

The method of placing the form and filling with grout was as follows: The barges were anchored at the leak and the overlying sand and mud first pumped off the pipe. Then to the flange coupling on the form was connected a 45-foot length of 4-inch pipe. Three rope lines were fastened to the front of the lower jaw of the form, one to the end of the closing chain and one near each side. The diver then took all three of these lines down around under the main and back up on the barge where a man was stationed at each line. Then, as the form was lowered away by the derrick with a line from the 4-inch pipe, the men took in on these lines and the lower half of the form, which dropped open when the form was picked up, was guided into place under the main. By lowering the upper half the form was closed. The piling was then set in the holes provided in the form and were driven flush with the top and the iron straps bolted over them. A jet was then put into the form through the 18-inch square openings and any mud in the form driven out and the joint thoroughly washed off. A piece of raveled, loose rope yarn was then tied securely around the leak to keep the cement

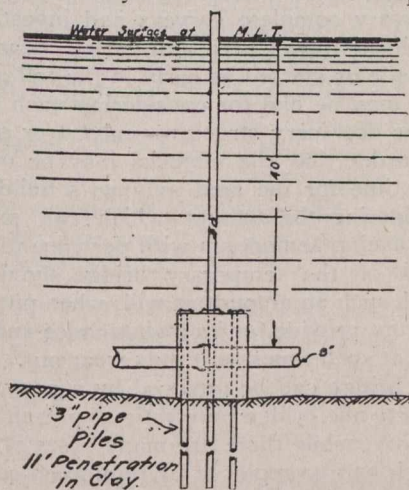


Fig. 3.—Form in Place.

from entering the main. The false forms over the ends of the form were then driven into place around the pipe and the form was ready for cement. The cement was mixed with salt water to a thickness that would just pour through a funnel into the 4-inch pipe leading down into the form. It was found necessary to pour it slowly in order to give it time to settle. Displaced water went out of the form through the holes around the piling in the top of the form. When the form was filled, the nuts on the bolts in the flange union fastened to the form were taken off and the 4-inch filling pipe removed, and the job was finished.

On the last leaks which were closed, pouring the cement through the pipe was abandoned owing to too much lost time in waiting for it to settle. The pipe, however, was still used to lower the form and to hold the form in position until piling were driven. After this it was taken off and the cement, which was mixed as thick as possible, was lowered down to the diver in buckets and poured into the form through the hole at which the pipe had connected.

Where the soft mud and silt was so bad that it could not be kept out of the form, a 4-inch centrifugal pump with a flexible suction end was used to clean out the form after it was in place and all closed, the mud being pumped out through the cement filling hole while a jet alongside stirred it up. In the work of closing these leaks it was found necessary to have the pipe and inside of the form absolutely clean, so that the cement would adhere to the

pipe. It was found necessary to take the form off the first leak and do the work all over again, as mud had been pocketed in the grout.

When repairs were completed, all cement was allowed to set a week. About 40 pounds of air pressure was then put on the main and kept on for over an hour. During this time not a single air bubble could be seen and the water meter showed the leaks had been stopped.

Four leaks were repaired and the entire work was executed in about four weeks, including the time of assembling plant, dredging, building forms, etc. By actual time a form was lowered and fastened around the pipe in forty-five minutes. To close the false end gates of the form required fifty minutes. To drive the piles required from one to one and a half hours, depending on how hard the driving was. To mix the cement and fill the form required one hour and fifteen minutes. The total cost of the repair work, closing four leaks, was \$2,300.

CARE OF RAILWAY BRIDGES.*

BRIDGE work is a perpetual and continuous job like track and all other classes of railroad work, but the kind and amount of the different varieties of the work changes with the seasons. In the winter surveys should be completed and plans made for future work, and maintenance should be kept up at the least possible expense. Light construction work should be dropped while heavy construction work on abutments, piers, and mass concrete can be pushed to advantage, especially in localities where the ice is strong enough to be of assistance in handling the work, and also where low water is necessary.

In the spring all bridges should be closely inspected and the necessary repairs ordered. Various methods for making inspections are in vogue. The general inspection may be annual or semi-annual, and be added to by periodical local inspections. When semi-annual, the fall inspection is made with a view of seeing that everything is in shape for the winter and to decide on the construction or heavy maintenance work to be considered and investigated for the next season's operations, while the spring inspection is for the purpose of planning and starting the work to be done in the immediate future.

On many roads the bridge engineer makes the general inspection of the large bridges and permanent work, while the inspection of the smaller temporary or wooden structures is left to the local officers. On at least one of the large western roads this process is reversed and the bridge engineer inspects the temporary structures yearly, leaving the permanent structures for the local officers. Possibly it would be well for bridge engineers to combine the two methods and inspect all bridges.

The maintenance and construction forces should be built up and work started as early in the spring as possible so that the beginning of summer will see the work well under way. All pile drivers, machinery and tools should be overhauled and repaired; material ordered, delivered and unloaded, and complete preparations made so that once work is started it can be pushed ahead without delay. A definite programme in the delivery of material to each bridge or each job of work should be outlined and insisted on so that there need be no delays waiting for material; and it should be so arranged that gangs can fully complete each job and then go to the next job without any delay.

*Railway Age Gazette.