

The defects are:—

(a) Slipperiness under certain conditions of the atmosphere.

(b) Disintegration if excessively sprinkled or otherwise subjected to constant moisture (although asphaltum is impervious and insoluble in either fresh or salt water).

(c) Tendencies to become soft under traffic in extreme heat and to present a wavy surface, and under extreme cold it may crack and become friable.

(d) Unsuitability for steep grades.

Asphalt Macadam.—It is proposed to use this form of construction on streets where the traffic is not quite so heavy as would be on asphalt pavement, and with the same foundation course, viz., concrete. It takes the place of sheet asphalt on grades steeper than 5 per cent.

The most common type of asphalt macadam roadway is laid on a Telford base, this base consisting of stones about 8 inches thick, laid on edge. The course on top of the concrete base, or the Telford base, whichever is decided upon, is composed of stone from $1\frac{1}{4}$ inches to $\frac{3}{8}$ of an inch, mixed with bitumen in its melted condition. From 17 to 20 gallons of bitumen will be used to each cubic yard of stone, thus covering completely each particle.*

This mixture is then laid on the concrete to a depth, after rolling, of not less than 3 inches. Before rolling, a grit course of clean stone screenings is spread over the surface in such quantity as will cover and fill the voids in the surface. The excess of this grit course is then removed and the road swept clean, and over the surface a squeegee coat of bitumen is applied, using about $\frac{1}{2}$ gallon per square yard. Over this again is spread the excess of screenings which was previously removed, to correct the stickiness of the bitumen. The road is then well rolled, until the screenings are bonded with the bitumen of the squeegee coat.

Asphalt and Stone Blocks.—This refers to work on streets where street cars are running. Asphalt has already been dealt with, while, as formerly stated, it is considered necessary to have stone blocks for the full width of the track allowance, and 18 inches outside on both sides. Several of the streets at present have sheet asphalt or some other bituminous mixture in the track allowance with, in some cases, only one or two courses of blocks outside. This, it is contended, is poor construction, as with the continued vibration of the rails, the sheet asphalt soon becomes disintegrated and crumbles to pieces, causing holes adjoining the rails and consequent danger to vehicular traffic. While stone blocks are not perfect, owing to surface drainage difficulties, they are preferable to asphalt, and failures in the blocks can be easily and rapidly repaired.

Another form of construction in the track allowance is solid concrete. This has been used with considerable success in Montreal.

Asphalt Macadam and Stone Blocks.—This is practically the same form of construction as described for asphalt macadam and asphalt with stone blocks, it, of course, being understood that sheet asphalt macadam is introduced for vehicular traffic on a grade with a concrete base for heavy traffic and, as already described, with a Telford base for traffic of a somewhat lighter nature.

Concrete.—Concrete for roads is somewhat of a modern idea, but so far seems to have been very successful and with proper care, particularly in drainage, there

is no apparent reason why construction of this nature should not be successful. It will be necessary to reinforce this concrete and also provide transverse expansion joints about 50 feet apart. The surface of the road might well be painted with some bituminous mixture, and afterwards sprinkled with sand, all tending to give a good surface.

Macadam Tar Painted.—This type of roadway will be built on the principles laid down by that well-known Scotchman, Thomas London Macadam, and not by some of the modernized versions of them. It is considered that many of the residential streets in the city, where traffic is light, should be macadamized. Where a foundation course is necessary a Telford base, as already described, should be put in. However, in numerous cases in the city it is not necessary to build a foundation course, some streets having had a good stone foundation course for years, in which cases all that is required is that this old foundation course be trimmed off to the proper convexity, then stone to pass through a 2-inch ring be laid to a depth of 5 inches. It should be then thoroughly blinded with gravel and a little clay, watered and thoroughly rolled. This is admittedly a cheap form of construction and suitable for light traffic in residential districts, and it is submitted that this form of construction is most suitable for a very large number of streets in the city of Ottawa.

The control and prevention of dust on this class of road is one which should have very serious and careful consideration, and particularly in view of the automobile traffic which in all likelihood will develop. Dust has always been a feature of macadam roads, being at the same time the result of use and a check upon excessive wear. Prior to the introduction of automobiles, dust was considered as nothing more or less than a nuisance; to-day, however, the existence of macadam roads depends upon the retention of the road dust formed by the wearing of the surface. It has been found from experience that the broad pneumatic tires of heavy automobiles driven at high speeds draw out by suction the small particles which bind the material of a macadamized road, with the result that the road soon disintegrates.

Various methods are in use for preventing or reducing dust, amongst which might be mentioned sprinkling with fresh or salt water, a mixture of water and calcium chloride, oil emulsion, and impregnating or surfacing with crude oils or coal tar products. The writer has tried all these methods and has come to the conclusion that good tar, properly applied, is the cheapest and best dust preventative and preservative of macadam roads, being both effective and durable. The quality of the tar is very important. If it is heated too much, and refined to too great a degree, it becomes brittle and makes black dust. If not sufficiently refined, and the light oils taken off, it will disintegrate.

Before tarring a road surface the weather should be warm, to be favorable; and the road thoroughly brushed and cleaned. The tar should be heated to its boiling point at convenient positions on the works, and should be applied as hot as possible, so that it may flow freely. Immediately on application the liquid tar should be brushed in so far as necessary to ensure regularity in the thickness of the coating.

The quantity of tar required will vary according to the physical conditions of the road, but generally, in the case of a road to be treated with tar for the first time, the quantity should be one gallon to coat from 5 to 7 superficial yards.

*The mixing will be done at the city's asphalt plant.