Later History
of the
Baltimore and Ohio Railroad Company

by

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Paper Presented

for

Admission to the

Phi Mu Honorary Engineering Fraternity

University of Maryland.

January 1929.

-*- F O R E W O R D -*-

In the limited space and time, the author has necessarily dealt with only the most important and interesting features of the subject as he sees them.

He has shown the extension of the system to its most important terminals. The relation between the development of the telegraph and the Baltimore and Ohio is not known to many, and is, therefore, of interest. Of special interest to a fraternity of this sort are the developments of tracks and trusses. Such excellent examples of engineering practice as Magnolia Cut-off, the New Coal Pier and the New Grain Elevator of the Baltimore and Ohio could not be omitted.

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EXTENSION OF THE SYSTEM.

By 1835 the tracks had reached Washington and Harpers Ferry.

The westward march had continued until in 1842 Cumberland, Maryland, was reached. This distance of 172 miles was just about half way to its objective, the Ohio River, as set forth in the charter.

It was fearless progressiveness that urged on and stimulated the skill of the fathers of the feat, and by January 1, 1853, the original Baltimore and Ohio line, as chartered from Baltimore to the Ohio River, was a reality when the tracks of the Company reached Wheeling, W. Va., a distance of 379 miles, just 26 years from its birth and 25 years from the laying of the first stone.

Following this, its extensions were more rapid in the West. In 1857 the Parkersburg Branch Railroad was completed and the Baltimore and Ohio was extended to Parkersburg, W. Va., also on the banks of the Ohio River. Onward its progress continued. By connections and agreements with other railroads, it reached Cincinnati, Ohio, over the Parkersburg Branch Railroad and the Marietta and Cincinnati Railroad, and subsequently through connection with the Ohio and Mississippi Railway it stretched out to St. Louis, Mo., May 1, 1857.

This onward progress was temporarily halted from 1861 to 1865, the years during which the United States was rent by Civil War. The Baltimore and Ohio tracks from Washington to Harpers Ferry, W. Va., run just north and south of the principal battlefields, so the railroad suffered much from destruction of tracks and loss of equipment.

In 1871, the Pittsburgh and Connellsville Railroad completed its line between Cumberland, Md. and Pittsburgh, Pa., and under its lease to the Baltimore and Ohio, that Company obtained entrance into Pittsburgh. Connection was made with Chicago, Ill. in 1874 by a line through Wheeling, W. Va., Newark, Ohio, and Chicago Junction.

By the acquisition of the Pittsburgh and Western Railway, the Pittsburgh, Cleveland and Toledo Railway, and the Akron and Chicago Junction Railway, the Baltimore and Ohio had a shorter route into Chicago in 1891, the route that it now uses for its through trains. Many branch lines were acquired, webbing the chief industrial centers of the United States with rails, now part of the Baltimore and Ohio system. In 1909, the Baltimore and Ohio acquired the Cincinnati, Hamilton and Dayton Railway, making a new line for it from Cincinnati through Dayton to Toledo, Ohio, which is now the Toledo Division of the system.

In 1886, the Baltimore and Ohio had completed its line into Philadelphia, Pa., and by means of the Philadelphia and Reading Railway and the Central Railroad of New Jersey effected an entrance into New York City, where on Staten Island it operates extensive and important waterfront terminals.

The Baltimore and Ohio has continually built and acquired, and the rails located as they are with abundant natural resources within easy access, reach thirteen of the richest states in the Union, carrying a regular flow of diversified traffic in addition to a great volume of coal and other minerals.

Pioneer in many things, the Baltimore and Ohio was the first to recognize the importance of establishing export terminals to carry on trade with foreign countries, and as early as 1868 steamship connections from the Company's waterfront terminals at Locust Point, Baltimore, to Europe through Bremen were established. Locust Point is today the principal Atlantic terminal of the Company, and here are located the most modern facilities for local and export traffic, especially those facilities for handling coal and wheat.

The Company employs 12,000 people and puts into circulation in the City of Baltimore approximately $25,000,000 a year. Its investments in property and facilities in Baltimore exceed $50,000,000.

Other important eastern terminals are at New York and Philadelphia. At Chicago, with terminal and belt line consisting of 81 miles through the industrial section of the city, the Baltimore and Ohio interchanges traffic

directly with 32 other railroads. At St. Louis, its other western terminus, is one of the proprietary companies jointly owning the terminal properties and belt line, through which interchange of traffic is made with the west and southwest.

In 1921, the Baltimore and Ohio opened an office in London, England, under the supervision of which there are 36 subsidiary foreign agencies throughout Europe, as far north as Sweden, as far south as Italy and as far east as Greece. These sub-agencies make it possible to issue through bills-of-lading from the shipping point in Europe to the interior destination in the United States.

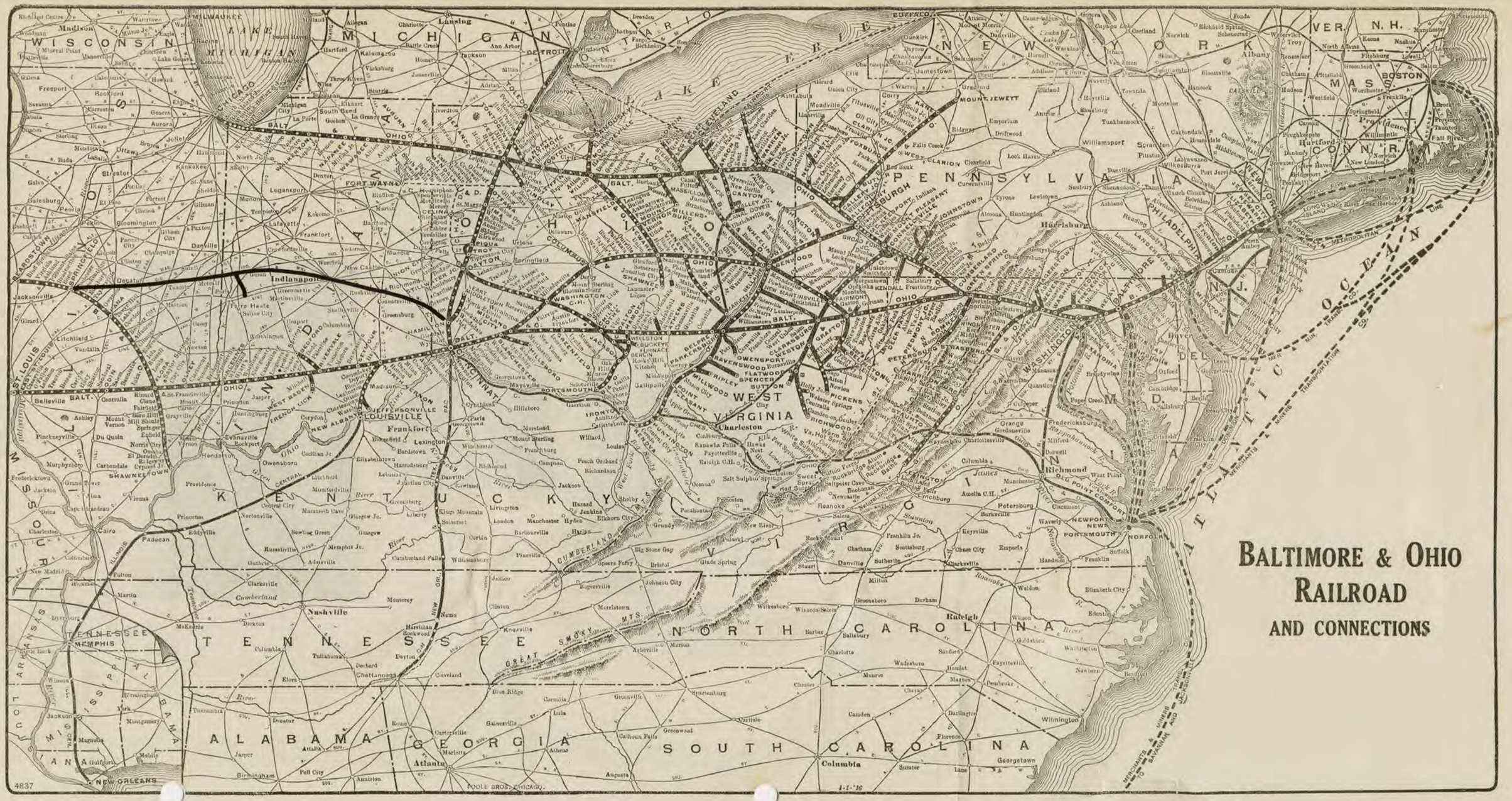
THE RELATION OF THE DEVELOPMENT OF THE TELEGRAPH TO THE BALTIMORE & OHIO.

The first telegraph line in the world was built along the Baltimore and Ohio Railroad between Baltimore and Washington through aid given by the Company to the inventor, Professor Morse.

Congress having granted $30,000 to Professor Morse to build a line of telegraph, the Baltimore and Ohio granted the use of its right-of-way between Washington and Baltimore. The line was laid underground in a trench two inches wide and twenty inches deep. This trench was dug by a specially constructed heavy plow, built at the Mt. Clare Shops. On account of leakage, this construction was abandoned and the wires were strung on poles. This line connected the Baltimore and Ohio depot at Baltimore with the Capitol at Washington, and the first message, "What hath God wrought", was sent on May 24, 1884.

By 1846 the telegraph line had been extended to New York and over the lines of the railroad, and commercial messages were handled.

With a view of sharing with the public this means of quick communication, the Baltimore and Ohio Telegraph Company was chartered on January 7, 1882. By 1886 the company had grown to control some 50,000 miles of wire, extending from Maine to the Gulf, westwardly to Kansas City, and to eastern Texas. The telegraph company continued to operate its lines until October 5, 1887, when they were sold to the Western Union Telegraph Company.


BALTIMORE & OHIO
RAILROAD
AND CONNECTIONS
WISCONSIN
MICHIGAN
LAKE MICHIGAN
LAKE ERIE
ONTARIO
NEW YORK
PENNSYLVANIA
VER.
N. H.
MASS.
BOSTON
CONN.
R.I.
Providence
Hartford
Albany
Harrisburg
PHILADELPHIA
N. J.
DEL.
MD.
VIRGINIA
WEST VIRGINIA
KENTUCKY
OHIO
INDIANA
ILLINOIS
MISSOURI
TENNESSEE
NORTH CAROLINA
SOUTH CAROLINA
GEORGIA
ALABAMA
MISSISSIPPI
LOUISIANA
ARKANSAS
Chicago
Milwaukee
Detroit
Toledo
Cleveland
Buffalo
Indianapolis
Cincinnati
Louisville
Frankfort
Lexington
Nashville
Memphis
Atlanta
Columbia
Charleston
Richmond
Norfolk
Portsmouth
Newport News
Raleigh
Wilmington
New Orleans
ATLANTIC OCEAN
POOLE BROS., CHICAGO.
4837
1-1-'16

TYPES OF BRIDGES USED ON THE BALTIMORE AND OHIO RAILROAD.

The stone arch bridge was fully explained by an earlier initiate in his treatment of "The Carrollton Viaduct".

The "Wooden Truss Bridge" represents an early type of railroad truss. It was designed by Mr. B. H. Latrobe, Chief Engineer of the Baltimore and Ohio, in the summer of 1838. The material was American white pine. The roof timbers were protected from fire by a sheet iron ceiling.

The Howe Truss marks a definite step in the development of the modern railroad bridge. It was the earliest type of simple truss and was patented in the United States in 1840.

The design combines the use of timber and metal. In the earlier trusses of this type iron was used only for the vertical web members, but a later development was the substitution of iron for wood in the bottom chord.

The Pratt Truss was introduced in 1844 as a modification of the Howe Truss.

In its original form, the Pratt Truss combined the use of timber and metal. Few Pratt trusses in the original form were built, and after 1850, the Pratt truss was widely adopted for spans in which metal alone was used. Panel joint connections were usually made by pins. The Pratt truss with both pin and rivet connections is still used extensively for railroad and highway bridges.

The Whipple Truss was introduced in 1847. It is a development of the Pratt truss, involving the use of a double set of web members, each diagonal, usually extending over two panels. Trusses of this type were used in wrought iron construction for spans of greater length than the ordinary Pratt truss.

The Bollman Truss was introduced about 1850 by Wendel Bollman, Master of Road of the Baltimore and Ohio, and bridges of this type were extensively used for railroad purposes until about 1875. This was one of the earliest type of bridges in which iron was used exclusively.

The Fink Truss was invented by Albert Fink in 1852, while employed in the office of the Chief Engineer of the Baltimore and Ohio at Baltimore.

The Fink Truss was widely used for both railroad and highway purposes between 1852 and 1880. A modified form is still used for roof trusses.

This truss is a development and improvement of the Bollman type with a view to simplicity and economy of material. A series of inverted "A" frames is used, and the loads are gradually transferred from the smaller to the larger trusses and thence to the end supports.

The Warren Truss has, with the improvement of riveting methods, largely superseded the Pratt Truss for short spans, and is extensively used for long span railroad bridges.

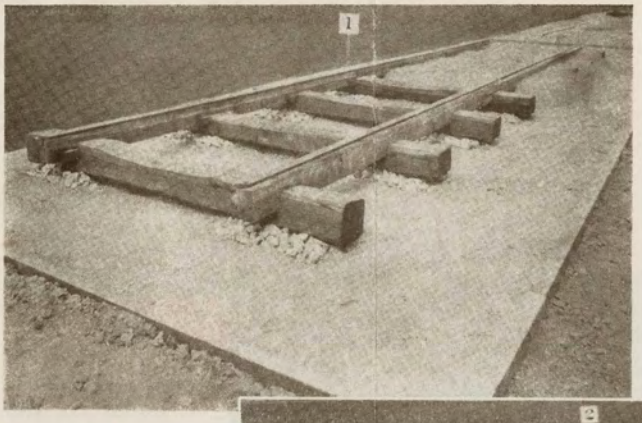
Plate Girders. The use of girders for short spans commenced at an early period of railroad development. The dimensions of plate girders have gradually been increased until for spans up to 125 ft. they have largely superseded truss construction.

Plate girders may be of the "deck" type in which the floor system rests on the top flange, or the "through" type in which it is carried by the bottom flange. The plate girder is of sturdy construction and maintenance charges are low.

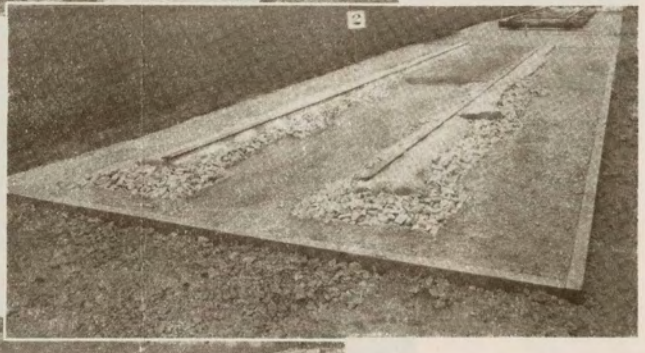
TRACK DEVELOPMENT SINCE 1841.

In 1841, B. H. Latrobe, of the Baltimore and Ohio, designed a rail known as the "Z" rail which was a combination of iron and wood. The iron part of this rail was similar to half of the "U" rail section which was the fourth type of rail and the first rolled in America. This rail weighed 40 lbs. per yd. and was rolled at the Mt. Savage Iron Works, near Cumberland, Md. These "U" rails were placed on wooden stringers and iron ties.

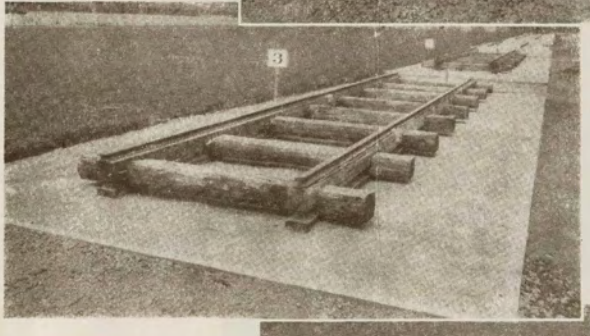
The fifth type of rail was the "T" or pear-shaped rail (1851-1852). This type of construction marked the beginning of the use of cross ties placed



1. Wood String and Sleeper



2. Stone Sill

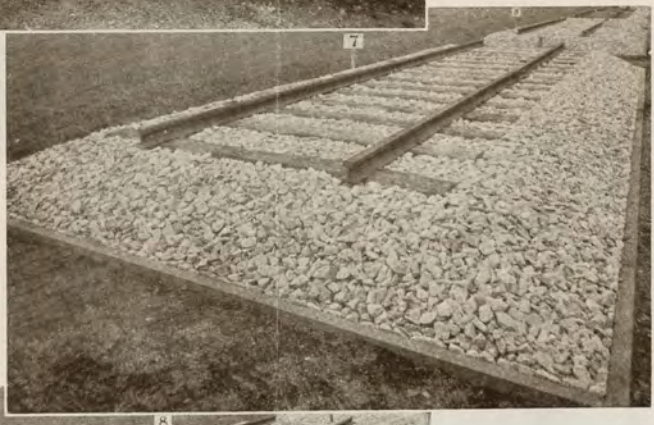


3. Wood String and Edge Rail

4. Wood String and U-Rail

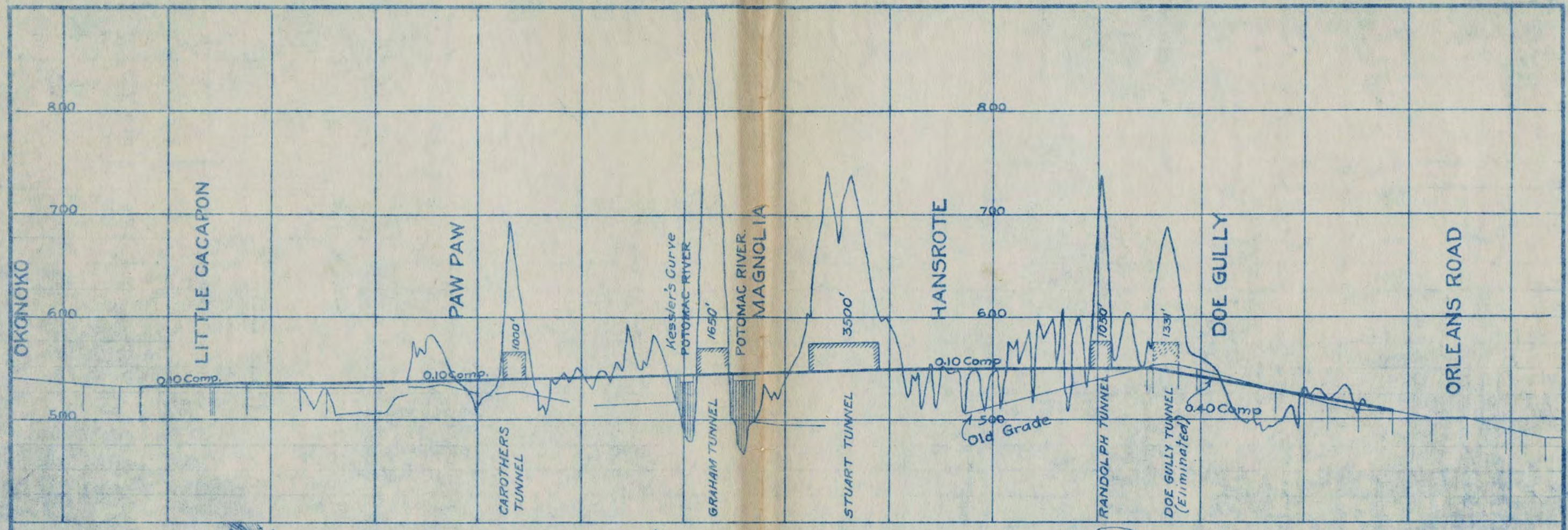
5. Cross Tie and Pearshaped Rail

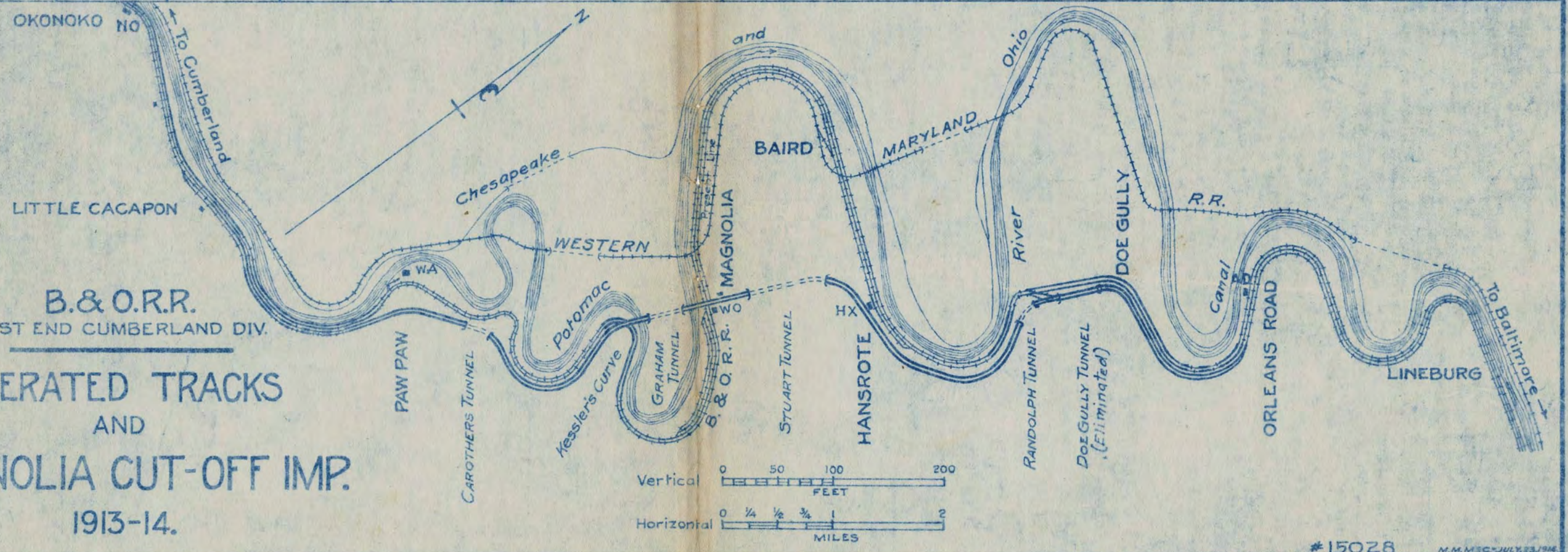
6. Cross Tie and John Brown Rail



7. Cross Tie and T-Rail

8. Cross Tie and T-Rail





B. & O. R. R.
EAST END CUMBERLAND DIV.

OPERATED TRACKS AND MAGNOLIA CUT-OFF IMP. 1913-14.

#15028 M.M.M.S.C. JULY 23/14

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directly on a bed of stone ballast. The "T" shape has been preserved through the years to date, the principal changes being in the weight and distribution of metal.

In 1869, the Baltimore and Ohio Railroad first used steel rail in renewing its existing lines in 1869. These rails were rolled in England.

In 1874, due to increased traffic and heavier locomotives, a 67-pound Bessemer rail was developed. This rail was rolled by the Cambria Steel Company at Johnstown, Pennsylvania.

The first 85 pound rail was used by the Baltimore and Ohio Railroad in 1889, and was employed as standard for both renewals and extensions until 1900.

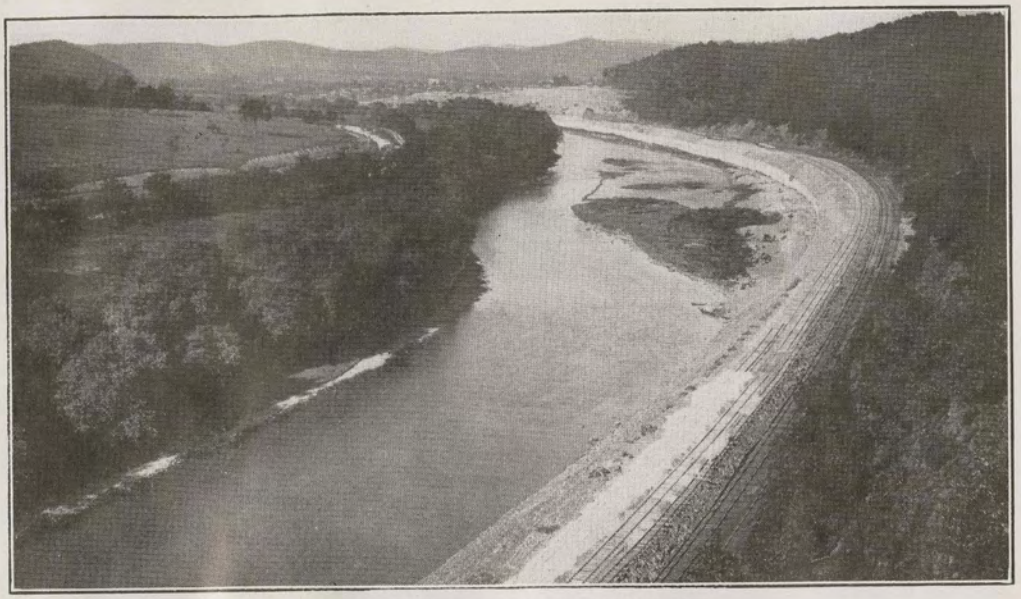
The A. S. C. E. 100 pound rail was used as standard on the Baltimore and Ohio until 1908 when the 100 pound A. R. A. rail came into general use. This rail was made of open hearth steel and gave a harder and longer wearing than the Bessemer process steel previously used. Tie plates and rail anchors came into use with this rail. Treated ties were used experimentally in 1909, and in 1913 became standard.

Since 1921 due to the heavy increase of wheel loads, the 130 pound A. R. A rail was adopted by the Baltimore and Ohio Railroad as standard construction for heavy-traffic freight and high-speed passenger lines.

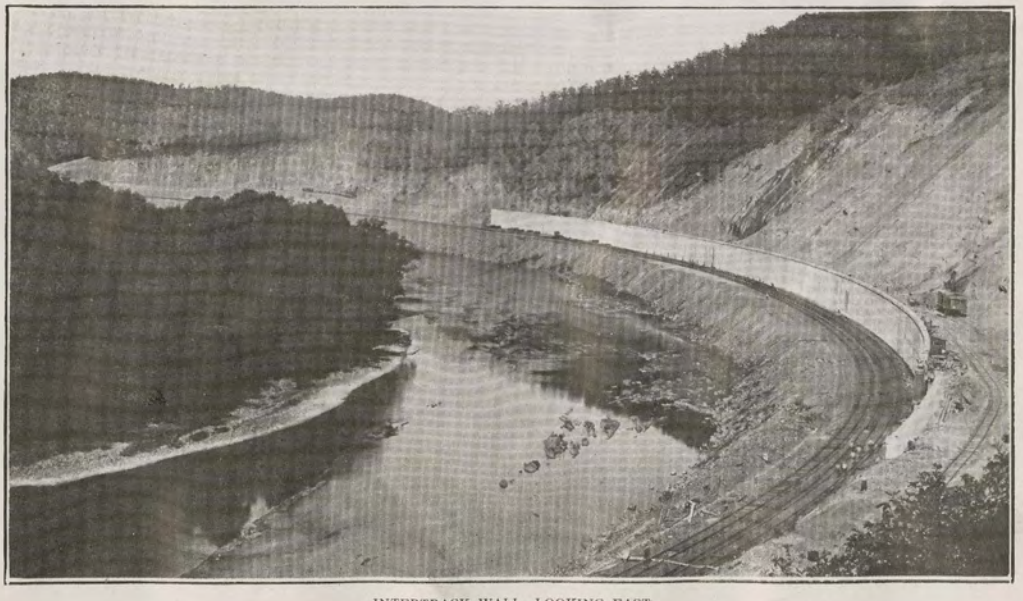
THE MAGNOLIA CUT-OFF.

The Magnolia Cut-Off on the East End of the Cumberland Division of the Baltimore and Ohio Railroad, costing $6,000,000 for a little more than 11 miles of road, is one of the most expensive pieces of roadway in the United States.

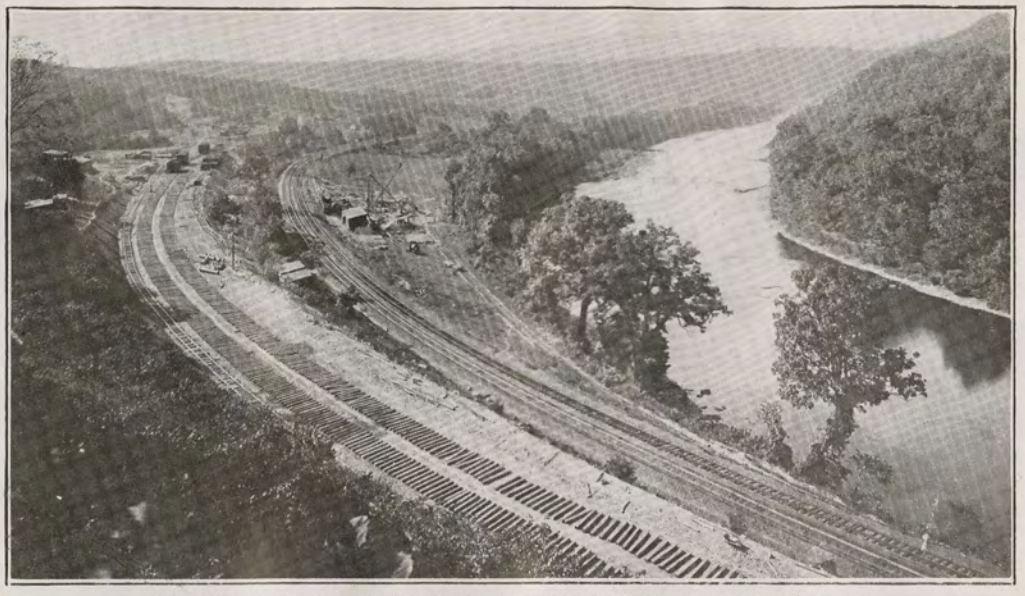
The new line is 5.78 miles shorter than the old and contains 877 degress less curvature. The eastbound grade is 0.10% compensated as compared with 0.80% uncompensated, and the westbound grade is 0.40% compensated as compared with 0.55% uncompensated. It is conservatively estimated that this cut-off will save $500,000 a year due to elimination of helper service and facilitating movement of traffic.



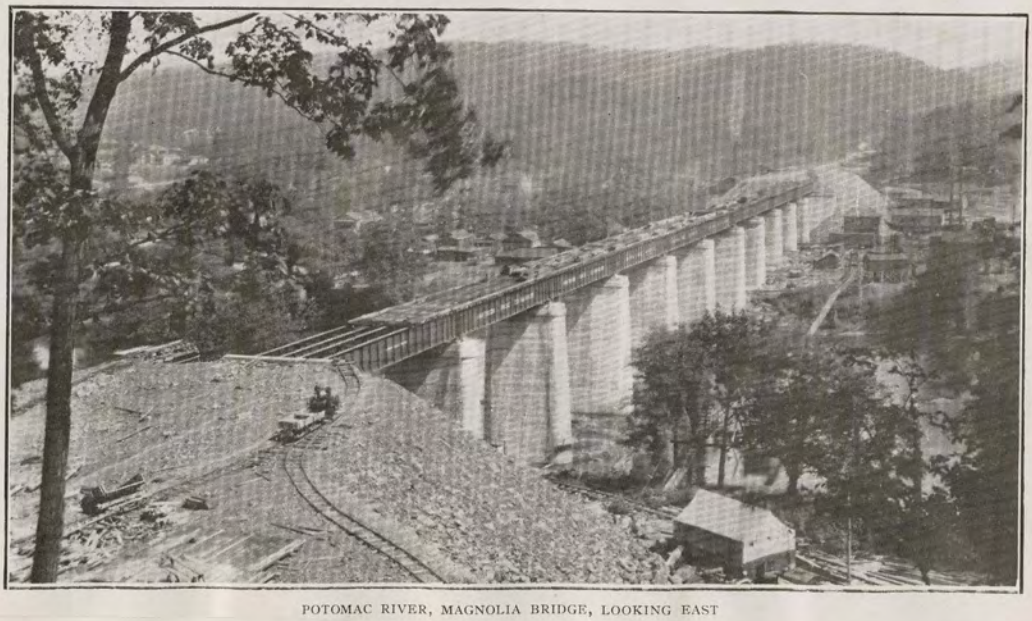
RIVER WALL WEST OF PAW PAW, LOOKING EAST



INTERTRACK WALL, LOOKING EAST

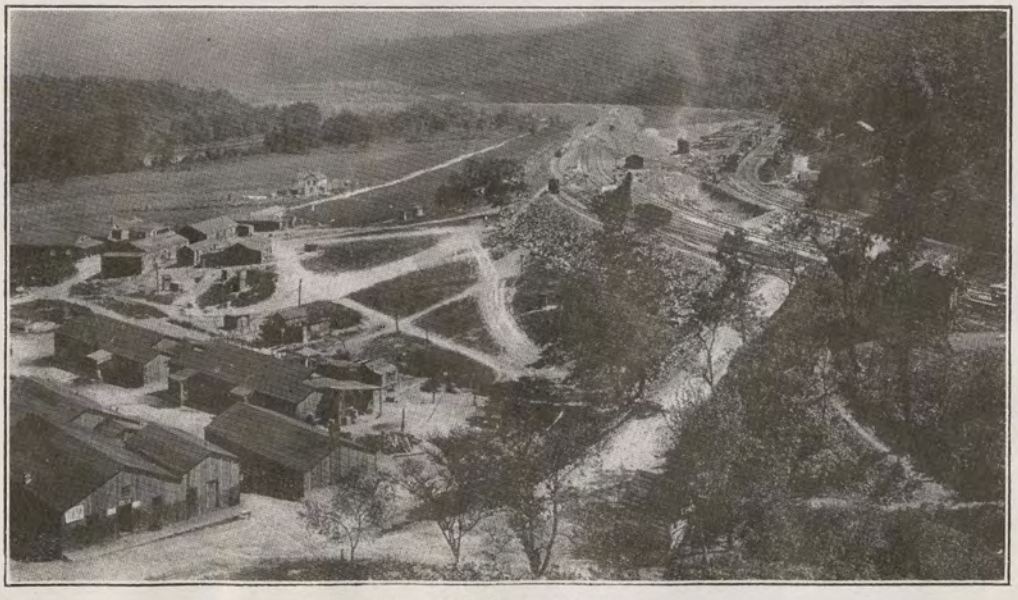


NEW AND OLD LINE, LOOKING WEST TOWARD THE EAST PORTAL OF CAROTHERS' TUNNEL



POTOMAC RIVER, MAGNOLIA BRIDGE, LOOKING EAST

DOE GULLY CUT, LOOKING EAST



DOE GULLY FILL, LOOKING EAST

This section was formerly termed the "Neck of the Bottle" as traffic converging from Chicago and St. Louis passes through this restricted portion and diverges to New England, Central Pennsylvania, the South and Tidewater. The grade scheme is based on the lowest possible grade from the Maryland, West Virginia and Pennsylvania coal fields to tidewater.

Four tunnels were driven, the Stuart, Carothers, Grahm, and Randolph, having a total length of 6,912 feet. A total of 3,300,000 cu. yds. of excavation was involved, not including 240,000 cu. yds. of rock from the tunnels. The 4,900 ft. of retaining wall and 2,000 ft. of bridge work required the placing of 3,000 tons of steel and 71,000 cu. yds. of concrete, not including 55,000 cu. yds. for tunnel lining.

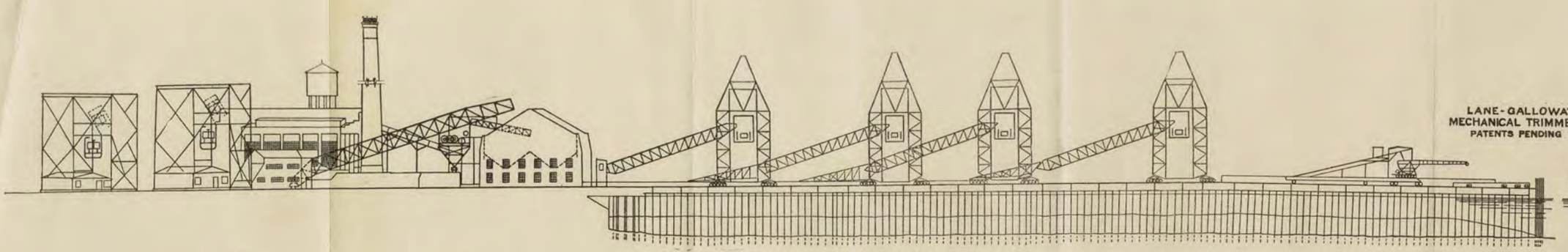
The new line is laid with 100 pound A. R. A. Section B rail, 25 percent of which is open hearth, and the remainder Bessemer steel. Track centers are 14 ft. and No. 16 crossovers are used.

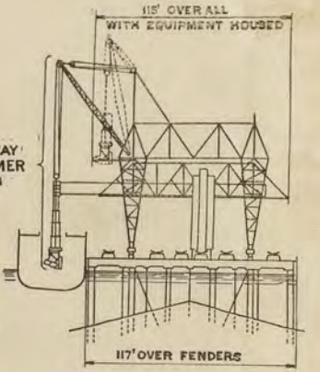
A force of 2500 men were employed on this work for whom model camps were erected. The contractor's plants aggregated 22 power shovels, 55 locomotives, 2 locomotive cranes, 550 dump cars, 6 concrete plants, 1 traveler, 116 air and steam drills and 2 power plants.

The improvements were completed prior to schedule time, with the cost slightly lower than estimated. The first train was run over the new line December 5, 1914, since which time it has been in continuous operation. This cut-off is one of the best examples of the management of the Baltimore and Ohio to maintain the reputation as the line of service.

THE EXPORT COAL PIER AT CURTIS BAY, BALTIMORE, MD.

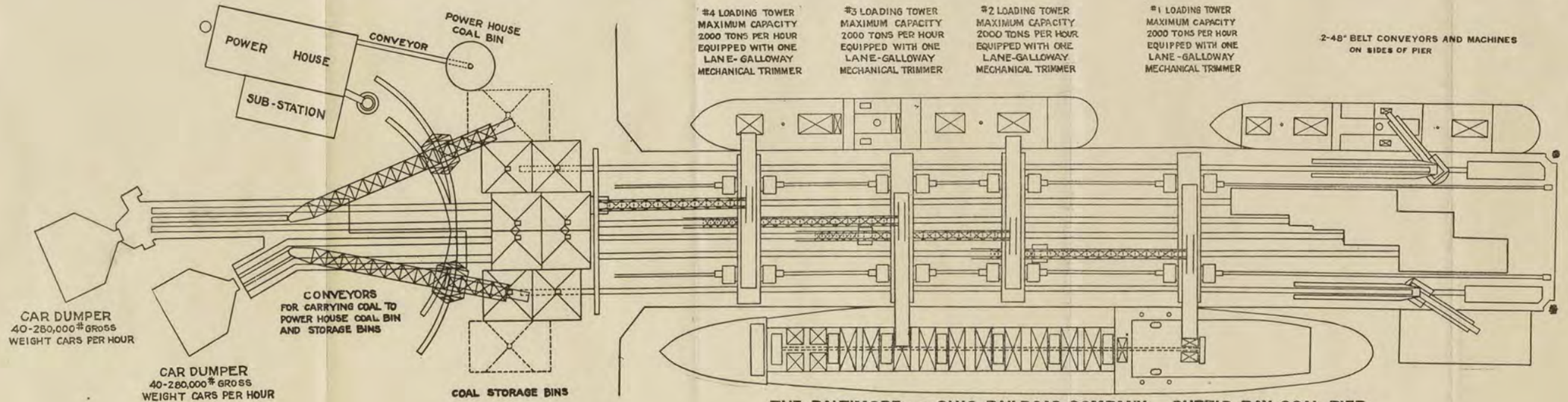
In the beginning of 1915 it became evident that new facilities must be developed for transferring coal from cars to vessels. Investigation of this problem resulted in the construction of the immense concrete and steel conveyor-belt coal pier, whose four moving towers attract the attention of all who visit this point.





LANE-GALLOWAY
MECHANICAL TRIMMER
PATENTS PENDING

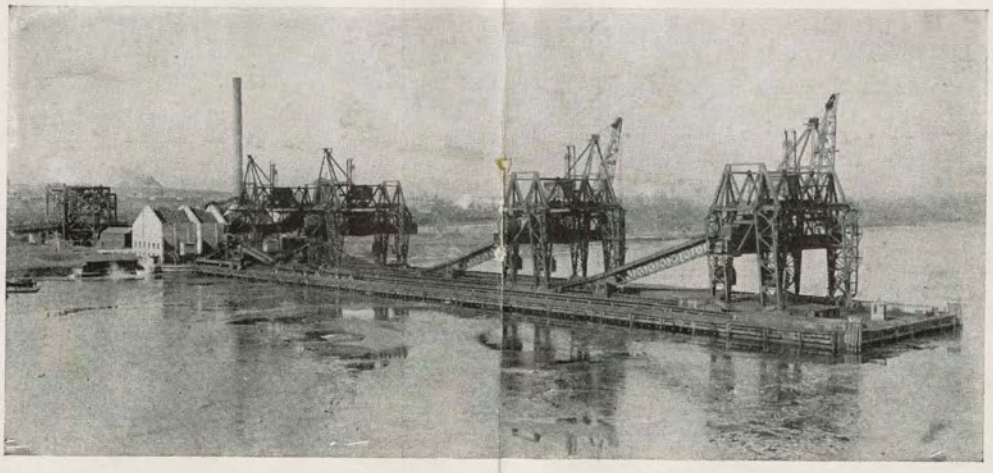
CROSS SECTION



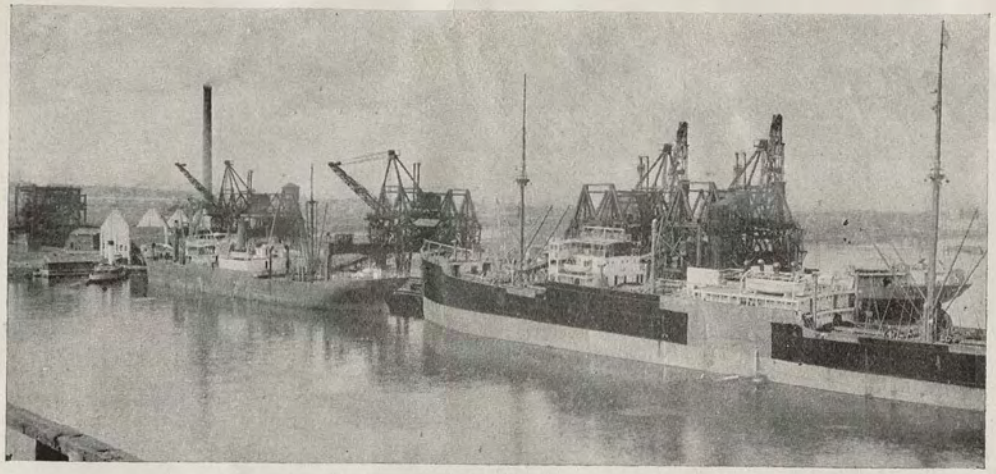
LANE-GALLOWAY
MECHANICAL TRIMMER
PATENTS PENDING
25 TONS PER MINUTE; 1500 TONS PER HOUR
MAXIMUM THROW 50 FT.
OTHER EQUIPMENT-
BUILT UNDER PATENTS OWNED AND
CONTROLLED BY FRANCIS LEE STUART.

THE BALTIMORE AND OHIO RAILROAD COMPANY CURTIS BAY COAL PIER
GENERAL PLAN
LOADING CAPACITY 7000 TONS OF COAL PER HOUR

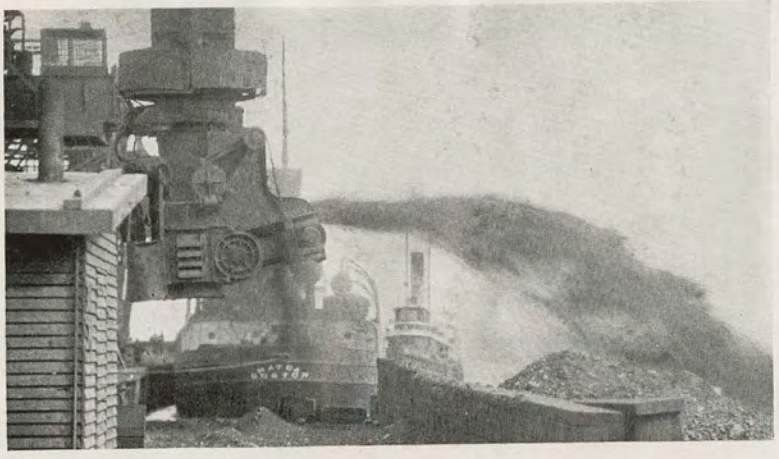
View Looking Toward End of Curtis Bay Coal Pier — Showing 60-inch Rubber Belts Conveying Coal to Movable Coal-Loading Towers



Curtis Bay Coal Pier — General View



Curtis Bay Coal Pier
Lane-Galloway Mechanical Trimmers working in a vessel



Lane - Galloway Trimmer Throwing 25 Tons per Minute, 1500 Tons per Hour. Maximum Throw 50 Ft. Practically No Breakage.

The Curtis Bay Export Conveyor-Belt Coal Pier of the Baltimore and Ohio Railroad Company has the largest capacity of any coal pier in the world. Mechanical facilities have been furnished which permit the maximum loading of 7,000 tons of coal per hour into vessels.

This pier marks an entirely new departure in coal terminals. Instead of the usual high structure to which railroad cars are by one means or another elevated and then emptied into bunkers through which chutes lead into vessels alongside, this plant consists of a pier 117 ft. wide, 700 ft. long, the deck of which is 8 ft. above mean tide. The pier deck is entirely of reinforced concrete construction, supported upon 1664 pre-cast concrete piles. The water around the pier and the channel leading to it has a minimum depth of 35 ft.

Some distance back of the shore end of the pier are two car dumpers. Each dumper feeds three belts 60 inches wide, with a maximum capacity of 2000 tons per hour and a maximum speed of 500 ft. per minute.

The two railway tracks serving the pier are diagonal to it. Each track leads to a car dumping machine, which elevates and overturns the coal cars, dumping their contents into an elevated bin of 120 tons capacity. The two machines can handle a maximum of 80 cars per hour. The cars have a gross weight of 280,000 pounds or a coal capacity of 100 tons. Over 50 cars per hour per car dumper have been dumped, the cars being ordinary coal cars in use on the railroad, having a capacity of 50 tons of coal. For frozen coal in cold weather a thawing shed is provided.

Two belts in each car dumper group run out on to the pier to a loading tower. These belts take the direct discharge from the elevated bins, thus giving a regular flow of coal to the main conveyors, and relieving the latter of heavy wear. The third belt in each group conveys coal to a storage bin. For each car dumper there are two movable coal loading towers; each loading tower is equipped with a cage supporting a shuttle ram. The cage is lowered

or raised to suit the height of the vessels being loaded, and has a variation of height of 27 ft., the minimum height above water being 15 ft. The shuttle ram can be run out on each side of the pier a maximum distance of 45 ft. With the towers traveling along the pier in a longitudinal direction and the shuttle working in and out at right angles and being capable of vertical adjustment, this apparatus will load a hatch uniformly.

Lane Galloway Mechanical Trimmers are used to trim the coal in the holds.

These export facilities represent an investment of approximately $3,000,000. The pier was constructed 1916-1917, and the mechanical trimmers were added in 1920.

THE NEW GRAIN ELEVATOR AT LOCUST POINT, BALTIMORE, MD.

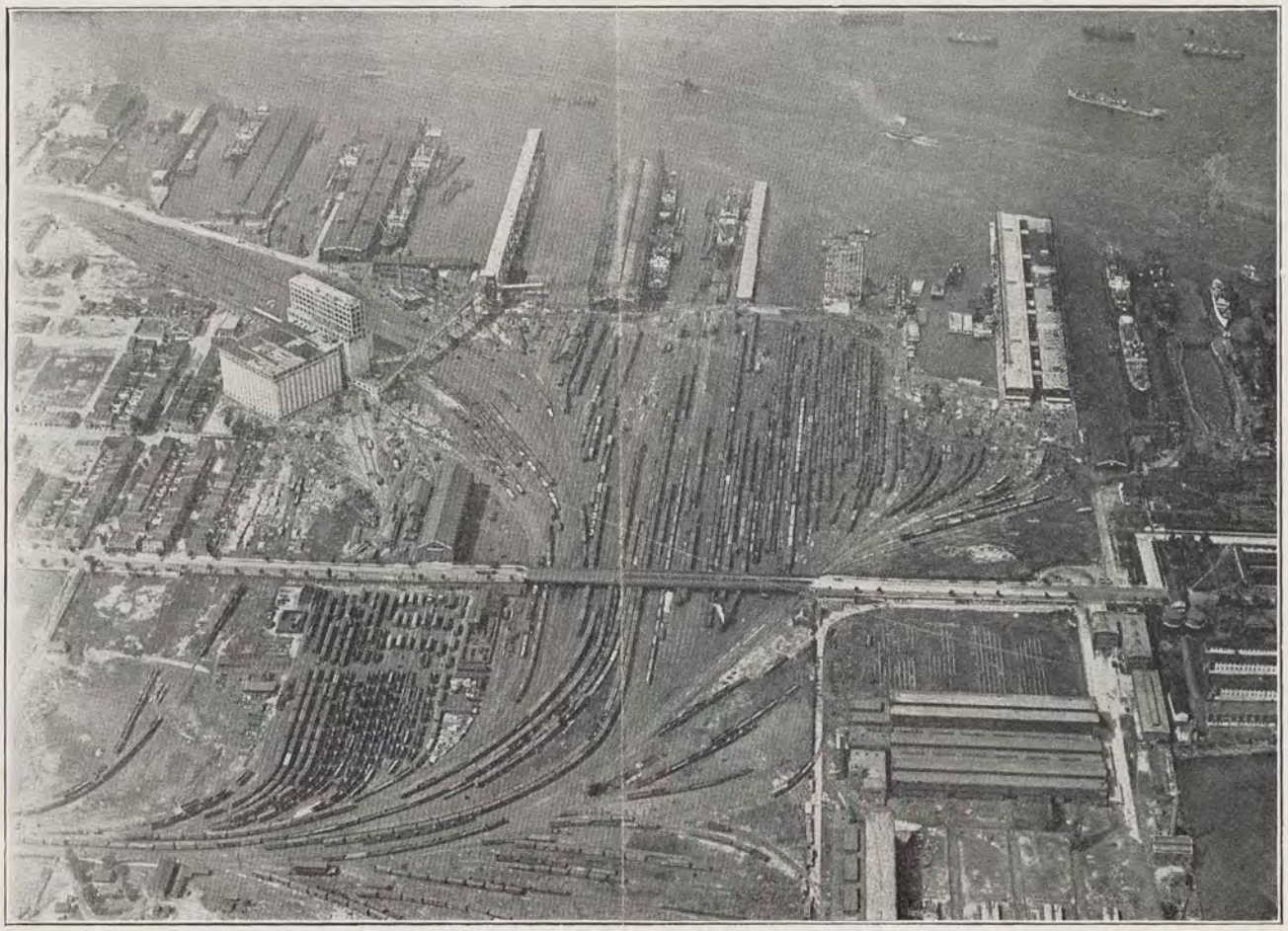
The most efficient and fastest grain elevator in this country is now in service at the Locust Point Marine Terminals of the Baltimore and Ohio.

Under forced operation an ordinary vessel can be loaded in three hours. The total shipping capacity of this plant is 150,000 bushels per hour. This amount can be divided, or 75,000 bushels per hour can be concentrated in one vessel. At some berths wheat alone can be loaded, while at others mixed cargoes can be loaded.

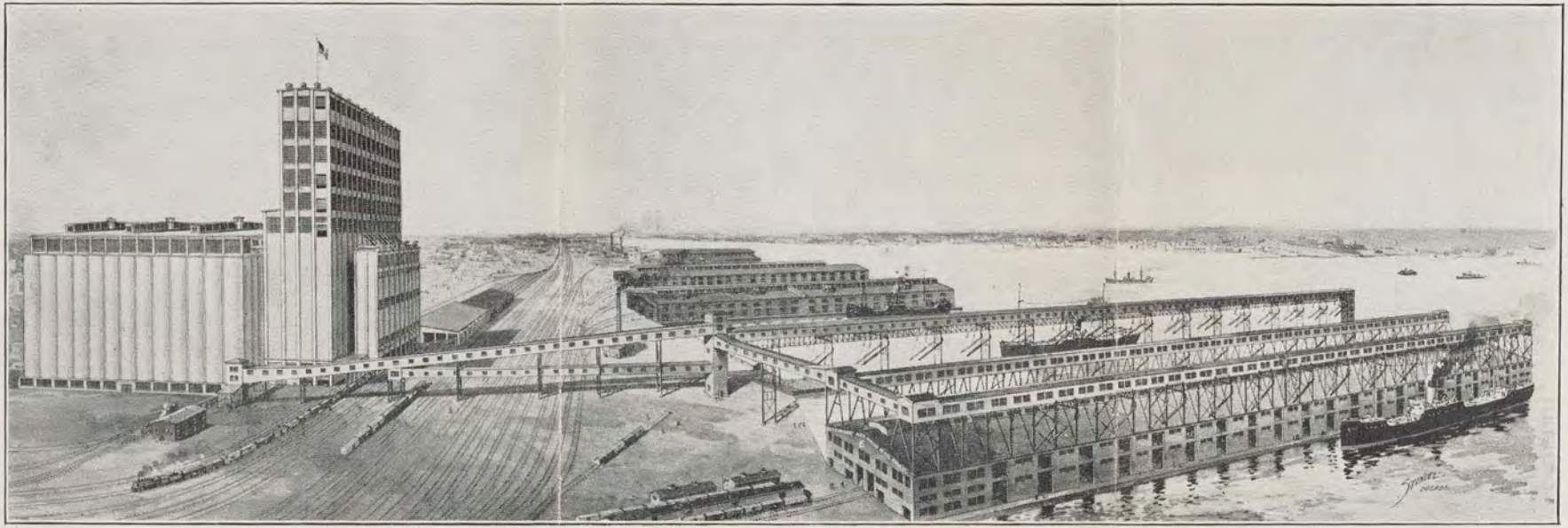
The important auxiliary operations of drying, cleaning, transferring and mixing grain can be carried on simultaneously without interfering with the major operations of receiving and shipping.

The plant has at present a storage capacity of 3,000,000 bushels which may be extended to 6,000,000 bushels as the plant has been designed for this.

This is the first elevator to be designed and built entirely in accordance with the new regulations recently adopted by the National Board of Fire Underwriters.



AERIAL VIEW OF GRAIN ELEVATOR AND MARINE TERMINAL FACILITIES
OF THE BALTIMORE AND OHIO RAILROAD
AT
LOCUST POINT, BALTIMORE, MARYLAND



BALTIMORE & OHIO RAILROAD COMPANY GRAIN ELEVATOR
LOCUST POINT, BALTIMORE, MD.

The entire plant is built of concrete, steel and other fire resisting materials, supported where necessary on concrete piles.

The new grain facilities were erected in 1924 as part of a program of improvements at the Locust Point Terminals of the company, involving over $10,000,000. It is hoped that they will have a large part in putting Baltimore in the 100,000,000 bushels per year class.

IN THE BEGINNING AND NOW.

The speed of the first locomotive was about 10 miles per hour, while today speeds of from 45 to 65 miles per hour are attained.

The first investments of the company totaled about $500,000; today it has assets of over $1,000,000,000.

The first line ran from Baltimore to Ellicott's Mills, about 14 miles. Today, the Baltimore and Ohio System embraces over 5,000 miles, touches 13 states and serves eight of the ten largest cities in the United States.

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2. Pamphlet on the Baltimore and Ohio as a Factor in Foreigh Trade.
3. Pamphlet on Magnolia Cut-off.
4. Pamphlet on Export Coal Pier.
5. Pamphlet on New Grain Elevator.
6. Foreword to the Corporate History of the Baltimore and Ohio.
7. Annual Report of the Company for 1927.

Much valuable assistance and information was obtained from Mr. E. L. Gosnell, Assistant to the Chief Engineer of the Baltimore and Ohio, and his Assistant, Mr. Adams.

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