

with the mortar. All sizes are made for sewers from 30 to 108 inches. The opening in the outer shell provides an underdrain.

The blocks are made two feet long and from nine inches to one foot wide, the thickness depending on the diameter of the sewer. This system can be reinforced transversely or longitudinally where conditions require it.

In constructing the sewer, the bottom blocks are laid to template and line up to the springing line. The liner blocks are then laid in up to the springing line, after which there is put in place the form on which the top half of the section is to be constructed. The liner blocks are continued over this arched form until the section is complete, and then the outside blocks are placed over the liner blocks in mortar. The composition of the mortar used is two parts of sand to one of cement. The form can be taken out almost immediately. The form used is approximately twelve feet long.

ROAD LOCATION.*

By C. R. Wheelock, County Engineer of Peel, Ont.

LOCATION is the first thing to be considered in planning a new road or road improvement, and as it is the most permanent thing in connection with the road it is probably the most important. The best of surfacing materials will in time yield to the wear and tear of heavy traffic and the action of the elements, and must be renewed more or less frequently, but the location and grade of a road, once properly established, become more fixed as years go by.

The establishment of location and grades should have the most careful consideration, a thorough examination of the locality should be made by an engineer with a well developed faculty for recognizing suitable road locations, and all the conditions in connection with construction, drainage, grades, maintenance and traffic, thoroughly investigated. The first considerations in the choice of locations should be the most direct route, easiest grades, and minimum cost of construction and maintenance.

Roads in Canada, with few exceptions, have been laid out to follow property boundary lines regardless of the topographical conditions of the locality through which they pass, and as these lines are generally unsuitable, the result is that most of our Canadian roads are poorly located and of the most expensive description, both to build and maintain. Hills are encountered where a small detour would have given a level road, swamps and bogs are crossed that could easily have been avoided, bridges have to be built at poor locations when places requiring shorter spans and having fewer engineering difficulties could readily have been found, and in many cases the length of the road is increased by being indirect between important points.

Upon a careful examination of the locality and conditions it may yet be found practical to remedy many of the above-mentioned defects. In some cases the expenditure of a small sum for land will provide for a detour around a hill which would cost much more to cut to a proper grade, or around a swamp where drainage difficulties exist and an expensive foundation would be required to support the surfacing, or perhaps a change of location for a bridge might be desirable. In considering the benefits of such changes the matter of maintenance should be

taken into account. This saving alone may often be sufficient reason for making a change.

Municipal councils are authorized to alter the locations of roads, in a manner fair to all parties, and it is advisable that the power be judiciously used.

In all cases when land is acquired for the purpose of road improvement an accurate survey should be made and a correct description provided in order that such land may be conveyed to the municipality by a good and sufficient deed.

Probably the first matter to be considered to determine the amount of work to be done and money expended will be the amount and nature of the traffic that the road will be asked to take care of. This must not be based on present traffic census, for as soon as the road is improved the traffic increases so greatly that all former traffic data are of little or no value and the greatest foresight is required in making estimates. The unimportant road of to-day may be the important road of five or ten years hence. Local points, between which the greatest amount of traffic has existed in the past, are no longer the governing factors in the value of a road. The improvement of main roads must be considered as a whole, one link in a chain of improved highways. Uniformity in construction and co-operation between counties are most necessary to bring this scheme for a system of improved roads to a successful issue.

Pioneer roads in Canada, in passing along the allowances, generally followed the line of least resistance, avoiding stumps, logs, large boulders, etc. Many of these roads still follow the same old winding lines, although the obstructions may long since have disappeared. The roads now being built should be a permanent foundation for all future improvements and before grading is commenced should be carefully located in the centre of the allowance. If the boundaries or limits are not well defined by posts or fences a survey should be made by a competent person and the road allowance properly located.

The graded roadway should be straight and located in the centre of the road allowance. To delay straightening roads means that much of the work now being put on them will be torn up when the straightening is undertaken. Keep the earth grade in the centre of the road allowance and the metal in the centre of the grade.

Detours of the road should be made with curves as easy, and the driver's sight-line as long as circumstances will admit. With horse-drawn vehicles a fairly sharp curve is not objectionable, but the high speed of the motor vehicle makes a necessity of easy curves and long sight-lines as an ordinary provision for the safety of the travelling public. Curves should have a radius of not less than 100 feet when practical and a sight-line of not less than 125 feet. All sight-blocking obstructions should be removed.

The determination of the grade lines to be established should depend largely upon the amount and nature of the traffic and the topographical conditions of the locality, but unfortunately the foremost consideration has too often to be the amount of funds available. It is generally agreed by engineers and roadmen that the maximum grade on main highways should not be more than 5%, but this may not always be found practicable. The maximum allowed by the regulations under the Ontario Highways Improvement Act is an 8% grade. It should, however, always be kept in view that to have our roads up to the standard adopted by both the United States and Canada the grades on main or trunk roads should not exceed 5%.

Steep grades increase the cost of transportation; no greater load can be moved over a highway than can be

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