The financing of road construction by the issuance of long-term debentures, say, up to 25 to 30 years, is, in the opinion of the writer, a most legitimate method. Certainly the large amount of this work that is so urgently required in this country at the present time could not be done on the "pay-as-you-go" plan. It is not, however, a question of the end justifying the means. Such works as drainage, earth grades, concrete and steel bridges and culverts—essential features in road construction—may well be considered permanent works with resultant benefit extending far into the future, and it is unfair indeed to ask the present-day ratepayers to pay at once for works of this nature.

Advantages of Sufficient Funds

Moreover, the securing of sufficient funds to undertake the construction of a system of roads permits the work being completed in shorter periods of time under more efficient organization and management, thus ensuring better work, more continuity of plans and immediate enjoyment of the resultant benefits.

The cost to the ratepayer in pursuing such a method does not necessarily entail a larger annual outlay than that at present being levied in many municipalities in endeavoring to construct roads in such length of sections as their respective yearly appropriations will permit. Many municipal councils in Manitoba are spending annually on road work as much as from $10,000 to $15,000 without getting very far in a connected system of highways. Now, from the capitalization of such an amount, or even a portion thereof, a very considerable fund could be secured with which to complete a substantial system of roads.

For instance, for several years previous to 1912, the municipality of Wallace, Man., was spending $15,000 annually in endeavoring to improve road conditions there with very poor results, the bulk of the money being spent in grading sloughs without any attention to drainage or other permanent work.

Planned 198 Miles

In 1912, the council decided to take advantage of the Good Roads Act then in existence, and with the assistance of the engineers' department, laid out a plan of work comprising the building of 198 miles of roads.

Debentures to the amount of $198,000 have been issued by the municipality, which amount, with the assistance of the province of a like amount, will carry the scheme to a satisfactory completion, giving the municipality 198 miles of well-built gravel roads, properly drained and bridged throughout with permanent concrete structures.

The annual levy on the ratepayers of the municipality to meet the indebtedness thus incurred is $12,205.53, or about $3,000 less than when the scheme was undertaken, which latter amount will more than maintain the mileage constructed for a number of years until the renewal of gravel surface is needed. Provisions for proper maintenance is a most essential feature in highway improvement work, especially should provision be made therefor where construction has been effected by debenture proceeds.

The Manitoba Act places the responsibility and expense of maintaining roads built under government assistance on the municipality; but reserves the right to the government of performing such work as may be necessary in this conection, and levying on the municipality for the money so expended, should the council neglect or fail to maintain those roads.

METHOD OF KEYING SECTIONS OF CONCRETE DAM*

By Frank P. Fifer

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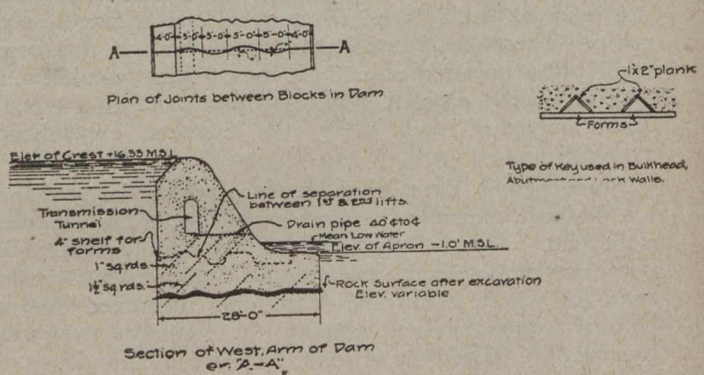
THE following novel method of keying and joining sections of a concrete dam was employed in the construction of the lock and dam on the Hudson River at Troy, N.Y.:—

The type of vertical keys used between sections in the bulkhead and abutments of the dam at Troy consisted of V-shaped grooves. This V type of key was also used in the monoliths of the dam proper for that part of the structure below the elevation of the apron, in addition to which the up and down-stream halves of each section were set at an angle to each other, thus making a V-shaped joint of the whole face. For that part of the dam from the elevation of the apron to the crest, a key consisting of a series of waves or curves was adopted. A plan view of this type of joint, together with a typical section of the west arm of the dam, is shown herewith. The east arm section is similar in outline, the crest being 2 ft. lower in elevation, and similar joints were used in it.



Plan View of Troy Dam, Showing Method of Keying the Sections

The curve type of joint secures a maximum effectiveness with a minimum cost in construction. Any other joint employing projections of the V-type or otherwise, would require for the same effectiveness a very large number of pieces, requiring much handling in placing and removing them at each joint, besides entailing some breakage. The bonding shown being integral with the form itself avoids the extra work, and is ready for use as soon as the form is secured.

The sections of the dam were placed in two lifts. The first lift extended from the prepared rock surface to the top of the apron. This foundation course was anchored to the rock surface by 1½-in. square rods, 10 ft. long, slanting downstream at an angle of 45°, spaced 10 ft. on centres, and are grouted about 5 ft. into solid rock. The second lift extends from the top of the apron to the crest of the dam. The bond between the two lifts is secured by making the line of separation between them a series of knobs and depressions. In addition to the bonding, 1-in. square rods were placed on a 45° downstream slant, the ends of the rods being embedded to an equal depth in each lift. These rods are spaced about 8 ft. centre, and are about 8 ft. long. They were simply stuck into the green concrete of the foundation.

*From "Professional Memoirs."