project are opened.

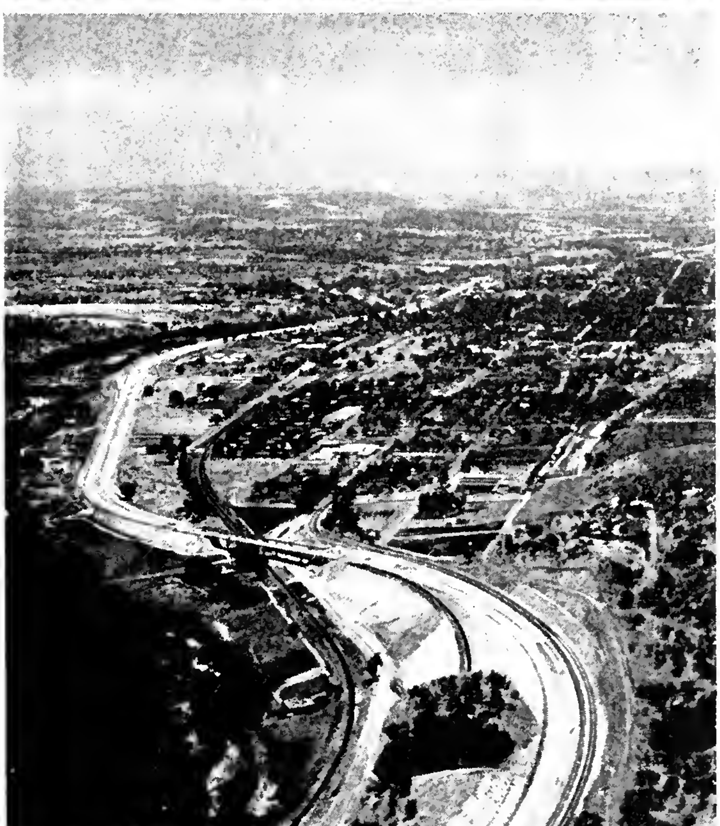
Safe Entrance Provided

At the intersection of State Sign Route 1 and the Baywood Park Road, a four-lane bridge will be constructed over Baywood Park Road, thus providing safe, easy entrance and exit from this road onto State Sign Route 1.

Construction of this project, which will cost approximately $1,165,000, will be completed in early 1959. This project is the first step in developing the substandard coast highway from San Luis Obispo to Morro Bay and from Morro Bay to San Simeon where the fabulous and unique Hearst Castle, now a state historical monument, is located. This monument was opened to the public early in June of this year, and traffic to and from the castle has increased beyond expectations.

Clearing and grading for the relocation of Sign Route 166 along the Cuyama River can be seen as a lighter line following the general location of the present highway in this aerial photo





UPPER LEFT Looking north on the freeway bypass of San Miguel. Mission San Miguel is the L-shaped group of buildings in the center foreground. UPPER RIGHT—The Los Alamos Bypass in Santa Barbara County, looking south. The project connects with previously completed expressways north and south of the town. LOWER LEFT A view southward of the Paso Robles Bypass The twin bridges in the foreground cross the old highway and the Southern Pacific railroad tracks. LOWER RIGHT Clearing and grading for the freeway project through Arroyo Grande can be seen left center. Present US 101 goes through portions of the business district to the right

Relocation of Sign Route 166 because of the construction of Twitchell Dam and eventual flooding of the present highway by the reservoir has required several large cuts and fills through rugged mountain terrain

Further development of this section of the coast highway will continue as soon as funds can be made available.

In addition to the state highway projects we have discussed, the cities and counties in District V who use a portion of our state gas taxes have been engaged in important and highly useful highway projects which should not be overlooked.

Modern Rural Highway

One good illustration is the federal-aid secondary project on the county road in San Luis Obispo known as Los Osos Road. This county road, now a modern rural highway used by local residents and out-of-town visitors taking advantage of the county's nearby recreation areas, was completed in May of this year.

The project, 8.3 miles in length and costing $356,577, begins at US 101 and extends westerly via French Road and Los Osos Road to the easterly edge of the community of Baywood Park. Work consisted of light grading within the existing right-of-way standard surfacing work, the construction of two multiple reinforced concrete boxes and widening one existing bridge.

In Santa Barbara County work is now well under way on the Santa Rosa County road improvement project using federal, state and county matching funds. Division of Highway employees are supervising construction work. This 6.5-mile construction project, costing an estimated $438,500, will improve the alignment, roadbed and service of this highway connection between the City of Lompoc and the community of Buellton on US 101.

Matching Funds Used

In Monterey County construction was completed in May on the important 2.8-mile Reservation County Road and Davis Road improvement project. This project, involving the expenditure of $197,691 of federal, state and county matching funds, improved the alignment, roadbed and surfacing of an important access road to the U. S. Army permanent facility at Fort Ord as well as providing a modern county road for use of local civilian population.

Federal, state and county matching funds were also used to good advantage to grade a new route called Panoche Road between the small community of Paicines on State Sign Route 25 and the Cottonwood County Road junction in San Benito County. This area, largely devoted to cattle ranching, is also near oil exploration sites and will be put to very good use by local people in this sparsely populated county. This $82,000 project was begun in October of 1957 and was completed late in May this year as operations were halted for some time due to the heavy rains of last winter. However, through the excellent cooperation of county employees, the roadbed was well enough maintained to prevent damage to the roadbed by the rains and resultant runoff.

Many other projects, large and small, in the counties and cities that make up our district have been brought

. . . Continued on page 64

Stanislaus County

First Major Project Completed In $12,000,000 Bond Program

By ELLIS R. DELBON, County Road Commissioner

MITCHELL ROAD, River Road, Snowden Avenue, El Vista Avenue, and Old Oakdale Road, totaling 11.5 miles, are now consolidated into one modern federal-aid secondary two-lane highway serving the East Modesto area from Riverbank to Ceres with direct access to the Modesto City-County Airport and the East Modesto industrial area.

This modern highway was originally proposed by the Stanislaus County Road Department in 1953 and recommended on the basis of known traffic desires in the East Modesto-Ceres area. Subsequent public hearings were conducted and the route established by the board of supervisors as the East Modesto Road from US 99 Highway at Mitchell Road northerly to State Route 13. In 1955, at county request, the U. S. Bureau of Public Roads approved this proposed highway as Federal-aid Secondary Route 1226.

All three contracts for construction of this route were awarded by the State Department of Public Works and construction was supervised by state and county personnel under county-state agreement and financed with federal, state and county funds.

To provide for ultimate four-lane improvement, 90-foot rights of ways were negotiated for by the road department at a cost of $140,000 for property taken and severance damages.

The first and northerly section of new construction begins at the south end of Old Oakdale Road and includes a reinforced concrete girder bridge

An aerial view of East Modesto Road looking south from the Stanislaus River. The highway will eventually connect with US 99 southeast of the City of Ceres.

A view of East Modesto Road (FAS Route 1226) looking in the opposite direction of the photo on the previous page showing the bridge across the Stanislaus River and the City of Modesto in the distance

over Dry Creek 206 feet in length with two five-foot sidewalks and 28-foot roadway consisting of three spans supported on reinforced concrete piers, and abutments on concrete pile foundations. Included in the same contract was one-half mile of two-lane roadway involving construction of graded roadbed with 45,000 tons of borrow, untreated rock base and plant-mixed surfacing.

The official opening of this section on October 26, 1956, created a facility which has proven its importance by the periodic traffic studies conducted by this department. Prior to opening this section, the best available traffic information indicated a possible 2,500 vehicles per day volume by the end of the first year and 4,000 vehicles per day in five years. The actual average volume during the first eight days exceeded 2,500 vehicles per day and one year later the average count over a period of four days was 4,900 vehicles per day.

The second section consists of two miles of two-lane highway construction from Snowden Avenue to Hatch Road and a reinforced concrete box girder bridge over Tuolumne River 656 feet long with a 28-foot roadway clearance between curbs.

This project was completed on September 13, 1957, two months ahead of schedule by Contractors M. J. Ruddy and Son, and Dan Caputo with Bob Wright of the State Bridge Department as resident engineer.

The importance of this section was predetermined by known traffic desires in the area since it would be a direct route from Ceres and the vast agricultural area east of US 99 Highway to the Modesto City-County Airport and the East Modesto industrial area.

The third and final section completed in July consists of constructing two miles of two-lane highway over the existing Mitchell Road, from Hatch Road south to US 99 Highway, by grading, paving and reconstructing several existing inverted siphons which serve to irrigate the adjacent agricultural lands.

This 4.7 miles of modern highway from Service Road to Scenic Drive was completed at an approximate total cost of $860,000 and is the closing link of the first major cross-county highway improvement to be completed in a planned 10-year program of major county highway improvements which includes construction of 11 major bridges and about 65 miles of federal-aid secondary highway improvements at an estimated cost of $12,000,000.

Cost Index

Construction Costs Continue Downward Trend During Second Quarter of 1958

By J. P. MURPHY, Assistant State Highway Engineer
H. C. McCARTY, Office Engineer
LLOYD B. REYNOLDS, Assistant Office Engineer

THE California Highway Construction Cost Index for the second quarter of 1958 continued the downward course and at about the same rate established during the previous quarter. The index now stands at 231.0 (1940 = 100), which is 10.8 index points or 4.5 percent below the first quarter. It is the lowest point reached during the last two years and it is 35.9 points or 13.5 percent below the same quarter in 1957.

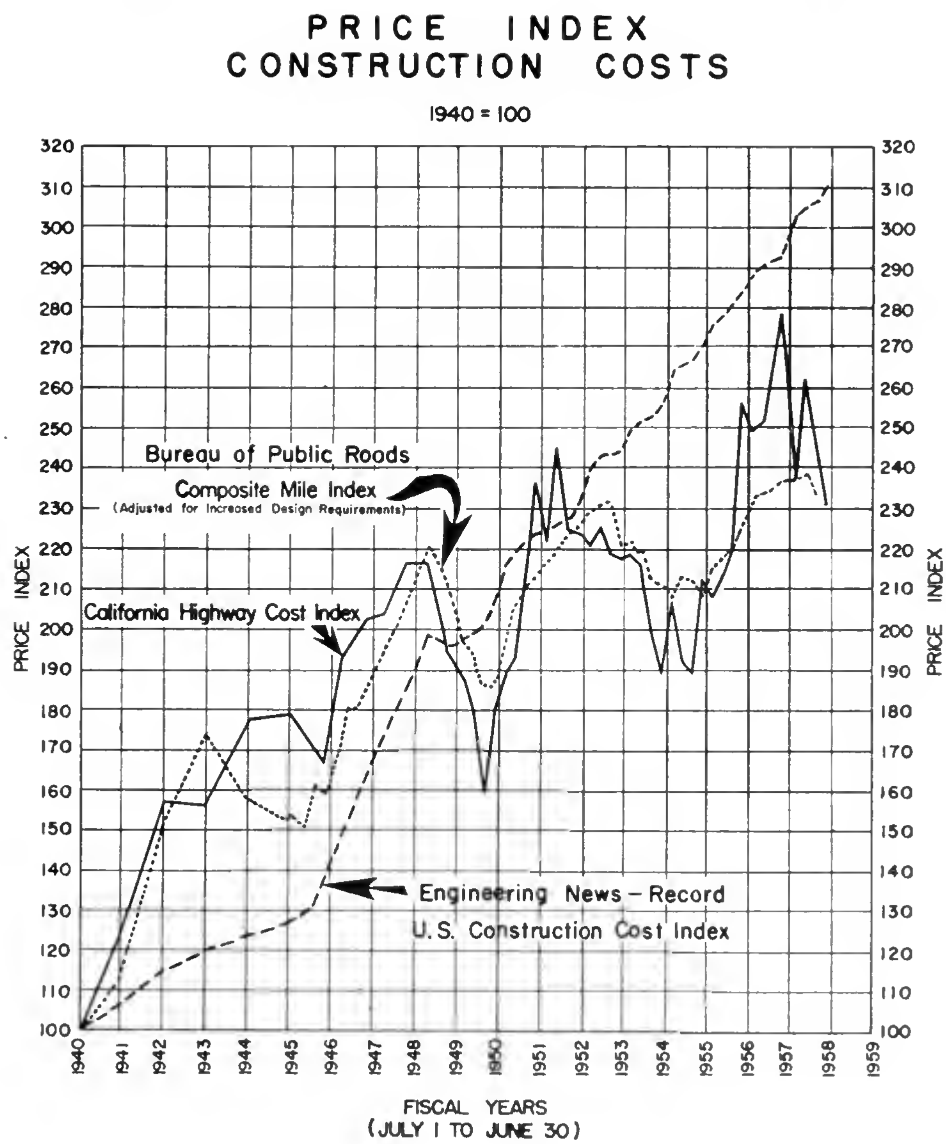
Past experience has shown that low bid prices generally result when there is a high average in the number of bids received. However, during the second quarter of 1958 bid prices were below the level of the previous period, while at the same time a sharp decrease occurred in the average number of bidders per project in comparison with the first quarter. The average number of bidders per project dropped to 5.4 in the second quarter after an average of 9.3 was established in the first quarter. It is generally considered that an average above five is in the realm of good competition.

The average was maintained above this level in the second quarter by the bidder interest shown on the many important and high value projects placed under contract during this period. Previous recent averages are: 5.5 for the second quarter of 1957; 6.6 for the first six months of 1958; and 6.9 for the 1957-58 Fiscal Year beginning July 1, 1957. Tabulations showing the average number of bidders arranged according to project value brackets for the semiannual and annual periods are included with this release.

The 197 representative statewide projects for which bids were opened during this quarter and which provide the data for preparation of this quarter's index are distributed as follows:

Range	*Number of projects*	*Value of projects*
Under $50,000	89–45.2%	$2,150,722– 3.3%
$50,000 to $100,000	37–18.8%	2,766,490– 4.2%
100,000 to 250,000	38–19.3%	5,476,456– 8.4%
250,000 to 500,000	12– 6.1%	4,081,675– 6.3%
500,000 to 1,000,000	6– 3.0%	4,142,995– 6.4%
1,000,000 to 2,500,000	8– 4.1%	11,184,319–17.1%
2,500,000 to 5,000,000	4– 2.0%	12,591,589–19.3%
Over $5,000,000	3– 1.5%	22,804,419–35.0%

. . . *Continued on page 60*



Citizen C

CHESTER H. WARLOW, FRESNO
Retired Banker and Attarney

JAMES A. GUTHRIE, SAN BERNARDINO
Newspaper Publisher

The members of the California Highway Commission are pictured at work at one of their monthly meetings.

The California Highway Commission was established by the State Legislature as a citizen group representing all Californians in guiding the State's highway program.

The State Legislature determined that the best way to keep California's expanding highway program close to the people and responsive to their wishes was to delegate the responsibility and authority for highway routing and budgeting to a commission—the California Highway Commission.

The Legislature establishes terminal points for state

JOHN O. BRONSON, SACRAMENTO
Insurance Braker

FRED W. SPEERS, ESCONDIDO
Newspaper Publisher

...mmissioners

California Highway Commission Guides State's Highway Program

CHAIRMAN C. M. GILLISS
Director of Public Works

highways and delegates the determination of the exact routing to the commission. The Legislature sets up rules governing the general apportionment of highway user tax funds and delegates the detailed budgeting to the commission.

The Legislature created a commission of a chairman and six citizen-members, representative Californians who take time from their own businesses to contribute their conscientious counsel to the state highway program. The law arranged the commissioners' terms to provide continuity of membership and policy through changes in state administration.

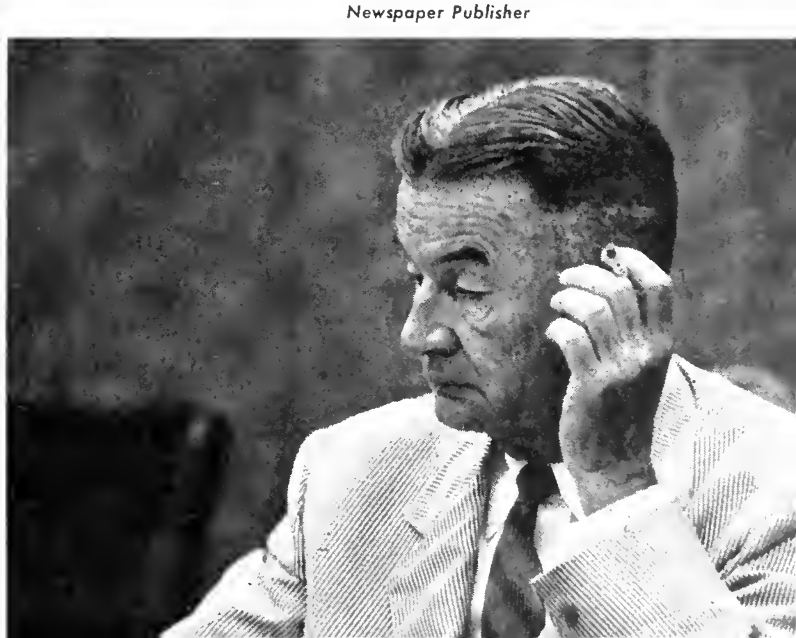
The Legislature made the Director of Public Works chairman of the commission to provide working liaison between the policymaking commissioners and the operating Department of Public Works.

The commission established procedures providing for its consideration and study of the views of interested citizens, the suggestions of local governmental agencies, and the recommendations of state highway engineers before it approves route adoptions and financial allocations.

The commission reviews these procedures continually in order that it may always keep in close touch with the people of California.

ROBERT L. BISHOP, SANTA ROSA
Automobile Dealer

ROBERT E. McCLURE, SANTA MONICA
Newspaper Publisher



Visiting Japanese Officials Discuss Highways, Right-of-way Acquisition With State Engineers

E. M. MacDonald, Assistant Chief Right-of-way Agent for the Division of Highways, explains land acquisition procedure to Japanese officials here on a tour under the auspices of the United States International Co-operation Administration

An 11-man team of Japanese Government officials was in Sacramento during the week of July 14th to 18th as part of a two-month highway study tour of the United States.

The delegation conferred with officials of the State Division of Highways on California's highway financing and right-of-way acquisition procedures.

The tour, which was under the auspices of the United States International Co-operation Administration, also included conferences with highway and transportation officials in Chicago, Detroit, Harrisburg, New York and Washington, D. C.

The group visited the Institute of Transportation and Traffic Engineering, University of California, and toured highways and bridges in the San Francisco area before arriving in Sacramento.

The visiting delegation was headed by Michizo Kishi, president of the Japan Public Highway Corporation, and Taro Ozawa, governor, Yamaguchi Prefectural Government. Others in the party were:

Tatsuo Futamura, submanager of the foreign department of the Industrial Bank of Japan; Hiroyasu Kunitomo, chief of the transportation division of the Highway Transportation Bureau, Ministry of Transportation; Moichi Miyazaki, planning officer of the Japanese Economic Planning Board; Tatsuo Nakagome, assistant controller of the Ministry of Finance; Tetsuya Nambu, chief of the accounting section of the Construction Ministry; Mitsuma Ohgushi, chief of the local road section of the Construction Ministry road bureau; Ryoichiro Tsurumi, chief of the general affairs section of the Construction Ministry road bureau; Fujio Yoshida, assistant chief of the taxation section of the Ministry of Finance taxation bureau; and Junichi Miyauchi, chief of the managing department of the Japan Public Highway Corporation.

Accompanying the visitors was Gerald J. Lally, project manager for the U. S. International Co-operation Administration.

AASHO Agenda for S. F. Meet Announced

Detailed agenda for 35 meetings of operating committees, an opening and closing general session, a field inspection trip and other events of the 44th annual meeting of the American Association of State Highway Officials, to be held in San Francisco December 1st through 5th, are nearly completed and ready for the printer at AASHO headquarters in Washington, D. C.

The complete programs, including names of speakers, specific topics for discussion and lists of technical and other papers will not be available until shortly before the opening of the meeting.

There will be a few presession meetings of some committees, including the executive committee, but the official opening will take place at 9 a.m. in the Sheraton-Palace Hotel, the headquarters location, under the chairmanship of President C. R. McMillan, Chief Highway Commissioner of South Carolina.

The opening general session, which will include addresses by members of Congress and other Federal Government representatives, will last throughout Monday.

Committee sessions will begin on Tuesday, with all day devoted to them, as will also be the case on Thursday.

Wednesday, December 3d, will be given over to a guided field inspection trip of San Francisco Bay area highways and bridges, including the Carquinez Toll project. Delegates will return in time to attend the family dinner which is a traditional AASHO meeting function.

The final sessions of operating committees will be held on Friday morning, December 5th, to be followed by the concluding general session that afternoon. This session will include reports of all committees, consideration of resolutions, election and induction of new officers and other association business.

Twenty operating committees, most of which will hold two sessions during the meeting, are as follows:

. . . Continued on page 63

Report From District VI

By W. L. WELCH, District Engineer

District VI, located in the southern half of the San Joaquin Valley, includes the Counties of Madera, Fresno, Kings, Tulare and most of Kern. It is bounded by the Coast Range on the west, the Sierra Nevada on the east, and extends from the Los Angeles county line to the Merced county line in a north-south direction. The population of these counties has increased from 479,000 in 1940 to 844,000 in 1957. This population growth has been accompanied by a vehicular registration increase from 179,000 in 1940 to 283,000, an increase of about 60 percent.

Included in this area are many miles of the world's richest farming areas, as well as a number of recreational areas (Bass Lake, Shaver Lake, Huntington Lake, Yosemite National Park, Sequoia National Park and Kings Canyon National Park, to mention only a few), which are fed by the 1,597 miles of state highways in the district. Annual travel on this network is in excess of 2,000,000,000 vehicle-miles and covers extremes from desert areas to the mountainous regions at elevations of 7,000 to 8,000 feet. Fresno, the district headquarters, is the geographical center of the State, 180 miles from San Francisco and 220 miles from Los Angeles.

Following are some highlights of current and recent construction throughout District VI.

US 99

US 99, the most heavily traveled north-south highway in the West, extends from Mexico to Canada and splits District VI almost in the center longitudinally for a distance of 180 miles. This highway is being rapidly developed to full freeway status.

A full freeway in California is a highway having no railroad crossings or highway crossings at grade, separated lanes for each direction of travel, no access to abutting properties, and no left turns.

This is to differentiate a full freeway from an expressway which, in this State, usually means a divided highway with restricted access to abutting properties and having some street or road crossings at grade.

Grapevine Grade

Just north of the Los Angeles county line there is presently under construction the largest highway contract let to date in District VI. This project involves the construction of four additional traffic lanes through Grapevine Canyon and reconstruction of portions of the existing four lanes to provide an ultimate eight-lane freeway between Ft. Tejon and two miles north of

(PHOTOS AT TOP OF PAGE) *LEFT—An aerial of the Madera Bypass looking northward. The old three-lane section of US 99 through the city is located to the right of the new freeway. RIGHT—The Visalia Airport Interchange on US 99 looking to the south with the Visalia Airport in the foreground.*

UPPER—The new separation structure carries traffic over Garces Circle in Bakersfield. This view is to the south along Chester Avenue with US 99 crossing the freeway from left to right. LOWER—A view eastward over the City of Fresno. Tuolumne and Stanislaus Streets cross the Southern Pacific Railroad in the center and the US 99 freeway in the foreground.

A view northward taken from the south end of the Chowchilla Bypass. The separation structure in the foreground connects US 99 and State Route 152. Beyond, the southbound lane crosses the railroad tracks on an overhead while the northbound lanes use an underpass.

Grapevine Station at the foot of the grade. This contract was awarded to Guy F. Atkinson Company on April 17, 1958. It is seven miles in length, is expected to cost in excess of $7,000,000 and should be completed in the summer of 1960. A more detailed description of this project appeared in the July-August issue of this magazine.

The original separation structure under the main line of the Santa Fe Railroad in Bakersfield was built by the railway company and the City of Bakersfield in 1926. It provided a 20-foot roadway and two five-foot sidewalks. Subsequently after determination of the state highway route through the city, the structure was widened in 1935 to provide four lanes of traffic under the two main line tracks. Later reconstruction of Union Avenue to a six-lane divided thoroughfare and proportionate increase in traffic resulted in the structure once more becoming a bottleneck, and plans were made to again widen it to provide capacity equal to that of the street section on either side. The steel plate girders in the existing structure were used in the widened structure. Traffic was routed over adjacent city streets and a double track railroad shoofly constructed on earth embankment in the underpass approach. This material was removed and disposed of after completion of the railroad structure. Traffic was rerouted through the new structure in June of 1957. Cost of the project was $450,000.

Garces Circle

A four-lane divided overpass structure was completed in 1957 over Garces Circle in the City of Bakersfield, thus relieving the congestion at one of the most heavily traveled intersections in the district. The structure is a welded plate girder bridge with reinforced concrete deck consisting of seven spans and a total length of 555 feet. The bridge has a width of 62 feet between outer curbs with a 6-foot median strip. There were six streets entering upon this traffic circle prior to the construction of the bridge, most important of which were the two legs of US 99, North Chester Avenue (which is State Highway 142) to Oildale, and Chester Avenue to the south, the main thoroughfare through Bakersfield. The average daily traffic through this intersection in 1957 was over 46,000 vehicles. A more detailed article on this project appeared in the March-April 1957 issue of this magazine.

Famoso and Delano

In June of this year the construction of a new overpass over the Southern Pacific Railroad at Famoso eliminated the last remaining section of undivided highway in Kern County, a short section where all traffic was carried under the railroad through a single structure. Also at Famoso a separation structure and ramps were built to provide an interchange for US 99 and US 466, thus eliminating another hazardous intersection.

From the southerly limits of Delano to the north end of Pixley, some 17 miles of full freeway have been completed in the past three years under three separate contracts with the Gordon Ball Company. The heavy US 99 traffic through Delano has been rerouted to a location three blocks westerly of its former location. Four grade separation structures carrying city streets over or under the freeway and two overhead structures over the Southern Pacific Railroad near the northerly limits of Delano were built in order to eliminate the traffic bottleneck through the city.

Earlimart and Pixley

Similarly, this section of freeway was rerouted one block easterly through the Towns of Earlimart and Pixley and the main cross streets in these towns separated from the highway traffic by depressing the freeway under the streets.

Tipton

One of the few remaining isolated traffic signals on US 99 in this district and a location of recurring accidents was eliminated in May of this year by the opening of an overhead structure at the main cross street in the Town of Tipton. As a result there are now no signals nor stop signs on US 99 between McFarland and Kingsburg, a distance of 63 miles.

This expressway on US 99 bypasses the business section of Tipton. The structure over the expressway at the center of the picture is the Sixth Street Overcrossing. The view is to the north.

Tulare

The first full freeway of any length through the district was the Tulare Bypass, an eight-mile section of freeway which removed the highway traffic from the business district of Tulare. This bypass was completed in 1954. It included seven road separation structures and one railroad underpass.

Visalia Airport Interchange

This complicated interchange of two major highways intersecting at a main line railroad and a major airport was completed in 1954. This project involved a new three-lane structure over the railroad for northbound and westbound traffic and three highway separation structures.

Goshen

The full freeway from the Visalia Airport Interchange was extended northerly to one mile north of Goshen in 1957 and involved separation structures in Goshen and over the Coalinga branch of the Southern Pacific Railroad.

Traver to Kings River

This 5.7-mile section of US 99 was developed to freeway standards in 1957 and included separation structures for county roads at Traver and Dodge Avenue and an additional bridge over the Kings River.

Fresno Freeway

This 5.9 miles of full freeway was opened to traffic in October of 1957 after 11 years of engineering studies and construction. The work was done under five separate contracts at a total cost of $11,000,000, including rights-of-way. The freeway has 23 bridges, seven pumping plants, two storm water retention basins and three storm water drainage fields.

Motorists traveling Route 99 are able to travel this six-mile section of full freeway in less than half the time pre-

UPPER—Overcrossings carry local traffic over the new US 99 freeway bypass of Delano. LOWER—The business section of Earlimart is bypassed by the freeway on US 99. The old highway follows the railroad to the left. The view is northward.

Sign Route 168 crosses Rancheria Creek at Huntington Lake in Fresno County. The China Peak ski area is in the upper left corner of the photo.

viously required, avoiding 16 traffic signals. A complete resume of this project appeared in the November-December, 1957, issue of this publication.

Madera Freeway

A full freeway bypassing the business district of Madera is presently under construction and expected to be completed this fall. The contractor on this section of freeway is Fredericksen and Kasler. The project is expected to cost about $3,000,000.

This project is four miles in length and involves the construction of eight highway separation structures, one railroad separation structure and two bridges over the Fresno River, and will eliminate the last remaining section of two-lane highway in this district. This short section of two-lane road just north of Madera has become a serious bottleneck, particularly during the peak travel periods on three-day holiday weekends.

Chowchilla Freeway

At the northerly end of US 99 in District VI, seven miles of freeway from Califa (the junction of US 99 and State Route 152—Pacheco Pass Road) to one-half mile south of the Merced county line have recently been constructed. Work on this project, which bypasses the City of Chowchilla, was completed in July, 1957, at a cost of $2,300,000. Fredericksen and Kasler were also the contractors on this project. A detailed report on the Chowchilla Freeway appeared in the March-April, 1957, issue of this magazine.

Proposed Projects

A project to eliminate the only remaining undivided section of US 99 in the district, a three-lane section just north of Fresno, is scheduled for construction the latter part of this year. Also, plans are going forward for the ultimate conversion of the entire length of US 99 to full freeway standards.

Sufficient width of right-of-way on all projects on US 99 has been or is being obtained, to provide for additional traffic lanes when needed. The one exception is the Grapevine grade where the eight lanes being constructed will be the ultimate development.

US 399

US 399 enters the district from San Luis Obispo County through Maricopa and Taft to a junction with US 99 at Greenfield, about seven miles south of Bakersfield.

Two lanes of an ultimate four-lane expressway, between the southerly limits of the City of Taft and Weed Creek, were completed in 1956. This work, 4.7 miles in length, was done under two contracts and eliminated a hazardous section of highway through Hill 36 by relocation around the hill on improved alignment and grade, at a cost of $440,000. A portion of this section adjacent to the City of Taft was constructed as a divided four-lane road initially to provide for better control of traffic at some of the busier intersections.

Route 140

Between Arvin and US 466, the White Wolf Grade, a 3.3-mile section of narrow, steep and winding road was reconstructed to modern two-lane highway in 1957 at a cost of $386,000. This road serves traffic from the southeasterly section of the valley destined for points east by way of Tehachapi, Mojave, etc.

US 466

This route enters Kern County from Paso Robles on the west, through Wasco to a junction with US 99 at Famoso. It is combined with US 99 to Bakersfield and then proceeds easterly through Edison and Tehachapi in District IX. From the easterly limits of Bakersfield this road was a heavily congested two-lane street with many roadside businesses on one side and the combined Santa Fe and Southern Pacific main line on the other. Because of the probability of a future relocation of the route on a freeway basis, it was decided to develop the present road to its ultimate capacity on the existing right-of-way, most of which was 80 feet. Kern County acquired additional right-of-way needed to provide a minimum of 80 feet on a portion of the project. Reconstruction to a four-lane undivided road with left-turn storage lanes at the principal crossroads was completed to the east at Legislative Route 143, the limit of extensive roadside development, in July of this year. The length of the project was 4.2 miles. It was built at a cost of approximately $400,000.

Route 142

North Chester Avenue in the community of Oildale, north of Bakersfield, was reconstructed to provide a six-lane divided thoroughfare between Beardsley Avenue and one-half mile north of China Grade Loop, a distance of 2.2 miles. This work was completed in 1955 at a cost of $300,000.

Sign Route 178

Sign Route 178 extends from US 101 at Santa Margarita in San Luis Obispo County to Freeman Junction on US 6 in Kern County by way of McKittrick, Bakersfield and the Kern River Canyon and is a portion of the route between Kingman, Arizona, and the Pacific Ocean known as the Cross Country Highway.

Prior to the completion of the Isabella Dam on the Kern River in 1954, approximately 15 miles of state highways had to be relocated to get above the future high waterline. These modern two-lane mountain roads were completed under several contracts in 1953 at a cost of $1,900,000, and were financed wholly by the Federal Government.

Looking north along Sign Route 178 toward Kernville from the west end of the main dam at Lake Isabella in Kern County

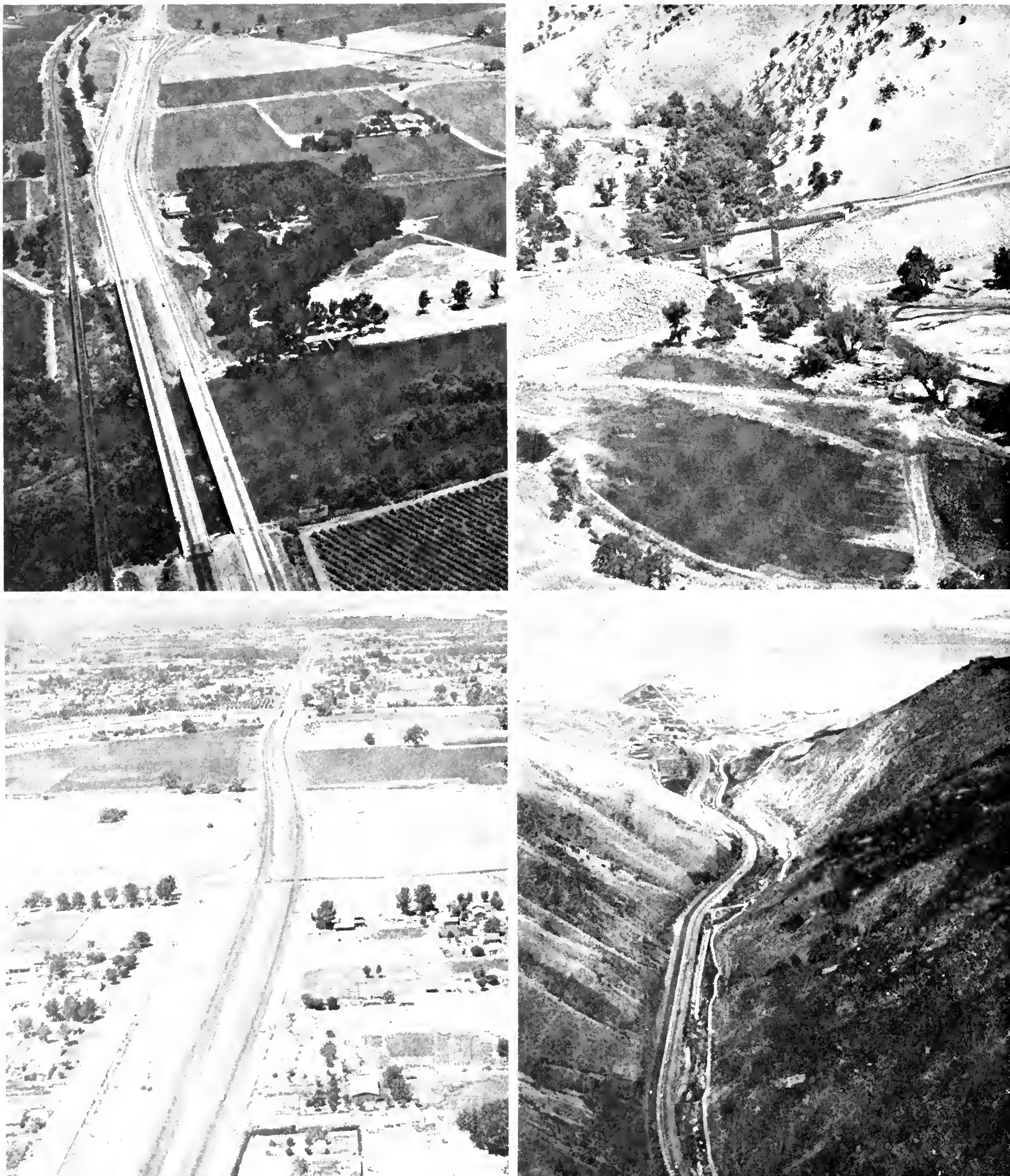
Sign Route 190

The construction of a dam to form the Success Reservoir on the Tule River east of Porterville necessitated the relocation of approximately seven miles of state highway. The proposed dam is being constructed by the U. S. Corps of Engineers as a flood control project. It will be an earth fill dam 3,500 feet in length at the crest, 140 feet maximum height, and will form a reservoir of approximately 2,400 acres. The highway relocation is presently under construction and will be completed this fall at a cost of $1,700,000, financed in entirety by the Federal Government.

An extension of this route to the west below the proposed dam is presently under construction to the vicinity of the Porterville State Hospital. Upon completion temporary routing will be over Grevilla Street to Porterville until such time as funds are available to continue the construction westerly to a junction with existing Route 190.

Sign Route 65

Sign Route 65 extends from US 99 north of Bakersfield to Sign Route 180 near Grant Grove in Kings Canyon



UPPER LEFT The US 99 crossing of the Kings River south of Kingsburg in Tulare County. UPPER RIGHT—Sign Route 190 will cross the South Fork of the Tule River in Tulare County over this bridge now under construction. Relocation of the highway is necessary because of the construction of Success Dam. LOWER LEFT A view of the Sign Route 65 bypass of Porterville taken from the south. LOWER RIGHT—A view of US 99 taken above the Grapevine Gorge looking north toward Bakersfield.

US 399 in Kern County has been relocated around Hill 36. Note the old highway leading directly across the hill (center). Ford City and Taft can be seen in the left background.

National Park. The section between Ducor and Woodlake along the east side of the San Joaquin Valley is locally known as the Orange Belt Highway because of the extensive citrus development in the area.

Some 16 miles of this route, between Deer Creek, just north of Terra Bella, and the City of Lindsay, have been designated as a freeway. Portions are being constructed to expressway standards. The section between Deer Creek and Linda Vista Avenue was completed in 1955, thus considerably relieving the congestion on Porterville's main business street. Portions of this section were constructed as a four-lane divided expressway initially, including a separation structure over Olive Avenue, an important FAS road adjacent to Porterville. The second section, between Linda Vista Avenue and Famoso Street in Lindsay, is presently under construction and is expected to be completed in March of 1959 at a cost of $800,000.

Route 135

Legislative Route 135 extends from Wasco on US 466 to a point just east of Hanford on Sign Route 198. It is a section of highway known as the Central Valley Highway, which is composed of sections of county highways and state highways between Bakersfield and Selma, serving communities along a route followed by the Santa Fe Railroad.

Two lanes of an ultimate four-lane expressway on the Central Valley Highway, between Corcoran and Sign Route 198, a distance of 20 miles, have been constructed under several contracts completed in 1957 at a cost of $838,000. This section of highway was built on new location to provide better alignment and eliminate two crossings of a main-line railroad. It was extended at the northerly end by Kings County by the construction on new alignment of four miles of FAS highway.

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US 66-91

Victorville-Barstow Freeway Replaces Miles of Winding Road

By E. J. WALKER, Resident Engineer, and
H. C. PRENTICE, District Construction Engineer

EARLY next year the traveling public will say goodby to 34 miles of obsolete and inadequate two-lane highway and begin using instead 29.3 miles of new four-lane divided freeway between Victorville and Barstow.

Until that time, 7,500 vehicles per day, including one-fifth of all the vehicles entering California, will continue to follow the US 66 and 91 signs over the present adaptation of the old wagontrail which generally follows the Mojave River. The average motorist is prone to feel that he is, for all practical purposes, traversing the original wagontrail, for the "adaptation" includes numerous curves, 17 of 1,000-foot radius or less. Thirty percent of the 34 miles is striped for "no passing," and dips impair the riding qualities to the extent of causing occasional carsickness.

Design Features

The embankment and structures of the southerly, or Victorville, one mile of the project were constructed under separate contract with Gordon Ball Company. The going contract includes cement treating and paving this portion, as well as complete construction of the remainder of the work.

This new construction is four-lane divided, with three inches of dense-graded plant-mix surfacing on six inches of Class "C" cement-treated base. One-half inch of open-graded plant-mix surfacing will provide delineation of the traffic lanes and provide an improved wearing surface to reduce maintenance costs.

Interchanges are provided at Victorville and at each crossing of the existing county highway known as Stoddard Wells Road. Alignment features long tangents with easy curves and grades. In the 29.3 miles, eleven curves, or one per 2.7 miles, average 22.5 degree central angle, with a total of three-fourths of a circle, as compared to a total of almost three complete circles for the old facility. Grades are generally not steeper than 2 percent, with 3 percent at a few locations.

A total of six bridge structures have been constructed: Stoddard Wells Road Overcrossing, 197 feet; Cement Company Undercrossing, 24 feet; Bell Mountain Wash Bridge, 224 feet; North Victorville Underpass, 208 feet; Wild Wash Bridge, 195 feet; and Lenwood Wash Bridge, 302 feet. The North Victorville Underpass, which provides a grade separation for the Mojave Northern Railroad, is an unusual structure for a separation of this nature. It is a 208-foot-long welded steel plate girder structure, consisting of two spans supported by a reinforced concrete pier and abutments.

Unusual Aspects

For several years, rumors of the project excited the interest of highway contractors for good reason. Seldom is there presented such an opportunity for freedom of action and high production. Some of the more attractive aspects were the virtual absence of utilities and almost negligible volume of public traffic to be handled, no haul over existing highways, and rather spectacular major quantities; for example, 3,420,000 cubic yards of roadway excavation, plus 1,285,000 tons of imported borrow, equal in

Use of FM Radio Saves Time and Lives

Building 29 miles of interstate expressway through the Mojave Desert on a completely new route presents a number of problems not ordinarily found on shorter stretches along established rights-of-way. One of the most serious of these problems is that of communications.

Obviously, these same problems are common to any long highway job. Literally hours can be spent carrying messages from one end to the other; equipment breaks down far from repair facilities; a dozen culvert jobs over as many miles must be watched; inspectors must be found when the contractor is ready to move on the next phase of a job.

Faced with these problems after the letting of the contract for the Victorville-to-Barstow 29-mile stretch of new alignment of US 66-91, District VIII of the Division of Highways considered a number of ways in which communications on such a long project might be improved.

The first idea was for a continuous courier service. At first glance this seemed a reasonable solution, but on further inspection it was realized such a method would not be much faster than special messengers, and would be very costly.

. . . Continued on page 57

Resident Engineer Edward Walker and Highway Field Office Assistant Doris Shealy at the FM transmitter-receiver unit in the construction field office at Victorville

A typical drainage facility along the new freeway is the Bell Mountain Wash Bridge, shown above

volume, roughly, to a square mile chunk three feet high; more than one-half million tons of imported base material, or 25,000 payloads of 20 tons or more; one-quarter of a million tons of PMS (plant-mix surfacing), or the equivalent of paving 12 feet wide, 1½ inches deep, and 400 miles long; and more than 8 miles of culvert pipe, including more than 16,600 feet of 48-inch CMP.

The submission of 13 bids reflected the unusual interest in the project by contractors. Fredericksen & Kasler of Sacramento was the low bidder, with a figure of $5,750,655.50. This success was achieved by such prices on major items as 32 cents per cubic yard for roadway excavation, 19 cents per ton for imported borrow, 60 cents per ton for graded imported base material, and $2.40 per ton for plant-mixed surface aggregate.

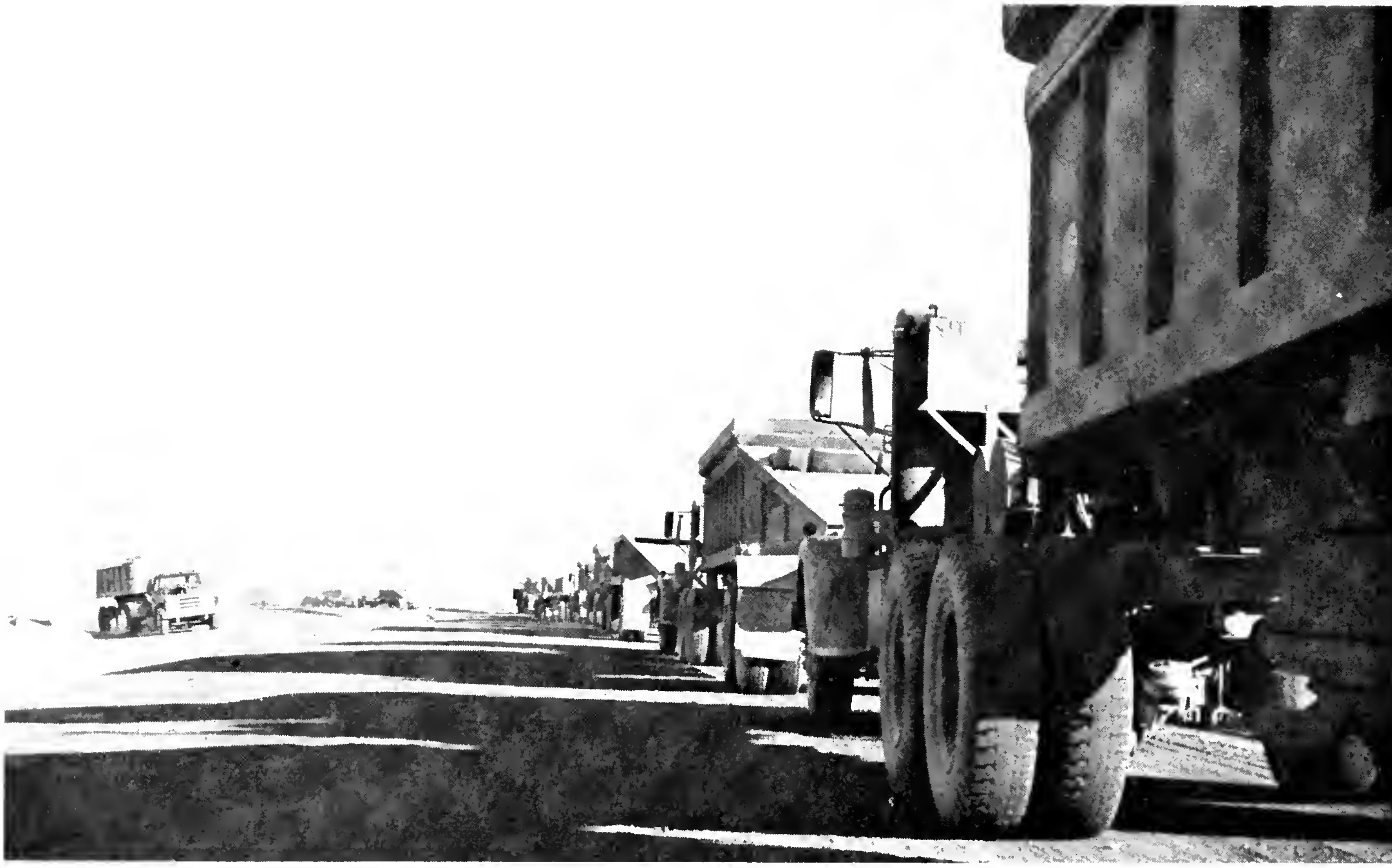
Production Rate High

Contractors in general, as well as engineers, have since watched with interest as the contractor continues to demonstrate how work can be economically performed at these unit prices.

From the very start, it became evident that he would take full advantage of the freedom to develop high rates of production afforded by the inherent nature of the project—rates such as 20,000 cubic yards per day of roadway excavation, 2,000 tons per hour of imported base material, and 4,000 tons per day of plant-mixed surface.

The contractor has handled the work with a staff headed by General Manager R. E. "Jeff" Kasler and assisted by Project Superintendent J. R. Beadles; Project Engineer R. Brown; earthwork, small structures, large structures, plant-mixed surface and plant superintendents; foremen as necessary; and as many as 170 operating engineers, teamsters, carpenters, and laborers. Radio has played an important part in handling the work. The contractor has a land station at his project office and has used as many as 15 mobile units.

The State is represented on the project by Resident Engineer E. J. Walker, who has used as many as three principal assistants and, at period of peak production, as many as 23 additional persons. In addition, three survey parties have been active on the project as an average, with as many as five as the maximum. The State, too, has used



UPPER—Trucks wait in line on the Victorville-Barstow job and then (LOWER) they are loaded at the Wild Wash base material plant radio to advantage, with a land station plus four mobile units.

During peak earthwork production periods, when as much as 23,000 cubic yards of earth were being handled per day, four engineers were employed in the field laboratory alone, processing an average of 28 compaction tests per day in addition to the other work, such as shrinkage determination tests, R-value test sampling, Class "A" concrete mix checkout, sand equivalent determination for structure backfill, as well as sampling and packaging various materials for shipment to district and headquarters laboratories.

Water Major Problem

Water for the project was available only at each end of the project. The contractor elected to drill a well near the Mojave River at Victorville and pump to earth reservoirs spaced through the job. Nearly 25 miles of eight-inch pipe were laid along one edge of the right-of-way from the Victorville end of the project toward Barstow. A 300-h.p. high-pressure electric pump draws from the 160-foot-deep well and delivers 700 gallons per minute at the far end of the 24.8 miles of supply line. The pump is operated 24 hours per day in order to charge 15 200,000-gallon earth reservoirs spaced at about two-mile intervals through the job. Water was also brought in from the Barstow end of the project for about one mile with an eight-inch line supplied from the City of Barstow system. A fleet of 12 2,500- to 3,000-gallon water trucks are supplied from the various reservoirs by six portable 3,000-gallon-per-minute pumps.

In addition, from time to time, a portable sprinkling system was used to apply water in the cuts. Here, six-inch aluminum pipe was used with sprinklers spaced at 80-foot intervals. This system was moved in and used for overnight application. In some instances, an area 500′ x 250′ received approximately 900,000 gallons overnight.

Anchor Chain Used

Prior to grading, 45 Joshua trees up to six feet in height were removed from the roadway prism and transplanted within the right-of-way.

The light growth of desert brush was cleared from about one-half the project by dragging an 80-foot length of battleship anchor chain with two crawler tractors. In areas where irregular terrain prevented the use of chain, bulldozers and blades were used.

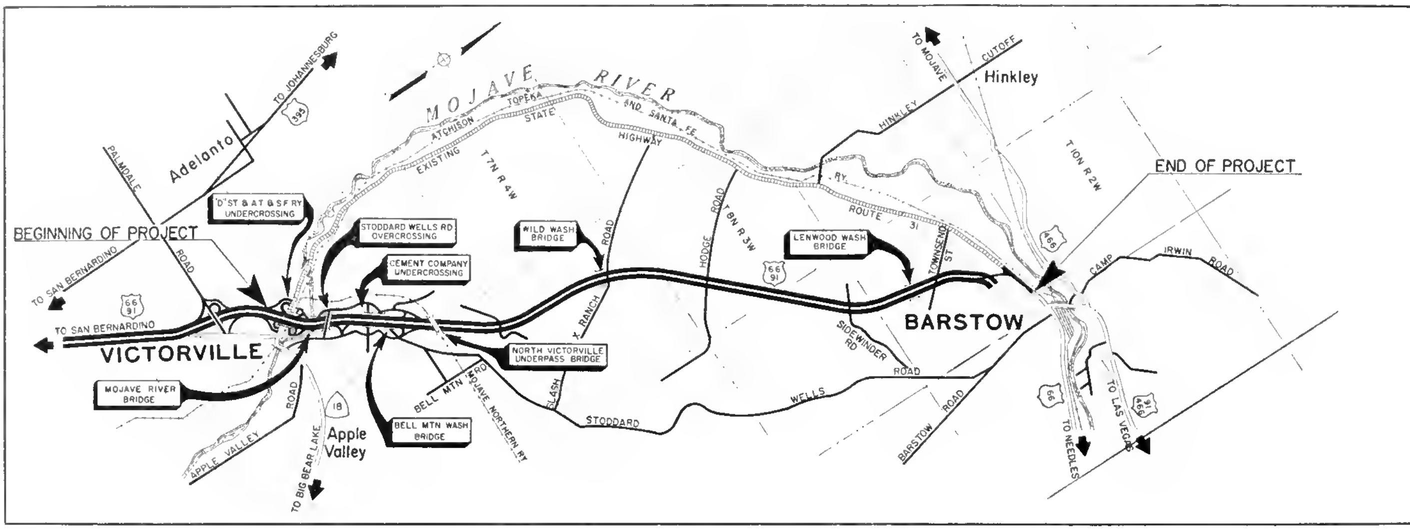
Working 10-hour days on average of 20,000 cubic yards of roadway excavation were handled per day during the heavy production period, with an average length of haul of 0.8 mile. An average of 23,000 tons of imported borrow were placed per day during that operation.

These production rates were achieved using a basic fleet of 12 large wheeled-tractor and scraper units and 20 crawler-type dozer and push tractors. These units, in general, were kept massed and handled each cut in order from one end of the project to the other. About 400,000 cubic yards of roadway excavation consisted of rock, and five years ago this would have been drilled and blasted; however, by full use of the latest rippers, the contractor reduced the amount which required blasting to about 75,000 cubic yards. Four types of the newest and biggest rippers were used. Almost every type of compacting machine and method imaginable was used on this work, depending upon the various soil conditions encountered.

Pit Site Chosen

After exhaustive exploration and tests, the contractor chose a base pit site about 12 miles from the Victorville end of the project and designed a production setup on the basis of 2,000 tons per hour. The pit is about one-half mile square and will be taken down uniformly about 12 feet. The heart of the operation consists of two side-by-side high-production hopper-type 42-inch belt-loaders, discharging into two surge bins. Oversize is screened across to a crusher and returned. One man generally controls this entire setup, including the belt speed of each loader and the surge bin discharge gates, from a centrally located control platform. Five scrapers, working with four crawler

A self-propelled mixer lays cement-treated base along the Victorville-Barstow freeway. A second unit is visible in the rear.



tractor pushers, charge the grizzly over the loading hopper. As many as sixty-five 24- to 28-ton payload trucks were used in transporting IBM (imported base material) to the grade. The average haul is around seven miles. Peak production of 2,100 tons per hour has been achieved when trucks were available. High-speed haul was aided by construction of a median strip haul road with detours around major structures. Here the planned drop inlets were constructed and then buried in order to grade a flat cross-slope for a smooth, fast haul road.

Cement-treated Base

Class "C" cement-treated base with 2 percent cement is mixed from loose windrows by two self-propelled mixers operating in echelon. Each windrow yields a net volume of 6½ cubic feet per lineal foot of com-

. . . *Continued on page 62*

The Victorville Overhead carries the new freeway over the old highway and railroad tracks

Long Beach

16½-mile Freeway Connects Los Angeles With Area to the South

By A. L. HIMELHOCH, District Engineer—Operations, District VII

(EDITOR'S NOTE: This is a sequel to E. G. Hanson's article on the plan and design of the Long Beach Freeway which appeared in *California Highways and Public Works* in November-December, 1957.)

A $48,000,000, 16.5-mile freeway linking the Cities of Los Angeles and Long Beach was officially opened on July 10, 1958. It is the newly constructed Long Beach Freeway which traverses Long Beach and East Los Angeles from the Pacific Coast Highway, US 101-Alternate, to a junction with the Santa Ana Freeway, US 101, at Olympic Boulevard in Los Angeles. This vital thoroughfare, a product of years of planning, design and construction on the part of the State Division of Highways in conjunction with the City of Long Beach and other agencies, provides a major alternate route between two rapidly growing industrial and business communities, Long Beach and Los Angeles. Thousands will benefit by the direct connection, and commercial and noncommercial traffic alike will gain a new means of access to and from the booming southeast section of the Los Angeles-Long Beach Harbor area.

The Long Beach Freeway now penetrates into the heart of industrial Long Beach and the harbor area, where there are 700 industries and a population of 322,500.

Dedication Ceremonies

The opening of the Long Beach Freeway was marked by appropriate ceremonies, arranged by the Long Beach Chamber of Commerce with band music and ribbon-cutting. A motorcade lined up on the new freeway just south of the Imperial Highway interchange to await the dedication and then pass in review to a luncheon at the Lafayette Hotel in the City of Long Beach. In attendance were state, county and city officials, contractors and civic leaders from neighboring communities. Among

Looking south over the Long Beach Freeway toward the Harbor area showing the Pacific Coast Highway Interchange in the foreground those present were Robert E. McClure, State Highway Commissioner; C. M. Gilliss, Director, State Department of Public Works; Edward T. Telford, Assistant State Highway Engineer, District VII, and members of his staff; Tom Polich and Steve Kral of the contracting firm of Ukropina, Polich and Kral; Raymond C. Kealer, Mayor of the City of Long Beach; John E. Biby, Jr., President of the Long Beach Chamber of Commerce and master of ceremonies; Richard Richards, State Senator 38th District; William S. Grant, State Assemblyman, 70th District; and Herbert T. Klocksiem, State Assemblyman, 44th District.

The principal address was delivered by Gilliss who outlined the history behind the construction of the Long Beach Freeway and stressed the importance of the newly completed project. He spoke "in praise of the cat skinners, the blade men, the ginny hoppers and all their fellows, their strawbosses and their big bosses—the contractors."

"These," Gilliss said, "are the men who really make the State of California look good by turning out top highway work. * * * It is a fine contracting industry which builds these freeways for California and Californians."

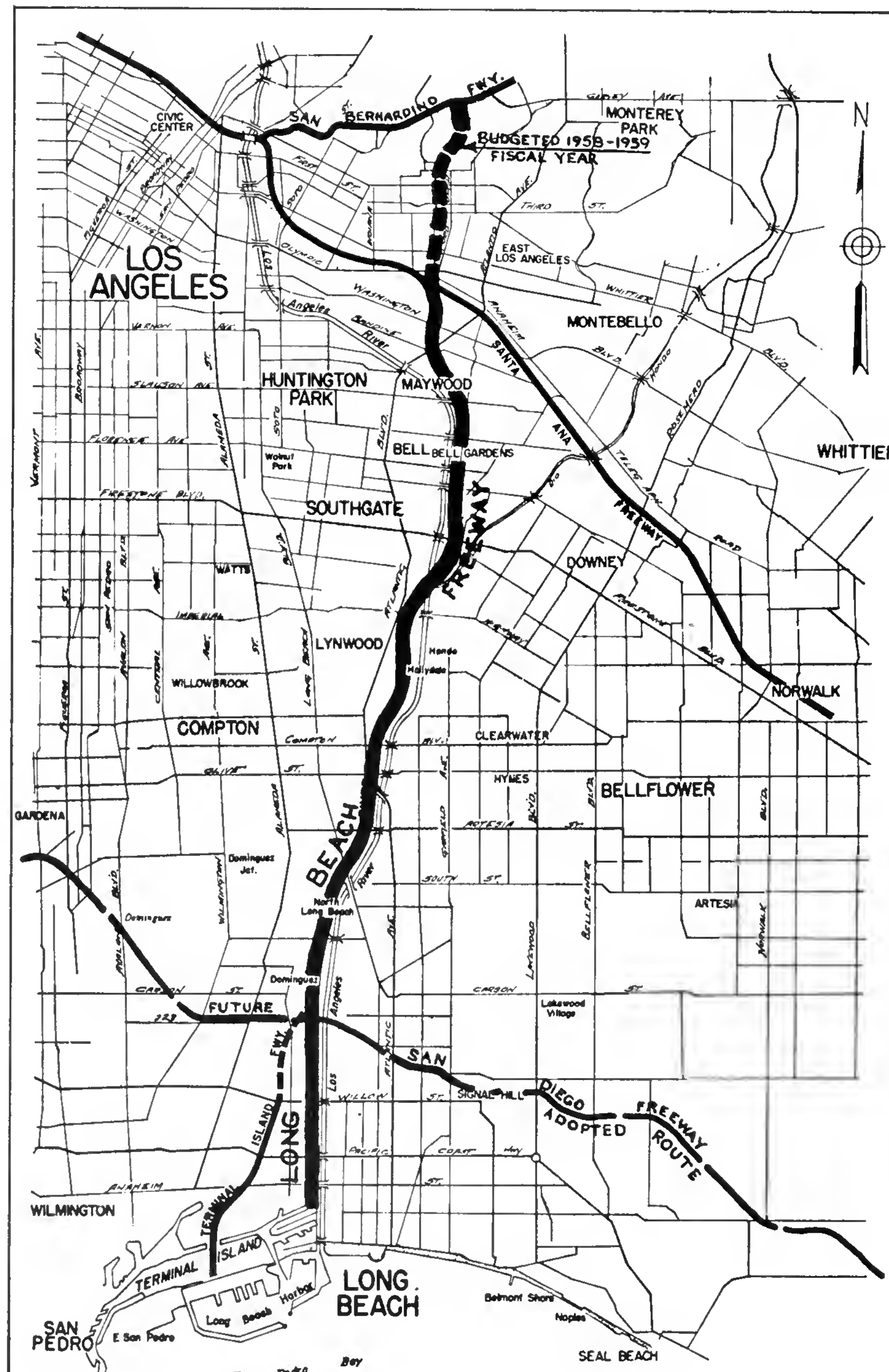
The Long Beach Freeway (formerly known as Pico Street and then as the Los Angeles River Freeway) was first conceived as a possible major traffic artery paralleling the Los Angeles River in 1913. It was just recommended as a freeway 28 years ago by the Long Beach City Engineering Department who proposed that a limited access highway be built along the westerly side of the Los Angeles flood control channel to carry through traffic between the City of Long Beach and Los Angeles and other northerly points. At that time (1930) this proposed limited access road was not on the State Highway System. It was, however, approved for inclusion in the Long Beach major city street system.

It was not until June 23, 1947, that the Long Beach Freeway was included in the State Highway System by legislative act, which described its limits as lying between Route 60 (Pacific Coast Highway) and the Santa Ana Freeway. The State Division of Highways was thus given authority to proceed with plans for construction.

First Contract Award

State construction on the Long Beach Freeway began on June 27, 1951, when the contractor, Griffith Company, set up operations under the field supervision of H. F. Meinke, Resident Engineer for the State. The limits of the project extended from Pacific Coast Highway north to 223d Street, a distance of 2.5 miles. Construction cost was $1,559,300 and the contract was accepted as completed by the Director of Public Works on January 12, 1953.

One bridge, a three-span reinforced concrete box girder type, was erected on Pacific Coast Highway at the Long



Beach Freeway and a retaining wall built at the separation structure at Belhart Street. In addition to standard construction items—drainage, facilities, curbs, ditches, culverts, etc. —the potential landscape areas were cultivated and covered with topsoil.

Early Contractors

Among first contracts on the Long Beach Freeway was one awarded to the 40-year-old company of Ukropina, Polich and Kral of San Gabriel, who subsequently undertook a total of seven contracts on this freeway.

According to John Ukropina, one of the partners, their first contract, between 223d Street and Atlantic Avenue, was the most difficult. Construction began in the mud with preliminary earthmoving operations. The contractors kept 250 men in the field and over $1,500,000 of equipment. In summing up his company's hand in the building of the Long Beach Freeway, Ukropina said: "Our contracts amounted to something like $12,600,000. Building our part of the Long Beach Freeway was a great experience and I am happy the job is done."

The completion of the first contract of the Long Beach Freeway project was the beginning of a series of jobs culminating in the Long Beach Freeway carrying many thousands of cars and trucks to Long Beach and Los Angeles through such communities as Compton, Lynwood, South Gate, Bell, Maywood and Vernon.

In the 16.5-mile stretch of freeway, 15 interchanges and 10 separations of streets were provided.

Between Pacific Coast Highway and the future San Diego Freeway, six lanes have been provided with a curbed median 16 feet in width. Northerly of the San Diego Freeway to the Santa Ana Freeway, the section consists of six lanes, separated by an uncurbed median of 40 feet. Concrete pavement was used on main freeway lanes. At some future time it is proposed to place two additional lanes in this median area, which will provide an ultimate eight-lane freeway northerly from San Diego Freeway. The maximum grade on the freeway is 3 percent.

Traffic Separations Designated

Grade separation bridges and traffic interchange facilities were provided at Pacific Coast Highway, Willow Street, Belhart Street, Del Amo Boulevard, Long Beach Boulevard, Artesia Avenue, Atlantic Avenue, Olive Street, Rosecrans Avenue, Imperial Highway, Firestone Boulevard, Florence Avenue, Atlantic, Bandini, and Washington Boulevards and a branch connection with the Santa Ana Freeway. Also completed were the structures across the Santa Ana Freeway and over Olympic Boulevard in anticipation of the northerly extension to connect with the San Bernardino Freeway and Huntington Drive.

Design on the freeway was initiated in the early part of 1950 and the district proceeded with construction on sections of the freeway, working from both ends toward the middle. Subsequently, nine bridge contracts, 10 road contracts, two illumination contracts and two erosion control contracts, costing approximately $28,-000,000, were completed. Nine of the contracts were financed in part with federal-aid funds administered by the U. S. Bureau of Public Roads.

State contracts were awarded to the following: Ukropina, Polich and Kral, seven contracts; Webb and White, three contracts; J. E. Haddock, Ltd., two contracts; Oberg Bros., two contracts. Other single contracts went to: R. M. Price Company; J. A. Thompson & Son; Webb & White & W. J. Distelli; N. M. Saliba Company; Jannoch Nurseries; Westates Electrical Construction Company; Fishbach & Moore, and Henry C. Soto Corporation.

Savings Realized

Meanwhile the United States Corps of Engineers included in its concurrent channel contracts the construction of the substructure for a bridge across the Los Angeles River north of Imperial Highway, and the construction of a railroad bridge across the Long Beach Freeway north of Rosecrans Avenue. By reason of this co-operation, a considerable saving in state highway funds was realized. The Corps of Engineers also contributed funds to cover a portion of the construction cost of the Domingues grade separations of the Union Pacific Railroad and Pacific Electric Railway tracks (between Carson Street and Del Amo Boulevard in Long Beach), which eliminated necessity for future construction revisions when its channel work was undertaken.

The Los Angeles County Flood Control District constructed a lined auxiliary channel between the Los Angeles River south of Southern Avenue in Compton and Jaboneria Road northerly of Firestone Boulevard. In its contract it included a covered channel under Firestone Boulevard and a covered channel under the Long Beach Freeway. Portions of the covered channel were financed by the State under the terms of a co-operative agreement.

The Firestone Channel development consisted of a double 10-foot square box-type culvert, which was put into place by wedging through the embankment of Firestone Boulevard by means of heavy-duty jacks. The contractor worked from both sides of the fill until both sections of the culvert were joined.

The City of South Gate, under the terms of another co-operative agreement, constructed a frontage road on the easterly side of the freeway southerly from Southern Avenue.

Co-operative Agreements

The Los Angeles County Road Department constructed bridges across the Los Angeles River and the Long Beach Freeway on Compton Boulevard. The Los Angeles County Road Department also constructed bridges across the Long Beach Freeway and the Los Angeles River for Olive Street. These bridges across the freeway and certain incidental approach work were financed by the State under the terms of co-operative agreements with the County of Los Angeles. The county, under terms of a co-operative agreement, financed cost of extending the Rosecrans Avenue bridges across the Los Angeles River channel.

A total of 11 co-operative agreements were entered into: three with Los Angeles County Road Department; three with the City of Long

UPPER—An aerial view of the Firestone Boulevard Cloverleaf and the Los Angeles River Channel along the Long Beach Freeway. The channel joining the river from the right is the Rio Hondo. LOWER—The Belhart Street Overcrossing built by Los Angeles County.

Beach; three with the U. S. Corps of Engineers; one with the Los Angeles County Flood Control District; and one with the City of South Gate.

The acquisition and clearing of rights-of-way on this project was a major problem. Some 1,200 parcels of right-of-way were obtained, and in carrying out clearing operations, 66 buildings were demolished and 691 were removed. The cost of right-of-way acquisition was approximately $20,000,000. (For further details see Plan and Design story by E. G. Hanson, *California Highways and Public Works*, November-December, 1957.)

The Los Angeles River during the rainy season provides drainage for the Long Beach Freeway, which flanks it, and for the communities adjacent. This at times means vast quantities of ponding waters that must either be drained off naturally by means of pipes or channels into the river, or by means of automatically operated pumping equipment. Drainage is relatively simple when water levels lying without the river banks are higher than the water level in the river bed itself. Simple runoff results. But when the condition is reversed, that is, when the water level in the main river channel exceeds that of the outlying areas, floodwaters must be handled by pumps.

Pumping Plants Necessary

The City of Long Beach with some state co-operation constructed and put into operation four pumping plants within the Long Beach Freeway right-of-way at the following interchanges: Pacific Coast Highway, Willow Street, Long Beach Boulevard, and Artesia Street. Equipped to handle freeway and local drainage, these pumping plants are concrete structures imbedded to a depth of from 30 to 40 feet in the ground and house electrically driven vertical propeller pumps. The gallon-per-minute pumping capacities of the several pumping stations are as follows: Pacific Coast Highway, 80,000; Willow Street, 110,000; Long Beach Boulevard, 70,000; and Artesia Street, 130,000.

City engineers have completed plans for another pumping station on the east bank of the Los Angeles River at the Ninth Street Bridge, with a pumping capacity of 40,000 gallons.

The Division of Highways constructed parallel 6,000-foot channels on either side of the freeway from Belhart Street to the Willow Street pumping plant. A pumping plant was constructed at Dominguez Street to drain the Union Pacific and Pacific Electric railroad underpasses.

Big Culvert Built

At Olive Street and the Long Beach Freeway was a large concentration of drainage originating from the communities of Lynwood and Compton. Here a large culvert was built to carry the water under the freeway and into the Los Angeles River. A pumping plant was also installed to pump drainage from the freeway into the Los Angeles River.

Other drainage structures were constructed north along the Long Beach Freeway, as follows: a large drain into the river south of Rosecrans; a concrete-lined channel approximately 3,000 feet in length on the west side of the freeway between Rayborn and San Miguel Streets, draining the Compton area; three large culverts south of the Pacific Electric Railway near Josephine Street, emptying into the river water collected from parts of South Gate and Lynwood; a 2,000-foot dike between Century Boulevard and the railroad, to prevent inundation of the freeway which is depressed at that location, and a pumping plant for freeway drainage at the railroad underpass; a large inlet to the river on the south side of Imperial Highway; a 3,000-foot concrete-lined channel and culvert crossing Imperial Highway for South Gate drainage and a 1,000-foot overflow channel draining to Louise Avenue and Wright Road, which operates at high water level; a Bandini trunk storm drain from Compton and Jaboneria Road across Firestone Boulevard and emptying into the river (a Los Angeles Flood Control District project); a pumping plant north of Firestone Boulevard near the Southern Pacific railroad underpass; a freeway drainage pumping plant on the south side of Florence Avenue, one at Gage Avenue and another at Slauson Avenue.

Subdrainage was provided between Olive Street and Rosecrans, and between the Pacific Electric Railroad at Josephine Street and Elmwood Avenue, where the freeway is below the mean ground level and is adjacent to the west levee of the Los Angeles River. Eight-inch perforated metal subdrains were constructed two feet in the ground in a continuous system of pipes at these locations in order to preserve the stability of the levee against percolation.

Concluding Contracts

One of the last remaining contracts on the Long Beach Freeway before formal completion was the 1.4-mile six-lane link between Atlantic Avenue and Rosecrans Avenue, under contract to Ukropina, Polich and Kral. This section was completed at a cost of $1,629,400. During construction, roadway excavation amounted to 97,000 cubic yards; imported borrow, 156,000 cubic yards; and concrete for the pavement of the freeway, 10,000 cubic yards. Work began on April 1, 1957, and despite a 48-day delay because of bad weather, the contractor finished on schedule, on July 10, 1958. In the extensive paving operations the contractor devised an unusual method of laying his cement-treated base material. It consisted of a spreader mounted on the front of a tractor-scraper equipped with rubber tires for greater mobility and maneuverability. Thus mounted, the spreader dispensed the base efficiently and uniformly.

There were no major obstacles encountered in the building of this portion of the freeway, except for the removal of about two feet of unsuitable material from the roadbed, which was below the water table. Sand was substituted and underdrains were constructed throughout the length of the job. Also, a dump site in the way of the freeway was cleared of 20,000 cubic yards of unsuitable material. Borrow was loaded with belt-loaders at the borrow pit at Wilmington Avenue and Del Amo Boulevard, with 12-cubic-yard capacity bottom dump trucks doing the hauling.

Before actual construction could start on the last major contract in November, 1956, Oberg Construction Company, under separate contract,

... north along the Los Angeles River and Long Beach Freeway showing the Ninth Street Bridge in the foreground, the Anaheim Street Bridge next and then the Pacific Coast Highway began preliminary clearing of the roadbed which passed through an old dump site. The dump contained 341,000 cubic yards of material, all of which was distributed outside of the limits of the roadway at various locations at a cost of $153,450. It is interesting to note that the future roadway, rising to bridge the Los Angeles River, was to pass 60 feet above the bottom of the dump, necessitating considerable hauling and compacting. Surcharged fills were put in to hasten settlement. In all, there were 7,554,504 station-yards of overhaul involved. Haulers trucked their loads across the Los Angeles River over specially constructed steel girder bridges, but the heavy rains of December, 1955, washed out these temporary contractor's bridges, hampering operations.

Second Dump Discovered

The roadway construction contract on this last section of the Long Beach Freeway was let to Ukropina, Polich and Kral, and was completed on schedule simultaneously with the previous contract despite 56 work days lost because of bad weather. This section of the freeway, 1.9 miles in length, was built at a cost of $2,575,000. A second dump south of Rosecrans was uncovered when grading had begun, and it was found to contain 25,000 cubic yards of material, rubber fragments, scrap metal, wood, brick and other rubbish. The contractor first tried a scraper in an attempt to clear the area, but finding it impossible to shear the tangle of junk with the blade, he resorted to clam bucket and truck, a method which proved successful. Further excavation for structures unearthed 40,000 cubic yards of abandoned riprap in the old river bed, which the contractor removed by means of a segmented dozer blade attached to a tractor. This material was used as fill for the freeway embankment. The most troublesome part of early construction was in fire control, odd as it may seem. As the debris was bucketed out of the dump, exposing the subgrade to fresh oxygen, spontaneous combustion would generate fire in the decomposed masses below. Consequently, in addition to building a freeway, workers were engaged often in trying to put out stubborn, smouldering fires in their path.

The freeway proper required 420,000 cubic yards of borrow material, 97,000 cubic yards of other fill materials and 18,000 cubic yards of concrete pavement. 28,000 lineal feet of reinforced concrete pipe and perforated metal drains were installed. Earthen dikes were put up to stem the flow of water as this phase of construction progressed. As the freeway took shape, long lengths of metal plate guardrail, 11,000 lineal feet, were erected on the fills, together with 21,000 lineal feet of 72-inch chain link fencing. Because the freeway was located along the river and along a large transmission tower line, fenced and gated maintenance access ramps were provided for the Los Angeles County Flood Control District and the Edison Company at Rosecrans under the Pacific Electric Railroad. Another feature of the job was construction of air-blown mortar ditches, in addition to the other drainage facilities, flanking the roadway. Nine hundred cubic yards of concrete was used for the ditches.

A new borrow site at Wilmington Avenue and Del Amo Boulevard was utilized in the construction of the Long Beach Freeway between Rosecrans Avenue and Imperial Highway. Trucks hauled fill from the 9,000,000-cubic-yard capacity pit, a distance of seven and a half miles.

Whittier Narrows Lake

Other imported materials came from the Whittier Narrows Fishing Lake, about 14 miles away, and were made available to the contractor cost free, since the Los Angeles County Recreation Department had selected that location for an artificial lake. Excavation was undertaken according to a contour plan set forth by the county. As materials were excavated and trucked away, the ground water rose to fill the lake. Whittier Narrows Lake, sometimes called "Legg Lake" in honor of the late County Supervisor Legg, is located just off Rosemead Boulevard at Worsham Road in East Whittier. It is a Los Angeles County recreation area with two lakes crossed by a levee. A third lake is nearby. Eventually, as the multimillion-dollar Los Angeles County construction program gains headway, the three lakes will become one, measuring some 100 acres in area. The more-than-300-acre park will provide many forms of recreation, including fishing, a golf course, picnic areas, etc. It will be one of the biggest recreational parks in Southern California. This entire recreational area developed by the county represents an ideal example of the dual use of land that can result from governmental co-operation and good planning. This park development is entirely within the lake area of the Whittier Narrows Dam, a flood control and regulating works constructed by the U. S. Corps of Engineers and operated by Los Angeles County Flood Control District. The park facilities utilize a portion of the area that would be flooded only on rare occasions during periods of unusually heavy rainfall. This available land lends itself admirably to development for recreation, utilizing facilities that would not be permanently damaged by infrequent inundation.

Long Beach Contributes

The City of Long Beach had been actively engaged in promoting a traffic arterial along the Los Angeles River for a number of years, and had secured much right-of-way in the city adjacent to the Los Angeles River for future highway purposes. In going forward with this development, the city in 1947 constructed a bridge across the projected highway for Willow Street and a second bridge for Long Beach Boulevard. At Willow Street provision was made for a six-lane divided highway under the bridge whereas at Long Beach Boulevard provision was made for an eight-lane facility. These bridges built by the City of Long Beach and financed with city funds became a part of the Long Beach Freeway.

Subsequently, in June, 1953, the City of Long Beach completed approximately one-half mile of six-lane divided freeway between Anaheim Street and Pacific Coast Highway. In July, 1953, the city also opened to traffic the Anaheim Street Bridge over the flood control channel. This project also included a cloverleaf interchange with the Long Beach Freeway at Anaheim Street. In March, 1953, work was started on the piers for the Ninth to Seventh Street Bridge. This bridge and its approaches is expected to be completed by May, 1959. The old Seventh Street Bridge was demolished and the utilities it carried are presently being relocated onto a utility bridge, scheduled for completion in May, 1959. The Pacific Electric Railway has been relocated to a special railway trestle north of Third Street across the Los Angeles River. Ocean Boulevard Bridge was relocated downstream to Santa Cruz Avenue on May 29, 1953, and is now being used as a temporary detour while the new Ocean Boulevard Bridge is under construction. The estimated completion date of this bridge is June, 1959. The Long Beach Harbor Department this year expects to begin construction of a six-lane divided service road which will act as a freeway terminus from Seventh Street south. This construction, together with the freeway proper (which may go to construction in five years) and a 10,000-foot railroad facility, is estimated to cost in excess of $7,000,000.

City Gas Money Used

"On the east side of the river, the terminal facilities for the freeway will be handled by the construction of the DeForest Avenue project from Ocean Boulevard to Seventh Street. The Ninth Street Bridge will terminate on the east side of the channel at Seventh Street in a rather elaborate three-level interchange. It is expected that the DeForest Avenue project, which will provide for an integration of the freeway traffic into a one-way street pattern of the intervening streets between Ocean Boulevard and Eighth Street, will cost approximately $5,000,000." (Remarks by Jess D. Gilkerson, Long Beach City Engineer, quoted in Long Beach Freeway story by E. T. Telford, District Engineer, *California Highways and Public Works*, July-August, 1954.) This construction will be financed by state gas tax moneys and a $3,000,000 municipal bond issue voted in February, 1955.

Commenting on the Long Beach Freeway, Jess D. Gilkerson, City Engineer, said that the City of Long Beach has to date obligated between $9,000,000 and $10,000,000 for past and present construction. The Long Beach Freeway in Long Beach has been financed by Long Beach Harbor and General City Funds, Los Angeles County Flood Control District Funds, bond issue and state gas tax funds. Gilkerson said that the increased traffic volume due to the extension of the Long Beach Freeway is building up and that the City of Long Beach will introduce a centralized signal control system on city streets to cope with traffic in 1959. Studies for this project are under way now, Gilkerson added.

The important construction work completed, in progress, and planned for the southerly extension of the Long Beach Freeway beyond Pacific Coast Highway by the City of Long Beach is an important achievement which should not go unnoted. The City of Long Beach can well be proud of the freeway design and construction which it has undertaken.

Northerly Extension

To the north of the Santa Ana Freeway plans for extension of the Long Beach Freeway to junction with the San Bernardino Freeway are nearing completion and right-of-way acquisition is progressing at a rapid pace. The California Highway Commission has allocated a total of $6,150,000 for this construction in the 1958-1959 Fiscal Year, and it is expected that this work will be advertised for bids before the end of 1958. The completion of the Long Beach Freeway Extension northerly to provide a circumferential freeway connection on the east side of Los Angeles between the Santa Ana Freeway and the San Bernardino Freeway will fulfill a great traffic need.

To bring this Long Beach Freeway project to pass the State has entered into 23 major construction contracts, in order to build 16½ miles of freeway, the total construction value of which is close to $28,000,000. In order to acquire the rights-of-way necessary for this construction, a total of $19,000,000 has been spent. The total cost of this freeway, including cost of construction by other governmental agencies and paid for by the State, has been slightly in excess of $48,000,000.

A view southeastward showing the Long Beach-Santa Ana Freeway Interchange

An aerial of the Olive Street Interchange on the Long Beach Freeway. The view is northward.

The construction of the Long Beach Freeway is a significant achievement that can be measured in terms of the vast sums of money saved through farsighted protective spending far in advance of construction and in terms of the hastened pace of construction occasioned by early right-of-way acquisition.

It was through close co-operation between various governmental agencies and other groups that the Long Beach Freeway became an actuality on July 10, 1958, and immediately undertook its assigned task of safely carrying large traffic loads. It is a welcomed addition to the Greater Los Angeles Freeway System.

VALLEJO, CALIFORNIA

Editor, California Highways and Public Works

SIR: Of all the magazines that come to our home there is none that I look forward to as yours. I started driving a car back in 1904 and I have covered practically every road in California. No one appreciates the work that has been done on the highways more than I.

The "12-mile-an-hour limit" those days might have been all right for the towns but was certainly superfluous on the roads outside the towns—a speed more than that would have shaken a car to pieces. Thirty years ago a crowd of us was going through the Santa Barbara Mission—we had encountered many detours on the way down from San Francisco. Many of the group were complaining about these detours when a woman spoke up and said "You folks must be from California—back east we would like to have our highways as good as these detours."

I have been driving now for almost 54 years. We have covered almost every state in the Union and, although there are some fine roads in all the states, we did notice that the directional markers along the highways cannot compare to those of California.

Yours very truly,

ALEX B. ROWLAND

USE OF FM RADIO

Continued from page 44 . . .

Field telephones were next considered, but were ruled impracticable because men would be roving, or be on rapidly restationed assignments. Walkie-talkies were also seriously considered, but discarded on the grounds of low power, short range, and ineffectiveness in broken terrain.

Finally, it was decided that good, first-quality radio installations were the only answer. As a result, with the co-operation of headquarters communications section, Resident Engineer Edward Walker last fall was furnished with two-way radio communications for the job.

Although certain contractors have been using radio for some time, and although it has been used in California highway maintenance for more than a decade, the Victorville-Barstow project is the first time two-way radio has been used by the Division of Highways as a construction tool.

The actual amount of radio equipment assigned is modest. Standard, stock model units were furnished, identical with those used by the maintenance forces throughout the State. A base station was provided for the resident's trailer office in Victorville, with a whip antenna on the roof. Since the contractor already was using radio for his operations, and his field office was close by the resident's interchange of information was possible a few steps away.

For use in the field, four mobile units were installed in sedans and pickups. These were assigned to the resident engineer, his general assistant, and two principal assistants, one of whom is in charge of structures, the other of grading.

The regular highway frequency in the 47-megacycle band was used. Although there has been some interference with maintenance communications in the area, it has not been serious because of the major mountain barriers which screen the Victorville-Barstow area from most of the other highway activities in the region.

Many Hours Saved

The job is going ahead rapidly, and the ready liaison between the contractor and the State's representatives which the use of radio has provided, is in part responsible for the smoothness of the operation, Resident Engineer Walker feels. Since a round trip over the job amounting to about 60 miles along a slow-speed, contractor's service road is the only alternative, getting the information in a few minutes by radio has saved many man-hours. Furthermore, there is a considerable saving on operation of pickups and other equipment.

One of the areas in which valuable time and equipment savings have occurred is the contractor's need for a state representative on the scene quickly. Conversely, a Division of Highways representative may see something being done by contractor's men which he questions, but which he has no authority to delay. Radio quickly brings a contractor's representative or the resident engineer for a conference to iron out the problem.

Radio has saved considerable time, too, on compaction tests. On samples taken back to the field laboratory, test results have been radioed back to the job, rather than carried by car.

Facility in getting weather forecasts out to distant points on the job is an advantage, also. When the forecast is for colder weather, for instance, arrangements can be made for providing heaters for late afternoon concrete pours.

Repairs can be made in the field more rapidly, and if injuries should occur they can be better cared for when there is radio—although both of these are more likely to be contractor's problems, since most of the equipment and men on the job are his.

Inspectors using radio to check blueprints out in the wide open spaces on the Victorville-Barstow expressway are, left to right, W. T. Murray, Art Austin and R. H. T. Norton

Driver's Life Saved

On the US 66-91 job, for example, before operations had been under way more than a few months, a scraper unit turned over and went down a railroad embankment, 11 miles out from Victorville. The driver had one of his legs cut off, and although first aid kept him from bleeding to death, he was badly in need of professional medical care. The contractor's radio had a doctor and ambulance at the scene in 20 minutes.

More recently, a state inspector picked up a "dead" rattlesnake to throw it off the grade and was raked on one hand by a fang as the rattler twisted in his grasp. A radio-equipped state pickup in the vicinity flashed word ahead with the result that a doctor was waiting with antivenin serum when the man arrived at the hospital. His two weeks hospitalization might have been greatly prolonged had not radio permitted prompt attention.

Although these are dramatic examples, perhaps the greatest value of radio for the highway representatives working on long jobs such as these, is simply the ability to keep in touch. A man and even an orange-colored pickup are quickly lost to sight in the wide expanses of desert through which this road is being built.

Meetings are arranged by radio, particularly if an unexpected representative shows up from headquarters, say, with a need to talk to the resident engineer who is "somewhere out on the job." Men go directly to their work stations and report in on the job by radio, rather than checking out through the field office. Decisions are made over the radio, without the conferees ever physically coming within miles of each other.

Although the construction situations in which the use of two-way radio is practicable are limited, the Division of Highways is considering its further use where conditions warrant.

Recommendations

Chamber of Commerce Procedure Explained

By LORAN C. VANDERLIP, California State Chamber of Commerce

The regional highway committees of the California State Chamber of Commerce presented recommendations concerning 680 state highway construction projects to the California Highway Commission on August 28th. The projects, covering state highway construction in all of the State's 58 counties, were for the Fiscal Year 1959-60. The recommendations were considered and decided during proceedings conducted at some 40 meetings held in all parts of the State during the months of June, July and August. The sessions were attended by about 1,500 Californians, including local and state governmental officials together with farm, business and civic leaders.

This procedure of sounding out the people's views, gathering and consolidating the ideas, then presenting them in a detailed compilation for the assistance of the California Highway Commission, has been undertaken by the California State Chamber of Commerce annually for the past 30 years or so.

Advance Notice Given

The regional meetings conducted by the chamber are open to the general public. They are real "grass roots" sessions. Advance notice of the meetings is spread widely so that all have opportunity to participate and contribute their suggestions and viewpoints.

The more important values of the state chamber's program may be summarized as follows:

1. It provides a means for highway leaders in each county to get together and agree on a highway program;
2. It brings together state highway and local governmental officials, as well as members of civic groups, in a discussion of vital state highway needs;
3. It makes it easier for the California Highway Commission to study highway recommendations of local groups which have been tempered with an understanding of regional and statewide traffic problems and patterns;
4. It serves as an excellent medium for bringing current state highway issues to the direct attention of local governmental agencies and civic bodies; and
5. It gives added importance and recognition to projects on the State Chamber listing when local groups make formal presentations before the California Highway Commission.

Realistic Viewpoint

Until two years ago, the projects were submitted to the Highway Commission with no attempt to record them in any order of priority. In order to portray the projects more realistically in a logical listing, the establishment of three categories, for all counties, was set forth for the first time in 1956.

The projects are now listed, in each county, under one of the following A, B or C categories:

(A) Projects recommended for construction or for the final application of funds for rights-of-way allocation (items in this category include projects which are ready for contract during the ensuing fiscal year);

(B) Projects recommended for survey, design and commencement of rights-of-way acquisition (this category includes projects for which final plans should be undertaken); and

(C) Projects recommended for long-term planning (this category includes projects which have not been incorporated in A or B, above, and includes items which may be considered to be eight or ten years in the future).

One area of wide interest which is purposely excluded from the recommendations to the California Highway Commission concerns additions of new mileage to the existing 14,000-mile State Highway System. Inasmuch as such projects are problems for the State Legislature and are not the responsibility of the commission, the items are not included in the compilation of recommendations for submission to the commission.

In practically every regional meeting someone asks about the matter of new mileage. The standard answer is that assistance will be given by the chamber to see that there is a presentation of the item to the proper legislative interim committee, which is charged with the responsibility for determining whether the new mileage should be added to the State Highway System.

Locally Sponsored

The 40 meetings conducted each year follow similar patterns. Local civic organizations or local governmental bodies sponsor the sessions and the meetings are built around local participation. Some of the sessions are completed within an hour and some of the meetings last for more than four hours. Every effort is exerted to obtain the full expression of participants by encouraging them to make direct statements or to ask questions of the highway engineers who are always present at the meetings.

It is of great interest to observe a highway meeting where many divergent views are expressed regarding projects. After a full discussion is completed and all questions are answered, the usual pattern is that persons in attendance will agree in a recommended program for the entire county.

In many counties, preliminary meetings are held prior to the session called by the local group in its meeting with the state chamber representatives. In those instances, all differences of opinion are usually ironed out so that the county group can come forth with a program which has the backing of all interested groups.

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COST INDEX

Continued from page 31 . . .

NUMBER AND SIZE OF PROJECTS, TOTAL BID VALUES AND AVERAGE NUMBER OF BIDDERS

(Jonuory 1, 1958, to June 30, 1958)

Project Volume	Up to $50,000	$50,000 to $100,000	$100,000 to $250,000	$250,000 to $500,000	$500,000 to $1,000,000	Over $1,000,000	All Projects
Road Projects							
No. of projects	104	47	48	16	12	7	234
Total value*	$2,408,217	$3,452,566	$7,106,381	$5,576,795	$8,721,594	$11,481,818	$38,746,371
Avg. No. bidders	6.5	5.7	6.9	9.8	9.8	9.3	6.5
Structure Projects							
No. of projects	22	5	5	1	----------	8	42
Totsl value*	$589,631	$453,914	$872,907	$439,837	----------	$22,108,574	$24,464,863
Avg. No. bidders	5.1	7.8	9.0	9.0	----------	8.5	6.7
Combination Projects							
No. of projects	----------	----------	----------	----------	1	11	12
Total value*	----------	----------	----------	----------	$941,621	$50,928,719	$51,870,340
Avg. No. bidders	----------	----------	----------	----------	14.0	8.9	9.3
Summary							
No. of projects	125	53	53	17	13	26	288
Total value*	$2,997,848	$3,906,480	$7,978,288	$6,015,632	$9,663,215	$84,519,111	$115,080,574
Avg. No. bidders	6.6	5.9	7.1	9.8	10.1	8.9	6.5

*Bid items only.

Total Average Bidders by Months

	Jan.	Feb.	Mar.	Apr.	May	June	Avg. for six months
1958	11.4	9.2	7.6	7.1	4.5	4.8	6.5
1957	7.1	7.3	6.7	5.5	5.5	5.9	6.1

NUMBER AND SIZE OF PROJECTS, TOTAL BID VALUES AND AVERAGE NUMBER OF BIDDERS

(July 1, 1957, to June 30, 1958)

Project Volume	Up to $50,000	$50,000 to $100,000	$100,000 to $250,000	$250,000 to $500,000	$500,000 to $1,000,000	Over $1,000,000	All Projects
Road Projects							
No. of projects	200	71	78	28	19	9	405
Total value*	$4,038,317	$5,283,871	$12,026,331	$9,647,299	$13,324,713	$14,213,115	$58,533,646
Ave. No. bidders	5.5	6.2	7.5	10.1	9.5	9.4	6.6
Structure Projects							
No. of projects	44	8	16	3	----------	12	83
Total value*	$1,034,619	$590,534	$2,728,685	$955,135	----------	$37,210,850	$42,530,923
Ave. No. bidders	5.8	7.9	11.1	9.7	----------	8.5	7.5
Combination Projects							
No. of projects	----------	----------	----------	----------	1	22	23
Total vslue*	----------	----------	----------	----------	$941,621	$92,213,959	$93,155,680
Ave. No. bidders	----------	----------	----------	----------	14.0	9.5	9.7
Summary							
No. of projects	244	79	94	31	20	43	511
Total value*	$5,072,936	$5,874,505	$14,765,016	$10,613,434	$14,266,334	$143,637,924	$194,220,149
Ave. No. bidders	5.6	6.4	8.2	10.0	9.8	9.2	6.9

*Bid items only.

Total Average Bidders by Months

	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Ave. Year
1957-58	6.2	6.3	5.7	8.2	9.2	9.7	11.4	9.2	7.6	7.1	4.5	4.8	6.9
1956-57	3.8	3.7	3.7	4.2	5.3	6.1	7.1	7.3	6.7	5.5	5.5	5.9	5.1

The total value of the above projects is $65,198,665.

Five of the seven items used in the preparation of the index show lower average bid prices during this quarter with portland cement concrete pavement showing the largest decrease. The two items with higher average prices are asphaltic and bituminous mixes and bar reinforcing steel. The following table shows average unit prices for the seven items used in preparing the index.

The average unit price for roadway excavation for this quarter is $0.48 which is $0.04 below the previous quarter. Projects for the second quarter were well spread over the State and since a great amount of the work is not subject to extreme traffic interference nor involves hard rock formations, a price average in the range generally considered as normal is the result.

The average unit price for untreated rock base for the quarter standing at $1.73 is $0.12 below the previous quarter and it is the lowest average price determined in the history of the Cost Index. However, it is in the range prevailing in the previous two quarters. The widespread distribution of projects apparently had a lowering effect on average prices in this period.

The average price for asphaltic and bituminous mixes is one of the two showing an increase during this quarter. The price of $5.67 is $0.22 above last period, but it is substantially below the price in the same quarter last year. The price was affected to some extent by the annual resurfacing program in which many of the projects are subject to traffic interference.

Portland cement concrete pavement was the one in this quarter which reflected the greatest reduction in average price. The average is $13.77 or $1.19 below the previous period. It is the lowest average price since the third quarter of 1955. This trend in a downward direction became apparent in the first quarter and continued into this period.

The average bid price for structure concrete dropped to $54.44 from $55.21 established in the first quarter.

The small upward change ($0.007 per pound) in the average price for

AVERAGE CONTRACT PRICES

	Roadway excavation, per cu. yd.	Untreated rock base, per ton	Plant mixed surfacing, per ton	Asphalt concrete pavement, per ton	Asphaltic and bituminous mixes, per ton	PCC pavement, per cu. yd.	PCC structures, per cu. yd.	Bar reinforcing steel, per lb.	Structural steel, per lb.
1940	$0.22	$1.54	$2.19	$2.97	--	$7.58	$18.33	$0.040	$0.063
1941	0.26	2.31	2.84	3.18	--	7.54	23.31	0.053	0.107
1942	0.35	2.81	4.02	4.16	--	9.52	29.48	0.073	0.103
1943	0.42	2.26	3.71	4.76	--	11.48	31.76	0.059	0.080
1944	0.50	2.45	4.10	4.50	--	10.46	31.99	0.054	0.132
1945	0.51	2.42	4.20	4.88	--	10.90	37.20	0.059	0.102
1946	0.41	2.45	4.00	4.68	--	9.48	37.38	0.060	0.099
1947	0.46	2.42	4.32	5.38	--	12.38	48.44	0.080	0.138
1948	0.55	2.43	4.30	5.38	--	13.04	49.86	0.092	0.125
1949	0.49	2.67	4.67	4.64	--	12.28	48.57	0.096	0.117
1950	0.40	2.25	4.25	3.75	--	11.11	43.45	0.079	0.094
1951	0.49	2.62	4.34	5.00	--	12.21	47.22	0.102	0.159
1952	0.56	2.99	5.00	4.38	--	13.42	48.08	0.098	0.150
1953	0.51	2.14[1]	5.31	4.58	--	12.74	50.59	0.093	0.133
1954	0.45	2.13	4.50	4.85	--	14.41	48.42	0.094	0.124
1955	0.39	2.22	4.93	--	--	13.35	45.72	0.095	0.142
1st Quarter 1956	0.40	2.08	5.40	6.50	--	14.05	52.51	0.105	0.166
2d Quarter 1956	0.51	2.06	6.27	--	--	14.64	57.13	0.113	0.219
3d Quarter 1956	0.52	2.27	6.12	--	--	15.57	56.32	0.121	0.178
4th Quarter 1956	0.52	2.21	--[2]	--[2]	$5.93[2]	14.95	59.63	0.112	0.197
1st Quarter 1957	0.59	2.10	--	--	5.94	17.28	51.14	0.129	0.235
2d Quarter 1957	0.63	2.10	--	--	6.18	15.59	58.61	0.119	0.204
3d Quarter 1957	0.42	2.34	--	--	5.10	14.34	58.68	0.130	0.200
4th Quarter 1957	0.58	1.78	--	--	5.45	16.88	59.76	0.129	0.177
1st Quarter 1958	0.52	1.85	--	--	5.45	14.96	55.21	0.118	0.192
2d Quarter 1958	0.48	1.73	--	--	5.67	13.77	54.44	0.125	0.158

[1] The item of crusher run base was used before 1953.
[2] Asphalt concrete pavement combined with plant mix surfacing in forth quarter 1956, and will be identified as asphaltic and bituminous mixes in the future.

reinforcing steel in this quarter is consistent with recent past fluctuations.

The average price for structural steel stands at $0.158 this quarter while an average of $0.192 was established in the first quarter. Most of this decrease can be attributed to a very low price submitted on a bridge project in the Los Angeles area where a large volume of steel is to be used.

The most recent bids received for state highway construction and the Index graph pattern indicate that a leveling-off will occur in the third quarter.

The California Highway Construction Cost Index, the Engineering News-Record Construction Cost Index, and the United States Bureau of Public Roads Composite Mile Index, all reduced to the base 1940 = 100, are shown on the accompanying graph. The latter two Indexes are based on nationwide construction costs.

The Engineering News-Record Cost Index, which now stands at 310.4, again shows a rise over the preceding quarter. It is up 3.0 index points or 1.0 percent from the fourth quarter. This index is strongly affected by many large projects outside the highway construction field.

The Bureau of Public Roads Composite Mile Index for the first quarter of 1958 at the level of 233.4, which is the latest available, was down 4.9 index points or 2.1 percent below the fourth quarter of 1957. Its behavior in the first quarter parallels the California pattern.

THE CALIFORNIA HIGHWAY CONSTRUCTION COST INDEX

Year	Cost Index
1940	100.0
1941	125.0
1942	157.5
1943	156.4
1944	177.8
1945	179.5
1946	179.7
1947	203.3
1948	216.6
1949	190.7
1950	181.2
(1st quarter 1950—160.6)	
1951	225.0
(4th quarter 1951—245.4)	
1952	225.9
1953	215.2
1954	193.5
(2d quarter 1954—189.0)	
1955 (1st quarter)	189.3
1955 (2d quarter)	212.4
1955 (3d quarter)	208.6
1955 (4th quarter)	212.6
1956 (1st quarter)	219.5
1956 (2d quarter)	255.9
1956 (3d quarter)	249.1
1956 (4th quarter)	252.1
1957 (1st quarter)	277.7
1957 (2d quarter)	266.9
1957 (3d quarter)	237.5
1957 (4th quarter)	262.1
1958 (1st quarter)	241.8
1958 (2d quarter)	231.0

DISTRICT IX

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recent improvement of State Sign Route 127 within District IX.

For that look at Death Valley you will leave Route 127 at Death Valley Junction via State Sign Route 190 which crosses the Funeral Mountains, the Panamint and Argus ranges, skirts the dry lake bed of Owens Lake and joins US 6/395 near Lone Pine. A side trip from Lone Pine to the base of Mt. Whitney should be included in your itinerary. A four-mile portion of this Inyo County Federal Aid Secondary Road is now being reconstructed under a contract which will provide improved alignment and width from the Inyo National Forest boundary to Hunter's Flat. This project involves extremely rugged construction over an alluvial fan strewn with huge granite boulders and up the steep granite scarps of the Sierra.

On your return to the south you could cross to Bakersfield on State Sign Route 178 over the historic Walker Pass, past the new man-made Lake Isabella and through the winding Kern River Canyon. Much of this route has had scant improvement, except for paving, from the old wagon road. One two-mile portion between Weldon and Onyx that followed the base of the foothills with many sharp curves and was subject to frequent flooding was reconstructed in 1957. This is a start on planned long range improvement for this entire route within District IX.

Those who return to the desert and high Sierra country that is District IX, year after year, will continue to find new highways that provide easier, faster and safer travel.

REPORT FROM DISTRICT VI

Continued from page 43 . . .

Sign Route 180

Sign Route 180 between Route 33 near Mendota and Kings Canyon National Park is the main east-west highway through Fresno. Presently much of this route in the city is on a one-way street system inaugurated in 1955.

Another section of this system was recently completed with the opening of the second of two one-way steel girder bridges over two city streets and the Southern Pacific yards.

Stanislaus Street, the westbound leg, extends over F and G Streets, and 21 tracks of the railroad on a structure 1,108 feet in length. The Tuolumne Street eastbound structure spans the same streets and 16 tracks and is 1,053 feet in length.

Due to the necessity of getting over one city street and down to grade at the next without excessive grades and to obtain sight distance, it was necessary to attain a maximum elevation of 34 feet above the rails on the Stanislaus structure.

The project was completed in July of this year at a cost of construction of $1,050,000, which included approaches and street work.

Sign Route 198

This lateral is from San Lucas on US 101 to Sequoia National Park by way of Priest Valley, Coalinga, Hanford, Visalia and Lemoncove.

Construction of a 4.75-mile section between the Visalia Airport Interchange and Visalia was completed in June of this year. The construction cost was $1,207,000. It provided a four-lane divided expressway with frontage roads on portions. The right-of-way was widened from an original 60 feet to 142 feet.

Sign Route 41

Blackstone Avenue, north of Fresno, a rapidly developing commercial street, has been widened to a six-lane divided thoroughfare between Hedges Avenue and the northerly limits of the community of Pinedale. This section was done under three contracts, covering a distance of approximately 6½ miles, the most recent section between Sign Route 168 and Pinedale having been completed in April of this year. The cost of these three sections was $1,068,000.

Sign Route 168

The construction of a modern two-lane mountain highway between Shaver Lake and Huntington Lake on new location, for a distance of 17 miles, was completed under several contracts by the U. S. Bureau of Public Roads in 1956. This section of road was turned over to the State for maintenance in 1957. The vast improvement over the original road, with its sharp curvature and steep grades, has provided much impetus for increased travel to the Huntington Lake and China Peak recreational areas.

US 66-91

Continued from page 48 . . .

pacted material. Approximately 11,000 lineal feet of two-lane width (31,800 square yards) is mixed and compacted per nine-hour day. A total of 750 barrels of cement per day go into this work.

The mixed material is spread by adjustable trailing strike-off blades mounted on the mixers, augmented by motor graders. Segmented-wheel rollers key the compaction operation. The completed subgrade takes a 0.25-gallon per square yard application of SC-2 prime coat, with ⅜ inch to ½ inch penetration.

At this writing, plant-mixed surfacing production is about to begin. Two PMS batch-type plants, one 5,000-pound and one 6,000-pound, have been erected side by side at the same pit location used for IBM. Here, the contractor plans for an average production of 4,000 tons per 10-hour day. The leveling course will be spread by motor graders and the surfacing course placed by two paving machines. A shoulder machine will be utilized in placing PMS berms and lining gutters.

Innovations have also featured the State's handling of inspection work. The original earthwork quantities were calculated by the use of electronic computers. Corresponding pay quantities have been independently calculated by this method, using original ground elevations taken during routine slope staking. Experience gained here has contributed to the State's knowledge of the controls necessary to permit full, free, and proper use of these methods.

At the contractor's request, finish grade stakes were offset on the slopes prior to completion of subgrade at bottom of imported base material. These stakes were driven to grades one foot above subgrade. The original intent was to permit use of motor graders with electronically controlled moldboards guided by grade wires or string lines attached to the high stakes. For various reasons, the contractor has not followed this plan through all blading operations. However, the high stakes have effected a real saving to the State in providing a guide for the operator of the motor grader.

Various Tests

The acid-base titration test was used as a measure of the transverse uniformity of cement distribution in the mixed CTB (concrete-treated base).

PMS asphalt content extraction tests will be run in the field to keep pace with the contemplated high rate of pavement production.

The extensive field laboratory work performed has been expedited by the use of radio, and by a mobile operation. One field laboratory is located at the resident engineer's office at Victorville. This is augmented by three temporary laboratories spotted through the work as necessary to minimize travel.

The production being achieved on this project apparently will result in the project being completed at least four months ahead of time, and early in 1959 the project will be presented to the traveling public at a net cost of $200,000 per mile. A total of 29.3 miles of freeway will be added to the interstate system, 35,000 vehicle-miles per day of length of travel will be saved by the traveling public in addition to the advantage of the greatly improved safety and comfort features. In addition, countless square miles of new area will be open to development.

Gladys Boswell Retires; With State 29 Years

Gladys Boswell retired on June 30th after 29 years with the State, including positions in the Secretary of State's Office and the Board of Registration for Civil Engineers. At the time of her retirement she was secretary to the Assistant State Highway Engineer, Operations. Mrs. Boswell's father, A. A. Harrison, was a long-time employee of the Division of Highways.

Mrs. Boswell and her husband, Harry, have purchased a stock ranch in Lassen County where they will spend most of their time after her retirement.

A. A. S. H. O.

Continued from page 34 . . .

Administrative Practices, Uniform Accounting, Traffic, Roadside Development, Highway Finance, Factual Surveys, Secondary Roads, Geology and Soils, Radio, Electronics, Maintenance and Equipment, Bridges and Structures, Materials, Legal Affairs, Right of Way, Design, Public Information, Construction, Transport, and Research Activities.

An innovation in the handling of annual meeting arrangements this year is a preregistration procedure which is expected to reduce congestion at registration desks in the Sheraton-Palace lobby. Delegates have been sent registration forms which are to be completed and mailed in to the AASHO Housing Bureau in San Francisco along with their reservations at any one of 12 downtown hotels.

Visitor or guest registration and reservation forms and advance information have also been mailed to organizations requesting them who normally are represented at the AASHO meetings. Representatives of nonmember organizations desiring to secure registration and reservation forms may do so by writing to the AASHO Bureau, P. O. Box 3159, Rincon Annex, San Francisco 19.

Bad driving conditions prevailed in less than 15 percent of the fatal highway accidents in the United States in 1957.

TWENTY-FIVE-YEAR AWARDS

Employees who received twenty-five-year awards since those listed in the July-August, 1958, issue of *California Highways and Public Works.*

District I
Travis, Charles W.

District II
Bidwell, James H.

District III
Culveyhouse, Elwood M.
Heflin, Robert W.
Miller, Marvin R.
Miller, Robert M.

District IV
Finley, Richard E.
Merango, Fred

District VI
Kahl, Edward James

District VII
Faulkner, Frew J.
Johnson, George A.

District VIII
Sides, Mildred K.

District X
Harrigan, Ben J.
Maciel, Manuel G.
Snooks, Jackson
Wells, R. Kenneth
Wraa, Elwood J.

Bridge Department
Barker, Robert S.

Shop 7
Davies, William H.
Warner, Charlie B.

Shop 10
Millard, William J.

THE METROPOLITAN WATER DISTRICT
OF SOUTHERN CALIFORNIA
Los Angeles, California

Editor,
California Highways and
Public Works

Sir:

On page 23 of *California Highways and Public Works* for May-June 1958 there appears an account of the plaque award to San Francisco-Oakland Bay Bridge as one of the "seven civil engineering wonders of the United States" by the American Society of Civil Engineers.

In this article in paragraph 6 there appears a list of the seven civil engineering wonders selected by the ASCE. One of the seven wonders is the Colorado River Aqueduct of the Metropolitan Water District of Southern California. However, in your article you list the Colorado River Aqueduct as "the Colorado River-Los Angeles Aqueduct." This, of course, is completely in error. The Colorado River Aqueduct is not a "Los Angeles Aqueduct" but is a water supply system financed, constructed and operated by the Metropolitan Water District of Southern California, which has within its boundaries 83 incorporated cities, including Los Angeles.

Very truly yours,
ROBERT B. DIEMER
General Manager and
Chief Engineer

The name "Colorado River-Los Angeles Aqueduct" was taken from a list of prizewinners announced by the American Society of Civil Engineers. We are happy to print the above letter giving the official name of the aqueduct.

THE EDITOR

Fred Jacobson Joins Bakersfield Chamber

Fred Jacobson, special representative of the State Department of Public Works, submitted his resignation and left the department September 12th to become manager of the Industrial Department of the Greater Bakersfield Chamber of Commerce.

Merit Award Board Winners Announced

Employees of the Department of Public Works receiving certificates of commendation and cash awards since the last list was published in the July-August issue of this magazine are:

Thomas L. Miller, Architecture, Sacramento. Certificate for proposing that a quantity of standard working drawing tracing sheets be reprinted to include across the bottom of the sheet a printed standard scale for plan and profile.

LaMonte E. Daniel, Highways, Stockton. Certificate of award and $10 for proposing that the daily record of platform scale weights form be prepared in triplicate with snap-out carbons included.

William R. Connelly, Jr., Highways, El Centro. Certificate of commendation for proposing that the distribution of charges between road sections on monthly progress pay estimates be discontinued.

Anthony J. Schneider, Highways, San Luis Obispo. Certificate of commendation for recommending the placing of handles on mixing bowls of mechanical mixers.

Jack Roy, Architecture, Los Angeles. Certificate of award and $15 for recommending that blueprints and specification books mailed from the Sacramento office be shipped or mailed in one parcel.

Mrs. Lucille Davitt, Architecture, Los Angeles. Certificate of commendation for proposing the use of filing pockets instead of fasteners.

Harold E. Atherstone, Highways, Stockton. Certificate of commendation for proposing that Form WH 16 and A529 be revised.

Roy H. Dutcher, Oakland. Certificate of award and $50 for recommending revisions of Vehicle Form 273 and S-120.

Mrs. Margaret S. Eggleston, San Bernardino. Certificate of award and $25 for proposing that her district use a numbering machine for placing entry numbers on file books, tracings, and plans.

Samuel E. Lazarus, Modesto. Certificate of award and $25 for recommending use of a cover demand design chart.

Franklin Lowe Young, San Francisco. Certificate of award and $50 for devising a procedure for making up contract plan coordinate sheets.

Stephen Rusick, Crockett. Certificate of award and $10 for proposing the use of a torque wrench device for tightening bolts on the Carquinez Bridge.

Henry S. Smith, San Bernardino. Certificate of award and $20 for proposing a revision of Form WH 29 A.

Jesse C. Bringham and *William C. Ensley,* Sacramento. Certificate of commendation for proposing the use of sliding parallel rules for use in mechanical lettering.

Meyer K. Hyman, San Francisco. Certificate of commendation for recommending a revision of the speed zone sheet.

Paul L. Bothner, El Monte. Certificate of commendation for recommending a revision of the resident engineer's and inspector's diary form.

Richard G. Peters, San Francisco. Certificate of commendation for recommending that a space be provided on the quantity sheet for showing cross-section scale.

Mrs. Julia E. Karr, Sacramento. Certificate of commendation for recommending that every page of the *California Highways and Public Works* magazine have the date printed at the bottom for reference purposes.

RECOMMENDATIONS

Continued from page 59 . . .

For highway boosters from all parts of the State to submit their views to the commission individually would require many hours of commission meeting time and of the citizens' time. But the State Chamber of Commerce project recommendation system makes available to the commission in one brief presentation the full force and effect of hundreds of man-hours of careful, regional consideration. And the printed report the state chamber compiles and delivers remains valuable for consideration all through the commission's budget work each August, September and October.

REPORT FROM DISTRICT V

Continued from page 28 . . .

to successful completion this past year, and many more are planned for the future and will be carried forward, we feel sure, in the same atmosphere of agreement and co-operation we have experienced in the past.

New Records Set On S. F. Bay Bridge

A total of 3,255,446 motor vehicles crossed the San Francisco-Oakland Bay Bridge during the month of August, 1958, to set a new monthly traffic record for the structure.

The daily average for August, 105,014 vehicles, was also a new high record.

The previous high month was last June with a traffic total of 3,127,124 vehicles. The daily average for June was 104,237, the previous high.

E. J. Saldine Retirement Marked

E. J. Saldine, industry contact engineer, retired on September 30th after a career of more than 32 years with the Division of Highways.

Born in Great Falls, Montana, in 1897, and educated in the public schools there, Saldine graduated from Montana State College in 1921 with a bachelor of science degree in civil engineering.

E. J. SALDINE

His engineering career began in 1919 while attending college. During summer vacations and after his graduation he worked on irrigation, highway and municipal projects in Montana until he came to California in 1923.

After joining the Division of Highways in Los Angeles in 1924, Saldine successively became assistant resident engineer, resident engineer and assistant office engineer, remaining in the Los Angeles office until 1927 when he launched his own business as a contractor.

In 1928 he returned to the Division of Highways in the Sacramento office and in the succeeding years served in key positions on the Headquarters Office staff.

His headquarters work in earlier years involved federal aid liaison, personnel and division management phases. In 1950 he became assistant operations engineer and in 1956 he was appointed industry contact engineer.

Some of his responsibilities during his years in Headquarters Office have included the handling of contractor prequalification, determination of prevailing wages in the highway industry, supervision of service agreement procedures, and administration of emergency, informal and right-of-way clearance contracts.

More than 21 percent of 1957 United States highway deaths occurred on Saturdays.

GOODWIN J. KNIGHT
Governor of California

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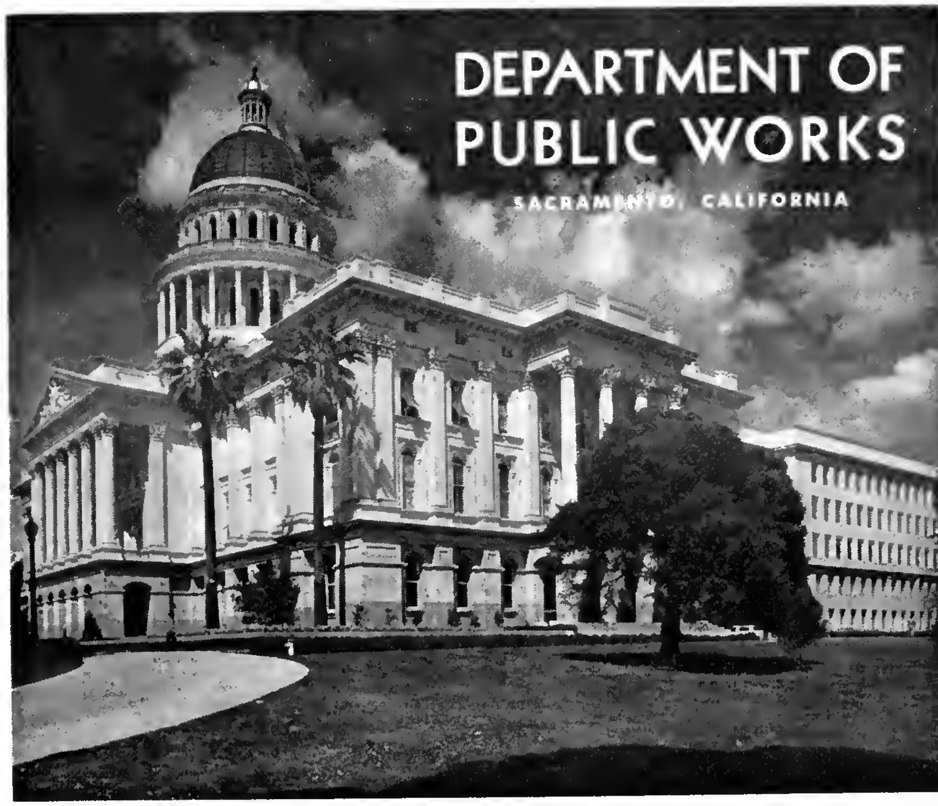

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printed in CALIFORNIA STATE PRINTING OFFICE 80306 9-58 51M

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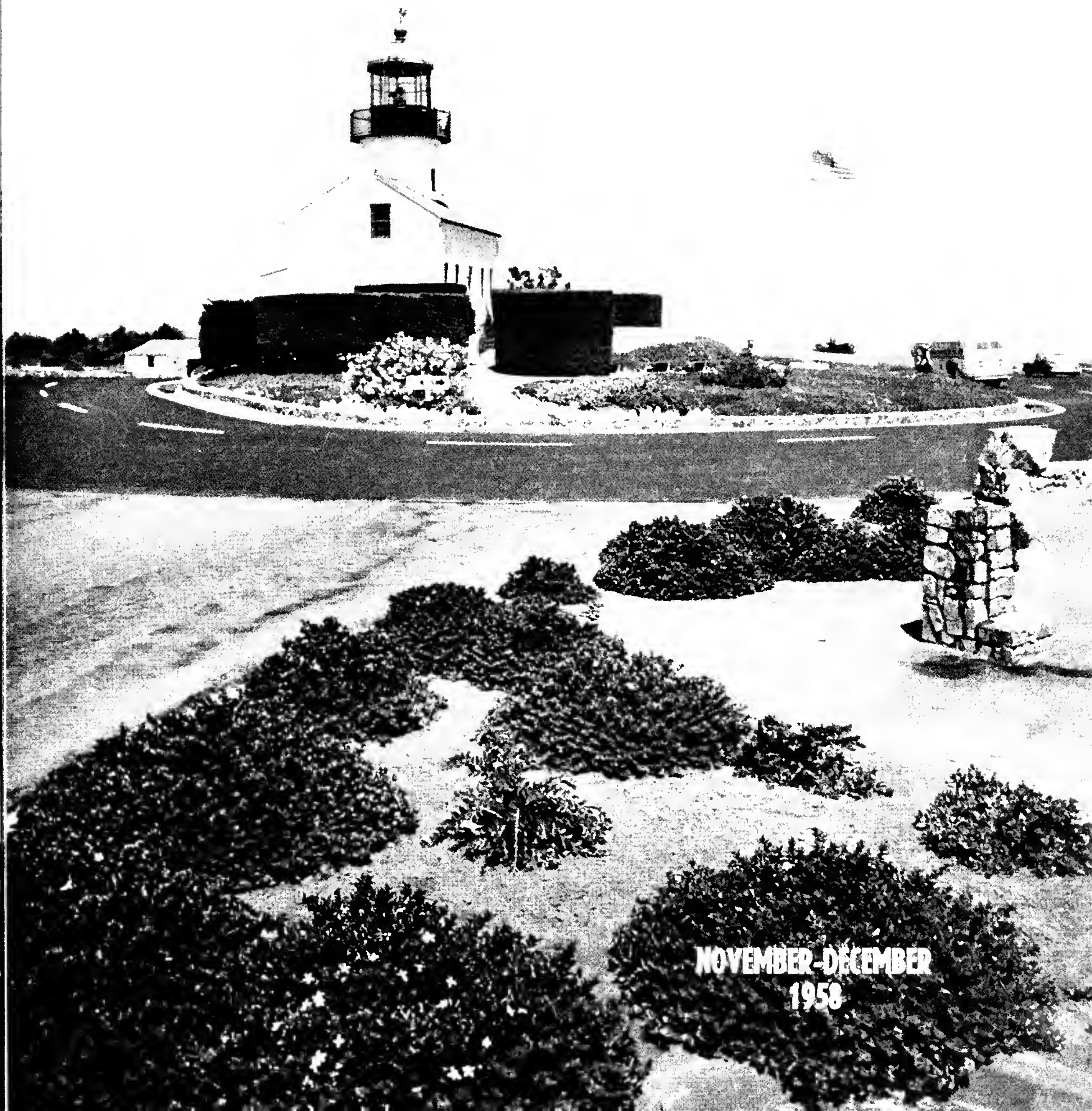

NOVEMBER-DECEMBER
1958

California Highways and Public Works

Official Journal of the Division of Highways, Department of Public Works, State of California

RICHARD WINN, *Editor*
HELEN HALSTED, *Assistant Editor*
STEWART MITCHELL, *Assistant Editor*
MERRITT R. NICKERSON, *Chief Photographer*

Vol. 37 November-December Nos. 11-12

FRONT COVER

Western terminus of US 80 is at this picturesque lighthouse located at the Cabrillo National Monument, Point Loma, San Diego.

—Photo by William R. Chaney

BACK COVER

Grout Bay Public Camp along Sign Route 18 near Big Bear Lake in San Bernardino County is the stopping place for many tourists each year.

—Photo by Robert A. Munroe

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Published in the interest of highway development in California. Editors are invited to use information contained herein and to request prints of any black and white photographs.

Address communications to

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SACRAMENTO 7, CALIFORNIA

State Roads

Talk Before Engineers in England Tells of State Highway Development

By J. W. VICKREY, Deputy State Highway Engineer

Here is the text of a talk by J. W. Vickrey, Deputy State Highway Engineer, which he delivered before the Pavings Development Group of the Cement and Concrete Association of London November 20th.

It presents a comprehensive treatment of the history of highway development in California and a background of the legal and policy considerations which influence the engineering of California highways.

Vickrey's talk to the group was incidental to a vacation trip around the world.

California is a land of superlatives, and our highway problem is no exception. A state on wheels, California ranks second in population among the states, with almost 15 million people. More importantly, California ranks first in motor vehicle registrations, having about one vehicle to every two residents. And these vehicles, 13 percent of which are trucks, now run up the staggering total of almost 70 billion vehicle-miles per year on the 136,000 miles of highways, roads, and streets in the State.

These statistics barely indicate the extent to which the State depends on the motor vehicle for its commerce, industry, agriculture, and even its day-to-day living. Los Angeles is world-famous for its dependence on automotive transport. But the picture is very much the same throughout the State, for even with its large population, the area of California is so extensive and its topography is such that there are vast sparsely populated regions; and these, as well as the populous urban areas and the thriving agricultural districts, must rely on motor transport for their existence. This dependence has been greatly accentuated by the fact that California's great growth has taken place during the automobile age and after the period of railroad expansion in the

J. W. VICKREY

United States, with the result that California, unlike eastern and midwestern states, is without benefit of an extensive network of rail lines. It is fair to say that the sheer force of circumstances has had much to do with California's acknowledged leadership in the development of modern highway facilities.

Road Development

Since our interest here is centered in the modern highway facilities for which the State of California is becoming justly famous, we are led to consider first the development of the system of which these facilities are a part. Responsibility for the establishment of the State Highway System and for the designation of routes in that system resides in the State Legislature. Their action in this matter is most general, consisting of the definition of the termini of each route and possibly a control point or two along the way.

Authority for actual location of a given state highway between termini rests with the California Highway Commission. The commission is empowered to "select, adopt, and determine the location for state highways on routes authorized by law." The function of the commission is to represent the State as a whole, and it is specifically instructed by statute to carry out the declared policy of the Legislature " * * * to provide for advanced planning and continuity of fiscal policy in the construction and improvement of the State Highway System. * * * " The commission is composed of six members chosen for staggered terms by the Governor with the approval of the Senate. The seventh member and ex officio chairman is the Director of the Department of Public Works.

The Department of Public Works is responsible for the actual design and construction of state highways and " * * * is authorized and directed to lay out and construct all state highways between the termini designated by law and on the most direct and practicable locations as determined by the commission." Authority to carry out this work is delegated to the Division of Highways, which is under the direction of the State Highway Engineer, who is appointed by the director but who has civil service status.

Good Roads Movement

Not only the present form of state highway administration but, indeed, the recognition of the interest and responsibility of the State Government in the provision of highways has evolved gradually over the last half-century. In many respects we lagged behind our European colleagues by some 50 years or more. In our early national existence, the states and our National Government participated to a limited extent in the provision of

Public Works Building
Twelfth and N Streets
Sacramento

CONTENTS

highway services. But the issue of states' rights took the National Government out of the scene, and the failure of the turnpike movement, the desire for local autonomy, and finally the coming of railroad transport, caused the states to lose interest in highways. It was not until near the end of the Nineteenth Century that a substantial good roads movement developed throughout the Country and stimulated interest in road improvement.

Reform developed gradually with changing concepts of the highway function and the introduction of improved methods of highway construction. Three general stages through which this renaissance took place were: (1) substitution of money taxes for statute labor; (2) expansion of the taxing and administrative unit; and (3) inauguration of a policy of federal aid to the states.

By 1890, the concept of the general utility of roads was sufficiently advanced to permit state aid for local highways and, as a logical outgrowth, state management of part of the highway network to insure a statewide system. State supervision naturally required definition of that portion of the road plant to be placed under state control and an organization responsible for its administration. A federal policy limiting federal aid funds to those states having adequate state highway departments insured the establishment of such agencies throughout the Country.

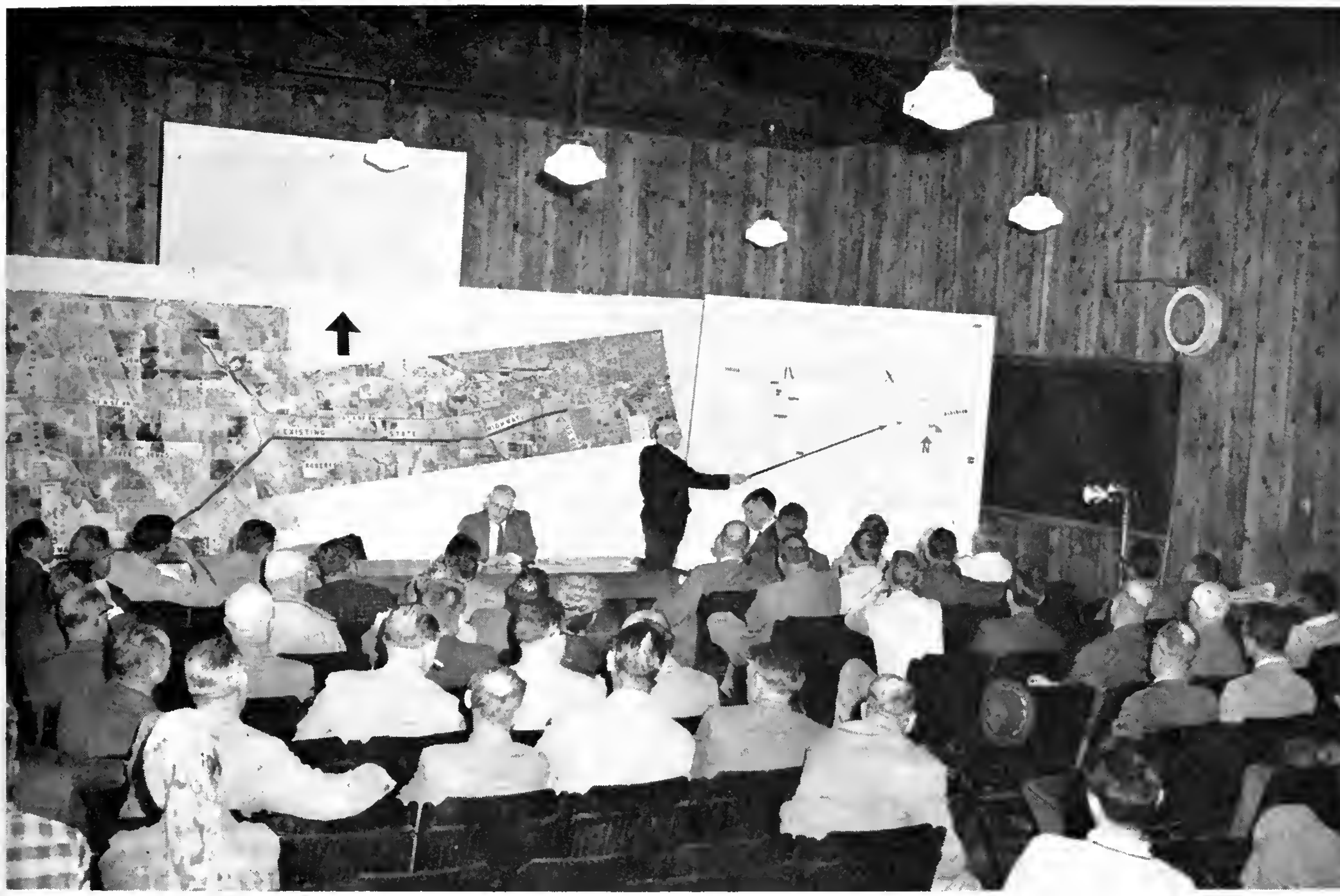
The general principles under which the California State Highway System has developed were laid down by the original Bureau of Highways more than 60 years ago in 1895. These were:

"1. To lay routes out along the lines which the physical features of the State forever fix as the easiest lines of communication.

"2. To traverse the great belts of natural wealth of the State by one or more highways.

"3. To connect all the large centers of population.

"4. To reach each county seat in the State and tie in with the county roads."



" * * Well-publicized public meetings, to which all interested individuals and organizations are invited in order that they may express their views on the engineering studies made by the Division of Highways." Photo shows a typical public meeting, involving a routing discussion in the Stockton area.*

From its inception in 1895 through the adoption by the Legislature of 58 miles of the original Emigrant Trail as a state highway, state highway mileage grew gradually for a number of years. However, the previously modest commitments were substantially increased in 1909 when, in conjunction with a highway bond issue, the mileage of roads under state administration jumped to over 3,300. Subsequent additions, including one of more than 6,000 miles in 1933, have raised the total of authorized routes to 14,314 miles, of which 13,769 miles have been constructed. In addition to the state system, there are over 67,000 miles of county roads, nearly 25,000 miles of city streets and some 30,000 miles of national forest and other public roads, rounding out the total of 136,000 miles.

User Tax Evolves

The same legislative act of 1909 that created the California State Highway System provided for a bond issue of $18 million for construction of the 3,000 miles in this newly designated network. By 1920 an additional $55 million in bonds had been authorized to complete the original system and for the construction of some 2,000 miles which had subsequently been added. The inadequacy of the funds initially provided was attributed to the higher cost of the four-inch concrete pavement which was finally selected instead of the cheaper but inadequate oil and macadam pavements originally contemplated.

Dissatisfaction with the bonding method of financing highways arose soon after passage of the Bond Act of 1919. Realization of the futility of piecemeal financing where the eventual interest costs would more than equal the initial investment; fuller understanding of the magnitude of the highway program and of the enormous cost of maintaining, improving and reconstructing the system already built; a severely limited state tax base and existing heavy demands upon local property, showed clearly the need not only for additional large sums but also, and more important, new sources of revenue.

With recognition that the provision of highways is one of the more important functions of government, ways must still be found to finance their construction and maintenance without placing too great a burden on the general tax base. In the earlier experience in the United States, toll financing of specific highways had been tried and found wanting. But the principle of requiring users to defray the costs of the highway services rendered to them was revived early in the Twentieth Century through the imposition of taxes bearing directly on the ownership and operation of motor vehicles which had no counterpart in the general tax structure.

Motor Fuels Taxed

The first highway-user tax in California was the motor vehicle registration tax adopted in 1905 which, in its inception, was intended purely for regulatory purposes but which has since evolved into an important source of revenue for highways. Now, with a flat fee for all vehicles and a graduated weight tax for commercial vehicles, motor vehicle taxes produce in the neighborhood of $125 million annually in California, more than one-fourth of user tax collections.

But it is difficult to conceive of a successful highway program in any state without heavy reliance on motor fuels taxation. Introduced first in Oregon in 1919, the gasoline tax was adopted by California in 1923 and has become the backbone of the State's highway financing program. Currently, a little over 5 billion gallons of fuel is consumed a year on the State's highways, roads, and streets, with the result that the six-cent tax yields in excess of $300 million, or about 70 percent of user tax collections. The gasoline tax has weathered good times and bad and continues to be one of our notably successful and relatively popular imposts.

Of particular importance to the highway administrator is the reliability and predictability inherent in the motor fuel tax. While the engineer is hard put to predict the amount of traffic on any particular section of road, it is much easier to predict the total vehicle mileage which will be traveled over the entire road plant in the next year or period of years. Thus there is a ready basis for estimation of available funds. Trends in travel and in fuel consumption have proved to be remarkably stable. An additional advantage is that fuel consumption and hence tax revenues for highway needs are roughly correlated since both are directly related to volumes of highway use. It is no wonder that the American highway engineers welcome the dedication of this source of revenue which gives them a firm base upon which to build their future plans.

Urban Highways

Originally, in California, as in the rest of the Nation, state responsibility for and jurisdiction over state routes ended at the limits of cities. In the early days of state highway development such limitations were logical and necessary. Existing city streets were quite adequate for the limited amounts of traffic they were called upon to handle. The real problem at that time was to tie the cities together and to provide the farm-to-market roads so badly needed in rural areas. In order to insure concentration of funds and manpower upon this rural system, state highway department activities were quite naturally restricted to these areas.

Emphasis upon rural highways was evident too in the federal-aid program which, almost from the start, limited the expenditures of federal funds to a selected proportion of interstate and intercounty rural roads. Acknowledgment of the urban transportation problem by the Federal Government did not come until 1941 with the authorization of the use by the states of a small percentage of federal funds in planning urban highway developments. In 1944, specific federal-aid construction funds were set aside for a large-scale co-operative attack by federal, state and local governments upon city traffic problems. Since then, earmarking of federal funds for urban use has continued at an increasing pace. Almost half of all expenditures for the so-called National System of Interstate and Defense Highways will be made in cities.

In California, the development of state interest in urban highways is most clearly illustrated by the evolution of state law regulating the activities of the Division of Highways in cities. It was not until 1925 that the Legislature permitted the division to include in the state system such portions of state highways whose "natural course" ran through municipalities of not over 2,500 people, and then, only upon dedication of the route by the local governing body. A limited program of city-state co-operation was inaugurated in 1931, although the responsibility of the division was severely restricted.

Cities Demand Equity

Beginning in 1933, a dual policy of state participation in urban areas began to emerge. Since 1923, the major source of revenue for state highways had been the motor fuel tax. The cities, particularly the larger ones, with their high volumes of traffic contribute a large proportion of this revenue, and they demanded on grounds of equity that a substantial amount be returned to these urban areas in one way or another. This could be done either through direct apportionment of part of the state gasoline tax to the cities for their use on streets or by direct expenditure by the State on extensions of state highways into cities. Both methods have been and are being used, but with shifting emphasis over the years.

The 1947 legislative act, the so-called "Collier-Burns Highway Act," under which highway expenditures are now made, maintains this dual interest in urban facilities, but the State has assumed full responsibility for the costs of constructing and maintaining state highways in cities. No distinction is made between rural and urban highways within any county insofar as state interest is concerned. While the co-operative program for city streets started in the early thirties has been continued and, in fact, was more than doubled in 1947, the State's program of direct expenditure in cities i[s] of much greater consequence. Califor[nia] has probably gone further than any other state in this direction, and the more impressive freeways fo[r] which we are known are actually state highways in urban areas.

Freeway Idea Grows

The dominant factor in Californi[a] highways today is undoubtedly th[e] freeway. Just as concrete pavement held forth the promise 30 years ag[o] for a measure of structural perma[-] nence, so today the concept of con[-] trolled access provides us with a mean[s] to insure the integrity of the highwa[y] itself and to protect its basic functio[n,] traffic movement, from inevitable de[-] cay by encroachment from adjacen[t] uses. In restricting highway use to on[e] of movement only, we are reaffirmin[g] the fundamental nature of the road i[n] which "the right of the public in [a] highway is an easement of passage onl[y] —a right of passing and repassing." Cer[-] tainly, this reaffirmation is not witho[ut] its dangers, for although the *function* of the road is movement its *purpose* is the welfare of the community and the State. But be this as it may, one cannot lose sight of the fact that a city freeway is three times safer and will carry three times as much traffic as a non-access-controlled city boulevard.

Under common law, an abutting owner had right of access at any point at which his land adjoined the highway, largely because he or his predecessors had designated that portion of land for highway use and even helped build the road by personal services or tax payments.

The California Freeway Law was enacted in 1939, permitting the Highway Commission to designate state highway routes as freeways and to limit access to routes so designated. Under this new freeway law legal interpretations of inherent access rights had to be adjudicated in costly court proceedings. The principal cases involved claims of decreased property values by restriction or proximity of the freeway, impairment of access or view, cul-de-sac creation, circuity of travel, and diversion of traffic from places of business. The freeway, then, s a legal concept and may apply to iny state route regardless of its design characteristics. Thus a freeway may e a two-lane rural highway with access permitted at a relatively large number of points and with side roads ntersecting at grade; or it may be an ight-lane divided highway with access and turns permitted only at a imited number of grade-separated inerchanges. In urban areas, where our najor highway needs are to be found, he vast majority of our new construcion projects are either full freeways vith complete control of access and urning movements, or expressways ermitting a limited number of interections at grade but so designed as to acilitate conversion to full freeway andards when traffic so requires and nances permit.

The extensive program of freeway onstruction upon which California as embarked has resulted in an impressive record of accomplishment. 'o date, over 4,000 miles of freeway outes have been adopted, more than)0 miles of freeways have been con-

" * * The State has assumed full responsibility for the costs of constructing and maintaining state highways in cities * * * California has probably gone further than any other state in this direction, and the more impressive freeways for which we are known are actually state highways in urban areas." UPPER—Aerial view along Blackstone Avenue in Fresno (State Sign Route 41), a major city arterial recently widened by the State. LOWER—Typical state-built freeway development, in San Francisco.*

structed, and in excess of 800 miles of expressways completed. Equally as important, we are developing in California a concept of the role of the freeway in our total transportation structure and are learning more about how these facilities relate to the vast urban complexes which have become the dominant environmental form in our western civilization.

Local Viewpoints Sought

Like the railroad and the streetcar before it, the freeway is shaping our cities and bringing profound change throughout the State. In rural areas we find little country crossroad towns expanding into small cities, and in our metropolitan complexes industrial development and suburban growth gather about the freeways like filings about a magnet. We are no longer merely building roads (although these new facilities have become the backbone of our urban transportation system); we are building the future, for the facilities which we are providing today will in large measure set the pattern of urban development tomorrow.

Aware of this grave responsibility, the California Division of Highways has endeavored to determine the wishes of the communities through which freeway routes are proposed and has strived to maintain a balance between these local interests and the statewide responsibility with which the commission is charged. On the staff level, close liaison is sought with local planning and engineering bodies from the inception of a project. Early in the process, public meetings are held by the Division of Highways to acquaint those interested with the tentative proposals and to gather information from local people which can be used in a final selection of a freeway route. Finally, if it is so desired by the community, the Highway Commission holds one or more public hearings before a decision as to the route location is made. Actual construction of the facility cannot proceed prior to the negotiation of a "freeway agreement" between the community and the division, setting forth the manner in which local traffic and street closures occasioned by the freeway are to be handled.

These considerations of "community values," as they are now called, have recently been written into the law and it is our hope that the localities will take full advantage of its provisions. For it has been our experience that freeway location is expedited and the most satisfactory results obtained in those cities which have long-range master or general plans and have a good idea as to the transportation network which they hope to develop. As the law makes clear, it is up to the communities, not the State, to determine "community values." It is the State's job to provide state highways.

Public Supports Program

I will discuss some of the technical problems of getting the job done—planning, design, right-of-way acquisition, construction, and operation of the freeways. Before doing so, however, I should like to state some of the basic ingredients of the success of our program which may not be immediately evident from a recitation of our laws and practices.

1. Our system of highway financing, while not always adequate to our increasing needs and rising costs, has given us an assured and steady source of income with which we could plan for the future.
2. The State Legislature has delegated to the Highway Commission and to the highway engineers sufficient freedom and flexibility in the budgeting of funds and the precise location of freeways, as well as the more technical details of design and construction, so that an orderly program of highway modernization can be carried out.

But these things are not accidental. Fortunately, and perhaps naturally, in a state so dependent on highway transport, our Legislature has taken a keen interest in major highway policy issues and has provided for continuing studies of highway problems, studies in which in the department have been most happy to co-operate. At the same time, we have enjoyed the lasting support of many civic groups who have an active interest in the political and economic destinies of the State. We like to think that we have earned this support because we have delivered a satisfactory product. Therefore, I will turn to the technical aspects of producing freeways.

Importance of Planning

The backbone of the engineering phases of highway work such as planning, design, acquisition of rights-of-way, and construction, is the advance planning program. A planning program is simply a time schedule listing specific projects and setting forth the year that construction is planned to begin and the prior year or years over which the necessary rights-of-way are to be acquired. The funds required during each fiscal year for right-of-way and construction are shown.

The importance of a planning program becomes apparent when it is considered that many major freeway projects require a minimum of four to five years from the inception of the project to the date of construction. In some cases it takes a minimum of two years before a freeway can be properly located and design work sufficiently advanced to acquire rights-of-way, and several more years before rights-of-way can be cleared to the point where construction can begin. This is particularly true in metropolitan areas. It cannot be overemphasized that a planning program is essential if engineering work is to be used to the best advantage, construction schedules are to be met, and the segments of the completed freeways are to fall in their proper place.

The most important single factor in the preparation of a planning program is the assurance, within reasonable limits, that specific funds will be available annually. We are fortunate in California, as we have already stated, that a progressive Legislature, by statutory action, has provided that assurance. The second important factor is the comprehensive knowledge of relative conditions along the highway system. This factor is assured by means of a continuing record of traffic volumes, accident incidence, and maintenance costs for the entire highway system, as well as the intimate first hand knowledge of the highway engineers.

"* * * Thus, a freeway may be a two-lane rural highway with access permitted at a relatively large number of points and with side roads intersecting at grade; or it may be an eight-lane divided highway with access and turns permitted only at a limited number of grade-separated interchanges." UPPER—Aerial view of US 50 in the foothills west of Placerville, showing initial two lanes of future four-lane freeway. LOWER—The Harbor Freeway in downtown Los Angeles.

Project Report Described

Each specific project in the planning program is the subject of a project report. A project report is essentially an engineering report that answers two basic questions: (1) What is wrong with the existing highway? and (2) What is the best and most practical solution to this highway problem? The data in the report are sufficient to establish the necessity, priority, and estimated cost of the proposed future improvement. It also establishes certain major basic features or controls upon which the detailed design will be based. In the case of a freeway, the project report establishes the following:

1. Justification of the project and its priority.
2. Location of the freeway.
3. Basic geometric features, such as design classification, number of lanes, and median width.
4. Location of separation structures and interchange facilities.
5. Estimated cost of right-of-way and construction.

Of these items, the manner of determining a freeway location may be of particular interest. There are three major factors that are considered in establishing the proper routing of a freeway:

1. Cost of right-of-way and construction.
2. Service to traffic that the freeway location will render.
3. Impact of the proposed freeway location on the area through which it passes.

The first two factors are determined through the use of well-established engineering methods. The relative impact that alternate freeway routes may have on an area is difficult to measure in terms that can be directly compared to the cost of the freeway or to traffic service. This is a fertile field for future research, and we have conducted and still are conducting studies in connection with this phase of the whole problem. A measure of the relative effect of alternate freeway locations on an area is obtained through consultation with local technical and planning staffs; through the use of any master plans available;

and through the medium of well-publicized public meetings, previously referred to, to which all interested individuals and organizations are invited in order that they may express their views on the engineering studies made by the Division of Highways. We, as highway engineers, are at times reluctant to allow what may be a nebulous area-impact factor to offset the advantages that a particular freeway location may offer in terms of cost and traffic service; we do recognize, however, that alternate freeway locations will have varying degrees of immediate and long-range impact on a community and that this must be given proper weight in arriving at a conclusion.

After the freeway route has been determined, the locations of interchange and separation structures established, and the basic geometric features set, the project is theoretically advanced to the design stage. Actually, design work in varying degrees has already gone into the determination of all of the features just enumerated.

Design Ideas Change

Design procedures during the past several years have gradually changed from that of providing the most economical roadway—usually governed by terrain, with intersections at grade practically unlimited—to the point where the interchange design is the controlling factor. In present freeway design, particularly in metropolitan areas, the primary design problem is the interchange, and the roadway or freeway connection between interchanges becomes a relatively simple matter. The relative importance of design features has been completely reversed, in that in the highway design of a few years ago the main roadway was of greatest importance and the intersections were incidental.

The design and plans of a highway only a few years ago were relatively simple, and considerable change could readily be made during construction without much concern as to the effect that the change would have on the finished project. In present complicated freeway designs involving interchanges, there are a multitude of ramps, grade separation structures, and drainage structures that are all interrelated, and any change in the location, elevation, or alignment of any portion would have a serious effect on the entire interchange design. Because of this interrelationship and the rigid controls of meeting highly developed city street areas, drainage and other controls, metropolitan freeway design must be detailed and exact and, once the design has been determined, modification of that design can be undertaken only after careful and complete analysis. It was not too long ago that bridges were a relatively minor part of highway construction. Present freeways, requiring bridges not only to cross waterways but also for separation and interchange facilities, as well as for viaducts to reduce right-of-way costs, have placed an increasingly important portion of the necessary design work on bridges.

Photogrammetry Used

In order to meet the expanded highway program that occurred in California at a time when skilled engineering personnel was scarce, it was essential that the lengthy and tedious design processes be streamlined and that the maximum possible use be made of laborsaving devices. This circumstance has led us to the early use of photogrammetric methods to accomplish work that was previously done by field survey parties. Aerial photogrammetry, properly controlled, provides accurate detailed data at relatively low cost and with a minimum expenditure of time and manpower. All aerial photogrammetry in California is done on a competitive bid basis by contractors specializing in this type of work.

The fairly recent development of electronic computers has relieved our engineers of a large portion of the tremendous mass of calculations required in the detailed planning of freeways. We presently have two fair-sized electronic computers that are on an almost full-time basis. Although these and other manpower-saving devices have reduced the time and cost of highway engineering work, probably the most significant result is that trained engineering personnel are being relieved from nontechnical duties and their professional training can be directed towards more important tasks.

Plan and design methods are reviewed periodically, unnecessary processes are eliminated, and design procedures are streamlined. Manuals of design have been prepared and are constantly being revised to reflect improved design standards. Establishment of standards and their incorporation in manual form is one of the basic necessities for the large highway program in California. The use of models, if not indispensable, has at least been of great help in complicated interchange designs, permitting the engineer to clearly visualize what the end product will be. Models can also be of considerable value in showing the interested public the type of highway facility that is planned for construction.

Right-of-Way Acquisition

Within the organization of the California Division of Highways there is a Right-of-Way Department properly staffed to carry out all necessary functions in connection with right-of-way work. After design has progressed sufficiently to determine the right-of-way requirements, the necessary data and information are turned over to the Right-of-Way Department. Each individual piece of property becomes the subject of an appraisal prepared by qualified appraisers. This appraisal establishes the fair market value of the property and forms the basis of negotiations with the property owner. The property owner is offered, initially, the appraised value, no more and no less. No attempt is made to barter on the price to be paid for the property. Changes in the appraised value are made only upon presentation of substantiating evidence. If no agreement can be reached on the fair value of the property to be acquired, then, as a last resort, the matter is brought into court. The effectiveness of this method of right-of-way acquisition may be tested by the fact that only from 2 to 3 percent of right-of-way transactions are processed through eminent domain proceedings.

In 1952, the California Legislature established a revolving fund of $30 million for the advance purchase of proposed highway right-of-way when such right-of-way was in danger of

. . . Continued on page 54

New Director

T. F. Bagshaw Appointed; C. M. Gilliss Goes to L. A.

T. F. BAGSHAW, state public works executive for five years and a city or county official for more than three decades, became Director of the State Department of Public Works and Chairman of the California Highway Commission November 10th.

The assistant director of the department was appointed by Governor Goodwin J. Knight to succeed C. M. Gilliss, who resigned to become Los Angeles County Road Commissioner.

Bagshaw, a veteran public administrator and business executive, also was named to the California Toll Bridge Authority, State Public Works Board, State Allocation Board and numerous other state boards, commissions and councils.

He first became associated with the Department of Public Works and the Highway Commission May 1, 1953, when he was named special assistant to the director. His appointment as assistant director was made in January, 1957. One of Bagshaw's first official acts as director was to appoint John Stanford, management analyst for the department for the past 2½ years, to be the new assistant director of the department. (See page 51 for details about the new assistant director.)

Bagshaw was chairman of the Board of Supervisors of Marin County for the 14 years prior to his initial state appointment.

He was engaged in the import business in San Francisco for many years and after World War II, owned and published the *Marin Journal* in San Rafael.

Bagshaw is a former Mayor of Mill Valley and former director of the Golden Gate Bridge and Highway District. He has been active in the California State Chamber of Commerce, State Supervisors Association, and Redwood Empire Association.

He has served in one or another city, county or state public post ever since he was 21, when he became a member of the Mill Valley City Planning Commission.

He is married and has one daughter and two grandchildren.

Gilliss had been a highway and public works administrator for 11 years, and had been an official of the State Department of Public Works for six years, before he resigned to accept the Los Angeles County Board of Supervisors' appointment as Road Commissioner.

C. M. GILLISS (upper); T. F. BAGSHAW (lower)

In his letter of resignation, Gilliss wrote the Governor:

"I could not refuse the challenging opportunity to reorganize and direct the affairs of the road department of the most populous county in the United States, a county with a larger budget than three-fourths of our states."

Gilliss said "it has been a gratifying experience to work together with the men and women of the Department of Public Works, so many of whom are giving a lot more to public service than is required by the civil service rules."

Gilliss was deputy director of the department when Governor Knight promoted him to director January 1, 1958. He had been an official in the department since 1952, except for a period of nearly a year when he was Legislative Secretary on the Governor's staff.

He went into state service from Riverside County, where he had been assistant road commissioner and highways administrator. In his earlier private business career, he was an accountant, engineer and engineering instructor.

Sections of Freeway Opened on 3 Routes

Newly constructed freeway sections on three of California's most important highway routes were opened to traffic November 24th and 25th.

A 10-mile section of State Sign Route 17 (Nimitz Freeway) between Warm Springs and Beard Road south of Alvarado in Alameda County was opened on the twenty-fourth.

On the twenty-fifth, the parallel Carquinez Bridge and freeway approaches on U. S. Highway 40 south of Vallejo were placed in operation, as was the five-mile Paso Robles Bypass on U. S. Highway 101 in San Luis Obispo County.

Clarence Bovey Retires; M. H. West Appointed

Clarence E. Bovey, Engineer of City and Co-operative Projects, retired on October 31st after more than 44 years of continuous service with the California Division of Highways.

CLARENCE E. BOVEY

Melbourne H. West, who has been assistant planning survey engineer of the division, has been appointed by State Highway Engineer G. T. McCoy as Bovey's successor.

As engineer of city and co-operative projects for the past 5½ years, Bovey was responsible for administering and supervising the apportionment and expenditure of the five-eighth cent per gallon gasoline tax which goes to California's 352 incorporated cities, amounting to about $32,000,000 in the current fiscal year.

M. H. WEST

Bovey's career in state service was the longest of any Division of Highways employee. Most of his service prior to becoming city and co-operative projects engineer was in District X, with headquarters at Stockton.

He was born in Grass Valley and educated in that area and in Sacramento. His first engineering work was on construction of the Sacramento-Walnut Grove branch of the Southern Pacific Railroad. Later he served as chief of the survey party on levee reconstruction.

He joined the Division of Highways in March, 1914, as an engineering draftsman in the Sacramento office, later working as resident engineer on construction projects and then as highway maintenance superintendent.

In 1926 he was appointed maintenance engineer for District X and served in that capacity until 1947, when he was promoted to assistant district engineer in charge of administration. He held that post until his promotion and transfer to Sacramento headquarters office in 1953.

Bovey's work with California cities in connection with expenditure of their share of gasoline tax funds for construction and maintenance of streets not on the State Highway System carried him to every corner of the State and made him widely known among city officials.

He has been active in Methodist church and Masonic lodge circles for many years. In addition to these organizations, he is a member of the Y. M. C. A. in Sacramento, the Commonwealth Club of California and of the American Public Works Association.

Friends and colleagues held a dinner in Bovey's honor at the Elks Club in Sacramento on Friday, November 7th.

West, who will assume Bovey's duties on October 31st, has also been working closely with California city officials, along with those of the various counties, especially during the past three years in connection with statewide studies of street, road and highway needs for reports to the Federal Government and the State Legislature. His most recent assignment has been the co-ordination of studies for the California Freeway System report which was submitted to the Legislature on September 3, 1958. He is currently representing the Division of Highways at regional hearings on this report which are being conducted by the Joint Interim Committee on Highway Problems.

West was born in Illinois, but grew up in Fresno and attended high school there. He was graduated from the University of California in 1928, and immediately began his career with the Division of Highways as a chairman on location surveys in the Fresno district. He worked on highway design and construction in various capacities for the next 12 years, most of them spent in the San Diego district.

His engineering career was interrupted by World War II, beginning in 1940, when he entered active duty as a captain in the Coast Artillery Corps. He was released from active duty in 1945 after service both in the C. A. C. and the General Staff Corps, most of it in the Hawaiian Islands.

Returning to the San Diego district in 1946, West specialized in traffic engineering. He was district traffic engineer from 1948 until his promotion and transfer to the planning survey post in 1955.

West is a member of the Institute of Traffic Engineers and a graduate of the Yale University Bureau of Highway Traffic. He is also an associate member of the Highway Research Board, National Academy of Sciences.

C. E. Waite Heads Streets Conference

C. E. Waite, Deputy State Highway Engineer, will serve as general chairman of the Eleventh California Street and Highway Conference which will be held at Berkeley from January 28th to 30th.

C. E. WAITE

The conference is held annually by the Institute of Transportation and Traffic Engineering of the University of California. It is designed for road officials from all governmental levels and for representatives of public and private organizations interested in highway problems.

The 1959 meeting will present an expanded program to cover the many local problems growing out of stepped-up construction schedules and the phenomenal growth of population and traffic throughout California. The program will include a series of small-group meetings where problems can be presented and discussed by conferees.

More than 500 representatives are expected to attend. The conference has become a principal forum for the discussion of matters ranging from broad plans and policies to specific problems and innovations in engineering, construction and maintenance techniques.

Report From District VIII

By CLYDE V. KANE, District Engineer

THE PROGRESS of freeway development in District VIII is being carried on in extremely diverse areas. In this district, there are 583 miles of routes which have been declared freeways by the California Highway Commission. The San Bernardino and Riverside Freeways embody urban metropolitan construction of the most complex type. On the other hand, virtually trackless desert wastes are crossed by current construction of the new US 66-91 between Victorville and Barstow, which may be opened to traffic by Christmas this year. Another extreme is typified by work now under way on the extension of the State Sign Route 30 freeway from Big Bear Lake to Barton Flats, with a summit elevation of over 8,400 feet at the head of the Santa Ana River watershed. Greatly improved access to the recreational resources and facilities in the San Bernardino National Forest will be provided by this project.

PHOTO AT TOP OF PAGE—Northern end of the new Victorville-Barstow Freeway under construction. The City of Barstow is in the distance.

In general, District VIII can be classified into three areas—the metropolitan area, the mountain area, and the desert area. Two prominent passes, familiar to many travelers, connect the metropolitan area with the desert hinterland. Cajon Pass carries US Routes 66, 91, and 395 over a 4,300-foot summit between San Bernardino and Victorville. San Gorgonio Pass carries US Routes 60, 70, and 99 over the 2,600-foot summit in Beaumont.

San Bernardina Freeway

The route officially designated as the San Bernardino Freeway extends eastward from near the Los Angeles Civic Center via US 70-99 to a junction with the Riverside Freeway just east of Colton. From this junction, the San Bernardino Freeway turns north via US 91-395 and terminates at State Sign Route 30 (Highland Avenue) in the northerly part of the City of San Bernardino. North of State Route 30, this freeway has not been officially named.

The final contract on construction of this freeway, a two-mile section in the City of San Bernardino from US 66 to State Route 30, is now under way, with completion estimated in the fall of 1959. Three contracts which will eliminate the remaining six initial stage at-grade intersections on this freeway in the Fontana and Rialto areas, have recently been advertised for bids. Completion of these grade separations and ramps is also estimated for the fall of 1959.

Construction of the 30 miles of the San Bernardino Freeway in this district beginning at the Los Angeles county line has cost a total of $24.8 million to date, including purchase of right-of-way. Additional costs which will be involved in the remaining work now under way to complete it are estimated at $7.3 million.

Riverside Freeway

Two projects which carry the Riverside Freeway (US 91 and State Route 18) through the City of Riverside have been completed. Work is now under way on a 5.6-mile section extending southward from the present terminus at Arlington Avenue to Van

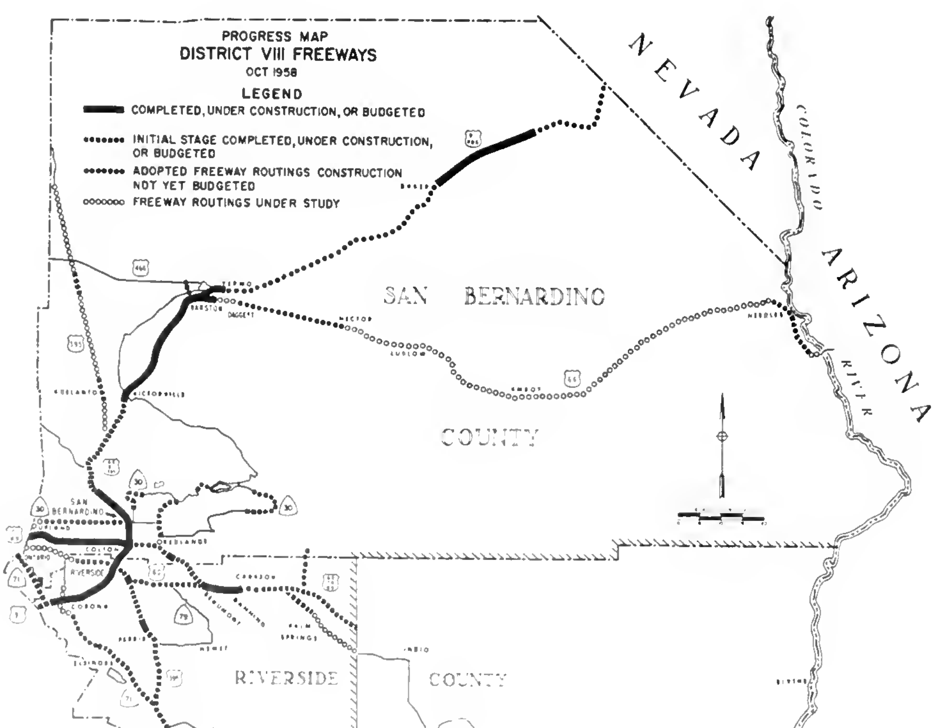
The three-level Colton interchange connects US 70-99 with US 91-395. Lowest level is US 70-99 westbound toward Los Angeles.

Buren Boulevard. This is a $2.2 million job expected to be completed by Winston Bros., Contractors, about March, 1959. Another 3.4-mile section continuing southwestward from Van Buren Boulevard to Pierce Street is expected to be advertised for bids in the near future. Plans for extension of the Riverside Freeway from Pierce Street southwesterly through Corona to the junction with State Sign Route 71 near the Prado Dam are virtually complete and right-of-way is being purchased at the present time throughout this section. Funds are provided in the new 1959-60 budget for construction of this final link.

North of Spruce Street in Riverside, the freeway joins a two-mile section of first stage construction (expressway) which was built along La Cadena Drive in 1950. This will be converted to full freeway standards by construction of grade separations and connecting ramps at Columbia Street and a
Center Street. These projects are now
in the design stage.

At present, the Riverside Freeway
is joined by US 395 north of Cente
Street. It then veers on new locatio
to the east of the former rout
through Colton. This portion is unde
construction by Yeager-Altfillisch
Lowe and Watson and is expected t
be completed by November, 1959, a
a cost of about $3.8 million. It wil
join the San Bernardino Freeway a
the Colton Interchange.

A total of $16.1 million has bee
expended for construction and right
of-way on this freeway to date, wit
an additional $16.6 million estimate
for the cost of work now under con
struction or budgeted for construc
tion.



Escondido Freeway

The Escondido Freeway in Distric
VIII begins at a junction with th
Riverside Freeway in the City of Riv
erside and extends via US 60 east an
then via US 395 south to the San Dieg
county line. About 16 miles of th
freeway have been constructed to th
initial expressway stage over the Bo
Springs Grade east of the Universit
of California at Riverside and sout
ward to Nuevo Road, south of Marc
Air Force Base. A military acce
road project completed in 1956 pr
vided a grade-separated interchang
of the freeway and Graham Avenu

the main entrance to March Field. The Perris Bypass, a 4.7-mile section to full four-lane divided freeway standards, was completed in 1953 between Nuevo Road and State Route 74. A landscaping contract is now under way on this section in co-operation with the City of Perris. Plans are completed for extending this full freeway 1.3 miles to the south and the right-of-way acquisition is completed.

The portion of the Escondido Freeway from the Riverside Freeway east to the University of California, a length of about five miles, is currently in the design stage as a full freeway and the right-of-way is about 90 percent purchased.

All of the remaining portions of this freeway are in various stages of design.

A total of $4,000,000 has been expended to date for construction and right-of-way on the Escondido Freeway.

Corona Freeway

The Corona Freeway was officially iamed by the California Highway Commission on July 23, 1958. It extends along State Sign Route 71 between the Los Angeles county line nd the Escondido Freeway. The route n District VIII has been adopted in everal segments beginning in 1947. At present, the only portion for which he general route has not been adopted

The new Riverside Freeway (US 91-Sign Route 18) passes through the downtown area

The Corona Freeway (Sign Route 71) crosses over Main Street in Elsinore

UPPER This aerial view of the three-level Colton interchange shows the Riverside Freeway (both roadways right foreground) joining the San Bernardino Fr way, which crosses from left to right. LOWER Eighth Street in Colton passes (back to front) under the San Bernardino Freeway, Ninth Street off-ramp c the Southern Pacific tracks (immediate foreground).

UPPER—The State Street interchange on US 66-91-395 under construction near the north entrance to San Bernardino from Cajon Pass. LOWER—An aerial taken over Barstow showing the construction on the northern end of the Victorville-Barstow Freeway in the distance.

by the California Highway Commission is from the south city limits of Corona to the Riverside Freeway.

Initial stage construction from the San Diego county line to Temecula was completed in 1951. From Temecula to Elsinore construction completed in 1956 provides a combination of full and partial freeway standards which will be brought to full freeway standards as needs develop. Similar construction was completed in May, 1958, on a 9.2-mile section from Elsinore to Alberhill. Design work is under way for the section between Alberhill and Corona.

Initial stage construction from the Riverside Freeway just west of Corona to Pine Avenue, south of Chino, was completed in 1950. A 5.3-mile project has just been started by J. A. Payton, contractor, in the vicinity of Chino. Work was recently completed on a project bringing this freeway from Los Angeles County to a point just south of the county line.

A total of $5.5 million has been expended for construction and right-of-way on the Corona Freeway, with an additional $1.2 million estimated for current construction and right-of-way acquisition.

Interstate Routes

In addition to named freeways, a great deal of other freeway development is being carried forward in District VIII, particularly on the interstate routes.

There are about 442 miles of interstate routes in District VIII, representing a little more than 20 percent of the total interstate mileage in California.

US 70-99

US 70-99 east of the Colton Interchange is under design as an ultimate eight-lane interstate freeway through the Redlands area. The route was adopted by the California Highway Commission on July 24, 1957. Right-of-way is now being purchased in this area, and plans being prepared for the 9.5 miles between the Riverside Freeway and Reservoir Canyon in Redlands.

The portion from Redlands to Yucaipa Boulevard is under design for

. . . Continued on page 47

Looking northward toward Cajon Pass from the Highland Avenue (Sign Route 30) separation showing construction of the new US 66-91-395 freeway. LOWER—At present, the southern terminus of the Riverside Freeway is at Arlington Avenue in Riverside; however, construction is under way for another five and one-half miles south.

Why Freeways?

Resigned Department Head Tells Views in Two Talks

By C. M. GILLISS, ex-State Director of Public Works

Two broad, general discussions of California's highway program were given by C. M. Gilliss in late September, a few weeks before he resigned as State Director of Public Works and Chairman of the California Highway Commission to become Road Commissioner of Los Angeles County.

Reproduced below is the text of one of these presentations, the talk he made before the annual joint meeting of the Supervisors' Association of California and the County Engineers' Association at Fresno September 26th. Excerpts from the other discussion are on the next page.

It has been my pleasure and advantage to attend your conventions for more than 10 years, and I have witnessed your eager and earnest efforts to exchange ideas, learn new procedures, and improve the old, so that you may go home and render a greater service to your people.

And through that association, I have also learned that nowhere are the people so directly represented as by their county supervisor. At this level, democracy really is at work.

I firmly believe that the pre-eminence in highways that California enjoys is a result of a job of work which all of us have done together in partnership.

I remember well that you, as county supervisors, deferred consideration of your own critical road needs in order that the more critical main-line system of state highways could be taken care of.

Perpetual Crisis

Yes, we have really been partners. But, why should we invest so much of our capital and energy in a highway system? We do it because ever since California became a state we have faced a perpetual transportation crisis—the population has doubled every 20 years. This continued increase is our greatest asset, but it is also the crux of our vexing highway problem.

Our State grew up after the era of railroad building. One-third of our towns have no railroads.

Eighty-five percent of the people who travel from city to city travel on rubber tires. Eighty-nine percent of all food and farm products reach their first markets by truck. Industry would be crippled without truck transportation. In this traffic jam caused by inadequate roads, there are people and goods urgently needed at their destinations.

Because of all the natural advantages California offers, enough people come each month to stay to establish a brandnew city the size of Reno, Nevada; Biloxi, Mississippi, or Independence, Missouri. And, they bring with them wealth of many kinds. They bring skills and knowledge. They bring private capital for investment. More important, they are, in themselves, a new and ready market for new homes, insurance, automobiles, merchandise and goods of all kinds. This continued healthy growth is one of the principal keys to California's continuing prosperity. It is, therefore, not difficult to recognize the need in California to have good roads for communication for moving people and goods.

Roadside Encroachment

But, why freeways? Why shut the people off from a commercial connection to the roads for which they have paid? Why deny the development of free enterprise on the roadside to serve the traveler? In the past, we have built perfectly good four-lane highways for traffic facilities only to have them become market places and parking places, because stores, motels, service stations, and other business are naturally attracted to the steady stream of potential customers. The resulting conflict of traffic destroys your investment in the road as a mover of people and goods. The conflict of traffic breeds property destruction, injury, and loss of life.

The record clearly shows that one freeway lane carries three times as much traffic as one lane of conventional city street. And, even at higher speeds, is three times safer to travel. Here is another point to ponder—this may be frightening to contemplate, but in our present and future highway program many of our major roads will be located and built for the very last time, because space is running out. In building these major facilities, we cannot make the same mistakes, we cannot afford to jeopardize the investment in the space required by permitting the highway safety and capacity to be undercut by miscellaneous developments along the roadside.

Now on a related subject—I have heard the complaint in your own meetings that highway right-of-way is robbing the county of much-needed tax base—that this fever of building superhighways all over the State is gobbling up the land—eating up the very properties they were intended to serve. But, you and I have seen an amazing thing happen within the last 10 years in California.

Land Values Increased

Where the highway is a freeway with limited access, factories and housing developments, subdivisions and shopping centers, are established farther from the city in distance, yet closer to the city in time. Freeways increase land values over an ever-widening area of countryside.

The State paid $500 an acre for right-of-way for the Eastshore Freeway near Oakland. Land next to that freeway is selling today for $26,000 an acre, 50 times the 1941 price.

The State paid 50 cents a square foot in West Covina two years ago. Three months later, the owner sold the May Company the rest of his property at $1.20 per square foot. Freeway plans more than doubled the value in 12 weeks.

Land price multiplication of 5 or 10 times as a result of freeway completion is common. On US 40 just north of Sacramento, the value per acre jumped from $2,000 in 1952 to $10,500 in 1955. Along the Eastshore Freeway near the new Ford plant, the increase was from $1,200 in 1951 to $5,400 in 1956. Seven miles southeast of downtown Los Angeles on the Santa Ana Freeway, the value of an acre of land jumped from $7,500 in 1948 to $65,000 in 1956.

I believe if we are fair, we will admit that this is what is happening all over in California. That there is a temporary minor shock to the assessment rolls, we cannot deny, but, unlike some other public investments, within 5 to 10 years, freeway valuations are returned to the rolls with interest.

Freeways Are Good Investment

We need to learn that instead of costing money, a good highway makes money. It generates enough revenue to pay for itself. More than that, it actually adds to our wealth by increasing land value, lowering car operating costs, reducing accidents, saving lives, and saving time. Our economists can convince even the skeptics that properly built highways, properly located, are a capital investment like a factory, farm or any other wealth-producing facility.

The Arroyo Seco in Pasadena, California, our first and pioneer freeway, earns an income of over 12 percent.

Earnings for the Los Angeles freeway system, which interchanges at the famous four-level structure, are estimated from 12 percent to more than 30 percent per year. Estimates which consider only vehicle savings begin at 12 percent. Those which would capitalize accident, operating, and time saving would pay off the Los Angeles freeway system in three years.[1]

Speaking still of assessed valuation, one other feature of the freeway should

. . . Continued on page 51

[1] Hugo Winter ASCE. Proceedings of the ASCE, *Journal of the Highway Division*, January, 1956, Volume 82, pages 874-10. Automobile Club Southern California. "An Appraisal of Freeways v. Surface Streets in Los Angeles Metropolitan Areas," 1954.

"Let's Take a Trip," Director Advises

Here are excerpts from a talk which C. M. Gilliss, then State Director of Public Works and Chairman of the California Highway Commission, gave before the 56th annual conference of the State Association of County Assessors of California at Santa Rosa September 29th. See the previous page for the beginning of the text of another general discussion he gave on the California highway program in late September.

I have heard the complaint in your own meetings that highway right-of-way is robbing the county of much-needed tax base.

I want to invite you all to take a trip with me—a trip in imagination. Let's begin our make-believe by forgetting we're at this conference and pretending I meet you in your office in the courthouse.

Walk across the park with me, will you, while I go into the post office for just a minute? My car's right around the corner; we'll get in and drive out Main Street by the city hall. That's the old grade school. The new one is going up on that 17 acres where the packinghouse used to be.

Now on out past the county fairground, and a little piece further. There's a turn here I don't want to miss. It's just before you get to the junior college. Here it is. This county road is a pretty drive and takes us by the veterans hospital and over to the state highway.

Guess I'm driving a little too fast. I wasn't really trying to catch up with those bombers up there—looks like they just took off a few minutes ago from the air base.

Well, we're back in Santa Rosa, back at the assessors' conference. It certainly didn't take long over the freeway.

Did you enjoy the trip? Were you comfortable while I let my imagination play? We went by a number of familiar spots, and along familiar streets. You all seemed pretty much at ease until the very end, when I thought I detected a suggestion of uneasiness at mention of the freeway.

I know that some of you are concerned about freeways because the State's purchase of right-of-way for them removes valuable property from the county tax rolls.

That imaginative trip we took had to do with freeways and with a lot of other property that isn't on the tax rolls because it's used in the public service by one or another branch of the government. Remember where we went?

We started at the courthouse, went through a park, into the post office, over city streets, by the city hall, the school and the county fairground, near the junior college, over county roads, by a federal hospital, and over a state highway. We weren't too far from one of Uncle Sam's air bases.

Our trip brought us in contact with a dozen kinds of properties which are off the tax rolls because they are serving the people in one way or another, because they belong to the people's government of local or higher level. I took you traveling to emphasize that freeway right-of-way is just one of the many government properties that are so familiar and so necessary to every citizen today.

McGinness, Everitt Get Appointments

The appointment of Service and Supply Engineer G. G. McGinness as Assistant Office Engineer in charge of the Industry Contact Section of the California Division of Highways has been announced by State Highway Engineer G. T. McCoy.

At the same time McCoy appointed F. L. Everitt as Acting Service and Supply Engineer. Everitt has been McGinness' assistant in the Service and Supply Department since 1953. In his new position he will be in charge of procurement of commodities, supplies and equipment, except automotive and heavy maintenance equipment, used by the Division of Highways.

McGinness, as head of the Industry Contact Section will take over a large portion of the work formerly supervised by E. J. Saldine, who retired on October 1st. In his new position, McGinness will be concerned with determination of prevailing wages for crafts employed on highway contracts, service agreement procedures and establishment of equipment rental rates.

Freeway Model

Construction of Complex Interchange Model Described

By WARREN S. LUDLOW, Bridge Architectural Associate

Bridge engineers designing the first group of structures in the East Los Angeles Freeway Interchange soon realized that a three-dimensional model would be a great aid to them. This traffic interchange of four freeways, ramps and city streets is extremely complex. In a relatively small area, 32 bridges and 20 retaining walls are needed to permit the interlacing of the roadways.

W. J. Jurkovich, Senior Bridge Engineer in charge of the design of the project, pointed out that a model would clarify the apparent chaos of line drawings, would lead to harmony of bridge types, would illustrate structural design problems and be of inestimable value for public display. Other models had already proved useful in similar special problem situations. Work on this model was started in May, 1957, by the Bridge Architectural Design Section.

A scale of 1″ = 50′ was chosen for several reasons. Study of a 1″ = 400′ plan revealed that the 50′ scale model would be about as big as working space would permit but would still include significant features at the extreme limits. This scale is commonly used in highway design and gives sufficient size and detail without needless refinements. A double-tapered "L" shape was selected. Each leg measured about 10½ feet long and from 3 to 4 feet wide and the two legs come apart for crating and shipping.

Since the existing Santa Ana Freeway was the core of the interchange we got the "as built" highway and bridge plans and redrew them to model scale. Meanwhile, we were collecting other data. Headquarters Photo Laboratory furnished aerial oblique photos from their files; then supplemented these with more detailed pictures made at our request. District VII supplied geometric design plans to start with and sent design layouts, profiles, contour grading plans, topography, lane striping and sign layouts and a wealth of other data as the model was developed. The Bridge Department Structural Design unit gave us the plans for the new bridges and walls as they were prepared.

Roadways Traced

We built a sturdy frame of 1″ x 4″ pine boards, glued, nailed and well cross-braced to prevent warping, and covered it with ⅜″ plywood for the model base. This was painted with two coats of flat white and sanded. On it we traced the edges of the road-

A photo of the model near completion stage. In the foreground is the three-level structure which will carry the Golden State Freeway across Seventh Street and the Santa Ana Freeway.

ways, their stationing lines and all the contours and topography shown on the geometric sheets. This gave us our plan projection.

Next we started to build up the model in the third dimension. On pine blocks we drew sections of the plan showing roadway widths and stationing, then carefully jigsawed and sanded them to the edge of roadway lines.

Getting the vertical dimensions was not so easy.

Highway profiles are usually exaggerated for clarity but this distortion would look unnatural in a model. So we redrew the profiles to our scale of 1″ = 50′ and pasted them on the sides of the roadway blocks. Because we found from past models that wood filler, glue and paint would build up the surface, we subtracted 1/32″ from all profile measurements. After the blocks were cut to proper height by following the profile lines (allowing for crown slopes and superelevations) we match-marked and glued them into position, leaving gaps for the bridges.

Made to Scale

Now the backbone of the skeleton model—the freeways—was established. More of the framework—the ramps, frontage roads and streets—were fashioned in a similar way, with one exception. The highway plans showed city street grades only within or near the right-of-way. Some grades beyond these limits we obtained from U. S. Coast and Geodetic Survey map contours; other we approximated by scaling from aerial obliques. If we could find some object of known height—such as a door or auto—we could project level lines or perspective lines to establish relative heights. This method was successfully used later on also to obtain the sizes of some of the outstanding landmarks such as a school, a hospital, some stores and several industrial buildings.

Understandably, we gave a great deal of attention to the bridge miniatures and tried to reproduce them accurately in detail consistent with the scale. Plans of the new bridges were rescaled to model size and used as patterns for the balsa wood prototypes. Existing bridges were faithfully

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Design of Interchange Was a Team Effort

By HEINZ HECKEROTH, Project Design Engineer

The design of the future interchange connecting the Santa Ana, Golden State, Pomona and Santa Monica Freeways is the product of the efforts of many people presently and formerly in the Division of Highways district office in Los Angeles. To be known as the East Los Angeles Interchange, it will be located east of the Los Angeles River with its center approximately at Seventh Street and Boyle Avenue. Its geometric layout represents an evolution of thinking and work over a long period of time.

HEINZ HECKEROTH

At its inception, before World War II, the interchange was to have been a simple Y-type connection between the Santa Ana and Santa Monica (Olympic) Freeways. Plans for the Santa Ana Freeway, drawn during the war years, made provision for this type of an interchange. The land at the northeast corner of Soto and Eighth Streets was acquired to protect against building encroachment; and, following the war, in 1957 a bridge was built to provide for the separation of the future westbound Olympic Freeway traffic from that of the Santa Ana Freeway. This bridge is used in the present design.

The interchange pattern might best be described as a direct type, with right-of-way, topographic controls, design standards and estimated future traffic volumes all influencing the ultimate geometric layout. The Santa Ana and Santa Monica-Pomona Freeways and the Santa Ana and Golden State Freeways will cross each other in the form of two distinct crosses, while the Santa Monica and Golden State Freeway connection forms a "Y." Thus, were it not for the fact that these three crossings are so close together, there would actually exist three separate interchanges.

Heavy Industrial Traffic

Further influencing the geometrics is the fact that the Golden State Freeway terminates at the interchange. This freeway is expected to carry large volumes of truck traffic whose origins and destinations are the industrial area lying southerly of the Santa Monica and Santa Ana Freeways. Some of these are expected to use Soto Street, a major traffic arterial, thus requiring surface street connections. An extensive system of existing on- and off-ramps to and from the Santa Ana Freeway has been retained and is being augmented by additional ramps to the new freeways.

The geometric design was the end product of numberless line diagrams (drawings with single lines representing each roadway and ramp) and also 12 design studies at 400 and 100 feet to the inch scale. Five of the most promising of these were estimated as to construction and right-of-way cost and compared before a selection was made. The final selection was based on right-of-way considerations and the alignment of the Santa Monica Freeway at the Los Angeles River.

When the design had been sufficiently advanced the Bridge Department in Sacramento was supplied with alignment and grade data which formed the basis for the bridge structure designs as well as the model work. Electronic data processing equipment was used throughout the design phase to calculate precise alignment, grade (roadway elevations), earthwork (quantities of cut and fill) and the engineer's estimate (units of material and work involved in construction).

Freeways Listed

The five freeways which emerge from or converge on the interchange can readily be identified as follows:

1. The Golden State Freeway leaves the model at the most northerly end near Fourth Street. The bridge over Fourth Street and the portion of freeway, including ramps, southerly to the Hollenbeck Lake-Boyle Avenue Bridge are presently under construction. This part of the Golden State Freeway, when completed early

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Warren S. Ludlow, author of the article, places fill at the abutment of the Hollenbeck Bridge while Jack Alexander (right) adjusts the old existing wooden arch bridge which spans the lake

FREEWAY MODEL

Continued from page 20 . . .

copied. If you look closely at the model you can recognize the monumental end posts and corbel decorations of the old Sixth Street Viaduct and the wooden truss bridge across Hollenbeck Lake. Each bridge was set loosely in position but not glued until the roadways below were painted and striped. This was done all at one time in the last stage of the work.

With the placement of the bridges the model began to pay dividends in aesthetics and economy of design.

At one location the model showed that the vertical clearance was impaired about one foot. A check verified this and the highway grade lines were corrected accordingly. In other places retaining walls and bridge lengths were adjusted for appearance, ease of construction and savings in cost.

Use Blocks and Putty

To cover the framework of our model and fill it out nicely, we gave it a heavy diet of plywood, blocks and putty. In critical areas where the eye would be sensitive to fit a curve we built the contours on a shapely base. Elsewhere we bulged it with blocks. Over all we shaped it with a water base putty to erase unsightly angularities. With the addition of balsa wood shoulder strips the model was ready for the makeup and costume artists.

This phase of the work really taxed our ingenuity. Materials, shapes and colors had to be chosen to give the appearance of reality. Color contrast was often more effective than a change in shape, and the proper material would frequently suggest realism better than a faithful copy.

From a fabric store we selected cambrics of different weave spacing. When sprayed silver and cut in strips, it made good property line fencing and bridge railings. Our search for scale trees, shrubs and grass took us to hobby shops, nurseries, and stores—cigar, hardware, grocery, dime, sporting goods and plastic supply. Unusual (for intended use) and exotic items interested us. Sponges, weeds, foam plastics, pipe cleaners, feathers, caribou hide, reindeer moss, Japanese seaweed, flock. We tried them all.

We found that Japanese seaweed made a very convincing, delicate evergreen tree. Reindeer moss, trimmed properly, made sycamores, oaks, and poplars. These were given a coat of glue and while wet were rolled in flock to give the foliage the proper coloring indicative of the species desired. Fine sponge rubber tapered conically made another kind of evergreen tree. Ground-up sponge rubber and lichen provided masses of varying sized shrubs. The oleander bushes located in the dividing strips of the freeways were imitated this way.

Oil Paints Best

We found that oil base paints were best for coloring live growth. Plastic sprays and latex paints dried out the materials and caused them to crumble at a touch.

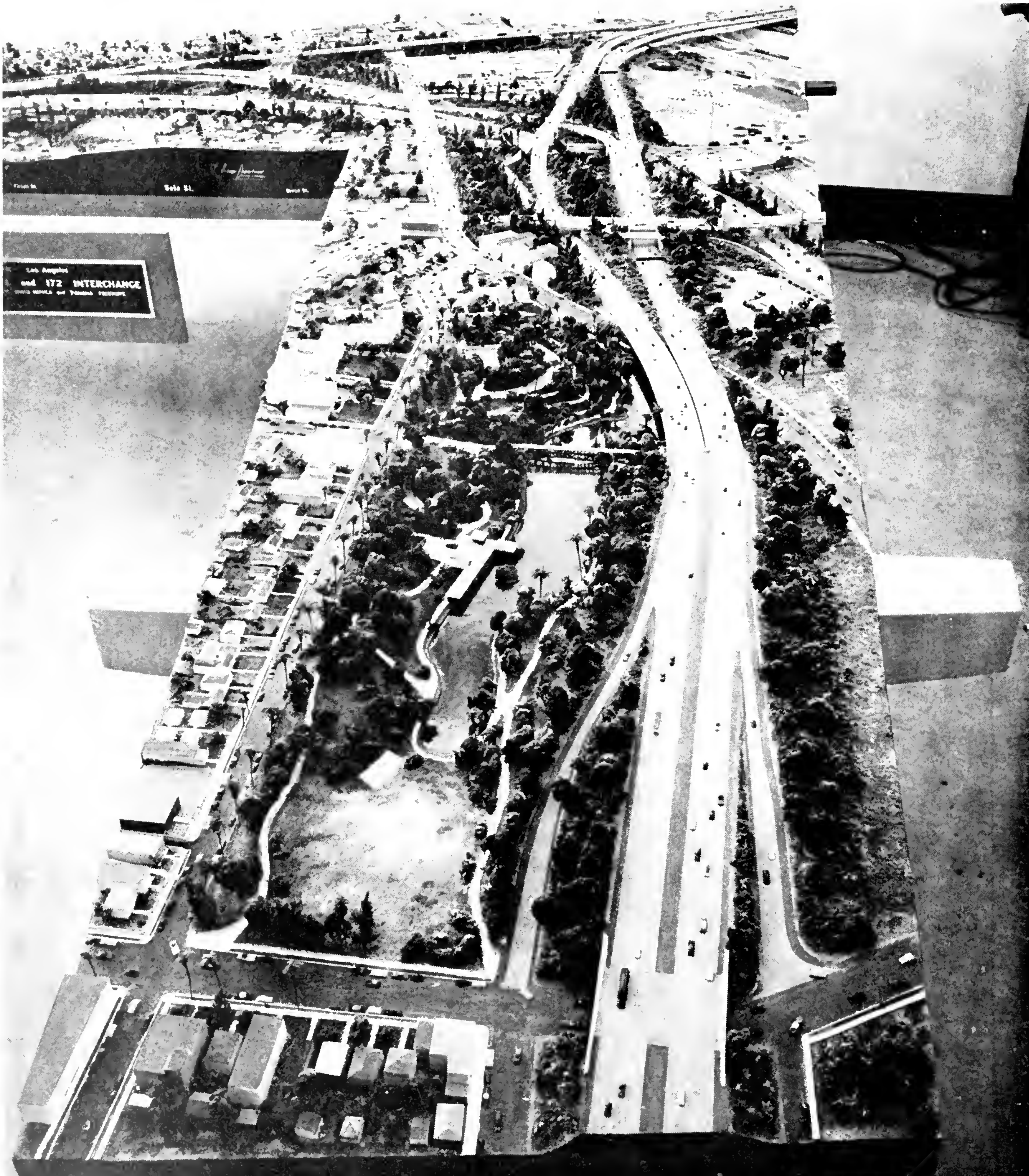
If you want a really good-looking little palm tree, tan a piece of caribou hide, cut it into strips and fasten it to the top of a piece of slightly bent wire. The effect is startlingly realistic.

Only five different house sizes were made, since matching each one of the 800 to 1,000 homes would have been out of the question. They were made of wood or water base putty cast in rubber molds. Groups were painted alike with contrasting roofs and distributed in random colors on the model. We tried to place them according to sizes visible in our aerial views, which we also used to plant the trees and arrange ground cover.

The larger buildings were detailed in wood and placed in proper locations to add authenticity

One particularly interesting landmark which affected the construction of a portion of the model was the *Times-Mirror* Press Building. It was first built exactly as it appears today. However, architectural plans of the

Lou Baker removes several acres of real estate to allow room for making a grade change for a railroad spur and access roads



The completed model showing Hollenbeck Park and the Golden State Freeway in the foreground and the three-level interchange structure in the right background future addition to the building were sent along with a relocation of the spur track crossing over the freeway. To make these changes we had to rip up buildings and grounds and replace them. On the roof of the revamped building we placed a small-scale helicopter and landscaped the area. The spur relocation affected the curvature of a bridge which had to be redesigned for construction and redone for the model.

Bridge Design Completed

Another outstanding and familiar topographical feature was Hollenbeck Park. Design of the bridge was actually done before the model was started and we had a photo retouch showing the freeway structure across the southern end of the lake with landscaped planter boxes at the base of the columns in the lake. This illustration was to be used by the district in its preliminary presentations to the public. The model bridge was built accordingly and installed, complete with planter boxes, in the plastic surfaced lake. However, subsequent changes due to lake drainage considerations and the addition of a filled service area and road under the bridge necessitated the removal of the planters and the holes in the plastic water had to be filled. The other land features in the park are all faithfully represented—the canoe storage house, baseball diamond, the correct number of palm trees and the old wooden truss previously mentioned.

The tiny route direction signs seen on the model are made to very accurate scale. Each sign had been lettered and drawn to scale for the actual construction plans. Copies were obtained from the signing section, and the reproduction section photostatted and reduced them until they matched the proper dimension on the model scale. These small prints were glued to pins and then mounted on the model where the real signs actually will be placed. The miniature signs are legible and can be read with a magnifying glass.

Model Cars a Problem

In order to give "life" to the model, about 2,000 vehicles were needed to populate the freeways, streets and frontage roads. As we couldn't afford

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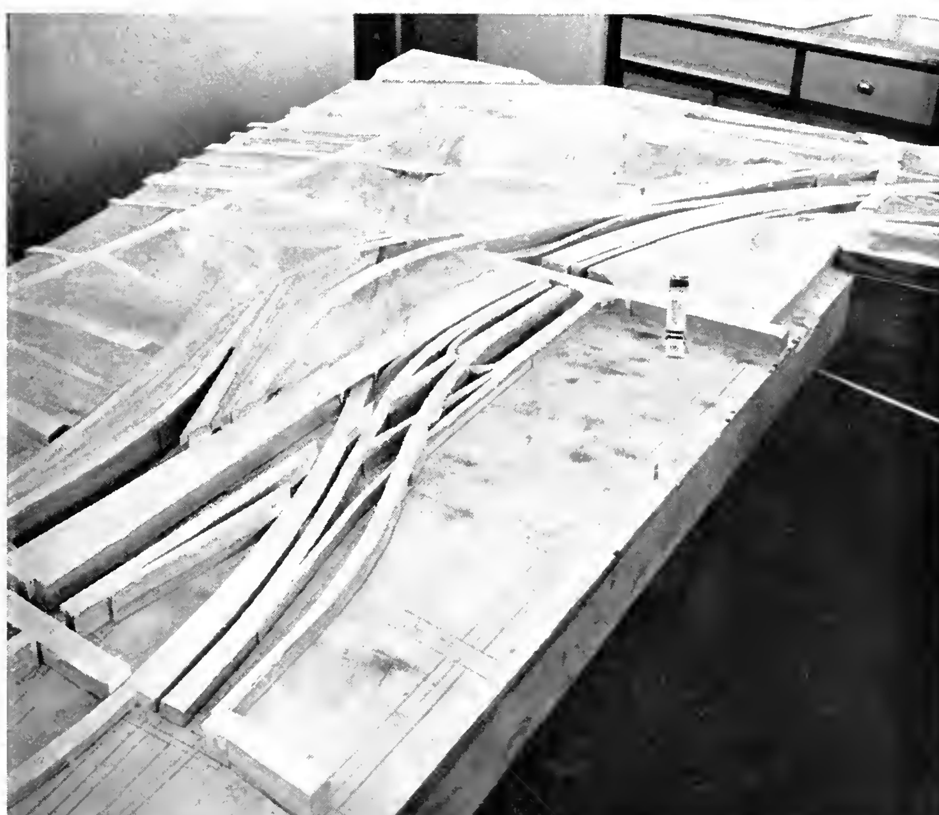

UPPER—Lou Baker (left) places the Santa Monica Viaduct spur into position. Jack Alexander (right) paints columns on the Los Angeles River Bridge and overhead connections. LOWER—A photo of the model taken in the early stages of construction showing preliminary buildup of roadways and ground fill. The package of cigarettes (right middleground) shows the relative size.

Cost Index

Construction Costs Show Leveling-Off Trend During Third Quarter of 1958

By J. P. MURPHY, Assistant State Highway Engineer
H. C. McCARTY, Office Engineer
LLOYD B. REYNOLDS, Assistant Office Engineer

The California Highway Construction Cost Index for the third quarter of 1958 continued in a downward course but at a considerably slower rate than has prevailed in several recent quarters. The index now stands at 228.5 (1940 = 100), which is 2.5 index points or 1.1 percent below the second quarter. The present value is the lowest point that has been reached since the first quarter of 1956, and is 9.0 points or 3.8 percent below the third quarter in 1957.

Bidder competition held at a satisfactory level as indicated by the average of 5.5 bidders per project determined for the period. This is the second quarter in which a lowering of the cost index value has occurred while the average number of bidders was low in the range considered as good competition. It appears that the lower price levels may have discouraged some contractors from estimating and bidding projects. A tabulation showing the average number of bidders arranged according to project value brackets is included with this release.

The 187 representative statewide projects for which bids were opened during this quarter and which provide the data for preparation of this quarter's index are distributed as shown in the table on this page.

The total value of these projects is $89,241,148.

Three of the seven items used in the preparation of the index reveal lower average prices during this quarter. Roadway excavation exerted the greatest lowering effect and untreated rock base together with structural steel reflected the greatest increase. The following table shows average unit prices for the seven items used in preparing the index.

The average unit price for roadway excavation in this quarter is $0.39, which is $0.09 below the second quarter. Bid prices for excavation on several of the large freeway projects ranged from $0.41 down to $0.22 during the period. While the projects for this quarter were well distributed over the State, there were no projects located in the high, mountainous regions where extremely hard formations are gener-

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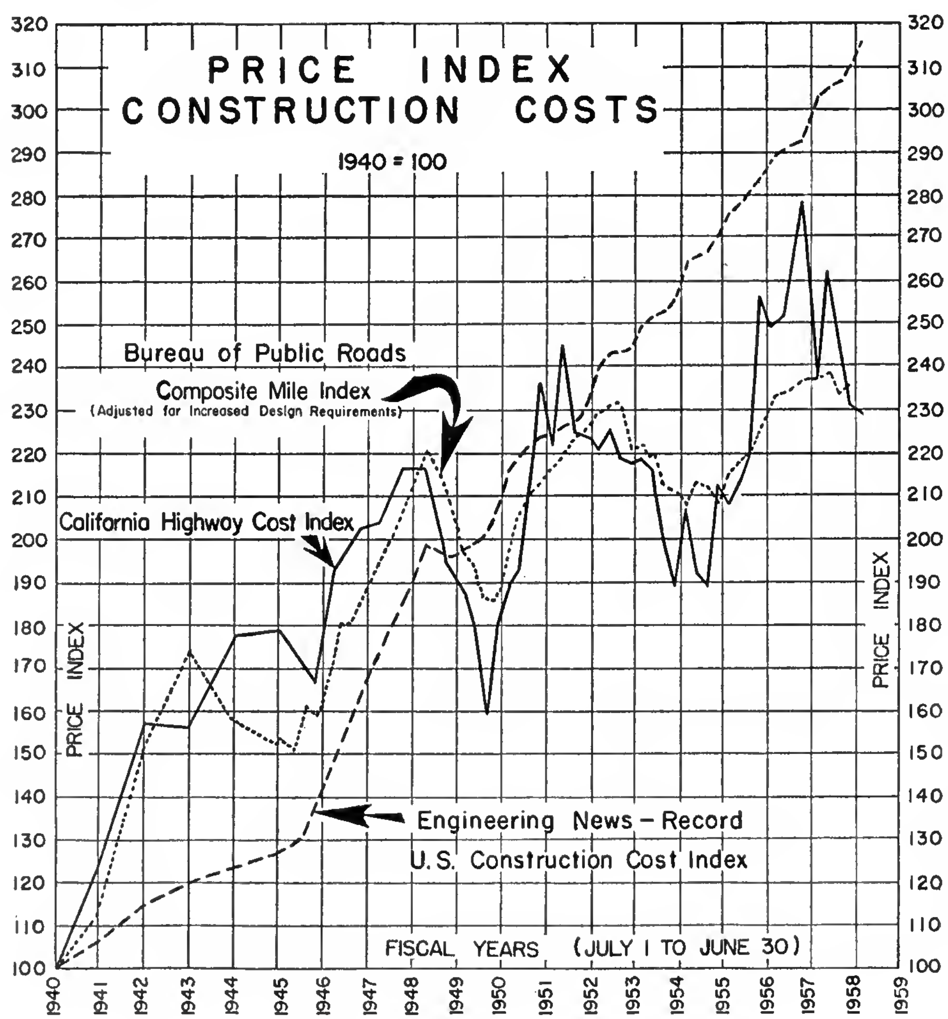
Range	Number of projects	Value of projects
Under $50,000	69—36.9%	$1,649,285— 1.9%
$50,000 to $100,000	33—17.7%	2,332,442— 2.6%
100,000 to 250,000	31—16.6%	5,303,844— 5.9%
250,000 to 500,000	18— 9.6%	5,886,287— 6.6%
500,000 to 1,000,000	11— 5.9%	8,441,988— 9.5%
1,000,000 to 2,500,000	15— 8.0%	22,119,565—24.8%
2,500,000 to 5,000,000	7— 3.7%	23,758,169—26.6%
Over $5,000,000	3— 1.6%	19,749,568—22.1%



Overhead Signs

Standard Plans Used for Structures

By GEORGE W. SMITH, Senior Bridge Engineer; and R. J. ISRAEL, Supervising Highway Engineer

California, with one-tenth of the Nation's motor vehicle traffic, has long faced the problem of accommodating high volumes of traffic on a substantial segment of its highway system. This situation has led to pioneering in the development of the modern freeway and in the signing essential to its operation.

The use of upper and lower case letters for guide signs, of proven advantage in recognition and legibility, was begun in California. The California style of lower case lettering was subsequently utilized for directional signing by the major eastern toll roads. This lettering has been adopted nationwide for destinations on the interstate system.

The use of reverse copy (white letters on a dark background) for more effective nighttime legibility was a California development. This also has had nationwide acceptance, particularly in directional signing.

One of the most important developments in the signing field has been the overhead illuminated signing with the necessary sign bridges, cantilevers and other structures to support the sign and the lighting fixtures. California began using overhead signs with the early development of urban freeways and, because of its higher traffic and more extensive mileage of freeways, uses this

This is a sign bridge. In this type the Standard Plans cover structures up to 10 feet high by 130-foot span. Although walkways and safety railing are on this structure, they are hardly perceptible to the motorist.

type of signing to a greater extent than any other state.

Visibility Problem

The two-lane road presents no problem in signing since ground-mounted signs at the edge of the roadway are readily visible to traffic in the adjacent lane. The four-lane divided highway begins to develop a problem since the outside lane of traffic may interfere with sign visibility for traffic on the inside lanes. This situation can be, and is, handled by dual advance information of turnoffs—one sign on the shoulder and one in the median. On four-lane rural freeways a limited number of overhead directional signs are used generally to designate important turnoffs, left-hand off-ramps and to give through-traffic and turnoff information at the direct connections to bypass communities.

When the highway has six or more lanes, the high volumes of traffic, particularly in the peak hours, make signs on the roadside or median relatively ineffective for primary directional information. On such highways, it is necessary to provide advance notice of all turnoffs and indicate the point of turning by the use of overhead illuminated guide signs. Primarily, the advance sign gives notice of the turnoff and assigns traffic to the proper lane by means of a down arrow. At the gore location, traffic is further directed to the turnoff by an appropriate arrow.

To provide 24-hour visibility, overhead signs are lighted through the use of fluorescent lighting. The lighting fixture is mounted below the sign in order to reduce glare and to eliminate the objectionable daytime shadow of the lighting fixture on the sign face. In order to maintain the lighting, to keep the signs clean and to make other necessary repairs or adjustments, it has been found advisable to provide maintenance walkways on the overhead sign structures.

As the development of the directional signs has progressed from small panels fastened to a single post, to large panels with messages that can be read at greater distances to meet the needs of fast-moving traffic, the Bridge Department of the Division of Highways has been called upon to provide adequate structures for the support of these panels. During the early stages of the development of overhead sign structures, their number was few, and plans were prepared for each individual structure. As the number of structures increased, it was realized in the latter part of 1955 that it was an uneconomical use of time to design them on an individual basis.

Standard Plans Developed

In the early part of 1956, the Traffic Department completed a study on the types and sizes of signs that would be required to cover all known conditions. With this information at hand, the Bridge Department undertook to study the possibility of developing a set of standard plans which could be inserted directly into a set of contract plans and which would cover all of the various sizes and types required for various installations. After considerable study, it was concluded that a set of standard plans would be feasible.

In 1956, concurrently with the design of sign structures on an individual basis (which by that time was reaching large proportions), the Bridge Department started the development of "Standard Plans for Overhead Sign Structures." They were completed in early 1957 and their use in contract plans was inaugurated immediately.

They cover four main types of structures: (a) cantilever type, which is erected on a single pole (photo on page 6); (b) butterfly type, which is erected on a single pole and is shown on page 3; (c) sign bridge type which is erected on two posts and spans the highway (photo on page 1). There is also a bridge cantilever type that is erected on two poles, spans the highway and has a cantilever portion which usually extends out over a ramp.

There is also a structure-mounted type of frame which is placed on existing bridge or pedestrian structures that span the highway. The structure-mounted types are only partly worked up as standards. In most instances they have features peculiar to the particular structure on which they are mounted, which makes it difficult to provide an overall standard to cover all of the various cases.

When mounting signs on prestressed concrete structures, particular care is given to providing mounting bolts in the prestressed members at the time they are being cast, or else the frame is so mounted that the prestressed members containing the high tensile steel are not disturbed in any way. Wherever possible, mounting bolts or details are placed in the cast-in-place portion of prestressed structures, generally in the curb or roadway slab.

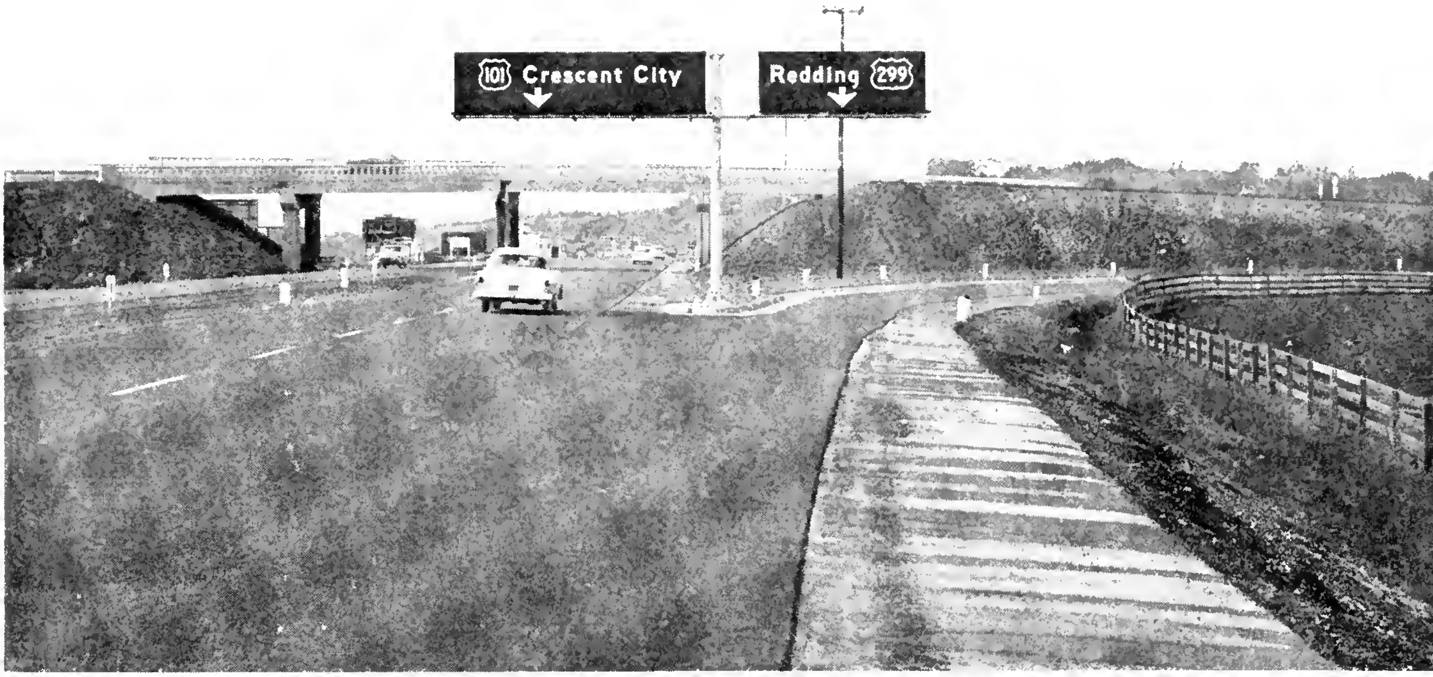
Advantages Cited

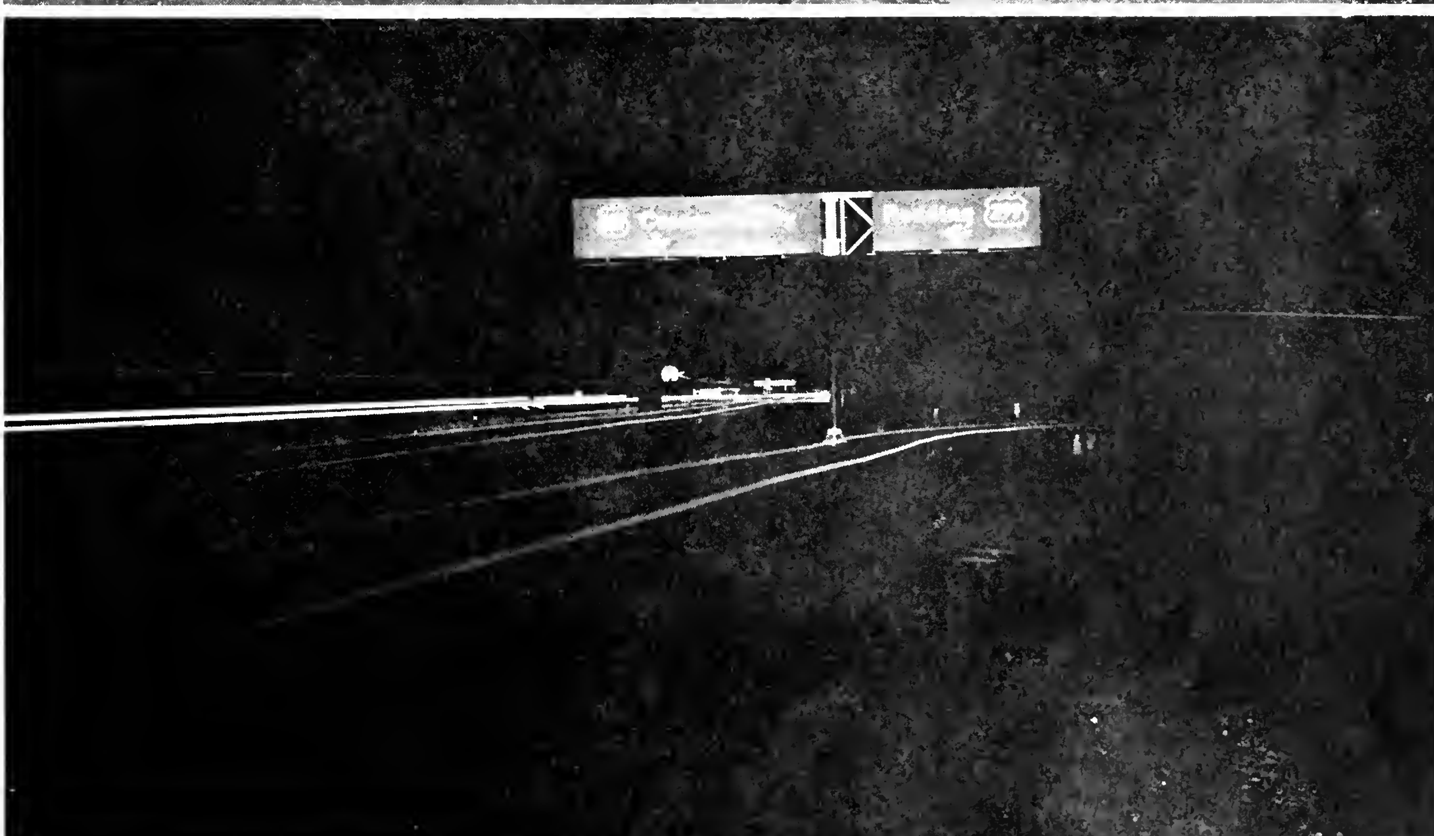
Development of the standard plans and their use since the early part of 1957 has been a boon to the Bridge Department in reducing the amount of design work now performed on overhead sign structures. In place of individual plans prepared for each sign structure, standard plans cover practically all of the types that are now being constructed.

Whenever signs are to be included in a highway project, the district office works up a format sheet showing the location, size, and type of all signs, determines the quantities for the various pay items involved, and forwards the data to Headquarters Office along with the contract plans. Headquarters then inserts the standard plans for the sign structures. Since the makeup of the standard plans is of a rather complicated nature, for the first year of their use it was the practice for the Bridge Department to review the contract plans to insure that they were being used in the manner intended. All parties concerned are now familiar with their use and of late this practice has been eliminated. Only those plans are now reviewed which contain special sign structures or those which cover structure-mounted signs.

Present indications are that the standard plans have contributed to more favorable steel prices. The various steel fabricators know exactly what to expect in each project. Except for periodic improvements the details are always the same, and they can tool up to fabricate the structures in the most economical way. Many improvements in details have been supplied by fabricators. A policy has been adopted to make changes about once a year. During the year all changes are accumulated and they are incorporated into the standard plans at one time.

Although there is a relatively small amount of maintenance involved on





UPPER—This is a butterfly type sign structure. Maximum size covered by the Standard Plans for this type is 10 feet high by 60 feet long. LOWER—The same sign taken from the same location showing night visibility.

sign structures, it is still an advantage to the Maintenance Department to know what to expect in the way of details when repairs are required. Primary maintenance consists in replacement of fluorescent tubes in the lighting fixtures, and washing of the sign panels. Sometimes, however, high loads hit the frames and repairs have to be made. An item of convenience which has been added to these structures is the placement of a gutter at the bottom of the sign panel to carry away excess water. It eliminates the necessity for taking special precautions for protecting cars from water that drips off during the washing of panels.

Design Criteria

All elements of sign structures are designed on the basis of a wind pressure of 30 pounds per square foot of actual exposed sign area. On sign bridges, as an alternative to this, the design is also checked on the basis of a wind load of 20 pounds per square foot acting on the total area of the frame, which assumes that at some future time the frame may be fully covered with panel.

While some of the structures might appear rather heavy and it would seem that they would be designed on the basis of dead load, nevertheless, the wind force is the governing factor. For example, the largest butterfly type frame covered by the standard plans is 10′ x 60′. The weight of the frame alone, including all appurtenances, amounts to approximately 4½ tons. A wind load of 30 pounds per square foot would amount to 6 tons if two-thirds of the frame were covered with panel, and 9 tons if the frame were fully covered.

The concrete footings or bases on which the sign structures rest are designed for a foundation load of 1¼ tons per square foot. It has been found that this allowable soil pressure provides a good balance of design. In the majority of cases, although there are foundation materials which would support much heavier unit loads, the design of the bases is not necessarily a function of soil capacity, but concerns the problem of stability.

In February, 1958, the Highway Research Board of the National Academy of Sciences, Committee on Traffic Control Devices, issued Circular No. 355 with recommended criteria for the design of sign structures on a national basis. Their recommendations do not differ materially from California's procedures.

In general, the members of sign frames consist of structural angles of sizes that are usually found in stock.

The poles that support the frames can be fabricated in several ways. The standard plans provide for three alternative methods. This allows a shop to fabricate the poles in the manner most suitable to their method of operation. They can be fabricated from pipe sections, or formed from plates shaped to meet the sections called for on the plans.

The frames and poles are all fabricated by welding. The welding procedure is governed by the latest specifications issued by the American Welding Society.

All fabrication is inspected under the direction of the Materials and Research Laboratory of the California Division of Highways.

Safety Features

In the design of these structures, primary consideration was given to the safety of the traveling public and of the maintenance men responsible for servicing sign panels and the lighting. Today's high-speed traffic makes it imperative that the blocking of lanes for maintenance purposes be eliminated wherever possible.

Prior to the development of the standard plans, the older types of overhead structures were serviced from a maintenance truck placed in the roadway. This has been eliminated by constructing a walkway for the full length of the sign structures. Access to the walkway can be had either by means of a boom from a maintenance truck parked on the shoulder, or by means of a ladder somewhere off the traveled way.

The walkway includes a safety railing. The railing is a requirement of the State Division of Industrial Safety for the protection of workmen. It is constructed so that it can be folded down and not obstruct the motorist's view of the sign message. The same brackets which support the walkway and safety railing are also used for support of the lighting fixtures used for illuminating the sign panels.

Wherever the poles supporting the frames are located in a position vulnerable to traffic, they are protected by a guard rail. Nevertheless, once in a while a pole is hit by a vehicle. There are no known instances of a frame being knocked down and creating a hazard to traffic. Because they are designed to take wind loads, the poles are incidentally made tremendously impact-resistant. This is an important feature from a safety standpoint.

The minimum vertical clearance on all overhead signs is 17′ 0″. This is two feet more than normally provided on highway structures that carry traffic. This is a desirable safety feature since the frames are of much lighter construction and more vulnerable to damage. If the loads will pass the highway structures, they will theoretically pass the sign frames. However, where there are no nearby structures, a frame may be hit by a high load. This may occur when moving farm equipment, or through lack of perception when moving other overheight loads. Fortunately, such mishaps are rare.

Integral Part

The signing of major freeways, particularly the freeway interchanges, is an integral part of planning and design. The horizontal and the vertical alignment are critical factors in sign legibility since traffic at prevailing speeds must view a sign long enough to read and comprehend the message. The location of bridges over the freeway must be worked into the signing plan so that the bridge does not mask an important sign. For these reasons, the overhead signing must be considered and worked into the actual design in the planning and design stages.

Standard metropolitan freeway signing will provide an overhead sign in the gore, generally of the butterfly type, to indicate the turnoff lane on the one side and assign the lane for the next turnoff on the other. In advance of major interchanges, or at other critical locations, advance sign bridges across the entire roadway provide turnoff information with lane assignment and through information, all with the proper route shields. In addition, a third type of illuminated overhead sign is used between turnoffs to indicate the next three turnoffs and the distances thereto in miles. Where such signs apply only to one direction of traffic, they are usually installed in the shoulder area. However, at some locations, a sign standard may be erected in the median with back-to-back illuminated signs providing this three-exit information for both directions of travel. A drawing of a section of a model which depicts this type of standard freeway signing is shown on this page.

Interstate Signing

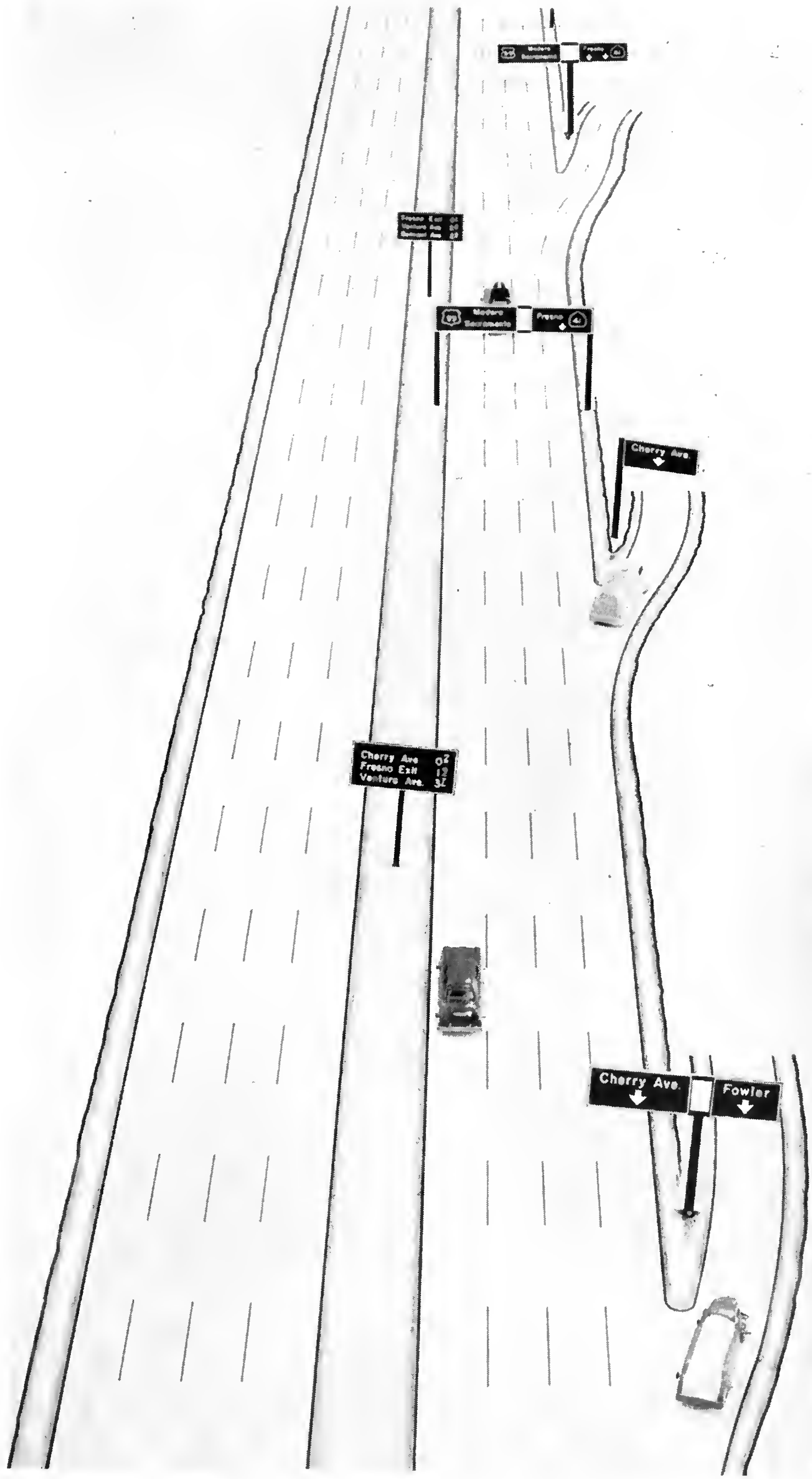
The National System of Interstate Highway, comprising some 2,200 miles of existing and proposed freeways in California, will involve changes in signing. It is the intention that the 41,000-mile national interstate system be signed uniformly, and a signing manual for this system has been developed.

Interstate signing will be different from the latest California standard.

The interstate guide signs will have a green background and wider borders, with rounded corners. The interstate manual reserves upper and lower case lettering for destinations only, so that exist distance, lane assignment, etc. will appear as all capital letters. This will involve the mixing of upper and lower case letters on the same sign. Perhaps the major difference in interstate signing will be the diagonal up arrow at the exit ramp gore where California now employs a down arrow.

Although overhead standards are primarily used for directional signing, important warning signs have recently been approved for installation on sign bridges or butterflies. One such overhead warning sign will inform truckers of the necessity to reduce gear on the steep Grapevine Grade, and other such warning signs are planned for two locations in advance of Department of Agriculture checking stations on freeways near the State's borders.

The total cost of the state highway sign program for the year 1957, including both the cost of installing and maintaining highway signs, was $2,-183,000. Total signing costs are on a sharp upward trend, in spite of savings in the individual sign structures, due primarily to the rapid development of multilane freeways and the necessary



Typical schematic signing layout, showing different types of sign structures and placement of messages.

Pictured here is a cantilever type sign structure. This type of sign reaches maximum proportions of 10 feet by 30 feet.

overhead signs to properly direct traffic on such facilities. The substantially increased funds which will be available for the interstate program in 1960 will materially accelerate freeway construction with a comparable acceleration in the signing program.

Summary

Within the present concept of designing supports for overhead signs, it appears that the structures provided are effectively and economically serving their purpose. Certainly, standardization of plans has minimized the amount of engineering manpower required to prepare plans for these structures. Uniformity of details has contributed to lower construction costs.

Placing of adequate sign structures has become an integral part of the modern highway or freeway installation. Present types of installation will not remain static; manufacturers and material suppliers are constantly putting forth new ideas.

The Division of Highways will continue to try to keep abreast of new developments, looking toward the most efficient and economical installations consistent with utility and needs of the traveling public.

Death Notices

August H. Henderson, Deputy Director of Public Works, Sacramento Headquarters, died October 1st.

William O. Toates, Structural Steel Painter Foreman, District IV, died October 26th.

Kenneth M. Garcia, Highway Equipment Operator-laborer, District V, died October 30th.

Richard Hon, Supervising Highway Engineer, District VII, died September 29th.

Albert L. Boren, laborer, San Francisco-Oakland Bay Bridge, died October 29th.

George F. Cruza, Senior Account Clerk, San Francisco-Oakland Bay Bridge, died October 14th.

Drake Boulevard

Three-Stage FAS Project Completed in Marin County

By A. P. STOKES, Deputy Director
Marin County Public Works Department

IN FEBRUARY, 1955, the Marin County Board of Supervisors authorized the County Director of Public Works to institute a co-operative project with the State Division of Highways and the U. S. Bureau of Public Roads under the Federal-aid Secondary Highway Program for the improvement of Sir Francis Drake Boulevard.

This Marin County primary road is FAS Route 608 and starts at the west end of the new Richmond-San Rafael Bridge and ends at the lighthouse on Point Reyes. After leaving the urban areas of San Anselmo and Fairfax, the route climbs White's Hill and enters San Geronimo Valley.

At the turn of the century, San Geronimo Valley was served by two railroads over which much of early San Francisco's timber, paper and dairy imports were hauled. With the improvement of the automobile, the railroads were abandoned and the last major road improvements were undertaken by bond issue in 1925. However, the development of the valley and west Marin County soon overtaxed the narrow concrete bond issue improvements. With the recreational facilities

Marin County's Federal-aid Secondary Route 608, Sir Francis Drake Boulevard, recently completed under three contracts. Former route may be seen at left. Woodacre connection is in foreground.

New alignment of Marin County's Sir Francis Drake Boulevard between Lagunitas School and 2.7 miles easterly recently completed under the Federal-aid Secondary Highway Program

at Samuel Taylor Park and Tomales Bay State Park generating heavy Sunday peak traffic, combined with the heavy logging and milk transports operating in the area, it was necessary to consider the construction of a pavement of adequate structural strength.

Road Section Relocated

The two-lane highway at this location currently carries about 2,500 vehicles per day, which increases to nearly 6,000 vehicles per day on weekends. The design criteria, proposed, provided for limited access, 40-foot paved width (two driving lanes each 12 feet wide bordered by eight-foot shoulders), minimum 100-foot right-of-way and a design speed of 60 miles per hour. The heavy annual rainfall (76.1 inches in 1955-56 and 71.8 inches in 1957-58) required special attention to adequate subsurface drainage and surface interception. The new alignment provides a modern highway from the westerly slope of White's Hill to the Lagunitas School just east of Forest Knolls, a distance of 2.7 miles. The old traveled way remains to serve as an outer highway, providing the leisurely traveler a quiet, shaded route through stands of fine redwoods.

The first stage of construction consisting of structures, grading and placing of selected material started in May of 1956, and was completed in November, 1956. The contract called for constructing the Woodacre connection but did not include the 10′ x 8′ reinforced concrete box culvert built in stage 2. Three 10′ x 8′ concrete cattle passes were constructed beneath the main line. Traffic was inconvenienced only for a short interval of time at the beginning and end of project where earthwork conform was undertaken.

Rains Hold Up Work

Stage 2 of construction completed the grading and structures, and provided base and surfacing with the exception of the top 1½-inch layer. Heavy rains in December caused the contractor to suspend his work just after oiling the completed base. Paving and finishing followed in May, 1958.

July, 1958, saw the project completed with the final course of plant-mixed surfacing. Striping and signing of the new route was completed by the county maintenance forces.

Net contract payments were $265,954 for the first stage, $130,285 for the second, and $37,539 for the third. The normal federal-aid secondary and state highway matching funds apportionment to Marin County totals approximately $100,000 per annum, making it necessary for the county to utilize stage construction methods or to accumulate these moneys for several years in order to carry out a project of this magnitude. This project being on new alignment was ideally suited to stage construction since the various contractors could complete their work with minimum inconvenience to the traveling public.

Design and construction engineering were performed by the county under Marvin W. Brigham, Director of Public Works. Stage 1 construction was performed by John Delphia; W. S. Kimble, Superintendent; and C. U. Karoly, Resident Engineer. Stage 2 was done by E. A. Forde Co.; William Forde, Superintendent; and A. T. Knutson, Resident Engineer. Final paving was provided by A. G. Raisch Co.; C. E. Harless, Superintendent; and W. Noll, Resident Engineer.

PHOTOS AT TOP OF PAGE—Two views of the US 80-Lake Murray Boulevard interchange in the San Diego area. Both look west.

Report From District XI

By JACOB DEKEMA, District Engineer

THE TWO most southern counties of California, San Diego and Imperial, as well as the eastern portion of Riverside County, make up District XI of the Division of Highways. The district's 1,137 miles of state highways are widely although not uniformly distributed over the 13,100 square miles that comprise the district. The district is composed of extreme variations of terrain, including coastal plain, mountainous regions reaching an elevation of 6,500 feet, as well as fertile agricultural valleys and arid desert regions. The planning, engineering and construction problems are therefore greatly diversified. In addition to the wide diversification of terrain, the variations of population and land use are equally extreme, ranging from the metropolitan San Diego area with a population of 770,000 to the uninhabited desert regions of the southern Mojave and Imperial Valley.

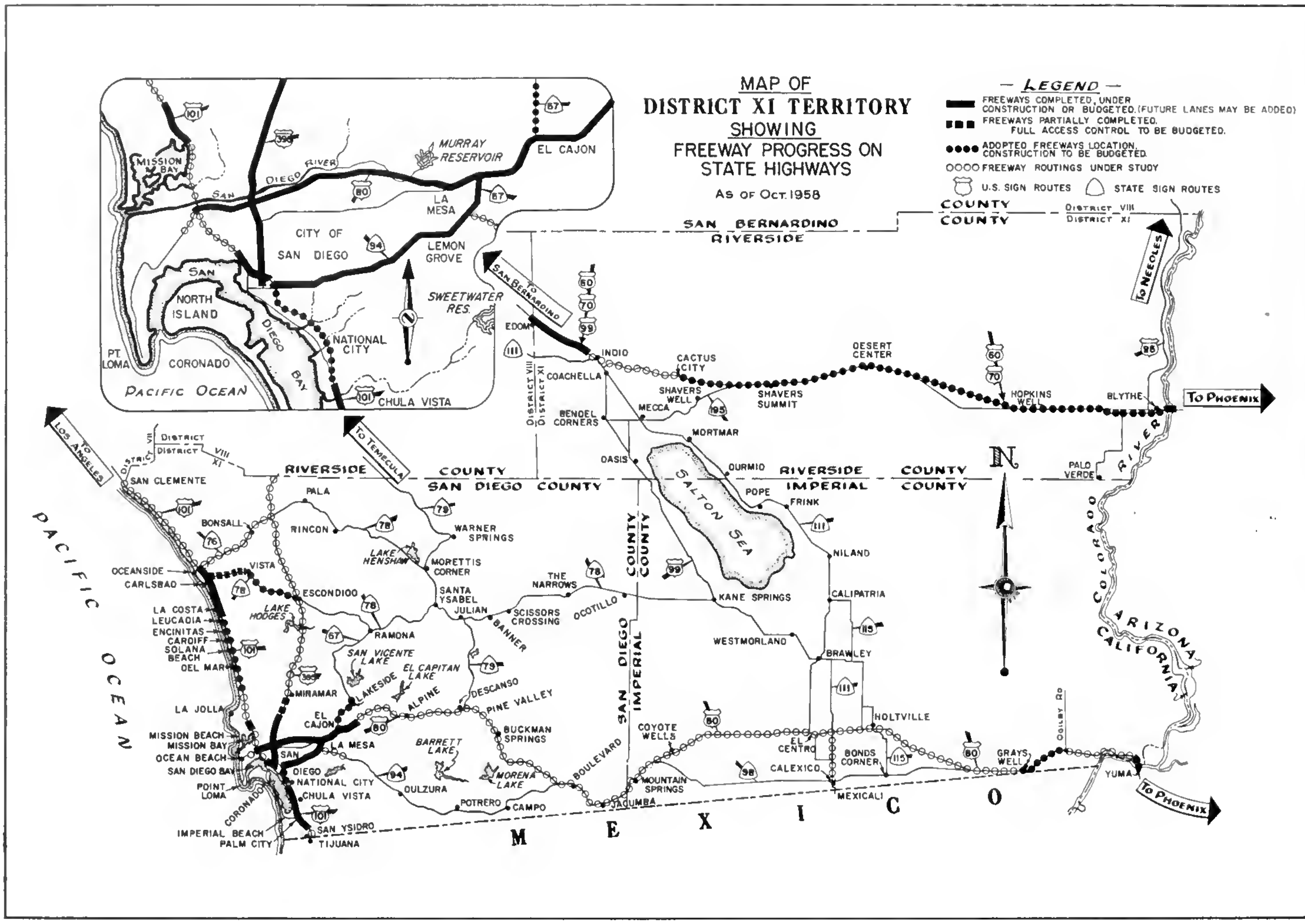
The economy of the San Diego metropolitan area is largely contingent upon an industrial development which has occurred in the past 20 years. Aircraft, missile and electronic research, as well as a recently developed atomic research center, have contributed heavily to making the San Diego area one of the most rapidly expanding metropolitan centers in the United States. Citrus and avocados grown on the coastal plain in conjunction with produce grown in the Imperial Valley east of the Coast Range comprise the bulk of agriculture within the region, while tuna fishing and employment in the numerous large military installations afford a livelihood for another large segment of the population.

The landlocked bays of San Diego, first discovered by Cabrillo 78 years before the Pilgrims landed at Plymouth Rock, are rapidly being converted to an extensive aquatic park for vacationists, and the mountain regions immediately behind the coast provide numerous camping and winter sports resorts.

The subtropical coastal plain with its "shortest thermometer in the world" encourages a large number of annual tourists. Local high spots such as the 200-inch telescope at Mount Palomar, Mission San Diego de Alcala, and a visit to Tijuana in Old Mexico, are invariably on the tourist's itinerary. It has been estimated that 10,000,000 tourists annually cross the international boundary.

Interstate Routes

District XI's unique position in the most southwest corner of United States, coupled with an unusually large number of major military establishments, has resulted in several routes within the district being designated on the National System of Interstate and Defense Highways. The federal legislation of 1956 included US 80, as well as US 101 and US 60-70, as routes scheduled for improvement to interstate freeway stand-



ards. A belt line for the San Diego metropolitan area was added in 1958.

US 101 originates at the international boundary and extends northerly in District XI to the south line of Orange County, while US 80 originates at a junction with US 101 in the vicinity of the district office in "Old Town" San Diego and extends easterly to the state line near Yuma, Arizona.

US 60-70 is also an east-west arterial in the northern portion of the district. It enters from District VIII approximately 12 miles northwest of Indio—a city in Riverside County of 8,000 population—and extends easterly to the Colorado River in the vicinity of Blythe.

US 101 Progress

With the recent completion of three traffic interchanges on US 101 between the International Border and National City, eight and one-half miles of US 101 were brought to full freeway standards. The completion of the interchanges at Dairy Mart Road, 27th Street and Palomar Street will go far toward providing safe and expeditious travel between San Diego and the international boundary.

Tijuana, Mexico, just south of the border, has developed a population in excess of 100,000 and is a heavy traffic generator on this southern portion of US 101. Plans are presently being developed in co-operation with the Federal Government's General Services Administration to provide a greatly expanded border crossing station, and it is anticipated that the enlarged facilities will alleviate the present congestion at the border gates.

The relocation of US 101 through the Cities of San Diego and National City is undoubtedly the most ambitious project yet attempted in District XI. Seven million dollars has been expended for rights-of-way, and clearance is already in evidence, making way for the eight-lane development which will skirt the central business districts of the Cities of San Diego and National City.

The most pertinent factor of this segment of US 101 is that its completion will convert the several segments of existing freeways, as well as those under construction, into a fully integrated freeway system. It will be the ultimate connecting link between US 80, US 395, State Sign Route 94, and the City's Wabash Freeway, while also carrying the heavy north-south load of US 101.

While most of the interchanges will be relatively complex, the projected four-level interchange at the intersection of US 395 will probably be the most extensive of all. The top deck of the structure carrying eight lanes of US 101 over the Cabrillo Freeway will tower 72 feet over the lower level, while the ramps providing the turning

This bridge carries US 80 across the Colorado River between Winterhaven in Imperial County and Yuma, Arizona

movements will be sandwiched between.

Another feature of this portion of US 101 is that it will be fully integrated into the one-way-street plans presently being instituted by the City of San Diego. There could hardly be a better example of the benefits to be derived by both the State and municipality than is demonstrated by this project. The many months of liaison and cooperative efforts of both agencies have paid off handsomely in gaining the utmost that could be derived from the proposed construction.

Alternate Structures

Right-of-way acquisition is nearing completion on the section between Market and Laurel Streets. Thirteen million dollars has been budgeted for the 1959-60 Fiscal Year for this construction. Stage construction involving alternate structures is planned to alleviate traffic problems caused by construction.

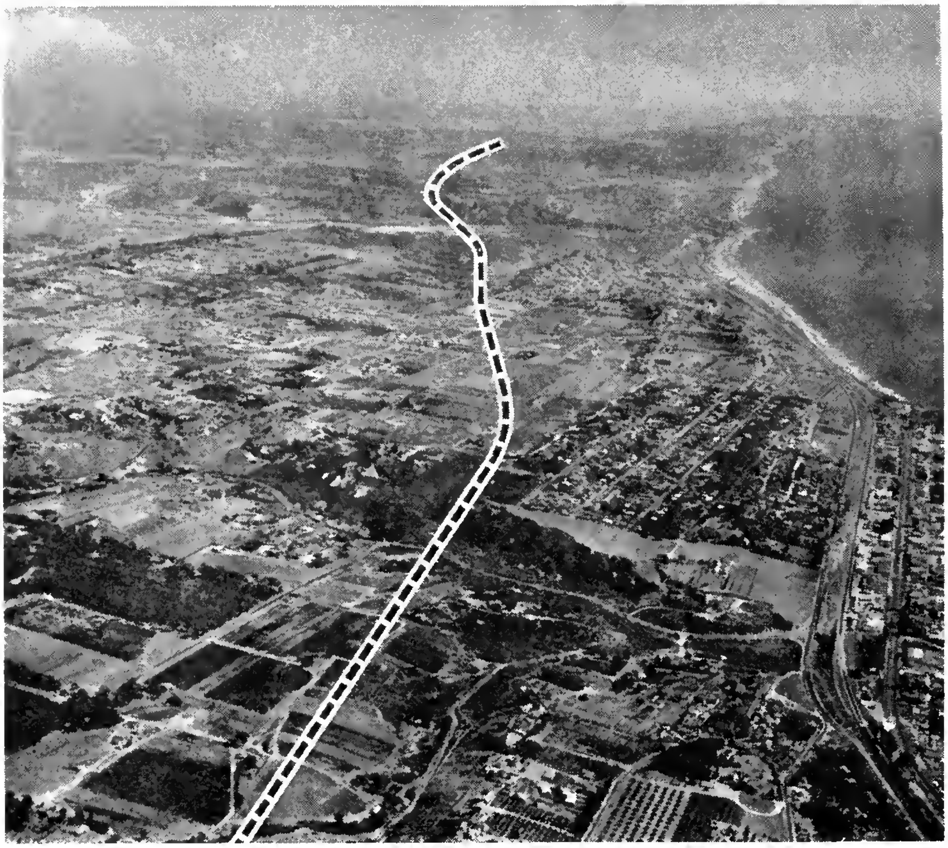
The portion of US 101 between Washington Street and Barnett Avenue in San Diego is presently under construction to full freeway standards. The $1,368,476 job converting one mile to freeway standards will be completed by the end of 1958. Progressing northerly to the north end of Mission Bay, the 1.7-mile freeway section constructed in 1954 at a cost of $1,335,000 serves to eliminate a bottleneck at Balboa Boulevard as well as to improve the alignment of US 101 into the mouth of Rose Canyon. This section of US 101 is usually referred to as the "Balboa Avenue Bypass."

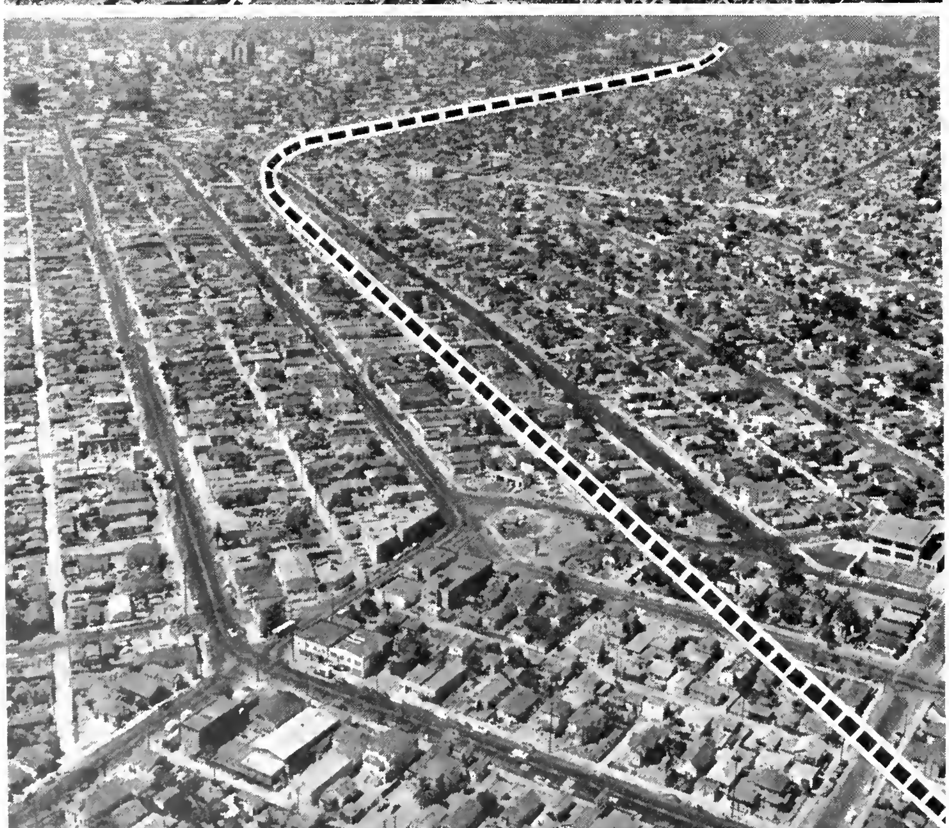
The State Highway Commission recently selected another section of US 101 from the north city limits of San Diego to Carlsbad to be developed to freeway standards. Design is proceeding on this critical section which bypasses several coastal communities.

The section of US 101 from the south city limits of Carlsbad to the Camp Pendleton gate just north of the City of Oceanside presently provides the motorist with full freeway development. The last of the several contracts which totaled approximately seven and a quarter million dollars, was completed in 1955.

US 101 from Oceanside north to the county as well as district line has been fortunate not to have been strangled by commercial ribbon development. Almost the entire alignment lies within the old Rancho Santa Margarita, which was held intact by its owners, the O'Neil family. Since its acquisition by the Federal Government at the beginning of World War II for a Marine training center—Camp

This view westward shows the US 80-Sign Route 98 intersection in southwestern Imperial County





UPPER—The superimposed line on this photo shows the future location of the Coastal Freeway extending south from Leucadia. San Marcos Road crosses the line in the middle foreground. LOWER—A view northwest shows the adopted line for the San Diego Freeway from above 27th Street and National Avenue. The routing in the middleground runs parallel between Logan Street (left) and Kearny Street (right).

Pendleton—the same policy has been adhered to. The present four-lane development, although not to freeway standards, bears witness to one of the basic concepts of modern highway design. That is, by eliminating the conflict caused by turning movements, the relative capacity of the highway is greatly enhanced.

The entire 72 miles of US 101 in District XI will be brought to full freeway standards as rapidly as available funds will permit.

US 80 Improved

US 80 budgetwise occupies the spotlight of the 1958 construction program. With the recent award made to R. E. Hazard and W. F. Maxwell Companies of San Diego, as a joint venture, in the amount of $1,214,000 for 1.3 miles of eight-lane freeway between US 101 and US 395, the western section of US 80 will soon be under construction. The project provides an interchange at Presidio Park. The eastern limits of construction join a mile of eight-lane freeway well advanced in construction at the junction of US 80 and US 395 in the Mission Valley area of San Diego. Five bridges, in addition to minor modifications to those existing, are included with the grading and paving contract which amounts to $3,318,000.

Design plans are completed and early advertising is expected on the segment of US 80 between the US 395 interchange and Fairmount Avenue. Eight lanes will be provided through traffic while high-type interchanges will be provided at Texas Street and Ward Road. The north and south frontage roads will be connected with a bridge just east of US 395. A new bridge projecting northerly across the San Diego River from the Ward Road Interchange will be a portion of the contract. The Fairmount Avenue Interchange now nearing completion serves the eastern section of San Diego, as well as providing a connection to Mission Gorge Road.

The portion of US 80 easterly of Fairmount Avenue traversing the Alvarado Canyon below San Diego State College is expected to be advertised for bid in the near future, for construction of which $4,010,000 has been budgeted. Provision has been made for interchanges at Waring Road and College Avenue before the six-lane development connects to a recently completed freeway section at 70th Street (Lake Murray Boulevard). The Baltimore Drive freeway section picking up on the eastern limits of 70th Street extends the six-lane development to the edge of the City of La Mesa, an incorporated area of 25,000 population lying just east of the City of San Diego. A gap of 2.32 miles remains to be developed between Baltimore Drive and La Mesa Boulevard, which marks the beginning of the Grossmont Summit job now under construction. The 1959-60 annual budget recently approved by the State Highway Commission allocates $3,040,000 for the construction of this section of US 80. It is anticipated that completion of the $3,594,000 contract on the Grossmont Summit will be accomplished by the time this article is in print.

This picture was taken under the Washington Street interchange on US 101 in San Diego. The columns have been arranged to provide for a railroad wye as well as the highway.

Interchange Problems

The Grossmont Summit contract is one of the district's more ambitious projects in design and cost. The interchange problems which accrued as a result of the high traffic volumes generated by the El Cajon Valley area as well as the junction of State Sign Route 67 freeway to US 80 at this western portal of the El Cajon Valley, were among the most complex yet faced by the district. At one point there will be 18 lanes side by side to handle traffic destined for El Cajon, La Mesa, San Diego, and way points via State Sign Route 67, to say nothing of accommodating residential communities lying both north and south of the freeway. Two structures will provide the motorist left-turning movements at the routes' junction near La Mesa Boulevard, while overhead bridges at Fuerte Drive and Grossmont Boulevard will serve the residential communities adjacent to the highway. A pedestrian overhead crossing will serve the Grossmont High School, with its 3,000 students. Chase Avenue marks the eastern limits of the going contract and the beginning of the next portion presently in the design stage.

A view westward taken above the US 101-Palomar Street interchange. The diked-off areas in the background are salt drying beds.

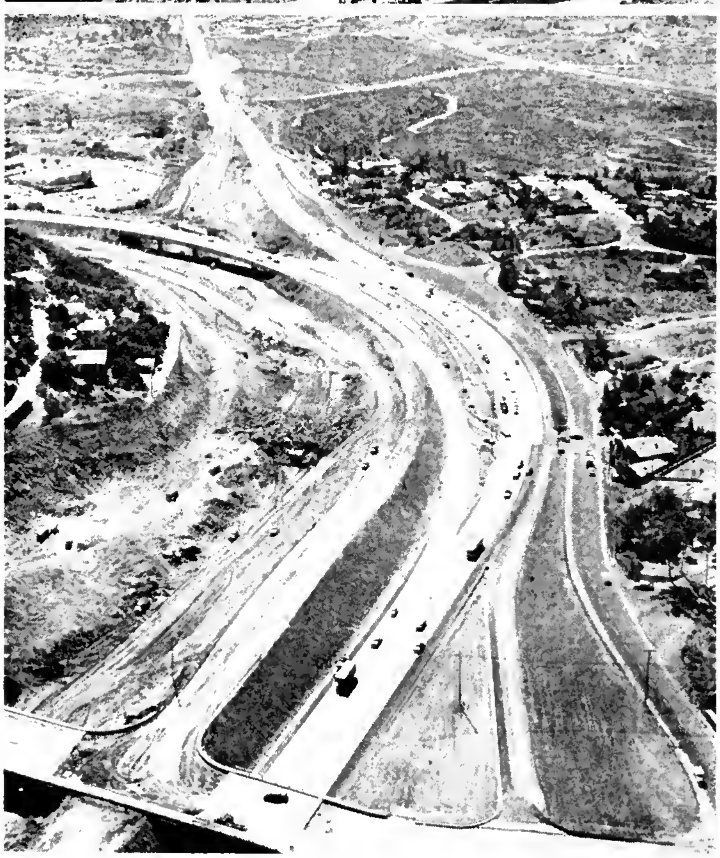
The route sweeps northerly from Chase Avenue, crossing over existing El Cajon Avenue and the railroad on overhead bridges to a diamond-type interchange at West Main Street. Curving easterly again, the six-lane improvement passes over Marshall and

This aerial view northward was taken above US 101 in Rose Canyon two miles north of Balboa Avenue

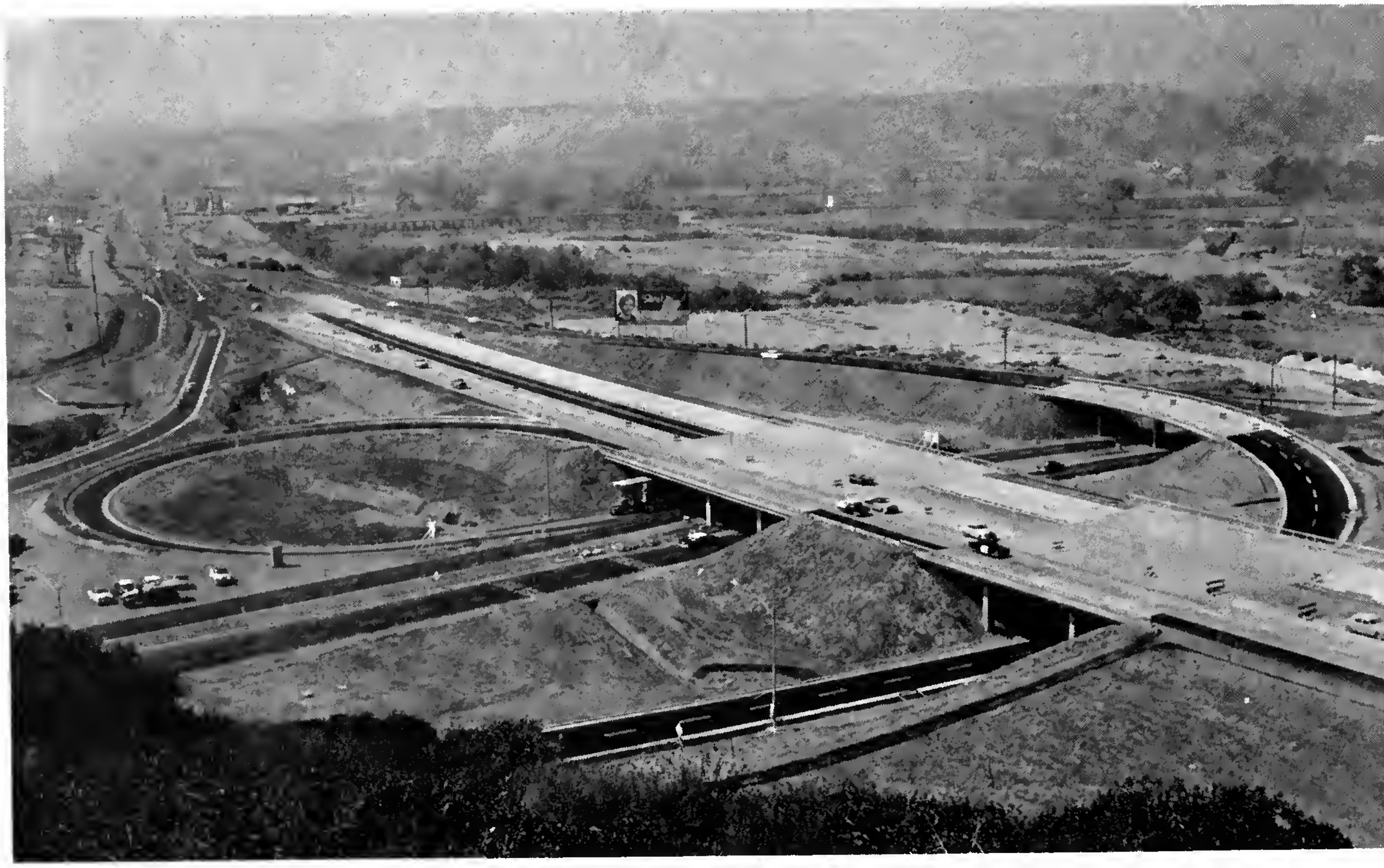
Johnson Streets on grade separation structures with a major interchange at Magnolia Avenue (State Sign Route 67).

The right-of-way program for the Chase to Magnolia Avenues section of US 80 is almost completed and it is expected that construction will be under way in 1959. A $4,000,000 item for this construction is included in the 1959-60 annual budget recently approved by the State Highway Commission. A portion of the fills have already been placed by excess excavation from the Grossmont section.

It is anticipated that four lanes running easterly from Magnolia Avenue will for the time being adequately serve traffic needs across the valley floor to the new freeway's intersection with existing US 80 in the vicinity of Third Avenue on the eastern edge of the City of El Cajon. Diamond-type interchanges are planned for Mollison and Second Streets, while grade separations are scheduled for Ballantyne and First Streets. Grape



UPPER LEFT—When completed, this interchange will connect US 395 and US 80. The City of San Diego is in the background. UPPER RIGHT—A view southward on existing US 101 through San Diego in the vicinity of Washington Street. LOWER LEFT—This interchange under construction will connect US 80 and Sign Route 67 at Grossmont Summit. Furte Drive is in the left foreground. LOWER RIGHT—Looking east on US 80 showing the Grossmont Boulevard separation and pedestrian overcrossing.



This pattern of bridges and ramps is the new US 80-Fairmont Avenue traffic interchange just east of San Diego

Street, near the eastern limits of the project, is the location for a pedestrian overhead crossing to serve schools in the area. Right-of-way acquisition is active on this segment of US 80 and construction is budgeted for the 1959-60 Fiscal Year. A temporary connection from the freeway to the existing highway will be provided near Broadway.

Subdivisions Served

The last section of US 80, where a route adoption has been made by the California Highway Commission and a freeway agreement has been negotiated, is between Third Avenue and Flume Drive. Preliminary engineering on this section points to a one-half-diamond interchange at Third Avenue and at Greenfield. Connecting ramps at Third will serve the east, while the Greenfield ramps will serve traffic of western origin and destination. A grade separation is planned for Broadway to serve the mushrooming subdivision developments, as well as several proposed schools in the area east of the freeway.

To summarize the activity on US 80, the entire metropolitan portion of US 80 from US 101 to Third Street on the east side of the City of El Cajon is either under contract or is at present budgeted for construction. Where the initial construction is not eight lanes in width, sufficient right-of-way has been purchased to permit future widening to eight lanes.

Planning is well advanced on construction to interstate standards of the Highway 80 project easterly to the state line. A public meeting was held on September 11, 1958, in Jacumba to discuss alternate routes of US 80 between Laguna Junction and Coyote Wells. The California Highway Commission took under consideration at its October meeting the matter of a freeway routing on this section. Further public meetings are planned for the near future covering the remaining portions of US 80 not yet routed or designated as freeways by the California Highway Commission.

State Sign Route 94

State Sign Route 94, a 64-mile east-west highway originating within the business district of the City of San Diego, takes a southerly bearing, almost touching the Mexican border before swinging northerly to join US 80 at White Star, approximately 12 miles west of the Imperial county line. This route serves Jamul, Dulzura, Barrett, Potrero, and Campo — small unincorporated towns in the most southern section of San Diego County—in addition to serving as a major artery in the metropolitan freeway system.

The segment which will join the relocation of US 101 through the City of San Diego to the existing freeway terminating at Home Avenue, has just recently been put to contract. With a previous contract for nine bridges nearing completion, the present grading and paving contract in the amount of $1,956,600 will provide a full freeway as far west as 24th and F Streets, only several city blocks from its ulti-

. . . Continued on page 46

San Clemente

San Diego Freeway Reaches Orange County Coast City

By R. M. INNIS, Resident Engineer

The most recent section of the San Diego Freeway to be completed is located in and south of the community of San Clemente, a seaside resort town of 8,000 located in southwest Orange County, just midway between Los Angeles and San Diego. San Clemente was originally founded by Ole Hanson in 1925 on land that once belonged to the Rancho Los Desechos under old Spanish land grant. The city was incorporated in 1928 as a "Spanish Village" and building regulations required that dwellings be constructed in native motif, with plaster exteriors and red tile roofs.

Future development of the City of San Clemente will be enhanced by the current construction activity on the San Diego Freeway from the San Diego county line through Capistrano Beach, San Juan Capistrano and El Toro, and the inclusion in the 1959-60 state highway budget of a project which will complete the freeway development through the community.

All construction on the San Diego Freeway in this area should be finished and ready for travel by 1960 or 1961.

Actual bid opening for the San Diego Freeway in and south of San Clemente took place on April 25, 1957, with award of a contract to J. E. Haddock and Cox Brothers Contractors following on May 9, 1957. Construction crews began operations on May 20,

Looking south along the new freeway through San Clemente. The north connection with present US 101, which passes under the freeway, can be seen in the foreground.

Another view of the San Clemente Freeway looking north showing the end of the freeway and present US 101 extending on through the northern section of the city

1957, with roadway excavation totaling 680,000 cubic yards. The $2,500,000, 2.3-mile job was economically handled because of minimum hauling distances, since materials—58,000 cubic yards—were obtainable in the immediate vicinity. Excess excavation was turned over to District XI for roadway embankment material for future freeway construction in northern San Diego County. The more significant features of freeway construction included: three reinforced concrete overcrossings; one steel girder bridge with single-cast girders measuring 177 feet over existing Highway 101, built of 710,000 pounds of structural steel; and 22,033 feet of storm drain pipe. Twenty-six thousand cubic yards of concrete was used for the 8-inch-thick, six-lane, divided roadway. A constant danger during construction was the presence of a high-pressure coastwise gas main measuring 12¾ inches and operating at a pressure of 400 pounds per square inch. Careful plans and yet more careful engineering prevented damage to the main throughout the construction period.

The San Diego Freeway from its junction with the Santa Ana Freeway at Niguel Road near El Toro south to the limits of San Juan Capistrano is under construction now and is expected to be completed in July, 1959. South through San Juan Capistrano another contract is rapidly nearing completion. These two construction projects will add another 12 miles to the growing mileage of completed portions of the San Diego Freeway in Orange County.

The only remaining gap in the freeway from El Toro to the San Diego county line is between the project nearing completion in San Juan Capistrano and the job recently completed in and south of San Clemente.

The 1959-60 state highway budget adopted by the California Highway Commission in October includes a freeway project which will close this 7.7-mile gap. Estimated cost of this budgeted project is $7,700,000 of which $7,000,000 is financed in the 1959-60 Fiscal Year.

Budget Exceeds $600 Million

Highway Commission Details Record Allocations for 59-60

This general story on the Budget is supplemented by other details appearing on pages 58 to 64.

THE CALIFORNIA Highway Commission has adopted and submitted to Governor Goodwin J. Knight a state highway budget for the 1959-60 Fiscal Year with an overall total of $610,711,862, of which $559,872,403 is for state highways.

The budget is predicated on the assumption that the Legislature will take action to retain highway user taxes at their present levels instead of allowing some of them to drop back on January 1, 1960. Present law provides for the gasoline tax to be changed from 6 cents per gallon to 5½ cents on that date and for other levies to be reduced correspondingly.

The budget provides approximately $491,000,000 for state highway construction purposes, including rights-of-way, said C. M. Gilliss, who was Director of Public Works and Chairman of the Highway Commission when the budget was adopted in October.

The current (1958-59 Fiscal Year) budget as adopted in October, 1957, and augmented by federal legislation in April, 1958, contained a gross total of $517,000,000.

Federal Aid a Key Factor

The principal factor in the 18 percent increase in the 1959-60 budget over the current one is the apportionment of federal aid for Interstate System highways on the basis of each state's actual needs instead of on the previous area-population-post road mileage formula. Congress' decision to follow the needs formula raised California's share of interstate apportionments from less than 6 percent of the national to about 10 percent.

The federal aid apportionment to California for 1959-60 is $302,020,852, of which $252,779,750 is for the Interstate System. The original 1958-59 federal-aid apportionment, based on the old formula, was $163,409,763, of which $115,365,437 was interstate. These were increased last April to $197,077,767 and $126,959,953, respectively.

Major sources of state-collected highway revenue expected in the 1959-60 budget include: $233,070,000 in gasoline taxes (up $3,000,000 from the previous year's estimate); $44,337,000 from motor vehicle fees (down $15,000,000 from the previous year's estimate because of increased budgets of the California Highway Patrol and Department of Motor Vehicles and reduced estimates of new car registrations); $20,000,000 from use fuel (diesel) tax (slightly up from previous year); and $10,000,000 from transportation taxes on for-hire carriers (about the same as the previous year).

Nonstate Highway Items

Of the nearly $51,000,000 in the budget for functions other than state highway work, the major item is $31,558,000 for major city streets other than state highways, based on ⅝ cents per gallon of the gasoline tax. Other nonstate highway items are:

Federal aid for county roads on the federal-aid secondary system, $8,724,389; state funds to counties for use in matching these federal funds, $4,273,060; state funds for matching city and county funds for elimination of railroad grade crossings on local streets and roads (not state highways), $5,000,000; and engineering funds for cities, $1,200,000.

Gilliss explained that the 1⅜ cents per gallon of the gasoline tax and a portion of the motor vehicle fees which are apportioned to the State's 58 counties for local road purposes do not appear in the state highway budget because they are disbursed directly by the State Controller. For the 1959-60 Fiscal Year these state funds for county roads will total an estimated $81,000,000.

State Highway Items

The approximately $491,000,000 in the budget for state highway construction purposes includes:

Major construction and improvement (contracts plus engineering), $356,977,000; rights-of-way, $127,500,000; contingencies (normally available for construction purposes), $6,645,403; resurfacing program, $5,000,000; minor improvements, $800,000.

Proposed expenditures for state highway purposes other than construction include: maintenance, $36,200,000; buildings and plants, $10,000,000; administration, $9,800,000; statewide highway planning survey, $3,000,000; maintenance of San Francisco Bay area state-owned toll bridges, $2,200,000; and honor camps, $1,750,000.

Planting Projects

The 1959-60 state highway budget contains 36 projects for roadside and dividing strip planting, including landscaping. The total outlay for these projects is estimated at $3,965,000, an increase of $785,000 over the planting funds budgeted a year ago.

Two-Year Budgeting

Gilliss pointed out that the 1959-60 budget contains a number of items which are only partly financed in a single fiscal year. This two-year budgeting was provided for by legislation enacted in 1957, and was first used in the 1958-59 state highway budget.

"This procedure has proved successful in placing particularly large and complex projects under contract without tying up heavy amounts of highway funds in a single budget item," he explained. "By financing out of one year's budget only the amount which will be needed for the job in that one year, we make room in the same budget for more projects."

Early Contract Awards

State Highway Engineer G. T. McCoy informed the commission that right-of-way acquisition and plans and specifications had already been completed on some of the projects included in the new budget, and that these projects could be advertised for bids beginning in mid-November

State law permits the awarding of state highway contracts as early as January 1st, six months before the start of the fiscal year, in order to take maximum advantage of favorable construction weather and complete jobs earlier.

Significant features of the 1959-60 state highway budget include:

Los Angeles Area

Los Angeles County projects with a total estimated cost of $105,215,000 are included in the 1959-60 state highway budget. Not all of these new projects are completely financed in the 1959-60 budget, however; some of them are being financed over more than one fiscal year

The budget also contained more than $52,000,000 for the purchase of rights-of-way on Los Angeles County state highway routes, including $15,800,000 for the San Diego Freeway and $15,650,000 for the Santa Monica Freeway.

Major construction emphasis is centered on completing important sections of the Golden State, Santa Monica and San Diego Freeways:

- On the Golden State Freeway the newly budgeted projects, estimated to cost a total of $30,600,000, will extend the freeway as far north as Lankershim Boulevard, completing a freeway bypass of downtown Los Angeles.
- On the Santa Monica Freeway the budgeted projects will provide for construction of freeway viaduct which will link the Santa Ana and Harbor Freeways. Total estimated cost of these Santa Monica Freeway projects is $46,500,000.
- Three projects included in the budget on the San Diego Freeway will provide for a section of freeway and for structures on the freeway route near Long Beach, as well as for structures on the freeway route near Inglewood.

Widening of three sections of the San Bernardino Freeway to six or eight lanes between the Long Beach Freeway and the San Bernardino county line is also included.

In addition, the 1959-60 budget provides funds to complete the financing on several projects including jobs now under construction which will complete the Ventura Freeway in the San Fernando Valley, and extend the Harbor Freeway as far south as 190th Street.

In Ventura County the budget provides for construction of a 4.6-mile section of freeway on US 101 in the City of San Buenaventura.

Orange County

The budget provides for construction of an eight-mile section of freeway through San Clemente to San Juan Capistrano which will close the final freeway gap on US 101 in Orange County. This project, together with other jobs now under construction, will provide 90 miles of continuous full freeway on US 101 from the San Diego county line, through the City of Los Angeles, to the west end of the San Fernando Valley.

San Diego Area

In the San Diego area, the budget provides for construction of the first unit of US 101 freeway through San Diego, and for the conversion to full freeway of the remaining expressway sections on US 80 between San Diego and El Cajon. When the budgeted projects on US 80 are finished, there will be 17 miles of full freeway between Taylor Street in San Diego and Third Street in east El Cajon. Total estimated cost of budgeted San Diego County projects is $23,500,000. In addition the budget contains $11,830,000 for rights-of-way on state highway routes in the county.

San Bernardino-Riverside

Freeway development in the San Bernardino-Riverside area will be continued by several large-scale projects including the extension of the Riverside Freeway through Corona, and construction of a freeway-expressway section east of Redlands at the Yucaipa junction and a six-mile freeway bypass of the City of Beaumont. The latter project will complete continuous multilane divided highway, nearly all freeway or expressway, for 125 miles between Los Angeles and Indio, except for the four-lane undivided section through Redlands.

On major routes north of San Bernardino, the budget contains allocations for construction of a freeway bypass of the City of Barstow, and also for 25 miles of freeway on U. S. Highway 91-466 between Baker and Valley Wells, which will convert the present Baker Grade to a freeway.

San Francisco Bay Region

The 1959-60 budget provides the first construction funds for two long-planned and extensive highway projects in Oakland—the Webster Street Tube parallel to the present Posey Tube between Oakland and Alameda, and the first unit of the MacArthur Freeway on U. S. Highway 50. Financing is also completed on a freeway section of US 40 now under construction in the vicinity of the El Cerrito Overhead.

South of San Francisco, the budgeted projects include widening to eight lanes on a seven-mile section of the Bayshore Freeway in San Mateo County, and freeway jobs in Santa Clara County which will extend the Bayshore Freeway as far south as Sunnyvale. When these budgeted Santa Clara County projects are completed, there will be 40 miles of continuous full freeway on the Bayshore between the San Francisco-Oakland Bay Bridge and Sunnyvale.

In San Francisco the budget contains allocations for 1.2 miles of eight-lane freeway at the approach to the Golden Gate Bridge, and for further construction on the Southern Freeway west of the James Lick Memorial (Bayshore) Freeway. In addition, financing is completed on the Southern Freeway-James Lick Memorial Freeway Interchange which is now under construction.

North Bay Area

Marin County budgeted projects on the Redwood Highway (US 101) will provide for additional construction to complete the Greenbrae Interchange, and also for construction of two interchanges north of San Rafael. To the north in Sonoma County a project is included which will complete a freeway bypass of Healdsburg. Funds are also allocated for 2.5 miles of freeway construction west of Benicia in Solano County.

Sacramento Region

West of Sacramento on the Winters-Dunnigan Cutoff, two projects will provide 19 miles of new highway, the initial two lanes of a future four-lane freeway on this interstate route. East of Sacramento the budget provides funds for construction of the Nimbus Interchange on U. S. Highway 50.

US Highway 40

Projects west of Sacramento on this important cross-state route include conversion from expressway to six- and eight-lane freeway in Solano County, construction of an interchange at Sign Route 12 near Fairfield, and conversion from expressway to freeway near Davis.

The 1959-60 budget contains three new projects covering 23 miles on U. S. Highway 40 east of Sacramento. Estimated total cost of these jobs is $30,450,000. In addition, the budget also provides funds to complete the financing on four freeway projects which are now under construction on this route.

Two of the new US 40 projects will cover a 13-mile section between east of Gold Run and west of Emigrant Gap, and the third will involve the relocation of US 40 as a freeway over Donner Summit.

When the projects now budgeted or under construction on US 40 are completed, there will be only a single 11-mile gap in continuous full freeway and expressway between Sacramento and the Nevada state line.

US Highway 101

On US 101, the budgeted projects outside metropolitan areas will continue the steady conversion of this route to freeway and expressway standards, both between Los Angeles and San Francisco and on the Redwood Highway. These projects include the freeway section through Ventura, and others west of Santa Barbara, through Pismo Beach in San Luis Obispo County, and through Soledad in Monterey County; an expressway section north of Willits in Mendocino County; and in Humboldt County a stretch of freeway south of Dyerville a parallel bridge over the Eel River south of Scotia, and a section of freeway in the vicinity of Trinidad.

The Pismo Beach job, together with other current projects in San Luis Obispo County, will provide about 70 miles of continuous freeway and expressway from north of the Santa Barbara county line to north of San Miguel.

US Highway 99

On US 99 the major projects outside metropolitan areas are two interchange projects in Kern County; the conversion of 5.3 miles from expressway to freeway in Tulare County; conversion of a section of the Stockton Bypass from expressway to freeway; and two projects in Shasta County, which, with other current jobs, will provide about 30 miles of continuous freeway and expressway in the Sacramento River Canyon between north of Shasta Lake and north of Dunsmuir.

(For list of state highway budget projects by counties see page 58.)

Richard Hon

Supervising Highway Engineer Richard Hon, head of advance planning in District VII and a Highway Division engineer since 1931, died of a heart attack September 29th.

His highway work was in Districts VIII and X before World War II. He was a naval officer from 1941 to 1946, serving at 11th Naval District Headquarters and Port Hueneme and in the 146th Construction Battalion and the Okinawa Campaign in the South Pacific.

Hon was a graduate of the New Mexico School of Mines in 1929 and was a mining engineer as well as a civil engineer. He was born in Sheridan, Wyoming, on May 12, 1907.

He is survived by his wife, Eleanor, two daughters, Sandra and Linda, and a brother and sister.

Senior Road Engineer Ray Collins Leaves

Ray Collins, Senior Engineer with the Division of Highways District VII office in Los Angeles, has retired after 26 years with the State.

Collins was born in Plainville, Kansas. Following grade school and high school training in Fremont, Nebraska, and Chicago, Illinois, he studied engineering at the University of Illinois.

RAY COLLINS

After graduating in 1909, Collins went to work with the U. S. Bureau of Lands in the Philippines as chief of survey party in Moro Province, Zamboanga.

Collins' surveying took him into many remote areas of the archipelago. He worked on uninhabited islands north of Borneo and south of Palawan, five of which had never appeared on a map until he surveyed them.

He returned to the United States and joined the Illinois Highway Department in 1914 but went back to the Philippines the following year as chief of cadastral survey at Cabanatuan outside of Manila. He returned to the United States in 1917 and became general superintendent for a paving firm in Akron, Ohio. He later worked as an engineer in Los Angeles, becoming chief of party for the City of Los Angeles in 1924.

Collins went to work for the State Division of Highways in 1932. He became a senior highway engineer in 1955.

Collins is married and has a son and four grandchildren. He plans to teach in parochial schools after his retirement.

DISTRICT XI

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mate terminus with the San Diego Freeway at 18th and F Streets.

The 7.8 miles of full freeway from Home Avenue to Campo Road has been in operation for approximately two years and represents a construction investment of $7,490,000.

State Sign Route 67, which forms the connecting link between State Sign Route 94 and US 80, fulfills the needs of the eastbound motorist desiring to reach the El Cajon Valley. This full freeway section between Campo Road, at the eastern limits of La Mesa, and the Grossmont Summit, was completed in 1957 at a cost of $1,625,000.

Planning studies are under way to develop 4.9 miles of State Sign Route 94 to full freeway standards from Campo Road at Spring Valley to the Sweetwater River Bridge just east of Jamacha Junction. Consideration is also being given to improving several rural segments which are in immediate need of attention because of substandard alignment, grade and sight-distance.

State Sign Route 78

Need for a route to connect the coastal US 101 to the inland US 395 near the center of District XI is met in State Sign Route 78. This artery, in addition to being a coast-to-inland connection between two areas of significant population, also serves the mountain resort areas of Ramona and Julian to ultimately connect to US 99 in the Imperial Valley just north of Kane Springs.

The existing section of Sign Route 78 between Oceanside and Vista is developed to four-lane expressway standards, while the planned freeway section between Vista and Escondido is presently in the design stage. A portion of the right-of-way along this route has been acquired, but no construction has been scheduled to date. The development of the expressway between Oceanside and Vista to freeway standard is also under consideration at the present time; however, construction is anticipated to be quite some time in the future.

US 395

Originating in the business district of the City of San Diego, US 395 extends inland almost due north of the city and serves traffic desiring to reach the eastern metropolitan areas of Los Angeles. While the most southern portion of the route traverses city streets, US 395 acquires freeway character at A Street at the southern tip of 1,400-acre Balboa Park, which is imbedded in the geographical heart of the City of San Diego. The Cabrillo Freeway sweeps with gentle curves through a central valley of the park, providing the motorist with one of the most scenic drives in California. The initial freeway effort in District XI, it still stands as a model of beauty and efficiency. Since the original development which terminated in Mission Valley, the freeway section has been lengthened until it now extends seven miles north to Clairemont Mesa Boulevard. The recently completed interchange at this boulevard was constructed at a cost of $546,314.

Planning is under way to convert US 395 to full freeway standards from Clairemont Mesa Boulevard through the City of Escondido, to the north district and county line. It is considered most fortunate that when the original right-of-way acquisition was made for the existing two-lane development, a major portion of the access rights were acquired at that time.

US 60-70

Traffic originating in the Los Angeles area wishing to go to Phoenix, Arizona, would probably enter District XI at Thousand Palms (Edom) about 12 miles northwest of Indio. From Thousand Palms to Indio, US 60-70 runs coincident with US 99. Branching at Indio, US 60-70—an interstate highway—extends easterly to Blythe on the Colorado River.

A long-standing deficiency on US 60-70-99, the portion from Thousand Palms to the Indio Overhead, a distance of nine miles, is expected to be remedied shortly. Two and a half million dollars has been budgeted to develop this segment of highway to freeway standards. Design plans call for full interchange treatment of Washington and Jefferson Streets along the route.

The segment of US 60-70 from Cactus City, approximately 14 miles east of Indio, extending easterly to Blythe, has a route adopted and declared a freeway by the California Highway Commission, while the segment between the Indio Overhead and Cactus City is in the planning stage, with public meetings anticipated in the near future.

At the Colorado River, the most easterly point of US 60-70, District XI has entered into a co-operative agreement with the Arizona Highway Department for the construction of a new bridge spanning the Colorado River. Plans are being prepared for the bridge and its approaches, for which California's share of $620,000 has been included in the 1958-59 Budget.

State Sign Route 111

Forming the principal north-south routes in the Imperial Valley between US 60-70 and US 80, on either side of the Salton Sea, US 99 and State Sign Route 111 serve one of the richest agricultural areas in the United States. Gradual improvement to freeway standards is contemplated for the future.

State Sign Route 115

Construction is under way at the present time to widen, grade and pave a section of State Route 115 from Sandia Turn to Alamorio. This contract was awarded to R. R. Hensler of Sun Valley, California, with a low bid of $992,000.

Another construction project completed during the 1958-59 Fiscal Year was the section between 0.4 mile north of the Orita Canal and the Standard Canal. Structural failure due to parallel irrigation facilities necessitated the reconstruction of the arterial at a cost of $537,000. Sign Route 115 originates in Calipatria at Sign Route 111 and projects southerly through Holtville on US 80 to terminate at Bonds Corner on Sign Route 98.

State Sign Route 98

Roughly parallel to and originating on US 80 near the Coyote Wells Underpass, State Sign Route 98 swings southeasterly to afford a direct line through Calexico at the international boundary and continues easterly to Midway where it rejoins US 80.

The most westerly section, from the Coyote Wells Underpass to Mount Signal, is sometimes referred to as the

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This section of Sign Route 18-30 is between Snow Valley and Big Bear Lake

DISTRICT VIII

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conversion from four-lane divided expressway to full freeway. Plans for a 2.1-mile section including the Yucaipa Boulevard Interchange are complete and right-of-way is cleared. This project, estimated to cost $1.4 million, will be advertised for bids in the near future, with funds provided in the new budget by the California Highway Commission.

Between Yucaipa Boulevard and Beaumont, design work is under way which will convert the existing expressway to full freeway. Plans for 5.3 miles of full freeway construction between the junction with US 60 west of Beaumont and 22d Street in Banning are nearly complete and $5.8 million is provided in the new 1959-60 Budget for construction of this unit.

Full freeway construction of a 3.5-mile section through the City of Banning was completed in 1956, and this section is now being landscaped with city, state, and federal funds. Between Banning and the vicinity of Whitewater, existing initial stage construction will be converted to full freeway and design work is well advanced. From Whitewater to Thousand Palms, initial four-lane stage construction of 14.4 miles was completed in 1956, including an interchange at Indian Avenue, the county road between Palm Springs and Desert Hot Springs.

US 91

Progress on US 91 was described in an article in the September, 1957, issue of this magazine. Since that time, two public meetings have been held in Yermo for discussion of location of the last remaining link in this route, a 27-mile section between Barstow and Field, including the community of Yermo. The California Highway Commission held a public hearing on this question in Yermo on September 9, 1958, and has just adopted the route at its October meeting.

Construction of 8.6 miles between State Sign Route 30 in San Bernardino and Devore, at the mouth of Cajon Pass, is expected to be completed by the contractors, Matich, Sundt and Bevanda, this winter.

Construction of 29 miles between Victorville and Barstow, now under way by Fredericksen and Kasler, Contractors, is expected to be open to traffic before Christmas this year. If this aim is achieved, the contractors will have saved about five months over the scheduled time for construction.

Design work and plans are now nearly complete on units of US 91 freeway through the City of Barstow and between Baker and Valley Wells, both projects financed for construction by the new budget of the California Highway Commission. The Baker-Valley Wells project will convert the present Baker Grade to a freeway.

US 60

US 60 will join and cross the Riverside Freeway in a cloverleaf traffic interchange which will be a part of the Escondido Freeway previously described. West of this interchange, the US 60 freeway will lie on new location for approximately 4.5 miles through West Riverside. Plans for this project are well advanced and right-of-way is 60 percent purchased.

Initial four-lane stage freeway construction has been in use between West Riverside and Mira Loma since 1946. From this point westerly to the Los Angeles county line, studies are under way for the general route to be adopted.

For the portion east of the Box Springs Interchange, where US 60 leaves the Escondido Freeway (US 395), design work is now under way for initial four-lane stage construction to the vicinity of State Route 79. From State Sign Route 79 to four miles west of Beaumont, a 5.2-mile section of expressway was completed in 1956. The final link, a 4.8-mile section to the west edge of Beaumont has just been placed under contract with Silva and Hill Construction Company for construction as a four-lane expressway to cost about $1.1 million. East of the end of this project, US 60 is coincident with US 70 and US 99 to the district boundary.

US 395

From the southern boundary of Riverside County, US 395 follows the Escondido, Riverside, and San Bernardino Freeways to Cajon Pass. For the portion north of Cajon Pass, planning studies for general route selection are under way. Route adoptions have been culminated on two sections, one in the vicinity of Adelanto and one in the Kramer Hills. These two sections have been constructed to initial stage standards for a total of 9.2 miles.

Other Routes

Freeway planning is progressing on a number of state routes which are not designated as U. S. highways. These include State Sign Routes 18, 30, and 111, and Legislative Route 187 through Morongo Valley.

The general location for the State Sign Route 30 freeway has been adopted from Upland to San Bernardino. A public meeting was held on September 18, 1958, in La Verne to discuss possible locations in the area west of Upland. Initial stage construc-

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COST INDEX

Continued from page 24 . . .

ally encountered and highest prices are to be expected.

The average price for untreated rock base in the last three quarters was well below the price range previously prevailing. This quarter the price average rose to $2.18 from the previous low of $1.73 and now approximates the alltime average.

The average unit price for asphaltic and bituminous mixes dropped from $5.67 to $5.56 in this quarter. The change is in the range of normally expected fluctuations.

While the average unit price for portland cement concrete pavement is up $0.22 to $13.99 per cubic yard, the price for the quarter is still at a low level when compared to averages prevailing for the last two years.

The average unit price for class "A" portland cement concrete (structures) standing at $53.93 is down $0.51 from the second quarter. It is the lowest average determined since the first quarter of 1956. Expanded use of innovations introduced on structure projects in the immediate past are primarily responsible for reduced bid prices.

The average unit price of $0.126 for bar reinforcing steel is but a slight increase over the second quarter.

The average unit price for structural steel for this quarter amounting to $0.182 is an increase of $0.024 above the previous period. It is again in the range of several past quarters. The low price obtained in the second quarter was forced to that level by bids for the item on one extremely large freeway project.

Past behavior of the index coupled with recent bid prices indicate that a further leveling off will occur in the fourth quarter.

The California Highway Construction Cost Index, the Engineering News-Record Construction Cost Index, and the United States Bureau of Public Roads Composite Mile Index, all reduced to the base 1940 = 100, are shown on the graph on page 24. The latter two indexes are based on nationwide construction costs.

The Engineering News-Record Cost Index, which now stands at 316.6, again shows a rise over the preceding quarter. It is up 6.2 index points or 2 percent from the third quarter. This index is strongly affected by many large projects outside the highway construction field.

The Bureau of Public Roads Composite Mile Index for the second quarter of 1958 at the level of 235.3, which

NUMBER AND SIZE OF PROJECTS, TOTAL BID VALUES AND AVERAGE NUMBER OF BIDDERS

(July 1, 1958, to September 30, 1958)

Project Volume	Up to $50,000	$50,000 to $100,000	$100,000 to $250,000	$250,000 to $500,000	$500,000 to $1,000,000	Over $1,000,000	All Projects
Road Projects							
No. of projects	71	31	31	17	8	4	162
Total value*	$1,614,807	$2,154,898	$5,298,811	$5,741,223	$6,160,918	$5,250,666	$26,221,323
Avg. No. bidders	3.9	5.0	5.5	6.0	8.8	9.8	5.0
Structure Projects							
No. of projects	9	3	2	3	1	4	22
Total value*	$228,089	$238,138	$383,862	$967,980	$588,847	$9,756,508	$12,163,424
Avg. No. bidders	6.0	4.7	14.0	6.7	9.0	9.5	7.4
Combination Projects							
No. of projects	----------	----------	----------	----------	3	17	20
Total value*	----------	----------	----------	----------	$2,473,650	$50,620,130	$53,093,780
Avg. No. bidders	----------	----------	----------	----------	3.3	7.9	7.2
Summary							
No. of projects	80	34	33	20	12	25	204
Total value*	$1,842,896	$2,393,036	$5,682,673	$6,709,203	$9,223,415	$65,627,304	$91,478,527
Avg. No. bidders	4.1	4.9	6.1	6.1	7.3	8.5	5.5

* Bid items only.

Total Average Bidders by Months

	July	Aug.	Sept.	Avg. for three months
1958	5.4	5.5	5.6	5.5
1957	6.1	6.7	5.7	6.2

AVERAGE CONTRACT PRICES

	Roadway excavation, per cu. yd.	Untreated rock base, per ton	Plant mixed surfacing, per ton	Asphalt concrete pavement, per ton	Asphaltic and bituminous mixes, per ton	PCC pavement, per cu. yd.	PCC structures, per cu. yd.	Bar reinforcing steel, per lb.	Structural steel, per lb.
1940	$0.22	$1.54	$2.19	$2.97	----------	$7.68	$18.33	$0.040	$0.083
1941	0.26	2.31	2.84	3.18	----------	7.54	23.31	0.053	0.107
1942	0.35	2.81	4.02	4.16	----------	9.62	29.48	0.073	0.103
1943	0.42	2.26	3.71	4.76	----------	11.48	31.76	0.069	0.080
1944	0.50	2.45	4.10	4.50	----------	10.46	31.99	0.054	0.132
1945	0.51	2.42	4.20	4.88	----------	10.90	37.20	0.059	0.102
1946	0.41	2.45	4.00	4.68	----------	9.48	37.38	0.060	0.099
1947	0.46	2.42	4.32	5.38	----------	12.38	48.44	0.080	0.138
1948	0.55	2.43	4.30	5.38	----------	13.04	49.85	0.092	0.126
1949	0.49	2.67	4.67	4.64	----------	12.28	48.67	0.095	0.117
1950	0.40	2.25	4.26	3.75	----------	11.11	43.45	0.079	0.094
1951	0.49	2.52	4.34	6.00	----------	12.21	47.22	0.102	0.169
1952	0.56	2.99	5.00	4.38	----------	13.42	48.08	0.098	0.150
1953	0.51	2.14[1]	5.31	4.68	----------	12.74	50.59	0.093	0.133
1954	0.45	2.13	4.50	4.86	----------	14.41	48.42	0.094	0.124
1955	0.39	2.22	4.93	----------	----------	13.35	45.72	0.096	0.142
1st Quarter 1956	0.40	2.08	5.40	6.50	----------	14.05	52.51	0.105	0.166
2d Quarter 1956	0.51	2.06	6.27	----------	----------	14.64	57.13	0.113	0.219
3d Quarter 1956	0.52	2.27	6.12	----------	----------	15.57	56.32	0.121	0.178
4th Quarter 1956	0.52	2.21	[2]	[2]	$5.93[2]	14.95	59.63	0.112	0.197
1st Quarter 1957	0.63	2.10	----------	----------	5.94	17.28	61.14	0.129	0.235
2d Quarter 1957	0.63	2.10	----------	----------	6.18	15.59	58.51	0.119	0.204
3d Quarter 1957	0.42	2.34	----------	----------	5.10	14.34	58.68	0.130	0.200
4th Quarter 1957	0.68	1.78	----------	----------	5.45	16.88	59.76	0.129	0.177
1st Quarter 1958	0.52	1.86	----------	----------	5.45	14.95	55.21	0.118	0.192
2d Quarter 1958	0.48	1.73	----------	----------	5.67	13.77	54.44	0.125	0.158
3d Quarter 1958	0.39	2.18	----------	----------	5.56	13.99	53.93	0.126	0.182

[1] The item of crusher run base was used before 1953.

[2] Asphalt concrete pavement combined with plant mix surfacing in fourth quarter, 1956, and will be identified as asphaltic and bituminous mixes in the future.

is the latest available, was up 1.9 index points or 0.8 percent from the first quarter of 1958.

THE CALIFORNIA HIGHWAY CONSTRUCTION COST INDEX

Year	Cost index
1940	100.0
1941	125.0
1942	157.5
1943	156.4
1944	177.8
1945	179.5
1946	179.7
1947	203.3
1948	216.6
1949	190.7
1950	181.2
(1st Quarter 1950—160.6)	
1951	225.0
(4th Quarter 1951—245.4)	
1952	225.9
1953	215.2
1954	193.5
(2d Quarter 1954—189.0)	
1955 (1st Quarter)	189.3
1955 (2d Quarter)	212.4
1955 (3d Quarter)	208.6
1955 (4th Quarter)	212.6
1956 (1st Quarter)	219.5
1956 (2d Quarter)	255.9
1956 (3d Quarter)	249.1
1956 (4th Quarter)	252.1
1957 (1st Quarter)	277.7
1957 (2d Quarter)	266.9
1957 (3d Quarter)	237.5
1957 (4th Quarter)	262.1
1958 (1st Quarter)	241.8
1958 (2d Quarter)	231.0
1958 (3d Quarter)	228.5

DISTRICT XI

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"Yuha Cutoff." Improvements were completed in 1956 on this 22-mile section at a cost of $303,000. Constantly increasing traffic on this, as well as many other farm-to-market facilities in the Imperial Valley, are an indication of the rapidly expanding agricultural economy of this area.

The multitude of construction contracts executed since District XI's inception in 1933 only emphasize the adjacent deficiencies. As in most other portions of the State, the rapid expansion of population has taxed most existing facilities to or beyond the breaking point. Every effort is being made, with the full co-operation of the cities and counties within the area, to keep abreast, if not in front, of the most critical needs of this southern portion of the State. With the construction of the National System of Interstate and Defense Highways getting into high gear, District XI is prepared to solve its share of the future's transportation problems.

Auto Crash Kills A. H. Henderson

A. H. "Gus" Henderson, Deputy Director of Public Works and longtime state official, died in an automobile accident in Sacramento on October 1st. His death ended a career of more than 40 years of state service which began when he went to work as a messenger boy for the Department of Motor Vehicles on January 12, 1918.

Henderson served as Director of Motor Vehicles under Governor Earl Warren from 1948 to 1953. One of his primary concerns as director was to provide adequate quarters for the rapidly growing department. This culminated in construction of a huge office building in Sacramento.

Director of Public Works C. M. Gilliss said Henderson was invaluable to the department because of the variety of his long experience. He cited Henderson's skill in screening huge highway contracts and settling disputes and other problems.

Other state officials joined in paying tribute to the veteran state executive.

Henderson was born September 1, 1902, in Angels Camp, Calaveras County, and attended school in Sacramento and Eureka.

After working as a messenger for the Department of Motor Vehicles, Henderson transferred to the old Bureau of Printing as a driver and messenger in 1919. He became a clerk in the office of the State Architect one year later and remained on that staff until 1932, when he transferred to the Department of Public Works as Disbursing Officer.

From 1933 to 1938 he was chief clerk for the Fresno District of the Division of Highways. He was promoted to Assistant Director of Public Works in 1943 and Deputy Director in 1947.

During World War II Henderson was put in charge of the gasoline rationing program for state vehicles and was commended by Governor Warren for his handling of the task.

Henderson returned to the post as Deputy Director of Public Works in 1955. He was in charge of the relief program for county roads and city streets damaged by floods in 1955 and 1958. His handling of the program won him commendation from the Board of Directors of the County Supervisors Association of California.

Henderson is survived by his wife, Edris, and a half sister, Mrs. Nancy Rhoads.

W. J. Braker Retires; Had 31 Years Service

William J. Braker, engineer with the District III Office of the Division of Highways in Marysville, has retired after 31 years with the State. All of his service was with District III where he started his career in November, 1927.

Braker was born in Allentown, Pennsylvania, but moved to California while he was still a child. He served with the 91st Division in France during World War I as a sergeant in Company B, 316th Engineers.

At the end of the war, Braker returned to work as a chainman, rodman and instrumentman for a private engineering firm. He then tried the field of auto mechanics for approximately five years before he entered state service in District III.

He soon became an expert on concrete and asphaltic paving and was associated with most of the large projects in District III during his period of service. At the time of his retirement he was district representative on the project to build the structures for the South Sacramento Freeway.

Braker plans to retire to his home in Suisun where he will spend much of his time indulging in his favorite sport of fishing for salmon and bass in San Francisco Bay and in the ocean near there.

DESIGN OF INTERCHANGE

Continued from page 20 . . .

in 1960, will connect temporarily into Boyle Avenue where Boyle Avenue leaves the model on the westerly edge.

2. The Santa Ana Freeway (inbound end) leaves the model at about the middle of the westerly edge just north of the Sixth Street Viaduct (Whittier Boulevard). This freeway is existing with no changes in alignment contemplated.

3. The Santa Ana Freeway (outbound end) leaves the model at the extreme easterly end. This also is the present alignment of this freeway. The existing Santa Ana Freeway roadways may be traced through the interchange by referring to two continuous roadways separated by a narrow dividing strip of uniform width.

4. The Santa Monica Freeway leaves at the southwest corner on the Los Angeles River Bridge and Overhead. This bridge, which is presently under construction and expected to be completed in 1959, represents the first construction on the 22-mile-long Santa Monica Freeway. The most northerly and southerly of this complex of roadways over the Los Angeles River and adjacent railroad tracks serve the Santa Fe Avenue on- and off-ramps immediately to the west of the model.

The future Pomona Freeway leaves at the northeasterly corner of the east end of the model. This freeway is still in the planning stage, and the route for this portion of it has not yet been adopted by the California Highway Commission.

Some identifiable north-south traffic arteries include Boyle Avenue, Soto Street and Euclid Avenue; east-west streets are Fourth Street, Whittier Boulevard, Seventh Street and Eighth Street. Some landmarks are Hollenbeck Park and Lake, east of the Golden State Freeway and south of Fourth Street; the *Times-Mirror* Press Telephone Directory Plant on Boyle Avenue in the triangle formed by freeway roadways; the Soto Street Elementary School on Soto Street near Seventh Street; the Los Angeles River channel at the southwest corner; and the Atchison, Topeka & Santa Fe Railroad tracks on the west side of the river and the Union Pacific tracks on the east side.

This closeup of the freeway model gives some idea of how the future East Los Angeles interchange will appear looking west along the Santa Ana Freeway

Probable Traffic Load

All the main interconnecting roadways have been designed for a safe speed of 50 m.p.h. or greater. In addition to providing smooth alignment, it is believed that sufficient lanes have been provided for smooth operation. Each of the following streets is crossed by 23 lanes of traffic: Soto Street, Boyle Avenue and Marietta Street. There are 14 lanes carried on the Los Angeles River Bridge and 18 lanes crossing Euclid Avenue. If you take a section of the model at just the right angle in the vicinity of Fickett Street, east of Soto Street, you would cut through 27 12-foot-wide traffic lanes. Traffic counts projected into the year 1980 indicate that 400,000 vehicles a day will be using this interchange. By comparison the four-level interchange is now being used by 350,000 vehicles daily.

To aid the motorist in his selection of a route, numerous overhead illuminated signs are to be installed. But in view of the necessary complexity of the interchange, the motorist on approaching roadways should have a clear idea in advance of what routes he should follow to reach his destination.

CAMP IRWIN, CALIFORNIA

Editor,
California Highways and
Public Works

SIR: I would like to be put on your mailing list for *California Highways and Public Works* magazine. As post aviation officer I am responsible for keeping our navigation maps up to date and briefing pilots before flights. The new freeways and construction sites make excellent check points for visual navigation.

KENT JONES
1st Lieutenant, U. S. Army

WHY FREEWAYS?

Continued from page 18 . . .

appeal to all of us. Build a conventional highway, and five years from now you will seek a new right-of-way, because of this commercial ribbon development and the resulting congestion. You will take more property from the tax rolls, destroy more homes and factories—but the freeway, once located and built, will carry its designed volume of traffic until you wear it out. Another advantage important to you as a county official—the community and the area may plan for an orderly expansion, secure in the knowledge that the transportation facility is, once and for all, permanently located.

I have one other matter to discuss. In *Look Magazine*, December 10, 1957, there was a shocking story titled, "Highway Robbery in Indiana." *Life Magazine*, August 6, 1957, reported several states in which high-placed officials were in trouble because of misuse or misappropriation of state highway funds. In California, with the largest highway program in the Country, there has never been any such scandal.

For this pre-eminence of our highway program and organization, credit goes to the Governor, the Legislature, groups such as yours, and to the people themselves. We have a Governor who religiously refuses to intrude politics into the important highway program.

We have legislators who established and are maintaining safeguards in the law—who delegated the budgeting of highway projects and the locating of freeway routes to the California Highway Commission to keep these functions as free as possible from politics—who enacted a State Contract Act requiring the award of contracts to the lowest responsible bidders. There is no room here for manipulation or monkey business. The citizens themselves established long ago in our State Constitution a provision that highway funds should not be diverted to other purposes. These things could not have been accomplished without the interest in good government constantly demonstrated by your own powerful association over the years.

I want to appeal to you today to continue your critical interest. In California we have a good organization and a good program, because you, and the citizens you represent, were interested at its inception. But, if we do not have your continuing interest and support, there will be no one to write the laws to set up the safeguards for the forward-looking highway programs of tomorrow, no one to support the Legislature in its desire to keep politics out of the highway program.

When the citizen's home or business is affected by a freeway location, he becomes, as you and I would, quite vocal. Naturally, these few who are disturbed for the benefit of the many, are the loudest voices heard by your legislators. And, so there are proposals which grow in strength at each legislative session; proposals to reorganize the department and the commission; to take back to the Legislature the freeway route locations and the highway project budgeting. The legislators don't want to do it, but they are pledged to represent their constituents, and when the only constituents they hear are asking them to make changes, they will introduce and pass laws to make these changes. That is, unless you as officials and responsible citizens, satisfy yourselves first that the highway program and organization is good. Then tell your legislators you think it is good. Tell them that it is important to the future of highways in California to continue to keep politics out of the highway program. You have demonstrated before how effective your voice can be. The transportation lifelines of this State for 1980 with 31 million in population depend on a revitalization of our partnership which built today's highway plant in California and developed today's program.

Three hundred years ago, a distinguished Englishman of learning, Lord Bacon, said, "There are three things which make the nation great and prosperous: busy workshops, fertile fields, and easy convenience of man and goods from place to place." California has those busy workshops. It has the fertile fields, and with the active support, endorsement, and co-operation that will come from our partnership, we will continue to provide for California easy convenience for man and goods from place to place.

John Stanford Named Assistant Director

John Stanford, Management Analyst for the Department of Public Works for 2½ years, became assistant director of the department November 10th.

He was selected to succeed to the civil service post which T. F. Bagshaw vacated on being named director. (See page 9.)

JOHN STANFORD

Stanford has been in management and administrative positions with the State of California since 1946. He went to the Department of Public Works from the Department of Finance, where he was a management analyst. Before that he was administrative service officer in the State Department of Insurance in San Francisco.

His professional affiliations include the American Records Management Association, American Society for Public Administration, and Society for the Advancement of Management. He is president of the Sacramento chapter of the first and a past president of the Sacramento chapter of the second.

A graduate of the University of California, Stanford received a master's degree in public administration at Syracuse University. He was a captain in the Army Air Corps during World War II.

Stanford is married and has three children. His home is at 5417 Spilman Avenue, Sacramento.

California Wins Eighth ITE Award

California has received the national Institute of Traffic Engineers annual award and certificate in recognition of a "high level of performance in traffic engineering" by the State Division of Highways during 1957.

The certificate was presented by Joseph E. Havenner, President of the I. T. E., at a meeting of the Engineering Division of the Governor's Traffic Safety Conference in Sacramento. State Director of Public Works C. M. Gilliss accepted the award in behalf of Governor Goodwin J. Knight and in turn presented it to George M. Webb, Division of Highways Traffic Engineer, who accepted it in behalf of State Highway Engineer G. T. McCoy.

The award was made to California "for maintaining a high level of performance in traffic engineering as reported to the annual inventory of traffic safety activities."

It was the eighth time since 1948 that the division has been singled out for honors with an I. T. E. award.

U. S. Forest Service Projects Approved

The U. S. Bureau of Public Roads and U. S. Forest Service have approved a 1959-60 forest highway program providing $4,705,000 for construction of six projects in Northern and Central California, State Highway Engineer G. T. McCoy reported.

Largest of the projects is a 2.3-mile section of four-lane divided highway on US 50 in El Dorado County, which will connect with a four-lane section recently completed on that route about 17 miles east of Placerville.

Projects on which forest highway funds are expended are programed on the basis of recommendations jointly arrived at by the Bureau of Public Roads, the Forest Service and the State Division of Highways, McCoy explained.

The State provides any necessary rights-of-way and assumes responsibility for maintenance of completed forest highway projects on state highways, and the county does likewise in the case of county roads.

In addition to the six construction projects, the California Forest Highway program for 1959-60 provides $100,000 for minor work on some routes and $100,000 for surveys, making a total of $4,905,000 allocated for the year.

Retired Army Engineer's Letter, Photo Recall North State Bridge Survey of Half Century Ago

The survey party crosses Clear Creek Bridge on the Klamath River Trail. The year: 1909.

Editor,
California Highways and
Public Works

SIR: While checking over some old photograph albums several pictures were noted which it is believed might be of some interest to you, and, perhaps, can give our bridge engineers something to ponder over in their line of work, so, I had some prints made.

The enclosed photographs were taken during the summer of 1909, while I was detailed to compile that portion of the Progressive Military Map of the United States pertaining to Del Norte, Siskiyou, and the northern part of Humboldt Counties. You will note that we had our pack-train with us; the mode in use at that time for carrying supplies along the Klamath River.

It is thought the pictures might be of some use in your historical file.

Sincerely yours,

GEORGE RUHLEN
Colonel, U. S. Army, Ret.

MILWAUKEE, WISCONSIN

To Whom It May Concern:

We have just returned from a two-week vacation which included California. Both of us enjoyed your State very much.

We entered California at the Topaz Station and from there started to climb over the mountains to Yosemite National Park. Going up the east side of the mountain, we had car trouble.

It was early in the morning and no traffic. One of your trucks from the Department of Roads stopped to help us. There wasn't much they could do, but following them was one of your mechanics. They stopped him, and he succeeded in helping us. What de did on our car I could never attempt to do.

After he fixed it I offered him money, but he said: "I have to get on to my job."

I am writing this note to thank you and your department for such wonderful courtesy. I would like to thank him again but I have no way of finding him. I think his name was Jim. All I know is he was working on the east side of the mountains before you enter the park, where they were fixing the road.

Sincerely,

DALE HULSE

(*Editor's Note:* According to J. M. Harris, Equipment Superintendent at Shop 9, Bishop, the Division of Highways employee who assisted Mr. and Mrs. Hulse was James H. Webb, Jr., heavy equipment mechanic.)

DISTRICT VIII

Continued from page 47 . . .

tion on this freeway has been completed as follows:

3.2 miles between Rialto and San Bernardino
15.0 miles between Highland and Running Springs

In addition, five miles are now under construction in mountain terrain east of Barton Flats, as previously mentioned.

Initial construction has been completed on several miles of State Sign Route 18 freeway in the San Bernardino Mountains. For most of the way from the mountains to Long Beach, State Sign Route 18 lies along the San Bernardino and Riverside Freeways.

The freeway location for Legislative Route 187 between US 99 and Morongo Valley was adopted in June, 1958, and design work for this project is now in progress. South of US 99, initial expressway construction on 4.1 miles of the route northwest of Palm Springs (State Sign Route 111) was completed in 1948. Planning studies for general location through the Palm Springs area are under way.

State Publishes New Statistical Abstract

The first issue of the California Statistical Abstract, just published by the State of California, is designed to bring together in one publication principal facts about California and to indicate sources of additional information.

The abstract is patterned after the Statistical Abstract of the United States and covers nearly the same subjects. It has been compiled by the State Interdepartmental Research Coordinating Committee and is sponsored by the Senate Factfinding Committee on Commerce and Economic Development.

Orders for the publication may be sent to: Documents Section, Printing Division, Sacramento, California.

The price is $3.50, postage prepaid within the United States, with 14-cent sales tax added for California addresses.

Retirements of 25 Highway Employees Marked

The Division of Highways has announced that the following employees retired during September and October.

Headquarters

Emil J. Saldine, Principal Highway Engineer, 32 years.

District I

McKinley H. Hudson, Assistant Highway Maintenance Foreman, 34 years; Ferruccio M. Gianoli, Highway Equipment Operator-laborer, 22 years.

District II

Walter H. Yeager, Highway Equipment Operator-Laborer, 24 years.

District III

Alfred J. Bellue, Highway Tree Maintenance Foreman, 25 years; William J. Braker, Assistant Highway Engineer, 30 years; Lauriston H. Frink, Highway Foreman, 29 years.

District IV

Lauriston H. Frink, Highway Foreman, 29 years; Isadore Goldberg, Highway Field Office Assistant, 21 years; James E. Kinyon, Highway Foreman, 33 years; John McGlinchey, Highway Equipment Operator-Laborer, 36 years; Joseph C. Quast, Highway Field Office Assistant, 22 years; Louis A. Stein, Drawbridge Operator, 26 years.

District V

Nathan J. Folks, Highway Equipment Operator-Laborer, 17 years.

District VI

John H. Williams, Highway Foreman, 36 years.

District VII

Ray A. Collins, Senior Highway Engineer, 26 years; Clarence M. Ellinger, Highway Leadingman, 24 years; Herman V. Greenwald, Skilled Laborer, 27 years; Harold H. Hultgren, Senior Delineator, 18 years; Joseph T. Ralston, Highway Equipment Operator-Laborer, 24 years; Alan R. Shira, Highway Foreman, 28 years.

District VIII

Emmett N. Berger, Highway Equipment Operator-Laborer, 21 years; Harry S. Bridgeman, Assistant Highway Engineer, 30 years.

District X

R. R. Westphal, Highway Field Office Assistant, 22 years.

District XI

Frank G. Coppess, Highway Leadingman, 25 years; James N. Parker, Highway Equipment Operator-Laborer, 25 years; Wayne H. Porter, Laborer, 12 years; Herman J. Price, Highway Equipment Operator-Laborer, 17 years.

Vanderlip Promoted By State Chamber

Loran C. Vanderlip, California State Chamber of Commerce official since 1945, has been promoted to a new post, State Legislative Representative of the State Chamber.

He has been Director of the Highway Department of the State Chamber since 1950, and since 1954 has also done part-time legislative work for the chamber. The legislative assignment will now be full time.

Vanderlip was an organizer and first secretary of the Fresno County Junior Chamber of Commerce while he was a student at Fresno State College. He was manager of the Coalinga Chamber of Commerce from 1934 to 1937, and fiscal analyst for the California Taxpayers Association from 1937 to 1945.

Appointed to be new Director of the State Chamber's Highway Department was Chester C. Williams, who has been administrative assistant in the Chamber's Southern California district since March, 1957.

Williams attended Brown Military Institute, Chouinard Art Institute and Valley Junior College. He served in the U. S. Air Force from 1952 to 1956, much of the time in public relations duties.

In 1957, 7,500 pedestrians were killed by autos in the United States.

STATE ROADS

Continued from page 8 . . .

imminent development. The passage of this law encouraged planning of freeways, the construction of which was some years in the future, with the assurance that funds would be available for the protection of right-of-way against major improvements. It is estimated that, up to the present, well over $150 million in right-of-way costs have been saved by the use of this fund. The fund is operated on a revolving basis whereby, as individual parcels so purchased are actually used for construction, the fund is reimbursed from current allotments and the money is used again for the same purpose.

Economic Studies

Soon after freeways began operating in California, it became apparent that economic studies were desirable for the purpose of factually determining the effect of freeway construction on communities, particularly those bypassed, and on the individual property owners. This information is important for the purpose of dispelling by factual studies the concern that communities may have in regard to the effect of freeway construction on their economy. This information is also important as a means to improve appraisal and negotiation techniques by providing a sound basis on which a determination can be made of a just compensation for the affected property owner.

Recognizing this, a Land Economics Study Section has been established within the Right-of-Way Department. The research and reports made by this section on actual cases of freeway construction through and around municipalities have conclusively proved that there is no foundation to the fear that freeways are detrimental to the community or to the value of adjoining properties. Copies of the reports on this subject are made available to anyone who is interested.

Construction Supervised

No one can question the importance of all of the engineering work leading to the start of freeway construction. However, most of this effort will have gone for nothing if the final highway product toward which all engineering work is directed is not properly constructed. The proper end product can only be assured by rigid but practical control of construction. All highway construction in California is done by contractors on a competitive bid basis. All bidders are prequalified on a financial and experience basis, and completion bonds are required. This procedure and method has produced a strong and able group of contractors that can readily handle the entire highway building program efficiently and expeditiously.

Construction is controlled by the engineers of the department. Construction control may be defined as the inspection and testing necessary to assure compliance with quality specifications, together with workmanship consistent with acceptable standards of practice. This control must be adequate to define the intent of plans and specifications and to clarify misunderstandings. Construction control may be divided into two main classifications: (1) fiscal; and (2) inspection and testing.

Fiscal control must assure that federal, state, and local regulations are complied with; orderly progress and final pay estimates issued promptly; careful and complete records maintained in order to reduce misunderstandings; and that contract modifications due to unanticipated conditions are properly processed.

The inspection and testing phase of construction control involves the greater part of the manpower assigned to construction contracts. Continual visual inspection and testing are required on almost all activities from heavy grading operations through the construction of bridges, drainage structures, pavements, and the final phases of completion. This inspection is maintained on a continuing basis, so that a contractor has reasonable assurance that a product, once placed to the satisfaction of an inspector, will be acceptable. This is contrary to the "post-construction audit" type of specification which checks into the quality of the work after construction, and under which procedure entire portions of work may be removed in order to replace one small section which may prove to be substandard.

The department operates a large research and materials testing laboratory at Sacramento, the state headquarters, and district laboratories are in operation in each of the several district headquarters. All construction materials are pretested, and sufficient check-testing is done to measure the acceptability of all materials going into the work. Research programs are under way continually, looking toward better methods and a better final product. An example of the results of construction control, materials testing, and research, is seen in the Pacific portland cement concrete pavements always referred to in California as concrete. We have only recently experimented with and accepted the construction of concrete pavement in 24-foot widths. The riding qualities have been improved, rate of construction accelerated, and the cost reduced.

Operotion Is Co-operative

The operation of freeways in California is a joint responsibility, the Division of Highways being responsible for all signing and traffic control devices, while the policing and actual traffic control insofar as such control is necessary is the job of the California Highway Patrol. The patrol is a separate agency, established for the specific purpose of patrolling the highways, controlling traffic, and enforcing traffic laws.

Due to the relatively high speed of traffic on the freeways, proper signing has taken on added importance. In order to be effective, it is essential that signing be uniform. Signs must be sufficiently large and clear to be easily read and understood by traffic traveling at the prevailing speed on the freeway; the message must be simple, the number of destinations on any one sign being limited to two, if practicable, and not more than three in any event; and signs applicable at all hours are illuminated or reflectorized. Large overhead signs are essential to convey directional messages to motorists on six- and eight-lane freeways in metropolitan areas, primarily due to the fact that vehicles in adjoining lanes interfere with the visibility of ground signs. In many cases these overhead signs require special structures for support, not only for the size but also for personnel maintaining the signs. The cost of signing, including the supporting structures in the cases of overhead signs, varies considerably; however, an average figure for a metropolitan freeway in California is $40 thousand per mile.

As an aid in efficiently carrying out the task of signing highways, a traffic manual has been prepared, setting forth standards and guides to be used in this and other traffic matters. Like other manuals prepared by the department, its contents are under constant review, with revisions being made as research and experience dictate.

Still Much to Do

I have taken you through the evolution of our freeway program to the present time; but, of course, we are not satisfied. We cannot be, because we have not caught up with the needs as they accumulated during the depression and war, nor the rising costs and skyrocketing traffic demands during the postwar period. We cannot be, because it has been California's experience to double in population every 20 years, and we expect this to happen in the next 20. The result will be two and one-half times as many vehicles in 1980 (17 million) and three times as many vehicle-miles on our highway plant (200 billion).

We could not hope to cope with the future demand without taking the next logical step in the orderly planning and development of our freeway program. This involves the selection of an entire, integrated system of freeways on a statewide basis. In response to a request of the State Legislature, the California Division of Highways recently published a report, *The California Freeway System,* which provides the basis for an the actual selection of such a statewide system. The proposed system blankets the State and consists of more than 12,000 miles, to be developed ultimately to freeway standards. It will cost, at today's prices, more than $10 billion. But, with only 11 percent of the miles in the total road plant, it will in 1980 accommodate 59 percent of all motor vehicle travel in the State. The freeway system will:

1. Connect major centers of population.
2. Connect primary centers of industrial activity and of natural resources with centers of supply of labor and material and with major shipping points.
3. Provide access to important military installations and defense activities.
4. Provide access to major recreational areas.
5. Connect seats of county government.
6. Provide for continuity of travel into, through, and around urban areas from rural freeway approaches.
7. Provide for large traffic movements between population and industry within urban areas.
8. Provide for needed capacity in the traffic corridors.
9. Connect with major highways of adjacent states.
10. Provide an integrated system, with a minimum of stubs and spurs, to permit general traffic circulation.

We believe this system to be technically, financially, and economically feasible. From the standpoint of the highway users, its benefits will more than twice exceed its costs. The report says, regarding the need for such a freeway system in California:

"There is need now, and more is coming rapidly, for a highway system that has the primary purpose of linking the major areas of traffic interest with high-standard facilities that provide for fast, consistently safe, protected through-traffic movement. No longer is it possible to serve such traffic on the same facilities that provide land service to abutting property. Such conflicts of interest produce the slowdowns, the highway accidents and fatalities, and the traffic congestion that blight expansion.

"Practically all of the traffic increase in the future must be carried on single-purpose, through-traffic facilities—relieving the present roads and streets of their existing overloads to permit them to resume their primary function of serving the land and the people directly, acting as distributors for the freeway system and providing the final links between origins and destinations."

Architecture Bids Reach Record High

During September a new high was reached by the State Division of Architecture for total value of projects advertised for bids in a single month. The September total was $22,955,000. The previous high was in June, 1958, with a total of $22,260,000.

The division also awarded 21 contracts totaling $4,453,637 and completed 33 contracts totaling $9,075,868 during September. During the same month a total of 114 public school construction plans totaling $23,555,082 was submitted to the division for approval.

The State Division of Highways reported in September that it had awarded 58 interstate highway projects totaling $201,587,000 since July 1, 1956, when the Federal Aid Highway Act of 1956 became effective. The highway division also reported that two more interstate projects totaling $7,621,000 had been advertised for bids.

During September 68 highway contracts amounting to $31,098,000 were awarded and 58 contracts totaling $27,143,000 were completed. On September 30th, the division had 328 highway contracts under way with a total value of $423,676,000.

By the end of September, 64 bridge projects were under way or pending award with a total value of $73,000,000. Plans were also completed during September for another 16 bridge projects totaling $10,500,000.

TECHNICAL COLLEGE
COVENTRY, ENGLAND

Editor,
California Highways and
Public Works

SIR: Many thanks for continued receipt of your journal which I find most helpful in my lectures on highway engineering. I enclose a copy of our local paper which gives some account of progress on a new motorway between London and the Midlands. Wishing you continued success.

Yours faithfully,
W. F. HALL

Merit Award Board Winners Announced

Employees of the Department of Public Works receiving certificates of commendation and cash awards since the last list was published in the September-October issue of this magazine are:

Mrs. Mildred G. Leight, Architecture, Sacramento, certificate of award and $125 for proposing that the practice of returning bid bonds to nonsuccessful bidders on state jobs be eliminated.

Walter S. Ferguson, Highways, Yuba City, certificate of award and $25 for proposing that Standard Plan A-62 show the pay limits of structure excavation and backfill for pipe flared end sections.

Fred V. Rayburn, Highways, Fresno, certificate of award and $100 for proposing that pilot lights be placed on traffic signal controllers to provide a means of rapid checking the condition and operation of detectors and controllers.

Eugene F. Daggett, Highways, San Francisco, certificate of award and $25 for recommmending a modification of contract special provisions deleting the progress schedule requirement on short-term contracts.

Miss Doris A. Welch, Highways, Eureka, certificate of commendation for a suggestion which resulted in a simplification of accounting procedures.

Mrs. Aurelia B. Rinderneck, Highways, San Diego, certificate of commendation for a suggestion regarding Department of Social Welfare forms.

Mrs. Alida R. Hiltibrand, Architecture, Los Angeles, for recommending a checkout system for paper used in a duplicating machine.

James D. Russey, Highways, Santa Rosa, for recommending that future specifications for automobile heaters provide a three-speed blower.

Willis H. Bartlett, Highways, Redding, for suggesting that shipping tags bearing the district office address be used for shipping construction samples to district laboratories for testing.

BUDAPEST VII, HUNGARY

Editor,
California Highways and
Public Works

SIR: I have always been interested in highways and traffic and had my first opportunity to see an example of your beautiful monthly. I was astonished at the imposing and grandiose system of modern highways all over your Country. Each of them is a proud symbol of American genius. The magazine is magnificent.

Very truly yours,

RONCZIK SANDOR

NOTE: The magazine is not a monthly, but is published every other month.—*The Editor.*

FREEWAY MODEL

Continued from page 23 . . .

to spend all our time making autos, trucks and busses, we had to devise a production method. We tried rubber latex molds and water putty castings with moderate success. Our final solution was to make hard plastic molds from a series of hand carved cars, coat the cavities with a mold release and pour in a liquid varicolored plastic. When the liquid set up, the cars were removed and rough spots finished. With this system, we could produce about 50 cars an hour. Only a few basic shapes were necessary—a sedan, sports car, jeep, station wagon, pickup truck and a large truck. We obtained variety by using different colored plastics and could even get two-tone effects. The cars were not scattered helter-skelter about but were grouped and placed throughout the model to set off or balance aesthetically with the landscaping and house colors. We discovered that grouping too many of the bright colors distracted attention from the primary interest—the freeways.

The model is a display unit complete with special legs, protective screen and shipping crate. It was constructed for ease of assembly and disassembly in sections with positive holding devices. The division between sections was carefully picked to miss cutting through any bridges. When crated it weighs about 700 pounds. During shipment to Los Angeles it was insured for $20,000, which prompted the van line company to send a representative from San Francisco to Sacramento to observe the packing procedure. A series of photographs showing each step in the disassembly and crating procedure accompanied the model.

After spending about 3,000 manhours during the 14 months we worked on this project, all four of us in the Bridge Architectural Design Section—Louis Baker, Jack Alexander, Fred Gordon, and Warren Ludlow—can assure you that modelmaking of this scope is far beyond the hobby stage. It encompasses much of bridge and highway engineering, landscaping, architecture and skilled craftsmanship. Almost every phase of Division of Highways activity had some influence on the model while it was building. We gratefully acknowledge our appreciation for the co-operation given us by District VII, all the headquarters offices and our own Sacramento and Los Angeles Bridge Department units.

Even though the model is unique, it only portrays the shape of things to come. The completed interchange which many of you will use will be even more spectacular. And this is only one of the devices used by the Division of Highways to plan safer, more efficient and more beautiful freeways and bridges.

Redding Engineer Leaphart Retires

Frank E. Leaphart, Office Engineer of District II, Division of Highways, Redding, retired on October 31st, ending an engineering career which began in 1923 after his graduation from the University of Missouri.

F. E. LEAPHART

Leaphart was born in Brookfield, Missouri, on October 4, 1888. He went from college to the Missouri State Highway Commission as a project highway engineer, serving in that capacity until March, 1943, when he resigned and moved to Alaska to accept a short term appointment with the Public Roads Administration as resident engineer on the Alaska Military Highway.

His employment with District II began in December, 1943, when he was assigned to the district construction office. He was appointed district office engineer in 1949 and served in that position until his retirement.

Leaphart and his wife, Adele, expect to find a 1etirement home on the Oregon coast.

/eteran Architecture :ngineer Retires

Carl A. Henderlong, Principal Me-:hanical and Electrical Engineer in the)ivision of Architecture, retired from tate service on December 10th follow-ng more than 44 years of service with he Architecture Division.

CARL A. HENDERLONG

Henderlong had been with the Division of Architecture longer than any other present or former employee.

State Architect Anson Boyd said that Henderlong has "an exceptional ınderstanding of the broad engineer-ng aspects of the mechanical, electri-al, civil, sanitary, and hydraulic engi-ıeering fields" and is recognized as a :ader in these fields by his colleagues, ther state agencies, and private indus-rial engineering firms.

"He has shown special ability and ound judgment in engineering design ı order to meet financial limitations," oyd said. "The division sincerely re-rets his leaving. It will be a great loss ɔ the state service."

Born in Alameda on October 1, 1896, Ienderlong came to Sacramento in 905. His father, Charles A. Hender-ɔng, was well known as a building ontractor. Henderlong's schooling 'as obtained in Alameda, San Fran-isco, and Sacramento. His formal edu-ation was supplemented with cor-:spondence courses for specialized aining.

In point of service, Henderlong is ıe division's oldest employee. He arted with the Division of Architec-ıre as a mechanical draftsman in 1914. t that time, when he was 18 years f age, there were 25 employees work-ıg in the division. Today 190 em-loyees are supervised by Henderlong ıd the division has grown to a state-ide organization of over 1,000 em-loyees.

In 1914 an annual construction pro-ram of a million dollars was consid-ed very large and an individual proj-:t of $30,000 was considered a major project. Today a major project is one costing $2,000,000 or more while the State's annual construction program runs between $80,000,000 and $130,000,000.

Henderlong is a licensed mechanical and electrical engineer and is a member of the Illuminating Engineering Society. He is a member of the Sacramento Consistory of the Scottish Rite and belongs to the Ben Ali Temple of the Shrine. He is also a member of the Elks Club.

Henderlong resides with his wife, Dorothy, at 1000 Entrada Road, Arden Acres. After retirement he expects to pursue his hobbies of golf, fishing, and woodworking, together with performing some private engineering consultation.

The Henderlongs plan to do considerable traveling. They have recently completed tours to South America, the Orient, and Central America, and next year they plan to tour Europe.

Jaywalking was costly in the United States last year—2,600 were killed.

TWENTY-FIVE-YEAR AWARDS

Employees who received twenty-five-year awards since those listed in the September-October, 1958, issue of *California Highways and Public Works*

District I
Anderson, James H.
Geoghegan, Hugh B.
Houx, Elvin

District II
Self, Harris B.

District III
Hillebrand, Francis D.
McKenzie, Mildred M.
Vierra, Daniel M.
White, Guy E.

District IV
Elton, Arthur M.
Hoen, Robert T.
Murray, Leo E.
Murray, Thomas J.
Prielipp, Ernest P.
Scoggins, Lee M.

District V
Hixson, Claude H.

District VI
Gilevich, Michael J.
Jackson, George F.
Stanley, Lyle

District VII
Allen, Harry J.
Carney, Edmund M.
Crooks, Walter E.
Mathieu, August E.
Owens, Edward Douglas
Pettis, Kenneth Bradford

District IX
Houghton, F. Edward
Kispert, Charles T.

District X
Graziani, William B.
Johnson, William A.
Stebbens, Wm. G.

District XI
Coppess, Frank G.
Pine, Arthur
Settle, Edwin R.
Tadlock, Robert M.

Headquarters Office
Carmany, Robert M.
Ritter, John

Bridge Department
Brown, John J.
Neff, John K.
Spicklemire, Nelson E.

Bay Bridge
Gewertz, M. W.

Materials and Research
Humbert, J. E.

Shop 4
Clisbee, Allan

1959-60 State Highway Budget Projects by Counties

County	Route†	Description	Approximate mileage	Estimated cost
Alameda	5, 69 (US 40-50, SR 17)	San Francisco-Oakland Bay Bridge to the East Bay Distribution Structure in Oakland; landscape	1.8	$130,000
Alameda	5 (US 50)	San Pablo Underpass in Oakland and Emeryville; resurface and drainage facilities		25,000
Alameda	5 (US 50)	Greenville to Mountain House Rd.; resurface	6.9	200,000
Alameda	5 (US 50)	East Bay Distribution Structure to Grand Ave. in Oakland (portions); grade, pave and structures for first unit of 8-lane MacArthur Freeway (Financed $10,000,000 in the 1959-60 fiscal year)	2.8	15,000,000
Alameda	5, 69 (US 40, US 50)	West and north of the East Bay Distribution Structure; resurface		72,000
Alameda	69 (SR 17)	Nimitz Freeway—At Farnsworth St.-Halcyon Dr. near San Leandro; overcrossing (Co-operative project; City of San Leandro's share, $100,000 to cover approaches)		*160,000
Alameda, Contra Costa	69, 7 (US 40)	Eastshore Freeway—0.3 mile south of El Cerrito Overhead to 0.2 mile south of Jefferson Ave. in Richmond; grade, pave and structures for 6-lane freeway, which with other current and budgeted projects will complete 75 miles of full freeway from Los Gatos to Vallejo. (Financed $1,300,000 in the 1959-60 fiscal year in addition to $4,300,000 in the 1958:59 fiscal year. Project now under construction)	2.3	5,600,000
Alameda	69 (SR 17)	Nimitz Freeway—0.6 mile south of Tennyson Rd. to 0.3 mile north of Jackson St. in Hayward; planting	1.8	80,000
Alameda	69 (SR 17)	Nimitz Freeway—State Highway Route 228 at Washington Ave. to High St. in Oakland; barrier rail in the dividing strip	6.8	306,000
Alameda, Contra Costa	75 (SR 24)	Broadway Low Level Tunnel; paint interior		55,000
Alameda	226	Webster St. Tube; construct 2-lane tube parallel to the present tube between Oakland and Alameda. (Financed $7,000,000 in the 1959-60 fiscal year)	0.8	18,000,000
Alameda	227	Warren Blvd.—Park Blvd. to south of Lincoln Ave.; landscape	1.4	25,000
Alameda	227	Warren Blvd.—Lincoln Ave. to 0.5 mile south of Carson St.; grade, pave and structures for 4-lane freeway (carried over from the 1958-59 budget). (Co-operative project—Oakland and Alameda County providing $150,000 per year each on Warren Blvd. freeway development)	1.6	*1,273,000
Alameda	228, 5 (US 50, and Nimitz-US 50 freeway connection)	From Sign Route 17 (Nimitz Freeway) to Center St.; landscape	3.8	110,000
Alameda	Various	Rights of way on State Highway Routes (including $13,000,000 for U.S. 50 freeway in and south of Oakland)		15,500,000
Alpine, El Dorado	23 (SR 89)	Picketts to Grass Lake (Luther Pass); grade, pave and structures (relocation). (Connects with Federal Government project now under construction to complete relocation over Luther Pass)	3.9	655,000
Alpine	Various	Rights of way on State Highway Routes		10,000
Amador, Alpine	34 (SR 88)	Summit of Carson Spur to 0.2 mile east of Amador-Alpine county line; grade and pave (construct wider highway on improved alignment)	2.2	430,000
Amador	Various	Rights of way on State Highway Routes		25,000
Butte	3 (US 99E)	The Esplanade—Big Chico Creek to 0.3 mile north of Lindo Channel in and north of Chico; grade, pave, signals and structures (widen to four lanes). (Co-operative project, City of Chico's share, $67,050, Butte County's share $24,750)	1.8	*600,000
Butte	Various	Rights of way on State Highway Routes		300,000
Calaveras	Various	Rights of way on State Highway Routes		80,000
Colusa	7 (US 99W)	North of High School Rd. to north of Gail Ave.; landscape freeway through Arbuckle	0.9	41,000
Colusa	88 (SR 45)	3.6 miles south of Grimes to 0.1 mile south of Leven St. in Grimes; grade, pave and structures (reconstruct and widen)	3.3	200,000
Colusa	Various	Rights of way on State Highway Routes		100,000
Contra Costa	7 (US 40)	Ridge Rd. in San Pablo to Crockett; planting	8.0	50,000
Contra Costa	69	Hoffman Blvd. at intersection with 47th St. in Richmond; traffic signals and channelization (co-operative project; City of Richmond's share, $40,000)		*80,000
Contra Costa, Alameda	69, 7 (US 40)	Eastshore Freeway—0.3 mile south of El Cerrito Overhead to 0.2 mile south of Jefferson Ave. in Richmond; grade, pave and structures for a 6-lane freeway which with other current and budgeted projects will complete 75 miles of full freeway from Los Gatos to Vallejo (financed $1,300,000 in 1959-60 fiscal year in addition to $4,300,000 in 1958-59 fiscal year. Project now under construction)	2.3	5,600,000
Contra Costa	75 (SR 24)	West of Sunnybrook Dr. to Hodges Rd.; planting on the Lafayette Bypass	2.8	50,000
Contra Costa, Alameda	75 (SR 24)	Broadway Low Level Tunnel; paint interior		55,000
Contra Costa	Various	Rights of way on State Highway Routes (including $1,500,000 between Danville and Walnut Creek on State Sign Route 21)		2,961,000
Del Norte	1 (US 101)	De Martins Point to Cushing Creek (portions); grade and pave (curve improvement at De Martins Point and truck passing lane at Cushing Creek)	1.2	250,000
Del Norte	71 (US 101)	Lopez Creek Bridge north of Smith River Reservation; (replace bridge with culvert)		25,000
Del Norte	Various	Rights of way on State Highway Routes		100,000
El Dorado	11, 38 (US 50, SR 89)	Mays to Globins; grade, pave and structures (widen to 4 lanes and reconstruct)	2.4	500,000
El Dorado, Alpine	23 (SR 89)	Picketts to Grass Lake (Luther Pass); grade, pave and structures (relocation) (connects with Federal Government project now under construction to complete relocation over Luther Pass)	3.9	655,000

† Numbers marked SR are State Sign Routes; numbers marked US are US highway routes; numbers not marked are legislative routes. * State's share.

County	Route†	Description	Approximate mileage	Estimated cost
El Dorado	38 (SR 89)	0.2 mile north of Eagle Creek to 0.9 mile north of Eagle Creek near Emerald Bay; remove loose rocks from cut slopes	0.7	$40,000
El Dorado	65 (SR 49)	0.2 mile north of Pilot Hill to 1.0 mile north of Hastings Creek northwest of Coloma; grade and pave (relocation)	1.7	250,000
El Dorado	Various	Rights of way on State Highway Routes		370,000
Fresno	10 (SR 198)	Second St. in Coalinga to Three Corners; grade, pave and structures (reconstruction, including widening to 4 lanes adjacent to Coalinga College)	2.6	251,000
Fresno	41 (SR 180)	Teilman Ave. to Tuolumne St. in Fresno; grade and pave (reconstruct portions of Whites Bridge Ave., Amador St., A and B Sts. to provide one-way street couplet)	1.2	210,000
Fresno, Kings	125 (SR 41)	Hanford-Armona Rd. to Floral Ave. (portions); structures (widen bridges and culverts)		161,000
Fresno	Various	Rights of way on State Highway Routes (including $2,568,000 for U.S. 99 freeway between Tulare County line and Fresno)		2,671,000
Glenn	45	Codora Four Corners to Butte City Bridge; grade, pave and structures (causeway across Sacramento River Overflow Channel)	1.2	1,150,000
Glenn	Various	Rights of way on State Highway Routes		150,000
Humboldt	1 (US 101)	Redwood Freeway—Myers Flat to 1.0 mile south of Dyerville; grade, pave and structures for a 4-lane freeway (financed $4,425,000 in the 1959-60 fiscal year) (preliminary work now in progress under earlier contracts) (connects with first Redwood Freeway unit now nearing completion between Dyerville and Englewood)	7.2	5,690,000
Humboldt	1 (US 101)	0.4 mile south to 0.2 mile north of South Scotia Bridge; grade, pave and structures (parallel bridge and approaches)	0.6	1,300,000
Humboldt	1 (US 101)	Little River to 0.3 mile north of Trinidad, grade, pave and structures for 4-lane freeway	3.7	2,700,000
Humboldt	Various	Rights of way on State Highway Routes		840,000
Imperial	187 (SR 115)	Junction of U. S. 80 to Sandia Turn north of Holtville; grade, pave and structures (relocation)	4.3	680,000
Imperial	Various	Rights of way on State Highway Routes		70,000
Inyo	23 (US 6-395)	Independence to Division Creek; grade and pave (reconstruct and widen, partly on new alignment including some 4-laning)	10.0	585,000
Inyo	Various	Rights of way on State Highway Routes		88,000
Kern	4 (US 99)	Zerker Road to 0.5 mile north of Lerdo Highway; grade, pave and structure (construct interchange at Lerdo Highway)	1.4	1,635,000
Kern	4 (US 99)	0.2 mile north of Perkins Ave. in McFarland to 0.2 mile south of Airport Ave; grade, pave and structures (reconstruction of north-bound lanes and interchange at Pond Ave.	4.2	1,200,000
Kern	33 (US 466)	Calloway Canal Bridge between Wasco and Famoso; structure and approaches (replace bridge)		65,000
Kern	58 (US 466)	Tower Line Rd. to Bear Mountain Ranch east of Bakersfield; grade, pave and structure for 4-lane expressway. (Financed $1,175,000 in 1959-60 fiscal year in addition to $6,150,000 in the 1958-59 fiscal year). (Project scheduled to be advertised for bids soon)	11.4	7,325,000
Kern	58 (US 466)	7.1 miles northwest to Mojave (portions); resurface	6.8	180,000
Kern	135	Central Valley Highway—Poso Creek Bridge north of Wasco—structure and approaches; (replace bridge)		131,000
Kern	58, 141 (SR 178)	Oak St.—Brundage Lane to 24th St.; grade, pave, structures and signals (widen to four lanes)	1.9	920,000
Kern	Various	Rights of way on State Highway Routes (including $2,343,000 for U.S. 99 freeway in and near Bakersfield)		2,824,000
Kings, Fresno	125 (SR 41)	Hanford-Armona Rd. to Floral Ave. (portions); structures (widen bridges and culverts)		161,000
Kings	Various	Rights of way on State Highway Routes (including $730,000 for Sign Route 198 freeway in the Hanford area)		750,000
Lake	89 (SR 29)	From junction of Lower Lake Rd. to Kelseyville; grade, pave and structures for two-lane relocation with access control)	4.0	510,000
Lake	Various	Rights of way on State Highway Routes		135,000
Lassen	Various	Rights of way on State Highway Routes		5,000
Los Angeles	2, 166	Hollywood and Santa Ana Freeways—Benton Way to 0.5 mile east of Lakewood Blvd. (portions); barrier rail in dividing strip	9.8	290,000
Los Angeles	2 (US 101)	Hollywood Freeway—Pilgrimage Bridge to Lankershim Blvd.; landscape	2.3	30,000
Los Angeles	2, 159, (US 101)	Hollywood and Ventura Freeways—Moorpark St. to Laurel Canyon Blvd.; landscape	1.7	200,000
Los Angeles	2, 158 (US 101, SR 7)	Hollywood, Ventura and San Diego Freeways— Lankershim Blvd. to San Diego Freeway (portions); grade, pave and structures for 8-lane freeway which with other current projects will complete the Ventura Freeway in the San Fernando Valley; and on the San Diego Freeway—Mulholland Dr. Overcrossing on the future freeway route and Mulholland Dr. relocation. (Financed $1,248,000 in 1959-60 fiscal year in addition to $7,348,000 in the 1958-59 fiscal year. Project now under construction).	4.5	8,596,000
Los Angeles	2, 158 (US 101, SR 7)	Ventura and San Diego Freeways—Sepulveda Blvd. to Encino Ave. on Ventura Freeway, and Valley Vista Blvd. to Burbank Blvd. on San Diego Freeway; landscape	3.5	400,000
Los Angeles	2 (US 101)	Ventura Freeway—Kelvin Ave. to west city limit of Los Angeles; landscape	3.5	75,000
Los Angeles, Ventura	2 (US 101)	Ventura Freeway—Los Angeles city limit to 0.1 mile east of Cheeseboro Rd., and 0.5 mile west of Moorpark Rd. to Conejo Grade Summit; resurface	10.5	730,000
Los Angeles	4, 161, 165, 205 (US 66, US 6-99)	Golden State and Pasadena Freeways—0.6 mile south of Pasadena Ave. to 0.2 mile northwest of Arnold St. on Golden State Freeway, and Bishop Rd. to Ave. 40 on Pasadena Freeway; grade, pave and structures for 8-lane freeway and interchange at the junction of the two freeways. (Financed $8,500,000 in 1959-60 fiscal year). (This project along with other current and budgeted jobs will complete a freeway bypass of downtown Los Angeles on the Golden State Freeway)	1.0	11,000,000
Los Angeles	4 (US 6-99)	Golden State Freeway—Alameda Ave. to Burbank Blvd. in Burbank; landscape	1.3	90,000

† Numbers marked SR are State Sign Routes; numbers marked US are US highway routes; numbers not marked are legislative routes.

County	Route†	Description	Approximate mileage	Estimated cost
Los Angeles	4 (US 6-99)	Golden State Freeway—0.25 mile east of Burbank Blvd. to 0.2 mile west of Roscoe Blvd.; grade, pave and structures for 8-lane freeway (financed $1,225,000 in the 1959-60 fiscal year in addition to $6,000,000 in the 1958-59 fiscal year) (co-operative project; U. S. Corps of Engineers' share $3,000,000 for flood control channel; City of Burbank's share $800,000 for extending Burbank Blvd. separation across railroad)	4.6	$7,225,000
Los Angeles	4 (US 6-99)	Golden State Freeway—0.2 mile southeast of Roscoe Blvd. to 0.2 mile northwest of Lankershim Blvd.; grade, pave and structures for 8-lane freeway	1.8	4,700,000
Los Angeles	4 (US 99)	Piru Creek to 8.8 miles north; resurface	8.8	475,000
Los Angeles	9, 157 (SR 118)	Foothill Blvd.—Sayre St. to Vaughn St. (portions); grade, pave, traffic signals and structure (widen to four lanes)	2.0	400,000
Los Angeles	26 (US 70-99)	San Bernardino Freeway—0.2 mile east of San Dimas Ave. to San Bernardino County line; grade and pave (widen to six lanes)	5.7	1,500,000
Los Angeles	26 (US 60-70-99)	San Bernardino Freeway—San Gabriel River to West Covina city limit; landscape	2.7	100,000
Los Angeles	26 (US 60-70-99)	San Bernardino Freeway—Rosemead Blvd. to Puente Ave.; grade, pave and structures (widen to 8 lanes)	6.5	2,250,000
Los Angeles	26 (US 60-70-99)	San Bernardino Freeway—Long Beach Freeway to Rosemead Blvd.; grade, pave and structures (widen to eight lanes)	5.3	2,000,000
Los Angeles	59 (SR 138)	Palmdale Blvd.—10th St. east to 23d St. in Palmdale; grade, pave and structures (widen to 4 lanes divided)	1.4	350,000
Los Angeles	60 (US 101 Alt.)	Cabrillo Highway at Crenshaw Blvd. in Torrance; traffic signals, lighting and channelization; (co-operative project; City of Torrance's share, $5,000	0.3	*60,000
Los Angeles	60 (US 101 Alt.)	Cabrillo Highway-Rosecrans Ave. to Imperial Highway; grade and resurface (shoulder improvement, channelization, traffic signal modification)	2.0	250,000
Los Angeles	62 (SR 39)	Azusa Ave. and San Gabriel Ave.—from Paramount Ave. to 0.3 mile north of Sierra Madre Ave.; grade and pave (reconstruct to provide one-way street couplet through Azusa)	2.2	500,000
Los Angeles	77	Valley Blvd.—0.1 mile east of Arden Dr. in El Monte to Mission Dr., grade and pave (reconstruct and widen)	1.2	300,000
Los Angeles	158 (SR 7)	San Diego Freeway—Studebaker Rd. to 0.1 mile east of the Long Beach Freeway (portions); structures, pumping plant, and grading of structure approaches on the route of the San Diego Freeway	--------	8,500,000
Los Angeles	158 (SR 7)	San Diego Freeway—0.1 mile east of Long Beach Freeway to Alameda St.; grade, pave and structures for 8-lane freeway (including portions of interchange at Long Beach Freeway)	1.3	6,500,000
Los Angeles	158 (SR 7)	San Diego Freeway—0.2 mile south of Manchester Ave. to 0.1 mile north of Vesta St. (portions); structures on the route of the San Diego Freeway	--------	2,500,000
Los Angeles	158 (SR 7)	San Diego Freeway—Matteson Ave. to Wilshire Blvd.; landscape	3.5	225,000
Los Angeles	161, 162 (US 6-99, SR 2)	Golden State and Glendale Freeways—0.2 mile southeast of Arnold St. to 0.3 mile northwest of Glendale Blvd on the Golden State Freeway, and 0.3 mile southwest of Riverside Dr. to 0.1 mile northeast of Los Angeles River on the Glendale Freeway; grade, pave and structures for 8-lane freeway and a portion of interchange at the junction of the two freeways (financed $11,000,000 in 1959-60 fiscal year)	3.7	14,900,000
Los Angeles	162 (SR 2)	Glendale Freeway—Fletcher Dr. to Verdugo Rd.; landscape	1.0	125,000
Los Angeles	165 (US 6, SR 11)	Harbor Freeway—0.5 mile south of 190th St. to 0.1 mile north of 124th St.; grade, pave and structures for 8-lane freeway (financed $2,100,000 in 1959-60 fiscal year in addition to $6,000,000 in 1958-59 fiscal year) (project now under construction)	4.9	8,100,000
Los Angeles	165 (US 6, SR 11)	Harbor Freeway—120th St. to 88th Pl.; landscape	2.2	200,000
Los Angeles	167 (SR 15)	Long Beach Freeway—For off-ramp at Long Beach Blvd.; grade and pave	0.5	60,000
Los Angeles	173, 165 (SR 26)	Santa Monica Freeway—Oak St. to Main St.; structure and approaches for 8-lane freeway viaduct including a portion of the Santa Monica-Harbor Freeway Interchange. (Together with other current and budgeted projects will complete the Santa Monica Freeway from the Santa Ana Freeway to the Harbor Freeway) (Financed $7,500,000 in 1959-60 fiscal year)	0.9	12,500,000
Los Angeles	173 (SR 26)	Santa Monica Freeway—0.1 mile west of Main St. to Hooper Ave.; structure and approaches for 8-lane freeway viaduct. (Financed $7,700,000 in 1959-60 fiscal year)	1.3	9,200,000
Los Angeles	173 (SR 26)	Santa Monica Freeway—0.3 mile west of Hooper Ave. to Eighth St.; structure and approaches for 8-lane freeway viaduct. (Financed $9,500,000 in the 1959-60 fiscal year)	1.1	12,500,000
Los Angeles	173, 2, 4 (SR 26, US 101)	Santa Monica, Santa Ana and Golden State Freeways—grade, pave and structures for an interchange at the junction of the three freeways. (Financed $9,700,000 in 1959-60 fiscal year)	2.8	12,300,000
Los Angeles	Various	Rights of way on State Highway Routes (including $15,800,000 for the San Diego Freeway and $15,650,000 for the Santa Monica Freeway)	--------	52,024,000
Madera	4 (US 99)	0.5 mile south to 1.5 miles north of Madera; landscape	3.9	250,000
Madera	4 (US 99)	Berenda to Califa; repave northbound lanes	3.7	369,000
Madera	4 (US 99)	Califa to 0.7 mile south of Merced County line; planting	6.1	35,000
Madera	Various	Rights of way on State Highway Routes	--------	1,492,000
Marin	1 (US 101)	Richardson Bay Bridge to San Quentin Wye (portions); planting	5.0	50,000
Marin	1 (US 101)	Vista Point at Golden Gate Bridge; roadway connections and southbound parking areas	--------	40,000
Marin	1 (US 101)	Greenbrae; structures and approaches to complete interchange	0.8	1,240,000
Marin	1 (US 101)	North city limits of San Rafael to Lucas Valley Rd. (portions); grade, pave and structures (two interchanges, frontage roads, and 1.1 miles of additional southbound lane)	2.4	1,250,000
Marin	Various	Rights of way on State Highway Routes	--------	394,000
Mariposa	18 (SR 140)	El Portal to Yosemite Park boundary; grade and pave (reconstruct and widen)	1.1	180,000
Mariposa	65 (SR 49)	2.0 miles north of Sign Route 140 north of Mariposa to Coulterville (portions); grade and pave (continuing widening and realignment)	--------	50,000

† Numbers marked SR are State Sign Routes; numbers marked US are US highway routes; numbers not marked are legislative routes. * State's share.

County	Route†	Description	Approximate mileage	Estimated cost
Mariposa	Various	Rights of way on State Highway Routes		$20,000
Mendocino	1 (US 101)	1.3 miles south of Robinson Creek to Smith St. in Ukiah (portions); resurface	4.8	500,000
Mendocino	1 (US 101)	0.9 mile south of Irvine Lodge to 0.8 mile north of Sherwood Rd.; grade, pave and structures for 4-lane expressway (which will complete expressway for 11 miles between Reeves Creek and Sherwood Rd.)	5.0	2,800,000
Mendocino	56 (SR 1)	Sansi Cattlepass and Sartori Cattlepass near Navarro River; structures (replace cattle-passes)		25,000
Mendocino	56 (SR 1)	Hardy Creek Bridge north of Westport; replace bridge		60,000
Mendocino	Various	Rights of way on State Highway Routes		653,000
Merced	4 (US 99)	Atwater Freeway—South of Canal Creek to Grove Ave.; planting	4.6	35,000
Merced	122 (SR 140)	V St. to U.S. 99 in Merced; grade and pave (widen and resurface)	0.6	75,000
Merced	Various	Rights of way on State Highway Routes		785,000
Modoc	Various	Rights of way on State Highway Routes		35,000
Mono	23 (US 395)	Bodie Rd. to Point Ranch south of Bridgeport; grade and pave (reconstruction and some realignment)	3.6	250,000
Mono	Various	Rights of way on State Highway Routes		15,000
Monterey	2 (US 101)	Through Chualar; planting	1.5	37,000
Monterey	2 (US 101)	0.3 mile south of Salinas River to 1.2 miles north of Soledad; (grade, pave and structures for 4-lane freeway Soledad Bypass) (This job, together with other current and completed projects, will provide continuous freeway-expressway for 45 miles from King City to Salinas, exept for short sections at Greenfield and Gonzales.)	3.3	2,510,000
Monterey	56 (SR 1)	San Luis Obispo County Line to Rocky Creek, north of Big Sur (portions); replace retaining walls		250,000
Monterey	56 (SR 1)	At Dolan Creek south of Big Sur; grade and pave (replace bridge with culvert on new alignment)	0.5	450,000
Monterey	56 (SR 1)	Carpenter St. to south city limit of Monterey; grade, pave and structures for the Carmel Hill Interchange (carried over from 1958-59 budget)	0.8	1,200,000
Monterey	Various	Rights of way on State Highway Routes (including $2,000,000 for Sign Route 1 freeway in the vicinity of Seaside and Monterey)		2,315,000
Napa	6 (SR 37)	Vichy Springs to junction with Sign Route 128 northeast of Napa (portions); grade, pave and structures (widen). (Cooperative project; Napa County's share, $34,000)		*100,000
Napa	Various	Rights of way on State Highway Routes		488,000
Nevada	15 (SR 20)	Slacks Ravine Bridge, east of Smartville; structure and approaches (reconstruct)		37,000
Nevada, Placer	37 (US 40)	Hampshire Rocks to Soda Springs; grade, pave and structures for 4-lane freeway. (Financed $1,392,000 in 1959-60 fiscal year in addition to $4,000,000 in 1958-59 fiscal year. Project now under construction.)	5.7	5,392,000
Nevada	37 (US 40)	Soda Springs to east end of Donner Lake; grade, pave and structures to relocate as 4-lane freeway over Donner Summit. (Financed $7,500,000 in 1959-60 fiscal year)	10.3	17,500,000
Nevada	37, 38 (US 40)	East end of Donner Lake to near Boca; grade, pave and structures for 4-lane freeway. (Financed $2,641,000 in 1959-60 fiscal year in addition to $5,400,000 in the 1958-59 fiscal year. Project now under construction)	8.7	8,041,000
Nevada	38 (US 40)	Near Boca to near Floriston; grade, pave and structures for 4-lane freeway. (Financed $964,000 in the 1959-60 fiscal year in addition to $6,900,000 in the 1958-59 fiscal year. Project now under construction). (The last four projects, together with the recently completed section between Floriston and the atate line, will provide 36 miles of continuous full freeway between Hampshire Rocks and the state line) (When these johs, along with projecta in Placer County, are completed, there will be only a single 11-mile gap in continuous freeway-expressway between Sacramento and the state line)	6.6	7,864,000
Nevada	Various	Rights of way on State Highway Routes		670,000
Orange, San Diego	2 (US 101)	San Diego Freeway—San Mateo Creek to East Avenida Cordoba in and south of San Clemente; landscape	2.2	150,000
Orange	2, 60 (US 101, US 101 Alt)	San Diego Freeway—0.6 mile south of Avenida Cadiz in San Clemente to 1.4 miles south of Sign Route 74 in San Juan Capistrano on U.S. 101; and from U.S. 101 to Serra Junction on U.S. 101 Alt.; grade, pave and structures for 6-lane freeway including an interchange at the U.S. 101-U.S. 101 Alt. junction. (Financed $7,000,000 in the 1959-60 fiscal year.) (This project with other current and completed jobs on the San Diego, Santa Ana, Hollywood and Ventura Freeways to the north will provide 90 miles of continuous full freeway on U.S. 101 from south of San Clemente to Calabasas west of Los Angeles)	7.7	7,700,000
Orange	2 (US 101)	San Diego and Santa Ana Freeways—South of Niguel Rd. near El Toro to Red Hill Ave.; planting	13.5	115,000
Orange	43 (SR 55)	Newport Freeway—19th St. to Palisades Rd. in and near Costa Mesa; grade, structures and traffic signals (construct a future freeway frontage road which, together with the existing State highway, will provide a one-way street couplet)	2.6	450,000
Orange	184	Main St. in Santa Ana—Seventh St. to Santa Ana Freeway; grade, pave and signals (widen to four lanes) (Cooperative project; City of Santa Ana's share, $278,000)	1.1	*135,000
Orange	Various	Rights of way on State Highway Routes (including $2,000,000 for the Newport Freeway between Costa Mesa and the Riverside Freeway and $1,500,000 for the San Diego Freeway)		4,541,000
Placer	3 (US 99E)	Roseville Underpass to Grove St. in Roseville; grade, pave, structure and traffic signals (overcrossing and roadway connections to Church St. plus traffic signals at Main St.)	0.3	120,000
Placer	17 (US 40)	0.5 mile east of Roseville to 1.0 mile east of Newcastle; grade, pave and structures for 4-lane freeway. (Financed $1,994,000 in the 1959-60 fiscal year in addition to $5,500,000 in 1958-59 fiscal year. Project now under construction)	11.1	7,494,000
Placer	37 (US 40)	0.5 mile west of Monte Vista to 0.7 mile east of Baxter; grade, pave and structures for 4-lane freeway. (Financed $5,000,000 in the 1959-60 fiscal year)	5.1	7,300,000

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County	Route†	Description	Approximate mileage	Estimated cost
Placer	37 (US 40)	0.7 mile east of Baxter to one mile west of Emigrant Gap; grade, pave, and structures for 4-lane freeway. (Financed $4,000,000 in the 1959-60 fiscal year.) (With other current and budgeted projects will provide 74 miles of continuous 4-lane freeway and expressway from Sacramento to one mile west of Emigrant Gap.)	7.9	$5,650,000
Placer, Nevada	37 (US 40)	Hampshire Rocks to Soda Springs; grade, pave and structures for 4-lane freeway. (Financed $1,392,000 in the 1959-60 fiscal year in addition to $4,000,000 in 1958-59 fiscal year. Project now under construction.)	5.7	5,392,000
Placer	37 (US 40)	Heather Glenn to Colfax (portions); landscape in vicinity of Weimar Interchange		25,000
Placer	Various	Rights of way on State Highway Routes (including $1,000,000 for U.S. 40 freeway in the vicinity of Emigrant Gap)		1,395,000
Plumas	21 (US 40 Alt)	Chambers Creek and Chipps Creek Bridges in the Feather River Canyon; structures and approaches (replace bridges)		285,000
Plumas	83 (SR 89)	1.0 mile north to 3.0 miles north of Almanor Dam; grade and pave (realignment)	2.0	350,000
Plumas	Various	Rights of way on State Highway Routes		10,000
Riverside	19 (US 60)	University Undercrossing; pumping plant, structure and approaches (construct undercrossing adjacent to University of California campus at Riverside)		230,000
Riverside	19, 26 (US 60-70-99)	U.S. 70-99 in Beaumont to 0.5 mile east of 22d St. in Banning; grade, pave and structures for 6-lane freeway (Beaumont Bypass). (When this is complete there will be 60 miles of multilane divided highway, nearly all freeway or expressway, between Redlands and Indio.)	6.0	6,500,000
Riverside	43 (US 91, SR 18)	Riverside Freeway—0.7 mile west of Corona to Pierce St.; grade, pave and structures for 4-lane freeway through Corona. (Financed $4,284,000 in the 1959-60 fiscal year.)	7.1	7,600,000
Riverside	Various	Rights of way on State Highway Routes		2,985,000
Sacramento	4 (US 99-50)	San Joaquin County Line to Stevenson Ave. south of Sacramento; planting	18.0	220,000
Sacramento	11 (US 50)	Nimbus Interchange; grade, pave and structure	0.7	600,000
Sacramento	232	El Centro Blvd.—Garden Highway near Sacramento to Sutter county line (portions); base and surface (reconstruct)	7.5	450,000
Sacramento	Various	Rights of way on State Highway Routes (including $1,500,000 for U.S. 99E-50 freeway and $500,000 for east-west freeway on U.S. 40-99W and U.S. 50 in Sacramento)		2,425,000
San Benito	Various	Rights of way on State Highway Routes		180,000
San Bernardino	26 (US 70-99)	0.2 mile to 2.4 miles east of Redlands; grade, pave and structures for 4-lane freeway and expressway, including interchange at Yucaipa Blvd.	2.2	1,250,000
San Bernardino	31 (US 91-66)	Victorville to Barstow; planting	31.0	50,000
San Bernardino	31, 58 (US 91-66, US 91-466, and US 66)	From 1.0 mile west of Barstow on U.S. 91-66 to junction with U.S. 91-466 3.0 miles northeast of Barstow, and also to 0.6 mile east of Montara Ave. southeast of Barstow on U.S. 66; grade, surface and structures for 4-lane freeway (Barstow Bypass). (Financed $5,000,000 in 1959-60 fiscal year)	9.9	6,800,000
San Bernardino	31 (US 91-466)	2.0 miles east of Baker to one mile east of Cima Road near Valley Wells; grade, pave and structures for 4-lane freeway, including section over Baker Grade. (Financed $4,800,000 in 1959-60 fiscal year)	24.7	6,800,000
San Bernardino	43 (US 91-395, SR 18)	Warm Creek to Fifth St. in San Bernardino; landscape	1.9	170,000
San Bernardino	43 (SR 18)	5.0 miles north of Big Bear City to 1.0 mile south of forest boundary (portions); grade and pave (curve improvement)		15,000
San Bernardino	145 (US 395)	U.S. 91-66 to U.S. 466 (portions); grade and pave (widening and easing humps and dips)	32.8	300,000
San Bernardino	Various	Rights of way on State Highway Routes (including $1,000,000 for U.S. 70-99 freeway in Redlands)		3,347,000
San Diego	2 (US 101)	Market St. to Laurel St. in San Diego (portions); grade, pave and structures (sections of roadway and structures in the first unit of the future 8-lane cross-town freeway on US 101 through San Diego). (Financed $10,000,000 in the 1959-60 fiscal year)	2.5	13,000,000
San Diego, Orange	2 (US 101)	San Diego Freeway—San Mateo Creek to East Avenida Cordoba in and south of San Clemente; landscape	2.2	150,000
San Diego	12 (US 80)	0.6 mile east of Lake Murray Blvd. to Sign Route 67 east of La Mesa; grade, pave and structures to convert 4-lane expressway to 8-lane freeway	2.4	3,000,000
San Diego	12 (US 80)	0.4 mile west of Chase Ave. to Ballantyne Lane in El Cajon; grade, pave and structures for 6-lane freeway	2.7	4,000,000
San Diego	12 (US 80)	0.2 mile west of Magnolia Ave. to 0.5 mile east of Third St. in El Cajon; grade, pave and structure for 4-lane freeway. (The last three projects, together with other current jobs, will provide 17 miles of continuous full freeway from Taylor St. in San Diego to Third St. in east El Cajon.)	2.5	3,500,000
San Diego	Various	Rights of way on State Highway Routes (including $9,780,000 for U. S. 101 freeway in San Diego)		11,830,000
San Francisco	2 (US 101)	Central Freeway—Mission St. to Turk St.; planting	0.8	125,000
San Francisco	2 (US 101)	Lyon St. to Sign Route 1; grade, pave and structures for 8-lane freeway approach to the Golden Gate Bridge. (Financed $4,400,000 in the 1959-60 fiscal year.)	1.2	5,100,000
San Francisco	68 (US 101, US 101 Byp)	James Lick Memorial Freeway—Third St. to Army St. (portions); barrier rail in dividing strip	2.7	100,000
San Francisco	2 (US 101)	Southern Freeway—Milton St. to James Lick Memorial Freeway Interchange; grade, pave and structures for 8-lane freeway (portions of this section are being graded under a current contract)	1.0	4,850,000
San Francisco	68, 2 (US 101, US 101 Byp)	Southern Freeway—James Lick Memorial Freeway Interchange; structures and approaches. (Financed $1,300,000 in 1959-60 fiscal year in addition to $1,730,000 in 1958-59 fiscal year and $3,000,000 in 1957-58 fiscal year. Project now under construction.) (Co-operative project; City of San Francisco's share $1,970,000.)	0.8	*6,030,000
San Francisco	Various	Rights of way on State Highway Routes (including $1,500,000 for the Southern Freeway in San Francisco)		2,470,000

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County	Route†	Description	Approximate mileage	Estimated cost
San Joaquin	4 (US 99)	Farmington Rd. to Calaveras River (portions); structures and approaches to convert an additional section of the Stockton Bypass from expressway to full freeway	1.6	$1,700,000
San Joaquin	5 (US 50)	East City Limit of Tracy to east of Southern Pacific Overhead; grade, pave and structures (widen overhead and approaches to 4 lanes)	0.2	550,000
San Joaquin	75 (SR 4)	Duck Creek Bridge east of Farmington, structure and approaches (reconstruct)		15,000
San Joaquin	Various	Rights of way on State Highway Routes		750,000
San Luis Obispo	2 (US 101)	Curbaril Ave. to San Jacinto Rd. near Atascadero; landscape	1.7	55,000
San Luis Obispo	2 (US 101)	0.3 mile south of Pismo Overhead to 1.0 mile north of Pismo Beach; grade, pave and structures for 4-lane freeway. (This project, with other current and completed projects, will provide about 70 miles of continuous freeway and expressway between north of the Santa Barbara county line and north of San Miguel.)	2.2	1,700,000
San Luis Obispo	Various	Rights of way on State Highway Routes (including $900,000 for State Sign Route 1 between Morro Bay and San Simeon)		1,290,000
San Mateo	56 (SR 1)	Miramar to Pedro Valley (portions); resurface	2.9	59,000
San Mateo	68 (US 101 Byp)	Bayshore Freeway—north of Harbor Blvd. to Santa Clara county line (portions); landscape interchange areas	1.1	200,000
San Mateo	68 (US 101 Byp)	Bayshore Freeway—Peninsular Ave. Overcrossing to Colma Creek (portions); grade, pave and structures (widen to 8 lanes)	7.0	1,900,000
San Mateo, Santa Clara	68 (US 101 Byp)	Bayshore Freeway—Stierlin Rd. to 0.7 mile north of San Mateo county line; grade, pave and structures for 6-lane freeway (carried over from the 1958-59 budget)	4.4	4,200,000
San Mateo	Various	Rights of way on State Highway Routes (including $1,000,000 for extension of Southern Freeway in Daly City area, and $650,000 for Junipero Serra Freeway)		2,907,000
Santa Barbara	2 (US 101)	Solomon Summit Undercrossing to Lakeview Rd. south of Santa Maria; planting	5.4	67,000
Santa Barbara	2 (US 101)	El Sueno Rd. to 0.5 mile north of Elwood Overhead; grade, pave and structures for 4-lane freeway. (This project, together with other current or completed jobs, will provide contincous 4-lane divided highway, nearly all freeway or expressway, for 39 miles between the Hollister Wye at the west city limit of Santa Barbara and the Santa Ynez River Bridge south of Buellton.)	8.4	5,000,000
Santa Barbara	Various	Rights of way on State Highway Routes		855,000
Santa Clara	2 (US 101)	Gilroy to Llagas Creek (portions); resurface	5.6	225,000
Santa Clara	2 (US 101)	El Camino Real—Sign Route 9 in Mountain View to Palo Alto (portions); resurface	6.5	200,000
Santa Clara	2 (US 101)	El Camino Real—Bailey Ave. in Mountain View, signals and channelization. (Co-operative project; City of Mountain View's share $10,000.)		*75,000
Santa Clara	5 (SR 17)	State Highway Route 42 (Saratoga Ave.) in Los Gatos to Bascom Ave. in San Jose; planting	8.8	125,000
Santa Clara	5 (SR 17)	Lexington School, Idylwild, and Summit Roads south of Los Gatos; grade, pave, channelization and flashing signal		85,000
Santa Clara	5 (SR 17)	East city limit of Los Gatos to 0.3 mile south of Stevens Creek Rd.; resurface existing Sign Route 17	4.4	29,000
Santa Clara	5, 42 (SR 17)	Los Gatos Creek in and near Los Gatos; drainage facilities and channel lining		100,000
Santa Clara	5, 42 (SR 17)	At Sign Route 17-Saratoga Ave. Interchange in Los Gatos; landscape	0.3	65,000
Santa Clara	32 (SR 152)	San Felipe to Hollister Wye; base and surface (reconstruct)	2.3	165,000
Santa Clara	5, 68, 69 (SR 17, US 101 Byp)	Bayshore and Nimitz Freeways—First St. in San Jose to 0.3 mile north of Bayshore Highway on Sign Route 17, and Taylor St. to 0.5 mile north of Brokaw Rd. on U. S. 101 Bypass; grade, pave and structures for 4-lane freeway, including an interchange at the junction of the two freeways (carried over from 1958-59 budget). (Financed $4,385,000 in the 1959-60 fiscal year)	3.9	5,100,000
Santa Clara, San Mateo	68 (US 101 Byp)	Bayshore Freeway—Stierlin Rd. to 0.7 mile north of San Mateo county line; grade, pave and structures for 6-lane freeway (carried over from 1958-59 budget)	4.4	4,200,000
Santa Clara	68, 113 (US 101 Byp, SR 9)	Fair Oaks Ave. to 0.3 mile north of Charleston Rd. (portions); grade, pave and structures for 1.1 miles of 4-lane freeway on Sign Route 9 and 4.9 miles of 6-lane freeway on U. S. 101 Byp (Bayshore). (Financed $3,947,000 in 1959-60 fiscal year.) (Interchange now under construction on this section at Bayshore Freeway and Mountain View-Alviso Rd.) (This project and preceding project, together with other current and completed jobs, will provide 40 miles of continuous full freeway on the Bayshore Freeway between the San Francisco-Oakland Bay Bridge and Sunnyvale.)	6.0	5,050,000
Santa Clara	114 (SR 9)	At Homestead Rd. in Cupertino; channelization and signals (co-operative project; City of Cupertino's share, $6,500; Santa Clara County's share, $2,000)		*72,000
Santa Clara	Various	Rights of way on State Highway Routes (including $1,800,000 on the Bayshore Freeway, and $1,500,000 on the Junipero Serra Freeway)		5,345,000
Santa Cruz	5 (SR 17)	0.3 mile north of junction with the new Sign Route 1 in Santa Cruz to Carbonero Creek at Glen Canyon Rd.; grade, pave and structures for 4-lane expressway	3.9	1,880,000
Santa Cruz	56, 5 (SR 1, 17)	East of Parkway to Sign Route 17 in and near Santa Cruz; planting	2.1	75,000
Santa Cruz	56 (SR 1)	Wilder Creek to 4.0 miles south of Davenport; grade, pave and structures (reconstruct and realign). (Co-operative project; Joint Highway District Nine's share, $240,000.)	3.1	*700,000
Santa Cruz	Various	Rights of way on State Highway Routes		245,000
Shasta	3 (US 99)	0.8 mile north of Shotgun Creek to 0.5 mile south of Castella; grade, pave and structures for 4-lane freeway. (Financed $5,000,000 in the 1959-60 fiscal year.)	6.1	8,300,000
Shasta	3 (US 99)	0.5 mile south of Castella to 1.0 mile south of the Siskiyou County line; grade, pave and structures for 4-lane freeway. (Financed $3,500,000 in the 1959-60 fiscal year.)	4.2	5,200,000
Shasta, Siskiyou	3 (US 99)	1.0 mile south of the Siskiyou county line to the Sacramento River Bridge in Dunsmuir; grade, pave and structures for 4-lane freeway. (Financed $960,000 in the 1959-60 fiscal year in addition to $3,600,000 in the 1958-59 fiscal year. Project now under construction.) (The last three projects with other current and completed jobs will provide 30 miles of continuous freeway-expressway in the Sacramento River Canyon between north of Shasta Lake and north of Dunsmuir.)	3.6	4,560,000

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County	Route†	Description	Approximate mileage	Estimated cost
Shasta	Various	Rights of way on State Highway Routes		$750,000
Sierra	25 (SR 49)	North Fork of the Yuba River to 0.25 mile east of Ramshorn Creek (portions); grade and pave (reconstruct as part of a continuing improvement of this route)		80,000
Siskiyou, Shasta	3 (US 99)	1.0 mile south of the Siskiyou County line to the Sacramento River Bridge in Dunsmuir; grade, pave and structures for 4-lane freeway. (Financed $960,000 in the 1959-60 fiscal year in addition to $3,600,000 in the 1958-59 fiscal year. Project now under construction.	3.6	4,560,000
Siskiyou	82	Shasta River Bridge east of Yreka; structure and approaches (new bridge)	0.4	155,000
Siskiyou	Various	Rights of way on State Highway Routes		75,000
Solano	7 (US 40)	Interchange at Sign Route 12 west of Fairfield; structure and approaches (carried over from the 1958-59 budget)		2,100,000
Solano	7 (US 40)	Carquinez Bridge to Sign Route 48 (Sears Point Cutoff); planting	5.0	100,000
Solano, Yolo	6 (US 40)	0.2 mile west of the Solano County line to Swingle; grade, pave and structures (convert from expressway to full freeway, including the Davis Interchange)	4.3	2,750,000
Solano	7, 6 (US 40)	0.5 mile west of Gum Grove Rd. northeast of Vacaville to Yolo County line; planting	14.0	85,000
Solano	7 (US 40)	Sign Route 12 at Cordelia to Chadbourne Rd.; grade, pave and structures (convert from 4-lane expressway to 6-lane and 8-lane full freeway)	4.3	4,500,000
Solano	53 (SR 12)	U. S. 40 to Pennsylvania Ave. in and near Fairfield; grade, pave and structures (widen to 4 lanes). (Co-operative project; City of Fairfield's share, $60,000)	0.8	*120,000
Solano	74 (SR 29)	Benicia Rd.—U. S. 40 to 0.4 mile west; resurface and widen to 4 lanes. (Cooperative project; Solano County's share, $45,000)	0.4	*40,000
Solano	74	U. S. 40 to west of the Benicia city limit; grade, pave and structures for 4-lane freeway	2.5	2,150,000
Solano	74, 208 (SR 29, 48)	Junction of Sign Routes 29 and 48; channelization and signals		55,000
Solano	90	0.5 mile north of Sweeney Creek to Yolo county line on the Winters-Dunnigan Cutoff; grade, pave and structures for the initial two lanes of a future 4-lane freeway (including a short section of 4-lane divided)	5.0	1,300,000
Solano	Various	Rights of way on State Highway Routes (including $1,150,000 in the Benicia area)		1,920,000
Sonoma	1 (US 101)	0.6 mile south of Guerneville Road to Lytton; grade, pave and structures for a 4-lane freeway (completes Healdsburg Bypass)	4.1	2,715,000
Sonoma	56 (SR 1)	Salmon Creek Bridge north of Bodega Bay; redeck		30,000
Sonoma	Various	Rights of way on State Highway Routes		1,690,000
Stanislaus	109	McHenry Ave.—Needham St. to Modesto Irrigation District Canal Number 3; grade and pave (widen to 4 lanes). (City of Modesto providing right of way.)	1.7	1,400,000
Stanislaus	Various	Rights of way on State Highway Routes (including $450,000 for U.S. 99 freeway in the Ceres-Modesto area)		660,000
Sutter	3 (US 99E)	Junction with Sign Route 20 in Yuba City to 0.5 mile north of Yuba City city limit; grade and pave (widen to 4 lanes)	0.8	240,000
Sutter	15 (SR 20)	Wadsworth Canal Bridge west of Yuba City; structure and approaches (widen)		185,000
Sutter	87 (US 40 Alt)	0.7 mile north of Robbins to Sutter Causeway; grade and pave (widen and reconstruct)	5.1	400,000
Sutter	Various	Rights of way on State Highway Routes		170,000
Tehama	29 (SR 36)	Dry Creek Bridge southeast of Beegum; structure and approaches (new bridge and realignment)	1.1	220,000
Tehama	83 (SR 89)	Junction with Sign Route 36 to Lassen Park south boundary; grade and pave (widen and resurface)	4.2	121,000
Tehama	Various	Rights of way on State Highway Routes (including $460,000 for U.S. 99 freeway in the Red Bluff area)		675,000
Trinity	29, 35 (SR 36)	Hayfork Creek Bridge east of Wildwood and Dobbins Gulch Bridge northeast of Peanut; structures and approaches (reconstruct)		61,000
Trinity	Various	Rights of way on State Highway Routes		20,000
Tulare	4 (US 99)	Tagus to Visalia Airport Interchange; grade, pave and structures (convert from expressway to full freeway)	5.1	2,270,000
Tulare	Various	Rights of way on State Highway Routes (including $895,000 for Sign Route 198 in the Visalia area)		1,690,000
Tuolumne	Various	Rights of way on State Highway Routes		150,000
Ventura	2 (US 101)	Ventura Freeway—0.25 mile east of Telephone Road to Palm St. in Ventura; grade, pave and structures for 6-lane freeway (first unit of freeway through Ventura). (Financed $6,000,000 in 1959-60 fiscal year.)	4.6	9,300,000
Ventura, Los Angeles	2 (US 101)	Ventura Freeway—Los Angeles city limit to 0.1 mile east of Cheeseboro Rd., and 0.5 mile west of Moorpark Rd. to Conejo Grade Summit; resurface	10.5	730,000
Ventura	151 (SR 150)	Ojai Ave.—West city limit to 0.1 mile east of Shady Lane in Ojai; grade and pave (widen)	2.1	60,000
Ventura	Various	Rights of way on State Highway Routes (including $1,500,000 for Sign Route 126 freeway between Ventura and Santa Paula)		2,535,000
Yolo, Solano	6 (US 40)	0.2 mile west of the Solano county line to Swingle; grade, pave and structures (convert from expressway to full freeway, including the Davis Interchange)	4.3	2,750,000
Yolo	7 (US 99W)	Main St.—Walnut St. to West St. in Woodland; grade and pave (widen to 4 lanes)	0.3	110,000
Yolo	87 (US 40 Alt)	Cache Creek Bridge north of Woodland; structure and approaches (replace bridge)	0.4	180,000
Yolo	90, 6	Solano county line to 2.8 miles north of Madison on the Winters-Dunnigan Cutoff; grade and pave to complete the initial two lanes of a future 4-lane freeway. (Structures and grading now under contract from an allocation in the 1958-59 fiscal year.)	13.7	2,000,000
Yolo	Various	Rights of way on State Highway Routes		630,000
Yuba	Various	Rights of way on State Highway Routes		190,000

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GOODWIN J. KNIGHT
Governor of California

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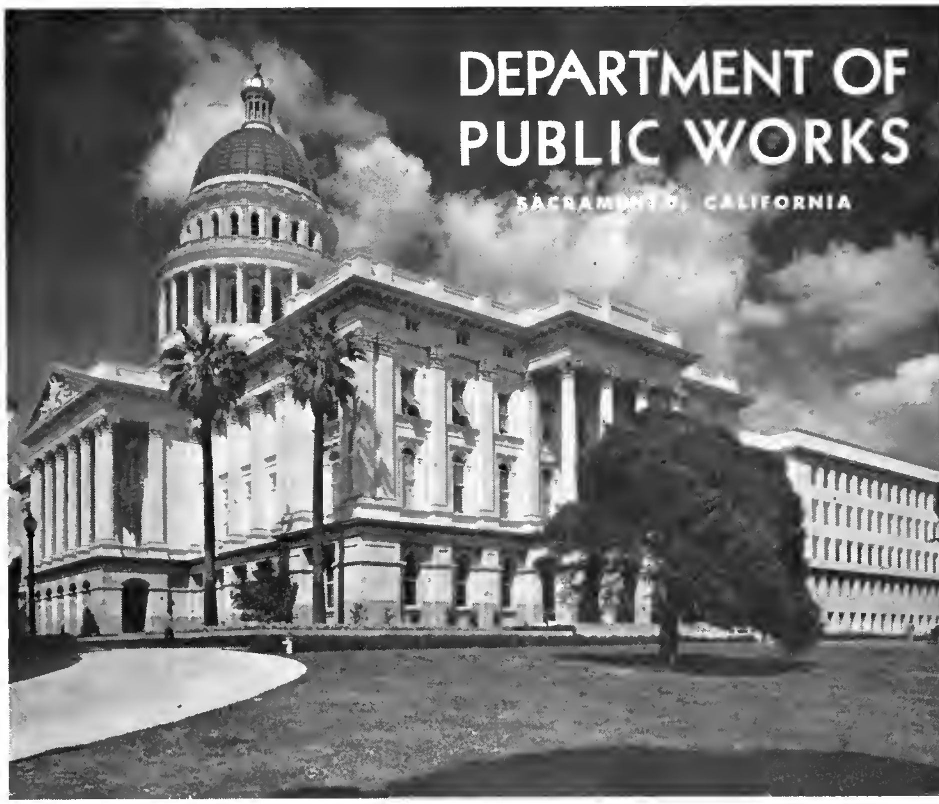

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printed in CALIFORNIA STATE PRINTING OFFICE 83654 11-58 50M

HIGHWAYS
P. O. BOX 1499
SACRAMENTO, CALIFORNIA

U. S. POSTAGE
PAID
Permit No. 152

CALIFORNIA
HIGHWAYS AND PUBLIC WORKS

JANUARY-FEBRUARY
1959

California Highways and Public Works

Official Journal of the Division of Highways, Department of Public Works, State of California

RICHARD WINN, *Editor*
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Vol. 38 January-February Nos. 1-2

FRONT COVER

The Civic Center in Los Angeles forms a background for this view. The white streaks were made by the headlights of autos on the Hollywood Freeway coming over the Four Level Structure and (extreme left) autos from the Pasadena and Harbor Freeways entering the Hollywood Freeway. The red streaks were made by the taillights of autos on the Hollywood Freeway going over the structure or leaving the freeway en route to the Pasadena and Harbor Freeways. (Photographer's note: Exposures were 1 minute at twilight for buildings and detail, 3 minutes after dark for vehicle and other lights.)

—Photo by Robert J. Rose

BACK COVER

Westbound traffic rolls along the Santa Ana Freeway toward downtown Los Angeles, crossing under the structure forming the northbound roadway of the Long Beach Freeway. The structure at lower right is a part of the interchange by which motorists in westbound lanes of the Santa Ana Freeway may reach the Long Beach Freeway northbound.

—Photo by Robert J. Rose

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Published in the interest of highway development in California. Editors are invited to use information contained herein and to request prints of any black and white photographs.

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CALIFORNIA HIGHWAYS AND PUBLIC WORKS
P. O. Box 1499
SACRAMENTO 7, CALIFORNIA

New Parallel Bridge

By L. C. HOLLISTER
Projects Engineer—Carquinez

On November 25, 1958, the new parallel Carquinez Bridge was open to traffic, breaking one of California's most critical highway bottlenecks. It also marked the culmination of many years of effort by Senators Luther E. Gibson, George Miller, Jr., and Assemblymen Donald D. Doyle, Samuel R. Geddes and S. C. Masterson and others who sponsored the necessary legislation making this very noteworthy project possible.

Appropriate ceremonies were conducted by the Contra Costa Development Association in which then Lieutenant Governor Harold J. Powers officially cut the chain opening the bridge to traffic. Since the chain cutting ceremonies thousands of cars each day have passed through the tollgates and over the new structure. On the Sunday following Thanksgiving 45,305 vehicles used the new bridge and its modern six-lane freeway approaches.

The new parallel Carquinez Bridge glistens in the sunlight while her drabber sister, some 31 years her senior, stands in the background.

There are several design and construction features in connection with the Carquinez Bridge and freeway approaches that have attracted a great deal of interest among highway and bridge engineers throughout the Country.

As for example the "Big Cut" involving the largest highway cut in history; the use of slip-form construction for the erection of the 120-foot-high piers for the complicated interchange and approach structure; the sinking of caissons to 132 feet below water with the difficulties and hazards encountered; the use of welded steel fabrication for the two 1,100-foot double cantilever spans; the use of high-strength bolts and a new very high-strength structural steel known as T-1. Some of these features are new developments and because they are progressive steps forward in highway construction have attracted the attention and interest of many engineers throughout the Country.

Stability Required

The "Big Cut" located immediately south of the bridge is approximately 2,500 feet long, 1,370 feet wide and nearly 300 feet deep at the deepest point. The elevation of the profile was controlled by the location of the bridge grades. To provide the degree of stability required in the type of formation encountered, the design provided for 2:1 cut slopes with a 30-foot-wide bench every 60 feet in elevation. A debris trough 40 feet wide was provided between the edge of the shoulder and the toe of the cut to allow room for maintenance to clear any sloughing that might occur without closing the traveled way. Initial construction provided three lanes in each direction and provision was made for an ultimate paved section of four lanes in each direction with a 12-foot division strip. This means that the total width of the cut from toe to toe is 204 feet and 1,370 feet from top of cut to top of cut at the widest point. At this location there were two stations that contained a million cubic yards per station. There were 8,800,-000 cubic yards in the "Big Cut." The two other cuts on the three-mile project contained approximately 1,700,000 cubic yards, making a total of 10,500,-

Public Works Building
Twelfth and N Streets
Sacramento

CONTENTS

Arthur Luddy of Sacramento Appointed to Highway Commission by Governor Brown

Arthur T. Luddy, Sacramento insurance executive and civic leader, was appointed a member of the California Highway Commission in late January.

Governor Edmund G. Brown announced the appointment, which is for a four-year term.

Luddy is secretary of the California-Western States Life Insurance Company and has been a member of the Sacramento City Planning Commission.

He has also been prominent in Sacramento civic affairs.

A Democrat, Luddy was a member of Governor Brown's finance committee during the last campaign.

Luddy succeeded John O. Bronson of Sacramento, whose term on the commission expired January 15.

000 cubic yards of roadway excavation for which the contractor bid 25.6 cents. The average haul for the total project was slightly over 4,000 feet, giving a quantity of 455,000,000 station yards of overhaul for which the contractor bid 2 mills per station yard. Overhaul was measured along the centerline with no consideration for side haul. These two items combined gave the contractor a total of approximately 35 cents per cubic yard for excavation and haul. No additional payment was made for placing and compacting.

Earthquake Problem

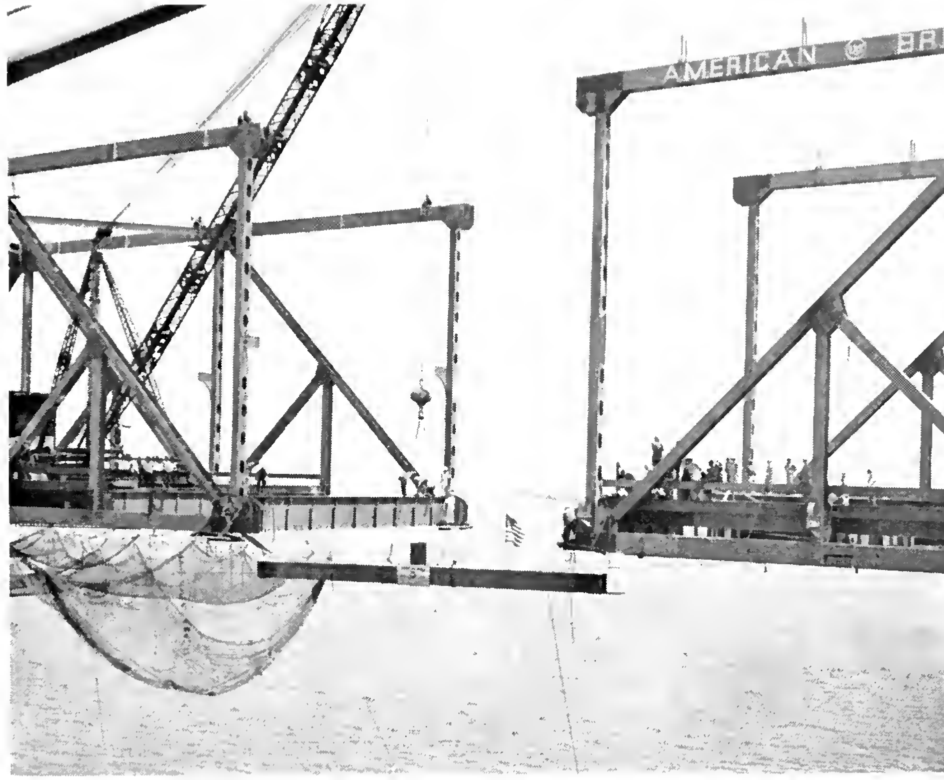
In general the Foundation Investigation Report of the "Big Cut" showed the area to be one of high seismicity and cut by two major faults, both of which are rated as active. These are known as the Franklin Thrust and Mare Island Fault. The earthquake record of the region since 1854 shows four shocks of high intensity and 58 of lesser intensity; also that the cut section would traverse interbedded shales and sandstones of varying thickness and altitude. The sediments range from hard sandstone to friable sand, from firm silty shale to soft clay shale, and will show interbeds and cross bedding from microscopic to visual. When originally deposited the sediments were uniform and competent; but due to intensive folding and faulting, deformation and weakening of the units have taken place.

The contractors, Ferry & Crow of Los Angeles, elected to use tractors coupled with scrapers hooked in tandem to move the majority of the dirt. This was possible because of the favorable –0.5 percent grade on the long haul. The average haul from the "Big Cut" was about 8,000 feet. Each unit was capable of making about four round trips an hour, moving an average of 37 pay yards per trip. The contractor's schedule called for moving an average of 25,000 cubic yards per day; his actual average for the entire project was approximately 26,000 cubic yards per 14-hour working day. The standard equipment for push loading and ripping was a tractor equipped with ripper teeth. The use of this equipment eliminated all blasting in the "Big Cut" with the exception of minor cracking of huge boulders. Many nests of these boulders averaging 8 to 10 feet in diameter were encountered at different elevations throughout the cut. These were pushed into piles, drilled and broken with powder to a small enough size that they could be loaded. They were then hauled to and incorporated in the fills.

Rains Cause Slide

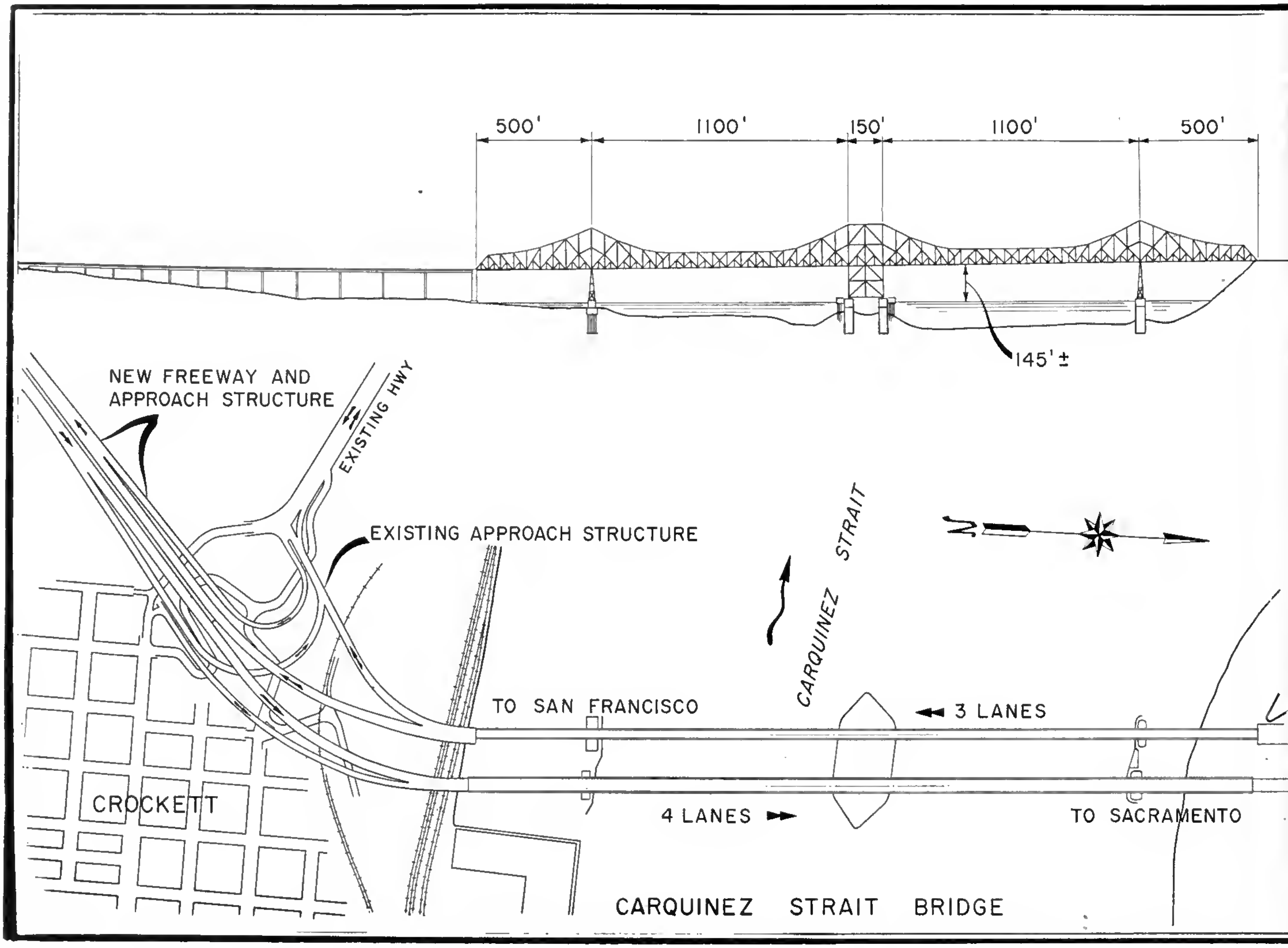
The "Big Cut" was nearly 10 percent complete prior to the heavy rains in the winter of 1957-1958. Considering the fact these were the heaviest recorded rains in 80 years, the slopes stood up remarkably well. Only one slide occurred, amounting to approximately 100,000 cubic yards. This took place at the top bench elevation and was approximately 60 feet deep. Unfortunately, it occurred in the only developed area bordering the cut and resulted in the removal of four homes. The remainder of the cut showed little signs of distress with only minor surface sloughing occurring.

The Crockett Interchange serves as a connecting viaduct between the



Starting the final closure between the two cantilever arms with the American Flag flying in the traditional custom of bridge builders throughout the Country. To make the final closure at this point six 500-ton jacks were used to jockey the suspended span into position so that bolting the final joints would be possible.

Lieutenant Governor Harold J. Powers is about to cut the chain starting the flow of 30,000 vehicles per day across the new Carquinez Bridge and its freeway approaches. Left to right are Assemblyman S. C. Masterson, Supervisor Mel Nielson, H. W. Saunders, Jo Ellen Fisher (Miss Contra Costa County), Senator George Miller, Jr., Lieutenant Governor Powers, Senator Luther E. Gibson, Wanda Kealty (Miss Solano County), Assemblymen Donald D. Doyle and Samuel R. Geddes.



General plan of the Carquinez Bridge showing principal dimensions. The old structure will carry three lanes of southbound traffic and the new bridge will carry four lanes of northbound traffic.

"Big Cut" and the south end of the main bridge. It also acts as an interchange structure providing on and off ramps for the town of Crockett.

This interchange structure is of conventional steel girder design, varying in span lengths from 120 feet to 205 feet. Girders are supported on 47 reinforced concrete piers. These piers vary in plan from 6-foot by 22-foot solid shaft to 20-foot by 76-foot boxed section shaft and in height from 20 feet to 123.5 feet, with the average height about 70 feet.

New Slip-Form Method

The piers were all designed without batter or offset so that slip-form construction could be used by the contractor if desired.

The contractor, Peter Kiewit Son's Company, investigated this method of construction for the piers and decided to proceed with slip-forms.

Slip-forms have been used before in the United States but they have been of the manually operated screw jack type. These have been cumbersome to keep level and troublesome to keep moving at a constant rate at all points.

The development of an automatic controller for operating the hydraulic ratchet jacks has greatly simplified this procedure.

These hydraulic ratchet jacks are supported about seven-foot centers by one-inch diameter high-strength steel rods. Each rod has a three-foot section of metal sleeve which protects the rod from bonding with the green concrete making it possible to salvage them after the last pour on the pier has been made.

At the start of each pier after forms have been carefully set on pier footings, the four-foot-deep forms are filled in layers of about eight inches. As soon as concrete in bottom has set sufficiently, which may be in about three hours, the jacking operations are started. Once the jacking operations are under way the forms are slipped up at the rate of 5 to 14 inches per hour with the average being about 10 inches per hour. Rate of slipping is dependent on rate of curing which changes with the ambient temperature and wind velocity. An experienced operator determines the pace at which forms are slipped by pushing a thin steel rod down into the concrete.

Forms Tapered

The forms are constructed so that the outside form of the wall is vertical,

Picture showing the "Big Cut" completed with the Corquinez Bridge in the background. To the right can be seen the 30-foot benches spaced every 60 feet in elevation going up the side of the cut. Slope of cut between benches is 2:1; that is one foot up for every two feet horizontal.

while the inside form is battered about three-eighths inch in the four feet. This makes the form three-sixteenths narrower at top and three-sixteenths larger at bottom than the nominal thickness of wall.

Comparative costs between slip forms and conventional forms are not available; however, on a job with a reasonable number of piers 40 feet and over in height there appears to be an excellent opportunity for economy. Other advantages are safety and speed of operation. Therefore, where time is of importance there is considerable advantage. Their simplicity and safety also appear to give them an advantage over the conventional methods on high piers.

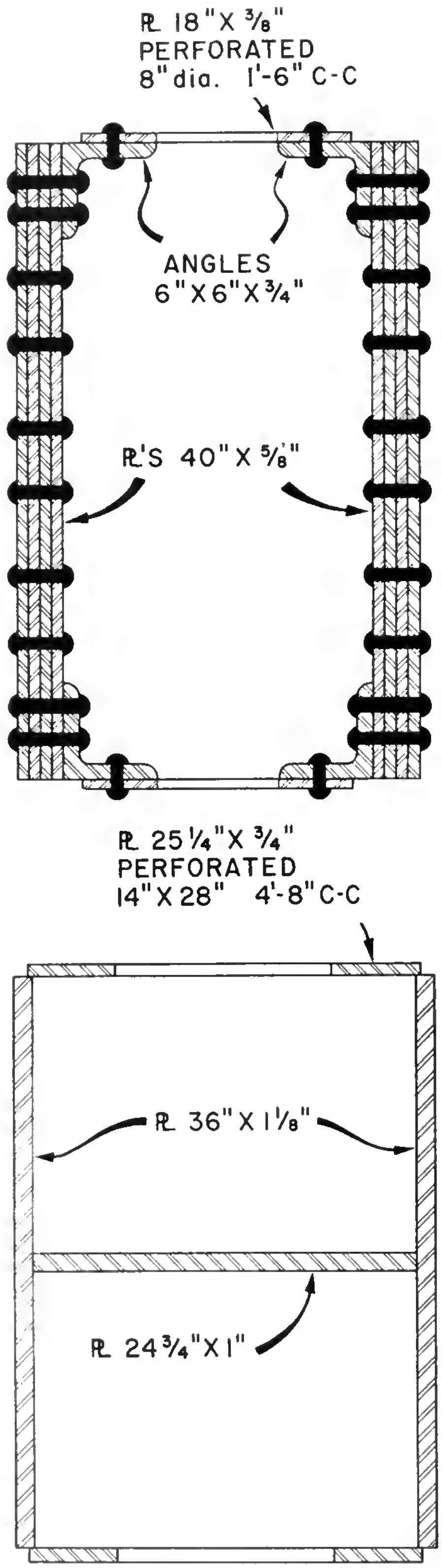
The Crockett approach structure involved the welding of over 8,500,000 pounds of structural steel for the girder spans. These spans ranged in length from 120 feet to 205 feet. The larger spans were made up of 144- by ¾-inch web plates with 24-inch flange plates top and bottom. The flange plates varied in thickness from 2½ inches at the center to one inch at the ends. Field splices were made by welding the heavy flanges and bolting the web plates with high-strength bolts.

The substructure for the main bridge consisted of four deepwater piers and two anchor piers or abutments. Three of the deepwater piers were of the caisson type lowered to bedrock 132 feet below the water surface. The other deepwater pier was of the conventional steel sheet pile cofferdam type founded on 260 heavy steel bearing piles.

Construction Hazards

Caisson pier construction is certainly not new but it is a type, nevertheless, which is not frequently used and requires special construction skills involving risks of the most hazardous type.

The Contractor Mason & Hanger, Silas Mason, Inc. & F. S. Rolandi, Jr., Inc., sunk the caissons by means of



Sketch showing comparison between the same member of the new and old structure giving a visual picture of the advantages of the new welded T-1 steel design over the old riveted silicon steel design.
UPPER—The old (A-94 steel, 840 pounds per foot) was made up of 14 component parts stitched together with over 1,000 rivets. It is 40 inches deep and required large pin connections at each end to overcome large secondary stresses.
LOWER—The new (T-1 steel, 470 pounds per foot) is made up of five plates fastened together by 340 feet of 3/8-inch fillet welds. It is only 36 inches deep and avoided the use of expensive pin connections at the ends to overcome secondary stresses. The new weighs almost half as much as the old, making transportation and erection much simpler.

jets, air lift pumps and clamshell dredging.

There were 18 dredging wells all of which were sealed at the bottom with arched laminated timbers. Through each of the timber "false bottoms" a 30-inch-diameter capped steel pipe was placed through which could be lowered a 6-inch-diameter jet pipe and a 10-inch-diameter air lift pump.

After predredging in the area of the piers to about elevation −100.00, there remained approximately 35 feet of overburden through which each pier was lowered. This overburden consisted mostly of fine sand and gravel and was removed for the most part by use of the jets and air lift pumps.

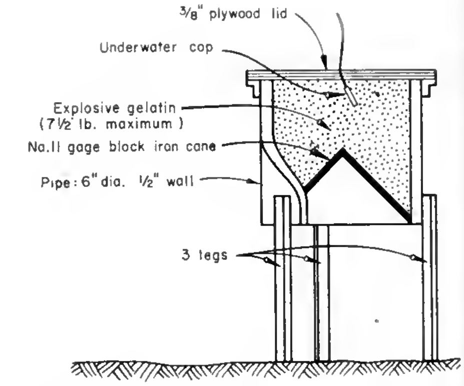
The jets and pumps were operated from the four center cells only; however, all the cells were equipped with the 30-inch capped pipes through which the jets and air lift pumps could be lowered if necessary. The jets loosened and churned up the sand and gravel permitting it to be pumped out by the 10-inch air lift pumps.

The jets were raised or lowered vertically by a work derrick. Rotation of jets was controlled by levers operated manually and movement of the nozzle was controlled manually by cables.

Shale Encountered

The bedrock at the bottom consisted of upturned layers of shale and sandstone with considerable variation in hardness. Pier No. 2 was located close to the north bank which forms a steep cliff with the layers of shale and sandstone exposed on the side wall of the cliff.

The nearness of this pier to the steep slope of the bedrock rising up to form the cliff provided very strong evidence that the plane of the bedrock



Sketch showing shaped charges used to remove bedrock at botton of Pier 2 caisson. The charges were placed by divers at the bottom of caisson 132 feet below water.

on which Pier No. 2 was to rest would in all probabilities not be level.

The caisson did reach bedrock on the cliff side about three feet higher than bedrock on the opposite side. The specifications required that the pier must not be out of plumb more than 1 in 100. It was therefore necessary that the high side of the caisson cutting edge be lowered through the bedrock about three feet.

The contractor chose to use blasting methods to break away the rock under the north cutting edge. Because of the depth of water about 45 minutes was the maximum time for a diver to stay at the bottom. For this reason, the contractor discarded the idea of drilling and blasting in favor of shaped charges. The shaped charges could all be placed during one trip of the diver.

The contractor was aware that one of the big problems in connection with underwater blasting was to design the charge of sufficient size to fracture the rock without causing any damage to the caisson walls or steel facing for the cutting edges.

Scant Information

The contractor found that there was very little published information on the forces exerted by blasting within a closed caisson at various distances away from the charge.

The caisson was designed for rather heavy forces directed from the outside toward the inside, but was not heavily reinforced for forces and impacts directed from the inside out.

The contractor prepared a table showing the maximum safe charge plotted against the distance from the caisson walls. This table was prepared from information secured in the book "The Effects of Atomic Weapons" prepared by the Los Alamos Scientific Laboratory. Another book with information on blasting is "The Science of High Explosives" by Melvin A. Cook, director of the Explosives Research Group at the University of Utah, and published by Reinhold Publishing Corp.

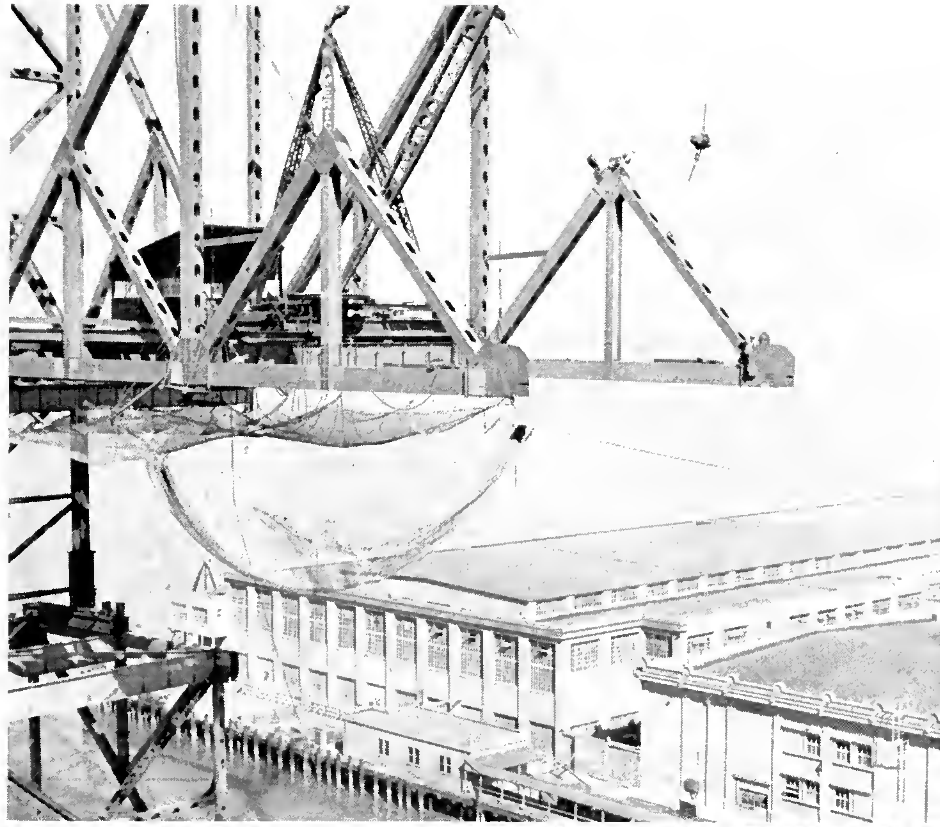
On the basis of the available literature and discussions with various people in the high-explosive field it appears that the science of underwater explosives has not yet been advanced to the point where accurate predictions as to forces exerted can be made.

We know that there is a certain amount of energy released with any particular blast, which can be determined with reasonable accuracy. The energy released is absorbed by: (1) breaking up the foundation bedrock, which is the sole purpose of the blast; (2) by raising the temperature of the water and rock, (3) by raising the elevation of the water surface and (4) by distorting or rupturing the caisson walls. The ideal condition would therefore be to have nearly all the energy of each blast absorbed by breaking up or shattering the foundation bedrock, with little or none remaining for distortion or damage to the walls.

Drill Blasting Safer

This therefore points out the advantage and safety of using drilled hole blasting methods as opposed to shaped charges. The drilled-hole method can be counted on to absorb most of the energy released by shattering the bedrock foundations. The shaped charges on the other hand will release a much greater part of their energies for distortion or even rupture of the caisson walls.

The Carquinez Strait bridge caissons were 102′-6″ long by 53′-0″ wide and divided into six cells lengthwise and three cells crosswise. The 102′-6″ north side of the caisson was lowered through about three feet of bedrock to make it level with the south side. The shaped charges used were



UPPER—For erection of the south anchor arm, steel was brought to the site by water from the Richmond assembly yard on barges. It was lifted into place by a 146-ton tower derrick mounted on two barges and assisted by stiff leg skid travelers. Most of the steel members were erected by cantilevering out; however, near each of the end towers eight panels of the suspended span were temporarily used as falsework, a portion of which can be seen in the lower left hand corner of the picture. LOWER—The bridge grows piece by piece to join with the other half of the cantilever span 145 feet above the waters below.

This photo of the southern end of the twin bridges gives some idea of the broad sweep of line incorporated into the design of the main and approach ramps.

spaced about seven feet centers along the wall and back from the wall about four feet.

The shaped charges consisted of about six to seven pounds of explosive gelatin. The explosive charge is shaped by a sheet metal cone placed in the bottom of a six-inch steel pipe. The explosive wave of the shaped charge forms a direct jet that concentrates its force on the rock below. Short legs hold the entire assembly up about six inches from the rock for better effect.

The average crater made by each blast was approximately four feet in diameter by about two feet deep, probably approaching a half sphere in shape, and containing approximately one-half cubic yard of material. It is estimated that about 10 pounds of explosives were used for each cubic yard of material removed and there were about 40 cubic yards removed in all. This large amount of explosives is evidence that only 10 to 15 percent of the available energy went into breaking up the rock.

One of the heavy box section compression members being welded by the submerged arc process at one of the American Bridge fabricating plants.

Some Damage Caused

The maximum charge for any one blast was six 7½-pound charges located along the north wall of the caisson. A total of 10 charges placed at various locations along the wall and in various sizes from 1½ pounds per shaped charge to 7½ pounds.

In spite of the precautions used subsequent inspection disclosed that considerable damage had been done. Divers were sent down where they found some large cracks at the junction of the interior 2′-6″ walls with the outside 3′-0″ walls. There was also evidence that the steel plate cutting edge which encased the bottom 13 feet of the walls was ruptured at one point.

The evidence of rupture was so strong in the six northerly cells that repairs and strengthening were necessary to remove any doubt of structural stability. The bottom 25 feet of the caisson cells were to be filled with tremie concrete in accordance with the original plans. This portion of the caisson was considered satisfactory after placing of this bottom seal. To repair the six northerly cells from the top of the concrete seal upward, it was decided to fill them with concrete to a height where there was little or no damage. The two corner cells were filled to elevation 35 feet below sea level which is 76.5 feet above the seal, and the four center wells along the north edge to elevation 60 feet below sea level which is 46.5 feet above the seal course. This required a total of 2,350 cubic yards of class A concrete to be added to this caisson.

The other two caissons were lowered into position without any of the difficulties encountered at Pier No. 2.

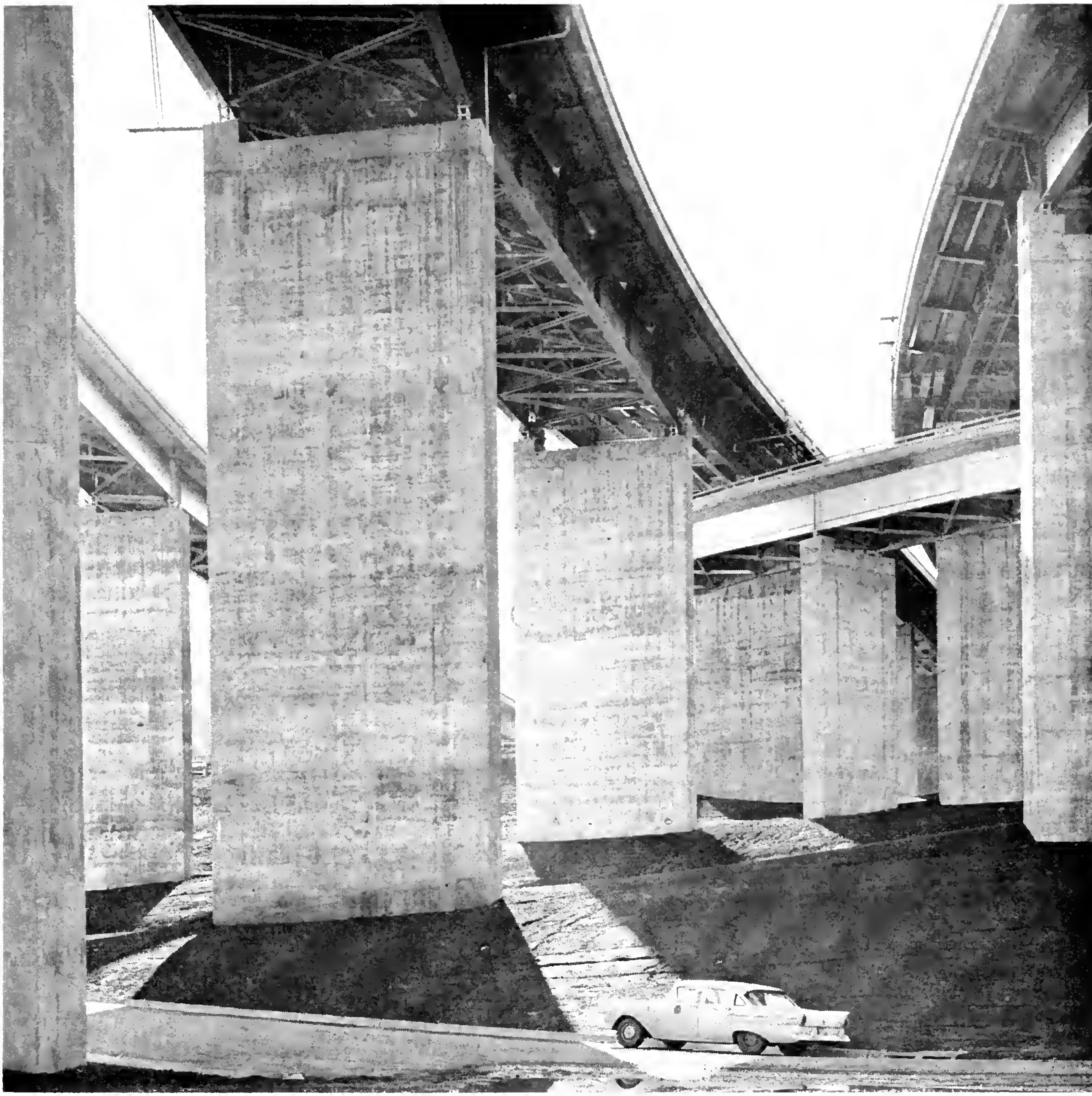
All of this points to the fact that bridge construction of the size of the Carquinez Bridge, particularly the deepwater foundations, is not accomplished without facing many problems and many hazards.

Welding Causes Interest

The design and fabrication of the two 1,100-foot cantilever spans by the use of welding rather than the conventional riveting method have attracted much interest among bridge engineers throughout the Country.

Welded fabrication of girders and beams has become a fairly well accepted practice in many states in the past few years. California, for instance, has completed over 240 all-welded steel bridge structures and has many more either under construction or ready to go to contract. These steel structures have involved the use of over 110,000 tons of welded steel fabrication. These structures have proven themselves to be completely satisfactory from a structural standpoint, they have shown considerable economy in the amount of structural steel required, their smooth surfaces have made maintenance much easier, and their smooth, clean lines have added much to the sharp, trim appearance of these bridge structures.

Because of this very favorable experience with the welded girder type of structure it was only natural that consideration be given to extending

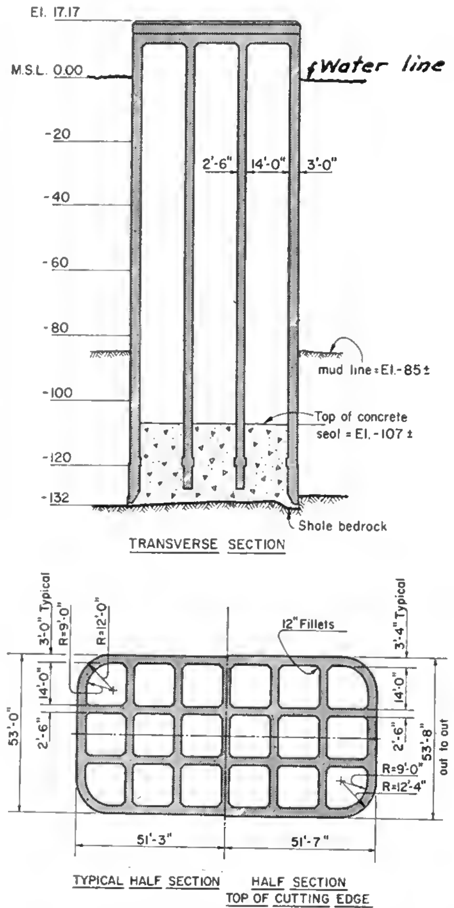


The interchange structure as seen from the streets of Crockett. Each of these pier shafts took only one week to construct. Slip-forms and modern bridge construction techniques made this speed possible.

the use of welding to the truss type of structure and thus gain these same advantages in this area of bridge construction.

Pros and Cons Weighed

There were, of course, arguments both favorable and unfavorable to such a move. In addition to the points already mentioned in favor of this move were these facts. Steel fabricating shops, over the past few years, have been continually improving their quality and efficiency in connection with their welded fabrication; our testing laboratory has done much in the past few years to standardize testing and shop inspection procedures; and one of the most important points in favor of welded fabrication for heavy bridge construction such as the Carquinez Bridge was the fact that it made possible the use of a very high-strength T-1 steel. The use of T-1 steel in itself accounted for a savings of over 4,200,000 pounds of structural steel and dead load to be carried on the bridge.



Sketch showing elevation and section of one of the three caissons. The use of explosives was necessary at Pier 2 caisson. Shaped charges were used along the north edge to remove bedrock and make this side of the caisson level with the opposite side, as seen in sketch.

On the unfavorable side were these arguments:

(1) This change from riveted to welded construction was a very definite break with past precedent, since trusses of this type and size of bridge structure had never before been fabricated by welding in this Country.

(2) There was no well established engineering precedence for member makeup or standardization of details as has been worked out for riveted fabrication over the past 50 years.

(3) Some welded structures in the past have failed including ships, tanks, and bridges.

Regarding (1) there is no question but that this was a strong break with past precedent. But the outstanding advancements made in the past 10 years in the knowledge and techniques of welding made this step now appear not only timely but also a very progressive step forward in bridge construction.

As to point (2) regarding engineering precedent for member makeup this point was discussed with the leading fabricators of the Country and practical details were worked out to the satisfaction of both the engineer and the fabricator.

Close Check Necessary

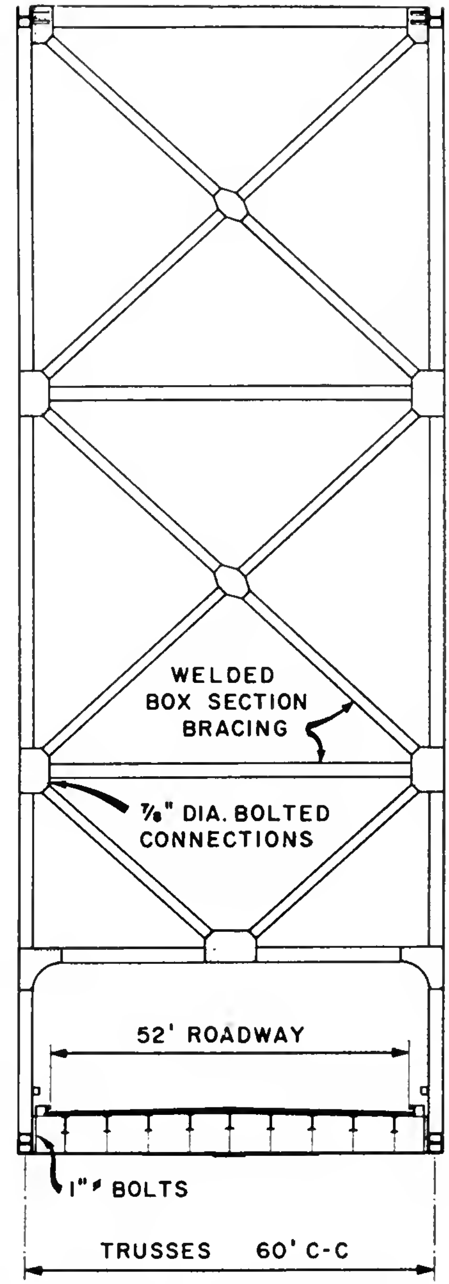
Point (3) was definitely a strong argument but there is no question that welding engineers and metallurgists throughout the Country have made such exhaustive studies sparked by the failure of a few welded ships that they now know how to overcome these past difficulties. The chemistry, particularly the carbon content of the steels to be used, would be closely checked and controlled. Truss members would be relatively small in cross section compared to ships and tanks. Members would be straight, simple in design and free from any geometric notches. Further, fatigue, rates of application of load, and operating temperatures would be very favorable. This last point in regard to operating temperatures is quite important. The lowest recorded temperature at the Carquinez Bridge site is +19 degrees Fahrenheit. This is well above the temperature at which any of the steel used on this job show any tendency toward brittleness.

These facts gave reasonable assurance that welded fabrication of truss members would be structurally reliable and therefore constitute a progressive step forward in bridge construction.

While the welded design and fabrication along with the types of steel used proved very satisfactory in every respect, the job was not completed without learning some lessons.

Damaged Plates Studied

During the latter part of April, the erection crews, due to a cable sling failure, dropped one of the heavy tension diagonals into Carquinez Strait. The member landed with the gusset plate end down, penetrating into the mud, sand and gravel for several feet. Upon recovery of the member from the bay, the gusset plates were found to be sufficiently bent to require replacement. It was decided



Sketch showing typical section of the new structure at one of the 168-foot towers. Floor beams are 66" x ½" web welded to 16" and 18" flanges. The concrete slab is 6¾" thick. Lightweight concrete was used on cantilever arms and suspended span, regular concrete on the two anchor spans.

that both the butt welds and fillet welds should be checked since the member had been subjected to severe impact. The butt welds were in perfect condition but inspection of the fillet welds revealed an occasional very fine transverse crack in the fillet weld metal.

These fine cracks were at first thought to be very minor surface cracks but further investigation revealed that some of them extended through the full section of weld. Further it was determined that the cracks had occurred before the shop coat of vinyl wash had been applied.

This eliminated the possibility that the cracks had occurred during shipping or handling. And it strongly indicated that something had gone wrong with the welding procedure during at least a part of the fabrication.

Immediately the contractor started checking for flaws in the fillet welds of other members. As a final result of this check, a total of 56 H section tension members were repaired. None of the compression box section members were found with any faulty fillet welds.

All Crack Traces Removed

Repairs consisted of removing fillet welds flush to the plate surfaces with a slight trace of the fillet toe remaining to aid the repair welders in making the right size weld. If any cracks remained it was necessary to penetrate the depth of the weld fusion zone to remove all crack traces.

The fillets were removed with an Arcair gouging tool, and were made in intermittent lengths of five feet in the interior portion of beam and about 1½ feet near the beam ends.

In all there were 56 members that required repairs out of a total of more than 1,100 truss members which represented about 3 percent of the total fabrication for the job. This has led to an investigation by both the State Division of Highways Materials and Research Laboratory and the research department of the American Bridge Division to determine the cause.

These studies have not yet been completed. Possible sources of trouble which are being investigated are: (1) hydrogen entering the weld through moisture in the flux or from free moisture in the joint; (2) surging of the amperage or voltage. Neither of these factors so far has been isolated as the single source of the difficulties; (3) there is some evidence produced from other fields of fabrication that the difficulty may stem from the critical nature of the chemical and physical characteristics of the welding wire and flux. This factor or any combination of these three general factors could have been the source of the difficulties, but the crack-producing combination has not yet been singled out by these investigations. In any case all of this points to a re-emphasis of the fact that fabrication by welding of structural members from either T-1 or A242 steel is much more critical than for members of structural carbon steel such as A7 and A373.

In any event our laboratory is completely confident that such deviations from the required rigid controls can and will be detected on future jobs of this nature and corrections made on the spot.

Due to the complete co-operation of the American Bridge Division of United States Steel Corporation, repairs were made to the complete satisfaction of the engineers and the job completed one month ahead of schedule.

New T-1 Steel Used

Early preliminary designs using A7-A373 and A242 steel and limiting plate thickness to 2½″ indicated that the required depth for the heavily stressed members would be 40 inches. This depth of member produced rather high secondary stresses.

A steel with a higher allowable working stress was therefore considered because it would facilitate a reduction in member depth and at the same time keep plate thicknesses for most members to 2½ inches without multiple side plates.

The new quenched-and-tempered T-1 steel was therefore considered. With the minimum yield strength of T-1 steel at 90,000 psi, a conservative

This view eastward shows the similarity of the outlines of the twin Carquinez Bridges, constructed 31 years apart. The old bridge is nearer the camera.

An interesting camera study of the southern approach ramps to the twin bridges taken from one of the city streets in Crockett.

working stress of 45,000 psi in tension and comparable working stresses in compression were used in trial designs. The resulting trial member makeup for the heavily stressed members indicated they could be kept to a 36-inch depth which resulted in reducing secondary stresses considerably. In addition there was a large reduction in tonnage of steel required which amounted to 4,255,000 pounds of steel.

As a further example of the savings in steel made the weight per foot for L16L18 was reduced from 864 ppf to 492 ppf when changed from A242 steel to T-1 steel.

It was therefore decided that T-1 steel had sufficient potential qualities to make worthwhile a thorough investigation of its use for welded truss members. Our testing laboratory therefore ran extensive tests on the welding and physical qualities from 3,000 pounds of T-1 steel plates.

Several Methods Tried

From these plates, numerous specimens of butt-weld joints were made and tested from ½-, 1- and 1½-inch plates. The welds were prepared using semiautomatic shielded arc, automatic submerged arc, and three types of manual low-hydrogen processes. The conclusions of the report on these tests were that T-1 steel could be satisfactorily welded into truss members but that narrow tolerances in the operating procedure were necessary. The full report outlined the precautions that must be taken.

The allowable working stresses used for A7, A373 and A242 were the same as those used in the A.A.S.H.O. Bridge Specifications. For T-1 steel members the allowable working stress for tension members was 45,000 psi and for compression $36{,}000 - 1.75\ (L/4)^2$. The A.A.S.H.O. Bridge Committee is now considering the inclusion of working stresses for T-1 steel in the bridge specifications.

All bracing and truss joints were fastened by use of high strength steel bolts. Bracing bolts were ⅞ inch and truss joint bolts were 1 inch and 1¼ inches.

Bolts were furnished and installed in accordance with the "Specifications for Assembly of Structural Joints Using High Strength Steel Bolts" approved February 27, 1954, by Research Council of Riveted and Bolted Structural Joints of the Engineering Foundation. The specifications called for field joints to be bolted and gave the contractor the option of riveted or bolted shop joints. The American

. . . Continued on page 63

ROBERT B. BRADFORD

JAMES F. WRIGHT

FRANK A. CHAMBERS

New Officials

Director, Deputy Director, C. H. C. Secretary Appointed

ROBERT B. BRADFORD, public administrator for a quarter century and public works official for much of that time, is the new Director of the State Department of Public Works and Chairman of the California Highway Commission.

Governor Edmund G. Brown appointed Bradford effective January 5th, when the Brown Administration took office. Bradford will also serve as a member of the California Toll Bridge Authority, the State Public Works Board, State Allocation Board, and other state boards and commissions.

Governor Brown made two other appointments to the Department of Public Works.

James F. Wright, Assistant Superintendent for Administration and Fiscal Management in the New York State Department of Public Works, was appointed Deputy Director of the California State Department of Public Works.

Frank A. Chambers, a Federal Government official from 1940 until early last year when he became Northern California manager for Attorney General Brown's gubernatorial campaign, was appointed Secretary of the California Highway Commission.

Bradford succeeded T. F. Bagshaw as director. Bagshaw resumed his former position as assistant director of the department, in which he had served from January, 1957, until last November, when he became director. John H. Stanford, who was assistant director while Bagshaw was director, resumed his former position as management analyst for the department.

Bradford resigned as executive director of the Redevelopment Agency of the City of Sacramento to take his new post. He had been in the redevelopment position for a year.

From 1951 through 1957, Bradford was regional director of the General Services Administration of the Federal Government, with offices in San Francisco. Much of the U. S. Government's public works program in Arizona, California, Nevada and Hawaii was his responsibility in this assignment.

When Bradford first came to California in 1947, he served as zone administrator for eight western states for the War Assets Administration and dealt with the disposal of World War II surplus property—war plants and other real estate as well as surplus materials and equipment.

Bradford was an executive in federal agencies in Washington, D. C., for 13 years before he moved West. He was with the War Production Board during World War II and the Surplus Property Administration for two years thereafter.

Bradford was born in Indiana in 1909. He graduated from Grinnell College in Iowa in 1931, and began his career with public relations work on the college staff. He and his wife have three children: Mary, 14, who attends California Junior High School in Sacramento; Bill, 18, a Stanford University freshman, and Jane, wife of Tom Wilson of Cupertino, and one granddaughter.

Wright became Assistant Superintendent of the New York State Department of Public Works in May, 1957, and served until he took the California appointment. Previously, he was for three years Assistant Director for Personnel and Training Requirements in the Office of Analysis and Review of the Navy Department.

. . . Continued on page 61

CHC Tour

Commissioners, City Officials, See Highway Projects in S. F. Area

Members of the California Highway Commission familiarized themselves with highway jobs and problems in San Francisco during their regular November meeting.

The meeting was held in San Francisco. After the paperwork was concluded on the second day of the two-day session, the commissioners went on a two-hour bus trip about the city.

The commissioners arranged the inspection in order to gain firsthand information about freeway work under way and planned.

Officials of the City and County of San Francisco met and toured with the commissioners and explained the city's viewpoint on state highway matters.

Engineers of the Division of Highways conducted the tour for the members of the commission.

UPPER—T. F. Bagshaw, then State Director of Public Works, Chairman Oscar Fisher of the Highway and Bridge Committee of the San Francisco Chamber of Commerce, and State Assemblyman Ed Gaffney (left to right) pause on the Embarcadero Freeway near the Ferry Building. LOWER RIGHT—The commissioners, state engineers, and San Franciscans were taken to the various construction projects by bus. LOWER LEFT—Highway Commissioner Robert Bishop (right) discusses highway matters with Harold Starr, Civic Development Official of the San Francisco Chamber of Commerce.

El Monte

City's Post-Freeway Progress Refutes "Chinese Wall" Fears

By JAMES K. KIMOTO
Headquarters Right-of-Way Agent

A report of the Land Economic Studies Section, Right-of-Way Department.

IT IS SAID that because of individual differences, no two persons are the same. Moreover, no particular person is today exactly the same individual he or she was some three years, five years, or any number of years, ago.

Perhaps because in large part they reflect the individuals in them, cities and towns likewise have their differences, and because here too time brings changes, a study of today's city in today's environment is most directly helpful in analyzing the more timely municipal problems.

Thus even though intensive analysis of the freeway "bypassed" city and town has been carried out by the Land Economic Studies Section of the California Division of Highways Right-of-way Department for over 12 years, careful analysis of current bypass situations still continues, despite the fact that results have consistently tended to confirm even the earliest conclusions indicated. Past experience is thereby regularly tested to see if its lessons are still valid guides to the solution of today's problems. Perhaps even more important, each "bypassed" city and town—because it is not entirely similar to others which may have already been studied—can make its own peculiar contribution to the growing fund of economic impact knowledge.

And so it was, even before freeway construction through the Southern California City of El Monte was completed on July 17, 1956, that areas own particular story had already started to unfold.

Study Situation

El Monte presented in many respects the typical "bypass" situation; nonetheless, with its own significant overtones, it had its own lusty story to tell the world.

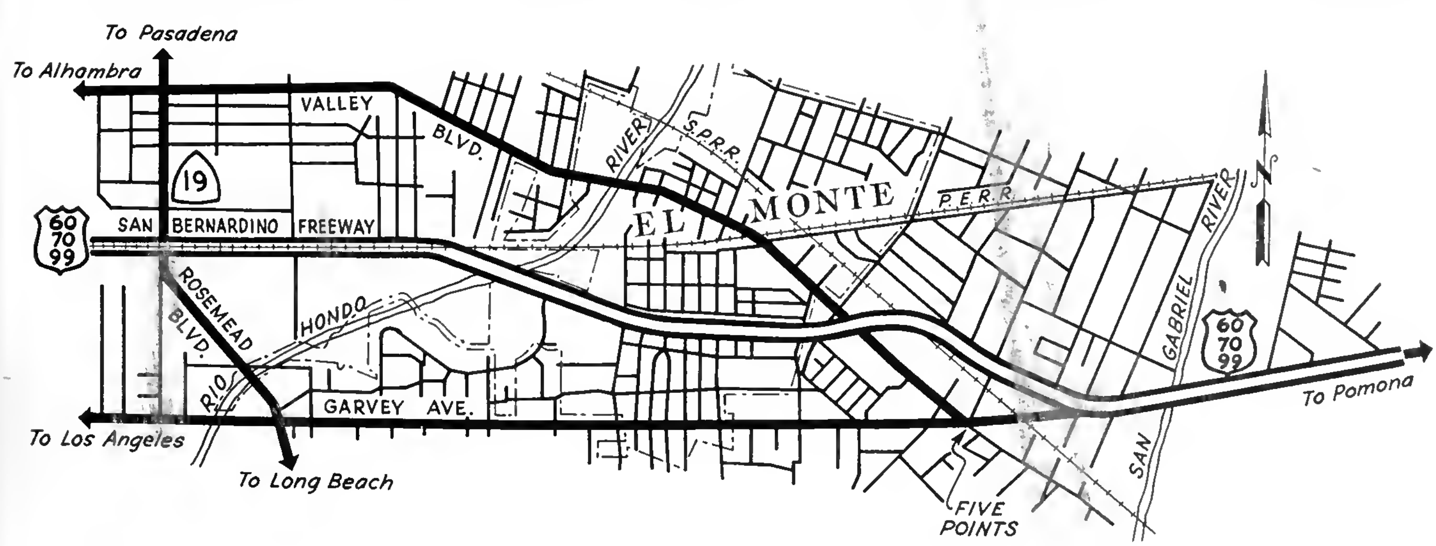
What are the peculiar effects upon abutting properties and community business and development of an *elevated* freeway bypass? Does this particular type of freeway construction create the so-called "Chinese Wall" situation—an impassible barrier to community expansion and commercial development? And what happens to the community when *two* former state highways are bypassed — *two highways whose abutting commercial developments account for over 66 percent of the total business done in the entire city?*

Rich in History

The overall picture of the changing El Monte community would be incomplete without a brief review of some of the past happenings which have shaped the city's present and future, and endowed it with its own individual character.

Founded in 1852 by some dozen families of a gold-seeking caravan headed for the "Gold Hills," El Monte began as a cattle raising community, lost out to agricultural interests, and finally emerged as a thriving Los Angeles County industrial center.

Its two-fisted history is replete with incidents that characterize the "strong rugged individualism" of its people who showed little reluctance to fight vigorously for the things they believed to be right. In the beginning there was a "range war" between the



This map shows the new freeway and other streets and highways through the City of El Monte.

cattlemen and the "squatter families" over land use and fences, a war which continued until the Fence Law of 1869. During the 1850's, with law enforcement almost nonexistent, the "El Monte Boys" rode the range, meting out decisive, though perhaps dubious, justice.

In the 1860's and early seventies, the ranchers agitated against a railroad line going from San Pedro to Los Angeles City because they felt that locomotive power would eliminate the need for horses, which, in turn, would affect the marketing of certain agricultural crops in which they specialized—barley, corn, feed, etc. During the hectic Civil War days, the community was definitely pro-South, and twice the federal troops from Wilmington had to invade the town to restore order. In 1861, 29 El Monte horsemen tried to join the southern armies by going through Texas but were caught and imprisoned for a short term at Fort Wayne.

Until the advent of the Pacific Electric Railroad in 1906, El Monte was one of the stopover points for the Pony Express, and bars and saloons did a roaring business from people passing through up to the time the temperance sentiment arose at the turn of the century. However, despite its many transients, El Monte, on incorporation date, November 18, 1912, had only 550 people, and the size of the city was a mere 1.21 square miles. Until 1945, the transition from an agricultural to an industrial community was rather slow and gradual.

After World War II, the transition to an industrial economy has been remarkably rapid. Today, there are over 750 highly diversified industrial plants in the greater El Monte area of which 20 percent are engaged in manufacturing and processing strategic military items. Today, El Monte claims recognition as the house trailer manufacturing center of the United States. It also has unrelated manufacturing industries such as ceramics, chemicals, garments, iron foundries, paints, plastics, and electrical machinery.

Other Factors

To more effectively analyze the effects of the freeway on the community, there are other pertinent and important factors that must be considered as well.

First, the tremendous industrial growth that has taken place in Southern California for the past decade has resulted in increased population for many small communities such as El Monte, and this in turn has created the need for expansion of existing facilities and construction of new facilities. Obviously, communities which were able to respond quickly to the demands of the new populace found themselves growing more rapidly than those that lagged. El Monte, with its long history of adjustments, reacted quickly to take advantage of the situation. Its citizens erected a modern civic center at a new location, provided additional recreational facilities, expanded their school system, and provided adequate housing facilities in the form of new residential subdivisions aimed at the moderate income groups. Industries were also encouraged by pointing up tax advantages, good transportation facilities, and adequate utilities.

Second, construction of the Rio Hondo Wash facility (a portion of the multi-million-dollar flood control project to tame the San Gabriel River and its tributaries), has had the effect of opening up considerable land for profitable and lasting development.

Third, El Monte has two railroad lines, the Southern Pacific and the Pacific Electric, which offer added inducement to industries seeking sound locations.

Fourth, the city's strategic geographic location itself. El Monte is ideally situated from downtown Los Angeles, only 13 miles away—a hub for the entire San Gabriel Valley area.

Methodology

This study, like most previous land economic studies, utilizes the "before and after" technique to determine the effects of a freeway on this city whose state routes, Route 26 (Garvey Avenue) and Route 77 (Valley Boulevard) were "bypassed." Sources of information include: (1) the quarterly sales tax data from the Board of Equalization; (2) verified real estate transactions; (3) the U. S. Census; (4) El Monte Chamber of Commerce data; (5) Los Angeles County Regional Planning Commission and Assessor's Office reports; (6) the Research Department of the Security First National Bank; (7) Federal WPA report entitled "A History of El Monte"; (8) El Monte Press; (9) city officials; and (10) real estate brokers, industrial plant managers, and merchandisers of El Monte.

Periods and Area Covered

Because of the complicating effects of the Monte Vista Bypass—a short bypass of the Valley Boulevard downtown shopping section which was constructed after the freeway itself (opening date—December, 1957)—this study does not cover the usual "two year before and two year after" periods. Instead a "one year before and a one year after" period has been chosen as the basis of this study. Another reason for using the shorter duration is the fact that a two-year period "after" would also take in much of the difficult-to-analyze general recession effects that commenced from the summer of 1957.

Although the City of El Monte tends to identify itself with the El Monte Postal District, an area five times its size, it was felt that for clarity the city boundaries as they were in 1955 should be utilized, and only the freeway effects on the community and the two major streets therein, namely Garvey Avenue and Valley Boulevard, which were the two former state routes as noted previously, should be considered.

"Chinese Walls"

El Monte citizens were greatly concerned that, in the "after" period, the completed freeway might easily become a figurative "Chinese Wall." The use of this expression has become widespread in planning and development discussion—it is interestingly pertinent to note the sequence by which it is derived.

To its planners and builders, the Great Wall of China was in effect an ancient type of life insurance policy. If its formidable bulk isolated the Chinese Empire from its neighbors and discouraged intruders whatever their mission and intent, it would have served its purpose well. If it presented an insurmountable barrier to intrusion and interchange, it would have been considered eminently successful.

Modern-day planners and builders, of course, deplore structures which in any way tend to isolate and bar, and those things which would have measured the success of the old Great Wall are considered today to be highly undesirable consequences of either private or public building activity. Concern and anxiety when improvements are proposed which in fact might bring about such effects, are thus ofttimes expressed by summing up the planned facility simply as a "Chinese Wall." El Monte citizens—pointing out five alleged "walls" already in existence—understandably were concerned with the effects of an elevated freeway structure.

The two former state highways with their combined 54,000 average daily traffic volumes constituted barriers one and two; the Southern Pacific Railroad and the Pacific Electric Railroad rights of way made barriers three and four, and the Rio Hondo Wash, bisecting the city in an opposite direction to the others, was barrier number five. The map of the El Monte area on page 15 graphically depicts this aspect of the overall study situation.

A view of the business district of the City of El Monte looking west on Valley Boulevard. Prior to the opening of the freeway this street was congested with traffic, making shopping difficult.

Allegations of premature obsolescence of abutting improvements, creation of isolated areas without possibility of profitable development, introduction of obstructions to further expansion and annexation, etc.—these were the predicted and implied effects of elevated freeway construction through El Monte. What then, are are facts?

Growth and Progress

The size of the City of El Monte at the time of this writing is about three and one-tenth square miles. Annexation of adjacent areas to the city cannot of course take place without the majority consent of affected landowners and residents. A divided city suffering from the many alleged ill effects of any so-called "barrier" division, would doubtless have little attraction to outlying areas. Annexation trends may thus helpfully suggest unincorporated area thinking about the future of the core city, and here is what we find:

1. Since opening of the freeway in July of 1956, annexation of adjoining areas has increased at an annual rate of over 14 percent per year. In significant contrast to this figure is the annual average trend of approximately 2 percent for the 43-year period immediately prior to freeway opening. *Almost 59 percent of the entire 43-year annexation gain for El Monte was accomplished in the two short years following freeway construction.*

2. In the area of land development, analysis reveals that since commencement of freeway construction, approximately 490 new homes have been built adjacent to the freeway. *Indeed, in this highly significant period, new residential building has shown higher totals on the average than for any other period in the last 10 years.*

3. All building permits for the city show additional remarkable gains. *In the year immediately after freeway construction, new building valuation tripled comparable totals of the year before and doubled totals for the year before that.* Activity in both the core city and annexed areas showed decided increases.

An aerial view of the San Bernardino Freeway through the City of El Monte. Peck Road interchange is in the foreground.

Population

Growth, of course, is not measured by one item alone. There are other factors which suggest expansion. Population for instance, by itself may not be significant, but taken collectively with other factors, may well prove illuminating. Prior to the freeway, the population of El Monte was 9,713 (census of November 10, 1955). Less than two years later, the special census of October 10, 1957, discloses that the population of El Monte had grown to 11,507, an increase of 1,794 or 18.5 percent over the 1955 figure. What is more significant is the fact that prior to the freeway, from 1950 to 1955, a period of *five* years, population had only increased 20 percent. Perhaps even more significantly, three-quarters of this increase took place within the old city limits and therefore does not reflect increases due to physical annexation. (It is enlightening to note that all of the annexed areas were considered to be "uninhabited.")

Duplication and Isolation

There is no visual or statistical evidence whatsoever of any so-called "isolation" of certain areas as a result of the elevated freeway; nor is there any evidence whatsoever of tangible interference with free and convenient interchange between the two, admittedly more separate, main business streets. *Since freeway construction actually became unmistakably evident, 16 new merchants have established themselves along both of the "bypassed" thoroughfares and remain in business today.* Moreover, the distinctive character of both streets—one a pedestrian traffic, typical downtown type mercantile area, and the other a commercial strip in its usual form—has been maintained without variation, and there is little reason to suspect that any isolating influences have been at work which might conceivably change this picture.

Sales Tax Analysis

The importance of these "bypassed" business streets to the economic welfare of the entire city has already been indicated. *One hundred forty-four retail establishments along Garvey Avenue and Valley Boulevard average around 20 million dollars' worth of business a year, two-thirds of the total retail business done yearly in the entire city.* Simply stated, if these merchants had taken an "economic beating" from freeway construction and traffic changes, the entire community would have taken a "beating" as well, for there was little else to cushion the blow.

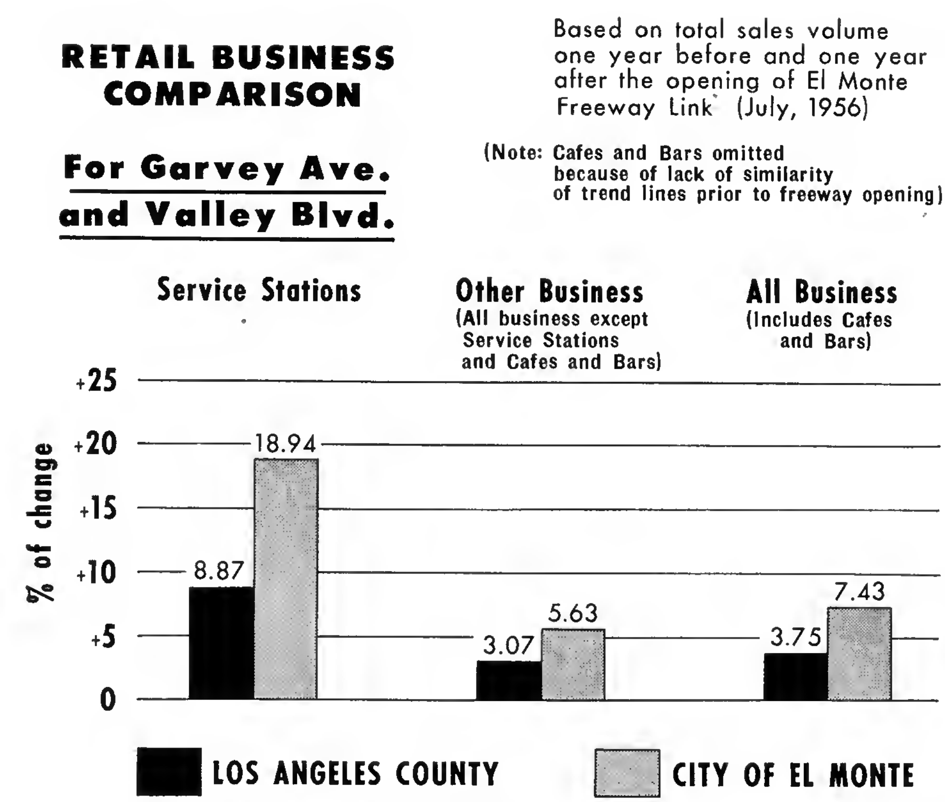
In analyzing changes in gross business volume for before and after periods, we have customarily employed the changes in the parent county as our measuring stick. This is done only after careful analysis has been made of business trends in both the city under study and its county to determine that both have consistently followed an identical trend prior to the freeway change. In the El Monte study, the County of Los Angeles proved itself to be an entirely accurate measure for all major business groups except one—the cafe and bar groups, a situation referred to in more detail hereinafter.

State sales tax data are used in determining the gross volume of business conducted by bypassed or freeway affected merchants in the "before" and "after" periods prior and subsequent to the freeway opening. Because of strict requirements of the State for honest and accurate reporting of gross sales, these sales tax data become very meaningful when they are compared with a control area or comparative base for the same periods. Any deviation in the trend lines of the two areas in the after period would denote an effect that may or may not be attributable to the freeway.

Retail Trade

In order to develop a more significant picture of the effects of an elevated freeway on the overall El Monte community, the combined gross sales of merchants on both "superseded" streets were analyzed under the following categories: (1) all businesses, (2) service stations, (3) cafes and bars, and (4) other businesses.

How well did the bypassed areas do in the year after freeway construction? *In all instances, retail business was significantly better than similar business in Los Angeles County.* The Valley Boulevard and Garvey Avenue "All Business" category registered a



The above graph shows percentage increase in volume of retail sales along the principal arterials, Garvey Avenue and Valley Boulevard, in the City of El Monte as compared with Los Angeles County during the two-year period of study.

7.43 percent gain in gross retail sales after freeway opening while all business in the county was up approximately half as much, or 3.75 percent.

For a clearer analysis of the 7.43 percent increase, the "All Business" group was broken down into three categories: (1) service stations, (2) cafes and bars, and (3) other business (other than service stations, or cafes and bars).

Service Stations

Service stations on "superseded" highways are generally good indicators of the effects of a bypass since they are highly sensitive to traffic changes. According to the sales tax report, *the service stations of El Monte along superseded highways did 18.94 percent more business in the after period as compared to the county's 8.87 percent gain. This is even more significant when one considers that traffic along the two superseded highways had dropped 36 percent whereas overall traffic within the County was up 8 percent and up only slightly less for the State as a whole over the same period.*

There was no increase in the number of stations during the "after" period.

Cafes and Bars

The other highly sensitive traffic catering businesses, cafes and bars, could not be objectively compared with the county since, as noted previously, in the "before" period El Monte's trend was dissimilar to that in Los Angeles County. (Probably one of the principal reasons for the dissimilarity may be attributed to the fact that the bypassed cafes and bars are a poor sampling of the county's cafes and bars.) Whether El Monte's gain of 47.66 percent is thus significant in the face of the county's gain of only 8.79 percent is a matter of conjecture. Perhaps the only significant statement that can be made pending further research is that the bypassed cafes and bars as a group did better in the "after" period than in the "before" period.

Undoubtedly of significance, however, is the fact that three new cafes and bars opened up in the "after" period.

Other Businesses

Other business, the nonhighway caterers if you will, was up in the after period as well. This group showed a 5.63 percent gain while similar businesses within the county were gaining only 3.07 percent.

New Developments

Admittedly, a one-year study period is ofttimes insufficient to enable slower moving developments, attributable in whole or in part to the new freeway facility, to make themselves clearly evident. Thus an entirely complete survey of such elements of the overall picture is rarely possible. Occasionally, however, exceptional developments occur which strongly indicate the trends in community development which can reasonably be expected in the "after" period. El Monte is excellently represented here.

Adjacent to the freeway at the easterly city limits of El Monte, a gigantic 35-acre Sears, Roebuck and related stores center is presently nearing completion. This development, attributable in part to the freeway improvement, will represent when completed an investment in freeway-adjacent-properties approximating some three to five millions of dollars. This sum becomes perhaps strikingly pertinent when the following facts are pointed out for comparison:

1. Between 1952 and 1955, 167 right-of-way parcels were acquired for the San Bernardino Freeway through this section for a total consideration of $2,160,000.
2. The three- to five-million-dollar investment represents, then, *in new, significantly freeway-induced development, over twice the total amount spent for right-of-way on the entire El Monte freeway project, if the latter estimate is used.*

Conclusion

Each item of the foregoing data sheds significant light upon the specific elements of the El Monte "bypass" situation which this study sought to investigate. Taken either singly or as a whole, they clearly point up that:

1. The elevated, controlled-access freeway through the City of El Monte has in no way hindered the growth of the entire community in:
   - (a) Area
   - (b) Population
   - (c) Commercial and residential development.
2. El Monte in the "after" period has shown the exact opposite of the alleged and feared "Chinese Wall" situation.
3. The "bypass" of Garvey Avenue and Valley Boulevard—the "superseded," approximately parallel highways which generate two thirds of El Monte's business —has not been accompanied by either business decline or loss to:
   - (a) The specific Valley-Garvey general business sections
   - (b) The overall El Monte commercial complex.
4. Without exception, every class of business analyzed in the "after" freeway period has recorded significant gross sales gains.

Oslo, Norway

Editor, California Highways and Public Works

Sir: I would like to use your magazine to write to the American engineers that I have met.

I had the great opportunity and luck to be allowed to visit the United States for almost one year, from September, 1956, to August, 1957. For most of this time I studied civil engineering and traffic engineering at Yale University. In addition I visited many highway departments, turnpike authorities, and other engineering offices.

I drove through 29 states from Rhode Island to California and returned to Albany, New York. On this study tour I saw many engineers in highway departments and in other highway offices and got more and better information than I had expected to get—many books, reports, drawings, and pictures of highway building.

Because I have been in a very great hurry with engineering work here in my office in Oslo, I have had no time to write and thank the engineers and authorities who gave me such valuable assistance.

Gabriel Froholm

A.A.S.H.O.

Highway Officials From All States Hold Annual Meet in San Francisco

One of the best attended annual meetings in the 44-year history of the American Association of State Highway Officials was held in San Francisco December 1st through 5th, with California as host state.

Nearly 1,600 delegates and visitors from all over the Nation attended the meeting, which included three general sessions, many committee meetings, a fashion show-luncheon for the wives, the traditional family dinner, and an all-day tour of highway projects in the San Francisco Bay area.

Dominating the delegates' discussion, apart from the wide range of technical studies and papers, was the problem of financing the Federal Government's share of the National Interstate Highway System construction program. U. S. Senators, Congressmen and other officials present pointed out that under the present financing schedule the program threatens to fall behind schedule in the next two years.

This problem was also reflected in the major resolution adopted by the association in San Francisco, which reaffirmed the ability and readiness of state highway departments to keep the interstate program on schedule if the necessary financing is forthcoming.

The association elected Ralph R. Bartelsmeyer, Chief Highway Engineer of Illinois, as its president for 1959. Boston was chosen as the site of the next annual meeting.

UPPER—T. F. Bagshaw, then State Director of Public Works, welcomes the A. A. S. H. O. delegates. Seated, left to right, are: Representative George H. Fallon of Maryland; A. E. Johnson, executive secretary of A. A. S. H. O.; Senator Albert F. Gore of Tennessee; Senator Francis Case of South Dakota. MIDDLE—The newly opened parallel Carquinez Bridge was one of the stopping points on the all-day field trip for A. A. S. H. O. delegates. LOWER—A view of the opening session. Representative Gordon H. Scherer of Ohio is the speaker. Inset shows another opening day speaker, Federal Highway Administrator Bertram D. Tallamy.

Achievement

G. T. McCoy Receives High Award at A. A. S. H. O. Meet

A HIGHLIGHT for Californians at the the opening general session of the 44th Annual Meeting of the American Association of State Highway Officials in San Francisco December 1 was the presentation of the Thomas H. MacDonald Memorial Award for outstanding achievement in the development of highways to George T. McCoy, State Highway Engineer of California.

The award, carrying with it a plaque and certificate, was established by A. A. S. H. O. in 1957 to honor the memory of the late Thomas H. MacDonald, who headed the U. S. Bureau of Public Roads for 34 years prior to his retirement in 1953.

McCoy was the second recipient of the award, and the first highway engineer in active service on whom it was conferred. The 1957 honoree was H. S. Fairbank, a retired Federal Government highway engineer.

The presentation took place before more than 1,000 highway officials and guests soon after the official opening of the weeklong annual meeting. Making the presentation was Dewitt C. Greer, State Highway Engineer of Texas, who, like McCoy, is a past president of A. A. S. H. O.

Greer said the award was based on McCoy's "long and consistent participation in national highway activities and his years of service in the important administrative post of State Highway Engineer of California, and on his wonderful achievement in the development of highways not only in California but in these United States."

At the same time Greer told the A. A. S. H. O. meeting of another tribute to "Chief" MacDonald – the start of a fund to establish a memorial chair in the Transportation Institute at Texas A. and M. College.

Responding to the presentation, McCoy commented that he had known and worked with the late "chief" over a period of 30 years, and added:

"This is a very great honor that the association has seen fit to grant me today. I consider it the highest award a man in my line of work can achieve."

State Highway Engineer G. T. McCoy, Chief of the California Division of Highways (right), is shown receiving the Thomas H. MacDonald Award of the American Association of State Highway Officials at the 44th annual meeting of the association in San Francisco. Making the presentation and congratulating McCoy is Dewitt C. Greer, State Highway Engineer of Texas.

The certificate which now hangs alongside the plaque in McCoy's office in the Public Works Building in Sacramento adds these words to the tributes paid McCoy for his accomplishments over the course of a 43-year highway engineering career:

"The American Association of State Highway Officials, on behalf of its members, presents to George T. McCoy this citation proclaiming his selection as the recipient of the Thomas H. MacDonald award in recognition of his outstanding career as a highway administrator and his great contributions to the highway field, both in his chosen state and at the national level; and in testimony to his honesty of purpose, warmth of character, breadth of vision, height of competence and generosity of counsel that assure forever his place of honor in the history of highway transportation in America."

McCoy has been with the California Division of Highways since 1927 and has been its chief since January, 1943. Under his leadership, California has attained acknowledged nationwide eminence in highway development, particularly in regard to freeways.

At its December meeting in Sacramento, the California Highway Commission adopted a resolution expressing its gratification at the recognition accorded California's State Highway Engineer by the Nation's highway leaders, and added that "this award reflects great credit on the California highway program and on all who have been associated with it."

McCoy acknowledged the commission's resolution by adding that the award "is a tribute to the people of the fine highway organization we have in this State and I feel it should have been given to them instead of to me."

County Funds

State and U. S. Aid Totals $12,997,449 to 57 Counties

APPORTIONMENT of $12,997,449 in state and federal funds to California counties for construction on county roads included in the Federal Aid Secondary System was announced today by the State Department of Public Works.

The allocation, which is for the 1959-60 Fiscal Year includes $8,724,389 from the Federal Government and $4,273,060 in state highway matching funds.

At the same time, State Highway Engineer G. T. McCoy reported that all the participating counties will succeed in meeting the deadline for obligating the additional 1958-59 federal aid secondary and state matching funds which were provided under the 1958 Federal Highway Act. The federal act requires that the added funds have to be applied to previously unscheduled projects and that these new projects must be under contract before December 1, 1958.

These additional 1958-59 funds were allocated to the counties in April. This special allocation totaled $5,191,904, including $4,098,605 in federal funds and $1,093,299 in state highway matching money.

"All of the counties that participated in this 'crash' program have obligated their funds by awarded or advertised contracts, and it now appears that the December 1st deadline will be met," McCoy said.

"The Division of Highways is proud to have been associated with the counties in this successful co-operative venture," he added.

The regular 1959-60 apportionment of $12,997,449 in state and federal funds, which was announced today, is distributed to the counties according to federal and state regulations.

The federal funds are apportioned to the various counties according to the same formula used by the Federal Government in distributing federal aid secondary funds to the states—one-third on the basis of area, one-third on rural population, and one-third on mileage of certain classes of rural mail routes.

COUNTY APPORTIONMENTS OF FEDERAL-AID SECONDARY FUNDS UNDER FEDERAL-AID HIGHWAY ACT OF 1958 AND ACCOMPANYING STATE MATCHING FUNDS, 1959-1960 FISCAL YEAR

County	FAS funds	State matching funds
Alameda	$130,807	$93,755
Alpine	43,622	31,266
Amador	43,622	31,266
Butte	150,325	100,000
Calaveras	52,992	37,982
Colusa	53,594	38,413
Cantra Casta	169,548	100,000
Del Norte	43,622	31,266
El Darada	75,613	54,195
Fresna	438,510	100,000
Glenn	66,797	47,876
Humboldt	192,897	100,000
Imperial	173,181	100,000
Inyo	218,589	100,000
Kern	404,889	100,000
Kings	100,936	72,345
Lake	58,018	41,584
Lassen	134,376	96,313
Los Angeles	450,519	100,000
Modera	119,116	85,375
Marin	53,347	38,236
Mariposa	58,449	41,893
Mendacino	167,686	100,000
Merced	170,026	100,000
Madac	103,428	74,131
Mana	77,590	55,612
Monterey	211,426	100,000
Napa	86,676	62,124
Nevada	53,182	38,118
Orange	157,879	100,000
Placer	111,266	79,749
Plumas	82,639	59,231
Riverside	333,793	100,000
Sacramenta	200,386	100,000
San Benito	59,644	42,750
San Bernardina	630,317	100,000
San Diego	318,090	100,000
San Jaaquin	204,225	100,000
San Luis Obispa	153,189	100,000
San Motea	60,812	43,587
Santo Barbara	148,478	100,000
Santa Clara	192,982	100,000
Santa Cruz	75,234	53,924
Shasta	161,998	100,000
Sierra	43,622	31,266
Siskiyau	207,538	100,000
Salano	86,008	61,646
Sanama	213,313	100,000
Stonislaus	211,712	100,000
Sutter	59,763	42,835
Tehama	109,797	78,696
Trinity	86,371	61,906
Tulare	346,856	100,000
Tualumne	75,983	54,460
Ventura	161,785	100,000
Yolo	80,005	57,343
Yubo	47,321	33,917
Totals	$B,724,389	$4,273,060

The money from state sources is for the use of the counties in matching the federal funds on the basis of approximately 58 percent federal to 42 percent local funds. According to state law, $100,000 is the maximum amount which may be made available in the 1959-60 Fiscal Year to a county for use in matching its federal allocation.

This $100,000 ceiling will permit 31 of the 57 eligible counties to match all of their federal allocation out of funds provided by the State, except for a small amount of county funds required for contingencies and engineering. The City and County of San Francisco is not eligible to participate in the federal-aid secondary road program because it is entirely urban.

County roads on which federal-aid secondary funds may be spent are those roads which have been designated by the county, with the approval of the California Highway Commission and the U. S. Bureau of Public Roads, as constituting the county's federal-aid secondary system.

For the most part, these roads are next in importance to state highways in terms of traffic volume and economic service to the locality, and are often referred to as "feeder roads" or "farm to market roads."

The largest federal-aid secondary allocation for 1959-60 will go to San Bernardino County—$630,317 federal and $100,000 state funds. The smallest allocations will be to Alpine, Amador, Del Norte and Sierra Counties. Each will receive $43,622 federal and $31,266 state funds.

Total motor vehicle registration in California reached 7,625,378 on November 1, 1958, as compared with 7,388,731 one year earlier, according to an end-of-the-year report of the Department of Motor Vehicles.

The 1958 motor vehicle registration sub-totals were: automobiles, 5,965,241; trucks, 864,809; trailers, 638,316; motorcycles, 59,203, and vehicles exempt from registration, 97,809.

Report From District VII

By EDWARD T. TELFORD
Assistant State Highway Engineer

THIS is the eighth annual report about freeways in District VII of the California State Division of Highways that has been published in successive January-February issues of *California Highways and Public Works*. From questions that are continually being asked of us concerning freeway development in this area, it would appear that very few persons have a clear understanding of how the personnel of the District VII organization operate in the furtherance of freeways.

It is quite generally known that for administrative purposes the State of California is divided into 11 districts, with the engineers in charge reporting to State Highway Engineer George T. McCoy in Sacramento and his two deputies J. W. Vickrey and Charles E. Waite. It is not so well known that while nine of the 11 districts are in charge of district engineers, District IV, the San Francisco district, and District VII, the Los Angeles district, both encompassing large metropolitan areas, are in charge of assistant state highway engineers.

In District VII, which comprises the three counties of Los Angeles, Orange and Ventura, the Assistant State Highway Engineer in charge, with an organization totaling over 2,300 employees, is assisted by two district engineers—L. R. Gillis and A. L. Himelhoch. The division of responsibility between these two engineers is on a functional basis and not a geographical one. Gillis has responsibility for functions under the general heading of "Planning" which includes advance planning, programing and budgeting, designing and traffic engineering. Himelhoch has charge of the functions known as "Operations," which includes surveys, materials, drainage, construction, maintenance, and, in addition, administration. In carrying out their work, the two district engineers are assisted by 10 assistant district engineers.

These assistant district engineers also operate on a functional basis. A geographical division of the district exists only in the case of the District Maintenance Department with respect to its superintendents and their crews and in the case of the three assistant district engineers engaged in design. Highway and freeway construction plans, the development of which constitutes design operations, are prepared by three engineering units each averaging around 120 employees, and each under an assistant district engineer. Design Section "A" takes care of the Los Angeles metropolitan area. Design Section "B" covers southeast Los Angeles County and all of Orange County. Design Section "C" includes roughly the northern half of Los Angeles County and all of Ventura County.

The work of the district could not go forward, particularly as to construction of new freeways, were it not for adequate rights of way upon which to build them. The acquisition of rights of way for District VII projects is the responsibility of Metropolitan District Right-of-way Agent H. W. Leonard, who is assisted by four supervising right of way agents. These supervisors divide the work along functional lines with each having responsibility for one of the following: organizational administration, right of way engineering, property

ABOVE—This view southward above the Harbor Freeway shows the Manchester Avenue interchange in the foreground paralleling the freeway are Figueroa Street (right) and Main Street (left).

appraising or right of way acquisition. Leonard reports directly to the Assistant State Highway Engineer.

District VII is the only district in the State having the advantage of an office of the Division of Highways Bridge Department housed with its own organization. The bridge engineer for the southern area is J. E. McMahon, who, under the general direction of State Bridge Engineer F. W. Panhorst in Sacramento, has responsibility for construction and maintenance of all bridges and other major structures in Districts VII, VIII, IX and XI.

For this eighth annual report on the freeway situation in District VII, particularly describing the accomplishments during 1958, Leonard for Right-of-Way, McMahon for Bridge Department and the assistant district engineers have all made contributions in their respective fields.

Mounting traffic volumes give evidence of the enthusiastic public acceptance of freeways and have resulted in an ever-increasing workload and growth for District VII. The initial organization of District VII dates back to the first payroll of February, 1912, which listed 20 men on the "Division VII" staff, as it was then called when Division VII included areas now embraced by Districts VII, VIII and XI. By the end of 1913 there were 71 employees on the staff payroll. Ten years later, in 1923, with some fluctuation in between, it happened again that there were 71 employees on the staff payroll, with expenditures during that year totaling $1,500,000. The next 10 years brought a steady increase in amounts spent and the number of employees, and in 1933 we find that with a yearly expenditure of $7,400,000 there were 218 staff employees. In the following 12 years both the yearly rate of spending and the number of employees stayed remarkably constant. In 1945 the yearly expenditure was again $7,400,000 and the number of staff employees was 239. Increased revenue resulting from 1947 Legislation furnished the impetus for continued growth. The accompanying tabulation indicates the progress made by District VII since that time.

GROWTH OF DISTRICT VII

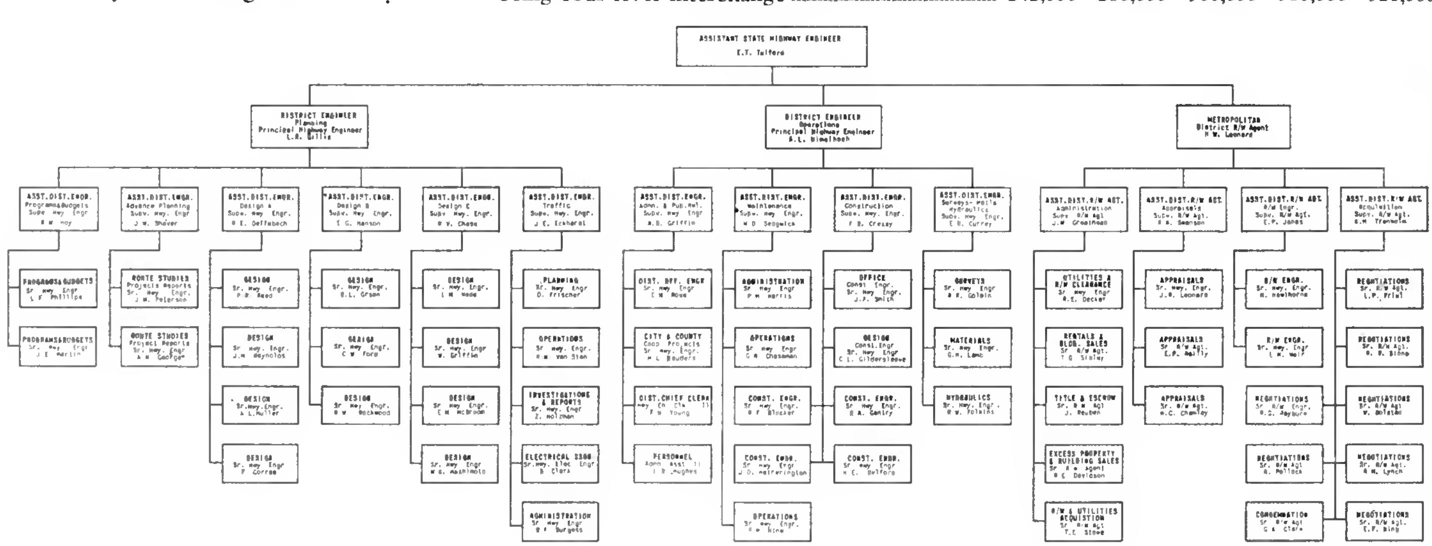
Fiscal year	*Yearly expenditures*	*Staff employees*
1945-46	$8,146,000	335
1946-47	15,486,000	454
1947-48	24,007,000	688
1948-49	35,674,000	735
1949-50	25,452,000	801
1950-51	35,532,000	957
1951-52	38,892,000	976
1952-53	45,853,000	1,040
1953-54	68,112,188	1,268
1954-55	75,411,715	1,464
1955-56	97,502,723	1,588
1956-57	122,345,757	1,776
1957-58	119,500,000	1,778
1958-59	129,650,000 (budgeted)	....
1959-60	164,293,000 (budgeted)	....

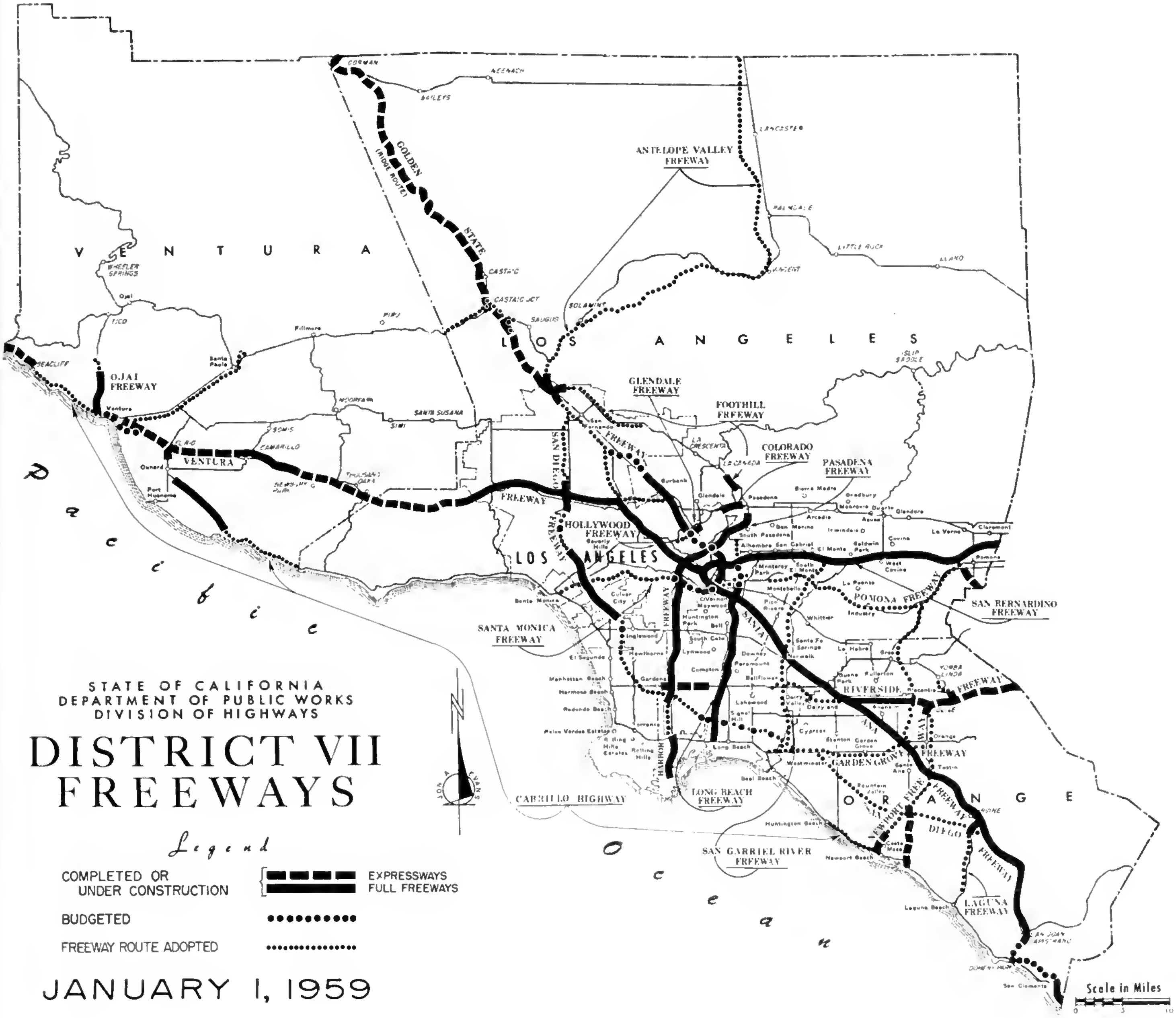
The increasing volume of work necessitating a corresponding increase in personnel caused the district staff long ago to outgrow the district offices at 120 South Spring Street. Several departments are now housed in five other offices buildings.

A $5,500,000 annex to the present district office building is now under construction. The new building will consist of basement and ground floors for parking and four floors of office space with approximately 50,000 square feet per floor. It will be ready for occupancy in the fall of 1959 and then the District VII staff will again be all under one roof.

A reference to the annual traffic counts will show a volume increase corresponding to the yearly expenditures. The annual traffic counts taken Sunday and Monday, July 13 and 14, 1958, indicate that, on some of our freeways in the City of Los Angeles approaching the Civic Center in the downtown area, the traffic saturation point has been reached. However, in the case of the four-level traffic interchange facility at the intersection of the Hollywood, Harbor and Pasadena Freeways, we find each year a steady increase in traffic use. The average daily traffic on freeways in this area for the past five years is shown by the following:

Location	*1954*	*1955*	*1956*	*1957*	*1958*
Hollywood Freeway (four-level westerly)	168,000	180,000	185,000	192,000	192,000
Pasadena Freeway (Elysian Park)	110,000	112,000	114,000	109,000	122,000
Santa Ana Freeway (Soto Street)	90,000	113,000	145,000	145,000	141,000
San Bernardino Freeway (Soto Street)	80,000	88,000	96,000	93,000	113,000
Harbor Freeway (four-level southerly)	125,000	160,000	175,000	190,000	192,000
Colorado Freeway (Linda Vista)	30,000	27,000	29,000	23,000	23,000
Long Beach Freeway (Pacific Coast Highway)	10,000	31,000	37,000	35,000	43,000
Using four-level interchange	242,000	280,000	300,000	318,000	321,000





ADVANCE PLANNING

By JOHN W. SHAVER
Assistant District Engineer

The Advance Planning Department of District VII with a staff of 40 people is charged with the responsibility of doing all things necessary at the district level to bring a freeway route from the legislative description through to adoption by the State Highway Commission. Included in this process are alignment studies, traffic estimates, construction estimates, and right-of-way estimates.

Along with the continuing evolution of State Highway Commission policy (see article on CHC hearings, page 55, *California Highways and Public Works*, March-April, 1958) in the direction of more and more local community participation in the processes of route adoption, has come an ever-increasing number of informal conferences with civic groups, chambers of commerce, local officials and their staffs, as well as more detailed public meetings and public hearings. These procedures have done much to win public acceptance of the freeway proposals locally by giving the citizens a chance to participate in the ultimate solution of the problems which the proposed freeway presents.

During the calendar year 1958, routes were adopted in District VII on portions of the Foothill Freeway, Route 79 Freeway and Pomona Freeway. These freeway routes totaled 19.0 miles and were estimated to cost $41,200,000, for construction and rights-of-way. Carried through the public meeting stage were portions of the Foothill, Antelope Valley and Artesia Freeways totaling 44.6 miles and estimated to cost $164,500,000.

Other advance planning projects under active study, totaling about 120 miles and estimated to cost 492 million dollars, include a freeway on Sign Route 134 from the Ventura

Freeway to Pasadena, portions of the Glendale Freeway, a freeway extension on Sign Route 35 near Seal Beach, a Sign Route 39 Freeway from the Santa Ana Freeway to US 101 Alternate, a US 399 Freeway from Foster Park to Ojai, a US 101 Alternate Freeway along the coast in Orange County, a Route 162 Freeway from the Hollywood Freeway to Beverly Hills, a freeway bypassing the City of Oxnard, a freeway on US 60 bypassing the City of Pomona, a freeway along the existing expressway in Santa Ana Canyon, a freeway connection in Pasadena, from Devils Gate Dam to the Colorado Freeway and a freeway from the Harbor Freeway in San Pedro to 1,000 feet east of the proposed bridge to Terminal Island.

In addition, advance planning prepared the district's part of the overall plan for future freeway development recently presented to the Legislature pursuant to Senate Concurrent Resolution 26. This included a district-wide study of a proposed freeway system totaling 1,400 miles and costing 4.25 billion dollars.

Because of the topography and differing traffic characteristics, the study in District VII was divided into three parts: Ventura County, North Los Angeles County, and the Los Angeles-Orange County Metropolitan area. For each part an estimate was obtained of the 1980 population and projected land use. Using these data and traffic generation factors based on land use, the total number of 1980 daily vehicle trips was calculated and placed on maps by means of dots.

The total land area involved was 5,700 square miles, and the total 1980 population was estimated at 13 million. The total 1980 daily vehicle trips amounted to 27.5 million. Based on average trip length this would result in 220 million daily vehicle-miles of travel in District VII by 1980.

Since no district-wide origin and destination survey was available, the traffic desires had to be synthesized. These were assigned to the proposed freeway system by manually describing each interzonal trip. Approximately 100,000 trip descriptions were written. These data were keypunched on tabulation cards and fed into the electronic computer at Headquarters. The resulting tabulation from the computer gave the 1980 traffic profile for each freeway in the system with turning movements at each interchange.

The techniques developed in these studies have great promise for solving traffic assignment and prediction problems, particularly in cases where origin and destination information is not available.

Looking north along a section of the Golden State Freeway showing construction through the City of Burbank. The cloverleaf in the foreground is the Alameda Avenue interchange.

PROGRAMS AND BUDGETS

By A. W. HOY
Assistant District Engineer

Programing basically consists of the preparing and maintaining a flexible advance construction and right-of-way program. The number of years covered by the program depends on the period as it relates to statutory budget controls. Headquarters Office furnishes the target figures for each year. These target figures are the estimated District VII total right-of-way and construction expenditures. The district recommends the allocation of this total between the three counties and also the allocation to construction projects and right-of-way acquisition. The allocations to the counties are predicated on the Mayo formula as set up by the Legislature in the Collier-Burns Act of 1947. District VII does not have a problem in meeting county minimums, as the deficiencies in all three counties are so great that the problem is one of determining priorities, and never having sufficient funds to accomplish all the high-priority projects.

In addition to the advance planning program as requested by Headquarters, it is necessary for the district to maintain an additional planning program in order that all of the steps leading up to the actual budgeting and getting the many projects under construction can be properly co-ordinated. The explosive nature of development in the Los Angeles metropolitan area results in an everchanging and increasing need for new freeways. This, together with periodic changes in financing and estimated revenues, makes "programing" a continuous operation throughout the year.

It is essential in the programing and budgeting of freeway projects to so plan the various construction units that each unit will, upon completion, immediately become usable to the public and serve a useful purpose in improving the traffic situation.

The Programs and Budget Section maintains the monthly status of all unadvertised projects. The status shows the estimated plans, surveys and estimate date, estimated cost of project, status of right-of-way acquisition, and date right of way will be clear for advertising, and the suggested advertising date. Other pertinent data relative to status of railroad agreements, co-operative agreements, and any other matter that may affect advertising of the project are also shown.

In connection with maintaining the status of unadvertised projects, it is necessary to see that all departments involved in any particular project are keeping their portion of work up to schedule so that the project can go to contract on schedule. If it appears that some problem has developed which will affect advertising the project on schedule, the matter is placed on the agenda for discussion at the regular monthly staff meeting of District VII department heads so that any problems can be ironed out.

Other functions of the Programs and Budgets Section in connection with the furtherance of freeways are as follows:

(1) Prepare route adoption maps.

(2) Prepare and process freeway agreements.

(3) Co-ordinate the processing of relinquishment of frontage roads and State highways that are replaced by freeway construction.

(4) Review co-operative agreements and preliminary reports to maintain uniformity as to form within the district, and in order to maintain an accurate accounting of funds.

(5) Prepare the semiannual status of District VII freeway projects.

SURVEYS, MATERIALS, DRAINAGE

By E. B. CURREY
Assistant District Engineer

This section of the district organization has a total staff of 350 employees. The entire section of three departments is, in a broad sense, a service organization to the entire district staff. It furnishes the basic engineering information so that planning, design, right-of-way engineering and construction can go forward.

The *Survey Department* is headed by a district chief of surveys, assisted by seven assistant district chiefs of surveys. Their work, with 40 survey parties in the field, includes preliminary surveying, aerial surveying, right-of-way surveying and construction surveying. The office staff produces the co-ordinate control maps from field survey work, which are, in turn, used by the three district design staffs and District Right-of-Way Department. One of the fastest growing subdepartments of the office staff in the Survey Department is the aerial photogrammetric squad. Three years ago the "squad" consisted of one man. Today it is staffed by six men.

The variety and magnitude of the work involving underwater surveys has resulted in the Survey Department purchasing its own boat that enables us to take soundings to determine the elevation of the ground surface below water level.

With approximately 250 men the Survey Department is in an excellent position to train personnel for other departments. The Survey Department obtains about 60 percent of all the beginning engineering help that starts in the district. In addition, men in the Survey Department with two years or more experience are eligible to be loaned to other departments for a one-year period for training in another branch of engineering to broaden their experience. At the present time we have about 40 men loaned out to other departments. During the summer an attempt is made to place one student trainee in each survey party. The junior civil engineer rotation program assigns many of the recent engineering graduates to the Survey Department for a six-month basic training period.

The District Drainage Department is in charge of a district drainage engineer and four assistant district drainage engineers with a total departmental personnel of 30. One of these assistants devotes his time to hydrologic studies throughout the entire district. These studies are ordinarily made several years in advance of freeway construction. Each of the other assistants handles drainage design and various drainage complaints and problems in areas which correspond to the three District Design Sections. These men handle the difficult hydraulic design problems which are referred to us by the Design Sections and co-ordinate work with other drainage agencies such as the Los Angeles City Storm Drain Department, the Los Angeles County Flood Control District, and the U. S. Corps of Engineers.

During the past year some of the more important projects on which we have worked in conjunction with various other agencies have been the "Dorchester Channel" adjacent to the Long Beach Freeway Extension just south of the San Bernardino Freeway and the Los Angeles County Storm Drain Bond Issue Project, a longitudinal encroachment along this same route. We also worked on the "Sepulveda Canyon Channel" between Mulholland Drive and Casiano Road which is being realigned for construction of the San Diego Freeway. We were consulted on the "Caballero Creek Crossing" of the Ventura Freeway which is connected with a project of the U. S. Corps of Engineers in the Encino area. We are also working at the present time on the "Torrance Lateral" of the Dominguez Channel which crosses the San Diego Freeway and the Harbor Freeway. About 90 percent of the design work of this department is in conjunction with the freeway development.

The District VII Materials Department under a District Materials Engineer provides services to other departments. These services include the operation of a laboratory at the Central Maintenance Yard in East Los Angeles Area for testing soils and mineral aggregates and the training and supervision of personnel for performing control tests on construction projects. The operation of the laboratory requires 12 to 18 persons and the control testing on contracts currently is requiring a staff of 27 employees. The control testing on construction projects includes the measurement of the density of embankments for compliance with the relative compaction specification, the sampling and grading analysis of mineral aggregates and the setting up of batch weights for portland cement concrete and for asphalt paving mixes. Probably the most important services performed by the Materials Department are the preliminary investigations made of proposed projects and the preparation of the materials report which attempts to anticipate and make recommendations for meeting the problems which will occur during the future construction and maintenance of the freeways. These investigations begin with the early preliminary location studies for the routes which are as much as five or six years in advance of construction and continue up until the time the final line and grade of the freeway has been determined by the Design Department. Preliminary materials investigations are in progress on the following freeways:

The San Diego Freeway from Culver City to Irvine, the Golden State Freeway from downtown Los Angeles to the Kern county line, the Antelope Valley Freeway from Los Angeles to the Kern county line, the Santa Monica Freeway, the Ventura Freeway through the City of Ventura to the Santa Barbara county line and the Pomona Freeway.

Some of the more interesting studies in connection with the Greater Los Angeles Freeway System have had to do with the application of soil mechanics to problems of stability for the 380-foot-deep cut at Mulholland Drive in the Santa Monica Mountains on the San Diego Freeway; for the proposed projection of the Antelope Freeway through an existing slide area; for the oilfield waste sumps along the San Diego Freeway alignment in the Long Beach area; and for peat bog areas along the San Diego Freeway between the San Gabriel River and the Santa Ana River in Orange County.

TRAFFIC

By J. E. ECKHARDT
Assistant District Engineer

In very broad terms the District Traffic Department's functions fall into two categories: one, preliminary research and studies on projects including new freeways to provide necessary information for other departments, and the other, the traffic control operations on existing state highways, including freeways.

An interesting part of the research in which the District Traffic Department recently participated was the U. S. Bureau of Public Roads study in July, 1958, using portable electronic equipment to determine the effect of trucks and grades on vehicular traffic volumes by measuring the speed, spacing and position within the lane of all vehicles. These studies were made at various locations within the district, mainly on freeways.

Considerable advances have been made in providing proper temporary connections at the ends of freeways within the Los Angeles metropolitan area where traffic volumes are extremely heavy. Liberal use of barricades, reflectors and signs, as well as flashing lights, have been found to be necessary, and with the traffic volumes involved, the expense has been more than warranted.

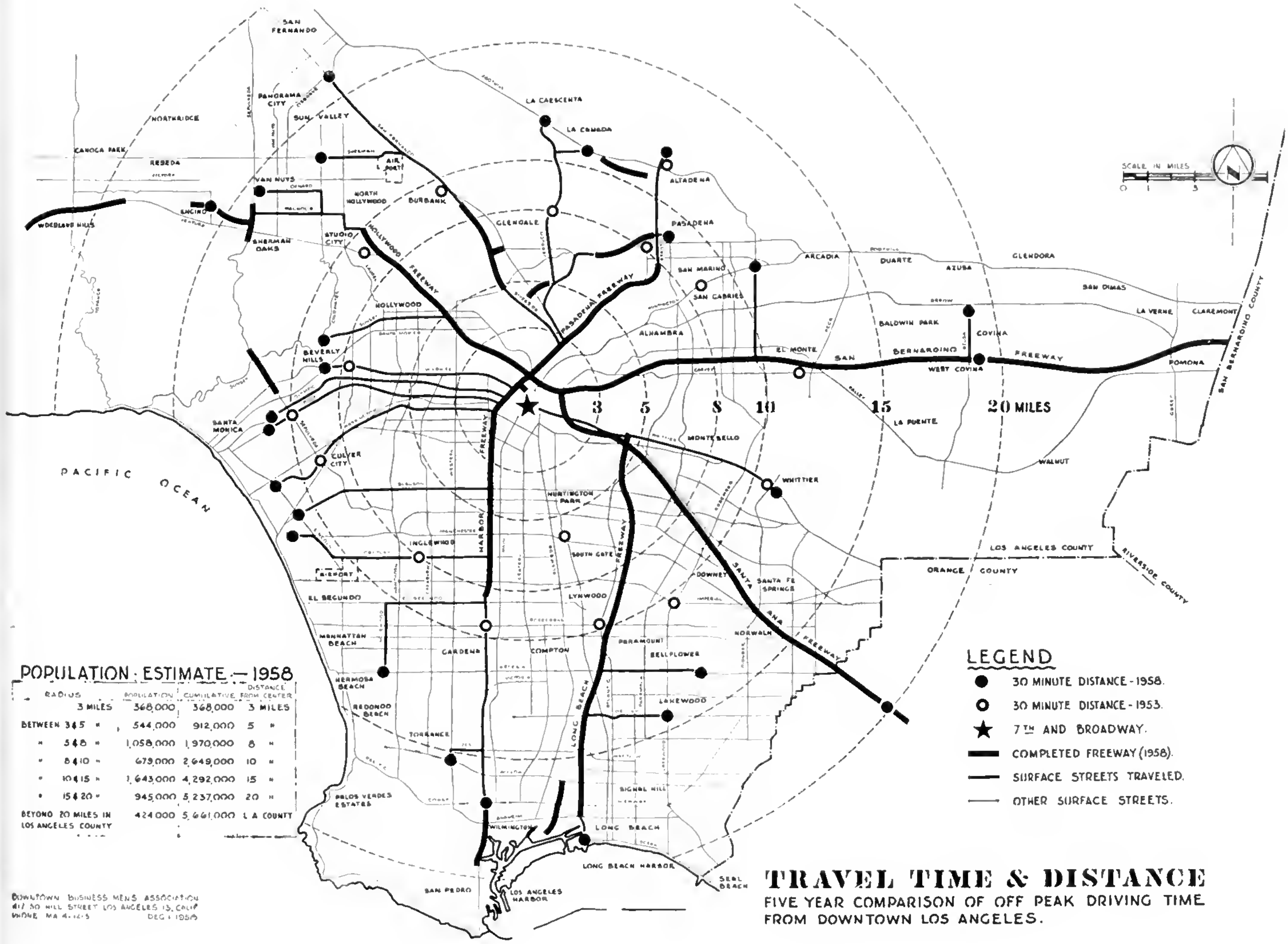
An origin and destination survey was conducted in the Los Angeles harbor area, during July and August, 1958, in co-operation with the Bridge Department and the firm of Coverdale and Colpitts, Consulting Engineers of New York City, to secure traffic data to be used for a study of the proposed San Pedro–Terminal Island Toll Crossing. Approximately 100,000 roadside interviews were recorded under the supervision of traffic department personnel, over a period of three weekends during late July and early August. The information obtained from an analysis of this survey will be valuable in determining future freeway routings in the harbor area.

Several improvements worked out by the District Traffic Department have been undertaken during the past year to eliminate the causes of traffic delay on the freeways. These include, among others, the construction of a connection for the southbound collector road adjacent to the Harbor Freeway just south of the four-level structure so that in the peak hours the existing three-lane section between the beginning of the collector road and the Fifth Street onramp, where a lane is added, can be bypassed and traffic then will be able to use the collector road getting back on the freeway at the Fifth Street onramp. Not only will this provide additional lanes for traffic, but it should reduce the amount of weaving between the traffic from the Hollywood and Santa Ana Freeways crossing the traffic from the Pasadena Freeway. This construction was completed on December 1, 1958.

On the Santa Ana Freeway just east of the four-level structure, a fourth lane has been added on the upgrade for westbound traffic in the so-called "slot" adjacent to the Los Angeles Civic Center. While there is a short section of three lanes still remaining in the vicinity of the Los Angeles Union Railroad Depot, the added lane on the upgrade with the various on and offramps has been a very noticeable help in the reduction of traffic congestion in the area.

Farther to the east, also for the benefit of westbound traffic on the Santa Ana Freeway, by a minor revision in a traffic island near the Union Depot, it has been possible to provide continuous four-lane operation from the junction of the San Bernardino–Santa Ana Freeways all the way to the Alameda Street offramp. The relief to traffic on both the Santa Ana and San Bernardino Freeways during the morning peak because of this relatively minor improvement has been very satisfactory.

In order to properly guide motorists on heavily traveled freeways, the best signing possible is always desirable. With this in mind action is being taken as financing becomes available to bring old signing up to current standards. Bids were opened on December 4, 1958, for a $55,000 project to provide new directional signing on the Hollywood Freeway inbound be-



tween Glendale Boulevard and the four-level structure. Improvements are also being made by the City of Los Angeles on the signing from city streets to freeways throughout the Los Angeles metropolitan area.

As many of the freeways in the metropolitan area of Los Angeles have been built with somewhat narrow medians for the high volume of traffic being handled, consideration has been given and plans prepared for the installation of median barriers at certain locations. Funds for such an installation beginning on the Hollywood Freeway near Benton Way and extending to a point on the Santa Ana Freeway east of Lakewood Boulevard in the amount of $290,000 were budgeted by the California Highway Commission in October, 1958.

Performing any type of work on the major freeways once they are open to public traffic presents a very serious problem. When it was determined that as a part of the Santa Monica Freeway construction, it would be necessary to detour the 180,000 vehicles per day on the Harbor Freeway in the vicinity of Venice Boulevard, it was decided that the detour would have to be a full eight-lane divided freeway. This detour was built between Washington Boulevard and Pico Boulevard providing a temporary wooden bridge structure to carry Venice Boulevard over the eight-lane detour. The detour falls within the area of the future Santa Monica-Harbor Freeway interchange and the earth temporarily used in the detour will be incorporated in permanent embankments in the interchange area. The detour was opened to traffic in August, 1958, and has been giving very satisfactory service.

DESIGN "A"

By R. E. DEFFEBACH
Assistant District Engineer

The work of designing freeways and other state highway projects to carry out a construction program of upwards of $100,000,000 per year in District VII, for administrative reasons has been divided into three geographical sections.

Design "A" with a staff of approximately 140 people is responsible for the preparation of construction contract plans for state highways and particularly freeways within the central Los Angeles metropolitan area.

The "East Loop"

Included among the more important freeway projects under preparation by "Design A" during the past year are those required for the completion of the Golden State–Santa

Monica Freeway loop to the east around the Los Angeles downtown area.

A 4.7-mile length of the Golden State Freeway from Ash Street in Burbank to Glendale Boulevard in Los Angeles was completed and opened to public traffic during 1957. Two Golden State Freeway projects totaling 3.4 miles in length from Sixth Street to Mission Road and from Mission Road to Pasadena Avenue, are currently under construction. Two additional projects, 1.0 mile long from Pasadena Avenue to Arnold Street and 2.0 miles long from Arnold Street to Glendale Boulevard, provided for in the 1959-60 Fiscal Year budget, will complete the Golden State Freeway to a connection with the Santa Monica Freeway on the east side of Los Angeles. This connection is made in the "East Los Angeles Inter-Change," the Bridge Department model of which has recently received wide publicity. This facility provides connections between the Santa Monica, Golden State, Santa Ana, and Pomona Freeways. From this traffic interchange, three projects on the Santa Monica Freeway financed in the 1959-60 Fiscal Year budget in addition to the Los Angeles River bridge and overhead now under construction, will be required to complete the extension of this freeway to a connection with the Harbor Freeway.

The "East Loop," when completed about two years hence, will offer an alternate route for through traffic now using the Hollywood Freeway, bypassing the four-level interchange and the freeways in the Los Angeles downtown area that are so badly overloaded. It is believed that this alternate route will do much to relieve the traffic pressure on the present existing freeway facilities. Some measure of the importance of this loop is indicated by the fact that eight different freeways are involved. These freeways are the Golden State, the Glendale, the Pasadena, the San Bernardino, the Santa Ana, the Pomona, the Santa Monica, and the Harbor. Of these, only the Pomona Freeway has not yet been adopted throughout its entire length.

These six projects (two on the Golden State Freeway, the East Los Angeles Interchange, and three on the Santa Monica Freeway), which are all financed in the 1959-60 Fiscal Year budget, will have an estimated total construction cost of approximately $75,000,000. Plans, specifications and estimates on four of the projects have been submitted, and design of the other two projects is scheduled for completion early this spring.

San Diego Freeway (North)

Of equal importance is the design work on the unconstructed sections of the San Diego Freeway. Currently open to traffic is the 2.0-mile section between Casiano Road and Ohio Avenue in the West Los Angeles area, completed in 1957, and the 1.2-mile section between Valley Vista Street and Burbank Boulevard on the San Fernando Valley side of the Santa Monica Mountains, which was completed in July of 1958. The last section includes the traffic interchange with the Ventura Freeway.

Two projects which will extend the San Diego Freeway southerly of Ohio Avenue to Jefferson Boulevard in the West Los Angeles area are presently under construction by Guy F. Atkinson Company.

It is anticipated that the first contract, betwen Venice Boulevard and Ohio Avenue, with a construction allotment of $6,200,000, will be completed and opened to traffic in February, 1959. The second contract, extending from Venice Boulevard to Jefferson Boulevard, with an allotment of $5,258,000 will be completed early in 1960. During the past year, plans have been pushed toward completion for the balance of the San Diego Freeway between the Harbor Freeway in the southerly portion of Los Angeles, and the Golden State Freeway at the northerly end of the San Fernando Valley.

Other Freeway Projects

Next in order of planning priority is the 13-mile length of the Santa Monica Freeway, from the Harbor Freeway westerly to Pacific Coast Highway in the City of Santa Monica, which is scheduled for completion of design within the next two years.

Additional freeway projects in the Los Angeles area are being currently worked on by Design "A," getting contract plans in shape so that construction can be carried out at some later date, after financing has been provided. These freeway projects include the following:

(1) Widening and improving the San Bernardino Freeway between the Golden State Freeway and the Long Beach Freeway Extension.

(2) Construction on Hollywood Freeway Extension from Ventura Freeway to Golden State Freeway.

(3) Construction on Harbor Freeway from Pacific Coast Highway (US 101 Alternate) to 190th Street in Los Angeles City.

(4) Construction on Ventura Freeway from the Golden State Freeway to the Hollywood Freeway Extension.

(5) Construction on Glendale Freeway from Glendale Boulevard to the Golden State Freeway.

DESIGN "B"

By E. G. HANSON
Assistant District Engineer

The area for which Design "B," with a staff of about 110 people, is responsible, includes southeast Los Angeles County and all of Orange County. In this area there are 10 freeways.

Santa Ana Freeway

During 1958, seven road contracts and one landscaping contract were completed on the Santa Ana Freeway. The road contracts totaled about 22 miles in length, and involved widening the existing four-lane freeway to six lanes between Lakewood and Rosecrans, completion of the six-lane freeway from Buena Park to Anaheim, and completion of approximately 9.2 miles of four-lane freeway southerly of Santa Ana. A 2.8-mile landscaping project in the vicinity of Santa Ana was completed. The total cost of work on this freeway completed during 1958 approximated $15,000,000.

The Santa Ana Freeway between El Toro in Orange County and the Los Angeles Civic Center, is now free of crossings at grade throughout

The much photographed yet always intriguing four-level structure in downtown Los Angeles. The camera looks south along the Pasadena-Harbor Freeway.

its entire length of approximately 43 miles. It is an interstate route.

At the present time, two reconstruction contracts are under way between Rosecrans Avenue and Buena Park, having a length of 4.3 miles and costing approximately $1,300,000. These contracts are for flood control bridge structures and widening from four lanes to six lanes. Upon completion of these contracts, scheduled for May, 1959, the Santa Ana Freeway will be completed to six- and eight-lane standards between the Los Angeles Civic Center and the City of Anaheim, and to four-lane standards southerly thereof.

San Diego Freeway (South)

During 1958, steady progress has been made on the design and construction of various sections of the San Diego Freeway from Long Beach to the Orange–San Diego county line at San Clemente.

In Orange County through the southerly portion of San Clemente, 2.3 miles of the San Diego Freeway was completed at a cost of $2,724,000 and opened to public traffic on October 20, 1958. Then on November 24, 1958, a four-mile section in the vicinity of San Juan Capistrano, passing to the east of the mission and costing $4,230,000, was completed and opened to public traffic. There is under construction in Orange County at the present time a contract on this freeway between Trabuco Creek and Niguel Road, having a length of approximately eight miles and an estimated cost of $4,104,900. It is anticipated that this contract will be completed in July, 1959.

There is included in the approved 1959-60 Fiscal Year budget, an item of $7,000,000 covering the construction of 7.7 miles between Capistrano Beach and San Clemente in Orange County. This will close the gap and complete the section of the San Diego Freeway from its junction with the

Santa Ana Freeway near El Toro, to the Orange–San Diego county line.

There are also included in the 1959-60 Fiscal Year budget, the construction of approximately 1.3 miles of freeway in and adjacent to the City of Long Beach at a cost of approximately $6,500,000 and another project in the City of Long Beach covering the construction of some 17 bridges, a pedestrian separation, pumping plants and incidental retaining walls, at an estimated cost of $8,500,000.

There are under design, sections of the San Diego Freeway between Harbor Boulevard in Orange County and the Long Beach Freeway in Los Angeles County totaling some 20 miles. The San Diego Freeway is on the interstate system.

Long Beach Freeway (South)

During 1958, six miles of the Long Beach Freeway were constructed at a cost of $9,000,000, completing this freeway and opening it to public traffic between Pacific Coast Highway in Long Beach and the Santa Ana Freeway at Olympic Boulevard, a total length of 16.5 miles. Details of the design work that had been previously accomplished on this freeway were described in the November-December 1957 issue of *California Highways and Public Works*. The details of construction covering this south section of the Long Beach Freeway were described in the September-October 1958 issue of this magazine.

Laguna Freeway

This is the official name given Route 185 between the City of Laguna Beach and the Santa Ana Freeway. It is 8.4 miles long.

Two miles of the freeway were completed to expressway standards during 1958 at an estimated cost of approximately $500,000. This construction covered two lanes of the ultimate four-lane freeway.

Route 19 Freeway

This route, extending 16.6 miles between the Santa Ana Freeway and Pomona Freeway, was declared a freeway by the California Highway Commission in 1956. This freeway traverses the Cities of Orange, Santa Ana, Placentia, Anaheim, Fullerton, as well as Los Angeles and Orange Counties. Preliminary design is now under way.

Route 176 Freeway

The routing and adoption of the Route 176 Freeway between Yorba Linda Boulevard and the Newport Freeway was covered by resolutions of the California Highway Commission dated January 15, 1952. The length of the freeway is approximately three miles. A two-lane bridge has been completed over the Santa Ana River, together with approaches, at a cost of $280,000. Design of this freeway is now under way.

Artesia Freeway

During 1958, design has been proceeding on the Artesia Freeway easterly of the San Gabriel River to the Santa Ana Freeway. Design is practically complete on 7.6 miles. On November 12, 1958, a public hearing was held in Los Angeles to cover the location of the Artesia Freeway between Alameda Street and Palo Verde Avenue, traversing portions of the Cities of Compton, Long Beach, Bellflower and Dairy Valley.

Riverside Freeway

The California Highway Commission, in 1952 and 1953, declared this section a freeway, between the Santa Ana Freeway and Route 43. The commission, in October, 1957, named this route the Riverside Freeway, from the Santa Ana Freeway in Buena Park to the San Bernardino Freeway near Colton.

During the calendar year of 1958, the Griffith Company completed a contract on the Riverside Freeway between the Santa Ana Freeway and Spadra Road, (State Highway Route 2). The length of that improvement was approximately 3.6 miles and cost

This view northeast toward downtown Los Angeles shows the detour now in operation on the Harbor Freeway while bridges for the future interchange with the Santa Monica Freeway are being constructed.

approximately $3,300,000. This freeway was completed to six lanes with a 22-foot median strip.

Easterly of Spadra Road, Ukropina, Polich and Kral have a contract under way covering 2.7 miles of freeway to Placentia Avenue, with a construction cost of approximately $2,500,000. Upon completion of the latter contract, a full freeway will exist on this route for a length of 6.3 miles. Easterly of the going contract, to the Riverside county line, a length of about 14 miles is completed to expressway standards.

Garden Grove Freeway

In 1954 and 1957, the California Highway Commission adopted routings and declared Sign Route 22 a freeway between US 101 alternate in Long Beach and the Newport Freeway easterly of Orange. The freeway was named the Garden Grove Freeway by the commission, on October 22, 1957. At the present time a divided highway project is under construction on the Garden Grove Freeway for a length of 3.4 miles, at a cost of $1,400,000. The construction is being handled by Cox Brothers Company and J. E. Haddock, Ltd., and is scheduled for completion during the latter part of 1959.

Design is under way on the Garden Grove Freeway between Knott Street and the Santa Ana Freeway and we are preparing to proceed with design easterly of the Santa Ana Freeway to the Newport Freeway.

Newport Freeway

The Newport Freeway was declared a freeway by action of the California Highway Commission by various actions between 1947 and 1954. Included in the 1959-60 Fiscal Year budget is an item covering the construction of frontage roads for the Newport Freeway in and adjacent to the City of Costa Mesa between 19th Street and Palisades Road; the length of the project will be 2.6 miles, and it is estimated to cost $450,000. Between Newport Beach and Costa Mesa, 3.3 miles of the route have been completed to expressway standards.

At the present time we are engaged in the design of the Newport Freeway between the Santa Ana Freeway and its junction with the Riverside Freeway. The length of freeway under design at the present time is approximately seven miles.

DESIGN "C"

By R. V. CHASE
Assistant District Engineer

Covering all of Ventura County and the portion of Los Angeles County northerly of Los Angeles City is the assigned duty of Design "C".

Design "C" staff averages about 120 to 130 people in engineering classifications. The section organization consists of the assistant district engineer, four senior highway engineers, and 20 project engineers. The project engineers are given the responsibility of preparing the construction contract plans, the specifications, and the estimates of a project. In most cases the project design engineers work on two or more projects simultaneously. A resume of the projects currently under way follows:

Ventura Freeway

The Ventura Freeway (US 101) between the west city limits of Los Angeles at Mulholland Drive and the Santa Barbara county line is in various stages of design and construction.

One section between Conejo Grade Summit and Fifth Street in Camarillo, a distance of five miles, is now being constructed to four- and six-lane freeway standards, a contract which is nearing completion at a cost of $3,500,000.

An item of $6,000,000 has been included in the 1959-60 Fiscal Year for construction of the Ventura Freeway through the City of Ventura between 0.25 mile east of Telephone Road and Palm Street. The remaining cost of approximately $3,000,000 for this project is to be financed in the 1960-61 Fiscal Year.

Scheduled for future financing is the extension of the Ventura Freeway westerly to a junction with the existing highway two miles west of the Ventura River. This project also includes an interchange joining the Ojai and Ventura Freeways. The cost is estimated to be $6,900,000.

The entire length from 0.25 mile east of Telephone Road to 2.0 miles west of the Ventura River involves two separations of the Ventura Freeway with the main tracks of the Southern Pacific Railroad and one separation of the Ojai Branch line. There will also be two ramp separations with the main tracks and one structure carrying the Ojai Freeway ramp connection over the Ojai Branch. There will be a total of 22 bridges including the above railroad structures and two pedestrian separations.

Conversion to full freeway of the expressway sections between the west city limits of Los Angeles and Conejo Grade Summit, a length of approximately 19 miles, and between Fifth Street in Camarillo and a point 0.25 mile east of Telephone Road, a length of 11 miles, are in the preliminary design stage. Development to an ultimate eight-lane freeway by stages is proposed. Preliminary designs are well along and it is expected that freeway agreements with Los Angeles and Ventura Counties can be completed in the near future.

West of the Ventura River to Santa Barbara county line, including a realignment out in the ocean at the Chanslor-Western Refinery is also in the early design stage. Construction to four-lane freeway on right-of-way for an ultimate six lanes is proposed. Public meetings are to be held this spring to acquaint the people of the area and local governmental agencies with the proposed plans.

Golden State Freeway (North)

Construction of the 1.3 miles of this freeway between Alameda Avenue and Burbank Boulevard in Burbank is tentatively scheduled for completion on or about October 1, 1959. A contract for landscaping from the Los Angeles River to Ash Street in Burbank is tentatively scheduled for completion on or about March 1, 1959. The 1958-59 Fiscal Year budget also included $6,000,000 for construction between 0.25 mile east of Burbank Boulevard and 0.2 mile west of Roscoe Boulevard. This project has been advertised with bid opening scheduled February 13, 1959.

The 1959-60 Fiscal Year budget includes funds totaling $1,225,000 to complete the financing on this section. Included in this project is the construction of the portion of the Burbank-Western Flood Control project between Burbank Boulevard and Roscoe Boulevard, by incorporating the United States Engineering Department plans with our freeway plans. The flood control channel and the freeway are so interwoven that one could not be built independently of the other. The construction and right-of-way costs are borne by each agency in accordance with the formal agreements covering the details thereof. Bridge construction on this project includes the Burbank Boulevard Overcrossing of the freeway and an overhead structure over the Southern Pacific Railroad, which is financed by the City of Burbank, Southern Pacific Railroad, and the State of California and will provide the third overcrossing within the City of Burbank of the freeway and the railroad, the others being Olive and Magnolia.

Also included in the 1959-60 Budget is an item of $4,700,000 for construction between 0.2 mile southeast of Roscoe Boulevard and 0.2 mile northwest of Lankershim Boulevard. Plans for this section have been completed, and the project is tentatively scheduled for advertising early in 1959.

The 1959-60 Budget also includes $90,000 for landscaping between Alameda Avenue and Burbank Boulevard.

Plans for the remaining 8.3 miles of this freeway between Lankershim Boulevard and the junction with San Fernando Road are scheduled for completion in 1959 and will include 22 vehicular structures and seven pedestrian structures.

It is proposed to improve the "Ridge Route" portion of the Golden State Highway between the north city limits of Los Angeles and the Kern county line to eight-lane freeway standards under the Federal Interstate Highway Program. The section from the north city limits of Los Angeles to Parker Road, a length of approximately eight miles, is now in the process of design.

A project from 1.25 miles south of Sign Route 126 to Castaic, a distance of 3.9 miles, is being prepared for construction when funds are available. This first project is proposed primarily to eliminate the substandard alignment and grades at the bridges of the Southern Pacific Railroad and the Santa Clara River.

Included in the project will be portions of cloverleaf-type interchanges with Sign Route 126 to Santa Paula-Ventura area.

Foothill Freeway

The portion of the Foothill Freeway between Filbert Street west of San Fernando and Foothill Place west of Sunland, was adopted by the Highway Commission on March 26, 1958. Preliminary design and negotiations for the freeway agreement for this 9.7-mile section are progressing satisfactorily.

Antelope Valley Freeway

This freeway routing of 54 miles in Los Angeles County on US 6 between the Golden State Freeway and the Kern county line has been adopted in three separate sections by the Highway Commission on June 20, 1955, March 21, 1956, and October 20, 1957. The preliminary estimate of construction and right-of-way costs for this route is 60 million dollars.

Design work on this freeway has included the conducting of detailed engineering studies for the determination of exact right-of-way needs and the working out of details sufficient for execution of freeway agreements with Los Angeles County. The alignment will provide a minimum of 60 miles design speed with maximum uphill gradients of 4½ percent. Initial construction will provide for additional truck-passing lanes where necessary.

There will be one railroad overhead required at the Southern Pacific Railroad crossing just southerly of the Santa Clara River.

Plans for the portion in the vicinity of Sierra Highway and Soledad Canyon Road for a distance of about 15 miles, traversing Escondido Canyon to Sierra Highway near Red Rover Road, will be completed August, 1959. This section, for convenience of construction, will be processed in three separate contracts.

This section bypasses the spectacular Vasquez Rocks area, traversing mountainous terrain for which an estimated eight million yards of excavation will be necessary. Cuts and fills to a maximum height of 240 feet and 180 feet respectively will be encountered. Extensive studies to determine the feasibility of separated roadways have also been made in this section.

San Bernardino Freeway (East)

The 1959-60 Fiscal Year budget includes the following items for construction on the San Bernardino Freeway, an interstate route:

1. $1,500,000 for widening from four to six lanes for a distance of 5.7 miles between 0.2 mile east of San Dimas Avenue to the San Bernardino county line, including widening of five bridges.
2. $2,250,000 for widening from six to eight lanes for a distance of 6.5 miles from Rosemead Boulevard to Puente Avenue, including widening of 11 bridges.
3. $2,000,000 for widening from six to eight lanes for the 5.3 miles between the Long Beach Freeway and Rosemead Boulevard, including widening of 13 bridges.
4. $100,000 for landscaping between the San Gabriel River and the West Covina city limits.

Completion of the widening projects listed above will provide a continuous eight-lane facility from the Long Beach Freeway to Puente Avenue and a six-lane facility from Puente Avenue to the San Bernardino county line.

Pomona Freeway

This freeway, consisting of Legislative Route 172 and a portion of Legislative Route 19, traverses the unincorporated territory of the County of Los Angeles and the incorporated Cities of Los Angeles, Monterey Park, Montebello, City of Industry, and Pomona. The limits, as defined by the California Highway Commission on November 16, 1955, are from the junction of the Santa Ana Freeway to the junction of Sign Route 7 (Corona Freeway).

The California Highway Commission on November 20, 1958, adopted the portion of the Pomona Freeway easterly to Woods Avenue from the junction of the Santa Ana Freeway near the proposed interchange with the Golden State Freeway and Santa Monica Freeway in the Boyle Heights district of Los Angeles. The previously adopted portion of this freeway extends from Potrero Grande Drive to Ninth Street in Pomona by actions of the California Highway Commission on April 21, 1954; April 20, 1955; and June 21, 1955.

Preliminary design has been completed on the easterly portion of the Route 172 section, and freeway agreements have been submitted to the County of Los Angeles and City of Industry for execution. Completion of the preliminary design has made it possible to review plans of local agencies and developers to insure that the freeway route is protected from improvements and that development with the surrounding properties is compatible.

The alignment will provide a minimum of 60-mile-per-hour design speed with maximum gradients of 3 percent. The typical section provides for initial construction of eight lanes between the Santa Ana and San Gabriel River Freeways, with the easterly portion based on initial six-, ultimate eight-lane construction. Major interchanges with four additional freeways are required for this route. They are the Long Beach Freeway at which a four-level interchange is being considered, the San Gabriel River Freeway, the Route 19 Freeway, and the Corona Freeway.

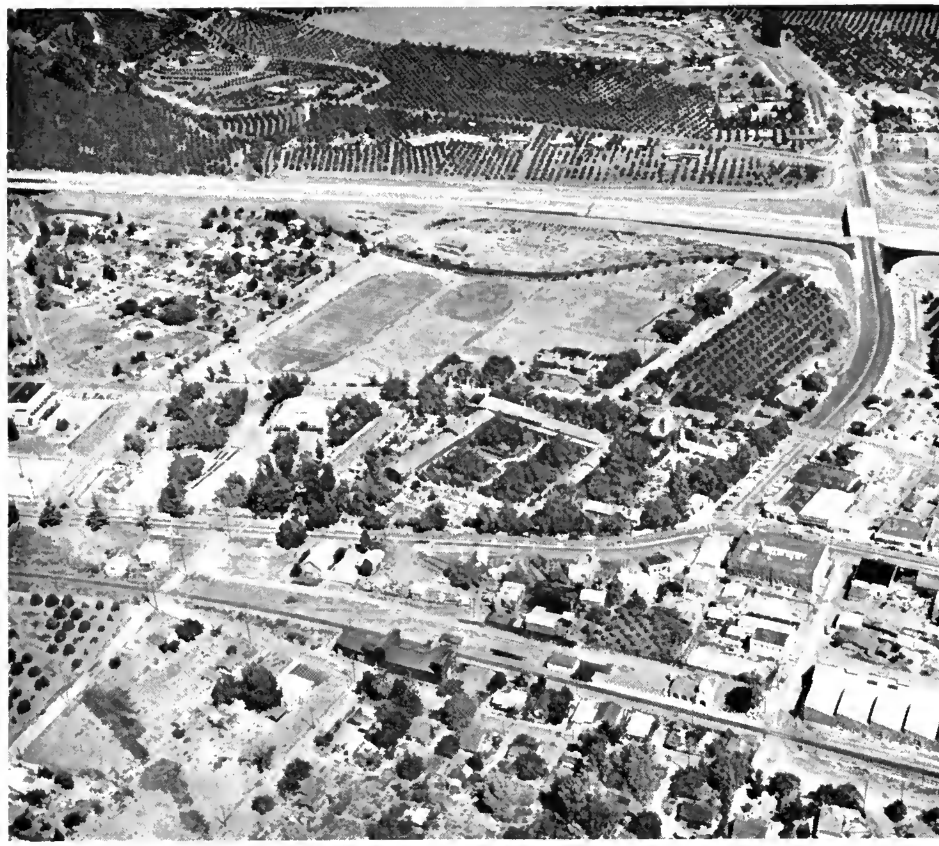
Separations or interchange facilities will be provided at most of the city and county master plan highways.

Corona Freeway

A 3.2-mile section of the Corona Freeway (formerly known as the Temescal Freeway) was completed to four-lane expressway standards in June, 1958, between Fifth Street in the City of Pomona southeasterly into San Bernardino County to a point one mile south of Riverside Drive.

Construction of a pedestrian overcrossing at Grier Street in the city of Pomona is presently under way financed in the 1958-59 Fiscal Year at a cost of $53,000. This structure has just been completed.

Plan work has been started for the conversion of the Corona Freeway to



UPPER—An aerial view eastward showing the Ortega Highway interchange crossing over the San Diego Freeway (right). The buildings in the middle ground are the San Juan Capistrano Mission. LOWER—Construction is now under way on the Ventura Freeway-Hollywood Freeway interchange. This view southward shows the northern end of the Hollywood Freeway.

full freeway standards from the San Bernardino Freeway to the San Bernardino county line, a length of 4.6 miles.

Construction of bridges at Holt Avenue, Valley Boulevard, Bellevue Avenue, and Fifth Avenue are involved. Widening of the bridges over the Southern Pacific Railroad and the Union Pacific Railroad will also be required. Interchanges with Holt Avenue, Valley Boulevard, and Fifth Avenue are proposed. The construction cost of converting this section of the Corona Freeway to a full freeway is estimated at $2,500,000.

Santa Paula Freeway

Preliminary plans for the 14-mile length of the Santa Paula Freeway in Ventura County from US 101 to the east city limits of Santa Paula are well advanced. Freeway agreements have been executed with Ventura County and the City of Santa Paula. Interchange designs have been prepared and right-of-way acquisition is in the early stage over the entire length.

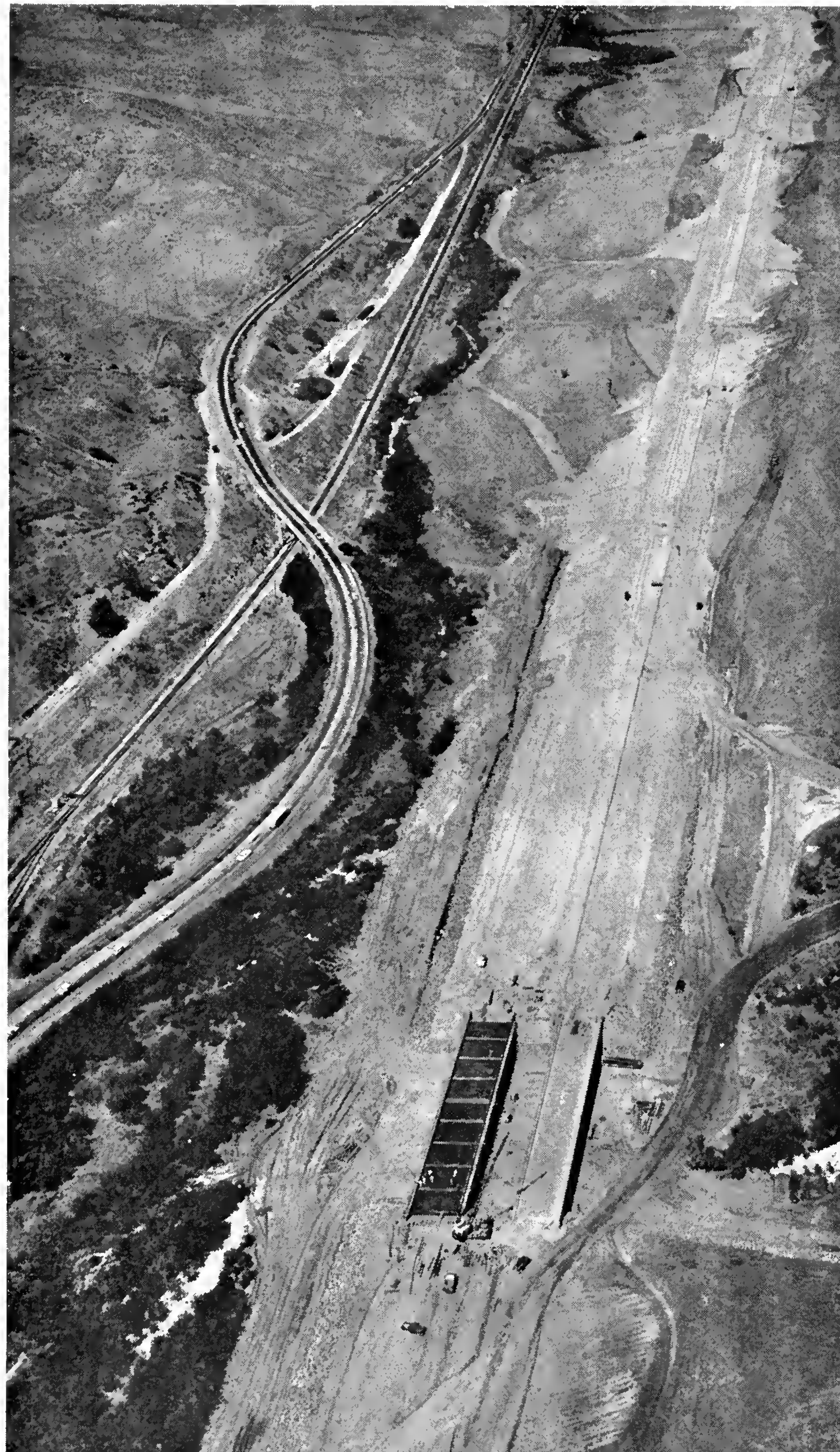
The proposed alignment is located approximately one-half mile south of existing Sign Route 126 (Telegraph Road). The terrain in general is relatively flat and grades are easy, the maximum grade being 3 percent.

Ojai Freeway

A section of the Ojai Freeway in Ventura County between existing US 101 in the City of Ventura and a point 0.4 mile south of Mill School was completed to four-lane freeway standards in 1956. Studies are well along for improving the section between 0.1 mile south of the Southern Pacific Railroad and Foster Park to four-lane freeway on right-of-way for an ultimate six lanes.

Long Beach Freeway (North)

Construction on a 3.6-mile section of the Long Beach Freeway will be started early in 1959) (bid opening February 5th). This six-lane freeway will extend from the present completed northerly terminus at the Santa Ana Freeway northerly to the San Bernardino Freeway and also involve construction of a flood control channel financed by the Los Angeles County Flood Control District and sanitary sewers financed by the City of Monterey Park. Rights-of-way have been acquired for construction of an ultimate eight-lane freeway with



Looking north along the San Diego Freeway under construction in Orange County between San Mateo Creek and Niguel Road. The Oso Creek bridges are in the foreground. The present highway and Galivan grade separation over the Santa Fe Railroad are on the left.

the additional lane to be constructed in the median when warranted by increased traffic.

The estimated construction cost for this section of the Long Beach Freeway totals $7,750,000, of which $6,482,000 is financed by the State and the remainder by the Los Angeles County Flood Control District and the City of Monterey Park.

Plans are being prepared for the extension of the Long Beach Freeway northerly from the San Bernardino Freeway to Norwich Avenue, a distance of 1.4 miles. A six-lane freeway is proposed with sufficient rights-of-way for an ultimate eight-lane freeway. The estimated construction cost of this portion of the Long Beach Freeway is $3,500,000.

San Gabriel River Freeway

Preliminary plans are being prepared for approximately 20 miles of the San Gabriel River Freeway, a part of the Interstate System, from the Orange county line to the San Bernardino Freeway, and approximately two miles from the Orange county line southerly to Garden Grove Boulevard. Interchanges will be provided with the San Diego, Garden Grove, Artesia, Pomona and San Bernardino Freeways and with major county roads and city streets.

Freeway agreements have been executed by the City of Norwalk, the City of Santa Fe Springs, the City of Baldwin Park, and the City of Long Beach, and it is anticipated that freeway agreements will be executed by the County of Los Angeles, the City of Dairy Valley, the City of Downey, and the City of Industry in the near future.

DISTRICT RIGHT-OF-WAY DEPARTMENT

By H. W. LEONARD
Metropolitan District Right-of-Way Agent

The right-of-way staff in District VII consists of 132 right-of-way agents, 159 engineering classifications and 178 clerical, a total of 469 persons. In charge of this group is a metropolitan district right-of-way agent assisted by four supervising right-of-way agents, Mr. E. P. Jones, Right-of-way Engineering; Mr. R. A. Swanson, Appraisals; Mr. K. M. Trenholm, Acquisition, and Mr. J. W. Greathead, Administration.

The Right-of-way Engineering section prepares all maps for appraisal reports, condemnation complaints, relinquishments or abandonments or superseded highways, and prepares all legal descriptions for the conveyance of property by deed or condemnation. The Right-of-way Engineering Section also maintains complete map records of the rights-of-way of all highways within the district. The appraisal section makes preliminary estimates of right-of-way costs for all contemplated projects and later prepares a detailed appraisal report on each parcel of property to be acquired. The acquisition section negotiates the purchase of all properties needed for highway or public works use.

The Supervising Right-of-way Agent, Administration, in addition to being assistant to the Metropolitan District Right-of-way Agent supervises the removal and relocation of utilities in the highway rights-of-way; relocation of buildings and other improvements; the sale of buildings to be removed from rights-of-way, or contracting their demolition when necessary; the securing of title reports and escrow service for processing payments; the rental of properties in the interim between acquisition and removal of the improvement for construction; the sale of remainders of land outside the right-of-way, and general supervision of the clerical personnel. Under his supervision a current record is kept of the status of acquisition of each parcel to be acquired for each construction project together with the maintenance of a record of program expenditures, and preparation of the yearly right-of-way budget; also vouchering for reimbursement for right-of-way acquisition for Federal Interstate Highways.

The Right-of-way Department comes into the freeway picture very early in the program. In connection with the studies of alternate lines for a proposed freeway the Advance Planning Section forwards maps of the lines being studied to the Right-ofway Appraisal Section for the preparation of cost estimates of right-of-way on each of the proposed routes including the costs of moving and relocating utilities and demolition of buildings obtained from the Utilities and Right-of-way Clearance Section. After the necessary public hearings have been held and the route adopted by the Highway Commission, the estimated costs of right-of-way, including utilities and demolition, are forwarded to the Right-of-way Administration Section for inclusion in the proposed budget for the following fiscal year. Funds for the project may be programed over several years, depending on the extent of the project. The proposed right-of-way program is forwarded to the district program and budget section for incorparation in the planning and next fiscal year programs.

Usually funds are first provided in the budget for the purchase of title reports and the making of appraisals. Following the inclusion of this item in the budget the design engineers transmit a preliminary map showing the proposed alignment to the Right-of-way Department. The Right-of-way Engineering Section prepares a map showing the properties affected compiled from the records of the county assessor. Parcel numbers are assigned to these ownerships and prints of this map showing the ownerships outlined in various colors are forwarded to the Right-of-way Title Section for ordering preliminary title reports from the title companies. Copies of these title reports are forwarded to the Right-of-way Engineering Section as received.

As the design of the project proceeds the design engineers forward maps to the Right-of-way Department showing the right-of-way necessary for construction of the highway project. The Right-of-way Engineering Section prepares maps showing the parcels to be acquired and forwards these maps together with copies of the title reports to the Appraisal Section and at the same time proceeds with the writing of the deeds. Upon completion of appraisal reports they are forwarded to the Metropolitan District Right-of-way Agent and to the Assistant State Highway Engineer in charge of the district for approval and forwarding to Headquarters Office for review and approval by the assistant chief right-of-way agent — Appraisals. Upon receipt of the approved appraisal report from Headquarters Office it is immediately transmitted to the Acquisition Section and in turn to one of the senior nogotiating right-of-way agents in accordance with their assigned negotiating areas.

The senior negotiating agent in turn makes a field review of both the properties to be acquired and comparable properties contained in the report with the right-of-way agent who made the appraisal and the right-of-way agent whom the senior assigns to these particular negotiations.

Following the negotiation and the purchase of a property by the right-of-way agent, the right-of-way contract defining the terms of the transaction, the deed and the auxiliary documents are transmitted by memorandum to the senior negotiating agent for his review and recommended approval and forwarded to the supervising right-of-way agent — Acquisitions, for recommended approval. The transaction is then forwarded to the Administration Section for entry in the acquisition record and forwarded to the Assistant State Highway Engineer for his recommended approval and transmittal to Headquarters Office for final approval. Following receipt by the district of an approved copy of the right-of-way contract from Headquarters Office, three copies are executed by the Assistant District Engineer—Administration and an executed copy is forwarded to the property owner. A copy of the approved and executed right-of-way contract goes to the Right-of-way Accounting Section, then to the Title and Escrow Section for scheduling which initiates payment procedures by the State Controller, and setting up the escrow with the title company. At the same time the Escrow Section forwards a notice of improved properties for rent to the property management section. If the acquisition is a partial taking of the property and the right-of-way contract provides for work to be done by the State a notice of the work to be done is forwarded to the Utilities and Right-of-way Clearance Section for preparation of plans and specifications and advertising for bids and awarding the contract.

In the event the State is unable to acquire the property by negotiation, which occurs only in a small number of cases, the senior negotiating agent so advises the supervising right-of-way agent—acquisition, and right-of-way engineering is advised to prepare a request to the State Highway Commission to pass a resolution authorizing condemnation of the subject property. Upon receipt of a copy of the Highway Commission's resolution authorizing condemnation, descriptions and maps are prepared and forwarded to the condemnation attorneys for preparation of the condemnation complaint and summons. Following the filing of the condemnation action and service of the summons on the property owner, appraisers, non-staff, are engaged to appraise the property for condemnation and serve as expert witnesses.

George C. Hadley, Assistant Chief Counsel, maintains offices at 3540 Wilshire Boulevard in the Tishman Building, with a staff of 27 attorneys who handle all the right-of-way condemnation cases for Districts VII, VIII and XI. A branch office is maintained in San Diego. By far the greater portion of their efforts are spent in acquiring rights-of-way needed for District VII freeways by eminent domain proceedings. Hadley reports direct to Robert E. Reed, Chief Counsel and head of the State Division of Contracts and Rights-of-way in Sacramento.

More and more, as recruitment and training of personnel permits, staff appraisers are used as expert witnesses in the condemnation actions. It is sometimes necessary to secure a court order of immediate possession to permit awarding the construction contract. Advertising for construction is permitted when a resolution has been passed by the Highway Commission authorizing the condemnation of any unacquired parcels. Award of the contract can be made when a court order for immediate possession has been secured on the unacquired parcels.

During the interim between the acquisition of the rights-of-way and the time the properties must be cleared of improvements for construction, the properties acquired are rented in order to recover as much of the acquisition cost as possible and to prevent vandalism until such time as the improvements are to be disposed of.

When the time approaches that the necessary rights-of-way must be cleared for construction, the buildings to be removed are sold at public auction on the site.

The current fiscal year right-of-way budget for this District VII is 75 million dollars. Additional funds in the amount of approximately 2½ million dollars have been budgeted for advance acquisition of properties, the acquisition of which has not yet been budgeted in the regular right-of-way program but on which the owners contemplate immediate development; if these properties were not acquired, the cost of the right-of-way to the State would be greatly increased. Also the Right-of-way Department will acquire additional properties valued at approximately four million dollars for the State Public Works Board. It is anticipated that this fiscal year the District Right-of-way Department will acquire approximately 3,500 parcels of property. Incidentally, only about 4 percent of the total parcels acquired last fiscal year were by condemnation action including those by stipulated judgment. Last fiscal year the property management section collected more than 2½ million dollars in rents from properties between the time of their acquisition and when the improvements had to be removed to clear the rights-of-way. The building and excess land sales section last year collected nearly three million dollars from the sale of buildings to be removed from rights-of-way and from the sale of remaining lands in excess of the right-of-way.

The 5½ million dollars received from rents and sales is a byproduct of the Right-of-way Department's main activity, that of getting rights-of-way cleared so that freeway projects can go forward to construction.

BRIDGE DEPARTMENT, SOUTHERN AREA

By J. E. McMAHON
Bridge Engineer

Every week, on the average, a major structure is completed in District VII.

The Bridge Department of the State Division of Highways is geared to keep pace with this extensive bridge-building program occasioned by freeway development. The functions of the Los Angeles office are divided into six sections: Advance Planning, Preliminary Investigations, Foundations, Construction, Maintenance, and Special Studies.

In the early stages of highway planning, the Bridge Advance Planning Section works closely with the district to the end that the influence of structures on road location may be given proper consideration.

After the location of the highway has been established, complete information regarding each structure site is assembled. This information is used in proportioning the structure and in arriving at the most economical and efficient type of bridge. The assembling of this information is the work of the Preliminary Investigations Section.

At the same time the Foundations Section investigates subsurface conditions at each bridge site in order that the structures may be supported on foundations that are adequate and economical.

All preliminary information is compiled in report form and forwarded to the Sacramento office of the Bridge Department, where all bridge design work is performed.

Following the award of a construction contract in District VII, the Construction Section of the Los Angeles office of the Bridge Department is responsible for the structural phases of the contract work. The Bridge Department Construction Section maintains close liaison with the district construction.

It is the responsibility of the Bridge Maintenance Section to see that completed bridges on the State Highway System are kept in a safe and serviceable condition. Each of the 1,300 state bridges in District VII is inspected annually by members of the Bridge Maintenance Section.

The Special Studies Section of the Bridge Department makes investigations and prepares reports on structural matters of a special nature, such as proposed tubes and toll bridges.

Since the beginning of the freeway program, an increasing percentage of grade separation structures has been built, as compared with stream crossings. At present, about 75 percent of the structures consists of grade separations on the freeway system.

The complexity of freeway bridge design has increased with the improvement in freeway standards. Examples: the four-level structure in Los Angeles and the 30 structures required to provide for the proposed interchange between the Santa Ana, Golden State and Santa Monica Freeways.

The largest single structure for District VII is the Santa Monica Freeway Viaduct in the City of Los Angeles which will connect the Santa Ana Freeway and Harbor Freeway. This viaduct, portions of which are now under construction, is over three miles in length and has a total estimated cost in excess of $30,000,000.

This view to the northeast along the Ventura Freeway shows the interchange with the San Diego Freeway.

DISTRICT VII CONSTRUCTION DEPARTMENT

By F. B. CRESSY
Assistant District Engineer

The singular and combined efforts of the many district departments about which you have been reading eventually culminate in an end product whereby the Construction Department begins to play its parr in the fulfillment of the district's ever-expanding freeway program. This major objective is completed plans for a project that is ready to be advertised for bids, which soon will become a construction contract. It is at this stage that the Construction Department really begins to make its presence felt in its annual handling of over 50 million dollars worth of freeway contracts. Here the assistant district engineer in charge of the department begins his plans for assignment of engineers to the contract, sets up the administrative program for the project, and arranges for showing the job to prospective bidders.

Actually the construction story begins somewhat earlier in the stage development of a freeway project. In a continuing attempt to improve design plans and specifications as they relate to construction, the Construction Department reviews plans, preliminary reports, and dummy specifications as these features are completed, to insure that latest construction techniques and methods can be utilized in the proposed design and/or specifications. Serving in this capacity is one of the six district construction engineers whose many duties also consist of maintaining continued liaison and coordination with all district departments so that the problems which continually arise as planning and design progress, can be worked out in time so that oversights are reduced to a minimum before the job is let to contract.

Of the six district construction engineers, two are assigned to the construction office, one being in charge of administration, with the other duties as just described. The other four construction engineers are detailed to the field, of whom two are assigned territories to supervise—each territory comprising about half the district. The remaining two construction engineers are assigned as senior resident engineers to the larger district freeway contracts.

Assisting the district construction engineer assigned to the office are six engineers who handle various administrative functions, including handling and preparing progress and final estimates and the final report upon completion of the contract. A secretarial and clerical staff of about 12 people round out the office.

Assisting the district construction engineers in the field are approximately 35 resident engineers and 170 assistant engineers and engineering aids, who perform the inspection, engineering, and administrative duties on the respective contracts.

The year of 1958 was significant in seeing completion of the Long Beach and Santa Ana Freeways to full freeway standards, although widening work in certain locations is still under way on the Santa Ana Freeway. A total of 18 major freeway contracts was completed and opened to traffic in 1958 as compared to seven contracts in 1957. These sections, including a major widening contract on the Santa Ana Freeway, are as follows:

	Miles	*Cost*
SANTA ANA FREEWAY		
Coyote Creek to Ball Road—Orange County	6.5	$6,060,000
Laguna Canyon Road to Browning Avenue—Orange County	5.7	3,380,000
Niguel Road to Laguna Canyon Road, plus 1.2 mile on Laguna Freeway—Orange County	4.2	2,220,000
10th Street to La Palma Avenue—Orange County	1.7	2,050,000
Widening—Lakewood Boulevard to Bloomfield Avenue—Los Angeles County	----	870,000
LONG BEACH FREEWAY		
Imperial Highway to Dozier Street in East Los Angeles	3.8	4,080,000
Rosecrans to Imperial Highway in East Los Angeles	1.9	2,290,000
Atlantic Avenue to Rosecrans	1.2	1,400,000
SAN DIEGO AND VENTURA FREEWAY		
Sepulveda Boulevard to Encino in San Fernando Valley	3.5	7,110,000
GOLDEN STATE FREEWAY		
Glendale Boulevard to Los Angeles River in Los Angeles City	3.2	5,130,000
HOLLYWOOD FREEWAY		
Lankershim Boulevard to Moorpark Avenue in San Fernando Valley	1.6	2,110,000
VENTURA FREEWAY		
Kelvin Avenue to Calabasas in West San Fernando Valley	4.0	3,480,000
Conejo Grade Summit to Fifth Street—Ventura County	5.0	3,990,000
HARBOR FREEWAY		
124th Street to 88th Place in South Los Angeles City	2.6	5,710,000
SAN DIEGO FREEWAY		
San Mateo Creek to Avenida Cadiz in San Clemente	2.3	2,570,000
Sign Route 74 to Trabuco Creek—Orange County	4.1	4,230,000
RIVERSIDE FREEWAY		
Santa Ana Freeway to Route 2 Spadra Road in Orange County	3.6	3,310,000
CORONA FREEWAY		
Fifth Avenue to Riverside Drive near Pomona	3.6	700,000
GLENDALE FREEWAY		
Los Angeles River to Eagle Rock Boulevard	1.0	2,830,000
Total	59.5	$63,520,000

As the above contracts were being completed during last year, new freeways were advertised and awarded, so that there was no slack in the construction program. Although slightly fewer in number than those awarded in 1957, the dollar volume is still large due to five contracts topping the five-million-dollar mark.

Representative of this group is the 4.8-mile contract on the Ventura Freeway between Laurel Canyon Boulevard and Sepulveda Boulevard, which involves an estimated cost of $8,900,000.

On page 41 are the freeway contracts that were awarded during 1958 in the chronological order of bid openings:

The two contracts on the Ventura Freeway shown in the list, which are now under way, will close the last two remaining gaps on this important system, and the completion of these sections will provide a continuous freeway and expressway between the cities of Los Angeles and Ventura, a distance of some 65 miles.

Upon the award and subsequent approval of a district freeway contract such as those listed on page 41, the Construction Department phase begins in earnest. The resident engineer and several assistants will move onto the project, locate the field office, and attend to the myriad duties preliminary to construction. In order to gain maximum advantage of his time, the contractor will usually move quickly onto the project and begin actual work. The resident engineer will thus find little time to get established before he finds himself completely engulfed in a seemingly endless series of meetings, discussions, and conferences with not only the contractor, but also five or six utility companies, public agencies, usually a railroad agency, the public and several district departments who are interested in start-of-job problems.

	Miles	Estimated Cost	Estimated Completion Date
SANTA MONICA FREEWAY From Oak Street to Figueroa Street in City of Los Angeles	0.3	$1,600,000	Sept. 1959
GOLDEN STATE FREEWAY From Sixth Street to Mission Road in City of Los Angeles, and improvement of San Bernardino Freeway	1.7	7,600,000	Jan. 1960
SAN DIEGO FREEWAY From 0.4 mile south of Trabuco Creek to 0.3 mile north of Niguel Road in Orange County	7.9	4,100,000	July 1959
SANTA MONICA FREEWAY Overpasses across Union Pacific and Santa Fe Railroad near Los Angeles River in City of Los Angeles	0.5	3,400,000	Dec. 1959
GOLDEN STATE FREEWAY From Mission Road to Pasadena Avenue in City of Los Angeles	1.2	3,000,000	Dec. 1959
SANTA ANA FREEWAY Widening existing freeway from four to six lanes from Rosecrans Avenue to Coyote Creek in Los Angeles County	-----	1,800,000	May 1959
VENTURA FREEWAY From Laurel Canyon Boulevard to Sepulveda Boulevard in San Fernando Valley—City of Los Angeles	4.8	8,900,000	Feb. 1960
GARDEN GROVE FREEWAY From 0.1 mile west of Los Cerritos Channel to Knott Avenue in Orange County	5.5	1,700,000	Nov. 1959
RIVERSIDE FREEWAY From 0.4 mile west of Route 2 to 0.1 mile east of Placentia Avenue in cities of Anaheim and Fullerton	2.7	2,600,000	Dec. 1959
VENTURA FREEWAY From 0.3 mile east of Encino Avenue to Kelvin Avenue in San Fernando Valley—City of Los Angeles	3.9	5,600,000	Feb. 1960
HARBOR FREEWAY From 190th Street to 124th Street in South Los Angeles City	4.9	8,100,000	Aug. 1960
SAN DIEGO FREEWAY From Jefferson Boulevard to Venice Boulevard in and near Culver City and West Los Angeles City	2.3	5,300,000	May 1960
TOTALS	35.7	$53,700,000	

By the time these meetings level off, the job has gathered a full head of steam and the resident engineer finds himself requiring additional assistants, a full-time materials man, a survey party, and the field representatives furnished by the Bridge Department who will handle all major structure work on the project.

On freeway contracts it has been found necessary to assign an experienced engineer as a principal assistant to the resident engineer with a primary duty of keeping abreast of the over-all problems in the contracting and assisting in assigning personnel to the individual items of work. The necessity for this is obvious when it is realized that freeway contracts are now running into millions of dollars and the resident engineer cannot handle all problems efficiently if he is also burdened by too many details.

As the job progresses the resident engineer's responsibilities resolve themselves into settling policy matters on construction features with the contractor, keeping track of job progress, determining the need for change orders and the preparation of change orders for approval by the State Highway Engineer, and getting out the monthly progress estimate for the contractor's progress payment, to mention but a few.

The inspection of work and accurate accounting of contract quantities in permanent field records is handled by the assistants and is a full-time duty. As the contract nears completion, the key item for the resident engineer to handle is the writing of the final report with its attendant "end of job." The end-product, the completed job, is then turned over to "maintenance."

FREEWAY MAINTENANCE

By W. D. SEDGWICK
Assistant District Engineer

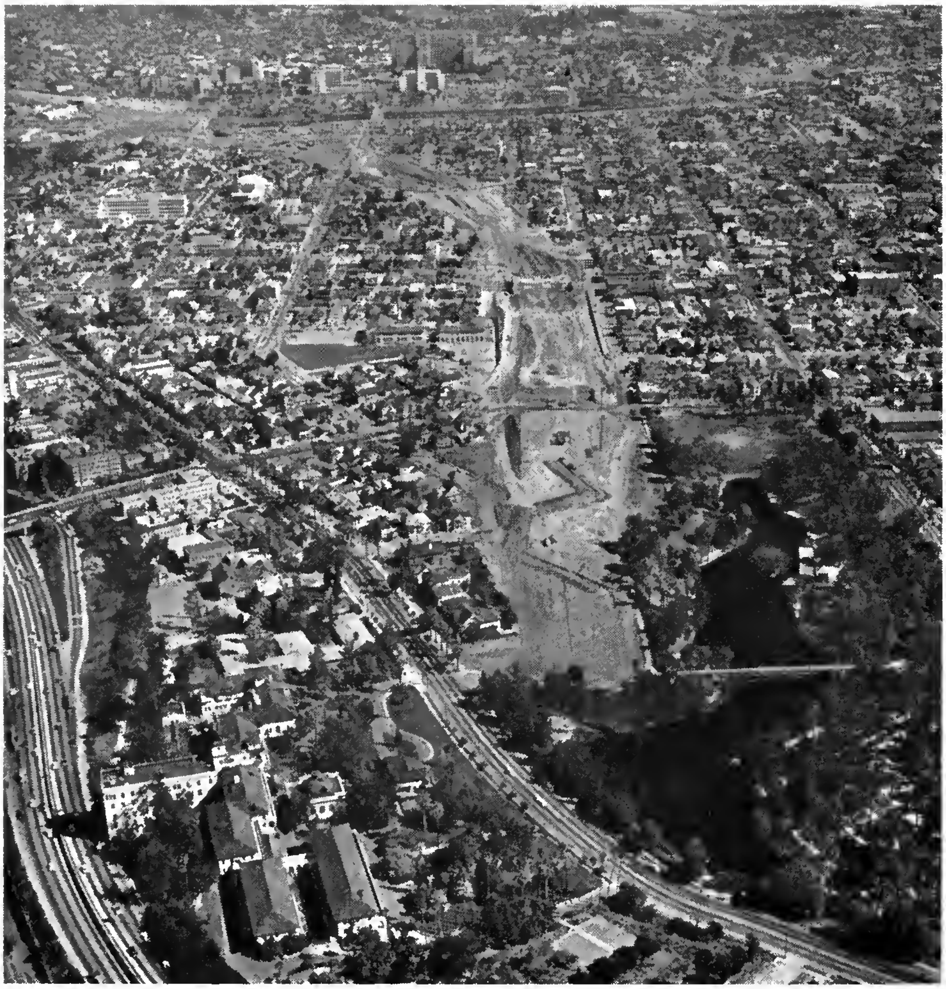
The maintenance of the freeways and highways in District VII during the 1957-58 Fiscal Year required a staff and field force of 449 state employees to accomplish work involving a total expenditure of $4,318,761. In addition, the State reimbursed the various cities maintaining state highways, other than freeways, in cities, for their cost in the amount of $719,487, and therefore the total of the program administered by the Maintenance Department was $5,038,248 for the last fiscal year.

The freeways are rapidly increasing the acreage of landscaped roadsides to be maintained as well as the added surface area due to long on- and off-ramps, and the multilane divided highways as compared to the conventional undivided highway.

The divided highways with curbed medians double the curbed miles of gutters to be swept as compared with the normal curbed streets or highways that they replace.

The traffic demand for all of the freeway lanes is so great that much of the maintenance required on freeways can only be done during early morning hours on Sundays, between daylight and church time. This includes traffic striping and patching.

The maintenance of the trees and landscaping is increasing to the extent that there will soon be as many field employees on this work as on maintaining the traveled way. In 1940 there were 15 field employees on trees and landscaping and 247 field employees on regular maintenance crews, with 10 employees on the sign and striping



Construction on the Golden State Freeway is under way in the Boyle Heights area of East Los Angeles. Hollenbeck Park is in the right foreground; Los Angeles County General Hospital in the background.

In studying the maintenance expenditures by various categories, it is interesting to note that the approximate annual maintenance cost per mile of about 140 miles of completed freeways was $9,950, while the cost of maintaining 31 miles of fully landscaped freeways was $21,200 per mile. Although the freeways are only 9.52 percent of the state highways in District VII, the cost of their maintenance was 27.36 percent of the total. Also in the same approach, although the metropolitan fully landscaped freeways checked on are only 2.13 percent of the district mileage, the maintenance cost was 13.06 percent of the total.

There were 122 miles of expressways which averaged nearly $4,000 per mile to maintain, which totaled 8.37 percent of the mileage and 9.64 percent of the total cost. Combining the freeways and expressways to obtain the divided highway averages, there is a total of 262 miles, with

crew. At the end of the fiscal year on June 30, 1958, there were 112 field employees on trees and landscaping, and 258 on regular maintenance, with 38 more on signals and safety lighting and also 37 on signs and striping. It is anticipated that about 150 men will be on trees and landscaping at the end of this fiscal year and 230 men at the end of the next fiscal year.

Emergency items are those which the public recognizes as major Maintenance Department responsibilities. The removal of snow and sanding of icy pavements on the Ridge Route as well as on the Angeles Crest Highway are major operations during and after storms, in order to keep the highways open to traffic. This also applies to removal of earth and rock slides on the mountain and coast highways.

The problem of replacing miscellaneous safety devices knocked down by vehicles has increased appreciably in the last few years. The annual cost has gone up from about $40,000 per year in 1952 to nearly $160,000 per year.

Besides the maintenance fund items, day labor forces are called upon to organize and take the huge annual traffic count which requires 2,275 additional temporary employees for the two-day count each July. Also accomplished are minor improvement jobs which are either of an emergency nature or do not lend themselves well to contract. Maintenance forces provide services for other governmental agencies not organized to accomplish them efficiently, in the total amount of $30,000 per year. Field forces are also called upon to inspect encroachment permits, involving a similar expenditure.

A view eastward along the Riverside Freeway in Orange County. The interchange in the foreground is with Brookhurst Avenue.

an average maintenance cost of $7,150 per mile, which is 17.89 percent of the miles with 37 percent of the total cost. This leaves 1,196 miles of undivided highway at an average cost of $2,653 per mile, which is 82.11 percent of the mileages and 63 percent of the total cost. Maintenance expenditures in District VII totaled $5,038,248 for 1,456.81 miles of state highways.

ADMINISTRATION

By A. D. GRIFFIN
Assistant District Engineer

Administration, which now includes 165 employees, is perhaps the one department not working in some way directly on freeways. We are unable to point to any specific thing about freeways and say, "This we did." Administration is strictly a service organization to facilitate the work of other District VII departments, to help engineering units of other governmental agencies (cities and counties) carry out their projects, and to provide essential information to the public. Its work is carried out through the District Personnel Department, the District City and County Co-operative Projects Department, the District Chief Clerk and the District Office Engineer.

As a part of Administration, the District Personnel Department computes the time worked, vacation and sick leave allowances, and prepares the payrolls for over 2,300 employees. Personnel keeps the inservice training program in active operation and makes the necessary arrangements for rotation of employees to broaden their experience and to increase the value of their services to the State. Personnel also carries out a comprehensive recruitment service.

Another important unit of Administration is the District Accounting Department. It is a function of this department to see that all freeway and other state highway expenditures in the district, which for 1958 will approximate $120,000,000, are detailed and properly charged to the various individual jobs. This work involves the preparation of hundreds of service agreements covering utilities, equipment rentals and minor contracts, the preparation of thousands of requisitions and purchase orders to supply the various needs of the entire organization, the preparation of schedules to process documents in payment of these services and purchases, the preparation of the salary and equipment cost detail of the entire staff organization. It also involves the record keeping of some 30,000 to 40,000 items of miscellaneous equipment, thousands of buildings, plants and lands inventory records, and property survey reports to write off obsolete, damaged and lost equipment. Also, the supervision of the work of eight field offices, the audit of daily extra work reports on contract, and the checking of contract final reports.

The State Division of Highways, in the course of its business, finds it necessary to accomplish work for other agencies which is closely related to its own work and this involves the receipt of from two to six million dollars a year of money paid by these other agencies. Agreements for such work must be closely scrutinized and procedures set up to see that proper follow-through is performed. There are other "accounts receivable" involving large amounts of money for the rental of state property, the sale of excess land and improvements thereon, and reimbursement for claims for damage to state property in highway accidents.

The District City and County Cooperative Projects Unit reviewed plans and administered the spending of $15,000,000 during the past year for co-operative projects on major city streets and on county roads. Some of these construction projects were necessitated by reason of changed conditions due to freeway development, and others were to improve traffic conditions on roads and streets that in many cases may be regarded as feeders to the state freeway system.

The District Office Engineer's staff opens the bids not only for all District VII contracts but also for the major construction contracts of Districts VIII and XI. During the past 12-month period, 711 bids were opened with a total value in excess of $80,000,000. In the case of 24 demolition bids that were opened during this period, contractors paid the State a total of $5,231 for salvage.

The District Reproduction Section is now doing $25,000 to $30,000 worth of business per month. During the month of October, 1958, a record was set when it was found that reproduction of maps and plans by Ozalid, Vandyke, and blueprinting processes if spread out would cover over six acres, and sheets reproduced by multilithing if placed end to end would extend seven miles.

The District Highway Information Section, consisting of a staff of seven, carries on an active program in dealing with the information-seeking public. During the past 12 months the District VII Highway Information Office has answered 8,246 personal and 16,811 telephone inquiries, or a total of 25,057 inquiries regarding highways and particularly freeways.

Speaking engagements under the general heading of "Activities of the State Division of Highways in District VII" at luncheons and evening meetings, before official and professional groups and service clubs numbered 108 for the year. In all, since 1950, when this phase of disseminating highway information was first introduced, more than 800 speeches on highway and freeway subjects have been given.

Besides inservice audiovisual training programs, the Highway Information staff have been directly concerned in innumerable freeway opening ceremonies, press conferences and interviews with people on the staffs of television and radio stations, newspapers and magazines. The Highway Information staff have also handled the drafting of many local press releases, articles (both for *California Highways and Public Works* magazine and for private publications), and official letters in response to public inquiries. Another important activity is the conducting of freeway tours for visiting engineers from such places as Abyssinia, Trinidad, Japan, India, Lebanon and South America.

The prospect for the current year, 1959, is one of broader and more accelerated activity on the part of the District VII staff. The keen interest of the public in freeway development as the Greater Los Angeles Freeway

STATUS OF DISTRICT VII PROJECTS—JANUARY 1, 1959

Freeway name	Total miles	Completed projects		Under construction		Right-of-way costs	Total obligated costs to date
		Miles	Construction costs	Miles	Estimated construction cost		
Pasadena Freeway 4-Level Structure to Glenarm St. in Pasadena	8.2	8.2	$10,821,000	......	....	$1,009,000	$11,830,000
Hollywood Freeway Spring St. via Cahuenga Pass to Junction on Golden State Freeway near Wentworth St.	17.2	10.5	33,814,000	0.4	$703,000	33,680,000	68,197,000
*Santa Ana Freeway Junction of San Diego Freeway near El Toro to Spring St. in Los Angeles	42.6	42.6	60,605,000	......	1,818,000	19,551,000	81,974,000
*San Bernardino Freeway Santa Ana Freeway in Los Angeles to San Bernardino County Line in Claremont	30.6	30.6	36,635,000	......	220,000	18,089,000	54,944,000
Harbor Freeway Battery St. in San Pedro to 4-level Structure	22.2	13.1	35,112,000	4.5	8,089,000	52,067,000	95,268,000
Long Beach Freeway Pacific Coast Highway in Long Beach to Huntington Dr. in South Pasadena	21.5	16.8	28,182,000	......	....	23,261,000	51,443,000
*Golden State Freeway Santa Monica Freeway-Santa Ana Freeway Interchange to Kern County Line	70.3	51.2	26,683,000	3.8	16,309,000	62,657,000	105,649,000
Ventura Freeway Junction Golden State Freeway to Santa Barbara County Line	75.5	48.0	26,741,000	9.3	17,554,000	32,135,000	76,430,000
*San Diego Freeway San Diego County Line to Junction Golden State Freeway near San Fernando	88.9	11.5	17,045,000	12.7	16,569,000	50,398,000	84,012,000
Colorado Freeway Eagle Vista Dr. in Eagle Rock to Holly St. in Pasadena	2.3	2.3	6,394,000	......	....	2,296,000	8,690,000
*Foothill Freeway Junction Golden State Freeway to Foothill Place and Hampton Rd. to Montana St.	12.0	2.3	2,270,000	......	....	628,000	2,898,000
Glendale Freeway Ardmore Ave. to Vermont Ave. and Glendale Blvd. to Ave. 36	3.2	1.1	2,882,000	......	....	4,600,000	7,482,000
Artesia Freeway Normandie Ave. to Santa Fe Ave. and Palo Verde Ave. to Santa Ana Freeway	12.5	4.9	2,455,000	......	....	2,972,000	5,427,000
Riverside Freeway Junction Santa Ana Freeway to Riverside County Line	19.1	17.0	7,553,000	2.2	2,609,000	5,344,000	15,506,000
Ojai Freeway Junction Ventura Freeway in Ventura to 0.4 mile North of Foster Park	6.0	4.0	2,140,000	......	....	1,170,000	3,310,000
*Santa Monica Freeway Junction Pacific Coast Highway to Junction Santa Ana Freeway	14.9	......	477,000	0.3	5,010,000	44,114,000	49,601,000
Pacific Coast Freeway Junction San Diego Freeway to Serra Junction; Newport Freeway to 3000' Wly of Rte. 171; Los Angeles County Line to South C/L of Oxnard and North C/L of Oxnard to Junction of Ventura Freeway	24.3	7.2	2,519,000	......	....	2,347,000	4,866,000
Garden Grove Freeway Pacific Coast Highway to Junction Newport Freeway	17.9	......	....	......	1,473,000	3,741,000	5,214,000
Other Freeways Covered by Resolution of Adoption by Highway Commission	181.2	6.8	3,114,000	......	37,000	10,731,000	13,882,000
Totals	670.4	278.1	$305,442,000	33.2	$70,391,000	$370,790,000	$746,623,000

* Interstate Highways

System expands and as the intensified construction program, made possible by heavier allocations of state and federal funds, gets under way there is assurance of another busy year—a year given to the dissemination of essential freeway information to a steadily growing population of freeway-conscious citizens.

SPECIAL DRIVING-TIME STUDY

The Downtown Business Men's Association of Los Angeles has recently completed a study indicating that freeways have brought nearly all areas five miles closer to Downtown Los Angeles than they were for a 30-minute driving period in 1953. This fact is indicated by the map prepared by

. . . continued on page 64

California Highways . . . 1958

An Annual Report

By G. T. McCOY, State Highway Engineer

The report which appears on Pages 45 through 60 basically covers the 1957-58 Fiscal Year, but has been revised to include important developments extending to December 31, 1958. Copies of this report may be obtained upon request.

MOBILITY provided by millions of motor vehicles is a key feature of California living and a vital element in the State's spectacular record of continuing economic growth.

In a typical California household the automobile is an important factor in nearly every phase of family life from routine homemaking to the annual vacation.

For the State's widely diversified economy, motor transportation often provides the only practical link between fields, factories and markets.

As a result, California has more cars and trucks than any other state, about 7,650,000. This is more than one motor vehicle for every two of the State's 15,000,000 citizens.

In a society where motor transportation plays such an important role in everyday living, good highways are essential.

California citizens have long recognized this fact and through the years have given strong support to a broad and continuing program of state highway development.

On the basis of several comprehensive traffic and financing studies, the State Legislature has implemented pay-as-you-go highway development through realistic user taxes. At the same time it has delegated to the California Highway Commission the authority and responsibility to determine highway routings and to allocate construction funds, subject to certain geographical controls.

These legislative policies have insured continuity in long-range planning and fostered the steady and orderly progress which has characterized California's highway improvement program.

Symbolizing California's spectacular progress in highway development is the parallel Carquinez Bridge on US Highway 40 at Crockett (right) and its extensive freeway approaches which were opened in November, 1958. Construction began on the $46,000,000 toll project in late 1955.

The result has been a network of state highways widely recognized to be the best in the Nation.

The significant progress in recent years toward meeting the State's still mounting highway needs is continuing at a rapid pace with new improvements completed nearly every day.

The Division of Highways, a unit of the State Department of Public Works, is in charge of the planning, right-of-way acquisition, construction, operation and maintenance on state highways. The division's activities cover the entire range of highway work from large-scale freeway and bridge construction to small but essential maintenance chores.

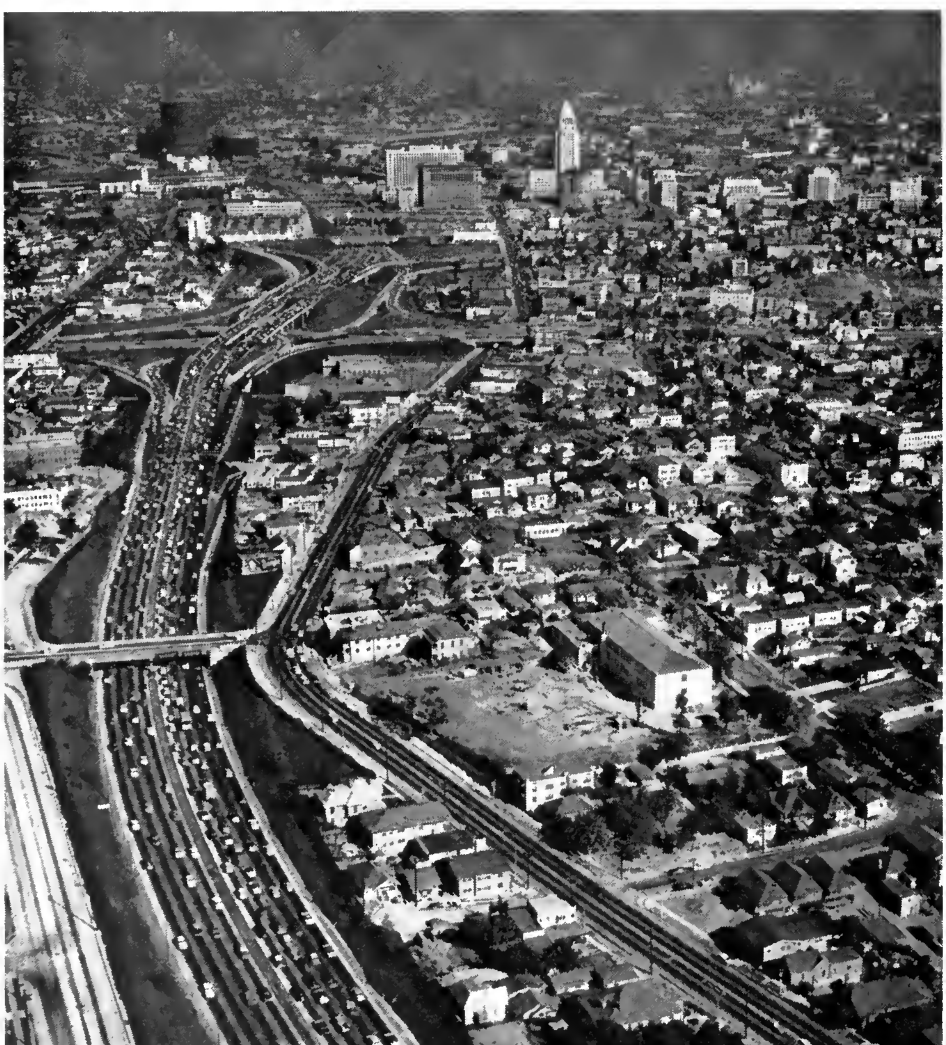
State highway development and operation for the fiscal year ending June 30, 1958, are reported in the Twelfth Annual Report to the Governor by the director of public works. This report contains sections on each phase of the highway program. It also includes detailed financial tabulations, contract statistics and other data. (Some of this information, together with other more recent data, is included here.)

Three significant developments, touching upon the major areas of planning, financing and construction, highlighted the past year:

1. A plan for a statewide freeway and expressway system was completed and presented to the Legislature's Joint Interim Committee on Highway Problems. The committee has now completed a series of public hearings on this "California Freeway System" in preparation for legislative recommendations.

2. Congress acted to provide for the apportionment of federal interstate highway funds on the basis of the relative needs of the various states instead of the old area-population-post road mileage formula. This resulted in a substantial increase in the apportionment to California.

3. Many important construction projects were completed or under construction to close freeway gaps on heavily traveled intercity and through routes and to provide new links in the basic freeway networks of major metropolitan areas. Largest of these completed projects was the parallel Carquinez Bridge and freeway approaches.



The most heavily traveled section of freeway in the State is this portion of the Hollywood Freeway near the Los Angeles Civic Center. Traffic conditions on this route and other central Los Angeles freeways will be improved by a series of current and budgeted projects on the Golden State and Santa Monica Freeways, which will provide a close-in bypass east of the downtown area. (Note absence of congestion on adjacent Temple Street, a major city thoroughfare.)

SCR 26 Report

The master plan for the California Freeway System is the first highway plan of its type ever attempted on a statewide basis without regard to city, county or state jurisdiction.

Studies leading to the plan were requested by the 1957 Legislature in Senate Concurrent Resolution No. 26.

The resolution called upon the Department of Public Works to undertake a study which would provide the basis for an overall plan of freeways and expressways. It specified that potential routes were not to be limited solely to state highways, but should also include city streets and county roads.

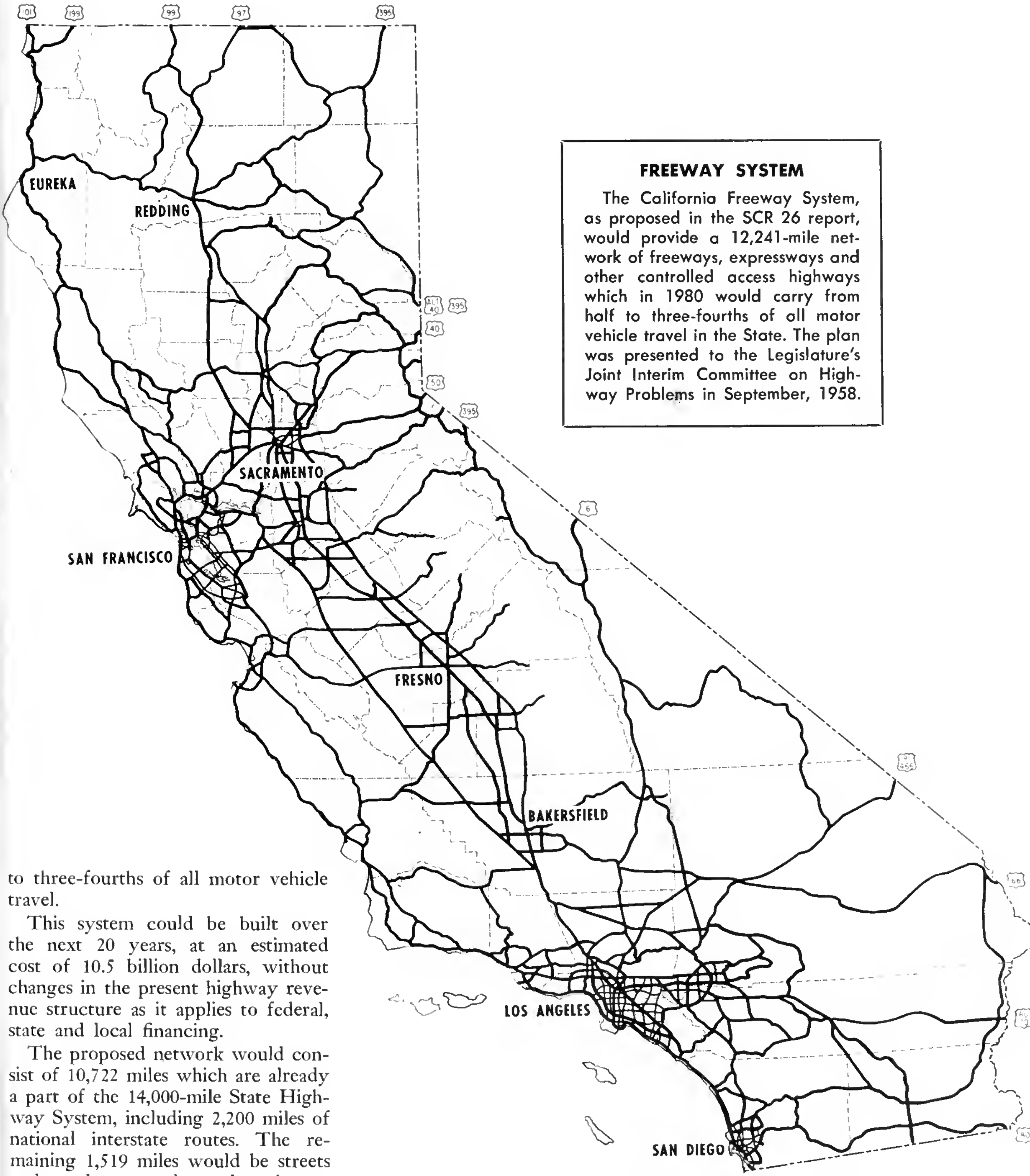
The 18 months of intensive work that went into the plan involved the most comprehensive analysis of motor vehicle traffic, population, and economic conditions ever undertaken in California for highway planning purposes.

In preparing the plan, the Division of Highways worked closely with a Legislature-appointed committee of city and county officials which acted in a technical advisory capacity. The Automotive Safety Foundation of Washington, D. C., and the Institute of Transportation and Traffic Engineering of the University of California also assisted.

County and city engineering staffs extended full co-operation. In a number of instances the division joined with counties and their incorporated cities in hiring engineering consultants to formulate regional highway master plans for use in connection with the statewide study.

A total of 23 separate meetings were held, involving 730 county representatives and officials from 280 cities.

The plan, as presented to the Legislature in September, 1958, in the SCR 26 report, proposes a 12,241-miles network of freeways, expressways and other controlled-access highways which in 1980 would serve every city of 5,000 or more in population and which would carry from half



FREEWAY SYSTEM

The California Freeway System, as proposed in the SCR 26 report, would provide a 12,241-mile network of freeways, expressways and other controlled access highways which in 1980 would carry from half to three-fourths of all motor vehicle travel in the State. The plan was presented to the Legislature's Joint Interim Committee on Highway Problems in September, 1958.

to three-fourths of all motor vehicle travel.

This system could be built over the next 20 years, at an estimated cost of 10.5 billion dollars, without changes in the present highway revenue structure as it applies to federal, state and local financing.

The proposed network would consist of 10,722 miles which are already a part of the 14,000-mile State Highway System, including 2,200 miles of national interstate routes. The remaining 1,519 miles would be streets and roads currently under city or county jurisdiction or not yet constructed. (See accompanying map.)

The plan is geared to an estimated population in 1980 of 31,000,000, and to motor vehicle registration of 17,000,000 with yearly travel by cars and trucks of some 200 billion vehicle-miles. (The current annual travel in California is an estimated 65 billion vehicle-miles.)

Commenting on the need for such a freeway plan, State Senator Randolph Collier, Chairman of the Joint Interim Committee on Highway Problems, has said that "a comprehensive freeway system for California is the next logical development in the effort to secure for the entire State an efficient transportation system to accommodate the economic expansion that is bound to occur in the years ahead."

Interstate Needs Formula

The 1958 Federal Highway Act, which was passed by Congress last year, put into effect the original provision of the 1956 Highway Act which called for the apportionment of federal interstate highway funds to the various states on the basis of their relative needs.

Approximately 10 percent of the motor vehicles in the United States are in California, and it has been found, in studies approved by the U. S. Bureau of Public Roads, that about 10 percent of the Nation's total interstate highway needs are also found in this State.

Thus, the apportionment of interstate funds according to need means that California, which previously received only about 6 percent of the national interstate apportionment, gets approximately 10 percent of the national total for 1959-60 and 1960-61.

As a result of the change, the State's 1959-60 interstate apportionment is approximately $137,000,000 more than the original 1958-59 apportionment, which was made under the old distribution formula.

Although the needs formula was activated for only two fiscal years (1959-60 and 1960-61), Congress is expected to consider applying this apportionment basis to future years in accordance with the intent expressed in the 1956 Federal Highway Act.

Construction Progress

From a construction point of view, the past year saw tremendous and gratifying progress on many major highway routes as California extended its national leadership in mileage of toll-free multilane divided highways.

When work is finished on several current and budgeted projects, this recently completed portion of the Ventura Freeway in the San Fernando Valley will be part of 90 miles of continuous full freeway on US Highway 101 from Calabasas, through Los Angeles, to the San Diego County line south of San Clemente.

By the end of 1958, California had 1,973 miles of this type of highway in operation and another 359 miles under construction as compared to 1,810 miles in operation and 358 under construction a year earlier.

The construction emphasis in recent years has been on freeways because of their time-tested ability to handle more traffic with greater safety than any other type of highway. This is possible through the control of access, the elimination of cross traffic and left turns at grade, and the separation of opposing traffic. Unlike conventional highways, freeways retain their capacity characteristics undiminished through time by adjacent development.

A total of 626 miles of full freeway was in operation at the end of the year, and another 248 miles were under construction.

In addition, most of the State's 864 miles of expressways, which have some intersections at grade, are designed for future conversion to freeway status. A number of controlled-access two-lane highways have been built in recent years, and most of these are also designed for ultimate conversion to full freeway or expressway.

In 1958 the highway construction program resulted in freeway improvements which enhance previously completed projects and add to the driving pleasure, comfort and safety of motorists throughout the State.

In the Los Angeles area, which generates 43 percent of the State's motor vehicle travel, the basic routes of the metropolitan region freeway network are virtually completed, and the emphasis of the construction program is being shifted to freeways which will skirt the central area and provide considerable traffic relief.

During the past year a total of 22 miles of freeway was completed and opened to Los Angeles traffic. Another 24 miles were under construction at the end of the year.

Projects under way or budgeted on the Ventura Freeway in the San Fernando Valley and on the San Diego Freeway in Orange County will complete U. S. Highway 101 as full freeway for some 90 miles from

At the end of 1958 work was nearly completed on this section of the double-deck Embarcadero Freeway in San Francisco. In the background is a portion of the San Francisco-Oakland Bay Bridge.

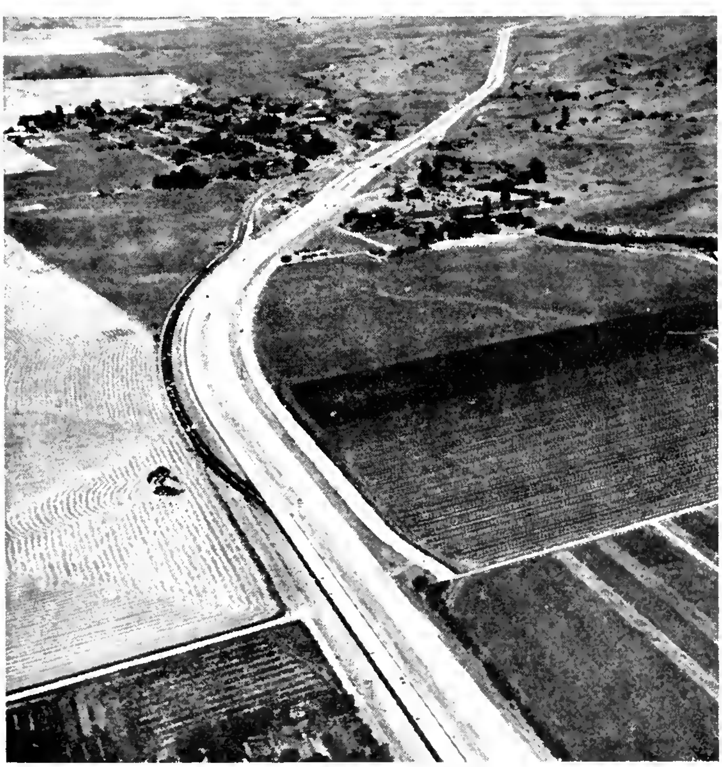
Calabasas to San Clemente. This includes the completed portions of the Hollywood and Santa Ana Freeways through and south of Los Angeles.

The San Bernardino Freeway is completed to freeway standards between Los Angeles and east of Ontario, a distance of about 38 miles, and work is now in progress on the conversion from expressway to freeway for an additional 14 miles to Colton.

In the past year construction on the Long Beach Freeway closed the final freeway gaps in a 17-mile stretch between the Santa Ana Freeway and Long Beach.

The Harbor Freeway was extended as far south as 124th Street near Compton, and at year's end construction of an additional five miles to 190th Street was under way. Freeway projects were also completed or under construction on the Riverside Freeway.

The 1959-60 State Highway Budget provides funds for a spectacular series of freeway projects on the Golden State and Santa Monica Freeways which, with projects under construction in 1958, will complete a close-in bypass of downtown Los Angeles.



Two important freeway projects completed in the past year were the Los Alamos Bypass on US Highway 101 (left) in Santa Barbara County and the new freeway section on US Highway 99 through Madera.

At the end of 1958, the major circumferential route, the San Diego Freeway, was being extended southward from the completed section in West Los Angeles. The 1959-60 budget contains large allocations for additional San Diego Freeway projects.

In San Diego County, work continued on the conversion from expressway to freeway on U. S. Highway 80 between US Highway 101 in San Diego and El Cajon. Projects included in the 1959-60 budget will complete the conversion and provide 17 miles of continuous full freeway. Funds are also budgeted for the first unit of the north-south freeway on US 101 through San Diego.

New stretches of freeway were opened to traffic in Riverside and in San Bernardino; and in December traffic on US Highway 91-66 began using 29 miles of freeway between Victorville and Barstow, the longest section of freeway ever constructed in California under one contract.

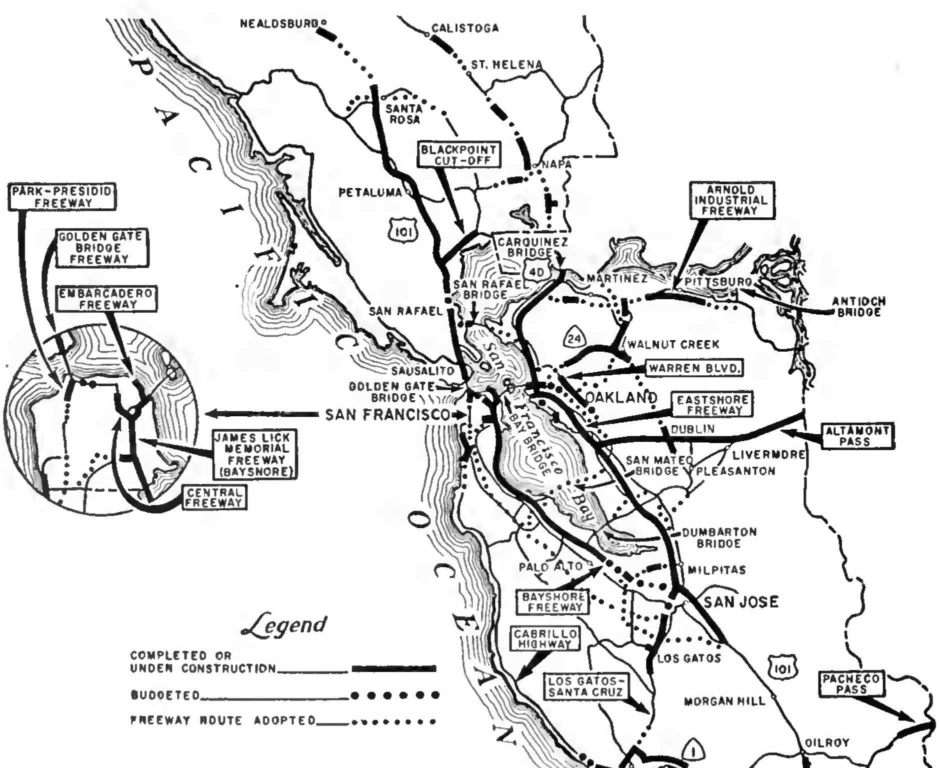
The rapid development of US Highway 101 to freeway and expressway standards continued with new projects completed or under way in each of the coastal counties between Los Angeles and the San Francisco Bay region, as well as in Marin, Sonoma, Mendocino and Humboldt Counties to the north.

This new stretch of freeway west of Auburn was one of four freeway sections completed during 1958 on US Highway 40 east of Sacramento. Completion of other current and budgeted projects on this route will leave only one 11-mile gap in continuous freeway and expressway between the state capital and Nevada. (Note old highway winding through Auburn Ravine at right.)

In the San Francisco Bay area US 101 Bypass (Bayshore Freeway) was completed as freeway for 35 miles between the San Francisco-Oakland Bay Bridge and Palo Alto. The final gaps in 46 miles of continuous full freeway on State Sign Route 17 (Nimitz Freeway) between Oakland and San Jose were also closed.

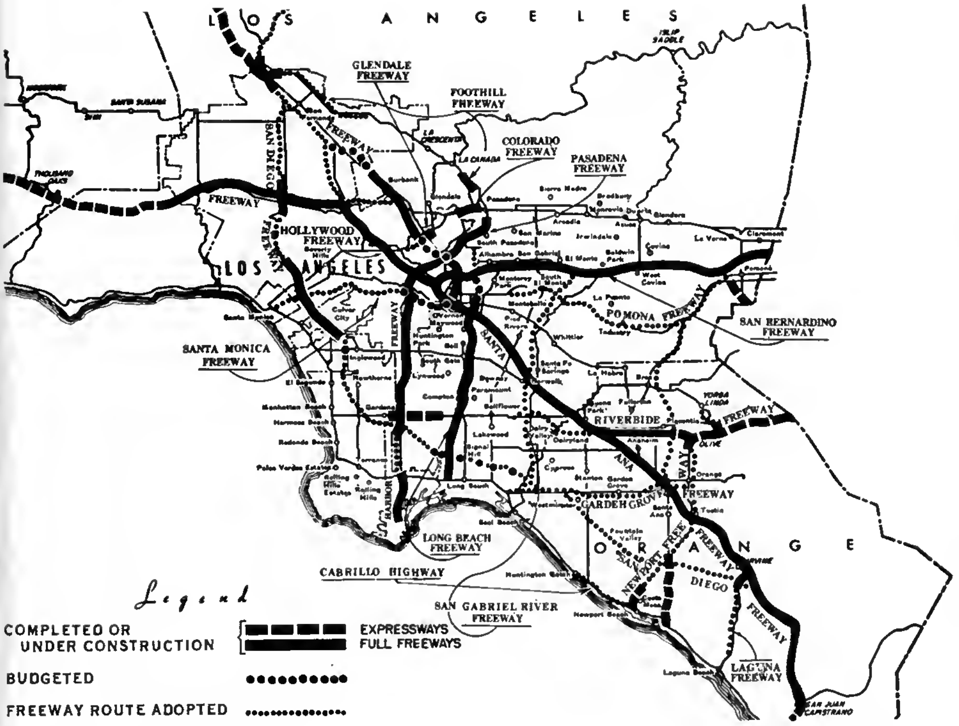
In San Francisco work was nearly completed on another section of the elevated Embarcadero Freeway and construction was continuing on the Central Freeway and on the first unit of the long-planned Southern Freeway.

North of San Francisco the last gap in continuous freeway on US 101 south of San Rafael was eliminated,

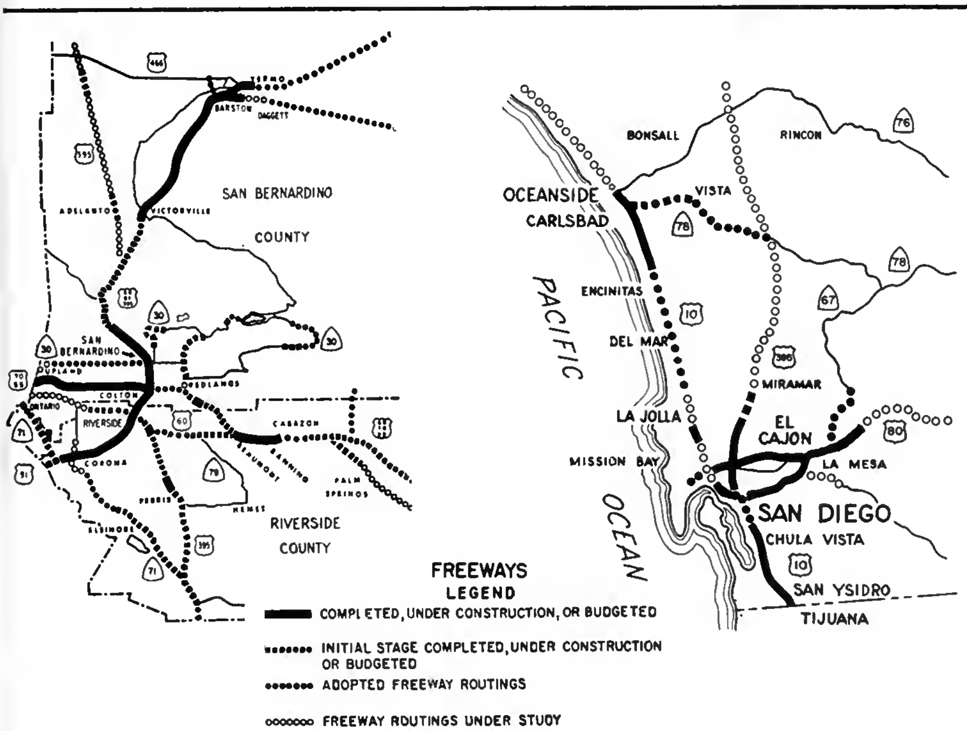


FREEWAY MAPS

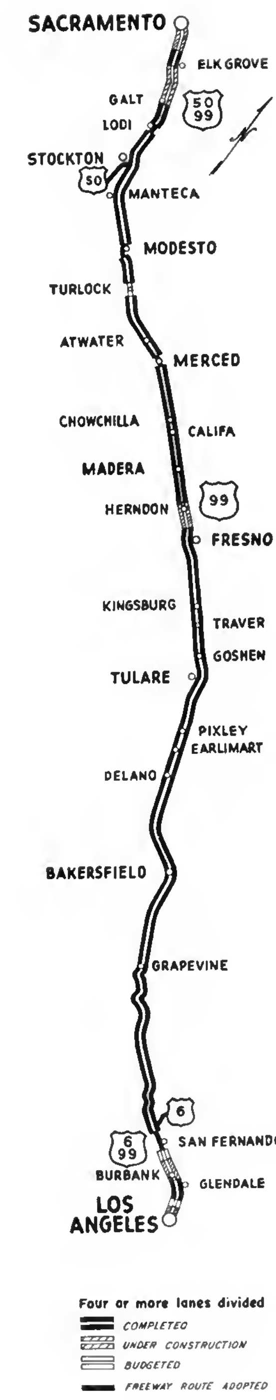
The maps on these pages show the expanding freeway and expressway networks in the San Francisco, Los Angeles, San Bernardino-Riverside and San Diego areas as well as the status of two important routes, US Highway 99 between Los Angeles and Sacramento, and US Highway 40 from the San Francisco Bay area to the Nevada state line.



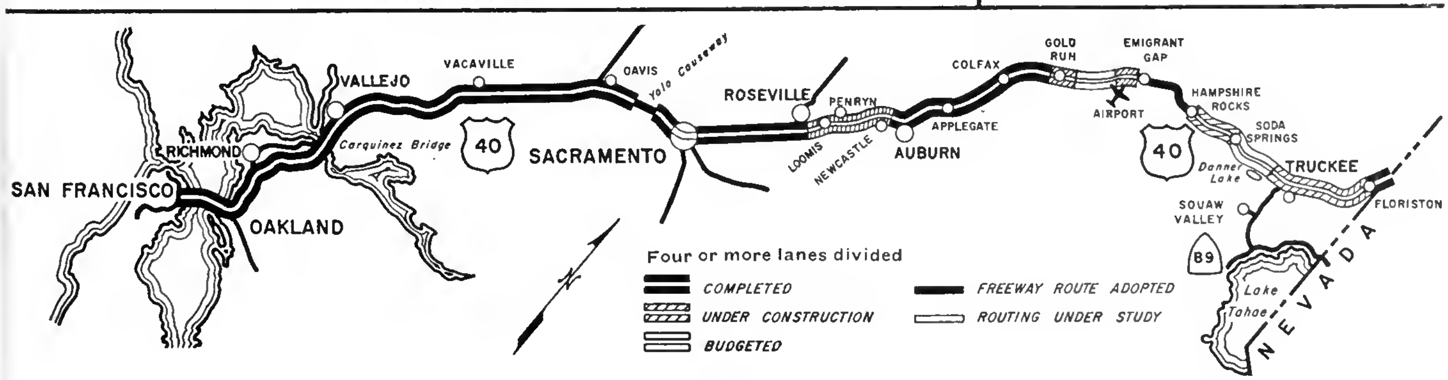
LOS ANGELES
GLENDALE FREEWAY
FOOTHILL FREEWAY
COLORADO FREEWAY
PASADENA FREEWAY
SAN DIEGO
FREEWAY
HOLLYWOOD FREEWAY
LOS ANGELES
SAN BERNARDINO FREEWAY
POMONA FREEWAY
SANTA MONICA FREEWAY
SANTA ANA
RIVERSIDE
FREEWAY
HARBOR
LONG BEACH FREEWAY
CABRILLO HIGHWAY
SAN GABRIEL RIVER FREEWAY
NEWPORT FREEWAY
ORANGE
SAN DIEGO FREEWAY
LAGUNA FREEWAY
Legend
COMPLETED OR UNDER CONSTRUCTION
EXPRESSWAYS
FULL FREEWAYS
BUDGETED
FREEWAY ROUTE ADOPTED



SAN BERNARDINO
COUNTY
VICTORVILLE
BARSTOW
SAN BERNARDINO
COLTON
REDLANDS
RIVERSIDE
CORONA
BANNING
PALM SPRINGS
RIVERSIDE
COUNTY
BONSALL
RINCON
OCEANSIDE
CARLSBAD
VISTA
ENCINITAS
DEL MAR
PACIFIC
OCEAN
MIRAMAR
LA JOLLA
EL CAJON
MISSION BAY
LA MESA
SAN DIEGO
CHULA VISTA
SAN YSIDRO
TIJUANA
FREEWAYS
LEGEND
COMPLETED, UNDER CONSTRUCTION, OR BUDGETED
INITIAL STAGE COMPLETED, UNDER CONSTRUCTION OR BUDGETED
ADOPTED FREEWAY ROUTINGS
FREEWAY ROUTINGS UNDER STUDY



SACRAMENTO
ELK GROVE
GALT
LODI
50
99
STOCKTON
50
MANTECA
MODESTO
TURLOCK
ATWATER
MERCED
CHOWCHILLA
CALIFA
MADERA
HERNDON
99
FRESNO
KINGSBURG
TRAVER
GOSHEN
TULARE
PIXLEY
EARLIMART
DELANO
BAKERSFIELD
GRAPEVINE
6
SAN FERNANDO
6
99
BURBANK
GLENDALE
LOS ANGELES
Four or more lanes divided
COMPLETED
UNDER CONSTRUCTION
BUDGETED
FREEWAY ROUTE ADOPTED
ROUTING UNDER STUDY



SAN FRANCISCO
RICHMOND
OAKLAND
VALLEJO
Carquinez Bridge
VACAVILLE
40
DAVIS
Yolo Causeway
SACRAMENTO
ROSEVILLE
PENRYN
LOOMIS
NEWCASTLE
APPLEGATE
AUBURN
COLFAX
GOLD RUN
EMIGRANT GAP
AIRPORT
HAMPSHIRE ROCKS
SODA SPRINGS
40
Donner Lake
TRUCKEE
FLORISTON
SQUAW VALLEY
89
Lake Tahoe
NEVADA
Four or more lanes divided
COMPLETED
UNDER CONSTRUCTION
BUDGETED
FREEWAY ROUTE ADOPTED
ROUTING UNDER STUDY

making this route nearly all freeway or expressway for some 50 miles to Santa Rosa.

A significant event in the freeway development on US Highway 40 was the November 25th opening of the parallel Carquinez Bridge and freeway approaches in Solano and Contra Costa Counties which eliminated a long-standing traffic bottleneck on this important interstate route.

Between San Francisco and Sacramento US 40 is now continuous multilane divided highway, except for three short four-lane undivided sections, one of which is presently being converted to freeway.

East of Sacramento work was completed on four new sections of freeway on US 40, and five other freeway projects were under construction. Three additional US 40 freeway jobs are in the 1959-60 State Highway Budget, including the relocation of this route as a freeway over the 7,135-foot Donner Pass.

When these projects are completed, there will be only one 11-mile gap in continuous freeway and expressway on US 40 between Sacramento and the state line.

On US Highway 99, the heavily traveled north-south valley route, new freeway sections were opened in Madera, in the vicinity of Chowchilla and north of Lodi; and construction started on freeway projects on the Grapevine Grade in Kern County and on a section north of Fresno. This latter project will eliminate one of the few remaining gaps in continuous multilane divided highway between Los Angeles and Sacramento.

On the north state portion of US 99 projects were completed, under construction or budgeted at year's end to provide 30 miles of continuous freeway and expressway in the Sacramento River Canyon from north of Shasta Lake to north of Dunsmuir.

The freeway projects referred to in the preceding paragraphs are only a few of the hundreds of improvements on all types of state highways which have recently been completed or which are now budgeted or under construction.

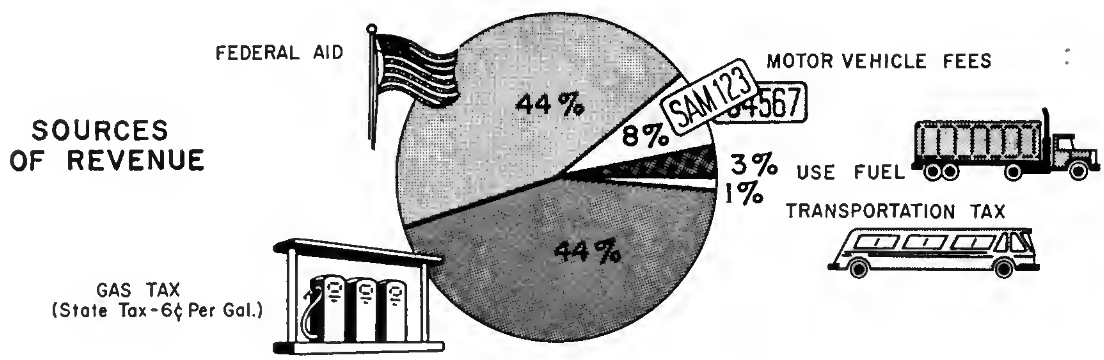
Not covered are extensive developments on less-traveled highways which are nevertheless important arteries in rural and scenic areas. Work on these routes during the past year resulted in many miles of new highway, completed reconstruction, realignment and other improvements.

Highway Financing

A total of $356,000,000 was allocated for construction and rights-of-way on state highways in the 1957-58 Fiscal Year. The total for the current (1958-59) fiscal year is $381,000,000, and the 1959-60 State Highway Budget, as adopted in October, 1958, provides $491,000,000 for construction and rights-of-way. The effect of increased federal aid, chiefly due to the introduction of the needs formula, is evident from these budget totals.

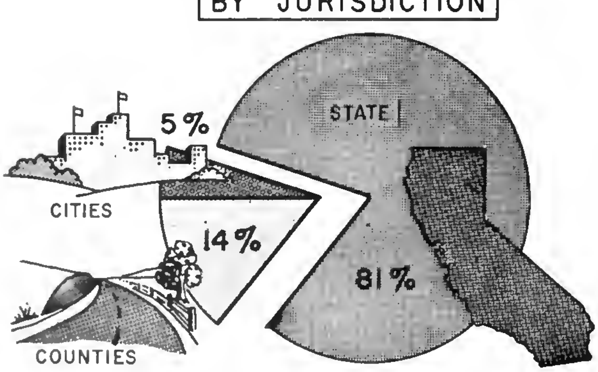
The backbone of California's highway financing structure is the state gasoline tax of 6 cents a gallon. Four cents is applied to state highways,

THE STREET, ROAD AND HIGHWAY DOLLAR IN CALIFORNIA



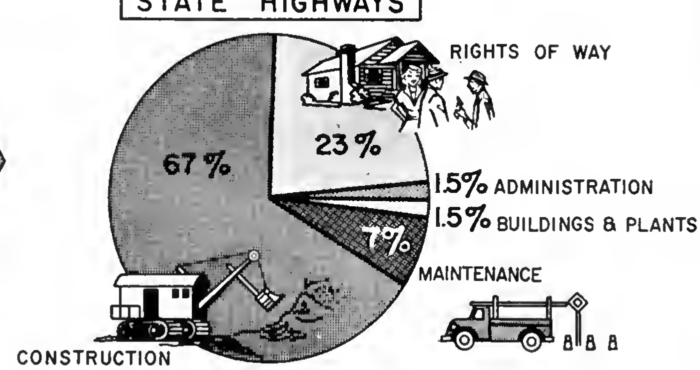
DISTRIBUTION OF FUNDS

BY JURISDICTION



DISTRIBUTION OF FUNDS

STATE HIGHWAYS



1⅜ cents goes for county roads, and ⅝ cent for city streets.

In addition to the gasoline tax, other sources of highway revenue in California are use (diesel) fuel taxes, transportation taxes, and motor vehicle, registration and weight fees. (Revenue sources and distribution for road purposes are indicated in the accompanying charts.)

According to the statutes, 55 percent of the state highway construction and right-of-way funds must be allocated to the 13 southern counties each year, with the remaining 45 percent going to the northern 45-county group. Each county is guaranteed a minimum share of the construction funds in a specified period of years. Federal highway funds must be applied to routes included in the various federal aid systems of secondary, primary, urban or interstate highways.

In preparing the annual state highway budget, the commission each year must review hundreds of high-priority projects and attempt to choose those which will meet the most acute local and regional needs, comply with federal requirements, and at the same time fit logcially into the long-range program of highway development on a statewide basis.

Thorough and conscientious study of all available data, including comprehensive statistics and information on traffic volumes, accidents, population changes, road conditions and other factors, is required.

The job of the commission is a difficult and exacting one with never enough money in a given year to do all the work that should be done.

Two provisions of California law are particularly helpful in expediting the financing and construction of highway projects.

One permits the award of construction contracts for highway projects as early as January 1st, six months before the start of the fiscal year in which the project is budgeted. Last year 159 contracts were awarded before the start of the 1958-59 Fiscal Year, thereby allowing a longer construction season and advancing the completion date on many projects.

Full public discussion of proposed freeway routes is a long standing policy of the Division of Highways and the California Highway Commission. Here a division engineer explains possible westside freeway routes at a public meeting in Los Banos early in 1958. The route was adopted by the Commission later in the year.

The other (split financing) makes it possible to finance certain large and complex projects in more than one state budget.

Under the "split financing" provision, contracts are awarded for an entire project, but the budget covers only the estimated expenditure during the pertinent fiscal year. Thus, more jobs can be budgeted since large amounts are not needlessly tied up in extensive projects.

Planning

The Division of Highways prepares plans and estimates on highway projects well in advance of the time when construction is actually expected to start.

This long-range planning program has in recent years enabled the Highway Commission to put to immediate use all money made available for state highway purposes. This program paid off dramatically again last year.

When additional funds were apportioned to California on short notice under the 1958 Federal Highway Act (the antirecession program), no time was lost in putting these funds to work in the form of going construction.

Plans and specifications were ready, the right-of-way had been acquired, and the division was able to advertise for bids on the newly financed projects shortly after the additional money was apportioned.

Under the antirecession program, 23 state highway projects with a total estimated construction cost of $29,700,000 were placed under contract well ahead of the December 1, 1958, deadline specified in the federal act. (Additional projects were undertaken on county roads, as described later in this report.)

Such rapid utilization of funds has resulted in huge savings to Californians due to early completion of projects, because it means savings in fuel and upkeep to motorists who enjoy earlier use of improved highways, and most important, it has resulted in earlier elimination of outmoded highway sections which often have had high accident rates.

Constant improvements are being made in the design and placement of directional signs on freeways to make it easier for motorists to find their destinations. At left is an overhead illuminated sign bridge typical of those now used extensively on freeways. At right is a sign showing distances to the next three turnoffs Standard plans and specifications for freeway sign structures have been developed and are included in major freeway construction contracts.

Freeway Route Discussions

Advance highway planning depends upon early determination of freeway routes by the Highway Commission. In most instances routings are adopted several years before construction funds are available.

The commission establishes freeway routes only after painstaking consideration of all available data, including review of extensive studies by the Division of Highways and information developed at a series of public meetings.

Complete public discussion of freeway routings has for many years been a firm policy of the Legislature, the Highway Commission and the division.

Last year this policy was re-emphasized with respect to consultations with local planning bodies and governmental agencies at the time the division first begins specific route studies.

Later, when sufficient engineering and economic data have been developed concerning possible alternate routes, the division conducts public meetings, map displays and hearings. A booklet entitled "Freeway Facts," distributed at these meetings, explains the route selection procedure. (Copies available on request.)

During the 1957-58 Fiscal Year, 49 formal public meetings regarding freeway routings were held by the Division of Highways. In addition there were several hundred preliminary informational meetings and map displays.

Also, the Highway Commission itself may hold official public hearings on proposed freeways in the areas where new routes are being considered. These hearings are scheduled either at the request of local authorities or on the commission's own initiative. Four such public hearings were held during the fiscal year ending June 30, 1958, one at the request of local agencies, and the other three on initiative of the commission. Eight more were held in the latter part of 1958, three of them on successive days in different areas.

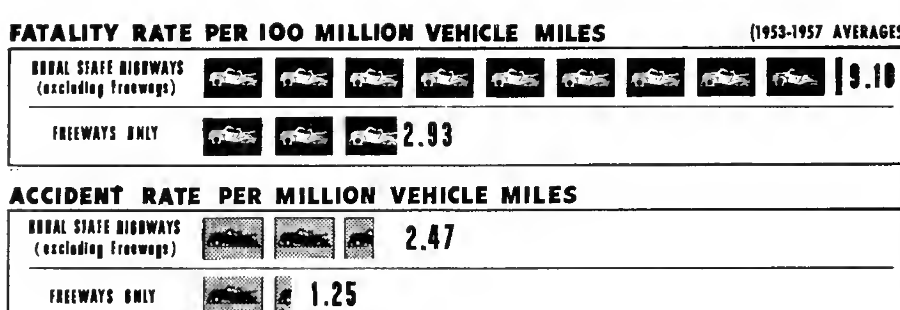
Freeway routes covering 486 miles were adopted during the past year, bringing to 4,691 the total mileage of declared freeways on the State Highway System at the end of 1958.

Improved Methods

New or improved methods and equipment have enabled the Division of Highways to meet the demands of the accelerated program of highway construction.

The increased use of electronic computers, aerial photography, and new surveying and map checking devices, plus other administrative and technical improvements, have in recent years saved thousands of engineering man hours which would have been required under former methods.

During the 1957-58 Fiscal Year alone, the use of electronic computers in calculating traverses in surveying increased about 50 percent. Earthwork quantity caculations by electronic means increased 40 percent to almost 3,500 miles. Electronic computers are also used in tabulating traffic data and statistics and in making structural calculations for bridge design.



Aerial photography or "photogrammetry" methods are now used in the design of nearly all projects which involve changes in alignment and grade. As a result, much of the time-consuming field surveying work of the past is no longer necessary.

Two other devices, the stereoplotter and the geodetic distance meter, have aided California highway designers in handling bigger workloads without proportionate staff increases.

Through the use of the stereoplotter, it is possible to make complete evaluations of design maps as soon as they are prepared. About 40 percent of all design mapping was checked for accuracy by stereoplotter during the 1957-58 Fiscal Year. Former field check methods were more expensive and less dependable.

The geodetic distance meter is an electronic instrument used in surveying to measure long distances for the purpose of establishing reference points for aerial mapping, construction staking and right-of-way surveys.

Traffic and Accidents

The fact that freeways save life and limb and effectively carry tremendous traffic volumes is once again demonstrated by recent traffic and accident figures.

In the five-year period from 1953 through 1957 the fatality rate on conventional California highways was 9.10 for every 100 million miles of travel. In the same period the fatality rate on full freeways was 2.93 for every 100 million vehicle-miles.

Thus, the life of a motorist on a modern freeway in the midst of dense and fast-moving traffic continued to be more than three times as safe per mile of vehicle travel as on conventional highways with lower traffic volumes.

The overall accident rate totals for the five years also show the safety built into modern freeways. During the five-year period there were 1.25 accidents in every million vehicle miles on freeways as compared to nearly twice as many, 2.47, on conventional routes. (See accompanying chart.)

An indication of the progress which highway engineers, safety groups and enforcement agencies have made is provided by the fact that the fatality rate on state highways has been reduced from a high of 17.2 deaths per 100 million vehicle-miles in 1945 to 8.64 fatalities per 100 million vehicle-miles in 1957.

As in previous years, freeways in the central Los Angeles area handled amazing daily traffic volumes again in 1958. Average daily traffic on downtown sections of the Hollywood and Harbor Freeways was 192,000 on each route. The four-level interchange, the world's busiest intersection, carried an average daily volume of 321,000 vehicles.

Another striking example of the safety benefits inherent in freeways was provided last year in a before-and-after study of accidents on a 10-mile section of U. S. Highway 40-99E northeast of Sacramento.

The study covered accidents during a 44-month period—22 months before the freeway was in operation, and 22 months after it was opened to traffic.

In the 22 months following completion of the freeway the accident rate decreased 86 percent, even though traffic volumes went up. The number of accidents also decreased on the superseded highway route due to reduced congestion.

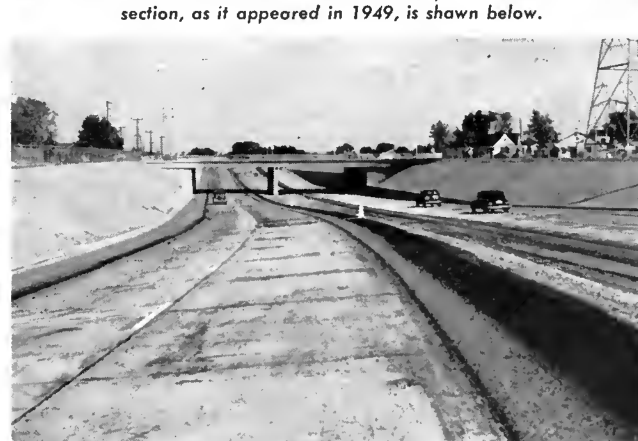
Directional Signs

Many advances have been made in the last few years in the design and placement of directional signs on California's freeways. These improvements provide for safer, more efficient freeway operation and make it easier for motorists to get to their destinations.

In addition to more and bigger signs on the recently completed freeways, several new features are being included in the sign systems. Among these are the following:

- Greater use of overhead illuminated signs which are more readily seen by motorists in heavy traffic.
- More advance notice of off-ramps to permit ample time for necessary lane changes. On some sections signs which give the distance in miles to each of the

Freeway landscaping adds greatly to roadside beauty and also serves functional purposes such as reducing headlight glare and traffic noise. Trees, shrubs and ground cover provide an attractive setting for the section of US 40-99E near Sacramento in the photo at left. The same section, as it appeared in 1949, is shown below.



This huge landslide along the Pacific Palisades closed US Highway 101 Alternate near Santa Monica and took the life of a Division of Highways maintenance superintendent. A temporary detour was constructed to reopen the highway, and at the end of the year work was being pushed on rerouting the highway around the slide.

next three turnoffs are being used.

- Down-arrows which give a positive advance indication of the proper lane or ramp which the motorist should use for a specific destination.
- Route numbers on directional signs to reassure motorists that they are on the right road and to give advance notice of impending highway junctions.
- Improved sign illumination to assist drivers at night.
- Walkways on overhead sign structures to permit servicing without disruption of traffic. This makes possible more frequent cleaning and aids in the replacement of burned out light fixtures, thus insuring a higher standard of legibility.

Roadside Planting

California's highways are the scene of an increasing number of planting and landscaping projects in accord with a Highway Commission policy adopted in 1957 at the request of the Legislature.

The 1959-60 State Highway Budget contains nearly $4,000,000 for 36 landscaping or planting projects as compared to approximately $3,000,000 for 32 such projects in the current 1958-59 budget.

In addition to these separately budgeted projects, the division's roadside development unit also plans the basic erosion control plantings or the planting preparation work included in a large number of construction contracts.

It is usually cheaper to include in the construction contract certain types of erosion control and such planting preparations as the spreading of topsoil and the installation of water lines under roadways.

The Division of Highways Nursery at Davis often supplies plants, shrubs and trees which are not available in quantity from commercial sources for highway planting projects.

Maintenance

Widespread damage to highways and several temporary road closures resulted from the severe storms which struck California last winter and spring.

To the division's maintenance crews, whose job it is to keep the highways open or to provide detours when possible in such emergencies, the storms meant long hours of difficult work in uncomfortable and sometimes dangerous circumstances.

A huge slide which occurred on the Pacific Coast Highway near Santa Monica on March 31 took the life of Maintenance Superintendent Vaughn O. Sheff of the division's Los Angeles office. Sheff was directing efforts to clear an earlier slide.

Total damage to highways as a result of the storms was estimated at about $11,000,000, some $4,000,000 of which is subject to reimbursement from federal sources. Most of the storm-damaged highways have now been repaired.

The maintenance of the State's highways is an important and continuing part of the work of the division. California's varied climate and topography dictate a broad maintenance program requiring equipment and personnel for a wide range of tasks.

In addition to such annual duties as snow removal and repairs after winter storms, the maintenance department also is responsible for such things as the care of roadside trees and landscaped highway sections, the posting of warning and directional signs, adjustment of electronic traffic signals, and a constant program of resurfacing, patching, sealing, painting, spraying and shoulder maintenance.

No small job for maintenance crews is picking up after highway litterbugs. In an effort to curb the expense of roadside cleanup, which cost about $650,000 in 1957-58, the division has installed 1,000 litter disposal cans along the State's highways. Signs indicating the locations of litter cans have also been installed.

The continuing statewide campaign by various groups to reduce roadside litter is believed to be producing generally beneficial results. In some locations, however, litter cans have been used for the disposal of household garbage and junk.

During the 1957-58 Fiscal Year, the division took over the maintenance of

146 miles of former county roads—sections on State Sign Route 1 in Sonoma and Mendocino Counties, on Sign Route 20 in Mendocino County, on Sign Route 49 in Sierra and Plumas Counties and on Legislative Route 232 in Sacramento, Sutter and Yuba Counties.

To better co-ordinate its broad, statewide activities and to provide up-to-the-minute reports of road conditions, the maintenance department has developed a radio network which at the end of 1958 included 175 radio stations, 23 microwave stations, and 850 mobile radio units.

During the winter, accurate road condition reports are received by radio from the field and supplied to newspapers, automobile clubs, radio and television stations, and other interested agencies through division-operated teletype facilities.

Personnel of the Division's Materials and Research Department moved into this new headquarters laboratory in May, 1958. The building provides 65,000 square feet of space and was constructed at a cost of $1,377,000.

Equipment

The operation and maintenance of California's highways requires considerable automotive and maintenance equipment including various trucks, automobiles, graders, snowplows, power shovels, tractors, and miscellaneous items such as rollers, mixers, trailers, pumps, drills and mowers.

The division's automotive and maintenance equipment inventory at the end of the 1957-58 Fiscal Year amounted to $23,500,000.

In the past five years, the number of equipment units under the jurisdiction of the division's equipment department has increased nearly 30 percent. At the same time the number of employees in this department has risen by only four, from 616 to 620. This favorable comparison is due largely to effective on-the-job training, increased operational efficiency, and improved equipment and tools.

During the 1957-58 Fiscal Year, the division acquired 1,360 pieces of equipment with a total value of some $4,500,000. A large part of this equipment was designed, assembled or constructed in department shops.

Among the recently designed or developed equipment items are a rotary snowplow mounted on a heavy-duty four-wheel-drive motor grader and a pushbutton highway striping machine which will eliminate the need for a man to ride in the striping buggy during the painting of lines on the pavement.

Materials and Research

The highlight of the past year for personnel of the division's materials and research department was the move to the new headquarters laboratory building in Sacramento.

The new $1,377,000 structure was formally dedicated by members of the Highway Commission and other officials May 21, 1958.

Staffed by about 200 employees, the new building provides 65,000 square feet of modern laboratory and utility space for various kinds of research and testing equipment.

The new Sacramento laboratory is headquarters for a statewide research and testing organization which includes specialized branch laboratories in Los Angeles, Berkeley, Santa Maria, and Bakersfield. The department also co-ordinates the technical work of laboratories in each of the 11 state highway districts.

The work of the materials and research department may be divided into two main categories—testing to make sure the State gets its money's worth from every highway construction dollar, and research to develop better methods and materials.

In addition to making sure the State's high standards for materials are being met, the department also conducts research into such subjects as the durability of paints, the stability of soils, the effectiveness of highway lighting, the effect of temperature changes on pavements, the skid resistance of pavements, and the durability of roadways under heavy traffic.

One unusual problem which is being actively investigated by the materials and research department is that of damage to vehicles from blowing sand on a section of freeway in Riverside County. Extensive data are now being accumulated in an attempt to find a permanent solution to this problem.

As part of the division's continuing studies of the effect on freeway safety of dividing strip barriers, the Materials and Research Department last year began conducting full-scale impact tests on various guard rails using remote control automobiles and special cameras and other technical equipment to record results.

Bridges

A significant addition was made November 25, 1958, to the list of great bridges in the San Francisco Bay area when the parallel Carquinez Bridge at Crockett was opened to traffic.

The bridge and its impressive freeway approaches in Contra Costa and Solano Counties had been under construction since December, 1955, with financing provided by $46,000,000 in Toll Bridge Authority revenue bonds.

The huge Carquinez project was one of the most spectacular of the recent bridge and highway construction jobs in California.

It included not only the new bridge, but also extensive viaduct, interchange facilities and 2.9 miles of freeway in Contra Costa County; 1.2 miles of freeway in Solano County; widening and new south connections on the old bridge (now under construction); and other related work. Twelve separate construction contracts were involved.

When the current work on the old bridge is completed this summer, the new bridge will carry northbound traffic and the old structure will handle southbound vehicles.

The freeway approach south of the bridges extends through a manmade canyon believed to be the largest cut in the history of roadbuilding. More than a quarter-mile wide at the top and as much as 350 feet deep, this "big cut" required the removal of nearly 9,000,000 cubic yards of earth.

Construction is scheduled to start this year on another major crossing of the Carquinez Strait, the long-planned bridge which will replace the present division-operated ferry service between Benicia and Martinez. This project will also be financed by Toll Bridge Authority revenue bonds.

The Division of Highways Bridge Department, with its own facilities for design, construction, operation and maintenance, is responsible for all structures on state highways.

These include elevated freeways, traffic interchanges, overcrossings and undercrossings, highway-railroad separations, and bridges over rivers, streams and other bodies of water.

The bridge department also supervises the operation and maintenance of the state-owned toll bridges—the San Francisco–Oakland Bay Bridge, Richmond–San Rafael Bridge, the San Mateo–Hayward Bridge, the Dumbarton Bridge, and the Carquinez Bridges.

Largest of the toll bridges is the San Francisco–Oakland Bay Bridge, which carried a total of 35,253,643 vehicles during the 1957-58 Fiscal Year, a gain of 4.5 percent over the previous year.

New laws pertaining to the financing of railroad grade separation structures on county roads and city streets, which were passed by the 1957 Legislature, went into effect during the past year.

These statutes provide that beginning with the 1958-59 Fiscal Year, $5,000,000 is to be set aside each year in the State Highway budget to help finance local railroad grade separation projects included on a priority list established annually by the State Public Utilities Commission.

The cost of such projects, after deduction of any contribution by the railroad involved, is shared equally by the local agency and the State.

At the end of the year, the Highway Commission had made allocations from this special fund to help pay the cost of nine local railroad grade separation projects on the 1958 P. U. C. priority list.

Motorists on the new US Highway 40 freeway approaches to the Carquinez Bridges in Contra Costa County travel through a manmade canyon believed to be the largest cut in the history of road building. The "Big Cut" is a quarter-mile wide at the top and up to 350 feet deep.

Right-of-Way

A total of 7,955 right-of-way transactions were concluded in the 1957-58 Fiscal Year. Of these, 95.6 percent were negotiated settlements with property owners. Only 4.4 percent of the cases were court proceedings in eminent domain.

The total amount spent for rights of way, including administration, was $121,235,749.

One big reason for the success in concluding amicable right-of-way negotiations is the division's policy of paying fair market value for required property. In dealings with right-of-way personnel, owners can expect to receive the same amount for their holdings as they would from any other buyer under normal market conditions.

The methods and policies of the Right-of-Way Department are outlined and explained in the booklet "More Than 14 Million People Want

My Property," which is mailed to affected property owners before their property is appraised. (Copies available on request.)

Acquisition of rights of way in California is expedited in some cases by a special fund which has been authorized by the Legislature.

This $30,000,000 revolving fund has been set up for the advance purchase of rights of way on which costly improvements are slated. Expenditures from the fund are repaid from regular highway funds when the construction period is reached for each project.

The effect of this procedure is to provide funds to purchase property before improvements are made, even though actual highway construction may be some years in the future.

It is estimated that a $170,000,000 saving in right-of-way acquisition costs has been made in the six years since the fund was established.

F. A. S. Roads

Out of the 69,000 miles of county roads in California, a total of 6,844 miles and included in the Federal-aid Secondary System. For the most part these roads are next in importance to state highways in terms of traffic volume and economic service. They are often referred to as "feeder roads" or "farm-to-market roads."

Projects on federal aid secondary routes are planned and in most instances constructed under the direct supervision of the county involved. The Division of Highways, under federal regulations, has the responsibility for reviewing and approving these county projects. The division also assists in other phases when requested to do so by the counties.

Working in close co-operation with the division, California's counties compiled a commendable record in the planning and construction of FAS county roads during the past year.

This was particularly rrue in connection with the use of "crash program" funds made available under the antirecession provisions of the 1958 Federal Highway Act.

Additional funds were apportioned to California under the 1958 federal act in April with the requirement that projects financed with the added money had to be under contract before December 1st.

California highway construction is performed under contracts awarded on the basis of competitive bidding. The longest freeway ever built in California under one contract was opened in December, 1958. A portion of this 29-mile stretch of freeway on US Highway 91-66 between Victorville and Barstow is shown above during construction.

With only a few months in which to take care of the countless details of planning, financing and administration, the participating counties and the division succeeded in obligating all the additional federal funds and state matching money by the specified deadline.

Under this program, 69 county road projects with an estimated cost of $6,666,017 were placed under contract before December 1st. These projects were financed by $4,405,040 in FAS funds, $1,093,299 in state matching money, and $1,167,678 in county funds.

There were other important accomplishments which also indicate the progress made by rhe counries in developing strengthened engineering organizations.

For the first time in more than 10 years of operation under the FAS program, surveys and plans for all FAS county road contracts awarded during a fiscal year were handled exclusively by the counties. Some state assistance had been required in previous years.

In addition, the counties supplied all or part of the construction engineers required on 90 percent of the FAS county road jobs.

The regular 1958-59 federal apportionment to the counties for use in improving roads on the FAS System amounted to $9,615,571. State highway funds made available to the counties for use in matching this regular allocation totaled $5,965,903. These totals do not include the special crash program funds.

The largest source of revenue for all county road purposes is the one and three-eighths cent share of the State's six-cent-a-gallon gasoline tax. These funds are distributed directly to the counties by the State Controller, and are administered by local boards of supervisors.

Apportionments are made according to law on the basis of proportionate motor vehicle registration and mileages of county maintained roads. For 1957-58 the counties received as their share of the gas tax, along with a portion of the vehicle registration fees, a total of $75,656,519.

City Streets

The Division of Highways administers the apportionment on a population basis of the five-eighths-cent gasoline tax revenue which goes to incorporated cities and reviews and approves city street improvements financed with these funds.

In addition, the division apportions state highway funds set aside for city street engineering and administration purposes. According to law, this apportionment ranges from $1,000 a year for cities with population of less than 5,000 to $20,000 for cities of more than 500,000 population.

During the 1957-58 Fiscal Year, a total of $30,427,652 was apportioned to cities in gas tax money and engineering funds. This is an increase of more than $1,000,000 over the $29,219,480 paid in the previous year. City street projects approved by the division during the fiscal year numbered 543.

Rising Costs

A constant problem in planning and financing highway improvements is the upward trend of construction costs. Even though more efficient methods and better construction machinery are now in use, these gains have not entirely offset the rising cost of labor and materials.

At the end of 1958, average construction costs were approximately 140 percent higher than in 1940, even though the cost index maintained by the division showed that construction cost averages have declined from an earlier high.

The average cost per parcel in right-of-way transactions is also climbing. In 1945 this average was $2,370. The 1957 average was $14,128 while in 1958 the figure had risen to $15,014.

Construction Contracts

California highway construction is performed under contracts awarded on the basis of competitive bidding. This insures that the public receives the greatest value for its highway dollar.

Contractors who desire to bid on state highway projects estimated to cost more than $15,000 are required to be prequalified by the division. Each contractor's financial capabilities, experience and resources are studied in determining the type and size jobs he is qualified to undertake.

At the end of the 1957-58 Fiscal Year, there were 1,018 contractors, with varying prequalification ratings, eligible for bidding on state highway projects, compared with 992 at the end of the previous year. Total bidding capacity of these contractors was $1,920,000,000, an increase of $141,000,000 over the year before.

Construction projects are advertised for bids by the Division of Highways after the Director of Public Works, on the division's recommendation, has approved plans, specifications and estimates. Contracts are awarded by the Director of Public Works, also on recommendation from the division.

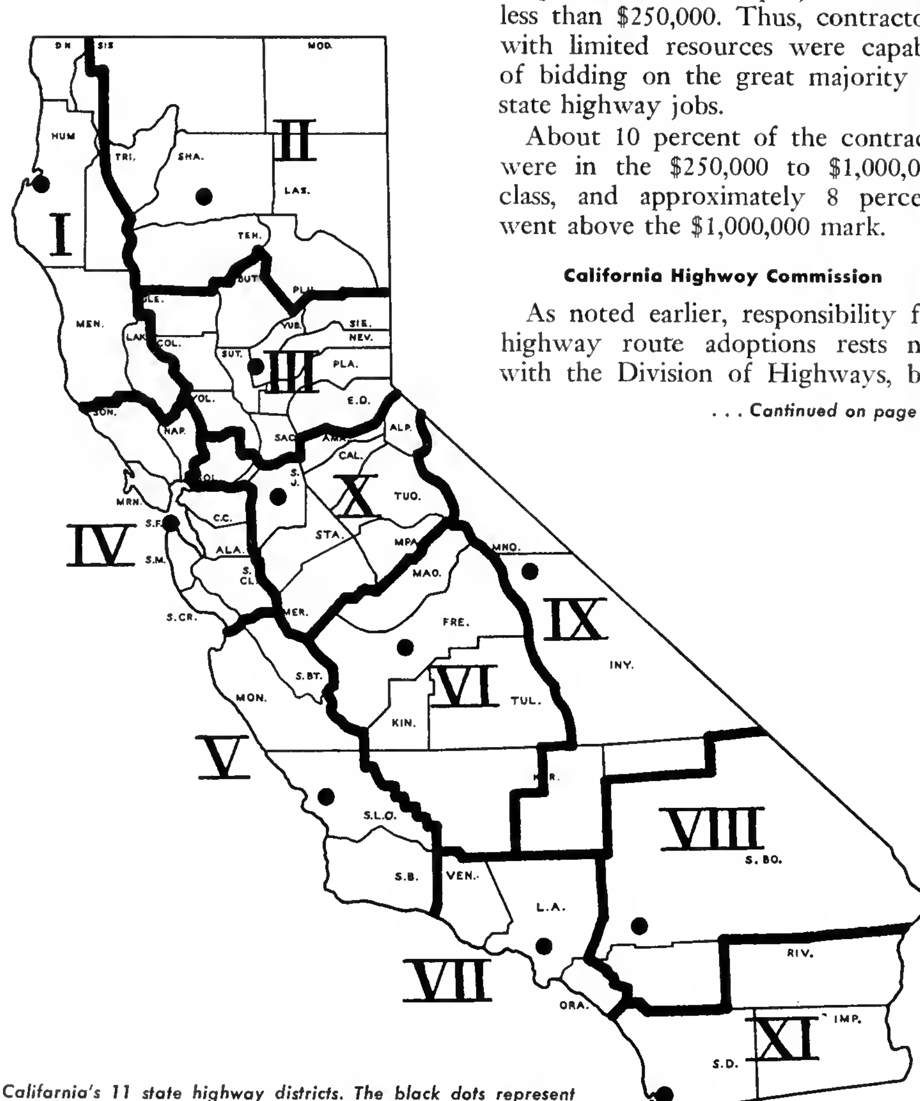
Of the 438 contracts awarded during the 1957-58 Fiscal Year, more than 82 percent were for projects costing less than $250,000. Thus, contractors with limited resources were capable of bidding on the great majority of state highway jobs.

About 10 percent of the contracts were in the $250,000 to $1,000,000 class, and approximately 8 percent went above the $1,000,000 mark.

California Highway Commission

As noted earlier, responsibility for highway route adoptions rests not with the Division of Highways, but

. . . Continued on page 64



California's 11 state highway districts. The black dots represent cities in which district offices are located.

Longest Freeway Contract Completed

A crowd representing more than 20 Southern California communities celebrated the opening of the new freeway between Victorville and Barstow. The freeway eliminates the old two-lane highway and shortens the distance between the two cities by nearly five miles. Constructed at a cost of $5,750,000, it was the longest stretch of freeway ever built in the State under a single contract. Among those taking part in the opening ceremony were (left to right) Everett Poncho, Indian runner; Bernard W. Keller, President of the Barstow Chamber of Commerce; George W. Oakes, Mayor of Barstow; Magda Lawson, county supervisor from Needles; T. F. Bagshaw, then State Director of Public Works; Edward A. Rademan, President of the Victorville Chamber of Commerce; Clyde V. Kane, District Engineer of the State Division of Highways; Irene Pearson, Construction Queen; Zelpha Wallace, Miss Victorville; and James A. Guthrie, State Highway Commissioner from San Bernardino.

NEW OFFICIALS

Continued from page 13 . . .

For six years before that, he was with the U. S. Bureau of the Budget, most of the time as principal examiner for all military personnel budgets.

During World War II, Wright served as a Navy officer in subchasers on convoy escort duty in North African waters. He is now a Commander in the Naval Reserve.

Wright's earlier career was in personnel work with the New York State and Federal Governments. He graduated from Syracuse University in 1937 and did two years graduate work in public administration at Syracuse. He was born in Auburn, New York, in 1915. The Wrights' children are: David, 17; Nancy, 15, and Jimmy, 8.

Chambers was appointed Secretary of the Highway Commission to succeed Ben D. Martin, who has been in the position since last August.

Since 1940, Chambers has held civil service posts with various Federal Government agencies in San Francisco. For the seven years before January, 1958, when he began management of Brown's Northern California campaign, he was Director of Business Service Centers for the western region of General Services Administration.

During the 1940's, Chambers was with the U. S. Department of Labor, War Production Board, War Labor Board, War Manpower Commission, Small War Plants Corporation and War Assets Administration.

Chambers was born in San Francisco in 1910. He studied at St. Joseph's College in Mountain View. He has made his home in Alameda with his wife and twin sons, 11, Robert and Stephen.

The State Department of Public Works awarded 41 contracts amounting to $16,233,200 during December. Fifty-five contracts amounting to $23,488,100 were completed. On December 31, the Division of Highways had under way 324 contracts with a value of $377,746,700.

L. B. Reynolds Retires; Joined State in 1928

Lloyd B. Reynolds, Assistant Office Engineer of the California Division of Highways, retired on November 28, 1958, after more than 30 years of state service.

For the last 10 years Reynolds was concerned with engineering reports and statistics for the Division of Highways, and had been in charge of that function since April, 1956. His work included the preparation of the quarterly index of California highway construction costs and related data as well as assisting in the processing of bids and construction contracts. His duties have also included preparation of the division's annual report.

LLOYD B. REYNOLDS

Reynolds was born in Ophir, Placer County, and attended high school in Auburn. He also attended the University of California. His engineering career began in 1920, when he participated in various studies being made of the California Highway System by the U. S. Bureau of Public Roads and others. Subsequently he worked for the Nevada Highway Department in Carson City; the Western Pacific and Southern Pacific Railroads and the Port of Oakland before joining the Division of Highways in Sacramento in April, 1928, as a draftsman.

He transferred to the Stockton district in 1936 as assistant chief draftsman, and returned to the Headquarters Office in Sacramento in 1945 to work on plans, specifications and estimates and subsequently on reports and statistics.

Reynolds and his wife, Marjorie, live at 3707 T Street, Sacramento. He is a member of Union Lodge No. 58, F. and A. M.

Half a billion cars have crossed the San Francisco-Oakland Bay Bridge since it was completed in 1936. This is enough to fill a six-lane freeway bumper to bumper from here to the moon.

Index of California Highways and Public Works

January to December, 1958

SUBJECT INDEX

INDEX OF AUTHORS

CARQUINEZ

Continued from page 12 . . .

Bridge Division of U. S. Steel Corporation, chose to use shop bolted joints because of the heavy gusset plates and heavy members which required a considerable force to draw up to a tight fit.

The high-strength bolts was one of the big factors contributing to the very fast rate of erection attained on the job. As Slim Edmonds, the erection superintendent for American Bridge said: "This job has gone together faster and easier than any truss of this size that I have ever erected."

Bolting Method Speeded

On most heavy trusswork of this size, it is frequently necesary to completely bolt up a joint prior to riveting. This is necessary in order to have the joint drawn up tight ahead of any riveting. As a result it is estimated that one bolting crew of two men can more than equal the work of a four-man riveting crew. For this reason, the bolting crews were easily able to keep pace with erection which it is believed would not have been possible with riveted joints.

Bolts were tightened by pneumatic impact wrenches. These impact wrenches were actually designed for ⅞-inch diameter bolts but were used for the one-inch and 1¼-inch bolts as well. On the joints with one-inch bolts it was necessary for the bolting crews to go over the joint twice with the impact wrench open to maximum capacity before each bolt was sufficiently tight. On the few joints with 1¼-inch bolts it was necessary to go over the joint three times to insure tightness.

Testing was done by inspectors using a torque wrench. Only about every third bolt was tested unless several bolts in a joint were found below minimum torque requirements, and then all the bolts in that joint would be tested.

Bolts were not checked to see if they exceeded any maximum torque because the nut will nearly always strip before the bolt reaches an unsafe tensile stress.

Both impact wrenches and torque wrenches were occasionally checked by the Skidmore-Wilhelm Bolt Tension Test Device which is designed for the calibration of impact wrenches.

The high-strength steel bolts proved to be completely satisfactory in every respect. While the bolts cost more to furnish than the rivets, a great deal of erection time and cost were saved by bolted joints.

The work in connection with this $46,000,000 Carquinez Toll Bridge Project was administered by the State Division of Highways under G. T. McCoy, State Highway Engineer, and his engineering staff. These engineers along with the contractors who have provided their skills and "know-how" can well be proud of the Carquinez Bridge and its freeway approaches.

DISTRICT VII

Continued from page 44 . . .

the Downtown Business Men's Association, reproduced on page 29.

The map shows that the distance which can be driven in 30 minutes from downtown in offpeak traffic hours has been extended in the past five years at least five miles in every direction except westerly, where there are no freeways. The radius which can be driven is between 10 and 15 miles in nearly all cases, and as much as 20 miles in some cases. Extensions of the 30-minute driving point shown on the map, as compared with a similar study five years ago, clearly indicate the role of the freeways in providing easier access to downtown Los Angeles and throughout the Los Angeles metropolitan area. Driving times indicated on the map are from the core area of downtown and include time driven on downtown streets to reach freeways or major surface streets to outlying areas.

The Downtown Business Men's Association emphasizes the fact that during the greater part of the day and night, traffic moves freely and rapidly on the freeways, as indicated by the map. Also, that the traffic congestion we hear so much about exists only for a very limited time during the morning and evening peak hours.

CALIFORNIA HIGHWAYS

Continued from page 60 . . .

with the California Highway Commission, which is a nontechnical, nonsalaried board of business and professional men representing the people of the State at large.

Commissioners are appointed by the Governor, and the appointments are confirmed by the State Senate.

The commission is a seven-man body with the State Director of Public Works, as ex officio chairman, serving at the pleasure of the Governor. The other six members serve four-year staggered terms.

Members of the commission at the end of 1958 were: Chairman, T. F. Bagshaw, Director of Public Works (succeeding C. M. Gilliss, who resigned in November); Robert L. Bishop of Santa Rosa; John O. Bronson of Sacramento (succeeding H. Stephen Chase of San Francisco, who resigned in February); James A. Guthrie of San Bernardino; Robert E. McClure of Santa Monica; Fred W. Speers of Escondido; and Chester H. Warlow of Fresno.

In addition to budgeting highway funds and adopting freeway and highway routes, the commission also approves county primary road systems and authorizes the execution of deeds, condemnation proceedings, and right-of-way abandonments and relinquishments.

Division of Highwoys

Chief of the Division of Highways is the State Highway Engineer. He is assisted by a headquarters staff in Sacramento composed of two deputy state highway engineers, four assistant state highway engineers, a chief right-of-way agent and a comptroller. Each of the assistant state highway engineers is in charge of a group of specialized units.

The State is divided into 11 state highway districts to provide for localized administration of the highway program. These districts have approximately equivalent state highway mileage. A district engineer is in charge of each district except in the San Francisco and Los Angeles areas where an assistant state highway engineer is in command.

The district engineer is responsible for all phases of the highway program in his district. Information concerning local highway matters is most readily obtained at his office.

District offices are in these cities:

District I
Eureka
430 West Wabash Avenue
Sam Helwer, District Engineer

District II
Redding
1657 Riverside Drive
H. S. Miles, District Engineer

District III
Marysville
703 B Street
Alan S. Hart, District Engineer

District IV
San Francisco
150 Oak Street
B. W. Booker, Assistant State Highway Engineer

District V
San Luis Obispo
50 Higuera Street
A. M. Nash, District Engineer

District VI
Fresno
1352 West Olive Avenue
W. L. Welch, District Engineer

District VII
Los Angeles
120 South Spring Street
E. T. Telford, Assistant State Highway Engineer

District IX
Bishop
South Main Street
E. R. Foley, District Engineer

District X
Stockton
1976 East Charter Way
J. G. Meyer, District Engineer

District XI
San Diego
4075 Taylor Street
J. Dekema, District Engineer

EDMUND G. BROWN
Governor of California

CALIFORNIA HIGHWAY COMMISSION

ROBERT B. BRADFORD . Chairman and Director of Public Works
CHESTER H. WARLOW, Vice Chairman . Fresno
JAMES A. GUTHRIE . . . . San Bernardino
ROBERT E. McCLURE . . . . Santa Monica
FRED W. SPEERS . . . . Escondido
ROBERT L. BISHOP . . . . Santa Rosa
ARTHUR T. LUDDY . . . . . . Sacramento
FRANK A. CHAMBERS, Secretary . . . . Alameda

DEPARTMENT OF PUBLIC WORKS

ROBERT B. BRADFORD . . . . . . Director
JAMES. F. WRIGHT . . . . Deputy Director
T. F. BAGSHAW . . . . Assistant Director
JOHN H. STANFORD . . . . . Management Analyst
S. ALAN WHITE . . . Departmental Personnel Officer
RICHARD WINN . . Departmental Information Officer

DIVISION OF HIGHWAYS

GEO. T. McCOY
State Highway Engineer, Chief of Division
J. W. VICKREY . . . Deputy State Highway Engineer
CHAS. E. WAITE . . Deputy State Highway Engineer
J. W. TRASK . . . Assistant State Highway Engineer
F. W. PANHORST . . Assistant State Highway Engineer
J. C. WOMACK . . Assistant State Highway Engineer
J. P. MURPHY . . . Assistant State Highway Engineer
F. N. HVEEM . . . Materials and Research Engineer
FRANK E. BAXTER . . . . Maintenance Engineer
GEO. LANGSNER . . . . Engineer of Design
G. M. WEBB . . . . Traffic Engineer
MILTON HARRIS . . . . . Construction Engineer
H B. LA FORGE . Engineer of Federal Secondary Roads
M. H. WEST . Engineer of City and Co-operative Projects
EARL E. SORENSON . . . . Equipment Engineer
H. C. McCARTY . . . . Office Engineer
J. A. LEGARRA . . . . Planning Engineer
F M. REYNOLDS . . . . . Planning Survey Engineer
L. L. FUNK . . . . . . Photogrammetric Engineer
SCOTT H. LATHROP . Personnel and Public Information
E. J. L. PETERSON . . Program and Budget Engineer
A. L. ELLIOTT . . . . Bridge Engineer—Planning
I. O. JAHLSTROM . . . Bridge Engineer—Operations
R. R. ROWE . . . Bridge Engineer—Special Studies
J. E. McMAHON . . Bridge Engineer—Southern Area
L. C. HOLLISTER . . . Projects Engineer—Carquinez
E. R. HIGGINS . . . . Comptroller

Right-of-Way

FRANK C. BALFOUR . Chief Right-of-Way Agent
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RUDOLPH HESS . . . . Assistant Chief
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District VII

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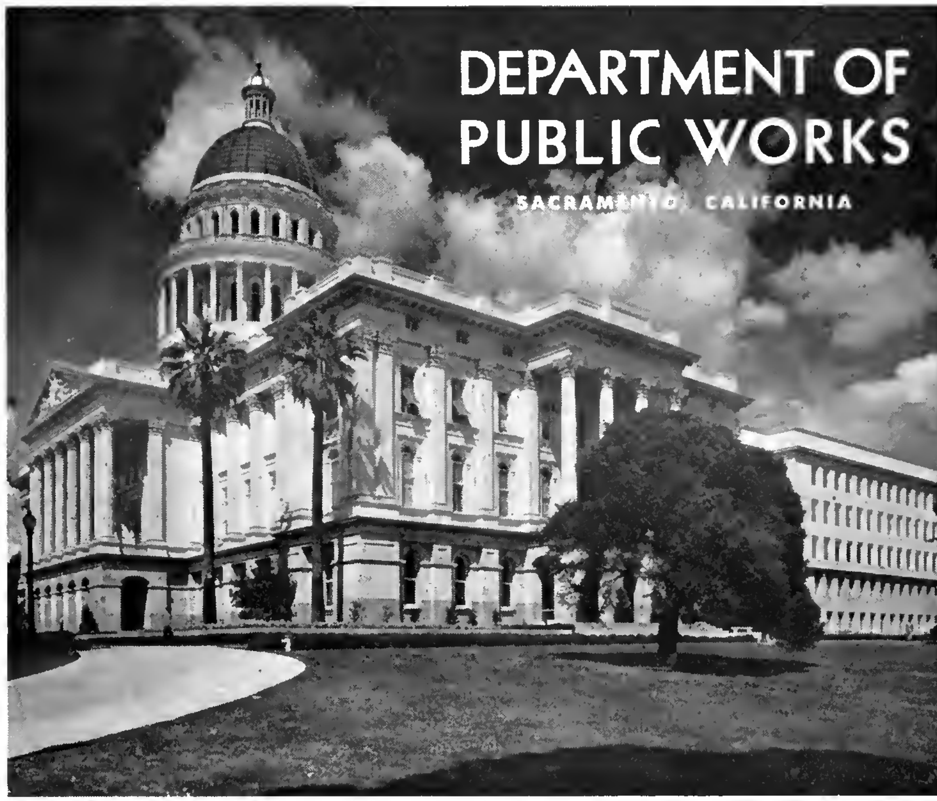

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printed in CALIFORNIA STATE PRINTING OFFICE 88600 1-59 50M

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P. O. BOX 1499
SACRAMENTO, CALIFORNIA

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CALIFORNIA HIGHWAYS AND PUBLIC WORKS

California Highways and Public Works

Official Journal of the Division of Highways, Department of Public Works, State of California

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Vol. 38 March-April Nos. 3-4

FRONT COVER

The junction of Sign Route 1 and Sign Route 17 in Santa Cruz, with its overcrossings and undercrossings, large directional signs, graceful connecting ramps and multilane, divided roadways, is typical of modern freeway interchanges.

—Photo by William R. Chaney

BACK COVER

All traffic is being routed over the new parallel Carquinez Bridge (right) until the work of widening the old bridge (left) can be completed after which time all southbound vehicles will use the old span and northbound the new one.

—Photo by William R. Chaney

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Published in the interest of highway development in California. Editors are invited to use information contained herein and to request prints of any black and white photographs.

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Report From District IV

By B. W. BOOKER, Assistant State Highway Engineer

With population in District IV racing toward the 1970 prediction of 5,000,000, traffic increases in the area demand major routes in all directions from the central core of the metropolitan area. Freeway development is therefore extensive in all populated areas including that in the central core. Construction and planning is well advanced for freeway systems radiating from such communities and cities as Santa Rosa, San Rafael, Richmond, Concord, Walnut Creek, Hayward, Fremont, San Mateo, San Jose, Los Gatos and Santa Cruz.

The year of 1958 witnessed many public meetings and hearings resulting in the adoption of freeway route location by the Highway Commission on a total of 52 miles in our district. This was accomplished in spite of the extremely complex problems of route location particularly in two of the major routes located during the year: the Junipero Serra Freeway extending from San Francisco to San Jose and to the south and the Grove-Shafter Freeway in Oakland, extending from the Nimitz Freeway to Contra Costa County.

The Junipero Serra Freeway adoption followed more than 40 informational meetings, map displays and three official public meetings held in areas adjacent to the routing by the Division of Highways before recommendation of a route was made by the State Highway Engineer to the California Highway Commission. In accordance with its established policy for route adoptions, the commission itself held two public hearings in the area subsequent to the recommendation and prior to route adoption.

The Grove-Shafter location, though shorter in length than the Junipero Serra, was no less complex, involving location through heavily developed areas.

Meetings Held

Unchronicled herein, though, and in addition to local activities, are the hundreds of meetings and conferences required of the Division of Highways personnel engaged in planning of these route locations. Conferences with local executives, planners, authorities in public works, fire, police, schools, health, parks, cemeteries, as well as churches, civic-minded organizations, industry, commerce, utilities and individuals in general are directed toward assurance that all factors of our way of life are appraised in the development of every reasonable alternate for route selections for consideration in the final determination of the route.

The year 1958 also witnessed much progress in assuring immediate future completion of extensive sections of continuous freeway systems from the metropolitan core. In this year, the

PHOTOS, UPPER—A scenic section of US 101 in Marin County. MIDDLE—An aerial of the Bayshore Freeway in Palo Alto. The University Avenue interchange is in the center of the picture. LOWER—US 40 looking south through the Big Cut from above the approaches to the twin Corquinez Bridges.

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Sacramento

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last links accomplishing continuous freeway from San Jose to Oakland were completed. Construction of the last project on U. S. 40 between Oakland and north of Vallejo is now in progress. When this 2.3-mile project is completed in early 1960 there will be a continuous freeway in service from south of San Jose to north of Vallejo. Also completed were projects extending the Embarcadero Freeway in San Francisco to Broadway and the Bayshore Freeway to Palo Alto. Nearly completed is extension of the Central Freeway in San Francisco to Turk Street. These improvements, together with construction to be completed in late 1960, will provide continuous freeway from Broadway in the downtown financial area of San Francisco or from Turk Street in the Civic Center area of San Francisco to Sunnyvale. Construction now underway extending the Bayshore Freeway northerly in the San Jose area to Brokaw Road leaves only a six-mile section to be financed to provide continuous freeway service from inner San Francisco to south of San Jose. Construction of the last link of the Route 5 Freeway in San Jose is also financed assuring early continuous freeway service from San Francisco via San Jose to beyond Los Gatos. Near future completion of continuous freeway service was also assured on US 101 northerly of San Francisco with the completion of one project at the San Quentin Wye and the start of construction of two projects: one at Greenbrae and the other from US 101 to the completed freeway approaches to the Richmond-San Rafael Bridge. When these projects are completed, continuous freeway service will exist from San Francisco to north of San Rafael and also to Richmond.

Spectacular Project

Among the year's accomplishments involving connecting links, perhaps the most impressive of the year was the completion of the additional Carquinez Bridge with its complex system of approaches, and the five miles of freeway which runs southerly to meet completed sections of US 40 in the hills above Hercules. While the

One of the bridges under construction at Corte Madero Creek on U. S. 101 in Marin County. The old bridge and lift span will be replaced by a new high level structure.

project is spectacular in its own magnitude—the huge structure duplicating the existing one, the graceful curves of interchange ramps serving the bridges from all directions and the monumental cut through high hills southerly from the strait—the most impressive feature is the saving of lives, time and miles between Vallejo and the San Francisco-Oakland Bay Bridge. The old route of transcontinental US 40 through growing cities and through the varied topography of the Bay's eastern shore had long been inadequate. Only a bold solution to the problems involving direct routing along new alignment could properly cope with tremendous volumes, current and predicted, which the artery serves. The completion of this facility saves 20 minutes between Oakland and Carquinez Bridge as compared to the old route. During summer weekends the savings amount to more than an hour.

The system of freeways which has been planned throughout our area for many years through co-ordination with local authorities is predicated on an integrated system of transportation utilizing expansion of existing facilities. About one-third of the freeway system as planned is completed and can only be considered as the first stage of the network. *It must be built in its entirety to be fully effective.* The congestion occasioned on completed portions of the system such as the Nimitz and Bayshore Freeways during peak hours, is not a reflection of inadequate capacity of these facilities. It is an indication that they are being called upon to serve considerable traffic volumes which would be carried by other portions of the planned system if such were available today. Toward this end, the early construction of the MacArthur and Junipero Serra Freeways, as well as other facilities both state and local, is being expedited.

Let us review in some detail the overall picture of freeway development along the various routes.

US 40—San Francisco to Carquinez Bridge

Starting at the intersection of James Lick (Bayshore) Freeway and Central Freeway at 13th Street in San Francisco, US 40 proceeds across the San Francisco-Oakland Bay Bridge (US 40 and 50) and northerly via the Eastshore Freeway through Richmond to the Carquinez Bridge and points north and east.

The eight-lane freeway from the distribution structure to south of the El Cerrito Overhead on US 40 was completed in November of 1956. This portion of U. S. 40 is also Sign Route 17. A landscaping project costing approximately $235,000 is presently under way within these limits.

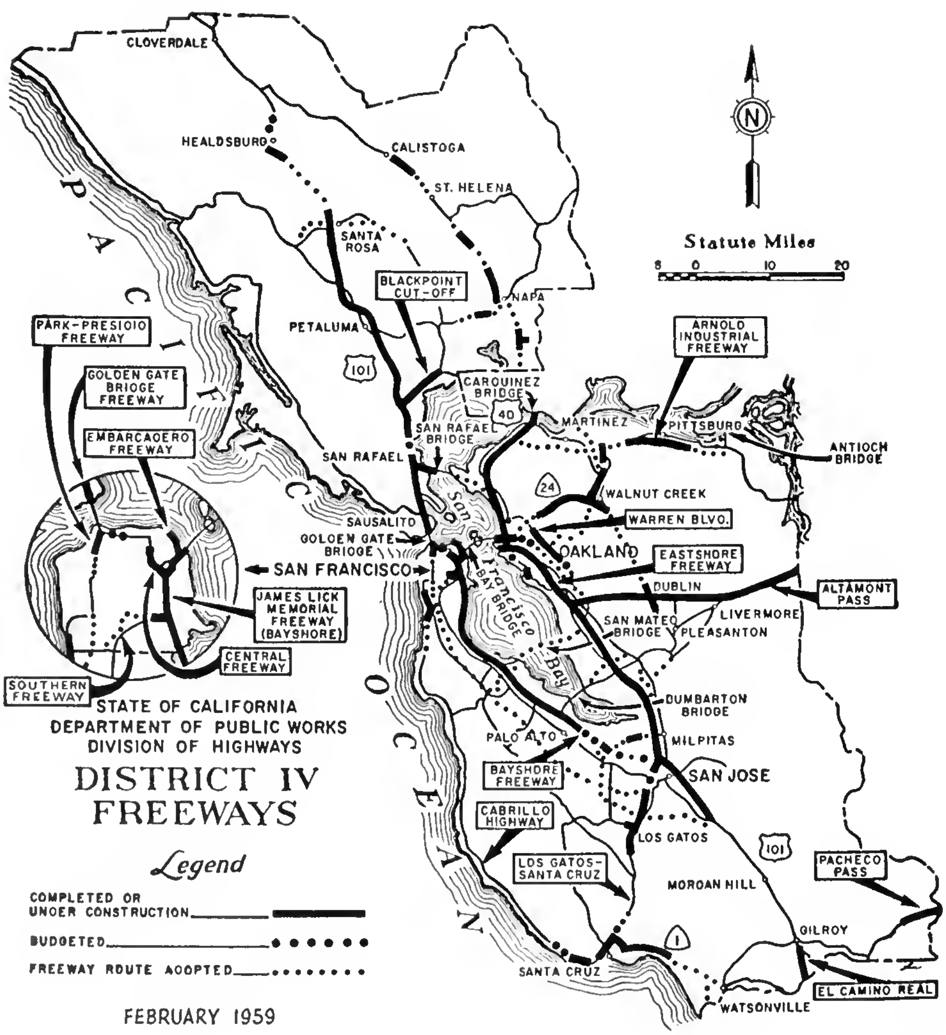
The last link of freeway between the Bay Bridge and Carquinez Straits is presently being constructed from south of El Cerrito Overhead to Jefferson Avenue in Richmond. The 2.3 mile contract is being performed as a joint venture by Piombo Construction Company, M & K Corporation and Connolly Pacific Company. It is estimated to cost approximately $5,583,-000 and is expected to be completed in January of 1960. Three interchanges and a pedestrian overcrossing are included in the development of this six-lane freeway facility.

Immediately to the north of the portion now under construction, 4.8 miles of freeway extending to Hilltop Drive, north of San Pablo, has been open to traffic since early 1957. In keeping with the Division of Highways policy of opening completed portions of freeway as soon as possible, a temporary connection from the freeway to the old highway just south of Rodeo was constructed and a major portion of the 4.9-mile project between Hilltop Drive and Hercules, which was constructed by McCammon - Wunderlich and Wunderlich Contracting Company, was opened to traffic in February of 1958. The remaining portion to Crockett was opened to traffic in November of 1958. Contractors on this $7,320,000 project was Ferry Brothers, J. M. Ferry, Peter L. Ferry and L. A. and R. S. Crow. This portion of the freeway contains the largest highway cut in the United States; being 3,000 feet long, 1,370 feet wide at the top and 300 feet deep.

Also opened to traffic in November, 1958, was the new bridge constructed easterly of and parallel to the existing bridge across Carquinez Straits. It is presently carrying two lanes of traffic in each direction. Temporary connections have been provided at each end to divert traffic during the completion of an additional contract for the Crockett approach ramp connection and modification of the present bridge which will carry three lanes of southbound traffic; the new bridge then will carry four lanes of northbound traffic. The contractor on this work is Rothschild, Raffin and Weirick and the cost is approximately $1,315,000. The existing bridge is expected to be reopened to traffic in July of this year.

Also completed this year have been signing and landscaping projects on the completed portions of the freeway north of Jefferson Avenue in Richmond.

North of State Sign Route 4 (Arnold Industrial Freeway), this project was financed by special toll bridge bonds as an approach to the Carquinez Bridge.



US 50—Bay Bridge to Castro Valley

Design studies are proceeding on the entire 15.3 miles of the future MacArthur Freeway routing between the distribution structure and the completed freeway at Castro Valley to the east. The first construction projects will be at the western extremities and funds in the amount of $10,000,000 have been included in the 1959-60 Budget to start construction of this eight-lane interstate facility between the distribution structure and Grand Avenue. Additional funds will be required in a future budget to complete this portion; the total construction cost of which is estimated at $15,000,000. A total of $39,166,000 has been expended or budgeted for rights - of - way acquisition on this major facility to date. The expediting of construction of this entire interstate freeway is anticipated and should provide relief to congestion now occasioned at peak hours on the Nimitz Freeway which is carrying considerable US 50 traffic at present.

Castro Valley to San Joaquin County Line

Freeway construction was completed in 1957 between Center Street in Castro Valley and Dublin, and to the east US 50 is an expressway with controlled number of intersections at grade. Studies are now under way for the future elimination of at-grade intersections by construction of interchanges along this interstate route. While future elimination of the intersections was contemplated at the time of original construction and some of the right-of-way acquired at that time, detailed design was not completed.

A $200,000 resurfacing project is included in the 1959-60 Fiscal Year construction program for resurfacing portions of this route between Greenville and Mountain House Road.

US 101—Golden Gate Bridge to San Rafael

Progress has continued in 1958 toward the completion of US 101 to full freeway. Funds are provided in the 1959-60 Budget for further development to high standards and extension of freeway portions.

Construction was extended northerly to the Greenbrae Intersection in 1957. Presently under contract is the second stage construction by Dan Caputo Company, Dan Caputo, and Cambrian Gateway, and includes the structures over Corte Madera Creek for the northbound freeway lanes and for the southbound on-ramp from Sir Francis Drake Boulevard. Included in the 1959-60 Budget are funds in the amount of $1,240,000 to complete this interchange. This work primarily will consist of eliminating the old bridge and lift span across Corte Madera Creek and replacing it with a new high level structure to serve as a northbound off-ramp.

Recently completed is a project extending 1.4 miles from the Greenbrae Interchange to 0.5 mile north of the California Park Overhead. The work which consisted of grading, paving, and structures for a six-lane freeway cost $1,919,000, and was performed by Frederickson and Watson Construction Company. The existing wooden structure over the Northwestern Pacific Railroad at California Park was replaced by twin three-lane structures. With the completion of the Greenbrae Interchange, US 101 will be completed to freeway standards between north of San Rafael and San Francisco.

From San Quentin Wye to the north city limits of San Rafael, the freeway has been completed and in use by traffic for some time. Included in the 1959-60 Budget are funds in the amount of $50,000 for landscaping portions of the freeway between Richardson Bay Bridge and San Quentin Wye.

Other projects planned on US 101 in southern Marin County include the improvement of the Vista Point at the Golden Gate Bridge. A $40,000 project in the 1959-60 Budget provides for construction of road connections and parking area for southbound traffic.

This pedestrian overcrossing near the Richardson Bay Bridge on US 101 in Marin County is typical of such structures being built across freeways throughout the State.

San Rafael to Petaluma

The 1959-60 Budget includes $1,250,000 for improvement of portions of US 101 between the north city limits of San Rafael and Lucas Valley Road. The 2.4-mile project includes construction of the Freitas Parkway interchange and frontage roads. An interim interchange will also be provided at San Pedro Road.

Just north of San Rafael, a contract has been completed adding a southbound truck lane over Puerto Suelo Hill. This project costing $139,000, minimizes congestion on through lanes due to slow moving vehicles on the sustained grade.

Twin bridges were completed in 1957 over the Northwestern Pacific Railroad at Forbes Station Overhead. Planning studies are well advanced for the future development of the existing 18.9-mile expressway between Forbes Overhead and south of Petaluma. This portion is planned as a future full freeway with no at-grade intersections.

Planning studies are well advanced for the future development of the expressway and nonfreeway portions of the remainder of this route connecting with the completed freeway at Petaluma.

Petaluma to Mendocino County Line

Five contracts were required to complete the 18.5-mile freeway portion from south of Petaluma to the south city limits of Santa Rosa. Presently under contract is a $21,000 planting project on this portion between Petaluma Creek and Santa Rosa. Through Santa Rosa, the existing expressway has been in use for many years. Agreement has been reached for full freeway development through this area.

North of Santa Rosa, the highway is not as yet constructed to freeway standards. Future freeway location has been adopted as far north as Lytton. Work is now being performed by Guy F. Atkinson Company constructing 1.2 miles of the Healdsburg Bypass south of the city and rough grading an additional 3.7 miles of the future freeway project to the north. This work between Grant Avenue and Chiquita Road will cost approximately $1,752,000 and includes partial construction of interchanges at Grant and South Healdsburg. Twin plate girder, reinforced concrete deck structures carry the four-lane, ultimate six-lane, freeway over the Russian River. Two million seven hundred fifteen thousand dollars is included in the 1959-60 Fiscal Year Budget to extend the Healdsburg Bypass freeway 4.1 miles to a connection with the present highway at Lytton.

Design for the other portions of the initial four-lane facility northerly of Santa Rosa to Lytton is well advanced. An expressway with some grade separation structures is being planned through this section. From Lytton to the Mendocino county line, studies for future development to freeway standards continue. Informational meetings have been held with the technical staffs of the local agencies and public hearings leading to final route adoption are anticipated in the near future.

Approximately $12,500,000 has been expended or budgeted for rights-of-way acquisition on US 101 from the Golden Gate Bridge to Lytton and $34,043,000 has been expended for construction of the 50.5 miles now completed.

US 101 (Bypass)—San Francisco to Polo Alto

From its intersection with US 101 at Alemany Boulevard in San Francisco US 101 Bypass is mostly referred to as the Bayshore Freeway as far as San Jose. With several projects on this route included in the 1959-60 Fiscal Year construction program there are approximately six miles from Fair Oaks Avenue in Sunnyvale to Brokaw Road near San Jose remaining to be financed for completion of this route to freeway standards between San Francisco and San Jose.

While a continuous full freeway is in service between these limits, other improvements are continuing along this portion of the route. Now under contract is a landscaping project across the recently completed "overwater fill" at Candlestick Point. Completed this year were bus stops at the Third Avenue Interchange in San Mateo at a cost of $41,000. Under construction is a revision of the East Hillsdale Boulevard Interchange and landscaping improvements between Peninsular Avenue and 16th Avenue in San Mateo.

Heavy turning movements during peak hours at various interchanges, providing for local service southerly of South San Francisco to San Mateo, have dictated early expansion of the present six-lane between Colma Creek near South San Francisco and Penin-

When completed this interchange on the James Lick Memorial Freeway (Bayshore) in San Francisco will connect with the first unit of the Southern Freeway under construction in the right middleground.

sular Avenue Interchange serving Burlingame and San Mateo. A $1,900,000 construction project will be under way in the 1959-60 Fiscal Year which will add an additional lane in each direction. The added lanes will, in general, be constructed along the outside of existing lanes without reduction in median width separating directions of travel. It will, however, be necessary to transition the widening from the outside to the median area at interchange locations. The widening will be accomplished within the existing rights-of-way.

From Bransten Road to the Santa Clara county line, the eight miles has been constructed as four separate projects. The first of these was the Willow Road Interchange completed in 1956. The second contract between Willow Road and 0.5 mile south of the Santa Clara county line was completed in June of 1958 by Charles L. Harney, Inc. Construction on this 2.2-mile section cost $1,832,000.

The two-mile project extending north of Marsh Road, the third project, was also completed in June of 1958. Like the other three, it provided an initial six-lane, ultimate eight-lane freeway at a cost of $1,697,000. The contractor on this project was also Charles L. Harney, Inc.

Linking the above three projects and the completed freeway to the north, the 3.8-mile relocation at Redwood City from Bransten Road to Marsh Road was completed in July of 1958. The $5,221,000 project was performed as a joint venture by Piombo Construction Co., M & K Corporation, and Connoly and Pacific Co.

Additional improvements are also contemplated during this next year on already completed portions of the freeway. Funds are included in the 1959-60 Budget in the amount of $200,000 for the landscaping project between Harbor Boulevard in Redwood City and the Santa Clara county line.

US 101 (Bypass)—Palo Alto to San Jose

Contracts are under way for the improvement of much of this section. Presently under construction is the interchange at the intersection with Sign Route 9. This project, costing approximately $1,257,000, will include an overpass structure carrying Mountain View-Alviso traffic over Bayshore Freeway and short sections of six-lane and four-lane divided highway within the interchange area. The contract on this portion is being per-

UPPER—US 101 in Marin County north of the Golden Gate Bridge. LOWER—The new Petaluma Creek Bridge on Sign Route 37 at the north end of San Francisco Bay.

formed as a joint venture by Dan Caputo and M. J. B. Construction Company.

Also under construction is 4.4 miles of freeway extension from the San Mateo-Santa Clara county line to Stierlin Road near Moffett Field costing approximately $3,465,000. This portion is being constructed by L. C. Smith Company and Concar Ranch and Enterprises.

A further extension to Fair Oaks Avenue in Sunnyvale will be under way this year with $3,947,000 included in the 1959-60 Fiscal Year construction program.

The section from 0.5 mile north of Brokaw Road to Taylor Street, 2.7 miles long, is now under construction. Estimated cost is approximately $4,315,000. The project includes a major interchange between the Nimitz Bayshore and Sign Route 17 freeways. It includes work on Sign Route 17 freeway to First Street in San Jose, and extends Bayshore Freeway to north of Brokaw Road. The work is being performed by Gordon H. Ball, Gordon H. Ball, Inc., Ball and Simpson and Lew Jones Construction Company.

Design studies are continuing on the remaining section between Sunnyvale and Brokaw Road. Completion of this 5.8-mile portion together with those portions under construction and already financed will provide a continuous freeway from San Francisco to south of San Jose.

San Jose to US 101 (Ford Road)

The last three-lane portion on the route was eliminated in 1957 by completion of a four-lane, future six-lane, freeway in the City of San Jose extending from Santa Clara Street to north of Taylor Street.

South of Santa Clara Street to Ford Road, the existing expressway has been in operation since 1947. Planning has proceeded for the eventual replacement of intersections at grade by interchanges.

US 101—El Camino Real

While not a freeway, improvements along this route justify inclusion in this article. Traffic signal and channelization projects have been completed at numerous locations. In addition, portions have been widened to four- and six-lane, undivided and divided, conventional city street arterial standards.

A major project recently completed was a 3.9-mile widening project between San Tomas Aquino Creek in Santa Clara to State Sign Route 9 in Sunnyvale. This $1,345,000 project was performed as a co-operative project. The Santa Clara County Flood Control District financed an estimated $175,000 for drainage improvements desired to be constructed at the time of the highway work. Work done consisted of grading, surfacing and structures necessary to widen the highway to four 12-foot lanes with a 16-foot curbed median. The contractor on this project was A. J. Raisch Paving Company.

To be advertised shortly is a $200,000 project for resurfacing portions of US 101 between State Sign Route 9 and Palo Alto.

Expansion of the existing highway to six lanes between Silva and Chadbourne Avenues in Millbrae was completed in November of 1958. This project which cost approximately $111,000 also included traffic signals and lighting. The City of Millbrae completed additional work in conjunction with this project including curbs, gutters, and parking lanes.

Also under construction is a traffic signal and channelization project between Shakespeare Street and Theta Avenue in Daly City. This is a cooperative project with the City of Daly City and is being constructed by Electric Maintenance and Service Company.

US 101—Ford Road to San Benito County Line

In 1956, the three-lane width between Ford Road and Llagas Creek was expanded to a four-lane section. Included in the 1959-60 Budget are funds amounting to $225,000 for the resurfacing of the four-lane section between Llagas Creek and Gilroy. Location studies are still underway for a freeway routing between Ford Road and south of Gilroy following land-use studies completed by the Santa Clara County Planning Department and Trafficways plan recently reported by the DeLeuw Cather and Company. Public meetings will be scheduled upon completion of studies. South of Gilroy to the San Benito County line, 5.8 miles of four-lane expressway have been in operation since 1951. This section is planned for a future six-lane freeway when traffic requirements and availability of funds permit.

US 101—101 Bypass in San Francisco

Construction is now underway on the first unit of the Southern Freeway. It consists principally of an interchange with James Lick (Bayshore) Freeway at Alemany Boulevard. The City of San Francisco is contributing approximately $1,400,000 to the cost of this $7,629,000 project. In addition to the interchange, the project being constructed by Guy F. Atkinson includes approximately 0.5 mile of freeway to the west.

The second unit of this freeway is included in the 1959-60 Fiscal Year budget. A total of $4,850,000 has been provided for construction westerly to Mission Street. Route location beyond this point has been determined as far as Orizaba Avenue near the south city limits.

Rights-of-way acquisition is well advanced with $15,625,000 appropriated prior to this year. An additional $1,900,000 was appropriated this year and $1,500,000 is included in the 1959-60 Fiscal Year budget. Overall construction costs on the entire 4.3 miles of the State's portion of the Southern Freeway are estimated at $18,000,000.

This freeway is intended to serve traffic in conjunction with a freeway project to the east from the James Lick (Bayshore) Freeway on a routing which is not now a part of the State Highway System.

James Lick Freeway (Bayshore)

Except for the revisions in the vicinity of Alemany Boulevard to provide connections to the Southern Freeway, James Lick (Bayshore) Freeway is completed within San Francisco. Landscaping, ground cover and erosion control work continues. A landscaping project costing approximately $42,500 is now underway between 5th and 15th Streets.

A sum of $100,000 is included in the 1959-60 Fiscal Year budget for

UPPER LEFT The new Sign Route 17 freeway from Route 42 in Los Gatos to Bascom Avenue will soon be opened to traffic. UPPER RIGHT Relocation of the Bayshore Freeway in Redwood City showing the Harbor Boulevard interchange in the foreground. LOWER LEFT—Bayshore Freeway construction near Moffett Field in Santa Clara County. Mountain View-Alviso Road interchange is in the center. LOWER RIGHT—Construction on the San Jose-Los Gatos freeway showing the Stevens Creek Road interchange in the foreground.

the installation of a barrier in the median between Third Street and Army Street. This is the second installation of this type on this freeway, the first unit having been installed in 1957 between 17th Street and Army Street to minimize the number and severity of spectacular accidents resulting from median crossings into opposing traffic.

Central Freeway

This freeway is a distributor to the Civic Center area of San Francisco. The first unit, a single-level elevated structure, was opened to traffic in 1955 from the James Lick Freeway, to South Van Ness Avenue. With the elevated portion of James Lick (Bayshore) Freeway, this portion is often referred to as the "San Francisco Skyway."

Nearing completion is the second unit, a 1.3-mile-long extension from South Van Ness Avenue to Turk Street. This portion is a two-level elevated viaduct over the city streets, leaving them free to handle cross-traffic movements. The $7,725,000 project is being constructed by the Peter Kiewit Sons Company and is expected to be open to traffic in April of this year. Southbound traffic will be carried on the three upper-level lanes and northbound traffic will be carried on the lower deck. Shoulders have been provided for emergency parking clear of the through lanes on each level of the facility. Rights-of-way acquisition has cost a total of $8,626,000 and construction costs will approximate $11,847,000. $125,000 has been included in the 1959-60 Budget for landscaping between Mission Street and Turk Street.

Sign Route 17

The freeway entrance to the City of Santa Cruz between the north city limits and Mission Street was completed in December of 1956, providing much-needed traffic distribution facilities in the Santa Cruz recreational area. Seventy-five thousand dollars has been included in the 1959-60 construction program for a landscaping project on Sign Routes 1 and 17 near Santa Cruz.

Bids were opened March 4, 1959, for construction of 3.3 miles of four-lane expressway, ultimate six-lane freeway, between the completed freeway at Sign Route 1 near Santa Cruz and Carbonera Creek near Glen Canyon Road. A total of $1,880,000 is available for the project which includes an interchange at Pasatiempo Underpass at Beulah Park and frontage roads along most of the new expressway section. This work will eliminate a section of three-lane highway. The remaining three-lane highway through Scotts Valley will be replaced by a future project now in the design stage.

From Lexington Dam to the Saratoga Avenue Interchange in Los Gatos, expressway facilities were constructed in 1956.

Construction of the 8.8-mile relocation project between the junction of the Saratoga-Los Gatos Highway in Los Gatos and Bascom Avenue in San Jose is nearly completed and may be open to traffic before the printing of this article. This project estimated to cost approximately $5,835,000 is a four-lane, future six-lane, freeway on relocation. Alignment of this section lies approximately midway between the Santa Clara-Los Gatos Road and the San Jose-Los Gatos Road (existing Sign Route 17). Work is being performed by Gordon H. Ball, Ball and Simpson, and Lew Jones Construction Company.

The 1959-60 Fiscal Year construction program includes $190,000 for landscaping at the Saratoga Avenue

This new high level bridge now takes US 101 traffic across Richardson Bay in Marin County.

Interchange and along the freeway to Bascom Avenue. It also includes $100,000 for drainage facilities and channel lining at Los Gatos Creek in Los Gatos.

The two remaining projects required to complete a continuous freeway from southwest of Los Gatos to north of Oakland are now under construction. One project between Bascom Avenue and North Fourth Street in San Jose will be constructed as an initial four-lane, ultimate six-lane, freeway and will complete a four-lane divided freeway through the City of San Jose. The work is being performed as a joint venture by Gordon H. Ball, Gordon H. Ball, Inc., Ball and Simpson, and Lew Jones Construction Co. The 2.5-mile portion will cost approximately $3,117,000 and will include four interchanges. Work is expected to be completed in the spring of 1960. The other project is the 1.2-mile portion between First Street and 0.3 mile north of existing Bayshore Highway. Initial construction will be four-lane divided with the future addition of two lanes contemplated when needed. The $4,315,000 project will include a full cloverleaf at the intersection of Nimitz and Bayshore Freeways and 2.7 miles of four-lane freeway on US 101 Bypass. Work is being performed by the same joint venture contractors.

San Jose to Oakland (Nimitz Freeway)

North of this point the initial four-lane freeway has been in service since 1954 as far as Warm Springs. The last unit, which completed the gap in continuous freeway San Jose to Oakland, was opened to traffic late in 1958. The $6,840,000 project, from Warm Springs to Beard Road north of Centerville in Fremont was constructed as an initial four-lane, ultimate six-lane freeway. The 9.9-mile-long contract was performed by contractors Gordon H. Ball and Ball and Simpson.

Immediately north of Beard Road, a 5.8-mile section of the freeway was completed to Jackson Street in 1957. During the past year, a pedestrian overcrossing was constructed at Eldridge Avenue to provide facilities for school children to cross the freeway. This structure located between Ten-

UPPER—The new Embarcadero Freeway in San Francisco connects traffic with Main, Beale, Mission, Fremont and Folsom Streets and north of Market Street with Broadway, Sansome and Battery Streets. LOWER—The Central Freeway Extension from South Van Ness Avenue (lower right) to Turk Street (center left). Civic Center in right middleground.

nyson Road and Jackson Street in Hayward cost approximately $54,000.

North of Jackson Street, the freeway has been in operation since 1953. The portion between Washington Avenue in San Leandro and High Street in Oakland was widened to six lanes in 1956 to handle the increased flow of traffic resulting from completion of the four-lane freeway connection between US 50 and the Nimitz Freeway. Plans have been completed for a project to provide a barrier in the median between High Street in Oakland and Washington Avenue. This $306,000 project is expected to minimize the number and severity of spectacular accidents that have occurred due primarily to median crossings on this 6.8-mile facility.

Included in the 1959-60 Budget is a project costing approximately $320,000 for construction of the Floresta Drive Overcrossing in San Leandro. This project will be performed as a co-operative project between the City of San Leandro and the State, with the city providing an estimated $160,000 of the funds required.

Nimitz Freeway Through Oakland

In November of 1958, the last unit in Oakland was opened to traffic. This 1.6-mile project extended from Fallon Street to Market Street in Oakland. An eight-lane freeway partially on elevated single - deck structure and partially earth fill was constructed. Construction costs for this project approximated $5,134,000. The contractor was Johnson, Drake and Piper, Inc. North of this project 2.1 miles of elevated, double-deck freeway was completed in 1957. The Cypress Street Overhead, as it is locally known, provides four lanes of traffic on each deck with opposing traffic traveling on separate levels. The former highway (Cypress Street) was reconstructed at surface level, thereby supplying a divided arterial street for use by local traffic. Funds in the amount of $57,000 have been included in the 1959-60 Budget for landscaping this portion of Sign Route 17 extending from Market Street to the distribution structure, the northerly terminal of the Nimitz Freeway.

US 40 to US 101

Soon after the completion of the San Rafael-Richmond Bridge in 1957, Sign Route 17 was extended from the Eastshore Freeway to connect with US 101 south of San Rafael at San Quentin Wye. The new bridge carrying three lanes of traffic on separate levels, and the east approaches extending to Marine Street in Richmond were constructed through bond financing by the Division of Bay Toll Crossings.

The route for the future connection between US 40 (Eastshore Freeway) at its intersection with Hoffman Boulevard has been adopted in its entirety. Preliminary design is under way for the initial construction of six lanes between the above limits, with provisions for eight lanes between 32d Street and Marine Street. Numerous interim projects, including channelization of various intersections and drainage improvements have been completed along the present Hoffman Boulevard routing to allow more efficient use of the existing facilities during the interim period prior to freeway construction.

The west approaches of the Richmond-San Rafael Bridge have been and are being constructed by the Division of Highways with state highway funds. A freeway approach from the bridge to west of Sir Francis Drake Boulevard was completed in 1957. Presently under construction is a two-mile project extending the freeway to the north terminus of Sign Route 17 at US 101 south of San Rafael. Construction will cost approximately $855,000. The work on this four-lane freeway is being performed by Gallagher and Burke, Inc.

Sign Routes 9 and 21

The route has been adopted from Warm Springs to Mission San Jose for the Sign Route 9 portion of this Interstate Route. The adopted location lies to the west of the existing highway. From Mission San Jose northeasterly to Sunol, the route has also been adopted and the location follows in general along the existing Sign Route 21 with substantial reductions in rate of grade over Mission Pass. Design studies are well advanced along both these sections of the interstate system. From Sunol to the connection with US 50 at Dublin, preliminary meetings have been held in the area and planning studies are under way for determination of final route location.

Dublin to Martinez

The route has been adopted and design studies are in advanced stages. Right-of-way is being acquired between Danville and Walnut Creek.

From south of Walnut Creek at Rudgear Road to a junction with Route 24 near Oakland Boulevard and thence to the newly completed freeway north of Walnut Creek, a 4.2-mile four- and six-lane initial facility is now under construction. This project started in June of 1957 is expected to be completed in the latter part of this year at a cost of approximately $8,546,000. The work on this project which includes five interchanges and 11 other major structures is being performed by Charles L. Harney, Inc. This project also constructs a part of State Sign Route 24 from Walnut Creek to the completed freeway east of Lafayette.

From Walnut Creek to Monument a 2.9-mile section of freeway was placed into operation in January of 1957, at a cost of $2,900,000. The route has been adopted and design is nearly completed from Monument to the future Martinez-Benicia Bridge. Construction of the bridge and approaches is to be financed through revenue bonds in conjunction with toll bridge project authorized by the Legislature in 1952. South of Escobar Street in Martinez, the freeway will be financed from federal and state participation in the Interstate Highway Program. The proposed high-level Martinez - Benicia Bridge will cross the strait immediately west of the existing Southern Pacific Railroad Bridge.

Sign Route 24

Sign Route 24 starts at US 40 (Eastshore Freeway) in Berkeley and proceeds easterly through Walnut Creek, Concord, Antioch and to points north via the Antioch Bridge. At the Broadway Tunnel an additional two-lane bore is to be con-

ALAMEDA COUNTY. UPPER LEFT—Looking south along US 40 toward downtown Oakland with the El Cerrito Overhead in the center and the Eastshore Freeway beyond. UPPER RIGHT—The new Fallon to Market Street section of the Nimitz Freeway. LOWER LEFT—The Beard Road interchange on the Nimitz Freeway south of Hayward. LOWER RIGHT—The Nimitz Freeway in southern Alameda County showing residential development adjacent to the freeway.

structed to the north of the two existing two-lane tunnels initially, then the additional lanes will allow four-lane operation in one direction during peak hours as well as permitting maintenance of the tunnels during off-peak hours without restricting traffic flow. An additional two-lane bore is contemplated for future traffic requirements.

Extending east from the portal of Broadway Tunnel, design is well advanced on a future eight-lane freeway. As an interim measure, an additional lane was added in 1956 to the westbound lanes between the tunnel and Orinda to permit normal traffic to pass slow-moving vehicles safely on this sustained grade. The Orinda Interchange has been in service since 1955.

Orinda to Arnold Industrial Freeway

Presently under construction is a six-lane ultimate eight-lane freeway between Orinda Road and 0.8 mile east of Sunnybrook Drive. This 2.1-mile project connects to the Lafayette Bypass completed in 1957. Work is being performed on this $3,900,000 project as a joint venture by Gordon H. Ball, Gordon Ball, Inc., and Ball and Simpson. Completion is expected in September of this year. The contract is a co-operative project of the Central Contra Costa Sanitary District, the County of Contra Costa and the State. Sewer work which is being done as a part of the freeway contract is being financed by the county and sanitary district at a cost of $380,000.

Also completed in 1957 under separate contract was the Pleasant Hill Interchange, immediately east of the Lafayette Bypass. This interchange serves as a connection between the state freeway and an important county expressway to the north. It will also serve in the future as a connection southerly with the Shepherd Canyon Freeway to Oakland. The remaining portion of the freeway to Walnut Creek is now under construction and is covered under Sign Route 21. By the end of 1959 a continuous freeway will be in service from west of Orinda to north of Monument near Concord.

Design is nearly completed for extending the freeway now terminating at Monument to a connection with Arnold Industrial Freeway north of Concord.

Concord to Solano County Line

Sign Routes 24 and 4 are identical routings between their westerly junction north of Concord and Neroly Road east of Antioch. The portion of the freeway between Willow Pass Road to A Street in Antioch was completed in 1952. From A Street to Neroly Road and thence to the Sacramento county line via the Antioch Bridge the route has been adopted and declared a freeway. Design studies are well advanced. East of Neroly Road to the San Joaquin county line the status of development is discussed under Sign Route 4.

Embarcadero Freeway

The last portion of this multilane elevated freeway for which a routing has been determined was opened to traffic in February of this year. Freeway service is now provided from the on and off ramps at Broadway and Sansome Streets, to the Skyway as well as to the San Francisco-Oakland Bay Bridge. This 1.2-mile section cost approximately $7,627,000, and work was performed by Charles L. Harney, Inc. Included in the work was extensive reconstruction work required to relocate portions of both the State Belt and Southern Pacific Railroad tracks on the Embarcadero under the freeway.

Construction was started on the first of the three projects for this freeway in May of 1955 by MacDonald,

The Morrissey Avenue interchange in Santa Cruz. Beyond are the ramps connecting Sign Route 17 with Sign Route 1.

The three-level interchange near Hercules where two freeways meet. Top level is US 40; bottom level is the Arnold Industrial Freeway; middle level is for on ramps to US 40.

Young and Nelson, Inc., and Morrison-Knudsen. The entire facility, 1.5 miles in length, has cost approximately $14,862,000 for construction and $11,720,000 has been expended or budgeted for rights-of-way acquisition.

Junipero Serra Freeway

On July 23, 1958, the Highway Commission adopted the route for the portion of Junipero Serra Freeway in San Mateo and Santa Clara Counties between San Bruno Avenue near the end of the existing Junipero Serra Boulevard and Saratoga Avenue southwest of Santa Clara. State Highway Route 239 as designated by the State Legislature in February, 1957, has now been entirely adopted from US 101 south of Ford Road near San Jose to San Bruno Avenue. The cost of the initial development is estimated at approximately $74,000,000 including rights-of-way. The portion of this freeway north of San Jose is a part of the Interstate Highway System, approximately 90 percent of which will be financed from federal funds. Design is being expedited on this very important route and numerous construction projects are anticipated. Extensive rights-of-way acquisition cannot commence until detailed design studies have progressed and freeway agreements reached with local authorities. It is expected that the first construction project, the limits of which are not known at this time, may not be under way for several years.

From San Bruno Avenue north to the present intersection with Sign Route 1 in Daly City, the existing expressway is designated as State Highway Route 237. It was constructed by Joint Highway District No. 10 which was dissolved by the Legislature in July of 1956 and taken into the State Highway System at that time. Studies are presently under way for possible freeway relocation between San Bruno Avenue and the San Francisco county line. Initial public meetings have been held and further studies are being made prior to other hearings leading to route adoption.

Sign Route 1 (Cabrillo Highway)

This route has been developed as an expressway between Edgemar Road in Daly City to Lake Merced Boulevard in San Francisco. This 4.6-mile expressway was completed in 1956 and the northerly portion from the south city limits of San Francisco to Lake Merced Boulevard was constructed by the City of San Francisco.

A $1,391,000 project was completed in 1958 between Edgemar in Pacifica and Skyline Boulevard at Edgemar Road in Daly City. This 2.2-mile, four-lane expressway bypassed the section of two-lane coastal road along Thornton Bluffs south of San Francisco. Maintenance of traffic due to wet weather slides had been difficult and costly on the old coastal road. Contractor was McCammon-Wunderlich and the Wunderlich Contracting Company.

A route was adopted on January 22, 1958, extending this expressway southerly to Pedro Valley in Pacifica and design studies are under way. Relocation studies for the Devil's Slide area are well advanced and preliminary meetings have been held.

In the vicinity of Santa Cruz the 2.1-mile initial four-lane, future six-lane freeway between the junction of Sign Routes 1 and 17 to 0.3 mile east of Morrissey Avenue was completed in November of 1958. The construction was performed as a joint venture by Dan Caputo and Dan Caputo and Edward Keeble. Also completed last fall were the initial two lanes of the future four-lane expressway on new alignment between Swift Street in Santa Cruz and Wilder Creek north of the city limits. This project was jointly financed by the State and Joint Highway District No. 9 with the State contributing $419,000 to the cost. The contractor was Granite Construction Company. From Wilder Creek to four miles south of Davenport plans are complete for the initial two lanes of a future four-lane, limited-access freeway. Seven hundred

Expressway construction on the Black Point Cutoff (Sign Route 37) with the new bridge across Petaluma Creek in the upper center and the Atherton Avenue interchange in the foreground.

thousand dollars is included in the 1959-60 Fiscal Year program for this project which will be under construction this summer.

South of Santa Cruz, an expressway has been in operation to Rob Roy Junction for some time. Design studies are now in progress to convert this portion to a full freeway. Studies are also being made to expand the existing three-lane highway between Rob Roy Junction and Watsonville. South of Watsonville to the Monterey county line, the route has been adopted and design is well advanced for a four-lane, ultimate six-lane freeway facility.

19th Avenue Freeway (San Mateo)

In March, 1957, the State Highway Commission adopted the route for this freeway extending from Sign Route 5 (Skyline Boulevard) west of San Mateo, to the Alameda county line, a distance totaling 7.2 miles. Design studies on this four-lane facility are well advanced and rights-of-way acquisitions are in progress. This freeway will connect to the route adopted in Alameda County from the county line to the Nimitz Freeway by action of the Highway Commission in 1952. It is anticipated that construction will begin as soon as availability of funds and priority of other worthwhile projects will permit. The Division of Bay Toll Crossings has recently completed a report of preliminary studies of expanding the San Mateo Bridge and approaches to freeway standards.

Pacheco Pass

Since 1951, a four-lane freeway has been in use on Sign Route 152 over Pacheco Pass. Advance planning studies are being made to extend this facility westerly to San Felipe.

Stevens Creek Freeway

The route has been adopted for this important cross-country freeway from Sign Route 17 in Los Gatos to the Bayshore Freeway near Mountain View and design studies are in progress. The southerly portion will be initially constructed as a four-lane facility and rights of way will be purchased for future eight lanes between the Junipero Serra Freeway in Cupertino and the Monterey Highway near Ford Road. From Junipero Serra to Bayshore Freeway (US 101 Bypass) an initial four-lane, ultimate six-lane project is being designed.

Mountain View-Milpitas Area

The location of State Sign Route 9 from Bayshore Freeway to Nimitz Freeway was adopted in December of 1954. From El Camino Real to Bayshore Freeway the route was adopted in September, 1958. Two lanes of the future Alviso Bypass Freeway have been in operation since 1957 on the portion between Lawrence Station Road east of Bayshore Freeway and the San Jose - Alviso Road east of Alviso. The 2.5-mile widening project between Lawrence Station Road and Bayshore Freeway was completed in August of 1958 by Edward Keeble, contractor. East of Alviso, design studies are well advanced for realignment in the vicinity of Coyote Creek.

Route 228—Nimitz Freeway to US 50

This important four-lane freeway was completed in September, 1956, and provides a connection from the Nimitz Freeway in the vicinity of Lewelling Boulevard to US 50 in Castro Valley, thus providing continuous freeway or expressway facilities between the Bay Bridge and Tracy in San Joaquin County. A landscaping contract was completed on this portion in October of 1958.

Webster Street Tube

The plans have been completed for a parallel two-lane tube and approaches between Oakland and Alameda and it is expected that this project will be advertised this spring. The new tube will be constructed generally parallel to and a short distance westerly of the existing two-lane Posey Tube. The tube will be 3,350 feet long and together with approaches amounts to a 1.1-mile project. Construction of the parallel tube and the Alameda and Oakland approaches will be accomplished in one contract and upon completion of this work, the new tube will be placed into operation and the existing Posey Tube will be closed for rehabilitation

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How FAS Works

Secondary Road Program Outlined

By E. R. HANNA, Road Commissioner, San Benito County

IN ORDER to properly explain the operation of the Federal Aid Secondary Highway Program in California, it is necessary that I explain public works operation in California counties.

California is divided into 58 counties. Fifty-seven of these counties operate under the direction of an elected five-man board of supervisors. San Francisco is in a class by itself, being a combined city-county government by special act of the State Legislature. Since San Francisco is entirely metropolitan and therefore ineligible for federal secondary highway funds, we need not consider them.


E. R. HANNA

The counties are governed by a five-man board of supervisors, elected by districts within the county to four-year staggered terms, and since we do not have township governments in California, the 57 county boards of supervisors are an important influence in California government.

Each county is required by the State Constitution to have a county surveyor. He may be either elected or appointed at the option of the board of supervisors. Each county is required by law to have a county road commissioner. He may, or may not be, the county surveyor, the county engineer, or the Public Works Director, again at the option of the board of supervisors; but in either event he must be an engineer found competent at a public hearing prior to his appointment, to handle the administration of the county road department. The road commissioner is an administrative officer of the county, and is directly responsible to the board of supervisors for the complete operations of the county road department.

This is the text of an address delivered on December 2, 1958, before the Committee on Secondary Roads at the 44th annual meeting of the American Association of State Highway Officials in San Francisco. Hanna has been Road Commissioner of San Benito County since 1947. He is a past president of the County Engineers Association of California, and was a member of the Technical Advisory Committee of city and county officials on the 1958 statewide freeway study.

Control Operations

Individually, the county supervisors have nothing to do with the county road administration. Collectively, when sitting as a board of supervisors, they are the policymaking board and have full control of the operations through adopting policy, adopting the budget, and providing the funds necessary to implement the budget.

In addition to the two public works officials required by law, the surveyor and the road commissioner, any county may appoint a county engineer for such engineering duties as may be delegated to him outside of the road functions, and the supervisors may, by ordinance, appoint a public works director. Since the road commissioner is responsible directly to the board of supervisors, the only way that a public works department can be set up under a single head, is to appoint the public works director as road commissioner. This has been done in many of the counties, although we can find every possible combination of the four offices from a single person holding all the titles, to a separate individual for each of the four offices.

In California, 98½ percent of the federal aid secondary funds are reallocated to the counties by formula, for expenditure upon county roads in the Federal Secondary Highway System. Through the Secondary Highways Act, our State Legislature has provided matching funds to the counties up to a maximum of $200,000 per county per year. Federal aid urban funds are used only on federal primary routes, which in California are all state highways.

Projects Selected

The counties do not actually receive any secondary money at the local level, but the funds are held by the State and made available for the use of the counties.

The mechanics of setting up and constructing a project are simple. The county, through the road commissioner and the board of supervisors, selects the project, makes an estimate of cost for budgeting purposes, together with a tabulation of the source of available funds, and submits it to the State Division of Highways, along with the proposed typical section. Upon receipt of the program, an engineer from the Bureau of Public Roads, and an engineer from the State Division of Highways, come to the county and together with the county road commissioner, inspect the proposed work. Upon tentative approval of the program by the bureau and the State, the county prepares the plans and the recommended specifications, and submits them to the Division of Highways together with an amended estimate of cost and an amended budget. The Division of Highways then prepares the project for bids, placing it under contract in conformance with the State Contract Act in the same form and manner as any state highway contract.

Upon opening of bids in Sacramento, and before approval of the contract, the county must forward to the State Treasurer the amount of county funds required to complete

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Gualala Bridge

New Structure Follows Ferry, Two Older Spans

THE NEW bridge across the Gualala River on Sign Route 1, opened this winter, is the third bridge to carry north coast traffic across this stream. The latest bridge, of standard reinforced box girder design on single column bents, crosses farther downstream than its two predecessors, and in addition to its historical interest, is typical of the bridge modernization program along this section of the California coast.

The original Gualala Bridge was a joint effort of Sonoma and Mendocino Counties, and was built in 1894. Prior to that there was a cable controlled ferry. This first bridge, a single span truss of wood and steel, was shaken out of position by the 1906 earthquake, but was so well built this did not put it out of service. Eventually it was jacked back into place and used for many more years.

In 1920 the old structure was replaced by another, also of single span, truss construction, but all steel, and sturdier. This span was secondhand, having once been the center portion of the Tuolumne River crossing at Modesto. The counties disassembled it and re-erected it at the new site. When it was replaced this winter after 38 years of service on the Gualala, corrosion had eaten holes all the way through its members in places, and it was blown up as valueless.

Placement of the new bridge was on realignment of State Sign Route 1, as part of the long-range modernization program on this route since it became a state highway in 1933. The new bridge is typical of the program, in that it eliminates one more annoying bend in the route.

These bends are carryovers from the days when the road followed the path of least resistance. When there were no canyons, it stayed just above the coastal cliffs, taking advantage of the level terrain along the old wave-cut terraces.

The jagged ravines at stream outlets were a problem, and there are many in this area of heavy rainfall. In each case, to avoid the steep grade down to the stream level, and the wide span near the mouth of the

PHOTOS ABOVE AND RIGHT—Two views of the new reinforced concrete box girder bridge across the Gualala River on Sign Route 1.

stream, the road turned upstream to an easier crossing. After crossing, it came back to the coast again. With these upstream crossings, bridges could be shorter and cheaper, and the grades were less difficult for the six-horse logging wagons.

Modern engineering and roadbuilding equipment permits much better grading and bridge construction, just as the modern automobile demands fewer curves and better line-of-sight design. In the 25 years since the State took over this section of the Shoreline Highway, almost 90 bridges have been replaced along the Mendocino County coast. In virtually every case, the new bridge was built downstream from the old one, with an accompanying road realignment which eliminated an upstream detour.

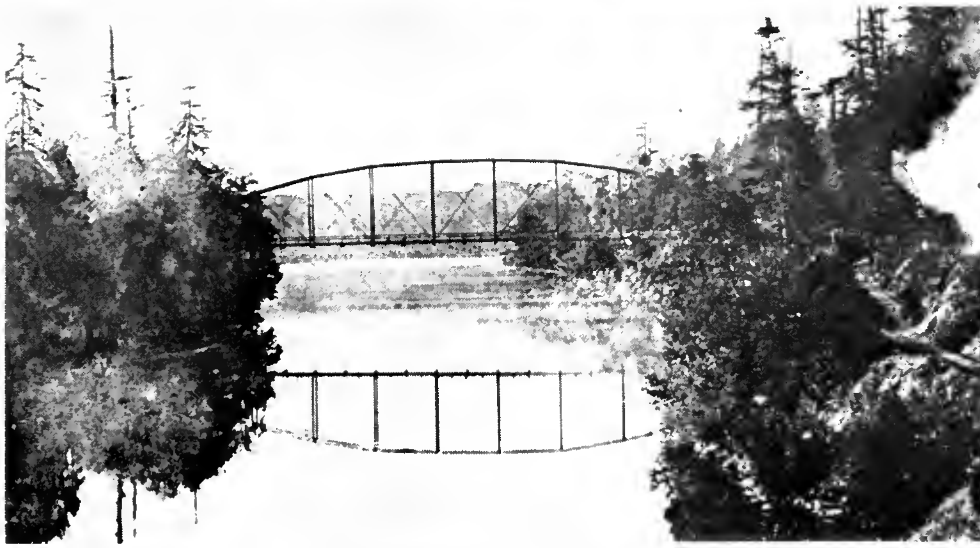
Many of the new bridges have colorful names like Schooner Gulch, Jughandle Creek, Ten Mile River, and Jack Peters Creek—names that reflect the early history of the country.

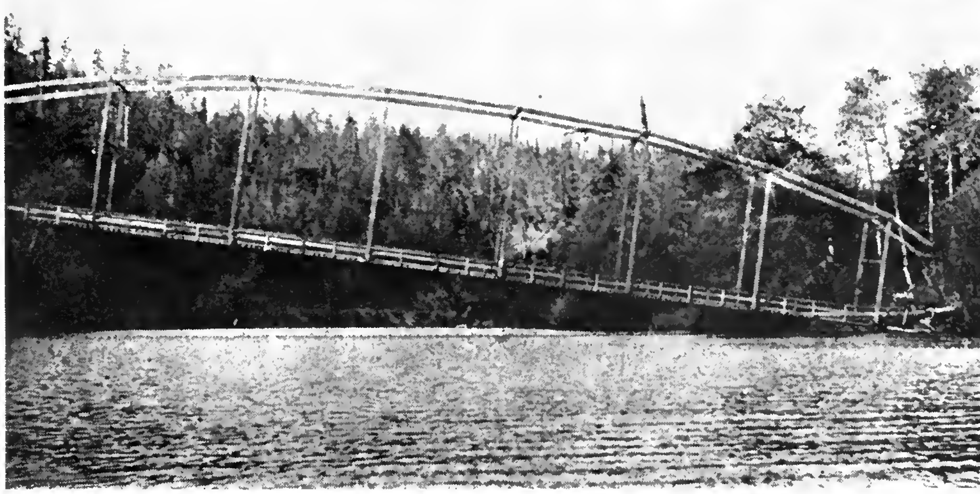
The Russian Gulch Bridge, just north of Mendocino City, was completed in the 1930's, and has been widely publicized as one of the most beautiful concrete arch bridges in the United States.

The bridges at Big River, Caspar Creek, and Mallo Pass Creek have been partially reconstructed to keep them in service a while longer, but they will be replaced within the next 10 years. A contract was recently let for a new bridge at Pudding Creek.

Only the bridge at Glennan Gulch, and two cattle passes under the highway, remain to be contracted for to complete the 25-year program.

A similar program has already been started on the new section of Sign Route 1 north of Westport, a section which was added to the State Highway System in 1957.





PHOTOS show four phases in the development of a highway crossing over the Gualala River. A cable ferry (top) crossed the river in the early 1890's approximately where the new bridge now stands. (This photo courtesy of Dean Allen of Oakland). The second photo down shows the original bridge near Gualala built in 1894 while the third photo shows the same bridge shaken from one of its piers by the Earthquake of 1906. Traffic used it in this position for some months until it could be reset on the pier. (These two photos courtesy of J. A. Halliday of Piedmont). Bottom photo shows Gualala Bridge Number 2 which was bought secondhand and transported piecemeal from Modesto for reassembly at the site.

Cost Index

Fourth Quarter Prices for 1958 Resume Upward Trend

By J. P. MURPHY, Assistant State Highway Engineer, and H. C. McCarty, Office Engineer

THE CALIFORNIA Highway Construction Cost Index for the fourth quarter of 1958 resumed an upward course after showing a downward trend for the first three quarters of the year. The index now stands at 238.5 (1940 = 100), which is 10.0 index points or 4.4 percent above the third quarter. However, it is still 23.6 points or 9.0 percent below the fourth quarter of 1957.

Increased competition raised the average number of bidders from 5.6 per project in October to 7.0 in November and 6.9 in December, establishing an average for the three-month period of 6.3 bidders per project. There were 5.5 bidders per project for the third quarter of 1958. A tabulation showing the average number of bidders arranged according to types of construction and project value is included with this release. This table includes all projects for which bids were received.

The number of projects for which bids were opened dropped from 187 for the third quarter to 174 for this quarter. These projects, which provide the data for preparation of this quarter's index, are distributed as shown in the accompanying table of the size of the projects considered in this survey.

The total value of the above projects is $36,189,715.

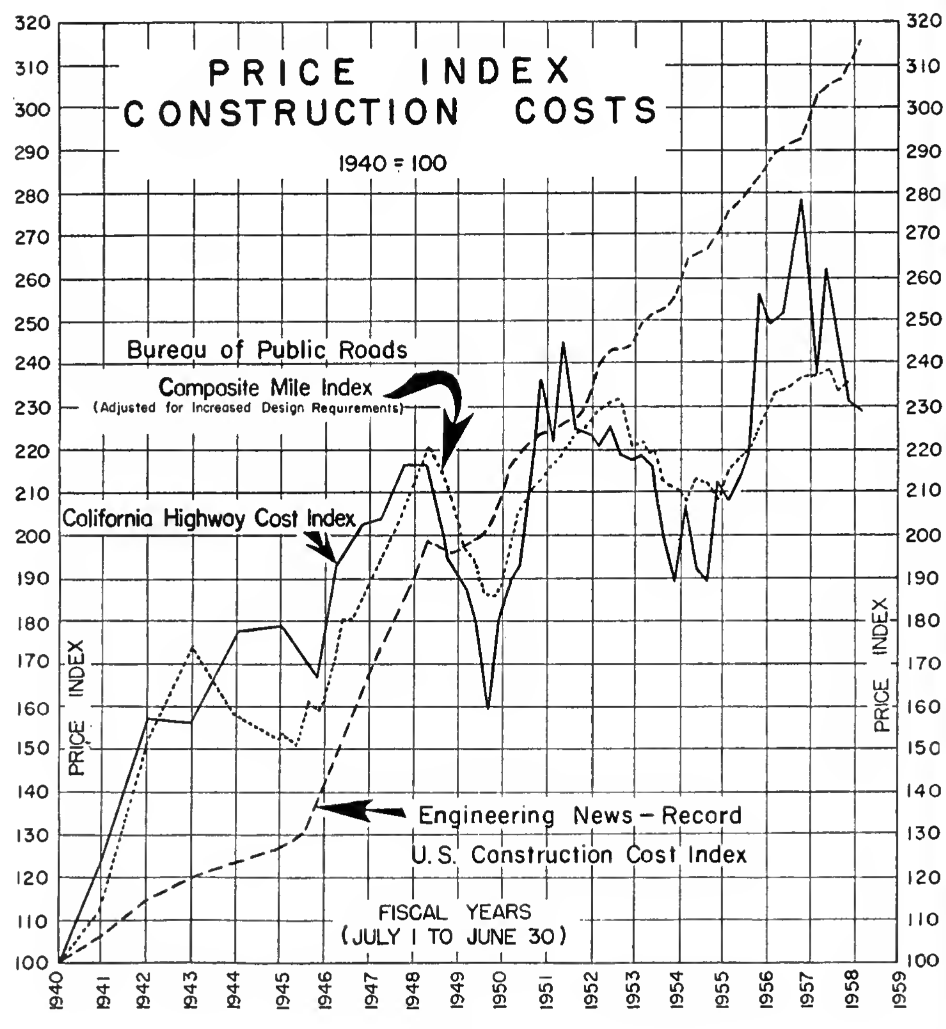
Four of the seven items used in the preparation of this Index show lower average unit prices than the previous quarter. The other three—Roadway Excavation, Asphaltic and Bituminous Mixes, and Class "A" Portland Cement Concrete (Structures)—show increases, of which Roadway Excavation exerted the greatest influence in raising the Index. The following table shows average unit prices for the seven items used in its preparation.

The average unit price of $0.52 a cubic yard for roadway excavation is $0.13 above the third quarter and returns the price for this item to its typical value for the last three years. Unit bid prices in projects exercising significant weight in establishing this average ranged from $0.27 to $0.80 per cubic yard, with a large freeway project in Kern County, which included more than 50 percent of the quantity during this quarter, exercising the greatest influence.

. . . Continued on page 50

SIZE OF PROJECTS CONSIDERED IN SURVEY

Range	No. of projects	Value of projects
Under $50,000	95—54.6%	$2,045,370— 5.6%
$50,000 to $100,000	20—11.5%	1,441,403— 4.0%
100,000 to 250,000	30—17.2%	4,681,150—12.9%
250,000 to 500,000	14— 8.0%	4,954,378—13.7%
500,000 to 1,000,000	9— 5.2%	6,040,814—16.7%
1,000,000 to 2,500,000	3— 1.7%	4,038,645—11.2%
2,500,000 to 5,000,000	1— 0.6%	2,564,777— 7.1%
Over $5,000,000	2— 1.2%	10,423,178—28.8%



Delano

Postfreeway Survey Shows Stability and Development

A Report of the Land Economic Studies Section, Right-of-Way Department

Summation by
HUDSON R. PHILLIPS
Right-of-Way Agent
District VI

OUR CITY now has two main streets with a two-block-wide commercial area. So spoke a leading Delano businessman as he sized up his San Joaquin Valley city two years after new freeway construction.

This simple statement actually summarizes in capsule form an all-important freeway economic effect. It is the change in a "bypassed" business street from a ribbon developed strip with little economic character to a stable commercial area with clearly recognized character and potential.

Elements Involved

Actually, more than a "bypassed" highway is involved here. What happened to other Delano business streets and to the East and West Delano sections are matters of just as much significance.

High Street, the old highway, was the city's first business street. As traffic and congestion increased, it lost most of its pedestrian commerce to Main Street a block away, the major business street today. More recently Cecil Avenue, a secondary state highway crossing both Main and High to the north, has developed as a third commercial artery. (See diagrams below for location and relationship of freeway and other major streets.)

Originally, High Street competed directly with Main. However, over the years each slowly attracted and developed its own type of businesses. As traffic increased, High Street uses became fixed, and a static condition prevailed. Even the old highway merchants themselves found it difficult to recognize the predominant character of their street—traffic service or non-highway-catering, business district.

Land development and land sales reflected the static nature of High Street in the years immediately preceding freeway construction. Values remained constant and sales were infrequent. Commercial building activity and development in Delano was confined almost solely to Main Street and Cecil Avenue.

In prefreeway days, the West Delano section reflected an economic listlessness as well. The intervening railroad right-of-way and the heavy traffic on High Street discouraged free movement between east and west. As a result, East Delano, with congestion-free Main Street, prospered and grew; West Delano remained static. With freeway construction, the entire pattern began to change.

New Freeway

On June 22, 1956, the four-mile, four-lane freeway was opened to travel, 3½ years after right-of-way acquisition was commenced in the fall of 1952. The right-of-way was cleared in late 1954, and the actual construction thus took an additional 1½ years.

By 1958, approximately two-thirds of the old highway's former traffic had moved to the freeway. Even so, 7,400 vehicles a day were still traveling on High Street.

Just how the new traffic order along High Street would be reflected on Delano's overall profit and loss sheet, was a question of moment. Concern that a third barrier between east and west had been erected was also expressed. However, before any analysis is achieved, the broader picture should first be sketched.

Economy and Growth

A Kern County city, Delano lies 30 miles north of Bakersfield in the rich and productive San Joaquin Valley. Agricultural activities provide its prime income stream. $84,000,000 in crops came out of the Delano area in 1957, the highest total in its history.

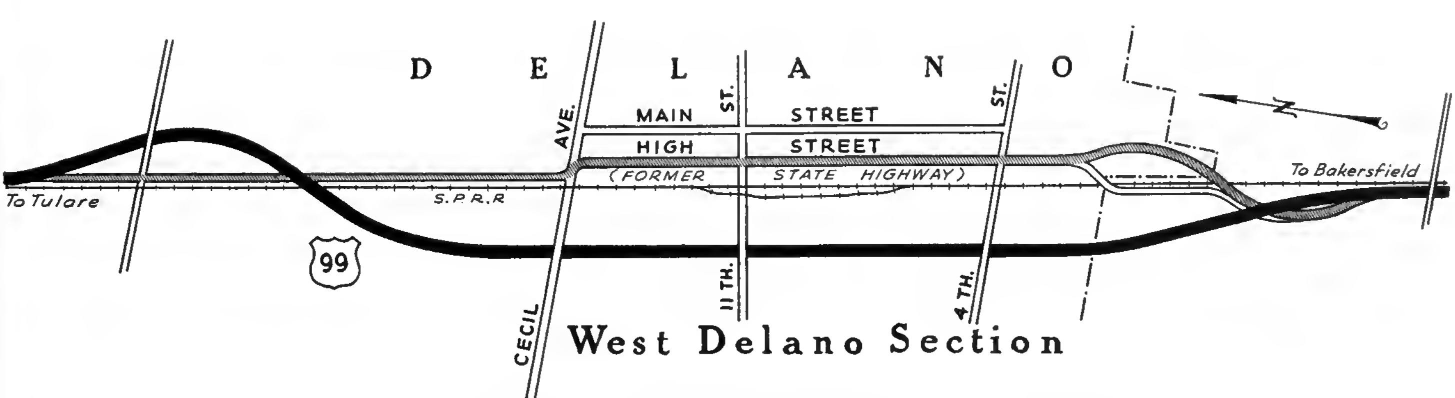


Diagram showing completed US 99 freeway through Delano. High Street, the former state highway, is shown as the shaded line adjacent to the Southern Pacific Railroad tracks. Main Street, Cecil Avenue, and the West Delano section—referred to in the text—are also indicated.

In 1870, Delano was a sheep trading center. Three years later, following construction of the central valley route of the Southern Pacific Railroad, it became a station stop. Subsequently, Highway Route 99 was constructed paralleling the railroad.

Early growth in the area spread both east and west of the railroad tracks. Following a characteristic pattern, a higher type development sprang up on the east side adjacent to the station building and highway. West side activities, on the other hand, centered around freight loading, railroad worker housing, and a minimum of retail developments. It was thus inevitable that the greater commercial and residential wealth of the city would be centered on the east side.

Over the years Delano has been growing and expanding at a steady rate. Unlike many California cities, it has experienced no great booms.

A city population of 4,573 in 1940 has increased to 11,150 in 1958, 8 percent a year on the average. Farm crop values have gone from $68,457,538 in 1954 to $84,000,000 in 1957, or at the rate of 5.7 percent annually. Additional acreage placed under cultivation since 1954 has increased at the rate of 3.1 percent annually. School enrollment since 1940 has shown a 5.5 percent annual increase, and postal receipts from 1948 through 1957 have risen at the rate of 7.3 percent annually. Retail sales have increased also and will be discussed separately in this study. All in all, no segment of Delano's economy has reflected any of the adverse effects of the recent economic recession.

1957 building permit statistics were the only ones not following the consistently upward trend. Here a decrease from 289 permits in 1956 to 178 in 1957, was reported. However, as of mid-1958, 165 permits had already been issued and 1958 was expected to easily re-establish the upward trend.

Reflecting the area's agricultural dependency are 15 cotton gins, 4 wineries, 25 packing sheds and cold storage plants, 8 implement dealers, 1 engineering company, 1 concrete pipe plant, 1 pump firm, 1 foundry, 2 ice plants, and an automatic cotton baler and sampler manufacturing plant. In all, a total payroll in excess of $4,000,000 is generated annually by these secondary activities. As late as 1956, only about one out of every five workers in the Delano labor market area was engaged in nonagricultural employment.

Overall, Delano may thus be appraised as:

1. Geared to an agricultural economy.

2. Characterized by a stable, uniform growth.

Transportationwise, the three developments of most significance to Delano are:

1. The construction of the railroad. (1873)

2. Original construction of the highway. (1914)

3. Subsequent construction of the freeway. (1956)

This last major occurrence will claim our immediate attention. In the following sections, the results of study into land sales, and land developments, and retail business volumes and characteristics are reported to determine the economic effects upon the Delano community of this significant highway change.

Property Values

Commercial land value changes and trends before and after freeway construction are excellent indicators of economic effect. All of the factors which contribute to a city's economic health and prosperity are ultimately reflected in the prices people pay and ask for available lands.

To develop a land value trend, all property sales on High Street, Main Street and Cecil Avenue were tabulated for the 6½ years from 1952 through mid-1958. This period in-

Representative section of High Street, the former state highway, looking north.

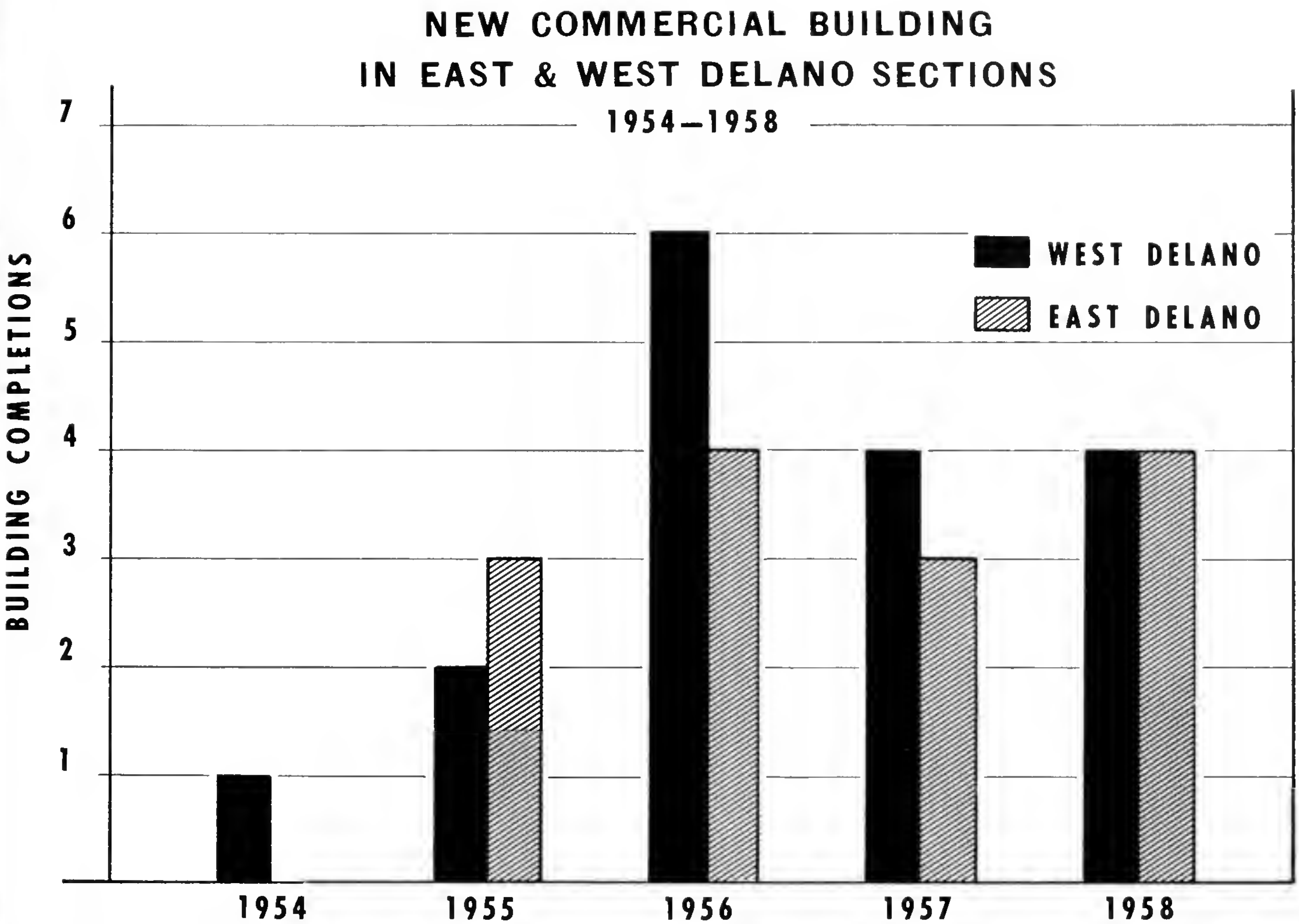


Chart showing East and West Delano business structures completed since commencement of freeway construction in late 1954. The surge of new commercial construction in the West Delano area is clearly indicated.

cluded 2 years after freeway opening and 4½ years before.

Forty-three market sales were recorded in all three areas over the entire period. Ten sales were made on High Street, 27 on Main Street, and six on Cecil Avenue. An analysis of these sales revealed three significant facts.

1. Almost half of all the 43 sales occurred after opening of the freeway.
2. "After" freeway values on Main Street and Cecil Avenue are twice as high as they were for the 4½ years before freeway construction.
3. Land values along Main Street for the entire 6½-year "before and after" period studied have remained relatively constant.

Residential Subdivision

Yearly changes in residential subdivision developments are not in themselves particularly helpful in assessing freeway economic effects. If, however, home construction activity has been stimulated by freeway change, then subdivision development and related comparisons may be directly pertinent to freeway land economic analysis. In the Delano area, such a germane relationship exists.

Residential subdivision activity in Delano has been relatively constant in the "before and after" freeway periods. One 20- to 40-lot subdivision a year has been the long-term average.

In mid-1953—almost a year after right-of-way purchases in the city had started — a 168-lot tract was subdivided, the largest since the original townsite was laid out in 1888. This subdivision was timed to provide new housing for owners whose properties were required for highway construction.

Two hundred seventy-eight dwellings—slightly over 10 percent of the entire city's total—were purchased for the new freeway. Average value of these dwellings was $5,000; for the new subdivision, they ran from $8,000 to $10,000. Most of the houses now covering a substantial portion of the new tract were acquired by freeway-displaced owners.

Business Plant Changes

What actual physical changes have occurred along the "superseded" highway since freeway construction?

Negatively, two major brand service stations and two cafe buildings have been removed representing four out of a total of 94 retail business structures. Additionally, two service stations and one cafe are without lessees and are temporarily closed.

Positively, total investment in completed commercial buildings on High Street since freeway opening exceeds a quarter million dollars. Five new structures and major additions to existing buildings account for this total.

Moreover, seven modern service stations adjacent to the new freeway have been added to the city's commercial plant. Two were direct replacements of former High Street stations.

Compared with High Street over the last five years, only one more commercial structure has been erected on Cecil Avenue, an excellent control area. Cecil compares almost exactly with High Street in traffic count and it has never had a major traffic pattern change. If anything, it is an optimistic control since it has been serving Delano's fastest-growing areas and is currently booming.

West Delano Development

Earlier in this report, the characteristic tendency for more and better improvements to develop on the east, "highway side" of the railroad tracks was briefly described. Over the years this east-west stratification has become more fixed and seemingly permanent. Both the railroad tracks and yard facilities and the heavy highway traffic contributed to this pattern—both restricted free and convenient movement between the two areas. Consequently, fewer changes and less development took place in West Delano than in any other part of the city. Even today, West Delano holds only about one-third of the entire city's population. With major developments confined solely to the eastern sections prior to freeway construction, city growth has moved east as well. West Delano thus comprises only one-fourth of the total city area.

Since freeway construction, nothing has changed with respect to the rail facilities and their barrier effects. However, with respect to the heavy High Street traffic, almost everything has been changed. With removal of its congesting traffic components, High Street is no longer a barrier in any sense of the word. Moreover, the new freeway itself, with conveniently located crossovers serving both sections with no traffic conflict whatsoever, is clearly the exact opposite of a barrier structure.

Prior to freeway construction, no commercial building of any significance has been completed in West Delano since the end of World War II when all building demand was at a peak. Since commencement of freeway construction in late 1954, 17 commercial buildings representing an approximate million-dollar investment, have been erected in West Delano. Over this same period in all the rest of Delano—on High Street, Main Street, and Cecil Avenue—only one more commercial building was constructed.

Retail Business

A direct comparison of all retail business along High Street on a two-year "before" and two-year "after" basis shows a gross business increase of 1.42 percent. This comparison in itself, however, is relatively meaningless—its results must be again measured against those drawn from similar comparisons in comparable areas.

Normally, the parent county is found to be a suitable measuring stick. In this instance, however, it was found that, for two years prior to the opening of the freeway, both High Street business and comparable businesses in Kern County (in which this city is located) were not even going in the same direction at least half of the time. Moreover, High Street business was similarly out of step with all the other business in the town itself. Main Street, for instance, didn't follow a "before" trend similar to High Street four quarters out of every eight. High Street also failed to parallel the statewide trend at least half of the time as well.

Since comparable cities and towns along U. S. Highway 99 which have not been affected by freeway construction are now relatively few, this type of comparison was of little assistance. Comparisons with the only city suitable, the City of Turlock, revealed a similar inconsistency in "before" trends as well.

This unusual dissimilarity is not without meaning in itself. A careful analysis of all retail sales data develops three facts which shed light upon the problem.

1. There are approximately 250 retail outlets in the entire city, about 25 percent of the total being located on High Street. These 25 percent of Delano's merchants, however, are doing 40 percent of the city's entire retail business. Thus even though High Street may not have been considered a "Main Street" prior to highway change, the volume of business it has been contributing would indicate it has been a "main factor" for quite some time.
2. Of all the outlets on High Street, 40 percent are in the traffic-sensitive categories (service stations and cafes and bars) and 60 percent are in the generally non-traffic-sensitive "other business" group. However, the 40 percent traffic-oriented merchants do on the average only about 13 percent of all High Street business, while "other businesses" pile up an overwhelming 87 percent. Since the "other" businesses are not likely to be directly affected by highway change, it can be seen that only a relatively minor portion of total old highway business would be directly subject to any adverse freeway effects if in fact there were any.
3. Of the "other business" on High Street—which is accounting for the 87 percent of total business—almost four-fifths is attributable to the farm supply and equipment group, the building equipment, service and supply group, and the automobile sales group. This concentration, which is peculiar only to the old highway, is of course a major reason why High and Main Streets are following dissimilar trends. Moreover, the predominance of these three groups appears to be becoming even more marked in the "after" years, although the trend in this respect is a gradual one.

Representative of the significant commercial building activity which has taken place in West Delano since freeway construction was started in 1954 are the new supermarkets (upper) and the new block of stores (lower) located on opposite corners of an intersection near the freeway.

Southerly view along Main Street clearly showing dominant pedestrian-type business establishments. This street is the major commercial thoroughfare in the City of Delano.

In any event, High Street seems always to have had its own retail character. Perhaps all that was needed was to remove the congestion so that it could be recognized and maximized.

Conclusions

Complete investigation into the effect of freeway construction upon the City of Delano involved study of five important community aspects. Each has yielded a clear picture of "before and after" changes.

1. **Land Values**
   Main Street, High Street, and Cecil Avenue contain Delano's biggest business concentration. Land values, which clearly reflect economic well-being, were higher along Main and Cecil after freeway construction than they have ever been in the city's entire history. On the other hand, High Street, the old highway, is only now beginning to find its niche. In the last 6½ years—including a 4½-year "before" freeway period—land values along High have remained constant.

2. **Subdivision**
   Stimulated largely by freeway acquisition and construction, the largest subdivision to be developed since the laying out of the original townsite in 1888 was commenced a year after right-of-way acquisition had started.

3. **New Investment**
   Investment confidence in High Street's business future remains high. Almost a quarter-million dollars in new commercial investment has been expended on the old highway since freeway opening—about twice the value of all High Street business structures closed or removed for whatever cause in the last two years.

4. **West Delano Development**
   Renewed interest in the entire West Delano area has been a direct reflection of the positive effects of freeway construction. Safer, more convenient access as a result of the elimination of the heavy traffic barrier on the old highway, has encouraged the first new commercial building of any consequence in West Delano since the end of World War II.

5. **Retail Business**
   As a direct result of freeway construction, "superseded" highway business is uniquely able to capitalize on the benefits of free traffic accessibility. While 40 percent of High Street businesses are in the so-called traffic-sensitive category, they accounted—even before freeway construction—for only about one-eighth of the total old highway business transacted. Thus the truly important segment of High Street merchants—doing seven-eighths of the total business volume—are direct recipients of the positive effects of through-traffic diversion.

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California Bridges

1958 Costs Show Marked Decline

By H. K. MAUZY, Senior Bridge Engineer and W. J. YUSAVAGE, Assistant Research Technician

This article is the seventh of an annual series dealing with California bridge construction costs. The sixth article appeared in the May-June, 1958, issue.

Overall highway construction costs in California are reported in the articles entitled "Cost Index," which appear regularly in *California Highways and Public Works.*

CALIFORNIA bridge construction costs, after closing 1957, the year of the highest recorded costs with an index value of 281, dropped to 259 during the first quarter of 1958, rose moderately to 268 during the two middle quarters, and closed the year at the level of the first quarter, or 259.

In terms of annual averages, costs during 1958 were down 5.5 percent from those of 1957, a saving to the bridge construction program of about 3½ million dollars for the year. This decrease in costs was the first decrease in a period of four years during which costs had risen to the successively higher values of 228, 265, and 283, during the years 1955, 1956, and 1957, respectively.

The Bureau of Public Roads Cost Index shows a similar reduction of about 5.5 percent in its construction costs during 1958, indicating that a depression in construction costs was general throughout the Country.

The level of costs for successive periods is presented graphically in the accompanying chart which summarizes the course of California bridge construction costs since 1934.

Construction Activity

Bridge construction continued at the high rate established in 1954, the year the additional increase to the State's highway budget voted by the State Legislature took effect and, in recent years, by the increasing amounts of federal aid for the interstate system of highways.

Table 1

INDEXES RELATING TO CALIFORNIA BRIDGE CONSTRUCTION AND PERIODIC DOLLAR VALUES OF LOW BIDS ON CALIFORNIA BRIDGE CONSTRUCTION

I Year	II Quarter	III Index of the cost of California bridge construction (1939-1940—100)	IV Index of the value of California bridge construction (1939-1940—100)	V Index of the volume of California bridge construction (1939-1940—100)	VI Dollar value of low bids on California bridge construction (in millions of dollars)
1934	..	94	*60	*64	3.1
1935	..	88	*138	*157	7.1
1936	..	98	*72	*73	3.7
1937	..	114	*60	*53	3.1
1938	..	99	*78	*79	4.0
1939	..	101	*99	*98	5.1
1940	..	99	*101	*102	5.2
1941	..	122	*78	*64	4.0
1942	..	158	*80	*50	4.1
1943	..	165	*16	*9	.8
1944	..	153	*29	*19	1.5
1945	..	167	*109	*65	5.6
1946	..	182	*247	*133	12.7
1947	..	215	*443	*202	22.8
1948	..	229	*307	*134	15.8
1949	..	201	*233	*117	12.0
1950	..	202	*262	*129	13.5
1951	..	248	*617	*247	31.8
1952	..	235	*561	*237	28.9
1953	1st	243	140	58	1.8
1953	2d	224	707	315	9.1
1953	3d	*229 231	*522 893	*227 387	26.9 11.5
1953	4th	235	350	149	4.5
1954	1st	221	691	313	8.9
1954	2d	217	1,196	551	15.4
1954	3d	*219 220	*870 1,002	*399 455	44.8 12.9
1954	4th	213	590	277	7.6
1955	1st	217	1,039	477	13.3
1955	2d	237	500	211	6.4
1955	3d	*228 228	*930 1,047	*408 461	47.9 13.4
1955	4th	237	1,148	484	14.7
1956	1st	245	833	340	10.7
1956	2d	284	1,083	381	13.9
1956	3d	*265 260	*1,117 604	*422 232	57.5 7.8
1956	4th	273	1,952	715	25.1
1957	1st	292	680	232	8.8
1957	2d	283	2,007	709	25.8
1957	3d	*283 275	*972 460	*343 167	48.0 5.9
1957	4th	281	740	263	9.5
1958	1st	259	1,219	471	15.1
1958	2d	268	1,841	687	23.7
1958	3d	*267 268	*1,287 1,468	*482 548	65.1 18.9
1958	4th	259	528	204	6.8

* Average annual information.

During the past three years, the rate has been about 10 times that of the base (1939-40) period in terms of current dollars and about four times that of the base period in (1939-40) constant dollars. The difference in the two rates, 10 to 4, is accounted for by

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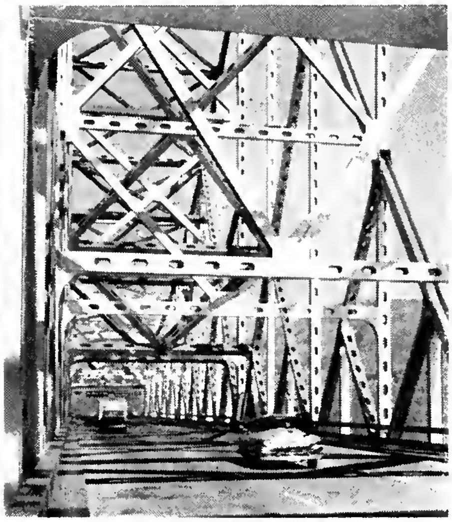
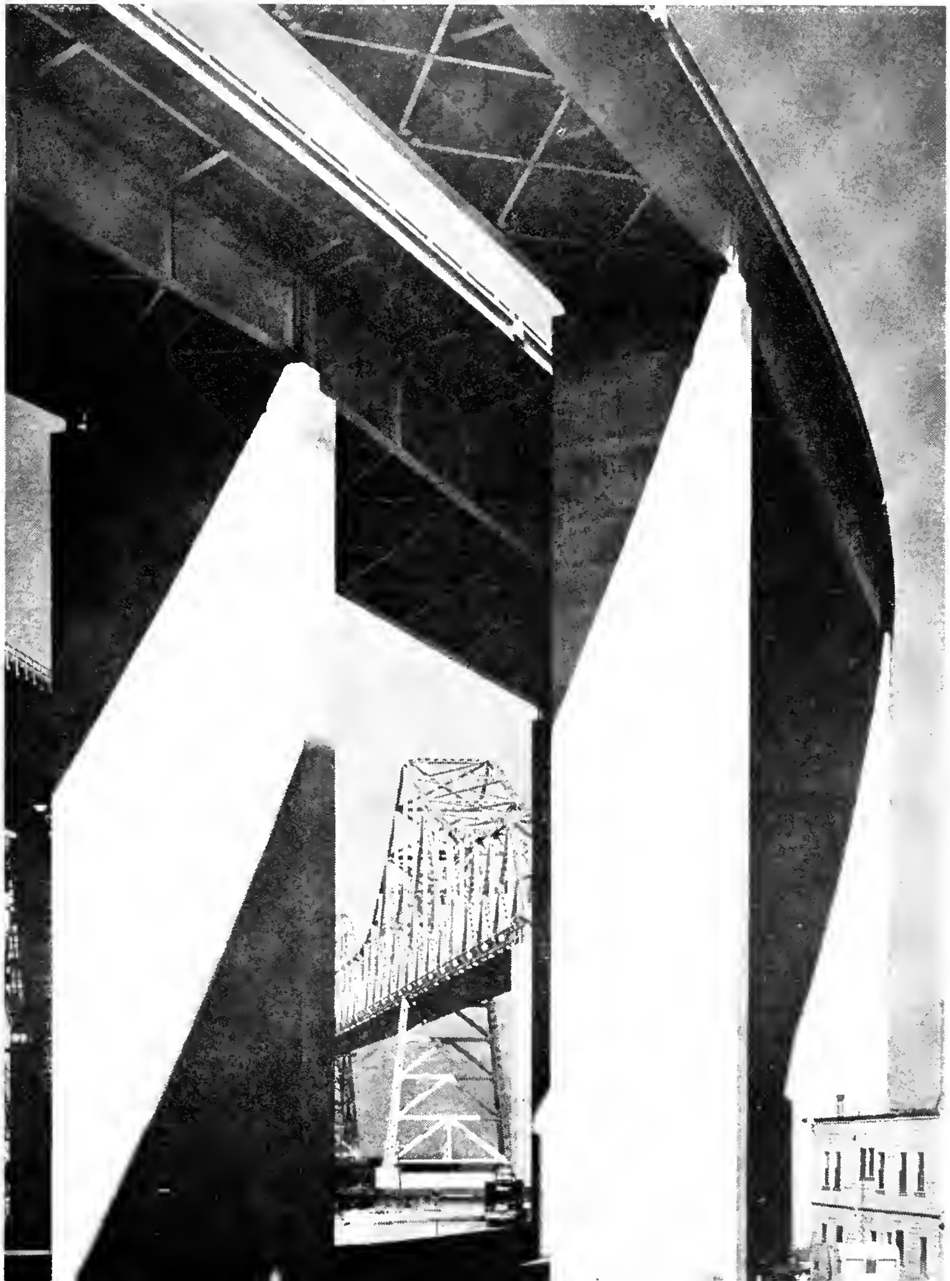
Carquinez Bridge

"Among the year's accomplishments, perhap the most impressive was the completion of th additional Carquinez Bridge. While the proje is spectacular in its own right—the structur duplicating the existing one, the graceful curve of interchange ramps and the monumental c running south through the hills—the most in pressive feature is the saving of lives, time an miles between Vallejo and the San Francisc Oakland Bay Bridge."

—*Report From District IV (see page*





Contract Control

Contract Progress Control Study Proves Effective, Realistic Aid

A division of Highways management study of contract progress is proving to be an effective aid in setting realistic project time limits and a useful tool in gauging the pace of construction against the job deadline.

Made by Milton Harris, Construction Engineer, and E. J. Carter, Assistant Construction Engineer, the study involved a long-term analysis of the relationship between elapsed contract time and the value of completed work on a large number of typical state highway projects.

Goals of the study were to develop a reasonable guide for determining progress of contract work, and to improve methods of establishing rational contract time limits before the call for bids. The study also sought a basis for improved procedures in determining and recording working and nonworking days. The study was begun in June, 1956, and completed in October, 1957.

In the first year after the study was completed, the number of time limit overruns on state highway contracts declined sharply; only 6 percent of the division's contracts went beyond the time limit. By contrast, in the two preceding years about 15 percent of the contracts involved overruns in time.

The study covered the time-progress relationships—value of completed work versus time elapsed—at various stages of 245 satisfactorily completed state highway contracts. The projects included nearly every type and size of job and represented a wide cross section of California highway construction.

Based on a detailed analysis of each of the projects, curves were plotted to show the normal time-versus-progress range for the entire group of contracts. These curves are included in the accompanying chart.

The two solid black lines enclose in an "envelope curve" the normal time-progress range for the contracts included in the original study; the bottom line is the lowest satisfactory progress rate, and the top line is a guide to normally accelerated progress.

The dash line is a hypothetical contractor's progress schedule based on his estimates of time required for various phases of the work. The dotted line represents actual progress charted during construction.

In the hypothetical case shown on the chart, work was progressing ahead of the contractor's schedule and was well within the normal progress range (the two solid curves) with 30 percent of the contract time elapsed. With half the time gone, the contractor was still on schedule, but the progress rate had dropped toward the lower limit of satisfactory progress.

After 80 percent of the contract time had passed, the project was running behind the contractor's schedule and the pace of work had fallen to the lowest satisfactory level.

At this point it is clear that there must be an increase in the rate of progress if the project is to be completed by the contract deadline.

(Followup studies are continuing in order to test the validity of the original envelope curve. As subsequent projects have been integrated with those used initially, only minute changes in the original curve have been found necessary.)

The study report also includes a discussion of time limit estimates for projects in the planning stage. It em-

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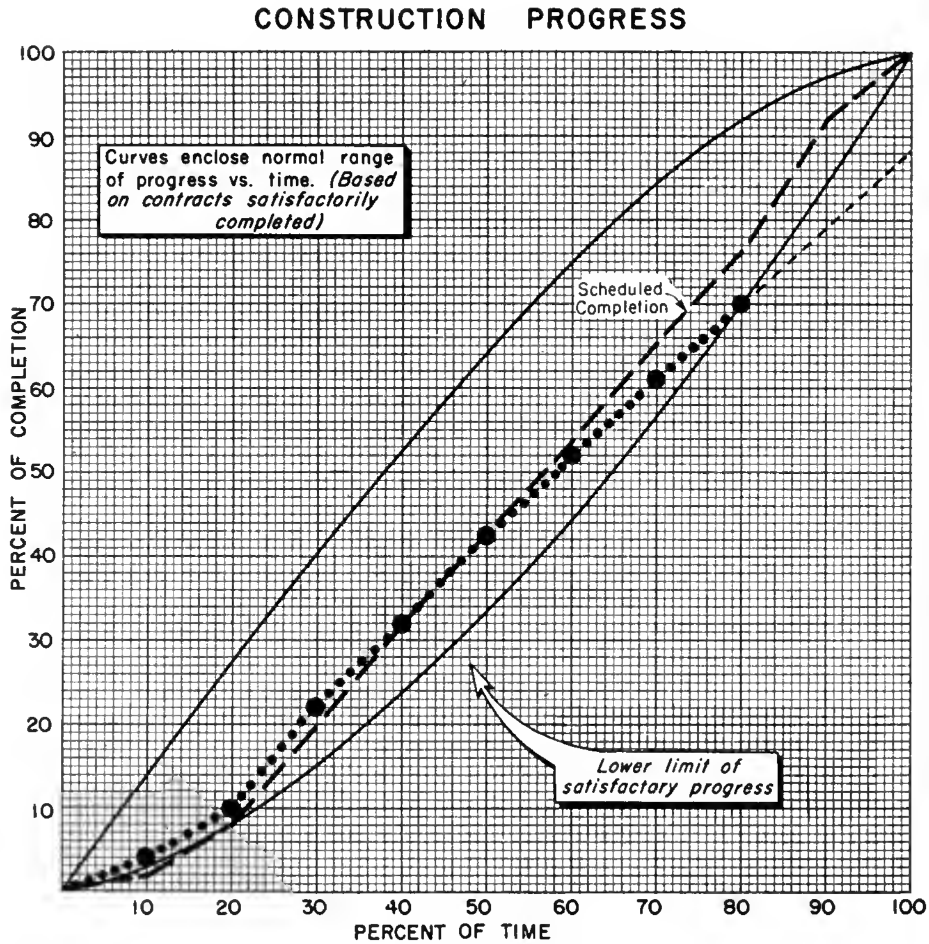


Trip to Egypt

Materials and Research Chief Visits 'Land of Nile' as Adviser

By FRANCIS N. HVEEM, Materials and Research Engineer

As THE RESULT of a request through the United Nations, I spent two months in Egypt last fall helping that country work out some of the technical details for a modern highway system in the shadow of the 4,000-year-old pyramids.

The mission, originally arranged by the Technical Assistance Administration of the U. N., was concerned only with the reorganization of the Egyptian Central Road Laboratory and the establishment of a research section in it which would use modern techniques. But on arrival, I found that Egyptian engineers were hopeful of more general assistance.

It quickly became evident that the Department Engineers and the Minister of Communications were also concerned over the smoothness of the roads, design, construction practices, and maintenance. They wanted advice covering the whole field of highway design and construction.

Obviously this advice could not be given without a comprehensive inspection of the Egyptian road system, so the major part of my first weeks in Egypt were spent in the field. Between trips I worked in an office assigned to me in the well-designed, modern building which housed the Training Center and Laboratory. Whenever possible, I talked to contractors and construction men.

As in most countries, I found that Egypt suffers from a shortage of engineers. Materials testing for roads was being done by a staff of 10, as compared to several hundred in our organization back in California. The two areas are about equal, but Egypt has 50 percent more population.

Motor Transport Increasing

California has many times the number of motor vehicles that Egypt has, of course, but despite the popular concept of Egyptians traveling exclusively on camels, motor transportation in that country is increasing rapidly. There is a great need for usable roads to connect villages and farms with the larger cities, for modern high-speed highways between such centers of population as Alexandria and Cairo, and for roads to the frontiers for defense purposes.

The engineer shortage is only part of the problem. In what has been traditionally a purely agrarian nation, the rapidly expanding population can no longer be fed by the available farming land. Although the government is seeking to get more land under irrigation, its main hope lies in expanding industry so its surplus products can be used to purchase food abroad. The first steel mill has just gone into operation, and the world's largest nitrogen fixation plant is under construction at Aswan.

Since the entire country is in a transition stage from a culture based on hand labor to one employing modern mechanical devices, the quality of the roads varies greatly. There are a few excellent roads, some fairly good ones, and many poor ones. Traffic on these roads is varied, too. On every mile can be seen motor vehicles, pedestrians, and animal transport.

Many of the wagons are equipped with solid rubber tires but many in the rural areas have narrow steel tires. Although the gross load of such vehicles is nominal, the concentration of pressure is great. Deep ruts may be observed on many sections as a result of these slow moving concentrated wheel loads.

Location of Materials

Roadbuilding materials are plentiful in some areas and scarce in others. Limestone is available near Cairo and at points along the Nile as far south as Luxor. There is good quality gran-

Francis N. Hveem, Materials and Research Engineer and author of the accompanying article (with cane), speaks at a special reception given to present him to Egyptian contractors, engineers and materials men.

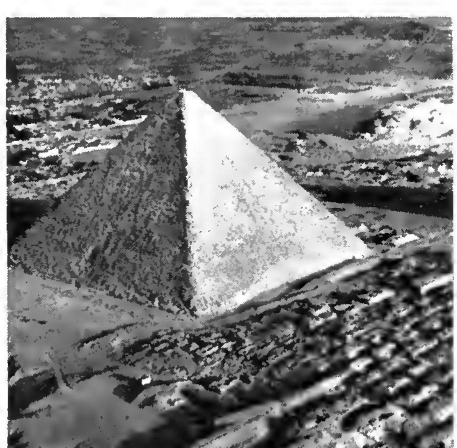
Hveem in the Laboratory in Cairo discusses techniques with lab men: (left to right) Ismail Shoukry in charge of the bituminous paving section in the laboratory; Ahmed Azab Karim in charge of the Training Section, Hveem, and Youssef Ezzel Din, Assistant Construction Engineer.

ite and basalt in southern Egypt in the vicinity of Aswan.

Limestone is the traditional road building material and I was informed that up to the time of the revolution of 1952, the government had been transporting limestone 500 miles up the Nile to build roads in an area where no limestone was available. Plentiful supplies of basalt and granite close at hand were ignored.

There are large cement mills in Alexandria and Cairo, and a limited mileage of concrete pavement has been laid. The present trend, however, is toward an increasing use of asphalt which comes from two refineries located at Suez, using crude oil from wells along the Red Sea. One of the Suez refineries is owned by the government, the other by Shell Oil, but directed by the government. The asphalt seemed to be of very good quality.

Many serious problems arise for a country such as Egypt when it attempts to convert from a handcraft system to the modern tools and techniques such as we use in constructing highways in the United States. We rather take for granted the interlocking complex of co-operating agencies such as producers of material, equipment manufacturers, service organizations, contractors and engineers.



The Great Pyramid at Gizeh, only one of the original Seven Wonders of the World still remaining, owes its permanence, Hveem feels, to foundations built on bedrock.

In its modernized road program, Egypt is using both German and American made equipment. However, skilled operators are not plentiful, and it is also hard to find experienced foremen and superintendents.

Replacement Difficult

One contractor, American educated, summed up his problems in this way:

"Mr. Hveem, contracting in Egypt is a great deal different than in the United States. There, if you break a piece of equipment, you get on the telephone and the parts are delivered the next morning. Here, I would be lucky if I could obtain a replacement part within six months."

He told how on a surfacing project near Aswan he concluded it was cheaper to have his road rock broken by hand than to set up crushing machinery with all its operating problems at such a remote site. The hand crushing later led to some controversy with the engineers because the product broken by hand met maximum size specifications satisfactorily, but was almost completely deficient in the finer sizes normally produced in a mechanical crusher. Such arguments between the Egyptian contractors and engineers had a very familiar sound.

Naturally, an engineer working in Egypt welcomed the opportunity to inspect the ancient ruins built by engineers of another culture thousands of years before, and I visited many of the important ruins on a sort of postman's holiday. I concluded the reason the Great Pyramid, for instance, still stands is because its foundations rest upon a level base of solid bedrock.

The ancient Egyptians made a great use of sandstone in the construction of their pyramids and temples, but many of the large statues and obelisks were carved from granite quarried near Aswan and transported down the Nile for hundreds of miles. The transportation and erection of these tremendous monolithic blocks of stone is a feat that would tax engineering talent today.

Karnak Temple Massive

The one project of these ancient engineering efforts which impressed me most was the Great Temple of Karnak at Luxor with its tremendous stone columns, some 11 feet in diameter and nearly 70 feet high. I stood before it, and in the best engineering tradition, wondered over the nature of the foundations which have supported these massive columns with no evidence of settlement or perceptible misalignment for more than 30 centuries.

Archaeological reports are silent on whether these column footings extend to solid rock. The temple was constructed quite close to the ancient channel of the Nile and it seems the silt deposits would be of considerable depth there.

At the time I left, the Egyptian highway department was installing equipment for the manufacture of road signs. A complete unit for the fabrication and construction of modern road signs has been furnished the Egyptian government by the United States under the Point Four Program.

The Egyptians have demonstrated a strong preference for American equipment, especially automobiles. While I got no authoritative figures, it was my impression that perhaps 75 percent of the automobiles in Cairo were American made. This contrasts markedly with the average European city.

Contrary to the many reports about treatment of Americans abroad, I want to emphasize that my experience was most pleasant and that I was extended every courtesy and assistance by the Egyptian engineers. I was also very favorably impressed with the personnel and work of the United Nations Technical Assistance Program. With very inadequate funds this organization is attempting to transfer knowledge from those who know, to those who need to know. It is interesting to note that this is by no means a one-way operation. Many of the countries, including Egypt, may need technical advice of one sort while they themselves are furnishing experts in other fields to other countries.

One might philosophize on the significance of this interchange between the East and West, and quote Kipling with "never the twain shall meet," but there is much evidence today to show that the East and West are meeting. It is constantly being proved that communication eliminates misunderstanding. Road engineers everywhere can be proud to keep in mind that highways, whether in America or Egypt, offer one of the best means of communication between people.

Governor Brown Names Roger S. Woolley, San Diego Lawyer, to Highway Commission

Governor Edmund G. Brown announced March 3d he will nominate Roger S. Woolley of Rancho Santa Fe (San Diego County) for a four-year term on the State Highway Commission.

ROGER S. WOOLLEY

Woolley, a San Diego attorney, replaces Fred W. Speers of Escondido. The appointment requires Senate confirmation.

Woolley was born November 18, 1924, in Chicago, Illinois, and moved to Rancho Santa Fe in 1952. He was graduated from the College of William and Mary in 1947, then took graduate work at London University in 1947 and 1948.

He was graduated from Columbia University Law School in 1951 and was admitted to the Bar in 1952. He is a partner in the San Diego law firm of John Gerald Driscoll, Jr.

Woolley was in the United States Navy from 1942 to 1946 as a lieutenant (j.g.) in the Pacific Theater of Operations.

He has been a member of the San Diego Highway Development Association for the past six years and currently is the organization's first vice president. He was previously a director and second vice president.

Woolley is an elder in the Presbyterian Church, a member of the Rotary Club, San Diego, California, and American Bar Association.

Woolley lives with his wife, Patricia, and two children, Elliott, 6, and Merrit, 2, in Rancho Santa Fe.

The Division of Highways Materials and Research Department has started a continuing laboratory training program for district personnel on the selection, use and control of highway materials.

First classes of the new series were held March 16th-20th at the Headquarters Laboratory in Sacramento.

Radio Signs

New Remote Control Signs Alert Motorists, Truckers

Because of California's great north-south length, and its many mountainous areas, weather conditions in one area may differ markedly from those in another. This is particularly true in winter. A storm may be raging in the passes on the important transcontinental routes while the sun is shining in the valley 75 miles away.

On a single day of this past winter there were heavy snow and blizzard conditions in some of the mountain areas and in the northern end of the State, heavy rains along the northern coast with numerous landslides, and rain in the southern counties of San Bernardino and San Diego. At the same time U. S. Highway 99, the major north-south route, was closed between Bakersfield and Wheeler Ridge by a dust storm.

Such weather extremes mean a wide variety of road conditions, sometimes posing a serious danger to the unsuspecting driver. These varied road conditions, often changing very rapidly, create a difficult problem in keeping drivers informed of the situation on the road ahead of them. One device which offers considerable hope in coping with this problem is the radio-controlled road sign.

Two such signs have been installed and are now in use experimentally on US 40. They replace the old style wooden signs at Colfax and Baxter which were manually changed whenever necessary to inform eastbound traffic about conditions over Donner Summit.

Development of a radio-controlled sign began in the California Division of Highways about two years ago. A remote control type sign had been developed for use on the Pennsylvania Turnpike, and California Division of Highways technicians began working on an adaptation of the idea suitable for California conditions. Their aim was a system which was simple, foolproof, and which would indicate to the control station not only receipt of an order, but compliance with an order.

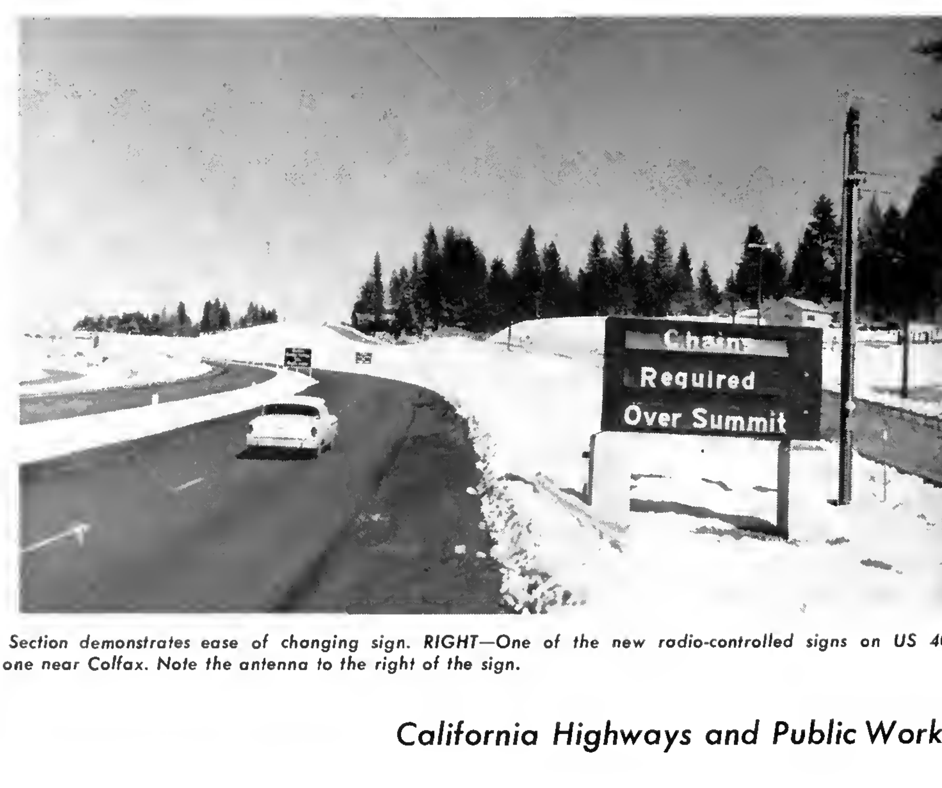
The design finally settled upon employs three long, three-sided units (triangular in cross section), one above the other, which are rotated by electric motors when the proper circuit is closed. The signal for closing the circuit is provided through a system of relays virtually identical with that used in dialing a telephone. In fact, an ordinary telephone dial is used to send the signal which changes the sign. Three-digit signal numbers are used; those in the 500 series are acted upon by one sign, those in the 800 series by the other.

When the sign changes and the new message panel drops into place, it closes a pressure switch much like the one which turns off a refrigerator light. This actuates another relay circuit and a transmitter, which sends a signal back to control, turning on a green light at the corresponding position on the control panel. A glance at the panel tells the operator what message each sign is showing at any time.

Radio control of the signs is from the highway maintenance station at Yuba Gap. Each is operated independently. In an emergency, control can be assumed by headquarters at Sacramento.

By various arrangements of the three movable units, 27 combinations

. . . *Continued on page 56*



LEFT—Cindy Kent of the Maintenance Communications Section demonstrates ease of changing sign. RIGHT—One of the new radio-controlled signs on US 40, this one near Colfax. Note the antenna to the right of the sign.

Embarcadero

Thirty Miles of Piles Used On New S. F. Freeway Viaduct

By DOUGLAS R. BROWN, Senior Engineering Geologist and DONALD R. HIGGINS, Senior Bridge Engineer

THE EMBARCADERO Viaduct, which was opened to traffic in February, is a double-deck, concrete box girder structure with four lanes on each deck along San Francisco's world-famed waterfront between Howard Street and Broadway. The south terminus connects with approaches to the San Francisco-Oakland Bay Bridge and with the freeway south on Highway 101. The ramps at the north terminus feed onto the busy Broadway thoroughfare and into San Francisco's financial district and North Beach area, several blocks east of the Broadway Tunnel.

An extreme variety of foundation conditions was encountered in the construction of foundations for the viaduct. These conditions necessitated foundations to vary from footings in bedrock to heavy section steel H-piles up to 225 feet long.

Geology of Bay Area

In order to put the foundation conditions of the viaduct into proper perspective, it is necessary to understand the general geological development of the San Francisco Bay area, since the two are intimately related. The underlying bedrock of the San Francisco Peninsula is the Franciscan formation. This formation consists predominantly of sandstone (but includes shale, chert, and serpentine) which was deposited during the Jurassic period of geologic time approximately 140,000,000 years ago. The sediments comprising this formation were gradually compressed and cemented to form the Franciscan sandstone that we see outcropping today in many areas around San Francisco.

Subsequent crustal deformation and erosion altered the surface of the Franciscan formation through succeeding geologic time. Through these geologic epochs, the situation was further complicated by several stages of uplift and subsidence with subsequent flooding by the ocean.

Uplift in the Bay area during Pliocene time uplifted the coastal ranges, including the San Francisco Peninsula. The uplift was rapid enough to block many rivers, but a major river, like the Sacramento, was able to erode at a fast enough rate to wear a channel through the rising mountain ranges. Thus were Carquinez Straits and the Golden Gate Strait formed. During this period the present Bay area was above sea level.

At the close of the Pleistocene, or great ice age epoch, the melting of huge continental glaciers, such as cover Greenland today, raised the sea level from between 250 and 350 feet. But, crustal deformation seems also to have been important in the lowering of land with relation to sea level. This was accomplished primarily by broad downwarping or folding, rather than by faulting, and resulted in the inundation by the sea to form the "drowned valley" which is the present-day San Francisco Bay. Sediments have covered the old landscape and filled the valley, or Bay area, to within a few feet of sea level, except for tide channels which have tended to keep clean by natural scouring.

The Embarcadero Freeway in downtown San Francisco shortly before it was opened to traffic showing the Bay Bridge beyond. The view is southeasterly.

Vioduct Conditions

At the site of the Embarcadero Viaduct before the downwarping the sculpturing of the topography of the Franciscan hills had been essentially completed. Contours on the bedrock surface, established by drill holes, apparently indicate an old shoreline surface with the water level approximately 250 feet deep. This shoreline environment is indicated by what appear to be rather steep wave-cut cliffs, a gently sloping foreshore to the east which steepens considerably two or three hundred feet further to the east. Gravel and cobble deposits were encountered on top of the Franciscan bedrock surface in many areas, though they were not everywhere present. This condition implies a location at or above sea level during the time of deposition, since material this coarse would be dropped almost immediately as a stream's velocity is checked upon entering a large body of water. The cobbles were apparently concentrated in depressions or stream channels in the old Franciscan bedrock surface. This is particularly true of the former river which was located at approximately the present location of Market Street. Immediately in front of the historic Ferry Building, these gravels are encountered at depths exceeding 200 feet.

The Embarcadero alignment was buried by geologically recent sediments just as was the rest of the Bay area. The sediments consisted chiefly of clayey silt and silty clay, though one 20-foot-thick stratum of sand was deposited at a present-day depth of a little over 100 feet. The clays were deposited in a swampy environment with marsh grass and other vegetation. This was dramatically demonstrated during exploratory drilling by the sudden release of trapped marsh gas while drilling at a depth of more than 100 feet. The resulting pressure blew mud fragments approximately 35 feet into the air, built a flat sloped mud cone about two feet high, and continued blowing for almost 24 hours!

Man Complicates Picture

The ends of the presently constructed two approaches to the Embarcadero Viaduct—one linking the viaduct to the Bay Bridge approaches, and the other terminating near the Broadway Tunnel just south of Telegraph Hill—are both supported by spread footings in sandstone. As one proceeds toward the center from both ends, the bedrock dips away and is covered by increasing thicknesses of "bay mud." Near the center of this low area, which is almost exactly in front of the Ferry Building at the foot of Market Street, bedrock is approximately 250 feet deep. Man, in most of this area, has greatly complicated the subsurface picture. Extensive dumping of debris to extend the waterfront was practiced for many years. Frequently, boats and large ships were simply covered over, particularly in the gold rush years when crew desertions were common. Timbers were encountered in exploratory borings on several occasions. Huge amounts of debris, resulting from the famed San Francisco earthquake of 1906, were added. To further complicate the picture, a wide sandstone rubble seawall had been built, then covered over, along almost the exact centerline of a substantial portion of the viaduct. A large timber wharf near the Ferry Building had similarly been filled over.

Quiet Myrt, one of the piledrivers used on the job, as it was being assembled.

Test Borings Slow Process

Drilling through the 40 feet or 50 feet of rubble fill usually present frequently took more than a day. Obtaining a sample at depths between 150 and 250 feet would normally take almost an hour for the two "round trips" involved, even if all went well and the hole did not squeeze in. Not the least of the problems in the area near the Ferry Building was the traffic (including trains) which seemingly could approach the equipment from every direction except out of the ground. A large number of borings and penetration tests were made, although buildings frequently prohibited drilling in critical areas. Some borings were made in parking lots after dutifully reimbursing the proprietor for the spaces occupied.

All of the debris, plus the low elevation of the ground, made a depressed section very impractical, although strongly desired by some San Franciscans for esthetic reasons. The continuous reinforced concrete design made elimination of appreciable settlement essential. Though the Embarcadero had been filled and paved for many years, settlement of streets caused by continuing consolidation of the normally loaded clays was still occurring at the rate of one-half inch to three-fourths inch a year. However, no lateral or seaward movement had been detected. Many buildings in the area, supported by piles founded in a sand layer more than 100 feet deep, had settled, some more than three inches.

This confirmed boring results which indicated fairly soft normally loaded clay below the sand. Therefore, it was decided that all piles should achieve bearing in bedrock, or in the gravel which existed just above bedrock in some areas. Heavy section steel H-piles were best suited for this purpose. Contours were drawn on the bedrock or gravel surface to serve as estimated pile tip penetrations. In order to test the ability of steel piles to penetrate the sand layer, a special contract to drive three test piles was approved and executed. All three piles encountered high resistance in the sand, but penetrated to bedrock.

Another view of the Embarcadero Freeway Viaduct under construction looking eastward with the San Francisco-Oakland Bay Bridge rising out of the fog.

Variety of Piles

Pile driving on the Embarcadero Viaduct contract was subcontracted to Macco Corporation of Paramount, California.

Piles placed included concrete piles, pipe piles, and H bearing piles. The concrete piles used were cast-in-drilled-hole piles with a design load of 45 tons. The pipe piles were concrete-filled, 12¾-inch O. D., one-fourth-inch-thick piles with a design load of 80 tons. The H bearing piles were 14BP89 and 14BP102 sections with design loads of 100 and 125 tons, respectively. Slightly over 30 miles of piles were driven in all. The quantities for each type of pile driven are tabulated as follows:

	Concrete	Pipe	14BP89	14BP102
Number of piles	20	70	82	822
Quantity on plans	210 l.f.	3250 l.f.	11,300 l.f.	144,000 l.f.
Quantity actually used	84 l.f.	3098 l.f.	10,865 l.f.	143,880 l.f.

The pile work amounted to $1,840,000. This is 26 percent of the total contract cost of $7,100,000.

Contract Requirements

In addition to the requirements of the Standard Specifications, other stipulations were specified in the Special Provisions to insure a good foundation under the special conditions encountered at the site.

One of these requirements was that the piles be driven in holes drilled or spudded through the rubble fill to the elevations shown on the plans. This was to prevent damage to the piles in driving through the fill, reduce drag on the top of the piles, and to help maintain plumb piles. Having both straight and plumb piles was considered important because of the long-term settlement of the area which would result in drag down on the piles.

In order to assure penetration to bedrock or gravel, piles were required not only to obtain dynamic bearing based on the Engineering News Record formula but also to penetrate to at least specified elevations within a few feet of the bedrock surface. Pile hammers of adequate size (minimum 28,125 foot-pounds) were required to drive the long, heavy 14BP102 sections.

Footing Excavation

Jackhammers were used to break through the cobblestone street surface. Further excavation for the column footings to depths of five to six feet below street level was accomplished by a backhoe rig. This was anything but easy digging, for old pavements, sidewalks, utilities, and other structures in the area had settled and new ones were built over them through the years. The remains of many of these old structures were uncovered in digging for the foundations.

In order to confine the limits of excavation and to avoid excessive sloughing due to the vibration of the pile-driving operation and the action of tidal water seeping into the hole, all footing excavations on the Embarcadero were timber lagged.

Pipe and Steel H-Piles Used

The pipe piles were driven by a skid rig which was built on the project by Macco. It carried 95-foot leads reinforced with a double A-frame. The energy was delivered by a 65-horsepower boiler to a single-acting steam hammer modified as explained in the following section on steel H-piles.

Difficult driving was encountered for the pipe piles and more than adequate bearing was obtained for most of the piles about three feet above specified tip. Lengths of piles driven varied from 16 to 70 feet, increasing in length in an easterly direction toward San Francisco Bay. The pipe piles were all located on the Broadway ramps.

The 14BP89 and 14BP102 piles were driven by two rigs affectionately named Quiet Myrt and Silent Sue. Quiet Myrt is the skid rig used also for driving the pipe piles. This rig was equipped with a 35-foot spud and an extractor. The extracting line was designed to exert 100 tons of uplift in addition to having an extracting hammer working simultaneously in the same line. Spudding was required for driving steel H-piles. The first spud used was a riveted box girder which broke up shortly after it was first used. A 14BP102 pile heavily reinforced at both the nose and butt ends was used thereafter. Silent Sue is an old steam shovel converted to a pile driver. Its 65-foot boom handled 60-foot fixed leads. A 140-horsepower oil-burning boiler supplied steam for pile driving as well as for operating the rig. The specifications required that the pile hammer for driving steel H-piles develop sufficient energy to drive the pile at a penetration rate of not less than one-eighth of an inch per blow at the specified minimum bearing value. Two single-acting steam hammers capable of delivering 32,500 foot-pounds of energy and a smaller single-acting steam hammer modified by adding weight to the ram to meet the specified requirements were used interchangeably on the two rigs as dictated by the need for repairs on any of the hammers.

The 14-inch steel piles were delivered to the job site in 55- and 60-foot lengths. The completed lengths ranged from 80 feet to 225 feet. Segments of pile were spliced by welding on the ground up to lengths of 90 feet in order to keep welding in the leads to a minimum. Three welders were employed for welding in the leads—one on the web and one on each flange.

Spudding and driving of the first section of pile were accomplished by Quiet Myrt. The second section and, where necessary, the third section were welded on and driven to bearing by Silent Sue. Occasionally, where driving was particularly difficult, Quiet Myrt completed driving of some of the piles to bearing in order that the two rigs would not be separated by too great a distance.

Pile Behavior During Driving

Various individual piles were logged during the driving operation. Some of these piles are near locations where test borings were taken. In these cases, it was possible to correlate the behavior of the pile with the geological formation through which it was being driven.

The behavior of a typical 200-foot 14BP102 located on the Embarcadero at Market Street where the longest piles were driven will be described. The spudding operation pioneered a hole through the initial 30 feet of fill consisting of a heterogeneous stratum of sand, pebbles, blocks of rocks, wood fragments and various debris. The pile was placed in this hole and driven through a 90-foot layer of soft clayey silt and clayey sand. Driving was relatively easy during this stage with a gradual increase in blow count indicating bearing resistance (ENR Formula) of from 20 to 40 tons. At approximately 130 feet below the street level, sand was encountered and driving was increasingly difficult through a 20-foot layer of progressively dense medium sand, coarse sand and gravel. Specified bearing was reached for 10 feet of this stratum as the blow count increased rapidly and then declined as the layer was penetrated. A 60-foot layer of compact grey silt with clay binder was the next obstacle. The blow count here indicated an average of 90 tons bearing capacity for this depth. Finally a shallow layer of very dense gravel was reached, below which was encountered the Franciscan bedrock where specified bearing of 125 tons was achieved.

Project Completion in 1959

Charles L. Harney, Inc., of San Francisco, the prime contractor, started work on this project in December of 1956. Pile-driving operations were started on February 25, 1957, and were completed on June 5, 1958. The only major delay was for two months when realignment of the State Belt Railroad track was necessitated by the proximity of the existing track to some of the footings.

The project was handled by the Bridge Department, Division of Highways, under F. W. Panhorst, Bridge Engineer. Representing the Bridge Department on the project was Resident Engineer D. R. Higgins.

DELANO

Continued from page 26 . . .

It may well be said that a business street, not unlike a man, must find its own niche. Main Street in Delano acquired its pedestrian traffic business character at the very outset; High Street for many years prior to freeway construction, was still grasping for economic identification and recognition. Perhaps the true business character of the old highway might not have emerged for many years had the freeway not been constructed. In any event, High Street—actually the oldest business street in the entire City of Delano—now shows every sign of capitalizing on its "new" business character and economic "respectability" as a second "main street."

In 1957, 1,330 Americans were killed in train-car crashes.

Crystal Lake

New 6-mile Road Is Built in Rugged, Scenic Angeles Forest

By GEORGE E. DICKEY, Construction Superintendent

CRYSTAL LAKE Road, 6.15 miles in length, a portion of State Highway Route 62, starts at Islip Saddle, on the Angeles Crest Highway, 41 miles north of Foothill Boulevard and extends southward along the easterly slope of Bear Canyon, thence swinging easterly into the head of the San Gabriel Canyon to join the existing paved highway in the vicinity of Crystal Lake.

This road passes through some of the most scenic mountainous areas of the Angeles National Forest and will afford the people of the eastern portion of the Los Angeles Basin a shortcut to the recreational areas. The U. S. Forestry Service is taking great strides in developing campsites and recreational areas in this part of the forest. The ski lifts at Mt. Waterman, Kratka Ridge and those in the Wrightwood area are constantly being improved to handle more skiers and to offer better facilities. As these recreational areas and facilities are improved, more and more people will be driving into the mountains and the Crystal Lake Road will be a useful link in our vast highway system for which California is so well known.

This photo of drilling operations on a section of Crystal Lake Road gives an idea of the ruggedness of the terrain.

The Crystal Lake Road is being constructed by the State Division of Highways under a conservation camp program in co-operation with the California Department of Corrections under which inmate labor is being used. The inmates at Cedar Springs Conservation Camp No. 37 are drawn from the California Institution for Men at Chino, after being carefully screened and approved for the conservation camp program. E. J. Oberhauser, Superintendent, and Captain J. T. Breen, Chief Camp Supervisor, both of the State Department of Corrections, have been highly co-operative in working out the details of the program. The majority of the men are finishing up their sentences and have less than two years to serve before going on parole. Some of the inmates have been in the various correctional institutions throughout California and have progressed sufficiently to justify their transfer to Chino and inclusion in the camp program.

Few Infractions

While in camp, the inmates are under minimum supervision and are allowed freedom within the camp limits provided they observe the camp rules and regulations. All of the men are in camp at their own request and very few abuse the privileges permitted them. Any serious infractions of the camp rules results in the violators being returned to Chino.

During the working day, the men are assigned to various crews supervised by State Division of Highways foremen. The men assist in the operation of the entire physical plant as well as in the construction of the highway. They have the opportunity to assist with and to get experience in the following types of work: painting, carpentry, plumbing, warehousing, clerical, welding, blacksmithing, stationary power plant operation, heavy and light equipment maintenance, equipment servicing and lubrication, jackhammer operation, blast hole drilling, handling, loading and shooting powders of all kinds, masonry, pipelaying, equipment operation, grade checking, dirt and rock excavating and other types of construction labor. An effort is made to place the men in the type of work in which they show the most interest and for which they are best adapted.

Construction work started in November, 1952. At this time the camp crews were also working on the Angeles Crest Highway. The work was at the far end of the job and the crews had to travel 15 to 20 miles to get to the site of the work. When the weather was bad, the crews could not get to the job on Angeles Crest Highway so they started working on the Crystal Lake Road. During the winter of 1955 the power shovel was moved onto the Crystal Lake Road job and work then continued on a full-time basis.

Same Hazards

In November, 1956, the Angeles Crest Highway was finished to Big Pines and all of the construction forces were then moved on to the Crystal Lake Road. By this time, the token forces had pioneered a roadway, a distance of 1.2 miles, and by December, 1957, had pioneered an additional two miles. During the year 1958 the pioneer crews worked all the way through to the end of the job and had developed a construction roadway passable to four-wheel-drive equipment.

The mountains of this area are made up of badly decomposed and fractured rock of igneous origin which in some places still retain granite texture and some of which have been metamorphosed and decomposed to such an extent that they have almost lost their geological identity. This condition has made the construction particularly hazardous because of the high cuts encountered and the instability of the excavation slopes. Almost all of the rock has to be blasted because it is too hard and blocky to be ripped and yet it is so fractured and faulted that it is extremely hard to drill.

The construction centerline was established on the ground by Don W. Chesley, Resident Engineer, from an old preliminary survey line run in by the U. S. Bureau of Public Roads many years ago. The terrain is so rugged in many places that mountain climbing techniques had to be used to set slope stakes. A clearing crew followed closely behind the surveyors or worked with them when necessary and cleared the right-of-way of all brush and timber. All of the timber of suitable size was hauled into the camp sawmill and was cut into lumber for use in construction and camp maintenance.

Precipitous Terrain

As fast as the clearing crews advanced, they were followed by pioneering drill crews who worked themselves out across the precipitous terrain and drilled the initial slope line trail. These men worked in 10-man crews under a highway foreman. Each crew had a 500-cubic-foot compressor, 1,500 feet of aluminum slip joint air line and a number of jackhammers. While four men worked the jackhammers at a time, the remainder of the crew packed in all of the necessary equipment. This work was a continuous process with the crews drilling, moving ahead and then shooting. Several crews were used in this manner as circumstances required. As the pioneering continued, a tractor dozer would work a trail over the shot area as close as possible to the pioneer crews in order to cut down the backpacking distance.

Sometimes an area would have to be hand drilled several times before the tractor could get through, then the area would have to be drilled several more times before we could truck in our supplies. During this period we transported supplies ahead by using a rack on the front of the dozer blade.

After the road is developed to the point where we can pull in our 600-cubic-foot compressors, we then drill 20-foot holes with four crawler-type blast-hole drills. Rippers were tried and were successful in some cases but in most cases the progress was so slow that it was found that blasting was much cheaper.

Work Planned in Advance

Although tractors and scrapers were used for a short time in a location that lent itself to this type of work, it is necessary to haul most of the excavated material with trucks because the hauls are long and the steepness of the terrain makes the roadway quite narrow. The trucks are loaded with a 2½-cubic-yard power shovel and also with a 3-cubic-yard tracklaying front end loader.

All work is planned in detail a year in advance and the general approach to the work is carried out to this end. However, the work program is revised at short intervals in order to compensate for unforeseen interference such as storms, landslides and other contingencies. J. P. Robinson, foreman, is most helpful in planning and scheduling of the work. As the work progresses and the roadway is brought to approximate grade, several crews follow along, installing culverts, masonry headwalls, retaining walls and other miscellaneous drainage structures.

The terrain at one location consists of almost vertical cliffs which extend about 1,000 feet above roadway grade and drop off about 500 feet below grade line. The cuts in this area are nearly 500 feet high in solid rock and it has been a difficult project to get a pioneer road to the top of the initial cut. However, this work is progressing favorably. In the meantime, in order to keep the work moving beyond these cliffs, it was necessary to build a temporary road down across the bottom of the canyon to bypass the cliffs and continue our pioneering. This roadway was quite hazardous at first but as materials were pushed off the top, the road was raised. It is now easily passable except when intentionally closed because of construction work above.

Explosives Used

During the past year 330,000 pounds of explosives were used on this project. When the work is progressing normally, powder is used at the rate of one ton per day. Three-and-one-half-inch bits are used to drill 20-foot holes and are driven with individual 600-cubic-foot compressors. Although the drills are able to tow their own compressor around the

UPPER—Another view of the rugged terrain through which the road is being constructed. LOWER—An aerial showing the alignment of the road. Note the dust cloud in the background where the construction is going on.

One of the late model drills being used on the Crystal Lake Road construction.

working areas, they have to be aided by tractors on the steeper hills.

From 400 to 1,000 feet is the average footage per shift by each drill according to the kind and condition of rock being drilled. The holes are normally drilled on a 7-foot by 9-foot pattern and between 200 and 600 holes are shot at a time, depending on conditions. During the summer months when the work is in full swing, shots are set off every three to five days.

This particular project, being located in the Angeles National Forest, requires that we conduct our blasting operation with minimum damage to the trees outside of our right-of-way line. Our problem is to break up the rock so that it can be economically loaded with a power shovel and still contain the shot so that it does not throw a lot of rock into the trees. When the natural slopes are 1:1 or steeper, a great amount of care must be taken. Various methods of drilling and loading have been used and through experimenting good results have been accomplished.

Conduct Experiments

There has been much discussion regarding the use of ammonium nitrate in large blast holes, but we were discouraged from trying to use it in small holes. It was doubted that ammonium nitrate could be used successfully in holes as small as 3½-inch by 20-foot. However, we have conducted experiments of our own. Everett E. Brooks, foreman in charge of drilling and blasting, kept a systematic record of loadings and shot results and finally came up with results as satisfactory as those using regular blasting powder, and at much lower cost.

The 3½-inch by 20-foot holes are loaded as follows: A primer, consisting of a 2 x 12 stick of 60 percent powder and an electric blasting cap, is placed in the bottom of the hole. The hole is then filled approximately 18 inches with grained ammonium nitrate because it can be packed denser which gives better fragmentation in the bottom. Prilled ammonium nitrate is then poured into the 5-foot level. At this point another stick of 2 x 12 60 percent powder is put in for a booster. Then the hole is filled to within six feet of the top. Prilled ammonium nitrate is used in the top portion in order to get the powder level higher in the hole without using too much powder. In extremely hard rock about six pounds of 40 percent bag powder is sprinkled in the hole with the prill in order to give a little boost to the prill.

The use of ammonium nitrate has been simplified on this project by the following methods. To be effective ammonium nitrate must be saturated with diesel oil. Originally this was done by pouring four-fifths gallon of oil into the 80-pound bag but spotty oiling resulted. We obtained even dispersal of the oil throughout the ammonium nitrate by using a gallon-size garden sprinkling can and sprinkling the oil over the top of the open bag. The sacks are then dumped into aluminum bodied wheelbarrows. Aluminum sugar scoops are then used to measure the nitrate as the holes are loaded.

Substantial Savings

Average costs have been kept over a period of time and it is found that the powder costs for straight powder are 10.5 cents per cubic yard of rock and the costs when using ammonium nitrate are 5.3 cents per cubic yard of rock. These costs indicate a great saving to the State, therefore this type of loading is being used whenever the weather is good. Ammonium nitrate is completely soluble in water while other powders are more durable in wet weather. Therefore, if there is indication of wet weather, we switch to other powders rather than risk losing a shot.

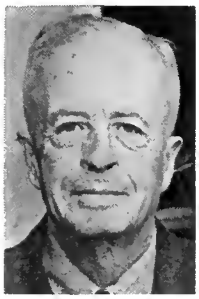
The progress on this project has been due to the perseverance and interest shown by the foremen and operators employed by the State Division of Highways and also to the co-operation of the correctional officers headed by Lieutenant L. W. Baugh and his recent replacement, Lieutenant B. E. Swisher. Much is to be said about the enthusiasm and interest shown by the inmates and their desire to produce a good job.

At the present rate of production, it is anticipated that this project will be completed in early 1961.

H. R. Lendecke, Bridge Engineer, Retires

H. R. Lendecke, Associate Bridge Engineer, Division of Highways, retired in November after 32 years with the State.

Lendecke was born on September 20, 1895, and received his early education in Georgetown, Colorado.



H. R. LENDECKE

After returning from service in World War I, he completed his engineering training at the University of Colorado where he received his bachelor of science degree in civil engineering.

His early engineering experience included one year of surveying with the Bureau of Public Roads, one year on construction work in Chicago with the Illinois Central Railroad and three years in Miles City, Montana, with the Chicago, Milwaukee, St. Paul and Pacific Railroad on the design of railroad bridges.

After coming to California, Bob worked on the subdividing of the Lake Arrowhead area. Later for a period of two years he was City Engineer of Winslow, Arizona.

He joined the Bridge Department of the State Division of Highways in 1926 and since that time has worked on many of the major bridge projects throughout the State. During the construction of the San Francisco–Oakland Bay Bridge he worked on the construction of all of the caissons for the east bay structure.

The state bridges on which Lendecke was resident engineer include such major structures as the Santa Margarita River Bridge on the Coast Highway, the four-level structure in Los Angeles and the Colorado Freeway Bridge across the Arroyo Seco in Pasadena.

Lendecke married Lucile Smith at the University of Colorado on January 2, 1920.

The Lendeckes live at 11444 East Keith Drive in Whittier.

SUPERVISION COURSE GIVEN IN ELEVEN DISTRICTS

By SCOTT H. LATHROP, Principal Highway Engineer

DURING the past year, a training course on "Principles of Administration and Supervision in Highway Practice" has been presented in each of the 11 districts of the Division of Highways and at the Sacramento Headquarters.

While the course was designed primarily to meet the needs of supervisors in the Division of Highways, it was given in co-operation with the Institute of Transportation and Traffic Engineering of the University of California and was made available at the same time to employees of cities and counties. Approximately 10 to 15 percent of the 1,300 or so who have attended the courses have been employees of organizations other than the Division of Highways.

A survey of all the districts of the Division of Highways some time ago indicated that most employees felt the need of some training in the supervisory area. An opinion survey conducted in June of 1957 confirmed this fact. Preparations for a course to help fill this need were started in late 1957 and completed in early 1958.

Most of the work on the syllabus for the course was done by Robert T. Martin, Administrative Assistant from District III in Marysville, with guidance from Doctor James R. Bell, Professor at Sacramento State College, and William Z. Hegy, engineer in charge of training and safety for the division. Material for inclusion in the syllabus was secured from a number of different sources.

In preparing the course, care was taken to include both theoretical presentations and practical applications pointed toward actual problems encountered in highway work. In selecting instructors, an effort was made to maintain the same balance. Doctor Bell carried the greater part of the theoretical presentation. Doctor Bell's background particularly suited him for the assignment, since for many years before recently joining the Public Administration faculty at Sacramento State he was one of the top executives with the California State Personnel Board. The other two instructors were selected from within the Division of Highways organization. Rudolf Hess is one of the assistant chief right-of-way agents for the division, and Scott H. Lathrop is the engineer in charge of personnel and public information. Both have had specialized instruction and experience in the training field.

The course itself was 12 hours in length. The presentations, following the usual I. T. T. E. pattern, were generally given on Friday evening and Saturday morning for two successive weeks. The course was divided into three primary sections, dealing with job management, man management, and self-development.

Response to the courses, which were given entirely on the employees' time and required a registration fee, has been excellent throughout the division. Attendants at the course have come from all parts of the highways organization (engineering, right-of-way, accounting, etc.) and from all levels.

Many favorable comments have been received, and many employees expressed a desire that additional opportunities be provided in the area of supervisory training in the future.

As a result of this expressed desire for additional supervisory training several districts are conducting six two-hour conferences in supervisory techniques for their staff, under the guidance of a trained conference leader.

All of the courses stress the consideration which has to be given to the recognition and evaluation of personal traits and qualities of the individual in the creation of a well-functioning organization. They delineate the tools available to a supervisor to improve his skills in handling his subordinates to obtain the objectives of the organization.

At the end of the 1957-58 Fiscal Year, the State Division of Highways was operating 160 radio stations, 21 microwave stations and 800 mobile radio units.

Merit Award Board Announces Winners

Employees of the Department of Public Works receiving certificates of commendation and cash awards since the last list was published in the November-December issue of this magazine are:

Lloyd B. Reynolds, Highways, Sacramento. Certificate of award and $25 for suggesting printed bidders bond forms to facilitate handling.

Alfred E. Hoerchner, Lindsay. Certificate of award and $10 for recommending that the daily diary be provided with a triplicate copy to be sent to the resident engineer.

Fred H. Rogers, Sacramento. Certificate of award and $15 for recommending the elimination of supplemental property survey reports.

James L. Anderson, King City. Certificate of commendation for recommending that Form R-13 be provided with additional sheets of carbon.

Richard F. Gregory, Architect, Sacramento. Certificate of commendation for recommending the placing of a routing check list on change order forms.

Leo E. Murray, Highways, San Francisco. Certificate of award and $20 for designing a bracket to be used for painting and repairing signs where the footing for a ladder is not level.

John E. Borchert, Highways, Sacramento. Certificate of award and $25 for proposing an acid titration method for the determination of cement content in cement-treated bases.

Ralph H. Yale, Highways, Sacramento. Certificate of award and $10 for recommending that grooving tool tips be made of low carbon steel.

Joseph L. Hart, San Francisco-Oakland Bay Bridge, Oakland. Certificate of award and $50 for designing a swing or swivel base for winch used to raise and lower scaffolds on East Bay towers of the bridge.

George E. Duclo, San Luis Obispo. Certificate of award and $150 for developing a tool consisting of a mirror, engineer's scale, and protractor, for plotting radial lines and perpendiculars.

Mrs. Eunice R. Latham, Oakland. Certificate of award and $15 for recommending revision of Form A-127.

Marvin E. Metzler, Fresno. Certificate of award and $60 for recommending that District VI acquire a typewriter with a special carriage and type to be used for typing tabulations on the contract plans, thus eliminating hand lettering formerly required.

Neal J. Frandsen, Sacramento. Certificate of commendation for recommending that the stores department stock mass diagram sheets 23" x 36".

Tillie Schindler, Sacramento. Certificate of commendation for recommending revision of Form A-127.

L. S. Sanderson, Division of Architecture, Los Angeles. Certificate of award and $25 for recommending the consolidation of drafting details pertaining to doors, door frames, transoms, sills, mullions, etc., on one sheet of drawings instead of being placed on several sheets.

Mrs. Gladys H. Rippon, Division of Contracts and Rights-of-Way, Sacramento. Certificate of award and $10 for recommending that an extra duplicate or triplicate copy of claim documents be made at the time initial copies are made on the Verifax machine.

Boulton Hertzog, Division of Highways, Stockton. Certificate of award and $50 for recommending use of a two-solution developer for photographic materials rather than the standard one-solution developer.

Mrs. Aurelia B. Rinderneck, Division of Highways, San Diego. Certificate of commendation for recommending the padding of Forms M-32 and M-123.32 into pads of 50.

Field Men Enroll in Maintenance Course

More than 100 road and highway field men are enrolled in an adult education course in highway maintenance which is being conducted in San Diego County under the direction of the county road department.

According to J. H. Mack, road commissioner, the course is included in the county's adult education program for the spring semester. Text for the course is the Division of Highways Maintenance Manual. Three-hour classes are held one evening each week at Grossmont High School and at Palomar College near San Marcos.

Instructors are Dale Talbot of the Division of Highways District XI office and J. Settles of the county road department.

Of the more than 100 field men taking the course, 35 are from the Division of Highways, 25 from the City of El Cajon, and the remainder from the county road department.

State Division of Highways maintenance forces painted traffic lines and pavement markings on 10,992 miles of state highways during the 1957-58 Fiscal Year. Cost of the work was $1,073,307.

Ed Wilson Retirement Marked in Marysville

F. E. "Ed" Wilson, District Right-of-way Engineer for District III, retired on February 1st after a career of over 31 years with the California Division of Highways. All of Wilson's California state service was in District III.

F. E. WILSON

He was born in Madison, Wisconsin, on Christmas Day, 1897. The Wilson family moved to Oregon while he was quite young. He attended public schools in Mosier and graduated in 1924 from Oregon State College with a bachelor of science degree in civil engineering. He was employed by the Oregon Highway Department as a draftsman and transitman from the time of his graduation until 1928.

Wilson joined the Division of Highways on January 13, 1928, as a draftsman. From then until his retirement, he became one of the district's most versatile engineers with experience in right-of-way engineering, in location work, in construction as a resident engineer, in design and in the preparation of reports. He also was among the first in the district to use aerial photography in highway development work.

On January 1, 1949, he was promoted to senior highway engineer and assigned as district location engineer. The initial work on the location of the freeway on Highway US 40 was made during this time. He served as district materials engineer from 1953 to 1957 during the period when the district materials laboratory was built. In 1957 he was appointed district right-of-way engineer.

A registered civil engineer, he is a member of the American Society of Civil Engineers. His fraternal associations include membership in the Masons and Elks.

He plans to remain active in engineering after his retirement from state service. He will make his home at his present address on Live Oak Highway in Yuba City.

District X Traffic Engineer Retires

Richard A. Wilson, District Traffic Engineer of District X in Stockton, retired in January after 37 years of service with the Division of Highways.

Wilson was born in Astoria, Oregon, in 1893. He attended the College of Civil Engineering at the University of California in Berkeley and worked in engineering capacities for the Coast and Geodetic Survey, Oregon Highway Commission and the City of Astoria prior to World War I, during which he served in the Coast Artillery.

RICHARD A. WILSON

After the war he went to work for the Division of Highways in District IV as an assistant permit inspector. He was soon promoted to permit inspector and later maintenance superintendent in Sonoma, Napa and Marin Counties.

In Maintenance Wilson gained experience in traffic engineering, since at that time Maintenance controlled work now performed by the Traffic Department. In 1941 Wilson was transferred to District X as District Traffic Engineer and served continuously in that capacity until his retirement except for a period in 1945-46 when he was traffic engineer for the Headquarters Military Police Division in the European Theater. While on this assignment he established standard road signs and signing procedures and prepared a booklet entitled "Road Sign Manual for the Control and Guidance of Military Traffic."

Wilson is an associate member of the American Society of Civil Engineers, a member of the Institute of Traffic Engineers and a member of the San Joaquin Safety Council. Mr. and Mrs. Wilson have a son, Robert, now living in Costa Mesa, and two granddaughters.

Speeding was blamed for 13,200 deaths on United States highways in 1957.

CONTRACT CONTROL

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phasizes the need for careful fact finding as a basis for estimating the time required for each stage of the project, and also offers suggestions on estimating these production limits with reasonable accuracy.

From estimates of the time required for each portion of the job, the report states, a tentative overall contract time limit can be set. This overall limit may be checked against the normal range of progress (as shown on the chart) to see how it fits in with the estimated production rates.

The report emphasizes that the curves on the chart will not actually determine the proper time limit. They will only provide a check by indicating whether or not the proposed overall time limit is consistent with the estimated rates of production.

"It will always be necessary to analyze the work to be done and to set production as reasonably as possible," the report says. "Once this has been done the use of the curves will serve as a check upon the reasonableness of the time specified.

"The methods of analysis presented cannot be considered as an end, rather they are only a means. Final conclusions must always be tempered with sound engineering judgment. The entire problem of time limits, contract progress and controlling items are, on the whole, so complex as to defy exact determination. All processes that may be developed will at best resolve the facts into a picture from which an engineer is able to draw reasonable conclusions.

"While it is not possible to reduce these matters to a mathematical certainty of A, plus B, minus C equals a decision, it is felt that the use of the methods presented herein will produce results within the structure of the specifications that are reasonable and fair to the State and the contractor alike."

Results of the study are reported in the pamphlet "Contract Progress Control" which is available to highway engineers and other interested persons on request to the Division of Highways.

Clementine Dougherty Of District VII Leaves

Clementine Dougherty, a state employee since 1925 and with District VII of the State Division of Highways since 1942, has retired. She was honored at a party in Los Angeles last December. Edward T. Telford, Assistant State Highway Engineer, presented her with a camera, a parting gift from her many coworkers and friends. Since 1947 Mrs. Dougherty had been in charge of the general file room.

CLEMENTINE DOUGHERTY

She was born in Glendive, Montana, and gradauted from Dawson County High School. She came to California in 1925 and married Earl Dougherty (now deceased) in 1927.

Division Publishes Design, Sign Studies

Two studies of interest to highway engineers, one new and one a revision of an earlier study, are now available from the Division of Highways.

The newly published report is entitled "Driver Needs in Freeway Signing." It was prepared for the Division of Highways by the Automotive Safety Foundation. It is believed to be the first time in highway history that the much-discussed question of how to sign freeways properly has been the subject of concentrated research, aimed at developing a set of guideposts for future traffic engineering practice. Interviews with drivers form the basis for the study.

The other publication is "Correlation of Geometric Design and Directional Signing," which was originally issued in 1956. It has now been brought up to date to conform to present day geometric design and signing standards for freeways.

Persons interested in either or both of these publications may request them from G. M. Webb, Traffic Engineer, Division of Highways, P. O. Box 1499, Sacramento 7, California.

CALIFORNIA BRIDGES

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the rise in bridge construction costs since 1939-40. In 1958, as a result of an increased budget, the rates rose to 13 and 5 for value and volume, respectively.

The activity indexes are designated as value and volume indexes in the accompanying charts where the values are given for all periods since 1934.

The average number of contracting firms bidding on contracts which included bridge work was 8.0 during 1958 as compared with an average of 7.4 bidders per contract during 1957. Since a high number of bidders is associated with greater competition, construction costs generally move downward when bidders are more active. In 1958, bidder activity was up and prices were down by 5.5 percent, indicating that competition was fairly strong during the relatively depressed economic period of the past year.

Unit Price Trends

Unit prices for the various bridge items reached record highs during 1957, declined during the first quarter of 1958 and varied very little from the new level for the remaining quarters of 1958.

Class A portland cement concrete (structures) cost an average of $58 per cubic yard in 1957 and dropped to an average of $55 per cubic yard in 1958, a reduction of about 5 percent. Structural steel cost an average of $0.205 per pound in 1957 and dropped to an average of $0.17 per pound in 1958, a reduction of 17 percent. The rather dramatic reduction in the price of structural steel is a reflection of the change in this industry's economic position from one of high demand and limited availability to one of limited demand and more than ample availability. Bar reinforcing steel, on the other hand, cost an average of $0.123 and $0.124 per pound for the years 1957 and 1958, respectively. The economic position of this industry apparently remains one of high demand and limited supply.

The foregoing items together represent a valuation which accounts for about 75 percent of the total value expended for bridge construction. The changes in the unit prices of these items therefore exert a preponderant influence upon the general trend of construction costs.

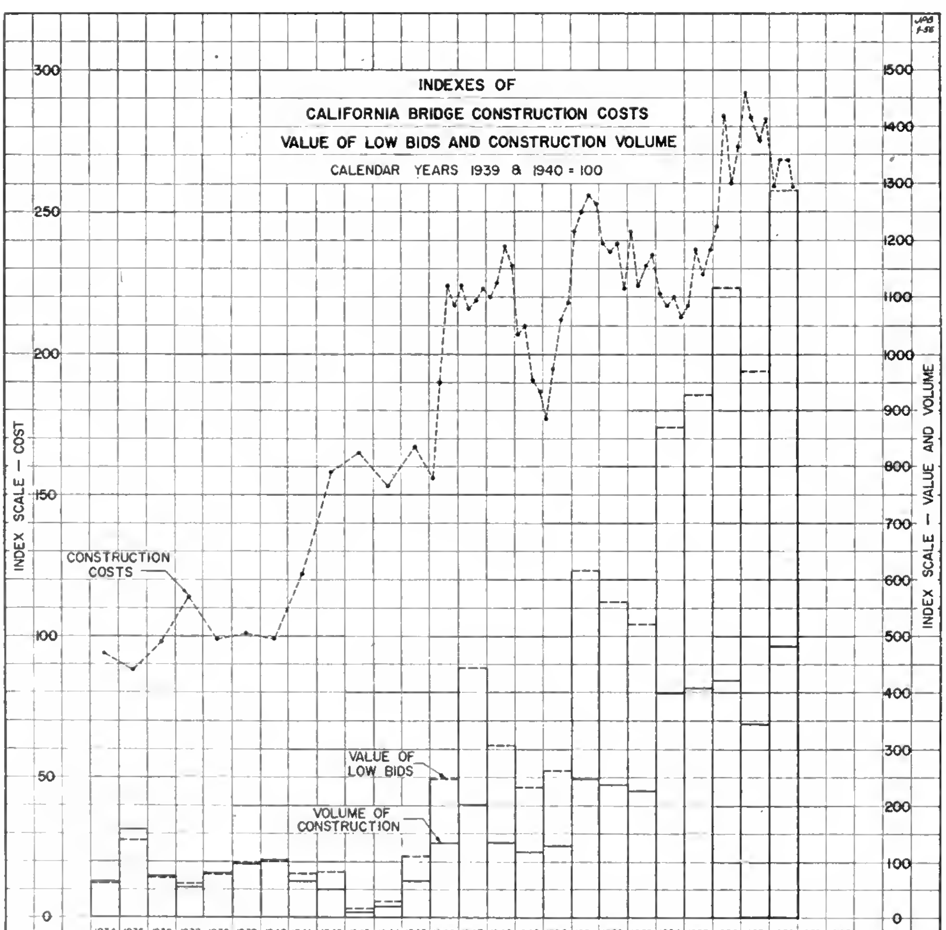
During the past four years the bridge construction program has required about 450,000 cubic yards of concrete, about 18,000 tons of structural steel, and about 50,000 tons of bar reinforcing steel annually. A change of $1 per cubic yard in the price of Class A concrete therefore implies a change in annual cost of $450,000, and a change of $0.01 per pound in the cost of structural steel and of bar reinforcing steel imply changes in annual cost of $360,000 and $1,000,000 for the items, respectively. Changes in the prices of these items are therefore significant when considered in terms of the annual program.

The prices for these items declined during the past 15 months, a decline which coincided with the trend of the last general economic recession. Since the general economic trend is now moving upward, the prices of these items may also be expected to move upward.

Summary

The period prior to about the third quarter of 1957 was a period of general prosperity and bridge construction costs were accordingly high. The most recent period of relative recession became apparent in the latter part of 1957 and, once under way, continued through the greater part of 1958. Bridge construction costs declined accordingly.

The year 1959 is currently being described as one of a slow but determined period of economic recovery and growth. It is also being assumed that the inflationary forces will not move into another period of sharp inflation. It may therefore be assumed that California bridge construction costs will again proceed upward during 1959 but at a much more moderate rate than that of the last period of inflation which began in 1955 and ended in the middle of 1957.



HOW FAS WORKS

Continued from page 17 . . .

the financing of the contract, which in no event is less than approximately 10 percent of the contract.

Upon approval of the contract by the state attorney, the county takes over and performs the construction engineering and prosecutes the contract to a satisfactory completion. The State and the Bureau of Public Roads inspect the work occasionally during construction in order to assure themselves that the work is being done to proper standards and that the county is complying with all state contract procedures.

Freedom From Interference

The county certifies to the State each month the amount due as progress payments, and upon completion of the job, the final amount is computed by the county and certified to the State. The State makes all payments due under the contract.

From start to finish the federal-aid secondary projects are county projects. Without interference in any way, we select our projects, determine the standards we wish to use, make our preliminary surveys and plans, and the recommended specifications. We do the necessary materials testing and perform our own construction engineering. When I say that we do this without intereference, I mean that as long as we operate within the framework of the appropriate state and federal acts, we encounter absolutely no interference. Inspections by state and federal engineers are in the nature of occasional visits, and are usually the minimum necessary to assure themselves that the project is being constructed within the intentions of the law. They can certainly never be accused of breathing down our necks.

When we get in trouble, or while we are learning, both agencies are Johnny-at-the-Rathole to help us out. When we lack qualified personnel for any phase of a project, we can request and get men from the Division of Highways. They will help us with materials testing and with selection and use of laboratory equipment. Upon request, they will prepare our plans and specifications, or will perform all construction engineering, or will do both. We can get help from them on short notice and in the degree that we need. Of course the county pays, which is only fair, but I want to emphasize the fact that we get only what we request, and are under absolutely no compulsion to accept any help from the State. Our federal aid secondary projects are truly county projects from start to finish except for printing the plans and specifications, advertising for bids, and awarding of the contract.

Organization Explained

The administrative machinery at the state level is somewhat as follows: Within the Division of Highways is the Officer of Engineer of Federal Secondary Highways, which since the inception of the program has been headed by H. B. (Red) LaForge. He has a staff of eight men, only four of them assigned to the FAS program, and in addition to handling the FAS program, the office is handed such odd jobs as assisting with the highway planning survey and the recent Federal 210 study, which in California was performed at the city-county level; 10- to 20-million-dollar state flood relief programs; and numerous other time-consuming jobs. In addition to the four men in the Sacramento office, each of the 11 state highway district offices in California has an engineer of city and co-operative projects, who works part-time in administering county co-operative programs at the local level.

The administration of the program in California has not always been sweetness and light, and the smooth operation we have today did not come about overnight. It took time and a monumental patience and faith on the part of our state highway engineers. As an example of the efficiency that we have achieved today, I would like to point out the manner in which the crash program, the so-called "D" money, was handled in California. The counties were notified of their apportionment on April 24, 1958, and by September 15, 1958, every one of the California counties had completed the preliminary engineering on their project, and the projects were ready to put to bids. This was accomplished in four and one-half months.

Activities Centralized

The evolution of this efficient program is interesting, and has developed because a few people in key positions in our State Government had faith in the ability of a strong local government to solve their problems at the local level and to develop the necessary engineering staff to do the job properly.

Back in 1945 when the present federal aid secondary program was started here in California, the counties were operating their road departments on a supervisorial district basis. Each supervisor could, and in most cases did, operate his district as his own little empire. A few counties had seen the light and had centralized their county road operations under a competent engineer. However, most counties were operating in a haphazard manner, and without any engineering organization.

Consequently, the Division of Highways and the U. S. Bureau of Public Roads had a monumental job to tackle. Many of the counties not only had no engineering staff at all, but had supervisors that didn't think that engineers were even a necessary evil. They knew how to build roads—just turn the money over to them and let them handle the work, was all that they wanted. That was the preponderant attitude. The pressure to permit day labor construction was terrific.

Early Jobs

The first federal aid secondary project in San Benito County was typical of many county projects under the 1945 program. The Division of Highways was requested to prepare the plans and specifications and to furnish construction engineering. The county furnished the right-of-way. The supervisors thought that the $185,000 available would build the seven miles of road for which they furnished the right-of-way, and the screams of anguish were loud and long when the contract was awarded for only three miles of road. The State built us a fine section of road, with three inches of plant-mix surfacing the full width of the roadbed, culvert inlet boxes, and plant-mix curbs and berms. It was a beautiful job done to the Division of Highways Standards. In the 12 years the section of road has been in service, surface maintenance cost has been zero. However, the county supervisors were very unhappy. They did not think that the county could afford to build roads to such high standards for a relatively low traffic volume.

There was similar grumbling from supervisors all over the State, and they gave the Division of Highways a bad time. In subsequent programs, where the county was required to provide their own matching funds without state assistance, some counties declined to accept their allocations, maintaining that they could take their half of the money and build more and better roads than they could under the federal secondary program.

In 1947, the Collier-Burns Highway Act went into effect, requiring each county to appoint a road commissioner and to operate the county road department as a single road district. Gradually the present efficient operation of the program began to take form. The staff of the Division of Highways were patient, and they stuck to their set of rules and procedures. They sat tight under the pressure, and the pressure came from all directions. There was agitation to have the State take over the program entirely, and there was considerable pressure to permit day labor construction.

Participation Voluntary

However, the cool heads prevailed, and the program was given a chance to prove itself, which it quickly did. Operating closely with both the County Engineers Association and the County Supervisors Association, the state engineers began to explain and to educate the counties.

We were not forced to participate in the program. Counties could elect to relinquish their funds to the State Division of Highways for use on FAS state highway projects within the county, and were thus relieved of the matching requirements and could still get needed improvements on highways within the county, but only upon the state highways. Of the 809 federal secondary highway projects in California since the 1945 act, 48 projects, accounting for 256 miles of state highway and 36 state highway bridges, were constructed all, or in part, with funds relinquished by the counties.

We were offered a program providing substantial funds for much-needed county road improvements, and the only way we could take advantage of these funds was to conform to the rules. The rules under which we are now operating have not been changed since the 1945 act went into effect. They are good, common-sense rules, and we have learned how to use them to the best advantage.

Compulsion by the State Government is not often a healthy influence on local government, but in this program the compulsion has been highly beneficial, both to local government and to the State Government. Being forced to conform to the rules, the counties have improved their engineering management on county roads, and have proved beyond a doubt that local government can adequately do a job without innumerable state laws and without interference from a higher government. State officials and our legislators now have confidence in the ability of local government to live up to its obligations, and this is being reflected in California by an ever-growing tendency on the part of the Legislature to return many governmental functions to county government.

Design Standardized

Being forced to conform in order to avail ourselves of the federal secondary highway funds, pointed up the need in all counties for improvement of management techniques, an engineering staff, and for laboratory facilities. A direct outgrowth of the FAS program has been the development by the County Engineers Association of uniform geometric and structural standards for county roads and for subdivision streets. These standards have been printed and distributed to the counties, and nearly all of the counties have adopted them as the county standard for all work within the county.

Our federal secondary highway system contains very few miles of primitive roads, and the overwhelming majority of FAS projects are reconstruction of existing all-weather roads to accommodate the ever-increasing traffic volume. The average daily traffic on all county roads in the federal secondary highway system in 1956 was 1,323 vehicles daily, and the average daily traffic on roads reconstructed under the program has been approximately 2,000 vehicles daily. Strangely enough, a paradox of the State's job has been to keep the counties from constructing to too high a geometric standard rather than getting them to raise their standards.

In 1946, over 80 percent of all engineering on the FAS projects was handled by the State Division of Highways at the request of the counties. The counties simply did not have either the personnel or the "know-how" to handle high-type design and construction. Today the situation is reversed. The counties are now handling well over 80 percent of the engineering. This is reflected in the expenditure of our own county funds. More miles of better roads are being constructed. More miles of road are being constructed to a proper alignment and grade, because we now have the engineering staff to do things properly.

No Tax Diversion

In California we do not have any state-imposed rules or regulations on expenditure of our county road funds. Highway users taxes returned to the county by legislative formula must be used on county roads, but the State Division of Highways has no authority over the county in the expenditures of these funds. Each county can operate in any way they wish, providing that they appoint a road commissioner to manage the county road department and that they certify to the State Controller at the end of each year to the effect that all highway users tax funds were expended on county roads. That is the extent of state control over our county road program. There is absolutely no requirement that we adopt uniformity in any degree, and yet we have accomplished an astonishing degree of uniformity through voluntary means.

Any county engineering employee can go to work for another county or for the State Division of Highways and find the work familiar, just as a contractor bidding on highway construction projects anywhere in the State will find the plans, specifications, and construction standards familiar. A subdivider will find that no matter where he subdivides in the State, the geometric and structural standards to which he must construct his roads and streets are about the same.

Standards High, Uniform

A recent survey among the California counties revealed that in the 1957-58 Fiscal Year, out of a total county road expenditure of $119,000,000, over $55,000,000 had been spent on construction. The three-year average of construction work done to standards equaling or exceeding the minimum standards of the County Engineers Association of California, was $46,000,000 per year. This indicates that approximately 83 percent of all county construction work is being done to extremely high and uniform standards. Federal aid secondary projects account for less than one-third of the total construction done to high standards.

The federal aid secondary highway program in California, since 1946, has resulted in the construction of 809 projects, costing $149,607,596.42. The work accomplished has given the motorists 2,586 miles of high-type highway and 396 modern bridges.

Of the 68 FAS contracts awarded during the fiscal year ending June 30, 1958, the engineering work was performed as follows:

	Preliminary engineering	*Construction engineering*
County	50	42
Consultants	16	0
State	2	26
	68	68

The above data are substantially correct. The counties sometimes split the fieldwork, foundation studies and final design between themselves and the consultants. The tables indicate, under construction engineering, the county or state resident engineer. However, as to actual personnel on the job, a canvass, during May of 1957, showed that construction engineering was being performed by 31 state men and 135 county men.

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Leavitt, Meta Powers Retire, Will Travel

Leavitt and Meta Powers, husband and wife with a total of 72 years in the service of the State of California, retired on March 1st from their positions in the Department of Public Works. More than 200 friends feted the couple at a dinner and dance at the McClellan Air Force Base officers' club.


LEAVITT POWERS

The Powerses began their state careers early in the 1920's with the California Highway Commission. Powers, who retired after more than 38 years of service, joined the commission in February, 1921, as a junior bookkeeper for the state highway area office, then called Division III, headquartered at that time in Sacramento at 34th Street and Stockton Boulevard. He was transferred to the commission's Equipment Department when it was created in 1923.


META POWERS

Mrs. Powers retired following 33½ years in state service. She was Meta Marie Bolte when she went to the commission as an intermediate stenographer in May, 1923. She was assigned as secretary to the equipment engineer in the equipment department where she met Powers. In January, 1926, she accepted a position in San Francisco with the commission's one-man contracts and right-of-way office. A year later Powers followed her to San Francisco as chief clerk at Shop 4 of Division IV. The Powerses were married in San Francisco in November, 1930.

In September, 1933, Powers was transferred to Fresno as chief clerk of Shop 6, District VI, of the Division of Highways. Mrs. Powers spent the next four years as housewife.

Late in 1937 Powers was returned to Sacramento to supervise the general accounting office of the Department of Public Works, serving the Divisions of Architecture, Ports and Water Resources, the Water Project Authority and the Water Resources Board. On July 1, 1956, when all water resource functions were separated from the Public Works Department, Powers was appointed accounting officer of the Division of Architecture, the position he held at his retirement.

Upon returning to Sacramento in 1937, Mrs. Powers went to work for the State Board of Control and later was secretary to the Deputy Director of the Department of Finance for five years. In 1944 she returned to her prime work interest, legal stenography, in the Department of Public Works' growing Division of Contracts and Rights of Way. In 1948 she was placed in charge of this division's headquarters clerical staff. She supervised 26 employees in Sacramento and had nominal supervision over 51 employees in San Francisco, Los Angeles and San Diego.

Powers was born in Angels Camp, Calaveras County, and was raised near Virginia City on the Comstock Lode, Nevada. In his youth he was chief clerk of the Nevada State Prison and was secretary to the Nevada State Police for more than a year. He is a member of the American Legion, the Tehama Lodge of the Masons, the Sacramento Consistory of the Scottish Rite, and the Elks. He is a charter member of the California State Employees' Association.

Mrs. Powers was born and raised in San Francisco. She is a former member of the Business and Professional Women's Club of San Francisco, and is a member of the State Women's Club, the Supervisors' Forum, the Woman's Forum and the Rainbow Chapter of the Eastern Star. She is also a charter member of the California State Employees' Association.

Following a three-month tour of Europe this spring and summer, the Powerses will tour the United States next winter. Powers then plans to go to school to study history and philosophy. Mrs. Powers will take up her duties of housewife on a full-time basis.

COST INDEX

Continued from page 20 . . .

NUMBER AND SIZE OF PROJECTS, TOTAL BID VALUES AND AVERAGE NUMBER OF BIDDERS

(July 1, 1958 to December 31, 1958)

Project Volume	Up to $50,000	$50,000 to $100,000	$100,000 to $250,000	$250,000 to $500,000	$500,000 to $1,000,000	Over $1,000,000	All Projects
Road Projects							
No. of projects	166	47	57	30	14	4	318
Total value*	$3,594,030	$3,320,422	$9,305,375	$10,351,150	$9,939,759	$5,250,666	$41,761,402
Avg. No. bidders	4.7	5.5	6.1	6.7	9.1	9.8	5.5
Structure Projects							
No. of projects	14	7	6	4	1	5	37
Total value*	$252,213	$514,017	$1,058,449	$1,312,431	$588,947	$10,795,057	$14,521,014
Avg. No. bidders	5.7	5.7	9.2	8.3	9.0	8.6	7.0
Combination Projects							
No. of projects					6	22	28
Total value*					$4,735,522	$66,608,179	$71,343,801
Avg. No. bidders					7.0	8.2	7.9
Summary							
No. of projects	180	54	63	34	21	31	373
Total value*	$3,946,243	$3,834,439	$10,363,824	$11,663,581	$15,264,228	$82,652,902	$127,726,217
Avg. No. bidders	4.8	5.5	6.2	6.9	8.5	8.5	5.8

* Bid items only.

TOTAL AVERAGE BIDDERS BY MONTHS

	July	Aug.	Sept.	Oct.	Nov.	Dec.	Avg. for six months
1958	5.4	5.5	5.6	5.6	7.0	6.9	5.8
1957	6.1	6.7	5.7	8.2	9.2	9.5	7.3

AVERAGE CONTRACT PRICES

	Roadway excavation, per cu. yd.	Untreated rock base, per ton	Plant mixed surfacing, per ton	Asphalt concrete pavement, per ton	Asphaltic and bituminous mixes, per ton	PCC pavement, per cu. yd.	PCC structures, per cu. yd.	Bar reinforcing steel, per lb.	Structural steel, per lb.
1940	$0.22	$1.54	$2.19	$2.97		$7.68	$18.33	$0.040	$0.083
1941	0.26	2.31	2.84	3.18		7.64	23.31	0.053	0.107
1942	0.35	2.81	4.02	4.15		9.62	29.48	0.072	0.103
1943	0.42	2.26	3.71	4.76		11.48	31.76	0.059	0.080
1944	0.50	2.45	4.10	4.50		10.46	31.99	0.054	0.132
1945	0.51	2.42	4.20	4.88		10.90	37.20	0.059	0.102
1946	0.41	2.45	4.00	4.68		9.48	37.38	0.060	0.099
1947	0.46	2.42	4.32	5.38		12.38	48.44	0.080	0.138
1948	0.55	2.43	4.30	5.38		13.04	49.86	0.092	0.126
1949	0.49	2.67	4.67	4.64		12.28	48.67	0.096	0.117
1950	0.40	2.25	4.25	3.75		11.11	42.45	0.079	0.094
1951	0.49	2.62	4.84	5.00		12.21	47.22	0.102	0.159
1952	0.56	2.99	5.00	4.88		13.42	48.08	0.098	0.150
1953	0.51	[1]2.14	5.31	4.58		12.74	50.59	0.093	0.133
1954	0.45	2.13	4.50	4.86		14.41	48.42	0.084	0.124
1955	0.39	2.22	4.93			13.35	45.72	0.095	0.142
1st Quarter 1956	0.40	2.08	5.40	6.50		14.05	52.51	0.105	0.166
2d Quarter 1956	0.51	2.05	6.27			14.54	57.13	0.113	0.219
3d Quarter 1956	0.52	2.27	6.13			15.57	56.32	0.121	0.178
4th Quarter 1956	0.52	2.21	[2]	[2]	[2]$5.93	14.95	59.53	0.112	0.197
1st Quarter 1957	0.63	2.10			5.94	17.28	61.14	0.122	0.235
2d Quarter 1957	0.62	2.10			6.18	15.59	58.61	0.119	0.204
3d Quarter 1957	0.42	2.34			5.10	14.34	58.68	0.130	0.200
4th Quarter 1957	0.68	1.78			5.45	16.88	59.76	0.129	0.177
1st Quarter 1958	0.52	1.85			5.45	14.96	55.21	0.118	0.192
2d Quarter 1958	0.48	1.73			5.67	13.77	54.44	0.125	0.158
3d Quarter 1958	0.39	2.18			5.56	13.99	53.93	0.126	0.182
4th Quarter 1958	0.52	2.10			5.74	13.55	55.20	0.122	0.165

[1] The item of crusher run base was used before 1953.
[2] Asphalt concrete pavement combined with plant mix surfacing in fourth quarter 1956, and will be identified as asphaltic and bituminous mixes in the future.

The average price of $2.10 a ton for untreated rock base is slightly below the third quarter price of $2.18 per ton. Thus, this item continues in this quarter to approximate the typical value established over the last several years.

While the average unit price of $13.55 a cubic yard for Portland Cement Concrete is down $0.44 per cu. yd. from that of the third quarter of 1958, this is a relatively slight change percentagewise, and within the range of normally expected fluctuations. It is interesting to note that this is the lowest average unit price recorded since 1955.

The average unit price of $5.74 a ton for asphaltic and bituminous mixes increased $0.18 from $5.56 per ton, but is within the range of average unit prices for the last two years.

The average unit price of $55.20 a cubic yard for portland cement concrete (structures) increased $1.27 from $53.93 per cu. yd. This is a return to the average unit price for the first quarter of 1958, which was the lowest average since the first quarter of 1956.

The average unit price of $0.122 a pound for bar reinforcing steel constitutes a slight reduction below the average unit price of $0.126 per lb. for the third quarter of 1958. It is interesting to note that the bid price for this item has declined despite rising steel costs and indicates the effect of increased competition in bidding highway construction projects.

The average unit price for structural steel amounting to $0.165 per lb. is a decrease of $0.017 under the third quarter 1958. A comparatively small quantity of steel was used in this quarter, with a substantial portion thereof being included in a grade separation project at a unit price of $0.136 per lb.

General Trends

During the next quarter bids will be opened on several multimillion-dollar freeway projects, including an eight-mile section in the Sierra Nevada Mountains where higher bid prices usually are found. In view of rising prices of basic materials, coupled with the effect of already-negotiated wage increases for construction workers, and generally improved business conditions, it is probable that an upward trend in prices will occur. On the other hand, increased bidder competition, which is usually evident on large projects, may show its effect to some extent in counterbalancing the tendency toward rising costs and prices. There is also the natural tendency for close competition on early season lettings when contractors endeavor to secure basic projects to engage their forces. The outlook, therefore, appears to be for moderate increases in the cost index in the first quarter of 1959.

Cost Index

The California Highway Construction Cost Index, the Engineering News-Record Construction Cost Index, and the United States Bureau of Public Roads Composite Mile Index, all reduced to the base 1940 = 100, are shown on the accompanying graph. The latter two Indexes are based on nationwide construction costs.

The Engineering News-Record Cost Index, which now stands at 320.1, again shows a rise over the preceding quarter. It is up 3.5 index points or 1.1 percent from the third quarter. This index is strongly affected by many large projects outside the highway construction field.

The Bureau of Public Roads Composite Mile Index is based on federal-aid highway construction contracts awarded by state highway departments. For the third quarter of 1958, which is the latest available, it decreased 3.9 index points or 1.7 percent from the second quarter of 1958 and now stands at 231.4. This seems to confirm the trend of stabilization in highway construction costs on a nationwide scale which has been established during the year.

THE CALIFORNIA HIGHWAY CONSTRUCTION COST INDEX

Year	Cost Index
1940	100.0
1941	125.0
1942	157.5
1943	156.4
1944	177.8
1945	179.5
1946	179.7
1947	203.3
1948	216.6
1949	190.7
1950	181.2
(1st Quarter 1950—160.6)	
1951	225.0
(4th Quarter 1951—245.4)	
1952	225.9
1953	215.2
1954	193.5
(2d Quarter 1954—189.0)	
1955 (1st Quarter)	139.3
1955 (2d Quarter)	212.4
1955 (3d Quarter)	208.6
1955 (4th Quarter)	212.6
1956 (1st Quarter)	219.5
1956 (2d Quarter)	255.9
1956 (3d Quarter)	249.1
1956 (4th Quarter)	252.1
1957 (1st Quarter)	277.7
1957 (2d Quarter)	266.9
1957 (3d Quarter)	237.5
1957 (4th Quarter)	262.1
1958 (1st Quarter)	241.8
1958 (2d Quarter)	231.0
1958 (3d Quarter)	228.5
1958 (4th Quarter)	238.5

Husband, Wife Construct Complex Freeway Model

As senior delineators for the Division of Highways in Los Angeles, John and Peggy Unruh have added perspective to their regular drafting jobs by building this model of the future Santa Monica-Harbor Freeways Interchange. After working on some of the drawings and plans for the big interchange as part of their daily jobs, the Unruhs used their spare time to construct the model in their West Covina home. They estimate that materials cost about $50, and that at least 100 man-hours of work were required. The base of the model is six feet square. Blueprints with a scale of 1″ = 100′ were superimposed to provide a horizontal control.—Photo courtesy Los Angeles Herald-Express.

Ella Katerndahl Ends 29 Years With State

Ella Katerndahl of the District VII Materials staff in Los Angeles, retired on January 1st after 29 years service with the State of California.

A farewell dinner was given in her honor last December.

ELLA KATERNDAHL

Mrs. Katerndahl was born in Marinette, Wisconsin. Following graduation from the local high school in 1910, she moved on to Chicago, where she worked as a secretary. In 1914, she met and married Carl E. Katerndahl, a high school teacher. She has three daughters and four grandchildren.

Mrs. Katerndahl began her career with the State in the Department of Agriculture in 1928. In 1932 she transferred to Highways as secretary where she remained until her retirement. She has worked in virtually all departments.

Mrs. Katerndahl intends to devote herself to church work as well as doing some traveling.

LEFT—The Greenbrae interchange on US 101 in Marin County. The southbound on ramp from Sir Francis Drake Boulevard is under construction to the right. RIGHT—Construction is under way on the freeway bypass of the Walnut Creek business district in Contra Costa County. The interchange in the left background will connect Sign Routes 21 and 24.

REPORT FROM DISTRICT IV

Continued from page 16 . . .

and maintenance work under another contract. When all work has been completed, directional traffic will be separated from the Nimitz Freeway in Oakland to Atlantic Avenue in Alameda.

The major construction activity at the present time consists of the relocation of a large, metal, Navy-owned hangar from the required rights-of-way area to a new location within Alameda Naval Air Station. The 600-foot by 150-foot structure will be partially dismantled, transported to the new site and reconstructed at the new site as a 300-foot by 300-foot building. Work is being performed by Arntz Brothers at a cost of $287,000. A contract completed in 1958 provided paved storage areas to replace the area purchased from the U. S. Government for tube construction.

Warren Boulevard (Mountain Boulevard)

This improvement will provide a 5.6-mile freeway from Sign Route 24 near Lake Temescal to a connection with the future MacArthur Freeway (US 50) at Calaveras Street near Mills College. This route, generally along Mountain Boulevard, was originally developed by Joint Highway District No. 26 which was dissolved in July of 1954. The County of Alameda and the City of Oakland have agreed to continue to provide a total of $300,000 per year, matching a like contribution from the State for the development of this route.

Between Broadway Terrace and Ascot Drive the freeway has been in operation since 1956. This portion includes the Park Boulevard Interchange which was designed as a future connection to the Shepherd Canyon Freeway. In August of 1958 work was completed on the 1.4-mile extension between Park Boulevard and 0.6 mile south of Lincoln Avenue. Contractor on this $1,290,000 initial four-lane project was Gallagher and Burke, Inc.

To be under construction soon is a further extension from Lincoln Avenue to 0.6 mile south of Carson Street. This 1.6-mile portion will cost approximately $1,500,000 to construct the initial four-lane, ultimate six-lane freeway. About 1.2 miles will still remain to be constructed from the end of this project to the junction of Warren Boulevard and MacArthur Freeway (US 50) near Mills College. Design studies are in various stages on this section which includes the Redwood Road Interchange and two additional contracts may be required to complete the freeway.

Shepherd Canyon Freeway

Adopted and declared a freeway in December, 1956, this future facility will consist of four lanes initially with provisions for six lanes ultimately. Starting at Park Boulevard Interchange on Warren Boulevard in Oakland, the freeway will traverse Shepherd Canyon and Tunnel approximately 1,400 feet through the Oakland hills. It crosses Moraga Valley just north of the present town site and terminates at Pleasant Hill Inter-

STATUS OF DISTRICT IV FREEWAY PROJECTS

MARCH 1959

Description	Total miles	Completed projects		Under contract		Budgeted		Right of Way expended and budgeted
		Miles	Construction cost	Miles	Construction cost	Miles	Construction cost	
US 101 AND 101 BYPASS								
Bayshore and James Lick Freeway								
US 101 Bypass, Southern Freeway in San Francisco to Ford Road South of San Jose	52.9	38.0	$42,317,000	5.8	$8,750,000	3.3	$5,500,000	$22,873,000
Southern Freeway	4.7				**8,008,000	1.0	4,850,000	17,009,000
James Lick Freeway	3.0	3.0	8,409,000					12,870,000
Central Freeway	1.8	1.0	4,122,000	0.8	7,725,000			8,574,000
Golden Gate Freeway	1.1					1.1	4,400,000	878,000
Ford Road South of San Jose to San Benito County line (portions)	5.8	5.8	1,095,000					546,000
Redwood Freeway; Golden Gate Bridge to Lytton	66.6	50.5	*33,528,000	1.4	3,670,000	3.7	5,295,000	12,511,000
US 40; SAN FRANCISCO TO CARQUINEZ BRIDGE (portions)	18.2	15.9	†56,375,000	2.3	5,818,000		50,000	13,286,000
US 50								
MacArthur Freeway, Distribution Structure to Castro Valley	15.3					2.8	10,000,000	39,166,000
Castro Valley to San Joaquin County Line	31.4	31.4	11,511,000				200,000	4,134,000
SIGN ROUTE 17								
Nimitz Freeway, distribution structure to Bayshore Freeway at San Jose	41.3	41.3	52,440,000		363,000		312,000	21,546,000
Santa Cruz to San Jose (portions)	19.9	13.0	9,200,000	3.4	4,613,000		290,000	10,023,000
US 40 near Albany to US 101 near San Rafael (portions)	9.9	1.0	1,206,000	1.4	768,000			1,377,000
SIGN ROUTE 9 AND 21								
Warm Springs to US 50 (portions)	9.7							653,000
US 50 to Walnut Creek	16.0	2.1	550,000	1.4	2,347,000			5,515,000
Walnut Creek to Monument	3.3	2.0	2,868,000	2.4	6,200,000			6,915,000
Monument to Solano County Line	7.4							1,894,000
Sign Route 9 North of Junction Route 21 in Fremont	2.2							
SIGN ROUTE 24 (portions)								
From Nimitz Freeway in Oakland to Walnut Creek	14.9	4.1	6,030,000	2.0	3,536,000		50,000	6,898,000
North of Monument to Sign Route 4, Concord	3.4		226,000					544,000
EMBARCADERO FREEWAY	1.5	0.4	7,219,000	1.1	7,534,000			11,720,000
PARK—PRESIDIO FREEWAY, GOLDEN GATE BRIDGE TO FULTON STREET	2.1	1.2	1,448,000					3,000
JUNIPERO SERRA FREEWAY								
US 101 South of San Jose to Sign Route 17	10.0							201,000
Sign Route 17 to San Francisco County Line	43.9							3,619,000
CABRILLO HIGHWAY								
San Pedro Creek to Lake Merced Boulevard in San Francisco	10.0	5.4	2,774,000					1,612,000
Watsonville to 4 miles South of Davenport (portions)	22.8	12.4	6,318,000			3.1	775,000	2,849,000
JUNIPERO SERRA FREEWAY TO NIMITZ FREEWAY								
19th Avenue Freeway, Junipero Serra Freeway to Alameda County Line at San Mateo Bridge (portions)	8.0							1,935,000
San Mateo County Line to Nimitz Freeway (portions)	9.2							
PACHECO PASS: 1 MILE EAST OF BELL'S STATION TO MERCED COUNTY LINE	5.3	5.3	1,286,000					12,000
STEVENS CREEK FREEWAY, SIGN ROUTE 17 TO BAYSHORE FREEWAY AT MOUNTAIN VIEW	13.6							2,042,000
MOUNTAIN VIEW—ALVISO FREEWAY—EL CAMINO REAL TO EASTSHORE FREEWAY	10.5	2.1	1,034,000			1.1	647,000	494,000
FREEWAY CONNECTION FROM NIMITZ FREEWAY TO US 50 (ROUTE 228)	2.2	2.2	2,803,000					2,237,000
BAY FARM ISLAND BRIDGE AND APPROACHES	0.6	0.6	2,062,000					165,000
WEBSTER STREET TUBE	1.1		220,000			1.1	7,530,000	2,370,000

STATUS OF DISTRICT IV FREEWAY PROJECTS—Continued

MARCH 1959

Description	Total miles	Completed projects: Miles	Completed projects: Construction cost	Under contract: Miles	Under contract: Construction cost	Budgeted: Miles	Budgeted: Construction cost	Right of Way expended and budgeted
Warren Boulevard Freeway: Sign Route 24 near Lake Temescal to MacArthur Freeway	5.6	3.2	‡4,524,000			1.3	‡1,273,000	1,682,000
Shepherd Canyon Freeway; Warren Boulevard Freeway to Sign Route 24	10.3							257,000
2.6 Miles East of Dumbarton Bridge to Sign Route 9 at Niles	5.7							50,000
Arnold Industrial Freeway; (Sign Routes 4 and 24) Hercules to Antioch Bridge	34.1	14.7	4,694,000					1,214,000
Sign Route 12; Sebastopol to Kenwood	17.7							1,948,000
Sign Route 29; Solano County Line to Calistoga (portions)	31.8	19.3	2,792,000	2.9	735,000			2,937,000
Sign Route 37; from Redwood Freeway at Ignacio to Napa	13.4	1.1	4,040,000	6.1	1,861,000			814,000
Totals	588.2	277.0	$271,091,000	31.0	$61,928,000	18.5	$41,172,000	$225,373,000

* Includes total of $5,000,000 by Golden Gate Bridge and Highway District.
** Includes total of $1,600,000 by City of San Francisco.
† $29,117,000 Toll Bridge Funds in this amount.
‡ Includes City of Oakland and Alameda County contributions.

change on Sign Route 24. Design studies are in progress and in various stages on this freeway and some rights-of-way have been acquired in hardship cases. Construction is not anticipated in the near future.

Dumbarton Bridge to Niles (Route 105)

The route was adopted on October 17, 1958, for the 5.7-mile freeway from Dumbarton Bridge Approach Road to Sign Route 9 north of Niles. Design studies have been begun on this initial four-lane, ultimate six-lane facility, which will be built on relocation north of the existing highway.

Sunol to Livermore (Route 108)

A public hearing has been held and the report of the hearing is now being reviewed. Approximately 10 miles long, the route will begin at a junction with Sign Route 9 at Sunol and is entirely on new location, bypassing Livermore, to a junction with US 50 in the vicinity of Livermore. An initial four-lane, ultimate six-lane freeway is proposed.

Arnold Industrial Freeway (Sign Route 4)

Design is in various stages from Hercules to a junction with Sign Route 24 north of Concord at Willow Pass Road. A short relocation at the Hercules end was constructed in conjunction with the construction of US 40 and was completed in 1958. In October, 1958, the route was adopted between Hercules and Martinez and design studies are under way for an initial four-, ultimate six-lane freeway. From Willow Pass Road to Neroly Road east of Antioch, Sign Route 4 is an identical routing with Sign Route 24 and is covered under that route. Studies are under way and preliminary meetings have been held on the portion between Antioch and the San Joaquin county line.

Grove-Shafter Freeway

The portion of this route from US 50 to the Broadway Tunnel is generally referred to as the Grove-Shafter Freeway. The routing for this unit as well as an extension from US 50 to the Nimitz Freeway was adopted on May 22, 1958. Design studies are now under way and freeway agreements have been negotiated with local authorities.

Construction of this unit will require a major interchange at US 50 (MacArthur Freeway) as well as other traffic service ramps and grade separations along the route.

Sign Route 12

On January 24, 1957, 17.4 miles of freeway route was adopted between Sebastopol and Kenwood. Design studies are under way and rights-of-way acquisition has begun for development of Sign Route 12 as an ultimate six-lane freeway between these points. In general, the adopted route follows the existing highway from the east city limits of Sebastopol to the vicinity of Wright Road, thence northerly of the present route and adjacent to the Petaluma and Santa Rosa Railroad to a junction with US 101 in the vicinity of Santa Rosa. The route then continues on a direct northeasterly course to rejoin the present highway east of Melita near Los Alamos Road and follows the present highway south to Kenwood. From Kenwood the route has not been adopted. However, planning studies are in progress and preliminary meetings have been held on the portion between Kenwood and Schellville.

Sign Route 37

The new bridge for the replacement of the existing two-lane substandard lift bridge over Petaluma

. . . *Continued on page 56*

George W. Thompson Retirement Marked

George W. Thompson, veteran Resident Engineer of the Bridge Department, retired on January 31st, after almost 39 years with the Division of Highways.

In 1924 the Bridge Department first began supervision of bridge construction in addition to bridge design, with a field force of four resident engineers. Thompson was one of the original four and is the last of these four to retire.

GEORGE THOMPSON

Thompson was born in Marion, Ohio, attended Ohio State University, holds an engineering degree in forestry from Darmstadt, Germany, and in science from the University of Washington. After five years with the U. S. Forest Service and lumber firms in the northwest, he served with the Signal Corps in railroad construction in the Columbia River area during World War I. He began his state service with District IV on the location of the Los Gatos-Glenwood highway and transferred to the Bridge Department in 1924.

Many major state highway structures, particularly in the Bay area, have been under Thompson's supersion. At one time he was in charge of five contracts involving about $16,000,000 on the San Francisco "Skyway."

Thompson and his wife, Irene, live at 130 Fulton Street, Palo Alto.

TOTAL CONTRACTS REPORTED

The Division of Highways had 284 contracts with a value of $360,320,400 under way on February 28th. There were 2,012 miles of freeways, expressways or other multilane divided state highways in operation and 346 miles under construction, a total of 2,358 miles.

From July 1, 1956, to February 28, 1959, 67 interstate projects totaling $228,489,200 were awarded.

TWENTY-FIVE-YEAR AWARDS

Employees who received twenty-five-year awards since those listed in the November-December, 1958, edition of *California Highways and Public Works*

DIVISION OF HIGHWAYS

District I
Fred Trimble
Adolphus O. Boyd
Theodore W. Maxwell

District III
Harry H. Sharp
John Q. Adams
Paul W. Gruenhagen
Carl F. White

District IV
James V. Rodrigues
Alexander White
Margaret E. Keohane
C. I. Largent
A. P. "Pat" Osborne
E. W. Stuenkel
Frank C. Woehl

District V
Charles E. Teague

District VI
Forest W. Pfrimmer
Edward Allen
Preston S. Jordan
Oscar O. Miller

District VII
Wilbur M. Price
Ralph E. Schott
John Simonich
Ellsworth R. Talmon
Henry E. Cowan
Alfred R. Mattos
Carrie S. Neff
Elmo M. Potter
Loral Guy Wiley

District VIII
Drury P. Wieman
Henry N. Noble

District IX
Ned B. Harvey

District X
Rod N. Bierce
Clayton P. David
William C. Franzen
Holmes B. Ives
Roneildo Williams
Donald T. Wade

District XI
Leland Walter McCleary
Robert A. Anderson
Irven D. Hartley
Emil B. Johnson
John C. Krabill
Jack B. Toller
Raymond W. Tombaugh

Bridge Department
Roy E. Fetter
Lawrence J. Hubbard
Ralph M. Sherick
George D. Gilbert

Bay Bridge
Thomas Hugill
Raymond Peter Murphy

Headquarters Office
Herbert P. O'Donnell
Mary L. Puccinelli

Materials and Research
William M. Blake

Shop 2
William J. Thompson, Jr.

Shop 3
Janice H. Wald

Shop 5
Walter H. Gaskin
Harry J. Kohlstedt

Shop 11
Edmund L. Malloy

DIVISION OF ARCHITECTURE
Lavalette Gardner
John S. Moore

DIVISION OF CONTRACTS AND RIGHTS-OF-WAY
Virginia C. Millerick

State Division of Highways maintenance forces maintained 1,300 signalized intersections of state highways during the 1957-58 Fiscal Year.

Bridge Department's L. J. Hubbard Leaves

Lawrence J. Hubbard, Associate Bridge Engineer in the Construction Office of the Bridge Department, retired on February 28th, completing more than 25 years of state service.

For the past 24 years Hubbard has been in charge of the Bridge Construction Section, responsible for the engineering phases of contract finances and payments to contractors. He has seen total payments on bridge department contracts grow from about $2,000,000 per year in 1935 to nearly $30,000,000 in the 1957-58 Fiscal Year.

L. J. HUBBARD

Hubbard was born in San Francisco and was graduated from the University of California in mining engineering in 1910. His first job was with Trinity Gold Mining & Reduction Co. at Carrville, Trinity County, which he left in 1913 after working up to assistant mill superintendent. After six more years with mining firms, eight with the Northern Pacific and Northwestern Pacific Railways and six in business for himself, he came to the Division of Highways as Resident Engineer in the Bridge Department in November, 1933.

Hubbard and his wife, Mildred, live at 2520 Memory Lane, Sacramento.

HOW FAS WORKS

Continued from page 49 . . .

Tabulations of highway actually constructed to completion under the program are difficult to make due to the large amount of stage construction used by the counties. Most FAS projects are done under some degree of stage construction. In some cases, all stages will be completed under the program, and on other projects, some of the stages are completed entirely by the county with their own funds. We have found stage construction to be the most advantageous way to tailor the FAS program to the needs of the particular county. By starting

REPORT FROM DISTRICT IV

Continued from page 54 . . .

Creek was completed in September, 1958. The new bridge, a single high-level structure, 2,200 feet long, and providing for four lanes initially, ultimately to be widened to six lanes, cost approximately $2,433,000. Work was performed as a joint venture by Ben C. Gerwick, Inc., and J. H. Pomeroy and Co., Inc.

Presently under construction is a four-lane expressway which will ultimately be converted to a six-lane freeway extending from US 101 at Ignacio Wye to Sears Point. Two lanes of this freeway were completed and opened to traffic in 1951 and under the same contract the roadbed for the future lanes was graded between Petaluma Creek and Tolay Creek. This $1,860,000 project, completing the four-lane construction, is expected to be completed in the fall of this year. The contractor is Peter Kiewit Sons Company. From Sears Point to the Napa county line, studies are under way for the relocation of this route and preliminary meetings have been held. In 1955, the initial two lanes of a future four-lane freeway were constructed from a point two miles east of the Napa county line to 2.2 miles east of Carneros School.

Sign Route 29

In 1956, a 3.8-mile section of two-lane, future four-lane, expressway was completed between four miles north of St. Helena and Calistoga. Between Rutherford to south of Napa, the route has been adopted and declared a freeway. Presently, construction is in progress for the initial two lanes of a future four-lane expressway bypassing Yountville. This 2.9-mile project will cost approximately $735,000 and the work is being performed by

---

with a high geometric standard, and constructing successive stages to high structural standards, we are able to construct economically and to keep the stages under construction ahead of the increasing traffic demand. The end result will be a secondary highway system that will handle the traffic demands for many years to come.

RADIO SIGNS

Continued from page 34 . . .

are possible. All combinations will not make an intelligible message, of course. Six combinations are being used on the US 40 signs, as follows:

Road clear over summit, road closed over summit, caution required icy ahead, chains required ahead, chains required over summit, and *caution required ahead.* The messages are on glass faces, with lights inside the units, so they can be read at night.

Allen Zellmer and Gene Jordan, supervising radiotelephone technicians of the Division of Highways, did a considerable part of the development of the new signs, under the supervision of Associate Communications Engineer Rolind Mahan. The only difficulty in function has been with wet snow sticking to the sign faces and obscuring the message. This is being corrected by installation of thermostatically controlled electric strip heaters.

The two signs now in use were built by Tele-Dynamics, Inc., of Philadelphia. Installation was by Marshall Electric Company of San Carlos, and Roy T. Phillips of District III (Marysville) was resident engineer for the Division of Highways. The approximate cost of both installations and the remote control equipment was $25,000.

McCammon-Wunderlich and Wunderlich Contracting Company.

In 1957, the project between Union Station and Orchard Avenue was completed on Route 29 north of the City of Napa. The additional two lanes constructed under this contract converts this 2.3-mile section into a four-lane expressway providing a faster and safer facility for traffic. South of Napa on Sign Routes 12 and 29, the present routes have been operating for many years as expressways, although a hearing recently held before the Napa County Board of Supervisors is the first step in ultimate full freeway development of the section from the Napa State Hospital at Imola Avenue to the Napa-Solano county line.

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Governor of California

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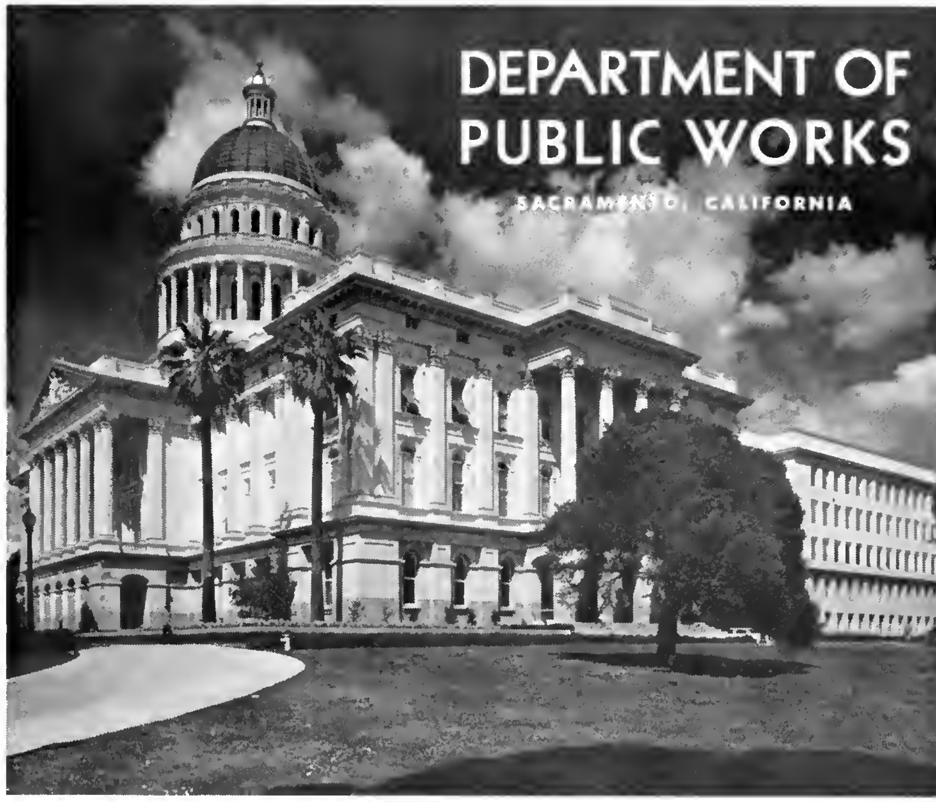

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printed in CALIFORNIA STATE PRINTING OFFICE 91950 3-59 49,500

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CALIFORNIA HIGHWAYS AND PUBLIC WORKS

MAY-JUNE
1959

California Highways and Public Works

Official Journal of the Division of Highways, Department of Public Works, State of California

RICHARD WINN, *Editor*
HELEN HALSTED, *Assistant Editor*
STEWART MITCHELL, *Assistant Editor*
MERRITT R. NICKERSON, *Chief Photographer*

Vol. 38 May-June Nos. 5-6

FRONT COVER

This section of US 60 passes through the foothills west of Beaumont in Riverside County. The cloud-wreathed San Bernardino Mountains in the background contain peaks well over 11,000 feet high. The view is northeastward.

—Photo by Bill F. Ruland

BACK COVER

Sand and sky of California's desert country serve as an effective setting for this steel bridge which carries US 80 over the All American Canal in southeastern Imperial County.

—Photo by Bill F. Ruland

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Published in the interest of highway development in California. Editors are invited to use information contained herein and to request prints of any black and white photographs.

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Local Plans

Consideration for Local Needs in Freeways Told by Governor, Director

The State Department of Public Works is doing everything in its power to meet the requirements of local communities in locating California's Freeway System, according to Governor Edmund G. Brown.

In the last analysis, however, the Governor said, there must be central planning so that highways and freeways will serve the needs of all the people and not stand as concrete monuments of engineering ingenuity.

Governor Brown made the remarks at a meeting of the Governor's Council in his offices in Sacramento on April 27th.

At the same meeting, Robert B. Bradford, State Director of Public Works and Chairman of the California Highway Commission, outlined proposed freeway plans through 1980.

Bradford emphasized that the State Division of Highways is giving earnest consideration to local problems in devising the system.

He listed four recent instances in which the division has changed its plans at the request of local officials. Hearings in Sacramento on a proposed east-west freeway have been postponed in response to the city council's request for time to make new land use studies, Bradford said.

The West Side Freeway route from Tracy to Wheeler Ridge was altered in four places, he explained, to keep it clear of irrigated areas. In Bakersfield, the route was changed so that it could be integrated into the city's one-way street pattern.

Bradford also pointed to the Junipero Serra Freeway from the San Francisco county line south through San Mateo County where a shift westward from the residential area to the Skyline Boulevard area was made at the request of local residents and local public officials. This shift sacrificed 86 million dollars in traffic savings to the driver but saved 64 million dollars in construction costs and settled a protracted controversy.

Bradford told of the extensive planning that went into the proposal for a 12,300-mile California Freeway System to meet the State's automotive vehicle traffic needs in 1980.

The Division of Highways made growth studies which led to the conclusion that, during the next 20 years, the population of California would increase from 15 million to 31 million. The number of motor vehicles registered in the State, the forecast said, would increase from 7½ million to 17½ million in the same period.

The number of vehicle miles traveled per year would increase from the current 65 billion to 200 billion in 1980, according to the prediction of the division studies.

The planning study dealt also with present and future locations of agricultural production in California, population centers, timber croplands, seats of local government, areas of recreational interest, and other similar factors.

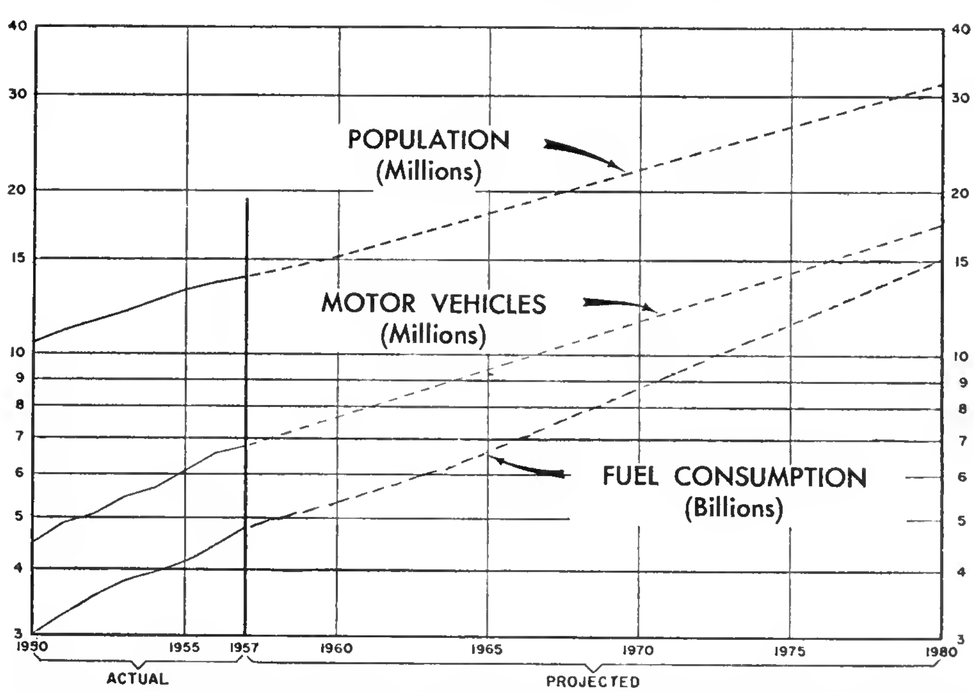
The statewide freeway system planned to take care of all these elements, Bradford explained, would cost 10½ billion dollars and would take 20 years to build. It would carry 59 percent of the State's traffic in 1980 and would save motorists 25 billion dollars in driving expenses against driving costs on present roads, streets and highways.

The proposed system should reduce highway fatalities by 60 to 75 percent, the State Public Works Director told the Governor's Council.

Bradford said that the California Freeway System he described was economically feasible on a pay-as-you-go basis without increasing current highway users' taxes.

Planning for the statewide freeway system was requested by the California Legislature in Senate Concurrent Resolution No. 26 of January, 1957. The completed plans were forwarded to the Legislature in September, 1958, and were incorporated in legislative proposals made to the 1959 session in January.

(The S. C. R. 26 report was detailed in the September-October, 1958, issue of *California Highways and Public Works.*)



The above chart, reproduced from the report published by the State Legislature's Joint Interim Committee on Highway Problems, forecasts probable population, motor vehicle totals and fuel consumption in California for the next 20 years.

Public Works Building
Twelfth and N Streets
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CONTENTS

Fresno Freeway Shows Marked Accident Drop

The accident rate dropped 66 percent on U. S. Highway 99 at Fresno in the year following completion of the Fresno Freeway, a Division of Highways before-and-after study has revealed.

The study covered traffic and accidents on the old US 99 at Fresno in the year before the freeway was opened, and on the freeway and the old highway, which became the US 99 Business Route, in the year after the freeway was placed in operation.

In the one-year "after period," the combined freeway-business route accident rate was 4.17 per million vehicle-miles of travel, a decrease of 66 percent from the preceding year's rate of 12.1 accidents per million vehicle-miles on the old highway.

The number of accidents was cut from 461 on the old highway to 34 on the freeway and 179 on the business route.

The comparatively small number of accidents on the freeway demonstrates the substantial traffic safety benefits from this type of highway.

The accident rate on the freeway alone for the first year of operation was a low 1.2 per million vehicle-miles. The rate on the business route was 7.6 accidents per million miles, also an impressive reduction from the previous year's rate.

The number of persons injured in accidents also declined.

The year before the freeway was put into use 71 persons were hurt in accidents on the old route. The following year 18 were injured in mishaps on the business route and 39 were injured in freeway accidents.

The reductions were recorded even though traffic volume on the freeway and business route combined was 32 percent higher than on the old highway.

Average daily traffic on US 99 at Fresno in the "before period" was 20,800 vehicles. In contrast, the freeway-business route average was 27,500 vehicles per day—15,700 on the freeway and 11,800 on the business route.

Report From District XI

By JACOB DEKEMA, District Engineer

The past several months in District XI have seen an unprecedented number of public meetings and route adoptions in this southern district. Three public meetings on US 80, a portion of the National System of Interstate and Defense Highways, preceded 134 miles of route adoption by the California Highway Commission. The route adoptions extend from the City of El Cajon within the San Diego metropolitan area, to Gray's Well, about two-thirds of the way between El Centro and the California-Arizona boundary. Construction and right-of-way costs are estimated at 100 million dollars.

In addition to the foregoing, public meetings have been held relative to route adoptions on segments of US 101, State Sign Route 67, and US 60-70-99. The portion of US 101, also on the Interstate System, under consideration was that section between Rose Canyon Creek and the former north city limits of San Diego, while on State Sign Route 67 a segment between US 80 and the San Diego River just north of Lakeside came under discussion. On US 60-70-99, several alternate routes east of the City of Indio and projecting easterly to Cactus City were debated publicly by interested factions. It was interesting to note the wide participation by local residents, which sometimes numbered from 200 to 500 people, in these public meetings held in relatively remote areas.

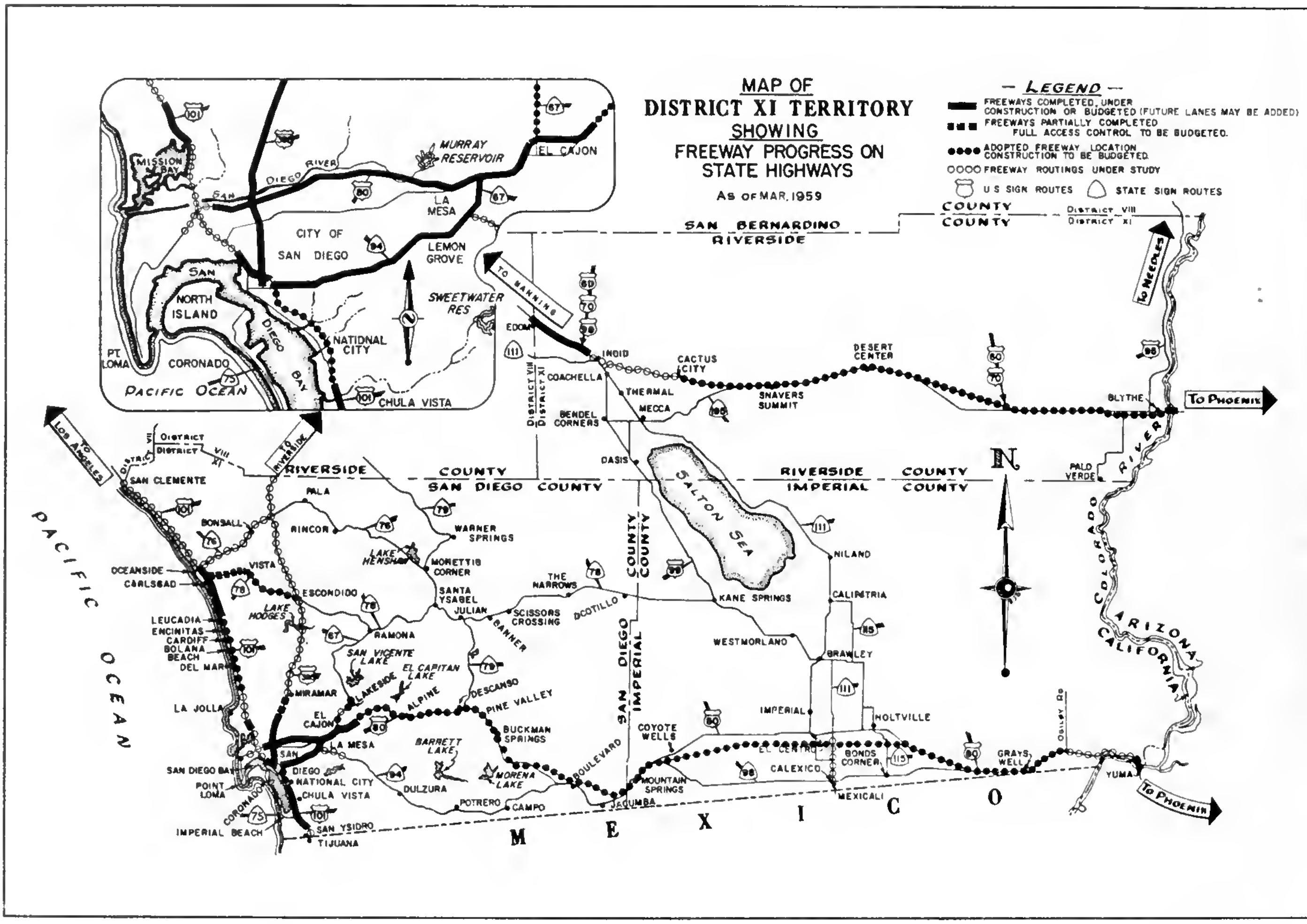
Full Freeways Built

Constructionwise in District XI, US 80 occupies the spotlight. Eleven major contracts for 17 miles of full freeway between US 101 and the east side of the City of El Cajon have been completed, are being constructed, or are budgeted for the current fiscal year. The westerly portion of US 80 lying on the south side of Mission Valley is particularly interesting in that it overlays the old Mission Trail (El Camino Real) which connected the early California missions. A number of monuments to California's early history will cast their shadows upon the eight-lane freeway presently under construction.

Between US 101 and US 395, 1.3 miles of eight-lane full freeway development is currently under construction by R. E. Hazard & W. F. Maxwell at a bid price of $1,214,000. Frontage roads will be constructed parallel to the entire development and structures will provide for motorists to cross the freeway. On- and off-ramps will be built at the Presidio Park structure near the western terminus of the contract.

One noticeable aspect of this area of construction is the rapid mush-

BELOW, LEFT—An aerial of the US 80-Fairmont Avenue interchange looking south along Fairmont Avenue. East San Diego is in the background. RIGHT—An aerial looking eastward through the Palm Desert from above the Sign Route 111-74 intersection in Riverside County.



rooming of motels. Property prices have skyrocketed since the initial freeway planning and the highway contractor will be hard pressed to keep up with the motel builders adjacent.

Traffic Presents Problem

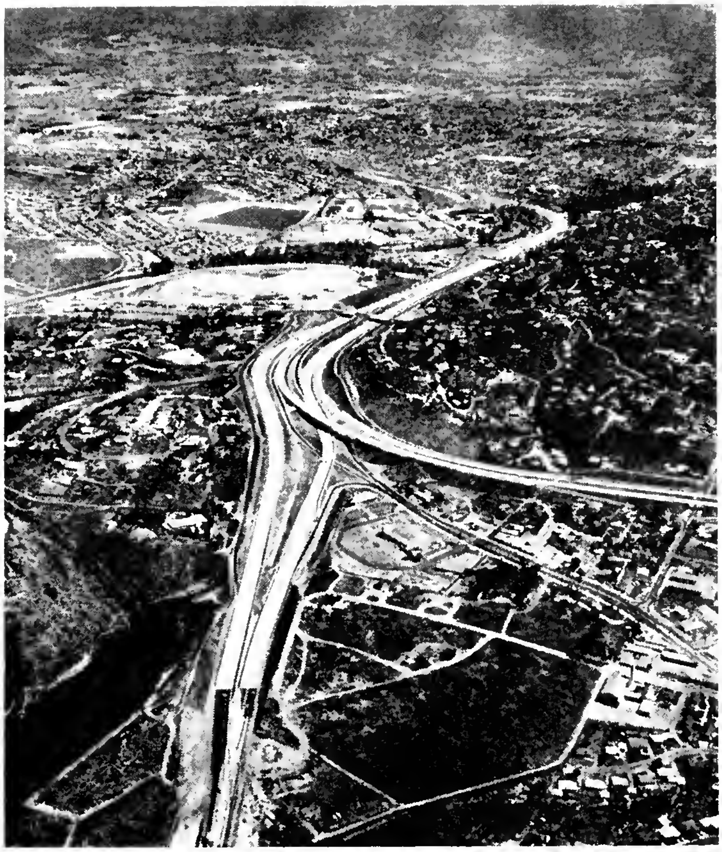
The next contract provides for a revision of the US 80-US 395 interchange and is approximately 70 percent complete at the time of this writing. Seven separate structures were necessary to provide direct turns for the major traffic movements, while loops suffice for the other movements. Traffic handling during construction has been particularly difficult, although surprisingly efficient, inasmuch as there are no major parallel facilities to use as detours. This condition is existent over almost the entire length of US 80 presently under construction.

The third contract on US 80, between US 395 and Fairmount Avenue, is the largest single contract yet to be awarded in District XI. The contract award was made to R. E. Hazard and W. F. Maxwell in the amount of $4,560,000 for the construction of 3.6 miles of eight-lane freeway, including three major interchanges in addition to two two-lane bridges over the San Diego River. Frontage roads will serve the properties adjacent to the freeway which are rapidly expanding with recreational and commercial enterprises. Due to unprecedented residential expansion north of Mission Valley area, it was mandatory that four-quadrant treatment of the interchanges be planned. Ward Road and Texas Street, sites of US 80 interchanges, are destined to become major arteries in the near future.

The Fairmount Avenue Interchange, recently completed, was the fourth among the 11 contracts planned for metropolitan US 80. It overlooks the Mission San Diego de Alcala and serves as a connection to Mission Gorge on the north and eastern San Diego, together with San Diego State College, on the south.

Alvarado Canyon Section

Contract number five in the US 80 chain is that segment between Fairmount Avenue and 70th Street (Lake Murray Boulevard). This six-lane freeway section will traverse Alvarado Canyon, with interchanges at Waring Road and College Avenue. The Waring Road connection will serve a large residential area presently expanding on the north of the freeway. The College Avenue interchange also will serve a large residential area to the north of the freeway and will eliminate two accident prone intersections by substituting a grade separation for a grade crossing of the high-speed arterial. It is considered fortunate that the City of San Diego, when originally developing Alvarado Canyon to expressway standards, acquired a major portion of the access



UPPER LEFT—Looking eastward along US 80 showing the Sign Route 67 interchange in the foreground. The City of El Cajon is in the background. UPPER RIGHT—This bridge near Blythe in Riverside County carries US 60-70 traffic over the Colorado River. The structure at the west end of the bridge is the agricultural inspection station. LOWER LEFT—Looking northeast along Balboa Avenue in San Diego. LOWER RIGHT This view looking north above Nimitz Avenue shows freeway construction now under way and Mission Bay Park in the background.

rights thereto, foreseeing a freeway development on the alignment in the future. The Griffith Company was low bidder for this 2.6 miles of freeway, which was estimated to cost $2,565,000.

The eastern terminus of Alvarado section of US 80 will deliver the motorist onto a newly completed six-lane freeway extending from 70th Street through Baltimore Drive in the City of La Mesa. This segment of US 80 was constructed under two contracts, at a cost of $1,663,000 for a 2.5-mile section. These, the sixth and seventh projects, added two new interchanges, to give the motorist access to Lake Murray Boulevard and the San Diego County-built Fletcher Parkway at Baltimore Drive.

Major Interchanges Planned

Segment eight in the contract chain of US 80, will be a six-lane freeway between Baltimore Drive and the recently completed Grossmont Summit section. Design is in the final stages, and the 1959-60 Fiscal Year budget adopted by the Highway Commission allocates $3,000,000 for this 2.3-mile link of US 80. Major interchanges are planned for connecting El Cajon Boulevard and Jackson Street with the Freeway. Three new bridges in addition to the one presently in use will be built to accommodate traffic crossing the freeway, as well as to afford entry and exit on the south at El Cajon Boulevard (former US 80). At Jackson Street in the City of La Mesa, it is possible to utilize the existing grade separation structure and, by adding another alongside, to accommodate the additional lanes together with several ramps, to develop a very desirable geometric design at a minimum of cost. Service is provided to the City of La Mesa on the south and La Mesa's industrial area to the north of the freeway.

Link nine of the US 80 chain of contracts is the recently completed $3,594,000 job in the Grossmont Summit area. Although the traffic paint is hardly dry, the project is functioning smoothly despite the tongue-in-cheek attitude of a multitude of sidewalk superintendents. The rapidity with which the traveling public adapted to the somewhat complex geometric design was very revealing and will be extremely useful in future interchange planning.

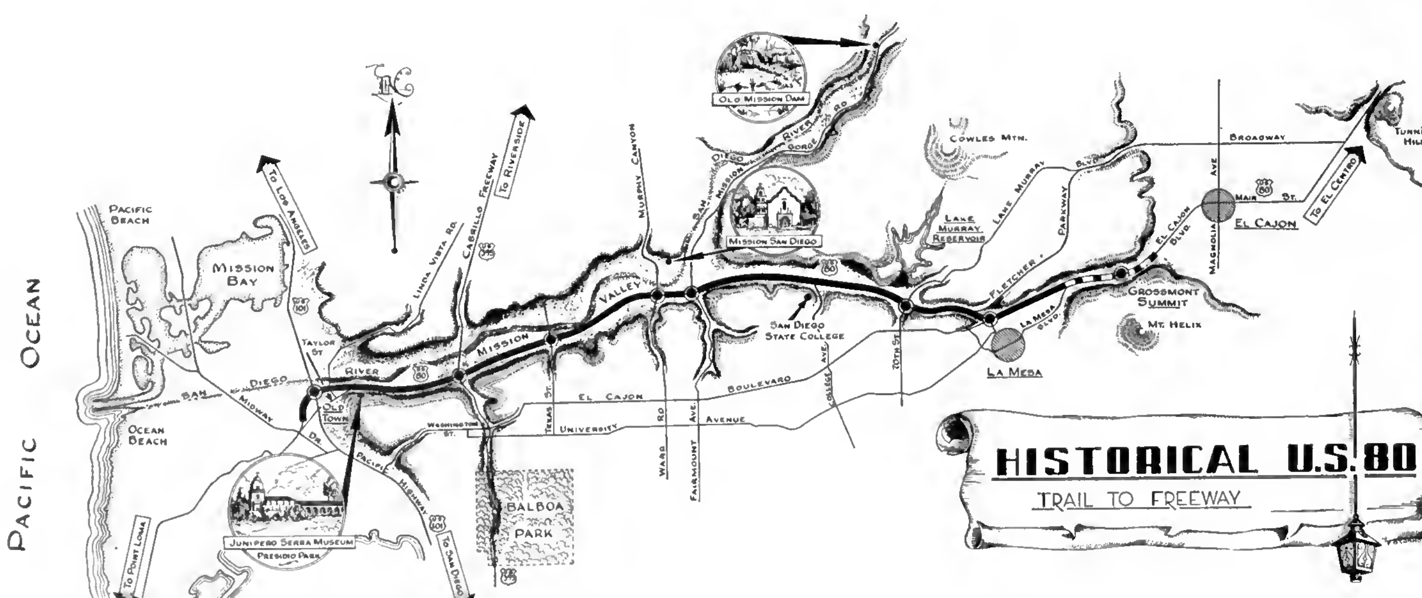
Surplus Excavation Used

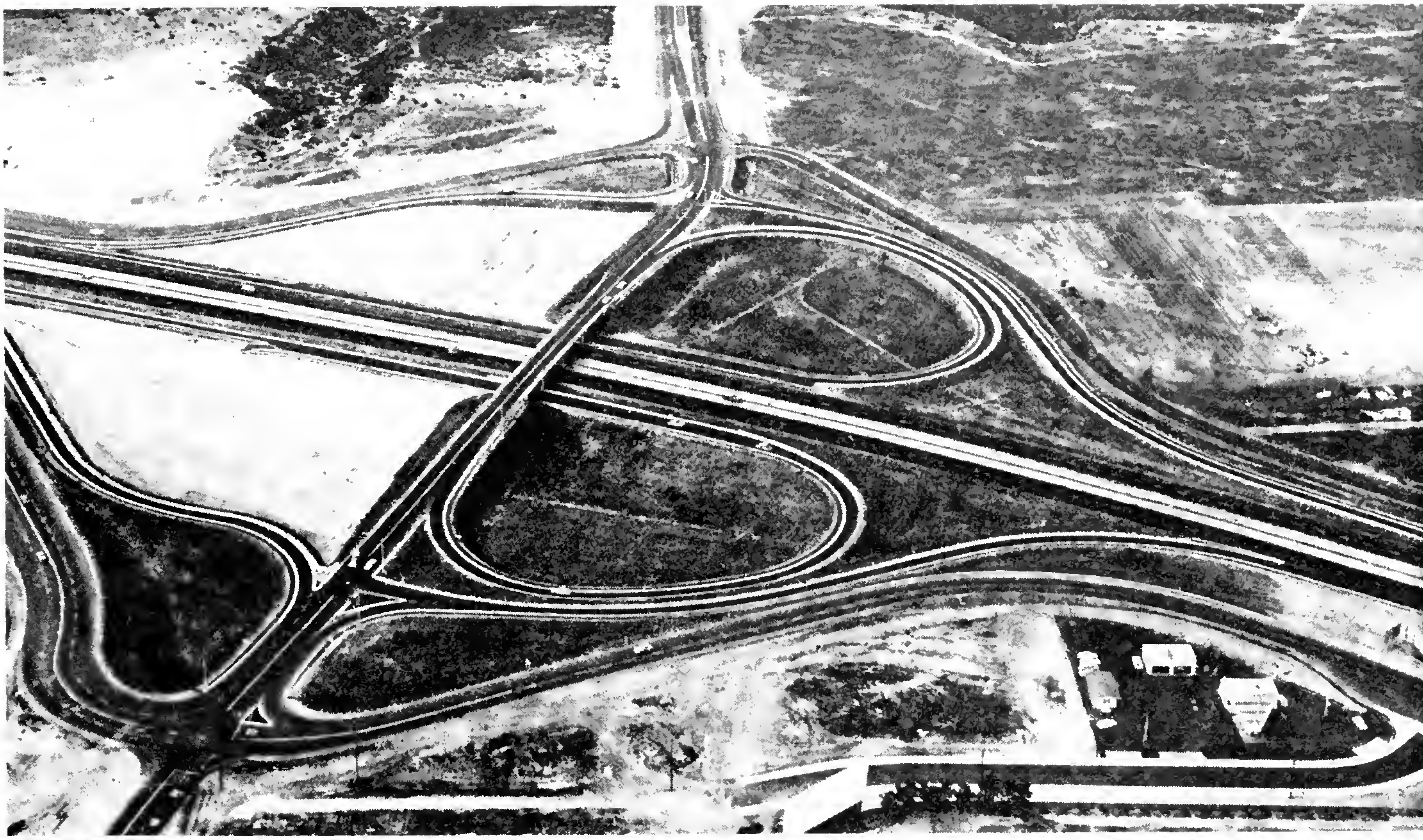
Momentarily, and perhaps before this article is in print, advertisement is expected on contract 10 of the US 80 freeway. This project will carry the development on six lanes along the western hillside overlooking the El Cajon Valley between Grossmont and Magnolia Avenue (State Route 67). Excess excavation from the Grossmont project has been placed to form a portion of the fills along this alignment which provides a diamond interchange at West Main Street and grade separations at Marshall and Johnson Avenues. A four-quadrant cloverleaf with collector roads will accommodate the State Route 67 Junction at Magnolia. Highway Commission action has budgeted $4,000,000 in the 1959-60 Fiscal Year for this link.

The eleventh and last development presently budgeted in the US 80 series of contracts will extend a four-lane freeway development from Magnolia Avenue on the westerly side of the El Cajon Valley to Third Avenue on the easterly side of the valley. This contract, which will provide for diamond underpasses at Mollison and Second Streets and grade separations at Ballantyne Lane and First Street, will include a half-diamond interchange at Third Avenue as well as a temporary connection to existing US 80 at Broadway. Foreseeing increasing traffic demands in the future, right-of-way sufficient to accommodate eight lanes is presently being acquired. With the completion of the foregoing 11 contracts in the near future, the traveling public will have 17 miles of full freeway across the metropolitan area of San Diego at an estimated construction cost of 29 million dollars.

US 101

With completion in sight of the major construction on US 80 in the





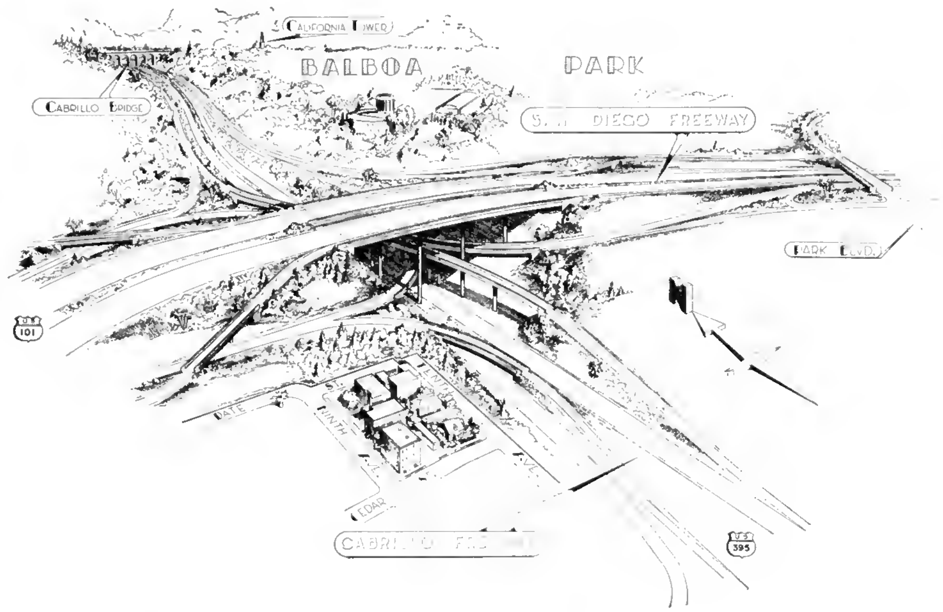
UPPER—This aerial, looking westward, shows the US 395 Clairmont Mesa Interchange in San Diego County. LOWER—An aerial showing construction along Nimitz Boulevard in San Diego. The view is south.

State Sign Route 111 winds its way through the desert country west of Indio in central Riverside County. Note the neatly demarked crop and orchard areas in the left fore-, middle- and background of the photo.

metropolitan area, it is anticipated there will be a shift of construction emphasis to US 101—District XI's principal north-south artery between the Mexican border and the northern district boundary.

Highway construction involved for the new border crossing station at the international boundary has been advertised, with bids opened May 7, 1959. Engineering design and contractual procedures will be handled by the State Division of Highways, with cost participation between the State and the Federal General Services Administration.

Progressing northerly, the section of San Diego Freeway (US 101) from Market to Palm Streets within the City of San Diego is in the final design stages, with the first contracts expected to be advertised in the fall of this year. Right-of-way acquisition is nearing completion for the first phase of construction, involving grading and a number of structures at and on either side of US 395. Thirteen million dollars have been allocated for construction and three million dollars for rights-of-way on this metropolitan segment of US 101 by the Highway Commission, for the 1959-60 Fiscal Year. The structures for the planned four-level US 101-US 395 interchange near Date Street will be a portion of this first contract for the projected eight-lane freeway development.



An aerial perspective drawing of the proposed four-level interchange which will connect the San Diego and Cabrillo Freeways.

With the completion of the one-mile section of eight-lane freeway between Washington Street and Barnett Avenue, what formerly was an arterial blocked solid with standing cars up to a mile in length at peak load hours is now a free flowing, 55-mile-an-hour freeway.

Recently, the Legislature added a new route to the State Highway System, Legislative Route 241. It will begin at US 101 near San Ysidro and end at US 101 near the northwest boundary of the City of San Diego. This route will be located east of existing US 101 and will serve as a north-south belt line route around the more heavily populated portions of San Diego County.

Planning studies are presently under way to ascertain the exact routing for commission action. The newly adopted route will be a part of the National System of Interstate and Defense Highways.

State Sign Route 94

With the recent completion of nine bridges on State Sign Route 94, and with grading and paving operations progressing rapidly, the freeway section between 24th Street and Home Avenue is fast becoming a reality. This eight-lane full freeway will serve as a connecting facility between the San Diego Freeway and the previously developed freeway extending easterly.

Interchanges will be placed at 25th Street, 28th Street, and at the City of San Diego's Wabash Boulevard, while 30th Street will bridge the freeway on a grade separation structure. Anticipated completion of this 0.8-mile unit in the fall of this year should go far toward alleviating the Market Street bottleneck presently feeding traffic into the freeway extending easterly toward US 80. The connecting fills and viaduct sections to accomplish the final connection to US 101 will be a portion of the US 101 construction.

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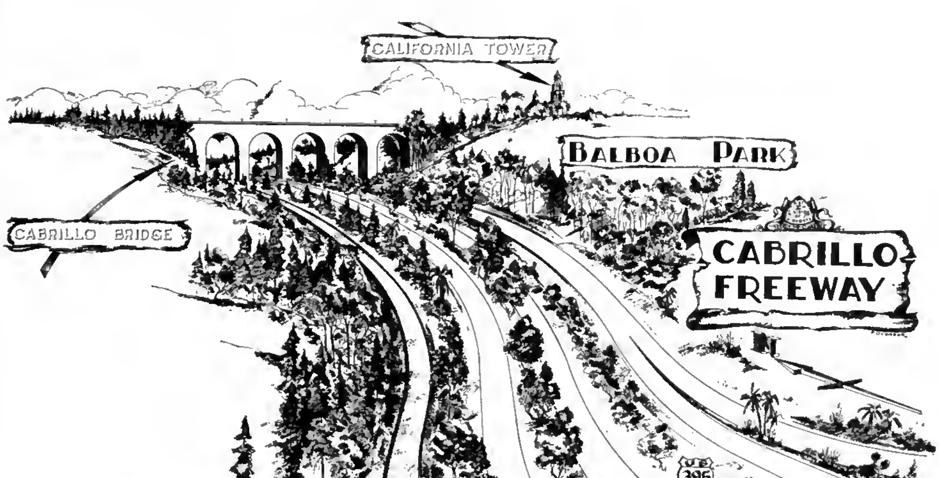


An artist's sketch of the Cabrillo Freeway in the vicinity of the future four-level interchange shown at the top of this page.

Oakland Study

Effects of Street Work on Tax Base Reported

By FRANK CHENEY, Senior Engineer
Street and Engineering Department, City of Oakland

A view westward along a portion of 27th Street between Telegraph Avenue and Broadway in Oakland which served as a study area for the accompanying article. The business establishments in the foreground are located on surplus property acquired for street right-of-way.

NEW FREEWAYS and street widenings have long been charged with feeding on a city's tax base. In light of current studies, this stereotyped criticism can no longer be justified.

The tax implications of any public works activity—either proposed or already accomplished—are properly and desirably matters of citizen concern. Subsequent expressions of that concern—enlightened by thought and study—are helpful. But statements predicated on little if any factual analysis have just the opposite effect.

Unfortunately, many widely held opinions of the effects upon the property tax base of property acquisition for street improvements and widenings, are based on lack of information. Of course, a certain amount of misconception is understandable. Street improvements generally require the purchase of taxable land for a tax exempt use and it may seem reasonable to assume that the community tax base will be correspondingly reduced. No further investigation of offsetting factors and influences, or study of actual case examples, seems necessary on first glance. As a result, little private research has been actually carried out or published.

There is, of course, another viewpoint that has pertinency—the impressions of those who are literally on the street improvement job itself. It is not surprising that these latter experiences and observations, drawn from review of areas where street widenings have been completed, have tended to create an impression of tax base effect which is quite different from the first glance impact already sketched. Higher land values, upgraded buildings and residences, and newer and more profitable land uses, all have been observed frequently enough following street improvement to strongly suggest beneficial, rather than adverse, tax effects as the more realistically predictable results of street betterments. Here too, however, little subsequent compilation and reporting has been achieved. The following city street improvement report thus attempts to begin to remedy that deficiency by factually analyzing the problem within Metropolitan Oakland, so that sound answers to a good many of the widely held tax effect assumptions can be developed.

Preliminary Study

As a necessary first step in this research project, extensive study was made of the entire Oakland area to determine which sections and which construction projects were available for "before and after" study and analysis. Four major street improvements which had been completed within the last 10 years were found to meet all the preliminary requirements initially suggested, and more intensive study of each was subsequently commenced.

Land and improvement inventories were established for each area, and assessed values and value trends were plotted for the years both before and after the street improvement in each was completed. Even from this relatively cursory examination, several factors became readily apparent:

1. Trends in all areas were clearly similar.
2. All areas were subject to city-wide fluctuations and influences, and street improvement effects themselves tended to be "masked" thereby.

The necessity for some type of "control area" analysis so that the effects attributable only to the street improvement itself could be isolated, was clear. Similar districts in close proximity to each study area were thus chosen, and identical comparisons for these "control sections" were carried out.

UPPER—This photo taken in 1953 looking eastward along 27th Street shows the end of the street, private homes and the U. S. Government housing that was removed to make way for the roadway. LOWER—This photo was taken from approximately the same location as the one above after the new divided roadway was completed in 1958. For a point of reference note the church spire in the right background of both pictures.

Again a similarity of trend and pattern was clearly evident in all four study areas. Because of the lengthy and comprehensive study and analysis which still had to be carried out, one project was chosen from the group for final study. This project, the 27th Street improvement between Telegraph Avenue and Broadway in Oakland, is reported in detail hereinafter.

It should perhaps be emphasized that this latter project is a representative situation rather than a unique one. The conclusions deriving from a study thereof are thus considered typical of at least the three other projects and areas initially studied—probably they are entirely representative of what we can expect, taxwise, from betterments within the entire Oakland area, and probably within other similar California cities as well.

Project and Area

Prior to the construction of this project, residential 27th Street was a discontinuous street, traveling in a generally easterly direction from Telegraph Avenue. Its improvement, commenced on July 21, 1955, and completed on March 22, 1956, was the second unit in the overall improvement of both 26th and 27th Streets between Grand and San Pablo Avenues. Construction resulted in the creation of two 41-foot roadways (one parking and three moving lanes) in each direction, with a six-foot median strip. (See accompanying photographs.)

Overall, this unit represents one of the closing links in a major cross-town arterial providing easy access to the San Francisco-Oakland Bay Bridge, and the cities of Emeryville, Albany, and other outlying cities of the Greater East Bay; thus relieving, in part, the growing traffic congestion in Metropolitan Oakland. The entire cost of the project was $390,491, including right-of-way acquisition costs of $274,435.

About 60 years ago the study area was developed exclusively for residential use in what might have been called the residential district of the city at that time. Today, as Oakland has grown, the area is located on the fringe of the downtown business district adjacent to "Automobile Row." Because of the age of its houses, it is probably only a matter of time before private developers will enter to purchase the properties, tear down the existing improvements, and erect new and modern business structures in their place. This then, was the type of development situation to which our attention was to be directed.

Problem Appraach

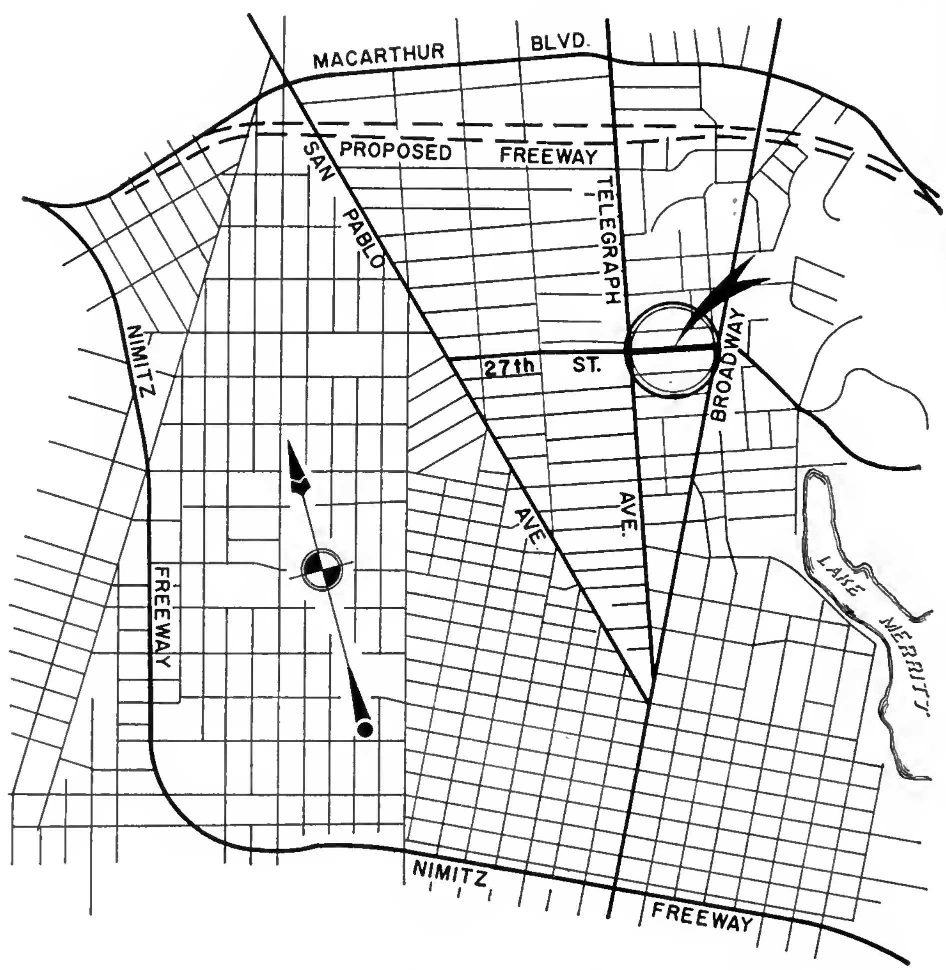
As indicated earlier, a "before and after" study approach was utilized. Assessed value trends for both the land and improvements within the study area were developed and compared. Also, market value trends were measured and analyzed. Identical factors were developed and assessed for the so-called control area as well, the nearby section not having been affected by a street improvement but similar in all other respects to the 27th Street section under study.

In this respect the Street and Engineering Department of the City of Oakland is fortunate in having, as an integral part of its organization, a "Block Book Section." Within this section is maintained a complete accounting of all property transfers, both public and private, that transpire within the City of Oakland. Through the use of microfilm all such transfers become an integral part of this department's records. Using this material, together with the records of the County Assessor of Alameda County, the factual property data necessary for this study were compiled. Certain summary facts became quickly apparent.

Summary Results

Careful analysis of all relevant factors has clearly indicated that street openings and widenings result in an increased tax base, together with other allied tax and community benefits. In the 27th Street improvement area, it was found:

. . . Continued on page 43



A vicinity map showing the location of the portion of 27th Street (encircled) studied in this report.

Benicia-Martinez Bridge

Construction of the Benicia-Martinez Bridge came a step nearer realization when the California Toll Bridge Authority, at its April 23d meeting, authorized the sale of 34 million dollars in bonds to finance the building of the bridge and its approaches.

The California Legislature in 1955 authorized 80 million dollars in Toll Bridge Authority revenue bonds to finance construction of both the Benicia-Martinez Bridge and the recently completed parallel Carquinez Bridge and approaches.

Of the total authorized amount, 46 million dollars in bonds were sold to cover the Carquinez Project. The bonds will be redeemed from toll collection on the two bridges.

Located about 200 feet west of the Southern Pacific Railroad Bridge across Carquinez Strait, the Benicia-Martinez Bridge will be of deck-truss type construction with a total length of 6,215 feet and an overwater length of 4,880 feet.

Nine piers, about 500 feet apart, support the structure. The bridge deck will provide a four-lane highway with a 10-foot dividing strip and will be about 180 feet above the water.

Minimum clearance for ships passing under the bridge in the main channel will be 138 feet, about the same as is provided by the adjacent railroad lift bridge in its highest position.

This artist's sketch of the proposed Benicio-Martinez Bridge is looking from above the approach and interchange on the Benicia side toward Martinez and the connection with Sign Route 21.

Photogrammetry

Department Engineer Wins Abrams Award

A study on the problems of photogrammetric map accuracy has brought national recognition to L. L. Funk, California Division of Highways Photogrammetric Engineer. The study, published in several periodicals circulated to photogrammetrists and to scientists in associated fields, was selected by a special committee as the most outstanding during 1958, and as meriting the Talbert Abrams Award.

This award is given annually to the member, associate member, or honorary member of the American Society of Photogrammetry whose published work is considered the best contribution to the science during the previous year. The recipient retains the trophy for a year, has his name inscribed on the base, and receives a $100 prize.

A number of distinguished men in the field of photogrammetry have won the award, which was first given in 1944. In 1948, for instance, Harry T. Kelsh won it for the Kelsh plotter, an instrument which greatly simplified the conversion of aerial photographs into contour maps. Indicative of how rapidly the science is being adapted to modern uses, the committee gave Dr. Hellmut H. Schmid the award in 1958 for "development of techniques and equipment enhancing usefulness of photogrammetry in solving geometric problems and also in the fields of missile testing and satellite performance."

Funk's study is concerned with the accuracy of contour mapping as it applies to highway design. He points out that many applications of photogrammetry are concerned with relative relief, and slight errors in overall elevation may be unimportant. The highway engineer is vitally concerned with vertical values, of course, in order to accurately calculate cut and fill quantities.

In exploring this facet of photogrammetry, Funk has reached the conclusion that while the current specifications for contour mapping for highway purposes are reasonably sound from a practical viewpoint, they allow a possibility, under certain conditions, for systematic errors. These errors, though well within the tolerance allowed by the mapping specifications, could be seriously inaccurate for contract pay quantities.

L. L. Funk, Principal Highway Engineer, in charge of California Division of Highways Photogrammetry Sections, poses with Talbert Abrams Award and photogrammetry exhibit in Public Works Building, Sacramento.

For instance, on a half-mile length of interstate highway 200 feet wide, a systematic error of one foot in elevation represents about 20,000 cubic yards of material. Yet such an error would be permissible under present mapping specifications. Fortunately, errors of this sort are rare, and are more apt to be high-low variations which tend to cancel each other.

Funk feels too much dependence is placed upon arbitrary use of a figure known as a "C-factor." Actually, this is the desired contour interval divided into the altitude of the airplane. Much confusion has arisen from the indiscriminate use of this term—some experts contending a C-factor of 1,500 is perfectly workable, while others contend it should be as low as 750 or 800.

Funk points out grass and weeds alone can cause an apparent error of one to two feet in stereomapping. Also, that for certain purposes a large contour interval will be satisfactory, allowing the pilot to fly high and cover more ground with each photo. Other jobs, requiring more accurate contouring, must be flown at lower altitudes.

It should not be assumed, however, that photogrammetric methods in use today are undependable. Photographic contouring for highway location and design offers many advantages over field party work. It saves both time and money, and it can be

LEFT—Photogrammetrist Brennan Davis operates one version of stereo-plotter, complicated mechanism for stereo-picture projection for map making. For accurate work, machine must be sturdy and built to close tolerance. RIGHT—Davis demonstrates use of stereo-plotter. A three-dimensional image is projected on white disk. The operator wears special glasses, one lens red, the other blue, to get three-dimensional effect. The machine traces contours as operator follows apparent relief.

done without stirring up premature speculation about possible route locations. If properly handled, it yields quantitative results as reliable as those obtained by field methods. For most location problems, a contour map, supplemented by a minor amount of field survey work, is all that is needed to design the highway.

Before an actual construction contract can be let, the route must still be staked in the field. This is a relatively simple job, however, since the major mapping has already been completed.

This field stake-out of the route follows the centerline of the roadbed, and gives an excellent check on the photogrammetric contouring. Usually, the two systems check closely. Funk feels, however, now that photogrammetry is becoming a more exact science, standards for its accuracy should be more clearly established.

A contour map made from aerial photography and used in study for road location. The map showed that grading catch points would be in the middle of a river bed, damming the stream. This projected route was discarded.

Cost Index

Construction Prices Down For First Quarter of 1959

By J. P. MURPHY, Assistant State Highway Engineer
and H. C. McCARTY, Office Engineer

The California Highway Construction Cost Index for the first quarter of 1959 shows a drop in construction costs on the basis of unit bid prices received during the period. The Index now stands at 216.1 (1940 = 100) which is 22.4 index points or 9.4 percent below that of the fourth quarter of 1958, which more than offsets the rise in the Index of 4.4 percent experienced in that quarter.

This 216.1 figure is 25.7 index points or 10.6 percent below the corresponding period of 1958, and 61.6 index points or 22.2 percent below the all-time high of 277.7 established in the first quarter of 1957. It is the lowest point reached by the Index since the four quarter of 1955, when it stood at 212.6. The accompanying tabulation shows the California Highway Construction Cost Index by years from 1940 and by quarters from 1955 to date.

The bidders' competition in this quarter for highway projects was high, averaging 7.7 bidders per project in January, 8.0 in February, and 8.7 in March, resulting in an average for the three months of 8.2 bidders per project. This compares with 6.3 bidders per project for the fourth quarter of 1958.

Included with this article is a tabulation showing the average number of bidders arranged according to types of construction and project value, and includes all projects for which bids were received.

In this quarter bids were opened for 74 projects with a total value of $66,975,520, compared with bid openings in the previous quarter for 174 projects with a total value of $36,189,-715. The higher average value of projects in the first quarter of 1959 is due largely to the opening of several large freeway projects in the 1958-59 Fiscal Year budget which had been scheduled for earlier advertising but were delayed by right-of-way negotiations, co-operative agreements, and other factors. In addition, bids were opened for several large urgent freeway projects being placed under way as quickly as possible under the 1959-60 Fiscal Year budget. On the other hand, the lower average value in the last quarter of 1958 is due in part to the so-called "crash" program under the Federal Aid Highway Act of 1958, wherein additional federal funds were available and utilized for a large number of county road federal-aid secondary projects of moderate size which were required under the act to be awarded prior to December 1, 1958.

An accompanying table lists, according to size, the 74 projects considered in this survey.

Five of the seven items used in the preparation of this Index show lower average unit prices than in the previous quarter. Of the remaining two, structural steel is unchanged and only portland cement concrete pavement shows a slight increase. A tabu-

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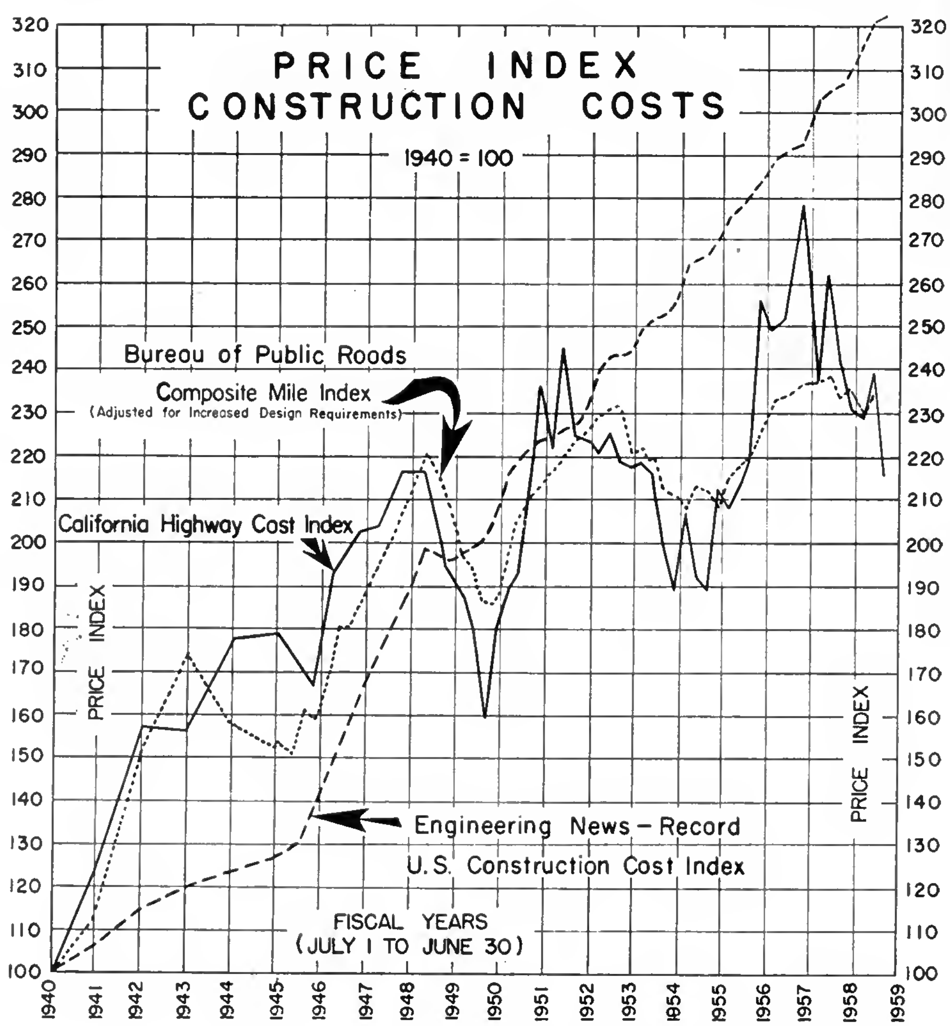


Cuyama Road

New Eight-mile Relocation on Sign Route 166 Nears Completion

By L. D. KRAATZ, Resident Engineer

A RATHER spectacular relocation of approximately eight miles of State Sign Route 166 is 66 percent complete and the contractor's operations have now reached the point where it is possible to visualize the final appearance of this new highway. This relocation is under way in conjunction with construction of the Twitchell Dam by the Bureau of Reclamation on the Cuyama River some seven miles east of US 101 north of Santa Maria. Approximately one-half of the existing highway will be inundated by the reservoir which will be created by the dam.

Highway 166, known locally as the Cuyama Road, connects the main north-south arterials, U. S. Highway 101 in the Central Coast and U. S. Highway 99 in the San Joaquin Valley. It commences approximately three miles north of Santa Maria and closely follows the Cuyama River through the Santa Lucia and San Rafael Mountain ranges while passing through large cattle ranges and rich oil fields, particularly near the town of New Cuyama, thence through Maricopa, finally joining U. S. Highway 99 approximately 23 miles south of Bakersfield. This route also serves as an important access for Central Coast residents to Mt. Abel, a popular winter sports area.

PHOTO TOP OF PAGE—Construction progresses on the new bridge across the Huasna River. Some of the reinforced concrete piers constructed by the new slip-form method described in the article can be seen supporting the bridge deck in the left middleground.

Existing Road Narrow

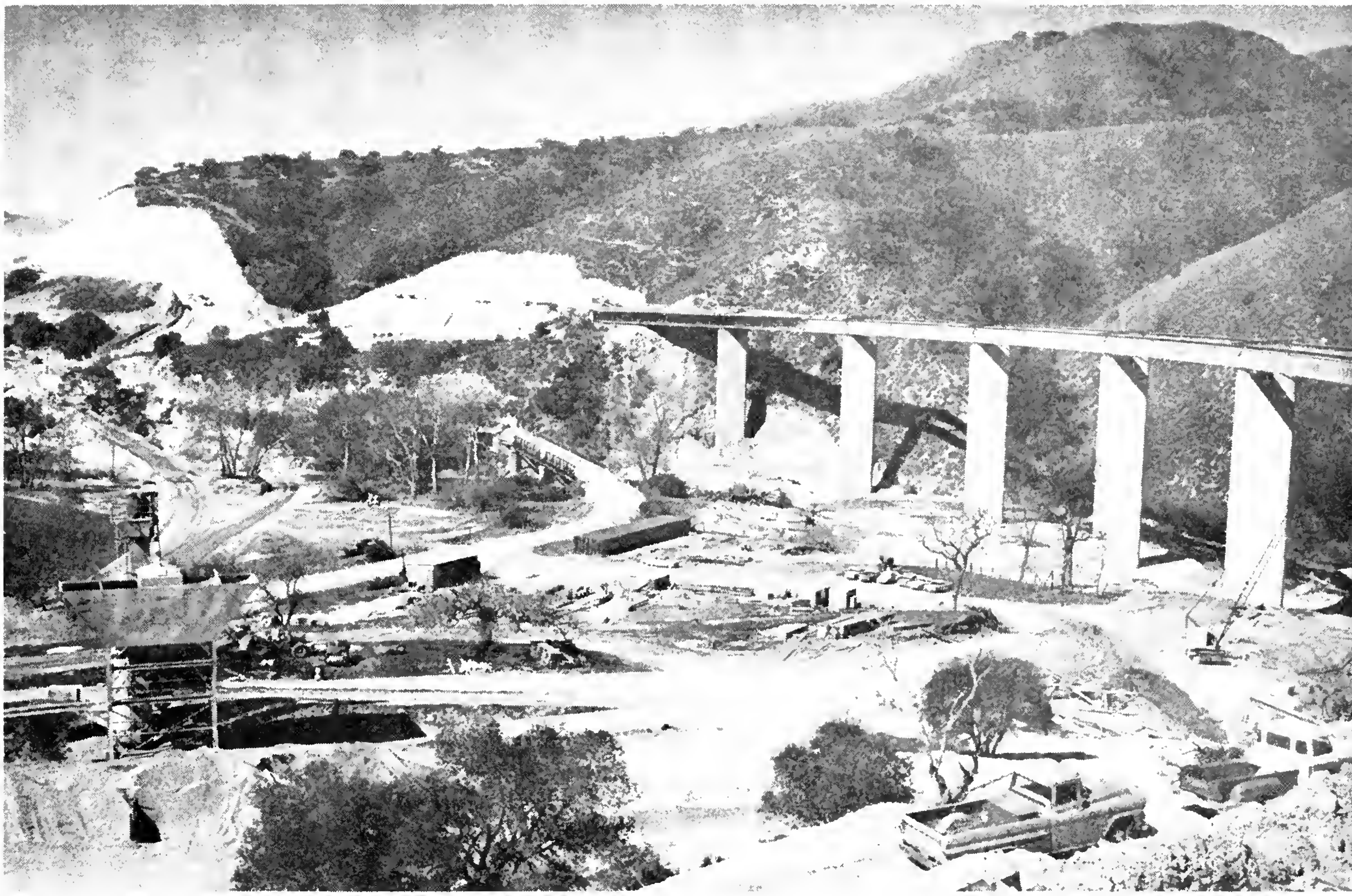
The first 30 miles of this road from Highway 101 easterly is located through extremely rugged terrain, with very substandard undulating grade and alignment with grades up to 7 percent, curves with 80-foot radius and safe driving speeds of 30 m.p.h. The existing roadway is quite narrow compared with modern standards with an oiled surface that averages only 17½ feet in width.

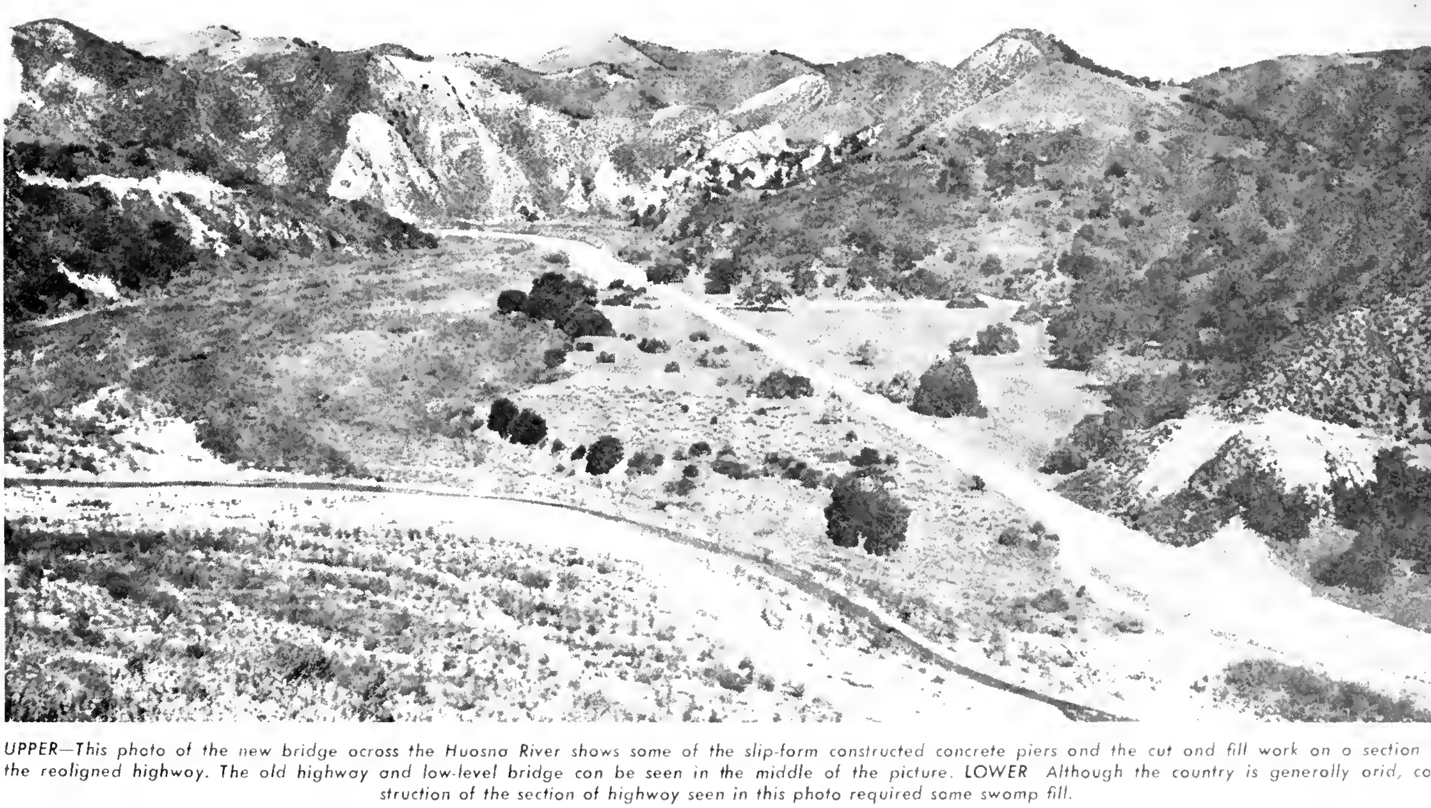
The 3.5-million-dollar project now under construction consists of eight miles of new alignment approximately in the middle of the existing "rugged 30 miles." Design speed is 50 m.p.h. with maximum grades of 6 percent and minimum radius of curvature of 850 feet. Approximately five miles of the project will be constructed adjacent to and above the reservoir area and three miles beyond the reservoir area to improve alignment and grade. The entire project will result in a distance saving of 1.7 miles. There will naturally be a considerable additional saving in time and vehicle operating cost due to the improved alignment and grade and additional lane width as the new facility will be 28 feet wide in cuts and 34 feet in embankments. The paved roadway will consist of 28 feet of three inches of plant-mixed surfacing over six inches of untreated base and four inches of imported subbase material.

Terrain Presents Challenge

The grading operation has been a spectacular test of modern methods and equipment pitted against nature's

Some idea of the size of this cut necessitated by the realignment of the highway can be gauged by the two pieces of road equipment visible at its base.





UPPER—This photo of the new bridge across the Huasna River shows some of the slip-form constructed concrete piers and the cut and fill work on a section of the realigned highway. The old highway and low-level bridge can be seen in the middle of the picture. LOWER Although the country is generally arid, construction of the section of highway seen in this photo required some swamp fill.

rugged arrangement of the terrain. Cut slopes are 1:1 in predominantly hard shale and range in height to 250 in areas where the slope of the natural ground is 1:1 or steeper. Embankment slopes are 1½:1 except within the reservoir area where 2:1 slopes are constructed and protected with three to five feet of light and heavy stone riprap. Major grading quantities consist of 1,500,000 cubic yards of roadway excavation, 265,000 cubic yards of ditch and channel excavation in four major channel changes of the Cuyama River, 34,000,000 station yards of overhaul, and 80,000 tons of stone riprap.

Pioneering and clearing and grubbing was accomplished by bulldozers. Oak trees and brush were buried off the right-of-way due to the extreme fire hazard involved in burning. The major portion of the dirt was moved by 15 three-axle rubber-tired 18-24-cubic-yard scrapers at rates of 5,000 to 10,000 cubic yards per day for hauls of up to two miles. Material in cuts was loosened by drag-type and hydraulic rippers. Occasionally it was necessary to drill and shoot hard ridges of shale. Sheepsfoot and 50-ton pneumatic rollers were used to obtain the required compaction.

Materials used in embankments contained 30 to 50 percent fractured shale larger than three-quarter-inch sieve. Fills across canyons were tied into the existing steep side slopes a minimum of four feet by continual removal of overburden with dozers. Stone riprap was produced approximately one mile north of the center of the project by normal quarrying methods, hauled to embankment areas by truck and placed by dozers as the embankment was constructed.

Precautions Against Flooding

The new alignment crosses numerous small and large canyons serving watersheds of varying extent. Drainage will be carried under fills via 18-inch to 60-inch corrugated metal pipe and 66-inch to 108-inch field-assembled corrugated metal plate culverts. Due to the height of the embankments, culverts were designed to be placed above the existing channel flow line to save on length of culvert required. At the inlet end the canyons were filled to flow line of the new culvert to prevent ponding and the culvert was placed to outlet in natural ground to avoid washout of the embankment.

Large culverts up to 300 feet in length were placed on two to three foot thick sand cushions and cambered to provide a uniform foundation and prevent serious distortion due to embankment subsidence. At various locations, reinforced concrete boxes and one nine-foot concrete arch culvert for cattle passes and drainage have been constructed.

The new alignment crosses the Huasna River and Alamo Creek just north of their confluence with the Cuyama River at the east end of the project. Also crossed is the Cuyama River. These crossings are accomplished by three bridges involving major quantities consisting of 10,000 cubic yards of Class "A" portland cement concrete, 2,125,000 pounds of reinforcing steel, 2,915,000 pounds of structural steel and 530 concrete and steel piles.

Slip-form Method Used

The Huasna River Bridge is one of the largest structures of its kind constructed in this State and the final cost will be over $1,000,000. It consists of a 28-foot-wide reinforced concrete deck supported by nine 174-foot spans of twin welded plate girders on reinforced concrete piers and footings and steel bearing piles. Total length is 1,570 feet on a curve with a radius of 1,100 feet. The deck is constructed with 10 percent superelevation. Pier footing excavations in the Huasna River channel were dewatered by direct pumping and well point systems prior to pouring concrete. Concrete piers range in height from 60 to 135 feet and were constructed by the "slip-form method." While not a new construction method, slip-forming has had limited use on bridge work in this State. The nature of the site and standard dimensioning of the piers made this method a natural choice from the economic standpoint. The piers are 27 feet long and six feet wide with three hollow interior cells, and semicircular ends.

The slip-form conforms to these dimensions and is six feet deep. It is raised at a rate of 12 to 20 inches per hour by eight hydraulic jacks supported on one-inch round extendable vertical jacking rods separated from the fresh concrete by a pipe sleeve within the slip-form. Concrete is added continuously via buggies loaded with a crane. The jacks are controlled from a common electric hydraulic pump mounted on the four-foot working platform surrounding the top of the slip-form. Each jack may be controlled individually to make minor adjustments for line and grade which is continuously checked by state personnel from fixed transit locations.

Method Described

In actual operation, the form is raised one inch every three to five minutes depending on the various factors which affect the setting time of concrete. The slip-form consists of the form itself with a working platform at the top and platforms roughly 15 feet above and below the working platform for placing reinforcing steel and finishing the concrete. Below the finishing platform a two-inch iron pipe fitted with nozzles applies a fine fog spray of water for curing purposes.

Rocker-type bearing plates anchored to the top of the piers and abutments support twin welded plate girders spaced 19 feet apart. Each girder is approximately 170 feet long, 10 feet deep and weighs 60 tons. Flange plates are 30 inches wide and vary in thickness from one and one-quarter inches to two and one-quarter inches. The web plate is one-half inch thick. Structural steel angle cross bracing provides lateral stability.

Girders were transported from Los Angeles to Santa Maria via railroad flat car and trucked to the site in halves. Ten miles of narrow twisting highway tested the contractor's ingenuity during the transportation of these girders. Butt welded splices were accomplished at the site and were checked by X-ray for defects. Girders were erected using "Chicago" type derricks mounted on each pier by a special structural steel yoke with power supplied by two drum-type winches. The erection operation,

. . . Continued on page 46

F.A.S. Highway

Road Linking US 101 and 395 Improved in San Diego County

By JOHN F. MULGREW, Assistant County Surveyor, San Diego County

DEL DIOS Highway between Rancho Santa Fe and Escondido was completed on February 27, 1959. This section, 9.9 miles long, is a portion of San Diego County Federal-Aid Secondary Route 728 between U. S. Highway 101 near Del Mar and U. S. Highway 395 at Escondido.

Beginning at Rancho Santa Fe on the westerly end of the project, the highway traverses country estates and rolling farmlands for 1.9 miles. It then enters the rocky central portion of the project, crawls around the right abutment of Lake Hodges Dam and for the last eight miles continues along the north shore of Lake Hodges past the resort and fishing settlement of Del Dios to the avocado and citrus groves and small farms which surround the City of Escondido.

F. A. S. Route 728 ranks high in the two-lane highway classification in regard to both importance and traffic usage. Well over two thousand vehicles per day have been counted on this route during the county fair and racing seasons when the recreational users and tourists are added to the regular commuter and farm-to-market traffic.

Development of this highway has taken place intermittently for the past 43 years. In December, 1916, Road Improvement District No. 3 was formed as provided for in the act of 1907 to construct a road from Del Mar to Escondido. Surveys were made and easements obtained but the road improvement district did not materialize and the project was abandoned.

Dam Road Built

During the year 1916 a contract was let for the construction of the Lake Hodges Dam and a road was constructed up the river from the Del Mar District by the contractor for handling supplies at the dam. After completion of the dam, the county realigned and widened this road to pass over the spillway of the dam and through to the City of Escondido.

This road was traveled until the winter of 1927 when the waters of the reservoir overtopped the spillway, washing out the roadway and doing such damage that it was necessary to reconstruct the highway at a higher elevation on the hillside above the spillway.

A contract was let by the county board of supervisors, but owing to the lack of funds the road was only constructed in part, a temporary connection being made with the then existing road just below the dam.

In 1931 construction work was again resumed, the contract being let in December, 1931, to Yglesias Brothers to finish the project.

In 1933 the County of San Diego made application to the State of California for use of federal funds which were being allotted to the states for the purpose of building highways and other public improvements. Contemplating that the funds would be used by the county for the improvement of the highway from Rancho Santa Fe to Escondido, the City of San Diego requested that the county relocate that portion of the highway along the north shore of Lake Hodges to a higher elevation so as to prevent flooding in the event that the spillway to the Lake Hodges Dam would be raised to elevation 405 as planned for the ultimate development of the resources of the San Dieguito watershed.

State Writes Specifications

Under an agreement with the State Division of Highways the County of San Diego was to secure the right-of-way, complete the surveys and plans in compliance with state standards, and stand all incidental expenses with the provision that the State would write the specifications, prepare the preliminary report and construct the Lake Hodges Feeder Road Project under a State Highway contract.

This construction contract was completed in 1935-36.

Before reconstruction, under the F. A. S. Project, the road consisted of a 20-foot-wide portland cement concrete pavement and a road-oil mix pavement with variable 4-foot to 8-foot unpaved shoulders.

This roadway section was reconstructed to provide for two 12-foot traffic lanes with 6- to 8-foot shoulders, paved with plant-mixed surfacing. Maximum grade is 6.50 percent with 700-foot minimum radius curves.

The structural section consists of 3 inches of plant-mixed surfacing on base material varying in depth from 6 to 17 inches for the traveled way, while the shoulders were paved with 3 inches of plant-mixed surfacing at the traffic lane edge tapering to 2 inches at the gutter line. Base material varied from 6 to 12 inches in depth for the shoulders.

Because of the mountainous terrain, no detours were available through the central portion of the project. It was necessary for the contractor to maintain at least one 10-foot-wide lane for traffic at all times during construction. Blasting operations in the deep igneous rock cuts made this requirement both difficult and hazardous, as did the close proximity of Lake Hodges Dam, the utility lines, nearby houses and a public water supply flume. Even though every effort was made to prevent traffic delays and blasting damage, several accidents did occur. Utility lines were damaged and two houses were struck by flying rocks.

For drilling the 2½-inch diameter holes for blasting operations, the contractor used a tracked wagon drill supplied with air from an air compressor. Stick and bag powder was used when control was necessary, and ammonium

The reconstructed Del Dios Highway after completion. This aerial view northeastward shows Lake Hodges Dam in the foreground and the City of Escondido in the background.

nitrate was employed in unpopulated areas.

Selected Material Available

Materials of satisfactory quality for the processed selected material were obtained from several cuts on the project which consisted of disintegrated rock or granite interspersed with layers of hard fractural rock of varying thickness.

Roadway excavation, including blasted rock, was handled by tractor-scrapers.

The contractor erected a crusher and asphalt plant, crushed and processed aggregate on the job, and produced up to 2,000 tons of 200-300 penetration asphalt plant-mixed surfacing per day.

The widening of two short structures over the City of San Diego's water flume which furnishes water for the Rancho Santa Fe and San Dieguito areas, provided a problem in the protection of the water supply and the assurance of uninterrupted flow.

Major items of work consisted of 420,000 cubic yards of roadway excavation, 130,000 tons of processed selected material and 47,000 tons of plant-mixed surfacing. The deepest cut was 140 feet and the highest fill 130 feet.

The contract was awarded to the A. Madonna Construction Company of San Luis Obispo, California, November 29, 1957, on a low bid of $1,052,253.

The completed job is the result of co-operation and teamwork by many individuals including the county board of supervisors, the State Division of Highways and the Bureau of Public Roads.

The engineering, fieldwork, right-of-way acquisition, design and a substantial amount of the construction inspection was performed by personnel from the county surveyor's department.

Co-operation and assistance were given by Jacob Dekema, District Engineer, State Division of Highways, and his entire staff and especially R. J. Datel, City-County Projects Engineer, C. E. Walcott, District Construction Engineer and P. E. Ruplinger, District Materials Engineer. Dick Chaffin was Superintendent of Construction for the contractor and James C. Thompson of the county surveyor's department was Resident Engineer for the project.

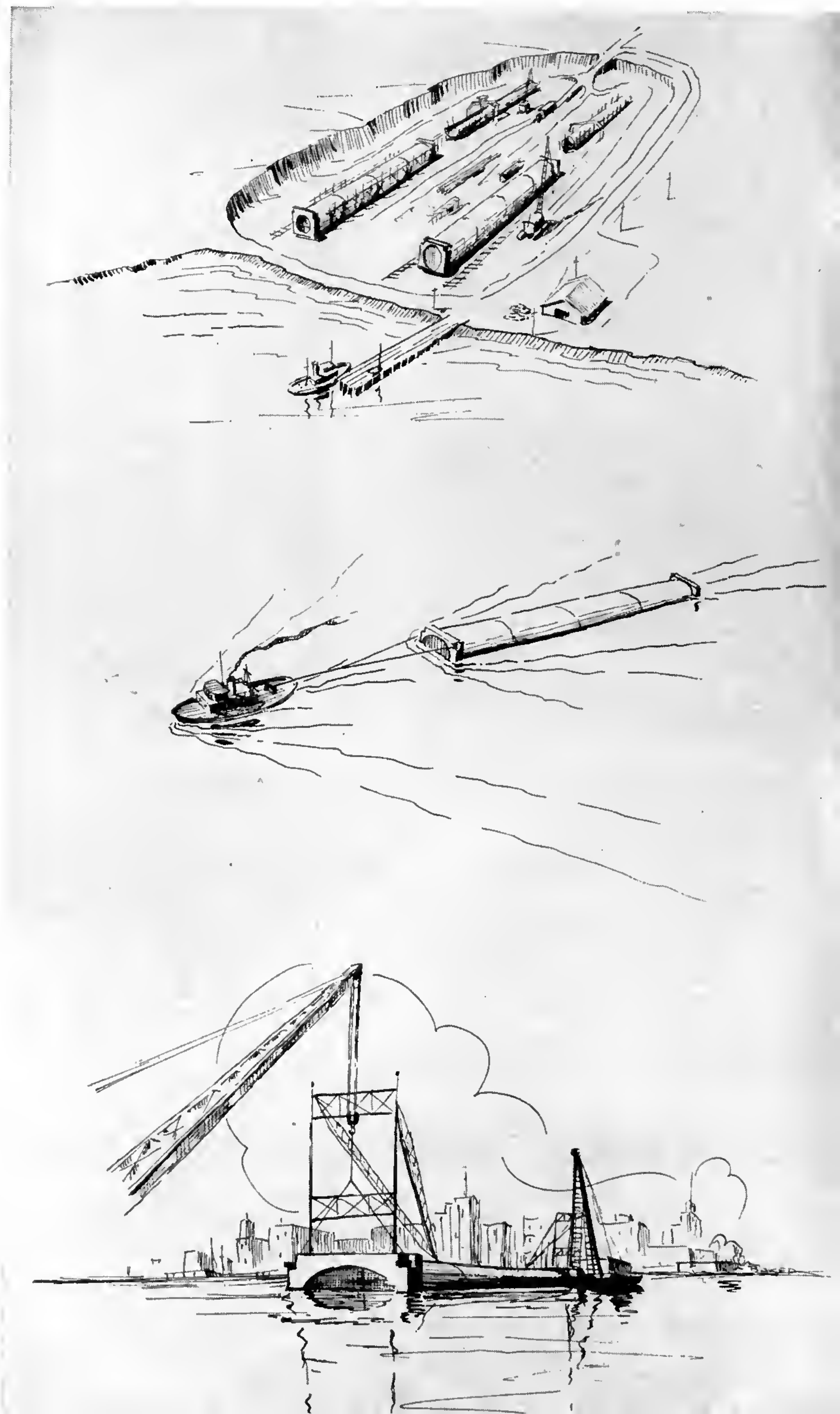
Improvement of the Del Dios Highway (shown here) was a co-operative federal-state-San Diego County project. This aerial view looking northeastward was taken near the west end of the project and shows the Rancho Santa Fe area in the foreground and the Lake Hodges Dam in the background.

Following renovation at a cost of $1.4 million, the old Carquinez Bridge was reopened to traffic on April 29th. Southbound traffic on US 40 is now carried on the old bridge, with northbound traffic using the new parallel structure completed in November, 1958.

Oakland-Alameda Tube

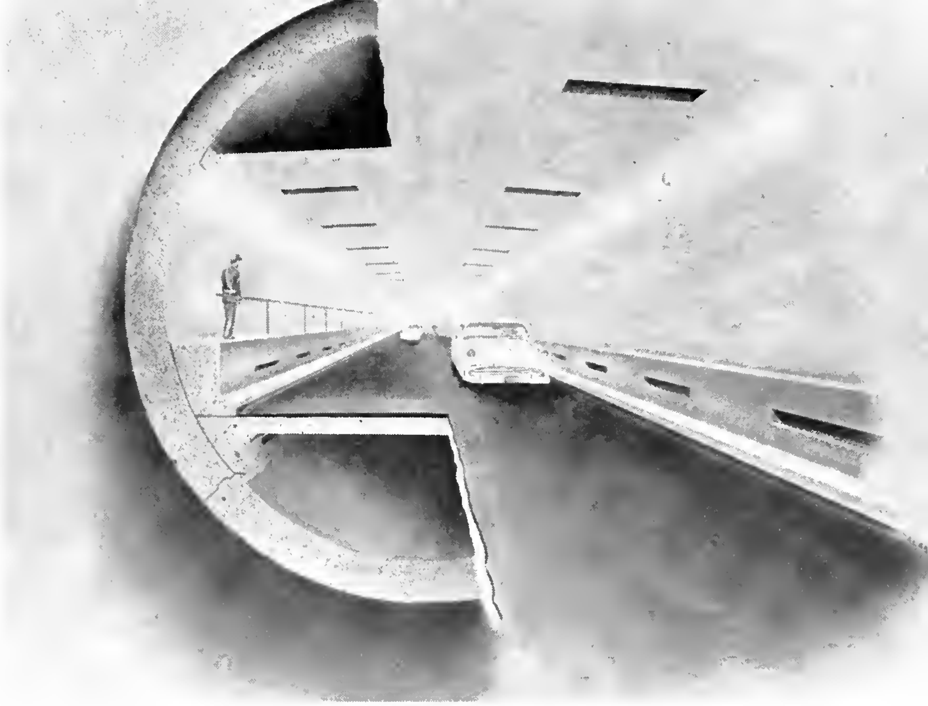
Constr
Secon

Location of the existing Posey Tube in the photo above is shown by the dotted white line on the right; the dotted line on the left indicates the location of the future Webster Street tunnel.

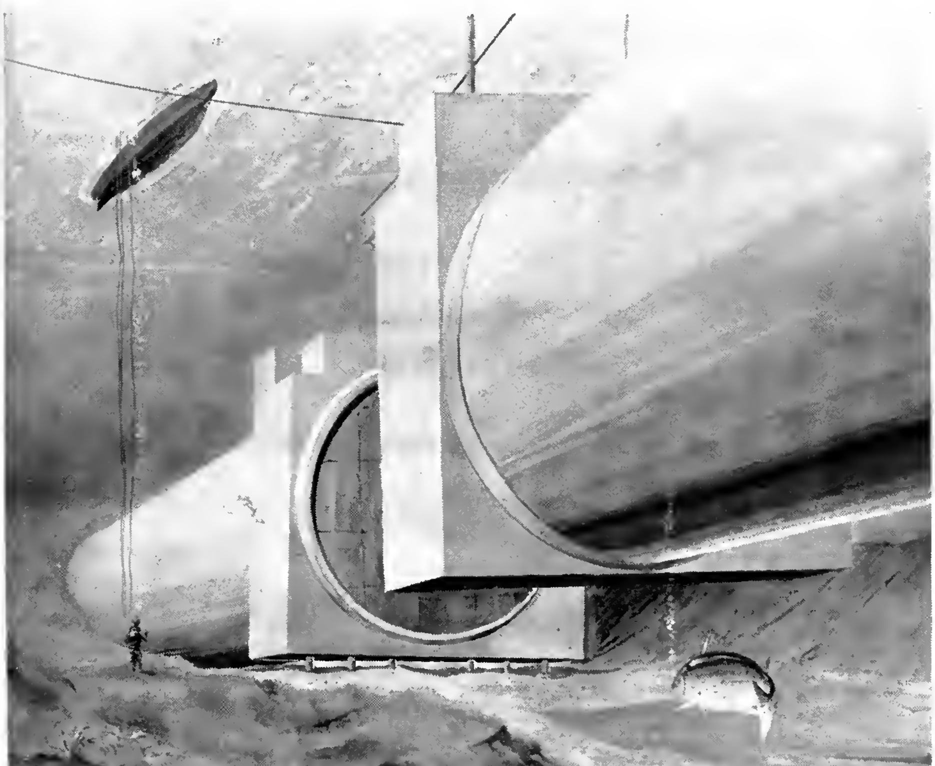


The series of drawings (right) shows how the segments for the new tube will be constructed in dry dock, floated to the site under tow and sunk in final position. The segments will be connected under water. Twelve tube segments, each 200 feet long and 37 feet in diameter, will be constructed. The remainder of the tube from First Street to Fourth Street in Oakland will be built in place in an open trench and then covered over. Total length of the tube will be 3,350 feet.

to Start This Fall on
er-Estuary Highway Tube



The new tube will be one of the most modern in the world and will have an all-tiled interior and continuous fluorescent lighting. Its 24-foot roadway will equal or exceed in width that of any other vehicular tunnel. It will carry two lanes of traffic.



Perhaps the most interesting feature of the project will be the connecting of the precast concrete tube sections under 90 feet of water. Because of the muddy water anticipated at this depth, divers will have to rely to a great extent on sense of touch only and the method of connecting the sections has been made as nearly automatic as possible.

Four blower and exhaust fans in the Portal Building at each end of the tube will supply nearly one million cubic feet of air each minute to meet the high ventilating standards established for today's traveling public.

B. W. Booker Retires, Sinclair Is Appointed

Assistant State Highway Engineer B. W. Booker, who has been responsible for state highway matters in nine San Francisco Bay area counties since 1952, retired May 1st.

Booker was succeeded by J. P. Sinclair, who has been district engineer under Booker in District IV, San Francisco, since Booker was named assistant state highway engineer.

B. W. BOOKER

During the seven years of Booker's administration highway improvements costing many millions of dollars have been effected. These include completion of the James Lick Memorial and Bayshore Freeways from the San Francisco-Oakland Bay Bridge to Palo Alto, completion of the Nimitz Freeway between San Jose and Oakland; virtual completion of US 40 as a freeway connecting to the new parallel Carquinez Bridge; and completed and current construction on many other routes.

In all, Booker has spent more than 16 years in District IV, having been appointed assistant district engineer in 1942 and promoted to district engineer in charge of operations in 1947. Five years later he became assistant state highway engineer, upon the retirement of J. H. Skeggs.

He was in charge of the Bay Area Metropolitan Traffic Survey, and participated in planning, design, construction and maintenance of some of the State's most important highways. One of his recent tasks was supervision of planning for the extensive Junipero Serra Freeway for which a route has been adopted down the peninsula.

Booker has not announced his plans during retirement. He has been with the State Division of Highways for 38 years, serving in four other state highway districts in Northern California before coming to San Francisco.

He was born in Topeka, Kansas, in 1891 and came to California in 1899. He was educated in the San Francisco public schools, Polytechnic High School and the University of California. He is married, resides in Oakland, and is a member of the American Society of Civil Engineers, Commonwealth Club and Olympic Club of San Francisco.

Sinclair, the new assistant state highway engineer, has held a key position in District IV and has been particularly responsible for planning and design.

JOSEPH P. SINCLAIR

He was born in Minneapolis in 1910 and was educated in California, receiving his B.S. degree in civil engineering from the University of South-

. . . Continued on page 46

Legislative Report On Freeways Ready

A comprehensive report on the proposed 12,200-mile California Freeway System by the Legislature's Joint Interim Committee on Highway Problems is now available on request.

The report recommends adoption by the Legislature, with some changes, of the plan for a statewide system of freeways and expressways which was prepared by the Division of Highways in co-operation with city and county officials. The plan requested by the 1957 Legislature in Senate Concurrent Resolution No. 26.

The 78-page booklet outlines some of the committee's findings at a series of public meetings on the freeway plan. Included are sections on public reaction to the proposal, methods of financing, and the freeway system's effect on local roads and streets.

Appended to the committee report is an analysis of financial and economic data pertaining to the California highway program, with emphasis on the freeway system idea. The analysis was prepared by Richard M. Zettel, committee executive secretary and economic consultant.

Zettel reviews the background, benefits and costs of the proposed system, outlines the highway revenue picture in California, discusses geographic distribution of highway needs, and deals with the financing of county roads and city streets.

The booklet contains many explanatory graphs, charts and statistical tables.

Interested individuals may obtain a copy of the report by addressing their requests to the Division of Highways, 1120 N Street, Sacramento; Attention: F. M. Reynolds, Planning Survey Engineer. A limited quantity is available.

In order to achieve uniformity with Federal requirements that guide signs on Interstate freeways must have green backgrounds, California has adopted the same background for guide signs to be installed on all other State freeways. This action will provide a uniform and distinctive type of guide sign on all freeways.

Report From District VIII

By CLYDE V. KANE, District Engineer

A MAJOR step in interstate highway construction was achieved on December 13, 1958, with the opening of the new freeway between Victorville and Barstow. The California Highway Commission has named this route the Barstow Freeway from its junction with the San Bernardino Freeway at Highland Avenue in the City of San Bernardino to the Nevada state line southwest of Las Vegas. Traffic counts made since the opening of the section between Victorville and Barstow indicate that approximately 90 percent of the average daily travel has now shifted from the old route to the new freeway. This very closely fits the prognosis made several years ago at the time of routing studies and economic analysis of alternate routes.

TOP OF PAGE PHOTO—This San Bernardino Freeway interchange is under construction at Haven Avenue east of Ontario.

Barstow Freeway

Another section of the Barstow Freeway extending from 27th Street in San Bernardino to Devore in Cajon Pass was opened to traffic on March 30, 1959. This project, 8.6 miles in length, brings the total initial stage and full freeway construction on the Barstow Freeway to 70 miles, upon which 13.8 million dollars have been expended for right-of-way and construction to date.

Plans are complete for construction of the eastward extension of the Barstow Freeway through the City of Barstow, and it is anticipated this project, for which 6.8 million dollars have been budgeted, will be advertised for construction this month.

. . . Continued on page 29

Victorville-Barstow Freeway Safety Record Noted

The built-in safety of modern freeways is again demonstrated by observation of the accident record on a recently completed section of the Barstow Freeway (US 91-66) north of Victorville.

Reporter Bob Bohon of the *Victor Press* checked the record at the Victorville unit of the California Patrol. His findings appeared in an April 9th news story which reported no fatal accidents for the first three and one-half months after the freeway opened. The news story follows in part:

"When the new freeway to Barstow was opened December 13th, only the most optimistic observer could foresee a full month before it would claim its first life.

. . . Continued on page 46

UPPER—This construction scene is on the Corona Freeway near Pine Avenue south of Chino. LOWER—A view of construction near the north end of the "Missing Link" section of the Riverside Freeway showing the Colton-Loma Linda Yard Overhead structures just south of the interchange with the San Bernardino Freeway.

DISTRICT VIII

Continued from page 27 . . .

Plans are nearing completion for another 24 miles of the Barstow Freeway between Baker and Valley Wells for which 6.8 million dollars have also been budgeted by the California Highway Commission. Construction is expected to start this fall and will require approximately 18 months to complete.

San Bernardino Freeway

Four projects are currently underway on this freeway. Three of them consist of grade-separated interchanges converting first stage (expressway) to full freeway at Haven and Milliken Avenues near Etiwanda; at Sierra and Cherry Avenues near Fontana; and at Riverside and Citrus Avenues near Rialto. It is anticipated these interchanges will be completed early in 1960.

The terminal link of the San Bernardino Freeway between US 66 and State Route 30 in the City of San Bernardino is under construction and expected to be open to traffic this fall.

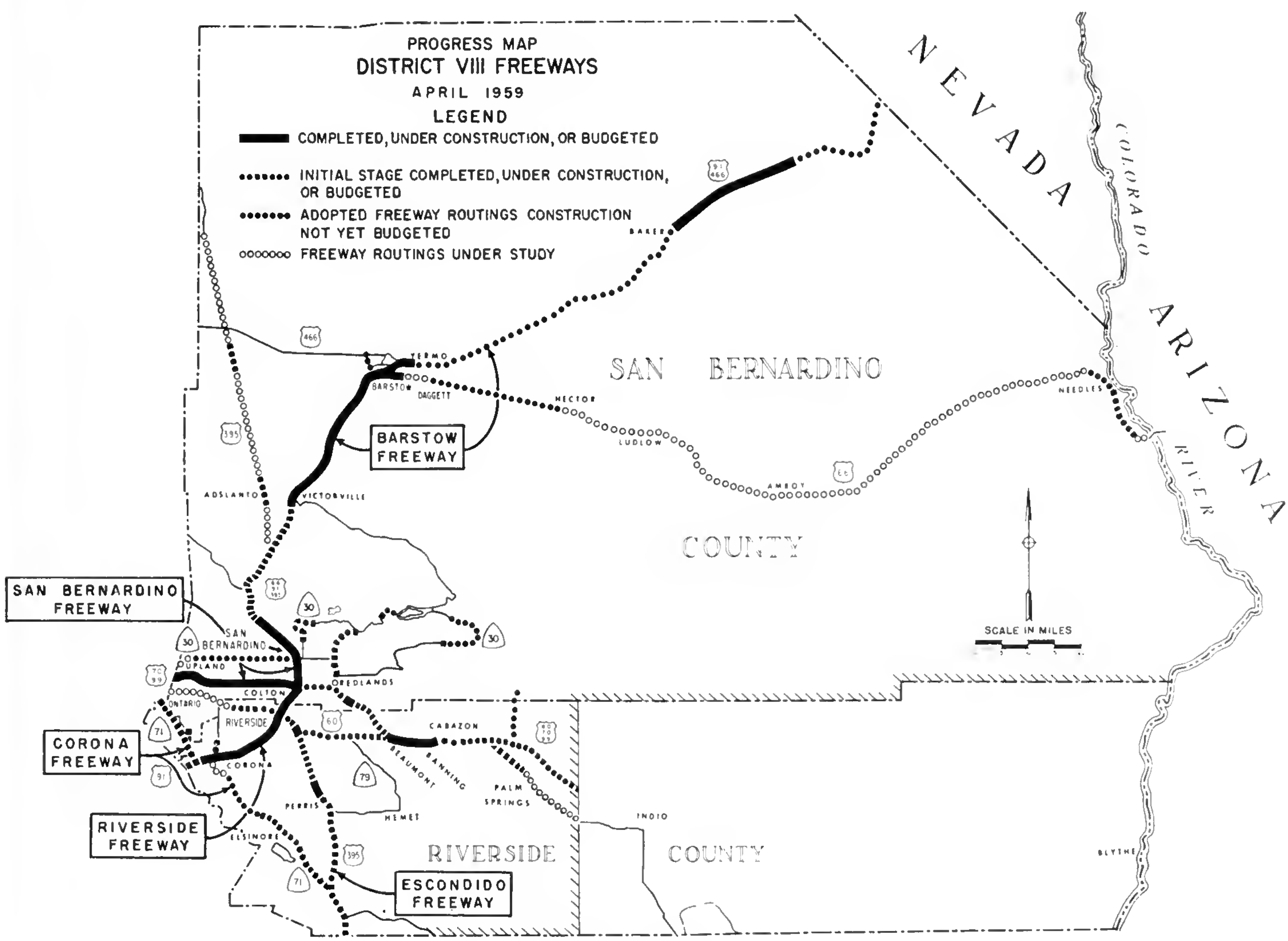
Riverside Freeway

Three major construction projects are under construction on this freeway; two of them are extensions of the freeway southward from the City of Riverside toward Corona, and the third one is the "missing link" connection between the San Bernardino Freeway and the junction of US 91 and US 395 just north of Riverside. The "missing link" project is expected to be completed late this year and will eliminate the current devious routing of US 91, US 395, and State 18 through the Colton area.

On the south side of the City of Riverside, the project between Arlington Avenue and Van Buren Street has recently been completed by Winston Bros., contractors, bringing the total completed construction of Riverside Freeway in the city to over 12 miles. South of this unit another contract extending from Van Buren Street south to Pierce Street was recently awarded to contractors Fredricksen and Kasler. This project, 3.4 miles in length, is scheduled for completion in May, 1960. Plans are complete and funds are budgeted for still another unit of this freeway extending southwesterly from Pierce Street to and through the City of Corona, connecting to the expressway in Santa Ana Canyon. It is anticipated that this project will be advertised for bids in the very near future.

Escondido Freeway

One project is underway at the present time on this freeway and a landscaping project on a portion in



Sign Route 2-138 runs through some scenic rock and mountain country west of Cajon in San Bernardino County.

the City of Perris has just been completed. The project underway just south of the completed landscaping job involves construction of an additional two lanes to provide four-lane divided expressway for an additional 1.3 miles to the westerly junction with State Sign Route 74. The contractor, A. S. Hubbs, is scheduled to complete work in May, 1959. Funds have also been provided by the California Highway Commission for further extension of this work to construct four-lane initial stage freeway for another 2.5 miles to the easterly junction with State Sign Route 74, the connection to the City of Hemet. It is anticipated that bids for this construction will be advertised this summer.

Advertising for bids on another project on the Escondido Freeway at the University of California, Riverside campus, is anticipated momentarily. This will be the first step in conversion of the existing four-lane highway to full freeway standards and will provide for a separation structure in the vicinity of Canyon Crest Boulevard and Campus Avenue. Plans and right-of-way acquisition for full freeway construction on the portion from the University of California to Main Street, in Riverside, including the junction with the Riverside Freeway, are nearly complete.

. . . *Continued on page 34*

UPPER—A view of the Victorville-Barstow Freeway and some of the rolling desert country through which it passes. LOWER—This interchange connects Highland Avenue (Sign Route 30) with US 66-91-395 in the City of San Bernardino.

UPPER—Work is progressing on the south end of the "Missing Link" section of the Riverside Freeway near the City of Riverside. The interchange in the distance will connect US 91 and 395. LOWER—The Grand Terrace Cut on the "Missing Link" section of the Riverside Freeway.

Two photos of recent construction of the San Bernardino Freeway show (upper) the new freeway looking south from the San Bernardino city limits and (lower) looking north from the vicinity of Highland Avenue.

Corona Freeway

One project is currently under construction on the Corona Freeway, consisting of 5.3 miles between Euclid Avenue and Merrill Avenue in San Bernardino County. This project, located south of the City of Chino, is being constructed to initial two-lane stage freeway standards and is scheduled for completion in June, 1959.

At present, the only portion of the Corona Freeway for which the general route has not yet been adopted by the California Highway Commission is through the City of Corona.

Interstate Progress

In addition to the named freeways, 6.8 million dollars is budgeted for another Interstate project, 5.6 miles in length, from Beaumont to Banning. Construction is scheduled to start this fall. It will include rebuilding the US 60-70-99 junction on the west side of Beaumont and will be constructed to six-lane full freeway standards.

Another project on this interstate highway west of Beaumont consists of a full freeway interchange now under construction at the intersection with Yucaipa Boulevard on US 70-99. Work on the Yucaipa Boulevard interchange is scheduled for completion in October, 1959.

Advance planning of the interstate highway on US 66 between Ludlow and the Arizona state line will reach an important step with a public meeting to be held May 7th in the City of Needles. This public meeting will secure the views of local communities and individuals concerning location of this freeway in California and the adjoining portion of the State of Arizona. Recommendations to be made following this public meeting will prepare the California Highway Commission for consideration of the route to be adopted for US 66 between Ludlow and Arizona.

US 60

A project is now under construction just west of the Beaumont junction of US 60-70-99 which is converting 4.8 miles of two-lane highway to divided expressway standards. This is the last section through the rough terrain known as the "Badlands" and should be completed about July, 1959. As mentioned previously, plans are nearly complete for construction of US 60 to full freeway standards through the City of Riverside, a portion of which lies on the Escondido Freeway.

Construction now under way through the "Badlands" west of Beaumont is converting a section of US 60 to multilane, divided expressway.

US 395

Half a million dollars has been budgeted for improvements on US 395 and work is expected to start about June. It will be interim-type construction consisting of the widening of the pavement and shoulders, resurfacing, and elimination of numerous dips between US 66-91 near Cajon Summit and US 466 at Kramer. Advance planning for ultimate freeway construction on this route is progressing and a public meeting to discuss the results of a location study will be scheduled in the near future.

Mountain Highways

A comprehensive traffic and planning study of the San Bernardino mountain area has recently been completed. The purpose of this study was to determine priorities for construction of many needed improvements in the mountain areas. It is anticipated that the results of these studies will be presented to the California Highway Commission soon for their consideration.

These areas have posed special problems in highway planning because of the expense of construction in rugged terrain and the unusually high peak traffic volumes associated with both summer and winter recreational uses. The proximity of the populous Los Angeles metropolitan area creates a problem somewhat unique to two-lane mountain recreational roads where frequently vehicular counts of 14,000 per day are recorded.

During April, the Department allocated $7.5 million to the 354 incorporated cities of California under the provisions of Section 2107 of the Streets and Highways Code. Two of the cities, Walnut in Los Angeles County and Union City in Alameda County, were incorporated in the first quarter of 1959.

Trees Moved

Highway Crews Transplant Giant Palms in South State

By J. M. HARRIS, Assistant Highway Engineer

SOUTHERN CALIFORNIA, in its natural and developed areas alike, has always been conscious of the part palm trees play in beautifying the countryside. The Division of Highways, in constructing the San Bernardino and Riverside Freeways, is now saving many of these stately beauties found within the freeway right-of-way by moving them to spots along future and present freeways. This not only adds beauty, but perpetuates the thoughts and plans of previous generations; the many years of growing time are not wasted.

Palms are relatively free from disease and require little maintenance compared to other trees. Palm trees 30 to 90 feet tall can be moved successfully when the work is well planned and well executed. Root action is most active in the period from April to September. This does help to establish the plant. With careful handling, however, they can be moved at any time; some of the methods used will be described later in this article.

Through the Redlands and Riverside areas in Southern California, many palms were planted in the 1880 and 1890 period. As you drive through the area, you realize the time, care, water, and forethought, our pioneers gave when they planted these great rows and clumps of majestic palms. We are seeing the result of a 75-year-old dream.

In San Marino, there is a palm growing that was moved from the Palm Springs area in 1840. In Arcadia are some that were moved from Palm Springs between 1850 and 1860.

Many Palms Imported

There are over 1,300 recorded species of palms. Many of them freeze easily and grow slowly. The palm is both a tropical and a semitropical tree. There are several varieties that have become common and grow well in Southern California. Many of them are natives of Australia, Asia, Africa, and South America.

Of the pinnate or feather-leaved palm, the Phoenix is most often seen. Due to cross-pollination and mixed planting, many of these cannot be defined species. The *Phoenix canariensis* with its massive trunk, enormous crown, graceful leaves, and orange colored datelike fruit is more widely used for ornamental purposes than the other Phoenix palms. The *Phoenix dactylifera* is the fruit-bearing date tree. The *Phoenix sylvestris* is very similar to the *Canariensis* and has cross-pollinated with it. In growth, it is a smaller tree.

We encounter many *Arecastrum romazoffianum*, commonly known as the "*Cocos plumosa.*" It is a native of South America and has a beautiful crown, although prevailing winds sometimes kink the leaves.

Our only native palms belong to the palmate or fan-leaved group. The *Washingtonia filifera* or desert fan

This photo shows some newly transplanted palm trees along the Ninth Street on-ramp leading to the freeway in Riverside. Palm trees play an important role in Southern California landscaping. The transplanted trees shown in the foreground of the photo are date palms (left) and queen palms (right). The tall, thin trees in the right distance are Mexican fan palms.

This photo shows some palm trees along the Riverside Freeway near the Seventh Street shortly after they were transplanted from the Eighth Street Underpass area. The shorter, heavier trees to the left are California fan palms; the two taller ones are Mexican fan palms.

palm is a native of Palm Canyon and other desert canyons, and is just as wild as cactus or other native trees and shrubs. It grows to a height of 80 feet and develops a heavy trunk. The fronds form a skirt to protect the trunk. Because of fire hazard and untidiness, they are often trimmed. The *Washingtonia robusta* has a much more slender trunk and smaller leaves than the *filifera.* It grows faster and often reaches a height of 100 feet.

Palms First Located

The first step in transplanting palm trees is to check the topographic maps for all palms within the limits of the freeway construction area. Plans are then made to move them to locations which will not interfere with construction operations or with the finished freeway landscape plans. Each tree to be moved is shown, by number, on a map, with its approximate height and distance to be moved. Next, the location where each tree is to be planted is shown by number on another map.

A truck crane cable is tied to the trunk of the tree with belting or other protective material to prevent any injury to the trunk or crown of the tree after the ball is excavated. A tractor is used to push it over. After the tree is down, the trunk is trimmed, and the fronds are trimmed and tied. This lowers the wind resistance on the top of the tree. The tree is now ready to be loaded on a low bed truck and transported to the planting location. In this process, one should consider that a *filifera,* 60 to 70 feet tall, weighs about 25 tons, and a *robusta* of similar height weighs about 20 tons.

A truck crane can be used to pick it up at a balance point approximately 10 feet above the ground level and place it in the planting hole. It is replanted two to three feet deeper than it was in the ground before. Palms send out new roots at the base of the trunk. These help to anchor and feed it. The *Cocos plumosa* are an exception to this; they are planted at their former ground level.

In transplanting, any injury, especially an injured crown, is likely to kill the palm. Reject sand is used for backfill. This will compact readily, and with very thorough watering the trees will require no guy wires to hold them in position. Trees as tall as 85 feet, planted in this manner, have withstood severe "Santa Ana" windstorms shortly after the transplanting operation. A good basin is very necessary. Weekly watering for a nine-month period should make the planting a success.

Dust Control

Special Mixes Alleviate Dust Problem on Detours

DENSE and choking clouds of dust were a persistent annoyance and hazard to early-day drivers who piloted their gas buggies and touring cars over California's then rutted and unpaved roads.

Goggles, face masks and canvas dust covers were often standard equipment for the hardy motorists who took to the road in the days when the automobile was still in competition with the horse.

With today's paved highways and modern cars, such cumbersome equipment is long discarded. As far as most California motorists are concerned, dust is an almost forgotten driving hazard.

To state highway engineers and contractors, however, dust control is a constant problem. Wherever highway construction is in progress, there is a potential nuisance and danger from dust.

The problem is intensified by the fact that Californians are conditioned to dust-free travel on smoothly paved roads. Even a short stretch of dusty road through a construction project will often mean numerous complaints.

Fortunately, with paved detours and extensive dust control measures, the California Division of Highways has been able to eliminate much of the dust annoyance from state highway construction projects.

Detours Built Beforehand

Because of the heavy traffic volumes on California highways and in the interest of holding public inconvenience to a minimum during construction, the division attempts whenever possible to route traffic through or around work zones on dust-free surfaces. Sometimes paved detours must be built before actual construction on the permanent highway can begin.

In some instances, however, it is not practical to provide paved detours because traffic control is needed for only a few days. In other cases rough terrain makes the cost of building such detours too high.

At these times, when traffic must be routed through construction on unpaved base rock or gravel, effective dust control measures are mandatory.

The most common method of keeping down the dust is as ancient as roadbuilding itself—putting water on the road.

Although this method is time-tested and generally reliable, and is widely used, it is not always the most efficient and lasting answer to the dust problem. This is especially true when relatively large numbers of vehicles must use an unpaved roadway through a construction zone for a long period.

When water is used as a dust palliative, the contractor must be prepared for a continuing cycle of application and reapplication in the face of often rapid evaporation, percolation and runoff.

In addition, the condition of the road under water treatment frequently ranges from too wet immediately after application to dry and dusty before the next application of water can be made.

Special Mixtures Used

These shortcomings are being overcome through the increased use of a special dust control mixture. Water is still the main ingredient, but something has been added.

Highway builders have found that by adding various amounts of asphaltic mixing emulsion to water, they come up with a mixture which effectively controls dust for longer periods and which also provides other benefits.

When this mixture is applied, the asphalt adheres to the dust particles after the water has disappeared. Thus, the dust particles stick together or are made heavier by the asphalt film, which accumulates with each application and results in successively longer-lasting control.

A big advantage of this kind of dust control is that the mixture can be applied by the same equipment used for water spraying. No special apparatus is required and there is no trouble with the mixing.

Other advantages include protection of the roadbed both during wet weather and in the summer.

In rainy periods, the asphalt film speeds the runoff of water, thus protecting the underlying base materials from saturation which leads to instability under the pounding of heavy traffic.

Through the dry months, the shape of the roadbed is maintained with less frequent watering and blading and with less likelihood of road surface "whipoff."

Used as Prime Coat

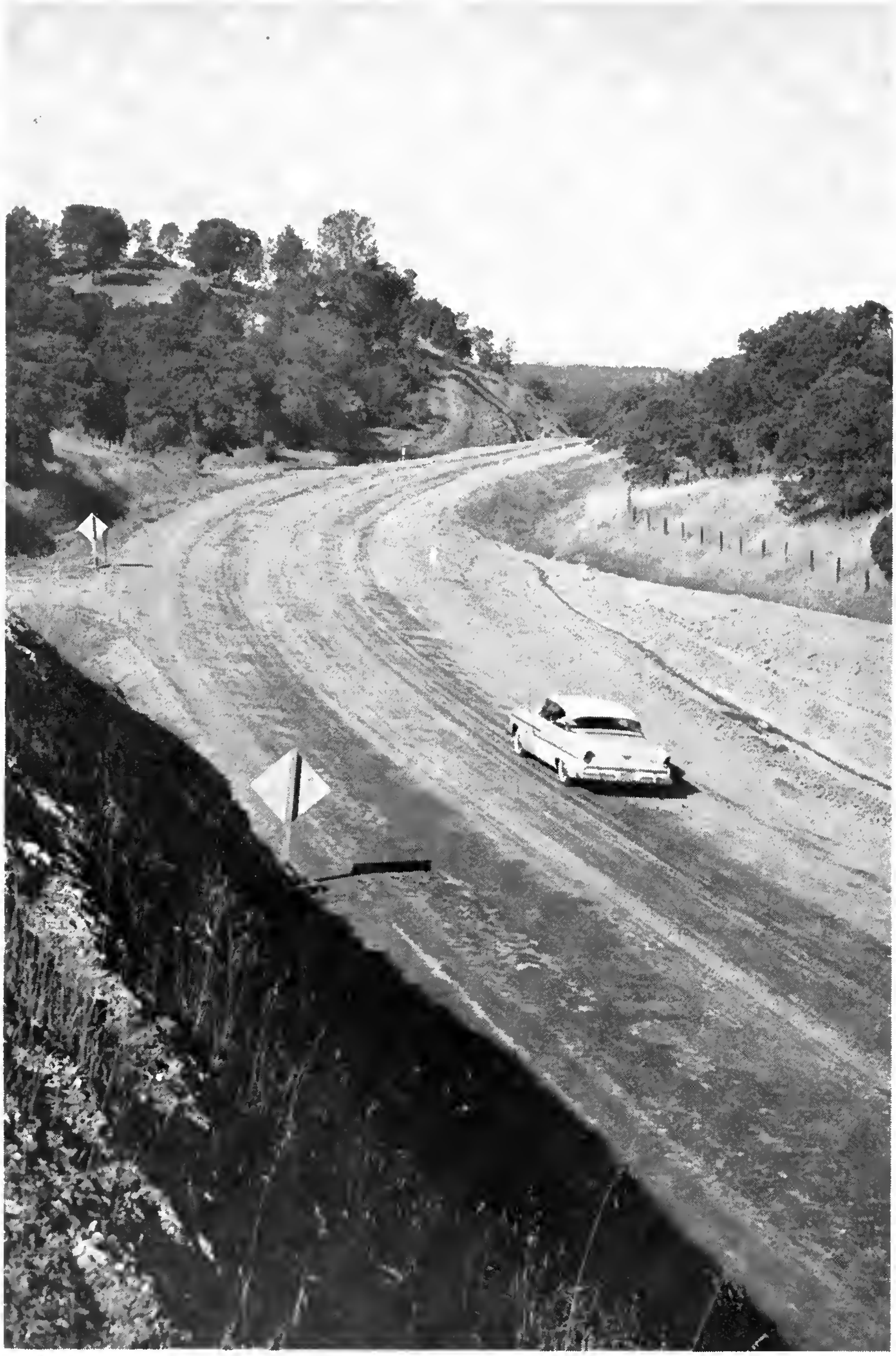
Finally, experience with this type of dust control procedure has indicated that in at least some cases the asphalt emulsion will serve as a prime coat before the start of paving or surfacing operations.

One recent state highway project in which the water-asphalt mix was used to good advantage was a 7.8-mile foothill realignment project on State Sign Route 88 between Ione and Martell, Amador County.

Resident Engineer C. F. Roderick of District X described the dust control operations on this project in a report to District Engineer J. G. Meyer. His report follows in summary:

The contractor had opened up the entire 7.8 miles of road on this contract and traffic had been maintained through the winter on unsurfaced base rock. In early spring a severe dust problem developed. It was being controlled by spraying from water trucks at considerable expense.

Faced with the need for adding another water truck to the two already in service, it was decided to



When traffic has to be routed through highway construction on unpaved road, dust control is an ever-present problem. On this section of State Sign Route 88 between Ione and Martell, Amador County, the resident engineer found that a mixture of asphalt and water effectively held down the dust and also provided other benefits.

try out the diluted emulsion on sections where the contractor would not be working for several weeks.

A mixture of 90 percent water and 10 percent mixing emulsion was used. A 4,300-gallon capacity water tank, mounted on a truck and equipped with a pump and spraying unit, made the spread. The emulsion and water were poured into the tank simultaneously. Temperature of the emulsion was about 120 degrees.

The mixture was placed on the road at about the normal speed used for applying water, with the exception of grades 6 percent and over where speed was increased to prevent excessive runoff.

First Application Effective

No special work was done on the road in preparation for the treatment. Most of the roadbed was untreated base. Portions were at the subgrade elevation for plant-mixed surfacing, and other sections lacked one course. A small section was pit run material which had been placed on the subgrade in order to carry traffic.

This first application was effective in laying the dust and one of the two water trucks which had been in use was eliminated.

Two to three weeks later the treated area was worked with a blade and watering was resumed. Water requirements for the reworked areas were considerably less than before the application of the emulsion.

About a month later two additional applications were made. The second covered three short sections on which the spread was tried down the center of the road. On one longer stretch the application was made one lane at a time.

It appeared that better results were obtained from the spread by separate lanes; also, traffic was not held up while the emulsion dried.

These applications held the base in good condition for several weeks, especially on the one long section where the application was made one lane at a time. In fact this stretch was in such good shape that no prime coat was required. After patching a few rough spots, the contractor was permitted to go ahead with paving operations.

The specifications for the water-asphalt treatment as a dust palliative are now included when applicable in the special provisions of Division of Highways construction contracts. The process will also be provided for in future standard specifications.

At the end of April, 286 highway construction contracts with a total value of $368.5 million were under way. Fifty-seven of these, valued at $23.4 million, were awarded by the Department during April.

Terminal Island

Highway Commission Votes Needed Funds

THE California Highway Commission decided April 30th to provide State Highway funds to complete financing of the proposed San Pedro-Terminal Island toll bridge in Los Angeles County.

The California Toll Bridge Authority has been planning for construction of the bridge under terms of legislation which provided financing from bonds and other sources. But this financing plan proved inadequate and the authority, at a meeting April 23d, asked the commission for assistance.

Artists of the Division of Highways have prepared this drawing to show how the new Terminal Island Bridge will appear after it is completed. It will form part of a link connecting the Long Beach and Harbor Freeways.

Governor Edmund G. Brown, chairman of the Toll Bridge Authority, advised the Highway Commission that the authority endorsed the bridge plan and requested sufficient financial help to permit an early start of construction.

State Director of Public Works Robert B. Bradford, Chairman of the Highway Commission and member of the Toll Bridge Authority, said the commissioners' action closes the $4,500,000 financial gap which that authority had been unable to fill by bonding.

The bridge and approaches will cost an estimated $18,000,000 plus $1,500,000 for engineering.

Legislation adopted in 1958 (A. B. 74, Thomas) provided for advances of not more than $5,000,000 out of the State Highway Fund and $2,000,000 each from the City of Los Angeles and Los Angeles County out of their shares of state highway user taxes, in addition to whatever funds could be raised by revenue bonds. The money advanced from the State Highway Fund and from the city and county would be repaid out of bridge tolls, after bridge bonds were repaid, according to the law.

Revenue bonds of $6,000,000 are the maximum that the proposed bridge would support, consultants reported recently to the authority. This, with the sums to be advanced under terms of the legislation, left the gap which was closed by the Highway Commission's action today.

The commission's decision was to advance the additional money under the same terms as provided for the other, that is with the understanding it will be repaid out of toll revenues after the bonds have been redeemed.

The commission also said its decision is contingent upon continuation of the current federal interstate highway financing program. There is a possibility of curtailment of this program and consequent loss to California of $500,000,000 in the next two fiscal years. If this occurs, Bradford said, the commission will have to review and curtail many plans, including those concerning the San Pedro-Terminal Island toll bridge.

State Highway Engineer G. T. McCoy estimated the structure and approaches would take approximately two and a half years to build. He said plans and specifications were well underway.

The bridge would be located near the west end of Terminal Island, slightly north of the present route of the Terminal Island Ferry, which it would replace. It would be on the State Highway System and would serve as part of a connecting link, designated by the Legislature, between the Harbor and Long Beach Freeways.

Plans of the Division of Highways call for a project totaling about 7,400 feet in length, including about 4,000 feet of approach structure, a 1,500-foot span between the two main suspension towers, and two 500-foot side spans between the main towers and the anchorages on either side. The remaining 900 feet would consist of sections of fill.

The bridge will have four traffic lanes, and provide for 185-foot vertical clearance above mean high water.

On the San Pedro side the bridge approach would cross over and connect with Harbor Boulevard near Regan Street. It would also connect with Pacific Avenue near Front Street. Provision would also be made for a direct connection to a proposed extension of the Harbor Freeway, which now ends at Battery Street.

On Terminal Island, where the toll plaza will be located, the project will end on the south side of Seaside Avenue near Morman Street.

Division of Architecture contracts in progress in April totaled $139.5 million. During April, contracts totaling $8.5 million were awarded.

Retirements of Public Works Employees Noted

The following Department of Public Works employees have retired since the previous list was published in the September-October issue of the magazine.

Division of Highways Headquarters

Clarence Bovey, Principal Highway Engineer, 44 years; Lloyd B. Reynolds, Associate Highway Engineer, 28 years.

District I

Hugh Ross, Light Power Shovel Operator, 30 years; Ralph W. Sorin, Highway Superintendent, 31 years.

District II

Frank E. Leaphart, Associate Highway Engineer, 14 years; Lile H. Barber, Laborer, 32 years; O. T. Eastlick, Highway Foreman, 34 years.

District III

Orville E. Collins, Laborer, 19 years; Robert G. Wallace, Highway Foreman, 32 years; Jerry S. Connelly, Laborer, 11 years; Phillip C. Schifferman, Highway Equipment Operator-laborer, 25 years; Fred H. Schmidt, Drawbridge Operator, 18 years.

District IV

Devere L. Detrick, Highway Field Office Assistant, 13 years; Norman Helgren, Highway Foreman, 37 years; M. C. Armstrong, Highway Equipment Operator - laborer, 21 years; Stephen G. Solovieff, Delineator, 2 years.

District V

Edward P. Soberanes, Highway Equipment Operator - laborer, 34 years; Charles H. Snyder, Highway Equipment Operator - laborer, 28 years.

District VI

Robert Rasmussen, Highway Equipment Operator-laborer, 24 years.

District VII

Frank W. Long, Highway Equipment Operator - laborer, 24 years; William A. Nye, Highway Leadingman, 20 years; Thomas Stubbs, Highway Leadingman, 24 years; Harry J. Allen, Highway Equipment Operator-laborer, 25 years; Henry E. Christian, Highway Equipment Operator-laborer, 34 years; Horacio C. Diaz, Laborer, 36 years; Clementine Dougherty, Senior Clerk, 31 years; Ella M. Katerndahl, Intermediate Stenographer-clerk, 25 years; John Simonich, Highway Equipment Operator-laborer, 25 years.

District IX

Paul Scanavino, Laborer, 24 years.

District X

Chester S. Scrimsher, Highway Leadingman, 35 years; Henry Sprock, Drawbridge Operator, 23 years; Clarence Quinn, Engineering Aid II, 33 years; Richard A. Wilson, Senior Highway Engineer, 36 years.

District XI

Frank Calohan, Associate Right-of-way Agent, 10 years; Joseph E. Coomes, Highway Equipment Operator-laborer, 17 years; Phillip S. Kerr, Highway Foreman, 29 years.

Bridge Department

Hugo R. Lendecke, Associate Bridge Engineer, 32 years; Lawrence J. Hubbard, Associate Bridge Engineer, 25 years; G. W. Thompson, Associate Bridge Engineer, 38 years.

Bay Bridge

Emily Van Dorn, Senior Account Clerk, 16 years.

Shop 8

Henry Wacker, Laborer, 24 years.

Division of Contracts and Rights-of-Way

Meta M. Powers, Supervising Clerk II, 32 years.

Glenn H. Cheeseman

Glenn H. Cheeseman, District Maintenance Engineer, District VII, died in Whittier on January 27th after 40 years of service in highway maintenance with the Division of Highways.

He was born in Michigan October 1, 1898, and came to California with his family in 1910 and settled in Imperial Valley. He completed high school just in time to serve a little more than a year in the Army in World War I.

On January 16, 1919, he started work with the State Division of Highways in District VII as a laborer at $3 per day, on what he believed to be only temporary employment of a few weeks' duration. However, promotion through the ranks of truckdriver and equipment operator was rapid and in October, 1921, he became a maintenance foreman.

He was promoted to maintenance superintendent when that position was established in 1933 and served in that capacity until he obtained his registration as a civil engineer and was promoted to senior highway engineer and district maintenance engineer in 1953. Although all of his service was in District VII, he was widely known throughout the State and assisted in developing maintenance procedures and policies.

During World War II he served as major in the Army Corps of Engineers and earned the Bronze Star Medal along with the European, African, Middle Eastern Campaign with four battle stars, World War II Victory and American Campaign Medals.

Cheeseman is survived by his wife, Lenore E. Cheeseman, his father, Dwight Cheeseman, and two sisters, Mrs. Charles Rosenberger and Mrs. Edith Pratt.

Inspection Procedure Courses Being Given

Division of Highways inservice training courses in street and plant inspection procedures for asphalt and portland cement concrete paving were held in the 11 highway districts in March and April.

The six-hour asphalt inspection course was given with the co-operation of the Asphalt Institute. The Portland Cement Association assisted with the eight-hour class on inspection of portland cement concrete.

The courses were part of the division's continuing inservice training program.

Central Freeway

South Van Ness-Turk Street Section Opened to Traffic

A new 1.4-mile section of the Central Freeway in San Francisco between South Van Ness Avenue and Turk Street, including an overcrossing of Market Street (foreground), opened April 22d. The Embarcadero Freeway and San Francisco-Oakland Bay Bridge may be seen in the background.

A 1.4-mile section of the Central Freeway in San Francisco between South Van Ness Avenue and Turk Street was opened to traffic on April 22d.

This section of the Central Freeway was the second to be placed under contract. The first contract provided a connection to and from the James Lick Memorial Freeway (Bayshore) at Mission Street and South Van Ness Avenue.

Peter Kiewit Sons Company, the contractor, began work on the newly opened section July 15, 1957. Construction cost of the project was \$7,803,948.

The structure changes from a single level at South Van Ness Avenue to two levels near Market Street with opposing traffic on different levels. Over most of the freeway section there are two lanes in each direction. Southbound traffic uses the top level while northbound traffic travels on the lower level.

The elevated freeway was constructed on relatively narrow right-of way to minimize the amount of property required and to allow normal city traffic to move without interruption over the surface city streets beneath.

The terminals of the new freeway are laid out to take maximum advantage of the city's one-way street system. The northerly terminal connects with the north-south Franklin-Gough one-way street pair and with the east-west Golden Gate-Turk one-way pair. The westerly terminal connects with the Oak-Fell pair leading into the Sunset. One block of Laguna Street between Oak and Fell Streets has been made one-way to facilitate traffic at the ramps.

Merit Award Board Announces Winners

Employees of the Department of Public Works receiving certificates of commendation and cash awards since the last list was published in the March-April issue of this magazine are:

Jack Roy, Architecture, Los Angeles. Certificate of award and $25 for recommending revision in the wording on structural tracings to save time in hand lettering.

Maynard L. Young, Highways, San Francisco. Certificate of award and $150 for recommending that pay quantity tables, covering drainage structures, be included in highway contract plans.

Miss Alma R. Terning, Highways, Los Angeles. Certificate of award and $20 for recommending that triplicate copy of the monthly time sheet be printed on green or blue paper so that it can be immediately identified.

John M. Fitz, Highways, San Francisco. Certificate of award and $50 for developing a method for coding ambiguous traverses for computation by the electronic computer so that the proper solution will always be stored for subsequent use.

Erwin R. Paaske, Highways, San Luis Obispo. Certificate of award and $30 for preparing a right-of-way engineering check list.

Sterling S. Searcy, Highways, San Francisco. Certificate of commendation for recommending the installation of permanent pushbuttons in traffic-actuated signal cabinets to facilitate rapid and safe checking of control equipment.

Lyman D. Bailie, Highways, Stockton. Certificate of commendation for recommending that a grip handle be placed on the bottom of canvas disposal bags.

Miss June H. Brush, Highways, Pinole. Certificate of commendation for recommending a procedure which reduced the number of long distance calls made in connection with passenger car mileage chargeable to Federal Aid.

Robert R. Wirts and Russell M. Gray, Jr., Highways, San Bernardino. Certificates of commendation for recommending that dirty canvas sample bags be washed and re-used instead of purchasing new ones.

Gary L. Simms, Fresno. Certificate of award and $150 for designing a "fuzz" pen for inking access lines on highway plans.

David V. Myron, Garberville. Certificate of ward and $25 for two suggestions: one recommending a revision of Form A 1226, Receiving Record; the other recommending a revision of Form A 523, Transfer Form.

Norval A. Ryder, Jay H. Carlton, and Darral D. Brooks, Fresno. Certificates of award and $30 for recommending the use of carbon sheets for route comparison studies when using T.S. 9.1 form.

Jack Lynn, Bridgeport. Certificate of award and $150 for designing and constructing a snow stake puller that speeds up the pulling of poles and reduces the breakage.

Robert W. Bower, San Bernardino. Certificate of award and $25 for recommending that portions of old discarded tires be used to mount clearance lights on snow and rock plows to protect and prolong the life of the lights.

Clarence J. Brownell, Sacramento. Certificate of commendation for recommending an improved method of filing reduced plan sets.

Charles G. Andert and Thomas F. Walsh, San Diego. Certificates of commendation for recommending that sectional horizontal repair plates be used to prolong the life and usefulness of HR and HRD pressure sensitive vehicle detector frames installed in pavement that has deteriorated due to heavy vehicle travel.

Donald D. Marty, Sacramento. Certificate of commendation for designing a plan hanger for reduced sized plans.

Clinton R. Smith, Salinas. Certificate of commendation for designing and building a detachable safety hand rail for getting on and off of flat bed trucks.

John M. Fitz, San Francisco, $50 additional award for an improved method of computing ambiguous traverses on machine computations, etc. (A certificate was issued at the time of the original award in March, 1959.)

Robert L. Thomas

Robert L. (Bob) Thomas, who retired March 31, 1948, after more than 30 years of service with the Division of Highways, died April 28th in San Jose. Funeral services were held in that city, which had been his retirement home.

Some of his better known engineering work included the location of the Weldon Canyon Road, Ridge Route Alternate, and the Angeles Crest Highway in District VII where he was employed as Location Engineer and Engineer of Special Investigation from 1927 to 1933. At the time of his retirement he was Assistant Engineer of Surveys and Plans, Headquarters.

Thomas leaves his wife, Mabel, two nieces who live in Garberville and another niece in Berkeley. A sister resides in Portland, Oregon.

The Thomas home in San Jose was at 1079 Camino Tablo.

Veteran Road 'Super' Clyde Rust Retires

Clyde W. Rust, Sr., highway superintendent in the Sacramento area, retired on April 30th after a career of nearly 46 years with the California Division of Highways.

CLYDE W. RUST

Rust was born on October 13, 1898, in Sacramento, California, and attended public grade and high schools in that city. He entered state service as an office boy at headquarters in 1913.

In 1917 Rust entered the U. S. Army and served until 1919 when he returned to state service as an assistant resident engineer with the Construction Department in District III. He worked on numerous construction projects throughout District III. From 1926 to 1930, he served as assistant maintenance engineer, and it was during this period that Rust was assigned the task of constructing a 0.7-mile detour around an uncompleted bridge and overhead grade separation for the Truckee River Highway celebration on June 10, 1926. He was given orders to complete the bridge in five days, and although it was hardly expected that the work could possibly be accomplished in that time, the bridge was finished on the evening of the sixth day.

From 1930 to the present time, Rust has worked in his present capacity as highway superintendent in the Sacramento area. During this lengthy career with the State, he has served under 10 Governors.

Rust is a charter member of the State Highway Employees Association, American Legion, Veterans World War I, and his fraternal associations include membership in the Masonic and Elks lodges.

Rust is married, and has a son and a daughter both residing in Sacramento.

Contractors' interest in highway projects was maintained at a high level during April. As many as 22 bids for one project were received. Bidders averaged seven per project.

OAKLAND STUDY

Continued from page 12 . . .

1. The assessed valuation of the area increased from $359,750 to $514,650, a jump of $154,900, despite the fact that the project removed from the tax roll property with an assessed valuation of $46,975.
2. Had there been no street improvement, the valuation would have increased $53,963 in line with an average 15 percent increase in citywide assessed valuation from 1952 to 1958. Therefore, the area's assessed valuation realized a net gain of $100,937, despite the "loss" from the city's right-of-way acquisitions.
3. As a result of any civic improvement, there customarily develops a certain amount of neighborhood pride which soon after manifests itself in the form of property improvements, i.e., "face lifting," repainting, additions, landscaping, old sidewalk replacement, etc. All of these beneficial changes can now be seen on the improved 27th Street.
4. Since 27th Street was improved, excluding additions and minor improvements to existing properties, $150,000 has been expended for private improvements or new construction within the one block abutting the new 27th Street improvement.
5. All property owners formerly located within the right-of-way have relocated within the City of Oakland, a sequence which can be expected to further enhance the local tax rolls.

SOUTHERN CROSSING STUDY

New studies seeking the best location for a Southern Crossing of San Francisco Bay were ordered by the California Toll Bridge Authority at its April 23d meeting. The Department of Public Works was directed to study the feasibility of a crossing from Sierra Point, San Mateo County, to Roberts Landing, Alameda County, and of a crossing in any location north from that line to the San Francisco-Oakland Bay Bridge. There will be need for another Bay crossing after 1972, when the modernized Bay Bridge will reach capacity, experts told the Authority.

New Expressway Completed in Antelope Valley

An eight-mile section of the US 6 in Los Angeles County was opened to traffic on April 15th. Reconstruction of this section of US 6, which is also known as the Sierra Highway, extends from Avenue R in Palmdale to Avenue I in Lancaster and involved four-laning the highway at a cost of $600,000. Work on the project was started last September.

LIKE FATHER, LIKE SON

EDITOR:

The Gualala River Ferry of which you had a picture in the March-April issue was owned by my father, Rufus Niles. He used to get 25 cents per team for ferry fare, the same fare the State charges now on the Bay Bridge.

My folks used to tell me how they did their banking. They would convert the ferry fares into $20 gold pieces and when there were enough my mother would sew them into the hem of a dress and take a lumber schooner down the coast to San Francisco and the bank.

My father went out of business when the county built the bridge in 1894 and moved to Oakland where I was born.

However, the bridge builders weren't through with us yet. When I grew up I got a job on one of the San Francisco Bay ferries. Along came the State and built the Bay Bridge and, like my father, I found myself out of work.

Actually, I feel quite close to bridges and highways as I am now a building engineer in the Public Works Building in Sacramento, where the Division of Highways has its headquarters.

Sincerely,
LEWIS R. NILES

E. Brooks Currey

Edward Brooks Currey, Assistant District Engineer in charge of surveys, materials and drainage for District VII, died after a protracted illness May 8th. He was 64.

Currey was first employed by the State Division of Highways as Senior Engineering Office Aid in July, 1931. Following a year's absence (1935-36), during which time he was employed by the Los Angeles County Surveyors Office, he returned to highways and remained until his death. He was appointed supervising highway engineer in May, 1951.

Currey was born on March 4, 1895, in Mountain Home, Idaho, and attended the Kearney, Nebraska, Military Academy from which he was graduated in 1912. He subsequently held various engineering jobs, enlisted in the 109th regiment engineers in World War I and served as city engineer of San Fernando from 1925 to 1930.

Currey, who lived at 1225 Westerly Terrace, Los Angeles, is survived by his son, E. Brooks Currey, Jr., daughter-in-law and grandchildren. Pauline Currey, his wife, died on April 30, 1959.

Veteran Maintenance Employee Retires

Phillip C. Schiffmann, a Division of Highways employee in the Chico Maintenance District, has retired because of disability. Schiffmann completed 25 years of state service in April, 1958.

He was born in Denver, Colorado, on August 1, 1903. He started his employment with the Division of Highways in the Oroville Maintenance District on April 5, 1933. All of his service was with the maintenance department of District III.

At a recent safety meeting he was presented a gold watch by his fellow employees. The presentation was made by District Engineer Alan S. Hart.

He served in the armed forces during World War II from July, 1942, to May, 1953.

Schiffmann will reside at his home on Lassen Avenue in Chico following his retirement.

R. E. Milton

R. E. Milton, 53, an employee of the Division of Highways for 29 years, died March 4th at his home in Sacramento. He had been ill for several weeks following a heart attack.

Milton, an associate highway engineer, had been a specifications writer at the division's Sacramento headquarters for the past 11 years.

He began his career in 1929 as a junior engineering aid for District II in Redding.

Milton was assigned to various departments in District II until 1948, when he transferred to the specifications section at the headquarters. He was a licensed civil engineer.

A native of La Grange, Kentucky, he was born February 2, 1906. He is survived by his wife, Esther.

During the 1957-58 Fiscal Year, the Division of Highways let contracts for 102 new traffic signal installations, and 45 existing signal systems were modernized. Of the new installations, 76 were traffic actuated and 26 were of the pretimed type.

Heslep Named Aide To Bridge Authority

Edward A. (Ted) Heslep was appointed executive officer of the California Toll Bridge Authority by Governor Edmund G. Brown on May 20th.

Heslep, 40, formerly served as legislative liaison for the State Senate Rules Committee. He was Northern California campaign manager for U. S. Senator Clair Engle in 1958.

Heslep was born November 24, 1918, in Narrows, Virginia. He attended Virginia Polytechnical College in Blacksburg, Virgina.

Heslep came to California in 1945 after service in the U. S. Army, during which he rose from the rank of private to lieutenant. He worked six years as a sales representative for several eastern firms in Los Angeles.

After a brief period in the insurance business in Modesto, Heslep moved to Sacramento and worked in the California Disaster Office until 1957, when he resigned to travel.

Heslep lives at the John Hay River House on River Road, northwest of Sacramento. He is a member of the Consistory of Sacramento and Ben Ali Shrine and is active in the Red Cross, Boy Scouts and YMCA.

Construction Course At Marysville Office

An orientation course in construction engineering was recently conducted for county road officials by the Division of Highways District III office in Marysville.

The 40-hour course was arranged under the supervision of the district cities and counties co-operative engineer.

Technical presentations were made by various staff members. Lectures and films were supplemented by instruction in procedures for typical field job control tests.

Twenty-two county road commissioners, resident engineers or construction inspectors participated, representing nine of the 11 counties in District III.

The training program sought to acquaint county personnel with field and office procedures necessary in FAS county road jobs. The course also covered current construction practice.

Clyde F. Johnson

Clyde F. Johnson, highway maintenance superintendent in charge of the Bakersfield territory in District VI, died on April 7th after an illness of five months.

Johnson was born in New Carlisle, Ohio, April 15, 1895, and attended grammar school and high school there. He attended Ohio State University and was in the Army Signal Corps in 1917 and 1918. He came to California in 1922 and went to work for the California Division of Highways shortly thereafter.

He worked in District IV in the San Francisco area from 1923 until 1937, where he was an inspector, a mechanic's helper, a timekeeper-clerk, and a foreman. Since 1937 he has been a highway superintendent in District VI, until 1940 in the Taft area, and then in the Bakersfield area until the time of his death.

Johnson was active in local organizations and civil service affairs. He helped organize the California State Employees' Association and the California State Employees' Retirement System. He was chairman of the Streets and Highway Committee of the Civilian Defense Council of Kern County.

He was a member of the Caledonia Masonic Lodge, the Bakersfield Scottish Rite Bodies, the High Twelve Club, the American Legion, and the Quarter Century Club.

He was fond of travel, photography, and bridge; and was a member of the Photographic Society of America, the Tejon Camera Club, and the American Contract Bridge League.

Johnson is survived by his wife, Pauline Margaret, and a sister, Miss Ruth Johnson, of Dayton, Ohio.

DISTRICT XI

Continued from page 9 . . .

Riverside County

A contract for the construction of nine miles of four-lane full freeway on US 60-70-99 between the Indio Overhead just northwest of Indio and Thousand Palms (Edom) has recently been awarded to Massey and Hill of Indio and San Gabriel as a joint venture. The low bid of $1,757,000 will provide interchanges at Jefferson Street, Washington Street, and at Kubic Road. The Washington Street bridge will span the railroad west of the freeway in addition to the freeway lanes.

The Indio Overhead to Thousand Palms section of US 60-70-99, together with the budgeted Beaumont Freeway, will provide 125 miles of continuous multilane divided highway between Los Angeles and Indio except for the undivided four-lane section through Redlands.

On another US 60-70 project, a new two-lane welded steel girder bridge will be constructed to carry east-west traffic over the Colorado River in the vicinity of Blythe, California. Osborn & Pierson were low bidders, asking $995,957 for the job. The new 1,112-foot bridge will be located just north of the existing structure and will be financed by cooperative funds from the States of California and Arizona. The connecting approaches will be handled under a subsequent contract.

Imperial County

With the recent completion of construction on State Sign Route 115 between Alamorio and Sandia Turn, another contract has been awarded projecting construction due south to connect to US 80 near Holtville. The new project provides for grading and paving 4.3 miles parallel to and approximately 1½ miles westerly of the existing facility. A 205-foot bridge over the Alamo River will be a part of the contract which was awarded Rice Brothers, Inc., in the amount of $518,000.

With minor exceptions, District XI's construction scheduling is meeting the planning timetable. Considering the large number of recent route adoptions, together with the public meetings anticipated in the near future and the designation of the new Legislative Route 241, the outlook is for continuing rapid development of the State Highway System in this southernmost part of California.

This aerial of construction on Sign Route 94 shows the Wabash Boulevard interchange in the foreground and the San Diego business section in the background.

Two District VII Retirements Marked

Two employees of the Division of Highways District Office in Los Angeles have retired from state service.

Ernest R. Scott, assistant highway engineer, ended 32 years with the division when he retired on March 31st.


ERNEST R. SCOTT

Clarence V. Zook, highway field office assistant with the District Maintenance Department, retired on February 27th after 23 years of service.

Scott, who was born in New Zealand, acquired U. S. citizenship after serving overseas with the U. S. Infantry during World War I. He worked for both private and governmental engineering organizations before being employed as a highway engineering draftsman in District IV in 1926. Transferring to District VII in 1929, he served both in design and right-of-way engineering capacities.


CLARENCE V. ZOOK

The Scotts will maintain their present home in Los Angeles, although foreign travel will occupy much of their time. Their first itinerary will take them to some of the South Pacific islands.

Zook, who was born in Crete, Nebraska, joined the District VII staff in 1936. He and his family reside in Montebello.

BOOKER RETIRES

Continued from page 26 . . .

ern California in 1932. He joined the Division of Highways after graduation and except for a short time with the Metropolitan Water District of Los Angeles and service in the Navy during World War II, has been with the Division of Highways throughout his engineering career. Before his promotion to district engineer in District IV in 1952, Sinclair was assistant district engineer (design) in District VIII, Los Angeles.

He is a member of the honorary civil engineering fraternity Chi Epsilon and the American Society of Civil Engineers. He is married and a resident of San Carlos.

VICTORVILLE-BARSTOW

Continued from page 27 . . .

"But weeks and then months went by without a fatality. On the freeway's 108th day, April 1st, the inevitable occurred." (A driver, apparently asleep at the wheel, was killed when his car ran off the freeway and struck an embankment.)

"Another impressive fact was uncovered at the CHP office:

"The 12.6 miles of the new freeway from Victorville to Wild Wash bridge had only one injury accident during the first three months of the year, a record which more than substantiates the State Division of Highways opinion that freeways are safe highways."

The news story also reported a big reduction in the number of accidents on the former highway, which was replaced by the freeway.

"At the CHP office, a 'pin map' is used to show where accidents have occurred during the current year. Last year old Highway 66 was dotted with pins representing more than 400 accidents.

"So far this year, old 66—now used much less—shows no fatalities, no injury accidents and only two property damage accidents."

(Statewide accident records maintained by the Division of Highways show that in the five-year period from 1953 to 1957 the fatality rate on full freeways was one-third the rate on conventional highways.)

All public school building plans in the State are checked for structural adequacy by the Division of Architecture. During the current fiscal year, from last July 1 to April 30, a total of 1,066 school projects valued at $221.8 million has been submitted. This is a decrease of $41.5 million from the corresponding period last year.

CUYAMA ROAD

Continued from page 20 . . .

complicated by the size of the girders involved, was further hampered by erratic wind conditions at the site.

Overhang Presents Problem

Falsework for the deck forms has presented quite a problem due to the deck overhang which varies from four to eight feet from the girder and is quite inaccessible due to the extreme height above ground. This was effectively solved by the use of adjustable triangular timber jacks mounted on the bottom flange of the girders and supported by U-shaped high-strength steel rods to be partially embedded in the concrete deck. Deck pours are progressing at the rate of one span (200 cubic yards) every 10 days.

The Alamo Creek and Cuyama River bridges are similar in design to the Huasna River bridge although much smaller by comparison and are being constructed by similar methods.

Traffic handling has not been a major problem due to the low volume. Where the new alignment conflicts with the existing road, paved detours have been constructed. Flagmen handle traffic on a one-way basis during grading operations where heavy equipment crosses the existing highway.

This project is the first step in the proposed improvement of 58 miles of Highway 166. Completion is scheduled for late in 1959. $1,994,340 of the the total cost of this highway project was contributed by the U. S. Bureau of Reclamation with the remaining funds being drawn from the State Highway Fund by action of the California State Highway Commission. This contract is administered by the Division of Highways under A. M. Nash, District Engineer of District V. L. D. Kraatz is Resident Engineer, and J. D. Norberg was Bridge Department Representative. Madonna Construction Company is the prime contractor represented by Superintendent H. D. Carder. Vinnell Steel Company subcontracted the structural steel.

The Division of Architecture is designing parking lots for the 38 residence hall units under construction at state colleges throughout California.

COST INDEX

Continued from page 16 . . .

NUMBER AND SIZE OF PROJECTS, TOTAL BID VALUES AND AVERAGE NUMBER OF BIDDERS

(January 1, 1959 to March 31, 1959)

Project Volume	Up to $50,000	$50,000 to $100,000	$100,000 to $250,000	$250,000 to $500,000	$500,000 to $1,000,000	Over $1,000,000	All Projects
Road Projecta							
No. of projects	43	4	3	4	3	0	57
Total value*	$789,714	$343,101	$548,226	$1,396,717	$2,195,009	$0	$5,272,767
Avg. No. bidders	7.3	5.5	12.0	10.5	9.3	0	7.9
Structure projecta							
No. of projecta	1	0	2	1	0	1	5
Total value*	$42,813	$0	$295,951	$416,621	$0	$1,838,925	$2,595,310
Avg. No. bidders	7.0		8.0	16.0	0	11.0	10.0
Combination projects							
No. of projects					1	14	15
Total value*					$975,625	$58,240,964	$59,216,589
Avg. No. biddera					9.0	9.0	9.0
Summary							
No. of projects	44	4	5	5	4	15	77
Total value*	$832,527	$343,101	$845,177	$1,813,338	$3,170,634	$60,079,889	$67,084,566
Avg. No. bidders	7.3	5.5	10.4	11.5	11.5	9.1	8.2

* Bid Items only.

TOTAL AVERAGE BIDDERS BY MONTHS

	Jan.	Feb.	March	Avg. for three months
1959	7.7	8.0	8.7	8.2
1958	11.4	9.2	7.6	9.3

SIZE OF PROJECTS CONSIDERED IN SURVEY

	Number of projects	Percent	Value of projects	Percent
Under $50,000	42	56.7	$815,055	1.2
$50,000 to $100,000	3	4.0	251,428	0.4
100,000 to 250,000	5	6.8	845,177	1.3
250,000 to 500,000	5	6.8	1,813,338	2.7
500,000 to 1,000,000	4	5.4	3,170,634	4.7
1,000,000 to 2,500,000	7	9.5	13,194,864	19.7
2,500,000 to 5,000,000	4	5.4	16,444,727	24.6
Over $5,000,000	4	5.4	30,440,297	45.4
Total	74	100.0	$66,975,520	100.0

lation of average contract prices is shown on the following page.

The average unit price of $0.41 a cubic yard for roadway excavation is $0.11 below the fourth quarter of 1958 price of $0.52 per cubic yard, and returns the price of this item to its low range value during the last three years. Unit bid prices in projects exercising significant weight in establishing this average range from $0.23 to $1.04 per cubic yard. The decrease in the average unit cost may be attributed primarily to the large volumes of earthmoving involved in individual projects, in locations subject to minimum traffic interference. Of the 17,200,000 cubic yards of roadway excavation in this quarter over 8,000,000 cubic yards were included in four contracts in Los Angeles and Orange Counties resulting in prices of from $0.23 to $0.36 per cubic yard.

The average price of $1.82 per ton for untreated rock base is $0.28 below the fourth quarter 1958 price of $2.10 per ton. Prices for quantities exercising a significant influence on the index range from $1.08 to $2.00 per ton.

While the average unit price of $14.00 a cubic yard for portland cement concrete pavement is up $0.45 from the fourth quarter of 1958 price of $13.55 per cubic yard, it is within the range of normal fluctuation.

The average unit price of $5.37 per ton for asphaltic and bituminous mixes decreased $0.37 from $5.74 per ton, but is still within the range of average unit prices for the last two years.

The average unit price of $49.40 per cubic yard for portland cement concrete (structures) decreased $5.80 from $55.20 per cubic yard. One-third of the total volume of 219,000 cubic yards in this quarter was in one project for the interchange structures for the Golden State, Santa Ana and Santa Monica Freeways. The unit price for this project was $47.50 per cubic yard, which had the greatest lowering effect.

Bar reinforcing steel dropped $0.014 per lb. from the unit price of $0.122 for the fourth quarter of 1958 to $0.108 a pound. The bid price for this item continued to decline despite rising steel costs, which appears to reflect higher productivity in construction and increased bidder competition.

The average unit price of $0.165 for structural steel did not change from the fourth quarter of 1958. A total volume of 10,357,000 pounds was used in this quarter with the prices ranging from $0.13 to $0.18 per pound.

General Trends

The drop of 9.4 percent in the Index is not necessarily indicative of the resumption of a downward trend in highway construction costs in the near future. In this quarter there occurred a combination of circumstances which had a predominant effect in lowering prices, particularly the natural tendency for close competition on early season lettings, when contractors endeavor to secure basic projects to engage their forces, and 15 relatively high-value projects (over $1,000,000 each), several in areas free from traffic interference, which normally lend themselves to more efficient operations and higher productivity, resulting in lower unit prices.

AVERAGE CONTRACT PRICES

	Roadway excavation, per cu. yd.	Untreated rock base, per ton	Plant mixed surfacing, per ton	Asphalt concrete pavement, per ton	Asphaltic and bituminous mixes, per ton	PCC pavement, per cu. yd.	PCC structures, per cu. yd.	Bar reinforcing steel, per lb.	Structural steel, per lb.
1940	$0.22	$1.54	$2.19	$2.97	----------	$7.68	$18.33	$0.040	$0.083
1941	0.26	2.31	2.84	3.18	----------	7.54	23.31	0.053	0.107
1942	0.35	2.81	4.02	4.16	----------	9.62	29.48	0.073	0.103
1943	0.42	2.25	3.71	4.75	----------	11.48	31.76	0.059	0.080
1944	0.50	2.45	4.10	4.50	----------	10.46	31.29	0.054	0.132
1945	0.51	2.42	4.20	4.88	----------	10.90	37.20	0.059	0.102
1946	0.41	2.45	4.00	4.68	----------	9.48	37.38	0.060	0.099
1947	0.46	2.42	4.32	5.38	----------	12.38	48.44	0.080	0.128
1948	0.55	2.43	4.30	5.38	----------	13.04	49.86	0.093	0.126
1949	0.49	2.67	4.57	4.64	----------	12.28	48.67	0.096	0.117
1950	0.40	2.25	4.25	3.75	----------	11.11	43.46	0.079	0.094
1951	0.49	2.62	4.34	5.00	----------	12.21	47.22	0.102	0.159
1952	0.55	2.99	5.00	4.38	----------	13.42	48.08	0.098	0.150
1953	0.51	[1]2.14	5.31	4.58	----------	12.74	50.59	0.093	0.133
1954	0.45	2.13	4.50	4.86	----------	14.41	48.43	0.094	0.124
1955	0.39	2.22	4.93	----------	----------	13.36	46.72	0.095	0.142
1st Quarter 1956	0.40	2.08	5.40	5.60	----------	14.06	52.51	0.106	0.166
2d Quarter 1956	0.51	2.06	5.27	----------		14.64	57.13	0.113	0.219
3d Quarter 1956	0.52	2.27	5.12	----------	----------	15.57	56.32	0.121	0.178
4th Quarter 1956	0.52	2.21	[2]	[2]	[2]$5.93	14.96	59.63	0.113	0.197
1st Quarter 1957	0.63	2.10	----------	----------	5.94	17.28	61.14	0.129	0.236
2d Quarter 1957	0.63	2.10	----------	----------	6.18	15.59	58.61	0.118	0.204
3d Quarter 1957	0.42	2.34	----------	----------	5.10	14.34	58.68	0.130	0.200
4th Quarter 1957	0.58	1.78	----------	----------	5.45	16.58	59.76	0.129	0.177
1st Quarter 1958	0.52	1.85	----------	----------	5.45	14.96	55.21	0.118	0.192
2d Quarter 1958	0.48	1.73	----------	----------	5.67	13.77	54.44	0.125	0.158
3d Quarter 1958	0.39	2.18	----------	----------	5.56	13.99	53.93	0.126	0.182
4th Quarter 1958	0.52	2.10	----------	----------	5.74	13.55	55.20	0.122	0.165
1st Quarter 1959	0.41	1.82	----------	----------	5.37	14.00	49.40	0.108	0.165

[1] The item of crusher run base was used before 1953.
[2] Asphalt concrete pavement combined with plant mix surfacing in fourth quarter 1956, and will be identified as asphaltic and bituminous mixes in the future.

At present the extent of wage increases, and their possible effect on bid prices, which will result from labor-management negotiations now going on or to be held before summer in the steel and construction industries, cannot be predicted. However, wage increases which have been provided for in existing long-term contracts no doubt will affect prices during 1959. Increases in construction wages, and in steel prices, which have increased for the last 14 consecutive years, could only be balanced by increased productivity and a reduction in profits.

Taking into consideration the above factors, it appears that a moderate rise in highway costs may be expected in the coming months.

Cost Index

The California Highway Construction Cost Index, the Engineering News-Record Construction Cost Index, and the United States Bureau of Public Roads Composite Mile Index, all reduced to the base 1940 = 100, are shown on the accompanying graph. The latter two Indexes are based on nationwide construction costs.

The Engineering News-Record Cost Index for the first quarter of 1959, which now stands at 322.1, again shows a rise over the preceding quarter, but at a slower rate. It is up 2.0 index points or 0.6 percent. This index is strongly affected by many large projects outside the highway construction field.

The Bureau of Public Roads Composite Mile Index is based on federal-aid highway construction contracts awarded by the state highway departments. The Index for the fourth quarter of 1958, which is the latest available, increased 3.9 index points or 1.7 percent from the third quarter of 1958 and now stands at 235.3, resuming the position of the second quarter of 1958.

The California Highway Construction Cost Index

The California Highway Construction Cost Index—Continued

Year	Cost index
1940	100.0
1941	125.0
1942	157.5
1943	156.4
1944	177.8
1945	179.5
1946	179.7
1947	203.3
1948	216.6
1949	190.7
1950	181.2
(1st Quarter 1950—160.6)	
1951	225.0
(4th Quarter 1951—245.4)	
1952	225.9
1953	215.2
1954	193.5
(2d Quarter 1954—189.0)	
1955 (1st Quarter)	189.3
1955 (2d Quarter)	212.4
1955 (3d Quarter)	208.6
1955 (4th Quarter)	212.6
1956 (1st Quarter)	219.5
1956 (2d Quarter)	255.9
1956 (3d Quarter)	249.1
1956 (4th Quarter)	252.1
1957 (1st Quarter)	277.7
1957 (2d Quarter)	266.9
1957 (3d Quarter)	237.5
1957 (4th Quarter)	262.1
1958 (1st Quarter)	241.8
1958 (2d Quarter)	231.0
1958 (3d Quarter)	228.5
1958 (4th Quarter)	238.5
1959 (1st Quarter)	216.1

San Mateo-Hayward Span Action Taken

The Toll Bridge Authority's meeting on April 23 included action on the San Mateo-Hayward Bridge. The Authority directed the Department of Public Works to seek the adoption of legislation to permit using revenues of the San Francisco-Oakland Bay Bridge as advances to finance construction to double the capacity of the San Mateo-Hayward Bridge. This would obviate the necessity of issuing new revenue bonds and consequently paying millions of dollars in interest. The money advanced for the reconstruction would be returned to the Bay Bridge Fund out of revenues from the San Mateo-Hayward Bridge after existing bonds are paid off.

In conformance with the recent revision in the law establishing speed limits, a statewide review of all State highways has been initiated to determine restricted speed zones to conform to the new legislation.

EDMUND G. BROWN
Governor of California

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District VII

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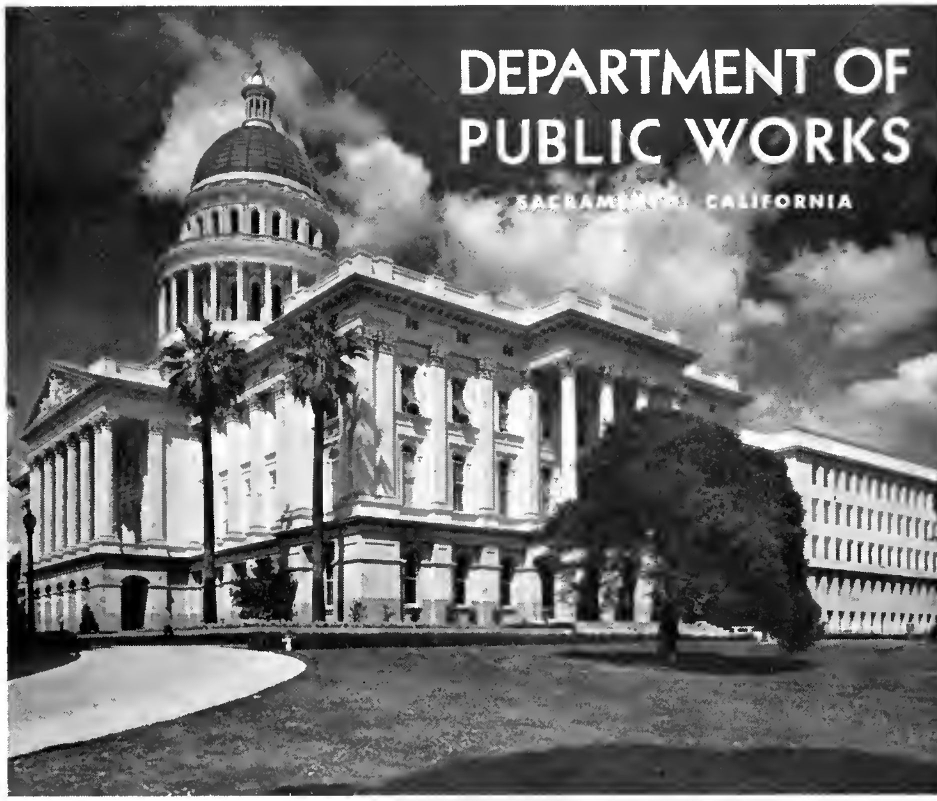

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printed in CALIFORNIA STATE PRINTING OFFICE 95300 5-59 40M

California Highways and Public Works
DIVISION OF HIGHWAYS
P. O. Box 1499
SACRAMENTO, CALIFORNIA

RETURN POSTAGE GUARANTEED

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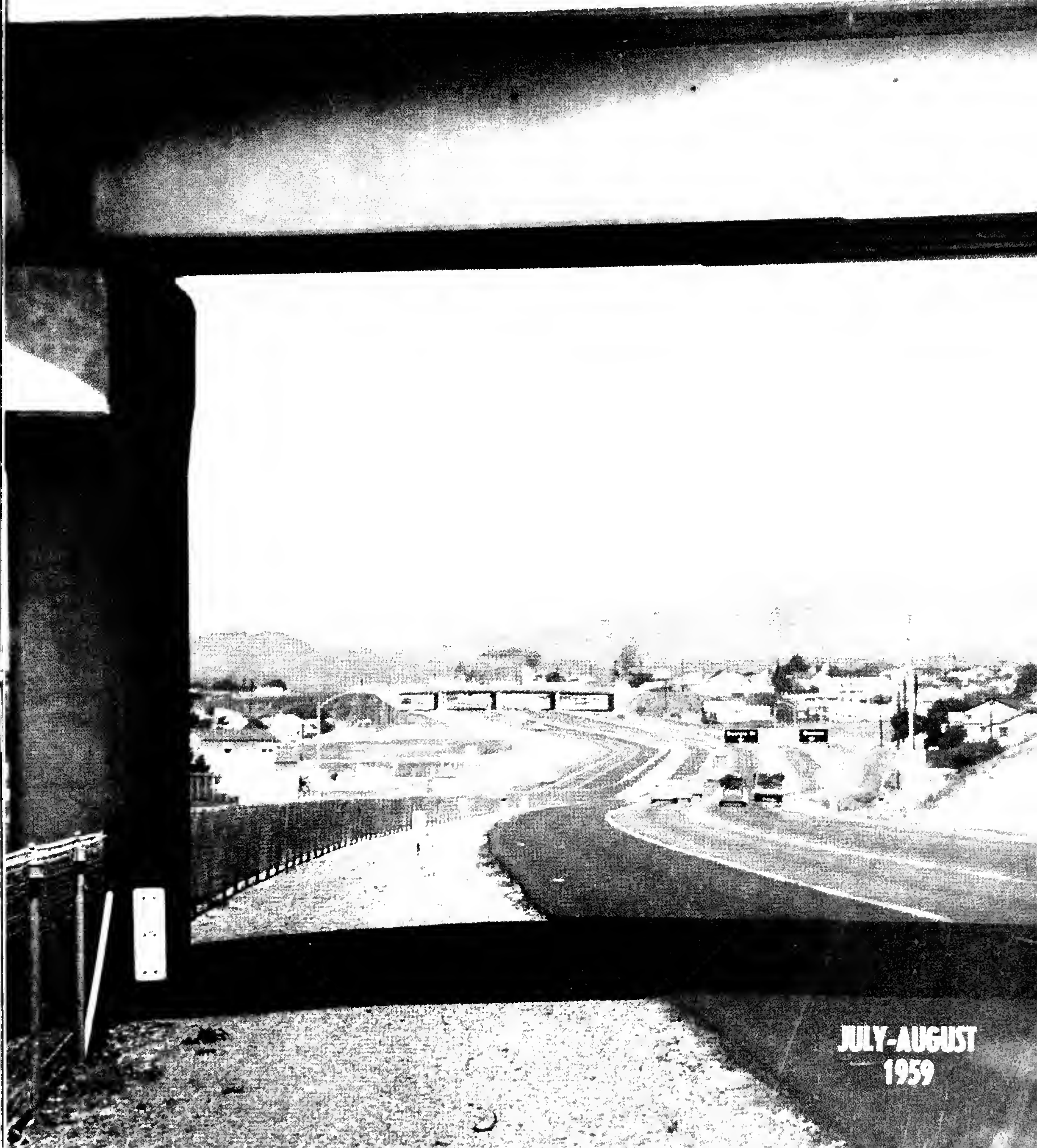
CALIFORNIA HIGHWAYS AND PUBLIC WORKS



JULY-AUGUST 1959

California Highways and Public Works

Official Journal of the Division of Highways, Department of Public Works, State of California

RICHARD WINN, *Editor*
HELEN HALSTED, *Assistant Editor*
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MERRITT R. NICKERSON, *Chief Photographer*

Vol. 39 | July-August | Nos. 7-8

FRONT COVER

The Magazine Street Overcrossing frames this northward view of the new US 40 Freeway through Vallejo.

—Photo by William R. Chaney

BACK COVER

Just east of Echo Summit US 50 starts down Meyers Grade toward Tahoe Valley and Lake Tahoe in the distance.

—Photo by Jack Meyerpeter

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Published in the interest of highway development in California. Editors are invited to use information contained herein and to request prints of any black and white photographs.

Address communications to

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SACRAMENTO 7, CALIFORNIA

Work Improvement

Governor Stresses Better, Faster, Cheaper Methods

On April 1, Governor Edmund G. Brown inaugurated the Work Improvement Project, an intensive statewide program among state employees to find better ways of doing their jobs. It will extend to February 1, 1960.

Following the Governor's directive, Robert B. Bradford, Director of Public Works, issued a circular letter on June 8th to all departmental employees pledging "participation to the fullest extent in this worthwhile program."

Just what is the Work Improvement Project or "WIP" as it has come to be known? What are its objectives and how will they be accomplished?

To begin with, WIP is much more than a simple economy program. WIP is bound to save the State money—probably quite a bit of it—and this is important. But, beyond this, it is interested in ways of giving California taxpayers better service, of doing more work with the men, money and materials we already have. It is a broad, positive program of which the saving of dollars is only one phase.

Nor does WIP mean that any state employee is going to lose his job. If positions are no longer needed, the necessary reduction will be made by not refilling when normal turnover occurs, or by transferring employees to other positions of equal level. On a positive vein, the impact of the State's population increase makes WIP's major problem one of how to handle more work with the present number of people.

Employee Participation Vital

Stated simply and inclusively, WIP's aim is to find ways to do work easier, better, faster and cheaper.

It is a "do-it-yourself" project which depends on participation by everyone in state service from top to bottom. It prospers in a favorable work climate which emphasizes the importance of finding these better ways and encourages supervisors and employees to think creatively about their work.

Supervisors form a key group in getting the program under way throughout the State. They will receive training in methods such as work, process, layout and motion analysis for evaluating work now being done and for improving methods and procedures in their sections. This training will provide an added way to tap the reservoir of practical knowledge represented by the supervisory group.

WIP training, which will be given at appropriate locations throughout the State, will include briefing sessions for management personnel, basic training groups for first-line supervisors, followup workshop sessions and training courses in pertinent subjects. In order to make maximum use of the personnel who attend the WIP trainers institutes, the basic WIP training will be planned and organized on a departmental basis. Interdivision training groups will be conducted where possible, serving all department employees in an area.

While planning and providing training courses will be on a departmental basis, the selection, scheduling and authorizing of individuals to attend the sessions will be the responsibility of regular supervisors and will be arranged through normal channels.

However, the individual employee remains the most important factor in WIP. It is on his effort and interest that the success of the program will rest. The cumulative result of each employee sitting back and taking a second look at the duties he performs could be tremendous.

Rapid Consideration Assured

Every work improvement proposal submitted under the program will receive prompt consideration. Review and referral of each proposal will continue until it has either been put into effect or turned down by an official who has the authority to adopt or reject it. The suggestor will always receive a written report of the final action regarding the proposal.

Recognition will be accorded employees who develop improved operations resulting in economies or increased efficiency by cash awards and commendations under the Merit Award Board employee suggestion program, reports of performance and personal commendation by superiors.

All official commendations will be made part of the employee's official agency personnel file.

Overall responsibility for WIP has been assigned to a Work Improvement Committee working under the general direction of the Governor's standing committee. Department of Public Works personnel appointed to the Work Improvement Committee include James F. Wright, Deputy Director, and Ray Rusk, Chief Clerk of the Division of Highways' Marysville office. Rusk is also President of the California State Employees' Association which has given its full support to the program.

Co-ordinators Named

The Director of Public Works has named T. F. Bagshaw, Assistant Director of Public Works, as departmental WIP co-ordinator to assist him in administering the program. The departmental co-ordinator will develop overall plans and assist the division chiefs and their staffs in implementing the program. He will also evaluate the progress of the program, see that information on improvements which may be of use to more than one division is disseminated to the others and see that those who make outstanding contributions as a result of the program are given proper recognition.

Each division chief will see that action is taken in his division to promote and maintain an effective program. This will include selecting supervisors to receive WIP training and making available any of his employees necessary to provide such training, seeing that employees so trained apply the work simplification techniques and

. . . Continued on page 56

Public Works Building
Twelfth and N Streets
Sacramento

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San Jose–Los Gatos Freeway Completed

On April 30th, the new freeway between San Jose and Los Gatos on Sign Route 17 in Santa Clara County was completed.

Construction of the four-lane, future six-lane, freeway, which began in 1957, cost approximately $5,900,000, exclusive of right-of-way. It is located approximately midway between the Santa Clara-Los Gatos Road and the San Jose-Los Gatos Road (former Sign Route 17), and follows the east bank of Los Gatos Creek between Los Gatos and Campbell, where it crosses the creek and proceeds north to the intersection with Bascom Avenue in San Jose. Included in the construction were frontage roads, six interchanges, four separations, one railroad underpass, one driveway undercrossing and bridges across Los Gatos Creek at two locations.

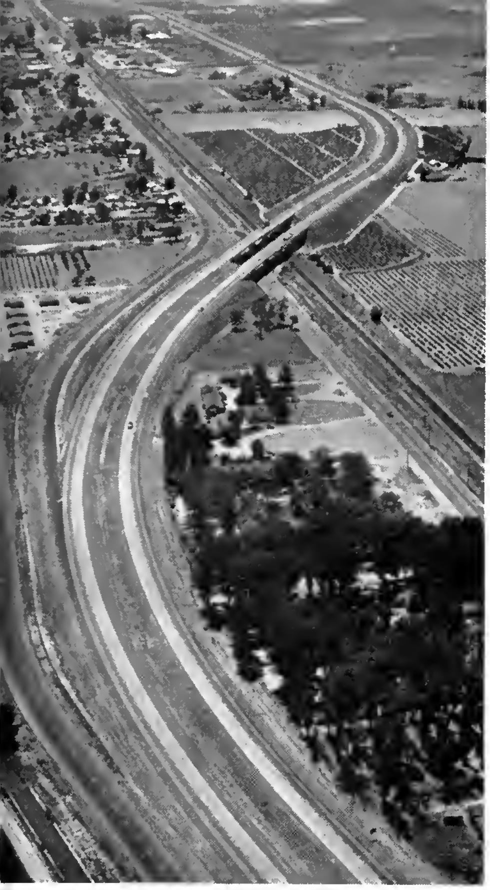
The portland cement concrete pavement was placed by a relatively new method of making a single pour eight inches in thickness and 24 feet in width. This was accomplished by using two dual-drum mixers operating in tandem. All finishing equipment was extended to carry on the 24-foot operation including a dual spraying system for placing curing seal. During 24½ working days the contractor placed and finished 50,100 cubic yards of Class B PCC pavement averaging 2,040 cubic yards per day. A profilograph, which is a new device that measures roughness, was run over the finished PCC pavement. The resulting profilogram indicated a vertical roughness of less than 3½ inches per mile. Specifications allow a maximum of seven inches a mile.

Opening of this 8.8-mile section of freeway has reduced by two-thirds the normal driving time between San Jose and Los Gatos and eliminated many traffic hazards.

Completion of two other projects now under way immediately north of this job will provide continuous freeway between Los Gatos and the south end of the Nimitz Freeway which extends from San Jose to Oakland.

Report From District X

By J. G. MEYER, District Engineer



UPPER—An aerial view southward of the US 99 Freeway Bypass of the town of Atwater in Merced County. LOWER—Looking south along construction on the Vacaville-Dunnigan Cutoff (Legislative Route 90), on interstate highway. The Russell Boulevard Interchange and the twin bridges over Putah Creek, both in Yolo County, are in the foreground with clearing operations visible in the background for a further five-mile extension of the freeway into Solano County.

SINCE last year's report in the July-August issue of *California Highways and Public Works*, District X has made steady progress in providing modern highways in central California. The extent of these accomplishments may be gathered from the following report:

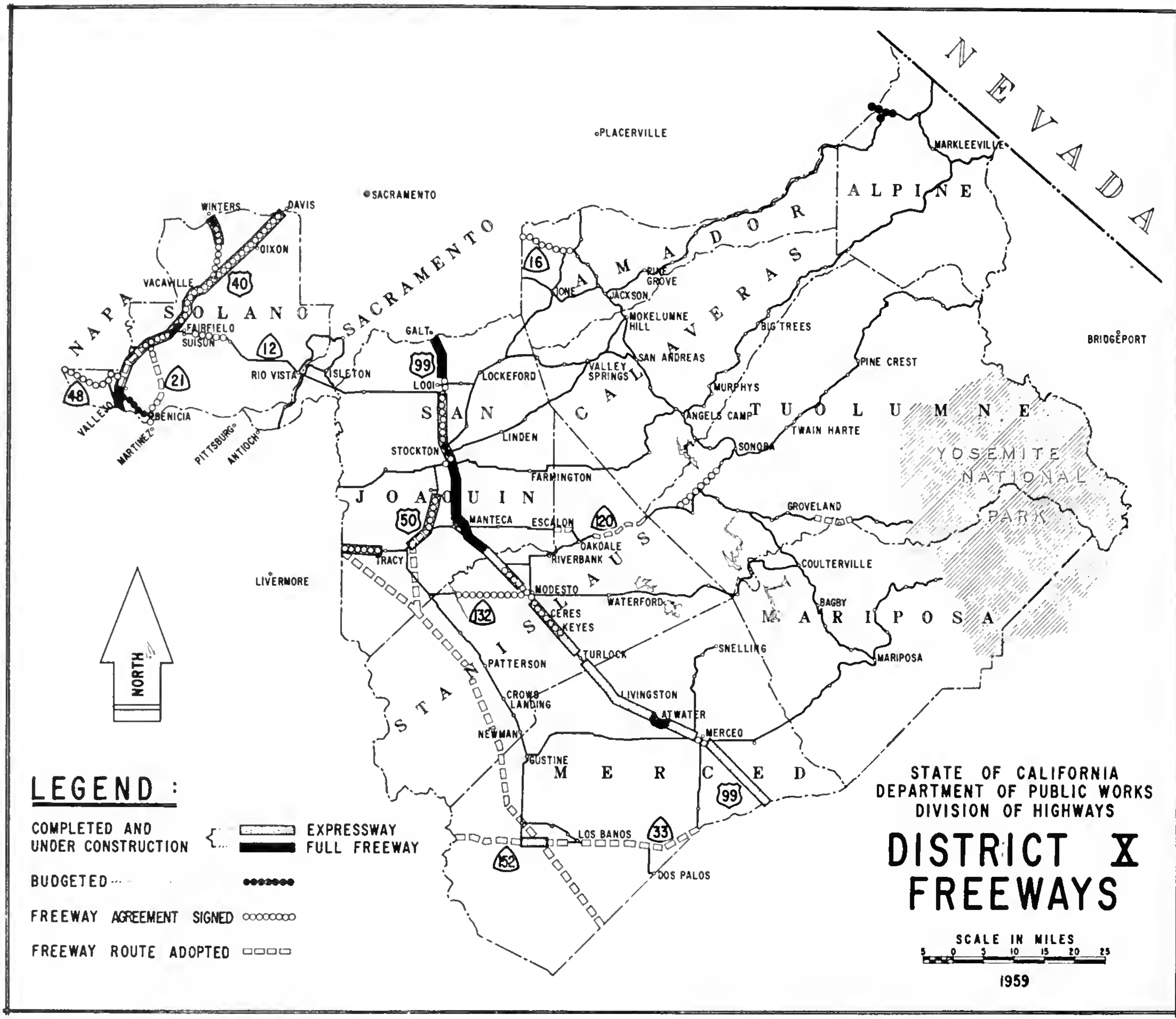
The past year saw many district meetings with the public and informational conferences with local government and civic organizations. The subjects of these meetings and conferences varied from the freeway complexities of the Westside Highway, the Turlock and Modesto Freeways, and the Stockton Master Plan to minor problems on recreational roads in the High Sierras. Public interest in these meetings was extremely high and the active participation by the general public proved invaluable in formulating plans and recommendations at the district level.

For the first time conferences and meetings were held relative to advanced planning of expressway extensions as a part of a freeway system in the mountain areas with low traffic densities and where future recreational potentials are great.

Progress on the Interstate System within District X continued steadily. Freeway agreements were completed and detailed planning initiated for 39 of the 44 miles on US 40. In addition, freeway agreements were completed for the entire 11 miles of Legislative Route 90 (Vacaville-Dunnigan cutoff), from east of Vacaville to the Yolo county line; and construction was started May 7 on the initial two lanes of an ultimate four-lane facility between north of Sweeney Creek and Putah Creek to connect with similar construction from Putah Creek north to Madison in District III.

Planning on State Route 238, the "Westside Freeway," reach the point where freeway agreements for the portions between the Fresno county line and the vicinity of Tracy are being prepared. The balance of this route from Tracy to the Sacramento county line is currently in the final study stage prior to holding public meetings.

Within the district all of US 99 has been expanded to four-lane status with approximately 95 percent of it being divided. Plans for the early conversion to full freeway status of the remaining portions are well advanced. These remaining portions are urban in nature with the attendant problems inherent in such areas. In the Merced area, however, the freeway agreements are complete and plans are entering the final stage. Public meetings have been held in the Turlock area. Freeway



agreements for the Ceres, Modesto and Lodi reroutes are complete and plans well advanced.

Major emphasis has been placed on the acquisition of rights-of-way needed for the Merced and Modesto freeway projects and on US 40, from Vallejo to Davis.

It is of interest to note that individuals and businesses displaced by the clearance program have been, for the most part, successfully assimilated into their respective communities, often in better facilities than previously occupied.

US 50

Three major projects between Tracy and Stockton were completed during the past year, converting the entire distance from the Tracy Overhead to Stockton to four lanes. From the Tracy Overhead to Grant Line Road and from Richards Avenue to Charter Way, four lanes undivided were provided as interim projects. From Mossdale to Richards Avenue a four-lane expressway, approximately seven miles in length, was completed. Included in the latter project were the Mossdale interchange between US 50 and State Sign Route 120 and an underpass at the Southern Pacific Railroad at a construction cost of $1,934,000.

A project to widen the East Tracy Overhead from three lanes to four is currently underway. The estimated cost of construction is $457,000.

US 40

An additional 3½ miles of freeway in Solano County was added to US 40 upon completion on January 6, 1959, of the portion between 0.2 mile north of Vallejo Wye and 0.4 mile north of Redwood Street. A four-lane expressway was converted to a six-lane full freeway with seven separation structures at a cost for construction of $4,501,500.

US 99

One project near Stockton will convert 1¼ miles to full freeway status. Two structures, eliminating two crossings at grade, the Mariposa Road Overcrossing and the Farmington Road Interchange, constitute the major portion of the work. It is estimated work will be completed about August, 1959, and the final cost will amount to $900,000.

State Sign Route 12

Work on the relocation of State Sign Route 12 from the Rio Vista Bridge across delta land to the Mokelumne River Bridge is about completed and it is anticipated the new stretch will be open to traffic in August. Final cost on this 5½-mile portion is estimated at $900,000. This new route will make a saving of 2.8 miles over the presently traveled route via Isleton. Work is still in progress on the Sacramento River Bridge and approach at Rio Vista.

Sign Route 49

A minor, yet interesting, project is located on State Sign Route 49, in Hell Hollow Ravine south of Bagby, in Mariposa County. This portion of the Mother Lode Highway dates back to the old mining days and was used to transport ore from the mines in the hills to the mills on the Merced River near Bagby.

This work of realigning and surfacing is an interim measure and has been carried on during the past three winters.

Sign Route 88

Work commenced in June on 2¼ miles of relocation of the Carson Pass Highway from Carson Spur to just east of the Alpine county line. The work involves heavy grading to improve alignment and eliminate a stretch of steep sidehill section with heavy curvature. It is estimated that 100 working days will be required to complete this project. The estimated construction cost is $425,000.

A section of Sign Route 88 between Lancha Plana Road and one-half mile east of Martell at a construction cost of $1,066,000 was completed late last year. A separate article on this project appears elsewhere in this issue.

State Sign Route 140

Work was completed on June 4, 1959, for one mile of grading and paving at the west entrance to Yosemite

UPPER—The new Rio Vista Bridge under construction across the Sacramento River. Extending from the far end of the bridge and into the background is the construction on the highway between the Sacramento River and the Mokelumne River in Sacramento County (Sign Route 12). LOWER—Looking southward over the improved portion of Sign Route 49 between Bagby (along river in left foreground) and Bear Valley in Mariposa County.

UPPER—The Mariposa Road (foreground) and Farmington Road Interchange on US 99 in San Joaquin County, a step in the conversion of the Stockton Bypass from expressway to full freeway. LOWER—The new US 40 freeway through Vallejo. In the foreground is the Tennessee Street Interchange.

National Park at a construction cost of $166,500. Sign Route 140 is known as the All-Year Highway into Yosemite and one of the more important recreational routes in District X.

Legislative Route 109

Work was started in June on a major interim project on McHenry Avenue between Needham Street and Modesto Irrigation District Lateral No. 3 at the north entrance into Modesto. This project will modernize a conventional two-lane highway into an all-paved four-lane undivided city street section with provision for parking. It is estimated the work will be completed early in 1960 at a construction cost of $1,100,000. Rights-of-way were provided by the City of Modesto.

Budgeted jobs still to be advertised this year are for Luther Pass to Picketts on Sign Route 89 and Cordelia to Fairfield on US 40.

County Roads

During the year of 1958, there were 15 federal-aid secondary county road and bridge projects under construction for a total cost of $4,545,000 in the nine counties comprising District X. The type and extent of construction varied from grading a 1.5-mile length of Blue Lakes Road in Alpine County at a cost of $42,000 to the construction of a double-leaf bascule bridge on Grant Line Road in San Joaquin County at a cost of $662,000.

City Streets

During the 1958-59 Fiscal Year, the 34 cities in District X were allocated $973,585 from Section 2107 gas tax funds for both general maintenance of city streets and construction on the major city street system. In addition, these cities were allocated $68,500 from Section 2107.5 funds for engineering expenditures on city streets. During the same period, the district processed memorandums of agreement for 80 city street projects.

On July 1 there were 1,045 contractors prequalified to bid on state highway projects. Their estimated combined bidding capacity is $2,115,000,000. Last year at the same time there were 1,018 prequalified contractors.

Toll Machine

Automatic Collection System May Prove Time, Money Saver

Governor Edmund G. Brown deposits the first quarter in one of the two new automatic toll takers installed at the San Francisco-Oakland Bay Bridge Toll Plaza.

An automatic toll collection system went into experimental operation on the San Francisco-Oakland Bay Bridge on May 21st, with Governor Edmund G. Brown depositing the first quarter in the machine.

The new system is designed to reduce traffic congestion caused by periodic brief jam-ups of traffic at the Toll Plaza without hiring standby personnel, State Director of Public Works Robert B. Bradford told the Governor.

"Where this has been tried in the East, people liked it," Bradford explained. "We want to test the local reaction."

Bradford pointed to another speed-up in toll collection for Bay bridges. The California Toll Bridge Authority changed the truck toll basis on the San Mateo-Hayward and Dumbarton bridges from weight to axle-count, effective June 1st, thus obviating delays while trucks are being weighed. The authority is considering making the same change on the San Francisco-Oakland Bay Bridge.

"These instances of increased efficiency in bridge toll collections," Governor Brown said, "are typical of the many ways in which we will save millions of dollars through work improvement and operating economies without reducing any necessary services to the public.

One automatic toll collection machine went into operation on May 21st to serve one westbound lane of the Bay Bridge; another was put into use the following week to serve one eastbound lane. If they work out successfully, additional machines will be installed.

The machines may be used only for passenger cars and only by motorists who have the 25-cent toll in cash. The machines cannot make change and cannot handle commute book tickets.

Use of automatic machines, if the experiment works out, will permit more lanes to be open during brief temporary peak traffic loads. The machines will enable motorists with the correct change to deposit their tolls as they proceed through the toll lane, slowly but without stopping.

Median Study

Research Project Determines Effect Of Barrier Design on Accident Rate

By GEORGE M. WEBB, Traffic Engineer

THE DIVISION of Highways has completed a new safety study dealing with accidents, particularly the infrequent but usually serious cross-median head-on collisions, on California's heavily traveled freeways, expressways and other divided highways.

The extensive study was the first of its kind and scope covering accidents on divided highways with extremely heavy traffic.

Purpose of the research project was to determine the effect of various median designs on accident rates, and to find the conditions under which a positive median barrier may aid in reducing the accident toll.

Included was a statistical and engineering analysis of 8,000 accidents which occurred on 265 miles of various types of divided highways in 1956 and 1957, plus a close examination of 407 fatal freeway crashes in the last three years. Special attention was given to cross-median accidents.

Divided highways chosen for the study were essentially limited access facilities — freeways, expressways or routes without roadside development —which carry an average from 15,000 to 200,000 vehicles a day. A similar study in 1952 dealt with average daily traffic volumes up to 25,000 vehicles.

Related Study Made

The study was made in conjunction with a series of radio-controlled crash tests, conducted by the Materials and Research Laboratory in Sacramento, in which new median barrier designs were developed. The impact tests and new barrier designs are described in another article in this issue.

As a result of this research, the new types of barriers will be installed shortly on sections of the Hollywood, Santa Ana, Ventura, and San Diego Freeways in the Los Angeles area, and the James Lick (Bayshore) and Nimitz Freeways in the San Francisco Bay region.

If experience with these initial installations proves successful, barriers will be installed on other heavily traveled freeways.

In reporting some of the principal findings of the safety study, it should also be emphasized that scores of recent highway engineering advances are incorporated in today's modern freeways, making this type of highway the safest ever known.

However, it is doubtful that anyone will ever come up with a completely accident-proof highway, and consequently safe driving practices and mo-

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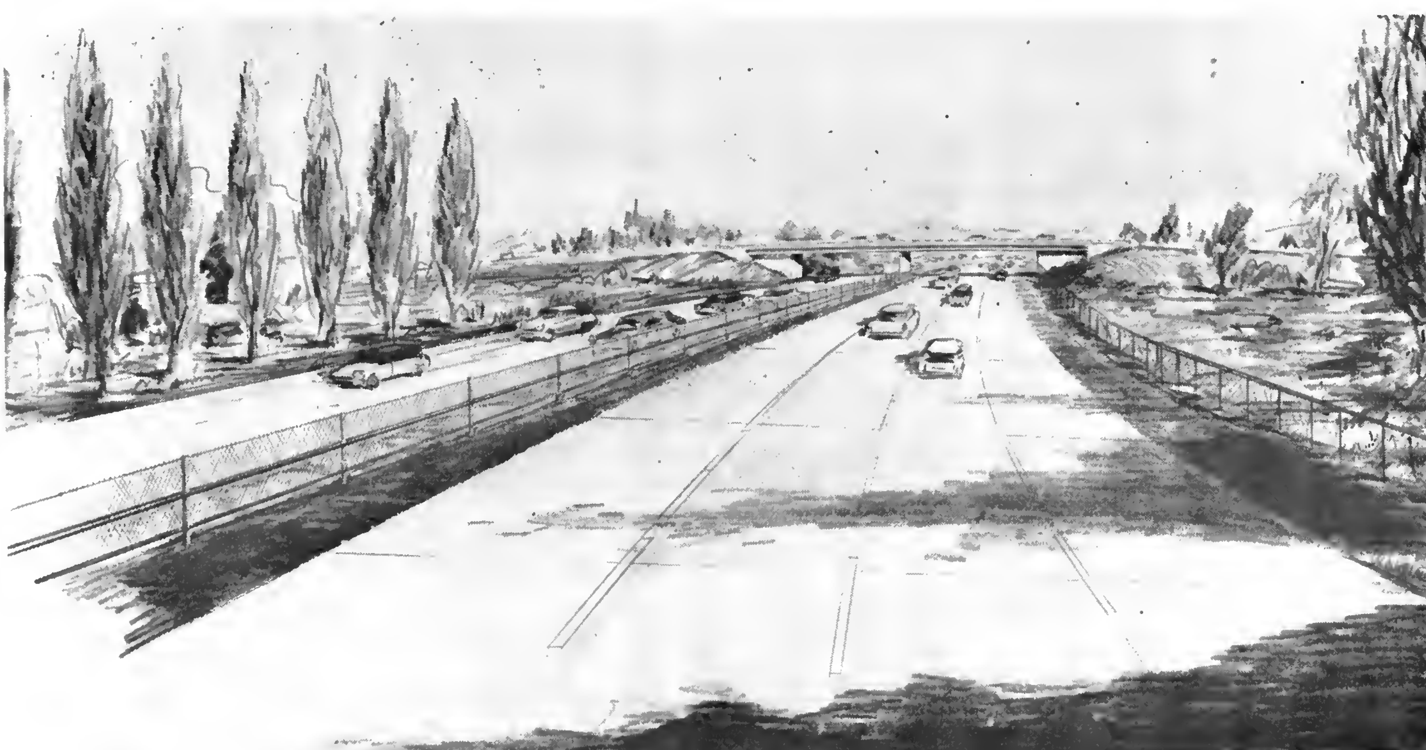


This drawing shows a new type of median barrier which will be installed in the center strip at some of the State's more heavily traveled freeways. The new barrier design was developed by division structural and materials experts during a series of full-scale crash tests. It is the only one of 15 types tested. The design utilizes chain link fence, light steel posts, and three ¾-inch steel cables.

Impact Tests

Barrier Test Crashes Reveal Valuable Data

By JOHN L. BEATON, Chief, Structural Materials Section, and
ROBERT N. FIELD, JR., Materials and Research Engineering Associate

THE DIVISION of Highways has had a comprehensive study of median barriers underway for the past several years. This article will describe one phase of this study—the actual dynamic testing and development of positive barriers for use in the median (center) strips.

It was the purpose of this study to develop a median barrier which would both prevent a high-speed vehicle from getting into the opposite lanes of traffic and to reduce the severity at the same time so far as possible of the accidents which result from a vehicle striking a barrier. It was therefore considered in the order of their importance that the following three functions should be considered to be primary features of a median barrier: (1) positiveness of preventing crossing of the median; (2) minimizing reflection of the offending vehicle back into the traffic stream; and (3) minimizing injury to the occupants of the offending vehicle. This dynamic phase of the study was initiated by the Traffic, Design, and Bridge Departments and approved by the State Highway Engineer on January 9, 1958. All work was guided by the Median Barrier Committee which consisted of members of the Traffic, Design, Bridge, and Materials and Research Departments. This committee originally approved the testing of three designs of bridge rails and 15 median barrier designs.

Figure 1. A 34-passenger bus is test-crashed into a cable-chain link barrier at 40 mph.

With all preliminary planning, instrumentation, and construction concluded during the spring of 1958, the first test was performed on July 10, 1958. The test site was an inactive runway of the Sacramento County Airport located near Franklin, California. Figure 2 shows a plan of the test site. Each test was conducted by first building the selected barrier design, duplicating field conditions as nearly as possible but yet retaining all factors under control so that each test would be as comparable as possible.

Factors Consistent

The crash car was driven into collision by remote radio control from a pilot car following to the rear and left of the test automobile as shown on Figure 2. All of the preliminary tests were conducted by driving a medium-weight four-passenger sedan automobile into the various test barriers at an approximate speed of 60 m.p.h. and at an angle of collision of 30°. This same weight of car, speed, and approach angle was used consistently within practical limits so as to obtain as good a comparison as possible between the various designs.

The preliminary tests were made on each of the original 15 barrier designs. Additional final tests, using both an automobile and a 34-passenger bus, were conducted on the two designs judged to be most efficient during preliminary testing. (The two most efficient designs are shown in Figures 4 and 5. Twelve other types are included in Figure 3; the design not shown was a modification of Type IV.)

The bus was driven into the barriers at 40 m.p.h. and an angle of 30°. The bus at 40 m.p.h. represented slightly more than twice the kinetic energy developed by the cars at 60 m.p.h. (Figure 1).

Since the primary aim of this study was to test the resistence of the various barriers, it was important that a severe type of oblique accident be employed. At the same time it was felt that the type of accident selected should not be beyond the realm of actual occurrence on a highway. The selection of the angle and speed of the test collision was based on this reasoning supplemented by a background of studies of many actual cross-median accidents as well as through analyzing this department's past experience with the many different speeds and angles of approach which were used during dynamic testing of bridge curbs and rails in the past. Thus it was decided that the 60 m.p.h. speed and the 30° angle of approach combination used for the standard passenger car test vehicle is representative of this severe type of oblique accident. With two exceptions this combination was used throughout the test program.

Approach Angle Varied

Since the majority of actual collisions with roadside railings and barriers usually occur between the angles of 15° and 20°, it was decided that at least one or more tests should be made at a lower than 30° angle of approach. Thus two such exceptions to the 30° approach were made so as to determine the change in reaction of the barrier due to the flatter angle of collision.

An anthropometric dummy restrained by a seat belt occupied the driver's seat of the test car during all collisions. Longitudinal and lateral deceleration recordings were taken from accelerometers located in the chest cavity. Similar decelerometer readings were taken simultaneously from the car frame.

Since the most important action in these test collisions takes place in less than a half a second and all of the movement occurs in less than three seconds, some means of accurately recording the proceedings was necessary for a later study. Therefore, a series of high and normal speed cameras were placed approximately as shown on the typical test site layout diagram, Figure 2, and used to record the tests covering all movements of the vehicle, the dummy, and the barrier during the collisions for this analysis.

The information on film, the strip chart recordings of the decelerations developed by "Sierra Sam" (the anthropometric dummy) and supplementary recordings of various dynamic strains by the use of SR4 gages located on some of the barrier systems made up the bulk of dynamic data collected during this study. In addition to this information, all physical changes in dimensions and conditions of the barrier systems were recorded by trained observers at the site along with observations and appraisals of damage to the car during and after collision.

Best Barrier Described

Of the 15 median barrier designs tested, only one satisfied all criteria as an overall efficient barrier when subjected to high-speed collision. The combination cable-chain link barrier, Figure 4, (1) acted as a positive barrier; (2) minimized the possibility of rear-end accidents by retaining the vehicle within the median strip, and (3) slowed the vehicle gradually, thereby minimizing the probability of serious injury to occupants of the car.

The second most successful design for a median barrier is the blocked out metal beam barrier shown by the test data sheet, Figure 5. This barrier answered all three criteria to some degree: (1) it did act as a positive barrier; (2) while it did reflect the offending vehicle back into the traffic stream, the speed and angle usually was such that following traffic would have some opportunity for evasive action; and (3) it resulted in decelerations of the offending car during collision which while high would be within the possible limits of human tolerance, so there is some probability of surviving a high-speed collision with this barrier.

For center strips where neither of the above two barriers are suitable, such as in areas where not enough space exists for the blocked out metal beam barrier or in places where earth foundation material is not available such as on a concrete structure, a concrete wall type barrier could be used. The concrete wall type design shown by barrier Number XII on Figure 3 proved to be too light by test. An adequate design would need to be slightly stronger than this tested design.

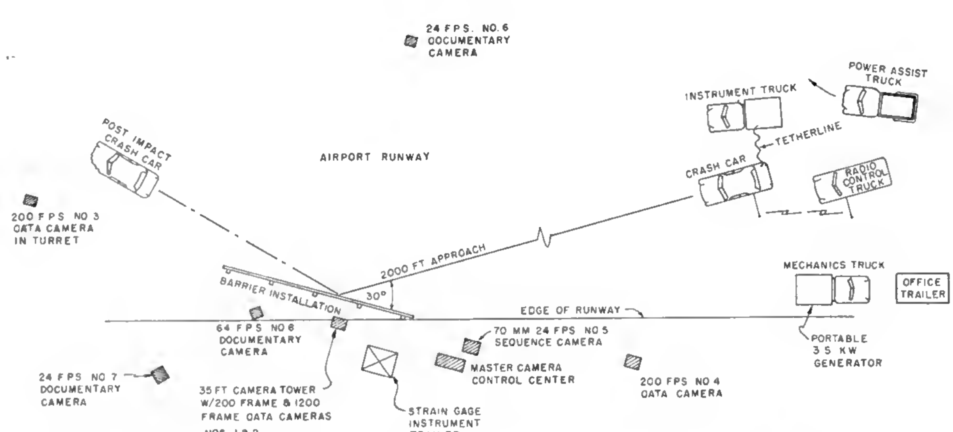
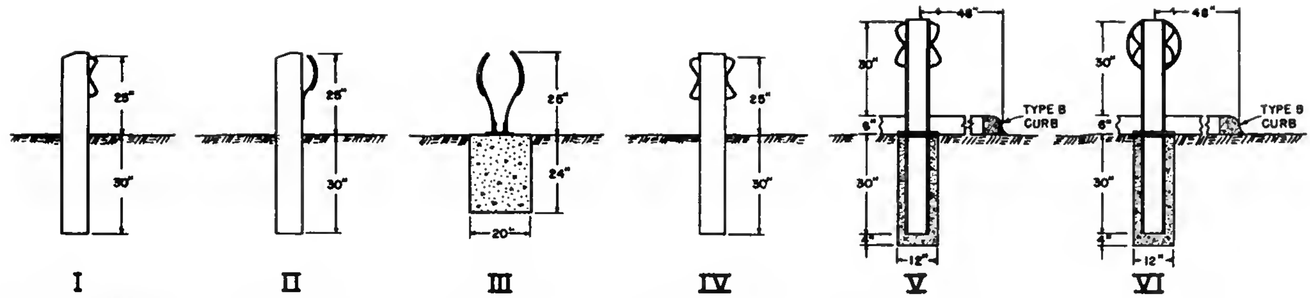
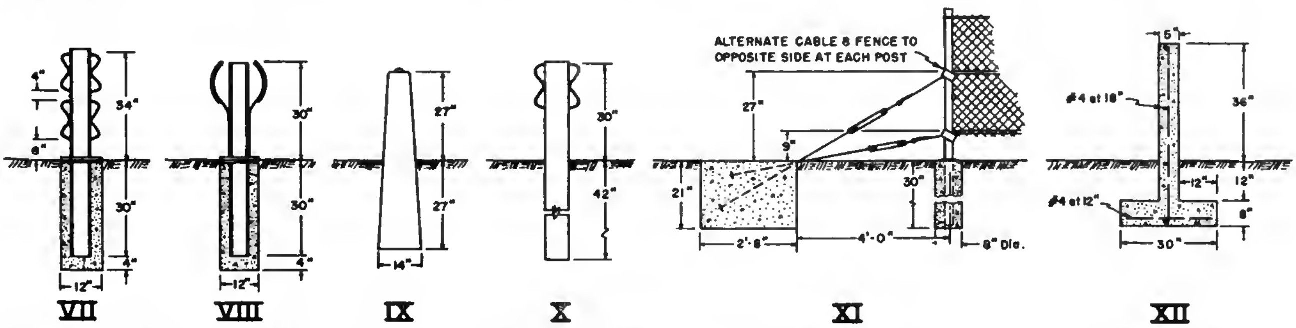


Figure 2. A plan view of the test site. The crash car was driven into collision by remote radio control from a pilot car following to the rear and left of the test automobile as shown above.



	I	II	III	IV	V	VI
RAIL	CORRUGATED BEAM	CURVED BEAM	CURVED BEAM	CORRUGATED BEAM	CORRUGATED BEAM	CURVED BEAM
BRACKET	NONE	HG15N	HG 26 N	NONE	NONE	HG 32 N
POST	8" x 8" D.F.	8" x 8" D.F.	HG 26 N	8" x 8" D.F.	6" WF 15.5 #	6" WF 15.5 #
POST SPACING	12'-6" CTRS.	10' CTRS.	6'-3" CTRS.	12'-6" CTRS.	6'-3" CTRS.	6'-3" CTRS.



	VII	VIII	IX	X	XI	XII
RAIL	CORRUGATED BEAM	CURVED BEAM	NONE	CORRUGATED BEAM	2-3/4" CABLE & CHAIN LINK	6" RIENF. CONC.
BRACKET	NONE	HG15N	NONE	NONE	NONE	NONE
POST	6" WF 15.5 #	6" WF 15.5 #	P.C.C.	8" x 8" D.F.	2 1/4" H 4.1 #	NONE
POST SPACING	6'-3" CTRS.	6'-3" CTRS.	5' CTRS.	6'-3" CTRS.	8' CTRS.	NONE

Figure 3. Preliminary tests were made on 15 barrier designs. Twelve of these are shown above. Two others, which proved the most efficient, are illustrated in Figures 4 and 5. The other design was a modification of Type IV above.

Concrete Barriers Tested

Successful tests on concrete wall barriers proposed as bridge railings show that when subjected to severe collisions this type of barrier will satisfy the first two criteria for a successful barrier but probably will not be a success in the third category. In other words, such railings can definitely be constructed to act as a positive barrier, will reflect the offending car back into its traffic stream, and the reflection angle will be such that the following traffic will have some opportunity for evasive action. However, the speed of the car caroming off the barrier will be so rapid that closely following vehicles will have little time for evasive action. Unfortunately, a concrete barrier produces much higher decelerations due to the change in direction during collision than either the cable-chain link or metal beam barriers and therefore the chance of survival during violent collisions appears to be minimized.

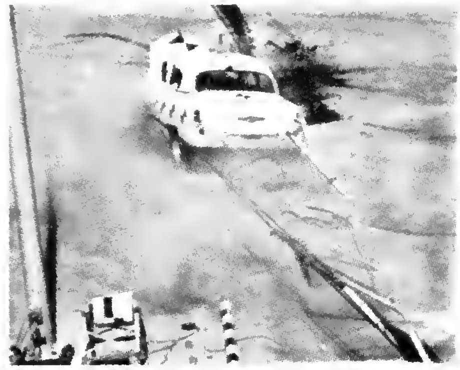
A departmental report has been prepared describing and analyzing the results of each test conducted during this program, but due to the limitations of an article of this nature, no attempt will be made here to develop this complete detail. The following discussion of this study is therefore limited to pertinent details.

The attention of the reader should first be directed to the fact that because of the cost of such a test program, it is always necessary to hold the number of tests to the very minimum needed to provide a proper guide to engineering judgment, rather than to attempt to perform sufficient testing to develop the absolute parameters of all details. It should also be pointed out that the results of this test program were tempered not only by the actual operating experience of the Division of Highways with several current designs of median barriers but also by a series of dynamic tests on various barrier curbing and bridge rails performed during the years of 1953, 1954, and 1955. This background will now be further supplemented by operating data of several trial installations of the two designs recommended by this study.

Barrier Types Listed

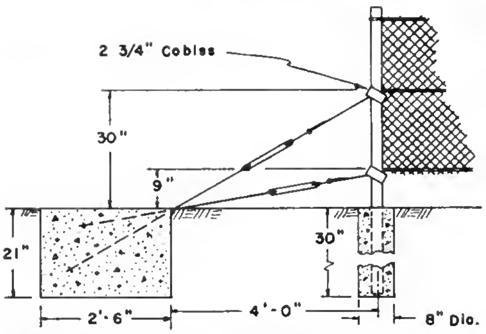
This study as well as research into studies by others led us to feel that barriers should be grouped in three broad classifications. These are the: (1) flexible type; (2) semirigid type; and (3) rigid. The criteria used in this study for a flexible type of barrier was a design which would fulfill the barrier concept while at the same time it would flex and deform under collision such that deceleration of the offending car would be tolerable to its occupants and at the same time would provide safe maneuvering time and space for any following cars in its own traffic stream. This being a relatively new concept insofar as median barriers were concerned, no practical working designs could be found, although certain varieties of rosebushes

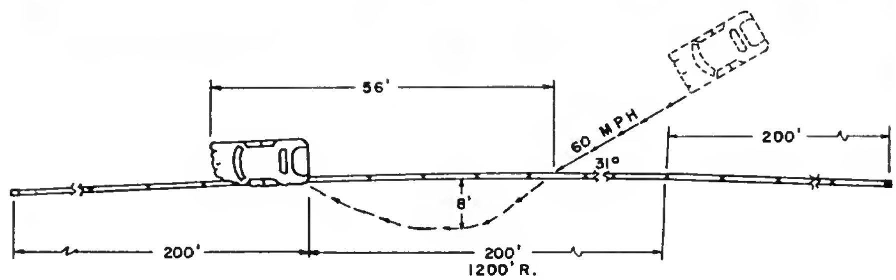
POST IMPACT



IMPACT + 750 M SEC.

IMPACT + 225 M SEC.





GUARDRAIL .... 36" Chain Link Fence w/2 3/4" cables 9" & 30" above pvmt.
POST .... 2 1/4" - 4.1 # H Section Fence Post.
POST SPACING .... 8' O.C.
LENGTH OF INSTALLATION... 600'
GROUND CONDITION .... Wet

DUMMY INJURY .... Scalp laceration, possible chest injuries.
GUARDRAIL DAMAGE .... 56' of fence knocked out. No damage to cables.
POST DAMAGE .... 12 posts damaged beyond repair.
VEHICLE DAMAGE .... Total loss.
MAX. DYNAMIC DEFLECTION OF RAIL ... 8'
VEHICLE DECELERATION (PEAK) ... Long. NG ...Transv. NG
DUMMY DECELERATION (PEAK) ..... Long. 6G ...Transv. 4G

TEST NO. 21
DATE 3-20-59
VEHICLE .... Chev. 53 Sedan
SPEED .... 60 MPH
IMPACT ANGLE ... 31°
VEHICLE WEIGHT... 3850 (W/ DUMMY & INSTRUMENTATION)

Figure 4. In order to determine the effect of a curve, a collision test was made on the outside of a barrier with a 1,200-foot radius, as shown above. The curvature had no effect on the overall results.

have been reported to function as such with partial success in wide medians in some of the eastern states. During the study period prior to this actual testing program, several different designs were considered by the Median Barrier Committee but were discarded for various reasons. One design, Design XI, Figure 3, was offered by the Landscape Design Section with the idea in mind that the chain link structure would have a double function as it could also be used to grow ivy or other leafy materials on it to serve as a headlight screen.

Six tests were performed on various detail modifications of this original design until the details shown on Figure 4 were developed. This design appears to be well balanced in that it functioned efficiently both at a low speed, low angle collision and at a high speed, high angle collision with passenger cars and at a high angle and speed bus collision. As noted above, it will support a growth of ivy or other vines to serve as a headlight screen. In areas where growth cannot be obtained, it is suggested that light wooden or metal strips be inserted in the chain link fabric to serve the same purpose. In the latter case it is probable that the chain link fabric should be at least 48 inches wide rather than the 36 inches used in this series of tests. Indications are that this additional foot in height will not seriously affect the operation of the design as a barrier as long as the cable system remains undisturbed.

Lower Cable Serves Purpose

The lower cable has a double purpose of serving to distribute the collision load to the back posts thereby stiffening the system in general while at the same time allowing the colliding wheel to pass over it during initial impact. This also serves as a trap preventing the return of the front wheel, thus helping to retain the car in the center strip. The nine-inch height appears to be about the right elevation for this trapping purpose.

The top cable chord, consisting of two cables, is the most important structural item in this system. Its placement with respect to height is critical, and its attachment to the post is likewise critical. If the cable is placed too low, it will either permit the car to pass on over the system or force the car to bounce back into the traffic stream. If placed too high, the cable might tend to slip over the car hood permitting the car to pass on through, perhaps severing the superstructure.

The final design height of 30 inches above the ground has proven to be approximately the proper height for this top cable. As this cable height is well above the center of gravity of most cars on the road today, there is no tendency for the car to roll over the cable. At the same time insofar as the average passenger car is concerned, the cable will cut into the body sheet metal and slip over the colliding wheel. This action helps to retain the car in the median area throughout the collision, as well as preventing the return of the vehicle to the traffic lanes. As shown by Figure 1, this height is also effective in stopping a bus.

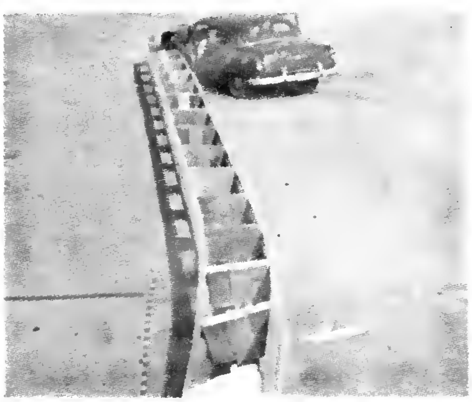
Single Versus Double Coble

The originally suggested design was tested using a single cable rather than the double cable shown in the final design. A load cell on this cable indicated that insofar as peak load is concerned, the single cable would serve. However, to be most effective the cable should be located on the collision side, thus the two cables. In addition the risk involved in kinking or cutting one cable during collision is such that the factor of safety provided by two cables is well worth the slight additional cost. The fittings used to fasten the cable to the posts must be so designed that they will clamp the cable firmly in place, but under collision loading can slip off the end of the posts, acting as a series of friction brakes. When installing this barrier, no attempt should be made to permanently fix the cable to the post. If the cable were fixed securely to the post, this would result in trapping and cartwheeling the car rather than gradually snubbing it to a tolerable deceleration.

The end anchorages do pose a definite problem. An anchorage strong enough to develop the strength of the cable is so strong that a car striking the cable at an anchorage is tripped rather than snubbed to a gentle stop. This tripping tends to cartwheel the colliding car in an uncontrolled manner with the possible unfortunate result that the car could pass on over the barrier, although such did not occur during the test of the anchorage system during this study.

Anchor Should Be Protected

Under operating conditions the anchor should be placed at a point where other fixed objects normally occupy the median area, such as a bridge pier. Insofar as distance between the anchors is concerned, it was determined by tests that each additional 100 feet of spacing would contribute not more than two or three inches of additional side deflection when subjected to collision. The only practical limitation in the length



POST IMPACT

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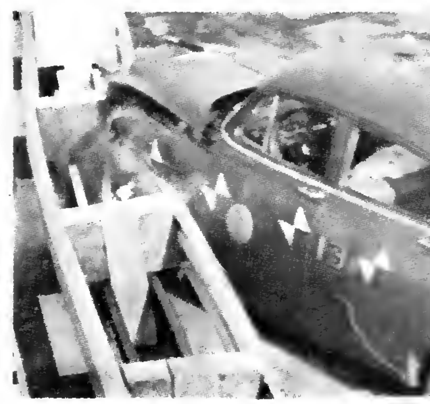
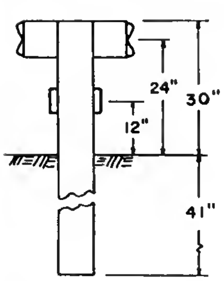
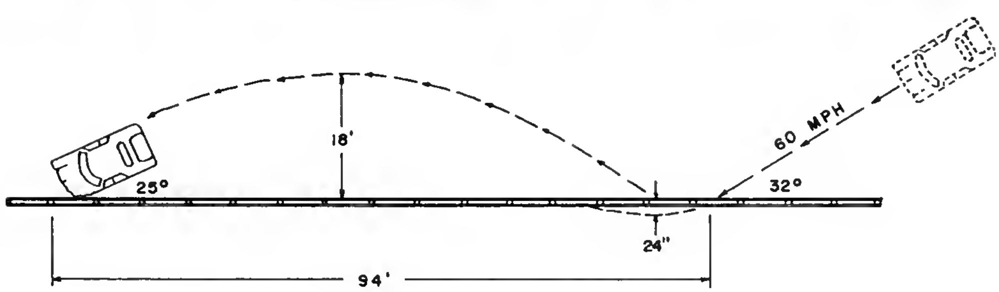


IMPACT + 100 M SEC.





GUARDRAIL	W Section	DUMMY INJURY	Possible left shoulder, arm & side injuries.	TEST NO.	13
CHANNEL	6" ⊓ 8.2 #	GUARDRAIL DAMAGE	4 Sections damaged beyond repair.	DATE	12-18-58
BRACKET	8x8x12 D.F Block	CHANNEL DAMAGE	4 Sections damaged beyond repair.	VEHICLE	Chev. 53 Sedan
POST	8x8 D.F.	POST DAMAGE	3 Posts damaged beyond repair.	SPEED	60 MPH
POST SPACING	6'-3" O.C.			IMPACT ANGLE	32°
LENGTH OF INSTALLATION	125'	VEHICLE DAMAGE	$ 900	VEHICLE WEIGHT	4000
GROUND CONDITION	Dry	MAX. DYNAMIC DEFLECTION OF RAIL	37"	(W/DUMMY & INSTRUMENTATION)	
		VEHICLE DECELERATION (PEAK)	Long. 104 G ... Transv. 198 G		
		DUMMY DECELERATION (PEAK)	Long. 16 G ... Transv. 18 G		

Figure 5. Tests on a semi-rigid barrier of timber posts in an earth foundation are shown above.

would be that determined by the effect of temperature or the taking up of slack during repair. If an anchor must be placed in an isolated location, then it should be protected with a metal beam barrier. In order to determine the effect of a curve, a collision test was made on the outside of a 1,200-foot radius curve as shown in Figure 4. The curvature had no effect on the overall results.

The cables should be placed and maintained in a snug condition but should not be stretched enough to produce any appreciable initial stress. In order to maintain the cable in this condition, turnbuckles need to be placed about every five hundred feet so as to permit adjustment for average seasonal changes as well as provide reasonable lengths for construction and replacement.

The cable-chain link barrier is estimated to cost slightly less than half as much as the blocked out metal beam barrier. The metal beam design is estimated to cost approximately $11 per lineal foot.

The criterion used in this study for a semirigid type of barrier was a design strong enough to fulfill the barrier concept while at the same time capable of deforming into a smooth curve without "pocketing" under collision. A change of direction of the colliding car would not be as abrupt as if the barrier were as completely rigid as a concrete wall. The semirigid barrier should provide some opportunity to the occupants of the offending car to survive and at the same time permit a reflection of the car at an angle flat enough to allow following cars an opportunity for evasive action.

Nine Designs Selected

During the study period prior to actual testing, nine different designs were selected by the Median Barrier Committee for testing. These are Designs I, II, III, IV, V, VI, VII, VIII, and X on Figure 3. The results of tests of these installations led to the barrier shown on test sheet Figure 5.

General findings of the tests on the first nine designs were that the semirigid barrier height has to be above the center of gravity of the vehicle and permit the front of the impacting vehicle to bind or be entrapped under the top rail. This action tends to brake the car, hold the rail at its original elevation, and reduce the tendency for the car to roll laterally with the barrier when the posts of the system are forced back and down. If such provisions are not made, then a tendency to roll is imparted to the car as is illustrated by Figure 6. Unfortunately, it was also found that when a rail is placed high enough for the car frame and wheel to get under it, it is necessary to protect the posts of the barrier system from direct collision with the vehicle, otherwise the car frame impacts the post and is subjected to excessive decelerations such as is illustrated by Figure 7.

These two problems were solved first by placing the top rail in a position blocked out from the post at a height so that the car, no matter what the angle of collision, would have just sufficient space to force under the rail. The posts exposed below the top rail were protected by a lower rail so as to prevent the car from direct collision with the posts. Test results also indicated that steel posts mounted in concrete were too rigid for this type of barrier, that a balanced design indicated better success with the system if the more resilient action of Douglas fir timber posts in earth foundation were employed. This latter combination created a barrier system which had a good dynamic reaction within the classification of semirigidity. The overall results are shown on the test data sheet, Figure 5.

Rigid Barrier Considered

For the purposes of this study a rigid barrier was considered to be a structure that would neither fail nor measurably deflect under collision loading. During this study only one design, Design XII on Figure 3, was constructed specifically as a median barrier. However, this particular design was supplemented by information gained by dynamic tests of five concrete bridge rails performed and reported in 1955 and two such rails tested during this program. The barrier utilized for the current series was extremely light and failed during the test. However, its results coupled with the other information already referred to indicates that a successful concrete median barrier could be developed to cost about $11 per lineal foot.

One other type of concrete median barrier was tested during this study. It is shown as Design IX on Figure 3 and consists of a series of truncated cone concrete posts placed at five-foot centers. This design was not effective as a positive barrier and so should be considered only as a deterring type of median barrier.

During this series of tests only one curb height was tested. This was the typical six-inch high Type B curb employed around many California highway median areas. However, the findings from these two tests are supplemented by some 200 previous full-scale tests performed on highway bridge curbing and so are sufficient to support firm conclusions as to the effect of curbings in front of a median barrier. At high speeds the six-inch high type of curb seems to have little or no effect on either the rise or deflection of the collision car. This is explained by the fact that wheels and springs of a car are deflected over the six-inch high curb with little appreciable change in elevation of the car itself. In other words, both the center of gravity of the car and the frame of the car maintain their traveling elevation while the raise of the curb is taken up in the deflection of the tire and the springing system of the car. This effect is only true where the travel time between the curb and the barrier is very short in that the car soon recovers its original relative elevation to the ground and due to rebound is for a short time elevated above normal. Previous studies show that where the curb is eight inches or higher, an immediate "dynamic jump" is imparted to the car. Therefore barriers behind such curbs must contain a provision to contain the dynamic rise.

Standard 4-door Sedans Used

Excluding one 34-passenger 17,000 lb. bus, the vehicles employed in this 1959 test series were standard 4-door sedans weighing about 4,000 lbs. with dummy and instrumentation. The center of gravity of these vehicles was between 21 and 23 inches above the pavement. In converting these cars for radio remote operation, the rear seat, spare tire, and gas tank were removed

UPPER—Figure 6. Tests showed that the height of a semi-rigid barrier must be above the center of gravity of the vehicle; otherwise, a tendency to roll is imparted to the car, as shown here. LOWER—Figure 7. Tests also revealed that if a rail is placed too high, the car frame and wheel may get under it and strike the post, decelerating the vehicle too rapidly, as shown here.

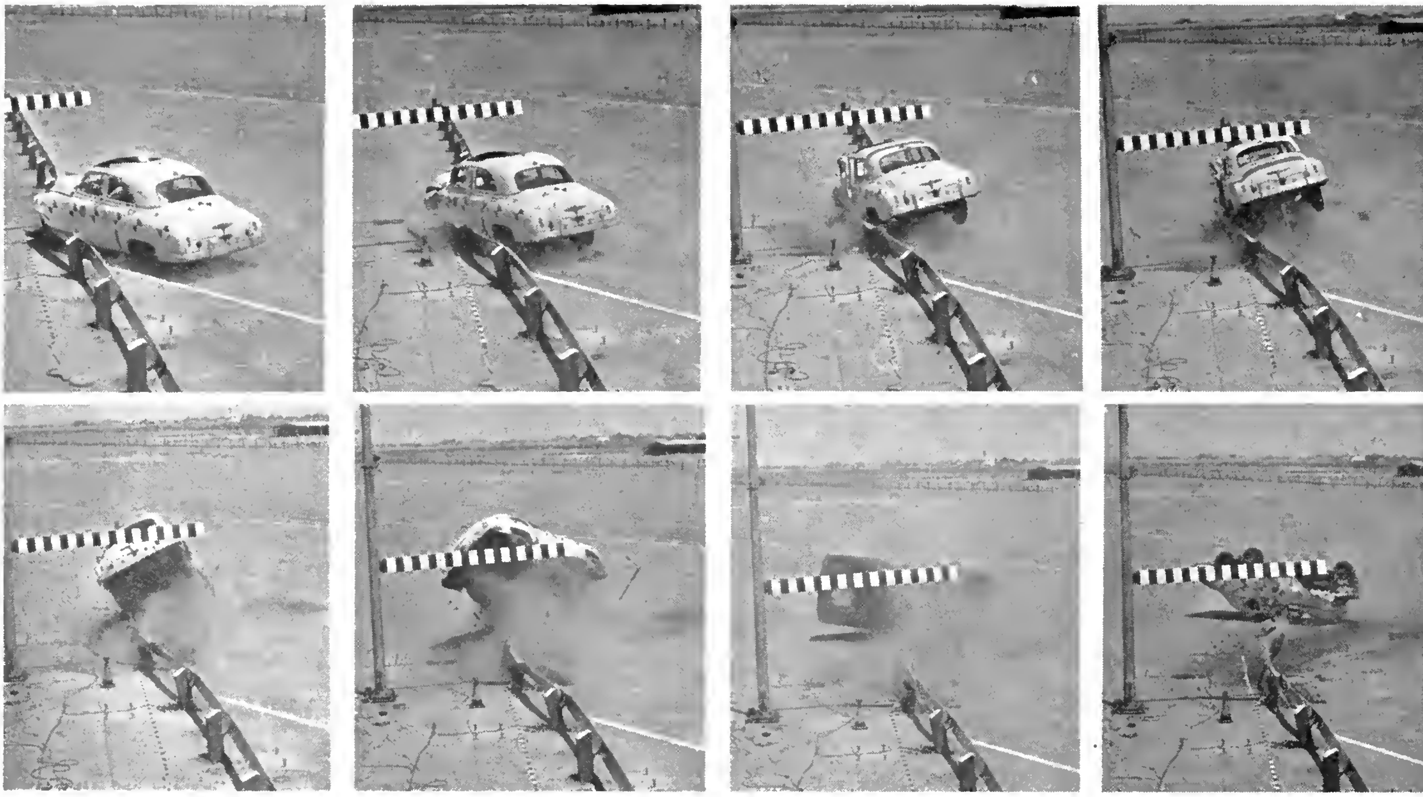


Figure 8. These photos illustrate the film strips used for test analysis. The series shows progressive positions of the test car from the first collision in the upper left corner to rest in the lower right.

and the following equipment was installed:

1. The radio control equipment for remote driving the cars was securely bolted down in the trunk compartment. Whip antennae were mounted on the rear of the vehicle.
2. A small walkie-talkie transmitter mounted adjacent to the radio control receiver rebroadcast the command signals back to the control operator following behind the crash vehicle. This feedback of signals was essential in providing the control operator audio contact with the crash car to insure that command signals were properly received and executed before the actual response of the vehicle was visible.
3. The 12-volt D.C. steering motor was attached to a mounting plate welded to the front floorboard. The motor was belt connected to an adjustable sheave on the steering wheel.
4. A motor actuated Bendix hydrovac booster was attached to the master brake cylinder.
5. The ignition system was bypassed and wired into the radio control receiver.
6. A one-gallon heavy wall gas tank was installed over the spare tire well. Safety vent and supply valves were employed to prevent fuel spillage or damage in case of fire.
7. Accelerometers mounted in the dummy and on the crash vehicle frame transmitted deceleration data to recording equipment through a coiled 300 ft. tether line connected between the crash vehicle and a close following instrument truck.
8. Two 12-volt storage batteries mounted on the rear floorboards furnished power to all control instruments and the radio equipment.

The radio control transmitter was mounted in the bed of the control truck. A special steering switch and brake switch on the dashboard of this pilot car transmitted three specific modulated tones. These tones were received through a selective relay system in the radio control receiver to steer or brake the crash test car. In case of emergency shutting off the transmitter or applying the brakes would kill the ignition in the crash car.

The crash car was placed in operation by clamping the throttle full open, placing the car in high gear, turning on the radio control transmitter which would activate the ignition, and pushing the car with a truck until the engine started and took hold. A peak speed of 58 to 62 m.p.h. on the 2,000 ± foot collision path was attained.

Camera Produces Sequence

The 70 mm. sequence camera was used to produce a documentary series which could be enlarged to examine details of the impact. The bulk of the photographs reproduced in this article were made with this camera which has proven itself a valuable tool. A sequence is illustrated by the series of stopped action photographs of one test shown by Figure 8.

During the two bus crashes an additional 200 f.p.s. camera was mounted

. . . Continued on page 55

Study Tour

Commission Has On-the-spot Look at North State Highways

Members of the California Highway Commission and engineers of the Division of Highways discuss regional highway problems with city and county officials and other leaders of the North Coast area at a luncheon at Hartsook Inn June 26th. This was one of a series of such meetings which the commission held during a 2½-day tour into Northern California counties.

—Photo by The Redwood Record, Garberville

The California Highway Commission made a 2½-day business tour into Northern California in late June after holding its formal June meeting in Sacramento.

The commission members familiarized themselves with freeway route proposals and other highway planning and inspected construction projects in Tehama, Shasta, Trinity, Humboldt, Mendocino and Sonoma Counties.

A series of similar trips is planned to take the commission to all parts of the State.

The July meeting was scheduled for Los Angeles, followed by a tour into Orange and San Diego Counties.

Robert B. Bradford, State Director of Public Works and chairman of the commission, explained the purpose of the trips.

"We want to get a firsthand impression of planning and construction and the people's ideas," Bradford said.

"Our trips will supplement the more formal procedure and ensure that we, personally and individually, keep in touch with the people and the problems."

After leaving Sacramento on the start of their northern trip, the commissioners drove north along US 99W to Red Bluff, where they split into two groups. One went north along US 99 to Dunsmuir and returned to Redding. The other reached Dunsmuir and Redding after driving over State Sign Route 36, through Lassen Volcanic National Park, and over State Sign Route 89 to US 99.

The first night of the trip the commissioners met Shasta County residents at a dinner in Redding arranged by the Redding Chamber of Commerce.

On the second day, the commissioners drove west on US 299 and stopped at Weaverville to meet with Trinity County officials and citizens. They continued on the same highway to Eureka, where they met North Coast officials and citizens at a meeting arranged by the Eureka Chamber of Commerce and Humboldt County Board of Trade.

During the afternoon of the second day, the commission members again split forces. Some inspecred US 101 projects at Trinidad and Big Lagoon, while others remained in Eureka for a public meeting to hear citizens.

The commissioners toured southward along US 101 on the third day, with stops to meet the public at Hartsook Inn, Ukiah and Santa Rosa. City and county officials, chamber of commerce members, and officers of the Redwood Empire Association met the commissioners at these affairs.

Officials of the Division of Highways from headquarters at Sacramento and from district offices at Redding, Eureka and San Francisco accompanied the commissioners on their tour.

Record Award

Department's Andrew B. Schoellkopf Wins $11,808 for Money-saving Idea

Governor Edmund G. Brown has presented an $11,808 merit award check to Andrew B. Schoellkopf, an accounting officer in the Sacramento office of the State Division of Highways.

The Governor said he was informed that this "is the largest check ever given to any federal, state, city or county employee for a suggested improvement in governmental operations."

Schoellkopf, 44, received the check in a ceremony on June 15th in the Governor's office at which his family was present. Also on hand were Director of Public Works Robert B. Bradford and Assemblyman Thomas J. MacBride of Sacramento.

Schoellkopf's suggestion called for legislation making the State Treasurer trustee for all counties in condemnation proceedings instituted by state agencies.

Under the legislation, sponsored by MacBride and approved in 1957, the amount of cash ordered deposited by courts in the condemnation proceedings is placed with the State Treasurer with accompanying instructions that he invest the money in securities with the resulting interest to revert to the State.

Until this legislation went into effect, the money was deposited with the clerks of the courts involved and there was seldom any interest on the money during the frequently protracted proceedings.

In the first year the legislation was in effect, the resulting gain in net interest earnings to the State was $140,176. With increasing interest rates, it is anticipated that the annual amount will be sharply increased in the future.

Schoellkopf received an initial award of $150 from the Merit Award Board. The additional check given him today is based on a sliding scale governing awards dealing with the savings of large sums in state operations.

Governor Edmund G. Brown presents Andrew Schoellkopf (left) the record $11,808 check for his Merit Award suggestion as Assemblyman Tom MacBride (center) beams approval.

Both houses of the Legislature approved a resolution authorizing the payment.

Marvin L. Blanchard, Chairman of the State Merit Award Board, said 16 other state employees are scheduled to receive additional awards this year.

Schoellkopf lives in Sacramento with his wife, Bernice, and two children, Andrew B., Jr., 6, and Nancy, 4. He has been employed by the Department of Public Works in the Division of Highways for 22 years.

"Mr. Schoellkopf's achievement has brought the State and himself substantial financial rewards," the Governor said. "I hope it also serves as a reminder to all of us that we should never accept the idea that there isn't some better way of doing almost anything being done in State Government.

"If we are alert, we can and will find hundreds of ways to improve state operations, to reduce expenses and to realize substantial savings for the taxpayers."

Director of Public Works Robert B. Bradford said in his congratulatory letter to Schoellkopf:

"It was a proud occasion for all Department of Public Works employees when Governor Edmund G. Brown presented you with the $11,808 award. All of us, all 14,000 of us, were glad that it was one of our fellows who contributed an idea that will annually earn for California taxpayers well over $100,000.

"Your suggestion alone would prove the value of California's merit award system. But your suggestion is only one of thousands which state employees make every year as their individual and personal contributions toward improved efficiency and economy in government. The total effect of all the employee suggestions is the significant strengthening of California's State Government."

The new west approach to the I Street Bridge across the Sacramento River at Sacramento was reopened to traffic on July 3d, six weeks ahead of schedule.

McCoy Honored

Legislature Lauds Career of State Highway Engineer

RESOLUTIONS honoring State Highway Engineer G. T. McCoy were adopted unanimously by the State Senate and Assembly in the closing days of the 1959 Regular Session of the Legislature.

Occasion for the resolutions is the impending retirement of McCoy, who will reach compulsory retirement age this fall.

The Assembly's Resolution No. 346 was introduced by Assemblyman Vincent Thomas of San Pedro and the Senate Resolution, No. 168, by Senator Randolph Collier of Yreka. Both resolutions take note of the growth and progress of the California highway program during McCoy's 16-year tenure as State Highway Engineer, and both call attention to the nationwide professional honors he has received.

Text of House Resolution No. 346, introduced June 9th, and adopted June 17th:

"WHEREAS, It has come to the attention of the Legislature that George T. McCoy, State Highway Engineer, is within a few months of attaining compulsory retirement age after a distinguished engineering career extending over 44 years in the public service, 32 years of it in the service of the State of California; and

"WHEREAS, Mr. McCoy has served as State Highway Engineer and Chief of the California Division of Highways since 1943, during which period he has been responsible for the expenditure of more than two and a half billion dollars in the construction, maintenance and operation of the State Highway System; and

"WHEREAS, Under Mr. McCoy's strong and capable leadership the highway program of the State of California has attained a position of widely acknowledged pre-eminence throughout the Nation and the world, particularly in the development of freeways and other modern contributions to the economy, efficiency and safety of motor vehicle transportation so essential to the growth and welfare of the State; and

"WHEREAS, Mr. McCoy has been accorded nationwide professional recognition and honor, including his election in 1954 as President of the American Association of State Highway Officials and his selection by that association in 1958 as the recipient of the Thomas H. MacDonald Award for outstanding achievement in the development of highways, reflecting great honor on the State of California and its highway program; now, therefore, be it

"*Resolved by the Assembly of the State of California,* That the Members of the Assembly of the State of California do hereby express to George T. McCoy the gratitude and appreciation of the people of California for his accomplishments in the field of modern highway transportation and their heartiest wishes for a long and enjoyable retirement; and be it further

"*Resolved,* That the Chief Clerk of the Assembly be directed to transmit a suitably prepared copy of this resolution to George T. McCoy."

Text of Senate Resolution No. 168, introduced and adopted on June 17:

"WHEREAS, The Members of the Senate have learned of the anticipated retirement in September 1959, of the Chief of the California Division of Highways, George T. McCoy; and

"WHEREAS, Mr. McCoy, who was born in Milton, Oregon, on September 12, 1889, spent his early life in the northwestern states, completing his education in engineering at Whitman College, and Columbia University in New York City; and

"WHEREAS, His professional abilities won early recognition with his first major assignment as assistant engineer on bridge and dam construction and highway relocation in connection with the $300,000,000 Catskill Aqueduct; and

"WHEREAS, Returning to the Pacific Northwest in 1916, Mr. McCoy held various positions with Washington, North Dakota, and the United States Bureau of Public Roads before coming to work for the State of California in 1927; and

"WHEREAS, During the succeeding years his exceptional administrative ability resulted in rapid advancement in the California Division of Highways, until in 1943 he was named Chief of the Division by Governor Earl Warren's Director of Public Works, Charles H. Purcell; and

"WHEREAS, As State Highway Engineer for the past 16 years, George McCoy has been in charge of the vast expansion of the State Highway System representing the expenditure of some $2,500,000,000, and involving the construction of 2,300 miles of multilane divided highways; and

"WHEREAS, He has accomplished this tremendous task with commendable speed and efficiency, winning an enviable reputation throughout the states as a top ranking highway engineer and administrator; and

"WHEREAS, His accomplishments were accorded nationwide recognition on December 1, 1958, when the American Association of State Highway Officials conferred on him the Thomas H. MacDonald Memorial Award for outstanding service in highway engineering; now, therefore, be it

"*Resolved by the Senate of the State of California,* That the members take this opportunity to commend George T. McCoy for his long and distinguished career in public service, and to extend their sincere and hearty good wishes for his future health and happiness; and be it further

"*Resolved,* That the Secretary of the Senate is directed to transmit a suitably prepared copy of this resolution to Mr. McCoy."

Benicia-Martinez Bridge Bonds Sold

The California Toll Bridge Authority has sold $34,000,000 revenue bonds to finance construction of the Benicia - Martinez Bridge and approaches.

The bonds were sold July 28 to F. S. Smithers and Company and Associates, New York City.

Low bids totaling $14,238,485 for construction of the bridge substructure and superstructure were received July 22 and 23 by the Division of Highways. The bids on these two largest units of the Benicia-Martinez project totaled about $9,000,000 under estimates.

As a result, it will be possible to go ahead with construction of freeway approaches under bond financing, as originally planned, instead of delaying work on the approaches pending availability of federal and state highway funds.

Total estimated cost of the entire project, including the freeway approaches, is now approximately $29,000,000. Upon completion of the project, the surplus remaining from the $34,000,000 bond money will be available for the bond reserve fund.

California Again Is Top Vehicle State

California again topped all other states in motor vehicle registration last year, according to figures released by the United States Department of Commerce.

A total of 7,013,163 vehicles was registered in California in 1958. This is more than 10 percent of the national total of 68,229,408.

New York had the second highest registration, with 4,876,748. Texas and Pennsylvania also had more than four million. Illinois, Michigan and Ohio had more than three million vehicles, and the totals for New Jersey and Florida were over two million. The nine leading states combined had 51 percent of the national motor vehicle registration total.

Delaware, Nevada, Vermont and Wyoming had fewer than 200,000 vehicles each.

The national percentage gain from 1957 to 1958 was 1.7 percent. California registrations increased 2.7 percent.

Veteran Nevada City Road Foreman Retires

Walter M. Barnes, highway foreman in the Nevada City maintenance territory, retired June 30th after nearly 37 years of service with the Division of Highways.

Barnes began his state service in September, 1922, at Colfax and was made a highway foreman in June, 1923, at Colfax. Succeeding years found him working at Alta from April, 1926, to November, 1926, and returning to Colfax in November, 1926. He also served as foreman at Yuba Gap for a period of seven months in 1941. During his lengthy career, Barnes has work on the three different highways from Auburn to Colfax and has served under nine maintenance superintendents.

Barnes has three daughters, two sons, and 12 grandchildren. He also has two brothers in state service—one with the Department of Employment in Sacramento and the other with the Division of Highways at Antioch.

His plans for retirement include some traveling and hunting.

Newspaper Defends Department's Method, Motives in Acquiring Land for Freeways

The following editorial appeared in the Long Beach Press-Telegram of June 17, under the title "Some Must Sacrifice When Roads Are Built":

"A Recent story in this newspaper aired some of the problems and protests of citizens whose homes are affected by the routing of the San Diego Freeway through this community.

"We sympathize with all who suffer hardships caused by freeway construction. But we think the public, instead of jumping to emotional conclusions, should consider why these actions againsr private properties occur.

* * * * * * *

"The Current complaints are not the first of their kind, and they will not be the last. Obviously the Division of Highways doesn't go around seizing property out of some warped urge to displace comfortably-housed citizens. The property is taken in the name of and for the welfare of the people of California.

"The right of government to take the land it requires for the development of public services is so well-established that it need not be defended.

"Freeways are a public service. Freeways—including the San Diego Freeway—are not imposed upon the public but result from public demand for swifter, safer facilities for the handling of California's enormous flows of traffic.

"By the year 1980, this State will have a population of about 31,000,000 people operating about 17,000,000 motor vehicles at a rate of 200,000,000 vehicle-miles annually. This traffic will require freeways and more freeways. The projected freeway system, according to the Joint Interim Committee on Highway Problems, will save 30,000 lives by the year 1980. The reduction of highway fatalities by 60 to 75 percent would seem a persuasive argument in favor of freeway construction, even though such construction may inconvenience some property owners.

"The process of planning a freeway and obtaining the property in its path is not a sudden, ruthless, and unpublicized one.

"First, the need is determined. Then the public is informed of tentative plans. Adequate hearings are conducted before a route is adopted. After that, the state determines ownership of the lands which are needed, and those lands are appraised by professional appraisers. The State tries to negotiate with the property owners—and in most cases is able to do so satisfactorily. Only in a small number of cases is it necessary to condemn the property in question.

"Property owners near the freeway route wonder, of course, what the freeway will do to property values in the area. The Division of Highways reports:

" 'Resale prices on homes next to freeways follow a pattern similar to that on comparable homes elsewhere in the same tract. Interviews with people living alongside freeways showed that to 5 out of 10 the freeway location made no difference, 3 out of 10 preferred their location and 2 out of 10 did not like it. Noise and fumes from free-flowing traffic on a freeway are much less noticeable than from ordinary stop-and-start traffic.'

"A large percentage of homes in any tract have been purchased through GI loans. When such homes are purchased by the State, GI loan privileges are restored to the owner and can be used for purchase of other property.

* * * * * * *

"So, the Acquisition of freeway rights-of-way is certainly not a process of sudden, inconsiderate eviction of families from their property. It is a considered, slow process based on public need, with adequate compensation granted by negotiation or, if the owner chooses, through court decision.

"As the State grows and the freeway system expands, many thousands of California citizens will find their property affected by state action. An understanding of the basis of the State's demands will make it easier for all concerned."

Sign Washing

Special Crew Keeps Large Freeway Signs Spic and Span

A RAPIDLY growing function of the maintenance department in District VII is the cleaning of freeway signs.

The 280 miles of freeways and expressways completed to date by the Division of Highways in Los Angeles, Orange and Ventura Counties contain more than 500 separate sign structures. Each sign structure supports from one to three signs, depending upon location and design. The signs vary in size from 40 inches to 120 inches in height and from 10 feet to 36 feet in length.

The location of the sign governs to a certain extent the frequency of desirable cleaning. Experience indicates that the average sign should be cleaned annually. However, since sign washing is an item of work that can be deferred in favor of other more urgent items, our cleaning program sometimes includes only the most critical installations.

The equipment presently in use in this district consists of tower trucks, a 300-gallon sign washer, and two types of personnel lifts. Each piece of equipment is specialized and is used at specific locations.

Cleaning in progress on one of the later model overhead signs with a catwalk, this one on the Harbor Freeway.

Normally, a two-man crew is sufficient for washing most of our signs; however, additional manpower and equipment are required at certain locations to provide for traffic control or flagging. On our newer type sign bridges where catwalks, drain spouts, and drip pans are in place, washing may be performed with little or no interference to traffic. On sections where it is necessary to close the outside lane of traffic, we may work only in the off-peak hours. Cones and high level warning devices are set out approximately 500 feet to 750 feet in advance of the work to transition traffic out of the closed lane. On sections where the inside lane, or lanes, must be closed in order that signs may be washed, this work must be performed in the period having the lowest traffic volume. Old type sign bridges and signs mounted on the face of overhead or separation structures, are typical of the type mentioned above. In these areas we perform this work on Sundays between daylight and approximately 9 a.m. when traffic can be funneled into one or two lanes. Local police departments or the California Highway Patrol are always notified in advance of this type operation and one or more officers are specifically assigned to work at the area in question.

Long Life Span

All of our overhead signs and most of our ground-mounted signs are made of porcelain enamel on either iron or aluminum sheeting and are reflectorized by means of acrylic plastic reflex reflectors or are illuminated by fluorescent electric lighting tubes. This type of sign has an anticipated life of over 20 years if not damaged by vandalism or by accident. This material will not be damaged or its life shortened by any standard cleaner that we have found available on the market.

The illuminated signs when new had a contrast factor of approximately 25 to 1 (measured in foot lamberts with a spectra brightness meter). Light readings have been taken on extremely dirty black and white signs and found to have a contrast factor as low as 6 to 1. On some of these signs we have merely washed the white lettering with a good glass cleaner. Although the daytime appearance has been very favorable we find in checking these signs with the brightness meter that we have not improved the nighttime visibility to any appreciable extent. Therefore, on the basis of the above, it would appear to be mandatory that the entire sign panel and particularly the background surface, be cleaned. We have found that by using a wet method—detergent and water—that we can do an effective cleaning job at the rate of 5 to 10 square feet per minute. This rate, however, is influenced by the amount of dirt on the sign, type of traffic encountered, traffic controls required, etc. Using the dry method—namely, with a paste or liquid applied directly to the panel and then wiped off by hand, we can do approximately two square feet per minute. While this method is more costly, it definitely does a superior job when used on those signs which are subject to the collection of diesel smoke or other foreign material. Actually it is the only satisfactory method we have found to date.

UPPER—On sections where an inside lane must be closed to wash signs, the work is done during a time when traffic is light, usually from daylight to 9 a.m. on Sunday. A flagman is always used to afford further protection to the men and equipment. LOWER—Signs such as this one on the Cahuenga Pass section of the Hollywood Freeway are cleaned from a tower lift on a truck parked on a paved shoulder.

New Crews Necessary

The washing of ground-mounted reflectorized signs is most effectively accomplished by means of a wet method—namely, mechanically washing with a standard detergent.

When considering the large number of ground-mounted and overhead signs in this district in conjunction with information gained from our sign-cleaning studies, it would appear that it will be necessary in the near future to establish a special two-man crew to handle this item of highway maintenance. They, of course, would be supplemented by additional men when required for more efficient operation. This crew will require a ladder truck and our present sign washer. The personnel lift, tower truck, and other specialized equipment normally utilized by our Signal Maintenance Department will also have to be made available when not in other emergency use.

Based on past experience, we would expect that this crew would wash every sign on our present freeway and expressway system, both ground-mounted and illuminated, at least once a year and in addition would be able to clean the problem signs at more frequent intervals when required.

Report From District III

By ALAN S. HART, District Engineer

DISTRICT III is in full swing on another construction season with a heavy current program and a large carryover from the past year. A major portion of the work is on US 40 in the higher elevations. Weather conditions shorten the construction season and every project of any magnitude requires two full seasons of favorable weather.

Major contracts started during the past construction season, having a value of $50,491,000 are being continued and are expected to be completed this fall. The current program covering projects valued at $41,671,000 is progressing rapidly with the various units either under contract or ready for advertisement. Some of these improvements will require more than one construction season to complete.

PHOTOS UPPER LEFT—Looking east at freeway construction on US 40 east of Kingvale in Nevada County. The present highway is on the left. UPPER RIGHT—Construction on US 40 near the Magra Overhead in Placer County showing the present highway (left) and the Southern Pacific Railroad tracks (right).

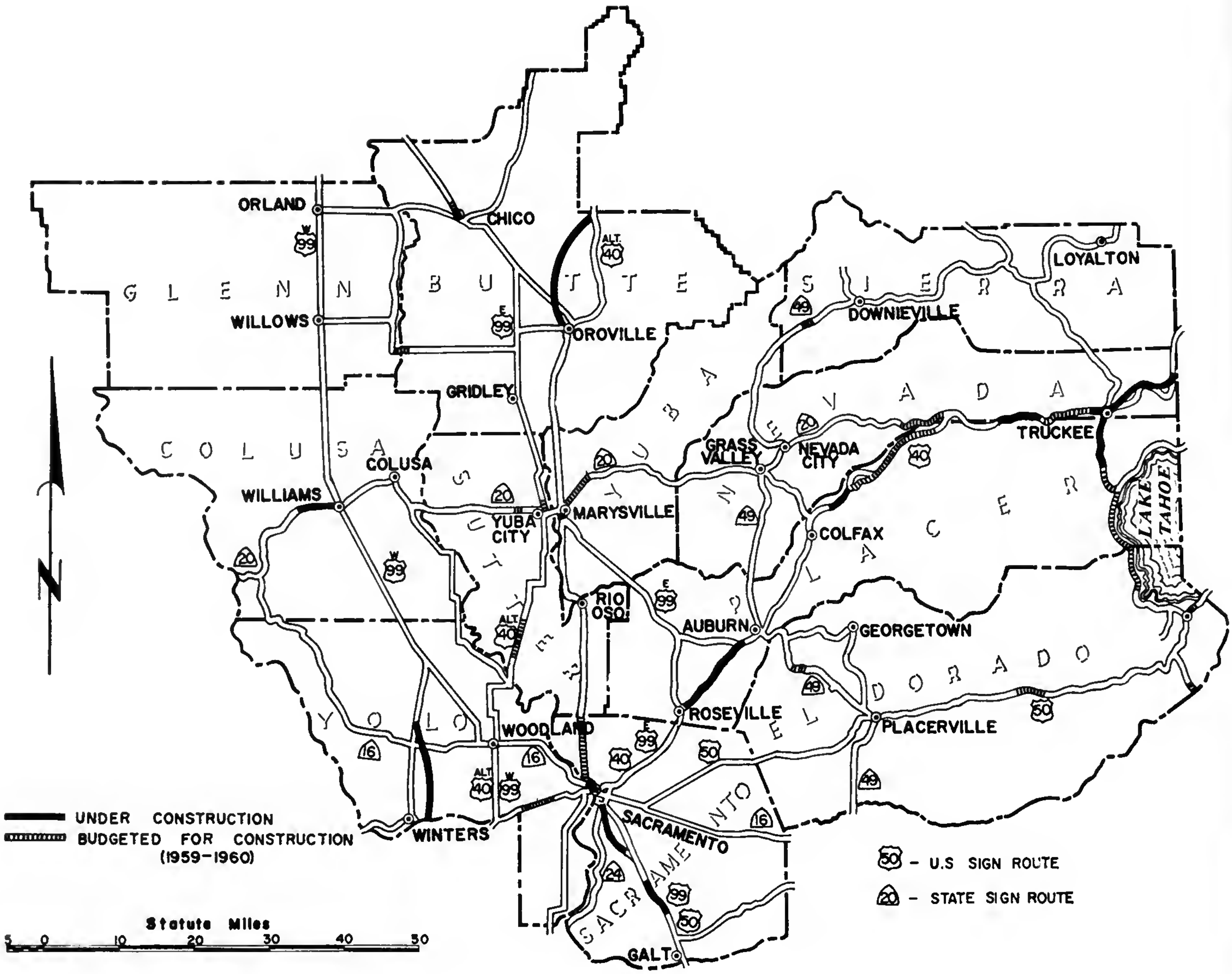
US 40

This season will see nine major projects underway in the conversion of US 40 to full freeway status. Eight of these projects are east of Sacramento. Five of these improvements, providing a total of 37 miles of four-lane divided freeway, are scheduled to be completed during this construction season.

The only major project on US 40 west of Sacramento in District III is the conversion of the four-lane divided expressway to a six-lane full freeway from the Solano county line to Swingle, just west of the Yolo Causeway. Bids were opened on this project on June 10, 1959, and A. Teichert & Son of Sacramento submitted the low bid of $2,083,222. Work is now getting into full swing and the project is expected to be completed during the 1960 construction season.

A public meeting was held in Sacramento on January 14, 1959, to discuss the East-West Freeway route through Sacramento. This project is the largest and probably the most important in the district involving the crossing of the Sacramento River, the access to the downtown area of Sacramento, the junction of the projected Woodland-Grapevine Freeway and the junction of US 40, US 50, and US 99. Because of the complexity and magnitude of the problem, additional meetings will be necessary prior to adoption of a route in this section.

On June 12, 1959, a public meeting was held in North Sacramento covering the proposed conversion of the North Sacramento Freeway from the existing four lanes to eight lanes between Arden Way and El Camino Avenue and to six lanes between El Camino Avenue and Marconi Avenue. The interchanges at Arden Way and El Camino Avenue will be improved with additional ramp facilities and detailed plans will be developed upon execution of the revised freeway agreement. No alignment changes are involved.



Public Meeting Held

The section from Roseville to one mile east of Newcastle, entirely on new alignment, and extending for 11.1 miles is under contract to A. Teichert & Son of Sacramento at a bid price of $6,946,992. The estimated date of completion is December 1, 1959. When opened to traffic, this section will complete a full freeway from Sacramento to Auburn.

A public meeting was held in Auburn on May 7, 1959, to discuss the conversion of the existing four-lane divided expressway between Auburn and Heather Glen to full freeway status, and details are being worked out on the freeway agreement with Placer County.

Between Heather Glen and Magra, west of Gold Run, projects were completed in 1958 bringing this area to full freeway status except for one future interchange structure at Illinoistown.

From Magra to 0.5 mile west of Monte Vista a four-mile full freeway project is under contract to Fredrickson & Watson Construction Company and Ransome Company of Oakland at a bid price of $2,617,777. Completion is anticipated by September 1, 1959.

Between Monte Vista and Baxter, a project to provide 5.1 miles of full freeway has been advertised for bids, to be opened in Sacramento August 19, 1959. The 1959-60 Budget contains $5,000,000 for this project with additional financing to be provided in the 1960-61 Budget.

Alignment Is Changed

From Baxter to one mile west of Emigrant Gap a 7.1-mile section of full freeway is under contract to A. Teichert & Son of Sacramento at a bid price of $4,787,742. This project diverges from the existing route through a part of its length and will accommodate eastbound traffic on the new alignment through this particular portion. Westbound traffic will utilize existing alignment which encompasses Airport Grade, one of the most troublesome snowdrift areas in the district.

From one mile west of Emigrant Gap to Hampshire Rocks 11.5 miles are in the design stage, and will be scheduled for freeway construction in future budgets.

Between Hampshire Rocks and Soda Springs a six-mile full freeway project is under contract to Clyde W. Wood & Son, Inc., Kirst Construction Company, and Alwood Corporation at a bid price of $5,052,434. The project has an estimated completion date of November, 1959.

Completion of this section will be a distinct improvement for all traffic. It replaces the Kingvale Grade where high elevation with its consequent power loss and curved alignment through rugged terrain made passing of slow moving vehicles difficult and resulted in long queues. During stormy weather this section has the heaviest chain control use. The new facility with full four-lane freeway pavements and broad surfaced shoulders will greatly improve all driving conditions.

From Soda Springs to the east end of Donner Lake, a 10.1-mile section, estimated at $18,000,000 is complete as to plans and right-of-way certification. It will require three construction seasons to complete the project for which a budget item of $7,500,000 was included in the 1959-60 Budget for the first season of work. This project is all on new alignment and crosses the summit approximately 1½ miles north of the present "Donner Summit."

One of the more serious problems on the existing summit is wind currents which create snow eddies during winter months, reducing visibility to zero and requiring stopping of traffic until the eddies subside. A wind current study made over a considerable period indicates that the new location will almost eliminate this problem.

Business District Bypassed

From the east end of Donner Lake to Boca, an 8.8-mile full freeway project is under contract to Fredrickson & Watson Construction Company and Ransome Company of Oakland at a bid price of $7,620,605. The project, when put in service at the expected completion date of November, 1959, will provide a bypass of the business district of Truckee where serious congestion has been a problem for several years.

UPPER—Work progresses on the new Yuba River Bridge at the south city limits of Marysville on U. S. Highway 99E. LOWER—A view of freeway construction looking eastward from near the foot of Airport Hill in Placer County. Present US 40 (left) will serve as the westbound lane of the new freeway. The eastbound lane is under construction (right).

From Boca to Floriston, a 6.7-mile section of full freeway is under contract to Isbell Construction Company of Reno, Granite Construction Company of Watsonville, and Gordon H. Ball & Gordon H. Ball, Inc. of Danville at a bid price of $7,325,011. The estimated completion date is October, 1959. Because of the rugged terrain on the eastern portion of this project and the traffic problems presented during construction, a detour, 2.8 miles in length from 0.8 mile east of Hirschdale to 0.8 mile west of Floriston, was constructed by H. Earl Parker, Inc. of Marysville, at a cost of $472,800 and has been in use for a major part of this season and last season.

The 5.4-mile section from Floriston to the state line was completed in the fall of 1958 by Gibbons & Reed of Salt Lake City at a cost of $4,976,000. This particular section was constructed without detours and required planned delay to all traffic. Comfort stations were provided at the control points and over 275,000 copies of a brochure entitled "Sorry You're Delayed" were distributed to the waiting motorists during the two construction seasons that the delays were invoked. A surprising aspect of this situation was that very few of these brochures were tossed out of the vehicles after being read. It appears that practically every copy was kept for souvenirs or for future reference by the motorists.

US 50

Several factors have given US 50 a fast-growing importance in District III. The unprecedented growth at the south shore of Lake Tahoe is attracting a large year-around population. The summer vacation attraction has long been recognized, but the more recent development of winter sports is bringing a major traffic stream to the route throughout the entire year. Closer to Sacramento, the development of Mather Air Force Base, Douglas and Aerojet General have magnified the problem. The mushrooming of subdivisions to serve the rapidly increasing employee population of these facilities is developing a constantly increasing traffic problem.

A freeway route has been adopted between Brighton and Nimbus and plans are being prepared for a project to be included in a future budget. The current budget contains an item for an interchange at Nimbus and plans are in preparation for advertising in the near future.

The intersection of Latrobe Road just east of the Sacramento-El Dorado county line was improved by removal of a cut bank to improve visibility by Contractor P. J. Moore, of Sacramento at a cost of $5,320, completed May 8, 1959.

The truck passing lane on Clarksville grade was lengthened over the crest of the grade and the Bass Lake Road intersection was improved under a contract to Reichhold & Jurkovich of San Pablo for $22,544. Work was completed April 24, 1959.

A contract was recently awarded to P. J. Moore to provide truck stopping lanes at the El Dorado railroad grade crossing. The bid price was $9,168 and the work is expected to be completed in August, 1959.

The U. S. Bureau of Public Roads is constructing a 1.8-mile section between Fresh Pond and Pacific House at a cost of $1,000,000. The contractor, Piombo Construction Company of San Carlos, hopes to complete the project late this fall.

A California Highway Commission hearing was held on May 19, 1959, on the proposed freeway route between Meyers and State Line. Adoption of the route will be considered after review of the transcript of the hearing.

As an interim project the existing route between Mays and Globins is being widened to a 64-foot section under a contract to Harms Brothers in the amount of $371,348. The anticipated completion date is October 1, 1959.

US 99

The reconstruction of the southbound lanes between 1.8 miles south of Cosumnes River and 0.2 mile south of Elk Grove Road was completed by Brighton Sand & Gravel Company of Sacramento at a cost of $829,310 for the 5.8 miles. It was opened to traffic on June 10, 1959 and completed US 99 to full freeway from the San Joaquin county line to 1.8 miles south of Florin Road.

From 1.8 miles south of Florin Road to Broadway in Sacramento, a contract covering the various structures is in progress. The contractor is Lew

Looking southward along Main Street in Chico showing the beginning of the one-way couplet which takes US 99E traffic through the city.

This scenic photo of State Sign Route 89 in Placer County (looking north) was taken near Cabin Creek, two miles south of Donner Creek Underpass.

Improvement of intersections is an important part of the district construction program. Typical of these are (left) the Nimbus Intersection, an interim improvement east of Sacramento on US 50 which will eventually be replaced by a full freeway interchange and (right) the Latrobe Road intersection, also on US 50, where part of a hill was removed near the highway to give better sight distance to motorists.

Jones of San Jose and Brighton Sand and Gravel Company at a bid price of $1,954,023. The expected completion date is September, 1959. Paving will be provided as a future project.

US 99E

The current budget contains $120,000 to improve Washington Street in Roseville between the Seawell Underpass and Grove Street. The project includes construction of an overcrossing, closing of Church Street and signalization of Main Street. Plans are complete and early advertising is expected.

The Yuba River Bridge at the south city limit of Marysville is under contract to R. M. Price Company of Pasadena at a bid price of $3,205,968. It appears possible that the contractor will complete the work prior to the time limit of May, 1960.

In Yuba City, Brown-Ely Company have a contract to widen Live Oak Road (99E) from Colusa Avenue to 0.8 mile northerly, at a bid price of $179,821. The estimated completion date is July 24, 1959.

Between Big Chico Creek in Chico and 0.3 mile north of Lindo Channel, A. Teichert & Son of Sacramento have a contract to widen the esplanade to a 4-lane divided roadway with lighting and traffic signals, at a bid price of $490,740. The estimated completion date is December, 1959.

The same contractor recently completed a contract covering widening of the bridges over Big Chico Creek and Little Chico Creek, improving channelization and traveled way and installing traffic signals at a cost of $206,692 to provide one-way couplet through the business section of Chico on Main Street and Broadway. A unique feature of this project is the radio interconnection of the entire signal system which was put in service April 5, 1959. The traffic signals on the esplanade will be equipped with radio receivers to extend the system to full radio interconnect coverage. The signals and lighting are a participating project in which both the City of Chico and Butte County are paying their proportional share.

US 99W

Plans are prepared for the widening of Main Street in Woodland from Walnut Street to West Street. The current budget contains an item of $110,000 for this project and advertising is expected in the near future.

Studies are well along and several public meetings are being planned for freeway development of US 99W between Woodland and Willows. From Willows to the Tehama county line, the freeway route has been adopted and design work is in progress.

Legislative Route 90

A portion of the Vacaville-Dunnigan Cutoff, Interstate 5W, is under contract to Gordon H. Ball, Inc. of Danville at a bid price of $1,392,945 to construct two lanes of a future 4-lane divided freeway for a distance of 13.9 miles from the Solano county line northerly. The structures and grading were done under a previous contract to the same firm. The expected completion date is late November, 1959.

US Alternate 40

A project covering a new bridge across Cache Creek north of Woodland is included in the current budget under an item for $180,000. Bids were received July 15, 1959.

This large benched cut on US 40 Alternate in Butte County is located just south of the future location of the new West Branch Bridge.

Between 0.5 mile north of Robbins and the Sutter Causeway, a 5.1-mile section of 40-foot all-paved roadway will be constructed by A. Teichert & Son at a bid price of $331,849. Bids were opened June 24, 1959 and work is expected to be under way immediately with a completion date of November, 1959.

The 13.7-mile relocation project between Wicks Corner and Jarbo Gap, under contract to McCammon-Wunderlich Company for $7,292,214, is practically finished, with a completion date of August 1, 1959. The West Branch Bridge and the section from Oroville to Wicks Corner, however, are awaiting financing as part of the Feather River Water Project.

State Sign Route 16

The west approach to the Eye Street Bridge in Broderick was opened to traffic on July 3, 1959, several weeks ahead of schedule. This project, constructed by Stolte, Inc. of Oakland at a bid price of $344,451 replaced the narrow approach that featured a sharp S turn at the top of the ramp. Traffic was necessarily detoured over the four-lane Tower Bridge, creating considerable congestion on both the bridge and Capitol Avenue with vehicles exceeding 60,000 per day. Cooperation from the Southern Pacific Railroad, the Sacramento Northern Railroad and river traffic as well as the City of Sacramento during peak periods eliminated stopping of this extra heavy traffic and facilitated the peak flow.

State Sign Route 20

A five-mile section from Williams westerly was improved to a 32-foot all-paved section under a contract with M. J. Ruddy & Son of Modesto at a bid price of $341,495. The work was completed in the latter part of May.

The bridge over the Wadsworth Canal west of Yuba City is being widened under a contract with Lester L. Rice and Sons, Inc., of Yuba City at a bid price of $176,696.

Portions of the section between Marysville and Dry Creek were resurfaced by Baldwin Construction Company of Marysville at a bid price of $32,975. Work was completed June 11.

A 7.9-mile section from Steep Hollow to the junction with US 40 is now under contract to Granite Construction Company at a bid price of $73,957.

A bridge over Slack's Ravine east of Smartville is being reconstructed under a contract with Power-Mullin Construction Company of Palo Alto at a bid price of $24,845.

State Sign Route 24

A project to reconstruct base and surface on a 7½-mile section in Sacramento County from Garden Way to the Sutter County line under a budget item of $450,000 has been advertised with bids due July 15.

State Sign Route 45

A 2.1-mile section south of Grimes is being reconstructed under a contract with Flores & Perry of Hanford at a bid price of $141,759. The bids were received June 24, 1959. Completion is expected October, 1959.

State Sign Route 49

The current budget contains an item of $250,000 to reconstruct and widen a 2.4-mile section between Pilot Hill and Hastings Creek in El Dorado County. Bids were opened July 8, 1959. Another budget item of $80,000 is designated for reconstruction and widening between the North Fork of the Yuba River and 0.3 mile east of Ramshorn Creek in Sierra County.

This photo taken two miles east of Cherokee in Butte County shows some of the heavy grading work involved in the construction of US 40 Alternate.

State Sign Route 89

A project providing a 44-foot all-paved roadway for 8.3 miles from Squaw Valley Road to Donner Creek Railroad Underpass is under contract to Frederickson & Watson & Ransome Company of Oakland at a bid price of $1,374,930. The work is virtually complete.

A project to resurface 23 miles from Bay View at Emerald Bay to Squaw Valley is under contract to Clements Construction Company of Hayward at a bid price of $168,900. The expected completion date is late in August, 1959.

Willows-Butte City Road

Another project in the current budget is a 1.2-mile causeway over the Sacramento River overflow area from Codora Four Corners to the Butte City Bridge in Glenn County. $1,150,000 is included in the budget for this project which is soon to be advertised.

Planting Projects

Four functional planting projects are included in the current budget. These include from the San Joaquin county line for 18 miles northerly on US 99; from Howe Avenue to Fulton Avenue on the Sacramento-Roseville Freeway (US 40); at the Weimar Interchange on US 40 and through Arbuckle on US 99W.

The Arbuckle project is under contract to Bernard Gayman of Sausalito at a bid price of $31,270. The Howe Avenue to Fulton Avenue project is under contract to the Capitol Nursery of Sacramento at a bid price of $7,113. The other two projects will be advertised shortly.

Another planting project in the district is at the Materials and Research building in Sacramento. This project, under contract to L. K. Nelson for a bid price of $21,629, and the expected completion date is October 21, 1959.

The interest shown in the North American Ski Championship events in Squaw Valley during February of 1959 indicates the possible spectator interest in the VIII Winter Olympics in February, 1960. District personnel are planning for special activity made necessary by the heavy traffic volumes expected in the area during the events.

The increase in population, both permanent in the growing industrial areas and transient in the recreational areas, indicates that our planning has not been over expanded. The continuation of our current program will provide the necessary facilities in the foreseeable future, and we are prepared to cope with the problems that arise in the development of the area.

LONG DETOUR AVOIDED

Slides occurred on US 101 Alternate west of Santa Monica, in the Pacific Palisades area where there have been many slides. In view of the possibility of additional slides, maintenance forces of the Division of Highways constructed a 1,200-foot detour by shifting the southbound lanes toward the ocean, and using the former southbound lanes for northbound traffic. This work was completed on June 15th. It was performed without closing the road to traffic, thus avoiding a lengthy detour.

First Contract

Future Interchange Will Join Harbor, Santa Monica Freeways

By LLOYD A. COMPTON, Resident Engineer, Bridge Department

The awarding of the separation portion of Santa Monica Freeway-Harbor Freeway Interchange on January 16, 1958, constituted the first major contract in the construction of the Santa Monica Freeway. The project is located within the metropolitan area of Los Angeles, more specifically, between Venice and Washington Boulevards, on the Harbor Freeway. The contractor began his operations on January 20, 1958. The project was contracted at a bid cost of $1,484,677.

The construction of bridges on highway routes usually includes the providing of a detour to facilitate normal traffic flow. In building the structures to carry the Santa Monica Freeway, with various distributor and connector roadways under and over the existing Harbor Freeway, it was necessary to construct detours. The detour problem was unusually complicated, in that Venice Boulevard, a major city traffic artery, passed beneath the existing Harbor Freeway adjacent to the project site and bisected the loop of the Harbor Freeway detour. This condition necessitated the construction of a temporary bridge, on offset detour alignment, to carry Venice Boulevard over the detoured Harbor Freeway. The normal flow of traffic had to be maintained along these two arterials during their construction and because of the heavy traffic along the Harbor Freeway (in the vicinity of 190,000 vehicles per day), extensive planning and co-ordination was required.

This view northward shows the Harbor Freeway detour around construction of the Santa Monica Freeway separation. Venice Boulevard (left to right) passes under the construction zone and over the detour.

Detour Bridge Built

The embankments for the detours were constructed simultaneously with the erection of a temporary detour bridge for Venice Boulevard. This detour bridge was constructed of timber bents resting on unreinforced concrete footings with approach spans carried by timber stringers and the two main spans supported by 36-inch-

UPPER—Venice Boulevard passes under the construction area (foreground). The north end of the Harbor Freeway detour is in the middleground. LOWER—A temporary bridge carries Venice Boulevard traffic over the Harbor Freeway detour.

wide flange rolled steel girders. Precast, reinforced concrete slabs 6½′ x 22′ x 6″ thick were utilized on the steel girders, being fastened to the top flange by welded stud bolts passed through precast holes in the slabs. The approach slabs were cast-in-place and the entire structure was paved with plant mixed surfacing.

The Venice Boulevard detour was completed, traffic rerouted and the existing roadway removed to facilitate the construction of the freeway detour. The freeway detour was completed except for the end "tie-ins." Owing to traffic volume, this operation had to be carried out on two week ends, after 10 p.m. on a Saturday and completed prior to 6 a.m. on Sunday. The northbound lanes, by nature of location, were the first to be detoured and by a system of confining traffic to the inner lanes, connecting the outer lanes and subsequent shifting of traffic, the transition was accomplished. The southbound lanes were routed onto the detour on the following week end. Long hours of work coupled with extensive co-ordination resulted in a smooth trouble-free operation. The cost of constructing these detours, totaled $380,000. This is undoubtedly the most heavily traveled and most costly detour yet constructed in the State of California for its freeway program.

Start of Major Construction

The completion of the detour, followed by the removal of portions of the freeway embankment, allowed the major bridge construction to begin. Two cuts through the embankment were made providing for bridges to carry Harbor Freeway traffic over the Santa Monica Freeway westbound roadway and for a west to south connector roadway. The westbound structure is a combination of box girders and cored slabs with three solid concrete roof girders. This rigid frame structure rests on a combination of spread footings and 24-inch diameter cast-in-place piles. The roof girders are as much as nine feet in depth and extend upward into the median and shoulder areas of the Harbor Freeway level. Six four-foot diameter columns rest on these roof girders and support a portion of the third

UPPER—Workers pour concrete on the third level of the new Santa Monica Freeway Separation. LOWER—Hundreds of reinforcing steel bars serve as a foreground to concrete pouring operations beyond.

A view of the completed portion of the third level of the separation structure with falsework supporting the uncompleted portion (right).

level. The larger roof girder contains approximately 275 cubic yards of concrete and spans 59 feet.

The westbound to southbound connector profile line was depressed so as to allow a slab deck, rigid frame structure to be constructed with deck grade up to five feet below the Harbor Freeway level. A cut and cover tunnel type operation resulted for approximately 150 of the 190 feet of total structure length, portal to portal.

Sand Blanket Used

The falsework for the bridges was constructed of timber columns with timber and structural steel I-beams as stringers. A system of double timber sills with elevating wedges between, facilitated grade adjustments, and also provided a means for lowering and subsequent repositioning. A sand blanket, approximately two inches thick, was laid under the lower sill. After the superstructure was completed, the sand blanket was washed out and the entire falsework was lowered. The space created by this lowering allowed separating the sills by hydraulic jacks and replacing the wedges with six-inch diameter steel rollers for lateral movement and reuse of the falsework. This repositioning process was repeated as many as five times and proved both efficient and satisfactory.

The third level, carrying the eastbound Santa Monica Freeway, three connector roadways and one distributor roadway consists of multiple span, box girders. It is supported on cast-in-drilled-hole piles, 24 inches in diameter. The piles extend through the existing embankment into an ancient alluvial material. The design loading of the piles is 100 tons. A load test, conducted by the Bridge Department Geology section, revealed a considerably greater capacity. There are 50 columns four feet in diameter supporting this level. The highest of these columns was just over 50 feet. Steel forms were utilized with very satisfactory results. The total structure width, approximately 250 feet, and the length, roughly 330 feet, presented a difficult problem in construction. The initial plan was to construct one portion at a time and move the falsework laterally in a manner similar to that described for the rigid frame structures, making a total of three moves. The time element interfered with this plan and it was necessary to construct additional falsework after only one move. A troublesome condition was created in that accessibility to the "inner" area was denied from the Harbor Freeway level. It was therefore necessary to construct a temporary timber trestle access ramp from the Harbor Freeway level to that portion of the completed third level.

Much Falsework Needed

The construction of reinforced concrete bridges entails considerable falsework erection; the extended area of the third level of structures on this contract made this very apparent. At this writing falsework supports approximately 52,000 square feet of soffit paneling. This means that considerably over an acre of bridge superstructure is being supported by falsework with some 620 twelve-inch diameter columns.

The details of the falsework construction were similar to that of the lower level rigid frames, with extensive use of structural steel shapes for stringers. The use of these steel stringers precludes the "dropping" of falsework upon completion of the superstructure and due to the super elevations of the various roadways, with the outer sides lower than the inner sides, a difficult falsework removal problem is presented.

For information regarding the general layout of the Santa Monica Freeway Interchange with the Harbor Freeway, see page 51, March-April, 1959, issue of *California Highways and Public Works* showing photograph of scale model fabricated by Mr. and Mrs. John Unruh.

The project is scheduled for completion during October of this year. Completion includes the removal of both detours and the detour bridge, with reconstruction to normal alignment of Venice Boulevard.

The contractor is Webb and White of Los Angeles with Paul Fredrickson representing the firm as project superintendent.

Survey Safety

Correct Practices Outlined For Highway Survey Crews

By A. K. GOLDIN, Chief of Surveys, District VII

THE GROWING volume of traffic on our state highway routes requires strict adherence to safety procedures and practices. The necessity for adopting specialized safety techniques to meet the variable conditions encountered in metropolitan areas is all too apparent if tragic accidents are to be avoided. The District Survey Department recognizes that no list of safety rules can be devised to meet all situations, but these are a start in the right direction.

The selection of effective safety procedures and the most suitable methods of performing assigned field tasks is one of the principal responsibilities of all survey supervisors and survey party chiefs. They must establish the work hours of the field parties to avoid working in traffic lanes during peak hours of traffic flow on freeways in the metropolitan areas. Only by working in this manner can the assigned tasks be accomplished on time and with safety.

BELOW—The "Buddy System," which requires a flagman to accompany each head or rear chainman or rodman, allows survey party members to carry on their work with less concern about their personal safety.

It is the experience of the Survey Department of District VII, that to get required work done in metropolitan areas with their large volumes of fast-moving traffic, larger survey parties are necessary to safeguard the personnel and equipment used in the performance of survey operations, than is required in outlying areas where traffic is lighter. The cost of increasing the size of the survey party in metropolitan areas is offset considerably by the time saved in performing the work more expeditiously. By having adequate help in caring for their safety while working, party members are less hindered in performance of their duties.

Extra Flagman Effective

The "buddy system," which requires a flagman to go along with each head chainman, rear chainman or rodman for the protection of his partner, allows survey party members to carry on with their duties relatively unhampered and unworried about their personal safety. This is conducive to both speed and accuracy. The "buddy system" flagmen perform their duties under the watchful eyes of the survey party chiefs who modify prescribed safety rules as becomes necessary to meet the exigencies of the situations that develop. The basic safety rules of procedure are those as set forth in the State Division of Highways Bulletin, entitled "Instructions to Flagmen." Flagmen following the "buddy system" on survey parties must develop good judgment and be extremely careful in estimating the speed of oncoming vehicles in order to prevent traffic tie-ups and collision accidents. This system has proven very efficient and is well worth the small additional labor cost.

Conscientious following of the State Division of Highways signing and traffic cone placement charts is essential when surveying work is being done under heavy traffic conditions. Use of vehicles, such as pick-up trucks, station wagons and survey trucks, properly signed and distinctively colored, has proven of great value. These vehicles delineate the work areas and protect the survey party and the engineering instruments being used. The most able and experi-

Members of survey parties working on any portion of a highway wear a red shirt, poncho, vest or coat. These may be luminous or standard cloth.

enced members of the survey crew are assigned to the task of driving these vehicles, because the safety of the party personnel and of the traveling public on the highway is in their hands.

Sign Placement Important

Careful attention is given the placing of advance warning signs. The signs are placed at distances far enough in advance of the site of the work to warn oncoming traffic and yet close enough to prevent traffic from picking up speed before reaching the work zone. The distances for signs is as set forth in the State Division of Highways Bulletin wherever applicable and other distances are established by the party chief, who takes into consideration the road conditions and special hazards.

A telescoping high standard to elevate flags is a new development and it helps warn oncoming traffic, delineates the work area and incorporates two features which make it more effective than the older warning devices. These features are a telescoping column and two or three sockets for holding flags. The telescopic column makes it possible for the sign to be raised so it can be seen over fairly high stationary objects and over automobiles.

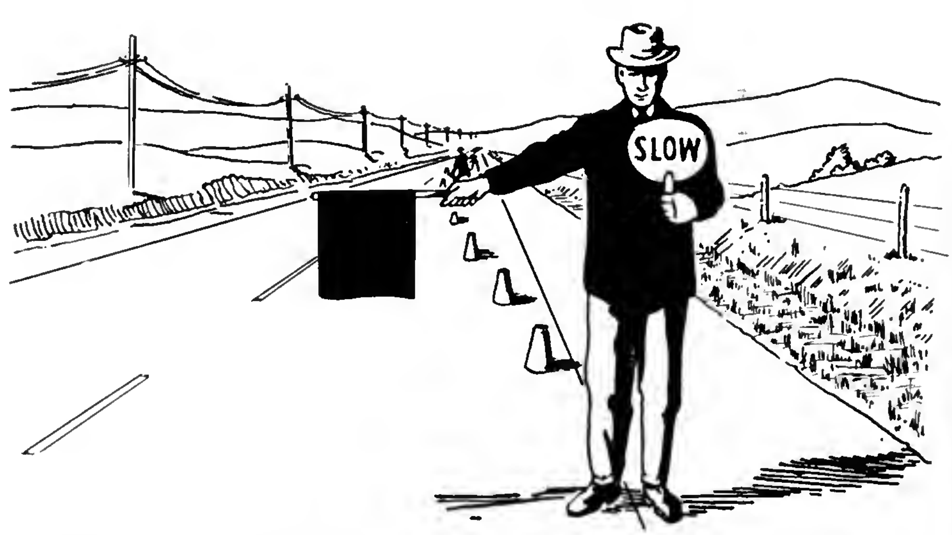
The placement of traffic cones is extremely important. The cones are positioned in a long taper for properly channelizing traffic to protect the instrument man and his survey instrument. Careful placing is necessary to provide workers with ample area for their operations but not as to impede traffic flow. The taper of the line of cones should be visible throughout its entire length to be most effective. Additional precautions should be taken when the roadway is on summit vertical curves or when freeway on or off-ramps complicate traffic flow into the work zone. In these special cases the party chief will use his best judgment in determining the placement of traffic cones. Our experience has shown that traffic cones should be placed far enough apart in the taper so as to protect and delineate and yet not allow so much space between them that drivers will become confused and drive between cones instead of along cones. As an average spacing, 50 feet apart is suggested for traffic cones.

Must Wear Red

It is mandatory in District VII that all members of survey field parties wear red jackets or red vests while working on traveled roadways. Other governmental agencies and some private organizations in this area have also adopted this procedure. The Survey Department Supply Section takes care of colored vests and jackets having them laundered and repaired as as necessary. The new luminous cloth used in jackets, vests and flags is an added improvement and has been well received both by our survey parties and by the traveling public.

Safety helmets or "hard hats" are issued by the department to crews working on construction jobs where work is in progress on overhead structures or where steep slopes may be subject to ravelling. Excepting for these special conditions, safety helmets are not required.

Clothing for our surveyors is not specified but short jackets and



Flagging is done with red luminous cloth flags in the method outlined in the Division of Highways pamphlet "Instructions to Flagmen."

Traffic on a freeway inlet is temporarily stopped while surveying operations are in progress.

sweaters are suggested so as not to impede action.

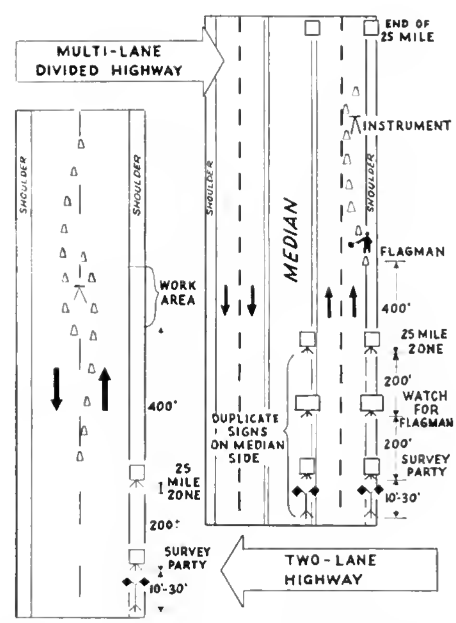
Attached to the roof of the survey truck, a covered wire cage with the hinged top allows the survey party to carry an adequate supply of stakes, lath, flagging materials and small tools. This appliance keeps the contained material from accidentally spilling on the roadway and obstructing or endangering traffic.

The warning sign attached on the rear of an express type truck is composed of two parts. The back part is full length with the word "Slow" on both sides. The second part is suspended by hooks and is reversible, with the "Keep Left" on the front and "Keep Right" on the back side. This sign helps to slow the fast traffic down more effectively than other types that have been used. The truck is usually 200 to 300 feet ahead of the other signs. When authorized, flashing lights may be added to the upright brackets. Experience has shown that where the flashing lights have been used there is a marked improvement in the control of traffic. District VII has used the flashing lights for surveys on completed freeways open to traffic.

Cross sectioning on any freeway, after it has been opened to traffic, is done by taking profiles, and then only one traffic lane at a time is tied up for the operation with a minimum hindrance to public traffic flow. This takes careful planning on the part of the supervisory staff of the Survey Department.

Instructions furnished by the manufacturer's agent in the use of power tools are strictly followed. Classes are held periodically in District VII and the manufacturer's agent serves as the instructor. Only employees who have been fully instructed are permitted to operate powder-actuated equipment. They are required to wear safety goggles and strictly follow the rules as set forth in "Construction Safety Orders, Article 28," under powder-actuated tools. This tool can be dangerous in the hands of untrained and inexperienced personnel.

The party chief gives instruction in the use of axes, brush hooks and other cutting tools to the new personnel. The party chief also supervises all brushing operations and sees that proper spacing is maintained between survey party members engaged in the operation. Vises have been placed on the rear of all District VII survey trucks to facilitate the sharpening of the cutting tools. The use of the vise has reduced accidental injuries from this cause.



Placement of warning signs, cones and barriers vary with conditions. They are placed where they will be seen by the motorist. The diagram above shows two examples with minimum distances indicated.

A member of a survey crew demonstrates a safe method of sharpening the blade of a brush cutter with the handle held in a vise.

Observance of proven safety rules at all times and development of new safety procedure have paid off. To the knowledge of the author there has not been a serious on-the-job accident in the survey department of District VII since the initiation of safety measures described in this article.

All Bridge Traffic Increases in State

Traffic counts were higher last month on each of California"s state-owned toll bridges in the San Francisco Bay area than in the same month in 1958, the Division of Highways reported today.

Traffic counts on the bridges were:

San Francisco-Oakland Bay Bridge—June, 1959, 3,221,575; June, 1958, 3,127,124. San Mateo-Hayward Bridge — June, 1959, 298,107; June, 1958, 288,502. Dumbarton Bridge—June, 1959, 166,278; June, 1958, 142,436. Richmond-San Rafael Bridge—June, 1959, 278,746; June, 1958, 253,330. Carquinez Bridge—June, 1959, 1,078,787. (Toll collection started November 25, 1958.)

Best Accident Prevention Record Wins Top Achievement Award for District III

Alan S. Hart (left), District Engineer, receives the Safety Certificate of Achievement on behalf of District III from Scott H. Lathrop, Principal Highway Engineer. The award was made at the Materials and Research Laboratory Building in Sacramento on July 7th.

District III, with headquarters in Marysville, has been declared winner of the 1958 award for the best accident prevention record among the various districts. The award was won in competition with California's 11 highway districts and the San Francisco Bay Toll Bridges. District V, with headquarters in San Luis Obispo, also won an award, for the greatest improvement in its safety record.

The Certificate of Achievement for District III was presented to District Engineer Alan S. Hart on July 7th at the Materials and Research Laboratory Building in Sacramento during the monthly District III Safety Committee meeting. Principal Highway Engineer Scott H. Lathrop made the presentation for State Highway Engineer G. T. McCoy.

This is the first award of this type won by District III. District Engineer Hart attributes his district's success to the constant and unremitting hard work of the district's safety supervisor. In accepting the award Hart commented, "If it weren't for the safety supervisor, perhaps some of you might not be here to listen to what I am saying."

District III includes the counties of Butte, Colusa, El Dorado, Glenn, Nevada, Placer, Sacramento, Sierra, Sutter, Yolo, and Yuba. It maintains almost 1,400 miles of state highway. Included in its mileage are vital routes US 40 and US 50 over the Sierra Nevada through an area where total winter snowfall sometimes is 80 feet, and also included is the booming Sacramento area with its complex freeway problems.

On July 10th at headquarters in Sacramento, State Highway Engineer G. T. McCoy presented District Engineer A. M. Nash of District V with a Certificate of Achievement for the greatest reduction in accident frequency among the districts in 1958. McCoy congratulated Nash on the reduction of accidents in his district during 1958 by more than 50 percent. District V is a central coast district and includes the Counties of San Benito, Monterey, San Luis Obispo, and Santa Barbara.

L. A. River Bridge

Will Form East End Of Freeway Viaduct

By H. J. SCOTT, Resident Engineer, Bridge Department

Work on the Santa Monica Freeway is well under way, with the second major contract on this freeway, the Los Angeles River Bridge and Overhead, now nearing completion. The Santa Monica Freeway is to be constructed as a viaduct from its intersection with the Harbor Freeway till it crosses the Los Angeles River, about 3½ miles away. On the Los Angeles River Bridge and Overhead, the freeway is carried across the coach yards and main lines of the Santa Fe Railway, the Los Angeles River, and the main line of the Union Pacific Railroad on six parallel roadways with a combined width of 14 traffic lanes. East of the Union Pacific tracks, the roadways divide and cross each other to connect with the massive interchange between the Santa Monica, Santa Ana, and Golden State Freeways, construction of which is now in progress under another contract totaling nearly $10,000,000.

The Los Angeles River Bridge and Overhead is primarily a structural steel girder bridge with concrete deck slabs designed for composite action with the top flanges of the steel girders. The girders are supported on reinforced concrete caps, columns, and footings, all of which are carried by concrete piles. Incorporated in the structure are three piers, one on each side and one in the center of the Los Angeles River, which were constructed under a separate contract by Jones Brothers Construction Company between June and November of 1957.

Load Capacity Tested

The concrete piles supporting the structure are cast in drilled holes having a minimum diameter of two feet

This view westward of the bridge construction was taken under the main eastbound roadways. There will be a total of six parallel structures with a combined width of 14 traffic lanes.

and varying in depth from about 25 feet to 50 feet. Average depth was about 30 feet. The top 12 feet of each pile (or the top one-third of the deeper piles) is reinforced by eight 1-inch steel bars. In the piers adjacent to the Los Angeles River, the pile reinforcement extends 3 feet below river bottom. The piles are designed to carry safely a load of 100 tons each. To check this capacity, three piles in line on five-foot spacings in one footing of Bent 7 were used as a test group. The outer two piles were used as anchors for a reaction beam and a load was applied to the center pile by hydraulic jacks. The test pile withstood a load of nearly 300 tons with less than the settlement allowable for double the design load. For further information, one of the anchor piles was tested for uplift, and successfully resisted a vertical upward load of nearly 200 tons.

Except in a few instances where it was necessary to bridge underground structures, the columns of the structure are supported upon individual footings, which are, in turn, supported by from 2 to 10 concrete piles. The columns, for the most part, are round and usually 4 feet in diameter, although some are 3 feet. A few special columns are elongated in section, 4 feet thick by 7 to 10 feet in long dimension, with flat sides and semicircular ends. Column heights vary roughly from 30 to 60 feet, and except for "2-story" bents, columns are unbraced from footings to bent caps. Bent caps are normally of concrete, the thickness being the same as the diameter of the supporting columns, and the depth from 4½ to 7 feet. Rigid frame bents of from 2 to 4 columns each are formed by each bent cap and each cap supports from 2 to 7 girders. Major reinforcement in columns and caps consists of large bars, each having a cross sectional area of 4 square inches.

This view of the construction area was taken just after the erection of the reinforced concrete columns which will support the six parallel bridges over the river.

Span Length Varies

In general, structural steel for the bridge consists of welded plate girders varying in depth from 4½ feet to 8 feet and in length from 75 feet to 172 feet, and of welded steel cap girders varying in depth from 5 feet to 10 feet and in length from 30 feet to 60 feet. Span lengths vary from about 75 feet in Span 13 to 190 feet in Span 2 which is over the Santa Fe Railway yard. Girders of Span 1 and 3 extend as cantilevers 30 feet into Span 2 to support suspended girders 130 feet long.

Steel plates varying in thickness from ⅜-inch to ¾-inch for girder webs and from ¾-inch to 2¾ inches for flanges are structural steel for welding conforming to American Society for Testing Materials Specifications, Designation A373. All major shop welding was performed by the submerged arc process and checked by selective radiographic inspection. Inspection covered 100 percent of welds in tension flanges and about 10 percent of other work. Of the 218 girders in the structure, 61 were too long to be transported to the job site in one piece and were, therefore, spliced in the field by full-penetration butt-welding, using low hydrogen electrodes. Field splice welding was checked by radiographic inspection covering 100 percent of the work.

Two-crane Operation

Erection of the steel was done by mobile cranes varying in capacity from 25 tons to 70 tons, working from the ground. The heaviest lift was approximately 39 tons, for the girders of Span 3, over the west half of the Los Angeles River, but the necessary reach was so great that two cranes, one of 70-ton capacity with 110 feet of boom, and one of 45-ton capacity with 100 feet of boom were used together to set these girders. Two cranes, one of 25 and one of 35 tons capacity were used to set the 33-ton girders of Span 1. All other steel on the job was set by a single crane.

The Santa Fe Railway Company co-operated in the erection of the 33-ton, 130-foot long suspended girders in Span 2 by clearing their yard and controlling train movements so that these girders could be set from the ground. The 20 girders involved were erected in 6 nights, working from shortly after midnight until about 7 a.m.

All girder bearings were held to concrete caps by 1½-inch anchor bolts and all masonry plates were supported by ½-inch thick, rubber impregnated fabric pads, rather than the customary grout pads. Because of this type of bearing, the contact areas of the concrete bent caps were ground to true planes with an overall maximum deviation tolerance of ⅛-inch.

Field connections of all girder bracing and fixed end connections of girders to steel bent caps were fastened by ⅞-inch diameter high strength bolts, which were tightened by the use of pneumatic impact wrenches to a minimum torque of 470 foot pounds. Equipment was adjusted and workmen were trained to consistently exceed this minimum. Spot checking the tightened bolts with a calibrated torque wrench indicated an average value of about 600 foot pounds was achieved. Where restricted clearance between overlapping roadways made the use of concrete impractical, steel girder bent caps were used. The steel caps are fastened to each of the concrete columns supporting them by from 4 to 8 high-strength steel anchor bolts, 3 inches in diameter and 10 feet long.

This crew is pouring concrete for the deck of the westbound distributor roadway over the Santa Fe Railway yard.

Specifications required that these large bolts be "prestressed" to 24,000 psi by torquing the lower of the double nuts holding the cap girder. Representatives of Headquarters Materials and Research Department installed and observed electronic strain gages to determine that the required stress was attained.

Barrier Will Protect Traffic

The concrete deck is being finished by the use of a mechanical strikeoff followed by double floating with a 16-foot "bull float" and final trimming with a 16-foot, steel-shod, cutting float, both of the latter being operated with the length of the float parallel to the traffic lanes. The mechanical strikeoff is operated on 1-inch by 2-inch steel channel screeds supported solidly from the top flange of the steel girders at 30-inch intervals. Transit mixed, Class A concrete is used. The mixers discharge into a portable hopper from which the concrete is transported to the forms by ½-cubic yard capacity power buggies.

Traffic on the bridge will be protected by barrier-type concrete railing, topped by a 5-inch diameter aluminum pipe rail.

The prime contract for the work, in the amount of $3,410,310, was awarded to Peter Kiewit Sons' Company and work started in May, 1958. Completion is expected by November, 1959. Major items of work include 5,200 tons of structural steel, 1,700 tons of reinforcing steel, and 18,600 cubic yards of portland cement concrete. Representing the contractor on the job are Julian S. Goble of their Arcadia office and Zel Mullican and Robert Davick, job superintendents.

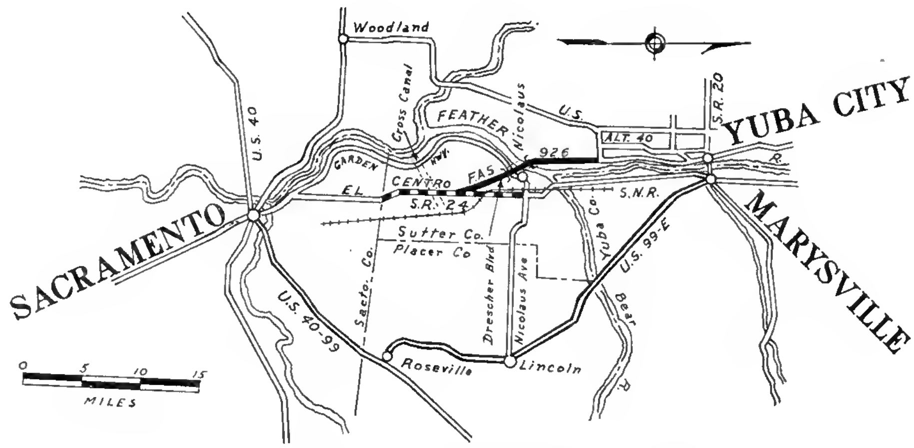
Contract administration is by the State Division of Highways Bridge Department under the general direction of F. W. Panhorst, Assistant State Highway Engineer–Bridges, with offices in Sacramento. Jason Plowe was chief designer for the project.

Sutter FAS

Last Section of County Master Program Completed

By E. E. WATKINS, Road Commissioner, Sutter County

On June 1, 1959, the Board of Supervisors of Sutter County opened to traffic the last unit of their first master FAS highway program, for which construction was started in March, 1949. The program consisted of 14 miles of new alignment and nine miles of reconstruction, including two major bridges: one 3,200 feet long and one 500 feet long. The total cost of the program was $3,569,000 (exclusive of right-of-way costs) embracing a total of 11 contracts, four of which involved the construction of a new bridge with approaches to replace the old bridge across the Feather River at Nicolaus, which was destroyed by the flood of December, 1955. The construction of this bridge was the major contract in this program.



The above map shows the location of the highway project described in this article.

In the late 1930's and early 1940's the authorities of Sacramento County and Sutter County conceived a direct farm-to-market highway between Yuba City and Sacramento. The adopted route, namely El Centro Boulevard (now State Sign Route 24), and the northern portions of the Garden Highway, was approved by the Bureau of Public Roads, as a part of the federal-aid secondary system. First construction in Sutter County started in March, 1949. This entailed two contracts: one for eight miles of highway construction consisting of grading, drainage and base, and one for a 500-foot, two-lane bridge across Cross Canal. The location of this first improvement was from the Sacramento county line northerly to the future intersection with Drescher Boulevard.

County Extends Road

In 1953 Sacramento County completed the southerly extension from the Sutter county line to Garden Highway at the Sacramento River. Upon the completion of this southerly connection the importance of the road was readily noticeable. During 1952 and 1953 Sutter County extended the improvement another four miles northerly to Nicolaus Boulevard. By 1955 this entire length of 12 miles constructed by Sutter County was fully paved. On July 1, 1957, this portion of Sutter County FAS route was taken into the State Highway System and is now known as Legislative Route 232, State Sign Route 24.

In the spring of 1955 the Board of Supervisors of Sutter County authorized route study and preliminary plans for that portion of the route northwesterly from El Centro Boulevard starting at the intersection of Drescher Boulevard thence across the Feather River and to tie into Garden Highway on the westerly side of the Feather River. These preliminary studies were underway when the disastrous floods of December, 1955, hit Sutter County destroying the existing bridge across the Feather River at Nicolaus. Passage of the Flood Relief Law of 1956 provided state funds to assist the county in financing the cost of a new bridge across the Feather River. Also available for replacing the destroyed bridge were federal emergency relief funds, which were allocated on a one-half cost basis.

The county, by use of these federal and state flood relief funds, constructed a new bridge across the Feather River on the adopted relocation line, which had been under study prior to the flood. The cost of this bridge with the immediate approach system was $2,300,000, one-half of which was federal emergency relief funds and one-half state funds authorized by the Flood Relief Law of 1956 (Chapter 9).

One Removable Span

The new Nicolaus Bridge is two-lane, 28 feet deck width, and is 3,200 feet long. It is constructed of precast, prestressed concrete girders, 105 feet long. The pier construction consists of reinforced concrete piers founded on 20-inch square, with 12-inch hollow core, precast, prestressed concrete piles. One mid-channel span is removable to permit passage of levee-repair dredges.

The location of the new bridge required construction of five miles of highway on the newly adopted alignment. The construction of this highway was accomplished by Sutter County through two federal aid projects. The work was effected under two contracts: one for a one-mile new highway northwesterly from the bridge to tie into existing Garden Highway, and one for four miles of

. . . *Continued on page 53*

Wilbur Avenue

Road Bond, FAS Funds Finance Highway Project

By VICTOR W. SAUER, Public Works Director, Contra Costa County

THE GROWTH of Contra Costa County from an agricultural community to an expanding industrial and residential area presented many problems to the governing body, one of which was providing adequate access roads to the developing areas. The people and the board of supervisors solved this problem by approving a road bond program of $10,250,000 on June 3, 1952.

A part of this program consisted of the reconstruction of Wilbur Avenue, which at one time served a few farms and fishing resorts, but which at this time had become a heavily traveled road with the development of the area into industrial and residential sites. The growth of the area and the importance of this road as a connecting link between the City of Antioch and State Sign Route 24, qualified it on October 4, 1956, for acceptance into the Federal Aid Secondary System.

With the approval of the road bond program by the voters of the county, the planning and design of Wilbur Avenue was started. It was planned that ultimately a four-lane road with a dividing median would be provided, but in the interim, stage construction, consisting of a heavy duty two-lane road with maximum grades of 3.5 percent would be provided.

Built In Three Sections

The road was built under three different contracts. The first section from A Street in Antioch to Orchard Avenue was placed under contract in August, 1956, and consisted of the grading and paving of a four-lane road. This section was built to the four-lane ultimate, as it passes through a densely settled subdivision area.

In December, 1957, the second section, extending from Orchard Avenue to 1,200 feet east of the Atchison, Topeka and Santa Fe Railroad, was let to contract. This section consisted of two 12-foot traffic lanes with two eight-foot shoulders.

This section also included the construction of a structure 485 feet in length over the railroad tracks. The overpass consists of 12 spans supported on two-leg pipe column bents. The superstructure provides for an an initial 28-foot roadway and two safety curbs. In the future, the design provides for an additional 28-foot roadway and a two-foot median strip.

The supersrructure consists of a steel stringer and concrete composite

This is a portion of Wilbur Avenue, an industrial highway east of Antioch, recently improved by Contra Costa County under its road bond and federal-aid secondary program.

The new overcrossing which carries Wilbur Avenue traffic over the Santa Fe Railroad Tracks east of Antioch. Note the method of aligning the columns to make them parallel to the tracks by staggering their positions in relation to the highway structure.

deck. The stringers are framed into the bent cross beams with high strength bolts. The bents are placed perpendicular to the road, while the railroad tracks are skewed 15 degrees. This necessitated 23-foot clearance under the cross bents which actually spanned the tracks. Framing of the superstructure steel stringers into the side of the bent cross beam instead of on top saved approximately three feet in the elevation of the deck, and thus considerably reduced the height of the bin walls and approach fills.

Many Tests Made

The substructure bents consist of a 36-inch wide flange beam with two 18-inch concrete filled pipe columns. Filling the columns with concrete greatly reduced the amount of steel required. An additional column is all that will be needed in the ultimate four-lane structure. The bent columns are supported on belled caissons drilled to a 10-foot depth. Extensive soil bearing and settlement tests demonstrated that the 70-foot layer of sand at the site was most favorable to this type of foundation. This type of foundation proved to be considerably more economical than piling.

Column base plates are supported on leveling nuts capable of jacking the entire structure if future differential settlement becomes a problem. Only one-inch maximum settlement on one of the columns was observed during the construction period.

Because of this method of construction, temporary relocation of railroad tracks during construction of the overhead was not necessary. The design for this portion of the project was developed under the supervision of John Shotwell.

While the second section was under construction, the third and final section extending east to State Highway 24 was let to contract. This section consisted primarily of two 12-foot traffic lanes with eight-foot shoulders, except at the entrance to the Crown Zellerbach Paper Plant and the Fibreboard Products Paper Mill, where median strips and left-turn storage lanes were provided.

One of the most unusual aspects of the project has been the financing. Funds from six different sources were used to finance the work; namely, county general tax, bond program, gas tax allocated to counties, federal aid secondary funds allocated through the United States Bureau of Public Roads, state highway matching funds administered by the Division of Highways, and funds of the Atchison, Topeka and Santa Fe Railroad Company.

Construction enginering was performed by the county under the supervision of Edmond M. McCarthy. Stage 1 was constructed by the Antioch Paving Company. Stage 2 was constructed by the Bos Construction Company, and Stage 3 by the Antioch Paving Company. Resident Engineer for Stage 1 was Dexter Ahlgren, for Stages 2 and 3, Roy L. Bailey.

Sign Route 41

Highway Relocation Through Kettleman Hills Completed

By J. M. McDOWELL, District VI Construction Engineer
and A. J. ZIMMERMAN, Resident Engineer

Motorists on the Morro Bay-Yosemite Park Highway in Kings County have bid a not-so-fond farewell to that portion of State Route 125 (SSR 41) with the lowest driving standards which has been replaced by 6.6 miles of new construction, knifing through the Kettleman Hills, cutting three miles from the length of the route.

The Kettleman Hills occupy an area about 30 miles long and five miles wide lying adjacent to the foothills of the Coast Range along the western border of the San Joaquin Valley. With an average annual rainfall of less than six inches, the ground surface is barren of shrubs and trees although a limited amount of livestock grazing is supported by a sparse growth of grass. The hills rise abruptly from the valley floor to heights in excess of 1,300 feet above sea level, then slope gradually to the south and merge again with the plain. An anticlinal formation of marine and sedimentary deposits, the initial oil discovery in 1928 has since determined the area to contain the great proportion of the petroleum resources of Kings County.

State Route 125, traversing this area, is one of the few laterals between US Routes 99 and 101 and is the most direct connection between Paso Robles, the San Joaquin Valley, and the recreational areas of Yosemite and Kings Canyon National Parks.

A large proportion of the traffic is thus of the summer recreational variety, although there is considerable heavy trucking to and from the oilfields and from neighboring farm communities during those periods when crops are moving to market.

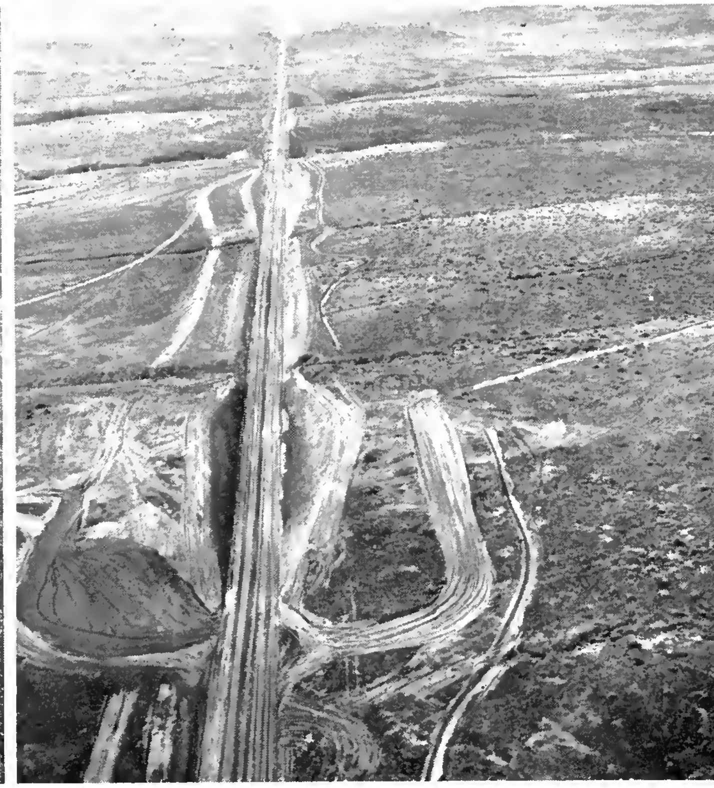
The former highway, built by the county and incorporated into the State Highway System in 1933, was of thin oiled earth of variable narrow widths having many short radius blind curves and grades of up to 10 percent. The sinuous alignment contained some 90 separate curves with total angular deflection in excess of 2,700 degrees.

The north end of the Sign Route 41 relocation project joins the existing highway at Kettleman City.

Water Was a Problem

By contrast the new construction consists of a 32-foot all-paved section made up of three inches of plant-mixed surfacing over six inches of Class C cement-treated base on variable thicknesses of select material. This material came from four sources located throughout the project and was placed in layers ranging from 6 inches to 17 inches depending upon the quality of the underlying soil. The maximum grade of the new highway is 5.7 percent and there are but four horizontal curves with a total deflection of 85 degrees. Minimum radius of curvature is 3,000 feet and intervening tangents are at least a mile in length.

Because water is hard to come by in this arid area and because of the hot, dry summer winds that cause rapid evaporation, a dry-fill method was utilized in constructing all embankments. No water was applied until the fills reached 30 inches below finished grade, the requirement being 90 percent compaction at the in-place moisture content of the material by



LEFT—The deepest cut (65 feet) and the highest fill (70 feet) are shown in the aerial with the detour on the left. RIGHT—This view southward from the middle of the job shows the relocated private road connections taking shape.

the impact compaction test. When the cuts were opened it was found that the moisture content of the material was at or near optimum which resulted in excellent compaction with a minimum of effort. Above this plane, optimum moisture was applied and 90 percent compaction by the 10-layer method obtained.

The titled nature of the material to be moved presented to view a wide variety of quite different soils with varying shrinkage factors. It became necessary to revise the profile grade line, widen fills, and level gullies when it became apparent that an excess of material was developing over that originally anticipated.

Special equipment, designed and constructed by the contractor to cope with the 780,000 cubic yards of roadway excavation and the attendant 7,000,000 station yards of overhaul, has contributed to the satisfactory progress of the grading operations. Stretching out the length of their scrapers by adding a four-foot telescoping extension to the scraper bed enabled each rig to be push-loaded with 24 yards of dirt in one minute's time. Production reached as high as 11,000 yards a day with six of these special scrapers working.

Contour Variance

Although local rainfall is light, the ruggedness of the terrain and the lack of cover vegetation combine to cause rapid storm water runoff. Prior to the start of construction operations it became apparent that estimated quantities for some drainage items would be exceeded because of variances from available contour maps. This led to one of the more significant contract change orders—an increase of nearly $17,000 in related drainage items which raised the value of contemplated work to $588,600.

Drainage from the larger watersheds is carried in two reinforced concrete double-box structures and three field-assembled metal pipes of up to nine feet in diameter. Smaller contributory areas are provided for with the placement of 3,500 feet of culvert pipe varying in diameter from 18 inches to 60 inches. It was also necessary to relocate or realign several natural drainage channels which meandered through the construction area. This work required the removal of 16,000 cubic yards of material and extensive use of sacked concrete riprap, used both for slope protection and for culvert inlet and outlet structures.

Aggregates for plant-mixed surfacing were manufactured by the contractor from a material site near the beginning of the project. Stream-laid gravel deposits were fed to portable crushers, then screened and stockpiled. A continuous type bituminous mixing plant was erected, from which material was transported to the project in large bottom-dump trucks.

Bill Anderson was job superintendent for the contractor, a joint venture of Ralph B. Ellis and Fisher and Stokes Construction Company. The authors are the representatives of the Division of Highways.

To the statistics of savings in time and distance which this new facility will provide, there must be added certain more intangible benefits to the motorist. Where previously many chose alternate routes rather than drive this tortuous section, there now will exist an easily traversable roadway of high standards, making for greater driver comfort.

Sign Route 88

Ione-Jackson Highway Improvement Completed

By C. F. RODERICK, Resident Engineer

THE IONE-Jackson Highway through Amador County on State Sign Route 88 has just added a little more history to its already historical background by the recent completion of a 7.8-mile stretch of modern highway between Lancha Plana Road and a point one-half mile east of Martell. This 32-foot wide all-paved section of highway has eliminated over 50 sharp-radius curves and a narrow pavement to make a safe and easy route into the Sierra Nevada Mountains for the use of hunters, fishermen and lovers of nature of all kinds as well as for trucking, industry and other business traffic.

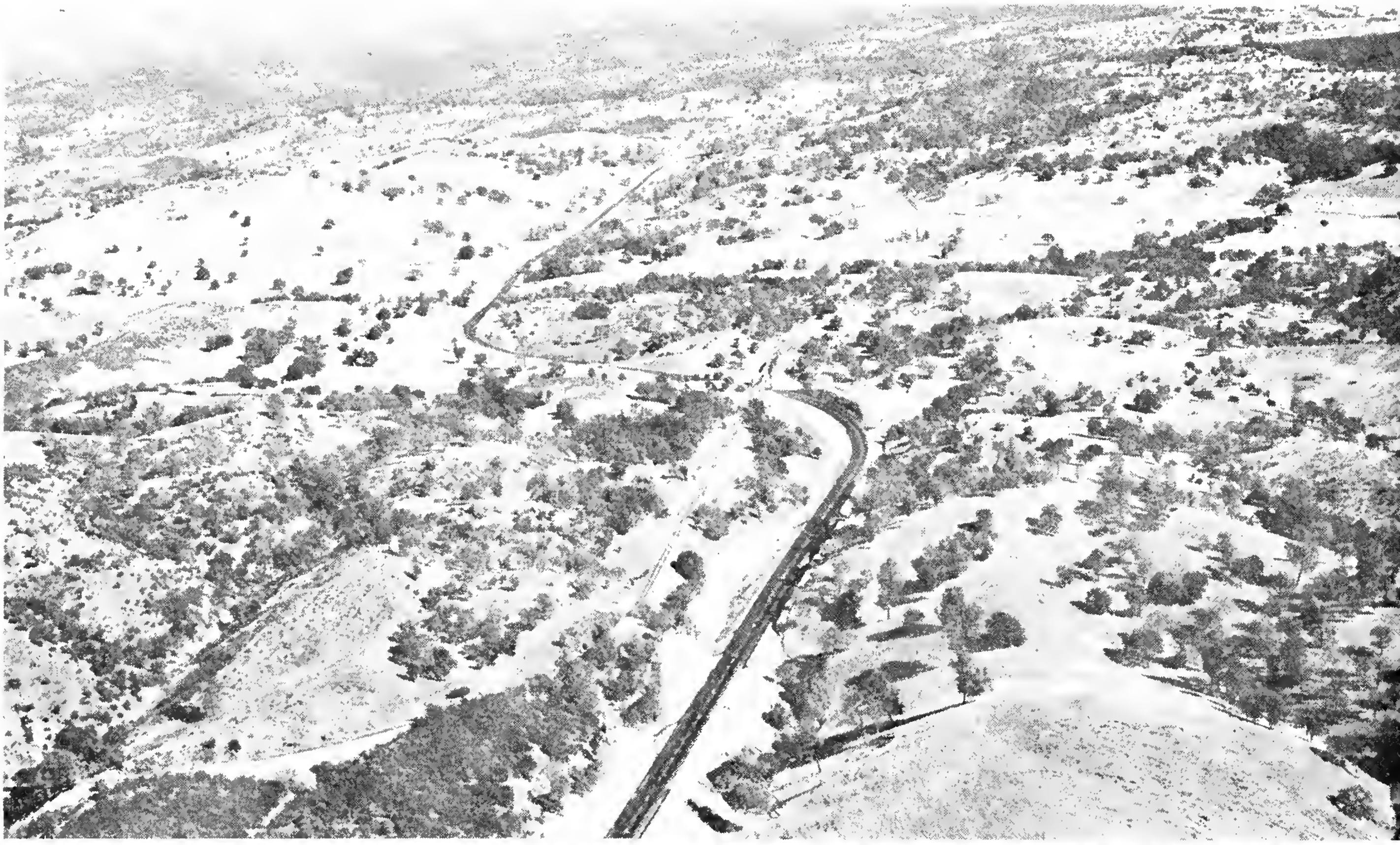
The new route closely follows the old, crossing it 23 times in all. The 12-mile-long Amador Central Railroad, said to be the shortest standard-gauge railroad in the United States, doesn't get too far from the highway alignment either. It is crossed by one underpass and three crossings at grade. The grade crossings now have new crossing alarm signals to protect them. At the East Ione Underpass, a new 95-foot riveted steel through girder span replaces the old wooden trestle underpass. Route 88 joins Sign Route 49 at Martell and the routes continue into Jackson before separating again. The last one-half mile of the project relocates the joint routes with an improved alignment which also provides a scenic view for the traveler.

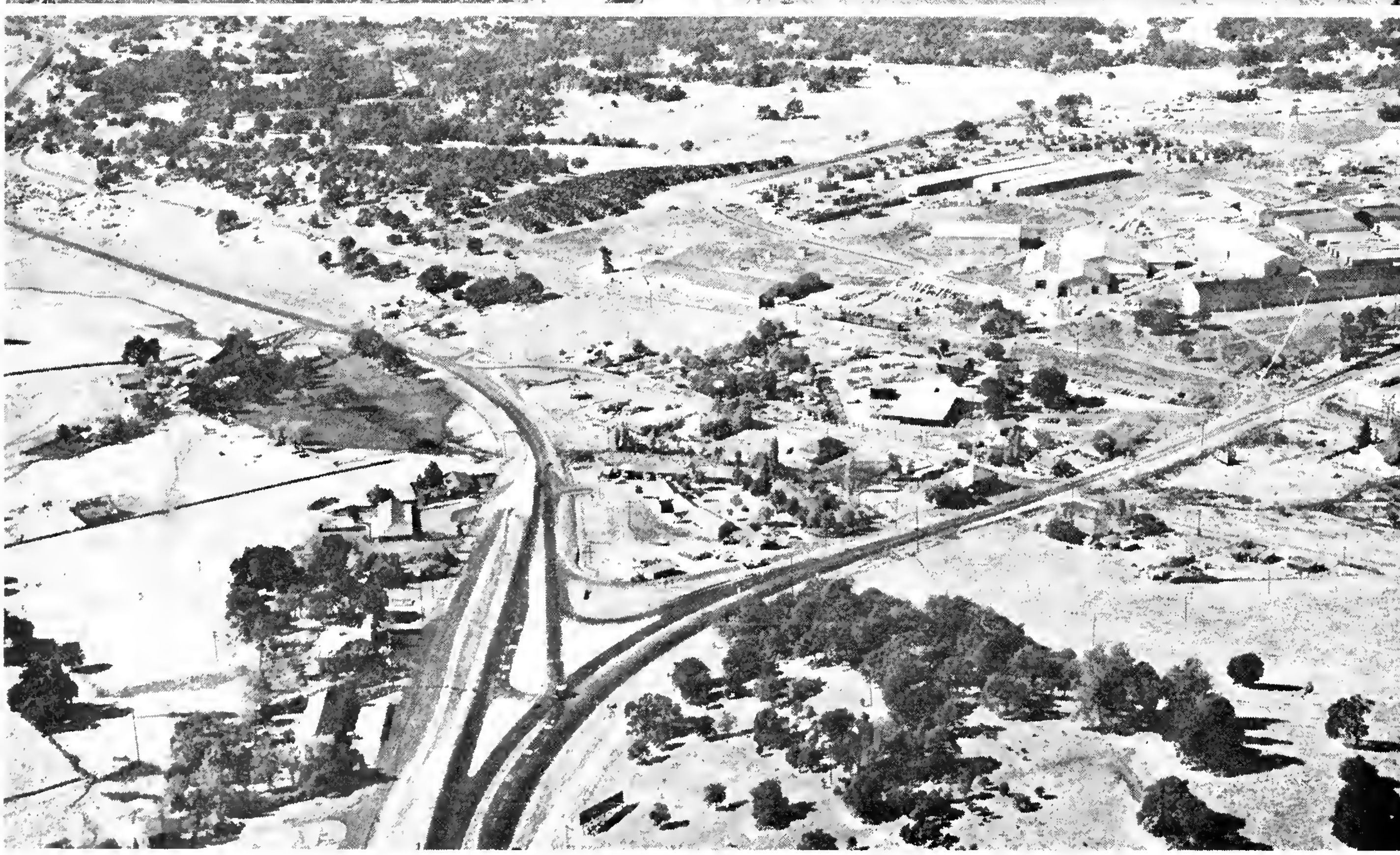
Intersection Modernized

The junction at Martell gives Amador County its first experience with a modern traffic-channelized intersection which includes traffic islands, traffic bars, and overhead highway lighting. The intersection occurs in a cut of 25-foot maximum which was widened considerably on the inside of the curve in order to secure a long sight distance and to provide needed fill material. About 65,000 cubic yards of roadway excavation was obtained within 1,000 feet and it was overhauled nearly two miles before being entirely used for making the embankments.

Many springs were encountered in the work, some of which were anticipated but many of which came as surprises. The most troublesome one was in the vicinity of the railroad crossing at Station 274 and at the lower end of the project's steepest grade, a 7 percent grade about 1,200 feet long. This was an anticipated spring area at the historic "Mountain Springs" stage coach station. The

The Martell Junction looking northwest. The highway in the foreground is combined Sign Route 88-49 with Sign Route 88 to Ione bearing left and Sign Route 49 North bearing to the right.





UPPER—Sign Route 88 looking toward Jackson. The new steel span of the East Ione Underpass can be seen in the middle of the photo. LOWER—An aerial of the Sign Route 88-49 intersection at Martell with Route 88 veering left and Route 49 heading right. Compare this photo with the ground level shot on the previous page.

spring serving the old stage coach station was still running and it was the State's obligation to pick it up and convey the water to the property owner at the right-of-way line. Construction operations caused loss of the spring at the original location but it was picked up again from under the highway and satisfactorily piped to the right-of-way line. The whole area from the railroad crossing at Station 274 ahead for about 700 feet was a wide streak-like spring area, easily diverted from one location to another by even a small amount of excavation. All the soft material overburden was removed until hard material was reached, thus exposing a rugged, rough surface. The entire area was covered with filter material giving a minimum thickness of 18 inches but with many places three to four feet in thickness. Eight-inch perforated metal pipe underdrains were irregularly spaced diagonally across the roadbed to lead the water to an open ditch along the low side of the highway. The ditch conveyed the water to specially built culvert boxes which normally pick up the water for the property owner's use but in time of storm carry the excess water well away from the highway. Between the filter material blanket and the untreated base of the roadbed broken rock from the nearby cuts was placed, insuring a firm, stable roadbed over this spring area.

No Traffic Holdups

Work began on this contract in July, 1957, and continued until December, 1957. Work was then suspended until April, 1958, when the work was resumed. The job was completed on October 31, 1958. The contractor was required to carry traffic through the project during all of his operations. (This aspect of the project was covered in an article entitled "Dust Control" in the May-June, 1959, issue of *California Highways and Public Works.*)

The Ione to Jackson Highway has a history, not as far back as some roads in the State, but an interesting one. Here, in brief, are some of the highlights of that history:

In 1849 the first white people settled in the Ione and Jackson areas, and consequently a road was necessary to connect these new settlements. The first was a mere trail and was a long way around. This trail left Ione and went some five miles south to Buena Vista, then easterly to Jackson along Stony Creek and came in on what is now called Hoffman Street, still noted as "the old road to Ione." This road was widened by the first Jacksonite, a man named Tellier (at his own expense), to permit wagon traffic. Prior to the widening of this route, freight was $1,000 per ton from Sacramento to Jackson.

The third route, which is very much the same as the present route, came into existence in 1866 with the construction of the "Kennedy Grade," which was the road from Jackson to the Kennedy Mine and on to what is now known as Martell. Subsequently a connection between Mountain Springs and Martell was built. As this was the shorter and better route, the second route was abandoned. The first route is now paved and used as a county road; however, the connection to Mountain Springs has been abandoned.

Old Way Stations

As these early routes became more traveled, way stations were set up for changing horses and food and rest stops for the travelers. The first of these on the route from Ione to Jackson was the "Miller House" located some 500 feet west of the East Ione Underpass. All remains of the site were obliterated by the construction of the highway in 1921.

Another rest stop was located just a short distance east of the "Miller House." On this site, the remains of the "Rantlett Post Office" were still standing until the construction of the present highway. The third stop is believed to have been in what is now known as "Sunnybrook." The next and possibly the most widely known, was "Mountain Springs" where evidence of buildings, etc., can still be noticed. The Mountain Springs area is now set up as a roadside rest area with benches and tables and fresh spring water for weary modern-day travelers.

The trip between Ione and Jackson is only a 15-minute drive today; but in the early stages, it was a full-day's ride on horseback or by stage.

In 1921 the California Highway Commission opened bids for state construction on this same stretch of highway. The construction work was done with old armored cars, trucks and tanks of World War I vintage. This was the last work done on the highway except for some work in the Martell area in 1932, until construction was started in 1957.

This later construction, completed in October, 1958, converted the highway to a 24-foot paved road with four-foot paved shoulders. The work was done by Transocean Engineering Corp. of Hayward; the Resident Engineer was C. F. Roderick, and was under the jurisdiction of District Construction Engineer W. F. Fleharty.

Commuter Habits Are Object of New Study

The State of California has begun a study of the commuting habits of its downtown Sacramento employees with the possible objective of rescheduling working hours to spread the traffic volume evenly throughout the hours of going to and from work.

The survey is part of Governor Edmund G. Brown's program for increased efficiency in State Government and is being conducted by a committee under the chairmanship of James F. Wright, Deputy Director of the Department of Public Works.

The Department of Public Works was the first state agency to make such a study of the commuting habits of its employees.

Questionnaires have been distributed to nearly 12,000 state employees in 11 state-owned buildings and 13 privately-owned buildings in the downtown area.

The employees indicate in the questionnaires how they travel between home and work, and the major traffic corridor they use. They are also asked to express a preference for hours of work – ranging from 7.30 a.m. to 8.30 a.m. beginning time, and including either one hour or 45 minutes for lunch.

MEDIAN STUDY

Continued from page 8 . . .

toring courtesy will continue to be the most effective weapons in the fight against traffic accidents.

Categories Described

For the purposes of the safety study, various median designs were placed in two categories—"deterring" or "nontraversable."

The deterring types includes many of the earth medians, the raised bar or low dike facilities, and the center strips with mountable double curbs.

The nontraversable category includes medians with barriers, and nonmountable curbs, separate roadways, and earth medians with a continuous obstruction or with steep slopes. In addition, all medians more than 100 feet wide were classified as nontraversable.

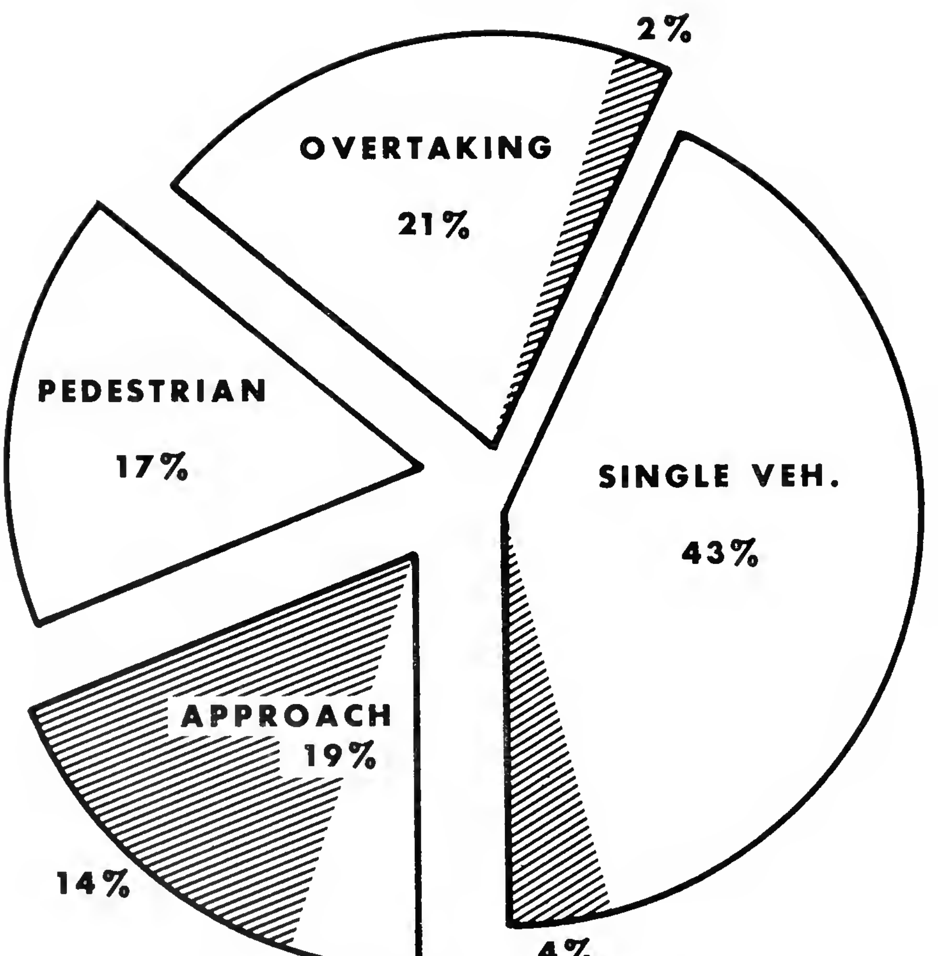
Part One of the safety study involved an analysis of 8,000 accidents which occurred over a two-year period (1956 and 1957) on the 265 miles of divided highways selected for the study.

Among the items considered in this portion of the study were the influence of traffic volume on the accident rates for highways with both types of median, and the influence of the median design on the type and severity of accidents.

Statistics were developed which indicated that operating conditions, as measured by average daily traffic, made a difference in the relative safety of routes with deterring medians and those with nontraversable medians.

In the volume range from 15,000 to 130,000 vehicles a day, nontraversable median designs had higher overall accident rates and higher injury (includes fatalities) rates. As expected, the nontraversable medians had fewer head-on accidents than deterring medians, but the higher rates for overtaking and single vehicle accidents more than offset this advantage. In this volume range, head-on accidents account for 1/25 of all accidents and 1/21 of the injury accidents.

On highways carrying more than 130,000 vehicles a day, the nontraversable medians showed lower rates than the deterring type for both injury accidents and all accidents.



This chart shows the types of fatal accidents on California freeways during 1956, 1957 and 1958. The shaded portion represents cross-median accidents.

Past Studies Noted

The findings of this portion of the study coincide with those of two before-and-after studies of freeway sections where barriers have been installed in the past.

Since 1951, the division has made three such before-and-after studies. The accident rates decreased after a steel guardrail was placed in the median on a section of the James Lick Freeway in San Francisco; however, the results were much different in the two other cases.

On the San Bernardino Freeway in Los Angeles, the accident rate jumped 75 percent and the injury rate increased 116 percent after a median barrier was installed. On the Grapevine Grade (US 99) in Kern County, the accident rate went up 88 percent and the injury rate climbed 53 percent in the afterperiod.

In view of the unfavorable record of barriers in two of the before-and-after studies and also in the new 265-mile study, it is worthwhile to examine some of the probable reasons for the adverse effect of barriers installed in the past.

First, the introduction of a physical barrier in a traversable or deterring median *reduces the usable width of the median*, thereby limiting the space available to motorists for emergency maneuvers and parking in the center strip. There are undoubtedly a large number of vehicles which enter and in some cases cross the median without being involved in an accident. More important, perhaps, is the fact that stalled vehicles are frequently parked in median areas.

In addition, collisions with barriers, such as those used in the past, may mean serious injuries to occupants of a vehicle, or result in other collisions as a vehicle bounces back into the traffic stream.

UPPER—The effectiveness of various median designs was evaluated in a recent Division of Highways safety study. Medians with barriers, such as this one on the James Lick Freeway in San Francisco, were among those classified as nontraversable. LOWER—This type of curbed center strip on the Hollywood Freeway in Los Angeles was one of the deterring median designs included in a recent Division of Highways freeway safety study.

Curbed or Earth Medians

These are probably the main reasons why Part One of the study indicates that a nontraversable barrier median is not as good as the curbed or earth median from the standpoint of overall traffic safety or severity of accidents, except on highways carrying extremely heavy traffic.

As a corollary to the accident analysis of Part One, the second phase of the study covered only the 407 fatal accidents which happened on the State's full freeways in 1956, 1957 and 1958. Emphasis was on the fatal cross-median accidents.

The purpose was to determine a basis for dealing with the problem of the infrequent but usually serious cross-median collision through the use of median barriers.

In connection with this part of the study, it is appropriate to note that 10 times as many fatal head-on accidents occur each year on conventional roads, streets and highways in California as occur on the State's freeways. Nearly all such crashes on both kinds of highway are the result of driver error or negligence.

While many people are inclined to attribute head-on crashes which happen on ordinary roads, streets and highways to speed, drinking, immaturity or some other driver factor, the comparatively few which occur on freeways are often blamed on highway design.

The factual study reveals this widespread impression to be a fallacy.

Pedestrian Rate High

As a starting point for the second portion of the study, fatal freeway accidents were classified according to type. As shown in the accompanying chart, 43 percent of the fatal accidents in the three-year period involved only *one vehicle;* an *overtaking* collision was responsible for 21 percent of the fatal accidents; and *pedestrians,* most of them illegally hitchhiking or using the freeway as a footpath, were involved in 17 percent of the fatal mishaps. (See "pie" chart.)

About 19 percent of the fatal smashups were the approach type. This includes crashes brought on by wrong-way drivers, as well as head-on accidents in which a car or truck crossed the dividing strip.

The number of fatalities resulting from each type of accident was also recorded. Forty-two precent of the fatalities resulted from single-vehicle accidents; 20 percent from overtaking accidents; 24 percent from approach accidents of all types; and 14 percent from pedestrian mishaps.

Crossings of the median were present in 55 of the approach type fatal accidents, seven of the overtaking type, and 15 of the single-vehicle fatal accidents. (See shaded areas in chart.)

It should be explained that the accident classification is determined by the first event. Thus, the cross-median overtaking accidents involved an overtaking collision before the vehicle crossed the madian.

Cross-Median Crashes

A significant fact derived from the classification of accidents was that the 62 cross-median collisions of two or more vehicles accounted for 95, or about one-fifth of all fatalities on freeways during 1956, 1957 and 1958. (During the same years there were 11,005 traffic fatalities on all types of streets, roads and highways in the State.)

The next step was to attempt to find the conditions under which cross-median collisions of two or more vehicles are most likely to occur.

The large majority of these accidents, it was learned, happened on sections of a relatively few heavily traveled freeways. In fact, two-thirds of all the fatal cross-median collisions occurred on routes which carry more than 60,000 vehicles a day.

Thus, to make a significant attack on the problem of cross-median collisions, consideration should be given to the installation of barriers on freeways with average daily traffic of more than 60,000 vehicles.

This poses a dilemma, since the first part of the study, as well as past experience, shows that barriers may have a detrimental effect on accident and injury rates, except on routes which carry more than 130,000 vehicles a day.

The answer to this dilemma may be found in the operating effectiveness of the new types of barriers developed by the Materials and Research Laboratory in the course of the impact tests.

Barrier Requirements Listed

To be an effective aid to safety, a median barrier must meet very exacting requirements. It must, of course, prevent crossings of the median; but it must also absorb high speed impact in such away as to minimize possible injuries to occupants of the vehicle and reduce the danger of the vehicle bouncing back into the traffic stream.

Barriers installed in the past have not been satisfactory in meeting all of these requirements, the crash tests revealed. The new designs, however, appear to be more effective, particularly in reducing the severity of collisions with the barrier.

This leads to the encouraging belief that the new barriers will prove to be beneficial under actual operating conditions on heavily traveled freeways.

Auto Club Counsel J. A. Davis Retires

J. Allen Davis, for 20 years general counsel for the Automobile Club of Southern California and representative of the motorists' organization in Sacramento, announced his retirement in July. He has been succeeded by Harry V. Cheshire, Jr., former legislative counsel.

Davis rewrote the California Vehicle Code in 1923 and has served continuously on the California Advisory Committee on Motor Vehicle Legislation since his first trip to Sacramento in 1922. From 1946 through 1950 he served as secretary to the Committee on Laws and Ordinances of the President's Highway Safety Conference.

Davis is a member of the statewide Highway Committee of the California State Chamber of Commerce which has sponsored important highway legislation in California.

He was born in Denver, educated in the public schools of Los Angeles and graduated from Stanford University in 1912, receiving his Juris Doctor there in 1914.

SUTTER FAS

Continued from page 42 . . .

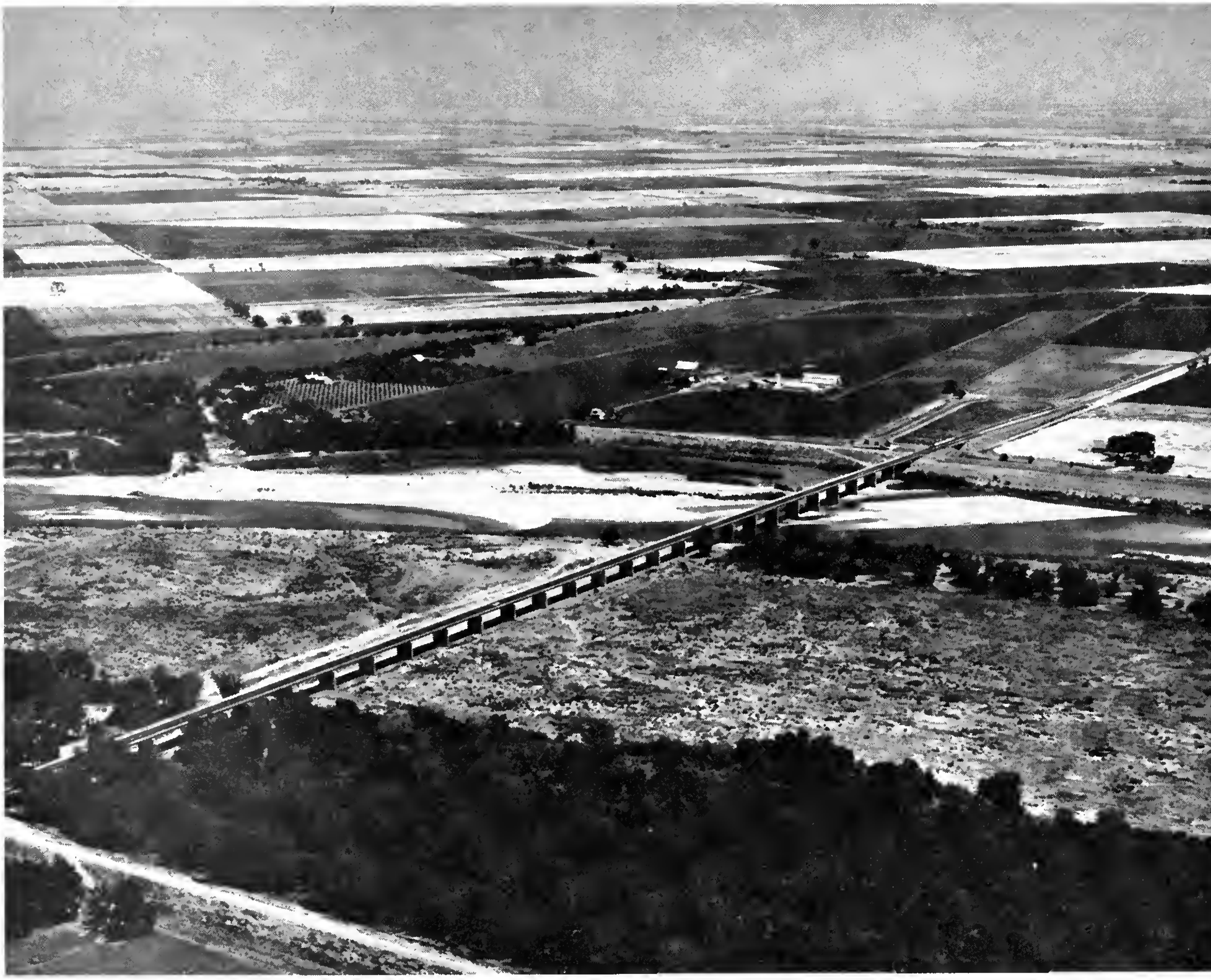
new highway running southeasterly from the bridge to tie into State Sign Route 24. This new highway is known as Drescher Boulevard. The latter contract was the one just completed and opened to traffic on June 1, 1959.

Some of the outstanding features of the completed FAS route, including that portion taken into the State Highway System since construction are:

1. The unrestricted highway distance between Sacramento and Yuba City is reduced from 52 miles to 41 miles.

2. The route eliminates a great many curves and many miles of dangerous levee roads by using flat valley alignment. (Only five curves with a minimum radius of 2,000 feet in 14 miles of new alignment).

This new section of Drescher Boulevard in Sutter County is the final link in 41 miles of improved highway between Yuba City and Sacramento. From a connection with State Sign Route 24, the recently completed FAS road (center) extends northwest toward Nicolaus, where a new bridge carries traffic across the Feather River.



Replacing the structure washed out in the floods of December, 1955, this modern concrete girder bridge now carries traffic across the Feather River near Nicolaus. Cost of the bridge and its immediate approaches was $2,300,000. Site of the old bridge is marked by the open space through the trees of the town of Nicolaus (left center).

3. The project provides a route from Yuba City to Sacramento without a single railroad crossing.

4. A 41-mile direct route from Yuba City south to Sacramento is established without a single arterial stop or traffic signal, while northbound traffic from Sacramento to Yuba City has only three arterial stops, two of which are at the outskirts of Sacramento and Yuba City.

This FAS route is truly a "farm to market" highway in the full sense of the term. Much credit for the successful completion of this project must go to the Board of Supervisors of the County of Sutter, for without their tenacity to see the completion of the project, it would never have been completed. All FAS funds allocated to Sutter County have been spent on this project.

The total amount of federal funds spent on this project is:

FAS funds and "D" funds	$574,000
Emergency relief funds	1,150,000
Total	$1,724,000

The total amount of state funds spent on this project is:

State highway matching funds and county highway aid act funds	$323,000
Chapter 20 Funds (Construction and Employment Act of 1946)	227,000
Chapter 9 Funds (Flood Relief Law of 1956)	1,150,000
Total	$1,700,000

The total amount of county funds spent on this project is:

County total	$145,000

The grand total of all funds is:

Grand total	$3,569,000

The Division of Highways has reported that, to date, more than 1,600 of its employees have been presented with 25-year service certificates and pins.

IMPACT TESTS

Continued from page 16 . . .

in the bus to record the kinematics of the anthropometric dummy.

Pressure sentitive micro switches mounted in the path of the crash car were uesd to trip flashbulbs located behind the barrier in view of the tower camera. These flashbulbs permitted accurate evaluation of the vehicle approach velocities by noting these flashes on the film of the 1,200 f.p.s. overhead camera. This particular camera also recorded 1,000-cycle timing pips on the film which permits accurate timing of the sequences as well as crash car velocities.

A third flashbulb mounted on the crash car was set to fire at a 2 "G" deceleration level. A pulse from this flash placed a pip on the accelerometer oscillograph base line, which permitted correlation of the oscillograph impact records with the reactions observed in the various data film.

A segmented drum revolving at 1,600 r.p.m. in view of the cameras provided a time interlock between all cameras.

Stresses Correlated

On those occasions when strain gage readings were made of the various guard rails, the individual timing pips were taken from the flashbulb circuits and placed on these oscillograph recordings in order to correlate the various stresses with the position of the crash car.

Altogether the operation of various cameras and the means of sequencing these units with the various instruments may appear complicated. In effect the system was relatively simple as all equipment was operated from a central control board. The care taken in interrelating the timing of sequences during the various crashes has paid off in correlating details while working up the final studies.

The actions and reactions of the anthropometric dummy during the crashes have been found to be exceedingly complex. In a number of the initial crashes a portion of the car roof was removed over the driver's seat in order to permit high speed photographic study of his gyrations. In general, the 30° angle of impact at 60 m.p.h. produced a transverse impact of 15 to 25 "G" against the left front door, causing the dummy to break the door open. During the initial part of the impact, the guard rail would retain the car door closed, but as the car reflected from the rail, the door would fly open. In most instances the seat belt was the only thing that prevented the dummy from being ejected from the car.

A number of other rather pertinent and interesting observations were made during the crash studies, but space does not permit inclusion of all of these. One rather unique experience was that with the special radio control receiver and relay system, which was used in all 25 crashes, the only damage sustained in the period was the loss of one tube and one wire pulled loose. This is an outstanding record as accelerometers on the car frames occasionally indicated peak decelerations as high as 200 "G."

TWENTY-FIVE-YEAR AWARDS

Employees who received twenty-five-year awards since those listed in the March-April edition of *California Highways and Public Works*

DIVISION OF HIGHWAYS

District I
Percy A. Main

District II
Cecil F. Koenig
Frank Noel

District III
James C. Cleek
Florence Jewell Schade
Henry R. Vierra

District IV
Leo Immel
Harry B. Pearce
Sidney Silver
Joseph D. Silvera
Lawrence D. Bigelow

District V
John E. Brocklebank
Arthur F. Durrant
L. E. Elder
Elmer H. Tenscher

District VI
Henry H. Rickels
Samuel A. Dodd
Raymond E. Munson

District VII
Marshall W. Burke
Bob J. Carter
Ralph V. Chase
Elmer L. Smith
George F. Stransky
Erwin O. Tagley
Ralph Truesdale
Leonard Walter Ford
Charles S. Gwinnup

District VIII
Leo P. Wagner

District X
Joe A. Macedo
Francis O'Neill
Joseph M. Silva
Clair N. Steele
Carl A. Bennett
Frank T. Lavagnino
Joseph H. Perrin
Kirk Thomas

District XI
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Claude L. Horton
Edward W. Shedaker
G. E. McCain
Laurence L. Pearson
Carl A. Wolin
Fred Young

Headquarters Office
Keith E. Pilkenton
Thomas W. Reynolds

Bridge
C. L. Caldwell
R. Robinson Rowe

Materials and Research
Roy B. Stratton

Shop 7
Arvid H. Mathlin

DIVISION OF CONTRACTS AND RIGHTS-OF-WAY
Jennie C. Thomson

Winners Announced By Merit Award Board

Employees of the Department of Public Works receiving certificates of commendation and cash awards since the last list was published in the May-June issue of the magazine are:

Charles D. Andert, Highways, San Diego. Certificate of commendation for recommending use of "KEPS" nuts in Traffic Actuated Dispatchers.

Donald D. Arndt, Architecture, Sacramento, $40 for recommending use of a color code to identify project folders.

Gordon D. Hanson, Architecture, Northridge, $40 for recommending zoning of gang showers and installation of gate valves for servicing.

G. W. Hevron, Highways, Oildale, $25 for recommending installation of coil springs on tail gate hinges of mechanics' trucks.

Guy C. Hudson, Highways, Big Sur. Certificate of commendation for recommending use of an attachment for front-end loaders.

James Lem, Highways, San Francisco, $25 for recommending use of double-exposure process for reproducing contract plans.

Jack Lynn, Highways, Bridgeport, $150 for recommending use of a special wrench for installing shear bolts on rotary snow plows.

William A. McCarron, Highways, Redding, $25 for recommending revision of control and detail cards.

Jack N. McQuown, Highways, Redding, $10 for recommending revision of daily shop time card.

Miss C. Vera Mesquita, Highways, Sacramento, $40 for recommending use of addressograph machine for addressing labels to engineers and district offices.

Bill A. Metzel, Highways, San Bernardino. Certificate of commendation for recommending that use of copyrighted material in State publications be controlled.

Lawrence M. Perry, Highways, Norwalk, $15 for recommending an improved position for pickup brooms in street sweepers.

Conrad G. Puder, and Frederick W. Schwarz, Highways, San Luis Obispo, $80 shared equally for recommending use of lightweight timber barricades.

Hamilton Quayle, Highways, Sacramento, $50 for recommending enactment of legislation requiring cities to file legal descriptions and maps of annexations with the Division of Highways.

Mrs. Wilma F. Rieger, Highways, Stockton, $30 for recommending that counties, routes and sections be specified on work orders.

Pippo M. Scandurra, Highways, San Francisco, $15 for recommending addition of driveway details on the standard plan sheet.

George A. Smith, Highways, San Diego, $40 for recommending installation of an electric timer to the off switch on all white printer machines.

Street Naming Honors District II Engineer

Aramayo Way is a new road name on the official maps of Tehama County—probably the first instance on record of a county road being named in recognition of the work of a State Division of Highways engineer.

The road runs between the towns of Los Molinos and Gerber, south of Red Bluff. It was completed this spring as a federal aid secondary construction project, and is named for Luis Aramayo, assistant district engineer of District II (Redding). Aramayo formerly served as City and County Co-operative Projects Engineer for the district.

Aramayo was invited to the ribbon-cutting ceremony without being told of the honor. As reported in the Corning *Daily Observer:*

"Aramayo was taken completely by surprise by the gesture of naming the road for him. Announcement of the choice of name for the stretch of highway linking the two communities was made by Don Drane, president of the Los Molinos Chamber of Commerce.

"Selection of the name by the board of supervisors, Drane said, was made in recognition of Aramayo's interest in the development of highways in the smaller counties of the State."

The honor accorded Aramayo is considered an additional mark of California's excellent state-county relationships in the planning and construction of county roads on the Federal Aid Secondary System.

New Booklet Answers Freeway Questions

The booklet, *Freeway Facts,* which is distributed at public meetings on proposed freeway routes, has been revised and reprinted by the Division of Highways.

The booklet outlines the freeway route selection procedure and answers general questions about freeways as part of the division's continuing effort to keep the public fully informed on freeway route matters.

Statistics have been brought up to date, and some of the material in the booklet has been revised to better answer questions frequently asked at the scores of public meetings on proposed freeway routes which are held each year by the Division of Highways.

Charles K. Boyle

Charles K. Boyle, Highway Engineering Technician, was killed by a truck while working on a construction project near Napa on June 4th.

He came to work for the Division of Highways in July, 1955, as a junior civil engineer.

Prior to coming to work for the Highway Division he was employed as an engineer by the City of Reno, Nevada, the California Division of Beaches and Parks and a private engineering firm.

He was born in Brooklyn, New York, where he graduated from high school in 1935.

During World War II he served with the U. S. Army in the European and Asiatic Theaters. He was awarded the Presidential Unit Citation with cluster and the French Croix de Guerre.

He was active in Boy Scout work.

He is survived by his wife, Carol, a stepdaughter, Billie Jean, of San Francisco, his mother, Mrs. Charles Cameron Boyle, of Brooklyn, New York, and a brother in East Meadows, Long Island.

WORK IMPROVEMENT

Continued from page 1 . . .

that frequent evaluation is made of the progress of the program within his division.

Each division chief will be assisted by a division WIP co-ordinator, whose duties will be similar within the division to those of the departmental co-ordinator.

As much as possible, WIP will be carried on through the regular organizational channels within each department. It is not the intention of WIP to curtail the right of any line official to determine work organization and methods in his section and the number of temporary WIP committees or positions under the program will be held to a minimum.

EDMUND G. BROWN
Governor of California

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L. C. HOLLISTER . . . Projects Engineer—Carquinez
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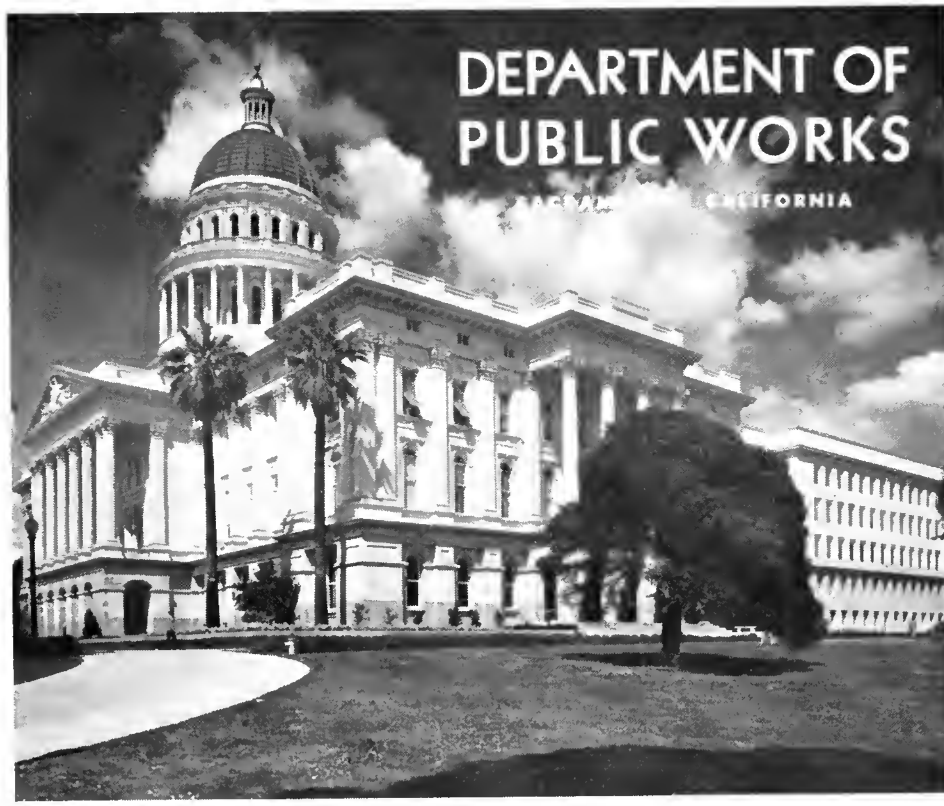
RUDOLF HESS . . . . Assistant Chief
R. S. J. PIANEZZI . . . . Assistant Chief
E. M. MacDONALD . . . . Assistant Chief



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District VII

E. T. TELFORD . . Assistant State Highway Engineer

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printed in CALIFORNIA STATE PRINTING OFFICE 99137 7-59 38,400

California Highways and Public Works
DIVISION OF HIGHWAYS
P. O. Box 1499
SACRAMENTO, CALIFORNIA

RETURN POSTAGE GUARANTEED

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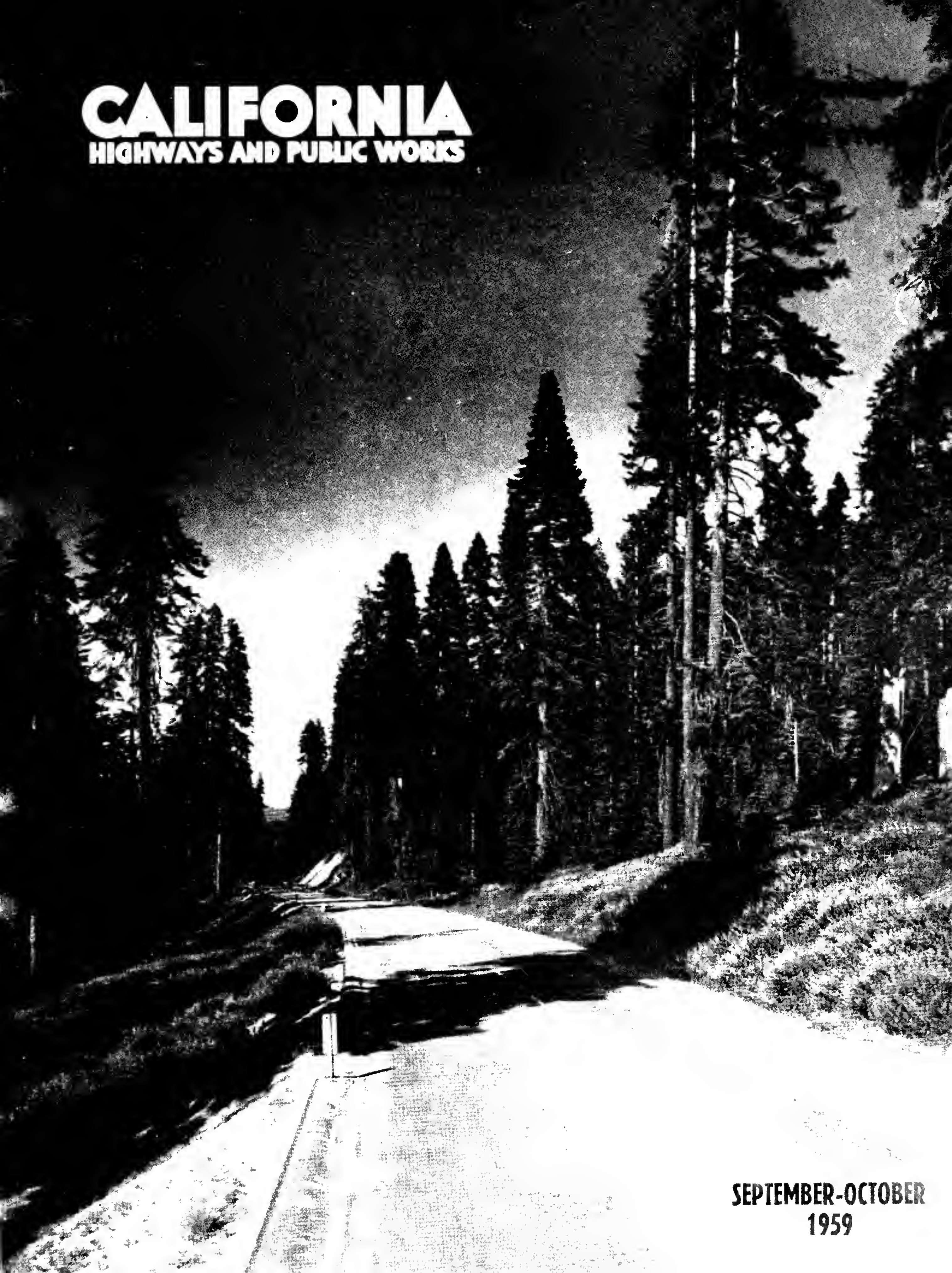

SEPTEMBER-OCTOBER
1959

California Highways and Public Works

Official Journal of the Division of Highways, Department of Public Works, State of California

RICHARD WINN, *Editor*
HELEN HALSTED, *Assistant Editor*
STEWART MITCHELL, *Assistant Editor*
MERRITT R. NICKERSON, *Chief Photographer*

Vol. 39 | September-October | Nos. 9-10

FRONT COVER

Roadside patches of purple lupine are a common sight during the early summer along this mountain section of Sign Route 168 near Huntington Lake in Fresno County.

—Photo by William R. Chaney

BACK COVER

A landscaped section of US 101 freeway near Mission San Luis Obispo. The colorful oleanders along the center strip serve as an effective screen against headlight glare at night.

—Photo by Jack Meyerpeter

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Published in the interest of highway development in California. Editors are invited to use information contained herein and to request prints of any black and white photographs.

Address communications to

CALIFORNIA HIGHWAYS AND PUBLIC WORKS
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Master Plan

Legislature Enacts Mammoth $10½-billion Road Program

A LONG RANGE highway plan of monumental scale became state law June 19th when Governor Edmund G. Brown signed legislation establishing the 12,414-mile California Freeway-Expressway System.

The master plan, which calls for a $10½-billion freeway-expressway construction program in the next 20 years, was adopted by the 1959 Legislature in Senate Bill No. 480.

The measure was introduced by Senator Randolph Collier of Yreka, Chairman of the Joint Interim Committee on Highway Problems. It became effective September 18th and is now included in California law as Chapter 1062, Statutes of 1959.

Governor Brown said the signing of the bill was "a momentous occasion in our State's history.

"This will eventually result in linking of all cities of 5,000 or more persons, and it will carry 59 percent of the total vehicle travel when completed," the Governor said.

Director of Public Works Robert B. Bradford reported that the freeway-expressway system will be by far the biggest public works project in the State's history, and the largest freeway program ever undertaken by any state.

When plans for the system were submitted to the Federal Bureau of Public Roads in Washington, Bradford added, it was praised as "the finest job of planning a highway network in history."

Future Routes Included

As adopted by the Legislature, the freeway system includes 10,811 miles of highway which are already under state jurisdiction as part of the 14,000-mile State Highway System. The remaining 1,603 miles are streets and roads now maintained by cities and counties, or new routes which are not yet built.

The plan is geared to an estimated population in 1980 of 31,000,000 and to motor vehicle registration of 17,000,000 with yearly travel by cars and trucks of some 200 billion vehicle-miles. Californians today drive an estimated 63 billion vehicle-miles in about 7,500,000 motor vehicles.

Over a 20-year period of use, the freeway-expressway system will return user benefits amounting to nearly twice the estimated $10.5 billion cost. This means savings in 20 years to the motoring public of some $20 billion.

Discussing the system in a recent address in Los Angeles, Director Bradford paid special attention to what he called the program's "practical planning philosophy."

Although general termini of routes in the system are designated in the law, Bradford explained, "the details of development for each route are not spelled out—they are left to the executive branch to determine, in line with existing policy."

At the same time, he continued, the Legislature provided clear guidelines for the Highway Commission and the Division of Highways to follow in getting the massive highway network into operation.

Adequate Right-of-Way Acquired

The Legislature directed that the system be completed with provision for control of access "to the extent necessary to preserve the value and utility of the facilities to be constructed."

"This provides," Bradford said, "for a range of development all the way from an initially constructed eight-lane freeway to an expressway in mountains or desert with only two lanes but with protected access."

Provision is also made for continuing review of the freeway-expressway system plans. The Division of Highways is required to submit a progress report to the Legislature every four years, beginning in 1963, and to suggest possible revisions as indicated by changing growth and economic patterns.

The suggested revisions are to be considered by the Legislature through its own committees and through advisory committees of city and county officials which the Legislature may appoint.

While work is progressing on routes included in the system, other state highways will not be neglected. The law calls for concurrent improvement of these highways according to relative deficiencies and traffic conditions. An estimated $1,133,000,000 will be spent by 1980 on the 3,578 miles of state highways outside the freeway-expressway system.

Legislature Requests Study

Studies leading to the overall plan for a freeway-expressway network were requested by the 1957 Legislature in Senate Concurrent Resolution No. 26.

The resolution instructed the Department of Public Works to undertake a study which would provide the basis for an integrated statewide system of freeways and expressways. It specified that potential routes were not to be limited solely to state highways, but should also include city streets and county roads.

Two years of intensive work went into the plan, involving the most comprehensive analysis of motor vehicle traffic, population, and economic conditions ever developed in California for highway planning purposes.

In preparing the plan, the Division of Highways worked closely with a Legislature-appointed committee of city and county officials which acted in a technical advisory capacity (see "SCR 26" in Sept.-Oct. 1958 issue of *California Highways and Public Works*). The Automotive Safety Foundation of Washington, D. C., and the Institute of Transportation and Traffic Engineering of the University of California also assisted. County and city engineering staffs extended full co-operation.

. . . Continued on page 52

Public Works Building
Twelfth and N Streets
Sacramento

CONTENTS

Pacific Palisades Slide Report Made

The New York City consulting firm of Moran, Proctor, Mueser and Rutledge, employed by the Department of Public Works to study and seek a solution to the problem of landslides along the Pacific Palisades in the Santa Monica area, has completed its work and submitted a report.

The studies were authorized by the 1957 Legislature, which made an appropriation of $300,000 from the State Beach Fund available for the purpose. The Cities of Los Angeles and Santa Monica and the County of Los Angeles co-operated in the studies.

The report recommended remedial measures which would cost in excess of $6,000,000, which would include installation of drains, the construction of berms or benches in some locations and the partial filling of some canyons. The estimate of costs is preliminary and subject to detailed engineering studies, the report said.

The consulting engineers stated:

"While it is certainly possible to flatten slopes to a point where they would become absolutely stable against any eventuality, such an operation would destroy much of the property it is desired to protect. It would be simple to call for such massive regrading and fills or large-scale drainage provisions in the landslide areas. But instead, recommendations are made only for control measures that are reasonable in magnitude, have a definite likelihood of alleviating the landslide threat, and which have a fair justification by the value of properties to be protected."

The report is contained in three volumes of text, drawings, and technical data.

Director of Public Works Robert B. Bradford said the report was thorough and showed intensive study of the problems. He said the consulting engineers' report would be studied by the co-operating agencies and that the Department of Public Works would present its conclusions to the Legislature.

McCoy Retires; Vickrey Named

George T. McCoy has retired as California State Highway Engineer, a post he has held since 1943 and in which he has won national fame as a leader in highway planning and construction.

The appointment of J. W. Vickrey, Deputy State Highway Engineer for the past three years, to succeed McCoy has been announced by State Director of Public Works Robert B. Bradford.

McCoy's retirement climaxes a notable career in engineering. After graduating from Whitman College in Walla Walla, Washington, and completing a course in civil engineering at Columbia University, his first major professional assignment was as assistant engineer on bridge and dam construction and highway relocation in connection with the $300,000,000 Catskill Aqueduct.

In 1916 he went to work for the Washington State Highway Department and rose to be assistant state highway engineer. McCoy came to California in 1927 as assistant office engineer, and in the following year was appointed administrative assistant to State Highway Engineer C. H. Purcell. In 1933 he was advanced to the position of Assistant State Highway Engineer, becoming State Highway Engineer 10 years later.

Robert B. Bradford (dark suit), State Director of Public Works, presents a gift to George T. McCoy, retiring State Highway Engineer, at a dinner given in McCoy's honor on September 23d in Sacramento.

J. W. VICKREY

In that office he was responsible for the expenditure of some two and a half billion dollars for state highway improvement and guided the development of California's highway system into a position of recognized leadership throughout the Country.

McCoy has held numerous offices and committee posts in the American Association of State Highway Officials and served as president of the organization in 1955. In 1958 McCoy received the MacDonald Memorial Award from A.A.S.H.O. for outstanding service in highway engineering. He was the first highway official in active service to receive it.

He is a native of Milton, Oregon, born on September 12, 1889.

At McCoy's retirement dinner on September 23, Chester H. Warlow of Fresno, on behalf of the California Highway Commission of which he is a member, paid the following tribute to the retiring State Highway Engineer:

"On the Way of Life, men travel by different paths—some for personal gain—some for honors and personal aggrandizement.

"Fortunately there are others who tread a trail where their energies are devoted to the walfare of mankind, each contributing, in his own particular way, something of value to his community and state, making the world a better place, a more pleasant place, a more beautiful place in which all men may live. On such a course, carefully and faithfully pursued, the individual achieves not only these results, but as he nears the end of his labors he finds that he has gathered undreamed of honors and fame, all added to the personal satisfaction which is his in the remembrances of

. . . Continued on page 54

Trip South

Highway Commissioners Inspect Projects in Southern California

The California Highway Commission convened in Southern California in July for a three-day business meeting and tour.

The commission, the citizen group which represents all Californians in guiding the State's highway program, visited Los Angeles, Orange and San Diego Counties.

The commissioners spent a day in regular business sessions, considering route adoptions and financial matters. They held this session in the Division of Highways Building in Los Angeles.

They spent another day inspecting construction projects and familiarizing themselves with freeway route proposals and other highway planning in the three counties.

Two half days were devoted to hearings in Los Angeles and San Diego, arranged to permit the public to make presentations to the commission.

Luncheon and dinner meetings honoring the commissioners were held in both Los Angeles and San Diego.

The Chairman of the Highway Commission is Robert B. Bradford, State Director of Public Works and a public administrator for a quarter century. He is the only salaried state employee on the commission, the others all having been selected and appointed by a Governor as representative Californians who take time from their own businesses to contribute their counsel to the State Highway Program.

Other Trips Planned

The commission is making a series of trips similar to this one in order that the members may study highway matters in all parts of the State, Bradford explained.

"We want to get a first hand impression of planning and construction in the people's ideas," Bradford said.

"Our trips will supplement the more formal procedure and ensure that we personally and individually keep in touch with the people and the problems."

Members of the commission, in addition to Bradford, are:

James A. Guthrie, Vice Chairman; a member of the commission since 1943, publisher of the San Bernardino *Sun* and *Telegram*, daily newspapers.

Chester H. Warlow, also a member of the commission since 1943; a retired banker and attorney of Fresno, a highway enthusiast for nearly a half century.

Robert E. McClure, a member since 1954; Editor of the Santa Monica *Evening Outlook*, daily newspaper; novelist and writer.

Robert L. Bishop, member since January, 1956; automobile dealer and former mayor, Santa Rosa.

Arthur T. Luddy, member since January, 1959; insurance man and former member of the City Planning Commission, Sacramento.

Roger S. Woolley, member since March, 1959; attorney and leader in the San Diego Highway Development Association, San Diego.

Duties Explained

The background and work of the commission were explained by Bradford, the chairman:

"The State Legislature determined that the best way to keep California's expanding highway program close to the people and responsive to their wishes was to delegate the responsibility and authority for highway routing and budgeting to the Highway Commission.

"The Legislature establishes terminal points for state highways and delegates the determination of the exact routing to the commission. The Legislature sets up the rules governing the general apportionment of highway user tax funds and delegates the detailed budgeting to the commission.

"The Legislature created the commission as a body of unsalaried officials to give conscientious guidance to the program. The commissioners' terms were arranged to provide continuity of membership and policy through changes in state administration.

"The Legislature made the Director of Public Works chairman of the commission to provide working liaison between the policy-making commissioners and the operating Department of Public Works.

"The commission established procedures which provide that it will consider and study the views of interested citizens, the suggestions of local governmental agencies, and the recommendations of the State Highway Engineer before it approves route adoptions and financial allocations."

Merit Award Board Announces Winners

Employees of the Department of Public Works receiving certificates of commendation and cash awards since the last list published in the July-August issue of the magazine are:

Charles G. Andert, Highways, San Diego, Certificate of Commendation for recommending a method for reducing armature travel on detector relays.

Walter H. Kuebler, Highways, Sacramento, $40 for recomemnding that sign bridge shop drawings be sent direct to the Bridge Department for approval.

M. L. Lindblom, Architecture, San Jose, $15 for suggesting use of insulated copper pull wires in underground electrical conduits.

Harold Sellman, Highways, San Francisco, $20 for suggesting revising standard tracing forms of highway project plans.

Richard A. Walker, Highways, San Luis Obispo, $50 for recommending multiple vertical spacing of the IBM Slope Stake Data Sheet.

HIGHWAY CONTRACTS AWARDED

There were 255 highway contracts under way at the end of August with a total value of $360,000,000. This included 48 contracts totaling $14,000-000 which were awarded during the month.

Co-operation

State, Community "Togetherness" Held Vital to Highway Program

EXTENSIVE co-operation between the State of California and its communities is an important factor in the success of the State Highway Program.

This was the message which Governor Edmund G. Brown and Director of Public Works Robert B. Bradford gave to a luncheon meeting of eight civic organizations in Los Angeles July 22d.

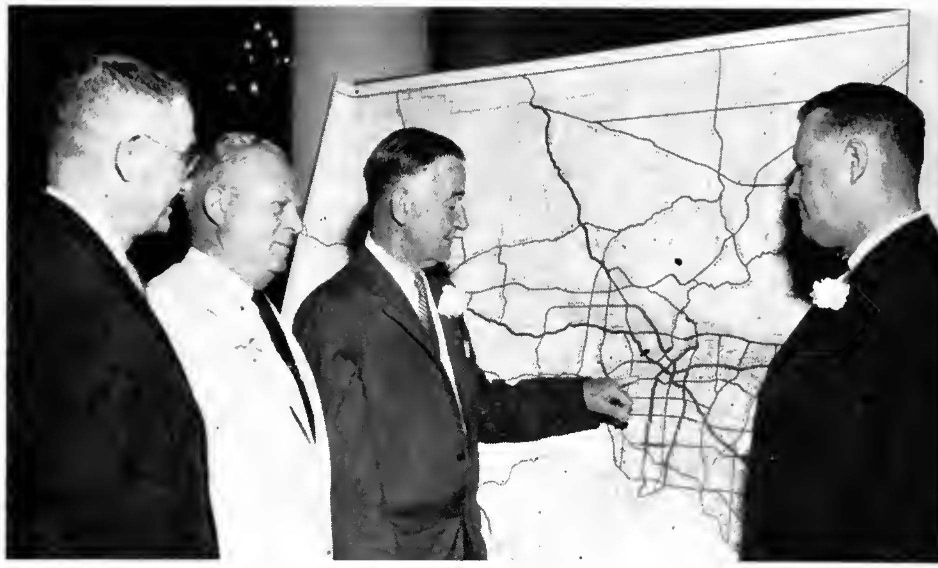
Governor Brown, in a statement read to the audience by Bradford, thanked the civic organizations for "helping us in State Government cope with our exploding population," and said:

"Pride of authorship is unimportant here. Whether I am supporting the people's program or the people are supporting my program is less noteworthy than the fact that real two-way co-operation does exist on the program. This meeting is an excellent example.

"My thanks to the important groups represented here not only for sponsoring this luncheon, but for years of grass-root support of the highway program statewide.

"You have worked with vigor in behalf of your community, too. It is vital that California keep pace with the State's metropolitan growth and provide mobility and related economic benefits to the public without sacrifice of community values.

"Keep up your crusading. Give us in State Government a push if you think we're slowing down. Speak out forcefully if we in government seem to overlook our obligations."



State Highway Commissioner Robert E. McClure points out a freeway location on the map to (left to right) E. T. Telford, Assistant State Highway Engineer, Harrison R. Baker, Chairman of a luncheon sponsored by the eight Los Angeles civic organizations honoring the commission, and Robert B. Bradford, State Director of Public Works and Commission Chairman.

Sponsors Named

The luncheon was arranged to honor the California Highway Commission, which held its July meeting in Los Angeles, and the commission chairman, Bradford. The sponsoring organizations were:

Automobile Club of Southern California, California State Chamber of Commerce, Downtown Businessmen's Association, Los Angeles Chamber of Commerce, Los Angeles Metropolitan Traffic Association, Los Angeles Traffic Advisory Board, Metropolitan Los Angeles Freeway Committee, and Metropolitan Transportation Engineering Board.

Bradford, in his address to the luncheon, summarized the background of successful freeways in the Los Angeles area with these words:

"The essence of the story is in one word—teamwork. Or in two words—co-operative planning. * * *

"The local governmental bodies—city, county and regional—were the ones who sat down with the State's highway planners and worked out the general plans. Independent organizations like yours, motivated by a desire to solve the mounting traffic problems on a sound basis, spearheaded the drive for public recognition, understanding and acceptance of the need for a well-planned freeway system. It was you who saw to it we were furnished the tools to do the job."

Extensive Planning Told

Bradford told the Los Angeles audience of the great amount of co-operative planning which went into the California freeway and expressway system (see page one of this issue of *California Highways and Public Works* for an article giving details of the system) and concluded his address with these words:

"The hallmark of the past and the future in California freeway planning has been teamwork; teamwork not only among governmental jurisdictions, but also on the part of civic groups and independent organizations.

"Wherever and whenever this teamwork has produced co-operative planning on a sound, big-picture basis, there has been genuine progress.

"The new program, looking 20 years ahead and with built-in provisions for continuing flexible and orderly long-range planning, offers us a challenge to keep building in line with the needs of our dynamic economy. I know you and your organizations join happily with us of the Highway Commission and the Division of Highways in welcoming this challenge."

John H. Skeggs

Colonel John H. Skeggs, who served more than 33 years with the Division of Highways in San Francisco, most of them in charge of District IV which embraces nine Bay area counties, died August 28th at his ranch home near Saratoga. He was 76 years old.

Colonel Skeggs retired April 1, 1952, as Assistant State Highway Engineer.

He attained his military rank during World War I. He entered the Army as a captain in the Army Corps of Engineers and saw active service in the St. Mihiel and Meuse-Argonne offensives as roads officer for the Second American Army.

He was a native of Somerville, Alabama, and came to California in 1901 after graduation from Alabama Polytechnic Institute.

Before joining the Division of Highways in 1919, he worked on railroads, on the Owens Valley-Los Angeles aqueduct and as a county surveyor in Los Angeles.

During his long career in District IV Colonel Skeggs was responsible for building, widening or repaving practically every mile of highway in the San Francisco Bay area.

Before the word "freeway" was known, Colonel Skeggs fought for and was successful in applying the freeway principle of control of access. Later under his leadership the Bayshore and Eastshore Freeways and other multilane highways were begun. He also participated in the building of the Golden Gate and San Francisco-Oakland Bay Bridge approaches.

The results of his work are evident throughout the Bay area. Opening the Lake County recreation area with the road from Calistoga north, the Russian River realignment from Cloverdale to Hopland, McDonald to the Sea (Sign Route 128) and the elimination of the Corte Madera grade were some of his projects.

His contributions to highway engineering also include the three major tunnels in the district, Broadway Low Level, Waldo and Funston.

One-Year SCR 62 Study of City-County Road Deficiencies Cited as Vitally Important

Work is under way on a one-year study by the state and local governments of California of the deficiencies on roads and streets under city and county jurisdiction.

The study is being carried on in accordance with Senate Concurrent Resolution No. 62, adopted at the 1959 session, which calls for a report by the Department of Public Works to the Legislature by August 1, 1960, analyzing the street and road deficiency reports of the cities and counties as a basis for future legislation aimed at meeting local traffic needs more rapidly.

"Such analysis," the resolution states, "shall include a report on the advisability of legislative consideration of a one cent increase in the state gasoline tax, and whether such additional tax revenues should be divided 60 percent to cities and 40 percent to the counties, together with alternative recommendations, if any."

The study was formally launched with a meeting in the Public Works Building in Sacramento on August 31st attended by state highway officials and members of a 14-man advisory committee. The advisory committee was appointed, as provided in SCR 62, by Speaker Ralph M. Brown of the Assembly and Senate President pro Tempore Hugh M. Burns.

At its opening session the committee chose Supervisor Francis Dunn, Jr., of Alameda County as its chairman and City Engineer E. A. Fairbairn of Sacramento as vice chairman and secretary. Other city officials on the committee are: Mayor Ira J. Chrisman of Visalia; City Engineer John A. Morin of Oakland; City Engineer Lyall A. Pardee of Los Angeles.

County officials on the committee are: Road Commissioners A. S. Koch of Orange County and William McIntosh of Lassen County; and Director of Public Works Victor W. Sauer of Contra Costa County.

Organization representatives on the committee are: Harry V. Cheshire, Jr., General Counsel, Automobile Club of Southern California; Kenneth Kendricks, Vice President, Standard Oil Company of California; Claude Minard, Director, California Railroad Association; Edwin S. Moore, Executive Vice President, California State Automobile Association; Wade Sherrard, Managing Director, California Trucking Association, Inc.; and C. Clarke Williams, Secretary of Statewide Highway Committee, California State Chamber of Commerce.

In a letter to officials of California cities and counties announcing the commencement of the study, State Highway Engineer G. T. McCoy said in part:

"It is reasonable to believe that this study and the findings therefrom will be the basis of legislative consideration of the city and county road and street deficiency needs. The study is therefore of vital importance to all of the cities and counties of the State of California.

"It is believed that this study can best be carried through to a successful conclusion if conducted along the lines of the excellent co-operative and co-ordinated working procedures and relationships which were developed between the city, county and state organizations during the Federal 210 and the State (SCR 26) freeway-expressway studies."

The work of carrying out the study and preparing the subsequent report has been assigned to the Highway Planning Survey Department of the Division of Highways, with assistance from the City and Co-operative and the Federal Aid Secondary Departments and from the various districts.

AUGUST TRAFFIC COUNTS UP

Traffic counts in August showed the number of passenger vehicles increased 7.9 percent over August of 1958 and freight vehicles increased 8.1 percent. The passenger vehicle count in August decreased 7.7 percent from that in July, although the average for the last five years shows August up 3.6 percent over July.

Report From District VI

By W. L. WELCH, District Engineer

The past year saw the completion of 10 major construction projects in District VI.

US 99

Two of these projects were on US 99, the most important north-south route in California.

In October, 1958, work was completed in the City of Madera on a full freeway which eliminated the last remaining section of two-lane road on this heavily traveled route. This four-mile project cost $2,278,000 and involved construction of eight road separation structures, one railroad separation structure and two bridges over the Fresno River.

In August of this year another project in Madera County was completed to correct a structural deficiency in the northbound lanes between Berenda and Califa. This was accomplished by resurfacing with portland cement concrete pavement. This 3.9-mile project was constructed by the Madonna Construction Company of San Luis Obispo at a cost of $380,000.

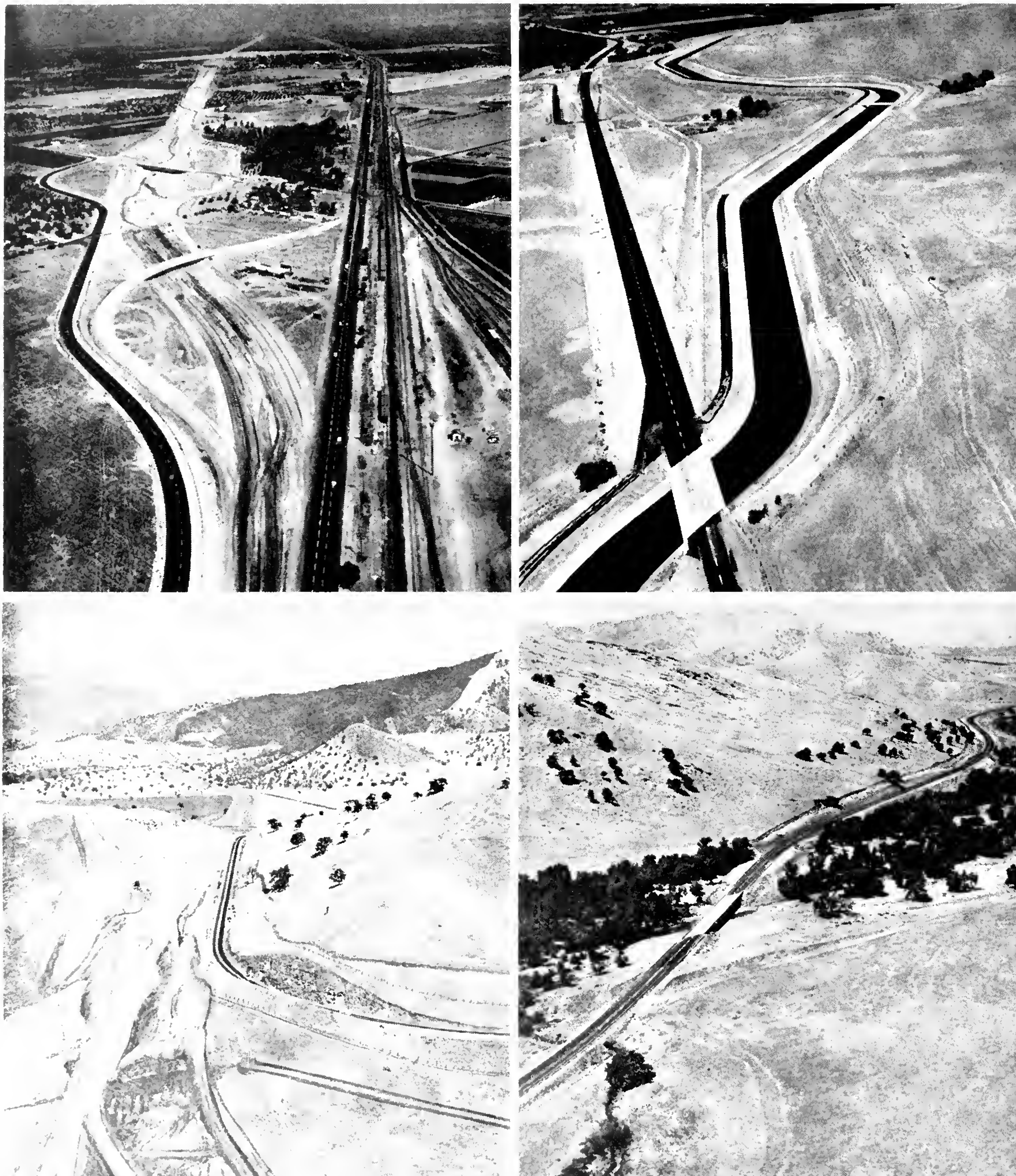
Construction on the Grapevine Canyon project just north of the Los Angeles county line has reached the halfway mark. This section of interstate highway, commonly known as the Ridge Route, is the largest highway contract ever undertaken by the district. The seven-mile $7,700,000 project involves the construction of four additional traffic lanes through Grapevine Canyon and reconstruction of portions of the existing four lanes to provide an eight-lane freeway between Fort Tejon and two miles north of Grapevine Station. This contract was awarded to Guy F. Atkinson Company on April 17, 1958, and should be completed in the summer of 1960.

In June of this year, Guy F. Atkinson Company started work on a $1,989,000 project which begins at the northern terminus of the Grapevine Canyon project and runs 12.3 miles to Sandrini Road, or 15 miles south of the City of Bakersfield. The work involves placing a 24-foot concrete blanket over the existing southbound lanes, constructing two interchanges and a weigh station for trucks. The project is expected to be completed in June of 1960 and is the first stage of ultimately converting this section to full freeeway status.

On the northerly extension of the Fresno Freeway to the Madera county line, construction is progressing on schedule and should be completed sometime in April of 1960 if the weather this winter does not delay the contractor unusually.

This $3,273,000 project is 7.7 miles in length and is being constructed by the Griffith Company of Los Angeles.

PHOTO TOP—An improved section of Sign Route 168 near Huntington Lake in Fresno County. MIDDLE—A northeast view of the Sign Route 41 project through the Kettleman Hills in Kings County. Note the old highway to the left and right of the new roadway. BOTTOM—Freeway construction progresses on Grapevine Grade on US 99 in Kern County. This aerial looking northward shows the Fort Tejon overcrossing (center).



UPPER LEFT Construction continues on another section of the US 99 freeway north of Fresno. The two overcrossings are Dakota Avenue (front) and Ashland Avenue. UPPER RIGHT The relocated section of Sign Route 180, east of Fresno, crosses the Friant-Kern Canal in the foreground. LOWER LEFT Operations have started on a big cut for the realignment of US 466 east of Bakersfield. LOWER RIGHT The bridge shown here takes the relocated section of Sign Route 190 across the Tule River in the Success Dam area near Porterville.

UPPER—Shoulder construction on the US 99 resurfacing project in Madera County. LOWER—A view southward of freeway construction in the Grapevine Grade (US 99).

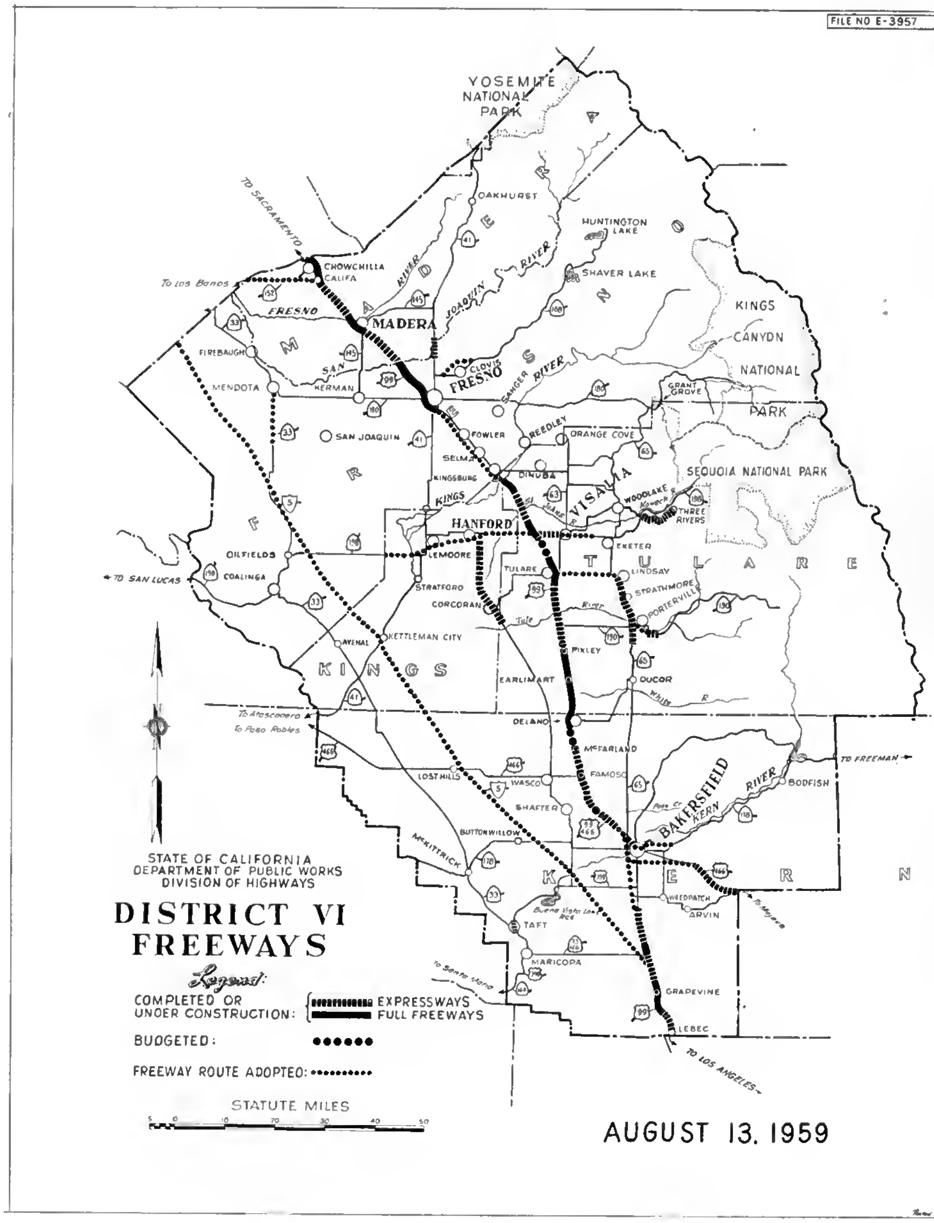
Work is nearly completed on all of the major structures on the project, which include five highway separations, one railroad separation and three bridges across the Herndon Canal, one of which carries a frontage road.

This project will eliminate the last remaining three-lane section of highway in the district and will complete the separation of opposing traffic on US 99 for its entire 190-mile length in District VI.

The gaps in the full freeway will continue to be closed. Plans are being made for the relocation of US 99 in the City of Bakersfield and rights-of-way are being acquired. The relocation, approximately 17 miles in length, is estimated to cost a total of $19,550,000. The project will relieve a serious bottleneck on US 99 and will prove of value not only to the high volumes of through traffic but also to the Bakersfield area in general.

The groundwork is also being laid for the construction of full freeway from Fresno to one mile south of the Tulare county line near the City of Kingsburg. The present facility, although four lanes divided, passes through three incorporated cities and has several traffic signals and many crossings at grade. The proposed improvement will be 21.3 miles in length and will be constructed in several units estimated to cost a total of $20,250,000.

Upon the completion of the relocations in Bakersfield and south of Fresno, the entire length of US 99 in District VI will be built either to freeway or expressway standards. However, the story does not end here. Plans are being formulated for the conversion of the expressway portions to full freeway standards, thus resulting in freeway varying from four to eight lanes completely throughout the district, from the Los Angeles to the Merced county lines.



These hills, lying adjacent to the foothills of the Coast Range, rise above the valley floor to an elevation in excess of 1,300 feet and occupy an area about 30 miles long and five miles wide.

The section of road which was replaced was originally built by Kings County and provided two very narrow oil mix traffic lanes. There were 93 curves, with a total deflection of 2,700 degrees and with grades up to 10 percent.

By contrast, the new alignment consists of 32-foot all-paved section with grades reduced to 5.7 percent. There are but four horizontal curves with minimum radius of 3,000 feet, with long intervening tangents.

The total cost of this project was $608,400.

Sign Route 41

On June 26, 1959, travelers on State Sign Route 41 bid a fond farewell to a 9.6-mile section south of Kettleman City when 6.6 miles of new construction knifing through the Kettleman Hills was completed and opened to traffic.

Sign Route 190

On November 14, 1958, traffic was diverted to 9.2 miles of relocated highway on Route 190, east of Porterville, Tulare County, between Hospital Road in Porterville and 4.5 miles southwest of Springville. Total cost of this project was $1,715,000, primarily financed by federal funds. The relocation of this route was necessitated by the construction of the Success

. . . Continued on page 55

PHOTO TOP LEFT—Grading operations in progress on the Golden State Freeway in the Lincoln Heights area. MIDDLE—A view southeastward of the completed Golden State Freeway in Burbank showing Magnolia Avenue (front) and Olive Avenue overcrossings and the Southern Pacific grade separation in the background. RIGHT—Excavation of the Burbank-Western Storm Drain Channel.

Freeway Loop

New Eight-lane Roadway Will Encircle L. A. Downtown Area

By LYMAN R. GILLIS, District Engineer

The annual meeting of the Downtown Business Men's Association of Los Angeles is always an important event well attended by local public officials, governmental engineers and civic leaders. Upon the occasion of the thirty-fifth annual meeting of this association at the Biltmore Hotel on June 24, 1959, its president, Donald Buckingham, prefaced his address with these statements:

L. R. GILLIS

"Within the next decade, the Los Angeles central area will undergo a dramatic change. Magnificent new office buildings, a part of the $150,000,000 construction now under way in downtown Los Angeles, will provide new headquarters for business and industry. Other signs of Los Angeles' growing maturity are the increased interest in beautification and our increased cultural, entertainment and convention activities. The new Santa Monica and Golden State Freeways will complete *a freeway loop around downtown* and permit easy access to the central area from all points."

Now Buckingham knows his freeways and fully appreciates their worth. However, the importance of the Santa Monica Freeway and the Golden State Freeway that form "the Freeway Loop" is perhaps not so generally recognized by others. The purpose of the present story is to describe the progress which has been made in the developmeent of the eight-lane freeway loop around the Los Angeles area, to present a pictorial record of the present status of this development as covered by staff photographers of State Division of Highways, and to point out the impact that this freeway development will have upon the community.

While other cities and communities in Los Angeles County will profit by this freeway development, the chief beneficiary is the City of Los Angeles. The first quarter of 1959 shows an estimated population of 2,423,300 within the city limits of Los Angeles, and 5,869,300 within Los Angeles County. In the City of Los Angeles, on April 1, 1959, there were an estimated 877,155 dwelling units spread over a land area of approximately 455 square miles. The total amount of all building construction for the year 1958 was $1,540,200,000, making Los Angeles the Nation's second construction market after New York City. During 1958, out-of-state automobiles coming into Southern California numbered 1,015,170, carrying 2,737,146 passengers. On January 1, 1959, there were 2,868,033 automobiles registered in Los Angeles County, indicating a car for every two persons, a higher ratio than any other major city in the world.

Los Angeles City has three transcontinental railway systems. It has 12 certificated air carriers with some 500 daily scheduled flights, transporting over 5,000,000 passengers annually. Los Angeles County has about 900 miles of state highways including freeways and expressways, 4,257 miles of county roads in unincorporated areas and 11,464 miles of city streets in incorporated areas. In Los Angeles County there are 285,000 registered commercial trucks; six major passenger bus lines; and 53,000 retail trade outlets doing an annual sales business of nearly 8½ billion dollars.

Los Angeles City is particularly fortunate in having a fine system of public parks under the efficient administration of its Department of Recreation and Parks. Three of these Los Angeles city parks were under careful consideration as critical controls in connection with location and design studies for the Golden State Freeway portion of the freeway loop. Where the Golden State Freeway passes through the Boyle Heights district of East Los Angeles, an encroachment of the freeway into Hollenbeck Park was unavoidable. While this park is relatively small in size, being a little over 21 acres in extent, it is attractively landscaped around the lake and provides facilities for picnicking and boating. In order to disturb the existing park facilities as little as possible, the freeway was carried over the most wesrerly portion of the lake on an attractively designed box girder reinforced concrete bridge with specially designed slender columns.

No Park Encroachment

Where the Golden State Freeway crosses the Pasadena Freeway and extends northwesterly, it skirts along the northeasterly boundary of Elysian Park. Motorists on the Golden State Freeway will have a good view of the attractively wooded hillsides of Elysian Park where it fronts upon Riverside Drive. This park is 603 acres in extent and provides playground facilities and tables for picnicking. It serves an area close to Los Angeles Civic Center where space for play and recreation are badly needed. The Golden State Freeway does not in any way encroach on Elysian Park.

Two miles northwesterly from Elysian Park, the Golden State Freeway passes through the easterly fringe of Griffith Park along the Los Angeles River, between Los Feliz Boulevard and Forest Lawn Drive. This park was named after Col. Griffith J. Griffith who made a gift of his 3,015-acre property to the City of Los Angeles in 1898. Since that time, additional parcels have been added to it, and the park now covers 4,254 acres. It is the largest park within a city anywhere in the United States.

In passing through the Griffith Park area, the freeway was located and designed to do as little damage as possible to park recreational facilities.

Northerly of Griffith Park, a segment of the Golden State Freeway enters the City of Glendale. Glendale's history dates back to 1784, to the first Spanish land grant in California and within 50 years of its incorporation in 1906, it had grown to far beyond the 100,000 mark in population. Assessed valuation in the City of Glendale was $199,531,780 for 1958-1959; to June 30, 1958, bank deposits reached $154,517,044; bank clearings, $877,982,891. The present estimated population of Glendale is 114,460.

While much has already been accomplished in providing a freeway system for the Greater Los Angeles Area, as reported in Assistant State Highway Engineer E. T. Telford's story about District VII freeways in the January-February, 1959, issue of *California Highways and Public Works*, additional freeways are now needed to relieve present peak hour traffic congestion. Of prime importance in this regard are the portions of the Golden State Freeway and the Santa Monica Freeway that make up the Los Angeles Freeway Loop.

Locotion and Design

In the location and design of sections of the Golden State Freeway and the Santa Monica Freeway that comprise the Los Angeles Freeway Loop, the usual problems were encountered. The choice of routes for freeways is a complicated business involving a great deal of time and a great many considerations. Properly located freeways will not only provide the best trafficway for motorists, but will also greatly benefit the communities through which they pass. For these reasons we carefully consider any and all possible alternate routes, so that the end result will be the best freeway location from a traffic service standpoint at the lowest possible cost.

The standards for location and design for all the freeway work included in the loop were in accordance with the latest State Division of Highways and federal interstate highways standards for urban freeways. The loop freeways were designed throughout and are being constructed as eight-lane freeways—four lanes in each direction. The only exception to this is through the interchange structure for the Golden State Freeway with the Pasadena Freeway where the interchange roadways will take off so much traffic that only six lanes of freeway are needed through the interchange for a short distance only.

The standard of sight distance is that required for a minimum design speed of 60 miles per hour. The maximum grade has been maintained at 3 percent, excepting in one instance. The one exception is where the Golden State Freeway passes through the Pasadena Avenue interchange. One of the roadways has a grade rate of 3.88 percent. Where this grade rate prevails, an additional traffic lane has been provided for trucks that may be proceeding at slow speed because of the grade. Throughout the freeway loop, all alignment is of high standard with horizontal curves of 2,000-foot radius or over, excepting in two instances. At one location within the Golden State-Pasadena Avenue interchange, there is a curve of 1,800 feet and in another instance through the Golden State-Glendale Freeway interchange, the radius of curvature is 1,500 feet.

Routing Problems Encountered

The design of the section of the Santa Monica Freeway between the Harbor Freeway and the Santa Ana Freeway presented a problem with many facets. Here the freeway location was over an area consisting of a gridiron system of city streets serving a large number of industrial installations. Interspersed were a number of railroad sidings and close to the Los

THE LOS ANGELES FREEWAY LOOP

Scale In Miles

2 1 0 2

12 AUGUST 1959

Angeles River mainline railroad tracks. Under the surface of the city streets were found dense networks of utility lines of various kinds. Subsurface investigations indicated that foundation conditions were none too good and that if the conventional freeway embankments were built to carry freeway construction over city streets that extensive ground settlement might occur which would cause great damage to the network of underground utility lines, as well as distort the street grades and cause expensive repair jobs. Since through this industrial area right-of-way costs were found to be very great, alternate economic studies of various systems of freeway location, alignment and grade were made and it was found that the most economic solution would be to carry the Santa Monica Freeway over this entire area between the Harbor Freeway and the Santa Ana Freeway on bridge structures. This is the design which was approved and upon which construction has started.

It goes without saying in freeway location and designing that interference with established institutions that represent large capital outlays should be kept to a minimum. This is illustrated by the section of the Golden State Freeway through the Boyle Heights area. On the left, a short distance from the Golden State Freeway as now being constructed, is the White Memorial Hospital. This is a medical facility and teaching institution of the College of Medical Evangelists, founded in April of 1918 and since several times enlarged. A total of 140,000 patients visit the clinic annually. Its medical staff numbers 360 physicians, 134 registered nurses and 300 nursing assistants.

Many Patients Served

Just a short distance northerly and on the right of the Golden State Freeway is the Los Angeles County General Hospital. This 56-acre medical institution, located on Marengo Avenue near Mission Road close to the Golden State Freeway now under construction, was established in 1878. More than 1,500 doctors are on the staff of General Hospital. The hospital has 3,579 beds; a total of 5,634 employees; including 900 registered nurses, and 1,800 auxiliary nurses. Admissions to the hospital since its founding, number 2,300,000; births, 231,000. The operating budget for fiscal 1959-1960 is $33,000,000.

Although in the cases of both these hospitals the Golden State Freeway was so located that there was no interference with either one, we were not so fortunate as to many other properties involving taking homes, business and industry. Details regarding this will be found in the paragraphs below under the subheading "Right-of-way Acquisition."

Right-of-Way Acquired

Right-of-way activity on the Golden State Freeway portion of "The Loop," extending from the Santa Monica Freeway north to Lankershim Boulevard in the San Fernando Valley, began with initial negotiations in December, 1954. In the intervening five years $50,231,886 was expended on 2,492 parcels. The average cost per mile along the 15-mile right-of-way line was $3,350,000, with the largest single transaction being $3,750,000. The route of this freeway traverses an area principally improved with light and medium industry and also contains commercial and old residential structures. Some of the representative types of properties acquired by the State were as follows: single and multiple family residences, commercial laundries, railroad yards, aircraft parts manufacturers, theaters, cafes, service stations, junk yards, and upholstery supply manufacturers. The average length of time necessary for moving the industries in this area to new locations was from eight to ten months from the date the consideration was paid.

Negotiations on the Santa Monica Freeway from the Harbor Freeway east to the Golden State Freeway at the East Los Angeles interchange, began in May, 1955, and extended over a four-year period. Right-of-way purchases totaled $24,830,000 and 709 parcels were acquired. The average cost per mile along the four-mile right-of-way line was $6,200,000, and the largest single transaction amounted to $400,000.

As in the case of the Golden State Freeway, the route of the Santa Monica Freeway within the limits set forth herein traverses an area of light and medium industry, commercial and old residential structures. Some of the more interesting properties acquired included casket manufacturers, mortuaries, trucking firms, jelly and jam processors, metal salvage yards, shoe manufacturers, dance halls, carpet manufacturers, bulk oil distributors and railroad switching yards.

Completed Projects

Three projects have already been completed on the Golden State Freeway section of the freeway loop. These, grouped together, extend 6½ miles from Glendale Boulevard near the south end of Griffith Park, northerly to Burbank Boulevard in the City of Burbank.

The first contract, 2.2 miles long with an allotment of $4,754,000, was awarded to Vinnell Company, Inc., and Vinnell Constructors on October 3, 1955, and was completed on September 6, 1957. This job extended from the northeast corner of Griffith Park in the City of Los Angeles near the site of the Old Rodger Young Village, long since demolished, across the Los Angeles River, through a small section of the City of Glendale to Ash Street in the City of Burbank. Under the title of "Golden State Freeway," by J. F. Smith and C. J. Woodbridge, this construction was described in *California Highways and Public Works* issue of September-October, 1957.

A second construction contract, 2.5 miles long, was completed on January 17, 1958, at a cost of $5,418,000, between Glendale Boulevard and a point south of the Los Angeles River. Contractor was likewise the Vinnell Company, Inc., and Vinnell Constructors.

The third and most recent Golden State Freeway contract to be completed is the Alameda Avenue to Burbank Boulevard, 1.3-mile link, which carried an allotment of $5,299,000. The contractor, Ukropina, Polich and Kral, concluded their work in August, 1959, though the freeway had been partially open to traffic since early May of this year.

On the Santa Monica Freeway section of the loop there is only one completed contract. This was for foundations and substructures construction in the Los Angeles River near Eighth Street. The purpose of the job was to facilitate the later building of the superstructure for the bridge to carry the freeway over the Los Angeles River and main line railroad tracks along the river banks, which work is now well along toward completion. The substructure and foundation work was completed by Jones Brothers Construction Corporation at a cost of $490,000.

Projects Under Contract

Of the six major construction contracts under way along the route of the loop, representing a combined construction cost of nearly $34,000,000, the first to be let was the Santa Monica-Harbor Freeway interchange. The contract was awarded to the firm of Webb and White of Los Angeles on January 16, 1958, with a contract allotment of $1,599,700.

This Santa Monica Freeway separation structure, located between Venice and Washington Boulevards in metropolitan Los Angeles, is unique in the district, since its construction required the detouring of traffic on a heavily traveled major freeway, the Harbor, with an average daily traffic count in the neighborhood of 190,000 motor vehicles; in addition, a busy east-west city street, Venice Boulevard, intersected the site of the project and consequently had to be carried by temporary timber bridge over the Harbor Freeway detour. The latter detour necessitated construction of an eight-lane bypass to the east of the Harbor Freeway, in order to maintain uninterrupted north-south freeway traffic flow through the construction zone. Periodic traffic restriction on the Harbor Freeway during off-peak hours allowed completion of the detour and the final switch of traffic. Thus the Harbor Freeway detour, costing $380,000, besides being a substantial part of the construction involved, is probably the most expensive and heavily traveled detour in the world.

With the complicated detouring done, the freeway bridge building project could go forward and construction is now scheduled for November, 1959, completion. (For further details see Resident Engineer Lloyd A. Compton's article in the July-August, 1959, issue of *California Highways and Public Works* and for details of the scale model of this interchange built by Mr. and Mrs. John Unruh of District VII staff see March-April, 1959, issue.)

This photo shows the form work in place for the botton slab of the Burbank-Western Storm Drain Channel.

Los Angeles River Bridge

A second construction project on the Santa Monica Freeway and another segment in "the Loop" is a bridge structure across the Santa Fe Railway, the Los Angeles River, and the Union Pacific Railroad just northerly of Olympic Boulevard in East Los Angeles. Under a $3,410,000 contract to Peter Kiewit Sons' Company, work started in May, 1958, and will be completed in October of this year.

At this location the Santa Monica Freeway is a structural steel girder bridge with concrete deck slabs supported by reinforced concrete caps, columns, footings and concrete piles. Materials used in the bridge include 5,200 tons of structural steel, 1,700 tons of reinforcing steel, and 18,600 cubic yards of portland cement concrete. (For further information see article by Resident Engineer H. J. Scott in *California Highways and Public Works*, July-August, 1959.)

East Los Angeles Interchnage

The third item of current construction is the East Los Angeles Interchange, located on the east side of the Los Angeles River in the vicinity of Boyle Avenue, Soto Street and Eighth Street in the City of Los Angeles. Here the Santa Monica, Santa Ana, Golden State and future Pomona Freeways meet in a complex pattern of roadways and bridges which provides for free flowing movement between the various routes.

Thirty major structures are combined in this project to provide separation between the freeways and to carry traffic under or over the city streets. To construct these bridges will require 63,110 cubic yards of concrete, 13,253,000 pounds of reinforcing steel and 4,235,000 pounds of structural steel at a total cost of over $6,000,000.

Of the 30 structures, seven provide for freeway separations, 20 for ramps and street crossings, one which will span an arm of Hollenbeck Lake, one railroad underpass, and one section of freeway viaduct. Also included in the bridge portion of the contract are 17 cantilever retaining walls.

Both spread footings and piles are used for the structure foundations. Piling will consist of steel H piles, driven concrete piles and cast-in-drilled-hole piles. The majority of the structures are of box girder design with spans ranging up to 162 feet.

The largest single structure to be constructed under this contract is the Santa Monica Freeway Viaduct Spur. This section of the Santa Monica Freeway originates at the Los Angeles River Bridge and Overhead and proceeds in an easterly direction for a distance of 1,488 feet. This structure is composed of 13 box girder spans, two plate girder spans and one precast, prestressed concrete girder span.

The Golden State-Santa Ana Freeway Separation consists of two separate plate girder structures, 589 feet and 753 feet in length, supported on concrete columns ranging up to 55 feet in height. The longest steel girder is to be 146 feet. Erection of the steel girders will necessitate the closing of the Santa Ana Freeway, at which time traffic will be routed over city streets. This work is to be done between the hours of 12.30 a.m. and 5 a.m., at which time traffic is at its lowest volume.

Special Consideration Given

Near the end of the project, the Golden State Freeway is to be carried over a segment of Hollenbeck Lake. Special consideration was given to the design of this structure to provide for a pleasing view of the park from the Hollenbeck Home for the Aged. Since the cost of an arch-type structure would have been prohibitive, the final selection was to build twin box girder bridges with spans of 90 feet to 125 feet supported on slender columns which will blend in with the landscape.

To facilitate the construction of the future Pomona Freeway to the east, which it is planned to bring into this interchange, portions of the foundations for the Pomona-Santa Ana-Golden State Separation will be built as part of this project.

During the design stage of this project, the Bridge Department Architectural Section built a three-dimensional mode (1 inch = 50 feet) of the complete interchange. This model was used to a great extent by the Design Department; and was especially beneficial in leading to harmony of bridge types, clarifying line drawings and in clarifying structural design problems. Later it became a popular public display. The model has now been housed on the project site and is proving to be a great benefit to the contractor's construction men and our engineers. With 854 sheets of detailed contract plans for the project, the ability to get an overall concept of the work to be done from viewing the scale model will undoubt-

A southward view along the Golden State Freeway construction and the future interchange with the San Bernardino Freeway.

This overcrossing takes Los Feliz Boulevard traffic across the Golden State Freeway.

edly help solve many of the problems that are being encountered.

Contractor for the project is Peter Kiewit Sons' Company of Arcadia, California, whose low bid was $9,924,-600. Completion of the contract is scheduled for March, 1961.

Sixth Street to Mission Road

On February 27, 1958, bids were opened for the fourth unit of current construction on the freeway loop, being the Golden State Freeway from Sixth Street to Mission Road including realignment of the San Bernardino Freeway from Macy Street to Cornwell Street. Included in the contract were the interchange structures, ramps and roadways between the two freeways. Low bidder for the contract was Vinnell Co., Inc., and Vinnell Constructors, and the construction allotment was $7,626,500.

The work to be done consisted, in general, of constructing 17 structures, 11 reinforced concrete retaining walls, grading and paving two separate roadways on the Golden State Freeway and the San Bernardino Freeway with their related ramps.

Excavation of nearly two million cubic yards of earth was necessary for the project, the bulk of which was due to the realignment of the San Bernardino Freeway. This shift in alignment of the San Bernardino Freeway eliminates the hazardous, curving section of freeway that followed the alignment of the Pacific Electric Railway tracks in the area since the early 1940's. Approximately three-quarter million cubic yards of excess material was hauled off the project. This excess material was hauled via city streets to state-provided disposal sites along Riverside Drive. These disposal sites will be incorporated as embankments in the construction of the Golden State Freeway from Arnold Street to Fletcher Drive.

Freeways and interchange roadways are paved with portland cement concrete pavement on cement-treated material, while the on- and off-ramps and the join areas to the old San Bernardino Freeway are plant-mixed surfacing.

As is usually necessary when construction operations involve the passage of traffic through the work, stage construction was required for the realignment of the San Bernardino Freeway. This was accomplished by utilizing the old freeway for the westbound traffic and the new freeway for the eastbound. The connection for the old eastbound freeway to the new alignment was then accomplished; however, a 2,000-foot detour consisting of the three permanent eastbound concrete lanes and three temporary plant-mixed surfaced lanes was necessary in the vicinity of Macy Street. This detour enabled construction of additional portland cement concrete pavement along the realigned westbound freeway and revision of the approach to the interchange ramp for the southbound Santa Ana Freeway.

One of the most troublesome construction difficulties encountered was the presence of perched ground water throughout the interchange excavation area. Perforated metal pipe was placed at the various trouble spots in order to provide a stable subgrade for base and surface courses. This ground water made storm drain and sewer construction difficult operations, as considerable pumping and diversion of water was necessary.

The project has 450 working days allotted for completion and is expected to be completed in January, 1960, approximately a month ahead of the time expiration.

Mission Road to Pasadena Avenue

This fifth unit of current construction on the loop is a 1.17-mile-long bridge and highway contract, being built on the Golden State Freeway between Mission Road and Pasadena Avenue in Los Angeles by contractors J. C. Boespflug and J. L. McLaughlin. The contract allotment is $3,040,500.

This construction through a densely populated urban area has entailed the usual heavy right-of-way clearance and building removal operations. Utility removing or replacement and local street remodeling at the start of the contract, added considerably to the contract work.

The roadway is eight lanes of portland cement concrete pavement on cement-treated subgrade and certain ramps and shoulders of plant-mixed surfacing on cement-treated base.

The structures consist of seven bridges of both steel girder and concrete box girder types and of seven retaining walls. There are also a concrete storage box and pumphouse and concrete pipes and box-type storm drains.

A special problem has been presented in the handling of telephone company ducts and T-V and radio cables through the North Broadway Bridge. In place of the usual spliced cable bypass around the structure, a scheme for supporting the ducts and cables on independent steel girders was devised. The ducts and cables were raised up and supported above the bridge deck level until sufficient bottom deck was constructed so they would be lowered into place. The top deck was then constructed to close them in. This procedure cost about $59,000 as compared with an estimated cost of $125,000 for cutting in and splicing bypass cables. The handling of cables was done by the telephone company. This contract will be finished about the first of January, 1960.

Burbank and Roscoe Boulevard

The sixth item of current construction on the freeway loop is the section of the Golden State Freeway between Burbank Boulevard and Roscoe Boulevard. This construction is for 3.5 miles of eight-lane freeway for which the contractor is Ukropina, Polich & Kral. The contract allotment is $8,324,000. Construction is largely in the City of Burbank and includes 14 major structures, one railroad overhead and five bridges over the Burbank-Western Storm Drain Channel, the construction of 3.7 miles of which is also a part of the State Division of Highways contract. The latter storm drain construction work as designed by the U. S. Corps of Engineers for the Los Angeles County Flood Control District is being constructed by the State Division of Highways under a co-operative agreement whereby costs are split in proportion to benefits received by each governmental agency. The financing of this construction contract on the basis of the triparty co-operative agreement provides for financing on the following basis:

State (including federal aid)	$5,895,000
Corps of Engineers, U. S. A.	2,024,298
City of Burbank	404,702
Contract cost	$8,324,000

The City of Burbank is financing construction of the Burbank Boulevard Overhead which will eliminate the grade crossing of Burbank Boulevard with the Southern Pacific Railroad. This construction is part of an overall program, which will eventually provide for grade separations at all major city cross streets with the Southern Pacific tracks in the City of Burbank. The program is financed by municipal bonds. Two of the grade separation structures have been completed under this bond act and are now in operation at Olive Avenue and at Magnolia Boulevard.

Flood Channel Construction

The Corps of Engineers in financing construction of the Los Angeles County Flood Control Channel, known locally as Burbank-Western Channel, which will extend 3.70 miles from its present terminus just southeast of Burbank Boulevard, then generally paralleling the freeway to its new terminus just north of Roscoe Boulevard. Also included in the channel work is the construction of 1,000 feet of Stough Canyon Channel, which will join with Burbank-Western under Burbank Boulevard and proceed in a northeasterly direction toward Stough Canyon in north-central Burbank. This contract provides for construction from the confluence to San Fernando Road. The Stough Canyon section will consist of a box section approximately nine feet square.

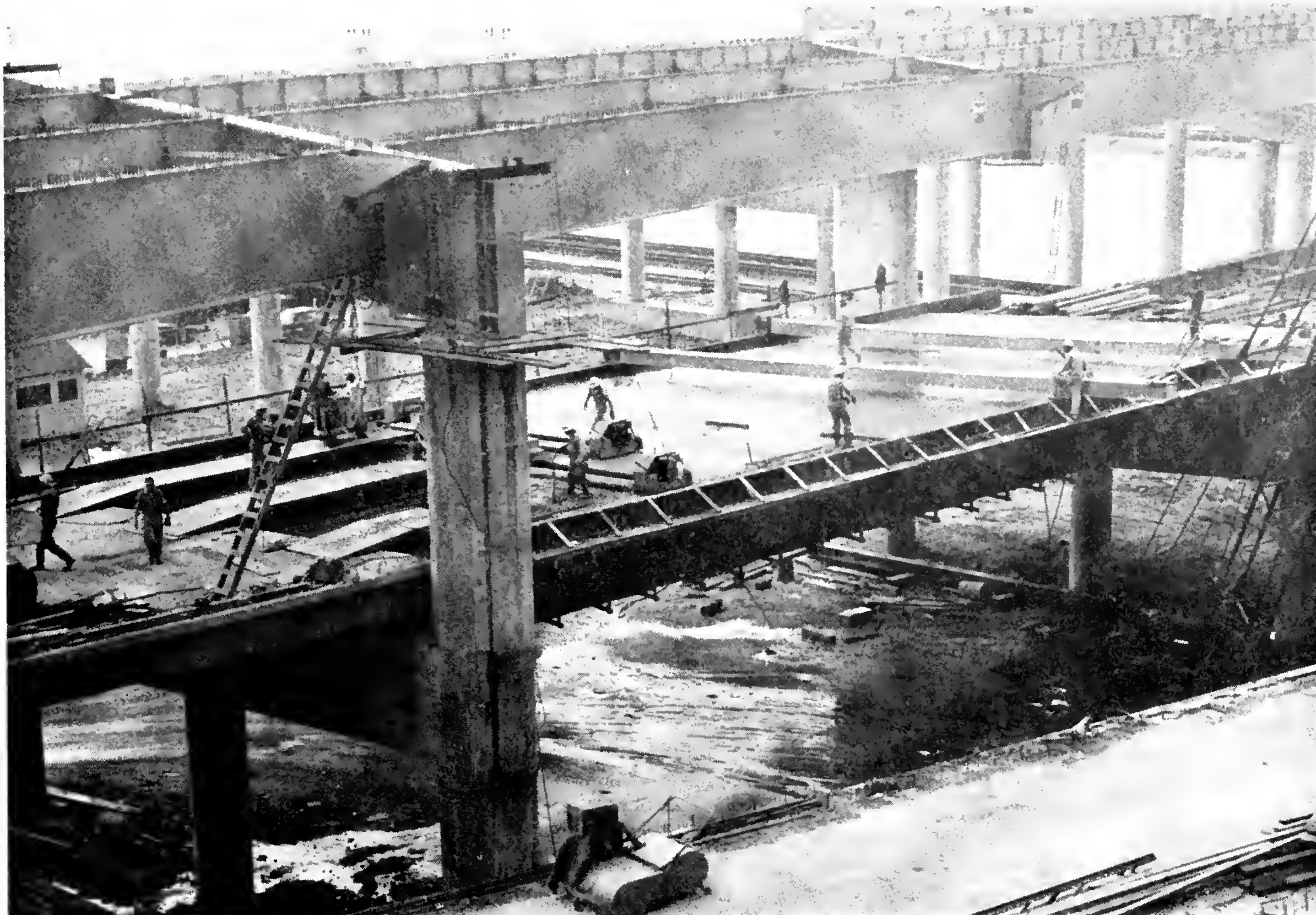
The Burbank-Western Channel will, in general, consist of about 0.6 mile of rectangular covered box section varying in height from 11 feet to 18 feet and in width from 20 feet to 30 feet and about 3.1 miles of open rectangular section varying in height from 11 feet to 23 feet with a constant width of 30 feet. The general depth of channel below ground line will be about 15 feet. The channel is lined with reinforced concrete throughout. A total of 66,000 cubic yards of concrete and 7,800,000 pounds of reinforcing steel will be used in constructing this channel.

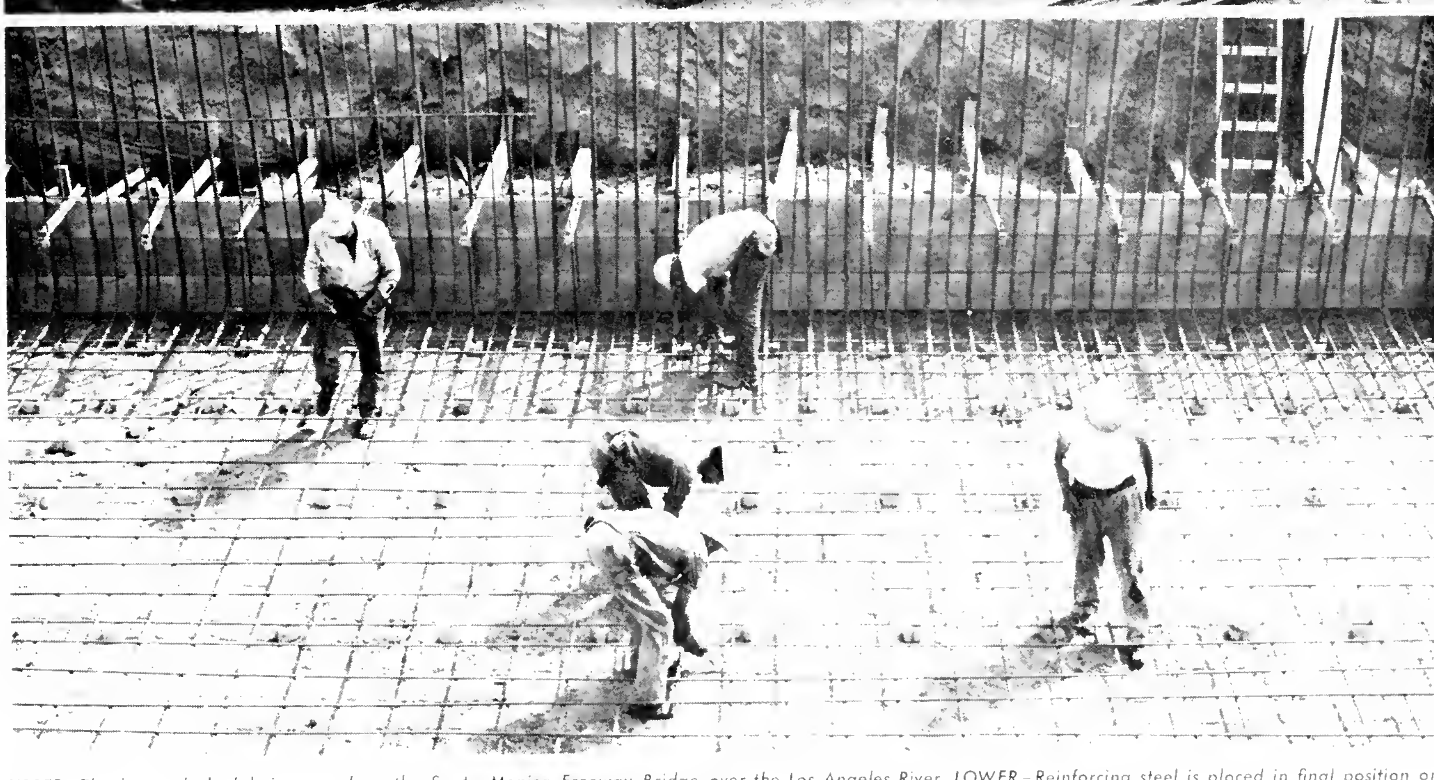
The 0.6-mile covered section of the Burbank-Western Channel had to be developed because of the freeway alignment crossing and paralleling the channel alignment. The channel was originally designed for open section throughout except for city street crossings which were to bridge the channel on simple spans. Due to the Golden State Freeway crossing the channel almost at the beginning of the project, it became necessary to design the first 1,500 feet of Burbank-Western, including the Stough Canyon confluence section, to a heavy covered section strong enough to support a 30-foot fill in addition to live street and freeway loading. Burbank Boulevard, a heavily traveled city street, will also cross the channel on a 30-foot fill at this location. As a result of these loadings it was found necessary to design and construct a box section with inverts as heavy as 4′ 3″ thick, walls 3′ 6″ thick, and a roof slab 3′ 9″ thick.

Completion of the Burbank-Western Storm Drain Channel is scheduled for October 15, 1960, under the terms of the contract specifications and the date for completion to finish the entire project is May, 1961. As of this writing, construction is estimated to be 20 percent completed.

The City of Burbank is rich in California history. Much of it was contained in the 36,400-acre Rancho San Rafael, granted by the Spanish crown to Don Maria Verdugo in 1797. The city was incorporated in 1911 with a population of 400 persons.

The City of Burbank in the year 1959 has 450 manufacturing plants employing 60,000 people, with a payroll amounting to $260,000,000; its population of 92,000 is centered within





UPPER—The lower deck slab is poured on the Santa Monica Freeway Bridge over the Los Angeles River. LOWER—Reinforcing steel is placed in final position and checked for the Burbank-Western Storm Drain Channel.

The shape of freeways to come is apparent in these two photos showing a section of the downtown loop just east of the central business district of Los Angeles. Photo (left) is a model prepared for design study purposes; photo (right) is the actual project now under construction.

an area of 16.9 square miles; assessed valuation is $145,318,510.

Signing Will Conform

Signing on the freeway loop will in general conform to the U. S. Interstate Highway standards pattern, with white lettering on dark green background for directional and guide signs and with the other incidental warning and regulatory signs of conventional colors.

Large overhead illuminated signs with down arrows will indicate the proper lane for the various destinations following the freeways. Street names will be used for the various turnoffs to city streets with a sloping up arrow. Reassurance signs with distances to the three next turnoffs will also be of the overhead illuminated type. The overhead signs are generally mounted on substantial steel sign bridges or post-supported frames designed to support the sign under a 90-mile wind velocity.

The lighting of the overhead signs is accomplished using fluorescent lighting fixtures developed by the State Division of Highways and mounted at the bottom of the signs. Large ground-mounted signs with white reflectorized legends and green background will be used to supplement the overhead illuminated signs to provide lane indication and supplementary information.

Shields for the interstate roads will be in blue and red background with white lettering. U. S. and state route shields will be white reflective background with black legends. Signing includes not only the signs on the freeway but directional signs on the streets indicating the proper ramps to use for traveling to the various destinations.

Within the freeway loop there will be 164 overhead signs with a total value of $1,300,000; 201 large ground-mounted signs at a cost of $110,000; together with a large number of miscellaneous smaller warning, regulatory and guide signs at a cost of $170,000.

Traffic Benefits

Engineers on the District VII staff have been irked from time to time by statements to the effect that "freeways are obsolete the day they are opened to traffic." What is really meant by such a statement is that the traffic volume desiring to use the new freeway facility is far in excess of the design capacity. People like the freeways too well!

In a metropolitan area such as Los Angeles, it obviously is not practical to design one freeway to handle all traffic desiring to travel it. Freeway planning in a metropolitan area must be based on the concept of a freeway network. With completion of the freeway network, traffic on various alternate routes will soon learn to adjust itself, and thus by reducing the peak loads most of the traffic tieups or slowdowns will be eliminated. The difficulty now is, we do not have alternate routes. The Los Angeles Freeway Loop will provide badly needed alternate routes.

The Golden State Freeway (U. S. Sign Route 99) coming into Los Angeles from the San Joaquin Valley, passes to the north of the Los Angeles Civic Center and connects to the Santa Monica-Santa Ana Freeways on the east side of Los Angeles at the East Los Angeles interchange. From this interchange, the Santa Monica Freeway goes westerly, passing to the

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New Lanes

Minor Improvements Aid Freeway Traffic Flow

By DONALD FRISCHER, Traffic Engineer, District VII

Freeway designs in the vicinity of the Los Angeles Civic Center were started some 20 years ago, when the planners had no conception of the excessive traffic overloads that these freeways would be called upon to carry. Each year many comparatively small items of additional construction are carried out on freeways under traffic to alleviate the congestion that always seems to result from the public's desire to use to the fullest extent the modern travel facilities afforded by freeways. Minor freeway improvements of this nature are hardly noticed by the motorists who benefit from them, but to the engineers who did the planning and the construction, they are sources of great satisfaction —particularly when the value of the benefits which accrue are so greatly in excess of the costs.

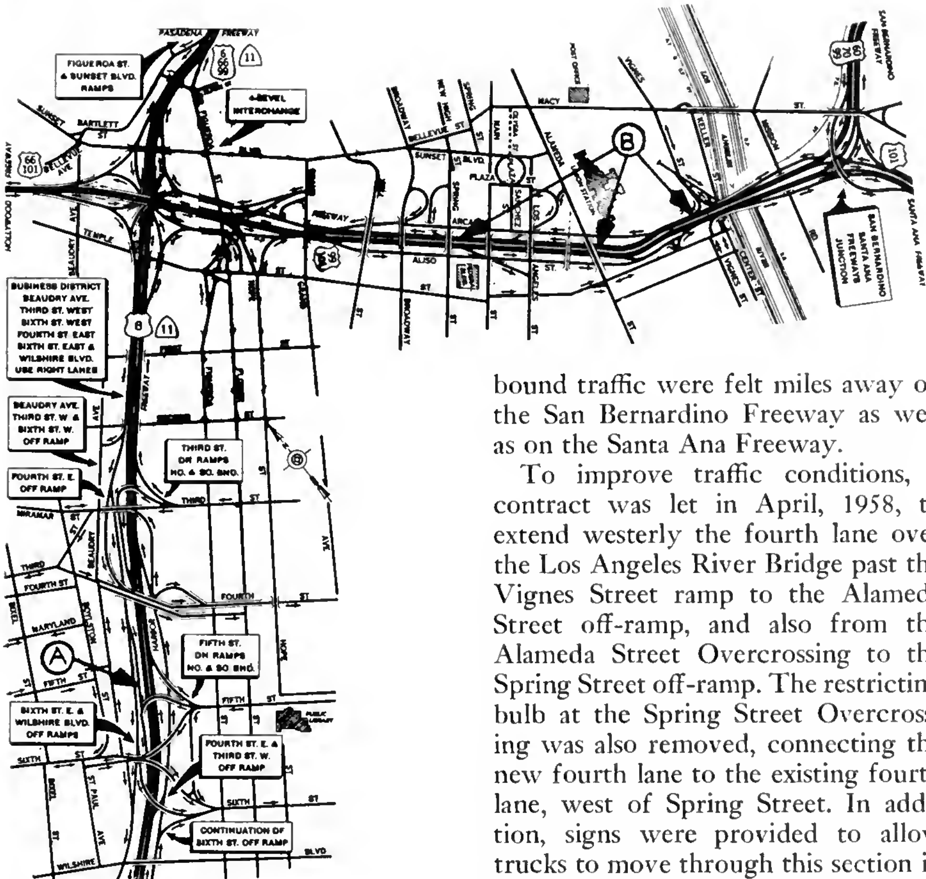
While the beneficial effects of a freeway improvement are usually felt immediately, the engineer's inherent sense of prudence does not permit him to evaluate the benefits until the "dust settles" and numerous observations have been made to justify his conclusions. During 1958, two freeway modifications were completed in the Civic Center area of Los Angeles City—one on the Santa Ana and Hollywood Freeways, east of the "Four-Level" interchange and the other on the Harbor Freeway, just south of the "Four-Level." The beneficial effects of these improvements and justification for their cost can now be proven.

Westbound Road Widened

The first reconstruction job involved the widening of the westbound roadway of the Santa Ana-

The Harbor Freeway, looking northward, showing the new slip ramp which handles traffic from the distributor road (left) to the curved Fifth Street southbound inlet (right).

UPPER This eastward view of the Santa Ana Freeway, taken from Los Angeles Street, shows the added lane for westbound traffic (extreme right). LOWER—A westward view of the Santa Ana Freeway at the Los Angeles Street on-ramp showing the added traffic lane occupied by the truck and trailer (right foreground).



This map of the four-level structure and vicinity shows the location of the lane improvements described in this article. The circled "A" and arrow points out the new slip ramp on the Harbor Freeway; circled "B" and arrows, the new westbound lane on the Santa Ana Freeway.

Hollywood Freeway from the Los Angeles River to Spring Street through the section that is being locally called "The Slot." The conditions that previously existed were as follows:

From the interchange of the Santa Ana and San Bernardino Freeways, the Santa Ana Freeway westbound roadway consisted of 4 lanes across the Los Angeles River Bridge, narrowing to three lanes at the Vignes off-ramp, and continuing as such to Spring Street. The roadway grade was, and still is, a plus 4.8 percent from Los Angeles Street to the "Four-Level" interchange. It is this steep grade that makes it necessary for trucks to change gears and causes a general slowing down of the westbound traffic (some 90,000 vehicles per day, of which 6,000 are trucks). During peak hours, the "stop and go" effects of this slowing down of westbound traffic were felt miles away on the San Bernardino Freeway as well as on the Santa Ana Freeway.

To improve traffic conditions, a contract was let in April, 1958, to extend westerly the fourth lane over the Los Angeles River Bridge past the Vignes Street ramp to the Alameda Street off-ramp, and also from the Alameda Street Overcrossing to the Spring Street off-ramp. The restricting bulb at the Spring Street Overcrossing was also removed, connecting the new fourth lane to the existing fourth lane, west of Spring Street. In addition, signs were provided to allow trucks to move through this section in the third lane as well as the fourth lane, thus allowing those trucks intending to continue west on the Hollywood Freeway to do so without changing lanes. This reconstruction job was completed in July, 1958, at a cost of $88,000. Vernon Paving Company of Vernon, California was the contractor. The author was resident engineer.

Downgrade Aids Trucks

The westbound roadway of the Santa Ana Freeway between the Alameda Street off-ramp and the Alameda Street Overcrossing was not widened and remains three lanes. This section is on a downgrade which allows trucks to accelerate prior to climbing the 4.8 percent upgrade. In addition, a sizeable amount of traffic leaves the freeway via the Alameda Street off-ramp. Therefore widening of this section was not needed.

The second reconstruction contract was on the southbound roadway of the Harbor Freeway and involved construction of a "slip ramp" between the southbound distributor road and the freeway at Fifth Street. Construction began in June, 1958, and was completed in December, 1958, at a cost of $84,000. V. A. Gilbertson of Beverly Hills was the contractor. The resident engineer was John O. MacNeill.

Prior to this contract, many observations were made to determine the cause of traffic delay and congestion south of the "Four-Level" Interchange on the Harbor Freeway. At this location the southbound roadway with five lanes just south of the "Four-Level" Interchange narrowed to three lanes within 1,800 feet, with two lanes leading into the distributor road running along the westerly side of the freeway from Second Street to Wilshire Boulevard. On the freeway, the three lanes continuing south are augmented by a fourth lane at the Fifth Street on-ramp. It was observed that the congestion on the Harbor Freeway in the area of the "Four-Level" Interchange was caused by southbound vehicles entering on the right from the interchange roadways of the Hollywood and Santa Ana Freeways, and then merging with the through traffic from the Pasadena Freeway traveling south on the Harbor Freeway. Traffic moving southerly on the Pasadena Freeway to the Harbor Freeway destined for the off-ramps at Second Street and southbound distributor road further complicated the situation because of the many weaving maneuvers in changing lanes. During peak hours, traffic here appeared to be standing still, and the effects of the congestion extended back to other connecting freeways, particularly westerly on the Hollywood Freeway.

Therefore the problem was to provide a new way so that traffic could remain in the two right lanes of the Harbor Freeway and continue south on the distributor roadway to a point where merging would not interfere with through traffic in the three fast lanes. To accomplish this, a contract was let to provide an opening from the southbound distributor road to the Fifth Street southbound on-ramp. This "slip ramp" provides a means for traffic entering the Harbor Freeway south of the "Four-Level" structure on the right, to remain in the two right lanes, travel down the distribu-

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Cost Index

Sharp Swing Upward Noted in Second Quarter of Year 1959

By J. P. MURPHY, Assistant State Highway Engineer and H. C. McCARTHY, Office Engineer

During the second quarter of 1959 the California Construction Cost Index took a sharp upswing to 270.4. The increase is 54.3 points or 25.1 percent above the first quarter of 1959.

Although this is the second highest point reached since maintenance of a cost index was started in 1940 (all-time high was 277.7 in 1957 first quarter), the index rise is not believed truly indicative of a major increase in construction costs.

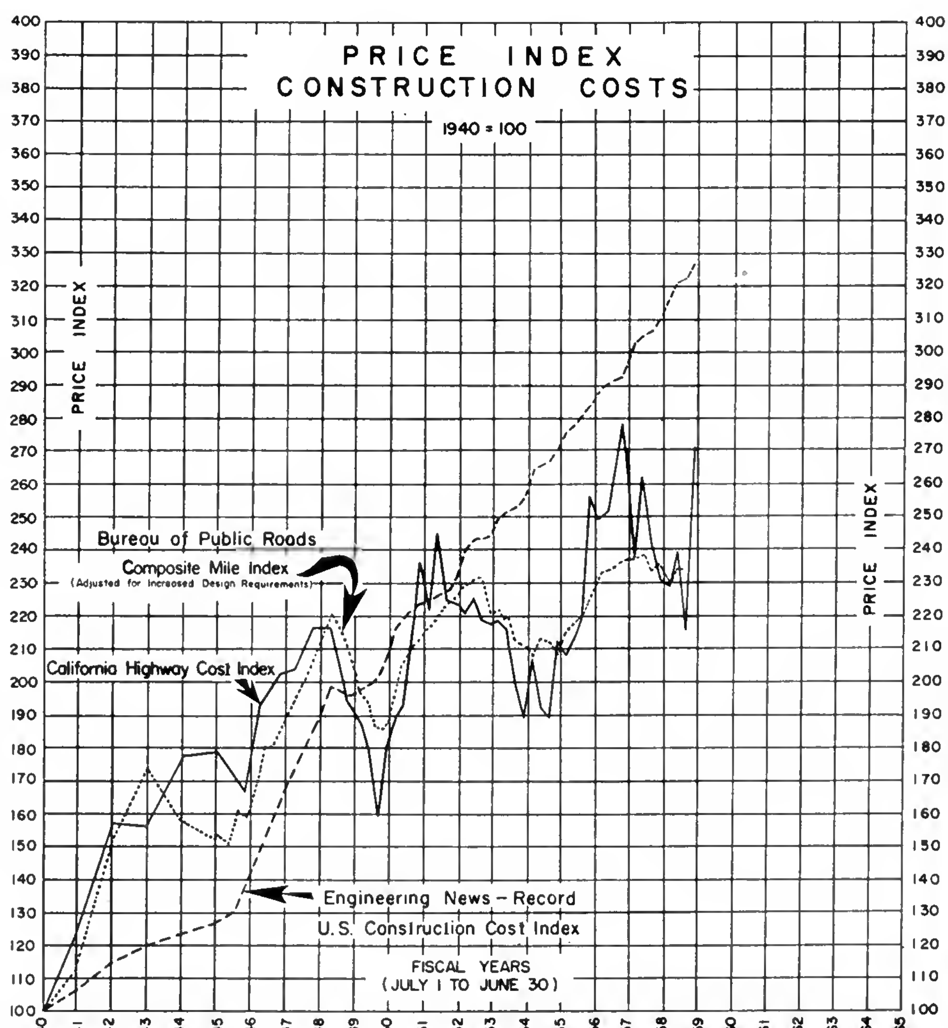
A review of the recent cost index trend indicates that the upswing in the 1959 second quarter is attributable generally to two factors.

One factor is simply the natural recovery from a false 9.4 percent decrease in the 1959 first quarter. That decrease apparently was occasioned by extremely keen competition among bidders who largely disregarded indicated cost increases and cut profits to the bone to secure basic projects to keep their organizations employed. Undoubtedly many bidders had a weather eye out for the predicted slowdown of the interstate highway program.

The other prime factor causing an apparent cost increase in the 1959 second quarter was the smaller size and different nature of the work predominating in the quarter. With future availability of federal funds in doubt, California was forced to reduce its advertising schedule. The reduction was mainly in the largest projects in the budget, projects which by their size and nature would permit large production and economies in plant setups or were more inviting because of lack of traffic interference. A number of the second quarter contracts were resurfacing projects, with considerable cost chargeable to traffic handling and with little opportunity for effecting major economies. During the 1959 first quarter bids were opened for 74 projects representing \$67 million of work with 89.7 percent of the value of work in projects over \$1,000,000 each and 45.4 percent in projects over \$5,000,000 each. In the 1959 second quarter bids were opened for 189 projects representing \$41 million of work with only 54.3 percent of the value in projects over \$1,000,000 each and 12.4 percent in a single project over \$5,000,000.

Bidder competition remained high during the 1959 second quarter, with an average of 6.3 bidders per project, but was below the 8.2 high average number of bidders in the first quarter of 1959.

In California the number of highway contractors and their bidding capacity (from prequalification totals) have increased. As of July 1, 1959, there were 1,045 contractors prequalified to bid on projects, with a combined estimated bidding capacity of \$2,115,000,000, as compared with a total one year earlier of 1,018 contractors with a bidding capacity of \$1,920,000,000.



Two accompanying charts show the average number of bidders arranged according to types of construction and project value for the Fiscal Year 1958-59 and for the six-month period from January to June, 1959, respectively.

The project values in this quarter are distributed as shown in the accompanying table "Size of Projects Considered in Survey."

SIZE OF PROJECTS CONSIDERED IN SURVEY

	No. of projects	*%*	*Value of projects*	*%*
Under $50,000	84	44.4	$1,793,553	4.4
50,000 to $100,000	37	19.6	2,727,396	6.7
100,000 to 250,000	43	22.8	6,732,578	16.4
250,000 to 500,000	12	6.4	4,445,442	10.8
500,000 to 1,000,000	4	2.1	3,054,407	7.4
1,000,000 to 2,500,000	6	3.2	8,712,212	21.3
2,500,000 to 5,000,000	2	1.0	8,444,745	20.6
Over 5,000,000	1	0.5	5,094,662	12.4
Total	189	100.0	$41,004,995	100.0

Six of the seven items used in the preparation of this index show higher average unit prices than in the previous quarter. Only untreated rock base dropped, with a reduction of $0.05 per ton. A tabulation of average contract prices is included in this article.

The average price for untreated rock base ($1.77 per ton) is $0.05 below the first quarter of 1959 price, which is within the range of normal fluctuation. Prices for quantities exercising a significant influance on the index range from $1.10 to $2.20 per ton.

The average unit price for roadway excavation ($0.66 per cu. yd.) is $0.25 higher than the first quarter of 1959. Unit bids in projects exercising significant weight in establishing this average price range from $0.40 to $1.50 per cubic yard.

Of a total quantity of 9,400,000 cubic yards included in contracts for this quarter, one project in Tulare County covering highway relocation at the Terminus Reservoir site in mountainous country where hard rock formations are encountered involved 1,900,000 cubic yards at $1.15. Elimination of this project would have resulted in an average price for this item of $0.54 per cubic yard.

The average unit price for portland cement concrete pavement ($14.03 per cu. yd.) is only three cents above the previous quarter, and is within the range of normal fluctuation.

The average unit price for asphaltic and bituminous mixes ($5.77 per ton) increased $0.40 from $5.37 per ton, but is still within the range of average unit prices for the last two years. The letting during this quarter of a number of thin blanket and seal coat contracts on which traffic control problems usually are experienced probably influenced the average unit cost of this item.

The average unit price for portland cement concrete structures ($65.36 per cu. yd.) increased $15.96 from $49.40 per cubic yard. The price for the first quarter was down because of a low bid on a large attractive project. The current price is above the previous trend, probably due to the scarcity of major projects involving large structures.

The average unit price for bar reinforcing steel ($0.134 per lb.) is an increase of $0.024 per pound above the unit price of $0.108 for the first quarter of 1959. Bid prices for this item ranged from $0.100 to $0.180.

The average unit price for structural steel ($0.198 per lb.) increased $0.033 from the first quarter of 1959. A total volume of 5,000,000 lbs. was used in this quarter, with the prices of significant quantities ranging from $0.110 to $0.210 per pound. About half of the projects using this item had a total value of less than $100,000.

Cost Index

The California Highway Consruction Cost Index, the Engineering News-Record Construction Cost Index, and the United States Bureau of Public Roads Composite Mile Index,

AVERAGE CONTRACT PRICES

	Roadway excavation,[1] per cu. yd.	Untreated rock base, per ton	Plant mixed surfacing, per ton	Asphalt concrete pavement, per ton	Asphaltic and bituminous mixes, per ton	PCC pavement, per cu. yd.	PCC structures, per cu. yd.	Bar reinforcing steel, per lb.	Structural steel, per lb.
1940	$0.22	$1.54	$2.19	$2.97	--	$7.68	$18.33	$0.040	$0.083
1941	0.26	2.31	2.84	3.18	--	7.54	23.31	0.053	0.107
1942	0.35	2.81	4.02	4.15	--	9.62	29.48	0.073	0.103
1943	0.42	2.26	3.71	4.76	--	11.48	31.76	0.059	0.080
1944	0.50	2.45	4.10	4.50	--	10.45	31.99	0.054	0.132
1945	0.51	2.42	4.20	4.88	--	10.90	37.20	0.059	0.102
1946	0.41	2.45	4.00	4.68	--	9.48	37.38	0.060	0.099
1947	0.46	2.42	4.32	5.38	--	12.38	48.44	0.080	0.138
1948	0.55	2.43	4.30	5.38	--	13.04	49.86	0.092	0.126
1949	0.49	2.57	4.67	4.64	--	12.28	48.57	0.096	0.117
1950	0.40	2.25	4.26	3.75	--	11.11	43.45	0.079	0.094
1951	0.49	2.52	4.34	5.00	--	12.21	47.22	0.102	0.159
1952	0.56	2.99	5.00	4.38	--	13.42	48.08	0.098	0.150
1953	0.51	2.14[2]	5.31	4.58	--	12.74	50.59	0.093	0.133
1954	0.45	2.13	4.50	4.86	--	14.41	48.42	0.094	0.124
1955	0.39	2.22	4.93	--	--	13.35	45.72	0.095	0.142
1st Quarter 1956	0.40	2.08	5.40	6.50	--	14.05	52.51	0.105	0.165
2d Quarter 1956	0.51	2.06	5.27	--	--	14.64	57.13	0.113	0.219
3d Quarter 1956	0.52	2.27	5.12	--	--	15.57	55.32	0.121	0.178
4th Quarter 1956	0.52	2.21	--[3]	--[3]	$5.93[3]	14.95	59.53	0.112	0.197
1st Quarter 1957	0.63	2.10	--	--	5.94	17.28	61.14	0.129	0.235
2d Quarter 1957	0.63	2.10	--	--	6.18	15.59	68.61	0.119	0.204
3d Quarter 1957	0.42	2.34	--	--	5.10	14.34	58.68	0.130	0.200
4th Quarter 1957	0.68	1.78	--	--	5.45	15.88	59.76	0.129	0.177
1st Quarter 1958	0.52	1.85	--	--	5.45	14.96	55.21	0.118	0.192
2d Quarter 1958	0.48	1.73	--	--	5.57	13.77	54.44	0.125	0.158
3d Quarter 1958	0.39	2.18	--	--	5.56	13.39	53.93	0.126	0.182
4th Quarter 1958	0.52	2.10	--	--	5.74	13.55	55.20	0.122	0.165
1st Quarter 1959	0.41	1.82	--	--	5.37	14.00	49.40	0.108	0.165
2d Quarter 1959	0.66	1.77	--	--	5.77	14.03	65.36	0.134	0.198

[1] Unclassified.
[2] The item of crusher run base was used before 1953.
[3] Asphalt concrete pavement combined with plan mix surfacing in 4th Quarter 1956, and will be identified as asphaltic and bituminous mixes in the future.

NUMBER AND SIZE OF PROJECTS, TOTAL BID VALUES AND AVERAGE NUMBER OF BIDDERS

(July 1, 1958, to June 30, 1959)

Project Volume	Up to $50,000	$50,000 to $100,000	$100,000 to $250,000	$250,000 to $500,000	$500,000 to $1,000,000	Over $1,000,000	All Projects
Road projects							
No. of projects	287	87	102	49	19	8	552
Total value*	$6,034,814	$6,362,663	$16,264,619	$17,140,369	$13,208,991	$9,983,876	$68,995,332
Avg. No. bidders	5.1	5.7	6.4	7.6	9.8	8.9	5.9
Structure projects							
No. of projects	28	10	14	5	3	6	66
Total value*	$703,883	$724,399	$2,511,489	$1,729,053	$2,569,031	$12,633,982	$20,871,837
Avg. No. bidders	7.0	6.6	8.9	9.8	9.7	9.0	7.9
Combination projects							
No. of projects					7	41	48
Total value*					$5,711,246	$142,367,550	$148,078,796
Avg. No. bidders					7.3	8.6	8.4
Summary							
No. of projects	315	97	116	54	29	55	666
Total value*	$6,738,697	$7,087,062	$18,776,108	$18,869,422	$21,489,268	$164,985,408	$237,945,965
Avg. No. bidders	5.3	5.8	6.7	7.8	9.2	8.7	6.3

* Bid items only.

TOTAL AVERAGE BIDDERS BY MONTHS

	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Avg. Year
1958-59	5.4	5.5	5.6	5.5	7.0	6.9	7.7	8.0	8.7	7.0	6.1	5.8	6.3
1957-58	6.2	6.3	5.7	8.2	9.2	9.7	11.4	9.2	7.6	7.1	4.5	4.8	6.9

NUMBER AND SIZE OF PROJECTS, TOTAL BID VALUES AND AVERAGE NUMBER OF BIDDERS

(January 1, 1959, to June 30, 1959)

Project Volume	Up to $50,000	$50,000 to $100,000	$100,000 to $250,000	$250,000 to $500,000	$500,000 to $1,000,000	Over $1,000,000	All Projects
Road projects							
No. of projects	121	40	45	19	5	4	234
Total value*	$2,440,785	$3,042,241	$6,959,244	$6,789,219	$3,269,231	$4,733,210	$27,233,930
Avg. No. bidders	5.6	5.8	6.9	9.1	11.8	8.0	6.4
Structure projects							
No. of projects	14	3	8	1	2	1	29
Total value*	$351,671	$210,382	$1,453,041	$416,621	$1,980,184	$1,838,928	$6,250,827
Avg. No. bidders	8.3	8.7	8.8	16.0	10.0	5.5	8.9
Combination projects							
No. of projects					1	19	20
Total value*					$975,625	$75,759,371	$76,734,996
Avg. No. bidders					9.0	9.2	9.2
Summary							
No. of projects	135	43	53	20	8	24	283
Total value*	$2,792,456	$3,252,623	$8,412,285	$7,205,840	$6,225,040	$82,331,509	$110,219,753
Avg. No. bidders	5.9	6.0	7.2	9.4	11.0	9.0	6.8

* Bid items only.

TOTAL AVERAGE BIDDERS BY MONTH

	Jan.	Feb.	Mar.	Apr.	May	June	Avg. for six months
1959	7.7	8.0	8.7	7.0	6.1	5.8	6.8
1958	11.4	9.2	7.6	7.1	4.5	4.8	6.6

all reduced to the base 1940 = 100, are shown on the accompanying graph. The latter two indexes are based on nationwide construction costs.

The Engineering News-Record Cost Index for the second quarter of 1959, which now stands at 326.5, again shows a rise over the preceding quarter. It is up 4.4 index points or 1.4 percent. This index is strongly affected by many large projects outside the highway construction field.

The Bureau of Public Roads Composite Mile Index is based on federal-aid highway construction contracts awarded by the state highway departments. The index for the first quarter of 1959, which is the latest available, dropped 1.2 index points or 0.5 percent from the fourth quarter of 1958 and now stands at 234.1.

The California Highway Construction Cost Index

Year	Cost Index
1940	100.0
1941	125.0
1942	157.5
1943	156.4
1944	177.8
1945	179.5
1946	179.7
1947	203.3
1948	216.6
1949	190.7
1950	181.2
(1st Quarter 1950—160.6)	
1951	225.0
(4th Quarter 1951—245.4)	
1952	225.9
1953	215.2
1954	193.5
(2d Quarter 1954—189.0)	
1955 (1st Quarter)	189.3
1955 (2d Quarter)	212.4
1955 (3d Quarter)	208.6
1955 (4th Quarter)	212.6
1956 (1st Quarter)	219.5
1956 (2d Quarter)	255.9
1956 (3d Quarter)	249.1
1956 (4th Quarter)	252.1
1957 (1st Quarter)	277.7
1957 (2d Quarter)	266.9
1957 (3d Quarter)	237.5
1957 (4th Quarter)	262.1
1958 (1st Quarter)	241.8
1958 (2d Quarter)	231.0
1958 (3d Quarter)	228.5
1958 (4th Quarter)	238.5
1959 (1st Quarter)	216.1
1959 (2d Quarter)	270.4

County Bridges

Flood Damage Restored With Federal, State, Local Funds

By W. C. KIEDAISCH, Supervising Bridge Engineer

An article at this time about flood damage that occurred nearly four years ago may seem to have little "news" value, but residents of the affected areas undoubtedly feel otherwise, particularly those who are still awaiting new bridges. It has been a long, hard pull, but the last county bridge to be replaced is finally ready for contract.

Although any adverse weather in California is tritely referred to as "unusual," the winter of 1955-56 was unusually unusual and in addition, unusually early. A storm in the middle of November brought high winds, heavy rain and early snow as far south as Mt. Baldy and then a series of weak storms in mid-December saturated the watershed mantles. Thus when the major storm waves arrived shortly thereafter and continued through December 26th, the runoff was immediate and flood levels in the rivers rose to record heights in Northern and Central California.

Geological survey measurements showed that the Klamath River near Klamath rose six feet higher than ever recorded previously and the Eel River at Scotia reached almost seven feet above the previous high. The Russian River flooded Guerneville first on December 20th, and again on December 23d, when it exceeded the previous maximum flood stage by nearly three feet.

These flood flows carried large amounts of drift and debris which gathered at each bridge. With each structure creating a partial or complete dam, the stream flow either dug a deeper channel under the structure, pounded its way over the bridge, pushed it out of the way completely, or bypassed the main spans of the structure and destroyed the approaches.

Although the storms continued during January and February of 1956, adding considerably to the total damage, additional bridge damage was confined principally to the temporary bridges that had been thrown across the streams after the December flood.

A survey by federal, state and county engineers during and immediately following the floods indicated that the costs of restoration would far exceed funds available from local sources.

Recognition of this situation was taken by the California Legislature and an emergency measure was enacted, entitled "The Flood Relief Law of 1956," under which local agencies could apply for state aid from the General Fund to augment already available, but inadequate, federal funds. Approximately $14,200,000 of state funds have been obligated under this statute to assist in the financing of damage totaling over $22,000,000.

The damage to major county bridges was spread over 24 counties at 134 different sites. The total repair and reconstruction cost of these bridges will approximate $10,500,000. About 60 percent of these structures were either completely destroyed or damaged so extensively as to necessitate replacement. Of the above total major bridge damage, $8,800,000 was concentrated within six counties. A brief description of the major bridge replacements in these counties follows.

Humboldt County

Humboldt County applied for state aid at 43 different bridge sites with an estimated construction cost of $3,200,000. New structures, varying from concrete slab trestles to large steel trusses, were required at 16 of these sites.

The county let formal contracts through competitive bidding for most of the projects but used force account for some emergency work. While construction of the larger projects was underway, the county was often forced to construct temporary detour roads and log bridges to provide access to critical areas.

At three sites, the destroyed facilities were old suspension bridges which had outlived their usefulness. The new structures for these three sites (two completed and the last advertised for bids), have a total estimated cost which is equal to the total of the other 40 locations. Following is a description of these three projects:

Willow Creek Bridge over the Trinity River is 508 feet long and has welded steel deck girder spans, two at 152 feet 6 inches and two at 101 feet 6 inches.

Fort Seward Bridge over the Eel River is 620 feet long and consists of welded steel deck girder end spans at 112 feet and 86 feet and two steel deck truss spans at 211 feet.

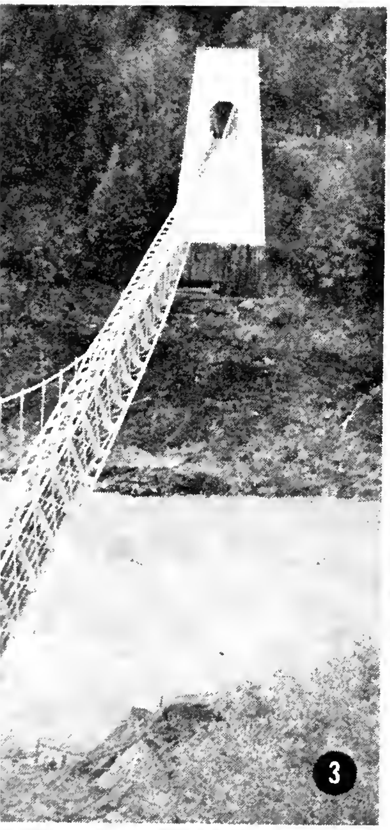
Martin's Ferry Bridge over the Klamath River will be 680 feet long made up of rolled steel girder spans at 45 feet and 35 feet and steel deck truss spans, two at 150 feet and one at 300 feet.

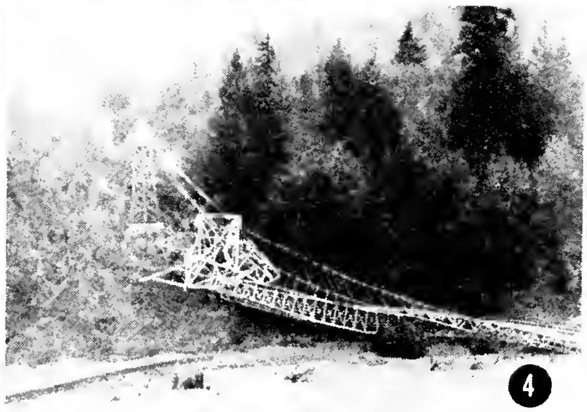
Mendocino County

With conditions similar to those in Humboldt County but not as severe, the Mendocino County damage was confined to 16 sites at a total cost of $540,000, with completely new structures necessary at eight sites. The most important of these were the new structures across West Branch Russian River at Calpella, Eel River Bridge at Hearst and the Outlet Creek Bridge at Longvale, total cost, $380,000.

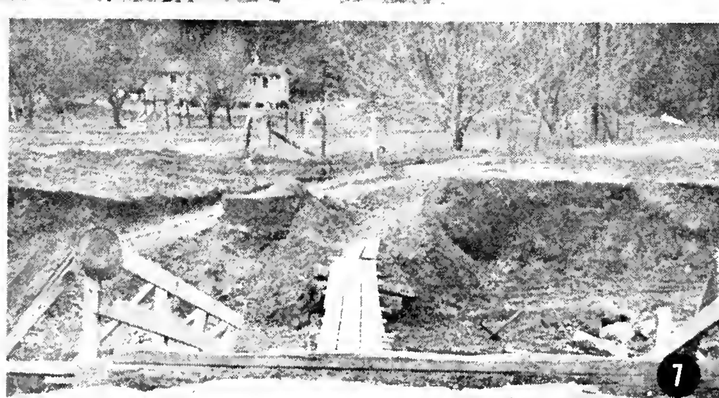
Sutter County

The Feather River Bridge at Nicolaus in Sutter County had a long history of flood damage which started while it was being constructed in 1916. This time a portion of the box girder spans (constructed because of the flood damage of 1938) were lost. Studies of the remaining portions of the bridge indicated the futility of replacing the missing portion when consideration was given to the probability of more flood damage in the future. Financed with federal and state funds,





See Page 27. *Photo 1*—The temporary crossin
in Mendocino County shortly after the bridge
Willow Creek Bridge in Humboldt County af
twisted span of the old single-lane suspensior
in Humboldt County shown here is now being
Photo 4—Flood waters destroyed the Eel Rive
Photo 13). *Photo 5*—This temporary crossing o
over Kenney Creek after the bridge was wash
Tylor-Foote Road Bridge on the Middle Fork o
ties. *Photo 7*—Robinson Creek Bridge crossing
flood *(see Photo 15)*. *Photo 8*—The crossing
Rivers, Tulare County after the flood. *Photo 9*—
Fork of the Eel River in Humboldt County. *Ph*
Mattole River Bridge on Lighthouse Road in
Bridge across the Trinity River in Humboldt Co
Bridge between Yuba City and Marysville rep
new Eel River Bridge at Fort Seward (see *Phot*
on the Longvale-Covelo Road, Mendocino C
Robinson Creek Bridge, Mendocino County (se
near Nicolaus replacing the one washed out b
duct along the Russian River in Sonoma Cou
Photo 18—The new Kenney Creek Bridge, Men



ır Outlet Creek on the Longvale-Covelo Road ›een washed out (see *Photo 14*). *Photo 2*—The had collapsed (see *Photo 11*). *Photo 3*—The ge across the Klamath River at Martin's Ferry :ed with a modern two-lane steel truss bridge. dge at Fort Seward in Humboldt County (see nty Road 429 in Mendocino County took traffic ıt (see *Photo 18*). *Photo 6*—Remains of the Old Yuba River between Nevada and Sierra Coun- Aendocino County Road 125 shortly after the he Middle Fork of the Kaweah River in Three lood-damaged Moody Bridge across the South 0—Floating debris caused this damage to the ›oldt County. *Photo 11*—The new Willow Creek (see *Photo 2*). *Photo 12*—The new Fifth Street ; spans destroyed in the flood. *Photo 13*—The *Photo 14*—The new bridge across Outlet Creek ' (see *Photo 1*). *Photo 15*—The reconstructed ıto 7). *Photo 16*—The new Feather River Bridge ∍ 1955 floods. *Photo 17*—The new sidehill via- replacing a section damaged by the floods. ıo County (see *Photo 5*).

a new structure consisting of 29 105-foot and two 68-foot prestressed precast T-beam spans was constructed at a cost of $2,300,000.

Similarly, the Feather River Bridge between Marysville and Yuba City on Fifth Street had been damaged severely. The concrete portions remaining were unstable and the through steel truss portion was too narrow for the mounting traffic demands. A new structure was placed at this site at a cost of $1,500,000 provided from state, federal, Sutter and Yuba County funds. It consists of eighteen 80-foot prestressed precast T-beam spans, one 88-foot prestressed precast I-beam span and two 150-foot continuous prestressed cast-in-place T-beam spans.

Yuba County

Besides contributing to the cost of of the above-noted Feather River Bridge on Fifth Street, Yuba County was forced to replace the flood-demolished Simpson Lane Bridge over the Yuba River at a cost of $300,000. This structure now consists of five 83-foot prestressed precast T-beam spans.

Sonoma County

The bridge damage in Sonoma County was confined to 11 sites (of which eight required new structures), with a total cost of $480,000. In all cases the new structures consist of structural steel and/or concrete superstructures on concrete substructures.

Tulare County

Damage was at 10 different sites in Tulare County with a total cost of $470,000, with new structures required at eight of the sites. These new structures also consisted of structural steel and/or concrete superstructures on concrete substructures.

Conclusion

To answer those who may be puzzled as to why it is taking so long to complete a program no more costly than one of the larger interstate freeway projects, the following should be added.

Many of the bridges destroyed were only one lane wide but were replaced with modern two-lane structures. As the difference in cost between a new one-lane bridge and a new bridge two lanes wide is not eligible for state aid, the funds to be furnished by the local agencies was greatly increased. This placed a heavy burden on Humboldt County, where the greatest portion of the damage occurred. Had not this county elected to provide modern structures in lieu of replacing the narrow bridges in kind, all work could have been long completed. However, in order to raise the one and one-third million dollars of county funds required to finance "betterments" under its flood restoration program, it has been necessary for Humboldt County to spread the reconstruction work over several fiscal years. This county is to be commended for its tenacity and its citizens for their patience.

The time-worn expression, "It's an ill wind that blows nobody good," certainly applies to the 1955 floods. With one exception, all of the county bridges suffering major damage were from 20 to 40 years old and were inadequate in roadway width and structural strength. Nearly all needed constant maintenance at excessive cost to keep them in service. In short, these bridges were due for replacement regardless of the floods. However, bridges in rough terrain are costly and the counties were having extreme difficulty in providing any more funds than were required for maintenance. The floods brought the situation to a head and resulted in the legislative action.

As a measure of the effectiveness of the bridge replacement program conducted under the Flood Relief Law of 1956, it may be noted that none of the new structures were damaged by the floods which occurred during the spring of 1958. This may account for the fact that although the floods of 1958 were in some respects more severe than those of 1955, the damage to public property was less than two-thirds of that caused by the earlier floods. It is thus quite obvious that permanent benefit is being derived from the State Flood Relief Programs and that the permanent Emergency Flood Relief Law enacted by the 1959 Legislature will be material help to the cities and counties in their struggle to modernize their street and road systems. Nevertheless, the expenditures under future flood restoration programs should become less and less as more of the substandard facilities are replaced with modern construction.

Norris J. Burke

Norris J. Burke, attorney with the Division of Contracts and Rights of Way in San Francisco, died July 29.

Burke had an extensive record in both state and federal service and in private practice. During his service with the Department of Public Works he had participated in much of its most complicated litigation.

A graduate of Boalt Hall, University of California at Berkeley, in 1926, Burke passed the Bar examination at the age of 20 and had to await his twenty-first birthday before he could be admitted to practice. In 1939 he was awarded a fellowship at Harvard University. While there he was granted both a master of laws degree and a doctor of juridical science. His first position with the State was as Chief Deputy Legislative Counsel at Sacramento in 1927. Between 1928 and 1936 he was in private practice in San Francisco and Sacramento.

In 1936 he left on a tour of the Far East, returning to Sacramento in 1937 to become a special investigator for the State Personnel Board. Following his attendance at Harvard, Burke was on the legal staffs of several federal agencies in Washington, D. C. In 1947 he returned to California as general counsel and co-ordinator of the California Legislative Committee on Constitutional Revision.

He became Principal Attorney with the Division of Contracts and Rights of Way in 1950, leaving in 1954 to become Chief Research Attorney of the Judicial Council and later Assistant Legislative Secretary to the Governor. In 1957 he returned to the legal staff of the Division of Contracts and Rights of Way in San Francisco.

Burke was a member of the California Bar Association and the Harvard Law School Alumni. He is survived by his wife, Edythe.

Report From District V

By A. M. NASH, District Engineer

As in past years, dominant element in the highway development program in District V is the construction or reconstruction of US 101 to freeway standards. As one of the two main north-south highway arteries in California US 101 is naturally subject to heavy traffic, as it provides a more scenic, often cooler north-south route than does US 99 in the central portion of the State. Moreover, as US 101 is continually improved more and more travelers choose this route which, in turn, makes greater demands on the remaining two-lane sections of US 101. Under these conditions it becomes of increasing importance that we provide the best possible divided four-lane highway on US 101 as soon as possible to meet the heavy traffic demands.

PHOTO TOP—The new US 101 freeway section between Buellton and the US 101-Sign Route 150 junction in Santa Barbara County.

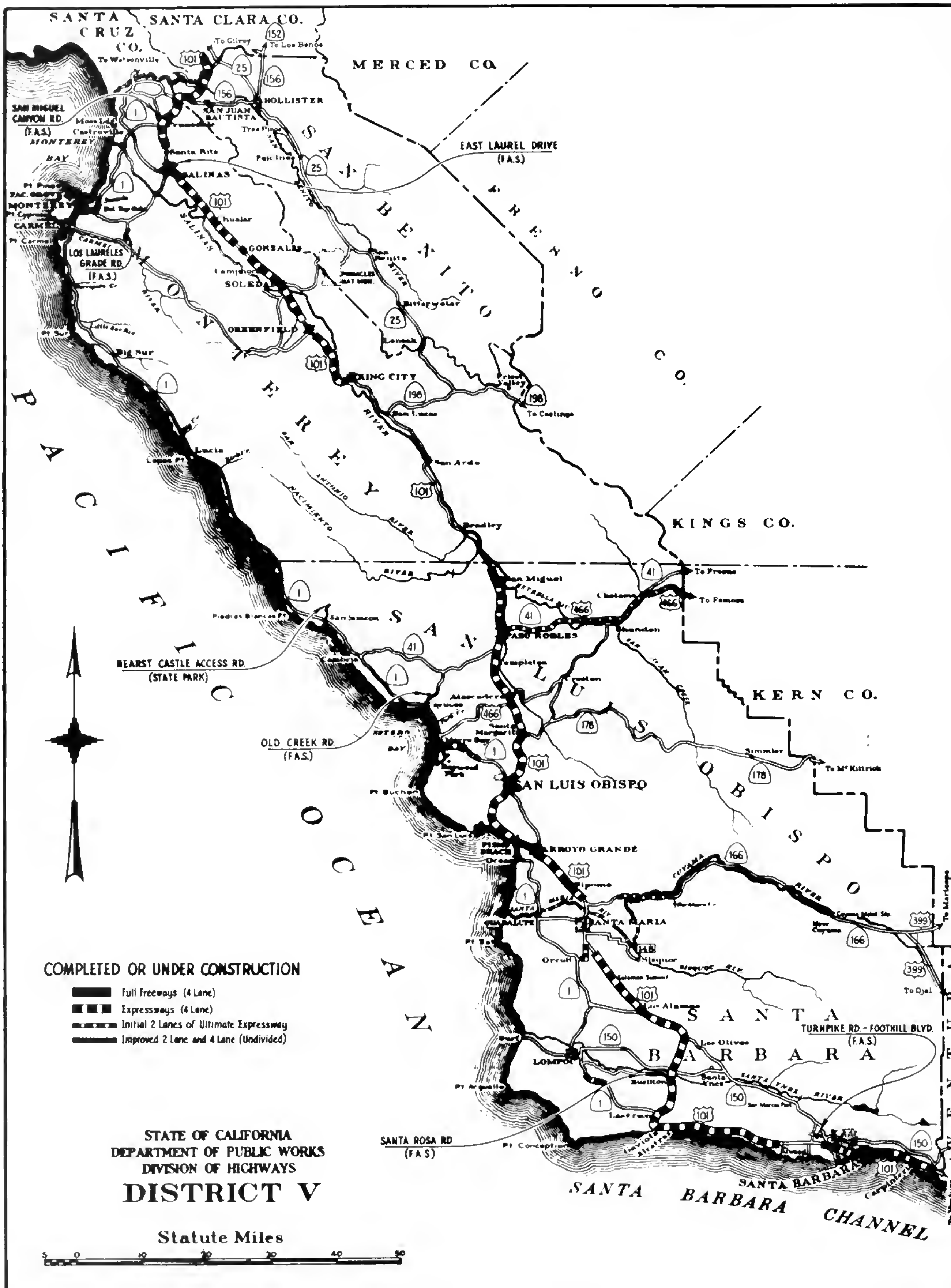
As a step forward in this program the Thomas Construction Company of Fresno completed in June of this year the "San Juan Interchange" in San Benito County separating US 101 from State Sign Route 156 which leads to Mission San Juan Bautista and Hollister. This eliminated an inadequate grade intersection having poor sight distance for motorists and consequently an area with, up to now, the highest accident frequency rate in San Benito County, as well as one of the highest in the district.

Atmosphere Preserved

At this intersection much of the familiar Spanish style adobe walls, wooden cross, and campanile, long a landmark and entry way to historic Mission San Juan Bautista, some two miles southeast on State Route 22, were carefully preserved, keeping intact as much of the quaint atmosphere of the intersection as possible while at the same time providing the traveling public with the essential safety and convenience afforded by a modern freeway interchange.

This $375,000 project was financed through the "antirecession" provisions of the Federal Aid Highway Act of 1958 and was completed in rapid time in line with the spirit and intent of that act.

In the northern, rapidly expanding section of the City of Salinas, heavy commercial and residential development adjacent to US 101 has rendered the divided four-lane section obsolete and presents a constant traffic


SANTA CRUZ CO.
SANTA CLARA CO.
MERCED CO.
SAN BENITO CO.
FRESNO CO.
KINGS CO.
KERN CO.
MONTEREY
SAN LUIS OBISPO
SANTA BARBARA
VENTURA
PACIFIC OCEAN
SANTA BARBARA CHANNEL
MONTEREY BAY
HOLLISTER
SAN JUAN BAUTISTA
SALINAS
MONTEREY
CARMEL
GONZALES
SOLEDAD
GREENFIELD
KING CITY
SAN LUIS OBISPO
ARROYO GRANDE
PASO ROBLES
SANTA MARIA
LOMPOC
SANTA BARBARA
SAN MIGUEL CANYON RD. (F.A.S.)
EAST LAUREL DRIVE (F.A.S.)
LOS LAURELES GRADE RD. (F.A.S.)
HEARST CASTLE ACCESS RD. (STATE PARK)
OLD CREEK RD. (F.A.S.)
SANTA ROSA RD (F.A.S.)
TURNPIKE RD.-FOOTHILL BLVD. (F.A.S.)
COMPLETED OR UNDER CONSTRUCTION
Full Freeways (4 Lane)
Expressways (4 Lane)
Initial 2 Lanes of Ultimate Expressway
Improved 2 Lane and 4 Lane (Undivided)
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS
DISTRICT V
Statute Miles

Reconstruction of the Hearst Castle access road was a co-operative project of the Division of Beaches and Parks and the Division of Highways. The castle can be seen on top of the ridge to the right.

hazard throughout the area. Preliminary studies have been made looking toward construction of a northerly extension of the Salinas bypass freeway from its present terminus at North Main Street to a point one mile north of Espinosa Road beyond any present development, roughly paralleling existing US 101 and west of it. However, further planning has been in abeyance pending development and approval of a master plan by city and county officials which has been under study for some time.

Was Jointly Financed

The County of Monterey completed in June a $229,000 expressway on East Laurel Drive between Natividad Road in North Salinas and Sanborn Road in the large, unincorporated community of Alisal directly southeast of Salinas to provide a direct route around the city lessening traffic congestion in the center of the city as a result. This was a jointly financed federal-county-state project supervised by state employees.

In the heart of the fertile productive Salinas Valley, considerable planning and construction are now under way on previously undeveloped sections of US 101. At the City of Gonzales plans are complete for a freeway bypassing the city on the east and right-of-way acquisition is in progress.

Between Gonzales and Soledad to the south a 5.7 mile four-lane expressway project is now under construction directly paralleling the existing highway on its east side with portions of the present highway being utilized

A new freeway section on US 101 between Elwood and Orella west of the City of Santa Barbara.

as southbound lanes with the remainder serving as a frontage road when construction is complete. Separation structures are being completed at Camphora Road and at the entrance to Soledad State Prison.

Directly joining this project on the south, construction is now under way on the Soledad bypass freeway paralleling the westerly city limit and running adjacent to the Southern Pacific Railroad in many places. This project is actually the connecting link between the expressway north of the city, now under way, and an expressway from the Salinas River to one mile north of Greenfield completed in the fall of 1958.

Span Crosses Railroad

Bridge construction is a major item on this project, as another bridge across the Salinas River almost identical to and parallel with the existing bridge is required as well as a separation structure south of the city and construction of four-span parallel structures over the Southern Pacific Railroad and the existing US 101 north of Soledad.

Asphaltic concrete is being utilized as both a base and a surfacing material as a test section on this project.

Contractors John Delphia and Fred J. Early, Jr., operating as a joint venture, have both this $1,850,000 freeway contract and the $1,500,000 expressway project between Soledad and Gonzales, and are attempting to complete both projects in November of this year, although they have until next July to finish the first named project. If the contractor is successful in his efforts, motorists will have approximately nine miles of divided four-lane highway opened to traffic at one time.

Design plans are complete on the proposed freeway bypassing the City of Greenfield on its east side and right-of-way acquisition has reached a point where construction can begin as soon as funds become available.

Planning and design is under way on the section of US 101 in Monterey County between the Salinas River Bridge south of San Ardo and the southern county boundary at Camp Roberts and right-of-way acquisition is under way on the most southerly portion.

Traffic Congestion Eased

In San Luis Obispo County the opening of the $3,500,000 Paso Robles freeway bypass late last year was a culmination of over two years' construction work and has already proved its worth to the motoring public by speeding through traffic around the city and easing traffic congestion through the center of town.

In San Luis Obispo County this year our efforts concerning US 101 were concentrated on construction of the $1,080,000 Arroyo Grande freeway bypass which was completed in June. Located within the city limits, a 1.93-mile freeway was constructed generally parallel to the existing highway but on an improved more direct alignment.

Four structures were included in this project and, interestingly enough, each of a different type to meet differing physical conditions. The Bridge Street undercrossing carrying local southbound traffic onto the freeway lanes is of steel girder type while the Valley Road overcrossing involved construction of a prestressed concrete slab 22 inches thick to provide greater head room, without excavating too deeply into the ground. At Arroyo Grande Creek "T" beam construction on concrete piles was used, and the Grand Avenue overcrossing utilizes the box girder type of construction with adequate width for four lanes of traffic.

The remaining unimproved section of US 101 in San Luis Obispo County runs through the City of Pismo Beach, a distance of 2.2 miles. Design plans are complete, all necessary right-of-way has been acquired, and utilities and other improvements removed from the right-of-way so that construction can begin. The project is in the approved budget for the 1959-60 Fiscal Year, but advertisement for bids is being delayed pending a decision in the Congress on the federal nationwide financial problem for federal aid highways. With completion of this freeway section motorists will be able to drive on divided four-lane highway on US 101 for a distance of 69 miles without any major traffic hindrance.

Freeway Bypass Planned

Across the county line in northern Santa Barbara County plans are well along for construction of a freeway bypassing the City of Santa Maria to the east, and the greater portion of the necessary right-of-way has been acquired.

The City of Santa Maria has been experiencing an explosive growth in population over the last two years with a resultant residential and commercial expansion greatly adding to the congestion problem of local and through traffic on existing US 101 running two miles through the center of the city. The major portion of this expansion has been a direct result of the establishment and development of the Vandenberg Missile Base some 18 miles southerly.

Four miles south of Santa Maria the southbound two lanes of the expressway between that point and one mile north of Los Alamos on US 101 are presently being reconstructed by A. J. Diani Construction Company of Santa Maria who began work in July of this year.

The present roadway, constructed in 1932, is being widened from its present 20-foot to 24-foot width and repaved with plant-mixed surfacing. Wider shoulders are also being provided to bring these heavily traveled southbound lanes up to modern expressway standards. The northbound lanes of this expressway had been completed in 1955, but due to limited funds this final stage in expressway construction could not be completed until this time.

Freeway Is Extended

In the center of Santa Barbara County, Fredrickson and Watson Construction Company of Oakland completed work in February of this year on a 5.0-mile section of divided four-lane expressway on US 101 between the northern limits of Buellton and the intersection of US 101 with State Route 150. Completion of this strategic section of US 101 now provides the traveling public with divided four-lane highway from a point four miles south of Santa Maria to the rail-

UPPER LEFT—A reconstructed section of Sign Route 41 in northern San Luis Obispo County. UPPER RIGHT—An aerial of the new section of US 101 freeway west of Santa Barbara near Elwood. LOWER—An improved section of Turnpike Road north of US 101 near Santa Barbara.

These twin bridges carry the US 101 freeway across Arroyo Grande Creek in San Luis Obispo County.

road point of Elwood some 10 miles west of Santa Barbara with minor exceptions at the Santa Ynez River south of Buellton, and a short section near Refugio Beach State Park.

We hope to soon begin construction of a divided four-lane freeway from Elwood to the westerly limit of Santa Barbara at the Hollister Wye joining a freeway section completed in 1958, closing one of the most significant and heavily traveled gaps in divided four-lane highway in the county. This project is also in the approved budget, but similar to the Pismo Beach job in San Luis Obispo County, the advertisement is being held up as a result of the present federal highway financing dilemma in the Congress.

Through co-operative planning with the County of Santa Barbara, Turnpike Road, a main access to this proposed freeway, was the subject of a $170,000 road improvement project so as to adequately handle the increased traffic flow on this artery expected after completion of the freeway project.

This area is faced with a fast growing traffic problem caused by the rapid industrial and residential growth of Goleta, previously a small citrus growing and packing community just west of Santa Barbara on the coast.

An additional significant factor in the growth of this area is the new and expanding University of California at Santa Barbara campus recently relocated at Goleta. To handle the resulting heavy traffic in this area, design is under way on State Route 236, referred to as the Clarence Ward Memorial Highway in honor of a former State Senator from Santa Barbara County. This new route on new alignment begins in the Hope Ranch area, skirting the university and terminating at US 101 near Patterson Avenue where separation and interchange structures will be constructed.

Future Needs Considered

Detail design work, as well as right-of-way acquisition, is well along on the proposed US 101 freeway section in the City of Santa Barbara between Bath Street and El Sueno Road. A divided four-lane freeway is already in existence beyond El Sueno Road to the west. The connecting section to the east between Bath Street and Salsipuedes Overhead, while only a conventional four-lane divided road, is handling traffic fairly well at the present time, but planning is presently under way to determine what will be necessary to bring this section up to full freeway standards.

On the Bath Street-El Sueno Road section some right-of-way for a widening of the present road was acquired just prior to World War II, but the type of improvement then planned was halted by the war. The much more complicated improvement now needed has naturally required further expansion of previous acquisition and much more new right-of-way. Right-of-way acquisition is now proceeding in line with funds available.

An expressway-to-freeway expansion project is nearing completion at the eastern fringe of Santa Barbara at Milpas Street, along with the expansion of a section of undivided four-lane highway at and near Ortega Hill to freeway standards. Both projects have been combined into one contract. The work lies between Park Place in Montecito and the Salsipuedes Street overhead where US 101 crosses over the railroad tracks adjacent to the street. An interchange is being constructed at Milpas Street where US 101 crosses overhead on twin 239-foot steel girder bridges. Several small grade crossings are being closed and all direct access to the highway is being eliminated. Further east near Ortega Hill another interchange is being constructed at Sheffield Drive on the outskirts of Montecito. Ortega Hill itself is being cut down 25 feet at its crest to improve sight distance. Completion of this $1,175,000 contract by Madonna Construction Company of San Luis Obispo is scheduled for December of this year.

Conversion to Full Freeway

From Ortega Hill to 0.5 mile south of the Ventura County line plans are being developed to convert the existing divided four-lane expressway between these points—except for the Carpinteria freeway bypass already in existence—to full freeway standards on the existing alignment except for a proposed new alignment through the hills and over Rincon Creek near the Ventura county line. A public hearing was held in the Veterans' Memorial Building in Carpinteria on March 25, 1959, to discuss these proposals. This meeting was attended by 88 interested persons who, after the Division of Highways presentation, submitted various additional data concerning the freeway routing which are now under study by the district.

Sign Route 1

Although not subject to the heavy traffic demands existing on US 101, State Sign Route 1 along our rugged, scenic coast from Morro Bay to the Carmel River is being subjected to increasingly heavy tourist traffic as a result of the opening of the Hearst Castle at San Simeon as a state historical monument. Thousands of tourists are visiting this attraction during the summer, and surprisingly the demand is also holding up during the winter months.

Further south, centered around Lompoc, the development of the huge Vandenberg Air Force Missile Base, as well as the Naval Facility at Point Arguello, has caused a very considerable increase in traffic on State Sign Route 1 in that area. For these reasons then, it is understandable that improvement of critical sections of State Sign Route 1 will assume increasing priority importance.

Population Growth Heavy

Farther to the north, in the rapidly expanding Monterey Peninsula area, traffic growth has been both exceptionally heavy and sustained since World War II. Not only has there been heavy population growth, but there has also been a constantly increasing volume of recreational travel into this area each year, with the result that the existing highways are being overburdened with the local and recreational traffic, with consequent congestion and high accident rates.

This district has been doing everything in its power to speed the development of adequate highway facilities to meet this heavy demand through its planning and design activities on State Sign Route 1 and Legislative Route 117, the Monterey - Salinas Highway, which are the two major routes leading into and through the area.

From the Santa Cruz county line to 1.5 miles south of Castroville, the California Highway Commission has adopted a freeway routing on new and improved alignment. Both the highway routing and detailed design work is being done in co-operation with District IV who have the responsibility for State Sign Route 1 in Santa Cruz County.

A public meeting was conducted on August 20th to discuss proposed plans for freeway development on State Route 1 from 1.5 miles south of Castroville to Seaside and from Marina to Fort Ord.

Freeway Agreements Negotiated

Heavy emphasis is being placed on development of a freeway system on the Monterey Peninsula for both State Sign Route 1 and Legislative Route 117. Hearings were held and routes were adopted in 1957 and early 1958 on both routes and freeway agreements negotiated with the City and County authorities.

Design is well under way from the south city limit of Monterey to Seaside and right-of-way acquisition and clearance in Monterey is progressing at a satisfactory pace.

Construction is presently well along on the 0.8 mile freeway project from the southern city limit of Monterey to the northern section of Carmel on State Route 1. This $1,000,000 project mainly involves construction of a trumpet-type cloverleaf interchange connecting the Carmel Gate road to Del Monte Forest and Pebble Beach beyond, the Pacific Grove-Carmel Highway, and State Sign Route 1. Annual traffic counts at this intersection in July 1958 recorded weekday 16-hour counts of 19,000 vehicles using State Route 1, 4,000 on the Pacific Grove-Carmel Highway, and 3,000 entering the toll gate and road to Del Monte Forest, indicating the need for this grade separation structure.

To keep local residents fully informed of our work progress in this area, the Resident Engineer on the project has advised local radio and television stations, and local newspapers of all major or minor construction changes affecting traffic conditions. As an added convenience to motorists our Design Department established an order of work designed to keep four lanes of traffic open on State Route 1 at all times. This will require 15 stages of detour construction before this project is completed in the spring of 1960.

Routes Adopted

Due to the greatly increased traffic to and from Hearst Castle and its surrounding seaside resort areas, our planning department has been concentrating their efforts on freeway development on the existing State Route 1 from Morro Bay to San Simeon. In

A section of new US 101 freeway between the northern outskirts of Buellton and the Sign Route 150 intersection.

1956 public meetings on freeway proposals from Morro Bay to Cayucos, from Cayucos to one mile south of Cambria, and from San Simeon to San Carpojo Creek at the Monterey county line, all following generally the present alignment, resulted in adoption of those routes by the California Highway Commission, and design and right-of-way acquisition are progressing satisfactorily on these sections.

In 1958 public meetings concerning development of freeways through Cayucos, and from the Cambria Maintenance Station to one mile north of San Simeon led to the same favorable results, and detail design work is now under way on those projects. A freeway agreement was executed this August pertaining to the section from one mile south of Cambria to the Cambria Maintenance Station.

Construction by the California Department of Water Resources of the Whale Rock Dam near Cayucos required relocation of Old Creek Road, a federal aid secondary county road, as most of the existing road will be inundated by the reservoir resulting from the dam construction. The Division of Highways was asked by the Department of Water Resources to handle both the design and construction of this relocation.

Co-operation Cited

The dam and road construction is being financed by a bond issue voted by the people of San Luis Obispo, augmented by funds voted by the State Legislature to pay for the share of the water supply which will be provided for two state institutions in this area. Co-operation on general and technical details of work has been excellent and the highway construction was divided into two units to accommodate phase construction on the dam itself.

Another highway improvement in this area requiring co-operation of state agencies to achieve a desired goal was completed in June of this year when the Division of Beaches and Parks and the Division of Highways co-operated to reconstruct a 1.7-mile two-lane, plant-mixed surface road from State Sign Route 1 near San Simeon to a connection with the access road on the steep mountain to the Hearst Castle State Monument. Included in the work was construction of a 600′ x 140′ parking lot.

On State Route 1 from Morro Bay 5.4 miles east towards San Luis Obispo, construction is in its final stages on a $1,260,000 improvement designed to provide a modern highway. The first 2.7 miles easterly from Morro Bay is being constructed to four-lane expressway standards, and the adjacent 2.7 miles provide the initial two lanes of a future four-lane expressway on improved alignment.

From the Orcutt "Wye" one and one-half miles south of Santa Maria on US 101 to Clark Avenue in Orcutt on State Sign Route 1, the Madonna Construction Company of San Luis Obispo recently began a $570,000 conversion of this substandard two-lane highway to four-lane divided standards to accommodate the recent heavy influx of traffic between Santa Maria and the Vandenberg Air Force Missile Base.

Substandard Roadway Replaced

Between Lompoc and US 101 at Las Cruces approximately three miles of State Sign Route 1 is being reconstructed on greatly improved alignment replacing a substandard roadway completed by the County of Santa Barbara in 1933. Here again construction of the Vandenberg Air Force Missile Base, with the resultant heavy increase of traffic, has served to sharply emphasize the serious deficiency of this San Julian Road as it is locally called. Stecker and Scott and J. H. Harrison of San Ardo expect to complete this $900,000 project in October of this year.

Completion of work on Santa Rosa Road, a Federal Aid Secondary county road out of Buellton toward Lompoc in December, 1958, has served well to take some of the traffic load off the main state routes in this critical area and is a good example of county-state co-operative planning for mutually beneficial highway development.

The east-west laterals in the district are now receiving increasing attention as a result of population and economic growth on the central coast and San Joaquin Valley areas. On State Sign Route 166 for example, a $3,300,000, eight-mile, two-lane highway relocation is being completed as an adjunct to and result of construction of the Twitchell Dam on the Cuyama River designed to serve the water needs of the Santa Maria Valley.

Involved in this reconstruction is a $1,000,000 bridge over the Huasna River. One of the largest of its type in the State, it has a clear roadway width of 28 feet, is 1,570 feet long, with piers from 65 feet to 140 feet above ground. Further details of this interesting project can be found in the May-June issue of this magazine.

Further improvement of this narrow, winding, substandard two-lane highway to future four-lane expressway standards is now in various planning and design stages. A public hearing was conducted at New Cuyama on March 19, 1959, to consider expressway routings on several sections from US 101 near Santa Maria to the Division of Highways Maintenance Station near New Cuyama. A routing generally following the existing roadway but on much improved alignment was developed by the California Highway Commission on August 26, 1959. A section from Deadman's Gulch to New Cuyama was adopted by the commission on June 20, 1956.

Prompt Action Taken

State Sign Route 178, a lateral used for cross traffic mainly between Kern County and the central coast, is also receiving increased attention. Proposals concerning improvement of a nine-mile section from 1.0 mile west of San Juan Creek to 0.5 mile west of Simmler Road were discussed at a public hearing at Simmler on September 25, 1958, and the route was promptly adopted by the Highway Commission a little over a month later.

On State Sign Route 41, the main east-west artery in the district, three separate construction contracts were let last fall using funds provided by the "antirecession" provisions of Federal Aid Highway Act of 1958.

Beginning 12.5 miles east of Paso Robles, the most westerly of the three projects bypasses the community of Shandon to the north on improved

. . . Continued on page 54

Relocation

People and Homes—Where Do They Relocate When the Freeway Comes?

A Report of the Land Economic Studies Section, Right-of-Way Department
Summation by JAMES R. SMITH, Headquarters Right-of-Way Agent

THE MAJOR function of any highway right-of-way department is to acquire the lands upon which a proposed highway facility is to be constructed. Some of these lands will be vacant and some will be improved. All will reflect varying uses and will be used to varying degrees.

Most right-of-way parcels in a typical project will be in private ownership. Most, then, will have an assessed value and will be taxed for local government support. Since the public use contemplated for the parcels will be a tax exempt use, these properties will no longer be tax assessible after transfer to public ownership. If it is assumed that the total local tax needs remain unchanged after this transfer to an exempt use, then it readily follows that someone or something must make up the "loss" in subsequent higher taxes.

Property owners whose lands are not required for the proposed facility are thus alarmed that they and their neighbors will be the "someone" whose tax bills will be raised to make up the difference. They become understandably concerned.

PHOTOS TOP—*A typical instance of willingness of home owners to reinvest in higher value properties after acquisition of their former residences for the freeway. Photograph (left) shows home purchased by the State in 1949, with an assessed value of $530. Photograph (right) is property this same owner subsequently acquired in 1950 with an assessed value of $1,800.*

Measuring the Difference

It is logical to attempt to determine this aspect of freeway effect by a relatively simple process involving the examination of three components of the overall picture. These are: (1) the land within the right-of-way upon which the facility is to be built; (2) the homes and buildings within the right-of-way which are acquired and subsequently cleared; and (3), the people who own and occupy the right-of-way homes and buildings who are subsequently displaced.

With respect to the first aspect, it is clear that the land which will ultimately lie under the freeway itself is going to be tax free, certainly for the life of the improvement. (Traffic service from the improvement and traffic and other benefits generated by it are not generally looked at from the tax viewpoint, to be related back to the assessed value of the right-of-way lands to see if, in fact, there is any ultimate gain or loss.) And so in a direct sense, the tax values attributable to the land itself which is needed for the freeway facility are presumed to be "removed" from the community base, and this is a realistic assumption.

Moving to the second and third components, the tax values attributable to homes and buildings are likewise assumed to be "lost" to the community, since it is evident the structures on improved properties are subsequently cleared from the freeway right-of-way. Moreover, when improved residential properties are involved, families are required to give up their homes, and concern is also expressed that a substantial percentage of these "tax paying units"—families—will move out of the area to other competing communities.

When one considers only these last two aspects—an area's people and their homes and enterprises—as a prime measure of the economic stability of a community, disruption of either or both is clearly cause for concern. It would follow, however, that if it were demonstrated that most families remain in the community, and if most of the improvements are relocated therein as well, the disruption would in reality be only a temporary one and taxwise, at least, it might be shown that much of the concern may be largely needless. The scope and purpose of this summation are thus suggested.

Study Limits and Purpose

This study of two communities analyzes the subsequent movements of people and the improvements they occupied to ascertain if there is any degree of validity to the statement that a large portion of tax impact can be measured by simply writing off all the taxpaying owners displaced by a freeway, as well as the tax values attributable to their homes.

Presently when freeway improvements are initially proposed for certain areas, such assumptions of complete loss and disruption are often made. The picture of freeway impact upon the community may thus be exaggerated, at least to the extent that such effects may not actually be so directly nor completely inferred.

As noted above, it is easily perceived that the land itself within any highway right-of-way becomes ultimately tax exempt. The need for an improved public service in itself should justify the use of land upon which that service is to be furnished. The beneficial effects on land values for all of the area coming within the influence of an improved service facility have been tabulated and reported in many previous studies. (Nolen and Hubbard, "Parkways and Land Values"; Norris and Elder, "A 15-year Study of Land Values and Land Use Along the Gulf Freeway"; Kelly, "Industry and Freeways" and "Industry and Frontage Roads"; Bangs, "Boost for Freeways"; Young, "Escondido Study" and "Freeway Ups Business"; and many others.) No study or further discussion of this component of the overall picture is thus attempted herein.

However, it is not at all widely known how many freeway displaced families relocate within, and thus remain in, a community after right-of-way acquisition. It is furthermore not at all widely known how many homes and buildings are actually destroyed by freeway construction and how many are relocated and rehabilitated within the area to continue to serve out their remaining utility. It is therefore the purpose of this study to follow—in two adjoining Southern California cities—these people as well as their former buildings to determine what is in fact the "after" situation in one instance. Such data may well be helpful in ultimately establishing a typical sequence of owner and building relocation activity in a residential area. Cities through which a comparable improvement is proposed may subsequently find such a sequence helpful in analyzing and assessing similar factors in their own community.

No attempt will be made to determine if the two study communities themselves are "typical" communities. People and their homes are the essential factors covered herein and we are, in a very direct sense, measuring the reactions of both to a directly affecting public improvement. However, it will be left to the reader to judge, after his own reflection, how typical may be the sequence described hereinafter and what carryover it will have to his own community.

The tax base concerns already described are anxieties "unaffected" property owners generally express, i.e., those whose property is *not* being taken. Fearing that the right-of-way homes and owners, and the taxes they represent, will be lost forever, they are the ones to whom the assumed higher taxes pose an undesirable prospect. The data reported upon herein will thus be of most interest to these property owners, for it is actually they who, in the absence of available facts, are left to assume that owners, homes, and taxes, are forever lost.

Method Explained

A direct approach has been taken. It has been implied in preceeding sections and is outlined below:

1. After freeway acquisition, what happens to the *people* directly involved?
   a. Where do they go?
   b. What replacement real estate do they buy?
   c. How do the assessed values of these replacements compare with those formerly owned?
2. After freeway acquisition, what happens to the *building improvements* directly involved?
   a. Where do they go?
   b. What is the "before and after" assessed value comparison?

Each of these two elements will be evaluated in the sections which follow. First of all, however, a brief description of the study area and its freeway improvement will be helpful.

Study Area and Freeway Facts

The side by side communities of Oceanside and Carlsbad are located along the Southern California coast approximately 35 miles north of the City of San Diego. The mild climate, nearby white sand beaches, and a spectacular surf have always been community assets, and the fact that both cities began and grew primarily as resort and residential areas reflects the early emphasis which these environmental aspects received. However, with the establishment in 1942 of nearby Marine Corps Camp Pendleton, the continued growth and prosperity of specialized farming in the surrounding agriculturally rich areas, and the gradual influx of light industry and manufacturing—all of these in many ways also attributable to the climate and other area and community amenities—both cities have become increasingly less resort-oriented over the years. The combined population of both is estimated at 28,000, about 21,000 of these living within the Oceanside section itself.

The 10½-mile Oceanside-Carlsbad Freeway was completed and opened to travel on November 16, 1953. Rights-of-way for the complete project involved the acquisition of 292 separate parcels of real estate, the bulk of which were acquired in 1950 and 1951.

Primarily, the freeway traversed vacant, undeveloped lands, rural homesite sections, and city residential areas. Two hundred five of the entire 292 parcels acquired were either completely unimproved or had only relatively insignificant, minor improvements. One hundred seventy actually involved the purchase of only a portion of a larger holding, and only upon nine of these remnants were significant improvements located within the portion acquired.

One hundred twenty-two parcels out of the total constituted acquisitions of entire properties, and 78 of these in turn contained one or more major building improvements. Eighty-

An aerial view looking south at the City of Oceanside and towards the City of Carlsbad, which is in extreme background. The 10½-mile freeway shown as the left leg of the "Y" with the old highway is visible on the right.

seven improved parcels were involved, then, in the Oceanside-Carlsbad project, and a total of 90 separate buildings and structures were purchased and cleared from the freeway right-of-way.

It is to these property improvements and to their owners that this analysis will be directed.

Disposition of Improvements

Of the entire 90 structures directly affected by the freeway alignment, 66 or almost three-fourths were relocated from the freeway right-of-way to other parts of the Oceanside-Carlsbad cities. In those instances where it was

DISPOSITION OF IMPROVEMENTS

Improvements	*Disposition*	*Assessed value at time of state's acquisition*	*Assessed value after relocation*
22	Retained and relocated by same owners	$39,070.00	$58,602.00
8	Exchanged with or sold to other right-of-way property owners	8,340.00	9,921.00
36	Sold to others at public sales	44,560.00	58,684.00
66 *	*Subtotal*	$91,970.00	$127,207.00
17	Demolished	$14,150.00	
4	Moved out of area	3,950.00	
3	Disposition not determined	8,680.00	
90	*Total*	$118,750.00	$127,207.00

* All 66 within the Oceanside-Carlsbad area.

economically feasible to do so, and where owners so desired, relocation and rehabilitation costs were paid by the State, and the improvements were moved by the owners to new locations clear of the right-of-way. In the remaining instances, improvements purchased by the State were sold to the highest bidders at public and sealed bid auctions and these new owners subsequently removed them from the construction area. Of the entire 90 improvements involved, only 17 were of such construction and in such condition that relocation was not considered desirable. These were ultimately demolished for salvage. Four other buildings were relocated entirely out of the study area, and the exact disposition of the three remaining structures could not be clearly determined.

The disposition of all improvements and their before and after assessed values appear on page 41.

It can clearly be seen that within the Oceanside-Carlsbad area *73 percent of the improvements which were removed from the highway right-of-way were not lost to the community* but instead were successfully relocated to other sites clear of the proposed construction.

Moreover, as a part of the entire relocation and rehabilitation process, the improvements were placed upon new foundations and received new utility and service connections and painting and decorating in most instances. All current building code requirements were met in the rehabilitation process, which meant—for older homes at least—rewiring and replumbing in many cases. Fencing, patio developments, landscaping, and other miscellaneous improvements were allowed for, and owners characteristically took full advantage of their opportunities to modernize and upgrade these aspects.

Thus as a result of analyzing these data, it may be premised that not only will most freeway-displaced homes be successfully salvaged, but that they can be expected to end up in a significantly improved condition to support higher "after" values as well.

Merely writing off improvements and the taxes they support, then, does not constitute a fair and realistic initial approach to the freeway impact problem.

UPPER—This modern residence, purchased by the State in 1950, supported an assessed value of $2,170. Its market value at the time of acquisition was $19,750. LOWER—The same residence after sale at public auction and relocation upon another site. Assessed value 1953, $4,610. Note characteristic "upgrading" changes completed even on this relatively modern improvement, i.e., the family room addition where the garage was formerly located.

Where Did Owners Move?

What about the property *owners* involved in the purchase of Oceanside-Carlsbad improved parcels? How many actually stayed in the area and what did they do after purchase of their respective properties?

Although 90 improvements were purchased, only 87 improved parcels were actually affected and only 86 owners were in turn directly affected in these improved parcel acquisitions. The resettlement activity of these owners and the before and after assessed value comparisons arising therefrom are shown on page 51.

It can be seen that almost exactly two-thirds—58 out of 86—of the displaced owners not only stayed within the Oceanside Carlsbad area but reinvested in substitute improvements shortly after acquisition of their former properties. It is also apparent that these owners, though certainly not required to do so, attempted to better their former residence situation.

In many instances, this inclination to get something better is actually made possible by the procedures utilized by the public agency itself in carrying out a buying policy of cash payments and the assumption of the usual escrow and other costs normally borne by the property sellers. Owners' fair market value net receipts are thus characteristically greater than they would usually be were the sale a transaction between private parties,

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Tunnel Lighting

Webster Tube Illumination Will Use Latest Techniques

By HAROLD SKOOTSKY, Senior Highway Electrical Engineer and
JOHN R. BRASS, Associate Highway Electrical Engineer

WITHIN a short time work will be under way on the Webster Tube, a 3,435-foot-long, two-lane, vehicular facility under the Oakland-Alameda Estuary. This tube will have tiled walls and ceiling and many outstanding design features, including a continuous-line, fluorescent lighting system which it is believed will economically provide a degree of driver visibility, particularly during the daylight hours, which has not been previously achieved. The lighting system is unique in that it was designed to fulfill certain lighting and performance requirements determined by advance studies. Earlier tunnel lighting installations investigated in these studies have compromised desirable performance characteristics due to inherent limitations of available lighting equipment.

Existing Systems Studied

The lighting of vehicular tunnels is, on the surface, a deceptively simple matter which becomes somewhat complicated only upon close examination. For example, a still common solution to the tunnel lighting problem is the more or less arbitrary selection of a standard lighting fixture which is then installed at intervals determined by what is assumed to be a desirable level of roadway illumination.

Some attempt is usually made to intensify daytime tunnel lighting within the entrance, in what is often called the entrance zone, although many engineers hold the belief that the extraordinary blinding effects of sunlight upon drivers looking into a dark entrance cannot be overcome by artificial lighting.

Although most tunnel lighting installations provide some method of dimming to lower light levels at night, the need for night dimming is not always recognized. For example, the I. E. S. Recommendations for Lighting Traffic Tunnels and Underpasses (I. E., June, 1957) indicate the night illumination level should be the same as the day level in the central zone. The appropriate comment to this is that if the night level is not excessive, then the same light level during the day is certainly inadequate.

New Approach Required

Suitable methods of lighting and the correct light levels for day and night conditions in the entrance and central zones must be arrived at by making properly controlled tests with the aid of typical driver observers. The results of tests will be summarized later.

The above comments are not intended to imply that most tunnel lighting installations have been thoughtlessly planned; the intention is only to point out the common practice of relying too heavily on incomplete theoretical data and expert opinions rather than controlled tests and observation of conditions at existing tunnels.

As an example of incomplete theory, it is generally believed and it seems theoretically sound, that daytime visibility into the entrance of a tunnel could be greatly improved by darkening the face of the portal (as well as other surrounding surfaces just outside the tunnel, and the sky in particular if possible. An ingenious idea developed by J. M. Waldram, a lighting engineer in England, was to construct a series of large black baffles spanning the roadway ahead of the entrance (at say 100-foot spacing) through which vehicles would pass. These baffles (which could be surfaced with black aluminum honeycomb) would overlap in perspective from the driver's point of view, thereby eliminating sky brightness as well as effectively reducing the average field brightness seen by the driver. But would the driver then be able to see into a relatively dark tunnel on a bright day? Theoretically yes, actually no. The series of baffles would of course have little or no effect (depending upon the time of day) on the intensity of sunlight falling on the dust and exhaust fumes in the air between the driver and the entrance. The apparent brightness of this body of contaminated air is in the range of 50 to 100 foot-lamberts when seen from a point 200 to 300 feet ahead of a tunnel entrance. This bright haze actually veils the entrance and makes it impossible to discern vehicles within a relatively dark tunnel entrance. The effect is comparable to the veiling glare of daytime reflections in store display windows and was apparently discovered independently and almost simultaneously here and in England by Waldram who then abandoned his earlier idea of entrance screens or baffles.

Tests Made

As mentioned above, numerous visibility tests were made at existing tunnels in the San Francisco Bay area. Two of the tunnels—the Broadway Low Level Tunnel and the Posey Tube—have central zone wall brightnesses in the range of 0.10 to 0.50 foot-lambert. Others—the Park Presidio, Waldo and San Francisco Broadway Tunnels—have central zone wall brightnesses in the range of 5 to 15 foot-lamberts. It is fortunate that the Bay area provides the opportunity of making tests at lighting installations of widely different quality under varying conditions.

Summary of Finding

The roadway should be largely ignored as a factor in providing visibility within a tunnel. Wall and ceiling brightness from the driver's point of view is of greatest importance in tunnel lighting. This approach is simply the result of observing how we best

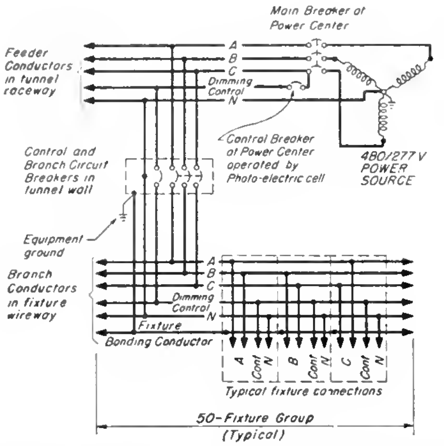

Figure 1—Schematic of power distribution system showing dimming control and typical branch circuit.

see on approaching and entering a tunnel. This is not to say that the roadway has no influence on visibility, but only that its role is much less important than commonly believed. In any case, if proper wall and ceiling brightness is maintained, adequate roadway illumination will automatically follow.

Considering the above, and the fact that bright fixtures should be avoided because of glare, then it becomes apparent that direct lighting of the roadway would be undesirable.

In order to stress this point, make the extreme assumption that the roadway has zero reflectance. Direct light confined to this surface would light objects on the roadway and the walls and ceiling would be dark. By directing the same amount of light only on walls and ceiling with 100 percent reflectance, the same amount of light would be directed on the roadway and visibility conditions would be greatly improved. Practical conditions are of course far less extreme, but the preferred method becomes obvious.

(a) *Daytime Entrance Zone Lighting*

In order to provide good daytime visibility into the tunnel entrance (the "Dark Hole") for approaching drivers, 60-foot-lambert lower wall brightness is required to clearly silhouette vehicles within the entrance. Fair silhouetting may be obtained with 30-foot-lambert lower wall brightness.

As described earlier, the veiling glare over a typical tunnel entrance has a brightness, on a sunny day, in the range of 50 to 100 foot-lamberts. Therefore, it is apparent that the 60-foot-lambert wall brightness recommended should be increased if conditions at the entrance are favorable to higher concentrations of dust and vehicle fumes. This situation might occur if the approach is upgrade and natural ventilation is poor, especially if traffic is very dense and has a high percentage of trucks.

The brightness of the field of view surrounding the entrance has far less effect on visibility into the entrance than the veiling glare discussed above.

The length of entrance zone lighting should be approximately equal to the safe stopping distance for the fastest entering vehicles. A 300-foot-long entrance zone will be adequate for speeds up to 55 mph. Much longer lengths of entrance lighting have been recommended by others. These recommendations are apparently based upon the need for slowly reducing the light level down to the very low level central zone lighting existing in older tunnels. However, the recommendation made here is based upon central zone lighting which provides nearly instantaneous adaptation after the driver has entered the tunnel. The daytime entrance zone lighting recommended here is actually more than needed for the driver who has entered the tunnel, but is not so great that the recommended central zone lighting beyond will appear dark. Therefore, long adaptation stages are required only if the central zone lighting is inadequate.

(b) *Daytime Central Zone Lighting*

The lower wall brightness in the central zone should be at least five foot-lamberts to provide good daytime visibility of vehicles. No tunnel is long enough to allow the retina of the eye to completely adapt to nighttime light levels during the day. Unlike iris adaptation, which occurs in a few seconds, complete retinal adaptation to dark surroundings takes up to 50 minutes. It is therefore necessary to have a much higher level of illumination in the central zone during the day than is required at night.

(c) *Nighttime Lighting*

Tests indicate that a lower wall brightness of only one-half foot-lambert in the entrance and central zones, provides good visibility of vehicles during the night. This may be easily proven. The Posey Tube incandescent lighting system, which has wall brightnesses in this range, is very deficient during the day. However, it is not only entirely adequate at night, it is actually more than adequate, as evidenced by the fact that certain circuits are turned off during the night. Therefore, it is emphasized that the high nighttime light levels recommended by others are not required for safety, visibility, comfort or any other known reason. A maximum maintained wall brightness of one foot-lambert is recommended. The high nighttime light level in many existing tunnels is simply the result of installing continuous lines of fluorescent fixtures which (due to inherent limitations) cannot be sufficiently dimmed. It seems incongruous to recommend lower light levels when the general trend in light levels is upward, but in view of the facts mentioned above, the additional operating cost of higher than necessary light levels cannot be justified.

Objectives of New Design

The Webster Tube lighting system has been designed to satisfy, with little compromise, the wall brightness and dimming requirements outlined above, and to be versatile enough for use in any tunnel, especially those with restricted overhead clearance.

Other design objectives may be listed as follows:

1. Special light control characteristics to provide relatively uniform wall and ceiling brightness.
2. Lamps shielded from driver's view.
3. Dust- and spray-tight fixture construction without sacrificing ease of relamping.
4. One-piece plastic cover which can be easily removed for thorough cleaning and does not require a metal frame or other hardware attachment.
5. Branch circuit or feeder wireway within fixture shell—to eliminate expense of separate wireway (or conduit with outlet boxes) and to facilitate installation in existing tunnels.
6. High-voltage branch circuits—to eliminate auto-transformers in ballasts and reduce line losses.

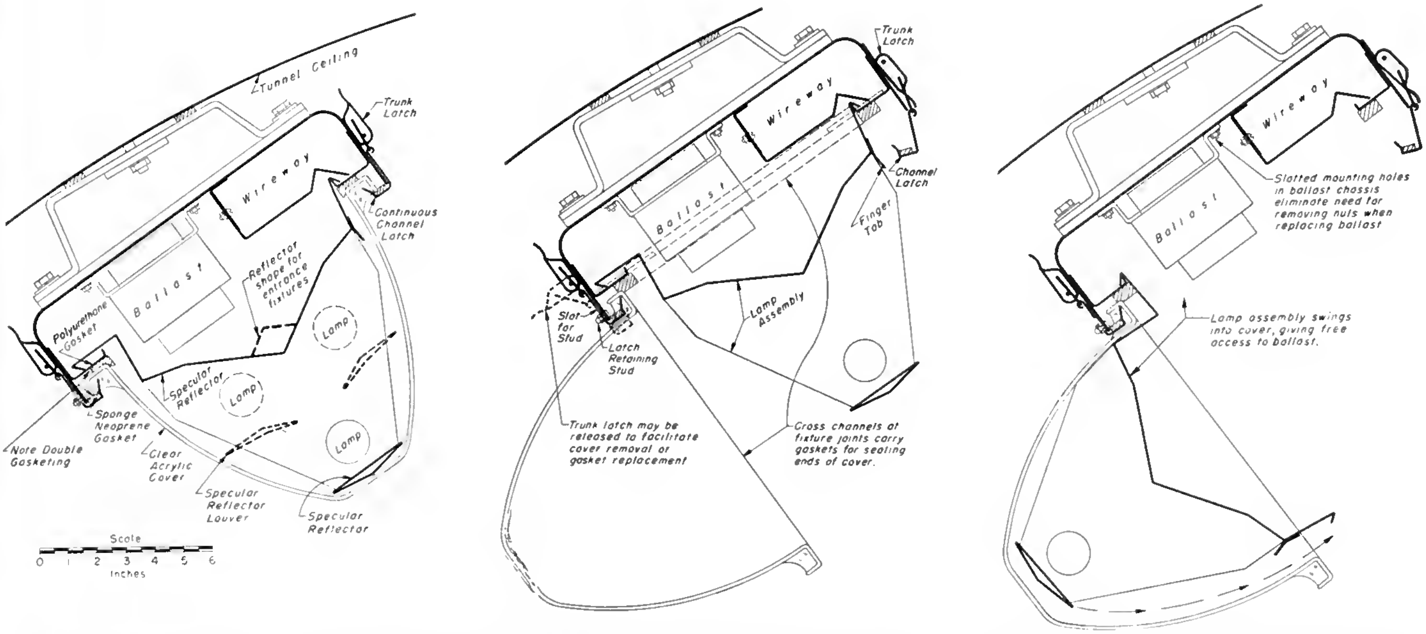

Figure 2a (left)—Cross-section of fixture. Dashed lamps and reflectors are part of entrance fixtures only. Lamps are 96", T 12, CW/VHO or SHO, operated at 1400 ma. in entrance zone, daytime; 600 ma. in central zone, daytime; and lower lamp only at 60 ma. throughout at night. Figure 2b (middle)—Illustrating hinging of cover and operation of latches. Figure 2c (right)—Showing lamp assembly swung into open cover for access to ballast.

7. Easily accessible, high quality, unity power factor ballasts.
8. Heat "sink" ballast mounting.
9. Free air circulation behind fixture shell to cool ballast and reduce air temperature in fixture.
10. Highest quality, corrosion resistant construction to reduce maintenance expense to a minimum.

Need For New Design

Since to this date no commercially available tunnel or underpass lighting fixture satisfies more than a few of the above requirements, it became apparent when work was started on the lighting system for the Webster Tube, that a new type of lighting fixture was needed. Therefore, the decision was made to design a suitable lighting fixture primarily to determine if the numerous special features could actually be obtained in a practical unit.

The first step was to select or design suitable components for the system.

Lamps

The most suitable lamp for a fluorescent tunnel lighting system should have a small diameter (to increase efficiency of multilamp fixtures and allow effective light control), high maximum light output (particularly for entrance zones) and should provide stable operation at very low light output. The high-current, rapid-start lamps with T-12 bulbs are a quite satisfactory compromise. For entrance zone fixtures, the 1.5-ampere, T-12, rapid-start lamps are desirable in order to keep the number of lamps per fixture to a minimum.

Eight-foot lamp lamps are desirable for their high efficiency and the reduction in the number of lamps to be maintained. Fixture cost per foot of length is also reduced.

Ballasts

Special 480-volt, 60-cycle ballasts were designed to satisfy the objectives mentioned above (particularly the dimming feature). A relay is incorporated in each ballast to switch lamps to the night inductor for dimming without interrupting cathode filament current. In entrance zone fixtures this relay also switches off the upper lamps during night operation. The inductors have been designed for low losses, minimum distortion of lamp current wave shape, and long service life. A ballast prototype has been thoroughly tested in a three-lamp fixture prototype and has been found very satisfactory in all respects.

Certain features of these ballasts which facilitate maintenance are described later.

New Design Features

The design of the fixture housing and lamp assembly satisfies the objectives outlined earlier and is more fully described below. The cross-section and mechanical operating features of the fixture are shown in Figures 2(a), 2(b) and 2(c). The fixture is also adaptable to center mounting in tunnels with high ceilings and in such installations will provide even better uniformity of wall brightness than it does when mounted as shown in Figure 4.

Light Control

Figure 3 shows the light distribution of a long line of entrance fixtures during the day. Also see Figure 4. The shape of the curve is essentially the same for night operation and for single lamp fixtures during the day, although the light intensity values will naturally be lower.

Integral Wireway Installation

One of the most important features of the new design is the accessible integral wireway within the fixture housing which greatly simplifies installation of the system, especially in existing tunnels. The first step in installing the fixtures is to place the brackets which support the two ends of adjacent fixtures housings (see Fig-

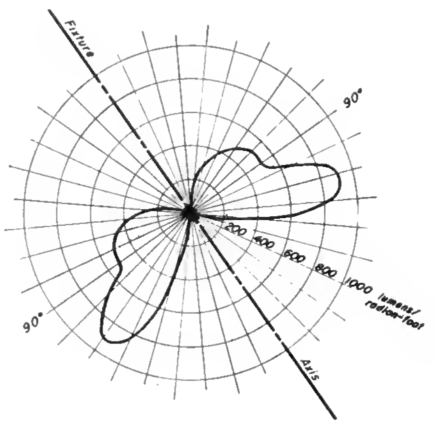

Figure 3—Curve showing cylindrical luminous intensity (Ic) in lumens/radian-foot at center of 10 or more 3-lamp fixture units.

ure 5). These brackets automatically align the housing ends so that the extruded vinyl sealing strip can effectively seal the joint. After the housings are in place with seal, the branch circuit conductors (which may be laid out on the roadway) are lifted up into the wireway as cross channels (see Figure 2(b)) are dropped into place at each joint to hold the conductors temporarily. Connections to the ballasts are then made and the wireway covers installed. The lamp assembly and plastic cover will be packaged separately and installed last.

Dust and Spray Tightness

It is very difficult to imagine the quantity of dirt which can accumulate in a tunnel in a short time. Conditions are far more difficult than for ordinary street lighting fixtures. Conventional methods of sealing tunnel lighting fixtures are not suitable; that is, any method which relies entirely on squeezing a long gasket between a cover frame and a housing flange, ordinarily develops small gaps in the seal through which dust and water may enter. To prevent the entry of water when a tunnel is being cleaned by a high pressure spray, a double-gasketed and baffled method of sealing a long fixture is preferred. See Figures 2(a) and 5. In this design, the spray of water is deflected by the continuous channel latch from the main gasket and cannot enter the fixture. Any water which bypasses the channel latch losses its force and drains out the end of the latch. This latch is operated by three trunk-latch type operators which automatically apply the correct sealing force to the gaskets.

Necessary Maintenance Simplified

As may be noted in Figure 2(c), the lamp assembly can be quickly swung down into the plastic cover to gain access to the ballast and wireway. For further ease of maintenance, the cover may be quickly removed for cleaning. Neither of these operations requires the use of tools.

Electrical maintenance is facilitated by the use of high quality ballasts which are fused to protect the units against excessive current, especially that caused by defective lamps which tend to rectify current through the ballast due to unbalanced aging of cathodes.

Terminal blocks on the ballast chassis allow quick changing of these units. A defective ballast may be taken to the maintenance shop and repaired, rather than scrapped, since components are mounted on a chassis and may be individually replaced.

Durable Materials

It has been found that a fixture of low first cost may in the long run be very costly. For this reason, special attention has been given to design factors which affect reliability.

Mechanical reliability depends to a great extent upon the corrosion resistance of metals used in exterior parts of the fixture housing. Aluminum, which is entirely satisfactory in outdoor lighting fixtures, especially if anodized, is not suitable where the fixture is subjected to the very severe corrosive elements in a tunnel. Some of the unusual causes of corrosion in a tunnel which have a destructive effect on aluminum are alkaline deposits from the tunnel lining, concentrated exhaust fumes and especially the rather harsh alkaline solution which must be used to thoroughly clean the tiled tunnel walls. Other problems also arise with aluminum construction. One is that aluminum hardware, such as machine screws, must be made of high strength alloys which have relatively poor corrosion resistance and which, at best, are weak compared to other metals used for this purpose. Another is the incompatibility of most other metals (including the best stainless steels) when used with aluminum and the resultant electrolytic corrosion. For equal strength, and where an attempt is made to achieve the best corrosion resistance from aluminum, aluminum construction will be only a little less expensive than all stainless steel construction. This will be true only if the design is adaptable to sheet metal fabrication. For the above reasons, stainless steel is favored for exterior metal parts of the fixture housing. Reflectors are to be made of specular finished aluminum with protective oxide coating as in most fluorescent street lighting fixtures.

The plastic cover is to be made of age-, heat- and craze-resistant acrylic material annealed after fabrication, and every indication is that it will be very satisfactory. Only very high concentrations of alkalies and oxidizing acids attack acrylic. Some care will

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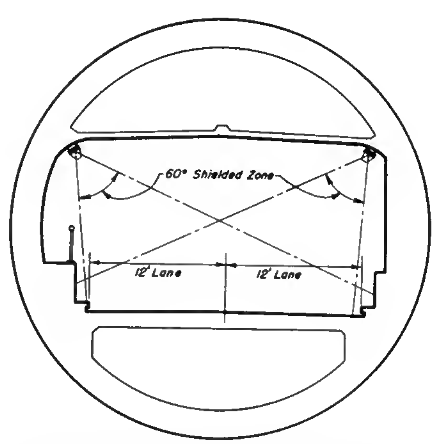

Figure 4—Typical cross-section of tube showing fixture orientation and illustrating shielding and light control.

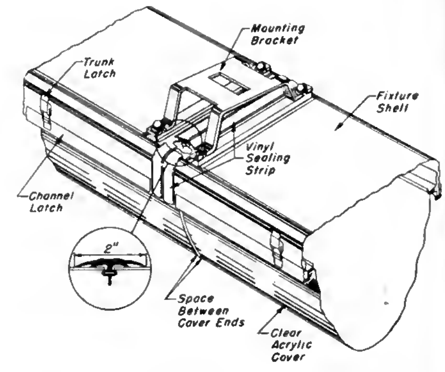

Figure 5—Joint between fixtures illustrating how mounting brackets support and align the two ends of adjacent fixture housings so that the extruded vinyl sealing strip can effectively seal the joint.

Santa Rita Road

Widened Highway, New Bridge Constructed with FAS Funds

By OLOF E. ANDERSON, Road Commissioner, Alameda County

In opening ceremonies sponsored by the board of supervisors and the Pleasanton Chamber of Commerce, Alameda County, on March 15, 1959, formally reopened Santa Rita Road to highway traffic. The project, constructed as a Federal Aid Secondary Project in co-operation with the Bureau of Public Roads and the California Division of Highways, marked completion of the reconstruction of a portion of Santa Rita Road (FAS Route 1019), located between Pleasanton city limits and the Arroyo Mocho Bridge, a net length of approximately 1.7 miles.

This project involved the reconstruction and widening of 1.7 miles of road and the replacement of the Main Street Bridge at the north city limit of Pleasanton, the improvement of two railroad grade crossings and miscellaneous work. The total construction cost of the project, exclusive of right-of-way, railroad crossing improvements, and engineering, was $357,000 and was defrayed by the utilization of federal, state, and county funds under the federal-aid secondary highway program.

PHOTO TOP OF PAGE—This new bridge at Pleasanton carries Santa Rita Road across Arroyo Del Valle.

Connects U.S. Routes

Santa Rita Road, a portion of FAS Route 1019, lies between the City of Pleasanton and U. S. Highway 50. The entire route is 4.9 miles in length and connects U. S. Highway 50 to State Highway Route 107, both part of the interstate system. Pleasanton is located approximately midway along FAS Route 1019. Previous work along this route included a $114,490 FAS contract in 1953, for road work south of Pleasanton, and four other county-let and financed contracts totaling an additional amount of nearly $115,000. Another 0.9 mile of this FAS route remains to be reconstructed and will be resurfaced with county funds during 1959.

Santa Rita Road acquired its name from the early California Rancho Santa Rita, surveyed in 1862. Opening of the road was on November 8, 1870, from the northerly end of Main Street, Pleasanton, at the Arroyo del Valle to the road from "Haywards" to Stockton near Tassajara Creek.

Pleasanton is the commercial, cultural, and recreational hub for the people of the Pleasanton-Murray Township area, many of whom are engaged in agricultural pursuits or employed in the area's several aggregate-production plants. These endeavors constitute the primary occupations followed in the area. Jackson and Perkins, the largest growers of roses in the world, cultivate an entire section. Henry J. Kaiser Co., Pacific Cement & Aggregates, Inc., and Rhodes & Jamieson produce enormous quantities of mineral aggregates, and their trucks subject it to a considerable amount of heavy traffic.

Harvest Season Brings Increase

Holly Sugar Corp. has a sugar beet loading station adjacent to Santa Rita Road. Field trucks transport the beets from the fields to the loading station where they are loaded into rail cars and semitrucks and trailers. During the harvest season the volume of truck traffic is sharply increased.

Two schools, Amador Valley Union High School, which is now being expanded, and Alisal Elementary School, front on Santa Rita Road. Along the easterly side of the road are residential subdivisions, plans for the future extension of which are already developed.

Pleasanton also hosts the Alameda County Fairgrounds where the annual county fair is held. Here a horseracing meet is held each year, using the oldest race track in the United States.

Prior to construction, letters were sent to the property owners and occupants whose properties abut Santa Rita Road. These letters explained the general nature of the project, encouraged removal of encroachments such as flowers and shrubbery, warned of unavoidable inconveniences, advised of detours, informed as to whom to contact in case of complaints, and sought the co-operation of the recipients during the course of the work. The paucity of complaints during the progress of the job can undoubtedly be attributed to this simple demonstration of regard for the public.

The roadway work involved the construction of a four-lane highway and sidewalk from the Pleasanton city limits northerly to the Amador Union High School's northerly boundary line, a distance of 0.31 mile, and a two-lane highway with 12-foot traffic lanes and eight-foot shoulders for the remainder of the project.

Bridge Alteration Necessary

Approximately 89 feet of Main Street in the City of Pleasanton was reconstructed to properly accommodate the 1½-foot lowering and the increased width of the new Arroyo del Valle Bridge and required removal of the existing pavement between curbs and replacement of base materials and surfacing.

At the Western Pacific Railroad Company's grade crossing, new flashing light signals, cantilevered over the roadway, were installed. At the Southern Pacific Company's grade crossing, the existing flashing light signals were relocated to clear the new roadway widening. Approach sight distance and riding comfort

This view northward from Pleasanton shows the reconstructed portion of Santa Rita Road (FAS Route 1019). The new bridge can be seen in the left center foreground.

The new bridge at Pleasanton has adequate roadway width as can be seen in this photo. Space for sidewalks is also provided on each side.

have been improved at both grade crossings.

The grade was lowered from Station 10 to Station 18 to reduce the height between the road and the adjacent subdivisions and Amador Union High School. Existing grades between Station 18 and the end of the project at Station 91 + 65 were followed quite closely, allowing the utilization of a maximum portion of the existing road as a subgrade for reconstruction. A 1,500-foot radius curve to the left was constructed at Black Avenue to improve horizontal alignment. Alignment between Black Avenue and the end of the project at the Arroyo Mocho Bridge followed the existing centerline of the road.

A section consisting of three inches of plant-mixed asphaltic surfacing, four inches of Class "A" cement-treated base, four inches of Class "B" cement-treated base and six inches of untreated base was adopted.

About the only difficulty experienced on the job was fitting the new road to the old road, to utilize as much of the old road as practicable. Embankment slopes were 2:1 or flatter and there were no excavation slopes. Good weather, good planning, proximity of materials, and the development of time saving operations contributed to the rapid completion of the project.

The new bridge over the Arroyo del Valle, replacing the old structure erected in 1902, offers many advantages over its predecessor. This steel and reinforced concreted structure, clearing the stream bed by about 22 feet, has three spans of approximately 55 feet, from center of supports, and an overall length of 171 feet. During the periods of high flow, these 55-foot spans, in contrast to the seven 25-foot spans of the former bridge, will permit fallen trees and debris to flow through, instead of damming the channel as was the case with the old structure. The old bridge was underpinned at least five times in recent years, due to the eroding action of the Arroyo del Valle. Pleasanton's "old-timers" remember the days when a team of horses could not be driven in the channel under this bridge, but at the time the bridge was removed there was a 23-foot clearance between the deck and the stream bed. Due to debris hung up on the piers of an earlier bridge, it is said that the Arroyo del Valle overflowed its bank many times, causing the flooding of Main Street in the then quaint and peaceful Town of Pleasanton.

Design and construction engineering for the project was provided by Alameda County under the direction of Olof E. Anderson, County Surveyor and Road Commissioner. Alameda County also paid the entire costs of acquisition of rights-of-way and relocating railroad crossing protection. Resident Engineer for Alameda County was Arthur Froerer. Robert J. Crossett was Engineer in charge of the construction of the bridge.

W. O. Halstead Leaves Chief Estimator Job

Wade O. Halstead, Principal Estimator of Building Construction in the Division of Architecture, retired from state service on August 31st following 20 years of service with the division.

Halstead has been in construction work for half a century. He was born in Cleveland, Ohio, and received his engineering training prior to World War I in Illinois and Michigan.

WADE O. HALSTEAD

He came to California in 1920 and for 15 years supervised many construction projects throughout the State.

Halstead joined the Division of Architecture on November 25, 1935, as an estimator. During World War II he was on leave of absence for three years working as a staff engineer on U. S. Army Engineers' construction in Hawaii.

His civilian employment with the Army Engineers began in the Hawaiian Islands in September 1941. He was on Bellows Field during the attack on December 7, 1941. For two years he was engaged in constructing air strips on Pacific islands. He was transferred to San Francisco in 1943 to assemble supplies for the Army's Hawaiian Command.

Following his return to the division in 1944, Halstead became acting head of the division's estimating section on October 1, 1945.

On July 1, 1946, he was appointed Supervising Estimator of Building Construction and Principal Estimator in 1949.

Halstead married Irma Richter in Oakland, California, in 1920. The Halsteads have two sons, Wade, Jr., of Sacramento, and Robert who lives in Roseville. They have three grandchildren.

Halstead will devote his spare time to construction activities as a consulting construction analyst.

JAPANESE BRIDGE ENGINEERS TOUR L. A. DISTRICT

By FRED T. FUJIMOTO, Project Design Engineer

Dr. Kasuo Aoki (front row, fifth from left), Professor of Engineering at Waseda University in Tokyo, headed a team of Japanese engineers which visited District VII on August 6 and 7. Hosts to the team during its tour were (front row, beginning second from left and reading right): Myron Garal, President of International Prestressing Company; Howard M. Christensen, US Bureau of Public Roads and Fred J. Fujimoto, District VII engineering staff. To the right of Dr. Aoki is Richard T. Murphy, International Co-operation Administration, Washington, D. C. and (behind Murphy in the rear row) is James E. McMahon, Bridge Engineer, Southern area. Others in the Japanese team included Hajime Ikedo, Assistant Chief of Erection Department; Teruo Kizake, President, Takodo Kiko, Ltd.; Kiyoli Kurosowo, Vice Chief, Nihon Road Corporation; Eiichi Murakami (Secretary), Chief of Local Road Section, Road Bureau; Shohei Noto, Chief of Road Section, Kanagawa Prefectural Government; Toichiro Okamato, Chief Engineer, Shiraishi Foundation Company; Yoshikazu Ozaki, Chief Engineer, Tokyo Steel Rib & Bridge Works; Shinji Tetsu, Assistant Chief of Designing Department, Matsuo Bridge Company, Ltd.; Tsunehiro Wado, Chief of Civil Engineering Department, Gifu Prefectural Government; Tsuguo Tategomi, Director, Osoko Branch, P. S. Concrete Company, Ltd.; Tadoshi Yoshimo, Chief of Civil Engineering, Tottori Prefectural Government; Y. Okamoto and Kusana, Japanese Interpreters, affiliated with I. C. A.

UNDER THE auspices of the United States International Co-operation Administration, a 12-man team of prominent Japanese highway bridge engineers was in Los Angeles on August 6 and 7, 1959, as a part of a one-month bridge study tour of the United States.

The tour included a visit to the construction site of the East Los Angeles Interchange, which joins the Santa Ana, Golden State, Pomona and Santa Monica Freeways. On August 7th, the team members were conducted to various bridge material manufacturing firms. Conferences were also held with E. T. Telford, Assistant State Highway Engineer, and members of his staff at which highway and bridge construction problems were discussed.

The visiting engineers said that the improvement of highways and bridges in Japan is an urgent and necessary step toward integrating and facilitating transportation for a multiple island economy. Special attention is being given to the construction of long-span bridges in their five-year highway planning program.

In Japan, the visitors said, there are very few bridges more than 300 feet long. Japanese engineers are anxious to learn all they can about the building of bridge substructures in deep water.

Most of the old bridges in Japan are made of wood and are considerably different in design and structure from the old stone bridges found in China or in Rome. Presumably, this is because lumber was plentiful in Japan and because the soft foundation near the mouth of a river or in the flat urban areas, where most of the bridges were built, was generally unable to support stone bridges.

One of the oldest bridges referred to in Japanese historical annals is the Bridge of Ikainotsu built in 326 A.D. It is said also that in 612 A.D. imported Korean craftsmen built some 200 bridges in various districts in Japan.

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RELOCATION

Continued from page 42 . . .

RESETTLEMENT OF STATE'S GRANTORS

Number of grantors	*Activity*	*Assessed value of improvements "before"*	*Assessed value of improvements purchased or retained "after"*
21	Retained and relocated own improvements	$39,070.00	$58,602.00
6	Purchased improvements from the State or received improvements in exchange from State	4,300.00	9,921.00
21	Purchased new homes	30,280.00	52,040.00
10	Purchased older improvements	14,300.00	47,862.00
58	*Subtotal*	$87,950.00	$168,425.00
5	Stayed in area, did not reinvest directly in real estate	$2,340.00	--------
12	Moved out of area, stayed in county	16,390.00	--------
8	Moved out of county	7,970.00	--------
3	Whereabouts and activity unknown	4,100.00	--------
86	*Total*	$118,750.00	$168,425.00

and being paid in cash without discount often enables the owners to assume a stronger bargaining position when entering the local real estate market than might otherwise be possible.

Clearly, then, freeway-displaced owners should not be completely and unequivocally "written off" as taxpayers and further contributors to heightened economic activity within the community.

Conclusions

1. Freeway right-of-way acquisition through primarily residential areas affects people and their homes. When the owners have moved and the freeway path has been cleared, it is not accurate to assume that both taxpayers and taxable improvements have been completely "written off" the community's tax and economic roster.

2. In the Cities of Oceanside and Carlsbad a before and after study of these two important elements of the overall right-of-way acquisition picture has been made in which it is clear that a majority of the displaced owners and their former homes and buildings remain in the incorporated area of the two communities. To the extent that this study measures the reaction of people to a directly affecting freeway improvement—as well as the relocation sequence of their homes and buildings—it can be a helpful measure of expected impact to those concerned with the problem in other communities where similar facilities are proposed. It may be premised that the sequence developed in this study area *is* both reasonable and typical.

3. The facts produce a pattern; the pattern permits theory. A sequence of building disposition can be premised. From the total number of improved properties acquired for a freeway project, a majority of homes will be relocated clear of the highway right-of-way but still within the immediate vicinity. In some cases the occupants will go with the homes; in other cases, the improvements will be sold to new owners to be subsequently removed from the right-of-way. In either case, after the extensive rehabilitation and upgrading, which relocation makes possible, these improvements as a group will support higher values than those which prevailed in previous locations.

4. A certain number of improvements on any project will not be allowed to be relocated and these will be subsequently demolished for salvage. Such improvements will *always* be buildings which do not currently meet community standards and are in such a condition so as not to justify the expense of bringing them up to the required levels. The marginal values attributable to such buildings will be removed from the community base.

5. Most of the owners displaced by right-of-way acquisition will remain within the immediate area. As noted in (3) above, some will retain and relocate their original buildings, while

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Bill McNeely Leaves, Joined State in 1912

William C. McNeely, assistant highway engineer who has been in charge of the "vital statistics" on freeway routings for the Division of Highways, retired August 1st after an engineering career dating back to 1912.

W. C. McNEELY

McNeely had been with the division since that year except for a period with private industry during World War I.

McNeely's first work with the division was with District III, which then had headquarters in Sacramento, in the field as a draftsman and on survey parties. Later he became associated with planning and has been concerned with freeways since the first routes were adopted in 1939. When freeway planning and construction was accelerated after World War II he was assigned to route adoption procedures in the Planning Department and has been in charge of freeway records and status since.

A native of Sacramento, McNeely was educated in the Sacramento schools and attended Chico Normal School (now Chico State College). McNeely is married and has a daughter, Mrs. James Hansen of Sacramento, and two grandchildren.

Known as an ardent golfer, McNeely plans to continue that sport in retirement, has scheduled work at his home, 2709 12th Street, and contemplates some trips.

A dinner honoring McNeely was given July 29th at the Officers' Club, McClellan Air Force Base.

Louis H. Kahl Ends Long Highway Career

Louis H. Kahl, District X Maintenance Superintendent at Altaville, retired August 1, 1959, after more than 34 years with the Division of Highways.

His retirement ended a career that began early in 1923 when he went to work as a laborer on highway and construction work in District III.

He transferred to District X when it was formed in 1923. From 1925 to 1931 he worked as a subforeman, maintenance foreman, and construction foreman in the Groveland area.

On May 25, 1931, he became a highway superintendent. He was superintendent of the Ione, Groveland, and Altaville territories during his career. He pioneered a number of early highways and improved many of the county roads which were taken into the State Highway System in the early 1930's. He also acted as construction supervisor on a $300,000 forest access road which was constructed in the early years of World War II.

Kahl and his wife, Belle, were married in Groveland in 1929 and have two children: Michael, who is an inspector for the Bank of America, living in San Francisco, and Joyce, who lives with the Kahls in Altaville. He is a member of the Knights of Columbus Lodge.

The Kahls have lived in Altaville in the mountain area for many years; however, they now plan to move to the Lodi area.

MASTER PLAN

Continued from page 1 . . .

A total of 23 separate meetings were held, involving 730 county representatives and officials from 280 cities.

These co-operative studies also developed valuable by-products in local street and road system planning. In seven instances, cities and counties conducted their own detailed trafficways studies, with some financial participation by the State, in connection with the statewide freeway system.

FREEWAY LOOP

Continued from page 20 . . .

south of the Civic Center. This loop around the Los Angeles Civic Center will, in the not too distant future, offer an alternate route for much of the freeway traffic now using the four-level interchange. This loop, together with the extension of the Golden State Freeway to the northwest through the San Fernando Valley and the extension of the Santa Monica Freeway westerly to the Pacific Coast, is important not only because it directly serves areas generating high volumes of traffic, but also because of its many connections to other important freeways and city street traffic arterials.

Outlook For Completion

It is apparent, in addition to the projects discussed in this article which have been completed or are now under construction, that there still is a great deal of work to be accomplished before the full traffic service offered by the Los Angeles Freeway Loop can be realized.

The loop could be completed with opening to traffic throughout its entire length in about three years if all of the projects included in the California Highway Commission's annual budget for 1959-60 could go forward as scheduled. These budgeted projects include two jobs on the Golden State Freeway, which will close the gap between Pasadena Avenue and Glendale Boulevard, and a third unit to extend the Golden State to the north between Roscoe Boulevard and Lankershim Boulevard. A total of $24,200,000 has been budgeted for these three projects.

Also included in the 1959-60 Fiscal Year construction program are three projects on the Santa Monica Freeway extending from Eighth Street at the west end of the Los Angeles River Bridge that is now nearing completion to Oak Street, which is immediately west of the Harbor Freeway. Budget items for these three projects total $24,700,000.

Both the Santa Monica and the Golden State Freeways are a part of the federal system of interstate and defense highways. Accordingly, their cost is borne by the Federal Government to the extent of 90 percent of the total cost. At the time of writing this article, there is a big question as to whether the interstate highway program will continue at a uniform rate, and federal funds be available for the construction projects in the 1959-60 Fiscal Year budget. Unless the present Congress takes affirmative action to insure the financing of the program at the established uniform rate, these projects already budgeted by the California Highway Commission may well be delayed for an indefinite period of time. Similarly affected would be projects unbudgeted by California to extend the Golden State Freeway to the north and the Santa Monica Freeway to the west.

The traffic service which can be realized by completion of this freeway loop around downtown Los Angeles is badly needed now and it is certainly hoped that steady construction progress can be continued. After completion, motorists will realize the time-saving features that can be obtained by using the freeway loop, and we can be positive that now existing traffic congestion on present freeways traversing the Los Angeles Civic Center will be greatly relieved.

RELOCATION

Continued from page 51 . . .

others will prefer to sell their homes and thereafter purchase or build another. It is characteristic that owners will attempt to better themselves by acquiring something more desirable—generally more valuable—than that which they have sold. In most instances the payment of cash and the assumption of almost all selling and escrow costs by the State provides the opportunity for such betterment with its resulting individual and community gains.

BIDS AVERAGE SIX PER JOB

Competition for highway jobs continued during August. Bids were received from 311 different contractors on the 47 projects advertised for bid opening during the month. This averages 6.6 bidders per job.

TUNNEL LIGHTING

Continued from page 46 . . .

have to be exercised to avoid scratching the covers during the cleaning process, but all things considered, the acrylic covers will be far easier and safer to handle than if made of glass.

The neoprene gaskets and the vinyl sealing strips are made of long life materials which have unusually good resistance to the effects of aging, water, alkalies, acids, oils, lights, heat and weathering, and are relatively free from compression set.

The polyurethane gaskets are not quite as durable as the above materials, but they will have longer service life than materials of comparable softness such as latex foam.

Attractive Appearance

As seen from the driver's point of view (see Figure 4) the lighting fixtures will have a unique and attractive appearance. Due to the small (2½″) spacing between lamp ends and the very small gap (3/16″) between the ends of the all plastic covers, the individual fixtures will not be apparent, and the installation will present a smooth unbroken line. The mounting brackets will be concealed and the latching hardware will not be discernible from the roadway. Since lamps and lamp images are shielded, the plastic cover will appear to "glow" softly with a brightness in the range of 200 to 400 foot-lamberts. Therefore, the overall range of brightnesses will be unusually small, contributing to good visibility, comfort and pleasing appearance.

Future Developments

Certainly the ultimate development in tunnel lighting will be a practical method of achieving luminous walls and ceilings. Installations of electroluminescent wall and ceiling panels may some day achieve this goal with very high efficiency, although low brightness, high cost and installation, wiring and maintenance problems now prohibit use of this system. However, improvements in fluorescent lamps will undoubtedly keep continuous line fluorescent tunnel lighting tunnel systems in the forefront for a good many years.

Wright Named Deputy In Water Resources

Governor Edmund G. Brown has announced the transfer of James F. Wright, Deputy Director of Public Works, to a new post as a Deputy Director in the Department of Water Resources.

"Department of Water Resources Director Harvey Banks is preparing his department for the vast job of carrying out the California Water Plan," Brown said. "At his request we have transferred one of the State's top experts on organizational, administrative and fiscal problems into that department."

Wright will fill the new deputy's post authorized by the 1959 Session of the Legislature.

The status of Ralph M. Brody, now Deputy Director of the department and Special Counsel on water problems to Governor Edmund G. Brown, will remain unchanged.

Brody's time is devoted principally to advising the Governor on water policy and legislation and working with leaders of the statewide water bond campaign.

Banks said he will place Wright in charge of administration and organization with "full authority to act," thus giving himself more time for consideration of policy on the complex engineering, economic and financial aspects of the water program.

"This gives us a splendid team in this vital department," the Governor said.

Wright moved to his new post October 1.

Before becoming Deputy Director of Public Works he was a highway and public works fiscal expert for the State of New York and had a long and successful career in federal administration of major public works projects.

The upward trend of traffic on the State's San Francisco Bay toll bridges continued during July. Biggest increase was on the Richmond-San Rafael Bridge, where traffic was up nearly 13 percent over the same month last year and revenue was up 16 percent. The San Mateo-Hayward and Dumbarton Bridges, reporting together, showed traffic increased 10 percent and revenue 14 percent. The San Francisco-Oakland Bay Bridge increases were 6 percent in traffic and 7 percent in revenue.

Engineering Costs In Field Analyzed

A unique study of field construction engineering costs has been completed by the Construction Department, Division of Highways, and a report prepared by J. C. Obermuller, Assistant Construction Engineer.

The study analyzes how manpower is utilized in construction engineering and the findings are set forth in table and graph form.

About $22 million per year is charged to construction engineering by the Division of Highways, and the study was an investigation of how the field construction engineering dollar is spent.

Present accounting procedure gives a distribution among payroll, operating expense, and equipment rental, but there have been no direct measures of how much of the construction engineering is field engineering or how the field construction engineering costs are distributed among the contract items of work. To get this information a detailed study was made of a group of sample projects.

As a result, the report offers data useful for management control and in estimating field engineering costs of future projects.

In one instance it was noted that the cost of engineering was more than the cost of the contract item.

In other instances the proportions of engineering costs were out of balance with the costs of the contract items and their bearing to the total cost of the projects. Corrective measures for this imbalance were indicated.

The report is published in pamphlet form under the title "Field Construction Engineering Costs" and is available to highway engineers and others interested on request to the Division of Highways, attention of the Construction Department.

DISTRICT V

Continued from page 38 . . .

alignment, eliminating three existing narrow bridges in the process. Completion of this $1,250,000 project in the middle of October will provide the initial two lanes of a four-lane divided expressway, as do all recent and current projects on State Sign Route 41. A similar and directly adjoining $315,000 project is already completed and open to traffic.

Now nearing completion, the most easterly section of this overall 19.5-mile highway improvement realigns that portion of U.S. 466, the Polonio Pass Road, from its intersection with State Sign Route 41 to the Kern county line, eliminating the hazardous curves and humps on the existing alignment. Such improvement will no doubt be welcomed by travelers between Fresno, Bakersfield and the central coast area. With completion of this project, we will have provided motorists with 31 miles of modern two-lane highway from Paso Robles to the Kern county line, replacing a completely substandard and hazardous highway in use only six years ago.

On shorter state highway arteries and federal aid secondary county roads, similar planning and construction activity has progressed throughout the year to properly distribute local traffic, while at the same time providing safety and convenience of travel so essential in this modern age.

Follows Existing Alignment

On State Sign Route 156 from 0.5 mile to 3.5 miles north of Hollister plans have been completed and right of way acquired for expressway development. From that point to the Santa Clara county line, an expressway routing following an existing alignment was adopted in February of this year following a public hearing in Hollister in July, 1958.

Plans are now complete for expressway development from the west city limits of San Juan Bautista to Cagney Road and design and right-of-way acquisition is under way from Cagney Road to the San Benito River just west of Hollister.

About 2.2 miles of San Miguel County Road between U.S. 101 and Strawberry Road and near the Prunedale junction is being completed in October as a federal aid secondary project at a cost of approximately $200,000. This project will widen the roadbed and eliminate sharp curves and will serve as an important link between Salinas and Watsonville for farmers in the area.

Construction of 3.95 miles of the Los Laureles Grade County Road, the connecting link between the Carmel Valley Road and State Route 117 which runs between Salinas and Monterey was completed in April of this year as a third stage of overall improvement of this county road. Work has just begun on the final 1.5-mile section which when completed will provide excellent transportation for local residents who commute to Salinas and Monterey and for tourists who visit the scenic Carmel Valley.

At another location on State Sign Route 150 directly north of the City of Santa Barbara, a public meeting was conducted in March this year discussing proposals for expressway development of a section of this route (San Marcus Pass Highway) from San Antonio Creek to U.S. 101. The route was adopted by the California Highway Commission on June 23, 1959.

Richard Winn Leaves To Take M.T.A. Post

Richard Winn, Information Officer for the State Department of Public Works and Editor of *California Highways and Public Works,* resigned in mid-October to take a new post.

He joined the staff of the Los Angeles Metropolitan Transit Authority as manager of its Public Information Department.

Winn had been with the State since 1957, when he retired from the Navy as a Commander. He served in the Navy for 15 years, holding public information and public relations assignments in Washington, D. C.; Charleston, South Carolina, and the Far East.

After graduating from the University of California in 1929, Winn was a reporter for the *Oakland Tribune* until he was commissioned in the Navy in 1941.

McCOY RETIRES

Continued from page 3 . . .

that which he has accomplished. These remembrances he continues to enjoy until his sun sets in the west.

"Few men have the knowledge, the ability, the kindness, the courtesy, the diplomacy, and the firmness to travel this course and climb to the summit of their profession.

"Mr. George T. McCoy, State Highway Engineer of the State of California, is one of these few. He has reached these heights and has received national acclaim. His garden of memory is beautiful to behold, and his fame and honor will long remain a bright spot in the history of California."

Vickrey will assume his new duties on October 1, succeeding McCoy.

Vickrey has been with the Division of Highways for 42 years, and for the past 12 years has been closely identified with the California freeway program as the division's chief planner.

Vickrey was born in Hendricks County, Indiana, in 1892, and was raised in that state. He studied engineering at Danville, Indiana, and later at the Los Angeles Polytechnic Institute.

After some engineering work with the Southern Pacific Railroad and the Los Angeles County Surveyor's Office Vickrey went to work for the Division of Highways at Willits (Mendocino County) in 1917 as a transitman. For the next eight years he worked as a construction engineer and on survey parties in various parts of the State.

In 1925 he was appointed assistant engineer in charge of location and construction for District III, at that time with offices in Sacramento, and three years later was appointed District Maintenance Engineer.

In 1932 he was transferred to District IX at Bishop as Acting District Engineer and the following year was appointed District Engineer of District I at Eureka. He remained there until his promotion to Traffic and Safety Engineer for the Division of Highways in 1938, and has been in the Sacramento headquarters office ever since.

In 1947, when California began its intensive highway modernization pro-

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DISTRICT VI

Continued from page 10 . . .

Dam on the Tule River by the Army Corps of Engineers.

The work, consisting of grading and constructing a standard 40-foot all-paved section using plant-mixed surfacing over Class "C" cement treated base, was started in July of 1957 by the Madonna Construction Company of San Luis Obispo. A bridge across the South Fork of the Tule River was constructed, consisting of three 132-foot spans. This bridge, when the reservoir is full, will be in the backwater of the lake and was constructed some 80 feet above the existing streambed.

In the early part of May, 1958, work was begun by Dicco, Incorporated, of Bakersfield, on 2.8 miles of highway between Hospital Road and Worth Road that joins the Success Dam relocation alignment at Worth Road. This project was completed in November of 1958 at a cost of $287,000.

Sign Route 198

Work began in July of this year to relocate Sign Route 198 east of Visalia, between Lemon Cove and Three Rivers. The project was necessary because of the proposed construction of Terminus Dam on the Kaweah River by the U. S. Corps of Engineers. As a result of this dam construction, the reservoir which will be formed will inundate the existing two-lane highway.

Compared with the existing route, the project, confined as it is to the sidehill location dictated by the resulting waterline of the proposed reservoir, is considerably more circuitous as the distance between common points exceeds that of the existing highway by 2.5 miles. The 7.6-mile, $3.5 million job was undertaken by the Isbell Construction Company of Reno, Nevada, and should be completed in June of 1961. The work is being financed chiefly by federal funds.

US 466

This route, located in Kern County, known as the Tehachapi Highway, is a part of an important east-west route. The portion of the route between Tower Line Road and Bear Mountain Ranch, about 10 miles east of the City of Bakersfield, is being constructed on 11.9 miles of new alignment as a four-lane expressway. Right-of-way has been acquired to permit ultimate conversion to full freeway standards. Work was begun on the $5.5 million job in January of 1959, by Griffith Company of Los Angeles and should be completed in September of 1960.

Shown here are same of the US 466 relocation operations now going on east of Bakersfield. The present highway is to the left.

Sign Route 180

Sign Route 180 between Sign Route 33 near Mendota and Kings Canyon National Park has added another link of improved highway to its length with the completion of 2.5 miles of four-lane divided highway. Much of this route in the City of Fresno is on a one-way street system inaugurated in 1955. It is the main east-west highway through Fresno. The portion completed in August, 1958, provided a four-lane divided arterial on Ventura Street in the City of Fresno, between R Street and Chestnut Avenue.

Stewart and Nuss, Incorporated, of Fresno were the contractors and the approximate final cost was $485,000.

Another portion on this route east of Minkler was completed in March of 1959. Two substandard curves, including a severe horseshoe, were eliminated in the portion between 0.7 mile east of Reed Avenue and 2.3 miles east of the Friant-Kern Canal. This project was a part of the continuing process of improving this route to the Kings Canyon and Sequoia National Parks. The improvement was completed by the Thomas Construction Company of Fresno at a cost of approximately $200,000.

Sign Route 65

This project, located between Linda Vista Avenue and the Tulare-Lindsay Highway in Tulare County, is the second link in an overall plan to convert this Ducor-to-Lindsay route to a four-lane divided highway facility. It provides an expressway on new alignment passing to the west of Strathmore and joining the Tulare-Lindsay Highway at the west city limits of Lindsay. Portions of Route 65 follow the old Fremont Trail.

This project was completed by Dicco, Incorporated, of Bakersfield in March of 1959 at a cost of approximately $815,000.

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NEW LANES

Continued from page 23 . . .

tor road, and re-enter the freeway at the Fifth Street inlet where the fourth lane southbound is already in existence.

Improvements Are Similar

These two improvements differ in that one involved the construction of a new lane adjacent to an existing freeway, while the other provided a connection from existing lanes to an existing freeway. However, they are quite similar, in that each provided additional traveled way to existing congested metropolitan freeways with the relatively small expenditure of $172,000 for both. Because of their proximity to each other, the two improvements cannot be separated when considering the beneficial effects they had on freeway traffic.

As a result of the widening, peak hour traffic increased about 42 percent, from 4,800 to 6,800, on the westbound Santa Ana Freeway, north of the Los Angeles River through the Civic Center Slot. There was a noticeable decrease in traffic congestion on the inbound San Bernardino Freeway and a definite increase in vehicle speeds observed by habitual users of these two freeways.

There are now close to 9,000 vehicles traveling southbound during the morning peak hour on the Harbor Freeway between the "Four-Level" Interchange and the Third Street off-ramp. The new "slip ramp" at Fifth Street now carries up to 1,000 vehicles per hour, which indicates the great reduction that has been made in vehicle weaving movements south of the "Four-Level" Interchange.

"Floating car" speed runs made before and after completion revealed that the average speed of traffic has increased as much as five miles per hour on the Santa Ana Freeway between the San Bernardino Freeway and the "Four-Level" during peak hours subsequent to the improvements.

Based on conservative estimates of the value of the time savings to the traveling public, it may be concluded that the cost of $172,000 for both projects, has already been fully recovered in less than one year after being opened.

JAPANESE ENGINEERS

Continued from page 50 . . .

Many Chinese crafstmen came to Japan in the Nara Period (710 A.D.-787 A.D.) bringing their techniques for the construction of Buddhist temples and bridges. These were all of wood construction, so that Chinese masonry techniques for the building of stone bridges was not transmitted to the Japanese.

A great development in the bridge construction methods occurred after the Great Earthquake of 1923 when many steel bridges were erected. These were all fabricated in domestic factories.

Because of frequent earthquakes there are many restrictions in Japan for the construction of long-span masonry or reinforced concrete arches. Until prestressed concrete bridges were erected in 1952, the majority of Japan's bridges have been of steel, except for the short-span bridges.

The study team recognized that some procedures in Japan are outdated and that more advanced methods should replace them. For example, it was pointed out that the manufacturing of bridges in Japan was accomplished by using full-sized drawings employing trial erection.

In addition, as the method is relatively new, Japanese bridge engineers have encountered problems with prestressed concrete girders.

After careful consideration by the United States Operations Mission in Tokyo and Japanese team members, the following points have been selected as those most necessary for study by Japanese bridge engineers sent to this Country:

1. The United States practice for rating bridges, highways and bridge reinforcement with relation to maximum loads and the use of larger-sized vehicles in highway transportation.

2. The planning and construction of long-span bridges.

3. The modernization of steel bridge manufacturing, including visits to some of the leading United States bridge companies.

4. The testing of bridges and highways, with a special visit to the AASHO Test Road Project in Ottawa, Illinois.

5. Construction—investigating the use of long piles, designing by means of electronic calculators, complicated grade separations, elevated bridges, viaducts and overpasses.

DISTRICT VI

Continued from page 55 . . .

Sign Route 168

The completion of 3.14 miles of six-lane divided highway on Shaw Avenue, between Sign Route 41 and 0.2 mile east of Chestnut Avenue, marked the beginning of an overall improvement program for Sign Route 168, which leads to the recreational areas of Shaver and Huntington Lakes.

As originally proposed, Shaw Avenue was scheduled for construction as a four-lane divided highway within a 120-foot right-of-way. However, due to the great increase in traffic volume resulting from the newly completed Fresno State College, and with indications pointing to an even greater increase in the next several years from residential and commercial developments, the ultimate six-lane divided roadway was constructed.

This project was constructed by Commercial Transfer, Incorporated, of Fresno, and was completed in May of 1959 at a cost of approximately $584,000.

McCOY RETIRES

Continued from page 54 . . .

gram under the Collier-Burns Act, Vickrey was appointed Assistant State Highway Engineer in charge of Planning. He was promoted to Deputy State Highway Engineer in 1955, and has since been responsible for all the various engineering phases of the California highway program.

Vickrey is married and has two sons, John W. Vickrey, Jr., of Alamo (Contra Costa County), and William J. Vickrey of Los Angeles. He is a member of the American Society of Civil Engineers and the American Association of State Highway Officials.

EDMUND G. BROWN
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printed in CALIFORNIA STATE PRINTING OFFICE 2350 9-59 38,400

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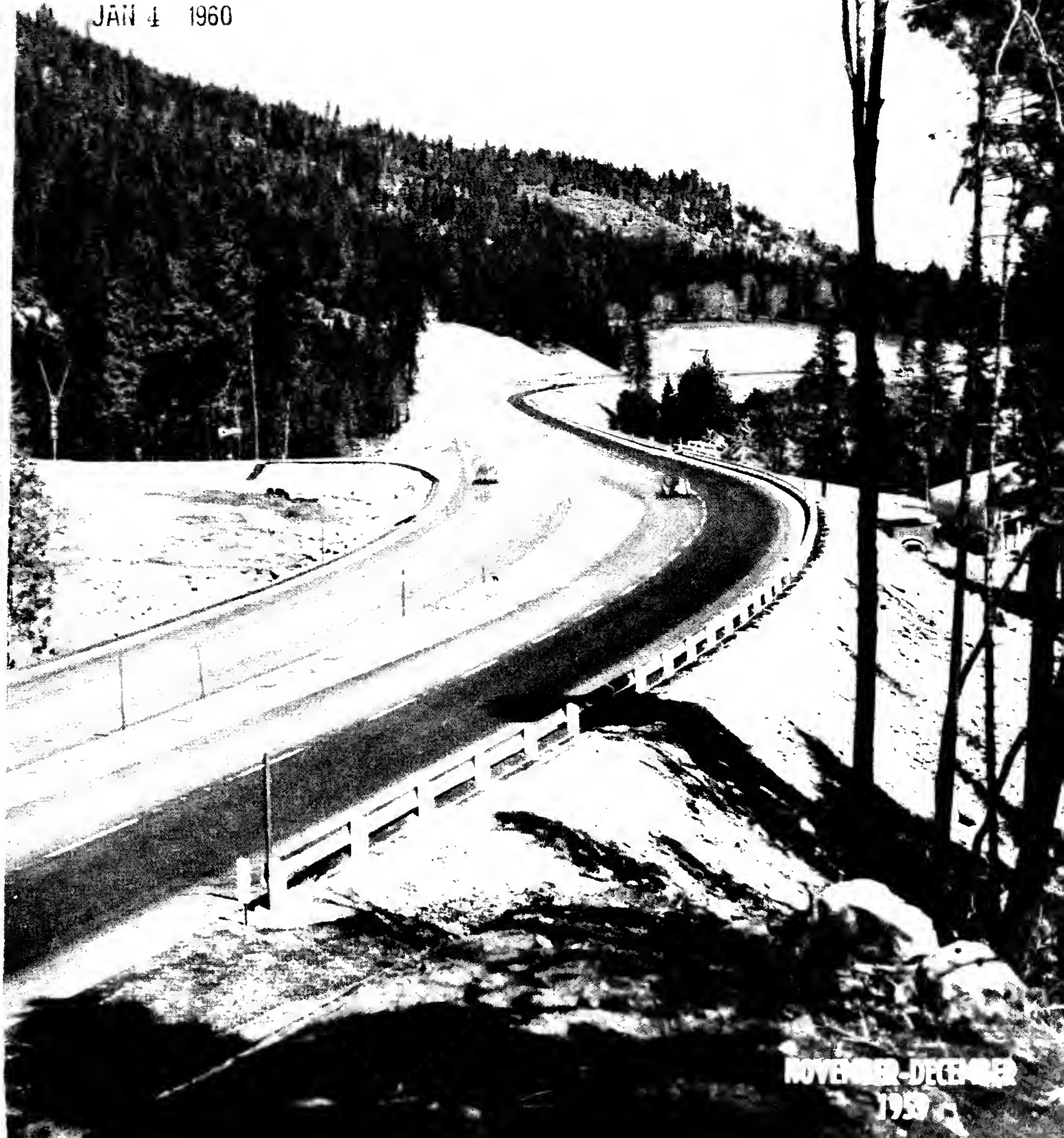

NOVEMBER-DECEMBER 1959

Recently completed section of US 40 (Interstate 80) in Truckee Canyon a few miles west of California-Nevada state line (see page 2).

California Highways and Public Works

Official Journal of the Division of Highways, Department of Public Works, State of California

Vol. 39 November-December Nos. 11-12

IN COVER—Recently completed expressway construction on . 99 north of Shasta Lake. The channelized intersection will mately be replaced with an interchange when this section is eloped to a full freeway under the Interstate Program. The nge snow markers have been placed for the winter season guide the snowplow operators. (See Report From District II, page 12.)

CK COVER—Looking northerly along the new section of free- on U.S. 101 (The Redwood Highway), in Rattlesnake Creek nyon, about 12 miles north of Laytonville. (See Report From District I, page 31.)

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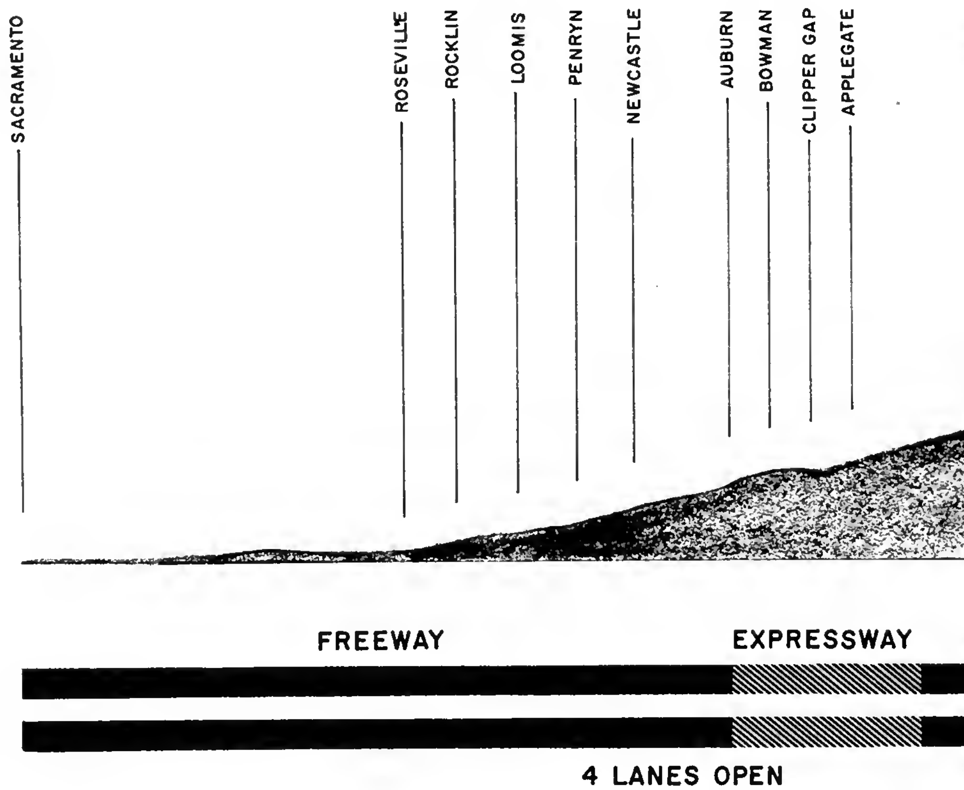
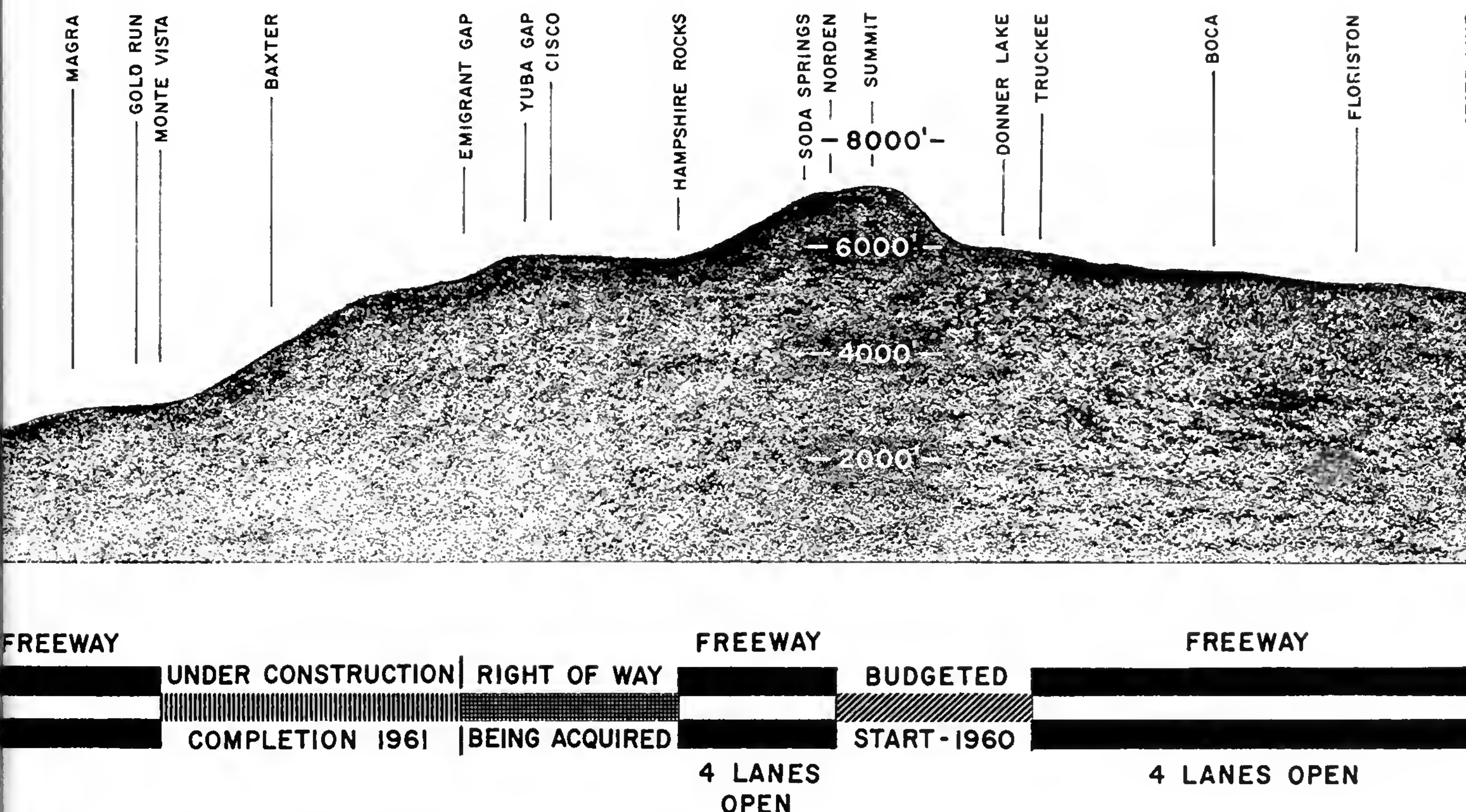
FIVE NEW SECTIONS OPENED THIS YEAR BETWEEN ROSEVILLE AND STATE LINE



By ALAN S. HART, District Engineer

Baca Bridge and Overhead upper left with Southern Pacific freight passing beneath. Looking west near upper end of Truckee Canyon.

More Freeway Miles



U.S. 40 has had more improvements completed in 1959 than in any other year in its history. Five new sections of full freeway, totaling 37.5 miles, were opened this year, and travelers to the 1960 Winter Olympics in Squaw Valley will enjoy 58 miles of uninterrupted four lanes on double roadway between Sacramento and Monte Vista.

This stretch, however, includes approximately 10 miles of expressway in and east of Auburn which requires 10 interchange structures to convert it to full freeway. These will be asked for in a future budget.

Traveling east, from Sacramento to the Nevada state line, these are the new sections which have been completed this year:

1. Connecting to the Roseville Freeway northeast of Sacramento, an 11.5-mile section from Roseville to Newcastle. About 8½ of these miles are a straight line across gentle undulations which are the beginning of the Sierra Nevada foothills.

This entirely new alignment south of the former route skirts the Towns of Rocklin, Loomis, and Penryn. The job, completed at a cost of $7,000,000 by A. Teichert and Son, Inc. of Sacramento, was opened to use in early December.

2. Beyond Auburn, almost to the old hydraulic mining gravel cliffs near Gold Run, is the new section from Magra to Monte Vista. This 4.5 miles was opened in August after being completed at a cost of $2,700,000 by Fredrickson & Watson Company, and Ransome Company, both of Oakland.

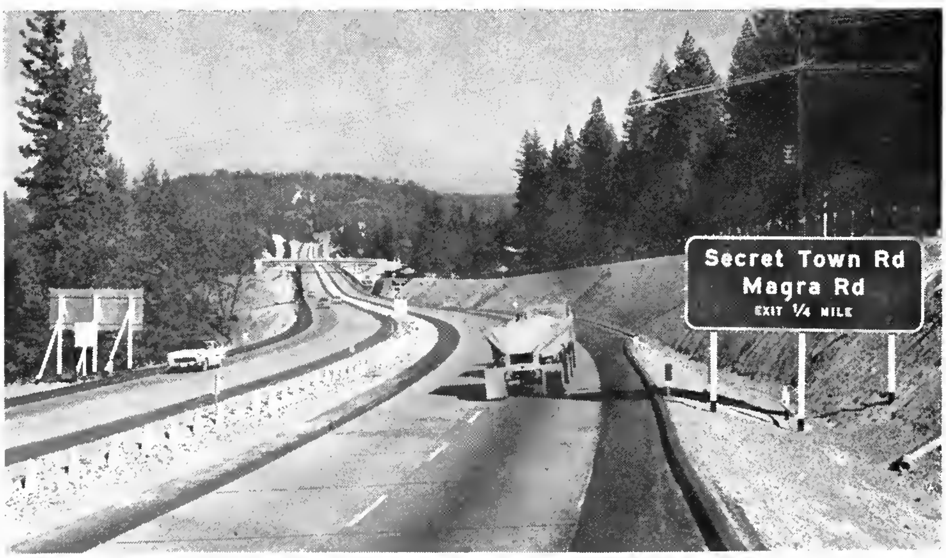
3. Much higher up, near the 6,000-foot level, the Hampshire Rocks to Soda Springs portion is now in use as a sample of what the high altitude section of the road will be like when it is complete. This six-mile portion, mostly on two levels, is built higher on the slope than the old route, and travelers will see an exciting panorama of the surrounding peaks as they drive along the shoulder of the ridge. It was opened to traffic November 4.

The entire 21 miles from the east end of Donner Lake to the Nevada state line is now full freeway. Two major contracts in this area were completed in 1959, connecting to the section completed last year between the California-Nevada state line and Floriston. Both were dedicated in a joint opening ceremony near Truckee on September 24.

4. The 8.8 miles from Donner Lake to Boca, bypassing Truckee, was completed by Fredrickson & Watson Construction Co. and Ransome Company, both of Oakland, at a cost of $7,620,606.

5. The 6.7 miles from Boca to Floriston was done by Isbell Construc-

Looking west on US 40 a few miles above Roseville on the new section between that city and Newcastle.



Recently opened new section looking east toward Magra Overhead.

Hampshire Rocks to Soda Springs portion just before completion while crews were completing asphalt shoulders.

tion Co. of Reno, Granite Construction Co. of Watsonville, and Gordon H. Ball & Gordon H. Ball, Inc. of Danville, at a cost of $7,325,011.

The Boca to Floriston contract completes the Truckee Canyon part of this route. Its conversion to interstate standards through this scenic canyon makes it truly one of the world's finest mountain highways. So narrow is the right-of-way in places, it was necessary to spend $472,000 for a 2.8-mile detour in the Floriston-Hirschdale area, to avoid prolonged delay of traffic during construction.

This narrowness of the right-of-way in the section completed in 1958 —Floriston to state line—provided such a scanty area for the road that a full median was not practicable, and this portion has only a four-foot median. Nevertheless, it is now possible to travel from Donner Lake to the state line at high cruising speeds over a road with gentle grades, wide sweeping curves, and no intersections.

On the section between Donner Lake and Boca a full diamond interchange has been provided in West Truckee at the intersection with State Sign Route 89, the route which will carry the Squaw Valley Winter Olympic Games traffic. State Route 89 has been reconstructed and widened to a 44-foot all-paved highway to handle the anticipated heavy traffic volume. Construction, comprising two 12-foot lanes with 10-foot paved shoulders, was completed several months ago at a cost of about $1,400,000. A modern channelized intersection also was provided at the Squaw Valley turnoff. The contractor was Fredrickson & Watson Construction Company and Ransome Company.

A local road near the U. S. 40-State Sign Route 89 junction also has been improved to handle overflow northbound traffic around the Southern Pacific Railroad underpass. Traffic will be diverted over this road by the California Highway Patrol when conditions warrant.

Last summer resurfacing of 23 miles of Sign Route 89 from Bay View Rest on Emerald Bay, Lake Tahoe, north to the Squaw Valley Road was completed by Clements Construction Company of Hayward for approximately $170,000.

Aerial view of western outskirts of Truckee and US 40-State Sign Route 89 intersection which is turnoff for Squaw Valley. Donner Pass is lowest notch above Donner Lake in background. New alignment will cross summit farther to right. Site of new plant inspection station is just above right center.

On the main highway, U. S. 40, which is also Interstate 80 in the new transcontinental network, only 35 miles of the old two-lane route remain. Thirteen miles of this is under construction, but will not be finished this year. Ten more miles are budgeted for construction, and 12 miles still await availability of funds.

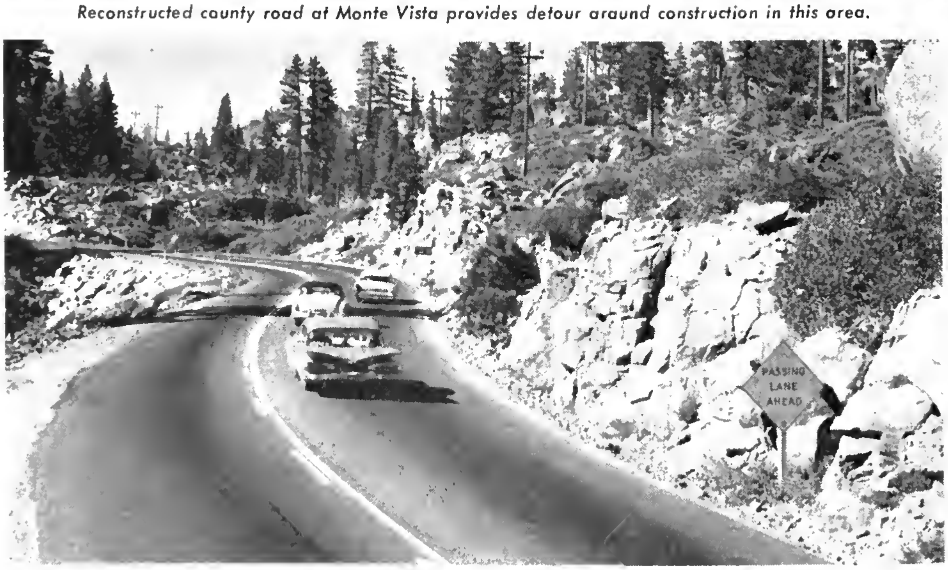
Twenty-five of the thirty-five miles of old road are between Monte Vista and Hampshire Rocks. This is divided into four sections for modernization, with two of these sections now under construction.

The five-mile Monte Vista to Baxter section got under way September 4 at a bid price of $4,739,175 by the Madonna Construction Company of

Recently rebuilt State Sign Route 89, looking northward at channelized intersection for Squaw Valley turnoff.


Section of expressway in vicinity of Auburn.


Reconstructed county road at Monte Vista provides detour around construction in this area.



Old road over summit is still only two lanes, but many passing lanes have been provided on up-grades.

San Luis Obispo, and is scheduled for completion in the summer of 1961.

The adjoining 7.8-mile section from Baxter to Emigrant Gap is under contract to A. Teichert & Son, Inc. of Sacramento on their low bid of $4,787,742. Work started this spring and is expected to be completed next fall.

The two sections from Emigrant Gap to Hampshire Rocks, totaling 11.5 miles, are in the final stages of design, and right-of-way is being acquired.

From Hampshire Rocks to Soda Springs is the completed section mentioned above which eliminates the frustrating Kingvale Grade. With its long rows of cars behind slow-moving vehicles, this was an especially difficult drive in snow conditions.

The remaining section to be improved, and the most formidable from an engineering viewpoint, is the 10 miles from Soda Springs to the east end of Donner Lake. Climbing to more than 7,000 feet at the top of the pass, this part of the road must be driven with great care in winter, particularly the steep slopes just east of the summit. Blizzards and snow closed the road here for six weeks in January and February 1952.

The route has been adopted for a new summit crossing. It will be about 1½ miles north of the present pass, avoiding the steep eastern face the road now descends, and gradually descending the slope above Donner Lake to connect with the completed section just west of Truckee.

The estimated cost of rebuilding this 10-mile section is $16,000,000. The 1959-60 State Highway Budget contains $8,300,000 for grading and structures on a seven-mile stretch as the first unit of the overall project, which may take as much as four years to complete.

The rebuilding of U. S. 40 between Sacramento and the Nevada state line so far has cost $58,000,000, with another $10,000,000 committed for the two jobs currently under way. Including the estimated $16,000,000 for the summit job, $36,000,000 should be sufficient to complete conversion. This will make the total cost of modernizing the state line to Sacramento portion $104,000,000.

A great investment in equipment as well as extra crews of men are required to keep U. S. 40 open in winter under normal traffic and weather conditions. With the large influx of spectators, contestants, and Olympics employees who will use the highway en route to Squaw Valley—from both east and west—snow removal will present extra challenges and extra problems. In the event of heavy snows during the games, the problem would be further magnified.

Included in the three years of advance planning for the conversion of U. S. 40, and for the games, has been the acquisition of an increased complement of snow removal equipment.

This is because of the more than doubling of highway mileage, or acreage to be cleared of snow, with the increase from a two-lane road to four-lane freeway.

There are currently 14 of the giant rotary plows in the mountain area, seven in the Truckee territory. Nine new ones will be delivered in the area prior to the snow season. They cost about $35,000 each.

Also in the area are 76 conventional snow plows, including 20 new ones brought in so far this year. For lighter jobs, trucks and blades will be used. Other rigs are needed for sanding, and still others for keeping signs clear.

An innovation in median delineators will greet motorists this winter in the Truckee Canyon section between Floriston and the state line. Proposed by the District III Traffic Department, the high-visibility centerline markers will provide an easy-to-see guide when the median is difficult to recognize during snowfall and inclement weather.

Of extruded plastic tubing four feet in height and about 1.5 inches in diameter, the markers are set in metal sockets anchored in the center of the four-foot paved median. The tubes have five alternate bands of orange-fluorescent and silver. The orange will give good daytime visibility and exceptionally bright contrast to snow; the silver will provide high nighttime reflectivity.

On straight stretches, the special delineators will be spaced about 200 feet apart with lesser intervals on curves. If they are overrun, the plastic tubes will give without damage to the vehicle.

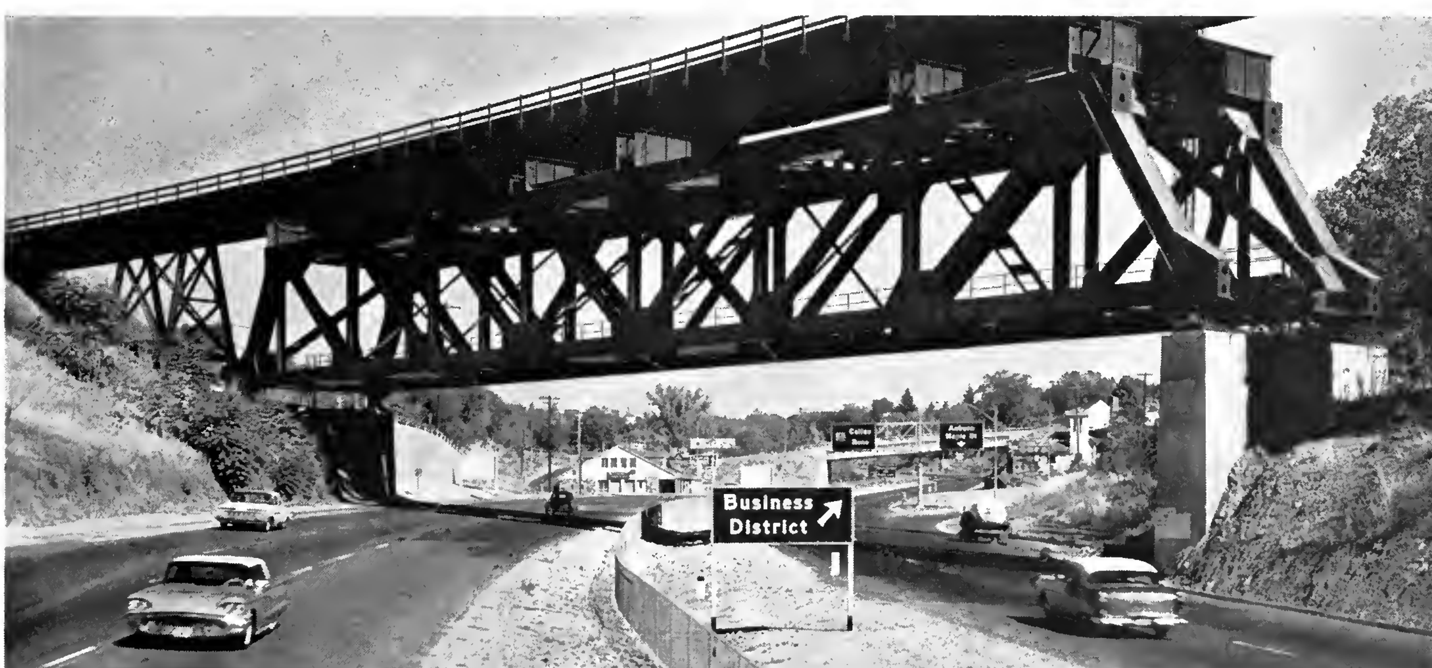
The current installation is partially experimental and other sections of the highway will be proposed in the future if they perform as expected. The initial 5.4-mile contract was awarded to Jay W. Wilmouth of Fresno on a low bid of $1,928 and was completed on November 4.

As a part of the inclusive program designed to provide motorists attending the Olympics with the smoothest possible traffic flow and minimum of inconvenience and confusion, District III will erect no less than 60 special temporary directional signs in the Truckee-U. S. 40-S. S. R. 89 area in eastern Nevada and Placer Counties.

These signs will serve to direct traffic both to and from the games, mainly with reference to U. S. 40 and points east and west of Truckee. Included will be three cable-suspended overhead signs with changeable messages to adapt vehicle movement to altered road and traffic conditions.

For the Winter Olympics period, the State Highway Patrol plans to import 150 officers from other stations throughout the State to help manage traffic in the area. They will be headquartered in Truckee.

Every effort has been made, and will continue to be made, to give the Olympics visitor the safest, fastest, and most convenient access possible to Squaw Valley within the limits of time and availability of funds necessarily imposed on an undertaking of such magnitude.



West Auburn Underpass—U.S. 40's famous "Piggyback Bridge" and a new landmark. The steel supporting structure for the railroad bridge was designed by the Division of Highways Bridge Department to carry the railroad across the widened highway without a center pier. The work was carried out without interrupting train service.

Cement Test

New Rapid Method Determines Cement Distribution in Bases

By DANIEL R. HOWE, Soils Engineering Associate, Materials and Research Department

FOR THE past several years there has been a growing need, during the actual construction period on California's highways, for a rapid field test which can be used to determine the distribution of portland cement in treated bases. This need has become more and more evident in recent times as aggregate quality was raised, cement content lowered and road mixing methods were being widely used.

With the exception of a few experimental projects dating as early as 1921, hardening of soils and base materials with portland cement began in California in 1937. In this early period mixing was accomplished by plows, disks and harrow methods with a fairly high cement content generally patterned after eastern "soil cement" practice. Later, modified bituminous mix plants of the pugmill type were used. In the plant operation, control of the ingredients by weight was usually good and little trouble was experienced in obtaining a uniform mixture.

In this latter period specifications were adopted requiring the use of processed aggregates having grading limits similar to those for untreated base material when cement treatment was to be employed. Minimum seven-day compressive strength requirements were also established for the treated mixture which had the effect of lowering cement contents considerably from those originally used for soils. About 1941 this product was named cement treated base or CTB and it retains this title at the present time.

In the late 40's and early 50's specifications permitted road mixing methods as a substitute for central plant methods and most contractors abandoned the plant method largely because of the increased daily production obtainable through road mixing.

From the engineer's standpoint however the lack of a rapid testing method in the road mixing type of operation made it more difficult and

FIGURE 1—The acid-base titration test can also be easily performed at the construction site.

FIGURE 2—Layout for the performance of the constant neutralization procedure is illustrated above.

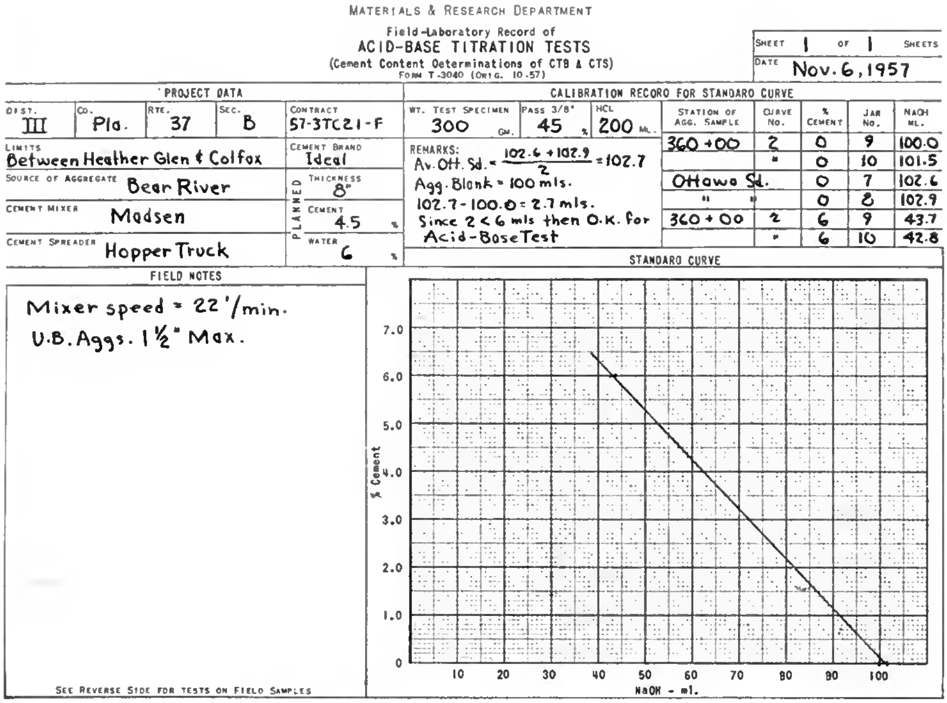


FIGURE 3—An example of a standard curve for the acid-base titration test.

often next to impossible to control several important variables in the construction of cement treated bases. Such things as the uniformity of material in the windrow, uniformity of cement spread in advance of mixing, uniformity and thoroughness of mixing due to high forward speeds of the mixer, size of the windrow in relation to the capacity of the mixer, depth of mixing as well as the mechanical condition of the mixer itself can all profoundly influence the uniformity of cement distribution. Furthermore the nonuniformity introduced by these variables cannot be controlled by normal methods of bulk quantity measurements. Somewhat similar variations and nonuniformities are experienced in plants of the continuous mix type when rigorous and reliable flow controls and ingredient feed interlocks are not provided. Actually only systematic quantitative tests giving measurements of physical factors related to cement distribution, performed on random samples, can provide the basis for the satisfactory evaluation of the efficiency of cement treated base mixing operations. It is the purpose of this article to describe such a test.

History of Tests

The California Division of Highways laboratory has in the past investigated several test methods which are aimed at determining the amount of cement in a sample of the mix. These tests are:

(1) Chemical analysis in accordance with ASTM designation D-806;

(2) Compressive strength tests to determine uniformity; and

(3) Electrical conductivity measurements.

For various reasons these methods did not prove satisfactory for monitoring field mixing operations. The chemical analysis method must be performed in a well equipped laboratory by a trained chemist and the compressive strength method requires at least a week to obtain results. These are distinct disadvantages which preclude effective use for field control. The electrical conductivity method, which is a broad modification of a test developed for portland cement concrete by Mr. L. R. Chada of India, proved to be a vast improvement over the other two methods in that it can be performed on the project and requires only about three hours to obtain results. However the electrical method was found to be sensitive to soluble salt inclusions in the aggregates and this often precluded the use of the test in California coastal regions where the aggregates had been exposed to ocean water or in certain inland areas where so-called "alkali" soils abound.

In the summer of 1957 our attention was directed to a method employed in England * for evaluating cement distribution by means of acid digestion and titration. The method as originally developed was used for soil-cement mixtures and required considerable modification before it could be applied with any degree of accuracy to the cement treated base mixtures used in California. However with modifications, a satisfactory test has been developed known as the "Acid-Base Titration Method," which may be easily and rapidly performed at the construction site.

Procedure Explained

The test is arranged, with respect to time, so that up to eight individual samples may be concurrently tested by one operator. Test specimens weighing 300 grams are prepared from the freshly mixed CTB and placed in plastic containers (approximately 2 qt. size). 200 milliliters of 3 normal hydrochloric acid (HCl) are then introduced into each sample and a standardized stirring procedure is followed for 18 minutes after which the acid is diluted to one normal concentration. In this process the acid neutralizes the cement and in the process there is a reduction in the acidity or Ph of the total solution. This reduction in acidity is measured by back titration with sodium hydroxide (NaOH) and the amount of NaOH required is inversely proportional to the cement content of the test specimen.

At 30 minutes after the first introduction of Hcl, a 100 milliliter aliquot portion of the residual acid is transferred to a beaker and prepared for titration by adding a small quantity of phenolphthalein solution. Titration is accomplished with 1 normal sodium hydroxide solution using a burette, graduated to 0.2 ml. The alkali is added slowly to the aliquot portion until a permanent red color is attained by the solution. The reading on the burette in milliliters will then indicate

* The Determination of the Cement Content of Soil-Cement III. An Investigation of Some of the Factors Involved by P. T. Sherwood. Journal of Applied Chemistry, 1957, 7, Nov. 1957.

the amount of NaOH that was needed to neutralize the residual acid.

In order to convert this burette reading into terms of percent of cement it is first necessary to establish a relationship for the particular cement, aggregates and water used on the project. This is accomplished by developing a "standard curve" from tests on prepared samples of the aggregate containing known amounts of the particular cement being used. Normally the curve is a straight line; therefore it is usually only necessary to perform tests on duplicate aggregate blank specimens (containing 0 percent of cement) and on duplicate specimens containing 6 percent cement. For convenience the titration values obtained are plotted on a graph against cement content as illustrated on an example of our work form in Figure 3. Since a straight line relationship exists between milliliters of NaOH and percent cement, it is merely necessary to draw a line between the averages of the paired tests. This then provides the standard curve from which the percentages of cement in individual field samples taken from the project may be determined.

Field and laboratory trials with the Acid-Base Titration method involving approximately 1,700 tests and 22 construction projects, indicates that the test provides a very satisfactory means of monitoring the distribution of cement. The test is comparatively simple and results can be obtained on groups of eight samples in about 45 minutes, excluding sampling and preparation time. Statistical studies show that the test is reliable and indicates a standard error of estimate of only ± 0.2 percent (cement).

Limitations Cited

Unfortunately this procedure cannot be used where the CTB aggregates contain significant amounts of such substances as limestone, calcite and dolomite. These minerals react to hydrochloric acid in a manner similar to portland cement and therefore cause false cement determinations. This condition is readily discernible and limiting test values are established which indicates to the operator when the test should not be used. It is estimated that in general this test will not be usable for perhaps 10 percent of the CTB projects in California. However, in a few districts the rate will be considerably higher.

Alternate Procedure

As a result of this difficulty a supplemental test procedure, referred to as the "Constant Neutralization Method" was developed by the Materials and Research Department for use on projects where aggregates susceptible to acid exist. While this method utilizes the same apparatus as the acid-base test, it is somewhat more time consuming and tedious and therefore less desirable in cases where aggregates reacting to the acid are not involved. It does however, provide a satisfactory means of control testing in the cases where the acid-base test cannot be used.

The constant neutralization method can be performed on a maximum number of four 300-gram test specimens at one time. The specimens are placed in a plastic container to which 250 milliliters of water and a small quantity of phenolphthalein solution are added. The solution will immediately turn pink due to the release of hydration products from the cement. Then using a burette containing 3 normal hydrochloric acid the operator continuously adds acid and stirs the mixture to maintain a colorless solution for a timed interval of one hour. He must not add any more acid than is just necessary to remove the pink color, for any excess acid will attack the susceptible aggregates. Likewise, if he does not add enough acid the hydration products going into solution from the cement will be arrested thereby affecting the end results. Conscientious attention to these details, by the operator, for the full time period of one hour is absolutely necessary in this test. The amount of hydrochloric acid used in this process is determined from volume measurements with a burette or by weight. Experience has shown that the amount is directly proportional to the cement content of the treated base sample. The cement content of the field sample is determined from a standard curve developed for the project using the constant neutralization method as illustrated in Figure 4.

Sample Preparation

The sampling and the preparation of representative specimens of cement treated bases presents a special problem in connection with both test procedures. In California, cement treated base aggregates are usually composed of coarse granular, graded materials. With such material the greater por-

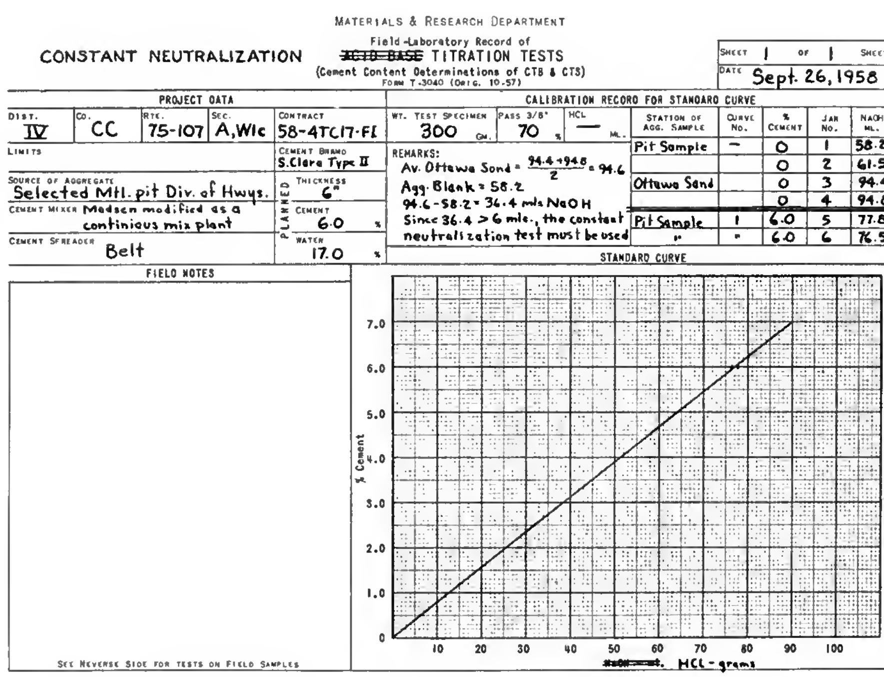


FIGURE 4—Example of a standard curve for the constant neutralization test.

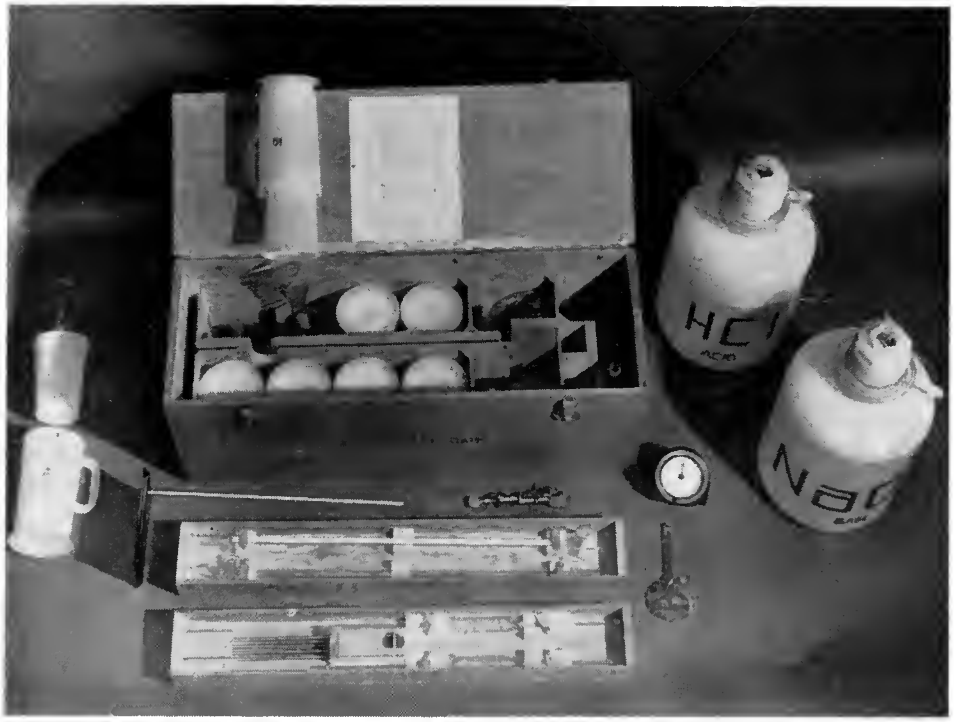


FIGURE 5—The field kit for the acid-base titration test.

tion of the cement normally combines with the fines leaving a lesser amount adhering to the coarser particles. This makes it essential that tests be performed on specimens having the same ratio of coarse to fines as exists in the road or windrow after mixing. Testing the fine portion alone would not solve this difficulty as the amount of cement adhering to the coarse particles is somewhat variable depending on moisture content. It would also be necessary to prepare multiple standard curves representing various gradings or varying test specimen weights in order to accommodate changes in the coarse to fine ratio. It has been found simpler and more accurate to include, in the test specimen, the coarse aggregate up to the 1½″ maximum size.

For the preparation of reliable test specimens, the field samples must be at least 3 kilograms in weight in order to be reasonably representative of the bulk material. Each sample is immediately separated on the ⅜″ sieve * and the proportions of the retained to passing calculated (including any retained 1½″ material). Any aggregate retained on the 1½″ sieve is then wasted and the two sizes of material (±⅜″) are recombined to form a 300-gram test specimen having typical proportions of plus to minus ⅜″. In the latter process, equivalent amounts by weight of the plus ⅜″ aggregate are substituted for any wasted rock larger than 1½″ in order to maintain the correct relationship of coarse to fines characteristic of the original field sample.

* Consideration was originally given to separating the sample on the No. 4 sieve. However, the larger size is easier and faster for field operations where moist samples must be hand sieved.

Statewide Field Control

Both of the titration procedures are incorporated in one test method for the California Materials Manual and district materials personnel are being equipped to perform the tests. The equipment has been conveniently arranged in kit form as shown in Figure 5. A chest has been designed for containing the numerous individual items (i.e. burettes, flasks, plastic containers, beakers, etc.) to minimize breakage and loss. Plastic containers have been used wherever possible including the 5 gallon carboys for holding acid and base working solutions. The entire equipment is easily and safely transportable in a station wagon type vehicle for field testing operations.

Since this method involves the use of acids and reagents it should be performed by technicians trained in laboratory techniques. While corrosive liquids are involved and present some hazard to personnel if improperly used, the State Safety Engineer has approved the method on the condition that use be limited to trained laboratory personnel. It is therefore planned that engineers from the district materials department will perform the test as needed on various projects within their respective districts.

This new test method has already proved to be an invaluable tool for monitoring CTB operations. During the developmental stages personnel from Headquarters Laboratory made numerous field trips to try the test under various operating conditions. Much was learned from the data obtained about the operating characteristics of cement spreaders, cement and aggregate feeds and mixing equipment. It is our belief that application of the test on a statewide basis will bring inestimable benefits to the State by helping to secure cement treated bases of consistently uniform quality. With uniformity will come savings in cement as accurate control will result in equal quality with less cement.

Acknowledgments

This article covering the development of a titration method for determining the cement distribution in cement treated bases represents the combined efforts of a number of people. The work was carried out in the Materials and Research Department under the general direction of Mr. F. N. Hveem, Materials and Research Engineer and Mr. Ernest Zube, Supervising Materials and Research Engineer. In the earlier stages the work was supervised by Mr. George B. Sherman and later by Mr. Clyde G. Gates.

Recognition should be given to Mr. Arnold Trotter and Mr. John Borchert for their conscientious and persevering efforts during the research stages and also to Mr. Herbert Rooney and Mr. Tom Shelly of the Chemistry Section who provided valuable assistance in the perfection of the method of titration.

Special acknowledgment is made to Mr. Borchert who originated the idea for the constant neutralization test.

This new section of expressway was recently completed on U. S. 99 in the Sacramento River Canyon in Shasta County. The view is northward toward Pollard Flats.

Report From District II

By H. S. MILES, District Engineer

THE HIGHWAY needs of this section of northeastern California present a varied picture. The terrain varies considerably, with highways reaching from the floor of the Sacramento Valley through mountain passes to the forests and green valleys of Siskiyou, Modoc, Trinity, Plumas, and Lassen Counties.

On the through routes, interstate freight trucks comprise a substantial portion of motor vehicle travel. There are numerous sections of two-lane road where restricted sight distance and steep grades force passenger cars to "queue up" behind slow-moving truck and trailer combinations. These conditions have caused many accidents.

Lumbering is the main industry of the area and the hauling of timber and waste materials now used in the production of various commodities has put increasing demands on automotive transportation. Livestock, minerals, and some farm products are also produced and reach market by truck which is often the only transportation available.

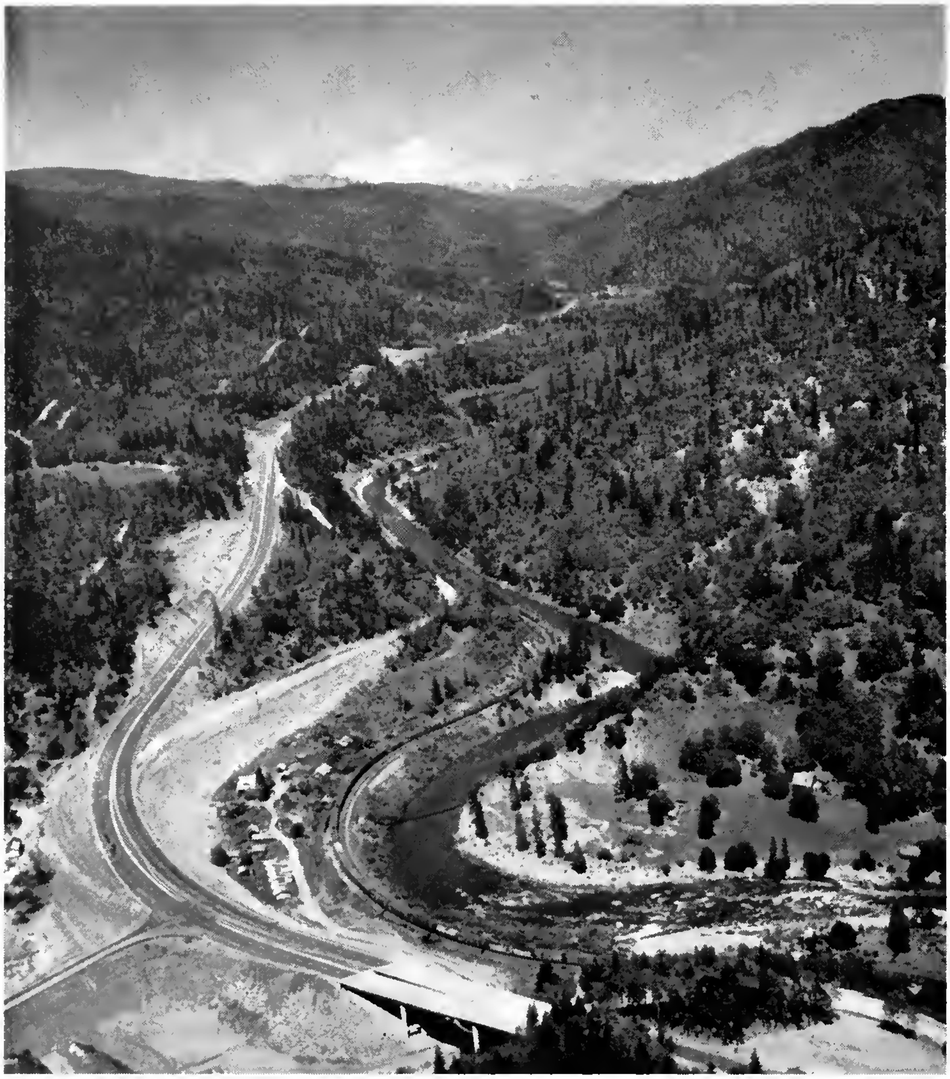
Recreational facilities in District II are among the best in the nation and tourists and vacationers are visiting the area in constantly increasing numbers. Camping and hiking in the mountains, fishing in the many streams and lakes, and boating and water skiing on the larger lakes and rivers are enjoyed by young and old alike during the summer season. The growing popularity of boating has increased boat trailer travel quite noticeably. Further increases are expected with the completion of the Trinity, Lewiston, and Whiskeytown Dams. Scheduled for completion in 1961, the reservoirs formed by these dams will add over 30 square miles of water surface to Northern California. The addition of the recently completed facilities at the Mount Shasta Ski Bowl to the other ski areas of Northern California will lead to an increased influx of winter sport enthusiasts. The advent of hunting season in the fall is also a contributing factor to highway congestion.

The state highway system in District II provides two major north-south routes and two east-west arterials as well as a number of auxiliary local routes within the district. During the past several years emphasis has been placed on planning and constructing projects on the interstate system.

U. S. 99W and U. S. 99

U. S. Route 99W extends from the southerly district boundary at the Glenn-Tehama county line to Red Bluff and continues northward as U. S.

Mount Shasta forms an effective backdrop to this scene of U. S. Highway 97 north of Weed in Siskiyou County.



A new expressway section on U. S. 99 in the Sacramento River Canyon, Shasta County. Slate Creek Bridge is in the foreground; Mount Shasta in the background.

Route 99 through Redding, up the Sacramento River Canyon past the westerly side of Mount Shasta and through Yreka to the Oregon border. This route is part of the federal interstate highway system.

In the Redding area previous to last year, there were numerous private and public accesses to the highway from a business and residential district west of the expressway and just south of the city. This condition was a contributory factor in a number of accidents. To correct this deficiency, a 1.1-mile-long frontage road west of the expressway was completed in May 1958, which combined the accesses into three road connections to the expressway.

In the City of Redding, traffic congestion was lessened to a great extent by the completion of a contract revising Market Street and Pine Street to one-way streets for use as the highway route through the business section of the city. Under the same contract, the two-lane highway north of the Sacramento River Bridge was reconstructed to a four-lane section with curbed medians to connect to a completed four-lane expressway north of Redding. The contractor was W. H. Darrough & Sons of Yuba City and the cost approximately $308,000.

North of Redding for a distance of 11.8 miles to Bass Hill, a four-lane expressway completed prior to 1956 at a total cost of $3,500,000 is adequate for present traffic but residential and business development will necessitate conversion of this section to a full freeway in the foreseeable future.

Studies for developing the 15-mile section from Bass Hill to Crespos to a full freeway are under way. This section was constructed in 1941 to replace the existing highway which was inundated by the lake created by the construction of Shasta Dam. It is an excellent two-lane road, considering the roughness of the terrain, but motorists are subject to considerable delay due to trucks and other slow-moving vehicles on steep grades. There are a number of vista points which afford the traveler excellent views of Shasta Lake and the surrounding mountains.

A long-planned four-lane freeway from the northerly end of Shasta Lake through the rugged Sacramento River Canyon and Dunsmuir to Big Canyon, a distance of approximately 30 miles, will soon be a reality with less than 14 miles yet to be completed. The remaining section is divided into three construction units as follows:

In July 1958, a contract was awarded for constructing 3.7 miles of four-lane freeway between one mile south of the Shasta-Siskiyou county line and the Sacramento River Bridge in Dunsmuir. The successful bidder was McCammon-Wunderlich Company and Wunderlich Contracting Company of Palo Alto with a low bid of $4,222,000. A second contract was awarded in April 1959, for constructing 4.4 miles of four-lane freeway between one mile south of Castella and 0.7 mile south of the Shasta-Siskiyou county line. The successful bidder was Gibbons and Reed of Salt Lake City with a low bid of $5,095,000. Funds in the amount of $8,300,000 have been allocated for the remaining 5.9 miles of four-lane freeway between 0.6 mile north of Shotgun Creek and one mile south of Castella. The two projects under contract will be completed late in 1960 and will comprise the first section of full freeway in District II.

From Big Canyon through the picturesque mountain cities of Mount Shasta, Weed, and Yreka the two-lane Route U. S. 99, partially on old alignment and partially on new alignment, extends northerly across the Klamath River through the Siskiyou Mountains to the Oregon border. Except for resurfacing, no construction was done

This traffic channelization at the junction of U.S. 99 and State Sign Route 44 in Redding is part of the new one-way street system through the city.

on this section in the last two years. A project for constructing a 3.2-mile section of four-lane freeway between Weed and 0.3 mile north of the Shasta River will be under way soon, following the opening of bids on November 18, 1959. The section this construction will replace is a narrow, winding road especially difficult in winter due to snow and icing conditions.

In general, progress on the interstate system within District II is being made as rapidly as funds are available. Route adoptions and freeway agreements have been completed on approximately 105 miles of the 178 miles of interstate highway, and design is underway on units in each of the three counties traversed.

U. S. 40 Alternate

U. S. 40-Alternate in District II extends from Jarbo Gap through the scenic Feather River Canyon to U. S. 395 about eight miles west of the Nevada line. It is the lowest route over the Sierra Nevada Mountain Range which all travel east from Northern California must cross.

In the last year one project was completed and one is still under construction on this route. A contract for grading and paving 5.2 miles of two-lane expressway on new alignment between Spring Garden and Sloat was completed by O. K. Mittry and Sons of Gardena at a cost of $1,061,000 for construction. New reinforced concrete bridges at Chambers Creek and at Chipps Creek east of Storrie are now nearing completion. The contractor is G. S. Herrington of Auburn, whose bid was $216,000.

The next scheduled construction on this route will be the grading and paving of 4.4 miles of the initial two lanes of an ultimate four-lane expressway between the junction of Sign Route 89 and Willow Creek, about four miles west of Portola. This project is included in the 1960-61 State Highway Budget with an allocation of $1,450,000.

U. S. 299

U. S. 299 in District II extends easterly from the Humboldt county line through Weaverville to Redding, thence northeasterly through Burney, Fall River Mills, and Adin to Alturas where it connects to U. S. 395.

A project for constructing 0.3 mile of two-lane highway on new alignment between 0.2 mile west of Douglas City and the Trinity River was completed in October 1958. The cost was $68,000 and the contractor, Harold P. Hastings of Lakeport. This work eliminated sharp curvature on the west approach to the Trinity River Bridge. Another project from the foot of Buckhorn Grade to the Trinity county line was completed in July 1958 by the same contractor at a cost for construction of $51,000. This work provided passing lanes at five locations on the steep Buckhorn Grade. Hauling of materials and equipment for the Trinity Dam construction near Lewiston has resulted in an influx of slow-mov-

This winter scene is on State Sign Route 44 at the north entrance to Lassen Volcanic National Park in southeastern Shasta County.


A new four-lane section on State Sign Route 36 just south of Lassen Volcanic National Park in Tehama County.

ing vehicles which make these passing lanes highly essential.

The flow of traffic on Route U. S. 299 in the City of Redding was further improved by the replacement of the narrow, obsolete overhead across the Southern Pacific Railroad with a four-lane reinforced concrete structure. Including approaches, the entire project from Court Street to California Street was 0.2 mile long. The contractor was Stolte, Inc., of Oakland who completed the work in November 1958, at a cost of approximately $250,000.

A contract was awarded to M. W. Brown of Redding in July 1958, for grading and paving 5.3 miles of two-lane highway on new alignment at two locations between 0.2 mile east of Hillcrest and three miles west of Burney. The low bid was $1,203,000. When the project is completed, the entire section of highway across the rugged Hatchet Mountain area from Montgomery Creek to Burney will have been reconstructed on new alignment as a modern two-lane highway.

A contract for constructing the initial two lanes of an ultimate four-lane expressway between 2.5 miles east of Towerhouse and 2.5 miles east of Whiskeytown is scheduled to be underway by the end of this year. The relocation of this 5.1-mile section of highway, about 10 miles west of Redding, is imperative because the existing highway will be inundated by the proposed Whiskeytown Reservoir, a part of the Trinity Dam project. Construction of an 875-foot-long bridge across an arm of the reservoir will be part of the contract. The U. S. Bureau of Reclamation, who is participating in the cost of the project, has set December 1, 1961, as the date the reservoir waters will cover the existing road.

U. S. 395

U. S. 395, known as the "Three Flags Highway," is an important inland route from Mexico to Canada. It enters the State and District II in the northeasterly corner of Sierra County and traverses the high desert plateaus and mountain valleys of Lassen and Modoc Counties to the Oregon border. A recent project on this route was the paving of 20.2 miles of highway between Ravendale and Madeline. The

The new highway and bridge on State Route 82 north of Fort Jones in Siskiyou County. The bridge on the old route across the Scott River (center) was washed out during the winter floods of 1955-56.

The California-Oregon State Line Road west of Tulelake. The route was recently taken into the State Highway System.

A new section of two-lane highway on State Sign Route 36 in Tehama County 31 miles west of Red Bluff.

contractor was Dorman Construction Company of Vancouver, Washington, who completed the job in October 1958, at a cost of $405,000.

Projects for constructing 1.2 miles of initial two-lane for an ultimate four-lane expressway from 0.8 mile south to 0.5 mile north of the Lassen-Modoc county line and 11.9 miles from Baxter Creek to north of Milford will be the next scheduled work on this route. The 1960-61 Budget provides funds for both these jobs.

State Sign Route 89

State Sign Route 89 in District II extends from the Sierra-Plumas county line northerly through Quincy around Lake Almanor and through Lassen Park to U. S. 299 about five miles east of Burney. From there it continues northwesterly through McCloud to a junction with U. S. 99 about two miles south of Mount Shasta.

Construction work commenced in July of this year on the relocation of 2.2 miles of two-lane highway between 2.0 miles and 4.2 miles north of Canyon Dam. The Healy Construction Company of Palmdale with a low bid of $266,000 is the contractor. The new alignment which skirts the shore of Lake Almanor eliminates a number of sharp curves.

A project for widening and surfacing 4.2 miles of two-lane highway between Legislative Route 86 and the Lassen Park boundary was recently completed. This southern entrance to the park is used in winter as well as summer, as it is the access route to a popular ski area.

A 5.5-mile base and surfacing project between 8.5 miles north of Hat Creek and U. S. 299, done to reinforce the existing roadbed, has just been completed. This improvement has made possible the removal of a load limit between the north entrance to Lassen Park and U. S. 299. The work was performed by contractor M. W. Brown of Redding.

State Sign Route 36

State Sign Route 36 traverses the width of the district from Peanut, in Trinity County, through Red Bluff and Chester to U. S. 395 east of Susanville.

About 31 miles west of Red Bluff, efforts to improve this route were continued by the construction of a bridge and approaches between 0.2 mile west and 1.1 miles east of Dry Creek. The contractor was the Thomas Construction Company of Fresno who completed the work in September 1959, at a cost of approximately $180,000.

A contract for grading and paving 4.9 miles of two-lane highway between 1.5 miles east of Lassen Camp and Mineral was completed in October 1958, by Stolte, Inc., of Oakland at a

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New Deputies

Three Deputy Directors, CHC Secretary Appointed

FRANK A. CHAMBERS

RUSSELL J. COONEY

HARRY D. FREEMAN

FOUR NEW appointments to high-level posts in the Department of Public Works has been announced by Governor Edmund G. Brown and Director of Public Works Robert B. Bradford.

Frank A. Chambers, who had been Secretary of the California Highway Commission since January, was named Chief Deputy Director of Public Works.

Russell J. Cooney, formerly City Manager of Merced, was appointed Deputy Director of Public Works for Management.

Harry D. Freeman, formerly Director of Planning, Engineering and Development for the Sacramento Redevelopment Agency, was named Deputy Director of Public Works for Planning.

Jack Cooper, a Sacramento and San Diego newspaperman, was appointed Secretary of the California Highway Commission, replacing Chambers.

Chambers, who was a federal and state government official for 20 years prior to joining the department, will fill the post vacated by James F. Wright whose appointment as Deputy Director of the State Department of Water Resources was announced earlier.

Chambers was Director of Business Service Centers for the western region of the General Services Administration of the federal government from 1950 through 1957. His headquarters were in San Francisco; his field of responsibility covered Arizona, California, Nevada and Hawaii.

During the 1940's, Chambers was with the U.S. Department of Labor, War Production Board, War Labor Board, War Manpower Commission, Small War Plants Corporation and War Assets Administration. He served in the Army Air Corps during World War II.

JACK COOPER

He was born in San Francisco in 1910. He studied at St. Joseph's College in Mountain View.

Chambers and his wife, Emily, and their twin sons, Robert and Stephen, 12, live at 840 Los Molinos in Sacramento.

Cooney has been Merced's City Manager for the past eight years, and earlier served as personnel director in Pasadena and in San Mateo County.

Cooney has had special training in public administration at the University of Southern California and in management at Harvard University. Before entering public service, he did industrial relations work for Lockheed Aircraft.

He is married and has two children.

Freeman, a graduate of the University of Illinois, was Director of Planning for Portland, Oregon, before he came to Sacramento and has had long experience as a city planner both in city government and private practice.

Freeman is married and has no children.

The two new deputy positions occupied by Cooney and Freeman were authorized for the department by the 1959 Legislature.

The new Highway Commission Secretary, Cooper, has been chief of

. . . Continued on page 46

Posts Filled

Three Key Appointments Made by Highway Division

THREE APPOINTMENTS to key positions on the California Division of Highways staff have been announced by State Highway Engineer J. W. Vickrey.

The appointments are:

J. C. Womack, promoted from Assistant State Highway Engineer—Planning to Deputy State Highway Engineer—Engineering.

John A. Legarra, promoted from Planning Engineer to Assistant State Highway Engineer—Planning.

L. L. Funk, Photogrammetric Engineer, transferred to Planning Engineer.

In his new position as Deputy State Highway Engineer, Womack will be replacing Vickrey, who was recently appointed State Highway Engineer upon the retirement of G. T. McCoy.

Womack's new responsibilities will include not only the various planning functions with which he has been identified since he was assigned to the Division of Highways Headquarters office in 1948 but also other engineering activities.

Born in Emmett, Idaho, in 1898, Womack studied at the University of Washington and spent seven years on road location and construction work for the U. S. Bureau of Public Roads in the Northwest. He joined the California Division of Highways in 1929, as Location Engineer for District III, working out of Sacramento and Marysville.

He remained with District III, serving in planning, maintenance, construction and other assignments, until he was promoted to Planning Engineer for the Division of Highways in 1948. He was again promoted in 1955, to the position of Assistant State Highway Engineer – Planning, supervising the activities of six departments including Advance Planning, Programs and Budgets, Design, Traffic, Photogrammetry and Highway Planning Survey.

Womack served in World War I as a second lieutenant of field artillery. He is married and has two sons. His home is at 2653 13th Street, Sacramento.

Legarra, who moves up to Assistant State Highway Engineer – Planning, was born in Marysville in 1912, attended school in Stockton, and received his civil engineering degree from the University of California in 1934. He was in private engineering practice in Stockton from then until 1941, when he joined the Division of Highways.

He was assigned to District VI (Fresno) for a short period, then served with the U. S. Navy Civil Engineering Corps during World War II. From 1946 to 1951 he was with District X (Stockton) of the Division of Highways. He was then transferred to Headquarters office in Sacramento, first as assistant traffic engineer. In 1955 he was appointed Planning Engineer, serving in that post ever since except for several months as Design Engineer.

Legarra lives at 4920 Crestwood Way in Sacramento with his wife and four children.

Funk, the new Planning Engineer, was born in Chicago in 1901, attended high school in Sheridan, Oregon, and received his civil engineering degree at Oregon State College in 1921. After various engineering jobs in the Northwest, he was first employed by the Division of Highways in 1923 as a draftsman in its Dunsmuir office.

He left state service in 1925 to spend six years in mapping and tax appraisal work involving aerial photography. In 1931 he re-entered Division of Highways work in the District V office at San Luis Obispo, and was there until 1956, advancing to the position of Assistant District Engineer—Planning. His next move was to Headquarters

. . . *Continued on page 46*

J. C. WOMACK

JOHN A. LEGARRA

L. L. FUNK

Appointments

Three Named to Top Posts In Architecture Division

THE APPOINTMENT of Earl W. Hampton, who has been in charge of the Division of Architecture's design and planning service since last January to the new position of Deputy Chief, Architecture and Engineering, has been announced by State Architect Anson Boyd.

EARL W. HAMPTON

Boyd also made appointments to two new assistant state architect positions under Hampton in the division's Sacramento and Los Angeles offices.

Arthur F. Dudman, Principal Architect and head of the division's Sacramento Design Section for the past 13 years, will be Assistant State Architect in charge of design and planning in the north. Tom Meret, Principal Architect and Project Management Supervisor, will move to Los Angeles to take over the companion position in the south.

The three new positions were established as part of an extensive reorganization program under way in the Architecture Division. The changes are part of a realignment of top positions directed towards improved management control and efficiency.

Hampton entered state service in 1922 with the Division of Architecture and for many years held various drafting and designing classifications.

In 1949 he was appointed head of the division's postwar design program performed by private architects. In 1953 he organized the Construction Budgets Section, which he supervised until 1955.

Hampton headed the division's budgets and fiscal affairs for four years prior to his appointment to the design and planning position nine months ago.

Hampton and his wife, Margaret, have two daughters, Erlene, of Sacramento, and Betsy, a student at the University of California in Berkeley.

Dudman's state service dates back to 1923 when he worked with the Division of Architecture for a short time as a junior architectural draftsman.

Following several breaks in service during which time he completed his formal architectural education and was employed in various architectural offices in San Francisco, Dudman was appointed Associate Architectural Designer in 1938, Senior Designer in 1945, Supervising Designer in 1946, and Principal Architect in 1948.

Dudman and his wife, Jean, live in Sacramento. They have no children.

ARTHUR F. DUDMAN

Meret joined the Division of Architecture in 1948 as an Associate Designer and was appointed Senior Designer a year later. In 1952 he was appointed Supervising Architect.

Meret took over the supervision of the Construction Budgets Section vacated by Hampton in 1955. Recently he was appointed Principal Architect and has headed the division's new Project Management Section which is developing improved methods for the control and management of the budgetary and working drawings processes engaged in by the division.

TOM MERET

Meret and his wife, Helen, will soon move to Los Angeles. They have two daughters, Mrs. Dorothy Edelstein, of Lake Charles, Louisiana, and Mrs. Marjorie Snider, of Sacramento.

Successors to the positions formerly held by Dudman and Meret have not been named. Hampton's former position has been abolished under the reorganization plan.

Occupancy of the Pilot Rock Forestry Conservation Camp in San Bernardino County, the first of several such conservation camp centers, is scheduled to begin on December 15, 1959. The facility will accommodate 80 men.

Cost Index

Construction Prices Drop During Third Quarter of '59

By J. P. MURPHY, Assistant State Highway Engineer and
H. C. McCARTY, Office Engineer

During the third quarter of 1959 the California Construction Cost Index returned to a lower level. The index now stands at 260.3 which is 10.1 points or 3.7 percent below the second quarter of 1959.

The index for both the second and third quarters is not believed to be a true measure of construction costs. A minimum number of projects was placed under way during these periods due to the uncertainty of federal highway legislation and the availability of future federal aid funds, particularly for interstate highways.

A project for the construction of the Webster Street Tube between Oakland and Alameda, with a bid value of $16,641,000 was not included in the cost index computation as the concentration of money, the type of construction, and the unusual specifications for this project are not comparable to the normal highway project.

The other contracts for construction of the substructure and superstructure of the Benicia-Martinez Bridge, with a total bid value of $14,238,400, were included in the computation of the cost index. A cost analysis of these projects showed no unusual unit prices for structural steel and bar reinforcing steel. Exclusion of these two projects would have resulted in an index figure of 256.3, which is only 4 index points or 1.4 percent lower than the index of 260.3 which includes these two projects.

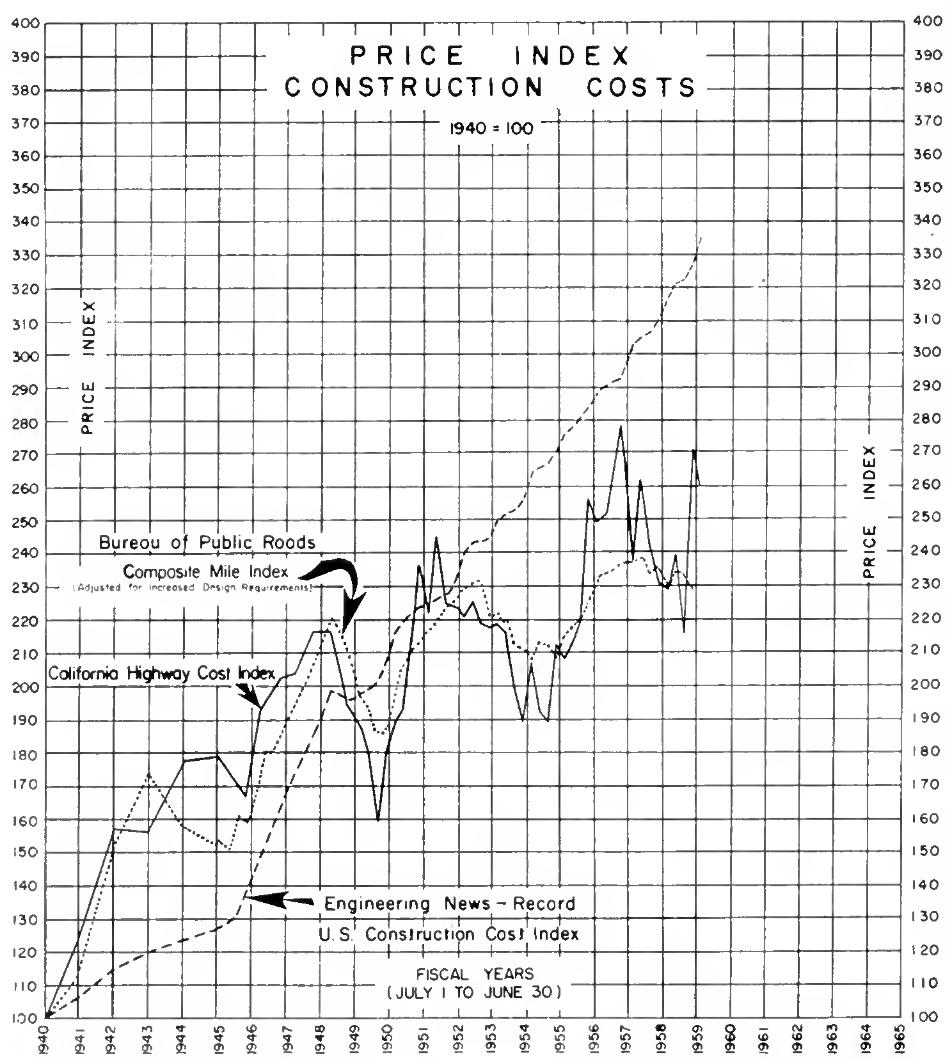
The highway construction picture involves possible steel price increases, higher interest rates on financing and the wage increases in the construction industry. There is continued intensive competition for a smaller number of highway projects, occasioned by the reduction of interstate funds and federal project controls on the rate of advertising projects involving federal funds. Strong competition for projects exerts great pressure on contractors to increase productivity and cut profits before raising their bid prices.

Bidder competition during the third quarter, with an average of 6.7 bidders per project, remained at a satisfactory level during the quarter. An accompanying tabulation shows the average number of bidders arranged according to types of construction and project value for the months comprising the third quarter of 1959.

The project values in this quarter are distributed as shown in the accompanying "Size of Projects" table.

Four of the seven items used in the preparation of this index show lower average unit prices while three items are higher than in the previous quarter. Principal reductions were in roadway excavation and portland cement concrete (structures). The reader's attention is called to the accompanying tabulation of Average Contract Prices.

The price for roadway excavation of $0.53 per cubic yard is $0.13 lower than the second quarter average unit price of $0.66 per cubic yard. Unit



SIZE OF PROJECTS CONSIDERED IN SURVEY

	No. of projects	%	Value of projects	%
Under $50,000	63	49.6	$1,292,700	3.5
50,000 to $100,000	17	13.4	1,268,000	3.5
100,000 to 250,000	28	22.0	4,193,400	11.4
250,000 to 500,000	13	10.2	4,381,100	11.9
500,000 to 1,000,000	3	2.4	1,929,000	5.3
1,000,000 to 2,500,000	1	0.8	2,240,800	6.1
2,500,000 to 5,000,000	1	0.8	4,739,200	12.9
Over 5,000,000	1	0.8	16,641,000 *	45.4
Total	127	100.0	$36,685,200 *	100.0

* Does not include $14,238,400 for two contracts Benicia-Martinez Bridge (substructure and superstructure), financed from Toll Bridge bond funds.

bids in projects exercising significant weight in establishing this average price range from $0.25 to $0.95 per cubic yard.

Of a total quantity of 5,393,000 cubic yards included in contracts for this quarter, one project in the Sierra Nevada Mountains on U. S. 40 involved 2,740,000 cubic yards at $0.60. Another project in Sonoma County at Healdsburg required 1,100,000 cubic yards at a price of $0.39. These two projects practically determined the average unit price for this quarter.

The average price for untreated rock base of $1.80 per ton is $0.03 above the second quarter price of $1.77 per ton. Prices for quantities exercising an influence on the index range from $1.10 to $4.50 per ton.

The average unit price for asphaltic and bituminous mixes of $5.70 per ton dropped $0.07 from $5.77 per ton, but is still within the range of average unit prices for the last two years.

The price for portland cement concrete pavement of $15.54 per cubic yard is an increase of $1.51 above the previous quarter price of $14.03 per cubic yard. Only 66,000 cubic yards were involved in the period, half of it on the Sierra Nevada mountain project mentioned above, at a price of $17.50, and 20,000 cubic yards in the Sonoma County project at a price of $13.50.

The average unit price for portland cement concrete (structures) of $58.16 per cubic yard decreased $7.20 from $65.36 per cubic yard. This price approximates the average of the last three years for this item.

The price for bar reinforcing steel of $0.130 per pound is an insignificant decrease of $0.004 per pound from the unit price of $0.134 for the second quarter of 1959. Bid prices for this item ranged from $0.120 to $0.300.

The average unit price for structural steel of $0.237 per pound increased $0.039 from the second quarter of 1959. A total volume of 27,000,000 pounds was used in this quarter, 26,000,000 pounds of it for the superstructure of the Benicia-Martinez Bridge determining the unit price of $0.237.

An alternate computation was made leaving out the Benicia-Martinez Bridge project, which resulted in an average price of $0.220.

Cost Index

The California Highway Construction Cost Index, the Engineering-News Record Construction Cost Index, and the United States Bureau of Public Roads Composite Mile Index, all reduced to the base 1940 = 100, are shown on the accompanying graph (Exhibit D). The latter two indexes are based on nationwide construction costs.

The Engineering News-Record Cost Index for the third quarter of 1959,

AVERAGE CONTRACT PRICES

	Roadway excavation[1], per cu. yd.	Untreated rock base, per ton	Plant mixed surfacing, per ton	Asphalt concrete pavement, per ton	Asphaltic and bituminous mixes, per ton	PCC pavement, per cu. yd.	PCC structures, per cu. yd.	Bar reinforcing steel, per lb.	Structural steel, per lb.
1940	$0.22	$1.54	$2.19	$2.97	----	$7.68	$18.33	$0.040	$0.083
1941	0.26	2.31	2.84	3.18	----	7.54	23.31	0.053	0.107
1942	0.35	2.81	4.02	4.16	----	9.62	29.48	0.073	0.103
1943	0.42	2.26	3.71	4.76	----	11.48	31.76	0.059	0.080
1944	0.50	2.45	4.10	4.50	----	10.46	31.99	0.054	0.132
1945	0.51	2.42	4.20	4.88	----	10.90	37.20	0.059	0.102
1946	0.41	2.45	4.00	4.68	----	9.48	37.38	0.060	0.099
1947	0.46	2.42	4.32	5.38	----	12.38	48.44	0.080	0.138
1948	0.55	2.43	4.30	5.38	----	13.04	49.86	0.092	0.126
1949	0.49	2.67	4.67	4.64	----	12.28	48.67	0.096	0.117
1950	0.40	2.25	4.26	3.75	----	11.11	43.45	0.079	0.094
1951	0.49	2.62	4.34	5.00	----	12.21	47.22	0.102	0.159
1952	0.56	2.99	5.00	4.38	----	13.42	48.08	0.098	0.150
1953	0.51	[2]2.14	5.31	4.58	----	12.74	50.59	0.093	0.133
1954	0.45	2.13	4.50	4.86	----	14.41	48.42	0.094	0.124
1955	0.39	2.22	4.93	----	----	13.35	45.72	0.095	0.142
1st Quarter 1956	0.40	2.08	5.40	6.50	----	14.05	52.51	0.105	0.166
2d Quarter 1956	0.51	2.06	6.27	----	----	14.64	57.13	0.113	0.219
3d Quarter 1956	0.52	2.27	6.12	----	----	15.57	56.32	0.121	0.178
4th Quarter 1956	0.52	2.21	--[3]-	--[3]-	[3]$5.93	14.95	59.63	0.112	0.197
1st Quarter 1957	0.63	2.10	----	----	5.94	17.28	61.14	0.129	0.235
2d Quarter 1957	0.63	2.10	----	----	6.18	15.59	58.61	0.119	0.204
3d Quarter 1957	0.42	2.34	----	----	5.10	14.34	58.68	0.130	0.200
4th Quarter 1957	0.68	1.78	----	----	5.45	16.88	59.76	0.129	0.177
1st Quarter 1958	0.52	1.85	----	----	5.45	14.96	55.21	0.118	0.192
2d Quarter 1958	0.48	1.73	----	----	5.67	13.77	54.44	0.125	0.158
3d Quarter 1958	0.39	2.18	----	----	5.56	13.99	53.93	0.126	0.182
4th Quarter 1958	0.52	2.10	----	----	5.74	13.55	55.20	0.122	0.165
1st Quarter 1959	0.41	1.82	----	----	5.37	14.00	49.40	0.108	0.165
2d Quarter 1959	0.66	1.77	----	----	5.77	14.03	65.36	0.134	0.198
3d Quarter 1959	0.53	1.80	----	----	5.70	15.54	58.16	0.130	0.237

[1] Unclassified.
[2] The item of crusher run base was used before 1953.
[3] Asphalt concrete pavement combined with plant mix surfacing in 4th Quarter 1956, and will be identified as asphaltic and bituminous mixes in the future.

NUMBER AND SIZE OF PROJECTS, TOTAL BID VALUES AND AVERAGE NUMBER OF BIDDERS

(July 1, 1959 to September 30, 1959)

Project Volume	Up to $50,000	$50,000 to $100,000	$100,000 to $250,000	$250,000 to $500,000	$500,000 to $1,000,000	Over $1,000,000	All Projects
Road projects							
No. of projects	58	12	26	13	2	----------	111
Total value*	$1,161,900	$849,700	$3,891,400	$4,381,100	$1,321,400	----------	$11,606,500
Avg. No. bidders	5.0	6.8	8.8	8.6	12.0	----------	6.6
Structure projects							
No. of projects	8	5	2	----------	1	3	19
Total value*	$170,100	$418,300	$302,000	----------	$607,600	$30,879,500	$32,377,500
Avg. No. bidders	4.6	6.2	10.5	----------	10.0	7.0	6.3
Combination projects							
No. of projects	----------	----------	----------	----------	----------	2	2
Total value*	----------	----------	----------	----------	----------	$6,980,000	$6,980,000
Avg. No. bidders	----------	----------	----------	----------	----------	12.0	12.0
Summary							
No. of projects	66	17	28	13	3	5	132
Total value*	$1,332,000	$1,268,000	$4,193,400	$4,381,100	$1,929,000	$37,859,500	$50,963,000
Avg. No. bidders	5.1	6.6	8.9	8.6	11.3	9.0	6.7

* Bid items only.

Total Average Bidders by Months

	July	Aug.	Sept.	Avg. for three months
1959	6.7	6.6	6.7	6.7
1958	6.1	6.7	5.2	6.2

which now stands at 334.8, again shows a rise over the preceding quarter. It is up 8.3 index points or 2.5 percent. This index is strongly affected by many large projects outside the highway construction field.

The Bureau of Public Roads Composite Mile Index is based on federal-aid highway construction contracts awarded by the state highway departments. The index for the second quarter of 1959, which is the latest available, dropped 6.3 index points or 2.7 percent from the first quarter of 1959 and now stands at 227.8. According to the Bureau of Public Roads, this sizable drop in the index following a 0.6 percent decrease in the previous quarter does not necessarily indicate a downward trend in highway construction costs. The small fluctuations of the past several years, together with the latest change, appear to indicate continuance of a trend of stabilization in prices.

THE CALIFORNIA HIGHWAY CONSTRUCTION COST INDEX

Year	Cost Index
1940	100.0
1941	125.0
1942	157.5
1943	156.4
1944	177.8
1945	179.5
1946	179.7
1947	203.3
1948	216.6
1949	190.7
1950	181.2
(1st Quarter 1950—160.6)	
1951	225.0
(4th Quarter 1951—245.4)	
1952	225.9
1953	215.2
1954	193.5
(2d Quarter 1954—189.0)	
1955 (1st Quarter)	189.3
1955 (2d Quarter)	212.4
1955 (3d Quarter)	208.6
1955 (4th Quarter)	212.6
1956 (1st Quarter)	219.5
1956 (2d Quarter)	255.9
1956 (3d Quarter)	249.1
1956 (4th Quarter)	252.1
1957 (1st Quarter)	277.7
1957 (2d Quarter)	266.9
1957 (3d Quarter)	237.5
1957 (4th Quarter)	262.1
1958 (1st Quarter)	241.8
1958 (2d Quarter)	231.0
1958 (3d Quarter)	228.5
1958 (4th Quarter)	238.5
1959 (1st Quarter)	216.1
1959 (2d Quarter)	270.4
1959 (3d Quarter)	260.3

California Engineers In AASHO Posts

Two California highway engineers were honored by the American Association of State Highway Officials at the annual meeting in Boston on October 10-16. State Highway Engineer J. W. Vickrey was elected to a two-year term on the executive committee, the governing board of the association. Deputy State Highway Engineer J. C. Womack was appointed chairman of the Design Committee.

The new AASHO president for 1960 is Dwight H. Stevens, Chairman of the Maine Highway Commission. Kentucky State Highway Engineer D. H. Bray was elected first vice president.

The five-day session was devoted to intensive discussion of national highway problems from the viewpoint of the various states.

Many Road Closures

Numerous forest fires continued to cause many road closures during the last half of October. State Sign Route 27, Topanga Road, from Mulholland Drive to the Pacific Coast Highway in Los Angeles County, was closed by fire for 35 hours between October 15 and 17. State Sign Route 2, in Los Angeles County, was closed from October 13 through the end of the month because of the extensive forest and brush fires raging through the Angeles National Forest during that time.

On the other hand, State Sign Route 79 in Riverside County was closed from 4 p.m. October 1 to 6.15 a.m. October 2 by a flash flood, while State Sign Route 108, Sonora Pass in Tuolumne County, was closed briefly during a snow storm, and dust and wind storms on October 29 and 30 near Mendota in Fresno County and north of Mojave in Kern County necessitated temporary closures in those areas.

Bridge Awards

Two State Spans Cited Among 'Most Beautiful' by A. I. S. C.

Two California bridges have been included among those considered as the most beautiful steel bridges opened to traffic during 1958 in the annual competition sponsored by the American Institute of Steel Construction.

The two bridges are the South Fork Eel Bridge at Dyerville on U. S. 101 in Humboldt County which received a first honorable mention in Class II, fixed spans under 400 feet and costing more than $500,000 and the Marsh Road Overcrossing, on the Bayshore Freeway in Santa Clara County, which received an honorable mention in Class III, spans under 400 feet and costing less than $500,000.

Both bridges were designed by the Bridge Department of the Division of Highways.

In all, the panel of judges appointed by the AISC selected 13 bridges in 11 states from 104 entries, the largest number of bridges ever submitted in the 31-year-old prize bridge competition.

Top winner in Class I, spans 400 feet long or more, was the new Mackinac Bridge across the Mackinac Straits in Michigan.

The awards for the bridges will be presented in special ceremonies to be arranged at the bridge sites at a later date.

The panel of judges said that a survey of the entries in the contest showed that "designers were obviously taking a new responsibility for the beauty of bridges and their surroundings."

Winner of the first honorable mention award in the Class II Division for Bridges with spans less than 400 feet long and costing more than $500,000, was this structure across the South Fork of the Eel River on US 101 near Dyerville in Humboldt County. (Aerial view on page 33.)

Honorable mention winner in the Class III Division for Bridges with spans less than 400 feet long and costing less than $500,000 was the Marsh Road Overcrossing south of Redwood City on the Bayshore Freeway.

F. A. S. Bridge

New Structure Replaces Spans Destroyed in Flood

By ELLIS R. DELBON, Road Commissioner, County of Stanislaus

THE NEW Stanislaus River Bridge on Federal-aid Secondary Route 903 was opened to public travel on June 30, during a brief ceremony conducted by Stanislaus and San Joaquin County Boards of Supervisors with more than 200 people in attendance including other county and city officials from both counties.

This modern two-lane structure, 1,136 feet in length, is the largest of two bridges included in the overall F.A.S. project, which extends approximately 1,200 feet into San Joaquin County and 1,800 feet into Stanislaus County. The shorter bridge was constructed over Dry Slough, approximately 300 feet south of the River Bridge.

The old McHenry Bridge was constructed prior to the advent of the motor vehicle 50 years ago. Its 450 feet of timber trestle approach to the two steel truss spans was washed away during the flood in December 1955. Most of the bridge sections were retrieved as the river receded and with a small amount of additional materials the trestle was replaced by county bridge crews and the bridge reopened to traffic in less than three months with traffic restricted to 10 miles per hour and gross load limit of 14 tons.

The importance of this route to many commuters and heavy freight traffic prompted this county to seek funds from all possible sources to finance a modern facility in its place. A $5,000,000 bridge and highway improvement bond was proposed as a means to finance this project and the reconstruction of several other critically deficient county bridges, and was subsequently approved by the voters in November 1956.

Participating funds from four sources were applied toward construction financing including federal emergency reconstruction funds, as authorized under Section 125, United States Highways Code, Title 23; F. A. S. funds and local funds by the two counties as indicated on the "Plan Showing Breakdown on Project Financing."

A northerly view of County F. A. S. and Flood Relief Project on F. A. S. Route 903 between Modesto and Escalon (in the distance). The old flood-damaged bridge and trestle occupied the diagonal bare area on the left.

An agreement was executed between the San Joaquin County and Stanislaus County Boards of Supervisors in regard to financial participation, with this county to be responsible for administration and engineering of the entire project.

Of the nine construction bids received, Stolte, Inc., was awarded the contract on the basis of their low bid of $439,837 and the project was under way in June 1958 under the supervision of Chris Hansen, representing the contractor, and Bob Wright representing the Division of Highways as resident engineer with engineering assistants assigned to the project by Stanislaus County Road Department.

Dry Slough Bridge, consisting of 12 concrete pile bents with 26-foot spans and two end spans of 17 feet, was completed and opened to traffic on October 3, 1958, with a minimum of inconvenience to traffic over the temporary detour maintained by county forces adjacent to the bridge site.

The Stanislaus River Bridge, consisting of 31 concrete pile bents with 26-foot spans and three box girder spans of 100 feet each, was opened to traffic on June 30, 1959, and the project accepted on August 11, when removal of the old river bridge was completed.

These modern two-lane structures provide a 30-foot-wide roadway between railings on a straight alignment, eliminating a dangerous curve which existed on the superseded alignment, where several major traffic accidents have occurred in recent years.

Silverado Trail

Work Prepares Road For Future Growth

By GEORGE R. REINHART, Director of Public Works and Road Commissioner, Napa County

The Silverado Trail, Federal-aid Secondary Route 607, in Napa County, is one of the two major north-south highways through the famed Napa Valley which extends from the City of Napa to the City of Calistoga. The other route is State Highway 49, Sign Route 29.

This road has great historic significance, particularly as a guide to the development and growth of the Napa Valley and Napa County. Because of its unique physical location it will continue to be one of the key roads in the county road system and will be affected directly by the growth.

The total length of the Silverado Trail as a primary county road is 26.85 miles. For the last 12 years, sections of this route have been reconstructed through the federal-aid secondary road program to provide an improved two-lane facility where there was the greatest need.

Recent Work Cited

The most recent improvement was in the section between Trancas Street, immediately north of the City of Napa, and Soda Canyon Road, a distance of 2.25 miles. Originally this consisted of a 19-foot graded roadbed with a 16-foot concrete roadway. Throughout a large portion of this section there was no room for traffic to pull off the traveled way.

With an average daily traffic count of approximately 1,200 vehicles, a modern 40-foot roadway providing two traffic lanes of 12-foot each with 8-foot shoulders would serve the traffic needs both now and in the near future, but with the anticipated growth in the areas adjacent to the Silverado Trail and the great increase expected in traffic volume within 20 years, it was felt that provisions for this future need should be incorporated into the current design and construction. A typical section for a four-lane divided highway with an ultimate 10-foot median strip and two roadways of 35 feet each was developed. Each roadway would have two traffic lanes of 12 feet each with an outside shoulder of eight feet and an inside shoulder of three feet.

Interim construction of the 40-foot two-lane would require both shoulders to be eight feet wide, but with the median strip, there would be no encroachment into the area of the future additional roadway. When the other roadway becomes necessary it can be built, and with minor revisions, the roadway constructed now will be incorporated into the ultimate highway.

In conjunction with the construction on the Silverado Trail, it was necessary to improve the Hardiman Avenue connection to the trail by the realignment of approximately 630 feet of Hardiman Avenue and the construction of a reinforced concrete slab bridge 62 feet long to replace a low water crossing.

All of the work in the aforementioned section was completed under two contracts during 1958 and 1959, using federal funds provided by the United States Bureau of Public Roads and state funds provided by the Division of Highways supplemented with county funds aggregating approximately $300,000.

Before and after construction views of the alignment at one of the bridges on Silverado Trail, Federal-Aid Secondary Route 607. The new alignment provides large radius curves with smaller interior angles and greater sight distances.

Working On U.S. 40

Contractor's crews finishing asphalt shoulder on Hampshire Rocks to Soda Springs section.

Crew setting guard railing on Boca Bridge approach.

Self-propelled scrapers and bulldozers cutting stabilization trenches near Alta.

Concrete saw cutting joints in new pavement near Soda Springs. Old highway is on level above.

Batch plant in operation near Baxter. This is site for new Whitmore Maintenance Station. Old highway extreme left, new route on fill upper right.

Truck-mounted profilagraph checking smoothness of paving on completed section near Boca.

Sign-raising crew placing freeway signs on recently opened Truckee Canyon portion.

While Division of Highways Photographer Jock Meyerpeter was making the photographs to illustrate this issue's feature on U. S. 40 (page 2), he made photographs of men and machines working whenever he came upon them.

These are some of his photographs.

They give some idea of the many complex operations which are part of the job of building a modern freeway. The operations are particularly complex when the freeway crosses one of the world's great mountain ranges.

Equipment drying out subgrade on new right-of-way between Monte Vista and Baxter.

Marysville Engineer P. R. Lowden Leaves

Perry R. Lowden, Assistant District Engineer of the Marysville District, California Division of Highways, retired November 1 after more than 34 years with the State and a lifetime of highway engineering and construction in California and Nevada.

PERRY R. LOWDEN

Born in Weaverville, Trinity County, Lowden attended grade school in French Gulch, Shasta County, and was graduated from Redding Union High School.

He joined the Division of Highways in 1916 as a teamster and rodman at Dunsmuir. After spending 1918 in France with the U.S. Army, Corps of Engineers, he returned to the Division of Highways at Dunsmuir as a transitman.

From 1920 until 1928 Lowden left state service to work on several highway engineering and construction jobs in California and Nevada.

He returned to the California Division of Highways in 1928 and was assigned to the Redding district where he worked on location, design and construction. In 1937 he transferred to the headquarters office in Sacramento as assistant construction engineer. From 1938 until 1950, when he was appointed to his present position, he worked out of Sacramento as field representative for the Surveys and Plans Department.

Lowden lives with his wife Margaret at 770 Jewell Avenue, Yuba City. They have three children and six grandchildren. His son, Perry, Jr., is an assistant highway engineer in the Design Department of the Marysville office.

A registered civil engineer, Lowden is a member of the Elks and E Clampus Vitus.

Retirement plans include time for his favorite sports of trout fishing, hunting ducks and deer, and touring with his small house trailer.

FREEWAY BENEFITS CITED AT TRAFFIC CONFERENCE

The safety benefits of modern freeways, such as those being constructed in California, were emphasized by publisher William Randolph Hearst, Jr., and by other speakers at the Tenth Annual Governor's Traffic Safety Conference October 7-9 in Sacramento.

The conference was attended by some 1,500 delegates including traffic engineers, educators, law enforcement officers, safety experts, public officials and private citizens from throughout the State.

Purpose of the annual conference is to examine ideas and methods for reducing the accident toll on California's streets, roads and highways.

Hearst, chairman of the President's committee for traffic safety, and Governor Abraham Ribicoff of Connecticut were the featured speakers at the general sessions of the conference.

Speaking at the conference luncheon, Hearst said the present programs of highway modernization and freeway construction, both in California and throughout the nation, should continue without delay.

"A considerable amount of safety is being put into these new roadways," he said. "We have learned that such engineering measures as controlling access, dividing opposing streams of traffic, and eliminating crossings at grade, pay off in lives saved and accidents prevented as well as greater freedom of movement," he declared.

Citing figures prepared for Congress by the National Safety Council, Hearst said that the controlled-access freeways already in use throughout the country "are reducing traffic deaths 700 a year below what they would be without those highways."

Hearst also spoke of California's position of leadership in highway planning matters in the United States.

"It is my understanding," he said, "that your Legislature already has enacted legislation, sponsored by Senator Randolph Collier, that spells out the first long-range master plan for modern highways to be adopted by any of the states."

Discussing future increases in motor vehicle traffic in the United States, Hearst said that "during the next 18 years we are going to see more vehicle-miles of travel in this country than we have seen so far in the 59 years of this century" including the horse-drawn mileage of earlier days. Hearst said preparations should be made now for meeting the traffic problems of the future.

"It is gratifying to me to learn that in this area, too, California is leading the way," he said. "It is my information that you already have at work a legislative study, under the chairmanship of Assemblyman Lee M. Backstrand, looking into the long-range problems of motor vehicle use.

"The idea for your specific study has the support of the business advisory panel of the President's committee for traffic safety. And the general idea that all states should undertake similar studies also has our enthusiastic backing and support and will continue to have," Hearst said.

Ribicoff spoke at the conference banquet and told delegates how strict enforcement practices and stiff penalties for traffic violators have reduced the accident rate in Connecticut.

State Director of Public Works Robert B. Bradford joined Robert McCarthy, director of the Department of Motor Vehicles, and Bradford M. Crittenden, California Highway Patrol Commissioner, in speaking before the commercial vehicle division of the conference.

"Here in California last year," Bradford reported, "motor vehicle travel amounted to 65 billion miles and took the lives of more than 3,500 citizens. Twenty years from now, in 1980, Californians will drive an estimated 200 billion vehicle-miles. This is an increase of over 300 percent.

"This means that we face the stark possibility of more than 10,500 traffic deaths in 1980—unless we can alter the present tragic ratio between miles of travel and fatal accidents.

"Fortunately, in the records on freeway travel we find evidence that the rate of fatalities per mile of travel can be reduced.

. . . Continued on page 56

Report From District I

By SAM HELWER, District Engineer

A portion of the completed first unit of the Redwood Parks Freeway on U. S. Highway 101 north of Dyerville at High Rock Road Undercrossing.

Correction and improvement of critical deficiencies in the District I Counties of Lake, Mendocino, Humboldt, Del Norte and portions of Trinity and Siskiyou reached an unprecedented level since our last report presented in the July-August 1958 edition of this magazine, affording further safety, comfort, convenience and reduction in driving time for the motorist.

Since our last report, 57 projects were completed or started, not including small projects constructed under minor contract procedure. The projects range in scope from major freeway and bridge construction to culvert replacements and minor improvements.

The development of the Redwood Highway to a four-lane freeway continues to be among the prime interests of the area. This is readily understandable because as various units of new freeway are completed there is an increasing awareness of the travel ease afforded by the new sections of freeway as compared to the old and obsolete sections of two-lane highway.

U. S. 101 North

As we tour north along the Redwood Highway, U. S. 101 and U. S. 199, we will see the major improvements completed and under way.

An interim improvement was completed in October 1959 on U. S. 101 in Mendocino County, between 1.3 miles south of Robinson Creek and Smith Street in Ukiah, for a project length of five miles. This project, although to be eventually superseded by a freeway around Ukiah, will, during the interim, provide a better highway and street facility and relieve traffic congestion on State Street (U. S. 101) in Ukiah. The project involved the strengthening of the pavement structure and resurfacing. On a portion of State Street within the City of Ukiah, the roadway was widened by moving back the curbs.

The City of Ukiah participated in the cost of that portion of the work involved in the widening of State Street. The completion of the project resulted in a four-lane street section for the total length of State Street (U. S. 101) in Ukiah. The work was performed by Granite Construction Company, of Watsonville, at a cost of about $473,000.

Another interim project at the of project under construction be- is included in the 1960-61 budget. Studies are being carried on for the eventual freeway around Willits, but a series of curves on the present route from the north city limits to 1.6 miles northerly have reached a high degree of obsolescence. The sum of $175,000 is included in the new budget, providing for grading and paving to ease curves.

From 7½ miles north of Willits, northerly through Long Valley Creek Canyon, four-lane freeway construction is still progressing. In the last report we told of work nearing completion on a 4.2-mile length of improvement from Hilvilla to Irvine Lodge. This has subsequently been completed so with a previously completed project there is now a 6.2-mile stretch of four-lane freeway completed. This is a neat improvement over the obsolete section of two-lane highway that it replaced. This completed improvement is now being extended northerly by a five-mile length of project under construction between Irvine Lodge and Old Sherwood Road, about 4½ miles south of Laytonville. This work is being done by Granite Construction Company of Watsonville at an approximate cost of $2,411,000. Upon completion of the current construction there will be a continuous length of four-lane freeway, for 11 miles, from Reeves Creek to Old Sherwood Road, eliminating entirely the old and particularly deficient section of highway for the full length of Long Valley Creek Canyon.

Old Section Replaced

As we proceed north to old Farmhouse Inn, about 12 miles north of Laytonville, we find that another obsolete section of old Redwood Highway has been replaced by a 2.8-mile length of four-lane freeway extending from Farmhouse Inn to just north of Tan Oak Park, which was completed in August.

This new four-lane freeway replaces another section of obsolete highway with its sharp curvature and narrow roadbed. The old highway created particularly bad winter driving when icy conditions persisted in the narrow and shady canyon of Rattlesnake Creek.

Work on this project was actually started in 1956 when a tunnel was constructed through a rock promontory at Tan Oak Park to divert the course at Rattlesnake Creek where the new highway embankment infringes on the original creek channel. This 136-foot-long tunnel was constructed by Mercer-Fraser Company of Eureka at a cost of $39,000.

The second contract, which completed the project was with Ball and Simpson of Berkeley, California, and involved an expenditure of approximately $2,134,000.

The freeway, constructed in a narrow canyon also containing the meandering course of Rattlesnake Creek and the old highway, posed particular highway design and construction problems. A prime problem was the handling of traffic with a minimum of delay during construction. The narrow confines of the canyon did not permit construction of practical detours. The specifications permitted periodic closure of the highway for four-hour periods during the night for a period of 50 consecutive days in order that desirable construction progress could be maintained. The contractors, Ball and Simpson, did not elect to take advantage of permissible closures and are to be commended for their efficiency and techniques which resulted in traffic going through at all times with minimum delays.

A cleared area prior to grading operations on the second unit of the Redwood Parks Freeway (US 101) between Myers and Dyerville in Humboldt County.

The project involved clearing of 75 acres of land and moving of 900,000 cubic yards of dirt and rock.

Channel Is Changed

To keep Rattlesnake Creek flowing freely, channel changes were necessary and new embankments were protected from erosive currents by 5,900 tons of rock slope protection.

The roadway is a 60-foot-wide all-paved section providing four 12-foot driving lanes, 4-foot division strip and 4-foot shoulders.

The next big freeway project we observe as we proceed northerly is the second unit of the Redwood Parks Freeway in Humboldt County. It extends for 7.5 miles from Myers to just south of Dyerville, connecting with the completed 4.4-mile-long first unit. Three contracts are involved in this second unit with two contracts completed and at this writing good progress is being made on the third contract, which will complete the project.

The first contract provided for the clearing of the area between slope boundaries which amounted to 167 acres.

The area cleared contained a considerable volume of salable timber of various species and of course large redwoods. This timber became the property of the contractor and the timber was sold by him to lumber mills. Under such circumstances the project was a combination logging and clearing operation.

Crosses Park Lands

The logging, however, had to be carried on in a somewhat different manner than usual. The greater portion of the project traverses state park lands and all clearing and logging operations had to be confined within the clearing flags so that all natural growth and trees outside the flags would not be damaged or disturbed in any manner whatsoever. It is therefore obvious that the trees could not always be felled in the most desirable direction or manner.

This clearing work was performed by Don F. Shuster of Willits, California, at a cost of $250,844.

The second contract, on this second unit of the Redwood Parks Freeway, provided for the construction of a reinforced concrete arch culvert at Mowry Creek, a short distance north of Myers.

A view southward showing the new George M. Leatherwood Memorial Bridge on the recently completed first unit of the Redwood Parks Freeway (US 101) at Dyerville in Humboldt County. The old highway bridge can be seen to the left of the new one. (See photo on page 25.)

The arch culvert is 514 feet long with a seven-foot arch. The contractor was John W. J. Petersen, Inc., of Loleta, who performed the work at a cost of $125,600. The work was expedited and an excellent quality structure produced by use of contractor devised, prefabricated steel forms.

The third contract to complete this second unit is now under way. The contract is with Morrison-Knudsen Company on the basis of their low bid of $4,912,329.

The project length is 7½ miles and connects with the completed first unit

The completed first unit of the Redwood Parks Freeway (US 101). This view is southward from above Englewood. The area on the right above the highway is logged off. To the left and below the freeway are virgin redwood groves of State Redwood Park. In the far left is the Eel River.

at Dyerville. Upon completion of the second unit in 1960, there will then be 11 miles of continuous Redwood Parks Freeway.

The work on this third contract consists in general of constructing graded roadbeds, drainage structures, placing plant-mixed surfacing on untreated base and cement treated base over imported subbase material and constructing roadway lighting systems. Four major structures will also be built, being Williford Road Undercrossing, Pesula Road Overcrossing, Weott Undercrossing and Women's Grove Overcrossing. As is usual in District I, there is considerable stabilization work to be done prior to the placing of embankments.

First Unit Completed

In our last report, the first unit of the Redwood Parks Freeway from Dyerville to Englewood was still under construction. It was completed and opened to traffic in the afternoon of October 27, 1958, after appropriate opening ceremonies and dedication of the George M. Leatherwood Memorial Bridge. The program was sponsored by the Humboldt County Board of Trade and the Greater Eureka Chamber of Commerce with numerous dignitaries, state and county officials participating.

The first unit as a forerunner of the eventual 43-mile length of Redwood Parks Freeway results in a startling comparison of the old and the new. Its 4.4-mile length of four-lane freeway replaced a section of original two-lane highway that was critically deficient in all aspects. The old section contained High Rock Hill and Englewood Hill and any appreciable volume of mixed traffic continuously created congestion and delays.

It is anticipated that progress on the 43-mile Redwood Parks Freeway will be continuous until completion. Detailed design work is under way on the third unit extending 11 miles from Sylvandale to Myers in Humboldt County. The location of this unit is across the South Fork of the Eel River from the existing highway in virtually virgin territory at least as far as major highway construction is concerned. The area to be traversed is now served only partially by a county road and logging roads. In order to get drill rigs in for foundation investigations, roads had to be specially constructed in some areas.

In all probability the third unit will be constructed in three phases due to the extent of work necessary and costs involved. The recently adopted 1960-61 State Highway Budget includes an allocation of $1,915,000 for a bridge and approaches at Myers Flat.

Leaving the Redwood Parks Freeway and proceeding north, the next major project, now under way, is the construction of a parallel bridge across the Eel River, about three miles south of Scotia, usually referred to as South Scotia Bridge. The original bridge at the crossing, constructed in 1916, although structurally sound, is seriously deficient in roadway width. It has long been posted as one-way with reduced speed for large trucks and buses.

Parallel Bridge Needed

The project's main purpose is to supplement the existing narrow bridge with a modern parallel structure to relieve the bottleneck of the narrow structure. The existing structure will serve northbound traffic and the new parallel structure will carry the southbound lanes.

The total length of project is seven-tenths of a mile which includes minimum four-lane approaches transitioning to the relatively good two-lane highway at each end of project.

The work is well advanced on the approach and substructure of the

A recent improvement made US 101 through Crescent City in Del Norte County a one-way couplet with four-lane appraaches. This southwest view shows the US 101-Northcrest Drive intersection in the right center.

bridge. The new bridge, a combination river crossing and an overhead across the tracks of the Northwestern Pacific Railroad, will be 998 feet long consisting of two steel truss spans and six welded plate girder spans supported on concrete piers and abutments on concrete and steel pile foundations and spread footings providing a clear roadway width of 28 feet.

The contract on this project is with Erickson, Phillips and Weisberg and Arthur B. Siri, Inc., on the basis of their low bid of $984,227.

In the district's densest traffic area, the Humboldt Bay area, progress in freeway construction is being maintained.

On October 30, 1959, traffic was routed onto a new section of freeway between the northerly city limits of Fortuna and 0.4 mile north of Fernbridge.

A recently completed freeway section on US 101 between Patricks Point and Big Lagoon in Humboldt County. This northward view shows the embankment across Big Lagoon which replaced the former timber trestle.

New Section Opened

This new section of four-lane divided freeway is 3.2 miles long and connects with the southerly end of the four-lane divided expressway over Table Bluff Hill that was opened to traffic last year. Together these two sections north of Fortuna give the motorists a 7.6-mile section of modern, four-lane divided freeway.

The Fortuna - Fernbridge section was built under two separate contracts, the first of which was started in April of 1957. The first contract, totaling $480,300, was completed by Mercer-Fraser Company in May of 1958, and provided three grade separation structures and their approaches. The second contract for grading, surfacing, and other necessary miscellaneous items was completed by the Norman I. Fadel Company at a total cost of $1,278,000. The freeway has four 12-foot traffic lanes, paved shoulders eight feet wide and a 22-foot wide division strip. The Fortuna area will see further activity on development of U. S. 101 to a freeway. The 1960-61 budget provides $910,000 for structures on a 3.9-mile section of freeway between 0.4 mile north of Alton and northerly city limits of Fortuna. This 3.9-mile section will fill the gap between completed sections of freeway, Robinson Ferry Bridge to Alton, and Fortuna to Hookton Road.

There is considerable interest in this dense traffic area to complete the freeway to Eureka at Elk River, just south of the southerly Eureka city limits. Toward this end, plans are completed and the new budget provides $2,590,000 to extend the freeway from the northerly end of the completed freeway over Table Bluff Hill at Hookton Road to just south of Fields Landing, a distance of 3.7 miles. Design work is under way on the balance of 2.7 miles from Fields Landing to Elk River.

From Eureka northerly and through Arcata, there is now 10 miles of continuous freeway. This resulted from the recent completion of a section extending the Eureka-Arcata freeway northerly from the U. S. 101-299 intersection to the intersection of U. S. 101 and Northbank Mad River Road.

This 1.5-mile project was constructed under two contracts. The first contract was completed by Mercer-Fraser Company of Eureka at a cost of $475,000 and provided a parallel bridge and approaches at Mad River. This new bridge will accommodate southbound traffic.

The work on the second contract was performed by Mercer-Fraser Company on their low bid of $801,717. This contract which completed the project, grading and surfacing, also provided for the replacement of the old trestle to the old Mad River Bridge with steel and concrete approaches.

The most northerly of the major freeway projects under construction at this time, is the current construction of a four-lane freeway between Little River and Trinidad, a distance, by new freeway, of 3.7 miles.

All work to complete the project is being done under one contract. Work is covered by 90 contract items from clearing 97 acres, moving 1,200,000 cubic yards of roadway excavation, to providing highway illumination.

Three major structures are included in the work. These are Moonstone Road Undercrossing, Sixth Street Overcrossing and Trinidad Road Undercrossing. This new freeway will supersede another section of originally constructed highway which is now obsolete. Narrow roadbed, sharp and continuous curvature and undulating grade are the characteristics of the old section, together with maintenance problems of slides and slipouts in unstable terrain along the ocean shore.

Crosses Rugged Terrain

The new freeway traverses rugged country cut with deep ravines and is inland for varying distances from the existing highway. Heavy and difficult clearing featured the preliminary work. The terrain traversed was to a great extent cut-over redwood land and therefore numerous large redwood stumps were involved in the clearing operations. These always pose problems in removal and disposal.

The contracting firm, which is making good progress while the sun shines, is John Delphia, Fred J. Early, Jr., & Company, and L. A. & R. S. Crow. Their low bid was $2,288,888.

The motorists in the extreme northern end of the district are also gaining the benefits of freeways and multilane facilities which are replacing old two-lane roadways. In the last report we told of work progressing on the Patricks Point-Big Lagoon Freeway which eliminated the old 4,000 feet long Big Lagoon trestle. The 3.6-mile length of freeway was officially completed on June 25, 1959. It was constructed under two contracts with Norman I. Fadel Company completing the first contract consisting of clearing and grading and Mercer-Fraser Company performing the bridge construction and surfacing as a second contract. The total cost of the project was $1,835,000.

Another multilane facility in the north end of the district was also completed since the last report. This was the one-way couplet on U. S. 101 through Crescent City with four-lane pavement at the southerly and northerly entrances to the city. All work on this project was completed on February 26, 1959, at a cost of $578,000.

An interesting project is developing on U. S. 199 in Del Norte County in the Hazelview Summit area. A complete relocation of U. S. 199 in the area is involved, which includes a tunnel, reducing summit climb, greatly improving alignment and reducing distance. Work will get under way at an early date as the 1960-61 budget allocates $770,000 for the grading at the north approach to the tunnel from 2.5 to 1.1 miles south of the Oregon line.

A new section of freeway on US 101 about 10 miles north of Willits in Long Valley Creek Canyon in Mendocino County.

Looking north along the construction of the freeway on US 101 between Fortuna and one mile north of Fernbridge in Humboldt County.

Lake County Improvements

In Lake County the rehabilitation and reconstruction of state highways has been continuous, affording driving ease and better service to the area.

The 6.3-mile two-lane expressway on Sign Route 53 between Cache Creek and Sign Route 20 which was mentioned in our last report has subsequently been completed.

An exceedingly obsolete section of highway in Lake County on Sign Route 29 was superseded by a project completed in October.

The improvement extends for four miles from Lower Lake Road at the foot of Cobb Mountain to Kelseyville. Long tangents, easy curves and grades superseded the old kinky curvature combined with grades and narrow roadbed. The work was carried on in an excellent manner and at a rapid pace by the Baun Construction Company of Fresno at a cost of about $366,000.

The complete improvement by relocation, reconstruction and/or resurfacing of Sign Route 20 through Lake County continuous to the Mendocino County intersection with U. S. 101 resulted when a portion of the route in Lake County was resurfaced this summer. The resurfacing was applied for a distance of 14½ miles from junction with Sign Route 53 easterly to Lake-Colusa county line.

Further improvements of Sign Route 53 from foot of St. Helena grade to Middletown will be undertaken at an early date. A 4.2-mile project is allocated $625,000 in the 1960-61 budget for construction of a two-lane freeway between St. Helena Creek and Middletown. Design work is also underway, on what will probably be the last gap in the total improvement of Sign Route 53 within Lake County. This is a section 4.3 miles in length between Harris Creek and Lower Lake.

Sign Route 1

On the Shoreline Highway, Sign Route 1, along the Mendocino coast the replacement of substandard bridges has continued to feature the improvement program. This has been a continuing effort since the route was included in the state highway system in 1933.

This northward view of Clearlake Highlands Road in Lake County shows a portion of the new Sign Route 53 relocation between Cache Creek and the Sign Route 20 intersection.

During the year two major structures were completed. The Gualala River Bridge project at the Sonoma-Mendocino county line was completed, at a cost of $570,000. The construction of the 584-foot-long structure with approaches resulted in a new facility one mile long replacing an old timber structure with very substandard approaches. The work was done by Peter Kiewit & Sons.

A departure from the numerous bridge replacement projects on Sign Route 1 along the Mendocino coast will take place next year. The narrow highway along the precipitous ocean bluffs just south of Navarro River, will be replaced by a 1.5-mile relocation. The 1960-61 Budget provides $410,000 for the work.

The budget also provides $735,000 for construction of a new bridge and approaches at Big River, just south of Mendocino, on Sign Route 1. The existing Big River Bridge is one of the old original bridges on the route; which structure has had major repairs several times and has reached a stage beyond further repair.

In September of 1958, a contract was awarded to Bos Construction Company of Berkeley on the basis of their low bid of $295,664 for construction of a new bridge and approaches at Pudding Creek at north city limits of Fort Bragg. The work on this project was completed in July of 1959.

The old 572-foot-long timber trestle structure was replaced by a reinforced concrete bridge 321 feet long. The bridge consists of eight precast prestressed concrete deck unit spans supported on reinforced concrete pile bents and concrete abutments. The new structure with approaches made a project 0.6 mile long.

Other smaller deficient bridges on the route also received attention. On Wages Creek Bridge, 17 miles north of Fort Bragg, a new concrete deck was constructed at a cost of $9,000.

One project consisted of the replacement of old deficient culverts at 20 locations and another replaced an old log culvert at Dunn Creek with a field-assembled plate culvert.

Other projects sometimes considered minor but yet contributing to the overall improvement to the route have been completed or are underway. Two old cattlepasses in the vicinity of Albion were replaced by modern structures.

In an endeavor to bring all appurtenances up to state highway standards on the section between Westport and Leggett Valley two culvert projects are underway. One project is replacing old deficient culverts at 20 locations and another replaces an old log culvert at Dunn Creek with a field-assembled plate culvert.

U. S. 299

On U. S. 299 the major activity is a continuing effort on the improvement of this route by the Honor Camp 42 forces.

Work is now progressing in the Green Point area. The work generally involved a major relocation of the route between North Fork Mad River and Berry Summit.

Grade has been completed with select material placed on a relocation between Preston Ranch, the location of Honor Camp 42, and intersection of relocation with existing 299 at Lord-Ellis Summit, a distance of one mile. This new grade is not yet in use by regular traffic, but serves as access to Camp 42.

A southward view of the Sign Route 53 relocation in Lake County showing the south end of Clear Lake in the background.

Grading on a portion generally crisscrossing the existing highway has for the larger part been completed from Lord-Ellis Summit easterly to Green Point, a distance of 2½ miles. A greater portion of the new grade has been bituminous treated and is in use by U. S. 299 traffic.

From Berry Summit to Willow Creek a series of contracts by the United States Bureau of Public Roads, as a forest highway improvement, completely modernized the section of highway. Work was completed in the late summer of 1958 by replacement of plant-mixed surfacing.

Sign Route 36

The portion of Sign Route 36 within District I, being from Alton to Peanut, was improved to a large extent by the reshaping of the roadbed and the application of a bituminous penetration treatment from Butte Creek to Peanut, a distance of 37 miles. This work was accomplished at a cost of $70,500. This project resulted in oil surface on the total length of the route within District I.

A project 1.2 miles west of Bridgeville, with a project length of 0.6 mile, eliminated a particularly deficient section of highway. The project involved grading and surfacing to modernize grade and line. Work was done by Marlin Tryon of Fort Dick at a cost of $90,000.

In addition to the construction program carried on during the past year there were seven storm damage repair projects completed with the improvement program.

The projects involved an expenditure of approximately $1,500,000. The projects were at various locations throughout the district and involved restoration and repair of damage resulting from the early 1958 storms.

Further improvements on S. S. R. 36 are scheduled for the coming year. Two bridge replacement projects at Little Laribee and Butte Creeks, east of Bridgeville, have a total allocation of $137,000 in the 1960-61 Highway Construction Budget. From 9.6 miles to 11.1 miles east of Bridgeville, a 0.4-mile-long project will result in realignment and construction of two cattle-passes. The sum of $65,000 is included in the new budget for that project.

U. S. 101, 299 and Sign Routes 20, 36, 128 and Bull Creek Park Road all had restoration projects which not only restored roadways and appurtenances, but generally insures against further damage by future storms.

Other Work Listed

The major projects tend to overshadow the numerous smaller projects, both in scope and expenditure, yet these smaller projects individually and in aggregate result in noticeable improvement and better service and efficiency.

We might mention some of the projects in this category.

On U. S. 101 in the Laytonville area, four reinforced concrete box culverts are being extended to eliminate roadway width restriction and permit a continuous desirable shoulder width.

On the first unit of the Redwood Parks Freeway on U. S. 101 at the Dyerville interchange highway lighting was installed greatly adding to the safety, comfort and convenience of night driving.

On U. S. 101 at the northerly end of the Pepperwood tangent a sudden sharp curve with restricted roadway width due to adjacent large redwood trees was eliminated by removal of several trees, easing curve, and widening.

On the southerly end of the freeway over Table Bluff at intersection of the old highway to Loleta, highway lighting was installed to facilitate nighttime traffic movements.

At the intersection of U. S. 101 and U. S. 299 just north of Arcata a proj-

. . . Continued on page 56

Recent Retirements From Division of Highways

Headquarters

Elrod R. Bradt, Assistant Highway Engineer, 30 years; George T. McCoy, State Highway Engineer, 32 years; Wm. C. McNeely, Assistant Highway Engineer, 45 years.

District I

Adolphus Boyd, Skilled Laborer, 25 years; George Dawe, Laborer, 9 years; Fred Trimble, Laborer, 25 years; Dora F. Stull, Intermediate Clerk, 6 years.

District II

Percy C. Crawford, Highway Equipment Operator-Laborer, 25 years; Ambrose J. Dooley, Laborer, 28 years; Cyril Gould, Highway Equipment Operator-Laborer, 26 years; James R. Owens, Laborer, 21 years.

District III

Ralph C. Abernathy, Laborer, 22 years; Walter M. Barnes, Highway Foreman, 36 years; Walter J. Butz, Highway Foreman, 40 years; Isaac Cormier, Laborer, 29 years; Marvin R. Miller, Assistant Highway Engineer, 26 years; Clyde W. Rust, Highway Superintendent, 43 years; Malion P. Wallace, Highway Equipment Operator-Laborer, 26 years; Frank E. Wilson, Senior Highway Engineer, 31 years.

District IV

Sterling Cloughley, Administrative Assistant, 15 years; Patrick A. Devine, Assistant Highway Engineer, 3 years; Herman E. Grosser, Highway Foreman, 37 years; August J. Handman, Laborer, 4 years; Warren McCullen, Highway Equipment Operator-Laborer, 22 years; George W. Otto, Highway Equipment Operator-Laborer, 26 years; George L. Vann, Laborer, 18 years.

District V

Robert L. Cate, Lead Groundsman, 9 years.

District VI

Howard F. Briggs, Senior Highway Engineer, 40 years; Earle R. Bunker, Supervising Right-of-Way Agent, 23 years; Ergen Craun, Associate Highway Engineer, 33 years; Edward J. Kahl, Highway Equipment Operator-Laborer, 26 years; Oda L. Mackie, Laborer, 22 years; Verne Simpson, Highway Foreman, 38 years; John J. Steinman, Associate Right-of-Way Agent, 28 years; Walter P. Stewart, Highway Leadingman, 26 years.

District VII

Roy E. Bruce, Highway Equipment Operator-Laborer, 23 years; Earle H. Dewing, Senior Highway Engineer, 29 years; Robert H. Galbraith, Highway Equipment Operator-Laborer, 22 years; Felix Jeunnette, Watchman, 10 years; Matthew Leipniker, Delineator, 6 years; Kenneth D. Lewis, Assistant Highway Engineer, 35 years; Russell Madden, Highway Equipment Operator-Laborer, 25 years; Ernest R. Scott, Assistant Highway Engineer, 26 years; Erwin O. Tagley, Laborer, 25 years; Warren E. Wescott, Sr., Highway Field Office Assistant, 21 years; Clarence Zook, Highway Field Office Assistant, 23 years.

District VIII

Ernest A. Bannister, Associate Highway Engineer, 39 years; William T. Gustin, Laborer, 20 years; Harry Isherwood, Plumber, 28 years; Thomas E. Smith, Highway Equipment Operator-Laborer, 30 years; Sidney J. Winter, Highway Equipment Operator-Laborer, 26 years.

District X

Costanzo M. Cicconi, Sr., Laborer, 22 years; Lum Hayhurst, Laborer, 24 years; Louis H. Kahl, Highway Superintendent, 24 years; Albert J. Kerner, Drawbridge Operator, 27 years; Thomas M. Sommer, Highway Foreman, 23 years; Arthur L. Stevens, Drawbridge Operator, 29 years; George Trekos, Deckhand, 6 years; Walter M. Warner, Highway Equipment Operator-Laborer, 20 years.

District XI

Cary D. Klump, Highway Foreman, 24 years; Howard E. Porter, Highway Equipment Operator-Laborer, 16 years.

State-owned Toll Bridges

Leo N. Idle, Assistant Steel Inspector, 19 years.

New Standard 'Specs' Revision Is Ready

A new edition of the Standard Specifications of the California Division of Highways dated January 1960 has been issued.

This new edition is the result of a year and a half of intensive work by many members of the staff of the Division of Highways and incorporates the latest ideas and developments in highway design and construction practices.

A number of meetings were held with organizations representing contractors, materials producers and equipment manufacturers before the final edition was printed. The result of these meetings has been to improve and bring up to date many of the specifications.

The new Standard Specifications supersede the previous edition which was dated August 1954 and will be effective for contracts to be awarded after January 1, 1960.

Copies of the new Standard Specifications may be purchased from the State Printing Plant, Printing Division, Document Section, Sacramento 14, California, at a price of $1.50 including sales tax for the paper-covered copy and $2.60 including tax for the flexible cloth binding.

Headquarters Office

Katherine Reid, Delineator, 7 years; Ray A. Dolliver, Storekeeper, 16 years.

Materials and Research

Louise Hawkins, Intermediate Stenographer-Clerk, 13 years; Alberta Weekley, Janitor, 6 years.

Shop 2

Albert T. Housman, Auto Mechanic, 23 years.

Shop 4

Henry R. Hallgren, Auto Mechanic, 15 years; Oscar A. Kamp-

. . . Continued on page 56

Hangar being moved. Note block and tackle method. Projecting ends of H columns for bin frameworks may be seen beneath building.

Record Move

Navy Hangar Relocated For Webster Street Tube

California claims the biggest building move on record in the relocation of an old airplane hangar in Alameda from the right-of-way for the new Webster Street tube. The move, completed this year, was a three-way cooperative effort between the Navy, which uses the building as a warehouse, the Division of Highways, and the Division of Architecture.

The hangar, built in the 1930's to serve the now vanished "East Bay Airdrome," was 601 feet long, 120 feet wide, 60 feet high, and weighed 1,100 tons. California engineers estimate it to be 40 percent bigger than the hangar recently moved in Massachusetts, which was claimed at the time to be the largest building ever moved.

The huge structure had to be moved 1,200 feet. Furthermore, the new site the Navy had for it would not accommodate its 600-foot length, but could take a wider building. To fit the site, the hangar was cut in two, and the halves placed side by side.

In making the move, the contractor, Montgomery House Movers of Oakland, used enough timbers, rollers, blocks and other wood to build 12 average size houses. Under the center columns, 24-inch I-beams 40 feet long, with standard railroad rails welded to them for the full length, were used for additional support against deflection.

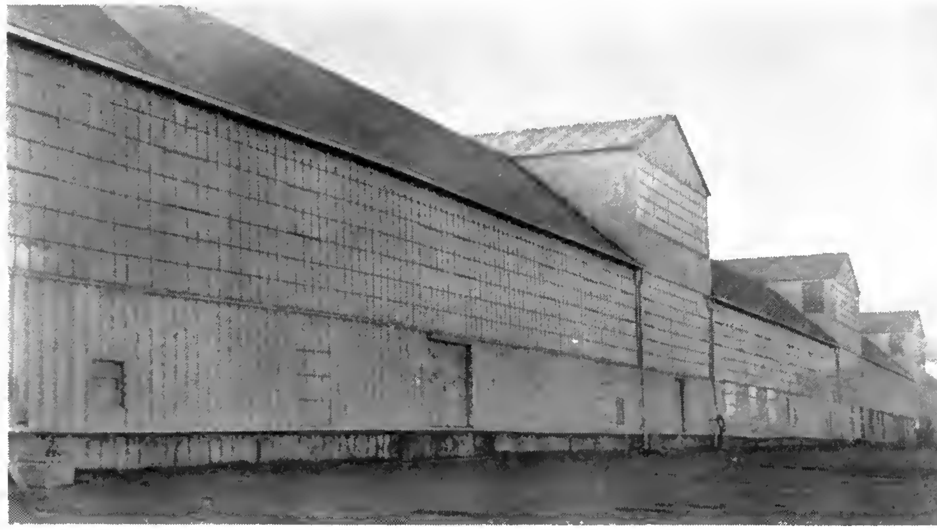
The contractor's big worry was wind. Without any substantial cross-bracing, with two sides and an end open, and the sides resting on piers without foundations, a gale could have lifted one of the big sections and reduced it to broken glass and scrap metal in a few moments. A light gale did rise once during the operation, but emergency crews were able to brace the building before the wind could distort it.

The path of the move was difficult, also. Not only was it necessary to move and replace fire hydrants, electric wires, and other installations, but a group of big scrap metal bunkers were squarely in the middle of the only feasible path. These were built on large H columns set in concrete slabs, and it was necessary to burn off the columns with acetylene torches, remove the bins, then weld the columns in place again afterward.

Rolling doors comprised most of the south wall of the building, and the remainder of the walls were steel sash and metal siding. The Navy required that the relocated building have sliding doors on both the north and south sides and that each side be similar in appearance.

After the building was cut in half, one of the halves was moved to the new position, then the other half was rotated 180 degrees as it was moved. This left the sliding doors on the two outer sides of the sections.

It was necessary to leave 12 feet between the two sections for the contractor's equipment to operate. A new flat steel deck roof with a waterproof membrane was built over this opening, joining the two sections and enclosing the roof space.



"Before" photo of building. Center dormer was removed entirely. (U. S. Navy photo.)

The open ends of the two halves were enclosed with steel sash and new corrugated metal siding. These end walls are supported on a new system of columns and girts. The roof framing also was altered to provide new lateral bracing to resist wind forces on the new end frame. A new concrete foundation, supported on 7,656 lineal feet of creosoted wood piles, was constructed at the new site.

Plans and specifications for the project were prepared by the California Division of Architecture. Construction work was supervised by the California Division of Highways. Peter Filipovich was resident engineer for the project under the general supervision of V. O. Smith, District IV Construction Engineer. Right-of-way negotiations were under the general supervision of F. J. Kane, Supervising Right-of-Way Agent.

Slab floor of old building settled seriously on tide land fill. Archie Prescott of Navy Public Works here shows where supplementary asphalt ramp had to be built to accommodate warehouse rolling stock.

Floor actually sank beneath foundation footings in places. Pile cap is almost exposed at this point.

IN MEMORIAM

Division of Highways

Headquarters

William W. McBeath, Photocopyist.

District I

Earl Klein, Highway Leadingman.

District II

Eugene P. Godman, Highway Equipment Operator-Laborer.

District III

Guy E. White, Highway Leadingman.

District IV

Charles K. Boyle, Highway Engineering Technician; George W. Loehr, Intermediate Clerk; Harvey J. Potter, Highway Leadingman; Denzil F. Squire, Highway Equipment Operator-Laborer.

District VI

Clyde F. Johnson, Highway Superintendent; Joseph T. Landers, Assistant Highway Engineer; Cecil A. Massie, Highway Equipment Operator-Laborer; Walter D. Stone, Highway Leadingman.

District VII

E. Brooks Currey, Sr., Supervising Highway Engineer; John Lowell Henderson, Highway Engineering Technician; Albert J. Janulaw, Highway Landscaping Leadingman; Keith G. Loeser, Highway Equipment Operator-Laborer; Kenneth Thornhill, Assistant Right-of-Way Agent.

District VIII

Cecil C. Monroe, Highway Equipment Operator-Laborer.

District IX

Mary E. Blake, Engineering Aid.

District X

Darrell J. Black, Highway Equipment Operator-Laborer; George A. Bledsoe, Laborer; Jack M. Garrison, Drawbridge Operator; Edmund A. Peard, Highway Equipment Operator-Laborer; Louella C. Ritter, Accounting Technician.

Bridge Department

Walter K. Kemp, Assistant Bridge Engineer.

State-owned Toll Bridges

William R. Shaw, Structural Steel Painter.

Headquarters Shop

Myrl Fleming, Mechanic's Helper; John A. Ruggs, Fusion Welder.

Shop 9

Roy L. Nerren, Laborer.

Division of Contracts and Rights-of-way

Norris J. Burke, Attorney.

Resident Engineer K. D. Lewis Retires

K. D. Lewis, long-time resident engineer with District VII, recently retired from state service. He was born in La Verne, California, on August 3, 1902, one of a family of four brothers and five sisters. He attended grade school and high school in Turlock in the San Joaquin Valley, where he was later employed as a packinghouse hand and grocery clerk. He entered state service on August 15, 1923, as chainman and rodman in District IV, San Francisco, then transferring to jobs in Eureka and at Lake Tahoe; in 1932 he was assigned to District VII, where he remained until his retirement. While in the Los Angeles office, he worked on road construction projects in Topanga Canyon, the Conejo Grade, Lincoln Boulevard in Santa Monica, Manchester Boulevard in Inglewood, Palmdale and the Ridge Route.


K. D. LEWIS

Joining K. D. Lewis in his new dairy homestead in Oakdale, Stanislaus County, are his wife, Myrtle Joanna, and daughters, Marsha and Myrtle.

Mules are being used to transport fencing materials in the rugged mountain terrain encountered on a highway project between Lemon Cove and Three Rivers in Tulare County.

Road Conference Set At UCLA Jan. 28-30

State Director of Public Works Robert B. Bradford will head a group of 10 department employees taking part in the Twelfth Annual California Street and Highway Conference on January 28 to 30, 1960. The conference, which is sponsored by the Institute of Transportation and Traffic Engineering of the University of California, will be held at the U. C. L. A. campus in Los Angeles.

Ellis Armstrong, Commissioner of the U.S. Bureau of Public Roads, is scheduled to deliver the keynote address at the opening session of the conference. The legislative view of the California highway program will be presented by State Senator Randolph Collier of Yreka and Assemblyman Lee M. Backstrand of Riverside. The welcoming address will be given by L. M. K. Boelter, Dean of the College of Engineering at U. C. L. A.

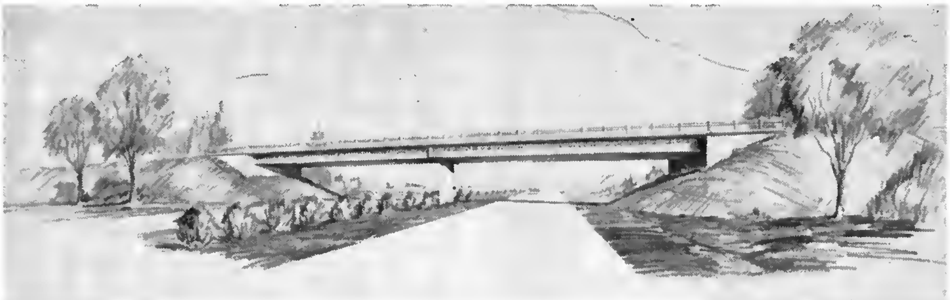
General chairman of the conference is Victor W. Sauer, Director of Public Works for Contra Costa County.

The other nine public works employees who will participate are:

Edward T. Telford, Assistant State Highway Engineer, District VII; H. B. LaForge, Engineer of Federal Secondary Roads; Frank E. Baxter, Maintenance Engineer; Karl Moskowitz, Assistant Traffic Engineer; R. J. Israel, Assistant Traffic Engineer; Cal Kiedaisch, Engineer of Federal Secondary Roads for the Bridge Department; Luis Aramayo, Assistant District Engineer of District II, all Division of Highways employees; Harry S. Fenton, Assistant Chief Counsel of the Division of Contracts and Rights of Way; and John H. Stanford, Management Analyst of the Department of Public Works.

During October, the Highway Commission completed allocations for 1959 from the $5,000,000 Grade Separation Fund, established by the Legislature in 1957 as a yearly appropriation from the State Highway Fund. $4,990,789 will be used to construct seven grade crossing structures which are not on the State Highway System. The remaining $9,211 of the fund has reverted to the State Highway Fund.

Bridge Entry Wins $5,000 Award for Three Engineers



The winning entry submitted by Jurkovich, Fraleigh and Shulman. Each of the spans is 80 feet long, making a total bridge length of 160 feet. According to the designers, the outstanding advantage of their entry is that, because of the single support column, the entire pier can be rotated to eliminate any skew without encroaching on either the horizontal or vertical clearance requirements.

Three Division of Highways bridge engineers were named winners of the $5,000 second honorable mention award in the professional category of the Steel Highway Bridge Design Competition sponsored by the American Bridge Division of U.S. Steel. William J. Jurkovich, Senior Bridge Engineer, and Douglas M. Fraleigh and Marvin A. Shulman, Associate Bridge Engineer, shared the cash award for their joint entry (shown in the accompanying photo).

WILLIAM J. JURKOVICH

The competition, which offered 15 professional and student awards totaling $44,000, attracted 300 entries from the United States and abroad. Judging was under the auspices of the American Institute of Steel Construction.

Jurkovich won his B.S. in civil engineering at the University of California in 1943 and came to work for the division in 1946. Since 1953 he has supervised the operation of the design section of the Bridge Department in the preparation of contracts, plans and estimates. At present he is working on the suspension bridge across the Los Angeles Harbor between San Pedro and Terminal Island.

DOUGLAS M. FRALEIGH

Fraleigh received his B.S. in civil engineering from the University of Kentucky in 1951. At present he is assigned to bridge and grade separation structure design and the design of welded towers for a proposed suspension bridge.

Shulman received his civil engineering degree from the University of California in 1951 and joined the Bridge Department the same year. His latest work has been as project engineer in preparation of contract plans for various types of bridge structures. He won first honorable mention in the AISC competition in 1957 for a design for the Trinity River Bridge.

MARVIN A. SHULMAN

Harry B. Milner

Harry B. Milner, Assistant Design and Planning Engineer of the Division of Highways headquarters office in Sacramento, died of a heart attack on October 21.

As a member of the design staff, Milner carried out preliminary investigations of the district plans for highway improvements and the status of plan production. He was also responsible for the review of the location and design of many projects submitted by the districts to the headquarters office.

A native of Clifton, Arizona, Milner attended public schools in Reno, Nevada. After working for the Nevada Highway Department and the U. S. Bureau of Public Roads, he came to work for the California Division of Highways in 1929 as an assistant resident engineer and later as a resident engineer.

From 1943 to 1945 Milner served as a lieutenant commander with the U. S. naval construction battalions in the United States and Europe.

He was promoted to Assistant Design and Planning Engineer in 1949.

Milner is survived by his wife, Marion, and a daughter, Mrs. Constance Felton, of Redding.

Bids were opened December 8 for steel work on a six-story addition to the Public Works Building in Sacramento.

Koritz Named Editor of Highway Magazine

Effective with this issue, the editor of *California Highways and Public Works* is Lester S. Koritz, former newspaperman and a public information officer in state service since 1948.

A native of Boston, Koritz began his newspaper career in that city, but left it for California in 1931. He returned to newspaper work after graduation from the University of Southern California, serving on the staff of the Santa Barbara *News-Press* from 1938 to 1948 (except for three years of military leave).

He served in Army combat intelligence in World War II from 1943 to 1946, including campaigns with the 28th and 86th Infantry Divisions in the European Theater of Operations. He was released from active duty as a first lieutenant.

Koritz entered state service in 1948 as public information officer for the Department of Veterans Affairs, and transferred to the Division of Highways in 1951.

As editor of the magazine, Koritz succeeds Richard Winn, who resigned from state service in October to become manager of the Public Information Department of the Los Angeles Metropolitan Transit Authority.

'Freeways For You' Display Wins Fair Award

"Freeways for You—Now and in 1980" was the theme used in the California Division of Highways exhibit at the California State Fair in Sacramento in September. Featured were two finely detailed models of city freeways—one showing a section depressed below ground level and the other a fill and viaduct section above ground level. Ultimate landscaping and relationships with the surrounding neighborhood were carefully delineated. It is estimated more than a hundred thousand people visited the exhibit during the 13-day State Fair run. The large wall map showed the routes included by the 1959 Legislature in the state highway system for freeway and expressway development between now and 1980.

Staff engineers of the Division of Highways were on hand to answer the numerous questions of the fairgoers and to distribute booklets on freeway planning and right-of-way procedures.

The display won second place in the Business and Professional Services Division judging of State Fair exhibits.

POSTS FILLED

Continued from page 20 . . .

office in Sacramento, as Photogrammetric Engineer.

Funk has been identified for many years with the expanding use of photogrammetry in highway location and design work. Earlier this year he won a national award for his contributions to photogrammetric science.

At the end of October, construction contracts totaling $139,000,000 were in force under supervision of the Division of Architecture.

Regular monthly traffic counts for October 1959 show an increase of 6.0 percent over October 1958, but a decrease of 4.1 percent under September 1959. Based on an average of the last five years, October counts have shown a decrease of 5.4 percent under September. Comparing October 1959 with October 1958, passenger vehicles show an increase of 6.4 percent and freight vehicles show an increase of 3.8 percent. Freight vehicles represented 18.0 percent of the total weekday traffic.

Sam Osofsky

Sam Osofsky, Highway Economist for the Division of Highways in Sacramento, died on October 25 following a short illness.

He played a major role in developing procedures for handling engineering computations for the division on punched card tabulating machines and on magnetic drum data processing equipment. He twice received honorable mention by the L. I. Hewes Award as a member of a team engaged in developing new techniques in this field.

A graduate in electrical engineering from the University of California at Berkeley, Osofsky came to work for the Division of Highways as a statistician in 1934. He supervised the Statewide Motor Vehicle Use Survey and the metropolitan origin and destination surveys made by the division.

A native of New York City, he attended city schools in Sacramento. During World War II he served as a navigator with the U. S. Air Force.

He was a member of the Western Governmental Research Association, the Institute of Traffic Engineering and the American Statistical Association.

He is survived by his wife, Pearl, and son, Raymond Carl.

NEW DEPUTIES

Continued from page 19 . . .

the Sacramento Bureau of the San Diego *Union* for the past seven years. He was previously a reporter for the San Diego *Union*, the Chicago *Daily News* and the Chicago *Tribune* and night editor of the Chicago City News Bureau.

Cooper was born in Kansas City, Missouri, in 1917 and studied at the University of Pittsburgh and the University of Minnesota. He served in the Marine Corps during World War II and the Korean campaign.

Cooper, his wife, Grace, and their two children live at 1124 45th Street, Sacramento.

New Budget

Allocations for 1960-61 Reflect Slowdown in Federal-aid Program

The California Highway Commission in October adopted a $569,243,867 State Highway Budget for the 1960-61 fiscal year.

The budget contains $452,784,507 for state highway construction purposes including rights-of-way.

The budget for the current fiscal year, adopted by the commission in October 1958, contained a gross total of $610,711,852, of which $497,000,000 was for construction and rights-of-way.

State Director of Public Works Robert B. Bradford, chairman of the commission, said that the decrease from the 1959-60 budget totals is due to a reduction in the federal highway apportionment for 1960-61.

The total federal highway apportionment to California for 1960-61 is $227,708,867, of which $181,086,840 is for work on routes included in the National System of Interstate and Defense Highways.

The 1959-60 federal apportionment was $302,020,852, including $252,779,750 for interstate highways.

"Although our federal share is about $74,000,000 less than for 1959-60," Bradford said, "the estimated revenue from state sources is up approximately $33,000,000 from the current year's budget estimates, as a result of constantly increasing motor vehicle registration and use.

"This increasing traffic, a reflection of California's continuing explosive growth, makes the stretchout of the federal highway program particularly hard on our State. It was simply not possible to include in this budget many urgent projects which are badly needed right now for safety and relief from congestion.

"We don't like to have to trim our sails on this vital program of highway improvement, but since the federal financing problem has made it necessary I think we have the best budget currently possible. It is based on sound, orderly long-range planning to meet future as well as current needs."

Tax Sources Listed

Major sources of state-collected highway revenue expected for the 1960-61 fiscal year include: $253,500,000 in gasoline taxes (up $20,400,000 from the previous year's estimate); $53,000,000 from motor vehicle fees (up $8,700,000 from previous year's estimate); $22,300,000 from the use (diesel) fuel tax (up $2,000,000 from previous year); and $11,500,000 from transportation taxes on for-hire carriers (up $1,500,000).

The budget contains $53,299,360 for functions other than state highway work.

The largest item in this category is $34,257,000 for major city streets other than state highways based on five-eighths cent per gallon of the state gasoline tax. Other nonstate highway items are:

Federal aid for county roads on the federal-aid secondary system, $8,388,160; state funds to counties for use in matching these federal funds, $4,254,200; state funds for matching city and county funds for elimination of railroad grade crossings on local streets and roads (not state highways), $5,000,000; and engineering funds for cities, $1,400,000.

$87,750,000 to Counties

Bradford pointed out that California's 58 counties receive 1⅜ cents per gallon from the State's 6-cent per gallon gasoline tax, plus a portion of the state motor vehicle fees. These funds are not listed in the State Highway Budget because they are disbursed directly by the State Controller. For the 1960-61 fiscal year these state funds for county roads will total an estimated $87,750,000. Another $1,100,000 per year in gasoline tax funds is earmarked by state law for airports and small craft harbors.

The $452,784,507 in the budget for highway construction purposes includes:

Major construction and improvement (contracts plus engineering), $317,519,000; rights-of-way, $121,787,304; contingencies (normally available for construction purposes), $6,178,203; resurfacing program, $5,000,000; signs and striping, $1,500,000; and minor improvements, $800,000.

Proposed expenditures for state highway purposes other than construction include: Maintenance, $37,200,000; buildings and plants, $8,000,000; administration, $10,300,000; statewide highway planning survey, $3,000,000; maintenance of state toll bridges, $2,800,000; and honor camps, $1,750,000.

The 1960-61 budget contains 29 landscaping and planting projects. The total budgeted for these projects is $4,582,000, an increase of more than $500,000 over the amount budgeted for such purposes a year ago.

Other significant features of the 1960-61 budget are as follows:

Los Angeles Region

The 1960-61 State Highway Budget provides for $84,886,000 in highway construction in Los Angeles, Orange and Ventura Counties, the three counties which make up District VII of the Division of Highways.

The budget also contains $61,565,000 for the purchase of rights-of-way in this three-county region, including $18,000,000 for the Santa Monica Freeway and $14,600,000 for the San Diego Freeway, both in the Los Angeles area.

Construction emphasis in Los Angeles County is centered on the San Diego Freeway, the Golden State Freeway, and on other key routes in the basic metropolitan freeway network.

Two budgeted projects on the San Diego Freeway, estimated to cost $13,700,000, together with an $8,600,000 project for which the commission last week voted 1959-60 funds, will complete the San Diego Freeway for nine miles from the Long Beach Freeway to 174th Street, including the interchange with the Harbor Freeway.

Another San Diego Freeway project will complete freeway development through the Santa Monica Mountains. This $13,950,000 job will connect with completed freeway sections to provide 14.3 miles of continuous freeway from Jefferson Boulevard in Culver City to Burbank Boulevard, north of the Ventura Freeway. In addition, this project includes grading for future freeway construction northward to Nordhoff Street.

Additional grading in the San Fernando area is included in a $14,000,000 project which also provides for freeway and interchange construction on the Golden State Freeway.

Funds are budgeted for interchange and freeway construction at the future Ventura-Golden State Freeway junction, and for the extension of the Hollywood Freeway north from the Ventura Freeway.

On the Santa Monica Freeway, a budgeted project includes the final portions of the Santa Monica-Harbor Freeway interchange. Together with current and previously budgeted projects, this job will complete freeway development between the Santa Ana and Harbor Freeways.

The budget also contains allocations for grading on the route of a future U. S. Highway 6 freeway southwest of Palmdale; for freeway construction on the Glendale Freeway, and for widening a one-mile section of the Santa Ana Freeway to eight lanes.

Eight landscaping and planting projects costing an estimated $1,525,000 are included in the budget for Los Angeles County.

The largest budgeted project in Orange County is the first unit of the Newport Freeway between the Santa Ana and Riverside Freeways. The budget also contains large allocations for the purchase of rights-of-way on the Newport and Garden Grove Freeways.

More than $11,000,000 is allocated for construction and rights-of-way in Ventura County, including $6,500,000 to complete freeway development on U. S. Highway 101 through Ventura.

San Diego Area

In the San Diego area, the budget contains $5,800,000 to provide structures and sections of roadway for a future north-south freeway on U. S. Highway 101 in San Diego. Also budgeted are a project to provide structures and grading on a future U. S. 101 freeway route north of San Diego, and a 5.5-mile freeway project on State Sign Route 78 west of Escondido.

Funds are allocated for 6.9 miles of freeway on U. S. Highway 80 through the sand hills east of Holtville, Imperial County.

Riverside-San Bernardino

Freeway development in the Riverside-San Bernardino area will be continued with the budgeting of large-scale freeway projects in this region.

Two projects on US Highway 70-99, estimated to cost $16,200,000, will provide 11 miles of continuous freeway through the Redlands area.

The budget also contains $800,000 to convert the Riverside Freeway from expressway to full freeway in and north of Riverside; $506,000 for approaches to the Colorado River Bridge now under construction near Blythe; and a total of $620,000 for two interchanges, one on the San Bernardino Freeway west of Colton, and the other on US 60-70-99 near Thousand Palms.

In addition to these projects, the Highway Commission last week voted $2,900,000 in 1959-60 funds to complete the financing on the previously budgeted 7.1-mile freeway project on the Riverside Freeway through Corona. Total allocation for this project is $7,184,000.

San Francisco Bay Area

The 1960-61 budget contains $17,800,000 for three large-scale freeway projects in the vicinity of Oakland, and another $10,000,000 for a third two-lane tunnel (Broadway Tunnel) on State Sign Route 24 at the Alameda-Contra Costa county line.

Two of the freeway projects are on the MacArthur Freeway (US 50). These projects, together with a previously budgeted job, will complete freeway development from the East Bay Distribution Structure to 14th Avenue. The third freeway job involves widening to eight lanes on a 5.6-mile section of the Nimitz Freeway (Sign Route 17).

A $6,000,000 project on the Southern Freeway in San Francisco will provide eight-lane freeway for 1.3 miles between Ocean Avenue and Mission Street. Landscaping along 3.5 miles of San Francisco's Central and James Lick Freeways is covered by an allocation of $460,000.

The budget contains $5,450,000 for 6.1 miles of freeway construction on the Bayshore Freeway north of San Jose. This job, together with projects now under construction or previously budgeted, will complete the Bayshore Freeway for 48.5 miles from San Francisco to San Jose.

The budget also provides funds for freeway construction on US Highway 40 north of Vallejo, on the Vallejo-Benicia Highway in and near Benicia, on US Highway 101 in and north of Santa Rosa, and on Sign Route 17 north of Santa Cruz.

Sacramento Area

The budget contains funds for three large-scale freeway projects in and near Sacramento. A total of $4,500,000 is included for construction of interchanges at Citrus Road and Folsom junction on US 50 east of Sacramento; $5,470,000 is provided to complete the South Sacramento Freeway (US 50-99); and $704,000 is allocated for widening a 2.1-mile section of the North Sacramento Freeway (US 40-99E).

On US 50 in the Sierra Nevada, there is a $3,240,000 freeway project for 2.7 miles in and east of Placerville.

U. S. Highways 101 and 99

On US Highway 101, the budgeted projects outside major metropolitan areas will continue the conversion of this route to freeway and expressway standards.

In Santa Barbara and San Luis Obispo Counties, the only remaining gap in 101 miles of continuous freeway and expressway will be closed by construction of a freeway bypassing Santa Maria. Another gap in a long stretch of continuous freeway and expressway will be eliminated by a freeway project at Greenfield, Monterey County. Three large-scale projects are included in Humboldt County, near Myers Flat, Fortuna and Fields Landing.

On US 99 the major projects outside major metropolitan areas are the first two units of the Bakersfield Bypass; conversion from expressway to freeway on a 13-mile section in Tulare County; a freeway project near Fowler; and the first units of freeway construction through Merced and through Modesto.

Other Major Projects

Several other million-dollar-plus projects in the budget will provide the initial two lanes of future four-lane freeway and expressway on major rural and mountain highways. Among them are:

US 40 Alternate, 4.3 miles in the Quincy-Portola area, US 395, 11.9 miles on a section southeast of Susanville, US 299, 5.1 miles just west of Shasta-Trinity county line, also relocation around Whiskeytown Reservoir; and State Sign Route 56, 12.1 miles between Cayucos and Cambria in San Luis Obispo County.

Another major project provides for a four-lane expressway on new alignment over Conway Summit, in Mono County, on US 395.

1960-61 State Highway Budget Projects by Counties

NOTE 1. Construction contracts may be awarded beginning January 1, 1960. Right-of-way funds may not be expended until July 1, 1960 (start of fiscal year).

NOTE 2. Projects which overlap county lines are listed under both counties.

County	Route†	Description	Approximate mileage	Estimated cost
Alameda	5 (US 50)	MacArthur Freeway—San Pablo Ave. in Emeryville to Broadway in Oakland; grade, pave and structures for 8-lane freeway	1.1	$8,000,000
Alameda	5 (US 50)	MacArthur Freeway—0.3 mile west of Grand Ave. to 14th Ave. in Oakland; grade and pave for 8-lane freeway. (These two projects, together with previously budgeted jobs, will provide 8-lane freeway from the East Bay Distribution Structure to 14th Ave. in Oakland)	1.7	5,000,000
Alameda	5 (SR 9)	Orchard Ave. to 0.1 mile south of Gresel St. in and near Hayward; grade and pave to widen from 3 to 4 lanes	3.6	690,000
Alameda, Contra Costa	69-7 (US 40)	0.3 mile south of El Cerrito Overhead in Albany to 0.3 mile south of Jefferson Ave. in Richmond; landscape	2.6	280,000
Alameda	69 (SR 17)	Nimitz Freeway—Hegenberger Rd. to Fallon St. in Oakland; grade, pave and structures to widen to 8 lanes	5.6	4,800,000
Alameda	69 (SR 17)	Fifth Ave. Overhead to Linden St. in Oakland; landscape	1.5	35,000
Alameda, Contra Costa	75 (SR 24)	Broadway Tunnel—Construct a third two-lane tunnel (will permit use of four lanes in one direction during peak travel hours)	1.1	10,000,000
Alameda	Various	Rights of Way (includes $4,940,000 for MacArthur Freeway)		8,335,000
Alpine	Various	Rights of Way		10,000
Amador	34 (SR 104)	Dry Creek Bridge west of Ione; new bridge and approaches		110,000
Amador	Various	Rights of Way		80,000
Butte	3 (US 99E)	The Esplanade—Big Chico Creek to 0.3 mile north of Lindo Channel in and north of Chico; planting	1.8	10,000
Butte	3 (US 99E)	20th St. to 1st St. in Chico; reconstruction and resurfacing (additional related work to be performed by the Sacramento Northern Railroad)	1.3	200,000
Butte	Various	Rights of Way		435,000
Calaveras	Various	Rights of Way		50,000
Colusa	88 (SR 45)	Main St. in Grimes to Sycamore; widening with some realignment	6.1	250,000
Colusa	Various	Rights of Way		440,000
Contra Costa	7 (US 40)	Ridge Rd. to Carquinez Bridge in and near San Pablo, Richmond, Pinole and Hercules; planting	8.0	25,000
Contra Costa, Alameda	69, 7 (US 40)	0.3 mile south of El Cerrito Overhead in Albany to 0.3 mile south of Jefferson Ave. in Richmond; landscape	2.6	280,000
Contra Costa, Alameda	75 (SR 24)	Broadway Tunnel—Construct a third two-lane tunnel (will permit use of four lanes in one direction during peak travel hours)	1.1	10,000,000
Contra Costa	75 (SR 24)	Orinda Rd. to west of Sunnybrook Dr. (west of Lafayette); landscape	1.7	125,000
Contra Costa	75, 107 (SR 24 and 21)	East of Pleasant Hill Rd. to Walden Rd. and Creekside Dr.; landscape (Walnut Creek Bypass)	4.5	350,000
Contra Costa	Various	Rights of Way (including $1,230,000 for Rt. 75-E in Concord area)		3,332,000
Del Norte	1 (US 199)	2.6 miles to 1.1 miles south of Oregon border; grading north approach to future Oregon Mountain Tunnel	1.5	770,000
Del Norte	Various	Rights of Way		75,000
El Dorado	11 (US 50)	Sportsmans Hall (east of Camino) to Strawberry; construct chain change areas at 4 locations		85,000
El Dorado	11 (US 50)	Riverton to Meyers; construct truck passing lanes at 6 locations		300,000

† Numbers marked SR are State Sign Routes; numbers marked US are US Highway routes; numbers not marked are legislative routes. * State's share.

County	Route†	Description	Approximate mileage	Estimated cost
El Dorado	11 (US 50)	Washington St. to Railroad Crossing in and east of Placerville; grade, pave and structures for 4-lane freeway	2.7	3,240,000
El Dorado	93	Georgetown-Cool Highway—Morgan Grade to Cool (portions); curve improvements		50,000
El Dorado	Various	Rights of Way		1,410,000
Fresno	4 (US 99)	0.4 mile south of Highland Ave. to 0.3 mile north of Chestnut Ave. in vicinity of Fowler; grade, pave and structures for 6-lane freeway	9.7	7,724,000
Fresno	138 (SR 33)	4.0 miles south of Belmont Ave. to Sign Route 180 in Mendota; grade and pave (widen to 4 lanes from Belmont Ave. to Sign Route 180) (Cooperative Project—Mendota's share, $11,000)	0.9	169,000 (State's share)
Fresno	Various	Rights of Way (includes $3,140,000 for US 99 freeway between Tulare County line and Fresno)		3,481,000
Glenn	Various	Rights of Way		250,000
Humboldt	1 (US 101)	Redwood Freeway—Eel River at Myers Flat; construct bridge and grade approaches		1,915,000
Humboldt	1 (US 101)	Chadd Creek (north of Redcrest); culvert and channel change		43,000
Humboldt	1 (US 101)	1.8 miles north of Sign Route 36 (near Alton) to 0.3 mile north of Fortuna; structures on future route of 4-lane freeway bypassing Fortuna		910,000
Humboldt	1 (US 101)	0.2 mile south of Loleta Dr. to 1.2 miles north of White Slough near Fields Landing; (portions) grade, pave and structures to construct 4-lane freeway and convert existing expressway to freeway	3.7	2,590,000
Humboldt	35 (SR 36)	Little Laribee and Butte Creeks (east of Bridgeville); replace two bridges	0.6	137,000
Humboldt	35 (SR 36)	9.6 to 11.1 miles east of Bridgeville (portions); realign and construct 2 cattlepasses	0.4	65,000
Humboldt	Various	Rights of Way		695,000
Imperial	27 (US 80)	1.1 miles west of Grays Well to 0.5 mile west of Ogilby Rd. east of Holtville (through sand hills); grade, pave and structures for 4-lane freeway	6.9	2,600,000
Imperial	Various	Rights of Way		300,000
Inyo	23 (US 6-395)	0.2 mile south of south city limit of Bishop to north city limit; reconstruct and resurface	0.9	95,000
Kern	4 (US 99)	2.8 miles south of McKittrick Rd. to Ming Ave. south of Bakersfield; grade, pave and structures for 4-lane freeway	12.2	7,860,000
Kern	4 (US 99)	0.3 mile south of the Atchison, Topeka and Santa Fe Railway to 0.2 mile north of Kern River (portions); structures and approaches for future freeway (this project and the previously listed job are the first two units of a new freeway on US 99 bypassing Bakersfield on the west)	1.0	1,150,000
Kern	4 (US 99)	0.4 mile south of Airport Rd. to the Tulare County line (near Delano); landscape	3.5	85,000
Kern	Various	Rights of Way (includes $2,287,000 for US 99 freeway in Bakersfield area)		4,307,000
Kings	Various	Rights of Way (includes $750,000 for Sign Route 198 freeway in Hanford-Lemoore area)		980,000
Lake	49 (SR 53)	St. Helena Creek to Middletown; grade and pave to construct 2-lane expressway	4.2	625,000
Lake	Various	Rights of Way		160,000
Lassen	29 (US 395)	0.4 mile south of Baxter Creek to 2 miles north of Milford; grade, pave and structures for realignment to provide initial 2 lanes of future 4-lane expressway	11.9	1,345,000
Lassen, Modoc	73 (US 395)	0.8 mile south to 0.5 mile north of the Modoc County line near Likely; grade, pave and structures for realignment to provide initial 2 lanes of future 4-lane expressway	1.3	125,000
Lassen	Various	Rights of Way		50,000
Los Angeles	2 (Old US 101)	Ventura Blvd.—Vineland Ave. to Kelvin Ave. in Los Angeles; resurfacing	12.8	210,000
Los Angeles	2 (US 101)	Ventura Freeway—Colfax Ave. to the San Diego Freeway in Los Angeles; landscape	5.0	250,000
Los Angeles	2 (US 101)	Ventura Freeway—0.3 mile east of Encino Ave. to 0.2 mile east of Kelvin Ave.; landscape	4.2	240,000
Los Angeles	4, 26 (US 60-70-99 and US 99)	Golden State and San Bernardino Freeways—On the Golden State Freeway between Sixth St. and Mission Rd. and on the San Bernardino Freeway from Macy St. to Cornwell St. in Los Angeles; landscape	2.3	200,000
Los Angeles	4, 158 (US 6-99 and SR 7)	Golden State and San Diego Freeways—On Golden State Freeway from 0.1 mile northwest of Osborne St. to San Fernando Rd. near Foothill Boulevard Interchange, and on the San Diego Freeway from Nordhoff St. to the Golden State Freeway; grade, pave, and structures for 8-lane freeway on the Golden State Freeway, and grading for future freeway on the San Diego Freeway	6.4	14,000,000
Los Angeles	4 (US 6-99)	Golden State Freeway—Mission Rd. to Pasadena Ave. in Los Angeles; landscape	1.0	75,000
Los Angeles	9 (US 66)	Foothill Blvd.—Georgia Ave. to Alosta Ave. in and near Azusa; signals and channelization (Co-operative project—City of Azusa's share, $15,700)	1.2	103,000 (State's share)
Los Angeles	19 (SR 71)	Garey Ave.—Near Second St. to near Monterey Ave. in Pomona; railroad grade separation structure. (Co-operative project—City of Pomona's share, $196,300; Union Pacific and Southern Pacific railroads, $600,000)	0.2	900,000 (State's share)
Los Angeles	23 (US 6)	1.2 miles east of Sierra Highway to 0.2 mile east of Red Rover Mine Rd. (portions); grading and structures for future 4 and 6-lane freeway (southwest of Palmdale)	8.0	8,000,000
Los Angeles	26 (US 60-70-99)	San Bernardino Freeway—At Grand Ave. in West Covina; separation structure (Co-operative project—Los Angeles County Share, $240,000)		260,000 (State's share)
Los Angeles	158	San Diego Freeway—Harbor Freeway to 0.1 mile north of 174th St.; grade, pave and structures for 8-lane freeway	3.7	9,000,000
Los Angeles	168	San Diego Freeway—0.7 mile east of Alameda St. to Carson St. in and near Long Beach; grade, pave and structures for 8-lane freeway	2.3	4,700,000

† Numbers marked SR are State Sign Routes; numbers marked US are US Highway routes; numbers not marked are legislative routes. * State's share.

County	Route†	Description	Approximate mileage	Estimated cost
Los Angeles	158 (SR 7)	San Diego Freeway—0.3 mile south of Casiano Rd. to 0.3 mile north of Nordhoff St. (portions); grade, pave and structures for 8-lane freeway (completes freeway through Santa Monica Mountains; grading only between south of Burbank Blvd. and north of Nordhoff St. in San Fernando Valley)	5.8	13,950,000
Los Angeles	158 (SR 7)	San Diego Freeway—Jefferson Blvd. in Los Angeles to Venice Blvd. in Culver City; landscape	2.3	150,000
Los Angeles	159	Hollywood Freeway Extension—Ventura Freeway to Magnolia Blvd. in North Hollywood; grade, pave and structures for 8-lane freeway	0.7	3,000,000
Los Angeles	161, 4 (US 99-6)	Ventura and Golden State Freeways—On Ventura Freeway from 0.3 mile west of Buena Vista St. to Golden State Freeway and on Golden State Freeway from the Ventura Freeway to 0.2 mile south of Colorado Blvd. extension in Burbank and Los Angeles; grade, pave and structures for 8-lane freeway and interchange at freeway junction	2.2	$4,400,000
Los Angeles	162, 161	Glendale Freeway—0.2 mile southwest of Glendale Blvd. to Golden State Freeway; grade, pave and structures for 8-lane freeway	1.0	2,700,000
Los Angeles	165 (US 6-SR 11)	Harbor Freeway—190th St. to 120th St.; landscape	4.4	300,000
Los Angeles	165, 205 (US 6-SR 11 and US 66)	Harbor and Pasadena Freeways—Jefferson St. to Glenarm St. (portions); median barrier		300,000
Los Angeles	166 (US 101)	Santa Ana Freeway—Long Beach Freeway to Atlantic Blvd. (near Montebello); grade, pave and structures to widen from 6 to 8 lanes	1.0	800,000
Los Angeles	167 (SR 15)	Long Beach Freeway—Pacific Coast Highway to East 26th St., in and near Long Beach, Compton, Lynwood, Southgate, Bell and Vernon (portions); planting	9.3	130,000
Los Angeles	167, 26 (SR 15)	Long Beach Freeway—Olympic Blvd. to San Bernardino Freeway in and near Los Angeles and Monterey Park; planting	3.5	180,000
Los Angeles	170 (SR 35)	Workman Mill Rd. to San Gabriel River Parkway in and near Industry; realignment to route highway under an existing railroad bridge, providing railroad grade separation	1.3	170,000
Los Angeles	173 (SR 26)	Santa Monica Freeway—0.2 mile west of Hoover St. to Oak St.; grade, pave and structures for 8-lane freeway. (Ties in with current and budgeted projects to provide continuous freeway from the Santa Ana Freeway to the Harbor Freeway, and includes final portions of Santa Monica-Harbor Freeway Interchange)	0.4	5,000,000
Los Angeles, Orange	174 (US 101)	Santa Ana Freeway—Coyote Creek to north of Harbor Blvd. in and near Buena Park, Anaheim, Fullerton, Orange and Santa Ana (portions); landscape	11.2	265,000
Los Angeles	175 (SR 14)	Artesia Ave.—Long Beach Blvd. to Downey Ave. in vicinity of Long Beach and Bellflower; signal modifications. (Cooperative project—City of Long Beach share, $47,300; City of Bellflower, $6,400)		53,000 (State's share)
Los Angeles	Various	Rights of Way (includes $18,000,000 for Santa Monica Freeway; $14,600,000 for San Diego Freeway; $4,780,000 for Golden State Freeway; $3,000,000 for San Gabriel River Freeway; and $3,050,000 for Pomona Freeway		50,362,000
Madera	Various	Rights of Way		424,000
Marin	56 (SR 1)	South of Stinson Beach to south of Olema; drainage improvements at five locations	0.5	120,000
Marin, Sonoma	56 (SR 1)	0.4 mile south of Marin County line to Bodega Bay (portions); reconstruction, resurfacing and drainage improvements	9.6	230,000
Marin	Various	Rights of Way		554,000
Mariposa	65 (SR 49)	Coulterville to Bear Valley (portions); continue widening and curve improvements	2.0	100,000
Mariposa	65 (SR 49)	Flyaway Gulch Bridge near Bagby; replace bridge		30,000
Mariposa	Various	Rights of Way		15,000
Mendocino	1 (US 101)	North city limit of Willits to 1.6 miles northerly (portions); grade and pave to ease curves	0.9	175,000
Mendocino	16	Hopland-Lakeport Highway—2.8 miles to 3.7 miles east of Hopland; grade and pave to widen	0.9	95,000
Mendocino	56 (SR 1)	Navarro River Bridge to 1.5 miles south; grade and pave to relocate highway at Navarro Bluff	1.5	410,000
Mendocino	56 (SR 1)	Big River Bridge south of Mendocino; new bridge and roadway connections	0.6	735,000
Mendocino	Various	Rights of Way		595,000
Merced	4 (US 99)	1.0 mile south of Merced to 2.0 miles north of Merced; grade and structures for future freeway through Merced	5.1	7,400,000
Merced	122 (SR 140)	1.4 miles to 2.3 miles east of Lincoln Rd. (west of Merced); raise grade to eliminate flooding	0.9	75,000
Merced	Various	Rights of Way		760,000
Modoc, Lassen	73 (US 395)	0.8 mile south to 0.5 mile north of Modoc county line near Likely; grade, pave and structures for realignment to provide initial 2 lanes of future 4-lane expressway	1.3	125,000
Modoc	Various	Rights of Way		50,000
Mono	23 (US 395)	Foot of Conway Grade to 0.5 mile north of Conway Summit; grade and pave to construct 4-lane expressway on new alignment	4.2	2,400,000
Mono	Various	Rights of Way		50,000
Monterey	2 (US 101)	1.7 miles south to 1.3 miles north of Greenfield; grade, pave and structures for 4-lane freeway through Greenfield (completes 46 miles of continuous freeway and expressway from King City to Salinas, except for short section through Gonzales)	4.0	1,955,000
Monterey	56 (SR 1)	Willow Creek Bridge (south of Lucia); new bridge and approaches	0.5	510,000
Monterey	56 (SR 1)	Anderson Canyon Bridge (south of Big Sur); replace bridge with culvert	0.6	425,000
Monterey	56 (SR 1)	Carpenter St. to south city limit of Monterey; landscape Carmel Hill Interchange	0.8	160,000
Monterey	Various	Rights of Way (includes $2,000,000 for Sign Route 1 freeway in Monterey-Seaside area)		2,430,000
Napa	8, 49 (SR 29)	Imola Ave. to 0.1 mile north of Old Sonoma Rd. (in and near Napa); grade pave and structures to convert expressway to freeway (includes overcrossing at Old Sonoma Rd.)	0.5	400,000

† Numbers marked SR are State Sign Routes; numbers marked US are US Highway routes; numbers not marked are legislative routes. * State's share.

County	Route†	Description	Approximate mileage	Estimated cost
Napa	102	0.9 mile east of Pope Valley Rd. to Monticello Dam Relocation (portions); grade and pave to realign and widen		50,000
Napa, Solano	7 (US 40)	1 mile south of Sign Route 48 (north of Vallejo) to 3 miles north of Sign Route 48; grade, pave and structures for 6-lane freeway (connects with freeway through Vallejo)	4.0	6,400,000
Napa	Various	Rights of Way		664,000
Nevada	83 (SR 89)	U.S. 40 near Truckee to 1.9 miles north of Hobart Mills; grade, pave and structures to relocate around future Prosser Dam Reservoir (Co-operative project—U.S. Bureau of Reclamation share, $440,000	6.9	610,000 (State's share)
Nevada	Various	Rights of Way		70,000
Orange	2 (US 101)	San Diego Freeway—1.6 miles south of San Juan Capistrano to North Niguel Rd.; planting	10.9	100,000
Orange	43,182 (SR 55)	Newport Freeway—0.5 mile south of the Santa Ana Freeway to 0.3 mile north of the Riverside Freeway; grade, pave and structures for 4-lane freeway	8.4	8,800,000
Orange, Los Angeles	174 (US 101)	Santa Ana Freeway—Coyote Creek to north of Harbor Blvd. in and near Buena Park, Anaheim, Fullerton, Orange and Santa Ana (portions); landscape	11.2	265,000
Orange	175 (US 91-SR 18)	Riverside Freeway—Santa Ana Freeway to Lemon St. in vicinity of Fullerton and Anaheim; landscape	3.3	150,000
Orange	Various	Rights of Way (includes $2,750,000 for Newport Freeway and $3,000,000 for Garden Grove Freeway)		6,535,000
Placer	3 (US 99E)	Washington St. Underpass in Roseville; revise lighting		60,000
Placer	Various	Rights of Way		70,000
Plumas	21 (US 40 Alt)	Sign Route 89 at Blairsden to Willow Creek; grade, pave and structures for realignment to provide initial 2 lanes of future 4-lane expressway	4.3	1,450,000
Plumas	Various	Rights of Way		50,000
Riverside	26 (US 60-70-99)	Ramon Rd. Interchange near Thousand Palms; structure and approaches	0.6	250,000
Riverside	43 (US 91-SR 18)	Riverside Freeway—0.3 mile north of Spruce St. in Riverside to San Bernardino County line; grade, pave and structures to convert from expressway to freeway	1.9	800,000
Riverside	64 (US 60-70)	Colorado River Bridge near Blythe; grade and pave to construct approaches to new bridge now under construction		506,000
Riverside	Various	Rights of Way		1,650,000
Sacramento	3 (US 40-99E)	Elvas Freeway to Marconi Ave. (northeast of Sacramento); grade, pave and structures to widen to 6 and 8 lanes	2.1	704,000
Sacramento	4 (US 50-99)	1.8 miles south of Florin Rd. to U St. in and south of Sacramento; grade, pave and structures to complete 4-lane South Sacramento Freeway	7.6	5,470,000
Sacramento	11 (US 50-SR 16)	55th St. to 0.2 mile east of 65th St. in Sacramento; turn lanes and curb adjustments	0.8	90,000
Sacramento	11 (US 50)	Power Inn Rd. to Zinfandel Dr. east of Sacramento; traffic signals and channelization at 6 intersections (Co-operative project—Sacramento County's share, $36,000)		180,000 (State's share)
Sacramento	11 (US 50)	0.7 mile west of Citrus Rd. to 1.1 miles east of Alder Creek; grade, pave and structures to provide interchanges at Folsom Junction and at Citrus Rd. (Nimbus Interchange previously budgeted)	5.8	4,500,000
Sacramento	232 (SR 24)	Sutter County line to 3.2 miles south; reconstruction	3.2	300,000
Sacramento	Various	Rights of Way (includes $4,136,000 for east-west and north-south freeways in Sacramento)		4,640,000
San Benito	22 (SR 156)	0.4 mile west of west city limits of San Juan Bautista to 0.3 mile east of Cagney Rd.; grade and pave for initial 2 lanes of future 4-lane expressway	2.0	610,000
San Benito	Various	Rights of Way		20,000
San Bernardino	26 (US 70-99)	San Bernardino Freeway—At Pepper Ave. (1 mile west of Colton); grade, pave and structure to provide interchange	0.6	370,000
San Bernardino	26 (US 70-99)	Riverside Freeway to Colton Ave. in Redlands; grade, pave and structures for 6-lane freeway	5.8	8,000,000
San Bernardino	26, 190 (US 70-99)	Colton Ave. to Reservoir Canyon in Redlands; grade, pave and structures for 6-lane freeway (This project, with previously listed job, will provide a freeway through the Redlands area)	5.1	8,200,000
San Bernardino	Various	Rights of Way		3,468,000
San Diego	2 (US 101)	3.2 miles north of Miramar Rd. to 0.8 mile south of Agua Hedionda Creek in and north of San Diego (portions); structures and grading for future freeway		2,900,000
San Diego	2, 200 (US 101 and SR 94)	Market St. to Palm St. (portions); grade, pave and structures to provide sections of roadway and interchange structures for future north-south freeway through San Diego	2.7	5,800,000
San Diego	196 (SR 73)	0.5 mile west of Rancho Santa Fe Rd. to 0.1 mile east of Nordahl Rd. (west of Escondido); grade and pave for 4-lane freeway	5.5	3,910,000
San Diego	200 (SR 94)	Kenora Dr. to Granada Blvd. in Casa de Oro (portions); grade and pave to widen to 4 lanes (Co-operative project with San Diego County)	0.5	95,000 (State's share)
San Diego	200 (SR 94)	Sign Route 67 to Campo (portions); grade and pave to widen and realign most deficient locations		150,000
San Diego	Various	Rights of Way (includes $8,250,000 for U.S. 101 freeway in National City and San Diego)		9,660,000
San Francisco	2, 68 (US 101)	Central and James Lick Freeways—Trumbull St. to Turk St. (portions); landscape	3.5	460,000
San Francisco	2	Southern Freeway—Ocean Ave. to Mission St.; grade, pave and structures for 8-lane freeway	1.3	6,000,000
San Francisco	Various	Rights of Way ($3,000,000 for Southern Freeway)		3,030,000

† Numbers marked SR are State Sign Routes; numbers marked US are US Highway routes; numbers not marked are legislative routes. * State's share.

County	Route†	Description	Approximate mileage	Estimated cost
San Joaquin	4, 5 (US 99)	Guernsey Ave. to Horner Ave. (near Stockton); landscape (Main St. Interchange)	-------	60,000
San Joaquin	4, 75, 5, 66, (US 99, 50)	Mariposa Rd., South Stockton Overpass, Farmington Rd. and Mossdale Interchange; planting	-------	45,000
San Joaquin	4 (US 99)	Cherokee Rd. near Stockton; structure and approaches for interchange	0.7	360,000
San Joaquin	97 (SR 88)	1 mile north of Clements to the Amador County line; widening with some realignment	6.7	470,000
San Joaquin	Various	Rights of Way	-------	950,000
San Luis Obispo, Santa Barbara	2 (US 101)	4 miles south of Santa Maria to Hourihan Grade; pave and structures to construct 4-lane freeway bypassing Santa Maria (Closes only remaining gap in 101 miles of continuous freeway and expressway from south of Buellton to north of San Miguel)	8.6	7,000,000
San Luis Obispo	2 (US 101)	Through Paso Robles; landscape	4.6	135,000
San Luis Obispo	56 (SR 1)	0.3 mile north of Cayucos to 1 mile south of Cambria; grade, pave and structures; initial two lanes of ultimate 4-lane expressway	12.1	2,386,000
San Luis Obispo	58 (SR 178)	San Juan Creek to Simmler (portions); grade and pave to reconstruct and widen	3.1	440,000
San Luis Obispo	Various	Rights of Way	-------	870,000
San Mateo	2 (US 101)	Market St. to Shakespeare St. (in Daly City); remove railroad tracks and construct median island	1.2	100,000
San Mateo	56 (SR 1)	1.0 mile north of New Years Creek to Whitehouse Creek; grade and pave to widen and realign (Co-operative project—Joint Highway District No. 9 share, $240,000) (Completes co-operative State-J.H.D. improvement program between San Francisco and Santa Cruz)	2.1	173,000 (State's share)
San Mateo	56 (SR 1)	San Gregorio Creek to 1 mile north of Tunitas Creek (portions); reconstruct base and resurface	3.8	150,000
San Mateo	68 (US 101-Byp)	Bayshore Freeway—16th Ave. to north of Harbor Blvd. in San Mateo, Belmont, San Carlos and Redwood City; planting	7.3	180,000
San Mateo	Various	Rights of Way (includes $5,000,000 on Junipero Serra Freeway and $1,500,000 for 19th Ave. Freeway in San Mateo area)	-------	8,180,000
Santa Barbara	2 (US 101)	Ortega Hill to Salsipuedes Overhead in Santa Barbara (portions); landscape	2.8	152,000
Santa Barbara, San Luis Obispo	2 (US 101)	4 miles south of Santa Maria to Hourihan Grade; grade, pave and structures to construct 4-lane freeway bypassing Santa Maria (closes only remaining gap in 101 miles of continuous freeway and expressway from south of Buellton to north of San Miguel)	8.6	7,000,000
Santa Barbara	149, 56 (SR 1)	East city limit of Lompoc to Santa Ynez River (portions); grade and pave to reconstruct and widen 2-lane highway	1.4	210,000
Santa Barbara	Various	Rights of Way (includes $900,000 for US 101 freeway in City of Santa Barbara)	-------	2,125,000
Santa Clara	5 (SR 17)	Santa Cruz county line to Black Rd., reconstruct and resurface	4.2	255,000
Santa Clara	5 (SR 17)	0.3 mile south of Roberts Rd. to Dana St. in and near Los Gatos, Campbell and San Jose; landscape	5.5	175,000
Santa Clara	68 (US 101-Byp)	Bayshore Freeway—Coyote Creek to Santa Clara St. in San Jose; landscape	1.9	100,000
Santa Clara	68 (US 101-Byp)	Bayshore Freeway—Brokaw Rd. near San Jose to 0.1 mile west of Morse Ave. (near Sunnyvale); grade, pave and structures for 4- and 6-lane freeway (Co-operative project with Cities of Sunnyvale and San Jose and with Santa Clara County Flood Control Dist.) (With projects now under construction or previously budgeted, will complete the Bayshore Freeway from San Francisco to San Jose, a distance of 48.5 miles)	6.1	5,450,000 (State's share)
Santa Clara	114 (SR 9)	Mathilda Ave.—Southern Pacific Railroad to Bayshore Freeway in and near Sunnyvale; grade and pave to widen to 4 lanes	1.4	220,000
Santa Clara	Various	Rights of Way	-------	4,682,000
Santa Cruz	5 (SR 17)	0.4 mile south of Glen Canyon Rd. to 0.6 mile north of Granite Creek Rd. north of Santa Cruz; grade, pave and structures for 4-lane freeway	2.9	1,500,000
Santa Cruz	Various	Rights of Way	-------	267,000
Shasta	3 (US 99)	Sacramento River Bridge at Redding; widen bridge and approaches to 4 lanes	0.5	790,000
Shasta	20 (US 299)	2.5 miles east of Tower House to 2.5 miles east of Whiskeytown; grade, pave and structures to relocate around the future Whiskeytown Reservoir, providing initial 2 lanes of future 4-lane expressway (Co-operative project—U.S. Bureau of Reclamation share, $5,550,000)	5.1	720,000 (State's share)
Shasta	Various	Rights of Way	-------	450,000
Sierra	Various	Rights of Way	-------	50,000
Siskiyou	46 (SR 96)	Seiad Valley to Klamath River Bridge (portions); drainage facilities and reconstruction	3.8	85,000
Siskiyou	72 (US 97)	4.6 miles to 5.7 miles north of Weed; grade and pave for realignment to provide initial 2 lanes of future 4-lane expressway	1.1	190,000
Siskiyou	Various	Rights of Way	-------	175,000
Solano, Yolo	6 (US 40)	South Davis Underpass to Swingle; planting	4.6	65,000
Solano, Napa	7 (US 40)	1 mile south of Sign Route 48, north of Vallejo, to 3 miles north of Sign Route 48; grade, pave and structures for 6-lane freeway (connects with freeway through Vallejo)	4.0	6,400,000
Solano	74	Vallejo-Benicia Highway—West city limit of Benicia to W. 3d St. in and near Benicia; grade, pave and structures for 4-lane freeway (connects with freeway approach to be built as part of Benicia-Martinez Bridge toll project)	1.7	1,750,000
Solano	208 (SR 48)	Walnut St. (Mare Island) to Napa River Bridge; grade and drainage facilities at the approach to a future Napa River Bridge near Vallejo	0.2	660,000
Solano	Various	Rights of Way	-------	1,360,000
Sonoma	1 (US 101)	North of Lynch Creek to south city limits in Petaluma; landscape	0.8	100,000

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County	Route†	Description	Approximate mileage	Estimated cost
Sonoma	1 (US 101)	0.6 mile south of Menodcino Ave. to Grant Creek in and north of Santa Rosa; grade, pave and structures for 4-lane freeway	9.2	5,200,000
Sonoma, Marin	56 (SR 1)	0.4 mile south of Marin county line to Bodega Bay (portions); reconstruction, resurfacing and drainage improvements	9.6	230,000
Sonoma	104 (SR 12)	1.5 miles to 2.2 miles east of Monte Rio; grade and pave to correct slip-out condition	0.7	200,000
Sonoma	Various	Rights of Way		971,000
Stanislaus	4 (US 99)	Whitmore Ave. in Ceres to 0.4 mile south of Modesto city limit; grade and pave first unit of freeway in Ceres-Modesto area (includes Hatch Rd. Interchange)	2.2	1,230,000
Stanislaus	Various	Rights of Way		1,050,000
Sutter, Yuba	232 (SR 24)	Bear River Bridge and connections at Rio Oso; new bridge upstream from present bridge and realignment of approaches		980,000
Sutter	Various	Rights of Way		90,000
Tehama	29 (SR 36)	Salt Creek Bridge (southeast of Beegum); replace bridge and realign approaches	1.0	210,000
Tehama	Various	Rights of Way		900,000
Trinity	20 (US 299)	2 miles east of Fawn Lodge to Shasta county line; grade and pave to construct initial 2 lanes of future 4-lane expressway	5.1	1,490,000
Tulare	4 (US 99)	Pixley to Tulare Airport (portions); grade, pave and structures to convert from expressway to full freeway	13.3	3,600,000
Tulare	Various	Rights of Way		1,085,000
Tuolumne	13 (SR 120)	7 miles east of Stanislaus county line to 0.9 mile west of junction with SR 49; realignment	4.2	895,000
Tuolumne	Various	Rights of Way		75,000
Ventura	2, 138 (US 101 and US 399)	Ventura and Ojai Freeways—Near Palm St. to west of the Ventura River on the Ventura Freeway; and from Ventura Freeway to Prospect St. on the Ojai Freeway (US 399); grade, pave and structures for 4- and 6-lane freeway (includes Ventura-Ojai Freeway Interchange and together with a previously budgeted project will complete freeway through Ventura)	2.9	6,500,000
Ventura	Various	Rights of Way (includes $3,200,000 for Sign Route 126 freeway)		4,668,000
Yolo, Solano	6 (US 40)	South Davis Underpass to Swingle; planting	4.6	65,000
Yolo	Various	Rights of Way		410,000
Yuba	15 (SR 20)	Dry Creek to Parks Bar Bridge (portions); curve improvements		75,000
Yuba, Sutter	232 (SR 24)	Bear River Bridge and connections at Rio Oso; new bridge upstream from present bridge and realignment of approaches		980,000
Yuba	Various	Rights of Way		60,000

† Numbers marked SR are State Sign Routes; numbers marked US are US Highway routes; numbers not marked are legislative routes. * State's share.

DISTRICT II

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cost of $192,000. This new alignment has eliminated numerous sharp curves and substandard width sections on a road subject to frequent winter use by sports enthusiasts going to and from the Sulphur Works Ski Area in Lassen Park.

State Sign Route 96

State Sign Route 96 in District II extends from about 10 miles east of the westerly border of Siskiyou County along the Klamath River to a junction with U. S. 99 near Yreka. This highway, through the rugged Klamath River Canyon, is one of the most isolated in the State. West of Happy Camp, there are still sections of one-way road. Considerable progress toward rectifying this situation is being made by honor camp forces from Camp 41 at Clear Creek about eight miles west of Happy Camp.

Grading has been completed and a seal coat placed on a six-mile section of modern two-lane highway on new alignment from Clear Creek easterly. From Clear Creek westerly, grading has been completed on a 2.5-mile stretch. The remaining 6.5-mile section from 2.5 miles west of Clear Creek to the district boundary is now under construction.

Honor Camp 41 was established for the purpose of grading all of State Sign Route 96 between the district boundary and Happy Camp. After completion of the units mentioned above, the remaining 2.2 miles at the westerly entrance to Happy Camp will be constructed.

A resurfacing contract between Walker Bridge and U. S. 99 and a minor bridge repair at Seiad were also completed on this route in 1959.

Legislative Route 82

Legislative Route 82 begins at Montague in Siskiyou County and continues via Yreka over Forest Mountain to Etna. Legislation enacted this year establishing the California Freeway and Expressway System added the 79-mile section of Federal-aid Secondary Route 1089 from Weaverville to Etna to this route.

The grading and surfacing of 2.9 miles of modern two-lane highway on new alignment between Greenview and 1.8 miles south of Fort Jones was completed in July 1959, by Baytec Construction Company and Trans-ocean Engineering Corporation of Hayward at a cost of $334,000.

Another project, the replacement of a narrow bridge across the Shasta River about two miles west of Montague, together with improved approaches, was completed by the Bos Construction Company of Berkeley this October at a cost of $108,000.

On the recently added mileage, Siskiyou and Trinity Counties have made excellent progress on the improvement of their sections of the route under the FAS program. In this manner work has been completed on 15 contracts and is underway on four more.

Legislative Route 210

A 19.2-mile section of highway running along the California-Oregon border from about three miles north of Dorris on U. S. Route 97 to Hatfield on State Sign Route 139 has become a state highway by virtue of its inclusion in the California Freeway and Expressway System. Under the FAS program, a 15.4-mile section of this length was constructed in 1948 and the remaining 3.8-mile section, which is half in Oregon and half in California as the centerline is the California-Oregon border, was constructed in 1956.

Recent construction on this route has been the resurfacing of the section between 10.3 and 3.8 miles west of Hatfield. This work was done under two contracts by Hayward Building Material Company of Fremont in 1958. A new bridge across Lost Creek immediately west of Hatfield also was completed in 1958 by Contractor Ben C. Gerwick, Inc., of San Francisco.

This road, known locally as the "State Line Highway," is on good alignment and grade and in good condition. As this section was constructed to required standards, the California Highway Commission has approved accepting the road for maintenance by the State effective November 1, 1959.

Joint Highway No. 14

The 68 miles of road between State Sign Route 36 in Susanville and Adin on U. S. 299 became a part of the state highway system by legislative action this year.

Work on this section was started by Joint Highway District 14 and progressed almost continually from 1948 to 1957 as FAS, state, and county funds became available. By 1957, under various contracts, the complete distance from Susanville to Adin was improved as a modern two-lane highway on good alignment and grade.

This highway passes along the easterly shores of Eagle Lake. Thirteen miles long and four miles wide, it is the second largest body of water entirely within California. Situated in the basin of an isolated valley, it was described in a recent magazine article as "The Lake That Time Forgot." It is unique in that its mineralized waters sustain native fish, including a native Eagle Lake trout, but fish brought to the lake and planted have curled up their fins and died in distress or disappeared.

This road also will be placed under the jurisdiction of the Division of Highways for maintenance on November 1, 1959.

The action of the Legislature this year in establishing a statewide system of freeways and expressways reaffirms previous efforts which were directed toward the improvement of much of the lateral and connecting mileage to expressway standards. This farsighted measure is an important step in the molding of our highway transportation system, and it will provide sound guidance for the big job that lies ahead.

Research Technician Wins Literary Prize

Edward L. Schreiber, Research Technician with the State Division of Highways and author of "Landed on New Shores," recently won a prize in the refugee year contest of the San Francisco *News Call Bulletin*.

A few weeks later, Schreiber was awarded a prize in a literary contest sponsored by the Insel Verlag in Wiesbaden, one of the leading German publishers, for his analysis of Herman Hesse's novel "Klingsors Last Summer."

FREEWAY BENEFITS

Continued from page 30 . . .

"On the basis of figures tabulated and analyzed by the Division of Highways from the records of the California Highway Patrol, we know that the fatality rate on our full freeways has consistently been about one-third the rate on conventional rural highways.

"The fatality rate on the State's conventional roads in the past five years was about nine for every 100 million vehicle-miles. The average for freeways was less than three deaths per 100 million miles."

Bradford pointed out that these figures provide the basis for "an encouraging belief that highway engineers are making a truly significant contribution to motoring safety."

Charles W. Prisk, director of highway safety studies for the U.S. Bureau of Public Roads, spoke before a joint meeting of the engineering and enforcement divisions.

Prisk said the California highway fatality rate per mile of travel was slightly lower than the national average last year.

"Here in California," the federal official said, "there is good balance in the traffic safety effort; your highway program is well advanced and with competent engineering and traffic supervision and active citizen support, your vehicle-mile death rate has been held commendably in check, and slightly below the average for the country last year.

"The records I have seen for California this year indicate that you still have a slight edge on the balance of the states."

Other speakers at Engineering Division sessions included S. S. Taylor, General Manager of the Los Angeles Traffic Department; Harmer Davis, Director of the Institute of Transportation and Traffic Engineering at the University of California; Fred Laymon of the Automobile Club of Southern California; J. C. Spencer of the California State Automobile Association; and William E. Schaefer and John L. Beaton of the Division of Highways.

RECENT RETIREMENTS

Continued from page 41 . . .

schmidt, Heavy Equipment Mechanic, 30 years.

Shop 5

David L. Ball, Heavy Equipment Mechanic, 30 years.

Shop 10

Bernard G. Sears, Highway Equipment Operator-Laborer, 16 years.

Shop 11

Alfred L. Fabares, Laborer, 24 years.

Headquarters Shop

Irene Francis, Telephone Operator, 31 years; Harold V. Kingman, Automobile Mechanic, 30 years; James B. Revelino, Intermediate Clerk, 28 years.

Franciscan Chert Is Topic of New Report

The problem of chert as a reactive ingredient in concrete aggregate is discussed in Special Report 55, "Franciscan Chert in California Concrete Aggregates," by Harold B. Goldman, member of the staff of the Division of Mines.

Sources of concrete aggregate in the coast ranges have been viewed with suspicion because they contain large proportions of Franciscan chert which has been categorized as potentially chemically reactive with the alkalies in portland cement. Data from laboratory tests are presented and evaluated.

The results of field examination by Mr. Goldman of concrete structures built with sand and gravel containing varying proportions of Franciscan chert revealed no signs of alkali-aggregate reaction after 20 to 50 years.

A table by Ira Klein, U.S. Bureau of Reclamation, contains data on the distribution of the chert in the major stream deposits to show that only a few deposits contain chert in large enough proportions to cause harmful expansion. These can be used providing the alkali content of the cement is controlled.

A copy of the report may be obtained by sending 52 cents to the State Department of Natural Resources, Division of Mines, Ferry Building, San Francisco 11.

DISTRICT I

Continued from page 40 . . .

ect provided complete highway lighting at a cost of $24,000.

On U. S. 101 in Del Norte County corrective measures to reduce hazards were applied to two sharp curves at DeMartins Point and Cushing Creek both between Klamath and Crescent City. Realignment and widening was done at a cost of $208,600.

North of Smith River on U. S. 101 at Lopez Creek an old, deteriorated timber bridge was replaced by a reinforced concrete box culvert.

Truck Lanes Completed

On grades on U. S. 101 in Del Norte County south of Crescent City truck creeper lanes were constructed at six locations. These were constructed at a cost of $43,500. They greatly facilitate traffic movements, reducing delays and increasing safety by permitting safe passing of slow moving vehicles.

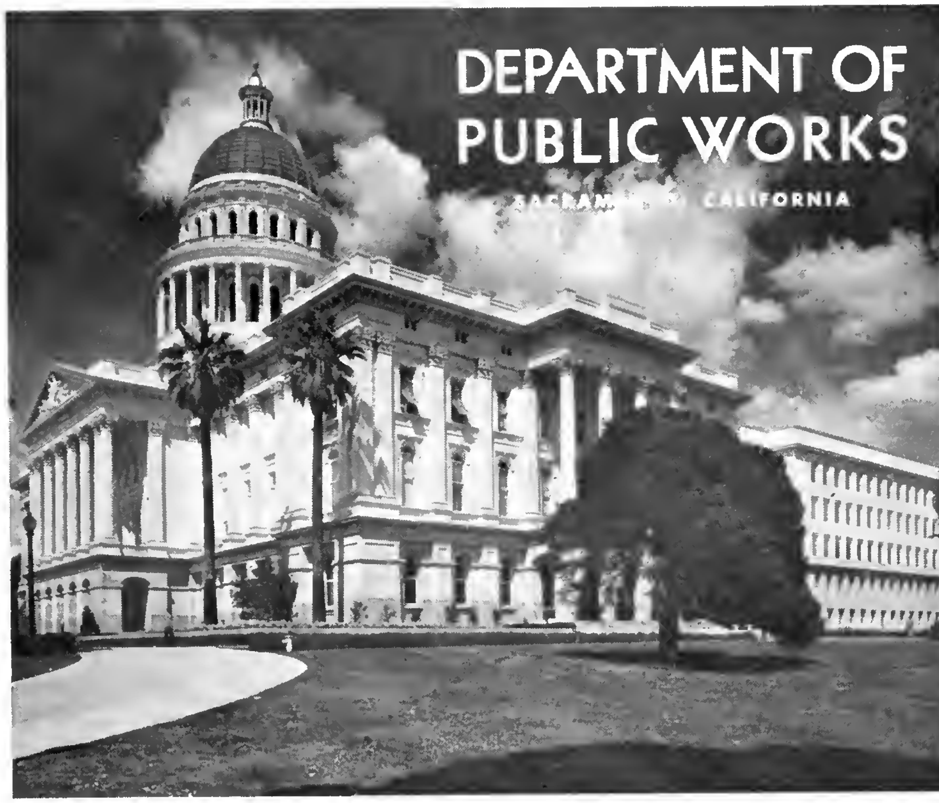
Maintenance operations have been made more efficient and the sanding of icy pavements expedited by installation of sand bins at four locations, two on U. S. 101 near Laytonville and two on U. S. 299 in the Willow Creek and Burnt Ranch areas.

On various portions of highway throughout the district the thin blanket resurfacing and seal coat program not only strengthened the pavement structure, but also provided a smooth-riding surface welcomed by the motorist.

In the planning and detail design stage are many more projects similar to these reported. When completed in the future, they will provide additional safety, comfort, convenience and reduction in driving time to many more miles of District I highways.

Actual figures after the first year of operation on the twin Carquinez Strait Bridges indicate financial return from tolls will be higher than was estimated in the preliminary studies by Coverdale and Colpitts. Records of the first year's operation show almost half a million more vehicles used the bridges than was predicted.

EDMUND G. BROWN
Governor of California



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