

## WHAT CONSTITUTES A COMPLETED JOB OF ROAD WORK.\*

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IT would be a source of profoundest gratification indeed to road builders, municipal men and ratepayers alike, if at some time in the history of a road, it would be possible to say that it was completed and that no more attention need be given it. This is an ideal condition in the life of a road that cannot be hoped to be attained. However, there are certain factors that enter into the building of a road that can be settled definitely and remain permanent fixtures therein.

The first point that should be settled before actual construction begins, is the location of the road. This is determined by its relative position in the district to be served, the comparative cost of construction with other locations and its general suitability to the purpose intended. The allowances set apart for road purposes in the prairie provinces of Canada are defined in the original survey of the country into its legal subdivisions, and follow the boundary lines of the sections. This in itself, while providing a right-of-way for road purposes at regular intervals throughout the country, often proves a source of extra engineering difficulties and expense when they are being transformed into travelled ways. The lines of demarcation of the townships and sections are run in set directions—north and south, and east and west—regardless of the topography or physical feature of the country. The efforts of the highway engineer, in so far as selecting the most suitable location for a road are, therefore, very much circumscribed and limited by having to accept the allowance thus provided for that purpose.

The alignment of the road should receive careful attention when construction work is being undertaken and improvements are being performed.

Whether the right-of-way selected be a government road allowance or a diversion therefrom, which latter course in some instances is absolutely necessary in order to avoid large bodies of water or hills which could only be crossed by following a straight course at prohibitive gradients or unwarranted costs, the centre line of the road-way should be fixed and the proposed improvement made about it so that where subsequent improvements or alterations in standard of road are found desirable, they may be made without disturbing work previously done.

It is customary, when laying out road work in Manitoba, for the engineer to make the centre line of the road-way coincide with the centre line of the road allowance, and unless there be good and sufficient reasons present in a given case for deviating from this by placing the travelled road in some other relative position on the allowance, this rule should be strictly adhered to. The point to be emphasized in this connection is, that the finished roadway, the necessary drains, culverts and bridges should conform to such well defined lines and courses that their positions on the road allowance may become, practically, permanent fixtures. It might be here stated that the width of roadway on rural main roads should be 18 feet. This width should be increased at the approach of towns and cities, to 20 and 24 feet, depending altogether on the amount of traffic to be accommodated. The inside lines of the ditches should be parallel with the centre line of the roadway, and not closer than 14 feet thereto. This

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arrangement will give a stretch of ground twenty-eight feet in width upon which to construct the roadway. The slopes of embankments and cutting, except in rock, should have at the least, a slope of one foot and one-half horizontal measurement to one foot vertical.

Another very important feature in connection with the building of a road is the determining of the profile which the surface of the finished roadway should assume. This is accomplished by a study of the profile of the natural surface of the ground to be traversed, and by so altering the same by means of embankments over stretches of comparatively level country, or by cutting down hills and elevating the intervening depressions where the surface of the country is rolling or broken, until a finished profile suitable to the nature and conditions of the soil met with is obtained. It is largely a matter of judgment based on knowledge gained from experience that enables an engineer to determine the proper height of fill which should be constructed across a certain stretch of country or the depth of cutting that should be made through a ridge. No set standard can be fixed to meet the varying conditions met with. If the land is low and flat and is liable to be affected by the accumulation of water in times of freshets, the embankment will necessarily have to be higher than over land where drainage is more easily effected. Where the country is very rolling and the profile a series of ridges and depressions, an excellent road can be made by cutting the ridges and filling in the depressions, and a grade line so established that the amount of excavated material from the ridges and the amount of the material in the embankment would balance. Again, there may be met with tracts of country where the soil is light, and natural drainage good, where the surface of the ground may be but little disturbed to provide a splendid roadway.

It is when building a road over a steep hill or across deep ravines, or across valleys of some of the larger rivers in this country, where the determining of a proper profile for a road requires consideration and thought. The maximum gradient which might be permitted on a main highway is six per cent. or a rise of six feet in every one hundred feet horizontal measurement. A much less gradient should be first sought and the maximum aforementioned only adopted when the engineer's difficulties encountered are of such a character that the cost of securing any substantial reduction might be considered prohibitive or unjustifiable.

The gradient of a hill may be reduced by increasing the depth of the summit cutting or by increasing the length of the road. The latter method is preferable. Deep cuttings are objectionable especially as in the winter seasons unless protected by snow fences they are liable to drift full of snow and cause blockades on the road. While it is almost impossible to entirely avoid them in rough mountainous regions, still, in endeavoring to reduce the gradient, distance should be increased by following the most practical course open along the slope of the hill until the bottom is reached, where the direction may be corrected on the flats below.

The bad effects of the steepness of hills are especially felt in the winter, when the ice covers the road, because the slippery surface causes danger in descending, as well as increased labor in ascending. If a hill has to be ascended, the road up it should nowhere have the smallest descent for that would make two hills instead of one. It should be so located, and have such cuttings and fillings, as will secure a gradual and uninterrupted ascent the whole way. In this respect engineering skill can make