water level, except the abutments and retaining walls, which are carried on spread footings.

The bridge is designed for 40-ton cars in accordance with the specifications of the Ontario Railway and Municipal Board.

A total of $10,986.86 has been spent on bridge maintenance during the past year, as compared with $9,947.22 in 1909, and $12,347.25 in 1908. This is very satisfactory, especially when it is considered that recent annexations have

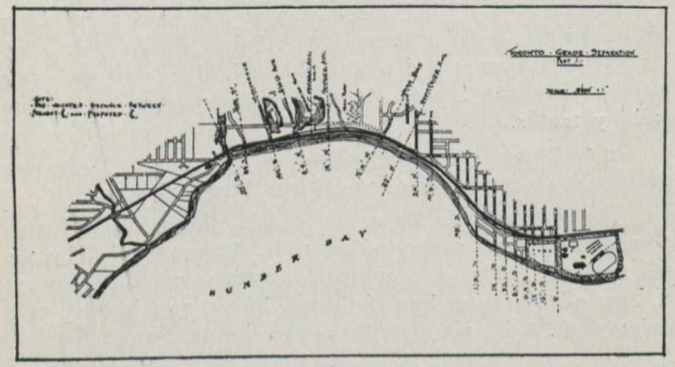

Fig. 6.

brought a number of additional bridges into the city, all of which have been in a deplorable state of repair.

THE COTEAU RAILROAD BRIDGE ACROSS THE ST. LAWRENCE RIVER.*

By Frank W. Skinner, M. Am. Soc. C.E.

The original crossing of the Grand Trunk Railway over the St. Lawrence River, about 37 miles west of Montreal, and one mile above the swift Coteau Rapids, was by a car ferry, which, in 1888, was replaced by a single-track through bridge, about 4,025 ft. long and 25 ft. clear above the water. This was built over two islands and three channels. Here the water was 23 ft. in maximum depth, with a current which at times attained 8½ miles per hour, moving over a bottom of smooth hard rock overlaid with 3 ft. to 6 ft. of cemented gravel and boulders. The river is not, however, subject to freshets, and for about seven months in the year is navigable at this point for large boats going down stream. In the spring the channel is filled with enormous quantities of heavy ice.

There were four 223-ft. spans over the south channel, ten 217-ft. spans over the middle channel, two 175-ft. and one 139-ft. fixed spans, and one 355-ft. swing span over the steamboat channel, which, as the plan shows, is adjacent to the north shore. The superstructure, weighing about 2,750 tons, had double intersection trusses with riveted connections, and was supported on 8-ft. by 24-ft. masonry piers on concrete footings, built in open wooden cofferdams, and located by measurements made on the ice.

The cofferdams for the fifteen fixed river piers were 20 ft. wide and 67 ft. long, with pointed ends and braced walls of 12-in. by 12-in. timber. They were built about a mile upstream from the bridge site, and floated to a position suspended from a pair of 24-in. by 24-in. oak beams on 20-ft. towers on the decks of a pair of barges towed by from two to five tugs. When within 800 ft. of the site, they were secured by five heavy anchors, the tugs released, and the anchor cables slacked off until the cofferdam was about 25 ft. upstream of the required position, when it was heavily loaded with steel rails and lowered nearly to the bottom by the four nine-part tackles previously used to lift it while passing through shoal water. Both anchor and suspension tackles were then simultaneously slacked to land it in exact position. The cofferdams were sunk in pits excavated to rock in about 15 days each by two dipper dredges. The swift current frequently broke the 18-in. by 20-in. oak anchor spuds of the dredges, and on one occasion overturned a cofferdam in 30 ft. of water, depositing its rail ballast in the pit.

After landing, the cofferdams were additionally loaded, and canvas curtains, previously nailed to the inner walls 2 ft. above the bottom, were unrolled and spread over the bottom by divers, who piled bags of concrete on them. Concrete was then continuously deposited by one and two-yard bottom dump-buckets and levelled 12 ft. below water-level. After it had set 48 hours, the water was pumped out in 30 minutes by an 8-in. centrifugal pump, and the masonry was built in the dry.

The fixed spans, weighing about 156 tons each, were erected on falsework on an island a mile above the bridge site, skidded on to barges, towed between the piers, and deposited on them by admission of water ballast to the barges. The bridge was put in service 10 months and 20 days after work on the substructure was commenced.

In order to provide for increased traffic and heavier loads the old superstructure was replaced in 1910 by a much heavier new one, on the same substructure, without seriously interrupting traffic. Seven of the channel spans are new, the three remaining ones being old trusses still in place. The new spans, like the old ones, were made and erected by the Dominion Bridge Company, Montreal, under the direction of Mr. Phelps Johnson, manager. The structure is riveted throughout. Its details were proportioned to take a load of two ten-wheel engines and tenders, followed by a uniform load of 5,000 lb. per foot run, but the floor-beams and stringers were also made strong enough to carry two concentrated loads of 62,000 lb. each, spaced at 7-ft. centres. The floor is of wooden ties. Guard-timbers, measuring 8 in. by 10 in., are provided. The most interestng feature of the bridge is, however, the method used to erect it and transfer it to place. A low pile falsework, 550 ft. long and 20 ft. high, was built

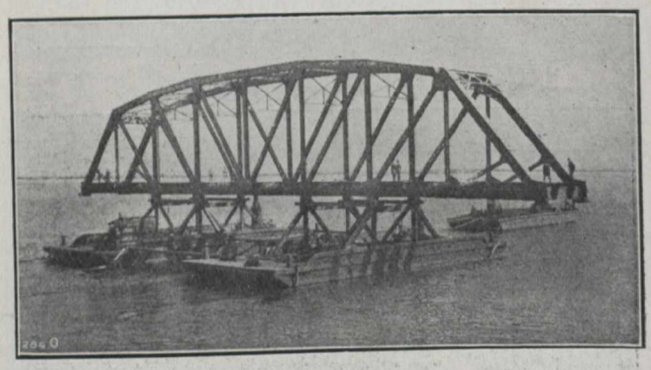

Fig. 1.

on the shore of one of the islands crossed by the bridge, and the steel, delivered from the shops alongside, was unloaded from the cars and erected on it by a travelling stiff-leg derrick moving from end to end of the falsework on a 32½-ft. gauge track on an independent falsework trestle.

The assembled spans, weighing 325 tons each, were supported at the second panel points from the ends on rollers moving on pile trestle piers about 200 ft. long, perpendicular to the erection falsework. The piers, 162 ft. apart, carried roller-tracks made of three lines of 15-in. I-beams graded down 2 per cent. towards the river end. The field-rivets

*Abstracted from an article in London "Engineering."