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# Construction of Water-Bound Macadam Roads

**How To Prevent Their Destruction By Modern Automobile Traffic Proves a Serious Problem for the Highway Officials of Quebec Province—Translation of Paper Read in French Before the Canadian Good Roads Association**

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SINCE the inception of the good roads movement in Canada, macadam has been the type of pavement most generally adopted. The paving methods of Macadam and Tresseillet had acquired great popularity in Europe, and, like a good many other progressive ideas, soon drew the attention of the American nations.

It did not take long for the provincial governments (at least for the Quebec government) to grasp the opportunity offered by this type of pavement for the betterment of rural roads in Canada. In this province the proposition was rapidly thought out, and was developed at a rate of approximately 400 miles per annum, since 1913. The Province of Quebec owns, at the present time, approximately 2,500 miles of macadamized and gravel roads. The pace does not seem to diminish, but a new problem, somewhat difficult and full of unknown factors, presents itself. It is that of up-keep of water-bound macadam.

The extraordinary development of commerce, industry and agriculture in the last twenty-five years have naturally revolutionized the transportation methods considered sufficient up to that time. It was considered sufficient up to that time to maintain the exchange of merchandise and of movement of traffic. At present, however, industry is becoming decentralized, spreading out around the cities and reaching even the small country villages. The distributor wishes to cover with his goods the largest possible area in the minimum length of time. Intensive and up-to-date farming necessitates the immediate distribution of farm products to the cities. The railways, excellent as they are for transportation in large quantities, do not provide a sufficiently detailed distribution.

The whole of commercial life has seized the advantage offered by the development of the automobile and auto truck industry to enlarge the radius of its businesses, and to add to pleasure trips. This entails boundless competition. As soon as good roads are developed and multiplied, truck traffic increases in density, and speed craze appears. Passenger automobiles ply between Montreal and Quebec, and are now reducing the time necessary for the same trip by railway.

### Cannot Carry Heavy Traffic

The strength of water-bound macadam is not sufficient to bear the heavy loads, which seem to increase endlessly. The blows of auto tires running at 35 or 40 miles an hour, tear out the surface stones and leave voids which promptly grow larger. Against these multiplied factors of disintegration, it seems as though macadam will have to be given up on most highways. A good many efforts have been made to solve the practical problem of the up-keep. None of the proposed solutions have been entirely satisfactory. This is so much the case that, in engineering circles, one no longer hears anything but concrete, bituminous macadam, bithulithic and Warren pavements, etc. All these pavements have deserved the somewhat pompous title of "Superior Pavements." They are indicated from every point of view on main highways, and in the vicinity of cities, but on account of their very high first cost they are not suitable for roads of purely local importance. All the roads which serve as tributories of the main highways, towards farms and villages, come in this latter class, and as the provincial government, which controls paving programs, is much interested in the welfare of the farmers, it is practically certain that at least 50% of the mileage that will be constructed will be water-bound macadam.

### Estimate of Annual Cost

Even if one leaves out all the factors of preference and if one considers good roads as a purely economical problem, the kind of construction that will be adopted under certain given conditions will depend on the annual expense for up-keep for the different kinds of pavement proposed. That is to say, the yearly interest on the capital to be expended, the yearly cost of up-keep and sinking fund. Taking for example a concrete pavement costing $20,000 a mile, with probable up-keep expenditure of $75 per mile per year, and a sinking fund period of, say, thirty years, interest being figured at 5%, and comparing this with a water-bound macadam whose first cost would be $7,000 a mile, and up-keep cost of $300 per mile per year, with a sinking fund period of ten years, interest rates being the same in both cases, a little calculation shows us that the yearly cost of delivery of the concrete road will be $1,376 a mile and that of water-bound macadam $1,206 a mile, showing a difference of $170 per mile per year in favor of water-bound macadam.

Under such conditions as outlined above, macadam should in every case receive favorable consideration as against concrete. This logic cannot be side-tracked, but a difficult problem is to arrive at the proper factors which vary widely both as to yearly up-keep and as to sinking fund period. Figures which statistics and experience seem to favor to-day as a rational basis for estimates will in a few years be replaced by others widely different because at that time the traffic conditions will have changed and construction methods will be much improved. However, the proposition remains the same, and although certain factors of the problem may change, the theory will remain the same. We can foresee the capitalization as based on the present data will favor water-bound macadam for roads of local importance, and that a good many milions will yet be expended to extend and complete the system of macadam roads in the Province of Quebec.

We know, also, that considerable sums will have to be put aside for the up-keep of these macadam roads. Under these circumstances we may be sure that the provincial and municipal authorities will give a good deal of attention to this type of construction, and the engineers of the Department of Roads of Quebec are working towards a more perfect solution of the problem of construction and up-keep of water-bound macadam. Our climatic conditions and the nature of the available materials differ so widely from those of Europe that although European countries are ahead of