Solving a Sewer Problem in Richmond, Indiana

A Neat Sewer Constructed with Vitrified Tile Invert and Concrete Super-Structure

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A problem of some interest arose in Richmond, Ind., when it became necessary for the city to extend a trunk sewer from its terminus at the corporation line to a disposal plant about one-half mile distant. The trunk sewer was of 54-inch equivalent diameter and carried the combined sanitary and storm drainage from an area of approximately 150 acres. The sewer terminated in an overflow manhole from which the storm water during heavy rains overflowed into a natural dry watercourse. The dry-weather flow was conducted through a 15-inch vitrified pipe from the overflow manhole to the disposal plant.

The construction of the overflow manhole was such that the inlet to the 15-inch pipe was directly opposite that of the outlet of the 54-inch trunk sewer. This faulty construction allowed the sand and gravel which entered the sewers from street inlets to be carried into the 15-inch pipe. Inasmuch as the sewer was laid on a grade of 0.0025, the washing of sand into it constantly gave trouble by stoppage. When this occurred, the raw sewage overflowed into the open ditch, creating a most unhealthful condition.

To overcome this situation, the city ordered plans made for continuing the trunk sewer to the disposal plant, and the construction of a better-designed overflow manhole.

Design

A sewer of 66 inches diameter was decided upon as being adequate to carry the storm flow for all future needs. The problem then resolved itself into selecting a shape of sewer line which would give the maximum velocity for the dry-weather flow, that is, a velocity which would be self-cleansing. The grade at the disposal plant being fixed, the slope of the new sewers had to coincide with the old. By observation, it was found that the present normal flow in dry weather did not fill the 15-inch pipe half-full. Consequently, a dry-weather flow which would half fill a 15-inch pipe was used for computing velocities.

Computations were made to determine the comparative difference in velocity of that volume flowing in a 15-inch channel pipe and
Figures Used As Basis Of Design

Construction Procedure

The contractor's procedure of construction is of interest. The excavation was in a shallow cut and was done by teams and slip scoops, the fine grading being done by hand. Concrete mixed in the proportion of 1:2:4 was then deposited in two layers at the bottom of the trench. Upon the first layer, mesh reinforcing rolled to the required diameter was placed, while upon or into the second layer a 15-inch vitrified channel pipe was embedded. The line and grade for these pipes were controlled by an overhead line attached to "Tee" boards.

One hundred linear feet of half-circle Blaw steel forms were used, one-half being used for the invert and one-half for the arch. The invert forms were placed directly upon the channel pipe line and braced. The reinforcing mesh was pulled and held into its proper position while concrete of wet consistency was poured and spaded into place. The arch forms were moved ahead on rollers onto each previous day's invert and poured.

Gravel was hauled and piled at regular intervals close to the work. The average wheel for concrete was about 125 feet. A gasoline-driven Jaeger mixer was used for the concrete.

Following is a table showing the labor hours required for the average performance of the different operations:

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<th>Labor Hours</th>
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| Fine grading by hand | 0.30  
| Laying 12-inch channel pipe and placing mesh reinforcing | 0.14  
| Setting forms, including moving, etc. | 0.70  
| Pouring concrete, including wheelers, shovels, and finishers | 1.79  
| **Total per linear foot** | **2.98**  

Inasmuch as the comparative velocity values would remain constant regardless of the value used for "n," and as it was the opinion that a glazed vitrified channel pipe would give as low a value as concrete, Figure 2 was adopted. With this information and a knowledge that the excavation was one suitable for monolithic concrete construction, the design shown in Figure 3 was evolved.