

manent, the average annual cost of maintenance, say, \$50,000, at the end of that period would be practically eliminated and the needs of every district amply served.

Although on first consideration such an undertaking would appear to be stupendous and financially impossible for any ordinary municipality, the issues at stake are so serious, and the necessities so imperative as not only to deserve mature consideration but also to demand prompt action. Permanent initial construction is the proper policy for any municipal or government authorities to adopt. Municipal bodies are active in the permanent road policy, but unfortunately the action is not concerted enough and the results are therefore disappointing and ineffective.

The proper administration of highways is a prominent feature of road economics which has not had the earnest consideration locally which its great importance deserves. In view of the increasingly urgent demands for the opening up of new roads for settlers, and the improvement of existing residential roads, a municipality should not altogether be saddled with either the construction or the maintenance of through highways. Such roads and the roads to which they link up should be under a highway commission, composed of engineers and representatives of some more permanent public bodies, such as is in vogue in England and in portions of Eastern Canada and United States. The adoption of such an administration would assuredly make for uniformity and continuity of construction, and result in a more even and equitable assessment of expenditures involved.

The provincial governments appear to be alive to the situation and have adopted progressive permanent measures in their road construction policy. Financial assistance is now given chiefly for permanent work, and, locally, Burnaby and South Vancouver have reason to be grateful for the material assistance received in the permanent paving of Kingsway.

There are many other interesting and important features associated with the question of semi-permanent and permanent roads and pavements, but the above remarks may serve to prove that progress towards the better highway and the better street, in which we are all so intimately interested, must be along lines that are utilitarian, logical and aesthetic, and further, that the wish for a more permanent highway will be visionary until the need for it is created and its claims urged upon the powers that be.

* The total value of the sales of sewer pipe in 1911 statistics as contained in the annual report on Mineral Production of Canada by John McLeish, B.A., was \$812,716, as compared with a value of \$774,110 in 1910, and a value of \$645,722 in 1909. Nearly 50 per cent. of the production in 1911 was made in Ontario. Following is a list of firms that reported production of sewer pipe in 1911: Standard Drain Pipe Company, St. Johns, Que., and New Glasgow, N.S.; Ontario Sewer Pipe Company, Toronto, Ont.; Dominion Sewer Pipe Company, Toronto, Ont.; Hamilton and Toronto Sewer Pipe Company, Limited, Hamilton, Ont.; Clayburn Company, Limited, B.C.; British Columbia Pottery Company, Victoria, B.C. The imports of drain pipe and sewer pipe during the calendar year 1911 were valued at \$382,929, of which \$338,644 worth was imported from the United States, \$44,278 from Great Britain, and \$7 from other countries. The production of drain tile as reported was not as large in 1911 as in 1910 or 1909. The total sales in 1911 were valued at \$339,812, as against \$370,008 in 1910, and \$408,440 in 1909.

FOREST DEVELOPMENT AND PRESERVATION.*

By R. H. Campbell, Esq., Director of Forestry, Ottawa.

IN considering the forest and its development, it is necessary to have clearly fixed in our minds the fact that the forest is a living thing, and that it grows and develops according to natural laws. In order to understand the forest, therefore, it is necessary to study the habits of life of the tree. The four great requirements for tree life are water, light, air and soil. The tree carries on its functions of life and growth very much in the same way as animals do. One of the great differences, however, is that the tree is in a fixed position and therefore cannot go to find its food or requirements where they may be. It is therefore necessary for it to adapt itself to the conditions as they exist where it is located. We will look at the materials which the tree requires for its growth, and then consider some of the adaptations that are necessary so that the tree may make use of them.

Water is the most important constituent for the use of the tree. The tree is continually drawing up from the earth through its roots, large quantities of water which pass up from the trunk and are exhaled from its leaves. In order to keep the tree in a healthy condition this flow of water must be kept constant, and the more freely the water passes through the tree the more vigorous will be its growth. We see this very clearly by following different characteristics of the tree growth in different portions of the Dominion. On the coast of British Columbia, in a moist climate, the growth of the tree is very vigorous and we have the immense Douglas firs and cedars that form one of the most magnificent forests in Canada. In the forests of the Selkirk Mountains in the central part of British Columbia where the rainfall is still heavy, there is a vigorous growth of white pine, cedar and fir. In the dry belt in the province of British Columbia, the mountains which receive the most of the precipitation are covered with a dense forest of lodgepole pine and fir, but in the lower portion of the dry district, where the rainfall is scanty, the forest thins out and there is a scattered growth of yellow pine. In the prairie country the Rocky Mountains carry a stand of lodgepole pine, Englemann's spruce and fir, which is more or less of a mountainous character, and therefore not so large in size as the forests of the Selkirk Mountains or the coast of British Columbia. The reason for this is that ascending the mountains or going northward in latitude the soil is cold for a longer period during the year, and this has a considerable effect on the rate of growth of the trees.

The trees are not directly affected by the lowness of the temperature, as some specimens of trees are found growing in the barren lands to the north, away beyond the general line of tree growth. The effect of the cold is, however, to keep the ground frozen for a great portion of the year, and therefore to prevent the tree from obtaining a supply of water with the result that it cannot continue its functions. In the muskegs of the north country the trees are very slow in growth and stunted. This is partly the result of the fact that the ground is kept very cold by the covering of moss, and therefore the growth is slow, but it is also partly due to the fact that there is considerable acid in the water of the muskegs and consequently

*Read at the Seventh Annual Meeting of the Association of Dominion Land Surveyors, Ottawa, March 5th, 1913.