are too high. The Dominion specifications allow 16,000 pounds per square inch for railway bridges.

The centre chord members of both trusses of the swing span, which receive their maximum stresses while the bridge is swinging, are designed for a unit stress of 20,000 pounds per square inch, due allowance being made for impact as per Clause 186 of the Dominion Government specifications.

The centre girders of the draw are designed for 18,000 pounds per square inch.

The arrangement of the centre and radial girders of the swing span is such as to load the drum at thirty-two points, but these points are not uniformly spaced, thirty of the spaces being about 4 ft. 3 ins., and two of them 15 ft. 0 ins., centre to centre. This gives uneven distribution of the load to the rollers. A portion of the load is carried to the centre pivot and the rollers and the lower track are securely tied to the pivot as required by good practice in draw-bridge designs.

In other particulars the bridge follows the lines of good practice in bridge design.

Tender No. 2.—The design submitted is similar to that of Tender No. 1, except that the swing span is the same length as on the official plans, but the pier design

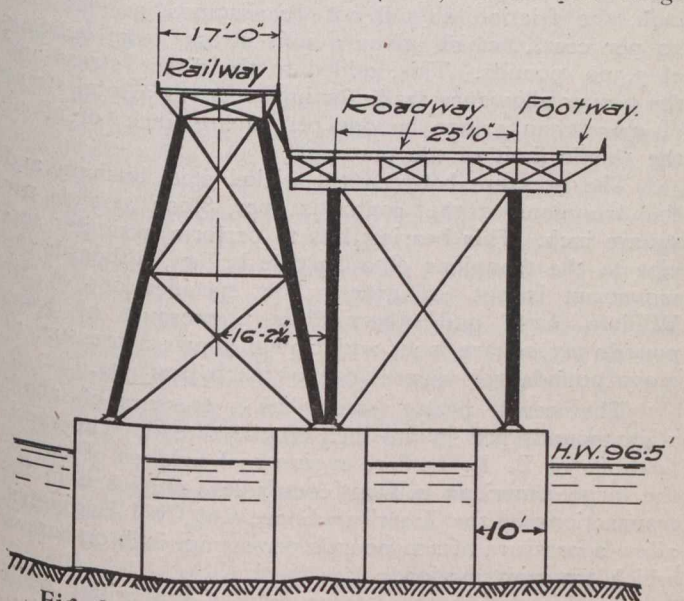

Fig. 2.—Typical Cross-Section of North Approach.

is such as to allow of this length being decreased, still maintaining the same clear opening.

Through plate girders are used in place of trusses for the highway approach over the Canadian Pacific Railway tracks.

The substructure has been designed for Dominion Government heavy loading on the railway track and two 40-ton electric cars on the tramway tracks, the balance of the floor has been figured for 100 pounds per square foot, or a 20-ton traction engine for the floor system, and 60 pounds per square foot for the trusses.

The 20-ton traction engine is practically equivalent to a modern heavy motor truck.

In proportion, the floor beams and truss members, the stresses due to dead load and railway loading have been provided for a unit stress of 16,000 pounds per square inch, tramway loading at 18,000 pounds per square inch, and highway loading at 20,000 pounds per square inch.

The centre chord members of the swing span which receive their maximum stress while the bridge is swinging are designed for a unit stress of 16,000 pounds per square inch. This unit stress has also been used in the design of the centre girders. Due allowance has been made for impact in all cases.

The drum is 42 feet diameter, which is smaller than used on other designs submitted, but the arrangement of the centre and radial girders is such that the rollers are evenly loaded and not overstressed. In this design, as in the design of Tender No. 1, a portion of the load is carried to the centre pivot, which is a desirable condition.

Two 200 horse-power motors are to be supplied for swinging the bridge. This is sufficient for rapid operation, with ample power in case one motor is under repair.

The design follows the lines of accepted good practice in modern bridge construction.

Tender No. 3.—The design follows the lines of accepted good practice in design for the channel crossing from low water to low water. It consists of one 60-ft. and one 80-ft. plate girder span, one 345-ft. truss span and the 586-ft. swing span.

The substitution of the three fixed spans for two, as on the official design, would necessitate a change in the Crown grant already obtained of portions of the bed of the Narrows.

The clearance above high water is not as great under the plate girder spans as for the same location on the official design.

The south approach consists of plate girder spans up to and over the tracks of the Canadian Pacific Railway.

The length of bridge shown on the plans for the south railway approach is about thirty feet short.

The north railway approach consists of a series of deck plate girder spans on reinforced concrete towers without longitudinal bracing. This portion of the approach is 39 ft. shorter, and the top of rail at abutment is 2 ft. 3 ins. higher than called for on the official plan.

Two designs have been submitted for the north highway approach. One of these consists of the mushroom system, or flat slab construction; the other consists of plate girder spans on concrete columns.

The alternative design submitted for the north highway approach consists of a flat, reinforced concrete, continuous slab on reinforced concrete columns on a pile foundation.

We do not consider that this is a good type of construction for this location. The strength of the structure depends upon a total absence of settlement of the supports, which it is practically impossible to get in this location with the details shown. Some of the supporting piles have a load of about 45 tons, or about 20 tons per pile overload.

The length of spans of the mushroom approach and the adjoining railway approach being different, the two lines of piers, about 9 ft. apart, obstruct about 33 per cent. of the waterway.

The plate girder spans of the north railway approach follow the lines of usual practice, but the end stiffener angles of the 60-ft. spans are too light to properly transfer the end shear from the webs to the angles and bearing plates.

No lateral bracing is shown or called for on the drawings, between the bottom flanges of the 60-ft. and 80-ft. deck plate girder spans; these are required by the Dominion specifications.

No longitudinal bracing is provided between the towers to take care of the forces due to traction or suddenly stopping a train. In the drawing presented these forces cause bending in the columns and the pedestals supporting the tower, which gives tension on the one side and excessive load on the piles under the opposite side of the pedestal. These piles, without the load due