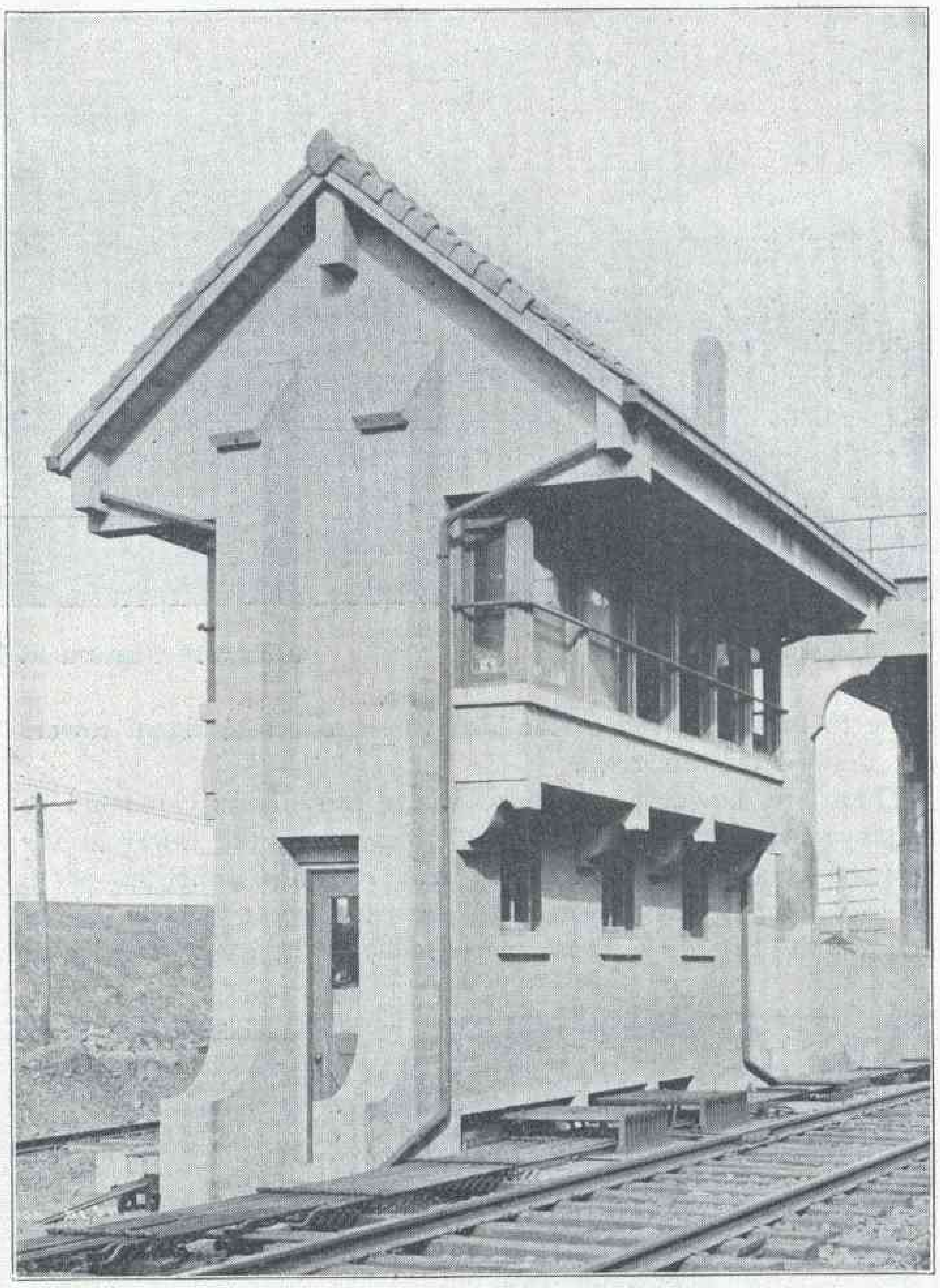
CONCRETE BUILDINGS ON THE LACKAWANNA.

Passenger Stations and Signal Towers of Substantial Construction and Attractive Design Adapted to Local Conditions.

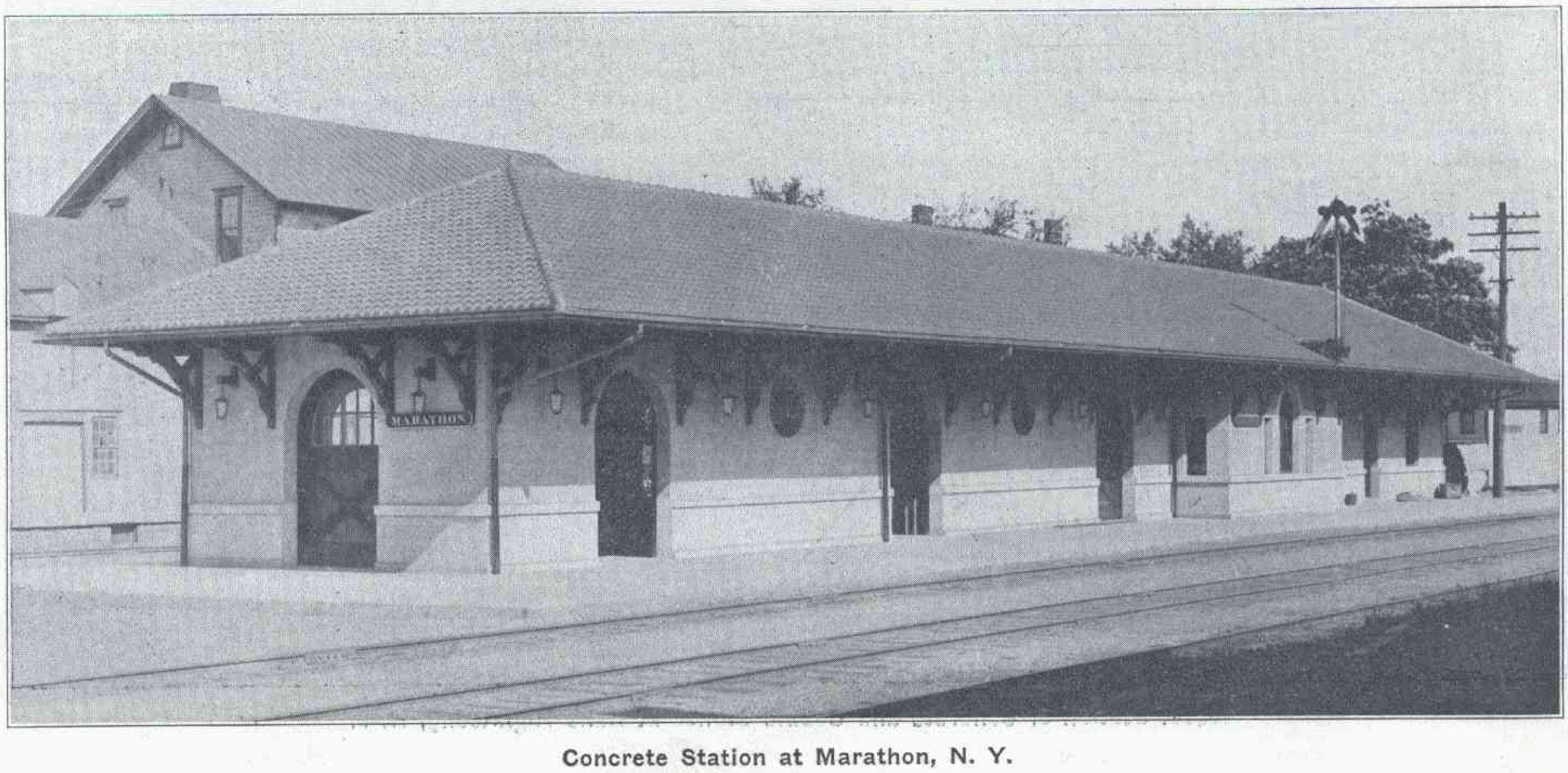
The Delaware, Lackawanna & Western has used concrete very extensively in a wide variety of structures within recent years. During the five years from 1907 to 1911, inclusive, 783,000 cu. yds. of concrete were placed on this road, 267,347 cu. yds. of which entered into structures on the Hopatcong-Slateford cut-off, described in the *Railway Age Gazette* of December 6, 1912, and January 3, 1913. On this work concrete was used for every structure from the Pauline Kill viaduct down to the smallest culvert, even the fence posts being made of concrete.

Standard Concrete Signal Tower at Port Morris, N. J.

An important application of this concrete work has been its adaptation to buildings, three new stations, a freight house and three signal towers being built entirely of this material on this one cutoff. One of these signal towers, located at Port Morris at the easterly end of the cutoff, is shown in one of the accom-



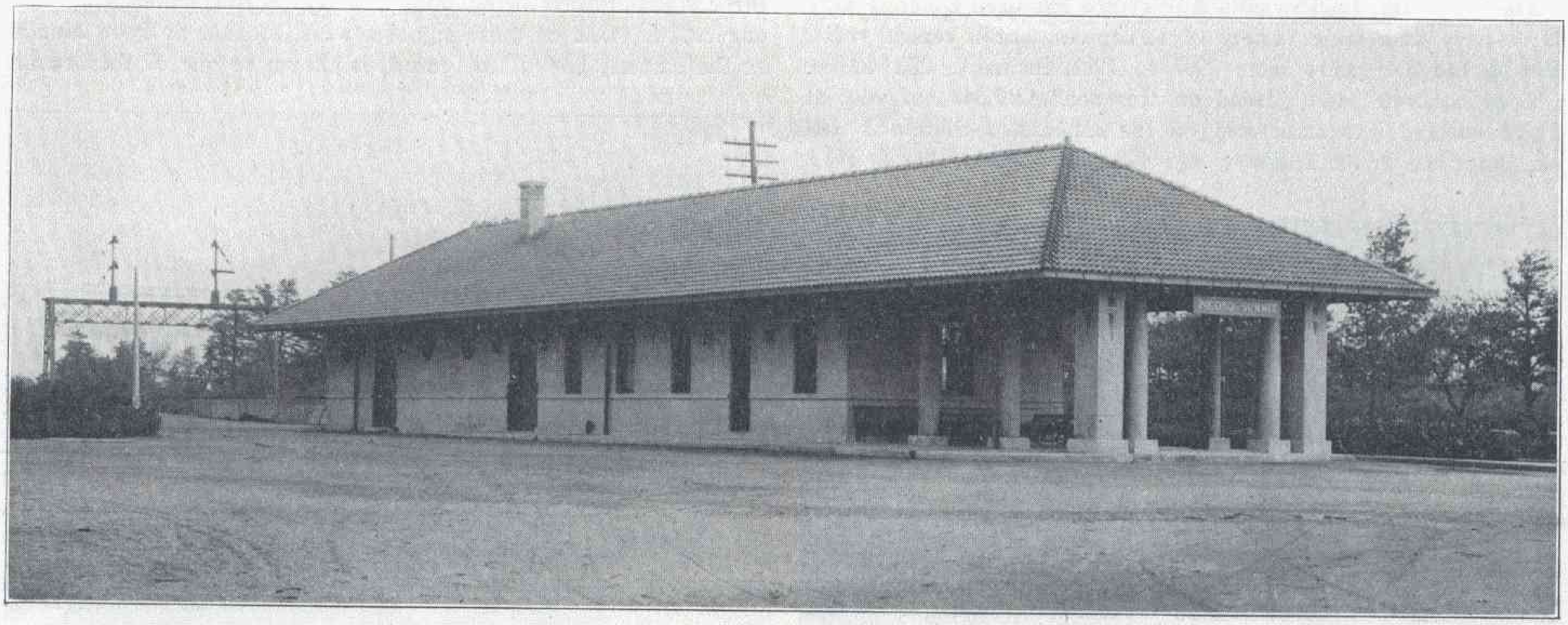
Special Concrete Signal Tower at Kearney Junction, N. J.



Concrete Station at Marathon, N. Y.

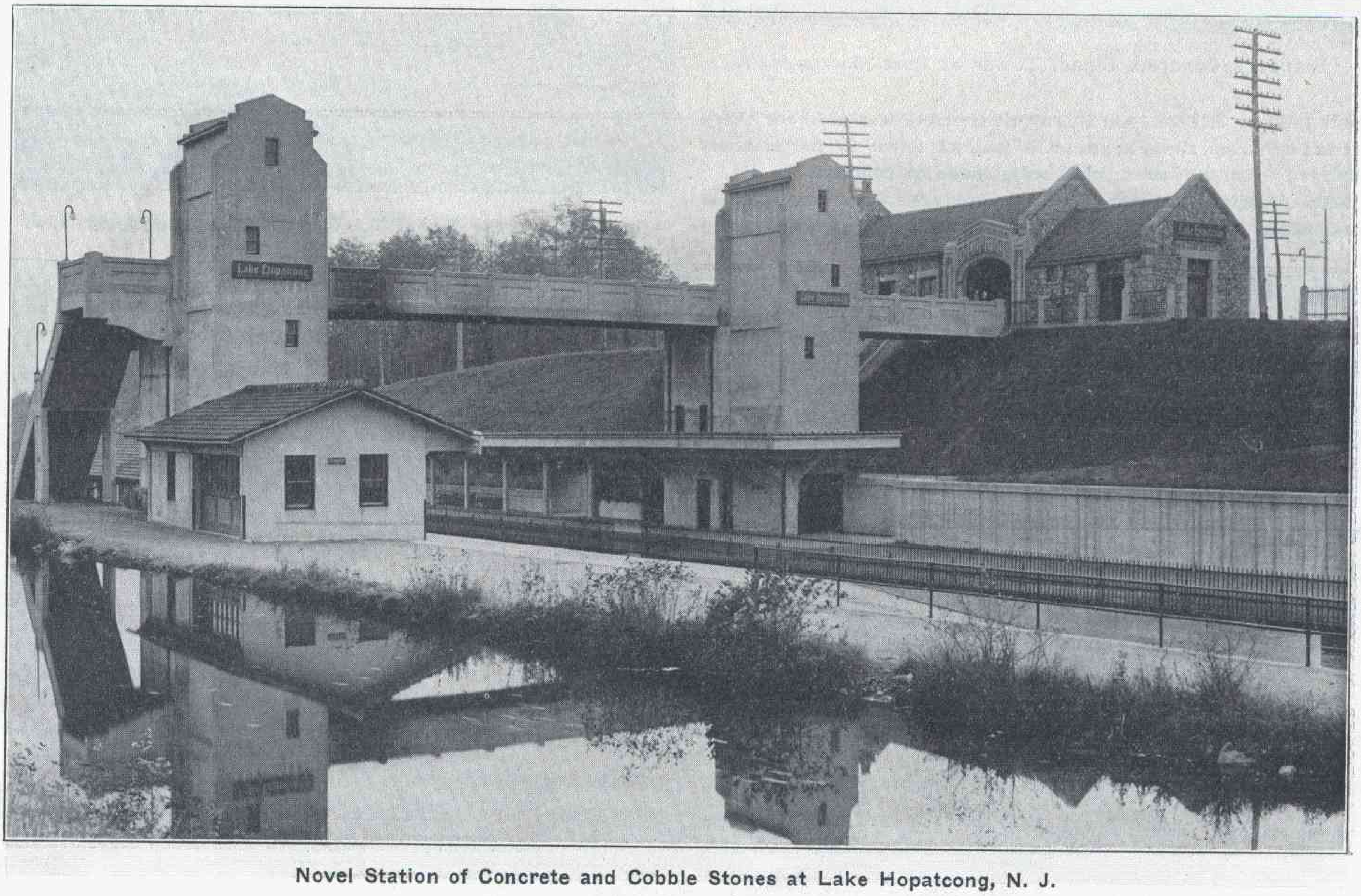
panying photographs. The other two are identical in design, and this same design has also been used at a number of other points on the Lackawanna, varying the length of the building to suit the requirements of the interlocking machine. Up to this time 10 of these towers have been built and this design has come to be considered a standard where concrete signal towers are desired on this road.

There are, however, situations where this design could not be employed, as illustrated by the photograph of the tower at the Pennsylvania overhead crossing near Kearney Junction, N. J. At this point it was necessary to place the tower between tracks and a width of only 6 ft. was permissible at the base. The tower shown was therefore designed 6 ft. wide x 25 ft. 8 in. long on the first story and supported on a foundation box 18 ft. wide x 27 ft. 2 in. long, carried on piles below tide level. The second floor is extended out to a width of 10 ft. 3 in. over the bays, which are supported on brackets cantilevered out from the walls below. The roof is 18 ft. wide over the eaves and is entirely supported on girders resting on the end buttresses wihch swell out at the bottom, giving the entire structure an appearance of stability.



Concrete Station at Pocono Summit, N. J.

Up to the present time seven all concrete stations have been built while four others have been built of solid concrete up to the window sills with stucco above, giving the appearance of a

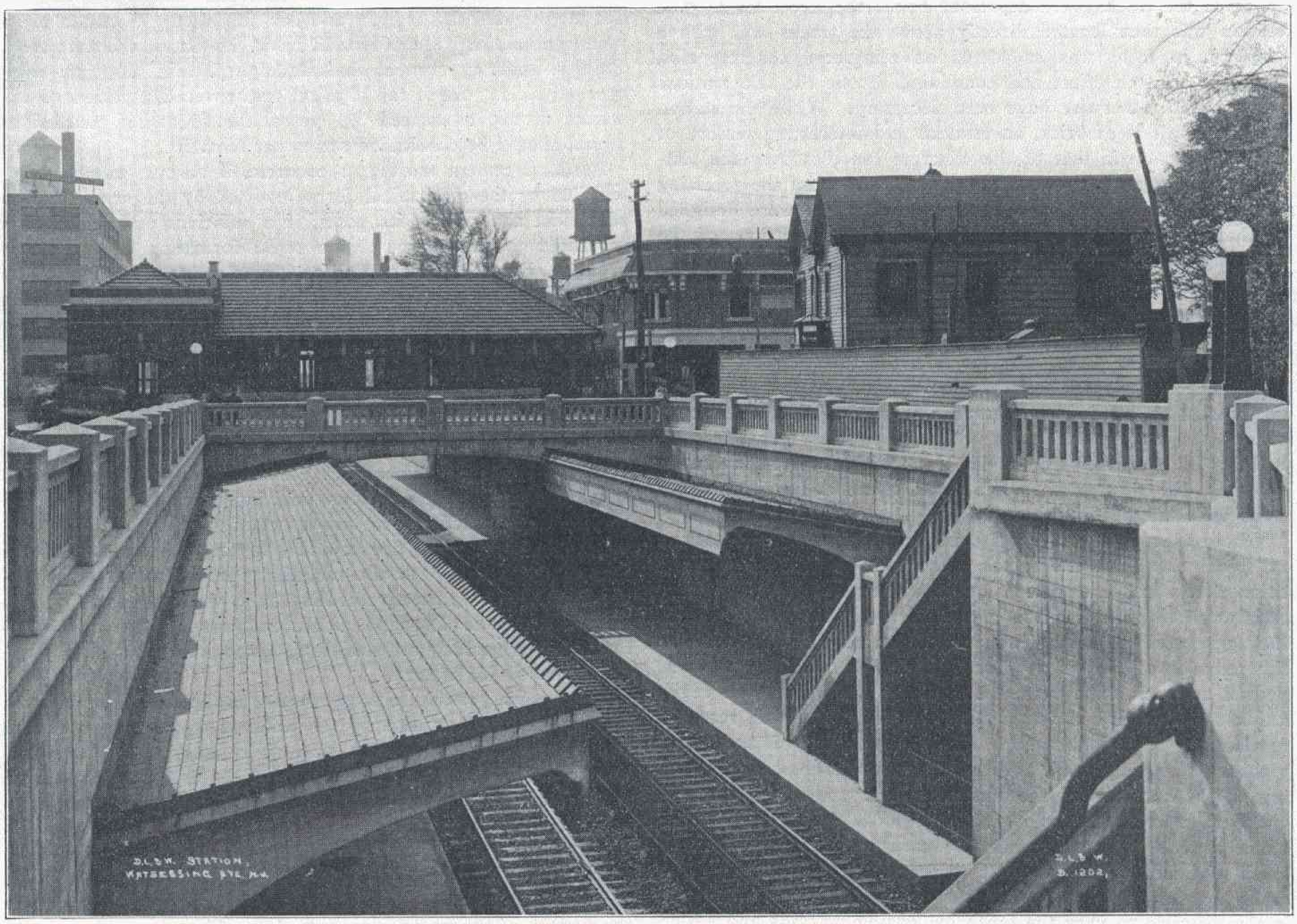


Novel Station of Concrete and Cobble Stones at Lake Hopatcong, N. J.

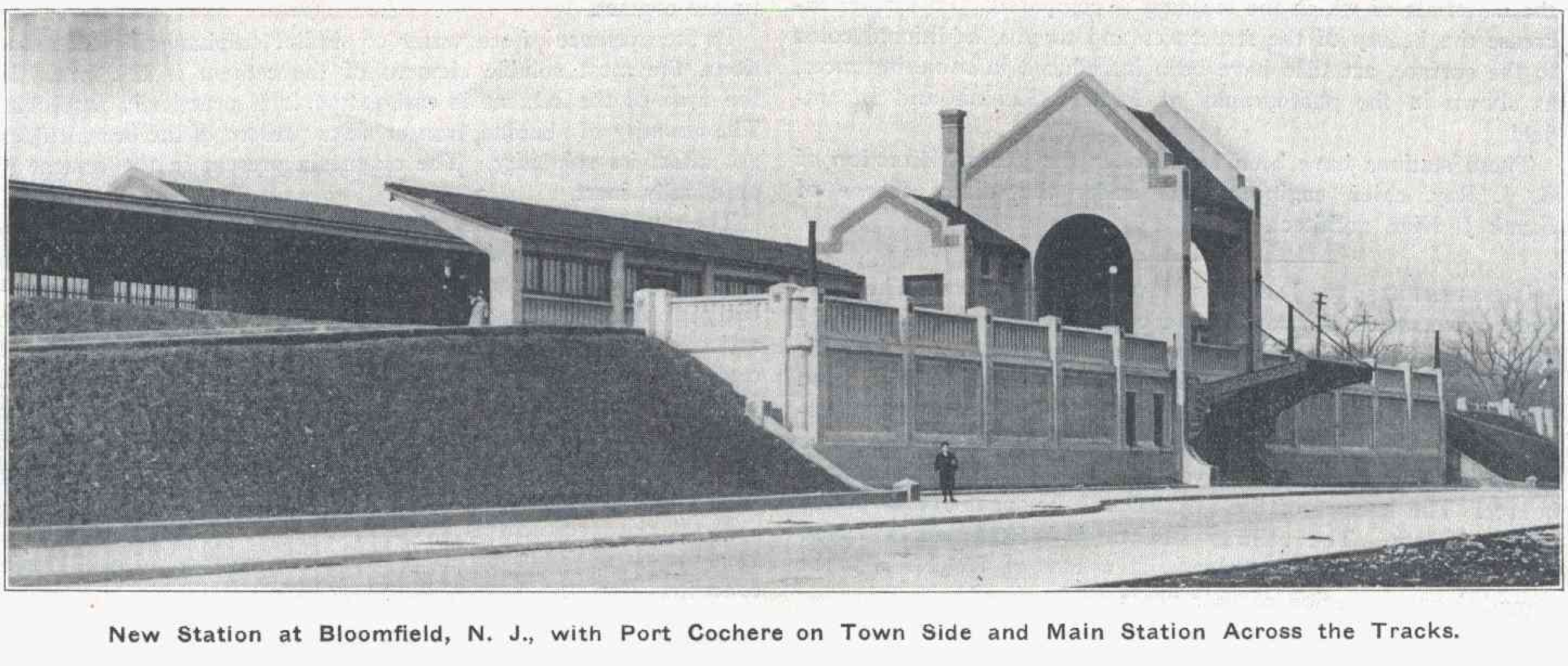
concrete structure. A number of others have been built of brick with concrete trimmings, which also give very pleasing effects, an instance of this latter design being the Montclair, N. J., station described in the *Railway Age Gazette* of July 4, 1913.

With the stations it has not been possible, nor architecturally desirable to follow the same design to any extent. In some instances where the requirements have been practically the same it has been possible to secure pleasing effects by simply varying the style of design slightly, as can be noted by a comparison of the stations at Marathon and Pocono Summit. At other points the local conditions and the topography have governed the design and have assisted in the development of unusual and pleasing stations.

At Lake Hopatcong, for instance, a high embankment on the town side of the track was used as a support for an overhead crossing of the tracks. As shown in the photograph, the station itself, which is of cobblestones with concrete trimmings, was located on a high embankment with a stairway descending to the adjacent track and with a concrete structure extending across the tracks to a platform on the opposite side. Elevators



Brick Station with Concrete Trimmings at Watsessing Ave., N. J., Showing Concrete Cantilevered Canopies.



New Station at Bloomfield, N. J., with Port Cochere on Town Side and Main Station Across the Tracks.

are provided over each platform for the handling of baggage and express.

At Watsessing avenue on the Mt. Clair branch a different problem was presented. Here the station was located in a thickly built up portion of the city and the company owned limited right of way. At this point in connection with changes in grade the tracks were depressed below the street level. The station was then located directly above the tracks and with a platform in front was supported on reinforced concrete ribs, giving it an arch effect and combining in one the two stations which would otherwise have been necessary. While the station building itself is of brick, an unusual and interesting feature of the construction is that of the concrete canopies over the platform. These canopies were cantilevered out from the retaining walls, eliminating any posts in the platform and were designed so that it was not necessary to increase the dimensions of the retaining wall in any way to provide for this increased load.

The station at Bloomfield, N. J., presented still another problem. Although practically all of the business was done on the eastbound side of the track and it was necessary for the station proper to be placed on that side, the town lay on the opposite side of the track and the people demanded that this building present an attractive appearance from that side. This condition was met by the construction of a small but attractive building on the north side of the track with a porte-cochere, as shown in the photograph, while ticket offices and waiting room were built on the opposite side.

Wherever concrete has been used in either passenger stations or signal towers an effort has been made to produce pleasing color effects and texture of surface by proper selection of materials and by removing the cement from the surface to expose the aggregates to view. This has been accomplished either by the removal of the forms shortly after the concrete has been poured and scrubbing the surface or by tooling it with regulation stone cutter's tools. Where scrubbing has been resorted to this has been done with a liberal application of water and vigorous scrubbing with stiff brooms or wire brushes, depending on the hardness of the surface. Great care must be exercised when using this method to preserve the arises. When stone cutter's tools are used, less care is necessary with the finish of arises, as the concrete is permitted to become considerably harder before the work is started. With this method it is also possible to vary the finish by leaving margins and either rubbing these with concrete stone or lightly bush hammering or tooth chiselling. The surface can either be bull pointed, crandelled or treated in such other manner as best pleases the designer.

This surface treatment has proved highly satisfactory, as it prevents unsightly surface checks, and at the same time gives a pleasing texture and color as well as an honest exposition of the materials of which the building is composed. To further increase the beauty of the structures and to give additional color to the surface, art tiles have been introduced in some instances, as shown in the photographs of Pocono Summit and Bloomfield.

These stations have been built under the general direction of G. J. Ray, chief engineer, and under the direct charge of Frank J. Nies, architect.

IMPROVEMENTS TO JAPANESE RAILWAY STATIONS.—The Japanese government railway bureau contemplates expending $196,000 in improving the Shimonoseki railway station. After the wharf now building is completed the present station will be so extended that the connection between the land and sea transportation depots will be more convenient and up to date. For this $78,600 will be spent this year in building locomotive roundhouses. The balance of the $196,000 will be spent over a period of four years. The railway station at Wakamatsu will also undergo extensive improvements, at a cost of $1,485,000, to be extended over a period of four years.

ACTION OF ALKALI AND SEA WATER ON CEMENTS.

Because of the various conflicting ideas which have been presented from time to time regarding the action of alkali water and sea water on cements, the United States Bureau of Standards has investigated this subject and has published the results of its investigations in bulletin No. 12 by P. H. Bates, chemist; A. J. Phillips, assistant chemist, and Rudolph J. Wig, associate engineer physicist. Since the physical test covered a period of exposure of not to exceed 3½ years, the following conclusions drawn should be considered somewhat tentative.

Portland cement mortar or concrete, if porous, can be disintegrated by the mechanical forces exerted by the crystallization of almost any salt in its pores, if a sufficient amount of it is permitted to accumulate and a rapid formation of crystals is brought about by drying; and as larger crystals are formed by slow crystallization, there would be obtained the same results on a larger scale, but in greater time if slow drying were had. Porous stone, brick and other structural materials are disintegrated in the same manner. Therefore, in alkali regions where a concentration of salts is possible, a dense non-porous surface is essential.

While in the laboratory a hydraulic cement is readily decomposed if intimately exposed to the chemical action of various sulphate and chloride solutions, field inspection indicates that in service these reactions are much retarded if not entirely suspended in most cases, due probably to the carbonization of the lime of the cement near the surface or the formation of an impervious skin or protective coating by saline deposits.

Properly made Portland cement concrete, when totally immersed, is apparently not subject to decomposition by the chemical action of sea water.

It is not yet possible to state whether the resistance of cements to chemical disintegration by sea water is due to the superficial formation of an impervious skin or coating, which is subsequently assisted by the deposition of shells and moss forming a protective coating, or by the chemical reaction of the sea salts with the cement forming a more stable compound without disintegration of the concrete, or by a combination of both of these phenomena.

Marine construction, in so far as the concrete placed below the surface of the water is concerned, would appear to be a problem of method rather than materials, as the concrete sets and permanently hardens as satisfactorily in sea water as in fresh water or in the atmosphere, if it can be placed in the forms without undue exposure to the sea water while being deposited.

Contrary to the opinion of many, there is no apparent relation between the chemical composition of a cement and the rapidity with which it reacts with sea water when brought into intimate contact.

In the presence of sea water or similar sulphate-chloride solutions, the most soluble element of the cement is the lime. If the lime of the cement is carbonated it is practically insoluble. The quantity of alumina, iron or silica present in the cement does not affect its solubility. The magnesia present in the cement is practically inert.

The change which takes place in sea water when brought into intimate contact with the cement is as follows: The magnesia is precipitated from the sea water in direct proportion to the solubility of the lime of the cement. The sulphates are the most active constituents of the sea water, and are taken up by the cement. Their action is accelerated in the presence of chlorides. No definite sulphate compound was established. The quantity of chlorine and sodium taken up by the cement is so small that no statement can be made as to the existence of any definite chloride or sodium compound formed with the cement.

Metal reinforcement is not subject to corrosion if embedded to a depth of 2 in. or more from the surface of well-made concrete.