reducing maintenance cost generally, that a serious investigation and study was undertaken of the problem of producing a permanent deck surface supported by timber piles, assumed as permanent below the water line.

This study has resulted in the entire elimination of the old style of wooden deck in new structures, and the production of a new type consisting of reinforced concrete laid directly on the transverse cap system of the wooden pier substructure. This concrete is laid in slabs, spanning the pile bents practically as simple beams.

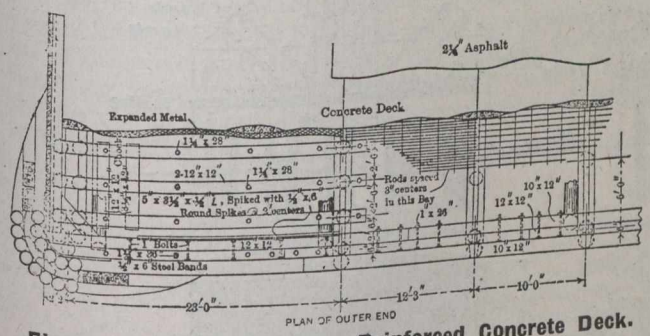

Fig. 2.—Corner Construction Reinforced Concrete Deck.

This new type of deck eliminates not only the 4-in. deck sheathing, but also the 4-in. deck proper and the underlying 12 by 12-in. yellow pine ranger system longitudinally of the pier on top of the transverse cap system, further increasing the life of the substructure.

A structure was thus evolved which had a permanent deck practically impervious to the penetration of moisture to the substructure, readily renewable from low water to the under side of the concrete deck, and permanent below the water line, with a first cost about equal to that of the old wooden deck pier.

The first step in the elimination of the great cost factor, the renewal of the deck sheathing, was the replacing of this sheathing by a concrete wearing surface, from 4 to 6 in. thick, laid directly on the old type of timber decking. This type forms a deck surface which is impervious to moisture, and is, therefore, a protection to the substructure, as well as a saving in maintenance.

The unit of cost of construction of a pier depends in a large measure on the size of the pier. As the outer portions, the sides, and outer end of a large pier are more rigid and heavier than those of a smaller pier, and, therefore, cost more in both labor and material, the relative cost per square foot of a short pier is considerably larger than that of a long one. The average cost of the old wooden deck pier of large dimensions is from $1.00 to $1.15 per sq. ft.

Further investigation and study resulted in the entire elimination of the wooden deck plank, deck sheathing, wooden floor rangers, etc., and the adoption of the present type of pier deck, as before mentioned, consisting of a reinforced concrete slab, 10½ in. thick, extending from centre to centre of the transverse pile rows placed generally 10 ft. apart. This slab is designed to carry a live load of 500 lb. per sq. ft. for the 10-ft. span between pile rows, and is reinforced with ⅝-in. square steel rods. The latter run longitudinally of the pier, are 6 in. apart, and are staggered so that only alternate rods terminate on the same pile row, with ⅜ by ⅜-in. separating rods. The slab is of 1:2:4 Portland cement concrete, with ¾-in. broken stone, the upper ½ in. of the slab being of Portland cement mortar finished smooth. This rod reinforcement is intended to be standard, but the substitution of trade sizes of equal strength and efficiency is permitted, subject to approval.

Definite illustrations of this type of pier construction are found in the two new piers recently completed by the Department of Docks and Ferries at the Gowanus Section, South Brooklyn, one at the foot of 31st Street, 1,475 ft. long, and the second at the foot of 33rd Street, 1,616 ft. long, each pier being 150 ft. wide. These piers are among the finest in the harbor, and are probably the largest of their type in the world. The unit cost is practically the same as that of the old wooden deck type. The decks have a crown of about 8 in., in order to shed the water. The in-shore end of the concrete deck rests on the bulkhead wall, but is not attached thereto, a horizontal plane joint allowing the deck to slide on the wall as it expands or contracts on account of changes of temperature.

Twenty-six piers with concrete decks have been built by the department during the past seven years. The earlier type, as exemplified by the Chelsea Section piers, consists of a 6-in. concrete deck surface reinforced with expanded metal and laid directly on the deck planking. The next type produced omitted the deck plank, and is represented by eight piers with decks consisting of a concrete slab, 6½ in. thick, reinforced with expanded metal, the slab spanning yellow pine rangers running longitudinally of the piers and generally about 6 ft. apart.

The final type evolved, omitting the timber floor system entirely, and placing a concrete slab reinforced with longitudinal steel rods directly on the timber-capped transverse pile rows, is represented by eight piers, the most important examples being those at the foot of 31st and 33rd Streets, South Brooklyn, and the Municipal Pier at Stapleton, Staten Island.

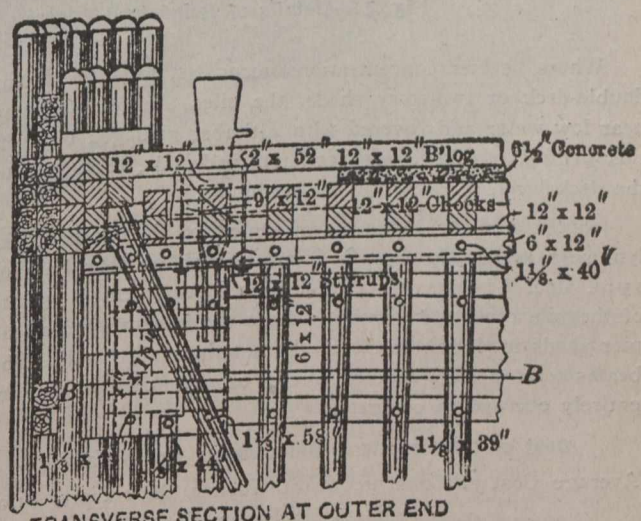

Fig. 3.—Pier Construction With Reinforced Concrete Deck.

All these piers have been built where the condition of the river bottom underlying them was such that no settlement could occur, and they have behaved admirably. No repairs have been necessary, except to the fender system, and none are anticipated for many years to come, excepting the renewal here and there of an imperfect pile, where rot may appear above the water line. Such renewals can be made at a minimum of cost—a few dollars per pile—by bench-capping, without any interference whatever with the integrity of the reinforced deck itself.

Column Foundations.—For single-story sheds, where additional bearing strength is required in the new concrete deck pier for shed column or superstructure support, the question