

A road of what may be called natural surfacing, if left for even a week during the summer season without attention, loses all its features of a good road. It must be constantly patrolled, all holes in it which have worn must be filled, all weak spots which develop must be repaired within a few hours after discovery or the road will so rapidly degenerate that it is useless as an "improved."

The higher types of roadway may be left for varying periods of time without attention, and while this results in the end in being a more expensive method of treatment it is only a loss of money. You still have the road which may be repaired, but if you attempt this sort of treatment upon the cheap surface you eventually lose your highway entirely.

My experience is that a patrolman with a horse and cart, an efficient drag or hone, and the willingness to work, will keep in almost perfect condition from 5 to 7 miles of cheaply constructed roadway, at an approximate cost of from \$175 to \$200 per mile. Given the same mileage of the higher types of road, he will require a helper, a much larger equipment, and if working upon bituminous roads probably not less than \$150 per mile for material in the way of bitumen, crushed stone, etc.

The average cost of maintenance upon the higher types of road including the use of a blanket treatment once in two years will not be less than \$500 per mile, and in many instances it will greatly exceed this. On the expensive road also you are constantly facing the fact that within a reasonable number of years you must re-surface at a cost approximating \$6,000 a mile, while upon your cheaper road, if properly patrolled, you will find that the surface material is thicker than it was at the time the road was built, and has been in practically perfect condition during the entire period.

If the dust nuisance upon the cheaper road becomes intolerable it may be alleviated greatly and practically removed by the application of light bituminous oils or tars. The objection of this treatment, however, is the tendency on the part of a patrolman to allow the road to get out of section by neglecting to drag it after every rain, as he does not wish to destroy the skin coating on top, which is left after the treatment. The cost of this treatment adds about \$150 per mile to the cost of maintenance and on the whole is not as satisfactory for light travel in its final results as adhering to the use of the natural soil and the regular treatment by dragging.

Road problems may be roughly divided into four subdivisions, and their order of importance is about as follows: Drainage, alignment, grade and surfacing. It is unfortunate that to most people the latter is more important, while relatively it is of far less importance than the other three. The surfacing material is frequently considered paramount and the settling of the question as to whether you have a bituminous road, penetration method or mixing, a concrete road, or a pavement type is the main subject of discussion, and with far more attention given to it than it rightly deserves.

The drainage, alignment and the change of grade are permanent features. The surfacing can never be permanent. I have sometimes wondered whether a bond issue to be paid for by posterity should ever be expended on any feature that is not permanent.

Concededly, surfacing of all kinds will require not only constant maintenance but rebuilding. With the essentials fully attended to, it is surprising how the surfacing may be maintained at a comparatively small cost. I believe that it is as necessary for us to turn our attention to the economic side of the road question as to the

scientific. A highway must have an economic road rental, as well as a fixed road maintenance, and wherever the actual cost plus its maintenance exceeds its rental value we are wasting money in building too expensive a road. We must so adjust the scales that our costs are such as to provide a roadway for the traffic at the least possible expense.

PROGRESS ON THE PACIFIC GREAT EASTERN RAILWAY.

In the recent report of Mr. F. C. Gamble, chief engineer of the Department of Public Works, to Hon. Thomas Taylor, Minister of Railways, it is stated that track laying on the Pacific Great Eastern will likely reach the Fraser River at Lillooet, 120 miles from Squamish, early in January, unless work is impeded by exceptionally heavy snow falls. The rails are already laid from Squamish to the Lillooet River, in Pemberton Meadows, a distance of about 58 miles. Thence it will be continued over that river on a temporary bridge to Anderson Creek. This bridge is necessary while the Federal Government is deciding whether the Lillooet River shall be crossed by a movable or fixed span.

Between Lillooet River and Anderson Lake, a distance of about 28 miles, there will be two truss bridges, one over Owl Creek, with 100-foot span, and the other over Birkenhead River, with 125-foot span, besides small trestles. These two streams, however, may be crossed by temporary bridges to hasten the track to Anderson Lake, which it is expected will be reached this month.

The track having reached the latter point, timber for the trestles along the lake, which are for the most part small, will be put into the water and towed to the different sites, and erected ahead of the track. From the south end of Anderson Lake to the Fraser River there will be several small bridges.

Between Squamish and Pemberton Meadows there are 39,877 lineal feet of side tracks and sidings. These are laid in the Squamish yards and at various points up to Pemberton. The track, to within nine miles of Pemberton, is in excellent shape. There are steam shovels at work in the ballast pit near Squamish.

Of interest at this time is the completion, at the Canadian Locomotive Company's works, Kingston, Ont., of two oil-burning locomotives for the new line. Each locomotive, weighing 190,000 pounds without tender, has four driving axles, the driving wheels being 57 inches in diameter. The cylinders are 22 x 28 in. and are operated by Walshaert valve gearing. The steam will have a working pressure of 180 pounds per square inch, the locomotive being equipped with a Schmidt superheater adding about 250 degrees superheat. Other characteristic features of the locomotives are flexible boiler stay bolts, radial buffers between engines and tenders, and turbo-generator set supplying power for head-light and other lights.

WELLAND CANAL CONSTRUCTION.

Expenditures totalling about \$6,000,000 have been made on the Welland Canal work this season (described in *The Canadian Engineer* for November 5th, 1914). The contracts for sections 1, 2, 3 and 5 are reported about one-quarter completed. Together they total over \$20,000,000. The sections still to be contracted for will not be let until the existing contracts have advanced considerably further. Nearly 3,000 men are at work.