

CONCRETE AS MADE ON THE TRENT CANAL.*

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BEFORE beginning the paper proper, it might be well to mention when and how concrete has been utilized on the great canal works of Canada. These will be taken somewhat in the order in which they were built.

In the first enlargement of the Welland Canal, the foundations of the locks were generally made of concrete and timber. Concrete was used very extensively in foundations, when the Lachine Canal was enlarged, and also in the locks along the Ottawa River. The canals along the St. Lawrence River, between the head of the Galops Rapids and the foot of the Cornwall Canal, have concrete and timber foundations in all their locks, some of these bottoms containing as much as 2,000 cubic yards of concrete. Then the Sault Ste. Marie lock advanced concrete a step by showing its utility as a material for backing walls. It was also used in foundations and culverts at the same place. But the Soulages Canal is really the pioneer as regards concrete for walls. Here the entrance piers, (about 1,100 feet in length) at the head of the canal are made of crib-work as high as the level of low water mark. After these cribs had properly settled, a wall of concrete eight or nine feet high was built upon them. Besides being very substantial, this has proven a success and looks quite as well as masonry. When the work on this canal was let, alternative bids were asked for masonry throughout and for concrete walls faced and coped with cut stone. Which of these kinds of work will be used the writer cannot say.

This brings us to the Trent Canal structures which were built wholly of concrete, no stone work being used at all. The concrete works constructed during the season

of 1896 were on the Peterborough-Lakefield division, of which the writer has charge. This division consists of sections Nos. 1 and 2, with a firm of contractors for each section.

The work on section No. 1 consisted of one lock, and the concrete in connection with two dams which were in the course of construction across the Otonabee River, for the purpose of raising it to the proper level for navigation.

The concrete works on section No. 2 consisted of the following:—Pivot piers and abutments for two swing bridges, abutments for one high level bridge, these latter abutments being 33 feet above the bottom of the canal, concrete in connection with a pipe culvert which conducts a creek under the canal, and concrete walls in two water tight embankments.

The writer proposes to give, as briefly as possible, a description of the methods used and the precautions taken in constructing some of these works.

The specifications state that the contractors shall supply at their own cost, all plant, labor, moulds and materials necessary for the satisfactory execution and completion of the works, with the exception of the cement, which is supplied by the government.

SAND AND GRAVEL.—Extreme care was used in selecting the materials for concrete. The sand and gravel

for section No. 1 were hauled in the winter, and were not at all difficult to find, as the conical and hog's-back hills in the vicinity are formed of these materials. Yet to find them free from clay, and to get coarse, sharp and well proportioned sand caused some delay. The contractors sub-let this to the surrounding farmers and local men with teams at so much per cubic yard delivered on the works. Samples were brought to the engineer's office by these people, and it was some weeks before the proper kind of sand was obtained. The well-intentioned sub-contractor thought that what he dug out should go into his sleigh box and none be wasted. So it was necessary to put an inspector at the pit to see that earthy matter, very fine sand and clayey gravel were all rejected, as it would be much more difficult to detect these after the material had been hauled to the works.

On section No. 2 the sand and gravel were obtained in a similar way; and, as the work progressed, delivered by dump-wagons at the side of the mixing platforms. These self-dumping wagons were of advantage to the contractors for this purpose, as they carried large loads and saved delay in emptying. Hauling the material as it was required saved moving it a second time; but unless the contractor had his own teams and wagons he could not be sure of a constant supply.

The following table is the result of sifting samples from two different grits:

	Residue on 400.	R. on 900.	R. on 2,500.	Passed 2,500.
1st samp. ...	19%	51%	22%	7%
2nd samp. ...	8	42	38	12

Both of these have given good results.

CEMENT.—The cement for the season was let by contract, to be delivered in cars at the railway siding nearest the work, where it was handed over to the contractor. One of our Canadian firms, the manufacturers of the Star brand,

secured the contract, but they were not able to keep the works supplied and also satisfy the demand from outside customers. The consequence was that after a time they supplied us with the Condor and Jossion brands of Belgian cement. All cements were subjected to the following tests:—Color: the cement to be of a uniform quality and of a light gray tint, after being made into thin cakes and exposed to the air, and in no case must it show yellowish blotches. Weight: the specific gravity to be not less than 3.1. Tensile strength, per square inch of section, to be as follows: neat cement after three days 250 lbs., seven days 400 lbs., twenty-eight days 550 lbs. Fineness: All cement to be ground of such a fineness that 90% of it passes through a sieve of 10,000 holes to the square inch. Soundness: This was determined by the Fajjas apparatus. All pats when subjected to a moist heat of 110° Fahr. and warm water, to show no signs of blowing, for 24 hours after the tests were begun. All the above mentioned brands gave good satisfaction, but the Star brand was found to be more finely ground than the other cements. Unlike the other brands, it was supplied in "jute" sacks, which were found by the contractors to be more easily handled when using the mixing machine; but the writer considers that there is more waste, as a certain amount remains in the sack when emptying them. Six samples of cement were taken from each car as soon as



CONCRETE MIXER.

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