HSL No. 74-3
FEBRUARY 12, 1974
THIS ISSUE CONTAINS:

HS-013 706 - HS-013 767
HS-013 769 - HS-013 777

U.S. Department of Transportation
National Highway Traffic Safety Administration

Shelve in Stacks S.B.T.

HighwaySafetyLiterature

. . . A SEMI-MONTHLY ABSTRACT JOURNAL

AVAILABILITY OF DOCUMENTS

Documents listed in **Highway Safety Literature** are **not** available from the National Highway Traffic Safety Administration. They must be ordered from the sources indicated on the citations, usually at cost. Ordering information for each of the sources is listed below.

NTIS: National Technical Information Service, Springfield, Va. 22151. **Order by title and accession number: PB, AD, or HS.**

GPO: Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. **Give corporate author, title, personal author, and report number.**

Corporate author: Contact corporate author.

Reference copy only: Consult your librarian.

See serial citation: Obtain through normal loan or purchase.

SAE: Society of Automotive Engineers, Dept. HSL, 2 Pennsylvania Plaza, New York, N.Y. 10001. **Order by title and SAE report numbers.**

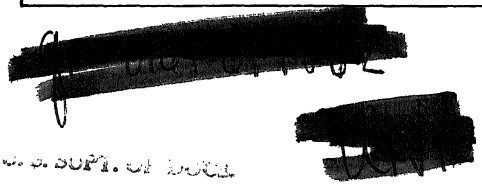
HRB: Highway Research Board, National Academy of Sciences, 2101 Constitution Ave., N.W., Washington, D.C. 20418.

Material directly related to Highway and/or Motor Vehicle Safety is solicited for inclusion in Highway Safety Literature. Topics must fall within the scope of the mission of the National Highway Traffic Safety Administration. Submit material, together with a written statement of approval for publication to:

Office of Administrative Services (N48-50)
National Highway Traffic
Safety Administration
400 7th Street, S.W.
Washington, D.C. 20590

Please indicate availability source and price for the material.

Special notice: Material published in HSL is intended only for information. References to brand names, equipment models or companies does not imply endorsement by the NHTSA or the U.S. Department of Transportation.



Reports HS 800 000; Compliance Test Reports HS 610 000; Contractor's Reports HS 800 000; Staff speeches, papers, etc. HS 810 000; Imprints HS 820 000.

A document containing several articles is announced as complete volume under an HS number referring to it as a whole. Entries for individual articles are listed under their own HS numbers.

SAMPLE ENTRIES

JOURNAL ENTRY

Title of Document: **SYNTHESIS OF CASE LAW JURISPRUDENCE RELATING TO WET-WEATHER HIGHWAY CONDITIONS**

Journal Citation: Highway Research Record n 376 p29-36 (1971)

Author(s): D. C. Oliver 1971

Sponsored by Highway Res. Board Steering Com. for Workshop on Anti-Skid Program Management and presented at the workshop.

Search Terms: Descriptors: *Liability, *Negligence, *Accident responsibility, *Legal responsibility, *Wet road conditions, *Court decisions, *State government, *Skidding accidents, *Warning signs, *Highway maintenance, *Litigation, *Icy road conditions,

Abstract: The extant case law on legal liability for accidents occurring on icy and wet highways has established three central areas and one subarea in the jurisprudence of maintenance liability. These areas are compliance with general duties in order to escape liability; damages resulting from noncompliance (negligence); contributory negligence as a bar to recovery; and advisory signing as a technique in meeting general duties. Court decisions covering these four areas are presented.

NHTSA Accession Number: HS-012 289

*Subject heading in Subject Index

CONTRACT REPORT

EQUIPMENT AND PROCEDURES FOR MEASURING GLARE FOR MOTOR VEHICLES. FINAL REPORT

Corporate author: Teledyne Brown Engineering

N. E. ChattertonJ. D. HayesE. W. George 1972 102p

Contract DOT-HS-089-1-139

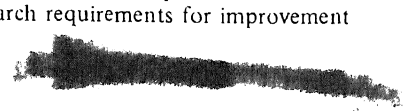
Availability: NTIS

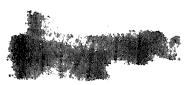
Descriptors: *Glare, *Glare reduction, *Visual perception, *Photometers, *Luminance, *Hydraulic equipment, *Central vision, *Field of view, *Backgrounds, *Contrast, *Light conditions, *Brightness, *Test facilities, *Test equipment, *Vehicle safety standards, *Simulators, *Light, *Reflectance, *Measuring instruments,

A procedure and description of equipment for measuring glare from a driver's own vehicle are presented. The procedures are based on a disability glare theory as applied to foveal vision. Two pieces of apparatus were constructed to provide the measurement capability. One of them simulates diffuse sky glare and the other simulates direct solar glare. Methods of combining data from these measurements are presented along with scaling laws selected to provide a value for glare as it would be under natural daylight conditions. A standard for allowable glare levels from the vehicle is developed which is independent of the measurement procedure. Test results from a passenger car are presented and compared with this standard. Recommendations for improvements to the apparatus and additional research requirements for improvement to the theory are made.

HS-800 731

*Subject heading in Subject Index





1B. Injuries

AUTOMOBILE HEAD RESTRAINTS--FREQUENCY OF NECK INJURY CLAIMS IN RELATION TO THE PRESENCE OF HEAD RESTRAINTS

For primary bibliographic entry see Fld. 5N.
HS-013 729

TIME SERIES FORECASTING OF HIGHWAY ACCIDENT FATALITIES. FINAL REPORT

National Bureau of Standards, Gaithersburg, Md.
A. R. Craw 1973 39p Rept. No. NBSIR-73-138, COM-73-10868
Sponsored by the National Hwy. Traf. Safety Administration.
NTIS

Fatality prediction, Time series analysis, Electronic accident analysis, Computer programs

Using twelve years of time series data on highway fatalities, the methodology currently employed by the National Highway Traffic Safety Administration (NHTSA) to forecast the annual (calendar year) total of highway accident fatalities was compared with results obtained by several computer routines based on exponential smoothing techniques available at the National Bureau of Standards. The use of unadjusted and seasonally adjusted data was also examined. It is found that there is no coercive evidence to lead to abandoning the present NHTSA methods in favor of readily available computer routines based on exponential smoothing methods. Of the methods examined, the best results were obtained with the EXPSMOOTHING routine using unadjusted fatality data.
HS-013 730

DEATHS ON MOTORCYCLES. A STUDY OF 120 FATALITIES

New South Wales Dept. of Motor Transport, Sydney (Australia)
For primary bibliographic entry see Fld. 5C.
HS-013 751

1C. Investigation And Records

A DECADE OF PEDESTRIANS AND THEIR TRAFFIC COLLISIONS (1963-1972)

California State Univ., San Diego
For primary bibliographic entry see Fld. 3K.
HS-013 724

FIRE IN ROAD ACCIDENTS

New South Wales Dept. of Motor Transport, Sydney (Australia)
R. G. Vaughan 1970 44p 15refs Rept. No. 1/70
Traffic Accident Res. Unit, Department of Motor Transport; Box 28, G.P.O., Sydney, N.S.W., Australia 2001

Vehicle fires, Accident caused fires, Accident statistics, Fuel tank location, New South Wales, Accident studies, Fuel spills, Crashworthy fuel systems, Accident rates, Accident severity, Volkswagens, Accident types, Chi square test, Accident case reports, Fatalities, Accidents by vehicle make, Ignition, Time of accidents, Morris Mini

The prerequisites for the occurrence of vehicle fires, means by which fuel spillage occurs, fuel tank locations, means of preventing fuel spillage, sources of ignition, crash testing, and and the incidence of particular types and makes of motor vehicles is examined. It is concluded that fire is a relatively rare event in road accidents; the risk of fire appears closely associated with accident severity; a necessary condition of a major vehicle fire is fuel spillage; the most important potential source of ignition for vehicle fires is electrical sparks; heavy vehicles appear to be far more susceptible to fire than lighter vehicles; and Volkswagen Beetle sedans and Morris Mini sedans have been involved in a disproportionate and significantly large number of fatal fire involved road accidents in New South Wales.
HS-013 747

HEAVY VEHICLE CRASH INJURY. A SURVEY

New South Wales Dept. of Motor Transport, Sydney (Australia)
For primary bibliographic entry see Fld. 1E.
HS-013 748

CRASHES AT RAILWAY LEVEL CROSSINGS

New South Wales Dept. of Motor Transport, Sydney, (Australia)
G. F. Messiter 1972 39p Rept. No. 1/72
Traffic Accident Res. Unit, Department of Motor Transport, Box 28, G.P.O., Sydney, N.S.W., Australia 2001

Railroad grade crossing accidents, Accident analysis, Vehicle train collisions, Vehicle fixed object collisions, Accident statistics, New South Wales, Sight distances, Speed studies, Speed limit effectiveness, Accident risks, Linear regression analysis, Poisson density functions, Accident prevention, Fatality rates, Injury rates, Histograms

Speed surveys were conducted at 13 railroad grade crossings and 486 railroad grade crossing accidents were analyzed to determine the validity of two New South Wales traffic laws requiring the person driving a motor vehicle not to exceed 15 mph when the vehicle is within 100 yards of a railroad grade crossing without gates and requiring vehicles carrying explosive or inflammable loading to stop within prescribed distances from the crossing even if a stop sign is not displayed. The study indicated that there is a possibility that the requirement that a vehicle stop at a crossing it is otherwise free to cross may increase rather than decrease its risk of collision by prolonging the time it will spend in the conflict area, and the speed surveys indicated that the special speed limit of 15 mph is widely ignored by drivers.
HS-013 757

THE THEORETICAL RECONSTRUCTION OF EVENTS LEADING TO AN IMPACT IN A ROAD ACCIDENT

Transport and Road Res. Lab., Crowthorne, Berks. (England)
I. D. Neilson 1973 25p 7refs Rept. No. TRRL-LR-575
Presented at the Federation Internationale des Experts en Automobiles Congress (16th), London, Jun 1972.
Corporate author

Accident reconstruction, Accident research, Accident investigation, Precrash phase, Crash phase, Impact velocity, Postcrash phase, Loss of control, Equations of motion, Head on collisions, Rear end collisions, Vehicle kinematics, Accident analysis, Vehicle dynamics

An accurate reconstruction of events immediately leading up to an accident is desirable for the police, insurance purposes, and for research into road safety. The magnitudes of various aspects of road accidents can be estimated by simple procedures, based on well known dynamic principles. A careful reconstruction of the relative positions of vehicles and road users during the various stages of an accident can greatly help in clarifying the situation. The estimation of velocity changes at impact is a relatively complicated task, impact test data are scarce, and the results are shown to vary greatly with the assumptions made. It is concluded that theoretical calculations can help in the understanding of a situation, but results must be used with discretion.
HS-013 772

2. HIGHWAY SAFETY

ROAD ACCIDENTS IN GREAT BRITAIN, 1971

52P
Her Majesty's Stationery Office

Accident statistics, Injury rates, Accident rates, Fatality rates, Great Britain, Age factor in accidents, Accident factors, Injury severity, Accident location, Time of accidents, Injury statistics, Light conditions, Environmental factors, Pedestrian injuries, Pedestrian fatalities, Bicycle rider fatalities, Accident severity, Bicycle rider injuries, Motorcycle operator fatalities, Motorcycle operator injuries, Driver injuries, Driver fatalities, Passenger injuries, Passenger fatalities, Skidding accidents, Defects

Traffic accident statistics are presented. Trends tables depicting casualties, casualty rates, and accident rates for 1961 to 1971 are included, as well as, more detailed tables for 1971 covering accidents, casualties, vehicles involved, drivers involved, and international comparisons. Explanatory notes are provided for each table.
HS-013 731

A SUMMARY OF THE RELATIONSHIPS BETWEEN ACCIDENT INDICES AND RATES FOLLOWING A REDEFINITION OF 'FAILURE'. FINAL REPORT

National Bureau of Standards, Gaithersburg, Md.
For primary bibliographic entry see Fld. 4G.
HS-013 744

HEAVY VEHICLE CRASH INJURY. A SURVEY

New South Wales Dept. of Motor Transport, Sydney (Australia)
M. Henderson, A. Sims 1970 26p 7refs Rept. No. 2/70
Traffic Accident Res. Unit, Department of Motor Transport; Box 28, G.P.O., Sydney, N.S.W., Australia 2001

Truck accidents, Accident studies, Accident statistics, Injury statistics, Vehicle vehicle collisions, Articulated vehicles, New South Wales, Accident rates, Fatality rates, Accident factors, Injury factors, Ejection, Safety design, Injury prevention, Occupant protection, Underride guards, Vehicle size, Vehicle weight

A survey was conducted of all accidents in New South Wales involving rigid and articulated trucks between January 1, 1968, and March 31, 1968. On the basis of the evidence available, trucks are over-represented in all reported accidents, and in accidents involving death to some road user. However, in truck-to-car collisions, truck occupants are less likely to be killed than the occupants of the lighter vehicle. Truck occupants who are ejected or who jump voluntarily from the cab are more likely to be injured or killed than those who remain within the cab. Safety for truck occupants would be increased by the use of seat restraint systems and by the application of other known principles of crash protection. The fitting of crash guards to prevent underride impact would add to the safety of the occupants of light cars.
HS-013 748

2. HIGHWAY SAFETY

2D. Design And Construction

IMPROVEMENT IN CABLE BARRIER DESIGN

National Aeronautical Establishment, Ottawa, Ont. (Canada)
G. F. W. McCaffrey 1972 29p 2refs Rept. No. LTR-ST.621
Presented at the Annual Convention of the Roads and Transp. Association of Canada, Winnepeg, 2-5 Oct 1972.
Corporate author

Barrier design, Cable barriers, Mathematical models, Barrier collision tests, Collision models, Ditches, Computerized simulation, Vehicle barrier collisions, Vehicle dynamics, Instrumented vehicles, Angle impact tests

Current practice in highway barrier design is reviewed, with particular emphasis on cable barriers. A mathematical model of the interaction of a vehicle with the barrier was developed and field experiments were conducted to assist in validating the model. The cable barrier chosen as a basic configuration consisted of steel cables supported on I-section posts socketed into a concrete base, cast in the ground. The cables (two 3/4-inch) were contained in an open slot cut in the web of the I-section at the top of the post and were anchored to concrete blocks set in the ground. A modification, made at the outset, was to notch the post at ground level to allow varying the post strength while maintaining the minimal variability of post strength inherent in the steel post socketed in a concrete base. A total of 108 full scale impacts were conducted. Eighty-eight of these employed a reinforced vehicle and were used to explore (usually with two replications) the effects of speed, angle of impact, post spacing, post strength, and cable pre-tension.
HS-013 726

THE NAE MODEL OF THE HIGHWAY CABLE BARRIER FOR PARAMETRIC STUDIES OF VEHICLE REDIRECTION USING DIGITAL SIMULATION

National Aeronautical Establishment, Ottawa, Ont. (Canada)
H. F. L. Pinkney, G. L. Basso, I. J. Fraser 1972 73p 10refs Rept. No. MS-133, NRC-12694
The main body of this report was previously drafted for limited distribution as working document LTR-ST.446.
Corporate author

Barrier design, Cable barriers, Computerized simulation, Mathematical models, Vehicle dynamics, Collision models, Accident simulation, Barrier tests, Barrier collision tests, Vehicle trajectories, Rebound, Instrumentation, Friction, Mechanical properties

The basis for experimental and analytical studies on the highway cable barrier and the analytical model of the cable barrier which has been formulated and programmed for digital simulation are described. The analysis contains a complete

description of an erected curved barrier in terms of post locations, post strengths, cable elevations, cable length, cable modulus, and cable pre-tension. The simulation realistically follows the cable interaction on the sprung mass and the release of the deflected cables by fracturing of the posts. The condition of friction between the vehicle and cables and the constraint posts and cables is included in the analysis. Data from five impact experiments show that the barrier model realistically describes the barrier response, and when processed with the BPR-CAL program provides an analytical model for parametric studies of the basic vehicle redirection as governed by vehicle and barrier mechanisms and properties.
HS-013 732

A SINGLE CAMERA METHOD FOR THE 6-DEGREE OF FREEDOM SPRUNG MASS RESPONSE OF VEHICLES REDIRECTED BY CABLE BARRIERS

National Aeronautical Establishment, Ottawa, Ont. (Canada)
M. C. van Wijk, H. F. L. Pinkney 1972 16p 6refs Rept. No. LTR-ST.622
Presented at Society of Photo-optical Instrumentation Engineers Seminar on Optical Instrumentation, Detroit, 20-22 Nov 1972.
Corporate author

Barrier design, Cable barriers, Photogrammetry, Barrier collision tests, Simulation models, Accident simulation, Degrees of freedom, Motion pictures, Computer programs, Impact angle, Roll, Pitch, Yaw, Sprung weight, Vehicle center of gravity, Vehicle trajectories

The development of a photographic method, using a standard 16mm movie camera, based on the photogrammetric solution for a single photograph is described. The application of the method to experiments on vehicle redirection by cable barriers is described. Comparisons with the analysis are given to show how the accuracy of the measured responses is necessary for validating and diagnosing the comprehensive analysis made possible by large scale digital computers. The method seems to offer a suitable solution for measuring the position and orientation parameters in a large number of applications involving moving objects.
HS-013 733

SIMULATION OF VEHICLE IMPACT WITH THE TEXAS CONCRETE MEDIAN BARRIER. VOL. 1, TEST COMPARISONS AND PARAMETER STUDY

Texas A and M Univ., College Station. Texas Transp. Inst.
R. D. Young, E. R. Post, H. E. Ross, Jr., R. M. Holcomb 1972 86p 9refs Rept. No. RR-140-5, PB-220 459
Sponsored by Texas Hwy. Dept. and Federal Hwy. Administration.
NTIS

Barrier tests, Median barriers, Concrete structures, Computerized simulation, Vehicle kinematics, Computer programs, Roll, Impact tests

The performance of the Texas Concrete Median Barrier (CMB) was evaluated from the standpoint of severity of impact, vehicle exit angle, maximum roll angle, and maximum pitch angle for a wide range of vehicle encroachment conditions. A modified version of the Highway-Vehicle-Object Simulation Model (HVOSM) was used to simulate a 4780 lb. automobile impacting the CMB at speeds of 50, 70, and 80 mph at angles of 5, 10 and 15 degrees for each of those speeds. These parameter studies were preceded by a validation phase where full-scale tests on the CMB were successfully simulated with the HVOSM. For impact speeds of 70 mph and greater with impact angles of 15 degrees and greater, automobile rollover can be expected. The results of all simulated impacts with the CMB are presented graphically with regard to a severity index based on vehicle accelerations. Simulation models; Impact angle; Impact severity; Severity indexes; Acceleration;
HS-013 739

2F. Maintenance

TEXAS CRASH CUSHION TRAILER TO PROTECT HIGHWAY MAINTENANCE VEHICLES

Texas A and M Univ., College Station. Texas Transp. Inst.
For primary bibliographic entry see Fld. 5N.
HS-013 738

2G. Meteorological Conditions

AUTOMOBILE EXHAUST EMISSION SURVEILLANCE. A SUMMARY
88P Rept. No. APTD-1544, PB-220 755

Contract EPA-68-01-0435
NTIS

Exhaust emission measurement, Exhaust emission tests, Exhaust emission sampling, Exhaust emission standards, Urban areas, Environmental factors, Vehicle age, Vehicle mileage, Hydrocarbons, Carbon monoxide, Nitrogen oxides, Discriminate analysis, Automobile models, Evaporative emissions, Evaporative emission control, Engine size effect on exhaust emissions, Acceleration, Steady state, Histograms, Exhaust emission control, Heuristic methods, Logarithms, Kansas City (Mo.), Houston, Los Angeles, Detroit, Denver, District of Columbia

Results are reported for three surveillance programs of light duty vehicle exhaust emissions conducted by the Environmental Protection Agency. Two programs employed the Federal Seven-Mode Test Procedure and the other program utilized the 1972 and 1975 Constant Volume Sampling Federal Test Procedure. Hydrocarbon and carbon monoxide emissions were assessed by comparing their mean emission levels with applicable Federal standards. To assess the extent to which local climate, terrain, driving practices, and other geographically differentiated factors affect emissions, vehicles were sampled in cities selected to span the range of such factors. The effect of mileage accumulation on vehicle functioning, as reflected by measurable changes in emission levels, was explored by making two or more emission measurements on the same vehicle at different points in its mileage-accumulation history.
HS-013 714

A TRANSPORTATION CONTROL STRATEGY FOR THE PHOENIX-TUCSON AIR QUALITY AREA. FINAL REPORT

242P 40REFS Rept. No. APTD-1369, PB-218 823
Contract EPA-68-02-0048
Report for 14 Aug-15 Dec 1972.
NTIS

Air pollution control, Air quality control regions, Exhaust emission standards, Arizona, Vehicle inspection, Vehicle maintenance, Retrofitting, Evaporative emission control, Vehicle

age, Hydrocarbons, Carbon monoxide, Nitrogen oxides, Air pollution measurement, Engine conversion, Traffic control, Traffic flow, Vehicle registration, Fuel rationing, Parking, Traffic bans, Staggered work times, Public transportation, Highway construction, Freeways, State action, Air pollution monitoring, Vehicle mileage, Power plants, Public opinion, Questionnaires, Air pollution control costs

The proposed transportation control strategy for Phoenix-Tucson is designed to meet hydrocarbon and primary oxidant standards by 1975 and the carbon monoxide standard by 1977. The strategy does not directly address itself to achieving the nitrogen dioxide standard. The Arizona State Implementation Plan was reviewed and the 1969 emissions inventory and air quality data from this plan were used as the baseline for making projections. Estimates of future air quality were made based on current stationary source control policies and forecasted growth. The strategy includes identification of the best transportation control measures to achieve the required air quality standards; prediction of emission reductions and air quality - impact anticipated from each control measure and strategy considered; assessment and documentation of expected political, institutional, legal, and socio-economic obstacles; and formulation of a timetable of key checkpoints to be used by the Environmental Protection Agency in monitoring implementation progress.
HS-013 766

ALTERNATIVES TO THE INTERNAL COMBUSTION ENGINE: IMPACTS ON ENVIRONMENTAL QUALITY

Resources for the Future, Inc., Washington, D.C.
For primary bibliographic entry see Fld. 5D.
HS-014 715

2I. Traffic Control

SPEED PROFILES AND TIME DELAY AT RAIL-HIGHWAY GRADE CROSSINGS. FINAL REPORT

BioTechnology, Inc., Falls Church, Va.
J. H. Sanders 1972 151p Rept. No. FHWA-RD-72-22, PB-220 713
Grant DOT-FH-11-7867
Subcontracted to Integrated Systems, Inc.
NTIS

Railroad grade crossings, Traffic delay, Speed patterns, Speed and delay meters, Electronic monitoring systems, Driver behavior, Data acquisition, Data processing, Railroad grade crossing signs, Rural intersections, Urban intersections, Sensors, Traffic simulation, Surface roughness, Speed reduction, Speed studies

One of the primary warrants for improving the level of grade crossing protection is cost in terms of vehicle delay. The purpose of this study was to provide a data base reflecting the behavior of motorists in the vicinity of crossings. Crossing parameters of urban/rural, two/four lane, high/low volume and active/passive grade crossing protection were considered in the selection of 26 crossings for instrumentation. At each site, the highway was instrumented at five points in each lane using the Traffic Evaluator System. The resulting magnetic tape permitted determination for each of over 40,000 vehicles at each point, speed, lane changing behavior, headway, wheelbase, and number of axles. Manual inputs were made to the system to indicate vehicles which were required to stop at the crossing, the activation of protective devices, the arrival and departure of trains, and train speed. The data base was organized to verify and improve an existing traffic flow model designed to provide information on motorist speed and time delay at crossings.
HS-013 727

A TRAFFIC SIGNAL SYSTEM FOR HIGH-SPEED ROADS

New South Wales Dept. of Motor Transport, Sydney (Australia)
G. F. Messiter 1971 32p 6refs Rept. No. 3/71
Traffic Accident Res. Unit, Department of Motor Transport, Box 28, G.P.O., Sydney, N.S.W., Australia 2001

Traffic signal timing, High speed highways, Vehicle detectors, Traffic actuated signals, Traffic signal cycle length, Speed sensors, New South Wales, Electronic traffic control, Amber traffic signals

The development of a traffic signal system for use on high speed roads is described. The aim of the system is to reduce the risk of driver error by minimizing the chance of the traffic signals changing from green to amber while a vehicle is within the dilemma zone associated with its approach speed. The equipment developed consists of a series of conventional vehicle loop-detectors installed in the roadway on the high speed approach to the signals. These detectors are coupled to a standard traffic signal controller through a timing and detector output control device which renders the detectors sensitive to vehicles in certain speed ranges. The relationship between the distance of each detector from the stop line and the range of its speed sensitivity are derived from Crawford's experimental results on driver judgment and error during the amber period at traffic lights.
HS-013 755

CRASHES AT RAILWAY LEVEL CROSSINGS

New South Wales Dept. of Motor Transport, Sydney, (Australia)
For primary bibliographic entry see Fld. 1C.
HS-013 757

THE EFFECTS OF VEHICLE DYNAMICS ON ASYMPTOTIC STABILITY IN CAR FOLLOWING

University of Southern California, Los Angeles
G. O. Burnham, G. A. Bekey 1972 14p 7refs Rept. No. AFOSR-TR-73-1104, AFOSR-71-2008, AD-762 587
Presented at Annual Conference on Manual Control (8th), Ann Arbor, May 1972.
NTIS

Car following, Computerized simulation, Vehicle spacing, Vehicle dynamics, Braking, Stability, Macroscopic traffic flow theory, Traffic models

Early models of car following utilized a point mass model of the automobile dynamics and were concerned primarily with a macroscopic view of car following theory. Based on that theory, the asymptotic stability of a string of cars was computed for various dynamic models of the vehicle. The results are compared and the limitations of the theory are discussed. The study showed that the results of a car following simulation can be varied substantially by changing the dynamic representation of the automobile. It was also shown that the point mass and the nonlinear models were asymptotically unstable but the first order lag model was asymptotically stable depending on the value of the time constant.
HS-013 767

THE INFLUENCE OF VISUAL PATTERN ON PERCEIVED SPEED AT NEWBRIDGE M8 MIDLOTHIAN

Transport and Road Res. Lab., Crowthorne, Berks. (England)
G. G. Denton 1973 18p 4refs Rept. No. TRRL-LR-531
Corporate author

Traffic circles, Velocity perception, Pavement markings, Speed control, Variance analysis, Time of day, Histograms, Scotland, Freeways

A contributory factor in accidents at intersections, particularly at intersections on high speed roads, is that drivers do not reduce speeds sufficiently to allow them to negotiate the junctions safely. A special pavement marking has been developed employing a geometric bar pattern that affects drivers' judgments of speed causing them to slow down. Markings of this type were laid in October 1971 on the approaches to the Newbridge roundabout on the M8 motorway, Midlothian. Measurements during the following month showed considerable and consistent reductions in speed. During the sixteen months following the installation two accidents have been reported at the site; there were 14 in the previous year.
HS-013 770

2J. Traffic Courts

AD HOCK TASK FORCE ON ADJUDICATION OF THE NATIONAL HIGHWAY SAFETY ADVISORY COMMITTEE. FINAL REPORT

53P 19REFS
Reference copy only

Traffic courts, Traffic law violations, Traffic law violators, High risk drivers, Driver improvement schools, Driver prosecutuion, Driver rehabilitation, Computerized driver records, Court cooperation with other agencies, Problem drivers

A special ad hoc task force of nine lawyer members reviewed over a three months' period the present traditional judicial adjudication of traffic violations, innovations in New York, Florida, Virginia, and California, available written materials, and similar findings of other commissions studying present methods of traffic adjudication. Recommendations include: adjudication of a lower-risk category of traffic infractions, criminal processing of high-risk offenses; combining traffic offense sentencing with driver improvement and rehabilitation programs; eliminating incarceration as a traffic infraction sanction; giving priority to identifying problem drivers, assigning them to treatment and monitoring the results; and creating a data processing system especially for the purpose of identifiying the problem driver.
HS-013 719

3. HUMAN FACTORS

TRANSPORTATION SAFETY EDUCATION AND MANPOWER TRAINING. SUMMARY REPORT OF A WORKSHOP, ORLANDO, FLORIDA, NOVEMBER 13-17, 1972

84P 1REF
Prepared for Dept. of Transp.
Corporate author

Highway safety programs, Safety education, Manpower utilization, Public information programs, Transportation planning, Man machine systems, Accident statistics

A synthesis of the deliberations in each of the workshop sessions and recommendations in the areas of problems in transportation safety, skills and disciplines required in transportation safety, organizational considerations for transportation safety programs, public edlcation requirements for transportation safety awareness, and manpower development and training requirements for transportation safety are presented.
HS-013 734

3A. Alcohol

HUMAN FACTORS IN TRAFFIC SAFETY: A REAPPRAISAL

New South Wales Dept. of Motor Transport, Sydney (Australia)
For primary bibliographic entry see Fld. 3D.
HS-013 753

THE INFLUENCE OF SENSORY PATTERN AND ALCOHOL ON VEHICULAR VELOCITY SENSING

Health Services and Mental Health Administration, Rockville, Md.
For primary bibliographic entry see Fld. 3D.
HS-013 775

3B. Anthropomorphic Data

DYNAMIC TESTS FOR SEAT BELTS

New South Wales Dept. of Motor Transport, Sydney (Australia)
For primary bibliographic entry see Fld. 5N.
HS-013 759

3C. Cyclists

DEATHS ON MOTORCYCLES. A STUDY OF 120 FATALITIES

New South Wales Dept. of Motor Transport, Sydney (Australia)
For primary bibliographic entry see Fld. 5C.
HS-013 751

HUMAN FACTORS IN TRAFFIC SAFETY: A REAPPRAISAL

New South Wales Dept. of Motor Transport, Sydney (Australia)
For primary bibliographic entry see Fld. 3D.
HS-013 753

3D. Driver Behavior

AD HOCK TASK FORCE ON ADJUDICATION OF THE NATIONAL HIGHWAY SAFETY ADVISORY COMMITTEE. FINAL REPORT

53P 19REFS
Reference copy only

Traffic courts, Traffic law violations, Traffic law violators, High risk drivers, Driver improvement schools, Driver prosecutuion, Driver rehabilitation, Computerized driver records, Court cooperation with other agencies, Problem drivers

A special ad hoc task force of nine lawyer members reviewed over a three months' period the present traditional judicial adjudication of traffic violations, innovations in New York, Florida, Virginia, and California, available written materials, and similar findings of other commissions studying present methods of traf-

fic adjudication. Recommendations include: adjudication of a lower-risk category of traffic infractions, criminal processing of high-risk offenses; combining traffic offense sentencing with driver improvement and rehabilitation programs; eliminating incarceration as a traffic infraction sanction; giving priority to identifying problem drivers, assigning them to treatment and monitoring the results; and creating a data processing system especially for the purpose of identifiying the problem driver.
HS-013 719

SPEED PROFILES AND TIME DELAY AT RAIL-HIGHWAY GRADE CROSSINGS. FINAL REPORT

BioTechnology, Inc., Falls Church, Va.
For primary bibliographic entry see Fld. 2I.
HS-013 727

THE ROLE OF COMMUNICATION AND PROPAGANDA IN TRAFFIC SAFETY

New South Wales Dept. of Motor Transport, Sydney (Australia)
For primary bibliographic entry see Fld. 4B.
HS-013 746

HUMAN FACTORS IN TRAFFIC SAFETY: A REAPPRAISAL

New South Wales Dept. of Motor Transport, Sydney (Australia)
M. Henderson 1971 68p 88refs Rept. No. 1/71
Traffic Accident Res. Unit, Department of Motor Transport; Box 28, G.P.O., Sydney, N.S.W., Australia 2001

Accident prevention, Accident statistics, High risk drivers, Driver behavior, Drinking drivers, Age factor in accidents, Adolescent drivers, Young adult drivers, Adolescent conduct codes, Driver experience, Aged drivers, Handicapped drivers, Penalties, Driver physical fitness, Drug effects, Accident proneness, Driver mental fitness, Driver personality, Motorcycle accidents, Vehicle pedestrian collisions, Driving task analysis, Driver education, Behavior modification, Driver licensing, Australia

Human factors which contribute to traffic accidents include alcohol and drug usage, driver age and experience, driver physical handicaps or illness, and driver mental fitness. Because behavior modification is extremely difficult, accident prevention measures must concentrate on traffic law enforcement, separation of vehicles and pedestrians, control of drinking drivers using methods designed to identify and treat alcoholics and pre-alcoholics, and centralized driver records. Research is required in the following areas: analysis of the skills used in driving, the current relationship of system demands to known human variables and skills, the importance of the socio-cultural environment, and the quantitative effect on accident occurrence of various levels of enforcement activity and of various methods of punishment and deterrence. As human failure will inevitably continue to occur during the driving task, the system should be designed so that, when human failure does occur, a crash does not necessarily result.
HS-013 753

AUTOMOBILE STOPPING DISTANCES FOR JUDGING HEADLIGHT PERFORMANCE

National Aeronautical Establishment, Ottawa, Ont. (Canada)
W. F. Campbell 1973 12p 9refs Rept. No. LTR-ST.595
Corporate author

Stopping distance, Wet road conditions, Dry road conditions, Visual perception, Driver reaction time, Stopping distance, Night visibility, Velocity, Tire pavement interface, Friction, Headlamps

One factor needed to measure the effectiveness of automobile headlights is the distance required by a driver to stop his vehicle once an obstacle has been observed in the road ahead. Some variables which affect stopping distance are discussed and curves giving the minimum stopping distance versus initital speed to be expected of most cars and drivers in most driving situations are given, covering the four night driving cases: the alert driver meeting an oncoming car on a dry level road; the same, on a wet level road; the normal driver on a rural road with no oncoming traffic on a dry level road; and the same, on a wet level road.
HS-013 761

INVESTIGATION INTO USE OF SAFETY BELTS

Central Organisation for Traf. Safety in Finland, Helsinki
For primary bibliographic entry see Fld. 5N.
HS-013 769

DRIVER BEHAVIOUR--NEWLY QUALIFIED DRIVERS

Transport and Road Res. Lab., Crowthorne, Berks. (England)
S. W. Quenault, P. M. Parker 1973 18p 4refs Rept. No. TRRL-LR-567
Corporate author

Driver experience, Driver performance, Driver behavior, Driver psychological tests, Statistical analysis, Driver classification

Five groups of 40 drivers drove around an assessment route under normal traffic conditions. The groups were composed of drivers with one, 13, 26, 39, or 52 weeks' experience after passing the official driving test. Average speeds in 30 mph and derestricted zones tended to become higher and car control tended to improve as the time following the official test increased. Most of the drive indices for the newly qualified drivers differed from those obtained from a random sample of drivers. When compared to 363 drivers chosen at random, fewer of the newly qualified drivers were assessed as driving safely, but with increasing experience the proportion increased and tended toward that of the random group. This result is consistent with the reduction in the accident rate of drivers with increasing experience.
HS-013 771

A DATA ACQUISITION SYSTEM FOR STUDIES OF DRIVER AND VEHICLE PERFORMANCE PARAMETERS IN REAL TRAFFIC CONDITIONS

National Aeronautical Establishment, Ottawa, Ont. (Canada)
R. Sewell 1972 20p Rept. No. LTR-ST.533
Corporate author

Driver performance, Automobile performance, Data acquisition, Driver monitoring, Night driving, Instrumented vehicles, Flow charts, Glare tolerances, Braking, Steering, Accident avoidance

A data acquisition system is described which has been installed in a standard North American automobile for the purpose of studying the problems associated with night driving tasks--that is, the ability of the driver to perceive and recognize specific

targets under glare conditions imposed by an approaching vehicle which can be fitted with a variety of headlamp configurations, and the associated responses of the driver and the test vehicle. These include measurement of the driver's pulse rate and reaction times during emergency braking. The system is open ended in that the pursuance of any particular line of research is limited only by the time required to develop specialized data acquisition subsystems (analog and/or digital sensing circuits), the preparation of specialized computer programs, and such system constraints as sampling rates and system accuracies.
HS-013 774

THE INFLUENCE OF SENSORY PATTERN AND ALCOHOL ON VEHICULAR VELOCITY SENSING

Health Services and Mental Health Administration, Rockville, Md.
S. Salvatore 1972 Rept. No. ICRL-RR-70-8, DHEW(HSM)-72-10003
GPO

Velocity perception, Alcohol effects, Visual fields, Time factors, Sound intensity, Driving simulation, Design of experiments, Test volunteers, Blood alcohol levels, Variance analysis, T test, Auditory perception, Visual perception, Peripheral vision

An investigation comparing the ability of subjects to judge travelled vehicular velocity with and without alcohol was performed. Auditory and visual cues to travelled velocity were presented alone and in combination. The time the cues were operative varied from 1/4 to one second. Judgments following low speeds tended to overestimation, and those following high speeds tended to underestimation. Auditory stimulation yielded more accurate velocity judgments than visual stimulation. Reduced observation time accentuates overestimation of low velocities and underestimation of high velocities. This effect of time on velocity is potentiated by alcohol. Both alcohol and reduced observation time increase the guessing that takes place. Under the influence of alcohol, when bisensory information is presented, a definite trend appears to evaluate only the auditory input, which is interpreted as a primitivization of the sensory attention mechanism rather than the employment of a strategy.
HS-013 775

3F. Driver Licensing

THE PROVISIONAL LICENCE SCHEME. A STATISTICAL EVALUATION

New South Wales Dept. of Motor Transport, Sydney (Australia)
M. Henderson, G. Messiter 1970 20p 1ref Rept. No. 4/70
Traffic Accident Res. Unit, Department of Motor Transport, Box 28, G.P.O., Sydney, N.S.W., Australia 2001

Temporary driver licenses, Special license plates, Driver license suspension, Driver license laws, Accident rates, Statistical analysis, Program evaluation, New South Wales, Driver license restrictions

In New South Wales, drivers in their first year of licensed experience are subject to a 40 m.p.h. speed limit, and must carry an identifying license plate. They may also have their licenses cancelled (usually for three months) for any one of a wide variety of moving traffic offenses. These measures were brought into effect in January, 1966, and are jointly known as the provisional license scheme. An analysis of the effectiveness of the scheme has been attempted in terms of a hoped for reduction in the accident rate of first year drivers. A small but statistically significant reduction was found; however, there is reason to doubt the validity of the data.
HS-013 750

DRIVER LICENSING–1972

Federal Hwy. Administration, Washington, D.C.
A. R. Mundy 1973 15p
Cover title: Drivers Licenses--1972.
Corporate author

Driver licensing, Driver licenses, Driver statistics, Driver sex, Driver age, Male drivers, Female drivers, Adolescent drivers, Young adult drivers, Adult drivers, Aged drivers

Statistics for 1972 indicating the ratio of licensed drivers to the population and licensed drivers by sex and age groups for 42 states and comparing licensed drivers 24 years old and under to total licensed drivers are presented.
HS-013 773

PHYSICALLY HANDICAPPED DRIVERS. A COMPARATIVE STUDY OF DRIVER RECORDS

California Dept. of Motor Vehicles, Sacramento
For primary bibliographic entry see Fld. 3I.
HS-013 776

3G. Drugs Other Than Alcohol

HUMAN FACTORS IN TRAFFIC SAFETY: A REAPPRAISAL

New South Wales Dept. of Motor Transport, Sydney (Australia)
For primary bibliographic entry see Fld. 3D.
HS-013 753

3H. Environmental Effects

CARBON MONOXIDE--WHAT IT IS, WHAT IT DOES

Traffic Safety v73 n8 p8-10, 38-9 (Aug 1973)
W. Berman, Jr. 1973
See serial citation

Carbon monoxide, Air pollution effect on health, Carbon monoxide poisoning, Blood carbon monoxide levels, Carboxyhemoglobin, Health hazards, Toxicity

Carbon monoxide intoxication is one of the nation's most common environmental hazards. Carbon monoxide itself kills about 1,300 people a year in the United States, though perhaps half of the nearly 8,400 nontransport annual fire deaths result from carbon monoxide intoxication. The characteristics, production, chemical behavior, and physiological interactions of carbon monoxide are described. Symptoms of carbon monoxide poisoning are outlined.
HS-013 718

3I. Impaired Drivers

HUMAN FACTORS IN TRAFFIC SAFETY: A REAPPRAISAL

New South Wales Dept. of Motor Transport, Sydney (Australia)
For primary bibliographic entry see Fld. 3D.
HS-013 753

PHYSICALLY HANDICAPPED DRIVERS. A COMPARATIVE STUDY OF DRIVER RECORDS

California Dept. of Motor Vehicles, Sacramento
D. R. Dreyer 1973 13p 4refs
Corporate author

Handicapped drivers, Driver records, Accident rates, Traffic law violations, Driver license standards, Insurance rates, Driver license restrictions, California, Driver characteristics, Male drivers, Female drivers, Statistical analysis

The driving records of physically handicapped drivers were compared to average drivers to evaluate the need for differential licensing or insurance rates for handicapped drivers. Handicapped drivers were defined as persons with loss of, or limited control of, one or more of their limbs. A 20% sample of the drivers license file resulted in 694 handicapped drivers with unexpired licenses, or an estimated population of 3,500. This handicapped sample was compared to a sample of 1,237 normal drivers. When compared on biographical variables, handicapped drivers were more likely to be male, single, and older. Their driving record appeared to be equal to, or better than, the normal driver. Both male and female handicapped drivers had a similar involvement in total accidents and a lesser number of convictions than the normal driver. From these results, it does not appear that differential licensing standard or insurance rates can be justified on the basis of the handicap alone.
HS-013 776

3K. Pedestrians

PEDESTRIAN PROTECTION THROUGH BEHAVIOR MODIFICATION

Traffic Engineering v43 n10 p14-6, 19-23 (Jul 1973)
J. B. Reading 1973 7refs
See serial citation

Pedestrian behavior, Pedestrian education, Child pedestrians, Child safety education, Vehicle pedestrian collisions, Pedestrian age, Time of accidents, Day of week, Month, Pedestrian safety, Safety campaigns, Accident statistics

A campaign to develop safer pedestrian behavior in school children under 12 years old was conducted in Salt Lake City. Phase one included the use of combined news media in a public awareness campaign. Local newspapers featured safety articles, scripts and slogans were written for use on the radio, six spot commercials on pedestrian safety were written for showing on local television stations, and a safety poster contest was held. Phase two consisted of behavior modification procedures beginning with assembly programs on safe street crossing behavior reinforced by street observers giving each child a good pedestrian citation. The percent of safe crossings increased greatly and remained high during the project.
HS-013 716

A DECADE OF PEDESTRIANS AND THEIR TRAFFIC COLLISIONS (1963-1972)

California State Univ., San Diego
W. E. Marsden, Jr. 1973 86p 74refs
Master's thesis.
W. E. Marsden, Jr., Community Services Dept., Texas A and M Univ. Texas Transp. Inst., College Station, Texas 77843 —5.00

Pedestrian accidents, Pedestrian safety, Reviews, Accident analysis, Accident studies, Pedestrian age, Pedestrian sex, Pedestrian behavior, Accident factors, Age factor in accidents, Sex factor in accidents, Accident prevention, Aged pedestrians, Child pedestrians, Traffic engineering, Pedestrian education, Traffic law enforcement, Safety program effectiveness, Drinking pedestrians, Vehicle pedestrian collisions

The findings of reports on pedestrian collisions published from 1963 through 1972 were analyzed and interpreted in an attempt to draw conclusions from them and make recommendations for effective countermeasures. The interpretation of the publications was divided into an analysis of age, sex, and pedestrian action and an examination of engineering, education, and enforcement countermeasures. Significant conclusions were that pedestrian collisions occur primarily to the very young and the very old; engineering countermeasures are not necessarily a cost-effective means of preventing pedestrian collisions; educational countermeasures hold little hope for immediate success in significantly reducing pedestrian collisions; and enforcement countermeasures with emphasis on alcohol enforcement appear to stand the best chance for the immediate reduction of auto-pedestrian collisions. A combination of engineering, education, and enforcement programs designed for the young, the elderly, and the drinking pedestrian is recommended.
HS-013 724

HUMAN FACTORS IN TRAFFIC SAFETY: A REAPPRAISAL

New South Wales Dept. of Motor Transport, Sydney (Australia)
For primary bibliographic entry see Fld. 3D.
HS-013 753

3L. Vision

CONTRAST SENSITIVITY OF PARTICIPANTS IN AUTOMOBILE HEADLIGHT EXPERIMENTS

National Aeronautical Establishment, Ottawa, Ont. (canada)
P. Huculak, R. Blais 1973 18p 5refs Rept. No. LTR-ST.600
Corporate author

Visual perception, Target detection, Contrast, Discrimination, Backgrounds, Brightness, Luminance, Least squares method, Numerical analysis, Visual threshold, Night vision, Laboratory tests

A program developed to measure contrast sensitivity at light levels comparable to those prevailing on roadways at night is described. Contrast is determined by the luminance difference between the adapting background and the target to be detected. The basic technique used is psycho-physical in which participants respond to a presented stimulus and the resulting behavioral effect is recorded in a laboratory environment. The task is the detection of a target which is brighter than its background and similar in difficulty to the detection of dark hazard-like objects while night driving. The test apparatus and procedure are described, basic equations for detection probability are presented, and the performance data are analyzed.
HS-013 728

A TARGET DETECTION EXPERIMENT AT NIGHT ON HIGHWAY 417

National Aeronautical Establishment, Ottawa, Ont. (Canada)
A. Smiley, P. Huculak 1973 13p Rept. No. LTR-ST.598
Corporate author

Target detection, Night visibility, Visual perception, Sight distances, Test equipment, Design of experiments, Headlamp glare

A series of target detection tasks were carried out at night on Highway 417 in southeast Ottawa. The purpose of these tasks was to collect data on seeing distances for a group of subjects of known visual characteristics using headlamps of known illumination characteristics. From this data it is hoped that a method will be derived for predicting, with a computer program, seeing distance for a particular set of headlights given the visual characteristics of a subject and the illumination at the eye. The subjects, equipment, site, and procedure used in conducting the experiment are described.
HS-013 760

THE INFLUENCE OF SENSORY PATTERN AND ALCOHOL ON VEHICULAR VELOCITY SENSING

Health Services and Mental Health Administration, Rockville, Md.
For primary bibliographic entry see Fld. 3D.
HS-013 775

4. OTHER SAFETY-RELATED AREAS

4B. Community Support

TRANSPORTATION SAFETY EDUCATION AND MANPOWER TRAINING. SUMMARY REPORT OF A WORKSHOP, ORLANDO, FLORIDA, NOVEMBER 13-17, 1972

84P 1REF

Prepared for Dept. of Transp.
Corporate author

Highway safety programs, Safety education, Manpower utilization, Public information programs, Transportation planning, Man machine systems, Accident statistics

A synthesis of the deliberations in each of the workshop sessions and recommendations in the areas of problems in transportation safety, skills and disciplines required in transportation safety, organizational considerations for transportation safety programs, public edlcation requirements for transportation safety awareness, and manpower development and training requirements for transportation safety are presented.
HS-013 734

THE ROLE OF COMMUNICATION AND PROPAGANDA IN TRAFFIC SAFETY

New South Wales Dept. of Motor Transport, Sydney (Australia)
G. C. Avery 1973 64p 81refs Rept. No. 3/73
Traffic Accident Res. Unit, Department of Motor Transport, Box 28, G.P.O., Sydney, N.S.W., Australia 2001

Safety propaganda, Safety campaigns, Safety program effectiveness, Attitude changes, Behavior research, Psychological factors, Personality, Fear, Sociological factors, Public information programs, Motivation, Australia

Approaches to traffic safety propaganda campaigns need to be examined critically before they are implemented. To this end, theories of attitude change are briefly reviewed; the process of communication and some communication variables are analyzed; the role of fear appeals in propaganda is reviewed; and traffic safety propaganda is examined. Based on the evidence presented, it is recommended that: all future propaganda be evaluated to ensure that resources are not wasted on ineffective propaganda; all future propaganda campaigns have specific aims to facilitate evaluation and acceptance of the campaigns; fear appeals be used only when a specific solution to the threatened consequences can be recommended in the communication; the news media reduce the number of references made to the road toll; and the potential value of confining all propaganda effort to informative campaigns be investigated in the event that persuasive campaigns are found to be ineffective.
HS-013 746

4C. Cost Effectiveness

A STUDY OF MANDATORY ENGINE MAINTENANCE FOR REDUCING VEHICLE EXHAUST EMISSIONS. VOL. 1, EXECUTIVE SUMMARY

51P Rept. No. PB-220 726

In support of APRAC Project No. CAPE-13-68 for Coordinating Res. Council, Inc. and Environmental Protection Agency. A joint effort by TRW Systems Group and its subcontractor, Scott Res. Lab., Inc.
NTIS

For abstract and search terms see HS-013 709--HS-013 713.
HS-013 708

A STUDY OF MANDATORY ENGINE MAINTENANCE FOR REDUCING VEHICLE EXHAUST EMISSIONS. VOL. 2, MANDATORY INSPECTION/MAINTENANCE SYSTEMS STUDY

69P 1REF Rept. No. PB-220 727

In support of APRAC Project No. CAPE-13-68 for Coordinating Res. Council, Inc. and Environmental Protection Agency. A joint effort by TRW Systems Group and its subcontractor, Scott Res. Labs., Inc.
NTIS

Exhaust emission control, Vehicle inspection, Engine maintenance, Exhaust emission measurement, Benefit cost analysis, Figure of merit, Inspection effectiveness, Nitrogen oxides, Carbon monoxide, Hydrocarbons, Computerized simulation, Statistical analysis, Exhaust emission tests, Forecasting, Inspection procedures, Inspection costs, Maintenance costs, Sensitivity analysis, Deterioration, Inspection frequency, Ambient air quality, Regional planning

The results obtained during the first year of the Extended Phase 1 Coordinating Research Council Emission Test Program are summarized. The main focus of this study was to assess the feasibility of reducing exhaust emissions through a program of mandatory inspection and maintenance. The basic differences between this analysis and one presented in the Interim Report involve the use of an improved experimental data base and refinements in the Economic Effectiveness Model. The selection of optimum procedures and a sensitivity analysis of the system are presented. Regional implications of vehicle inspection/maintenance are discussed. The conclusions derived from this study are generally similar to those given in the Interim Report. This analysis differs from the previous one in the following regards: the entire vehicle population is considered; experimental data on the reliability of repair and maintenance dura-

bility is used for the first time; and the results are based upon the 1972 Federal Emission Test Procedure.
HS-013 709

A STUDY OF MANDATORY ENGINE MAINTENANCE FOR REDUCING VEHICLE EXHAUST EMISSIONS. VOL. 3, A DOCUMENTATION HANDBOOK FOR THE ECONOMIC EFFECTIVENESS MODEL
91P 2REFS Rept. No. PB-220 728
In support of APRAC Project No. CAPE-13-68 for Coordinating Res. Council, Inc. and Environmental Protection Agency. A joint effort by TRW Systems Group and its subcontractor, Scott Res. Labs., Inc.
NTIS

Computerized simulation, Mathematical models, Evaluation, Benefit cost analysis, Exhaust emission control, Vehicle inspection, Engine maintenance, Computer programs, Sensitivity analysis, Simllation models, Statistical analysis, Forecasting, Evaluation, Figure of merit, Systems engineering

The Economic Effectiveness Model serves as a research and design tool for assessing the various implications of a mandatory program of vehicle inspection/maintenance. The model is designed to analyze the regional feasibility of vehicle inspection/maintenance as well as to specify an optimal system design. The model can also be used to analyze the sensitivity of system performance to various model assumptions and basic data inputs. The main function of the model, in addition to analyzing policy variables, is in simulating the behavior of the inspection/maintenance process over time. Here, the economic-effectiveness of various strategies can be measured in terms of emission reductions and program costs at each time interval. A statistical analysis of these reductions can be undertaken as a further check on predicted model performance. The final step in this process is to utilize the unadjusted or statistically adjusted figure of merit for selecting the optimal model design for each candidate region.
HS-013 710

LOW COST URBAN TRANSPORTATION ALTERNATIVES: A STUDY OF WAYS TO INCREASE THE EFFECTIVENESS OF EXISTING TRANSPORTATION FACILITIES. EXECUTIVE SUMMARY
Pratt (R. H.) Associates, Inc., Kensington, Md.
For primary bibliographic entry see Fld. 4H.
HS-013 721

LOW COST URBAN TRANSPORTATION ALTERNATIVES: A STUDY OF WAYS TO INCREASE THE EFFECTIVENESS OF EXISTING TRANSPORTATION FACILITIES. VOL. 2. RESULTS OF CASE STUDIES AND ANALYSIS OF BUSWAY APPLICATIONS IN THE UNITED STATES
Pratt (R. H.) Associates, Inc., Kensington, Md.
For primary bibliographic entry see Fld. 4H.
HS-013 723

ALTERNATIVES TO THE INTERNAL COMBUSTION ENGINE: IMPACTS ON ENVIRONMENTAL QUALITY
Resources for the Future, Inc., Washington, D.C.
For primary bibliographic entry see Fld. 5D.
HS-014 715

4E. Information Technology

CNTR: A HEADLAMP RESEARCH PROGRAM FOR PRODUCING A CONTOUR PLOT OF THE GRID SURFACE
National Aeronautical Establishment, Ottawa, Ont. (Canada)
A. L. Harrison 1972 51p 4refs Rept. No. LTR-ST.603
Corporate author

Computer programs, Headlamps, Computerized design, Graphic techniques, Flow charts, Plotters, Data processing, Lighting, Brightness, Isocandela maps

The CNTR program produces a contour plot of a surface defined over a uniform grid. A description of the grid surface, the plotting parameter specification, and the plotting features, an analysis of the program structure, and a discussion of its implementation are presented. Appendices are included which present the source listing for the program and a sample execution of the program.
HS-013 762

4F. Insurance

AUTOMOBILE HEAD RESTRAINTS--FREQUENCY OF NECK INJURY CLAIMS IN RELATION TO THE PRESENCE OF HEAD RESTRAINTS
For primary bibliographic entry see Fld. 5N.
HS-013 729

4G. Mathematical Sciences

EXPERIMENTS ON ROTARY VALVE UNDER STEADY AND UNSTEADY FLOW CONDITIONS
Tokyo Electrical Engineering Coll. (Japan)
For primary bibliographic entry see Fld. 5F.
HS-013 706

A STUDY OF MANDATORY ENGINE MAINTENANCE FOR REDUCING VEHICLE EXHAUST EMISSIONS. VOL. 1, EXECUTIVE SUMMARY
51P Rept. No. PB-220 726
In support of APRAC Project No. CAPE-13-68 for Coordinating Res. Council, Inc. and Environmental Protection Agency. A joint effort by TRW Systems Group and its subcontractor, Scott Res. Lab., Inc.
NTIS

For abstract and search terms see HS-013 709--HS-013 713.
HS-013 708

A STUDY OF MANDATORY ENGINE MAINTENANCE FOR REDUCING VEHICLE EXHAUST EMISSIONS. VOL. 2, MANDATORY INSPECTION/MAINTENANCE SYSTEMS STUDY
69P 1REF Rept. No. PB-220 727
In support of APRAC Project No. CAPE-13-68 for Coordinating Res. Council, Inc. and Environmental Protection Agency. A joint effort by TRW Systems Group and its subcontractor, Scott Res. Labs., Inc.
NTIS

Exhaust emission control, Vehicle inspection, Engine maintenance, Exhaust emission measurement, Benefit cost analysis,

Figure of merit, Inspection effectiveness, Nitrogen oxides, Carbon monoxide, Hydrocarbons, Computerized simulation, Statistical analysis, Exhaust emission tests, Forecasting, Inspection procedures, Inspection costs, Maintenance costs, Sensitivity analysis, Deterioration, Inspection frequency, Ambient air quality, Regional planning

The results obtained during the first year of the Extended Phase 1 Coordinating Research Council Emission Test Program are summarized. The main focus of this study was to assess the feasibility of reducing exhaust emissions through a program of mandatory inspection and maintenance. The basic differences between this analysis and one presented in the Interim Report involve the use of an improved experimental data base and refinements in the Economic Effectiveness Model. The selection of optimum procedures and a sensitivity analysis of the system are presented. Regional implications of vehicle inspection/maintenance are discussed. The conclusions derived from this study are generally similar to those given in the Interim Report. This analysis differs from the previous one in the following regards: the entire vehicle population is considered; experimental data on the reliability of repair and maintenance durability is used for the first time; and the results are based upon the 1972 Federal Emission Test Procedure.
HS-013 709

A STUDY OF MANDATORY ENGINE MAINTENANCE FOR REDUCING VEHICLE EXHAUST EMISSIONS. VOL. 3, A DOCUMENTATION HANDBOOK FOR THE ECONOMIC EFFECTIVENESS MODEL

91P 2REFS Rept. No. PB-220 728

In support of APRAC Project No. CAPE-13-68 for Coordinating Res. Council, Inc. and Environmental Protection Agency. A joint effort by TRW Systems Group and its subcontractor, Scott Res. Labs., Inc.
NTIS

Computerized simulation, Mathematical models, Evaluation, Benefit cost analysis, Exhaust emission control, Vehicle inspection, Engine maintenance, Computer programs, Sensitivity analysis, Simllation models, Statistical analysis, Forecasting, Evaluation, Figure of merit, Systems engineering

The Economic Effectiveness Model serves as a research and design tool for assessing the various implications of a mandatory program of vehicle inspection/maintenance. The model is designed to analyze the regional feasibility of vehicle inspection/maintenance as well as to specify an optimal system design. The model can also be used to analyze the sensitivity of system performance to various model assumptions and basic data inputs. The main function of the model, in addition to analyzing policy variables, is in simulating the behavior of the inspection/maintenance process over time. Here, the economic-effectiveness of various strategies can be measured in terms of emission reductions and program costs at each time interval. A statistical analysis of these reductions can be undertaken as a further check on predicted model performance. The final step in this process is to utilize the unadjusted or statistically adjusted figure of merit for selecting the optimal model design for each candidate region.
HS-013 710

A STUDY OF MANDATORY ENGINE MAINTENANCE FOR REDUCING VEHICLE EXHAUST EMISSIONS. VOL. 4, EXPERIMENTAL CHARACTERIZATION OF VEHICLE EMISSIONS AND MAINTENANCE STATES

500P 13REFS Rept. No. PB-220 729

In support of APRAC Project No. CAPE-13-68 for Coordinating Res. Council, Inc. and Environmental Protection Agency. A joint effort by TRW Systems Group and its subcontractor, Scott Res. Labs., Inc.
NTIS

Exhaust emission tests, Exhaust emission measurement, Design of experiments, Vehicle inspection, Engine maintenance, Inspection equipment, Test equipment, Data reduction, Data analysis, Data processing, Computer programs, Deterioration, Statistical analysis, Engine operating conditions, Engine inspection, Tuneup, Inspection procedures, Hydrocarbons, Nitrogen oxides, Carbon monoxide, Detroit, San Bernardino, Chemiluminescence, Infrared analyzers, Ultraviolet analyzers

Three distinct experimental programs were conducted to characterize vehicle emissions and maintenance states: a large scale fleet evaluation to determine vehicle engine parameter setting distributions and component deterioration characteristics with time and mileage; statistically designed tests (orthogonal experiments) of 1971 California and pre-emission controlled vehicles to determine the main effects and first order interactions of emission response to engine parameters; and a survey to determine the maintenance condition of vehicle engine tuneup parameters and emission control systems and components of vehicles in the Detroit area. The designs and results of each of these experiments are presented.
HS-013 711

AUTOMOBILE EXHAUST EMISSION SURVEILLANCE. A SUMMARY

88P Rept. No. APTD-1544, PB-220 755

Contract EPA-68-01-0435
NTIS

Exhaust emission measurement, Exhaust emission tests, Exhaust emission sampling, Exhaust emission standards, Urban areas, Environmental factors, Vehicle age, Vehicle mileage, Hydrocarbons, Carbon monoxide, Nitrogen oxides, Discriminate analysis, Automobile models, Evaporative emissions, Evaporative emission control, Engine size effect on exhaust emissions, Acceleration, Steady state, Histograms, Exhaust emission control, Heuristic methods, Logarithms, Kansas City (Mo.), Houston, Los Angeles, Detroit, Denver, District of Columbia

Results are reported for three surveillance programs of light duty vehicle exhaust emissions conducted by the Environmental Protection Agency. Two programs employed the Federal Seven-Mode Test Procedure and the other program utilized the 1972 and 1975 Constant Volume Sampling Federal Test Procedure. Hydrocarbon and carbon monoxide emissions were assessed by comparing their mean emission levels with applicable Federal standards. To assess the extent to which local climate, terrain, driving practices, and other geographically differentiated factors affect emissions, vehicles were sampled in cities selected to span the range of such factors. The effect of mileage accumulation on vehicle functioning, as reflected by measurable changes in emission levels, was explored by making two or more emission measurements on the same vehicle at different points in its mileage-accumulation history.
HS-013 714

IMPROVEMENT IN CABLE BARRIER DESIGN
National Aeronautical Establishment, Ottawa, Ont. (Canada)
For primary bibliographic entry see Fld. 2D.
HS-013 726

CONTRAST SENSITIVITY OF PARTICIPANTS IN AUTOMOBILE HEADLIGHT EXPERIMENTS
National Aeronautical Establishment, Ottawa, Ont. (canada)
For primary bibliographic entry see Fld. 3L.
HS-013 728

TIME SERIES FORECASTING OF HIGHWAY ACCIDENT FATALITIES. FINAL REPORT
National Bureau of Standards, Gaithersburg, Md.
For primary bibliographic entry see Fld. 1B.
HS-013 730

THE NAE MODEL OF THE HIGHWAY CABLE BARRIER FOR PARAMETRIC STUDIES OF VEHICLE REDIRECTION USING DIGITAL SIMULATION
National Aeronautical Establishment, Ottawa, Ont. (Canada)
For primary bibliographic entry see Fld. 2D.
HS-013 732

A SINGLE CAMERA METHOD FOR THE 6-DEGREE OF FREEDOM SPRUNG MASS RESPONSE OF VEHICLES REDIRECTED BY CABLE BARRIERS
National Aeronautical Establishment, Ottawa, Ont. (Canada)
For primary bibliographic entry see Fld. 2D.
HS-013 733

SIMULATION OF VEHICLE IMPACT WITH THE TEXAS CONCRETE MEDIAN BARRIER. VOL. 1, TEST COMPARISONS AND PARAMETER STUDY
Texas A and M Univ., College Station. Texas Transp. Inst.
For primary bibliographic entry see Fld. 2D.
HS-013 739

A SUMMARY OF THE RELATIONSHIPS BETWEEN ACCIDENT INDICES AND RATES FOLLOWING A REDEFINITION OF 'FAILURE'. FINAL REPORT
National Bureau of Standards, Gaithersburg, Md.
A. R. Craw 1973 18p Rept. No. NBSIR-73-154, COM-73-10865
Sponsored by National Hwy. Traf. Safety Administration.
NTIS

Accident rates, Single vehicle accidents, Vehicle vehicle collisions, Mathematical analysis, Statistical analysis

Using Cerrelli's association of failure with active involvements in the case of two vehicle accidents, one can define failure indices, accident involvement indices, failure rates, accident involvement rates for single vehicle, two vehicle, and for the union class of one and two vehicle accidents. This note presents, in a condensed form, all of the definitions of these measures, and a number of useful relationships and interrelationships that exist between these different measures. These formulae should prove useful in the calculation of the resulting indices and rates and of converting from one set of measures to another.
HS-013 744

DETERMINATION OF SWEPT PATHS OF VEHICLES
New South Wales Dept. of Motor Transport, Sydney (Australia)
For primary bibliographic entry see Fld. 5R.
HS-013 749

SCALE MODELING OF EQUILIBRIUM TIRE TEMPERATURE
For primary bibliographic entry see Fld. 5V.
HS-013 764

MECHANICS OF THE PNEUMATIC TIRE. PT. 1. THE TIRE UNDER INFLATION ALONE
For primary bibliographic entry see Fld. 5V.
HS-013 765

THE EFFECTS OF VEHICLE DYNAMICS ON ASYMPTOTIC STABILITY IN CAR FOLLOWING
University of Southern California, Los Angeles
For primary bibliographic entry see Fld. 2I.
HS-013 767

ALTERNATIVES TO THE INTERNAL COMBUSTION ENGINE: IMPACTS ON ENVIRONMENTAL QUALITY
Resources for the Future, Inc., Washington, D.C.
For primary bibliographic entry see Fld. 5D.
HS-014 715

4H. Transportation Systems

LOW COST URBAN TRANSPORTATION ALTERNATIVES: A STUDY OF WAYS TO INCREASE THE EFFECTIVENESS OF EXISTING TRANSPORTATION FACILITIES. EXECUTIVE SUMMARY
Pratt (R. H.) Associates, Inc., Kensington, Md.
J. H. Dupree, R. H. Pratt 1973 76p
Contract DOT-OS-20034
Prepared for the Department of Transp. Office of Urban Transp. Systems. For abstracts and search terms, see HS-013 722 and HS-013 723.
NTIS
HS-013 721

LOW COST URBAN TRANSPORTATION ALTERNATIVES: A STUDY OF WAYS TO INCREASE THE EFFECTIVENESS OF EXISTING TRANSPORTATION FACILITIES. VOL. 1. RESULTS OF A SURVEY AND ANALYSIS OF TWENTY-ONE LOW COST TECHNIQUES
Pratt (R. H.) Associates, Inc., Kensington, Md.
J. H. Dupree, R. H. Pratt 1973 297p refs
Contract DOT-OS-20034
Prepared for the Department of Transp. Office of Urban Transp. Systems. Executive summary is HS-013 721.
NTIS

Transportation studies, Urban transportation, Busways, Transportation system costs, Transportation of poor, Car pools, Staggered work times, Bus lanes, Reserved lanes, Traffic metering, Traffic surveillance, Jitneys, Public transportation, Ground transportation feeder systems, Airport access, Trucks, Taxicabs, Limousine services, Railbuses, Minibuses, Traffic volume, Fuel consumption, Driver aid systems, Demand scheduled buses, Demand responsive transportation systems

Each of the 21 techniques was evaluated by 13 criteria with particular emphasis on its potential for increasing volume and/or

reducing time in moving people via existing transportation facilities. The evaluation also considered various cost parameters, impacts on the disadvantaged, environmental and transportation safety factors, technical and institutional viability, and the expected response from travelers. The most promising techniques were exclusive bus lanes on urban arterials, exclusive reserved lanes on freeways for mass transit, exclusive busways on specially constructed rights-of-way, work scheduling changes, and highway traffic engineering systems improvements.
HS-013 722

LOW COST URBAN TRANSPORTATION ALTERNATIVES: A STUDY OF WAYS TO INCREASE THE EFFECTIVENESS OF EXISTING TRANSPORTATION FACILITIES. VOL. 2. RESULTS OF CASE STUDIES AND ANALYSIS OF BUSWAY APPLICATIONS IN THE UNITED STATES

Pratt (R. H.) Associates, Inc., Kensington, Md.
J. H. Dupree, R. H. Pratt 1973 186p refs
Contract DOT-OS-20034
Prepared for the Department of Transp. Office of Urban Transp. Systems. Executive summary is HS-013 721.
NTIS

Transportation studies, Urban transportation, Busways, Transportation system costs, Bus lanes, Transportation system financing, Federal aid, Traffic volume, Bus lane signs, Peak hour traffic, Travel time, Bus usage, Freeways, Accident rates, Cones, Barriers, Traffic signal preemption, Traffic signal delay time, Ramp control

Seven operating exclusive bus lanes were studied. Three of the lanes operate as contraflow facilities on freeways, three as contraflow bus lanes on arterial streets, and one as a specially constructed bus lane. Findings indicate that busways offer the potential for substantial gain in total capacity to move people. There is strong evidence that commuters are attracted to public transportation such as can be provided via an exclusive bus lane if travel time saving is achieved. Bus lanes can be made operable in a matter of weeks at a cost that can often be absorbed within operating budgets. The potential for bus lanes in five diverse urban environments is analyzed. Data is provided on Federal funding appropriate to establishing bus lanes.
HS-013 723

FORECASTS OF VEHICLES AND TRAFFIC IN GREAT BRITAIN. 1972 REVISION

Transport and Road Res. Lab. Crowthorne, Berks. (England)
A. H. Tulpule 1973 20p 12refs Rept. No. TRRL-LR-543
Corporate author

Traffic volume, Vehicle registration, Great Britain, Forecasting, Demographic projections, Vehicle mileage, Transportation statistics

Forecasts of numbers of vehicles and volumes of traffic are revised in the light of 1971 data on vehicle licences and traffic flows and of the latest population forecasts. It is estimated that the number of vehicles in Great Britain is likely to rise from 15 million in 1971 to 22 million in 1980, 27 million in 1990, and 33 million in the year 2010. The forecast for the year 2010 is 3 million lower than the previous estimate. Most of this difference is due to the downward revision of the population forecasts. The forecast of volume of traffic in the year 2010 is 478 thousand million vehicle kilometers, slightly lower than the previous figure, and just over double the figure for 1971.
HS-013 745

5. VEHICLE SAFETY

5A. Brake Systems

A PARAMETER-VERIFICATION TECHNIQUE FOR PASSENGER-CAR ANALOG MODELS

Bendix Technical Journal v6 n1 p47-52 (Spring 1973)
R. T. Hendrickson 1973 4refs
See serial citation

Automobile modeling, Computerized simulation, Simulation models, Tire pavement interface, Brake performance, Brake tests, Coefficient of friction, Tire road conditions, Dry road conditions, Parameters, Braking recorders, Wet road conditions, Wheel slip

A technique for verifying the accuracy of simplified analog computer models of braked passenger cars is presented. Tape-recorded brake-pressure and wheel-speed data from vehicle road tests are introduced directly into the vehicle simulation, and a comparison of actual and simulation model vehicle braking performance over a wide range of speed and road conditions is automatically generated. Necessary model-parameter adjustments suggested by these performance data result in a more accurate model and better defined limits of operation than have been afforded by previous verification techniques.
HS-013 737

A DATA ACQUISITION SYSTEM FOR STUDIES OF DRIVER AND VEHICLE PERFORMANCE PARAMETERS IN REAL TRAFFIC CONDITIONS

National Aeronautical Establishment, Ottawa, Ont. (Canada)
For primary bibliographic entry see Fld. 3D.
HS-013 774

5C. Cycles

LOW COST URBAN TRANSPORTATION ALTERNATIVES: A STUDY OF WAYS TO INCREASE THE EFFECTIVENESS OF EXISTING TRANSPORTATION FACILITIES. VOL. 1. RESULTS OF A SURVEY AND ANALYSIS OF TWENTY-ONE LOW COST TECHNIQUES

Pratt (R. H.) Associates, Inc., Kensington, Md.
For primary bibliographic entry see Fld. 4H.
HS-013 722

HOW STEERING WORKS. WHY YOUR MOTORCYCLE GOES AROUND CORNERS WELL--OR WHY IT DOESN'T

For primary bibliographic entry see Fld. 5R.
HS-013 735

DEATHS ON MOTORCYCLES. A STUDY OF 120 FATALITIES

New South Wales Dept. of Motor Transport, Sydney (Australia)
M. Henderson 1970 14p 8refs Rept. No. 5/70
Traffic Accident Res. Unit, Department of Motor Transport; Box 28, G.P.O., Sydney, N.S.W., Australia 2001

Motorcycle operator fatalities, Motorcycle passenger fatalities, Accident studies, Fatality causes, Fatality prevention, Headgear laws, Time of day, Day of week, Sex factor in accidents, Age factor in accidents, Motorcycle visibility, Fatality rates, New South Wales, Headlamp daytime usage

Report forms concerning the deaths of 120 motorcycle riders in traffic crashes in New South Wales have been studied. Most of those killed were young men. The under 25-year-olds suffered 93 (77.5%) of the fatalities. Deaths were particularly common after 6:00 p.m. and on weekends. In many cases the driver of the colliding vehicle had not been aware of the motorcyclist's presence. Any measure which would make motorcycles more easily visible, such as the constant burning of headlights, should have a beneficial effect. Head injury was very common. If 100% of motorcyclists in New South Wales wore crash helmets, rather than the 75% as at present, the death rate would be cut by about 35%.
HS-013 751

5D. Design

SIMPLE AUTOMOBILE GAS TURBINE COMBUSTORS FOR LOW EMISSIONS

United Aircraft of Canada Ltd., Longueuil, Que.
For primary bibliographic entry see Fld. 5F.
HS-013 707

SAFETY REQUIREMENTS AND SPECIFICATIONS FOR MOBILE VEHICLES USED FOR TRANSPORTATION OF PASSENGER TO AND FROM AIRCRAFT AND PASSENGER TERMINALS

10P
Corporate author

Design standards, Specifications, Structural design, Fuel systems, Brake system design, Control equipment, Vehicle lighting, Interior design, Exhaust system design, Vehicle safety standards

The design and functional specifications recommended by the Air Transport Section of the National Safety Council are outlined. Included are specifications for: structural requirements, environment adaptation, component ratings, fuel systems; exhaust system, brake system, controls, lift safety devices, illumination, access stair/ladders, emergency exits, interior design and materials, and stabilizers.
HS-013 725

DETERMINING VEHICLE INERTIAL PROPERTIES FOR SIMULATION STUDIES

Bendix Technical Journal v6 n1 p53-7 (Spring 1973)
M. B. Gordan, G. W. Hurlong, Jr. 1973
See serial citation

Vehicle mass, Inertia, Vehicle center of gravity, Vehicle weight, Moments of inertia, Pendulums, Equations, Roll, Pitch, Yaw

Three basic methods can be used for determining vehicle-mass properties. The analytical method yields the desired physical descriptors by direct calculation, with vehicle component and subassembly drawings serving as data sources. Experimentally, measurements can be made directly by using a cradle structure having pivots that can be located on each of the vehicle horizontal axes, together with a rotatable table for vertical-axis measurements. The alternative method of direct measurement takes advantage of the properties of the compound pendulum. The period of oscillation of pendulums constructed from the vehicle and a suitable support structure is determined, using both vertically suspended and torsionally oscillated configurations. These data, in combination with known vehicle weight and geometry, yield the required mass-property values. Pendulum configurations and the apparatus needed to determine center of gravity locations and moments of inertia, using the compound pendulum approach are described.
HS-013 740

ALTERNATIVES TO THE INTERNAL COMBUSTION ENGINE: IMPACTS ON ENVIRONMENTAL QUALITY

BY Johns Hopkins Univ. Press, Baltimore, —12.00
Resources for the Future, Inc., Washington, D.C.
R. U. Ayes, R. P. McKenna 1972 339p refs
Publisher

Environmental impact statements, Exhaust emission control, Internal combustion engines, Rankine cycle engines, Electric automobiles, Hybrid vehicles, Engine modification, Engine design, Batteries, Exhaust emission measurement, Exhaust densities, Engine performance, Energy conversion, Urban areas, Acoustic measurement, Sound intensity, Engine noise, Fuel cells, Exhaust emission standards, State action, Engine operating conditions, Rotary engines, Gas turbine automobiles, Stirling engines, Vehicle operating costs, Benefit cost analysis, Mathematical analysis

Alternatives to the internal combustion engine which may meet future exhaust emission standards are examined with emphasis on energy conversion requirements for automotive purposes; energy storage; new developments such as rotary and constant pressure reciprocating engines and emissions control due to incomplete combustion applications to automobiles of gas turbines, Rankine-cycle, and noncondensing gas cycle engines; electric propulsion systems; electric vehicles; hybrid power systems; fuel cells; and performance and cost comparisons. It is suggested that the gas turbine, Rankine-cycle engine, or hybrid could be adapted to automotive purposes with no significant sacrifices in terms of performance.
HS-014 715

5F. Fuel Systems

EXPERIMENTS ON ROTARY VALVE UNDER STEADY AND UNSTEADY FLOW CONDITIONS

Tokyo Electrical Engineering Coll. (Japan)
J. Iwamoto 1973 11p 6refs Rept. No. SAE-730668
Presented at Combined Commercial Vehicle Engineering and Operations and Powerplant Meetings, Chicago, 18-22 Jun 1973.
SAE

Rotary valves, Air flow, Steady state, Poppet valves, Intake valves, Four stroke cycle engines, Two stroke cycle engines, Engine tests

Although the flow through the poppet valves of the four-stroke cycle engine and piston valves and rotary valves of the two-stroke cycle engine is unsteady, because of the periodic area change of the flow passage of the valves, the flow characteristics of these valves is usually evaluated by steady flow conditions. Experiments with flow characteristics under steady and unsteady conditions, using a rotary valve, were performed in

order to specify the difference between them and to identify the factors that effect this difference. According to the results obtained, inertia of the mass of the fluid in the flow passage of the valve is the most important factor in creating this difference of flow. A theoretical analysis of this inertia was useful in predicting the effect of various parameters on flow through the passage of the valve under an unsteady condition.
HS-013 706

SIMPLE AUTOMOBILE GAS TURBINE COMBUSTORS FOR LOW EMISSIONS

United Aircraft of Canada Ltd., Longueuil, Que.
J. A. Saintsbury, P. Sampath, H. C. Eatock 1973 16p 12refs
Rept. No. SAE-730670
Contract EPA-68-04-0015
Presented at Combined Commercial Vehicle Engineering and Operations and Powerplant Meetings, Chicago, 18-22 Jun 1973.
SAE

Gas turbine engines, Exhaust emission control, Combustion chamber design, Performance tests, Exhaust emission measurement, Exhaust emission tests, Fuel economy, Hydrocarbons, Carbon monoxide, Nitrogen oxides, Test facilities, Barometric pressure, Air injection, Nozzles, Air fuel ratio, Humidity, Fuel injection, Atomizing, Laboratory tests, Regeneration

Combustors suitable for both simple-and regenerative-cycle automotive gas turbine engines have been designed and rig developed for low exhaust emissions. The simple-cycle combustor has demonstrated potential for meeting the Environmental Protection Agency 1976 automotive emission standards, employing simple practical hardware with no variable geometry. Low emissions have been rig demonstrated with the regenerative combustor, but techniques such as variable geometry and/or regenerator bypass will probably have to be used to achieve target emission levels. Severe transients under actual driving conditions of the regenerative engines are expected to make it particularly difficult to duplicate rig results.
HS-013 707

A STUDY OF MANDATORY ENGINE MAINTENANCE FOR REDUCING VEHICLE EXHAUST EMISSIONS. VOL. 1, EXECUTIVE SUMMARY

51P Rept. No. PB-220 726
In support of APRAC Project No. CAPE-13-68 for Coordinating Res. Council, Inc. and Environmental Protection Agency. A joint effort by TRW Systems Group and its subcontractor, Scott Res. Lab., Inc.
NTIS

For abstract and search terms see HS-013 709--HS-013 713.
HS-013 708

A STUDY OF MANDATORY ENGINE MAINTENANCE FOR REDUCING VEHICLE EXHAUST EMISSIONS. VOL. 2, MANDATORY INSPECTION/MAINTENANCE SYSTEMS STUDY

69P 1REF Rept. No. PB-220 727
In support of APRAC Project No. CAPE-13-68 for Coordinating Res. Council, Inc. and Environmental Protection Agency. A joint effort by TRW Systems Group and its subcontractor, Scott Res. Labs., Inc.
NTIS

Exhaust emission control, Vehicle inspection, Engine maintenance, Exhaust emission measurement, Benefit cost analysis, Figure of merit, Inspection effectiveness, Nitrogen oxides, Carbon monoxide, Hydrocarbons, Computerized simulation, Statistical analysis, Exhaust emission tests, Forecasting, Inspection procedures, Inspection costs, Maintenance costs, Sensitivity analysis, Deterioration, Inspection frequency, Ambient air quality, Regional planning

The results obtained during the first year of the Extended Phase 1 Coordinating Research Council Emission Test Program are summarized. The main focus of this study was to assess the feasibility of reducing exhaust emissions through a program of mandatory inspection and maintenance. The basic differences between this analysis and one presented in the Interim Report involve the use of an improved experimental data base and refinements in the Economic Effectiveness Model. The selection of optimum procedures and a sensitivity analysis of the system are presented. Regional implications of vehicle inspection/maintenance are discussed. The conclusions derived from this study are generally similar to those given in the Interim Report. This analysis differs from the previous one in the following regards: the entire vehicle population is considered; experimental data on the reliability of repair and maintenance durability is used for the first time; and the results are based upon the 1972 Federal Emission Test Procedure.
HS-013 709

A STUDY OF MANDATORY ENGINE MAINTENANCE FOR REDUCING VEHICLE EXHAUST EMISSIONS. VOL. 3, A DOCUMENTATION HANDBOOK FOR THE ECONOMIC EFFECTIVENESS MODEL

91P 2REFS Rept. No. PB-220 728
In support of APRAC Project No. CAPE-13-68 for Coordinating Res. Council, Inc. and Environmental Protection Agency. A joint effort by TRW Systems Group and its subcontractor, Scott Res. Labs., Inc.
NTIS

Computerized simulation, Mathematical models, Evaluation, Benefit cost analysis, Exhaust emission control, Vehicle inspection, Engine maintenance, Computer programs, Sensitivity analysis, Simllation models, Statistical analysis, Forecasting, Evaluation, Figure of merit, Systems engineering

The Economic Effectiveness Model serves as a research and design tool for assessing the various implications of a mandatory program of vehicle inspection/maintenance. The model is designed to analyze the regional feasibility of vehicle inspection/maintenance as well as to specify an optimal system design. The model can also be used to analyze the sensitivity of system performance to various model assumptions and basic data inputs. The main function of the model, in addition to analyzing policy variables, is in simulating the behavior of the inspection/maintenance process over time. Here, the economic-effectiveness of various strategies can be measured in terms of emission reductions and program costs at each time interval. A statistical analysis of these reductions can be undertaken as a further check on predicted model performance. The final step in this process is to utilize the unadjusted or statistically adjusted figure of merit for selecting the optimal model design for each candidate region.
HS-013 710

A STUDY OF MANDATORY ENGINE MAINTENANCE FOR REDUCING VEHICLE EXHAUST EMISSIONS.

VOL. 4, EXPERIMENTAL CHARACTERIZATION OF VEHICLE EMISSIONS AND MAINTENANCE STATES

500P 13REFS Rept. No. PB-220 729
In support of APRAC Project No. CAPE-13-68 for Coordinating Res. Council, Inc. and Environmental Protection Agency. A joint effort by TRW Systems Group and its subcontractor, Scott Res. Labs., Inc.
NTIS

Exhaust emission tests, Exhaust emission measurement, Design of experiments, Vehicle inspection, Engine maintenance, Inspection equipment, Test equipment, Data reduction, Data analysis, Data processing, Computer programs, Deterioration, Statistical analysis, Engine operating conditions, Engine inspection, Tuneup, Inspection procedures, Hydrocarbons, Nitrogen oxides, Carbon monoxide, Detroit, San Bernardino, Chemiluminescence, Infrared analyzers, Ultraviolet analyzers

Three distinct experimental programs were conducted to characterize vehicle emissions and maintenance states: a large scale fleet evaluation to determine vehicle engine parameter setting distributions and component deterioration characteristics with time and mileage; statistically designed tests (orthogonal experiments) of 1971 California and pre-emission controlled vehicles to determine the main effects and first order interactions of emission response to engine parameters; and a survey to determine the maintenance condition of vehicle engine tuneup parameters and emission control systems and components of vehicles in the Detroit area. The designs and results of each of these experiments are presented.
HS-013 711

A STUDY OF MANDATORY ENGINE MAINTENANCE FOR REDUCING VEHICLE EXHAUST EMISSIONS. VOL. 5, EXPERIMENTAL INVESTIGATION OF SERVICE ORGANIZATION MAINTENANCE PERFORMANCE

97P Rept. No. PB-220 730
In support of APRAC Project No. CAPE-13-68 for Coordinating Res. Council, Inc. and Environmental Protection Agency. A joint effort by TRW Systems Group and its subcontractor, Scott Res. Lab., Inc.
NTIS

Exhaust emission control, Engine maintenance, Service centers, Repair industry, Repair costs, Variance analysis, Evaluation, Maintenance costs, Engine failures, Engine inspection, Service stations, Reliability, Accuracy, Engine operating conditions

The overall objective of this experiment was to develop measures of service organization effectiveness in correcting engine part failures, malfunctions, and tuneup parameter maladjustments which cause high exhaust emissions. Quantitative data from the experiment are to be synthesized for use in the Economic Effectiveness Model. The experimental program was conducted by systematically introducing known malfunctions and maladjustments into test automobiles and submitting the vehicles to service organizations for repair. After service had been completed, the vehicles were inspected to determine how well the maintenance organizations were able to detect and repair the deliberately introduced malfunctions. The repair costs were recorded and an estimate was made of unnecessary repairs performed on each vehicle. Results of the study indicate that the full benefit of a mandatory emission inspection and maintenance program cannot be realized with current service organization practices and procedures.
HS-013 712

A STUDY OF MANDATORY ENGINE MAINTENANCE FOR REDUCING VEHICLE EXHAUST EMISSIONS. VOL. 6, A COMPARISON OF OXIDES OF NITROGEN MEASUREMENTS MADE WITH CHEMILUMINESCENT AND NON-DISPERSIVE RADIATION ANALYZERS

31P Rept. No. PB-220 731
In support of APRAC Project No. CAPE-13-68 for Coordinating Res. Council, Inc. and Environmental Protection Agency. A joint effort by TRW Systems Group and its subcontractor, Scott Res. Labs., Inc.
NTIS

Exhaust emission measurements, Nitric oxide, Nitrous oxide, Chemiluminescence, Infrared analyzers, Ultraviolet analyzers, Gas analysis, Measuring instruments, Chemical analysis

At present, two distinctly different types of instrumentation are widely used to measure automotive exhaust emissions of the oxides of nitrogen. Until quite recently, virtually all such measurements were made using non-dispersive infrared (NDIR) analyzers for nitric oxide and non-dispersive ultraviolet (NDUV) analyzers for nitrous oxide. The use of chemiluminescence (CL) analyzers has recently gained wide acceptance for the measurement of both nitric and nitrous oxides. However, significant differences have been noted in the data obtained with both of these measurement techniques. An experimental study which was undertaken to describe the differences between CL and NDIR/NDUV measurements, as applied to dilute samples of automotive exhaust gas is described.
HS-013 713

AUTOMOBILE EXHAUST EMISSION SURVEILLANCE. A SUMMARY

88P Rept. No. APTD-1544, PB-220 755
Contract EPA-68-01-0435
NTIS

Exhaust emission measurement, Exhaust emission tests, Exhaust emission sampling, Exhaust emission standards, Urban areas, Environmental factors, Vehicle age, Vehicle mileage, Hydrocarbons, Carbon monoxide, Nitrogen oxides, Discriminate analysis, Automobile models, Evaporative emissions, Evaporative emission control, Engine size effect on exhaust emissions, Acceleration, Steady state, Histograms, Exhaust emission control, Heuristic methods, Logarithms, Kansas City (Mo.), Houston, Los Angeles, Detroit, Denver, District of Columbia

Results are reported for three surveillance programs of light duty vehicle exhaust emissions conducted by the Environmental Protection Agency. Two programs employed the Federal Seven-Mode Test Procedure and the other program utilized the 1972 and 1975 Constant Volume Sampling Federal Test Procedure. Hydrocarbon and carbon monoxide emissions were assessed by comparing their mean emission levels with applicable Federal standards. To assess the extent to which local climate, terrain, driving practices, and other geographically differentiated factors affect emissions, vehicles were sampled in cities selected to span the range of such factors. The effect of mileage accumulation on vehicle functioning, as reflected by measurable changes in emission levels, was explored by making two or more emission measurements on the same vehicle at different points in its mileage-accumulation history.
HS-013 714

THE BENEFITS AND RISKS ASSOCIATED WITH GASEOUS FUELED VEHICLES

Little (Arthur D.), Inc., Cambridge, Mass.
D. Shooter, A. Kalelkar 1972 86p 10refs
Report to Massachusetts Turnpike Authority.
Massachusetts Turnpike Authority

Compressed natural gas, Liquefied natural gas, Liquefied petroleum gases, Exhaust emissions, Exhaust emission reactivity, Air quality standards, Air fuel ratio, Fuel costs, Vehicle operating costs, Fuel consumption, Probability theory, Hazards, Fuel tank rupture, Fires, Explosions, Fuel systems, Engine conversion

This study investigated the impact on overall air quality to be expected from the conversion of motor vehicles to operation on gaseous fuels and the additional risks involved (if any) if such vehicles are allowed to use Massachusetts Turnpike facilities. Benefits of conversion of fleets to gaseous fuels include reduced exhaust emissions, improved air quality, and lower fuel costs. Well designed conversion systems appear to present no more of a risk than gasoline powered vehicles. Poorly designed conversion systems, however, greatly increase the risk of fatality and property damage. It is recommended that safety standards for gaseous fueled vehicles be developed and enforced and that vehicles conforming with the standards be allowed to operate in the tunnels and on the Turnpike.
HS-013 720

CLOSED-LOOP EMISSIONS CONTROL FOR AUTOMOTIVE ENGINES

Bendix Technical Journal v6 n1 p1-6, 25 (Spring 1973)
J. N. Reddy 1973 4refs
See serial citation

Exhaust emission control, Exhaust emission standards, Air fuel ratio, Exhaust gas recirculation, Spark timing, Torque, Fuel consumption, Oxygen detectors, Stoichiometry, Feedback control

To date, fuel metering--whether by the conventional carburetor or by electronic fuel injection--as well as spark timing and exhaust gas recirculation have drawn upon open-loop approaches wherein empirically determined requirements are pre-programmed into appropriate computation mechanisms. A limitation inherent in such open-loop approaches is the inability of these computation mechanisms to make adjustments for engine variations resulting from production tolerances or for component aging or parameter changes that have a second-order effect. By monitoring the variables to be controlled, closed-loop approaches permit control systems to constantly optimize control inputs automatically under all operating conditions. Closed-loop control techniques in which exhaust content and torque output are monitored have demonstrated a potential for reducing automotive emissions to previously unattainable levels, well within the projected Federal requirements for 1976.
HS-013 736

FIRE IN ROAD ACCIDENTS

New South Wales Dept. of Motor Transport, Sydney (Australia)
For primary bibliographic entry see Fld. 1C.
HS-013 747

A SINGLE-CYLINDER ENGINE STUDY OF THE EFFECTS OF FUEL TYPE, FUEL STOICHIOMETRY, AND HYDROGEN-TO-CARBON RATIO ON CO, NO, AND HC EXHAUST EMISSIONS

Ford Motor Co., Dearborn, Mich.
J. A. Harrington, R. C. Shishu 1973 16refs Rept. No. SAE-730476
Presented at Automobile Engineering Meeting, Detroit, 14-18 May 1973.
SAE

Fuel composition, Exhaust emission measurement, Single cylinder engines, Hydrocarbons, Carbon monoxide, Nitric oxide, Stoichiometry, Air fuel ratio, Fuel properties

The effect of variation in fuel composition on exhaust emissions from a single cylinder engine has been studied with 11 different fuels. Exhaust emissions, at fixed engine speed and load, were measured over a range of air fuel ratio (A/F) settings. At identical A/F values carbon monoxide (CO), hydrocarbons (HC), and nitric oxide (NO) emissions varied significantly from fuel to fuel. At the same equivalence ratio CO emissions were identical for all fuels. However, at fixed equivalence ratio values, both NO and HC decreased with increasing fuel hydrogen-to-carbon ratio.
HS-013 758

A TRANSPORTATION CONTROL STRATEGY FOR THE PHOENIX-TUCSON AIR QUALITY AREA. FINAL REPORT

242P 40REFS Rept. No. APTD-1369, PB-218 823
Contract EPA-68-02-0048
Report for 14 Aug-15 Dec 1972.
NTIS

Air pollution control, Air quality control regions, Exhaust emission standards, Arizona, Vehicle inspection, Vehicle maintenance, Retrofitting, Evaporative emission control, Vehicle age, Hydrocarbons, Carbon monoxide, Nitrogen oxides, Air pollution measurement, Engine conversion, Traffic control, Traffic flow, Vehicle registration, Fuel rationing, Parking, Traffic bans, Staggered work times, Public transportation, Highway construction, Freeways, State action, Air pollution monitoring, Vehicle mileage, Power plants, Public opinion, Questionnaires, Air pollution control costs

The proposed transportation control strategy for Phoenix-Tucson is designed to meet hydrocarbon and primary oxidant standards by 1975 and the carbon monoxide standard by 1977. The strategy does not directly address itself to achieving the nitrogen dioxide standard. The Arizona State Implementation Plan was reviewed and the 1969 emissions inventory and air quality data from this plan were used as the baseline for making projections. Estimates of future air quality were made based on current stationary source control policies and forecasted growth. The strategy includes identification of the best transportation control measures to achieve the required air quality standards; prediction of emission reductions and air quality - impact anticipated from each control measure and strategy considered; assessment and documentation of expected political, institutional, legal, and socio-economic obstacles; and formulation of a timetable of key checkpoints to be used by the Environmental Protection Agency in monitoring implementation progress.
HS-013 766

ALTERNATIVES TO THE INTERNAL COMBUSTION ENGINE: IMPACTS ON ENVIRONMENTAL QUALITY

Resources for the Future, Inc., Washington, D.C.
For primary bibliographic entry see Fld. 5D.
HS-014 715

5G. Glazing Materials

VEHICLE WINDSCREENS: THE CURRENT ISSUES

New South Wales Dept. of Motor Transport, Sydney (Australia)
M. Henderson 1971 19p 18refs Rept. No. 4/71
Traffic Accident Res. Unit, Department of Motor Transport; Box 28, G.P.O., Sydney, N.S.W., Australia 2001

Windshields, Tempered glass, Laminated glass, Windshield caused injuries, Glass fracture behavior, Economic analysis, Chemically strengthened glass, Australia, Injury prevention

The 0.030 inch interlayer high penetration resistant (HPR) laminated windshield, which has been universally used in American cars since 1966, offers improved safety performance over tempered windshields (almost universally employed in Australia) and 0.015 inch laminated windshields. Experimental laminated windshields with an inner layer of tempered glass have an even lower injury potential, but the gains they offer over the 0.030 inch HPR windshield are not as large as those which became apparent when HPR glass replaced 0.015 inch laminated windshields in the U. S. In Australia glass is cheaper initially, but stone-induced shattering imposes a higher replacement cost than that for laminated glass. There is also the danger suffered by road users resulting from sudden loss of effective vision when the windshield shatters. A tempered windshield would be more economical over ten years of urban driving, but in rural areas a laminated windshield would probably be desirable.
HS-013 756

5I. Inspections

A STUDY OF MANDATORY ENGINE MAINTENANCE FOR REDUCING VEHICLE EXHAUST EMISSIONS. VOL. 1, EXECUTIVE SUMMARY

51P Rept. No. PB-220 726

In support of APRAC Project No. CAPE-13-68 for Coordinating Res. Council, Inc. and Environmental Protection Agency. A joint effort by TRW Systems Group and its subcontractor, Scott Res. Lab., Inc.
NTIS

For abstract and search terms see HS-013 709--HS-013 713.
HS-013 708

A STUDY OF MANDATORY ENGINE MAINTENANCE FOR REDUCING VEHICLE EXHAUST EMISSIONS. VOL. 2, MANDATORY INSPECTION/MAINTENANCE SYSTEMS STUDY

69P 1REF Rept. No. PB-220 727

In support of APRAC Project No. CAPE-13-68 for Coordinating Res. Council, Inc. and Environmental Protection Agency. A joint effort by TRW Systems Group and its subcontractor, Scott Res. Labs., Inc.
NTIS

Exhaust emission control, Vehicle inspection, Engine maintenance, Exhaust emission measurement, Benefit cost analysis, Figure of merit, Inspection effectiveness, Nitrogen oxides, Carbon monoxide, Hydrocarbons, Computerized simulation, Statistical analysis, Exhaust emission tests, Forecasting, Inspection procedures, Inspection costs, Maintenance costs, Sensitivity analysis, Deterioration, Inspection frequency, Ambient air quality, Regional planning

The results obtained during the first year of the Extended Phase 1 Coordinating Research Council Emission Test Program are summarized. The main focus of this study was to assess the feasibility of reducing exhaust emissions through a program of mandatory inspection and maintenance. The basic differences between this analysis and one presented in the Interim Report involve the use of an improved experimental data base and refinements in the Economic Effectiveness Model. The selection of optimum procedures and a sensitivity analysis of the system are presented. Regional implications of vehicle inspection/maintenance are discussed. The conclusions derived from this study are generally similar to those given in the Interim Report. This analysis differs from the previous one in the following regards: the entire vehicle population is considered; experimental data on the reliability of repair and maintenance durability is used for the first time; and the results are based upon the 1972 Federal Emission Test Procedure.
HS-013 709

5J. Lighting Systems

AUTOMOBILE STOPPING DISTANCES FOR JUDGING HEADLIGHT PERFORMANCE

National Aeronautical Establishment, Ottawa, Ont. (Canada)
For primary bibliographic entry see Fld. 3D.
HS-013 761

CNTR: A HEADLAMP RESEARCH PROGRAM FOR PRODUCING A CONTOUR PLOT OF THE GRID SURFACE

National Aeronautical Establishment, Ottawa, Ont. (Canada)
For primary bibliographic entry see Fld. 4E.
HS-013 762

ISO: A HEADLAMP RESEARCH PROGRAM FOR PRODUCING AN ISOCANDELA MAP FOR A GIVEN LAMP

National Aeronautical Establishment, Ottawa, Ont. (Canada)
A. L. Harrison 1972 86p 3refs Rept. No. LTR-ST.601
Corporate author

Headlamp brightness, Mapping, Graphic techniques, Computer programs, Computer printouts, Flow charts, Fortran, Isocandela maps

The ISO program provides the user with the ability to read a data set organized under one of three formats, to fit the data onto a specified grid, and to print and store the resulting surface. The input data forms, the generation of an isocandela map, the output features, an analysis of the program structure, and the execution of the program are described. A copy of the source listing for the program and selected output printed by sample programs to demonstrate the generation of a measured illumination map and an isocandela map for a particular lamp, and the generation of a series of isocandela maps for the same

lamp according to a series of different grid surface specifications are presented. The program is written in Fortran for the IBM 360/67 TSS computer.
HS-013 777

5K. Maintenance And Repairs

A STUDY OF MANDATORY ENGINE MAINTENANCE FOR REDUCING VEHICLE EXHAUST EMISSIONS. VOL. 1, EXECUTIVE SUMMARY
51P Rept. No. PB-220 726

In support of APRAC Project No. CAPE-13-68 for Coordinating Res. Council, Inc. and Environmental Protection Agency. A joint effort by TRW Systems Group and its subcontractor, Scott Res. Lab., Inc.
NTIS

For abstract and search terms see HS-013 709--HS-013 713.
HS-013 708

A STUDY OF MANDATORY ENGINE MAINTENANCE FOR REDUCING VEHICLE EXHAUST EMISSIONS. VOL. 2, MANDATORY INSPECTION/MAINTENANCE SYSTEMS STUDY
69P 1REF Rept. No. PB-220 727

In support of APRAC Project No. CAPE-13-68 for Coordinating Res. Council, Inc. and Environmental Protection Agency. A joint effort by TRW Systems Group and its subcontractor, Scott Res. Labs., Inc.
NTIS

Exhaust emission control, Vehicle inspection, Engine maintenance, Exhaust emission measurement, Benefit cost analysis, Figure of merit, Inspection effectiveness, Nitrogen oxides, Carbon monoxide, Hydrocarbons, Computerized simulation, Statistical analysis, Exhaust emission tests, Forecasting, Inspection procedures, Inspection costs, Maintenance costs, Sensitivity analysis, Deterioration, Inspection frequency, Ambient air quality, Regional planning

The results obtained during the first year of the Extended Phase 1 Coordinating Research Council Emission Test Program are summarized. The main focus of this study was to assess the feasibility of reducing exhaust emissions through a program of mandatory inspection and maintenance. The basic differences between this analysis and one presented in the Interim Report involve the use of an improved experimental data base and refinements in the Economic Effectiveness Model. The selection of optimum procedures and a sensitivity analysis of the system are presented. Regional implications of vehicle inspection/maintenance are discussed. The conclusions derived from this study are generally similar to those given in the Interim Report. This analysis differs from the previous one in the following regards: the entire vehicle population is considered; experimental data on the reliability of repair and maintenance durability is used for the first time; and the results are based upon the 1972 Federal Emission Test Procedure.
HS-013 709

A STUDY OF MANDATORY ENGINE MAINTENANCE FOR REDUCING VEHICLE EXHAUST EMISSIONS. VOL. 5, EXPERIMENTAL INVESTIGATION OF SERVICE ORGANIZATION MAINTENANCE PERFORMANCE
97P Rept. No. PB-220 730

In support of APRAC Project No. CAPE-13-68 for Coordinating Res. Council, Inc. and Environmental Protection Agency. A joint effort by TRW Systems Group and its subcontractor, Scott Res. Lab., Inc.
NTIS

Exhaust emission control, Engine maintenance, Service centers, Repair industry, Repair costs, Variance analysis, Evaluation, Maintenance costs, Engine failures, Engine inspection, Service stations, Reliability, Accuracy, Engine operating conditions

The overall objective of this experiment was to develop measures of service organization effectiveness in correcting engine part failures, malfunctions, and tuneup parameter maladjustments which cause high exhaust emissions. Quantitative data from the experiment are to be synthesized for use in the Economic Effectiveness Model. The experimental program was conducted by systematically introducing known malfunctions and maladjustments into test automobiles and submitting the vehicles to service organizations for repair. After service had been completed, the vehicles were inspected to determine how well the maintenance organizations were able to detect and repair the deliberately introduced malfunctions. The repair costs were recorded and an estimate was made of unnecessary repairs performed on each vehicle. Results of the study indicate that the full benefit of a mandatory emission inspection and maintenance program cannot be realized with current service organization practices and procedures.
HS-013 712

5N. Occupant Protection

EVERYTHING YOU NEED TO KNOW ABOUT SAFETY BELT INTERLOCK SYSTEMS

Traffic Safety v73 n8 p16-8, 37-8 (Aug 1973)
Anonymous 1973
See serial citation

Ignition seat belt interlocks, Seat belt design

The Department of Transportation requires automobile manufacturers to install safety belt interlock systems in 1974 passenger cars. An interlock system prevents an automobile equipped with it from being started unless the belts in the system are fastened after the front seat occupants are seated. If an auto manufacturer chooses, he may equip a vehicle with a passive restraint system instead of an interlock system. However, he must still equip the vehicle with safety belts. Questions concerning the design, operation, and effectiveness of ignition seat belt interlocks are answered.
HS-013 717

AUTOMOBILE HEAD RESTRAINTS--FREQUENCY OF NECK INJURY CLAIMS IN RELATION TO THE PRESENCE OF HEAD RESTRAINTS

American Journal of Public Health v62 p399-406 (Mar 1972)
B. O'Neill, W. Haddon, Jr., A. B. Kelley, W. W. Sorenson 1972 26refs
See serial citation

Head restraints, Restraint system effectiveness, Whiplash injuries, Insurance claims, Rear end collisions, Injuries by vehicle

make, Injuries by sex, Driver injuries, Injury rates, Head restraint positioning

The frequency of whiplash injury insurance claims from drivers of struck cars in rear-end collisions was used as an indication of whether the federally mandated introduction of head restraints has been associated with a change in the incidence of neck injuries in crashes. Because of anthropometric differences between males and females, and studies suggesting variation in whiplash susceptibility between the two sexes, differentiation of claimants by sex was a basic aspect of the study. There was an 18% reduction, from 29% to 24%, in the frequency of claimed neck injuries to drivers (both sexes combined) in cars with head restraints as standard equipment compared with the frequency for drivers in cars without head restraints as standard equipment. The results are encouraging but the neck injury problem continues to be widespread and must be given more study.
HS-013 729

TEXAS CRASH CUSHION TRAILER TO PROTECT HIGHWAY MAINTENANCE VEHICLES

Texas A and M Univ., College Station. Texas Transp. Inst.
E. L. Marquis, T. J. Hirsch 1972 46p 8refs Rept. No. RR-146-6, PB-220 388
Sponsored by Texas Hwy. Dept. and Federal Hwy. Administration.
NTIS

Crash cushions, Trailers, Highway maintenance, Impact tests, Impact protection, Energy absorption, Kinetic energy, Drums, Stopping distance, Momentum, Impact attenuation

The Texas Crash Cushion Trailer of 20 gage 55-gallon steel drums with 8 in. holes in the top and bottom with a set of wheels and a trailer hitch has been successfully tested in a head-on collision. When properly attached to a maintenance vehicle such as a dump truck it will provide protection to the maintenance vehicle, maintenance or construction personnel, and the driver and passengers of an errant vehicle. There is still a need for testing and evaluation for impacts at angles up to 10 degrees.
HS-013 738

COMPULSORY WEARING OF SEAT BELTS. A FEASIBILITY STUDY

New South Wales Dept. of Motor Transport, Sydney (Australia)
N. Skinner, M. Henderson, D. Herbert 1970 25p Rept. No. 6/70
Traffic Accident Res. Unit, Department of Motor Transport, Box 28, G.P.O., Sydney, N.S.W., Australia 2100

Seat belt usage laws, Feasibility studies, Exemptions, Seat belt medical factors, New South Wales, Age factors, Driver occupation, Seat belt legal factors

An analysis is made of the questions to be resolved in the event of a decision to introduce compulsory wearing of seat belts by vehicle occupants generally. Exemptions are suggested on grounds of medical and other personal characteristics such as age, occupational factors, and the unsuitability of existing belts for particular vehicle types. A two year timetable for the compulsory retro-fitting of seat belts is suggested, it being implicit that the program as a whole can be deferred to suit a commencing date later than that proposed. Intensified public education is suggested in order to counter firmly held but unfounded objections and so that greater voluntary compliance with any compulsory wearing law may be encouraged. Closer consultation with seat belt manufacturers to eliminate features inimical to increased seat belt usage is proposed.
HS-013 752

SEAT BELTS: A SURVEY OF USAGE AND ATTITUDES

New South Wales Dept. of Motor Transport, Sydney (Australia)
K. Freedman, P. Champion, M. Henderson 1971 64p 12refs Rept. No. 2/71
Traffic Accident Res. Unit, Department of Motor Transport, Box 28, G.P.O., Sydney, N.S.W., Australia 2001

Seat belt usage, Attitudes, Surveys, Public opinion, Safety propaganda, Questionnaires, Age factors, Sex factors, Social class, Sydney (Australia), Psychological factors

In 1970, 995 persons in Sydney were interviewed on their attitudes to seat belts. Nearly 50% reported rarely or never wearing seat belts, although the majority believed seat belts to be important to safety. Reported usage varied according to sex, age, motoring habits, whether or not the respondent was a driver, and subjective social class. Reasons for public resistance to seat belts and problems in overcoming this resistance are discussed. Improvements in seat belt design and installation, legislation, and public education are seen as ways of reducing major costs and making benefits more apparent. The effect of propaganda on seat belt attitudes was studied in conjunction with the survey. The propaganda was effective in communicating information about seat belts to the group aged 30-50 years. It is suggested that propaganda should be designed to appeal to the specific audience at whom it is directed.
HS-013 754

DYNAMIC TESTS FOR SEAT BELTS

New South Wales Dept. of Motor Transport, Sydney (Australia)
D. Herbert, T. O. Davis, R. G. Vaughan, B. A. Vazey 1973 98p 18refs Rept. No. 2/73
Traffic Accident Res. Unit, Department of Motor Transport, Box 28, G.P.O., Sydney, N.S.W., Australia 2001

Seat belt tests, Dynamic tests, Seat belt standards, Anthropometric dummies, Seat belt buckles, Test equipment, Mathematical models, Seat belt loading, Calibration, Specifications, Acceleration pulses, Deceleration, Inertial forces, Australia, Collision models

A dynamic test for seat belt assemblies is soon to be a mandatory requirement for new cars sold in Australia. As an aid to the development of suitable test requirements some national standards and international specifications for the dynamic testing of seat belts were examined and seat belt dynamics in accident situations were studied. Specifications for anthropometric dummies used in testing seat belts were developed. A simple collision model, test dummy specifications, and the draft Australian specification for dynamic testing of seat belts are presented. Results of tests on both lever and push-button operated seat belt buckles are also presented.
HS-013 759

INVESTIGATION INTO USE OF SAFETY BELTS

Central Organisation for Traf. Safety in Finland, Helsinki
L. Oranen 1973 18p Rept. No. LIIKENNETURVA-14
Corporate author

Seat belt usage, Finland, Driver behavior, Driver attitudes, Opinion polls, Urban areas, Weather, Traffic characteristics,

Summer, Winter, Speed limits, Road conditions, Driver experience, Age factors

Observations were made during June-November 1972, in every province in Finland to determine seat belt usage rates and patterns. During this time a survey of driver attitudes towards seat belt usage was also conducted. About 143,000 observations were made and 7,183 passenger car and delivery van drivers were interviewed. The effects of traffic, weather, and road conditions on seat belt usage were investigated. According to the investigation seat belts are used infrequently. In highway driving, where seat belts are most commonly used, the percentage of users was 7-28% depending on traffic conditions. In urban areas, seat belt usage was only 4-6%. The results of the opinion survey indicated that 61% of the drivers using seat belts wear them mainly on long trips and at higher speeds and making seat belts obligatory was supported by 62% of those interviewed.
HS-013 769

5P. Registration

HIGHWAY SAFETY GOALS OF MOTOR VEHICLE REGISTRATION

Traffic Quarterly v28 n3 p351-64 (Jul 1973)
J. P. Grillo 1973 12 refs
See serial citation

Vehicle registration, State action, Identification, Vehicle inspection, Accident prevention, Reflectorized license plates, Stolen vehicles, Defect correction, Recall campaigns, Abandoned vehicles, Scrapped vehicles, Flow charts

The Federal Motor Vehicle Registration Standard is being revised to establish a more effective and rapid means of vehicle and owner identification; prevent registration of stolen vehicles and assist in their recovery; control the use of vehicles to insure their safe condition by registering only vehicles in safe condition, suspending registration of vehicles involved in major crashes in noninspection states, and assisting in the defect recall campaign; control vehicle use by problem drivers; reduce rear end collisions at night by use of reflectorized license plates; and increase administrative effectiveness.
HS-013 741

5R. Steering Control Systems

HOW STEERING WORKS. WHY YOUR MOTORCYCLE GOES AROUND CORNERS WELL--OR WHY IT DOESN'T

Cycle Guide v7 n10 p42-6, 51-2, 91-2 (Oct 1973)
P. Dean 1973
See serial citation

Steering, Motorcycle handling, Vehicle dynamics, Steering system design, Forks, Turning, Vehicle stability, Motorcycle design, Tire pavement interface, Motorcycle characteristics

The basics of motorcycle steering in straight and cornering maneuvers are discussed. Elements of a motorcycle's steering system are described.
HS-013 735

DETERMINATION OF SWEPT PATHS OF VEHICLES

New South Wales Dept. of Motor Transport, Sydney (Australia)
R. G. Vaughan, A. G. Sims 1970 31p Rept. No. 3/70
Traffic Accident Res. Unit, Department of Motor Transport; Box 28, G.P.O., Sydney, N.S.W., Australia 2100

Cornering, Articulated vehicles, Vehicle dynamics, Steering, Mathematical models

When a vehicle, after travelling in a straight line, is driven along a curve, the path swept by the vehicle increases in width. If a curve of constant radius is followed, the vehicle's swept path approaches a constant width. Swept paths provide a means of comparison for new or proposed vehicles with those already being driven along existing road curves. Swept paths may also be used to provide data for the design of road layouts. They may be determined by measuring the paths described by actual vehicles or by vehicle models. The first method is not possible when a vehicle is in the design stage only, and both are very time consuming. Determination of the swept paths of vehicles using a mathematical model is described. The model is concerned solely with the physical attributes of the vehicle and takes no account of difficulties encountered by drivers in curve following.
HS-013 749

A DATA ACQUISITION SYSTEM FOR STUDIES OF DRIVER AND VEHICLE PERFORMANCE PARAMETERS IN REAL TRAFFIC CONDITIONS

National Aeronautical Establishment, Ottawa, Ont. (Canada)
For primary bibliographic entry see Fld. 3D.
HS-013 774

5T. Trucks And Trailers

TEXAS CRASH CUSHION TRAILER TO PROTECT HIGHWAY MAINTENANCE VEHICLES

Texas A and M Univ., College Station. Texas Transp. Inst.
For primary bibliographic entry see Fld. 5N.
HS-013 738

HEAVY VEHICLE CRASH INJURY. A SURVEY

New South Wales Dept. of Motor Transport, Sydney (Australia)
For primary bibliographic entry see Fld. 1E.
HS-013 748

5V. Wheel Systems

HYSTERETIC LOSSES IN ROLLING TIRES

Rubber Chemistry and Technology v46 n2 p425-44 (Jun 1973)
P. R. Willett 1973 18refs
See serial citation

Crossply tires, Hysteresis, Viscoelasticity, Tire rolling resistance, Tire properties, Energy consumption, Tire tests, Tire deflection, Tire temperature, Equations, Tire treads, Tire casings, Tire cords, Tire ply number, Tire test equipment, Tire inflation pressure

A relationship between the observed energy losses for a tire that has reached a state of thermal equilibrium when operating at a constant speed, and the viscoelastic properties of the tire components has been formulated. The analysis was carried out by systematically varying tire components and operating parameters, using the Vibron Viscoelastometer and tire test wheel dynamometer. The investigation was carried out for 6.95-14 cross ply passenger tires. From the derived dependence of the tire energy losses on viscoelastic properties, the effect of

changes in tire tread compound, ply rubber, and tire cord on the tire energy losses can be predicted. This enables the design of a tire with the properties to meet desired service characteristics.
HS-013 742

RUBBER STOCKS FOR IMPROVED PERFORMANCE OF POLYESTER CORD TIRES

Rubber Chemistry and Technology v46 n3 p442-8 (Jun 1973)
Y. Iyengar, D. F. Ryder 1973 7refs
See serial citation

Polyester tires, Tire cords, Tire materials, Tire casings, Rubber compounds, Tire tests, Durability tests, Tire treads, Adhesion, Fatigue tests, Amines, Temperature endurance tests, Tire inflation pressure, Laboratory tests

Carcass stocks were developed with acceptable properties and good adhesion to polyester tire cords after severe heat aging in laboratory tests. These stocks contained vulcanization accelerators that did not liberate amines. In a variety of wheel tests designed to assess durability under extreme conditions, two ply tires with cords of Dacron polyester containing amine-free tread and carcass stocks showed highly improved durability (180-440%) compared to control tires made with stocks containing amines. In low pressure endurance test, tire durability increased with decreasing amine content of the rubber stocks used. In a special high temperature tire fatigue test to produce break-about-bead failures, tires combining an experimental Dacron polyester with low carboxyl content and in amine-free stocks ran 350% longer than tires of standard T-68 Dacron in amine-containing stocks. These tests clearly illustrated the additive benefits of combining an improved polyester with stocks having reduced amine content.
HS-013 743

APPLICATION OF HOLOGRAPHY TO THE STUDY OF TIRE VIBRATIONS

Tire Science and Technology v1 n3 p255-66 (Aug 1973)
G. R. Potts 1973 7refs
Presented at a meeting of the Society for Experimental Stress Analysis, Cleveland, 23-26 May 1972.
See serial citation

Holography, Tire vibration, Vibration analysis, Resonant frequency, Bias tires, Bias belted tires, Radial tires, Tire characteristics, Tire riding characteristics

Tire vibrations were studied by applying an oscillatory load to bias, belted bias, and radial ply tires in the radial, lateral, and circumferential directions. Resonant frequencies were noted in each type of tire and the corresponding mode shapes observed with both real time and time average holography. The importance of tire vibrations in affecting vehicle ride is noted and the variables affecting these vibrations are discussed.
HS-013 763

SCALE MODELING OF EQUILIBRIUM TIRE TEMPERATURE

Tire Science and Technology v1 n3 p267-89 (Aug 1973)
D. J. Schuring 1973 14refs
Contract CC-166
Prepared in cooperation with Goodyear Tire and Rubber Co.
See serial citation

Tire temperature tests, Scale models, Tire performance, Heavy duty tires, Off the road vehicles, Model tests, Stress (mechanics), Tire pavement interface, Coefficient of friction, Heat transfer, Tire loads, Tire inflation pressure, Mathematical analysis, Tire cords

Examination of heat generation in an earthmover tire traversing rigid terrain indicates that most heat originates in the tire bulk; heat generated in the contact area is small and can be neglected. Modeling of equilibrium bulk heat requires using the same compound for model and prototype, keeping both tires geometrically similar, and running them at constant speed to reach equilibrium temperature. Then, three model rules apply; one allows for geometrical distortion of cord arrangement in static loading, and the others impose similar mechanisms of heat generation and dissipation on the model and prototype. The effect of cord distortion on heat generation is unknown and must be assessed experimentally. Preliminary tests indicate that the model rules of heat generation are basically correct. Problems associated with stress distortion, heat convection, and inflation pressure buildup remain. Self-modeling tests on the same tire, and scale model tests with geometrically similar tires are recommended.
HS-013 764

MECHANICS OF THE PNEUMATIC TIRE. PT. 1. THE TIRE UNDER INFLATION ALONE

Tire Science and Technology v1 n3 p290-345 (Aug 1973)
E. Robecchi, L. Amici 1973 21refs
See serial citation

Pneumatic tires, Tire mechanics, Tire inflation pressure, Stress (mechanics), Tire forces, Stress analysis, Tire shape, Tire profile measurement, Bias tires, Tire cords, Tire ply number, Strain (mechanics), Radial tires, Rayon tires, Nylon tires, Tire materials, Tire loads, Equations of equilibrium, Mathematical models

The theoretical basis for inflated tire calculations is explained, and models of the tire are developed that exhibit a high degree of accuracy. After establishing the fundamental equations common to the various models, the simplest case, a net of inextensible cords, is treated. The effects of cord extension and angular distributions different from the simple cosine law are then considered. For each model it is convenient to proceed to a particular form of the fundamental formula in order to simplify the calculations and to clarify the influence of the various parameters. The models are of value for conventional tires; in the case of radial tires it is only possible to study the part of the carcass away from the belted zone.
HS-013 765

REPORT NUMBER INDEX

HS-013 722	4H
HS-013 724	4H
HS-013 724	3F
HS-013 725	5N
HS-013 726	2D
HS-013 727	2I
HS-013 728	3I
HS-013 729	3F
HS-013 730	1C
HS-013 731	1C
HS-013 732	3D
HS-013 733	3D
HS-013 734	3
HS-013 735	5J
HS-013 736	5F
HS-013 737	5A
HS-013 738	5N
HS-013 739	2D
HS-013 740	5D
HS-013 741	5B
HS-013 742	5V
HS-013 743	5V
HS-013 744	4G
HS-013 745	4H
HS-013 746	4B
HS-013 747	1C
HS-013 748	1E
HS-013 749	5R
HS-013 750	3F
HS-013 751	5C
HS-013 752	5N
HS-013 753	3D
HS-013 754	5N
HS-013 755	2I
HS-013 756	5G
HS-013 757	1C
HS-013 758	5F
HS-013 759	5N
HS-013 760	3I
HS-013 761	3D
HS-013 762	4F
HS-013 763	5V
HS-013 764	5V
HS-013 765	5V
HS-013 766	2G
HS-013 767	2I
HS-013 769	5A

PR-220 730	
HS-013 712	5F
PR-220 731	
HS-013 713	5F
PR-140-5	
HS-013 739	2D
PR-146-6	
HS-013 738	5N
SAE-730476	
HS-013 758	5F
SAE-730668	
HS-013 706	5F
SAE-730670	
HS-013 707	5F
TRRL-LR-531	
HS-013 770	2I
TRRL-LR-543	
HS-013 745	4H
TRRL-LR-567	
HS-013 771	3D
TRRL-LR-575	
HS-013 772	1C
1/70	
HS-013 747	1C
1/71	
HS-013 753	3D
1/72	
HS-013 757	1C
2/70	
HS-013 748	1E
2/71	
HS-013 754	5N
2/73	
HS-013 759	5N
3/70	
HS-013 749	5R
3/71	
HS-013 755	2I
3/73	
HS-013 746	4B
4/70	
HS-013 750	3F
4/71	
HS-013 756	5G
5/70	
HS-013 751	5C
6/70	
HS-013 752	5N

U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
Office of Administration
WASHINGTON, D.C. 20590
OFFICIAL BUSINESS
Penalty For Private Use, $300

POSTAGE AND FEES PAID
NATIONAL HIGHWAY TRAFFIC SAFETY
ADMINISTRATION
517