Lackawanna Raises Tracks Above Streets in Syracuse, N. Y.

Grade separation project involves elevation of two miles of line and includes the construction of a new passenger station

TWENTY-THREE grade crossings between city streets and the tracks of the Delaware, Lackawanna & Western in the city of Syracuse, N. Y., have been eliminated as the result of a recently-completed grade-separation project involving the elevation of the railroad's tracks for a distance of approximately two miles through the heart of the city. Among other items of work, this project entailed the construction of bridges across 15 streets and a creek, and the building of a modern passenger station. While the undertaking is of interest for various reasons, the bridges attract particular attention because of the extreme lengths of some of the spans, requiring the use of girders of nickel and silicon steel at several locations, and various innovations in design and construction. Incidentally, only two of the street bridges are on tangent track and make right-angle crossings; all of the others are on curves, mostly with skew layouts.

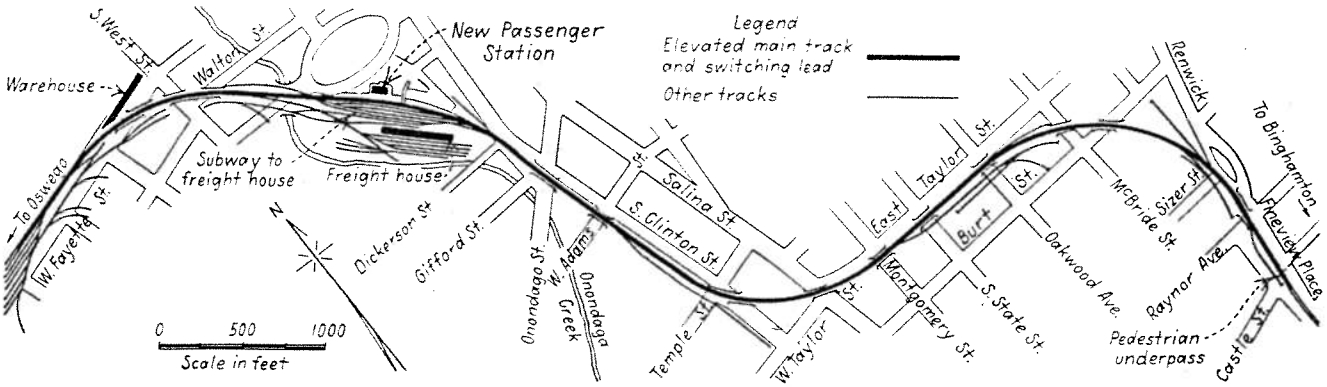
The line of the Lackawanna that extends through Syracuse is a portion of the single-track Syracuse division. In passing through the city, roughly from southeast to northwest, the line negotiates a number of relatively sharp curves, several of which approximate 6 deg. Various industries are served in the city, most of which are located on the west side * of the main track, and to permit these to be reached independently of the main line the railroad's trackage includes a continuous switching lead paralleling the main line on its west side. Hence, for practical purposes, the company has a double-track line through the city.

For some years there has been considerable agitation for the general separation of grades between the tracks of the railroad and the city streets of Syracuse. At the time the recent project was undertaken, only a few separations had been carried out, and these were in outlying sections. All crossings in the center of the city were still at grade, and, in addition, the tracks extended longitudinally along parts of two streets. As early as November, 1935, preliminary plans for a general separation of grades in the city were under preparation by the Syracuse Grade Crossing Commission, a state-appointed body. Subsequently, public hearings were held by the New York State Public Service Commission, which issued an order on January 20, 1939, directing that the elimination be carried out. The work was performed under the provisions of the constitutional amendment that was passed in New York State in 1938, which provides that a maximum of only 15 per cent of the cost of grade-separation projects shall be assessed against the railroads, the remainder being financed by the state.

Principal Features of Project

Briefly, the project involved the elimination of grade crossings and the removal of the tracks from two streets, by elevating the railroad line for a distance of approximately two miles through the most congested part of the city on an alinement that deviates only slightly from the original location. In this section only three streets that had previously crossed the tracks at grade were closed, the remainder being carried under the elevated tracks in street subways. The project also involved the separation of grades at two crossings outside the limits of the track elevation. One of these is at East Colvin street, somewhat to the south of the main project, where an individual street subway was installed by depressing the street grade. The other individual grade separation is located north of the elevated section and involves the crossing of a double-track lead to the railroad's engine terminal, which is located west of the main line, and West Fayette street, which parallels the main line. Here, the separation was achieved by a combination of street

* Throughout this article the directions given are based on the assumption that the line extends in a north-south direction, although, in reality, since it follows a winding course, these do not always correspond to the cardinal directions.



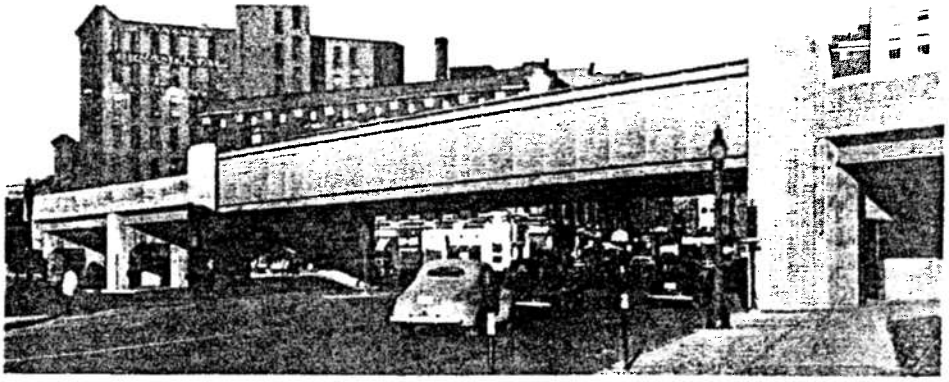
Plan of the Elevated Section of the Lackawanna's Line at Syracuse, Individual Grade Separation Projects at East Colvin Street and West Fayette Street Not Shown

depression and track elevation. Incidentally, a crossing of West Fayette street with the main line was among those eliminated in the track-elevation section of the project; hence, this street was involved at two locations.

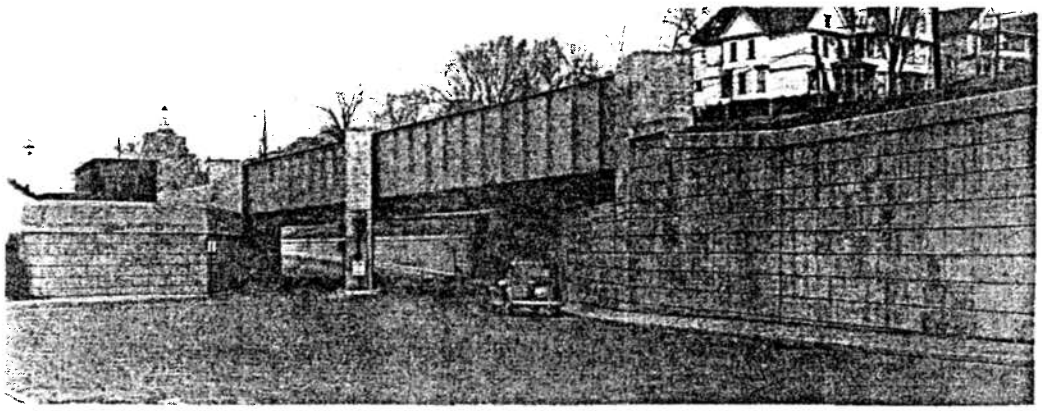
Altogether, the project entailed the construction of bridges at 13 streets within the limits of the elevated section. Other bridge work included the building of an underpass to carry a driveway leading to the company's freighthouse, the construction of four separate bridges to carry five tracks across a stream known as Onondaga Creek, the construction of a pedestrian subway at a street crossing, and the extension of an existing private underpass serving an industrial plant. In addition, as already mentioned, a new passenger station was built, being located on the site of the original structure, and minor alterations were made in the company's freighthouse and a warehouse. Facilities at the passenger station include separate subways for passengers and baggage.

Owing to grade changes occasioned in the tracks at the engine terminal by the construction of the grade-separation structure at West Fayette street involving the lead tracks, it was necessary to abandon the existing trestle-type coal pocket and wet ash pit at this point, these being replaced with a 100-ton capacity mechanical coal and sand plant and a crane-type cinder-handling plant serving two tracks.

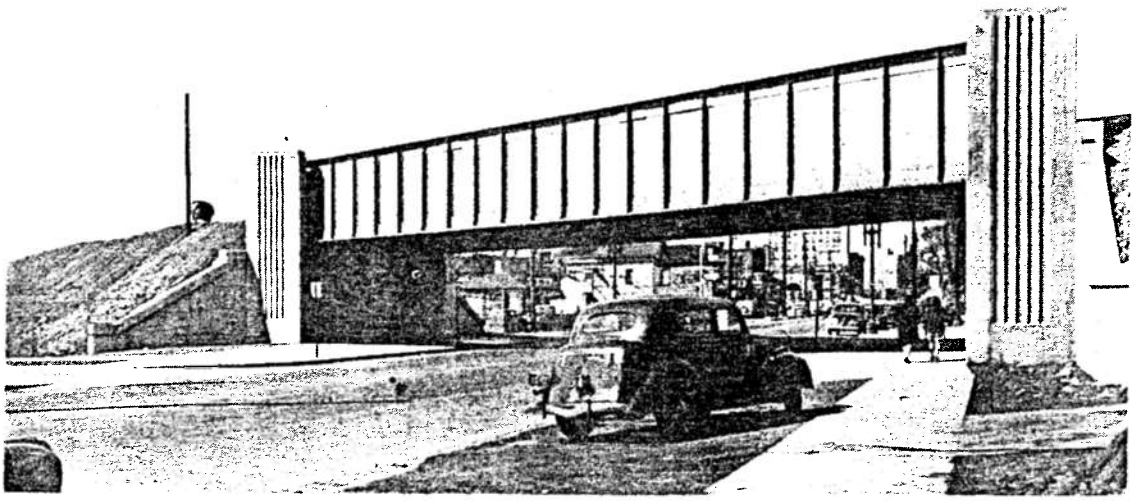
In that section of the line where the tracks were elevated, the raise in the grade amounted to a maximum of about 20 ft., the object being to obtain underclearances of 14 ft. at the bridges without more than minor altera-



The Onondaga Street Bridge, in Which the Girders, Largely of Nickel Steel, Are 130 Ft. Long and Weigh 128 Tons Each

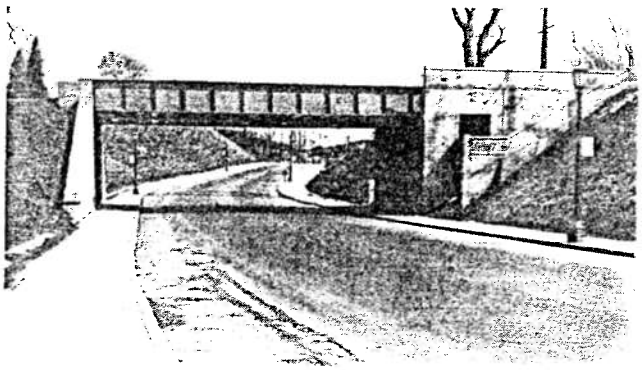


This Bridge at Renwick Avenue Is the Only One on the Project Where a Center Support Was Used



A View of South Salina Street Bridge Illustrative of Attractive Effect Produced by Massive Pilasters in the Abutments

tions in the street grades. For the most part, the elevated line is carried on an earth embankment, except that viaduct approach structures are provided at two of the street bridges. Because of limited side clearances, the embankment is confined behind retaining walls at some locations, notably where the tracks are flanked on the



The Bridge at East Colvin Street. Note Sidewalk High Up in Abutment

east side by South Clinton street, and in the vicinity of the passenger and freight stations, which are located at the street level on opposite sides of the elevated tracks. The retaining walls are mostly of reinforced concrete, although at a number of locations, including several places where unfavorable sub-soil conditions were encountered, the walls are of precast concrete cribbing.

All Industry Connections Maintained

Connections with industries previously served by the road, as well as the company's freighthouse, are all maintained by means of ramp tracks which, in several instances, have grades as steep as 3.5 per cent. In fact, at two locations it was necessary to resort to the use of switchbacks in laying out the industry tracks. Incidentally, all but two of the industries served are located on the west side of the tracks, a fact that simplified the problem of maintaining industry connections during the construction period.

All street bridges that were built in connection with this project are of the same general type, consisting of through plate girder spans on concrete abutments, but in adapting the structures to the varying conditions encountered at the different sites it was necessary to introduce many variations in detail. On the main portion of the project, that is, where the tracks were elevated, the main-line bridges are all of double-track construction and have ballasted decks consisting of floor beams covered with reinforced concrete slabs. All the main-track bridges in the elevated section have only two girders each, while at the individual grade separation at East Colvin street the bridge is a three-girder structure. The bridge at Renwick avenue in the elevated section also represents a departure from usual practice on this project in that it has two girder spans with a center support in the roadway, whereas all other bridges have single girder spans across the roadways.

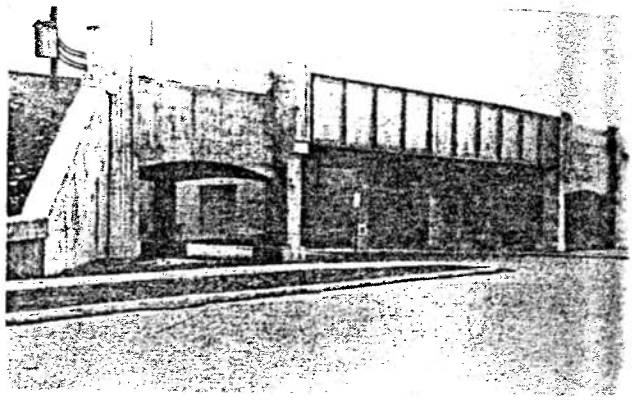
Some Long Spans

As mentioned at the beginning of this article, all but two of the street bridges are on curves and are skewed. For this reason, and particularly because some of the skew angles are relatively sharp, a number of the bridges have extremely long spans. Among the longer bridges are those at Onondaga street, with a length between end bearings of 128 ft.; at West Fayette street (in the elevated section) with a length of 124 ft. 8 in.; at Walton street, with a length of 113 ft.; and at South Salina street, with a length of 112 ft. In fact, in order to keep the size of the girders for these bridges within reasonable limits, it was necessary to employ nickel steel for the webs, flanges and end stiffeners of the girders in the Onondaga and West Fayette Street bridges, and silicon steel for the corresponding parts of the Walton Street and South Salina Street structures. Even with the use of nickel steel, the girders in the Onondaga Street bridge have a height of 11 ft. 6½ in. between the backs of the flange angles, and weigh 128 tons each.

The bridges at three other locations on the elevated section are also worthy of mention. These are the structures that carry the tracks across Montgomery street, South State street and Oakwood avenue. The streets named are all located adjacent to each other in a section where the tracks are flanked on the east side by East Taylor street, which is located in such close proximity to the tracks that the embankment is held by a retaining wall for its full height. Here, the problem was to provide means whereby motorists in either East Taylor street or those coming under the bridges in either of the three intersecting streets would be permitted an adequate view of opposing traffic.

Supplementary Spans for Visibility

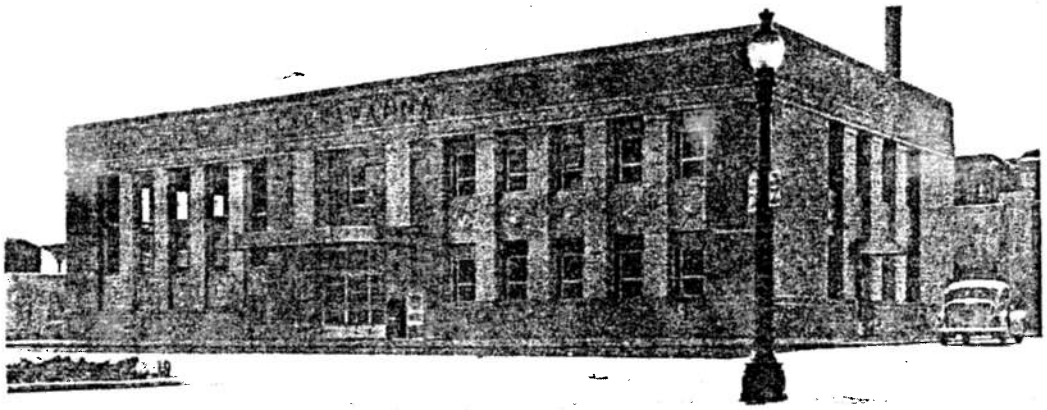
This was accomplished by introducing a supplementary span at each end of each of the three bridges, thereby



The End Spans Were Introduced in This Bridge at Oakwood Avenue, as Well as in Two Other Bridges, to Give a Better Angle of Vision for Motorists

providing openings through the embankment that give the desired angle of vision. These openings do not carry either vehicular or pedestrian traffic. The supplementary spans are each 23 ft. 6 in. long and are of reinforced concrete slab construction. The adjoining ends of the main and supplementary spans at each of these locations are supported on structural steel bents in which the columns and caps are encased in concrete, while the outer ends of the supplementary spans are carried on reinforced concrete abutments.

Because of special conditions prevailing at Onondaga and Walton streets, the bridges spanning these thoroughfares are flanked by approach spans. At Onondaga street there are three such spans at one end of the street bridge and seven at the other. Averaging about 43 ft. in length, these spans are of steel-beam construction with concrete slab decks, and have facia beams encased in concrete or



This New Station Was Built in Connection With the Grade Separation Project

oth sides, which are surmounted by concrete balus-rades. The approach spans are supported on concrete iers.

At Walton street there are five approach spans on the outh side of the street bridge. At this location the rackage on the approach spans includes a ramp track in addition to the main line and the switching lead. The construction here is generally similar to the approaches t Onondaga street, except that the spans for the main rack are of deck-girder instead of steel-beam construc-ion. At the north, or opposite, end of the Walton Street ridge, in a triangular area separating this structure rom the adjacent end of a bridge across South West street, the tracks are carried on a reinforced concrete lab.

Ballastless-Deck Bridges

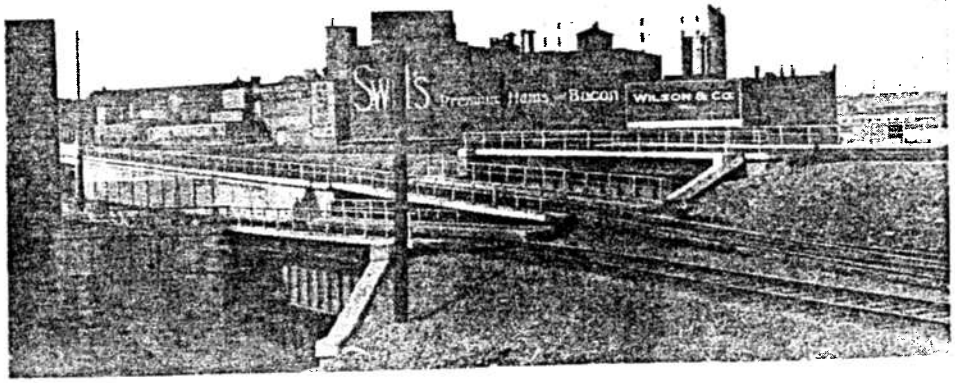
At two locations on this project it was necessary to esort to the use of ballastless-deck bridges because of he necessity of restricting the depths of the decks to a minimum. One of these is at the individual grade separation involving the double-track lead to the engine terminal and West Fayette street, while the other involves a structure that carries a ramp track across South State street in the main portion of the project. At the West Fayette Street bridge, the amount which the tracks could e raised was restricted by the necessity of avoiding excessive grades in the engine terminal lead tracks, while he extent to which the grade of the street could be lowered was governed by the fact that West Fayette street ntersects Magnolia street immediately adjacent to the ridge, and the lowering of the street to any great extent would have necessitated an expensive adjustment in he grade of Magnolia street.

At this location each track is carried by a separate through girder span on box-type abutments. In addition o being on a sharp skew, the two tracks at this crossing are both on curves approximating 12 deg. and on grades of 3 per cent, descending toward the engine terminal. In both spans the deck systems consist of floor beams covered by ½-in. copper-bearing steel plates. Adjacent sections of the plate decks are butt-welded to each other and, in addition, are riveted to the floor beams. An interesting detail of the construction is that each rail is laid in a 15-in. channel and is fastened by bolted clips. To protect the rails and fastenings from corrosion, each channel is filled with a bituminous material. The deck construction for the bridge carrying the ramp track across South State street is essentially similar to that for the two structures at West Fayette street.

At East Colvin Street

The individual grade separation at East Colvin street was achieved by lowering the street grade on a slightly different alinement. The railroad bridge at this location consists of a double-track single through-girder span (three girders) extending over the roadway and two sidewalks. In bringing about this grade separation, which is located in a residential neighborhood, it was necessary to make provision for pedestrians using the original street to pass from one side of the tracks to the other without crossing them at grade. Since the level of the street on the new alinement is considerably below that of the original street, stairways extending down to the low-level sidewalks would have been of considerable height. To overcome this objection, one of the abutments was made of the box type and the opening, carrying a sidewalk for pedestrians using the higher level, was established as close to the top of the abutment as conditions permitted.

In addition to the various street bridges that were built as part of this project, a subway was constructed under the tracks in the vicinity of the passenger station to give access to the freighthouse from the east side of the tracks. This structure, which extends under seven tracks, is of rigid-frame concrete construction with semi-



This View Shows Three of the Four Bridges That It Was Necessary to Build Across Onondaga Creek

gravity abutments, and provides a clear roadway width of 28 ft. 7½ in.

Concrete Details

Certain aspects of the concrete construction on this project are worthy of mention. For example, in most of the street bridges pilasters of massive construction with fluted surfaces were provided at the ends of piers and abutments. The attractive appearance presented by these elements in the design was enhanced by the judicious use of concrete facia walls at various points, such as in the approach and supplementary bridge spans. It is interesting to note that the pilasters at the ends of the bridge seats were poured monolithic with the abutments, rather than being placed separately after the steel work had been installed. This policy had the advantage of precluding the introduction of construction joints in the pilasters near the bridge seats.

The retaining walls that were built in connection with the project are largely of conventional design, but the manner in which their exposed faces were treated at certain locations to obtain a pleasing effect is somewhat unusual. At intervals in the faces of these walls vertical "V" grooves were provided in such a manner as to simulate pilasters. Surmounting the retaining walls are concrete balustrades containing true pilasters that continue the lines of the simulated pilasters in the faces of the walls, thereby enhancing the effect. The decorative scheme also includes rectangular panels, formed by "V" grooves, in the surface areas of the walls between the pilasters.

Bridges at Onondaga Creek

Among the new bridges that were built in this project are four separate spans carrying five tracks that were constructed across Onondaga creek. Of the five tracks extending across this creek, only two, the main track and the switching lead, are at the same level and grade, and these two are carried across the creek on a double-track span. The other three tracks, being on different ramp grades, each required a separate span. All the bridges at the creek crossing are single-span deck plate-girder structures with reinforced concrete decks. The decks are trough-like in cross-section, and each bridge incorporates a concrete sidewalk for the use of trainmen along each side. Hand rails of wrought iron are provided on all these bridges.

All of the Onondaga Creek bridges are carried on concrete abutments supported on H-section steel piles. A feature of these abutments is their unusual height which measures as much as 38 ft. between the bottoms of the footings and the tops of the backwalls. The abutments at all other bridges, as well as the retaining walls, are supported on creosoted timber piles, except at certain locations where the subsoil conditions required the use of concrete piers. Broadly speaking, the subsoil encountered on this project consists of generally unstable material overlying shale or hard gravel which was found at various depths. In fact, the overburden ecountered at the individual grade-separation job at West Fayette street proved to be so soft that the entire construction area had to be enclosed with wood sheeting in order that the work could proceed. Incidentally, at a number of locations where the penetration of the timber bearing piles was relatively small, an unusually large proportion of the upper parts of the piles was enclosed in concrete in order to increase their lateral stability.

The new passenger facilities that were provided as part of this project are of the two-level type. The station is located at the ground level on the east side of the tracks, with a subway of concrete construction extending under the embankment to stairways leading up to a covered island platform consisting of a concrete slab supported on piles driven through the fill. The platform canopy, of the butterfly type, is of structural steel construction with a cast-in-place concrete slab roof. Baggage is handled between the station and the passenger platform in a separate subway and an elevator is provided for raising it to the upper level. Trackage at the station includes a number of storage tracks and a spur track for handling mail and express. Because of the proximity of the passenger station on the east side of the tracks and of the existing freighthouse on the other, the embankment is enclosed between concrete retaining walls throughout the station area.

The new station, which contains various division offices in addition to the passenger facilities, is an attractive modern structure. Rectangular in plan, it is 48 ft. 8 in. by 96 ft. in external dimensions, and is two stories in height, except for a small section at the rear. The main entrance is located in the center of the facade, while secondary entrances are provided in both end walls. From the main entrance a passageway extends through the building to an enclosed connecting passage between the station and the entrance to the passenger subway under the embankment. The connecting passage is necessary because the rear side of the station is separated from the face of the embankment retaining wall by a 16-ft. space.

To the left of the main entrance in the station is the waiting room, 30 ft. by 37 ft. in plan, which extends the full height of the building. In the rear wall of this room is an alcove containing a newsstand, and to the left of this is the entrance to the ladies' rest room. The men's room is also located to the rear of the waiting room, being reached from the passageway.

To the right of the main entrance are the office of the city passenger agent, the ticket office and, at the rear, a short corridor containing telephone booths and lockers, which leads to the baggage room. Other facilities to the right of the main entrance on the first floor include, in addition to various closet and storage space, a conference room and an office for railroad police. On the second floor there are offices for the division freight agent, the claim agent, the roadmaster and various auxiliary space, including a fan and heater room. An entrance at the office end of the building gives access to the first-floor offices and baggage room and to a stairway leading to the second floor. There is also a stairway leading to a small basement.

Exterior Features

Of concrete, brick and steel construction, the station is finished on the exterior with buff-colored face brick, is trimmed with Indiana limestone and has a base course of brown New Hampshire granite. Effective use is made on the exterior of fluted limestone pilasters between the windows and on each side of the main entrance, and of window spandrels of the same material, each of which carries a circular design done in aluminum. Directly above the main entrance the word "Lackawanna" is spelled out in large letters of stainless steel. All the entrance doors are of plate glass with aluminum sash and frames, and above each entrance doorway there is a marquee of modernistic design with aluminum finish. The window sash and frames are also of aluminum.

(Continued on page 902)

position of the company in the confidence and regard of the people it serves throughout the world."

D'Alton Corry Coleman becomes the Canadian Pacific's fifth president and brings to that post a wealth of practical knowledge of the railroad industry. He was born at Carleton Place, Ont., in 1879, and was educated at Arnprior Collegiate Institute. He entered railway service as a clerk in the engineering department of the C. P. R. at Fort William, Ont., in 1899. During his subsequent career, he was superintendent at Nelson, B. C., in 1907; superintendent at Vancouver, B. C., in 1908; superintendent, car service, at Winnipeg, Man., in 1908; general superintendent, Manitoba district, in 1912; general superintendent, Alberta district, in 1913; assistant general manager, western lines, in 1915; vice-president, western lines, in 1918. He was elected vice-president of the Canadian Pacific system on September 10, 1934.

Mr. Coleman also is president of the Quebec Central and the Dominion Atlantic, and is an officer or director of many other enterprises including the Eastern Abattoirs, Ltd., the Pennsylvania-Ontario Transportation Company, the Metropolitan Life Insurance Company of New York, the Canadian Marconi Company, the Toronto Terminals Railway and the Vancouver Hotel Company. He is chairman of the executive committee, University of Bishop's College, and served as chairman of the board of governors of the University of Manitoba from 1932 to 1934.

Lackawanna Raises Tracks Above Streets in Syracuse, N.Y.

(Continued from page 900)

The interiors of the public rooms in the station are colorful and attractive. In the waiting room and the passageway, the walls are finished in travertine of varying shades of pink and buff, while the floors are of terrazo, with aluminum dividing strips, in different shades of brown. The base course is of brown marble. The ceiling in the waiting room and passageway is of acoustical plaster, and these areas are lighted by ceiling fixtures of the flush type. All interior doors and trim in the public rooms are of aluminum, including the grille work, counter panels and foot rail at the ticket window. Of especial interest is the fact that all seats in the waiting room consist of individual maple chairs upholstered in either blue or terra cotta leather. In the toilet rooms the walls, as well as the toilet partitions, are of brown marble, and the floors are of green terrazo. Glass block windows are provided in both toilet rooms.

The station is heated by a hot-air duct system through recessed outlets, except that unit heaters are provided in the baggage room. Steam for the heating system is furnished by a coal-fired stoker-fed boiler plant located in a boiler room underneath the tracks, where coal is delivered to the storage bin directly from cars on one of the overhead tracks. Steam from the boiler plant is delivered to the fan room on the second floor of the station, from which heated filtered air is distributed to the waiting room. The offices and various other rooms are heated by recessed convectors placed under the windows. A mechanical method of ventilation is employed in the toilet rooms.

Construction Procedure

The procedure that was followed in carrying out the track-elevation work on this project was to build a single-track temporary line along the west side of the original alinement so that the construction work could be conducted in the clear. Incidentally, because of the congested nature of the district traversed, it was necessary to remove many buildings in order to obtain the required width of property. The old passenger station was demolished early in the work and a temporary station was constructed at another location for handling passenger business during the construction period. The problem of heating the temporary station was solved by using the boiler plant that was later installed for heating the permanent station. Other temporary construction included a timber trestle that was constructed across Onondaga creek to carry the temporary line.

All the concrete that was placed on this job was proportioned at a central batching plant, although transit mixing was allowed only when the concrete was to be placed in close proximity to the batching plant. In the bridge erection work the girders were usually brought in on flat cars over the temporary track and lifted into position on the abutments by crawler cranes, although, in at least one instance, the girders had to be hauled by truck and trailer for some distance through the city streets to reach the bridge site.

This was an undertaking of considerable proportions, as is indicated by the fact that two of the girders handled in this manner were 85 ft. long.

The grading was not particularly heavy, amounting to about 175,000 cu. yd. of excavation and 50,000 cu. yd. of borrow, and all haulage was by motor truck.

Track Work

All track work required on this project was performed by railroad forces. An interesting sidelight is afforded by the fact that all ballast, ties, rail and fastenings required for the tracks on the elevated section of the line were delivered on the job in trucks, hired locally, using the ramps that had been employed by the grading contractor. The rails, fastenings and ties were transferred from railroad cars to the trucks at a local yard, but the ballast was hauled directly from the source, six miles distant, to the point of installation. By using trucks for this work, it was possible to construct the tracks as soon as the embankments were completed and without waiting until the bridges had been installed. In fact, it is estimated that the track work was completed about two months earlier than would have been possible if conventional methods had been used.

The plans for this project were drawn and the field work was supervised by railroad forces under the general direction of George A. Phillips, chief engineer. John L. Vogel, engineer of structures, had direct supervision over the design work, while the work in the field was under the supervision of A. F. Reiland, assistant engineer, assisted by H. W. Machemer, also assistant engineer. The Syracuse Grade Crossing Commission, of which Nelson F. Pitts is chief engineer and Charles Slack is assistant engineer, exercised general supervision over the entire project. The general contract was held by the Elmhurst Contracting Company, Corona, Long Island, N. Y., except that the bridge steel was furnished and erected by the American Bridge Company, the passenger station was built by the Irish Construction Company, Syracuse, and the coal, ash and sand plants were furnished and erected by the Ross & White Co., Chicago. Fred B. O'Connor, Syracuse, was the architect for the passenger station. Work on the general contract was started on June 11, 1940, and was completed on January 15, 1942.