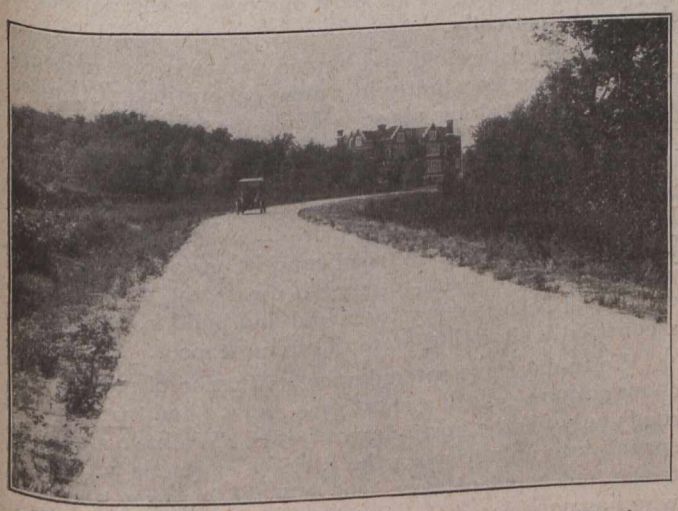
portions accurately maintained as the materials are placed in the mixer."

I would like now to say a few words regarding the general construction. Heavy stress should be laid on the making of subgrade and drainage. Unequal settlements should be avoided. No concrete should be laid over fills which are not thoroughly compacted or have not yet attained their ultimate settlement, which takes place at the end of about one year. A flat subgrade gives more concrete in the centre, where it is most needed, though one that is shaped to conform with the finished surface takes less concrete and gives better drainage. The subgrade should be rolled and reshaped until it has the specified shape and uniform firmness. This will not only prevent waste of concrete, but will also facilitate the movement of the pavement due to contraction and expansion, and, therefore, prevent the formation of cracks. It is a well-known fact that a rough and uneven subgrade renders the transverse joints about useless.

The system of drainage should be carefully studied and planned. It should not only take care of surface and underground waters, but provision should also be made for temporary drainage, so as to prevent the washing of green concrete by surface water. Such occurrences often necessitate the tearing up and removing of the entire pavement slab. The problem is to keep the subgrade dry by using the different resources or materials available. Were it not possible to do so, the design of the pavement, for such a length as may be found necessary, should be changed. In a poorly-drained subgrade there is a tendency for the edges to dry out quicker than the centre, with a consequent settlement and production of longitudinal cracks in the pavement surface, especially when the cold sets in or goes out of the ground. Nearly all engineers to-day are of the opinion that the unsightly cracks that one may notice in many concrete pavements are due to a very great extent to poor drainage.

Finishing

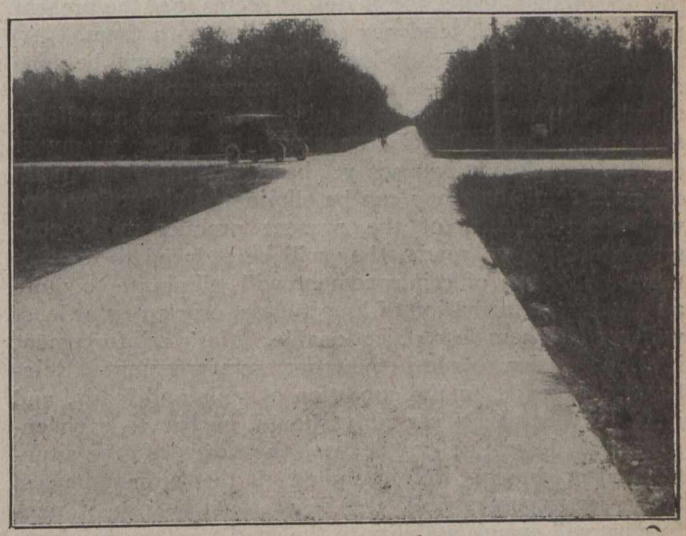
General practice seems to favor the wooden float for finishing. If handled by a skilled workman, it will give



Another Prettily Located Concrete Road Near Winnipeg that is Popular Among the Motorists

a satisfactory surface, sufficiently rough for all ordinary grades. The thinnest possible skin coat of cement should be brought to the surface so as not to cause scaling. Over-floating not only costs more money to the contractor, but does not give so good a surface.

It must be borne in mind that after concrete is deposited and floating done, the pavement is not finished. Good care should be taken that green concrete is not exposed to the hot rays of the sun. Canvas should be kept over the green concrete for about twenty-four hours, after which it can be sprinkled. No empty cement sacks should be allowed on the green concrete. Dirt can be used at the end of forty-eight hours, and should be kept wet for ten days. These precautions, if they are not overlooked,



Fort Garry Drive, Crossing Point Road, Near Winnipeg. Two of Manitoba's Oldest Concrete Roads

will prevent shrinkage cracks and conserve water, which will be needed for the chemical combination of the cement. Curing by ponding is also a very excellent method. The inspectors should see that all the dirt is completely removed and the surface well cleaned before the road is opened to traffic. As to the time of opening such roads to traffic, I would quote the following extract from the "National Conference on Concrete Roads for 1916":—

"The length of time necessary to keep the pavement closed to traffic will depend entirely upon weather conditions. During warm weather the pavement should be kept closed to traffic for at least fourteen days and preferably for three weeks. When the conditions are such that the temperature of concrete is less than 50° when placed, hardening takes place very slowly. As is well known, the hardening of concrete is a chemical action requiring heat. The hardening will take place in direct proportion to the amount of heat present, and takes place very slowly at a temperature of 35° Fahrenheit or below.

"When a concrete pavement has been laid in the late fall, it is sometimes difficult to determine when it will be safe to throw the road open to traffic. In rare cases it may be necessary, owing to peculiar local conditions, to open the road or street to traffic before it is absolutely safe to do so. Under such conditions, if about 3 inches of straw be placed on the pavement and this covered with several inches of earth, the surface of the pavement will be protected sufficiently against abrasion to allow the opening of the road sooner than could be safely done without such protection. This cover will, however, not minimize the danger of damage to the pavement by heavy loads, which will tend to crack pavement that has not developed its full strength. Concrete roads have been utterly ruined by opening to traffic too soon. Few people realize how slowly concrete hardens under unfavorable conditions, which will undoubtedly prevail on some jobs before the work is finished. All those in charge of concrete pavement work should have the necessity of adhering to the foregoing cold weather precautions strongly impressed upon them."

The recommended practice for transverse joints is that joints should be placed across the pavement, perpendicular to the centre line, about 50 feet apart. There seems to be a tendency to lengthen the distance between joints, and even to eliminate same entirely. Many en-