

## EARTH AND GRAVEL ROADS.\*

By Robert C. Terrell.†

Earth roads must be well drained and properly crowned, in order to be serviceable at all times. The maintenance of a road thus constructed is comparatively easy and not very expensive if the work is done at the proper time, but good drainage is very costly, if not altogether impossible, unless the road is properly located. A road, in order to be properly drained, must have the proper longitudinal grade; a minimum grade of  $\frac{1}{2}$  of 1 per cent., with a maximum grade, generally, of 5 per cent. The minimum grade is necessary in order to give the side ditches the proper amount of fall to carry the water quickly away from the road. Side ditches should never be made deep and narrow. If extra drainage is necessary, roads should be undertaken by use of tile or by excavating a deep ditch and filling with large stones. Where roads are located along side hills a ditch should be dug on the upper side sufficient to take all the water coming down the hill. Where the grade exceeds 5 per cent., the ditch should be paved with stone and the water should be carried under the road from the upper side at short intervals and disposed of.

If the road has been properly located and properly drained, the point of most importance is the crown; the parabola form is the best, having a centre elevation equal to  $\frac{1}{24}$  of the width of the road. Frequent causes of mudholes are the unevenness in the texture of the soil and the combining of vegetable matter with the soil while working the roads; this vegetable matter holds water, thus damaging the surface. In no case should stone be piled into a mudhole, as it only forms a rough and unsatisfactory surface and permits the formation of mudholes at either end from the impact of loaded vehicles. The road, however, can be successfully repaired by the removing of the softer soils, or soils containing vegetable matters, and replacing with clay, or soil of the same consistency as the remaining portions of the road, and by removing the shade, so that the sun may have free access to that portion of the road.

Earth roads should have their principal working in the spring of the year when the soils will work most readily and will have time to become consolidated before the fall rains begin. A scraping-grader drawn by a traction engine will do excellent work in giving a road sufficient crown. The earth removed from side ditches should not be thrown into the centre of the road.

In the construction of the gravel road, beginning with the sub-grade, it is probably best to open the trench to receive the gravel, giving it the same crown or cross section as the finished roadbed should have, which should be a parabola, with the centre height equal to  $\frac{1}{40}$  of the width of the road. Gravels containing clay or sand, or even loam, not exceeding 20 per cent. of the entire quantity, make excellent road material and will bind or compact very readily. After the gravel has been properly placed on the sub-grade it should be thoroughly sprinkled and rolled. In western Kentucky gravel roads cost approximately \$1,000 per mile. In eastern Kentucky the cost is slightly higher.

In my opinion the maintenance of earth and gravel roads will never be effectively accomplished until we receive government aid for all post roads and until every road becomes a post road. I do not mean, however, by "government aid"

that the government shall bear the entire or major portion of the expense of constructing and maintaining roads, but that the government will merely assist in the construction and maintenance of roads to such an extent as will enable the government to direct the local authorities how the work must be done before the federal aid is available, and then that these roads be put under direct government inspection by making each and every rural mail carrier the inspector of his route, reporting deficiencies in the road as they occur to the local authorities and to make reports to the federal government once each month as to the condition of the road.

## CANADA IMPORTS MUCH CLAY.

Canada's clay imports are classified by the department of customs under three main subdivisions: clays, brick and tile, and earthenware and chinaware, and their total value is shown as \$5,156,544, or 62 per cent. of the domestic production, in the annual report of Mr. J. McLeish, B.A., chief of the division of mineral resources and statistics. The imports of clays in 1911 were valued at \$270,247, and included chiefly china clay and fire clay, with a small quantity of pipe clay, and others clays not classified. The value of china clay imports was \$125,768, and of fire clay, \$125,199.

The imports of these clays have varied considerably from year to year, and do not show the same general increase as do the imports of manufactured clays. The imports classified under brick and tile were valued in 1911 at \$2,369,761, of which about 34 per cent. was firebrick, other important items being building brick, sewer pipe, and paving brick.

There was also an importation under this class of manufactures of clay not specifically designated, valued at \$523,998. The imports of these "unclassified" brick and tile have increased steadily year by year, the value of such imports in 1905 having been only \$20,804. The total imports of brick and tile in 1910 were valued at \$1,755,773, showing an increase in 1911 of about 35 per cent.

The imports of earthenware and chinaware, of which the most important class is tableware, were valued in 1911 at \$2,516,536, as against \$2,283,116, an increase of about 10 per cent.

There is also a considerable annual importation of "chalk, china or cornwall stone, cliff stone and feldspar, fluorspar, magnesite ground or unground," much of which is no doubt used in connection with the manufacture of clay products.

The value of these imports during 1911 was \$147,640; of which \$90,119 was from the United States, \$54,548 from Great Britain, and \$2,973 from other countries. The value of the imports under this item during the calendar year 1910 was \$121,959.

There is also an annual importation of "baths, bath tubs, basins, closets, lavatories, urinals, sinks, and laundry tubs of any material," the value of such imports during 1911 being \$285,847, as compared with \$262,667 during the year 1910.

Imported clay products are derived chiefly from Great Britain, and the United States, although considerable quantities of earthenware, china, and porcelain ware, white granite or ironstoneware, etc., are brought from Germany, France, Austria-Hungary, and Japan.

Of the brick and tile imported, 76.7 per cent. was from the United States and 23.2 per cent. from Great Britain; and only \$578 worth from other countries.

Of the earthenware and chinaware, 62 per cent. was imported from Great Britain; 15 per cent. from the United States; 9 per cent. from Germany; 7 per cent. from France, and considerable values also from Japan, Austria-Hungary, and other countries. The crude clays were imported principally from Great Britain and the United States.

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