used as the basis for contending that highway improvements might properly be financed by a tax upon gasoline used for motor purposes. A tax of this nature would be somewhat difficult to collect. Each province would require that the owners of garages and gasoline supply depots give affidavits as to the amount of gasoline received by them and sold to the public for motor purposes. However, owing to the extraordinary increase in the price of gasoline within the last year there is no doubt that a tax of this nature would not be very popular with our Canadian motorists. As a measure of alleviation of the rising cost of gasoline, it has been suggested that the provincial governments should take over the control of purchases and sales of all gasoline used for motor purposes. As "The Nation" (N.Y.) puts it: "Why not one fluid more? Why not the one fluid that makes the motor world go round, whose very drops are the touch of nature which makes the whole world spin?" If the tax on gasoline could be collected without too much trouble and expense, it would be a very fair means of arriving at the amount of service which motorists receive from a provincial highway system, and of reimbursing the public for the amount of wear and tear caused to highways by motor vehicles.

Expenditure per Mile to be Covered

With regard to the amount of expenditure per mile of road that a debenture issue is to cover, it may be said that, providing the actual tonnage of traffic now using the road as well as the approximate increase of traffic that will result from the improvement is known, the justifiable expenditure can be quite readily determined. All that is required is a calculation based upon the actual differences in the cost of hauling one ton for one mile over the various classes of roads. For instance, supposing the difference between the cost of hauling one ton for one mile is 10 cents greater over an ordinary earth road than over an improved gravel road, or in other words that there is a saving of 10 cents per ton mile in hauling over the gravel road; and that there is a daily traffic of only 5 tons amounting in a year of 300 working days to 1,500 tons. The result is clearly a gain of $150 in the cost of hauling over this mile during the year. Now, suppose you capitalize this annual saving with interest at the low rate of 5%, and assume that such a saving continues for twenty years, then the amount of highway expenditure that is economically justifiable on this mile is $3,000. On the same basis there might properly be expended on a road carrying a daily traffic of 50 tons the sum of $30,000, and so on according to the traffic. Hence it would appear that the traffic a road is required to sustain is the determining factor in the amount of expenditure to be made thereon and of the amount of debentures required for any given stretch of road.

Marketing Highway Debentures

In conclusion, I might briefly touch on the question of the best way to sell highway debentures. Owing to the prevailing high rates of interest, it is desirable to sell an issue as cheaply as possible. This, of course, is usually done by asking for competitive bids, but there is a further consideration in connection with highway expenditures—namely, as to the desirability of offering debentures of this character to the public as a worthy enterprise that should be taken up and promoted from the standpoint of patriotism and the general public interest. While Canadians are prone to smile at some of the so-called amendments to the constitutions of some of the American states owing to their having relation to matters of essentially passing importance, there is this much to be said for an amendment to a state constitution proposing a debenture issue for highway purposes, that the public become informed as to the nature of the benefits accruing from improved highway conditions; and a lively interest is secured in promoting the welfare of the country in this regard. Our provinces are not in a position to amend their constitution periodically by popular vote. However, there is no good reason when debentures for highway purposes are being floated, that an active campaign should not be instituted to help in selling them, setting forth the expected benefits to be derived from the expenditure proposed and urging popular support to the debentures on the duel grounds of patriotism and good business.

ASPHALTIC CONCRETE PAVEMENTS

(Continued from page 544)

just as good wear as a concrete road and is a very pleasant type of pavement to look at. It harmonizes with the surroundings. You do not have those ugly cracks staggering all over the road and staring you in the face, and you have a road that is very desirable for automobile traffic, not too slippery for horse-drawn traffic and one that, as I said before, will last and give you the service, as has been proved.

In our part of the country, we have kept very close watch on paving costs, and, judging from our experience, the roads that stand out as the most economical for ordinary traffic, not for the very heavy motor truck traffic that exists between cities on some roads, but for roads accommodating from ten to sixteen thousand automobiles a day, mostly passenger cars and a few motor trucks, those that are the most economical to build and maintain are of asphaltic concrete. The concrete truck road gives service and does not require very extensive repairs, but it costs much more to build it, and it does not prove to be so economical as the other type.

Service Test Road in Philadelphia

I was asked to say a word or two about the service test road built in Philadelphia in 1912, consisting of twenty-eight different types of construction. This was very conscientiously maintained until the United States got into the war. One section was asphaltic concrete laid cold, that is an asphalt cut back and mixed in the plant and then hauled out to the road, laid cold and rolled. It is a very satisfactory type of road for ordinary park motor traffic, but it is not so good as the hot asphaltic concrete and will not stand heavy motor traffic. A number of different types were put on this road without considering whether they were types of pavement suitable for the particular traffic existing there, and in analyzing the results obtained, if one style of pavement did not last in that section of road in which it was laid, it should not be condemned. They were analyzed according to the traffic they will stand. The roads that stood up the best were of brick. They are there to-day, and have not had one cent of repair, but they cost twice as much to construct as the concrete and asphaltic concrete. One section of the asphaltic concrete, coming under the specification I have just noted, of 55-60% of stone passing through a 1½-in. or 1¼-in. grade and 7½% of asphalt, has not had any repair. Another section of the road, with the same specification, had only cost two cents a yard, on an average to maintain for seven years. The pavement laid with the smaller stone, the so-called Topeka pavement, has cost only five or six cents a yard to maintain for the same period of years. All the pavements stood up with practically no repairs until the fall of 1917. Up to that time the traffic was the ordinary motor truck traffic with a larger percentage of passenger cars. When we got very active in the war, that particular road was part of the Lincoln Highway and was the main motor truck road to New York and Philadelphia. There were then streams of motor trucks passing over it day after day. And when that started, all the sections laid by the penetration method failed. The traffic was too heavy for them. They were not intended for the heavy pounding of motor trucks. As I say, up to 1917, when this extraordinary motor traffic began all the different types of pavement stood up well, including the macadam with surface treatment, but when

(Concluded on page 561)