

## STUDIES IN ROAD CONSTRUCTION

COUNTY ROAD ENGINEERS AND SUPERINTENDENTS IN THE PROVINCE OF ONTARIO MEET FOR INSTRUCTION AND DISCUSSION REGARDING MATERIALS AND METHODS.

THE decision of Hon. F. G. Macdairmid, Minister of Public Works for Ontario, to hold a short course of lectures on highway construction as a means of giving definite instruction on the subject to county engineers and superintendents who are in charge of roads subsidized by the Provincial Government under the Highway Improvement Act, resulted in a most successful session and an impetus to road making that will assuredly leave its mark and create throughout the province an incentive to better and more scientific work. The course was arranged by, and carried out under the direction of, Mr. W. A. McLean, Chief Engineer of Highways of Ontario. It was primarily intended as a means of departmental instruction, and took the form of short papers, many of them illustrated by lantern views, followed by half-hour discussions. The lectures were given in the Parliament Buildings, Toronto, on February 23rd, 24th, 25th and 26th, Mr. McLean presiding. They were thoroughly practical in all particulars, and specially referred to local requirements of county road construction.

The chief aims in view were to provide an opportunity for an intimate discussion among the road superintendents, of their duties and methods; and to impart to them a considerable amount of direct instruction. It was thought that the convention would lead to a greater uniformity of work throughout the province, to a clearer understanding of the requirements of the Department and to an exchange of experiences by various county engineers.

The convention was opened by introductory addresses by Hon. F. G. Macdairmid and by Mr. W. A. McLean.

The following are extracts of the papers presented at the various sessions:—

**TYPES OF COUNTRY ROADS.** By Robt. C. Muir, A.M.Inst.C.E., assistant engineer, Ontario Office of Public Highways. The speaker emphasized the growing demand for good roads and referred to the excellence of the old Roman highways from the permanency point of view. A brief historical sketch was given of the knowledge and practice in this respect, not only of the Romans, but of the Grecians, Carthaginians and others. The construction of the famous Roman roads was outlined as follows: (1) A trench was dug to the desired width and depth. (2) The foundation, consisting of two courses of large flat stones, was laid in lime-mortar. (3) A layer, 15 inches thick, of broken stones, brick and pottery mixed with lime-mortar was then spread on. (4) Upon this was laid the finished surface, composed of flat stones 6 inches thick set in mortar.

The speaker then passed on to roads of more recent date and outlined the Telford method of construction, which is, in brief, as follows: (1) On a prepared flat subgrade a foundation of hand-set stones ranging in depth from 4 to 7 inches is laid, the larger stones in centre and smaller at sides, all set on edge and firmly wedged with stone chips. (2) On this foundation a 6-inch layer of 2-inch broken stone is spread and allowed to be rolled into position by traffic. (3) On this is spread a layer of smaller stone and the whole thoroughly compacted.

Then the Macadam method was outlined, in which the importance of drainage was first realized, and the founda-

tion course such as Telford's omitted. The method consists of: (1) On a prepared subgrade a layer of 2-inch broken stone. (2) On this a layer of finer stone. (3) The whole rolled and compacted.

The utility of a combination of these ideas, and the importance of a good, sound, well drained foundation, were then brought out.

**Earth Roads.**—An earth road with a soil composed of a mixture of sand and clay is much more satisfactory than one composed of either of these soils alone. A soil composed wholly of clay acts just the opposite from sand under different weather conditions. In dry weather the surface becomes hard, and if kept in proper shape, makes a good surface. In wet weather, the water soaks into the clay and softens it, with the result that the traffic cuts up the surface and makes the road almost impassable.

Where a suitable soil is not found ready to use, it is advisable to use a mixture of sand and clay, mixing same on the road. The idea of a sand-clay road is that the voids between the grains of sand in surface should be filled with clay.

The chief factor on an earth road, in fact all classes of roads, is proper drainage. If the surface of road is kept shaped so as to throw surface water to ditches and underdrainage used, there should be no difficulty in making this road passable at all times. A camber of about  $1\frac{1}{2}$  inches to the foot is usually sufficient.

The principal work in maintaining an earth road is to keep it smooth and well crowned. This is done by using the log drag, which is essential to the upkeep of earth roads. An earth road should not be dragged when dry. Should this be done, the surface crumbles up and causes a layer of loose material which quickly becomes dust and later into mud. The proper time to drag is when road is wet; the muddier it is the better. The road should be dragged at all seasons.

**Gravel Roadway.**—Gravel, though not as durable as crushed stone, has proved very serviceable as a road covering. The subgrade should receive careful attention and must be prepared so that it offers a firm surface. The binding quality is the chief point to be considered in selecting gravel. Bank gravel is more suitable than stream gravel, as it contains more fine material which acts as a binder. Iron oxide, found in some gravels, is an excellent binder, and roads built of this material have given good results. Gravel of this type is found in Middlesex County, where the gravel roads speak for themselves. Gravel should be screened so as to have surplus clay and loam removed; 15 per cent. of clay is all that is necessary to act as binder.

There are two methods of construction:—

**Surface Method.**—The subgrade having been brought to proper shape, the gravel is dumped on roadbed and smoothed out, larger stones being raked to the bottom. The surface is then rolled until firmly compacted. This is the usual method of construction and the material taken from ditches goes to form the shoulders.

**Trench Method.**—A trench is constructed in the subgrade of same width as gravel surfacing. Gravel is then