

WESTON ROAD CONCRETE PAVEMENT

BY E. A. JAMES

Chief Engineer, Toronto and York Roads Commission

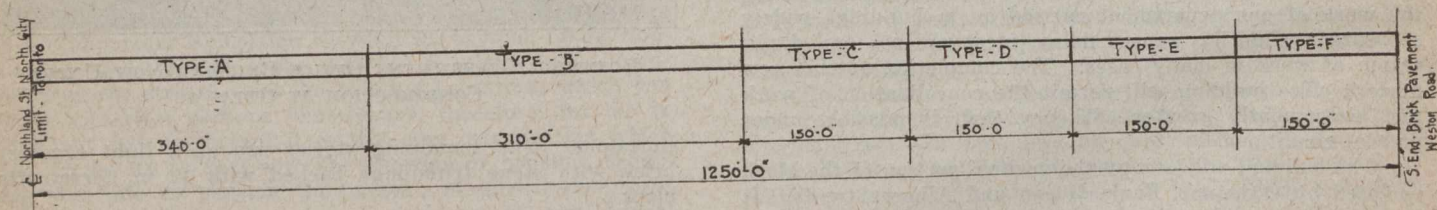
IN 1911 the Toronto and York Roads Commission built two miles of concrete pavement on the Lake Shore Road, but because of the necessity for a wider and a relocated pavement, it was replaced in 1917.

When the paving program for 1918 on roads under our jurisdiction was under consideration, it was decided to pave a section of the Weston Road, immediately adjoining the city of Toronto, with concrete. Having in mind that other sections of this system are so located as to traffic, subsoil and availability of material as to make concrete a suitable road material, it was decided to build sixteen different types of pavement so that we might be in a position to judge as to which, if any, would be suitable for future work.

A traffic census was taken, and the average spread over several weeks may briefly be summed as follows. The traffic census per hour from six in the morning to nine at night gives the following average:—

Bicycles, 7; horse-drawn vehicles, 34; motorcycles, 1; automobiles, 44; and motor trucks, 15.

A study of the drawings accompanying this article will indicate that the types of pavement selected were used with a view to determining the most suitable section, the best shape for the surface of the sub-soil, and the proper location of the reinforcement if such were found necessary.



PLAN SHOWING LOCATION OF DIFFERENT TYPES LAID IN EXPERIMENTAL ROAD

The total length of the pavement is approximately 1,250 ft., and this was divided into six sections, located as shown in the accompanying plan. The width throughout was made 22 ft., and the surface was given a crown of 2 in. The grades were light, the minimum being 0.08 per cent. and the maximum, 0.38 per cent. Little trouble was experienced with drainage, as open ditches were easily located which were carried to a manhole midway in the section paved, and from there to a suitable outlet.

Expansion joints were constructed at right angles to the centre line at intervals of 25 ft. and 30 ft., depending upon whether the contractor was able to lay 50 ft. or 60 ft. in the day's run. In two sections a longitudinal expansion joint was also used.

In every case the expansion joint consisted of two thicknesses of three-ply, tarred, roofing felt, built up so as to make a joint about $\frac{1}{4}$ in. thick and extending high enough that the felt frayed out over the joint.

Clauses From Specifications

The following clauses in the specification indicate the method of construction and the character of material used:—

1.—*Portland Cement*.—The cement must be a well-known brand of Portland Cement, and shall meet the requirement and tests of the Canadian Society of Civil Engineers.

2.—*Fine Aggregate*.—The fine aggregate shall consist of any material of siliceous, granitic or igneous origin, free from mica in excess of five per cent., and other impurities, uniformly graded, the particles ranging in size from $\frac{1}{4}$ in. down to that which will pass a No. 100 standard sieve.

3.—*Course Aggregate*.—The coarse aggregate shall be sound, broken trap rock, or granite having a specific gravity of not less than 2.6. It shall be free from all foreign matter, uniformly graded, and shall range in size from $\frac{1}{4}$ in. up, the largest particle not to exceed in any dimension one and a quarter inches.

4.—*Natural Mixed Aggregates*.—Natural mixed aggregates shall not be used as they come from deposits, but shall be screened and re-mixed to agree with the proportions hereinafter specified.

5.—*Water*.—Water shall be clean, free from oil, acid, alkali, or vegetable matter.

7.—*Preparation*.—The sub-grade shall be brought to a firm and unyielding surface by rolling with a self-propelled roller weighing not less than five tons; all portions of the sub-grade inaccessible to the roller shall be thoroughly compacted by hand tamping, to the satisfaction of the engineer, and shall be puddled if the engineer considers the same necessary. All soft and spongy places shall be removed and all depressions shall be filled with gravel, broken stone, or other material approved by the engineer, and shall be thoroughly compacted in layers, each of which shall not exceed four inches in thickness. When a fill exceeding one foot in thickness is required to bring the sub-grade to the proper elevation, it shall be made in a manner satisfactory to the engineer.

8.—*Sub-base*.—Should it be necessary to build a sub-base, the same shall consist of clean hard material not exceeding four inches in the largest dimension. All materials for this purpose shall be approved by the engineer. The sub-base shall be thoroughly compacted and brought to the proper elevation as before specified.

9.—*Wetting*.—While being compacted, the material of the sub-base shall be kept moist and the surface shall be in that condition when the concrete is deposited.

10.—*Drainage*.—Proper provision shall be made for the removal of ground water. Under drains shall consist of not less than 4-in. tile drain. The bottom of the drain shall be at least twelve inches below the crown of the sub-grade. Outlets and lateral blind drains shall be provided as indicated by the engineer.

12.—*Proportions*.—The densest possible mixture of the material making up the concrete is desirable. In order to produce such a dense mixture the voids in the fine and coarse aggregates shall be determined. The cement shall overfill voids in the fine aggregate by at least five per cent. and the mortar shall overfill the voids in the coarse aggregate by at least ten per cent. When the voids are not determined, the concrete shall be mixed no leaner than the proportion of 1 cu. ft. of Portland cement, $1\frac{1}{2}$ cu. ft. of fine aggregate, and three cubic feet of coarse aggregate. The concrete when mixed under field conditions in the proportions decided upon shall give a compressive strength of at least 1,500 pounds per square inch at the end of twenty-eight days.

13.—*Mixing*.—The ingredients of the concrete shall be thoroughly mixed, sufficient water being added to obtain the desired consistency, and the mixing continued until the materials are uniformly coated with cement and each particle of the coarse aggregate is thoroughly coated with mortar.

Where a mechanical concrete mixer is used, the materials must be proportioned dry, then deposited in the mixer all at the same time. The mixer must produce a concrete of uniform consistency and color, with the stones thoroughly mixed with water, sand and cement.

14.—*Consistency*.—The materials shall be mixed wet enough to produce a concrete of a consistency that will flush readily under light tamping, but which can be handled without causing a separation of the coarse aggregate from the mortar.