

# Completing the Summit Cut-Off of the Lackawanna

The Last Concrete Has Just been Placed in the  
Nicholson Viaduct. Other Work Practically Finished

On September 8 the last concrete was poured for the Tunkhannock viaduct, the largest structure on the new line of the Delaware, Lackawanna & Western, between Clarks' Summit, Pa., and Hallstead. All the other structures on this line have been completed and only a small amount of excavation remains to be removed from a large rock cut about four miles east of Nicholson. It is expected that the entire line will be completed and placed in service by November 1.

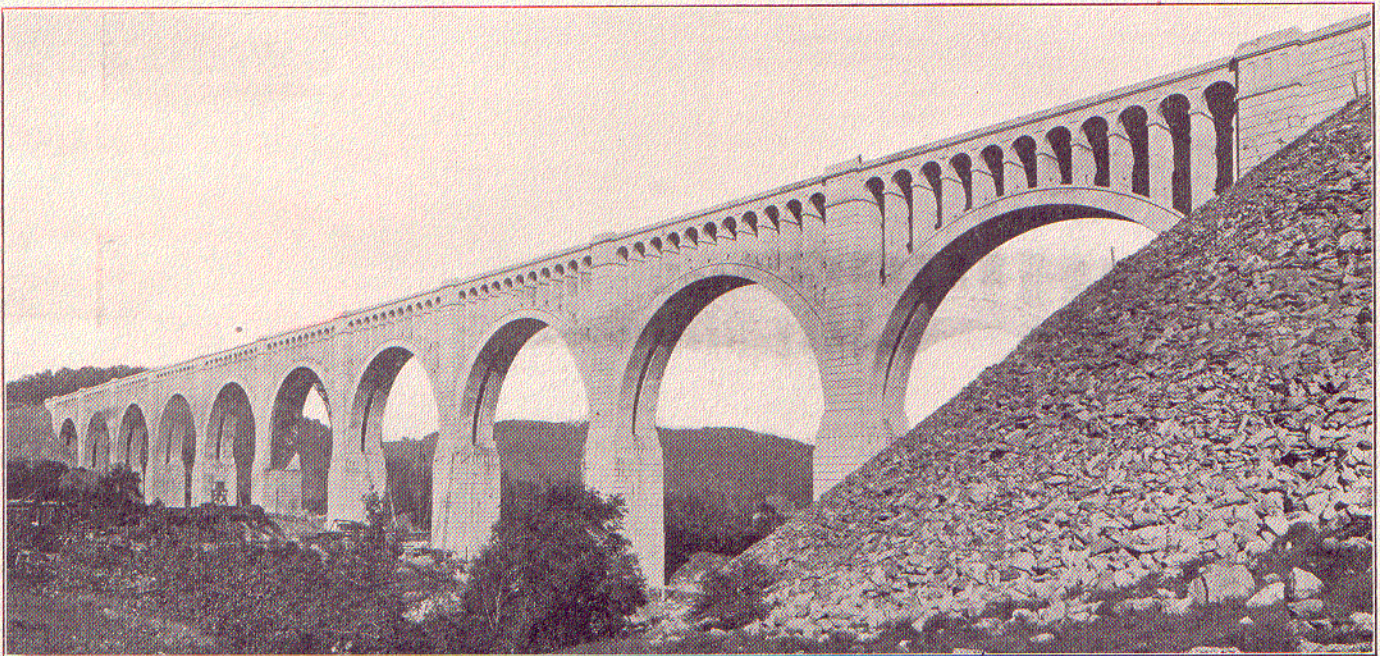
A section  $3\frac{1}{2}$  miles long between New Milford and New Milford Summit was placed in operation last fall. The 5 miles between New Milford and the connection with the old line near Hallstead was turned over to traffic on June 5, 1915. Track has been laid from New Milford Summit up to Tunkhannock viaduct and from the east end of the cut-off to the rock cut, leaving only four miles still to be laid.

This project has been of unusual interest because of its magnitude as a whole, because of the size of the structures involved and because of the high standards adopted in its construction. This line, 39.6 miles long, saves 3.6 miles in distance, 327 ft. of rise and fall and 2,440 deg. of curvature. It reduces the maximum grade eastbound from 1.23 per cent

to a maximum of 1,600,000 yd. The methods of handling this earthwork were described in detail in the *Railway Age Gazette*, November 14, 1913, page 903.

All structures are of permanent construction, 35 bridges being of concrete and 6 of steel. All grade crossings with highways were eliminated. Likewise, with two exceptions, all farm crossings at grade were avoided, entire farms being purchased in some instances to make this possible.

The most noteworthy structure is the Tunkhannock viaduct, a 12-span concrete arch bridge with a total length of 2,375 ft. and a height from bed of stream to top of coping of 242 ft., making it the largest structure of its type ever built. This structure, which is built for double track, consists of ten 180-ft. and two 100-ft. arches. It involved 167,000 cu. yd. of concrete, requiring unusual construction methods. As much as 14,000 cu. yd. of concrete has been deposited in one month by two mixers; nine thousand cu. yd. being deposited in forms. The methods employed by the contractor in placing this concrete were described fully in the issue of the *Railway Age Gazette* of February 5, 1915, page 235.



The Completed Tunkhannock Viaduct at Nicholson, Pa.

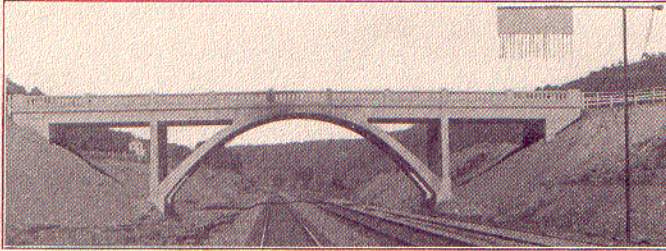
uncompensated to 0.68 per cent compensated, and westbound from 0.52 per cent uncompensated to 0.237 per cent compensated, while it reduces the maximum degree of curvature from 6 deg. 22 min. to 3 deg. Eastbound, the pusher service consisting of two pusher engines for tonnage trains between Hallstead and New Milford on the old line and three from Nicholson to Clarks' Summit will be reduced to one pusher engine at each point. The one pusher engine now required from Clarks' Summit west to New Milford on all tonnage trains will be eliminated. The importance of this saving will be realized from the statement that the tonnage moving over this line averages over 20,000,000 ton miles per mile of line annually.

This line cost approximately \$12,000,000. The grading amounted to over 13,318,000 cu. yd. or over 336,000 cu. yd. per mile of line. This was divided between 7,600,000 cu. yd. of rock, 5,100,000 cu. yd. of earth and 618,000 yd. of miscellaneous exca-

Very careful attention has been paid to the waterproofing of this structure. The floor and sides up to the elevation of the base of rail are covered with 3-ply Minwax membrane covered with 1 ply of asbestos felt. Above this,  $1\frac{1}{2}$  in. of Johns-Manville mastic concrete consisting of Johns-Manville asphalt and torpedo gravel was applied hot in two layers, each  $\frac{3}{4}$  in. thick, with the joints lapped. An expansion joint was placed over each pier and over the quarter point of each span. These joints are flashed with copper sheeting covered with 3-ply waterproofing and the interstices are then filled with mastic. The total area being waterproofed on the viaduct is approximately 78,000 sq. ft. Ten down spouts lead to drains between the centers of the tracks on each span. Cast-iron drains extending to within 2 in. of the top of the tie are placed in recesses in the waterproofing directly above these down spouts, discharging freely between the arch rings.

The Martin's Creek viaduct was the next largest structure, containing 78,000 cu. yd. of concrete. The last concrete was poured in this structure on November 14, 1914.

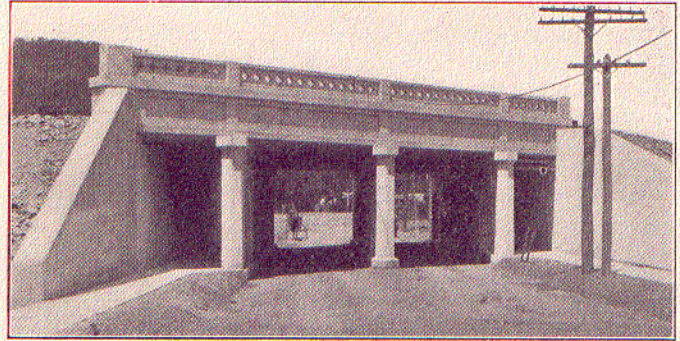
With the exception of one double barrel 24-ft. arch culvert, 471 ft. long under an embankment 120 ft. high above the top of barrel, the remaining structures were nearly all for the purpose of carrying highways across the tracks. These struc-



Skeleton Arch Near New Milford, Pa.

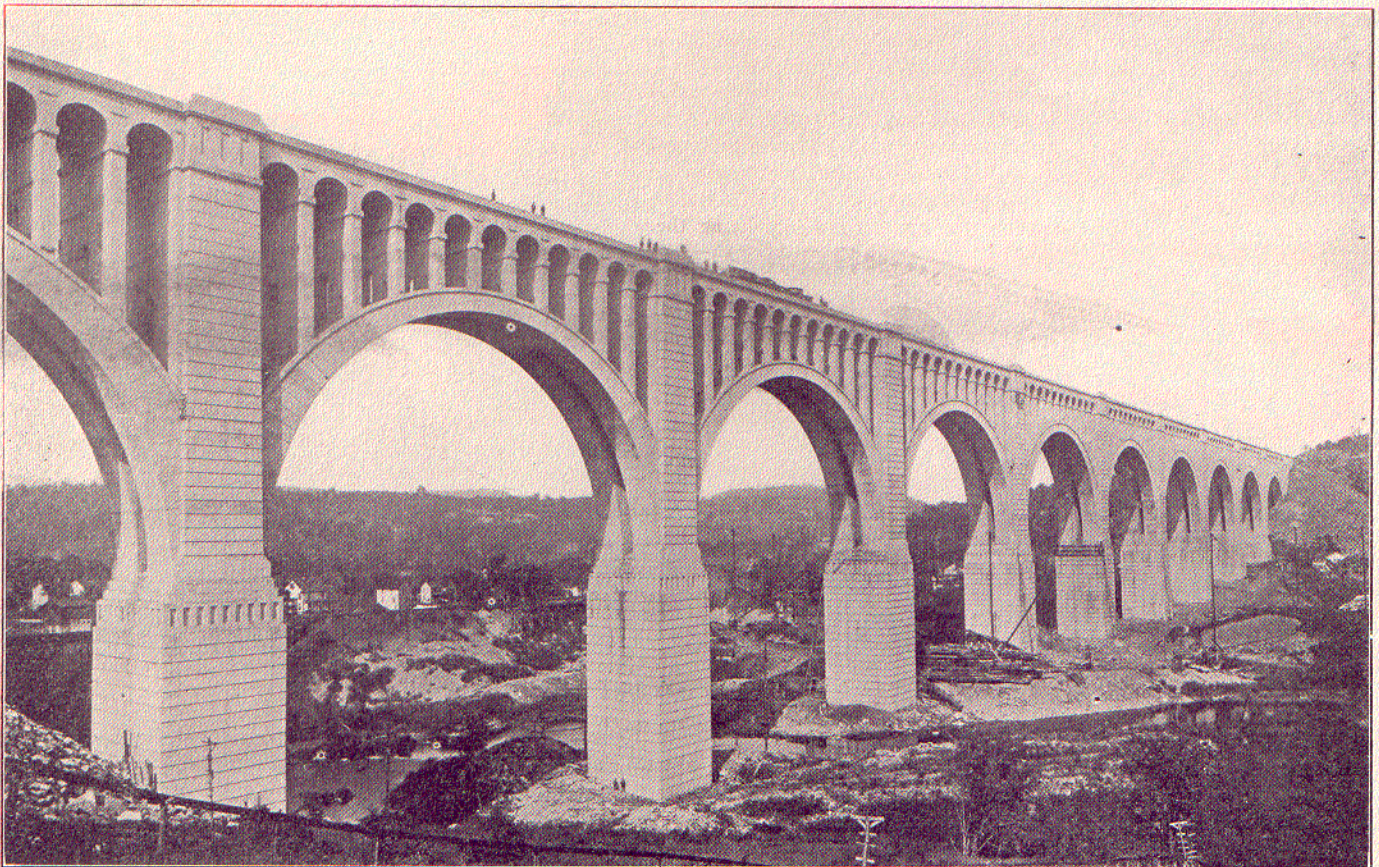
tures show a considerable diversity of design, the result of a variation in local conditions. One of the most interesting is a reinforced concrete arch carrying a highway over the tracks, one mile east of New Milford, Pa. This structure consists of a skeleton arch with a span of 76 ft. 6 in. and a rise of 23 ft. 9 $\frac{3}{4}$  in. with vertical bents at the haunches and at the top of

carried to a depth capable of sustaining a load of 3 $\frac{1}{2}$  tons per sq. ft. and with a head room of 14 ft. it was necessary for the abutments to be about 28 ft. high. Mass abutments for this situation would have required large foundations and much



Church Street Subway at Hallstead, Pa.

concrete. For this reason a special design consisting of a face wall to the level of the sidewalk and counterforts of sufficient size to carry the load below were adopted. These counterforts were spaced 15 ft. between centers and extended forward to the piers on the curb line. This type of construction permitted the earth pressure to be transmitted through



A Closer View of the Tunkhannock Viaduct

slope. A design involving end spans and bents was more economical than one requiring abutments at the skew backs. This design not only gave an attractive structure but an economical one.

Another interesting structure of a different type was constructed to carry the tracks over Church street in Hallstead. This was on a skew of 50 deg. 21 min., giving a distance between abutments of 50 ft. With the excavation for the abutments

between the counterforts and very materially decreased the amount of concrete required in the wall. The fill was tamped carefully as it was laid up to the sidewalk level.

This entire cut-off has been built under the direction of George J. Ray, chief engineer, and F. L. Wheaton, engineer of construction. A. B. Cohen, concrete engineer, has been in charge of the design of the structures, and C. W. Simpson is resident engineer on the Tunkhannock viaduct.