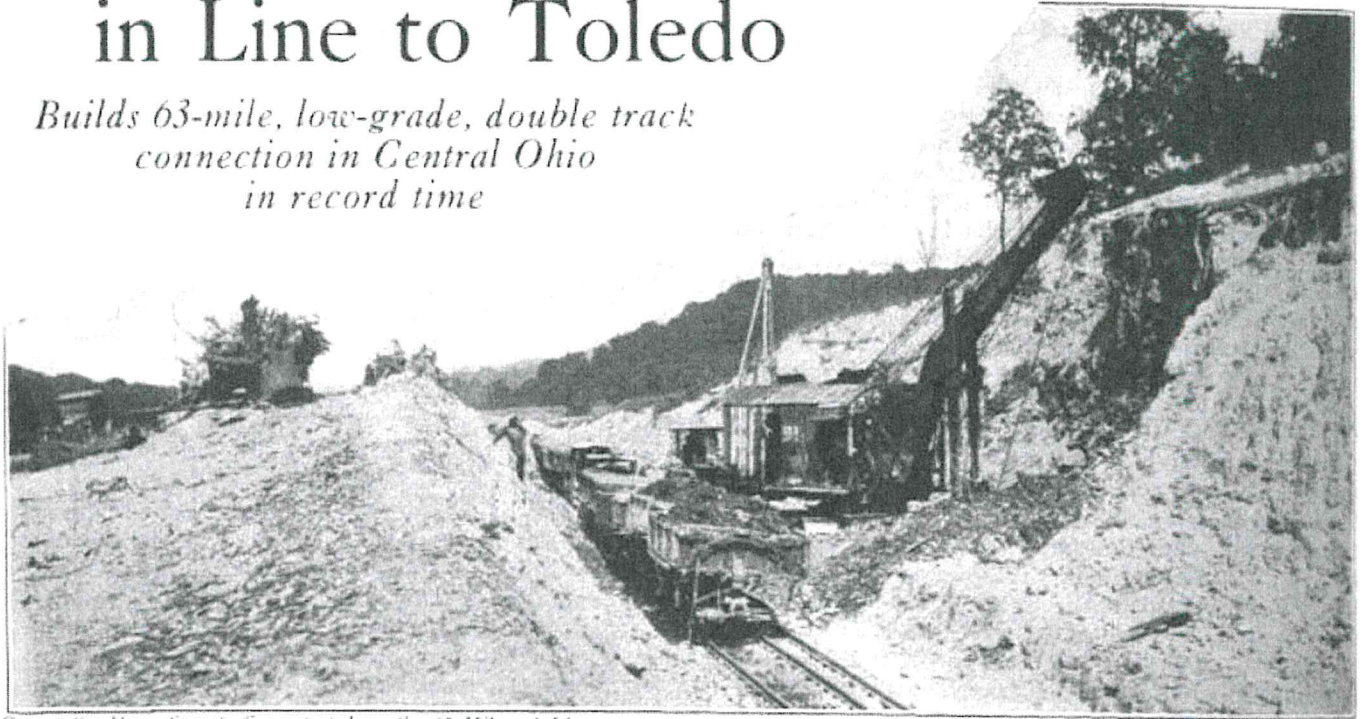


# C. & O. Completes the Last Link in Line to Toledo

*Builds 63-mile, low-grade, double track  
connection in Central Ohio  
in record time*



One of the Many Shovels Concentrated on the 63 Miles of Line

**O**N September 16, 1927, the Chesapeake & Ohio started operating trains over a new double-track line extending from Gregg, Ohio, to Valley Crossing, a distance of 63 miles, thereby completing a remarkable record for speed in heavy railway construction. As work on this line was not started until November 25, 1926, the construction period aggregated only 294 days, of which 45 days were lost on account of rain. The work included the moving of 4,600,000 cu. yd. of earth, and 1,080,000 cu. yd. of rock, the placing of 130,000 cu. yd. of concrete and the setting of 10,000 tons of structural steel, in addition to the laying, ballasting and surfacing of 130 miles of track.

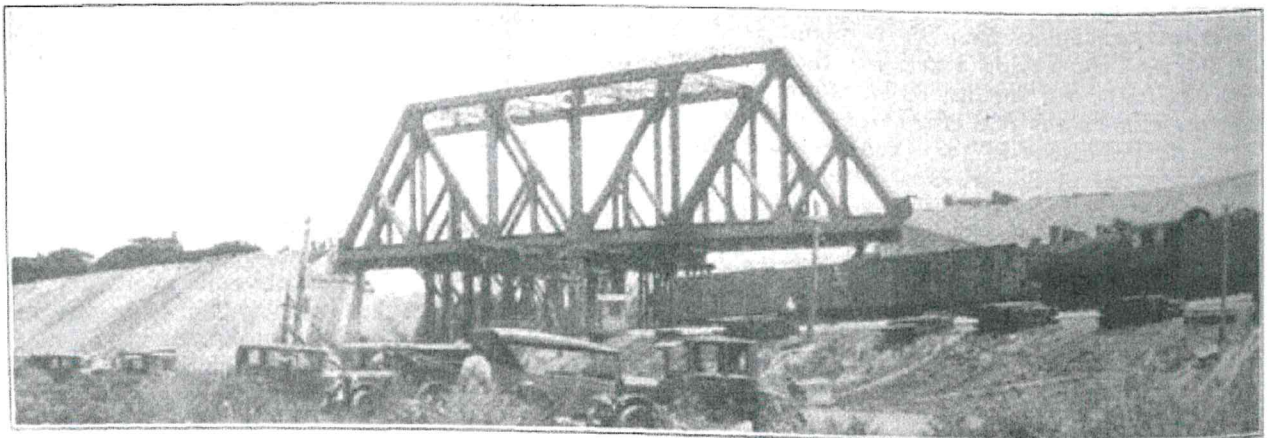
The completion of this new line, which was built under the appropriate name, Chesapeake & Hocking, to effect a connection between the end of the Chesapeake & Ohio line at Gregg and its subsidiary, the Hocking Valley, at Valley Crossing, comprises the fulfillment of an objective which has been before the directors of the Chesapeake & Ohio for many years, namely that of having under their complete control a thoroughly effective route for the transportation of coal from the

West Virginia fields to the Great Lakes at Toledo. Much of the coal billed for Toledo was delivered to the Cincinnati, Hamilton & Dayton at Cincinnati, or to the Norfolk & Western at Kenova, the latter road turning it over to the Hocking Valley at Columbus.

## Develop New Line Further West

In 1914, in compliance with a decision of the United States District Court, the Chesapeake & Ohio disposed of its interest in the Kanawha & Michigan, thereby leaving a gap in its route from the coal fields to the Hocking Valley. To close this gap the Chesapeake & Ohio in 1916 built a line, known as the Chesapeake & Ohio Northern, extending from its own line at Edgington, Ky., across the Ohio River and thence for a distance of 33 miles to a connection with the Norfolk & Western on the east side of the Scoto River opposite Waverly, Ohio. It also secured trackage rights over the Norfolk & Western from this point to a connection with the Parsons yard of the Hocking Valley at Valley Crossing, a short distance south of Columbus.

This route to Toledo, via the Chesapeake & Ohio



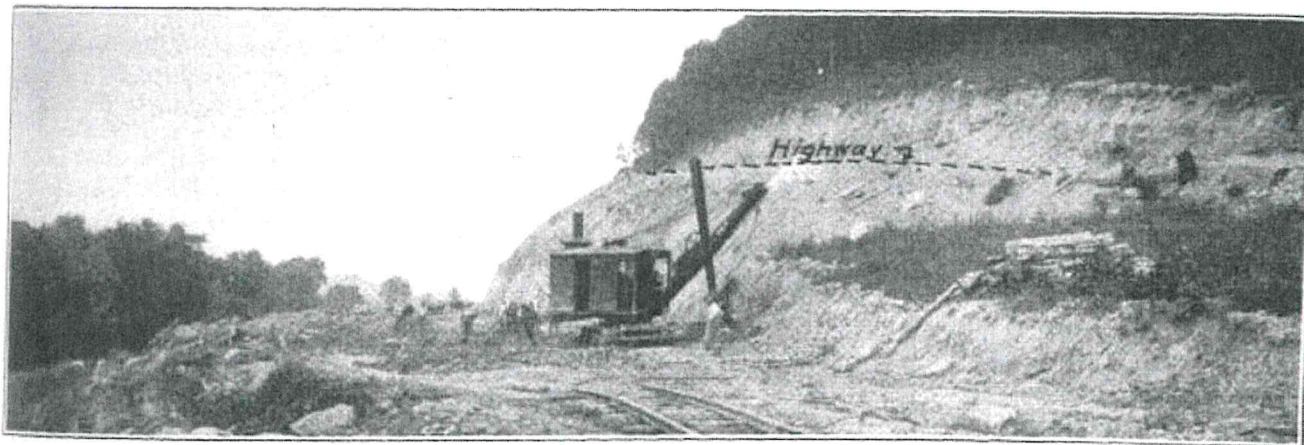


Northern, the Norfolk & Western and the Hocking Valley, was an exceedingly valuable one to the Chesapeake & Ohio during the 10 years that it was employed as an outlet for coal to the Great Lakes. However, with the marked increase in the northbound movement of West Virginia, Virginia and Kentucky coal over both the Chesapeake & Ohio and the Norfolk & Western, the joint use of the Norfolk & Western's line between Gregg and Valley Crossing proved unsatisfactory to both carriers, because of the congestion in this neck in the bottle. It imposed a particular handicap on the tenant carrier because the capacity of the line made it necessary to restrict its operations to a maximum of 12 tonnage and 1 time freight trains daily, a limitation that frequently made it necessary to detour a portion of the lake coal via interchange connections at Cincinnati. Furthermore, the use of the Norfolk & Western line with a ruling grade of 0.35 per cent against northbound trains denied the Chesapeake & Ohio the full operating advantage of the 0.2 per cent grade of its own line from the mines to Gregg, as well as over the Hocking Valley from Columbus to Toledo. This state of affairs led to the decision to construct an independent line generally parallel to the Norfolk & Western between Gregg and Valley Crossing, this line being lo-

new line lies adjacent to the Norfolk & Western is a comparatively flat country in which the grading for roadbed is exceedingly light except for embankments at the larger stream crossings. Highway grade separation, as on other portions of this project, was an important factor in the grading quantities; for example in one mile of this portion of the line the yardage in the approaches to a single overhead highway bridge totaled more than three times that required for the rail road roadbed.

The first roadway grading of any consequence encountered south of Valley Crossing is in the vicinity of Hagerty where there is an embankment three miles long of a maximum height of 15 ft., requiring about 200,000 cu. yd. of fill, practically all of which was obtained from side borrow. Heavy work was required through Circleville where the line is located between the town and the Scioto river on an embankment having a height of from 10 to 33 ft. over a distance of 6,000 ft. which contains about 380,000 cu. yd. of fill. While this embankment was necessary to meet the grade line requirements, it also served as a means of separating grades at three streets, two private crossings and a crossing over the Pennsylvania.

South of Circleville the east side of the Scioto River



South of Salt Creek the Highway Was Placed on a Bench in the Cut Slope

cated on a grade of 0.2 per cent against northbound traffic and 0.42 per cent against southbound traffic. By reason of the extremely flat northbound grade it is possible for a 2-8-8-2 locomotive to haul a train of 10,000 tons in the direction of loaded movement, the same locomotive readily hauling the empty movement over the 0.42 per cent grade in the return direction.

#### Character of the Country Traversed

The territory traversed by the new line is one covering a wide range of physical characteristics. From Valley Crossing to Kinnikinnick the terrain is one described by Ohio geologists as the Till plains, a fertile rolling farming country with little relief other than occasional glacial moraines. Slopes become more pronounced and differences in elevation increase where these Till plains join the northern edge of a glacial plateau that is traversed between Kinnikinnick and Chillicothe, while south of Chillicothe an unglaciated country presents a much more rugged aspect in which waterways occupy narrow steep sided valleys with marked differences in elevation. Here the geologic strata exposed are primarily of the Waverly formation in which sandstone and Waverly shale predominate.

For the first 16 miles south of Valley Crossing the

valley rises on a gradual slope to a considerable elevation above the river. In this territory the Norfolk & Western lies high up on this slope whereas the new Chesapeake & Hocking was located closer to the river, at some points as much as three miles from the Norfolk & Western. Because of the greater depth of lateral valleys close to the river this location involved heavier grading, but was selected because it avoids the climb to the higher ground further up the slope; in fact, at one point the new line is 96 ft. lower than the Norfolk & Western.

#### Heavy Grading

The grading of this portion of the line is heavy and includes a cut 7,000 ft. long with a maximum depth of 35 ft. This portion of the line is largely in a gravel formation, but this runs out south of Kinnikinnick creek where the line is closer to the river in a much more undulating country in heavy clay. The two miles embracing the embankment across the valley of Kinnikinnick creek and the cut immediately south of it are two of the heaviest on the entire line, Mile 33 having 70,900 cu. yd. of excavation and 255,300, cu. yd. of embankment and Mile 34, 254,000 cu. yd. of excavation and 47,000 cu. yd. of embankment.

At Hopetown the line turns away from the river and



crosses over the Norfolk & Western at a summit in the grade line which required an embankment two miles long of a maximum height of 45 ft. and containing 470,000 cu. yd. of fill. In addition to a 198-ft. skew through truss span over the Norfolk & Western, this fill is pierced by a deck girder span over a traction line,



The Chesapeake & Hocking Is the Last Link in the Route from the Mines to the Lakes

four under passes for highways and a 28-ft. water-way arch.

#### Long Embankment for Overcrossing

From this overcrossing to a point opposite Chillicothe the country is more broken, the elevation changing as much as 132 ft. in a horizontal distance of 550 ft. However, the following 10 miles is in open country in which the grading is much lighter. In Mile 44 there is a crossing over the Baltimore & Ohio, requiring practically two miles of continuous embankment containing 200,000 cu. yd. of filling, all of which was from borrow.

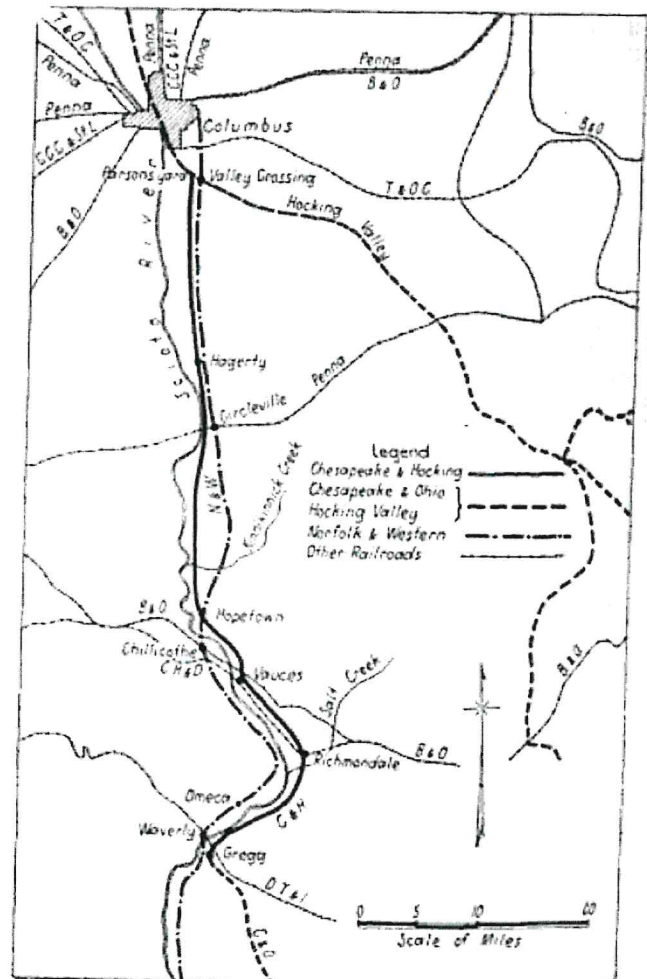
From Vauces to Salt creek valley, as the result of a paired-track agreement with the Baltimore & Ohio, use is being made of six miles of the Cincinnati, Hamilton & Dayton line. A second track was built at 13-ft. centers from the old line and the old line was rebuilt to standards established for the new one. However, as the country is practically level, little revision of the old grade line was required, except that in the vicinity of Mile Post 52 it was necessary to relocate the C. H. & D. line for a distance of 4,000 ft. in order to permit of a satisfactory junction of the two lines at the south end of the paired track. Here the new line crosses the valley of Salt creek on a one-degree curve, 7,600 ft. long, of which 6,000 ft., is on an embankment from 25 to 30 ft. high, containing one-half million cubic yards of fill. The crossing of Salt creek is effected by a bridge of four 90-ft. deck girder spans on concrete piers and abutments.

#### From Salt Creek to Gregg

South of Salt creek, the line lies close to the Scioto river for the remaining distance of 11 miles to Gregg,

and is supported by side-hill cuts in the shoulder of these bluffs or on embankments across the ravines between them. The grade line on this portion of the location was established at an elevation five feet above high water level of the 1913 flood.

The construction of this part of the line was complicated by the fact that the face of the bluffs was occupied by a highway on substantially the same grade as the railroad, but following the contour of the bluffs, so that the line of the railroad crossed the highway repeatedly. To avoid these crossings, the highway was removed from the location bordering the shoulders of the bluffs to a shelf on the uphill side of the cuts for the railroad roadbed, and since the slopes ran far up the bluff side, this resulted in a pronounced increase in the excavation quantities. Thus, of a total quantity in excavation amounting to 2,310,500 cu. yd. in the 10 miles from Salt creek to Gregg, 1,488,200 cu. yd. was charged to highway relocation. It is only in this territory that any rock was encountered, an over-burden of from 5 to 44 ft. of clay being underlaid with alternating strata



Route of the New Line Between Gregg and Valley Crossing

of rock, clay and slate. The total volume of material classified as rock aggregated 1,080,000 cu. yd.

#### Effecting the Connection

A rather complicated situation was encountered in effecting the connection with the existing line at Gregg, where the Detroit, Toledo & Ironton occupied the location desired for the new line for a distance of about 800 ft. To overcome this, it was necessary to relocate the D. T. & I. for a distance of about 2,000 ft. by mov-



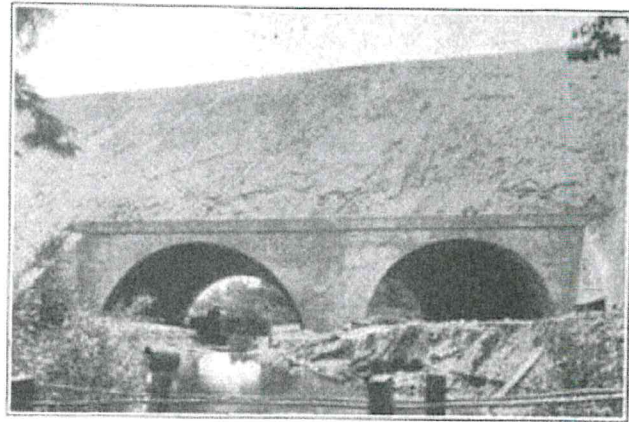
ing it further into the hillside, thereby entailing heavy rock excavation. The situation was further complicated by a highway undercrossing of both lines, the crossing under the D. T. & I. being located where the railroad is in a cut 30 ft. deep.

The new line represents a descent from elevation 754.60 at Parsons yard to elevation 595.50 at Gregg. However, adverse ascents result in 138.44 ft. of rise and fall, a large part of which was made necessary by highway and railway grade separations. Of 442 highway crossings encountered on the new line, 41 have been separated, most of them by undercrossings which in some cases necessitated an artificial summit in the grade line of the railroad. In addition to these highway grade separations there are five crossings over other railways. The total curvature in the line is 1088 deg. of central angle, the greatest amount in any one curve being 76 deg. 21½ min. in the one-degree curve at the crossing of Salt creek valley. With exception of four 3-deg. curves and three 1-deg. 30-min. curves, the curves are all of 1 deg. or less. Embankments have a width of 33 ft., while cuts at roadbed level are 41 ft. wide. An allowance of 10 per cent on the sides and tops of embankments was made on trestle fills, while the shrinkage allowance on team work fills was 5 per cent. The tracks are laid 13 ft. center to center with 100-lb. A. R. A. type B rail in 39-ft. lengths. Seventy-five per cent of the ties are treated hardwood and the other 25 per cent are untreated white oak. Three center sidings have been provided each with a capacity of 125 cars. Water stations with treating plants have been established at approximately the third points in the length of the line.

**Much Bridge Work Required**

Bridge work represents an important feature of the project. In addition to the structures required for the

sist of through plate girders with I-beam floors covered with a deck plate, while the crossings of minor highways or private crossings were made with 12-ft. by 14-ft. box culverts. The floors of steel structures are all covered with three-ply membrane waterproofing with mas-

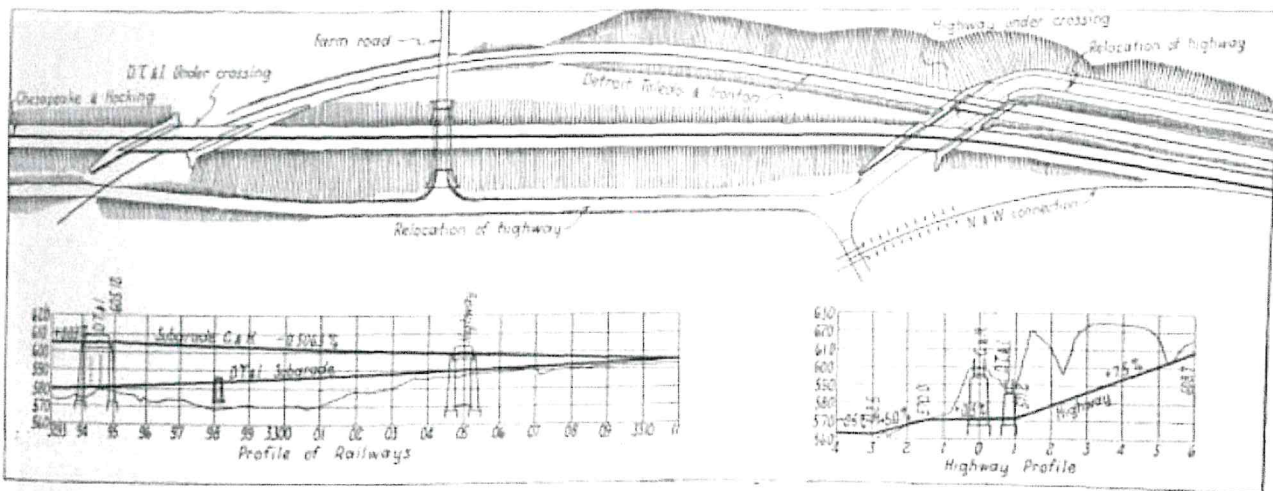


**A Double Arch Culvert**

tic protection, Johns-Manville material being used for the north half of the line and Carey waterproofing for the south half.

**Measures to Insure Rapid Progress**

To complete 63 miles of double-track railroad, involving heavy construction, in less than 10 months was no simple task. It involved the thorough fulfillment of two fundamental requirements—adequate supervision and concentration of grading equipment on the job. The first step in meeting these conditions was to divide the line into construction sections of appreciably shorter



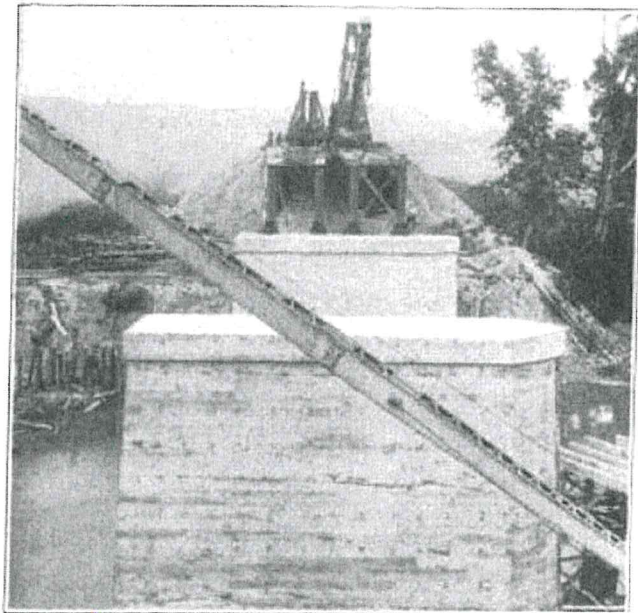
**A Complex Grade Separation Layout at Gregg**

grade separations, there are a large number of waterway openings ranging from the four 90-ft. spans over Salt creek to 36-in. culvert pipe. All of the larger streams were crossed with deck or through girder spans. There are a number of box culverts and several arch structures, of which the largest has one 24-ft. and one 16-ft. opening. The pipe culverts are of concrete with the exception of a few cast iron pipe lines in locations where the cover was limited. The highway grade separations were effected with a variety of structures, of which the most common for the undercrossings is a longitudinal steel trough design in spans ranging from 24 ft. to 30 ft. clear. The longer spans generally con-

length than is ordinarily deemed necessary for work of this kind, namely, eight sections ranging from 5.1 to 10.8 miles long. Each of these sections was virtually an independent construction unit, being placed under the direction of the resident engineer with a party of adequate size to insure that the work would be laid out sufficiently in advance of the grading operations to avoid any delays. In addition, the work on each section was awarded to a separate general contractor, with the exception of two adjoining sections, Sections 5 and 6, totaling 10.7 miles long, which were let to one firm, because of the distribution of materials and in order to expedite track laying.



By these measures and a careful study to insure that the firms employed were possessed of adequate equipment it was possible to start the work simultaneously on virtually the entire line at the outset and after it was well under way to have as many as 70 shovels of various sizes and capacities employed simultaneously, most of them working double shifts. The contractor on Section 8, 10.8 miles long, employed 12 shovels including one 70-ton and two 100-ton machines. As a consequence it



Erecting 90-ft. Girder Spans Over Salt Creek

was possible to obtain the maximum output of 295,000 cu. yd. in one week. Bridge work was also prosecuted actively, and as many as 44 gangs were engaged at one time in placing culvert pipe and building concrete structures.

The Walsh Construction Company of Davenport, Iowa was the contractor for Sections 5 and 6. The other six contractors were the Fritz-Rumer-Cooke Company, Columbus, Ohio; Ferguson & Edmondson Company, Pittsburgh, Pa.; the Sturm & Dillard Company, Columbus, Ohio; Dominion Construction Company, Niles, Mich.; A. Guthrie & Company, Inc., St. Paul, Minn.; and H. W. Nelson Company, Inc., New York. The general contractors handled the bridge masonry and track work as well as the grading.

#### Grading Methods

The grading was handled with a variety of machines from the smaller types to 100-ton shovels. The haul was divided about equally between standard and narrow-gage equipment. The large number of grade separations resulted in an excess of embankment, such that about 2,000,000 cu. yd. had to be taken from borrow which, when possible, was developed in the cuts, but a number of large side borrow pits were also found necessary. Between Valley Crossing and Circleville and between Hopetown and Richmondale the line is sufficiently close to other railroads to make the problem of hauling in equipment relatively simple. However, on other portions of the line, particularly between Salt creek and Gregg, the contractors were confronted with long hauls over hilly and rough roads. Long hauls were also imposed for the delivery of much of the concrete material.

Material for some of the structures south of Salt

Creek was brought across the Scioto river from Omega and dumped in narrow-gage cars for delivery to the mixer plants. At Gregg, concrete for a number of structures was mixed at a central plant and hauled in dump trucks for distances up to 1,000 ft.

#### Locomotive Cranes Used

Track laying was prosecuted progressively from material yards located at points where temporary connections could be made with the Norfolk & Western or the Baltimore & Ohio. Locomotive cranes were used extensively for track laying, both for unloading ties and for setting rails in place.

They were also used to marked advantage for ballasting. By having the cranes on one track lift the opposite track at points about 15 ft. apart for making the first raise, it was possible to make much better progress than with the use of jacks.

The effect of the extra effort to complete the line in minimum time was not only less costly in the end but it resulted in a material saving and provided a much needed transportation link which proved most beneficial and satisfactory to the shippers and the public and prevented a restriction of the movement of coal to the Northwest at a time when the consumers were anxious to get their winter supply delivered.

#### Careful Planning

Expediting this work was accomplished by careful planning, organizing and scheduling of the various operations; using the most modern and efficient methods and



Highway Under-Crossing on a Sharp Skew

machinery; and displacing hand labor with labor saving machines which worked efficiently both night and day. There was a saving in overhead expenses and interest on the investment due to a shorter period of construction time and a further advantage in getting an earlier benefit of the operating savings obtained by lighter grades and less restriction of movement.

The Chesapeake & Hocking was located and constructed under the direction of William Michael, chief engineer of the Hocking Valley and the Chesapeake & Hocking, with C. A. Whipple, district engineer, in direct charge.

THE "DON'T SWEAR CLUB" has been organized among railroad men at Shawnee, Okla. J. L. Coss, train dispatcher of the Rock Island Lines, is president. Favorable notices have been received from the Little Rock Gazette and from the Rev. William A. Sunday.