Reinforced Concrete Pipe Sewers in St. Joseph, Mo.

A harbor line has recently been established along the Missouri River front in St. Joseph, Mo., 175 to 375 ft. outside of the old main bank of the river. The Union Terminal R. R., of St. Joseph, is filling in this strip of land, which was 20 to 30 ft. below the river bank, for a distance of 5,300 ft., thus reclaiming about 35 acres. Several of the main sewers of the city discharged into the river at different points along the strip that is being filled, and had to be extended to the harbor line. The first work that was done in reclaiming the low land was to build a dike of piles along the harbor line and cross dikes from it to the shore. The dike on the harbor line consists of three rows of heavy timber piling in bents of three piles each, the bents being inclined upstream. The bents are heavily cross-braced and the whole dike is braced by top and bottom longitudinal stringers to each row of piles. The cross dikes are built of two rows of piles, similarly braced, the piles in the rows being staggered. The dikes were built to catch and deposit in the low area back of the harbor line some of the extremely large amount of silt carried by the river. More than 1,000,000 cu. yd. of material were deposited back of the harbor line in less than a year after the dikes were started in March, 1905. The remaining 900,000 cu. yd. necessary to complete the fill to 8 ft. above high water line is being deposited by centrifugal dredges, which pump sand from the river channel into the space surrounded by the dikes.

The cross dikes were built on the lines of the sewers which had to be extended across the area that is being reclaimed. Four of these sewers, a 36-in., a 42-in., a 48-in. and a 72-in., have been extended with reinforced-concrete pipe, built in 3-ft. sections on the river bank and then laid in place. The pipe was made by the Reinforced Concrete Pipe Co., of Jackson, Mich., and in order to be absolutely certain to secure good results the same company also took the contract for laying the pipe. The extensions were laid on transverse timbers carried by the lower longitudinal stringers on the rows of piles in the cross dikes. These transverse timbers are spaced 18 in. on centers, so each 3-ft. pipe section is supported at two points. At the time the extensions were made, the deposit of sand over the area enclosed by the dikes had not been raised to the timbers carrying the pipes, so the latter had to be carried entirely by the timber structure.

THE ENGINEERING RECORD.

As the current in the river has a velocity of at least 8 ft. a second during floods, even inside of the dikes, the pipes had to be built to withstand this current until the fill is made around them by the dredges with the sand from the river.

The extension had to be made during the winter and finished before the spring floods occurred in the river in order to avoid blocking the sewers with the silt which would be deposited back of the dikes during these floods. Tents were set up on the river bank as close as convenient to the land ends of the cross dikes on which the pipe extensions were made. The concrete was mixed and the pipe sections were made and cured in these tents, the temperature in the latter being maintained well above freezing by coke fires in salamanders. The pipes were all made in the regular forms of the Reinforced Concrete Pipe Co. The thickness of wall for the various sizes is 4 in. for the 36-in., 4 1/2 in. for the 42-in., 5 in. for the 48-in., and 7 in. for the 72-in. pipe. Each pipe section is reinforced longitudinally by five bars, except the 72-in. pipe, which has seven longitudinal bars. Each section is also reinforced by two transverse circular bands, one placed 9 in. from each end of the section.

The thickness of one end of each section is reduced by a rectangular rebate, and by a beveled edge, both extending around the circumference. The other end is correspondingly flanged so that when the several sections are laid in position, the contact by entrance of one end to the other gives a smooth surface on the inside and leaves a uniform groove on the outside at the joints of the assembled sections. The longitudinal reinforcing bars in each section protrude with hooked ends into the rebated space which forms the outside groove when two sections are placed together in position. The sections are then interlocked by a tie-band which passes completely around the sections in the grooves at the joint and through the hooked ends of the longitudinal reinforcing bars. After the sections had been thus interlocked, the joint was girdled, except for some 20 in. on the top, with a galvanized iron shield. The outer surfaces were wet thoroughly, and the groove completely filled by pouring it with 1 1/2 Portland cement mortar, mixed with 25 per cent. water. The joint was protected from freezing immediately after pouring by a burlap wrapper filled with straw and manure.

In the process of manufacturing the pipe, a bottom plate of cast iron is used, shaped so as to give the flanged or receiving end of the pipe section. The core defining the inside diameter of the section is assembled in four sections of
rolled sheet steel on the upper and inner flange of the cast-iron plate; the longitudinal reinforcing bars are inserted in receiving sockets in the plate and the outer case is then added on the lower and outer flange. The reinforcing bars are held in place at the top by space clips. The circular reinforcing bands are slot-punched, so as to receive and accommodate the longitudinal bars when the bands are put in place, as the process of making is followed. The concrete is shoveled into this form in very small quantities and the tamping is continuous, with the result that there are no layers or creases in the finished pipe. The concrete used in this work was composed of 1 part American Portland cement, 2 parts river sand, and 3 parts crushed limestone; the latter being a mixture of two grades, ranging from pea-size to 1 in. in diameter. The resulting concrete was exceptionally dense. Although the first pipe was made Dec. 20, last, and the sewage was turned into the extensions on Feb. 16, there has been no cracking or settlement of the extensions, nor has there been any leakage at the joints. The method of making and laying the reinforced-concrete pipe produces an unusually smooth and uniform cross-section with perfectly tight joints, as may be seen in the accompanying illustrations.

Mr. S. W. Fox, chief engineer of Union Terminal R. R. Co., of St. Joseph, Mo., made the plans for the reclamation of the area back of the harbor line and is supervising their execution. The Reinforced Concrete Pipe Co., of Jackson, Mich., not only took the contract for building the pipe, but also for laying it, with the exception of the 36-in. pipe, which was laid by the forces of the railroad company. Mr. Wm. H. Floyd, Jr., is city engineer of St. Joseph.