spread on and compacted in layers. The material taken from trench is spread on sides to form shoulders, which are compacted during final rolling.

Macadam Roadway.—The modern method of construction is as follows:—

A trench is cut to desired width of macadam surface, the bottom of which is parallel to finished surface of road. Here again, the hard material taken from trench is spread on sides to form shoulders. Subgrade should be thoroughly compacted with a steam roller, and weak places filled in with hard material.

The subgrade being prepared, a layer of 3-in. stone or tailings is laid thereon as a foundation course, then the stone, graded to pass a 3-in. ring and retained by a 1½-in. ring, is spread to required depth. On this a thin coating of stone passing 1½-in. ring, except dust, is spread to fill voids, the whole then rolled by a 10-ton steam roller. The screenings, ½-in. to dust, are then applied and thoroughly soaked with water and rolled. More screenings are added as desired and sprinkling and rolling continued until the road is thoroughly consolidated. A light coat of screenings is then spread on finished surface.

In finishing a macadam road, wet the surface until a wave of mud, a puddle in other words, forms in front of roller; plenty of water is essential to build a good macadam road. Care should be taken, however, that water does not injure the roadbed. Above all, do not roll the screenings dry.

The use of brooms is strongly recommended for finishing. This practice is very seldom carried out in this country. It is an essential point in macadam road construction The intention of sweeping the surface when water is being applied is to brush the screenings into voids, thus helping the binding; also to avoid water lying along shoulders, which would otherwise soak into roadbed. Too much attention cannot be given to the spreading of stone, which really requires great care and skill as the evenness of wear of the surface greatly depends upon uniform spreading.

Telford Macadam Roadway.—The Telford foundation as constructed to-day is a great improvement on the method advocated by Telford some 90 years ago; in fact, it is more after Tresaguet's method. This class of road, though very rare in Canada, has been extensively used as a foundation for suburban roads in Britain. The stones are set on edge by hand and wedged by chippings on a prepared subgrade, parallel to finished surface of road. The stone used should not exceed 6-in. in width. The stone being laid on edge has not the same tendency to heave as when laid flat. The projecting edges of stones above surface are knocked off, the spaces between stones filled in and surface of Telford blinded. The whole is then rolled with a steam roller. The crushed stone is then laid thereon and finished as in a macadam road.

Brick Roadway.—This class of road has only quite recently come to be used in this continent, the first being laid some 25 years ago. At first, failures were numerous, these failures being due to poor foundation or the quality of the brick.

The advantages of brick pavements are: Easily cleaned and repaired; makes traction easy; good foothold for horses; little dust and no mud. The chief defects are: The lack of uniformity in the brick; noise.

There are various types of brick roadways; the type of road usually adapted for country use is one with concrete shoulders, and should be constructed in the following manner: The subgrade, having been thoroughly consolidated, should receive, if of clay, a layer of cinders or gravel, 6 in. thick. The concrete foundation is then laid 6 in. thick, this surface to be parallel to finished surface of roadway. At least 4 dry days should elapse before brick is laid thereon. A cushion of sand 1½ in. in thickness is spread on concrete to receive brick. The brick is then laid on the cushion and rolled with a 5-ton roller. The bricks having been rolled to a perfect surface, the joints are then filled with cement grout, except the two longitudinal joints at shoulders and a transverse joint every 30 feet, which are filled with pitch and called expansion joints.

Bituminous Macadam Roadway.—Penetration Method.—Before constructing a bituminous surface on a macadam road, all ruts and holes should be filled with a bituminous-coated stone to provide an even surface. All surplus dirt must be removed so as to expose the stone surface, before bitumen is applied. Should the surface not be cleaned, or any cakes of dirt be allowed to remain, the bitumen will not penetrate into macadam.

There are two methods of applying bitumen, *viz.*, gravity and pressure.

The advantages claimed for the pressure method are: More even application; ability to distribute a small quantity per square yard; economy in first cost; economy in long run; simplicity of operation and avoidance of expensive machinery, and not to mention freedom from patent infringement claims.

In applying bitumen it is essential that it should be applied as hot as possible and therefore should be heated right on the work. The quantity of bitumen required will vary according to the physical conditions of the road, but generally 1½ gallons to the square yard is ample; for surface painting thereafter, ½ gallon per square yard, and this should be carried out annually.

The method of construction is: The existing surface of macadam having been prepared and thoroughly dry, the bitumen is then applied, which is carried out by means of a pressure distributer attached to a special tank wagon capable of containing steam under pressure; said wagon is drawn by a steam roller, the boiler of which is connected with the tank wagon, furnishing the pressure on the bituminous material. An uniform layer of stone screenings is then spread on.

Mixing Method Known as "Bituminous Concrete."—This consists of mixing with the stone a sufficient amount of bitumen; the mixing is usually done at a plant some distance from the work, but if at all possible, should be done right on work. The materials are mixed in a heated state and may be done by hand or machinery for the purpose.

The treated material is then spread on and rolled, and then a flush coat of bitumen and grit, and again rolled.

The advantages claimed for this method by its advocates are: Uniformity of surface and composition of same; maximum value of surface for materials used, and economy in use of materials. This method has proved capable of producing first-class results, but there are instances of its utter failure.

The quantity of bitumen used in this method is 2½ gallons per square yard of surface.

The mixing method involves a considerable investment for machinery and, with its initial cost, has led to the development of the penetration method.

Asphaltic Concrete Roadway.—Asphaltic concrete roadway is one having a wearing surface composed of stone and a bituminous material incorporated by mixing methods; similar to "bituminous concrete," except in grading of stone. Where the traffic is exceptionally