were delivered to the pile. Most of the piles were driven to refusal. An idea of the force of the blow of the hammer can be obtained from the following incident: A  $\frac{3}{6}$ -in. bolt broke, somewhere on the hammer, and the nut and a

part of the bolt dropped onto the plate at the head of the pile and before the steam could be shut off, the hammer struck it one blow, flattening the bolt and nut to  $\frac{1}{16}$  in. thick. Although the tops of the piles are not below water level, yet the perpetual dampness of the clay soil keeps the piles wet and prevents decay. The calculated loading for each pile was fifteen tons.

The abutments and piers are built of mass concrete with local reinforcement. The concrete mix was 1:3:5 below underside of coping and 1:2:4 above. The abutments are 26 ft. high and 100 ft. long with 20-ft. wing walls parallel with the street line. The base of the main wall is 13 ft. 3 in. wide. Reinforcing steel (square twisted rods) is supplied in the base over the piles, under the bridge seat, at the rear of the back wall and around the corners. No expansion joints were used.

The piers are about 10 ft. square at the ground line and taper up at a batter of 1 in 12. They are 15 ft. square at the top of the piling. From base of piers to roadway is about 40 ft.

The piers are panelled on four sides and are joined transversely by means of a concrete strut which is constructed in the shape of an arch. On top of the piers is a concrete pedestal 6 ft. 2 in. high on which rest the 40-ft. girders. These pedestals are doubly reinforced by 6-1-in. square twisted rods bent in the form of an inverted U, the asof the piers and struts and diagonally through the arched portions of the struts.

The finishing of the exposed concrete surfaces is best described by quoting an extract from the specifications:



Fig. 4.—Loading Specifications.

"As soon as the forms are removed and all cavities filled, the concrete surfaces shall be thoroughly rubbed with cement grout compound of one part cement to two parts fine sand until all irregularities in the surface are filled, after which the whole surface shall be gone over with a piece of sandstone or carborundum brick and ground



Fig. 5.—Design of East Abutment.

sumption in the design being that the pedestal has to withstand the expansion and contraction forces of the 40-ft. girders caused by the friction between the bearing plates. Reinforcing steel is also supplied along the top down sufficiently to remove all irregularities. The grout surfacing herein specified shall, in no case, be used for the purpose of producing a plaster coating to cover irregularities in the surface, produced by sagging or similar