Letter to the Editor

INCRUSTATION IN VANCOUVER SEWER PIPE

Sir,—The City of Vancouver began to use machinemade concrete pipe in the year 1909, and up to the end of 1917 had laid probably over ten miles of this class of sewer pipe in sizes from 8 to 30 inches in diameter. The specification upon which the contract for the supply of this pipe was based was as follows :—

"All cement concrete pipe supplied under this contract shall be the very best of machine tamped pipe manufactured. They shall be composed of a mixture of portland cement and fine crushed granite, or portland cement and Sufficient clean, coarse, sharp sand or fine gravel. clean water is to be used in the mixture to insure its thorough hydration. The inside or the wearing surface of the pipe shall be trowelled by the use of a revolving metal core until it presents a polished or glazed appearance. The pipes must be capable of withstanding an inside hydraulic pressure of thirty pounds per square inch for fifteen minutes, and pipe when placed in an upright position and filled with water must be sufficiently non-porous to retain ninety-five per cent. of the water for twenty-four hours. Each pipe must not be less than two feet in length, and of not less than the following thicknesses : 4-inch, 3/4-inch ; 6-inch, 7/8-inch; 8-inch, 1-inch; 10-inch, 11/8-inch; 12-inch, 14-inch; over 12-inch, not less than one-eighth of their diameter. Pipes 18 inches in diameter and under are to have spigot and socket joints, similar to those specified in Clause 11 for clay pipe; those over 18 inches in diameter, grooved and tongued joints of approved pattern."



Fig. 1—Sample of Incrustation on Inner Surface of Vancouver Sewer Pipe—Natural Size

No stipulation was made as to the proportions of the materials entering into the construction of the pipe, as it was considered best that the manufacturers should be responsible for their product. It is however known that the proportion of cement in the pipes hereinafter described was not less than one of cement to three of aggregate, though the manufacturers afterwards made pipe which they claimed to be of superior quality, with the proportion of one of cement to five of aggregate.

In the year 1915 some pipe of 12 and 14 inches in diameter, which had been laid in 1913 as temporary outlets pending the construction of a trunk sewer, was taken up and found to be so fragile that it was impossible to use it for relaying elsewhere. This led to an examination of other sewers, but as the small sizes could only be looked into where they entered large trunk sewers, a more thorough examination was confined to sizes over 20 inches in diameter.

The conditions found in two sewers, one of 24 inches laid in 1910, and carrying combined sewage from a residential section, and one of 27 inches, laid in 1909, carrying storm water only, are here described.

For examina-

tion of the 24-inch sewer the sewage was blocked off and pumped from a manhole into an adjoining sewer on another system. Two lines of firehose were used to flush the sewer, which had a grade of one per cent., and a rope was floated down by which a small bogie carrying the observer was pulled through the sewer, the hose being kept running.



Fig. 2—Sample of Concrete from Vancouver Sewer Pipe, Magnified Two Diameters—Black Areas Indicate Voids

Previous observation on large defective pipe, and examination from the trunk sewers of some small sized pipe which showed a stalactitic deposit on the crown, caused attention to be directed at first to the crown of the sewer. It had only been entered a short distance when the bogie jammed through the piling up of material in front of the wheels, and the observer had to be pulled back.

The sewer maintenance foreman then volunteered to go through the sewer without keeping the hose running, so as to locate and remove the obstruction. In the dry sewer it was seen that the obstruction was not caused by sand or road debris left in it, but that on each side of the sewer at the level of the ordinary dry flow, about four inches above the invert, there was a thick incrustation of material which looked very much like lime mortar, and that the wheels of the bogie broke this material and formed the obstruction. It was also found that in spite of the prolonged flushing in the endeavor to cleanse the sewer for examination, paper and sewage still adhered to the rough edges of this incrustation.

A 27-inch sewer carrying storm water only was then examined, and similar conditions found; so that it was evident that the incrustation was not caused by sewage. Many other sewers of the same class of pipe were examined, and it was found that the presence of this incrustation was most marked where the pressure of ground water was most evident. In one sewer where the pipes had been laid in tunnel and covered with coarse concrete, incrustation was only found at one or two joints; and in sewers built of concrete in situ, the same thing applied, the continuous scale on the water line of the sewer being peculiar to the machine-made pipe.

The sewer maintenance foreman had often told the writer that the concrete pipe sewers took longer to flush clean than the vitrified pipe sewers; and if incrustation of the character herein 'described is general in the smaller sizes, the reason is obvious. In the 24-inch pipe carrying sewage, the obstruction to flow was most marked. This