

HISTORY OF TAR-CONCRETE PAVEMENTS IN ONTARIO.*

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Tar-concrete, or more popularly, "tar-macadam" pavements have been in service in several cities of Ontario, Canada, for a number of years, and the history of the earlier of these, while not accompanied by all desirable data, presents features of interest, in view of the growing use of bituminous materials for country highways.

Reference has, from time to time, been made in the technical press to the tar-concrete pavements of Hamilton, Ont., and it is the purpose of this paper to include also the experience of Toronto, Ont., London and other cities. In all cases the pavements have been laid by the mixing process, and coal gas tar (supposedly) was employed.

The beginning of tar-concrete roadways in Ontario was in the year 1880, when the Gas Company of Hamilton laid a short section (Mulberry Street) about 1,300 square yards, in that city. No further work of this class was done until 1891, when the same company laid 2,983 square yards at a contract price of \$1.50 per yard; and in 1893 another area of 3,768 square yards was laid at a contract price of \$1.75 per yard. Experience with these roadways was such that, in 1899 when a considerable extent of old cedar block pavement needed renewal, "tar macadam" was selected and about ten miles of roadway were built of that material.

Hamilton.—The following is the specification under which the later pavements (since 1899) were laid in Hamilton:—

(1) "All earth or other material above the sub-grade shall be excavated, so as to conform to the level of the sub-grade, which will be twelve inches below the finished surface of the roadway; and should the sub-grade be above the level of the natural ground, then earth shall be deposited until the level of the sub-grade is reached. The sub-grade shall be shaped to the profile and cross-section which will be furnished by the city engineer.

(2) "After the sub-grade has been formed to the proper camber of the road, generally one-half inch per foot, or six inches for a 24-foot roadway, to be thoroughly rolled with the steam roller, and if by this means soft spots are revealed, they shall be filled with good solid material.

(3) "The first six inches shall be made in the ordinary way for a macadam or telford roadway thoroughly rolled. If so required it may be made of hard broken stone, furnace clinkers, or brick rolled smooth and finished to the required camber of the road. Upon this shall be placed the tarred stone. The first layer, three inches of hand-broken stone to pass through a 2-inch ring, then a 2-inch layer of machine-broken stone; the whole smoothed off with a hand roller, and after top dressing is applied, thoroughly rolled with a steam roller. On this a layer of fine gravel and quarry clippings, mixed in equal proportions, three-quarters inch thick, shall be placed, and well rolled in so as to fill all interstices. Before finishing, a dressing of stone screenings, for the purpose of coloring, shall be scattered broadcast to be worked in by the traffic. All layers, including the coloring layer, shall be thoroughly compacted by rolling.

(4) "The stone to be tarred shall, if moist, be heated on an iron floor, under which are flues from a fire, until the moisture is driven out. The material in its heated state is then thoroughly mixed with a sufficient quantity of tar.

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The broken stone in warm weather may be sun-dried, but in all cases the finer course must be artificially dried. At the same time care must be taken not to get this material too hot. The tar should be boiled in iron kettles holding one hundred imperial gallons. Eight imperial gallons should be added to each cubic yard of the coarser material or more if required to completely cover the stone, and seventeen to eighteen gallons to the finer kind of stone.

(5) "The tar must be pure coal tar free from all foreign substances, and containing not more than 5 per cent. of water, and shall contain upon analysis not less than 56 per cent. pitch.

(6) "The work must be done in the summer months, and all work must be suspended during wet weather."

The tar-concrete was used to replace cedar block pavement, and the preliminary work consisted in the removal of the old cedar blocks. As these were ten inches in depth, it was necessary to remove two inches of sand upon which they were placed, to make room for the twelve inches of macadam, and bring it to the proper elevation with respect to the curb.

The cedar blocks and surplus sand having been removed, the sub-grade was thoroughly rolled with a 15-ton steam roller.

Care was taken in forming the sub-grade, and in laying each layer of stone, to bring the surface in each case parallel to the finished crown of the roadway. The first six-inch foundation course, referred to in section 3 of the specification, was made up of flat stones, from 6 to 12 inches in greatest dimension, laid roughly by hand on their natural beds. On this, smaller stones were placed and broken into the interstices, so as to keep the bottom course in place.

The next two courses of tarred stone were then applied. Large kettles were hung close to the work, and in them the tar was kept at a workable temperature. Convenient to the kettles, the stone to be tarred was placed on mixing boards. With a dipper attached to a wooden handle, the tar was then applied to the stone, being scattered over it by a swinging motion of the dipper.

With shovels kept hot to facilitate the work, the stone was turned over twice after the first application of tar. More tar was then scattered over the stone, and the stone again turned over. These operations of tarring and turning the stone were repeated until each stone was seen to have a coating of tar, there being no bare spots on the stone. One part of tar to 22 parts of stone was specified for this course.

As soon as the stone had been tarred, it was shovelled into wheelbarrows, placed on the road to the desired depth, and raked to the required cross-section. It was found of advantage to roll the tarred stone immediately after being placed on the road, since, if left two or three days, it would not consolidate as perfectly.

The top course of fine tarred gravel was mixed in the proportion of about 20 gallons of tar to one cubic yard of gravel; or one part of tar to 8 or 9 parts of gravel. The gravel, before mixing, was screened through a $\frac{3}{4}$ -inch mesh. This material was prepared in an asphalt mixer, being brought hot to the road, and carefully raked to the required grade and cross-section. This having been rolled, stone screenings from the crusher were scattered over the surface to harden it, and improve the appearance.

The cost of the various pavements varied considerably. In 1899 the average was about 79 cents a square yard, but labor then cost 15 cents an hour, and coal tar f.o.b. Hamilton \$2.60 per barrel (50 U.S. gallons). The average in 1900 advanced to about 88 cents a square yard; with labor at 17 cents an hour and coal tar at \$3.75 a barrel. With the