Hills.

Roads located on hills, or along the sides of hills, are generally found difficult to build and maintain, and very often we find a large proportion of the statute labor annually placed on them, to little effect. The difficulty usually arises from the rushes of storm water, and from springs underneath the road, and, especially on sidehill roads, from water soaking from higher levels.

The rushes of storm water are often occasioned by the practice of carrying water long distances in open drains, and finally pouring it over the hill by the roadside. If the hill is steep, and a cut has been made, the water is not, and very often at the time of spring floods and freshets, cannot be kept in the open drain, and so is allowed to make a channel of its own down the centre of the road. This condition is the common result of not disposing of water in small quantities along natural watercourses. No water should, as a rule, be allowed to pass over the hills by the roadside, except that which naturally falls on the surface of the slope. Provision should be made for the disposal of water of the drains back of the hill, by carrying it through private property, under the provisions of the Drainage Act, if necessary. Property-owners, however, should understand the wisdom of permitting drains to be constructed across their lands, when the benefit to be derived is not only better roads but better drainage of their own fields as well.

The surface drainage on hills should be very pronounced. The crown of the road should be slightly higher than is needed on level ground, a rise of one and one-half inches to the foot from side to centre being advisable for gravel roads. The crown must be sufficient to draw the water to the side gutters, and to do so, it must be sufficient to overcome the tendency of the water to flow directly down the hill, following the line of the wheel tracks. If the water commences to take the latter course, the wheel tracks are quickly deepened to ruts, stones are loosened or protrude, and the road becomes roughened and channeled.

Underground currents of water often find outlets on the hillsides. If any of these springy places occur under the roadbed, it will be necessary to tap them at a good depth below the surface with tile drains. In such cases tile drains will be needed under the open drains at the sides of the road, and the blind drains may then be carried diagonally across the road into the side underdrains. The open drains will sometimes need to be protected with cobble stones, if the hill is long or subject to damaging rushes of water.

Roads passing along the sides of hills are frequently softened and injured by the soakage water from high laying lands. This water should be intercepted before it passes under the road, by a deep drain along the side of the roadway next the hill. Tile should be used, if possible instead of a deep open drain, and the trench filled with gravel, stone or other porous material, to more readily intercept and absorb the soakage water.

Municipalities will usually find it a measure of economy to bring hill roads to the grade at which they are desired to remain as quickly as possible, and to this end special money grants will be necessary. To leave such work to be performed by statute labor alone is often not satisfactory. The grading done one year is apt to be so inefficient that it is, in a large measure, destroyed by the rushes of water in the ensuing wet seasons. The roadway, moreover, being annually covered or cut for a number of years, is slow to settle, becomes impassable on the slightest provocation, and absorbs labor which is needed by other sections. Municipal grants are needed on main roads, but they are also needed in doing permanent work on the lesser travelled roads, where hills or other unusual circumstances of location render the construction of roads a matter of more than average difficulty. The labor and cost of road building should be equalized as far as practicable among the different sections of the municipality, so that efforts put forth in road improvement will not be retarded by discouraging difficulties.

A Concrete Arch.

A considerable number of townships are this year constructing concrete arch culverts. The majority of cases appear to be met by a span of about six feet. For a semi-circular arch of this opening, recently erected, the thickness of the arch at the top is ten inches. The top of the abutment is two feet in thickness. Half way between the top of the abutment and the top of the arch, the thickness of the arch is eighteen inches. From the top of the abutment to the foot, the outside of the wall is given a frost batter of about two inches to the foot. The base of the abutment rests on a hard-pan stratum. These dimensions are not such as would be demanded by a stone arch, but appear to produce a substantial work in concrete. With good material, workmanship and an absolutely secure foundation, a concrete arch becomes a single stone of great strength which should last for ages.

Concrete Fence Posts.

Artificial stone fence posts is one of the most recent applications of that remarkable material, cement concrete. These posts are set deeply in the ground beyond the reach of frost, and holes are moulded, through which to attach the wire, which is woven from post to post. By bracing these posts firmly, and stretching the horizontal wires to their limit of tension, these posts have been spaced forty rods apart. A great saving in first cost as well as for repairs is claimed for them.

Bridge Sites.

The question of choosing the site of bridges is an important one. If the selection is not restricted to a particular point, the river should be examined for a considerable distance above and below what would be the most convenient point for crossing; and, if a better site is found, the line of the road must be made subordinate to it. If several practicable crossings exist, they must be carefully compared in order to select the one most advantageous. The following are controlling conditions; (1) Good character of the river bed, affording a firm foundation. If rock is present near the surface of the river bed, the foundation will be easy of execution, and stability and economy will be insured. (2) Stability of the river banks, thus securing a permanent concentration of the waters in the same bed. (3) The axis of the bridge should be at right angles to the direction of the current. (4) Bends in the river are not suitable locality and should be avoided if possible. A straight reach above the bridge should be secured if possible.

In making the final selection, the principles to be observed as far as practicable are:

Follow the route which affords the easiest grades. The easiest grade for a given road will depend upon the kind of covering adopted for its surface.

Connect the places by the shortest and most direct route commensurate with easy grades.

Avoid all unnecessary ascents and descents. When a road is encumbered with useless ascents, the wasteful expenditure of power is considerable.

Give a centre line such a position, with reference to the natural surface of the ground, that the cost of construction shall be reduced to the smallest possible amount.

Cross all obstacles (where structures are necessary) as nearly as possible at right angles. The cost of skew structures increases very rapidly.

Cross ridges through the lowest pass which occurs.

Cross either under or over railroads if practicable, for grade crossings mean danger to every user of the highway. Guards and gates frequently fail to afford protection, and the daily press is filled with accounts of accidents more or less serious, and while statistics fail to give total casualties, the aggregate must be great.

The township council of Lancaster, Ont., has an arrangement with the Grand Trunk and C. P. R. by which gravel is laid down by the carload at small cost for road improvements. As a result, the township will soon have roads second to none in the province.