PLATE XII.

GIRARD AVENUE BRIDGE.

The Girard Avenue bridge is one of the most celebrated roadway structures of its kind. It spans the Schuylkill River, in the city of Philadelphia, on the line of the main avenue of approach to Fairmount Park, and it is remarkable as the first attempt in this country to combine the American system of pin-connection bridges with a solid roadway of stone constructed in the most massive and substantial manner.

There are seven lines of trusses placed 16 feet apart centres, and united by horizontal and vertical bracing. All compression members are Phoenix columns. Upon the top of the posts, and transversely, are laid heavy 15-inch eye-beams, and on these are placed longitudinally 9-inch beams 2 feet 8 inches apart centres. Transverse corrugated plates rest on the latter and support four to five inches of asphalt concrete, making a watertight surface. The roadway is 100 feet wide and paved with granite blocks in the usual manner, except that it is divided into seven ways by two lines of iron tracks, adjacent to the sidewalks, for horse-cars, and five lines of carriage tramways made of cut granite blocks 1 foot wide and laid to a 5-feet gauge. The total width of 100 feet is divided into one carriage-way of 67½ feet and two 16½ feet sidewalks.

The moving load of 100 pounds per square foot, in addition to the weight of the structure, constitutes a total load of 30,000 pounds per linear foot of bridge.

PLATE XIII.

TRENTON CITY BRIDGE.

This roadway bridge was built for the Trenton City Bridge Company, of Trenton, N. J., and crosses the Delaware River at that place. There are seven spans with a total length of 1280 feet. Each span contains nine panels of 20 feet each, and the depth of truss is 28 feet. There is a clear width of 20 feet for the roadway, and 6 feet for each of the two sidewalks.

The design of the structure represents the most advanced system of construction as applied to the ordinary roadway bridge. Two lines of iron stringers extend the entire length of the seven spans, and carry at the centre of each panel an intermediate transverse beam, on which rest iron joists of half a panel length. All the economic and other advantages of long panels were thus made available, besides eliminating everything combustible, with the unavoidable exception of the floor-plank and three lines of light- timber stringers to which they are spiked.

The sidewalk railing serves the double purpose of a guard and trussed stringer for a portion of the sidewalk load. With its lines plainly expressive of the purpose of its construction, it materially contributes to the light and graceful, yet most substantial, appearance of the entire structure.

PLATE XIV.

CAPE MAY PIER.

During the past few years the field of engineering construction has been extended so as to cover ocean piers built entirely of wrought iron, with the exception of the timber floor, and that at Cape May is one of the finest examples to be found on the Atlantic coast. With its length of 1000 feet, and pavilion located at the outer extremity on an extent of 28,900 square feet of floor, there is ample space not only for the demands of business, but for the gratification of the crowds of people who delight to make the pier a promenade. Its adaptability to the latter purpose makes it one of the principal attractions of this popular summer resort.

The width of the stem of the pier is 30 feet, and the size of the head 130 by 290 feet, while the centre bay is 60 by 80 feet. The entire floor is elevated 21 feet above low water.

The columns are all of the Phoenix section and fitted at the lower extremity with cast-iron feet 24 inches in diameter. These were sunk 10 feet into the sand, and so rigidly braced together, both longitudinally and transversely, that the pier would stand firmly in position with no support but its own bracing.

The columns were sunk to the required depth by the water-jet process.

FRONTISPIECE.

PHILADELPHIA AND READING RAILROAD BRIDGE,
OVER FRENCH CREEK, AT PHILADELPHIA, PA.

This bridge carries the double track, main line of the Philadelphia and Reading Railroad, across both the canal of the Phoenix Iron Company and French Creek, at the confluence of the latter with the Schuylkill River. The span of 140 feet is divided into seven panels of 20 feet each. The centres of the trusses are 28 feet apart, while the depth of truss is 32 feet. Each track is carried on three lines of iron stringers resting on transverse floor-beams.

The proportions of the bridge and its various parts are thus seen to fulfil the requirements of the heaviest traffic, and at the same time answer every demand of economy. The location of the structure at a short distance from the Phoenixville depot is such as to constantly subject its floor system to the traction of the locomotives of all outgoing trains to the north, and the violent thrusts induced by the air-brakes of all trains bound south. These circumstances, in connection with the high speed of the passenger trains and the extraordinary heavy coal traffic of this road, render the service of this bridge very trying in its character. But its design was undertaken in view of these conditions, and its remarkable sturdiness and stability under moving loads in every variety of motion show how perfectly the end was accomplished.

The depth of trusses was so taken that the requisite systems of upper and lower lateral bracing could be supplemented by the transverse system shown in the plate. That degree of stability necessary to the circumstances of the location was thus effectually secured.

Shortly after its completion the resistance of the floor system was severely tested by a derailed locomotive and car, which ran nearly halfway across the span on the ties, but eventually came to rest without material injury to the structure.

The bridge was designed to carry, in addition to its own weight, a moving load on each track of two coupled locomotives, each weighing 177,800 pounds, in 54 feet 2 inches, or 196,000 pounds on a driving-wheel base of 14 feet 9 inches, followed by a uniform train of 2240 pounds per linear foot.