

ENGINEERING DEPARTMENT.

A. W. CAMPBELL,

O.L.S., C.E., M.C.S., C.E.

The Essential Feature of a Good Road.

The essential feature of a good road is good drainage. This is true in all climates, but it becomes absolutely imperative in Canada where rains are heavy, at seasons almost continuous, and attended in the winter, autumn and spring seasons with severe frost, snow and slush. Every rule has its exception it is frequently said, but the maker of roads can safely follow the principle under all conditions, that drainage cannot be too perfect; that where drainage is perfect there is a perfect road.

On first sight this statement may seem exaggerated. The impression has so long existed that if we get a surface of gravel or broken stone piled on a ridge of earth we have built a road; it is difficult to adjust our minds to other principles. No doubt, working with this object, many fairly good roads have been produced, but they are in a measure, the result of accident rather than reasonable and clear-headed design. When roads are built with the fundamental purpose of doing so by securing perfect drainage we will be on the most direct and shortest route toward securing good roads. Much unnecessary labor and money will be saved, as well as much disappointment and dissatisfaction.

Doubtless the dweller in the country of sand will be inclined to think lightly of this advice, for he knows in wet weather, not too wet, his roads are at their best. He will be inclined, if he has never lived on clay lands, to think that advocacy of road building with such an object is a false doctrine. Yet even on sand lands the principle of good drainage is the principle of good roads.

An essential part of good drainage is to attend to the shape of the road surface. This must be crowned or rounded up toward the centre. The shape of the road will tend to throw off to the side, the water as it falls in rain and the water of melting snow.

In addition to being crowned, the surface must be smooth—that is free from ruts, wheel tracks, holes and hollows. If these exist on the surface of the road, instead of being thrown to the side the water is held back, is absorbed into the roadway which softens and yields readily to the wearing of wheels. Like the water poured on a grindstone, so the water on a road surface assists the grinding action of wheels. When the road is wet the holes and ruts rapidly increase in size, wagon after wagon sinks deeper, until finally the road becomes utterly bad and perhaps impassible as we so frequently find Canadian roads in late fall and early spring.

In order to provide for a smooth, rounded roadway, that will remain so in

wet weather, it is necessary that the surface of the road be hardened with some stony material, and for this we use gravel and broken stone. By resisting wear, ruts and hollows do not form readily, or when commenced they do not increase with such great rapidity.

Having now crowned the road and made it smooth, having placed on it a coating of metal to harden it and assist in keeping it so, it is necessary to provide for the water which flows from the travelled roadway to the open drains we provide at the side. These open drains must have an outlet to which the water flows readily and freely. Drains which have not a good fall and free outlet, which merely catch the water and hold it until it sinks into the earth are of little service to the road. The reason for this points to another of the main features of good drainage.

That is, it is not sufficient that we round off the surface making it hard and smooth, and carry away the surface water in open drains at the side of the road. It is absolutely necessary that the natural earth sub-soil which we crown and coat with stone shall be kept dry, for to keep it dry is to keep it firm and strong to support the load. The gravel or stone which we place on the road does not support the load, this metal as we have said, resists wear; the natural earth underneath has to support not merely the load but the surface material as well. It is, therefore, as previously stated of prime importance that the water caught by the side drains shall be carried away immediately, before it can sink into, and soften the road foundation.

More than this, not merely must the surface water be carried away quickly, before it can sink into the soil, but underdrainage must frequently be resorted to. In many sandy and gravelly localities and even in clay districts nature provides sufficient natural underdrainage, but frequently we find low, wet sections where the water-line must be lowered by means of tile drainage. A tile drain under each open drain is, in nearly every case, the best plan to pursue where underdrainage is needed.

The vast good which can be accomplished by means of tile underdrainage on the roads has been too long overlooked in Canada. Agriculturalists who have used tile underdrainage of farm lands, will be able to better understand its action on the roads. Just as there are lands which are useless for farming without underdrainage, so there are roads which are useless without underdrainage. A dry sub-soil can support any load. But with a wet and consequently weak sub-soil, the road metal is at once forced down and buried in the mud, while the mud rises to the surface. And so, for want of a firm, dry foundation, the crown of the road is destroyed, the stone is mixed with the mud and the surface becomes soft and rough, easily worn, and surface drainage is thereby interfered with.

Here, then, we have in brief the principles of roadmaking, which resolve themselves essentially into a matter of good drainage. A smooth, hard, rounded surface throws the water to the side drains and the side drains carry it quickly away. The metal covering is both a roof and floor: A roof, since it sheds the water to the side before being absorbed into the sub-soil beneath; a floor, in so far as it resists wear. The underdrainage of the roadway provides a firm, dry foundation, and so, in our structure, we have provided foundation, floor and roof, all by means of good drainage. Sand, unless in a low section, seldom requires underdrainage, but with a good road covering of gravel or stone frequently makes the strongest of roads—so also with gravel. Clay is most frequently in need of underdrainage, particularly in low and swampy districts. But in every class of soil at every season of the year the waterline should be kept three feet below the surface of the road. If nature does not do this then artificial means, the underdrains, should be resorted to.

It is by means of good drainage that we provide against the action of frost on our roads. Frost can only be destructive where there is moisture. The upheaving action of frost on soil is caused by the presence of water. Water expands on freezing and forces the soil upward; when thawing takes place the ground is left spongy and wet and the roads "break up." Keep the roads dry and they will not break up. Our energies, then, in the making of good roads, must be directed to the essential feature, good drainage.

The city of St. Thomas is in the van of progress. This year contracts have been let for two new public schools, the corner stone of a new city hall has been laid, the street railway has been electrified and much extended, a new brick pavement is being laid on Talbot street, the main business thoroughfare, plans have been accepted for a new court house and county building, a new railway, the Wabash, has entered the city, and the citizens are agitating for the formation of The Peoples' Telephone Company. The record is a good one.

The city of Glasgow owns its gas and water plants, its street railway system, a labor bureau, is bound to maintain and has charge of ten churches, provides public wash-houses and baths which are so low in price as to be almost free, owns several modern lodging houses and dwellings for working men, gives concerts during the winter at an admission of one penny, and many band concerts in summer free, has opened a peoples palace, has laid out a golf course with a 2d. a day for playing, has its own hospitals and is very much disturbed because the governmental authorities have refused the privilege of purchasing the telephone system.