

road crew working under the personal direction of the divisional superintendent.

This system of operation keeps the control of the work and the payment of money grants entirely in the hands of the Highways Department, and we find that the municipal councils on the whole are co-operating very well in carrying out the work, both as to location and method of construction.

Motorists Report Road Defects

Saskatchewan has now some 55,000 automobile owners out of a population of about 827,000, and the greater percentage of these cars are owned by farmers. This ownership of an automobile has also lent an impetus to the improvement of our roads as well as to the maintenance of main arteries of travel. Motor clubs are very general throughout the province, and these have a system of reporting special defects on all roads to the Department of Highways through the secretary of their executive body, and it is encouraging to note this as a sign of the interest being developed in the direction of permanent good roads.

As time went by, the importance of maintaining roads upon which money had been expended for construction became more and more pronounced. To such an extent did this obtain that definite legislation was passed in an endeavor to cope with the problem. To this end a grant to each rural municipality of \$500 (on the basis of a nine-township municipality) was provided for. Each municipality in the spring designates the sections of roads it wishes to maintain. These are checked up, and, if found to be satisfactory, permission is given it to undertake this work. The sections undergoing improvement are inspected during the season, and the municipality makes its return of the actual extent of the roads maintained and the expenditures incurred. If the inspectors' reports are favorable, the amount is deemed to have been earned.

There are two difficulties which face the department in connection with this: First is the tendency, fortunately in only a few cases, to use the money in making good certain bad places on the roads, which improvement cannot properly be considered as maintenance work; and second, the dividing of the amount of the grant into a number of parts corresponding to the number of council divisions in each municipality, irrespective of the number of miles of main roads in each division or of the special claims of certain well-travelled roads to be considered. But so long as this council view prevails, just so long will the department be faced with this difficulty.

Unsatisfactory Road Locations

Whether by design of nature or the perversity of the Dominion land surveyors who gave the allowances, it is nevertheless a fact, that an undue proportion of sloughs, lakes, bad hills and awkward bridge locations occupy the road allowances, and, while it leaves more land for agricultural purposes, this serves to increase our difficulties and the cost of our road improvement work. To overcome many of these difficulties it is necessary to divert from the road allowances. To deal with these matters in a satisfactory manner, the department has provided a number of district surveyors, working under the direction of the director of surveys, who is responsible to the deputy minister and with him signs all plans of diversions, etc., before these become legal highways.

The proper location of these diversions demands a knowledge of road-building, as the question of drainage, gradients, side-hill work, suitable bridge and culvert locations and other features all enter into the determination of a well-selected diversion location.

The usual method followed is for the rural municipality to request a diversion survey, after having made an agreement with the owner for the purchase of the land required, which agreement is filed with the director of surveys. The survey is then made and the amount of land taken determined, and the construction of the improvement follows. In cases of improvements where the lands are not patented, the diversions are made on the recommendation of our divisional superintendents, the surveys are made and registered, and the diversions are made a part of the road allowances, to be

deducted from the acreage of the section affected; while in unorganized municipalities, the same procedure is adopted with the exception that payment is made to the land-owner directly through the department.

In some cases where the topographical features make the selection of a diversion unusually difficult, it is found much better to make a preliminary arrangement with the land-owner for the land needed, to construct the needed improvement, and then to make the survey and payment for the land taken. This avoids a clash between the surveys branch and our construction department over the securing of the best possible location, and also avoids the need of a re-survey when the improvement cannot be confined to the limits of a survey already made.

In connection with the construction end of the work it is not necessary to say much, as this subject has been dealt with in so many papers, magazines and text books that no new matter of interest can be given, so that only a few general observations, relative to the handling of road problems as they are met, are required. First comes the question of the importance of the road to be improved, which determines the proper width of the road to be graded, the character of any bridges and culverts required and the maximum permissible grades for the traffic demands of that district.

General Requirements in Design

On main roads near the larger towns and cities, a width of 34 to 36 ft. between ditches is considered as necessary; for less important main roads, from 28 to 32 ft.; and for feeder roads and those more remote from towns, from 20 to 26 ft., according to the local conditions.

On important main roads it is aimed to provide permanent bridge structures of either steel or concrete, and either concrete or galvanized steel culverts; while on roads of lesser importance, timber bridges on either pile or frame-bent abutments are constructed, and the use of wooden box culverts are permitted where necessary.

The maximum permissible grade on a recognized main road is 7%, and an effort is made to keep it down to 5% wherever possible without incurring unwarranted expense in doing so. In many cases on less important roads the topographical features at times make it necessary to adopt grades as high as 10% to 12%, but these, fortunately, are the exception and only permitted where they cannot be avoided.

The amount of drainage is of greatest importance, as, with earth roads particularly, the removal of water from the road and side-ditches is very essential if the highway is to be of use at all seasons of the year.

In order to provide for effective drainage the ditches should have a continuous fall to certain points where the water can be led away from the road allowances, and where such cannot be provided by natural drainage it must be provided artificially where possible to do so.

The whole of the road drainage question may be summed up as follows: In order to have a good road the water must be got out, off and away; out of the road by under-drainage and by ditches of sufficient depth and gradual, continuous grades to off-take ditches or natural depressions; off the road by means of a properly crowned cross-section of the road; and away in the ditches as already described.

General Rules of Construction

Regarding the actual construction work, the organization of the working crew and the equipment required depends on the nature of the work to be done, and it is not possible to suggest a general outline which would fit all the varied conditions which might be met with.

On ordinary grading work, with close borrow pits for fills, or on the ordinary steep side-hill grades, the use of slip or wheeled scrapers or fresnos are recommended. On fills of a sufficient length and height to warrant a bigger crew and equipment, the use of an elevating grader is recommended, and it will be found to be economical even with the added cost of discing the long grade and crowning the surface with an ordinary road-grader. On lighter fills, side-hill work where the side slope is not very steep, and turnpiking, the only