



FIGURE 1.—SHUBENACADIE RIVER BRIDGE.

We experienced much difficulty in getting this caisson to the bed rock, having to take it about 14 ft. deeper than indicated, through a very hard tenacious material, which necessitated the use of a large quantity of dynamite. We could not make much impression on it with ordinary picks, and had to resort to drills, steel bars and explosives. However, we finally reached bed rock, and made a first-class concrete pier.

We next went over to pier 2, which is the draw pier and is located about 42 ft. from the centre of pier 1. It will readily be seen that the opening for vessels to pass is small. On pier 2 rests the small jack-knife draw. We experienced great difficulty in getting the rock under this pier level enough to receive our caisson, as at low water there was only 2½ ft. of water at one end and nearly 12½ ft. at the other. This necessitated doing some under-water drilling and blasting before bringing the caisson down. The point of location of this pier was the most difficult to do this work in, as it had to be done at extreme low water, and the lower the water the greater was the concentration of the tide. The incoming tide, in time and force, depended somewhat on the direction and force of the wind in the lower bay that would cause it to vary as much as thirty minutes between some tides. One day it came up so much before it was expected, it washed away our steam drills and tools, swamping the heavy working float that was held by heavy steel wire cables. This float came up after the tide slacked up, but the tools were never seen afterwards. There is no use trying to handle these tides during the strong run. After a hard fight and persistent effort we finally got this rock so levelled up by the use of stone and clay thrown in on the slack tide from our cable bucket, that it was possible to put this caisson in position and get enough weight on top to hold it down. This enabled us to get inside of it and level the rock, taking the caisson down through the temporary filling and making a first-class job. We filled the working chamber and completed this pier up to the coping, none of which was set, however, until the concrete was well settled.

The next pier was no. 3, and with this one we had the least trouble. This is not saying it was easy work, but we had been well drilled into the work with the others by this time, that this one seemed comparatively easy. After the experience I had with the material and location of bed rock in no. 5, I concluded I would alter the form of the cutting edge and strengthen the caissons for piers 3 and 4. This was done by putting on the outside a course of vertical timbers, 12 x 12 ins., letting them extend down about 12 ins. below the other side timbers, and bolting them through into the working chamber; putting in extra through rods, etc., etc. We got no. 3 to bed rock and filled with no more than the to be anticipated amount of trouble. This, however, was the calm before the storm. We started in on no. 4, the last of the caissons, and which was known as the "Z. I. Fowler," named after the Chief Engineer of the Midland Ry. This caisson was launched and taken down to the bridge

site in good time and without accident, getting it out into position, and leaving it about 12 ft. above the direct centre line of the bridge. We did this to enable us to put on the first lot of concrete as the flotation of the timber in the caisson was so great, and the time between the tides so short, we could not get weight enough on it in one tide to hold it down. We used two day-light tides to do this work. We put in all the concrete we wanted on the first tide, the caisson riding safely over the night tide. The next morning we located it exactly in position and were anxiously watching it settle. At this time the water was passing freely over the sand-bar directly above us; this seemed to stop instantly and the bar was exposed; this caused the water to strike the west bank of the river, concentrating the full force of the falling tide against the upstream west side of the caisson, which parted the three steel cables and forced the caisson out of position, and in five minutes it was hard aground 8 ft. out of position toward the east. All the moving cables were rigid except the broken ones. These we had to renew and the others to slack up before the tide came again to allow the caisson to rise with the incoming tide.

This it did successfully; but before we could get down to renew the broken side cables, the sand-bar had been removed, due to the presence of the caisson above it, causing a very great concentration of tide under the working chamber. This caused the structure to roll over, bottom side up, and I thought, perhaps, the concrete which had been put in would roll out, but in this I was disappointed. You will notice there are times when it does not pay to use an extra quality of concrete. I knew the caisson could be rolled back, but the same conditions would exist, and the momentum of rolling would have to be cared for. I concluded to try, as we might succeed. We put on the purchase and rolled it back, but it kept rolling. At once I decided to remove the caisson to the shore, if possible. All the cables except the inshore upstream one were cast loose and allowed to drag on the bottom, and thus steady the caisson as it flanged to the bank. It did all I anticipated it would, until the mooring gear, which was now on the under side, caught in one of the large anchors, which brought too much strain on the cable and parted it. The caisson then floated up the river on the strong flood tide, and we followed it in our yawl boats and with strong manila lines. We rowed much faster than the caisson drifted, and securing a 1,000-ft. line to a tree on shore, we rowed out to meet the caisson, and in this way navigating

it into slack water, then landing it until the returning tide, when, with the assistance of our tug boat, we took it on the early ebb tide to our building yard, there taking out the concrete, using dynamite. We then wrapped four 1½ inch steel hawsers around the caissons, two each way, and led these on shore. Putting a heavy purchase on to each, and taking the hauling parts to separate engines, we rolled the caisson back into position. Notwithstanding that this caisson had endured such hard usage, it was but very slightly damaged. We at once made the necessary repairs and prepared to get it into position, which we did with perfect success. We experienced a new difficulty in filling this crib on this caisson. Every pier put in, reducing the opening for water passage in the river, seemed to act like so many wedges, and made the current more violent in the openings. During the spring tides it seemed next to impossible to keep the new concrete from being washed away. This happened several times, and we would lose the result of a day's hard work. We finally abandoned the use of canvas and used woolen blankets. Those seemed to conform more to the concrete, and in this way we managed to get above the tide. We



FIGURE 2.—PIER 1, SHUBENACADIE RIVER BRIDGE.