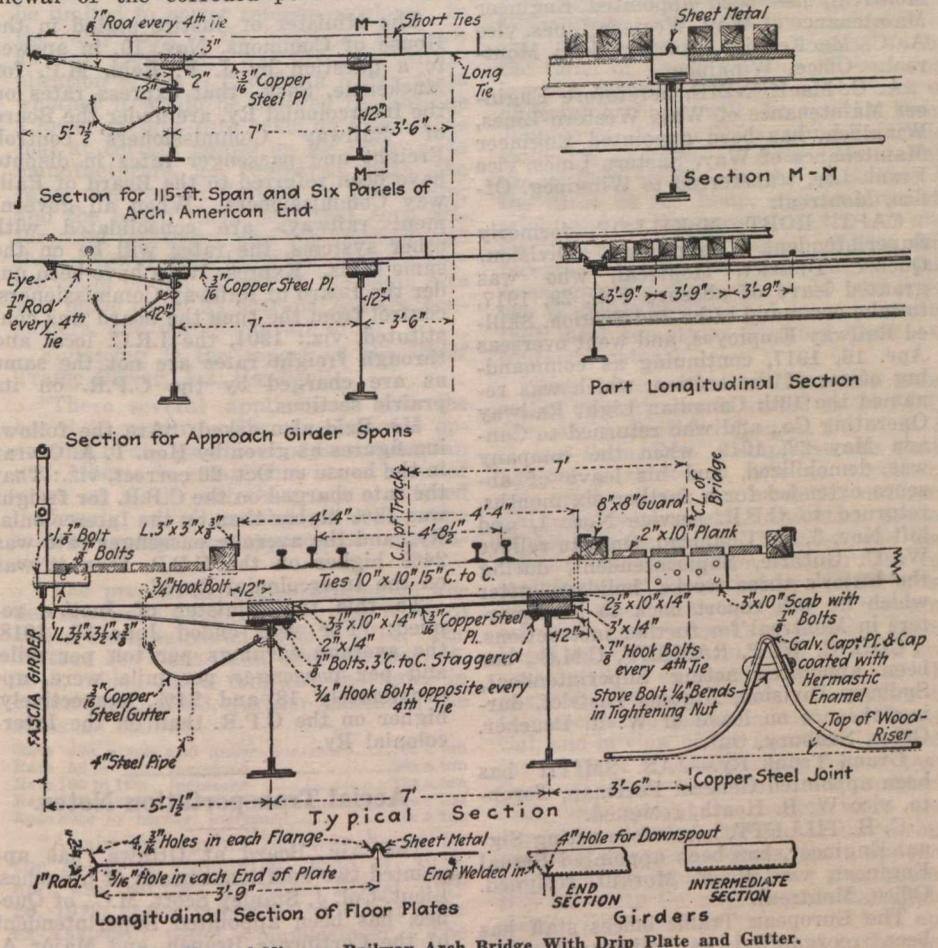
Steel-Plate Drip Floor for Niagara Railway Arch Bridge.

Floor protection of novel character is being applied to the lower Niagara arch bridge, by which the Grand Trunk and five other railways cross the Niagara gorge. Corrosion of the floor system by salt water drippings from refrigerator cars has become serious here, as it has on many other bridges, especially near terminals, where the blowoff, from switching locomotives, of water carrying various boiler compounds seems to add to the trouble. The effect of this action was one of the elements that led to a general overhauling and detail examination of the structure a year ago, as a result of which extensive repairs and reinforcement are being carried out to bring it into condition for the heaviest modern loading. In connection with renewal of the corroded portions of the floor system it was desired to provide protection against further corrosion. To this end C. E. Fowler, consulting engineer for the work, designed a special drip-protective floor which is being installed by the Terry & Tench Co., New York, contractors for the repair and reinforcement work, under direction of Mr. Fowler and H. B. Dickinson, Superintendent of the bridge for the owners.



New Floor of Niagara Railway Arch Bridge With Drip Plate and Gutter.

At the examination of the bridge the main structure was found to be in splendid condition, but the top flanges of floor beams and stringers and the stringer laterals showed losses of 25% to over 50% in thickness from corrosion. Reinforcement of the weakened members was imperative, and as it was desired also to bring all parts of the bridge up to E 60 capacity the two pieces of work were taken in hand at the same time. The bridge was originally designed for about E37, although the principal members of the 550 ft. arch span are of much higher capacity and require no reinforcement.

The bridge is a double deck structure, 1,080 ft. long. The upper deck, at the level of the top chord of the arch, is the double track railway floor. Below this is a highway floor, framed between the trusses. The railway deck has always had a tie floor, with wooden troughs, so that the highway traffic was more or less exposed to rain and drip. Brine drip and locomotive blowoff, especially in case of standing trains, were the most troublesome features of the situation so far as the condition of highway traffic was concerned. The new drainage floor for the railway deck was designed with protection for the highway deck as one of its objects.

In carrying out the floor system repairs and reinforcement, the cover plates and in some cases the flange angles of the stringers were cut off, traffic being restricted to one track while work was going on in the width of the other track. About 65,000 rivets had to be cut out. Where injury to the metal from heating was not to be feared, rivet heads were cut off by oxyacetylene torches fitted with special tips; such a torch cut off 500 to 700 heads of ⅞ in. rivets a day, or four times as many as one hand crew could do. New and heavier flange material was then riveted in place with countersunk rivets, so as to leave a flat surface as a seat for the drainage floor. All old metal was cleaned with sandblast and then painted with tockolith, with a view to counteracting the influence of any remaining rust.

As this strengthening work was completed the drainage floor was set in place. This, as fully shown by the accompanying drawing, consists of plates of copper-steel 3-16 in. thick, resting on maple raising strips bolted to the top flanges every 3 ft. by countersunk bolts. By making the strips on the inner stringer thicker than those on the outer stringer a drainage slope outward was given to the plate; a longitudinal gutter of copper steel under its outer edge takes the drainage to downspouts. The plate floor under each track is 9 ft. wide.

The track ties, 10 x 10 in., are dapped to 9½ in. depth for a length of 14 in., to receive 10 x 14 in. raiser blocks of hardwood, in order to raise the ties clear of the drip plate. The thicknesses of the blocks over the inner and outer stringers differ by 1 in., as shown, so as to make up for the difference in thickness of the raising strips under the drip plate and thus bring the ties level. The blocks are spiked to the ties. All the timber is treated with hot carbolineum. The copper steel floor plates are flanged sections 3¾ ft. wide, their length of 9 ft. extending crosswise of the track. The ends of the sheets are left plain. The side flanges, which form the joint between abutting sections, are 2 in. high, flaring, with fillet of 1-in. radius at the junction of flange and plate. Each flanged edge is punched with four 5-16 in. holes; the two joining flanges are covered for protection by a channel of no. 16 galvanized sheet steel fastened by stove bolts, which also hold the adjoining sections together.

As the track structure rests on these plates without any bedding or through-bolting, attention had to be given to anchoring the track firmly. The ties are held down by hook bolts at the inner edge of the inner stringer only, the holes for these bolts through the drainage plate having no special significance because they are near the upper end of the slope of the plate. These bolts are spaced at every fourth tie, which is equivalent to one bolt per plate section. At the low side of the plate it was not considered advisable to have holes through the plate, on account of the opportunity this would give for the start of corrosion. However, every fourth tie was extended out to provide anchorage as well as to carry a footwalk; it is anchored back to the web of the outer stringer by a steel rod, either through the fascia girder or (on the approach spans) directly by a bolt attaching the rod to the tie. The inner ends of the long ties are fastened together at the middle of the deck by 3 x 10 in. scabs, 3 bolts in each tie.

Ties are spaced 4¾ in. in the clear, to allow room for coating the drainage plate with enamel. Borden tie spacers are used throughout. The rail joints are of the bridge type, and, although the grade of the track is only 0.1%, the track is equipped with anti-creepers, partly because it is desired to maintain tight joints at the expansion points at each end of the structure, where 5 in. of expansion must be taken care of. Expansion joints of Quebec bridge type are provided at these points.

In addition to the inner guard rails, and outer guard timbers faced with steel angles, with which the deck was equipped, an outer guard rail has been added, as extra safeguard in derailment. This was done on account of the great height