

ways, commencing with the gravel roadway for light traffic, and—if the gravel is suitable—for heavier traffic, oiling it, treating it with asphalt or tar, or using it in the construction of a concrete pavement. The type of surface can be adapted in many ways, to the local materials available.

Materials Used in Pavements.

The materials used in roads and pavements are comparatively few. In their many combinations and adaptations lies the art of roadmaking.

Commencing with the preparation of the earth foundation by drainage and grading, other materials more commonly involved are gravel, sand, stone, clay and shale, wood, asphalt and tar; asphaltic petroleum and creosote oils; also a few chemicals of more occasional use. The principal element of cost in roadmaking and paving is labor. The materials employed, in their original state and location, are of comparatively little value. The cost of pavements is principally dependent on the labor market, and skill in using labor.

The types of roadways and pavements more commonly used in Ontario are as follows:—

Village Streets.

Residential or Side Streets.—Earth, gravel, broken stone.

Business Section.—Broken stone, oiled or with bituminous penetration; concrete.

Through or Main Street.—Gravel; broken stone; broken stone, oiled or with bituminous penetration; broken stone with Telford foundation; concrete.

Town Streets.

Residential Streets.—Earth; gravel; broken stone; broken stone, oiled or with bituminous penetration.

Business Section.—Broken stone, on substantial foundation, oiled or with bituminous penetration or bituminous mixed surface; concrete; vitrified brick on concrete foundation; bituminous surface on concrete foundation; wood block on concrete.

Through or Main Streets.—Broken stone, oiled or bituminous penetration, and with or without Telford or rubble foundation; concrete.

City Streets.

Residential Streets.—Gravel; broken stone, with or without bituminous treatment; concrete; sheet asphalt; or other bituminous surface on concrete foundation; wood block on concrete foundation.

Retail Business or Office Section.—Sheet asphalt or other bituminous surface on concrete foundation; wood block on concrete foundation; vitrified brick on concrete foundation; asphalt block on concrete foundation.

Wholesale Business Section.—Sheet asphalt; wood block or granite setts on heavy concrete foundation.

Street Railway Allowances.—Broken stone; wood block; vitrified brick or granite setts on heavy concrete foundations; concrete.

Street Intersections.

A development in street improvement resulting from automobile traffic is the demand for curves of larger radius at the corner of street intersections. Past practice resulted in a corner that was nearly square, or had a curve varying from 4 to 10 feet radius. This means that the vehicle could not turn into an intersecting street until it had passed the corner. The driver of a car must either

shift gear and slow down to a suitable speed for the turn, or else he may take the turn with an abruptness that is a menace to other vehicles as well as pedestrians. A further alternative practiced by many drivers is to swing widely at the turns, a practice which carries them to the wrong side of the roadway and risks accident.

Toronto, Ottawa, Windsor, Stratford, Chatham, and other cities in Ontario are widening and rounding many of their street intersections. The increasing radius of the curves enables an automobile to follow a course parallel to the curb and keep on the right side of the roadway, with greater convenience and safety.

Permanent Grades.

Permanent grades for all streets are one of the important needs of all villages, towns and cities in planning for immediate and future development. The fixing of such grades means that the sidewalks when laid will conform to the ultimate elevation of the roadway or vice-versâ; and that foundations of residences or other structures fronting on the street will be carried to a height to suit the elevation of walks and roadways.

The lack of permanent grades is seen in nearly all towns and villages of the province. Sidewalks have been laid to suit the surface of the ground on one side of the street, and the necessities of the other side of the street have not been considered. When the time comes to improve the roadway, it is found that its necessary grade is not the same as either of the walks. The result is a lack of uniformity that is very unsatisfactory in appearance, with increased difficulties of drainage. The entrance to some houses or stores is too high above the walk; others are below the walk, with drainage from the walk turned into them. Actions for damages are threatened by property owners.

Remedy is always more or less expensive, difficult or impossible. Prevention is the only satisfactory means. To this end, an engineer should be employed to prepare a plan of permanent grades to which all future street improvement and construction of houses on the street, should thereafter conform. Fixed grades are one of the important factors in a scheme of town planning, which make for future economy and satisfactory results.

Drainage.

Good drainage is a first principle of roadmaking or street construction. This is particularly true in a climate such as that of Canada, where the action of frost is severe. A clear understanding of drainage and its influence on pavements is essential to a skilful handling of the work.

On country highways, open drains at the side of the road are usual for carrying away surface or storm drainage. In many cases it is desirable to supplement open drains with tile under-drains to carry away sub-soil water, or to "lower the water line." Under-drains have a marked effect in keeping the sub-soil of the road free from water, which is particularly necessary in the spring or other wet periods of the year.

Paving can scarcely be considered apart from sewers. Before laying permanent pavements, the probable sewerage requirements of each town, village or city should be carefully considered. To pave streets, then to tear them up to lay sewers, or other under-ground services, is wasteful and short-sighted in the extreme. The town with a good system of sewers has taken the preliminary step toward modern street improvement. If circumstances are such that sanitary sewers will not be required within the life of the roadway or pavement, a village may