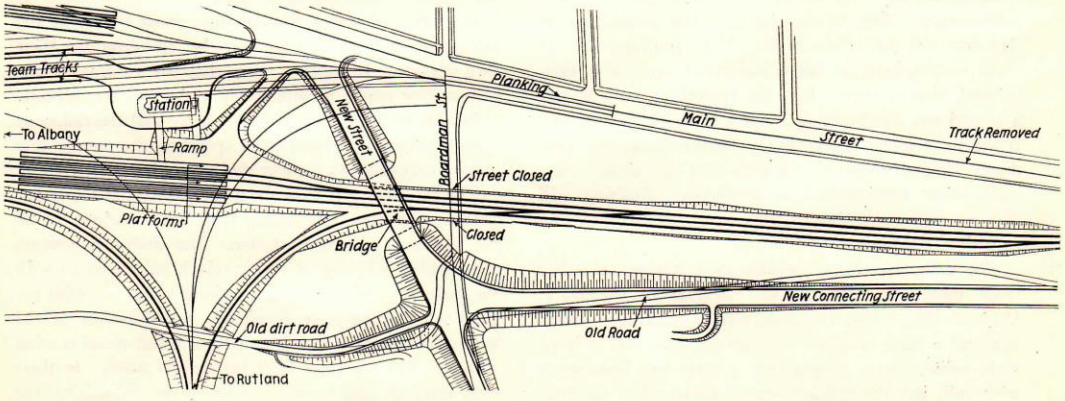
The Track Layout at Whitehall was Formerly on the Opposite Side of the Station Building

Old Tunnel Demolished and Grades Separated Under Traffic

Interesting project on the Delaware & Hudson at Whitehall, N. Y., carried out under difficulties, has remedied adverse conditions

ONE of the most effective and interesting improvement projects that has been carried out on the Delaware & Hudson during the last few years has been completed recently at Whitehall, N. Y., about 77 miles north of Albany, where, in a combined effort to improve existing railway facilities and to eliminate grade crossings, a 677-ft. single-track tunnel was uncovered and the cut double tracked, line changes removed the tracks from a city street for about 1,000 ft., and several grade crossings were eliminated by street alterations and the construction of overhead bridges. As a result of the work, adverse railway operating conditions were corrected and, with all grade crossings within the town eliminated, both local and through highway traffic have been greatly benefited.

Prior to this work, the railroad extended northward on the west side of the passenger station, crossed Boardman street, and then continued as a single track up through the center of Main street, an important street on a through traffic route, for a distance of approximately 1,000 ft. Just beyond the point of divergence of the street and the railroad, or approximately 2,500 ft. north of the passenger station, the track passed through an old single-track tunnel, 677 ft. long, which caused a bottle neck in the two-track main line. Over the tunnel, the railroad was crossed in succession by Saunders, Division and High streets and, about 175 ft. north of the north portal, the single track was crossed at grade by Bellamy street, which is at the north limits of the town in this vicinity. Another street, Church street, extended partially over the tunnel longitudinally, branching off from Main street at the point where the track left that



General Plan Showing the Track and Street Changes Made Through the

street to enter the tunnel, and continuing up over the side hill, parallel with and partially over the old tunnel. This street, which was of secondary importance, extended north to just beyond its intersection with High street, from which point it swung to the northwest and continued to a connection with the state highway to points north.

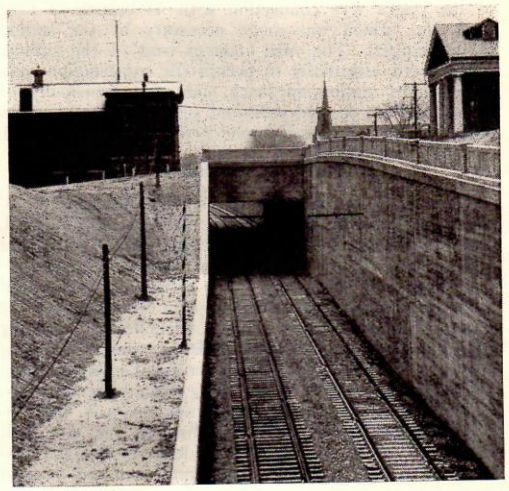
Many Changes Made

In the improvement project, which, including property damages, cost approximately $1,400,000, the main line for approximately 7,300 ft. south of the tunnel was moved to the east a maximum distance of about 200 ft. This change completely removed the track from Main street, and, incidentally, brought the new line along the opposite side of the passenger station at a lower level. The old tunnel, except for 241 ft. at the south end, was made a two-track open cut, retained on the west side by a high concrete wall. The 241-ft. section, which was in very unstable ground, was replaced by a two-track reinforced concrete box, which not only insures stability of the railroad in this section, but also acts as a bridge to carry both Saunders and Division streets over the tracks. High and Bellamy streets were both closed on each side of the tracks, but another street between these two, Clinton avenue, formerly closed at the right-of-way, was widened and improved and carried over the new railroad cut on a girder bridge.

Just north of the station, the old Boardman Street crossing was closed and a new street was extended over the tracks on a girder bridge. Immediately east of the tracks, this new street joins with a newly constructed north and south street which extends north to a point of connection with Main street on the east side of the tracks.

The provision of this new route made it unnecessary to continue the track crossing of Main street and thereby greatly simplified construction, since, because of the topography of the ground and the sharp angle of Main street with the railroad, about 30 deg., a bridge in this location would have been unusually long and expensive. Furthermore, it would have presented many difficulties to highway traffic.

While the improvement of Clinton avenue in connection with the street changes already mentioned afforded a through route north and south without grade crossings, an even more direct route was afforded by the improvement of Church street, paralleling the west side of the railroad in the vicinity of the old tunnel. This street, which was widened to 36 ft. and paved, now forms a practically straight link for through highway traffic between Main street, on the west side of the tracks, and the state highway north of the town.



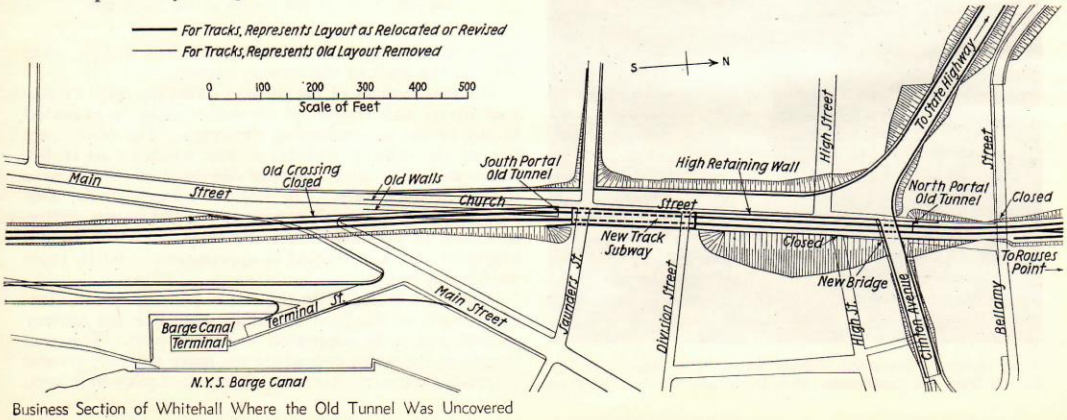
Looking South Through a Section of the New Double-Track Open Cut That Replaces the Old Tunnel

Changes Required in Passenger Station

In the line change at Whitehall, the relocated tracks were placed in a cut, which is about 12 ft. lower at the passenger station than the old tracks. With only slight alterations, the existing passenger station was adapted equally well to the shifted track layout, the principal change being the construction of a concrete ramp about 85 ft. long, down to the new track level.

Four tracks are provided in the new station layout, including the two mains, a running track on the side away from the station, and a relatively short station siding, connected at both ends to the southbound main. Three new platforms, each 400 ft. long, serve the station, these being provided with arcades in the immediate vicinity of the ramp from the station, which will also be housed in to afford passengers protection from the weather in passing to and from trains.

Other track changes made at Whitehall include major alterations in the old freight yard facilities directly west of the passenger station, the construction of a new 570-car freight yard further to the south, and the relocation



Business Section of Whitehall Where the Old Tunnel Was Uncovered

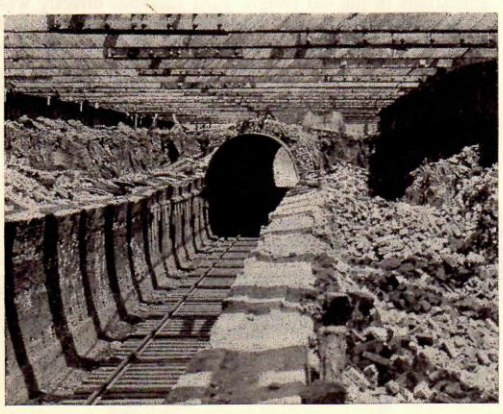
of the road's wye connection with its branch to Rutland, Vt., which was made necessary by the station track changes. The yard changes west of the station, which were essentially to permit the construction of a large paved station approach, consisted principally of stubbing all of the old yard and auxiliary freight tracks where required to provide the new plaza area desired.

Old Tunnel Uncovered

While the improvements and changes described completely modernized the railroad facilities at Whitehall, with especially important advantages to the town and highway traffic, the most important phase of the improvement from the standpoint of the railway, and the most interesting from a construction point of view, was the tunnel elimination work. The tunnel, built in 1843 by the Rensselaer and Saratoga Railroad, was 677 ft. long and, as constructed, had a horse-shoe shaped brick lining, 30 in. thick, supported on low stone masonry bench walls. Contrary to usual tunnel construction methods, the tunnel was not drilled or holed through the side hill. Rather, an open cut was first made to permit the construction of the masonry lining, and then the original ground level, as high as 40 ft. above the arch at one point, was restored by back filling.

Much of the original lining still remained at the time of the recent work, having been repaired from time to time, but, owing to unstable foundation or local failures, three sections of the old lining had been completely rebuilt at different times. The first of these sections, about 80 ft. long and extending north from a point about 70 ft. from the south portal, was built in 1873. Here, failure was caused by the giving way of the soft blue clay sub-soil so prevalent in this territory. In repairing the failed section, an entirely new lining was provided, consisting of high massive masonry bench walls with a semi-circular brick arch, 30 in. thick, supported on a heavy timber grillage continuous over the floor of the tunnel from back to back of the walls. The second lining failure to be repaired extended over about 90 ft. near the north end of the tunnel, while the last portion of the tunnel to require complete renewal of the lining was within the first 70 ft. from the south portal. Repairs in these sections were made in 1885 and 1886, respectively, and, while of heavier construction than the original, timbering of the tunnel floor was not required or resorted to.

To remove the tunnel and widen out to a two-track cut was recognized at the outset to be a difficult problem, first because of the necessity for maintaining unrestricted train operation throughout the work, and also because of the unstable character of the ground support for the high retaining walls, which it was known would be encountered. However, all of these difficulties were met successfully in an effective manner.

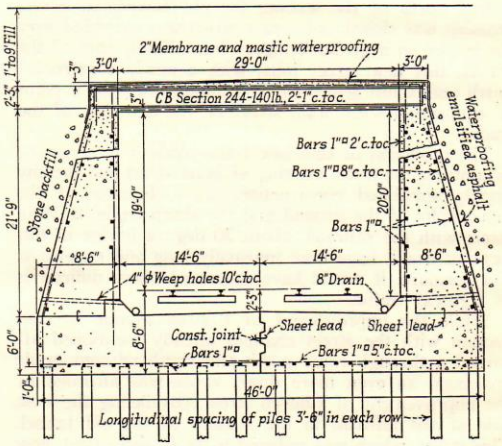


Heavy Horizontal Struts and Diagonal Braces Were Required to Support the Sheet Pile Construction Walls During the New Cut Operations

Massive Box Subway Required

In the finished work, the old tunnel is replaced by a two-track open cut through the hill, except for 241 ft. near the south end, where, because of the particularly unstable condition of the ground and the presence of several sizable buildings directly alongside the east right-of-way line, it was necessary to construct a massive two-track concrete box subway, with an invert 6 ft. thick to afford stability. The roof of the subway is made up of 24.4-in., 140-lb. CB-section beams placed 25 in. center to center and entirely encased in concrete. This supports an earth back fill of from 2 to 8 ft., paved over in part and made to carry Saunders and Division streets across the tracks.

A high mass-type concrete retaining wall was provided throughout the open cut along the west side, the deep side and that supporting Church street which lies directly alongside its top edge. The east side of the cut, on the other hand, was sloped back on an angle of 1½ to 1,



Section of the New 241-ft. Concrete Box Subway Replacing a Part of the Old Tunnel in Soft Ground at the South End

supported only by a low concrete toe wall and by wing walls at the ends of the subway section.

The massiveness of the subway structure, with its six-foot invert slab supported on timber piles, is indicated in one of the accompanying drawings. The inside section of the subway provides a clear width of 29 ft. between wall faces and a vertical clearance of 19 ft. above the top of track rails. The size and relation of the west side retaining wall with respect to the old tunnel section is shown in another of the drawings. The maximum height of wall constructed is approximately 40 ft. from foundation to cap.

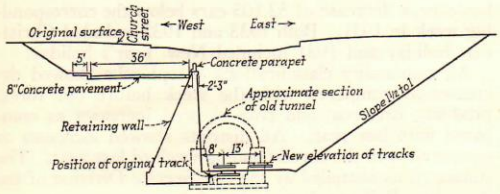
While not indicated in the latter drawing, a considerable length of the high retaining wall, like the subway section, had to be supported on timber piles. This was largely at the south end where the more unstable ground conditions were encountered. Forty-foot piles were used

and were driven to rock, except toward the extreme south end of the wall where piles of this length would not reach rock. Here, however, the reduced height and weight of the wall made it unnecessary that the piles bear on rock.

Details of Procedure in Tunnel Work

In carrying out the tunnel uncovering work, the first operation was to remove the overburden, using steam shovels and motor trucks. When close to the tunnel arch, continuous faces of steel sheet piling were driven along both side limits of the work to support the earth sides as excavation continued, these being placed sufficiently far apart to permit the full construction of the box subway and the retaining walls. Then excavation continued down to the tunnel arch, following which horizontal timber braces, or struts, on 10-ft. centers, were extended between the tops of the sheet piling walls, where required, to assist in resisting the lateral earth pressures on the walls.

With the walls thus braced, the brick arch ring was dismantled by jack hammers, while train operation with-

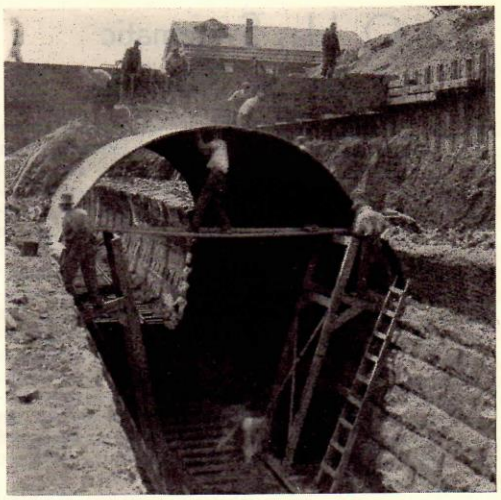


Typical Cross Section of the New Open Cut Which Replaces the Old Tunnel North of the Concrete Box Subway—Note Relation of New Retaining Wall to Old Tunnel, and New Position of Church Street

in the tunnel, directly beneath this operation, was protected by a steel shield. As the arch roof was removed, diagonal timber braces were set up between the horizontal braces, extending from pile wall to pile wall, sloped alternately in opposite directions and as steep as possible without interfering with train operation. At the south end of the tunnel, where the especially soft and unstable clay was encountered, special built-up strut braces, placed horizontally and provided with lateral bracing, were employed.

The steel shield used within the tunnel during the dismantling of the roof arch was about 50 ft. long and was given support on the stone side walls or on posts set back into the walls. This shield was made up of steel liner plates, designed especially for this class of work, which were bolted together to form rigid continuous centering. As the arch was dismantled, exposing the steel shield, the exposed plates were taken down and re-erected ahead within the tunnel. Owing to the shallowness of the liner plates, clearances within the tunnel were reduced by only about two inches, a factor which was of large importance because of the already restricting clearances.

Following the removal of the tunnel arch and the haunches, which was done with a clamshell bucket, the track was shifted as close as possible to the west wall and a continuous row of relatively short steel sheet piles was driven along the center-line of the tunnel cut, with its top about flush with the old tunnel floor. With this additional piling in place, the old east wall of the tunnel was broken down in short sections, the cut was widened out, and horizontal timber braces were placed at intervals between the sheet piling on the east side and the piling through the center of the cut. As this work was completed, the east wall of the new concrete box subway and



Removing the Old Tunnel Arch While Steel Liner Plates Protected Train Movements

the low east side retaining wall were constructed. Upon the completion of these and the east half of the new subway invert, the track was shifted as far as possible to the east side of the cut and similar operations were carried out on the west side. Later the subway roof was constructed and backfilled, Saunders and Division streets were extended over the subway, the new girder bridge to carry Clinton avenue was erected, and the second main track was laid.

In connection with the improvements described, new signaling facilities were provided through the track area affected. The switch at the new end of double track, 300 ft. north of the station, was equipped with a power-operated machine which, together with the signals for directing train movements, is controlled remotely by a four-lever C.T.C.-type of control machine located in the operator's office at Whitehall. Automatic block signals were installed on the new section of double track to connect up with the signaling on either end.

The work at Whitehall was planned and carried out under the direction of James MacMartin, chief engineer of the Delaware & Hudson, represented in the field by Edward Penrose, resident engineer. The signaling equipment was furnished by the General Railway Signal Company and was installed by Delaware & Hudson forces under the supervision of A. H. Rice, signal engineer. The general contractor on the work was the Hecker-Moon Construction Company, Cleveland, Ohio.

A Proposed Code of Fair Competition for the wholesale fresh fruit and vegetable distributing industry was considered at a public hearing in Washington on January 8. The code, proposed by the National Fresh Fruit and Vegetable Council, would affect, among others, approximately 15,000 wholesale dealers in fruits and vegetables who are licensed under the Perishable Agricultural Commodities Act. It is also claimed, says the Agricultural Adjustment Administration press release announcing the hearing, that approximately 5,000 additional firms are engaged in this business without license and would be affected by the code. The unlicensed operators are principally those engaged in distributing fruits and vegetables by motor truck without a fixed place of business, the A. A. A. release adds.