

cement concrete and brick. A complete discussion of any one of these types would take up as much space as it is purposed to occupy with this entire paper, and would probably present, furthermore, only a very small amount of matter at all new to the members of this congress. It seems best, therefore, to touch only on those features of construction concerning which there has been more or less difference of opinion among engineers, and to express such opinions regarding these features as the experience of the Office of Public Roads would appear to justify.

It should be borne in mind, however, that no typical sections could be made sufficiently general to meet all conditions, and still be of value. Special cases will frequently arise which must be given individual consideration, if the best results are to be obtained.

The amount of crown which should be given the cross-section of an improved road, for example, is a matter of very great importance and one which has been much discussed. The two factors which have had most influence in determining this detail are: first, the desirability of draining water off to the sides as quickly as possible after it falls on the road, and second, the desirability of keeping the cross-section as flat as practicable in order that traffic may not be unduly encouraged to use only the centre of the roadway. The character of the road surface determines which of these factors should be given most consideration.

Another much discussed point relates to whether the subgrade for brick and concrete roads should be given a flat or crowned cross-section. The Office of Public Roads at present recommends the flat cross-section, especially for concrete pavements, where the width does not exceed about 20 feet. This recommendation is based, for the most part, on the fact that fewer longitudinal cracks have been observed in pavements having flat subgrade cross-sections than where the subgrade is crowned, and the use of such flat cross-sections adds comparatively little to the cost of the narrower concrete pavements, in which longitudinal cracks are most objectionable.

Defective foundations can be corrected in a number of ways. Surface drainage is, of course, the first consideration, and when properly planned, is ordinarily adequate. Some combinations of soil and topographic conditions, however, render effective surface drainage impracticable, and in such cases, one of three methods of foundation treatment will usually be found satisfactory. The Telford base is especially adapted to soils which, even when well drained, are more or less unstable; the V-drain to localities where field stones may be cheaply obtained, and the side ditches to all locations where the soil is inclined to be springy or hard to drain.

Some of the other questions concerning which opinions differ are: What are the proper sizes of stone for the different courses of macadam roads, what methods of bituminous treatment are most satisfactory under given conditions, what kinds of coarse aggregate are best for concrete pavements, whether Portland cement grout or bituminous cement should be used for filling the joints in brick pavements, and whether brick pavements should be provided with expansion joints both laterally and longitudinally, or only longitudinally. The present attitude of the Office of Public Roads concerning these and other similar points has already been expressed in its published bulletins and specifications, and they are mentioned here only in order that the attention of engineers may be called to the need for collecting and assembling data bearing on the efficiency of different detail methods of construction.

Maintenance.—No paper on the subject of "Rural Highways" would be complete without discussing at least to some extent, the important question of road maintenance. Scientific care in planning and constructing public roads cannot possibly obviate the necessity for maintaining them, though it can no doubt greatly assist in meeting this necessity by causing it to be fully recognized and its importance properly appreciated.

The work of maintaining public roads is necessarily more routine in character than other classes of road improvement work, and would, therefore, seem to be more susceptible to advantage from standardization of methods. In the United States, however, there are discouragingly few localities in which any attempt at systematic maintenance has been made, and these are to be found only in states having strongly centralized control. In many of the states which have well organized highway departments and even those in which state aid for construction is an established policy, all road maintenance work is still being done or left undone under the supervision of the county, township or other local administrations. Judging by the annual reports of the various state road officials, however, it seems that they are practically all agreed that this arrangement is not satisfactory and are accordingly seeking to have the laws or appropriations under which they operate so changed that the work of maintaining the state-aid roads will be done under state supervision. This change has already been made in a number of states, and so far as is known, an immediate improvement has resulted.

In conclusion, it seems fitting to pay some tribute of appreciation to the efforts of highway engineers and other public road officials throughout the country who, notwithstanding the arduous nature of their prescribed duties, are always ready to co-operate in collecting and disseminating information relating to road improvement work which might be of value to other communities, and who almost uniformly show even a broader-minded disposition in their willingness to profit by the experience of others whenever the opportunity is afforded them.

NOVEMBER MUNICIPAL BOND SALES

The municipal bond sales in Canada for November, as compiled by *The Monetary Times*, amounted to \$2,265,892, compared with \$1,245,874 for October and \$622,049 for the corresponding period of last year.

Comparing the record of November, 1914, with that of the month just ended, the bond sales are as below:—

	1914.	1915.
Canada	\$622,049	\$2,265,892
United States	170,200	1,000,000
	<hr/> \$792,249	<hr/> \$3,265,892

This month total sales are more than four times the November sales of last year and reflect the improved state of financial affairs in Canada generally, apart altogether from the absorption of the fifty million domestic war loan and the bond offerings of provincial governments. A Montreal issue of \$1,000,000 was sold to United States investors.

The following are the particulars of the November municipal bond sales in Canada by provinces:—

Ontario	\$1,152,342
Manitoba	620,000
Quebec	328,000
Alberta	101,500
Saskatchewan	59,950
British Columbia	3,100
	<hr/> \$2,264,892