

the crust of a gravel road in fall or spring. At all times narrow tires on wagons of heavy draught are the greatest destroyers of roadways. To get the most benefit from the s'atute labor and other road expenditure in the Province, to lessen the cost of road making and maintenance, narrow tires must be discarded by those engaged in heavy teaming on our roads.

Broad tires, on the contrary, are in a way a benefit rather than a detriment to roads. Their broad surfaces perform the work of rollers in keeping a smooth and compact roadway free from ruts. Wide tires more than any other means that can be adopted, distribute wear over the surface of the road. Narrow tires do the work of a pick on a roadway, while broad tires do the work of a pounder. The one tears up, the other consolidates.

Drainage of Roads.

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 because of insufficient drainage are destroyed more than in all the remaining ten months of the year. Because of neglect in the simple matter, road labor and expenditure are 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 center of the road. This is soon roughened and tracked so as to hold water on the surface until it penetrates into the roadbed; thus softened, each succeeding vehicle deepens the track to a rut, then to a series of 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 under-drainage—to support not only the weight of the road metal, but also the traffic upon it.

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.

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 intercept 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 upwarped, 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, above 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.

It is bad practice to carry water long distances and pour it over hills by the road side. Deep and dangerous gulches 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 drain along the inner side of the roadway, and the entire roadway sloped towards the hill. Unless this is done the water is apt to run over the side of the embankment and wash it away, necessitating constant and expensive repairs. The trench containing the tile should be filled with gravel, broken stone or other porous material to readily intercept the soakage water from the hill.

Water in "springy" places on a road-bed should be conducted by blind drains from the centre of the road diagonally to the side underdrains. Springy places on a hillside embankment should also be tapped by a blind drain and the water led quickly to the tile drains.

Take the water out and keep the water out.

Forming a Roadbed.

System is as much needed in constructing a roadbed as in building a house. When the improvement of a road is undertaken definite plans should be decided upon, so that all work done from year to year will be successive steps towards the one end. When "system" is neglected the work of one year becomes useless by the change and interchange of plans adopted from year to year, gravel is placed on the road before a foundation is provided, or other premature work is attempted.

In making a road the grading and draining should be carried on during the same season, first the grading, then the draining. A road which is graded only, and then subjected to the traffic of fall and spring before draining is undertaken is generally a shapeless mass by the ensuing summer, and a large amount of grading must necessarily be repeated. A road should also be drained and brought to the grade which it is to retain permanently before the road metal (gravel or crushed stone) is placed on it. Metal placed on

an undrained roadway is so mixed with mud in spring and fall as to be almost wasted. The natural soil under the gravel must be sufficiently firm to sustain not only the gravel, but the weight of traffic upon the gravel. No soil will do this unless it is sufficiently drained.

The roadway must be crowned, or rounded up towards the centre to shed the water from the surface; the surface must be kept smooth and free from tracks, and it is as much the duty of gravel or crushed stone placed on a road to form a smooth, hard surface that will permit the water to flow readily off from it, as it is to form a durable covering to resist the wear of wheels.

The centre of the road should be excavated to receive the gravel or crushed stone. Where this care cannot be taken the metal may be placed on the centre and the sides graded up. The crown of the road should be obtained chiefly by rounding up the natural soil, but the metal should be several inches deeper in the centre than at the sides. On country roads a crown of one inch rise to one foot of width from the side to the centre is generally sufficient; on hills it may be greater, so as to prevent the water following the wheel tracks and deepening them to ruts.

The width of roadway to be metalled depends on the amount of traffic it will be required to accommodate. From eight to sixteen feet will be ample for the majority of roads in rural districts. Roads forming the approach to towns may sometimes be metalled to a width of twenty or twenty-five feet. For residential streets of towns and villages from twenty to twenty-six feet between the curbs is generally sufficient.

The metal should be placed on in layers and each layer thoroughly rolled, the subsoil having also been first well consolidated.

After the work of forming the roadbed has been completed a great deal may be done toward leveling the sides, seeding, planting trees, etc., and not until the road allowance between the fences is brought to a right condition should the road be considered finished. No investment offers better returns than the building of good roads.

Different with Municipalities.

"I shall have to give up that case of Dusenbury's, on which I have been engaged so long," said the eminent lawyer to a friend. "I shall feel rather odd with it out of the way, for it has been one of the stand-bys of the office for many years."

"You have exhausted all legal expedients, have you?"

"No, but Dusenbury's money is all gone—"

The comparatively small kingdom of Italy has 51,000 miles of highway.