The Canadian Engineer

A weekly paper for Canadian civil engineers and contractors

PNEUMATIC CAISSON WORK ON THE PETITCODIAC RIVER BRIDGE PIERS*

DESCRIPTION OF AN UNUSUAL PIECE OF FOUNDATION WORK—VELOCITY OF RIVER, RAPID RISE OF TIDE MADE CONSTRUCTION DIFFICULT—METHODS OF CONSTRUCTION

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(Concluded from March 1st issue.)

OWING to the first attempt at launching having proved unsuccessful, the second launching was thrown forward into a period of the highest spring tides, when the velocity of current was greatest. However, since the current at the location of No. 1 pier from our observations had never shown as much velocity as at No. 2 pier, on which all the calculations were based, it was decided to proceed with the placing of the caisson. The first tide having been passed through without any trouble developing, it was thought all danger was past. On the second ebb tide, however, after the heaviest run had appeared to be over, a species of tidal wave occurred which was deflected straight across the river when it reached the old piers and caught the caisson broadside on with a heavy surge, parted the breast lines, then snapped the heavy mooring cables like pipe stems. The men on the caisson pumped for their lives to the scow moored alongside, then to the boats, and followed the wreck downstream.

Caisson Design.—In view of the fact that the probabilities were that the bearing under the cutting edge would be very uneven and that the caissons would be subjected to very severe conditions, it was decided to make the design very rigid—much more rigid than the known stresses would warrant. That this decision was prudent, it may be mentioned that the one caisson which went adrift and was tossed around on the mud flats was in perfect condition when finally placed in position. The only damage was the breaking of the 12-in. x 12-in. cross-struts inside the air chamber. These were readily renewed after air had been applied.

Starting from the bottom of the caisson, we first find a 9-in. x 5/8-in. flat plate bolted to the lower timbers and forming a shoe for the cutting edge, which was formed out of an 8-in. x 16-in. hardwood timber bevelled off on the inside. On this were laid the 12-in. x 12-in. hard pine timbers, forming the outer wall of the air chamber. The inner wall consisted of 12-in. x 12-in. vertical timbers, securely screw and drift bolted to the outer timbers with 1-inch iron in all cases and large plate washers under both head and nut. Every fourth vertical timber passed up through the roof and continued well up to low-water elevation on the inside of the cofferdam, as we shall call the portion of the caisson above the roof of the air chamber. By means of 1-inch screw bolts, every 2 feet into the outer walls, this upright timber increased the rigidity and further prevented the tendency of the various timbers to pull apart under displacement when the cofferdam was pumped out.

*Paper read before the Canadian Society of Civil Engineers, February 22nd, 1917.

The roof of the air chamber consisted of two tiers of 12-in. x 12-in. hard pine timbers placed transversely and with staggered joints. Great care was observed in securing tight joints everywhere, but more especially where the verticals passed through this roof, since there was the greatest danger of air leakage when under pressure. Heavy single-ply roofing paper was laid between the two tiers of the roof and all joints well pitched as a further precaution against leakage. Each roof timber was side-bolted to its neighbor with three 1-inch drift bolts.

Eighteen inches of 1:2:4 concrete reinforced with 1-inch rods spaced 12 inches apart, both longitudinally and transversely, was poured on top of the timber roof for additional strength and incidentally to further prevent air leakage. Another very important feature of this concrete roof was the purpose of keeping the centre of gravity as low as possible, resulting in greater stability while afloat.

The weak point in a caisson is the junction of the air chamber with the cofferdam above the roof. We consider the method adopted strengthened our work very materially. This consists, as shown by a reference to the plan, in a 12-in. x 12-in. waling timber immediately under the roof and another on top of the concrete roof, bolted every 2 feet in each direction.

Six 12-in. x 12-in. hard pine struts were placed inside the working chamber as close to the cutting edge as feasible to resist the inward pressure and six 1½-inch rods used to resist any possible outward pressure. In ordinary cases these rods are of doubtful value, but may have been of some benefit in the case of the caisson which went adrift.

Heavy roofing paper was placed between the two tiers of timber in the side walls of the air chamber as well as in the roof to prevent air leakage.

The air chamber was sheathed inside and outside and on the bottom of the roof with 3-inch planed hardwood sheathing with caulked joints.

Two threads of oakum were driven in all joints in the air chamber and well pitched.

All horizontal timbers were drift-bolted with 1-inch drift bolts, 22 inches long, every four feet.

The cofferdam consisted of a single wall of 12-in. x 12-in. timber, hard pine or white birch, half dove-tailed at corners, and drift-bolted every four feet. Six sets of 12-in. x 12-in. timbers served as transverse ties for the outer walls, the ends being dove-tailed in, and one set of longitudinals served the same purpose. At intersections, these ties were screw-bolted together.