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FIG. 1—RELOCATION of old National Road near St. Clairsville, Ohio, showing new high-level viaduct over stream and railway and stone arch of old road constructed in 1826.

Realignment of Old National Road

More than a mile of road near St. Clairsville, Ohio, laid out in 1826, relocated to reduce curvature—High-level concrete-arch bidge carries new road over river and railway

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A CROSSING elimination and highway-straightening operation of more than local interest and involving an expenditure of $306,000 on a little more than a mile of highway has been carried out during the last twelve months by the Ohio department of highways. This work was located about 3 miles east of St. Clairsville, Ohio, which is almost directly west of Wheeling, W. Va., a few miles across the Ohio River. It was a revision of a part of the Cumberland or National Road, one of the great highways of history, and this part was built in 1826. Since being built, the old location had remained and the old structures, one of which is shown in the first illustration, had served the Conestoga freight wagon and Concord passenger coach as they are still serving the automobile and motor truck.

Old and new road

The old road location, as shown by Figs. 1 and 2, was crooked, and since its construction (which antedated the railway) a railway had been built which created a grade-crossing at low level. In 1914 the old road in the stretch being considered was paved 16 ft. wide with brick and 6-in. concrete curbs. But no material change was made in alignment and structures except to repoint the old stone masonry. In profile the road was up and down hill into and out of the valley of Wheeling Creek. To accomplish a road-rail crossing improvement on the old location necessitated raising the old stone arch bridge. Considering this fact and the line and profile, a complete relocation and a new bridge were decided on, leaving the old road and bridge to serve as an access road for the settlement along the railroad and creek.

The new location in respect to the old is shown by Fig. 2. It included 1.457 miles of road in which was a viaduct 1,118 ft. long. This more than a mile of new road has ten curves with a total curvature of 226 deg. and a minimum radius of curve of 520.78 ft., or 11 deg. The old road had 21 curves with a total curvature of 1,196 deg. and radii varying from 53.71 to 143.24 ft. Little was saved in maximum grade (7.88 per cent old, 7.36 per cent new) but length was reduced 670 ft. The grades on the new road are shown on the profile on Fig. 2.

The road structure

The roadway is 49 ft. wide and is paved 30 ft. wide with 10:8:10-in. concrete. A concrete gutter 4 ft. wide was constructed in the cuts. The maximum center-line cut and fill is 50 ft. However, the cut slopes, 1 on 1, extend as far as 125 ft. from the center line due to the slope of the present ground.

The viaduct consists of five reinforced-concrete girder spans from 37 to 46 ft. c. to c. of piers; one incased steel-girder span over the B.&O. R.R., 46 ft. long, and four reinforced-concrete arches of lengths c. to c. of piers 146.5. 132.5, 118.5 and 103.5 ft. The height of the span over Wheeling Creek from low water to roadway level is 89 ft. To take

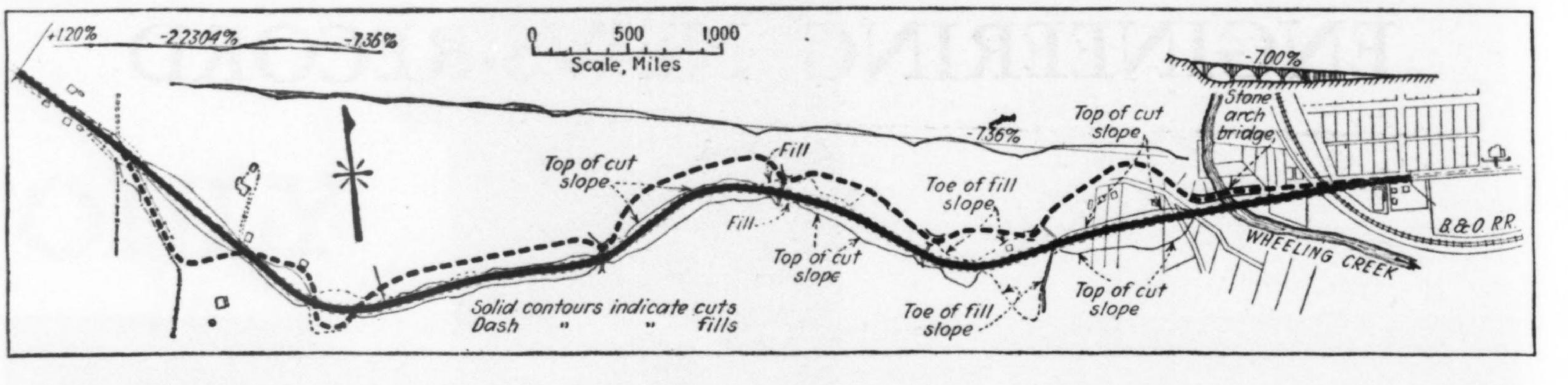


FIG. 2—LINE and profile of relocation of old National Road, reducing the curvature 970 deg. and eliminating a railroad grade-crossing.

care of a county side road and minimize property damage east of the B.&O. Railroad, a retaining wall from 6 to 30 ft. high and 226 ft. long was built on each side of the roadway. A shale fill from the hill was placed between the walls to carry the roadway. The viaduct roadway is 34 ft. wide with a sidewalk on each side.

As will be seen from plan and profile, the major construction operations were two heavy cuts and the viaduct. The quantities included about 266,000 cu.yd. (⅓ rock) on the grade and about 6,500 cu.yd. for the bridge foundations. The concrete paving ran about 23,300 sq.yd., and the concrete in bridge and walls about 8,000 cu.yd. The viaduct required about 31 tons of structural and 466 tons of reinforcing steel. Railings, gutters, drains, etc., increased these quantities.

Both the grading and bridge work were adequately equipped by the contractor. In the big cuts well-drills were used. On the cut at the hill top at the west end of the line the contractor drilled holes 20 ft. c. to c. and to the total depth of the cut, which was as much as 40 ft. These holes were filled to the top with carbon sticks, dipped in liquid oxygen; a cordite fuse or cord was placed the full length of the hole and capped, and four holes were fired at once. No earth and rock was thrown from the right-of-way in shooting, and no windows were broken in a large inn that was located only 220 ft. from the center line of the road. This cut was composed of 10 ft. of earth and from 20 to 30 ft. of shale in which there was a 4-ft. layer of very hard seamed sandstone. The shots penetrated to the full depth of the holes, and all rock except the sandstone was well broken up, but the force of the explosion followed the seams in the sandstone and did not break it up. However, the shooting was well worth while in loosening the shale, which facilitated handling with the shovels.

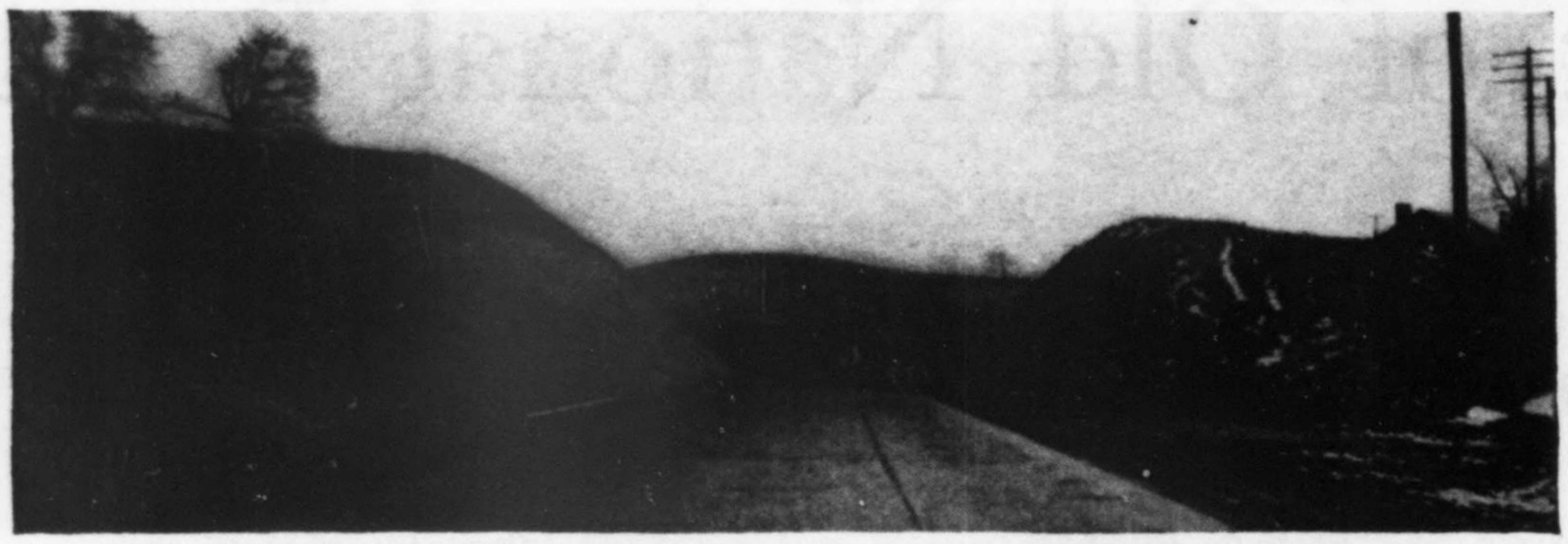


FIG. 3—CUT AT TOP OF HILL at west end of relocation, showing new concrete pavement.

FIG. 4—COMPLETED ARCH RIBS of new concrete viaduct with deck construction in progress at one end.

The cut just west of the viaduct, the largest cut on the project, contained 90,000 cu.yd., and had a center-line depth of 25 to 50 ft., a vertical upper-slope cut of 90 ft. and contained about 70 per cent rock—mostly shale, cement rock and limestone. This cut was first excavated to the rock, which was about 15 ft. below the surface, and then drilled with the well drill and shot as described. However, upon being shot the rock was scattered over 200 ft. from the center line and the shot did very little to break it up, the force of the explosives following the rock seams. Several shots were fired, but with the same results; and since the roofs of four homes located 150 ft. from the center line were damaged, this method was abandoned.

An air compressor was secured and 8½-ft. holes were drilled and shot first with black powder, with dynamite and finally with yellow powder. This yellow powder apparently was the most easily controlled, and with dynamite in small quantities it was used for completion of blasting in this cut.

All except 20 per cent of the hauling was done with 1½-ton trucks, and this 20 per cent was done with crawler tractors and 6-cu.yd. gravity dump wagons, which were fairly successful in mud and on short hauls, their greatest fault being that the 30- and 35-hp. tractors were not large enough to operate them efficiently.

Excavating for the footers of the bridge was done by shovel or crane equipped with a clamshell bucket. Steel sheetpiling was driven to rock to form a cofferdam for each pier footer and was then excavated with the clam to rock. The rock was broken up by blasting, and it was removed by hand labor and clam. Shoring was not necessary below the bottom of the steel piling, and no slides or cave-ins occurred during the placing of forms and the pouring of the concrete in the footers. Except for the pier footer in the channel of Wheeling Creek, the water was easily pumped away, and this pier footer was not especially difficult to keep free from water. All footings were placed on rock except the two piers west of the B.&O. Railroad, in which reinforced-concrete pipe piles were used to avoid underpinning the B.&O. roadbed.

Timber was used for all falsework. It was necessary to drive timber piling to support the falsework and forms for the arch ribs. This method was very successful since the greatest deflection on any arch rib was less than ¾ in., and this settlement was probably not a direct settlement of falsework but rather deflection, due to the pouring of concrete. The ribs were poured in three pours; first the haunches of the arch were poured, then the top center, and lastly the two sides of the ribs. For the most part the deck was supported by falsework placed on the arch ribs. This method was very successful since the railing line on both sides is perfect.

The aggregates for concrete work were batched 10 miles from the job and hauled in trucks to the mixer. All aggregates were heated at the plant when the temperature was below 50 deg. F., and hot water was used at the mixer. In all work below the ground level the concrete was chuted in place, but above the ground level it was hoisted by a crane in buckets to a bin and chuted or buggied into place. About 100 cu.yd. per eight hours was placed in this manner, which required seven trucks hauling to the plant.

The project is a part of the emergency federal-aid program under Director O. W. Merrell, of the Ohio State Highway Department. It was designed by the bureau of bridges and built by the Hecker-Moon Co., Cleveland, Ohio, at a cost of $306,000, Belmont County and the B.&O. R.R. Co. participating in the cost. The hill was sublet to Springer & Springer Construction Co., Wheeling, W. Va. B. J. O'Connor was superintendent for the contractor on the viaduct, and Howard Springer was superintendent for the subcontractors. The writer is resident engineer for the Ohio state highway department.

Second Vehicle Tunnel to Be Built at New York

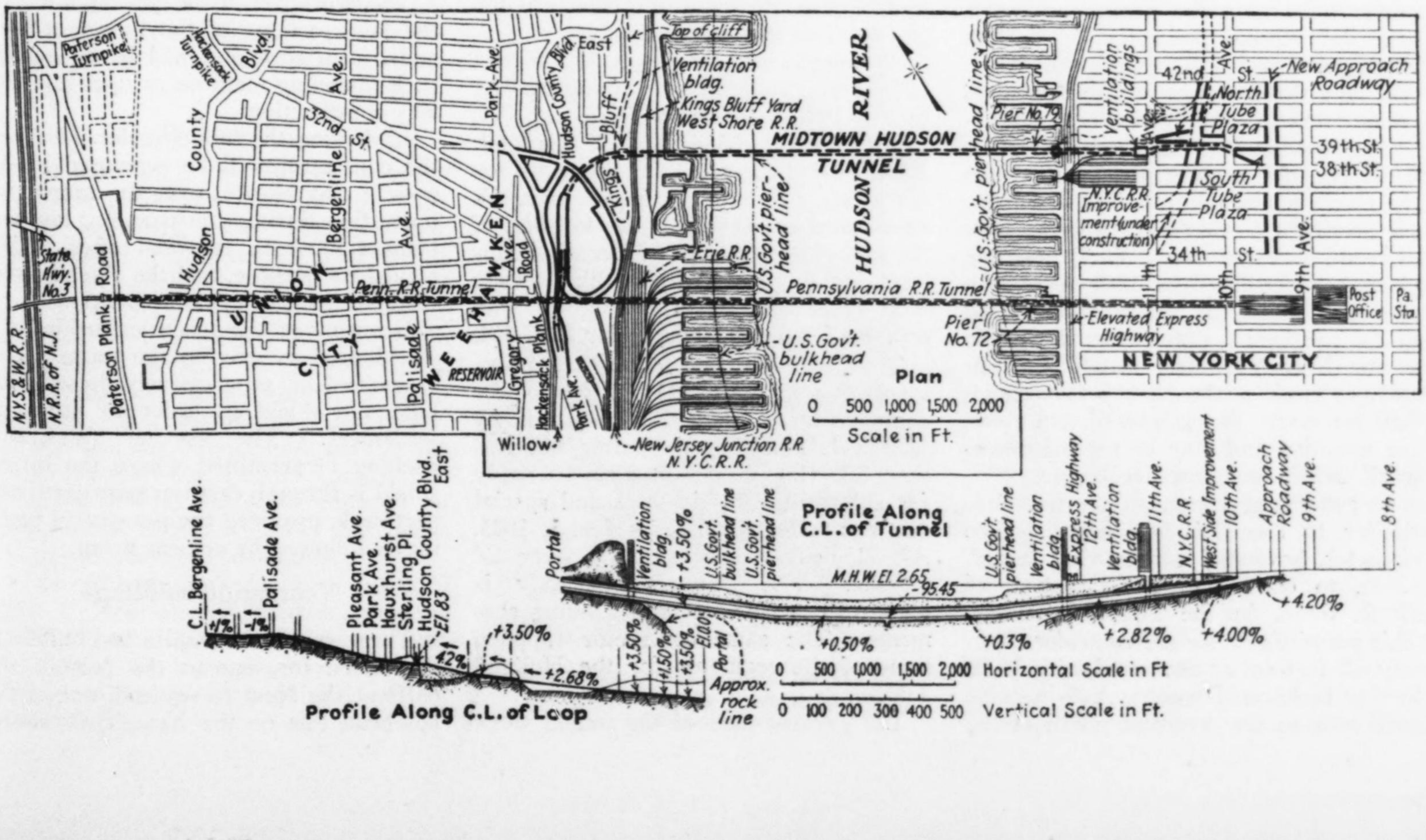
Bids have been received and a contract is to be let soon for the under-river section of one tube of a projected two-tube tunnel under the Hudson River at New York

ACTUAL CONSTRUCTION on a second vehicle tunnel under the Hudson River at New York is expected to be under way within a few weeks, bids having been opened on Feb. 21 for construction of the under-river section of the south tube of the Midtown Hudson Tunnel, a two-tube tunnel extending from the neighborhood of West 39th St. on Manhattan Island to Weehawken and Union City in New Jersey. (The amount of the bids received was published in our issue of March 1, p. 304.)

The Midtown Hudson Tunnel is to be built by the Port of New York Authority as its third highway crossing of the Hudson River at New York, the Port Authority having built the George Washington Bridge and having had the Holland Tunnel turned over to it for maintenance and operation subsequent to its completion.

The new vehicle tunnel, located about midway between the wide crosstown thoroughfares of 42d and 34th Sts., is to provide the industrial and commercial establishments in the midtown section with more direct connection with the railroad terminals and main highways in New Jersey.

The accompanying drawing shows the location of the south tube of the proposed tunnel, the one now under construction, the approved layout of the New York approaches and a tentative approach layout at the New Jersey end. The New Jersey approach layout is complicated by the fact that the land rises sharply back of the railroad yards along the riverfront, ultimately reaching a



MIDTOWN HUDSON TUNNEL, New York, plan and longitudinal cross-section. The approach street and plaza arrangement at the New York end of the tunnel as shown here has been approved by the city administration. The arrangement at the New Jersey end has not been approved. Modifications are expected to include an approach roadway extending across the high land in Union City to connections with the trunk highways west of the city.