(3) That the grade is straight, hills brought to a permanent level, and all drains given a good fall to a free outlet.

(4) That the stone is placed in a straight line, and properly spread.

(5) That a good quality of stone is used. Special care should be taken to avoid stones that weather or "rot" quickly. If field stones are used, cull all that are weak or brittle.

(6) That the stone is graded according to size, and the coarsest spread in the bottom and the finer on top.

(7) That a roller is used, first to compact the earth sub-grade, then to consolidate the road metal.

Broken stone very often gives less satisfaction than gravel, because the latter binds quickly under traffic owing to the presence of sand and clay. To get the best service from broken stone a road-roller should be used to consolidate it, otherwise the stones will roll loosely for a considerable length of time. The feeling of councils with regard to its use often is that it makes a passable road for a short time in fall and spring, but that a good but no test is so conclusive as actual wear on the road. Broken stone should be separated into grades according to size, the coarser stone to be placed in the bottom of the road and the finer at the top. This grading of the stone is done by means of a rotary screen attached to the crusher. If the stone is placed in the road without being graded in this manner, the smaller stones wear more rapidly than the larger, and a rough surface results. Large stones at the surface, moreover, are more apt to become loose, to roll under the horses' feet or the wheels. For country roads there should be placed in the roadbed :

(1) A layer of stones such as will pass through a $2\frac{1}{2}$ -inch ring.

 $lambda_{1}$ (2) On this a layer of stones such as will pass through a one-inch ring.

(3) On this a sprinkling of screenings—that is, the dust and chips created in crushing.

The cost of broken stone roads can be kept at a minimum by careful management of labor, including teams. This includes a skilful arrangement of the quarry, and of the crushing outfit. The wagons for hauling should be of a specified size, and the number of loads to

dirt road for summer use is spoiled. Townships which have only broken stone for road metal will receive decided benefit from the use of a steam or horse road roller, which will at once consolidate the stone, and make-a thoroughly good and smooth road for all seasons of the year. There must be a sufficient body of broken stone to consolidate into a compact



A WENTWORTH COUNTY ROAD

layer. A sprinkling of stones over the surface is useless. It merely impedes travel on what might otherwise be a good dirt road. Six inches of broken stone is the least which should be used in making a durable roadway for any purpose, and it should be the aim of councils to thicken this covering as circumstances will permit.

Stone varies greatly in quality, and a proper selection requires experience and care. Some rocks are difficult to quarry, but very quickly turn to clay when exposed to the air. Limestone, granite and gneiss are very commonly used in the Province. A good quality of any of these makes a good road metal. Limestone is frequently softer than the others, but its binding qualities are excellent, enabling it to make a more waterproof road covering. A heavy stone is usually better than one that is light. A stone that breaks into cubical shapes is desirable; while one that breaks into thin, flat shapes is objectionable.

A practical man can judge of the qualities of a stone by applying simple tests; by breaking the stone with a hammer, wearing it on a grindstone, crushing it in a blacksmith's vice, scratching with an iron nail, breaking small pieces with the fingers; by such simple means a general idea of the stone can readily be formed, better appearance as contrasted with the increasing price of lumber and the poor quality obtainable. Plank walks are at best short lived, require a great deal of repairing, and when they begin to wear out are frequently dangerous. A well-built concrete walk, on the other hand, is practically permanent and does not demand the care that plank walks require.

Without resorting to walks made merely of a bed of gravel or finely crushed stone (laid very much after the manner of the gravel or stone foundation commonly used for concrete walks), it is difficult to find a cheaper walk than concrete. Contracts were let in 1906 for concrete walks at 9 cents per square foot. This is a very low figure, and is very near the actual cost, but under favorable conditions serviceable walks can be built for that price.

For residential and outlying districts particularly, there has been in some towns and cities a tendency to lay concrete walks in a more expensive manner than is necessary. Under suitable conditions, and especially with a dry, sandy sub-soil, light but durable concrete walks can be laid without a gravel or broken stone foundation—merely a $3\frac{1}{2}$ -inch concrete base, and a

179

constitute a day's work should be fixed. Teams can usually travel 24 miles in a day, and the number of loads can be fixed accordingly. The County of Wentworth in the county road work requires wagon boxes to hold two cubic yards.

CONCRETE SIDEWALKS

Concrete sidewalks are growing in favor owing to the greater durability and