

## SIZES, MATERIALS AND SHAPES OF SEWERS IN THE CITY OF HAMILTON.\*

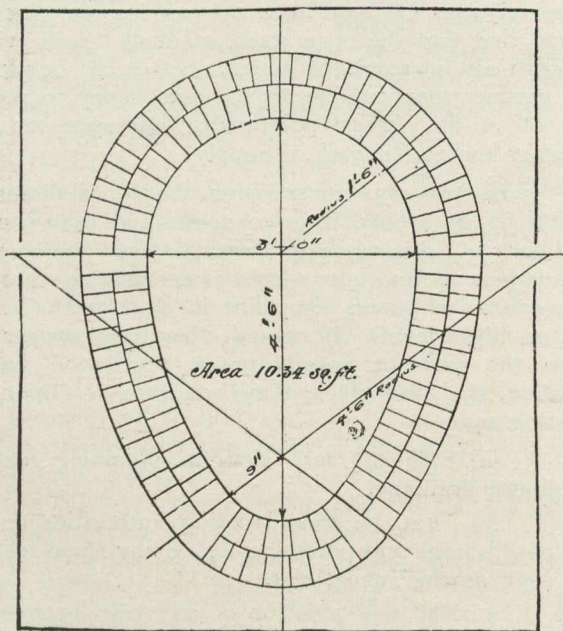
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It is at times interesting and profitable, especially for the municipal engineer, to take a peep backward into the early history of a city and carefully examine and consider the character of the engineering works constructed at the commencement of its existence, and then follow step by step the various changes in designs and materials which have taken place from time to time in accordance with the advancement made in engineering knowledge.

The object of this paper is not to give an account of the sewerage system of Hamilton, which would take more time than is at present at my disposal, but to describe the various forms and materials of sewers which have been introduced from time to time pointing out any defects which have been discovered, and stating also the cost of each particular class.

The first sewers built in Hamilton were commenced in the year 1852 and completed in 1857. They consisted of egg-shaped brick sewers, and were about  $3\frac{1}{2}$  miles in length. (At the present time there are 83 miles of sewers in Hamilton).

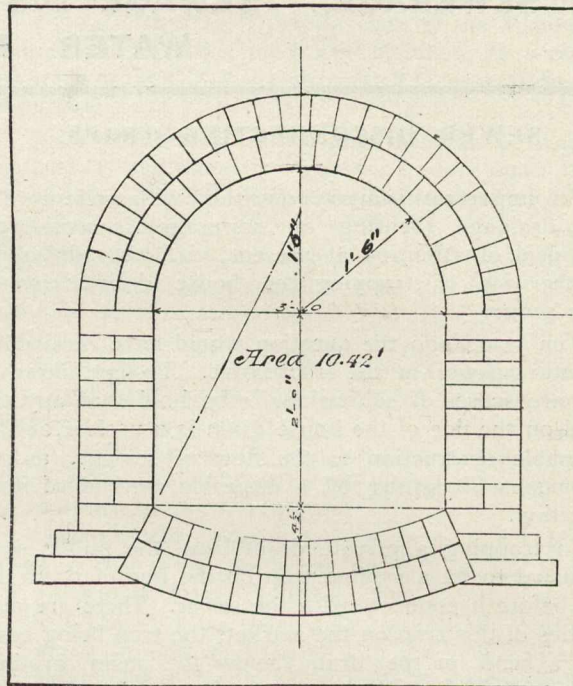
These brick sewers were mostly 4' 6" by 3' 0", as shown on the accompanying drawing. A small portion at the lower end was 5' 6" by 4' 3". The sewers on James and Catharine Streets were of the same size and area throughout their entire length, and of late years have become gorged at the lower parts and were totally inadequate to take storm waters. There is no record of how the size and area of these sewers was determined. The higher part is unnecessarily large and the lower part too small. They were built of brick with ordinary lime mortar. The top part, or crown of these sewers, as also the sides, are now in a good state of preservation, but the invert has been worn away and has had to be constantly repaired.



It is probable that the smooth surfaces now presented by cement walks and permanent roadways were not taken into consideration when the sewers were designed, and it is likely also that the higher parts were made large so as to admit of the passage of men through them.

\*Read before the Ontario Land Surveyors.

The advantage claimed for the oviform shaped sewer is its adaptability for varying flows; i.e., when there is only a small flow the invert of an egg-shaped sewer gives the necessary scour and keeps the sewers cleaner than a round or a wall-sided sewer. Evidently the wearing at the bottom of this class of sewer calls for a harder material than ordinary sewer brick.



It is really wonderful, however, how well the top and sides of these sewers are preserved, being now 60 years old. It has been necessary to relieve these sewers by overflow sewers, and still, during extraordinary rainfall, they are occasionally gorged. The cost of these sewers was \$5.10 per foot, and their average depth 13 feet.

The next form of sewer was what is called the wall-sided, and was introduced into the system by Mr. Haskins, City Engineer. The first sewer of this class was built in 1889 and formed the trunk sewer for the west end district. The egg shape form was discarded because the ordinary flow was fairly uniform and copious, and the inequality of flow for which an egg-shaped sewer is particularly suitable was not present in this case, and by the adoption of the new form a cheaper sewer could be built and the wear of the invert on the egg-shape sewer avoided. This sewer cost \$5.01 per foot, and was about 12 feet 6 inches deep. It is in a good state of preservation, and the invert is not worn to any appreciable extent. Water lime was the cementing material used.

Vitrified pipe sewers were first laid in 1877, and the joints were made with clay. It was found that the roots of trees, especially the poplar, got into the sewer through these joints and clogged them. There was also a large leakage of sewage at these parts. The above defects led to the introduction of cement joints in the year 1895.

No vitrified pipe sewer larger than 24 inches has been laid in this city, and many engineers consider 15 inches as the largest size they would recommend.

The first concrete sewer was built in 1905 on Sanford Avenue, and was circular in form and 3 feet in diameter. It was composed of one part of cement, 3 parts sand, and 5 parts gravel. The lower two-thirds of the sewer was built in moulds placed in the trench, and the remaining part was constructed above ground in two-foot lengths.