kind and quantity of the bituminous material used, the character of the aggregate and the type of construction employed. Type A: Using an aggregate of one size crusher run stone mixed 1.5 gals. of bituminous material per square yard of 2-in. wearing surface and a flush coat of 0.75 gals. per square yard, the cost varies from 25 to 35 cents in excess of water-bound macadam. Types B and C: The cost of pavements with mineral aggregates of broken stone and sand, with or without other fine material, varies from $1 to $2.25 per square yard including the foundation course and light grading.

**Cleansing and Watering.**—Bituminous surfaces and bituminous concrete pavements constructed on highways outside built up districts when subjected to considerable motor car traffic are found to remain clean and practically free from dust. When subjected to excessive horse-drawn vehicle traffic in suburban or urban districts, the practice of periodical flushing at night has proved efficacious. Sprinkling with water bituminous surfaces and bituminous concrete pavements is universally condemned as tending to shorten the life of pavements and as being characteristic of uneconomical administration of street cleaning.

## THE RAILWAY TIE SITUATION IN EASTERN CANADA.

By E. S. Clements,

The timber supply in Canada is by no means extraordinarily large. From the best information regarding the forests of Canada as a whole, the standing timber totals about one hundred and twenty billion cubic feet, or about fifteen thousand cubic feet per inhabitant, based on the present population. Merely as a matter of comparison, there are in the United States about five hundred billion cubic feet of standing timber, or about six thousand cubic feet per inhabitant.

So that there is only one-fourth as much available merchantable timber in Canada as in the United States, even though there is about 2½ times as much available timber per inhabitant in Canada as in the United States. It must also be considered that to a large extent the timber standing in Canada is quite small, and the amount of merchantable timber per square mile is not very great, particularly in northern forests. This explains the fact that while there are extensive forest areas in Canada, much larger than the present standing forest areas in the United States, relatively there is not the supply of timber in Canada that there is in the United States.

In the eastern portion of Canada the wooded areas along the lakes and the St. Lawrence River have been practically cut off. Lumbering operations in the territory near the lakes and the St. Lawrence River stopped some years ago. The lumber cut off was mostly white pine, but the forests have been pretty thoroughly cut up where they could be reached from the stream.

The principal lumber supplies now for Eastern Canada are the Georgian Bay district, the north shore of Lake Superior and the Ottawa River district. Mills in these sections are cutting Norway pine, spruce, hemlock, tamarack and jack pine. These are the principal woods so far as lumbering operations are concerned. They are what are called workable woods at the present time. There is, however, a large amount of hard wood, particularly in the territory which has been logged over. There is a good deal of hard wood available in the territory between Georgian Bay and the mouth of the Ottawa River, and between the Ottawa River and the lake. This timber has not been cut to any extent. The principal hard woods in this territory are birch, beech and maple. There is practically no oak.

There were 13,683,700 cross-ties purchased in Canada in 1911. The timber at present being used is cedar, spruce, tamarack, hemlock, jack pine.

There is, as stated before, hard wood available, but it is of such a character that it will rot very quickly in the track unless previously treated. The timber at present used is, of course, of a softer and weaker character, and in order to get stronger timber some of the railways have imported long-leaf hard yellow pine ties from southern United States. The native woods which are used, excepting cedar, have a life averaging, say, seven years. Some of the woods, like jack pine, have less life than this. Under the present requirements of speed and load, these woods cut very quickly, and it is difficult to hold the track to gauge. This, of course, can be remedied by the use of tie plates, but the woods, excepting cedar, are very short lived and it does not pay to use the tie plates. The ties themselves rot nearly as quickly as they wear out.

A good, sound cedar tie is a most satisfactory railway tie for lighter loads. It gives a long life under light traffic conditions, and is most economical. For heavy traffic conditions and high speed, however, the cedar tie does not make a safe track, even with tie plates. As an example, the Michigan Central Railroad, on its main line, has found it absolutely necessary, as a matter of providing safe track for its high speed heavy trains, to abandon the use of cedar ties. Furthermore, for the railways located in Eastern Canada, generally speaking the cedar tie is becoming somewhat scarce and the quality available has deteriorated very materially. Consequently the Canadian railways have, in the effort to make safe tracks, imported hard pine ties from the United States, even going so far as to import yellow pine ties from Louisiana, hauling these ties 1,500 miles. It is, therefore, of great importance to note that there are hard woods available in Canada at present which, when properly treated with creosote oil, will give most satisfactory results as well as being economical.

Beech, when sound, is stronger than white oak It is very much stronger in compression across the grain than is white oak. Creosoted beech ties which have been used on the Big Four Railway in the United States for over eight years under comparatively heavy traffic show very little rail wear. The most important information as to the use of creosote in beech ties comes from France. Creosoted beech ties in that country give from twenty to thirty years' service. Creosoted beech ties have also been used on the Prussian States Railway in Germany.

The birch tie also lends itself to preservation. Its sap wood can be penetrated thoroughly. There were put in on the New York Central Railway about 1,100 birch ties treated experimentally at Shirley, Indiana, about seven years ago. These ties are at present sound, and their appearance is such that the New York Central Railway has started a campaign to get all the birch ties possible in the Adirondack territory.

Maple ties, that is the hard maple, compares favorably with beech. The sap wood can be thoroughly penetrated with creosote. Of the other woods the jack pine is the most permanent so far as creosoting is concerned. This wood being softer, it is imperative that large tie plates be used. If it is not done the ties will be rail cut long before they begin to decay.

The old English railway tracking practice was to inject from eight to ten pounds of creosote oil per cubic foot of wood. Results from this were such that Baltic fir ties (a soft