but on some of the roads the system includes maintenance, a man being specially employed to fill wheel tracks, ruts and hollows and to keep drains clear of obstruction.

Road Drainage.

The most frequent cause of bad roads in Ontario is lack of drainage. When a road is good during the summer months but scarcely passable in spring and fall the plain inference is that, if it could be kept dry it would be good the whole of the year. In a couple of months of spring and fall, roads, otherwise good roads, because of insufficient drainage, are destroyed more than in all of the remaining ten months of the year. Because of neglect in the simple matter, road labor and expenditure is very largely wasted. No farmer or business man can conduct his personal affairs in such a manner without failure.

Excavations called "drains" are, it is true, made at the side of the road but frequently are not provided with outlets, or the outlets are allowed to speedily fill up. From these receptacles, water soaks into and softens the foundation of the road. Loose dirt from this "drain" is piled in the centre of the road. This is soon roughened and tracked so as to hold water on the surface until it penetrates into the roadbed; producing pitch-holes—and actions against the municipality for damages. Under-drainage is seldom thought of to carry the water away from the foundation. The object of our roadmakers appears to be to cover the water with gravel or crushed stone, a tedious and costly process. A road must have a firm foundation obtained by drainage, since it is the natural soil which must support not merely the road metal but the traffic also. Strength in a roadbed must be had not so much in the road covering as in the natural soil beneath it.

Under-drainage is as necessary as surface drainage. A dry foundation is more necessary than a dry surface. Under-drains are needed not so much to carry away the water which falls on the surface of the road as to interrupt the water rising in the saturated earth from the impenetrable stratas beneath, "to lower the water line." Common field tile should be used three or four inches in diameter, hard, well-burned, and unwarped, every care being taken to lay it in the trench with a constant fall to a free outlet. Usually it is best to lay two tile drains, one on each side of the road, about two and a half or three feet below the bottom of the open drains. Thus placed they may be used as outlets for the surface drains if better cannot be obtained, proper catch-basins being provided. Lay the tile to an even and uniform grade and make the joints close. It is a good practice to cover the joint with sod, grass side down. A coating of straw is good in quick or running sand, but it is much better to completely surround the tile with sawdust.

A perfect system of drainage is obtained by surface and tile drainage. The surface of the road must be sufficiently rounded or crowned in the centre to shed the water readily to the side ditches or gutters. The water in its course to the gutters must not be impeded or held by hollows, tracks or ruts in the roadway. The gutters must be carried to a free outlet as often as possible having a good fall.

It is bad practice to carry water long distances and pour it over hills by the road side. Deep and dangerous gu ches are thus created. This water before reaching the hill should, if possible, be carried through adjoining property to an outlet. Roads along sidehills should have a tile drain and an open gutter along the inner side of the roadway, and the trench containing the tile should be filled with gravel, broken stone, or other porous material to intercept the soakage