A 30-ft. Re-inforced Concrete Arch Under Construction.

The Highway Bridge

An Important Portion of a Good Road---Types---Location

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A 150-ft. Steel Span on Re-inforced Concrete Abutments

To the majority of those who travel our country highways a bridge is merely a portion of the road, and is not further recognized. But when something goes wrong so as to give it a distinguishing mark, the bridge immediately becomes the subject of numerous complaints to the authority whose business it is to keep it in repair. Frequently its designers and builders are made the butt of some not very complimentary remarks—not always privately expressed. That is as it should be. The physical features through which a road passes should not, as far as is reasonably possible, make any difference to the ease with which traffic passes over it. The aim of the designer is to secure this ideal and to make it a prevailing condition at all seasons.

To accomplish this and at the same time economically combat the troubles which afflict the highway bridges in the prairie provinces, necessitates the consideration of a number of problems, which it is the purpose of this article to briefly review. These will be better understood if we first describe the various types of bridges. It will be necessary to confine ourselves to the types suited to our local conditions.

Three Main Classes of Bridges

These are divided broadly into three classes, as follows: (1) Permanent bridges, comprising those built of stone or brick masonry or of reinforced concrete; also steel structures supported by masonry foundations. (2) Semi-permanent bridges, comprising all those built substantially of heavy timbers with every precaution taken to make the structure last out the life of the material of which it is composed, and (3) Temporary bridges, comprising all emergency crossings and those built of material ready to hand because of lack of funds and equipment for building anything better.

All three types have their legitimate place in the present state of development of the country. The first is without doubt the most economical type for bridging streams which cross well-established main roads carrying a havy traffic. Bridges of this kind should therefore be built in and near towns where the route is not liable to change, and where, owing to the greater population, there are greater revenues to stand the initial cost of permanent work. Such bridges should be built out of capital funds, in which the cost is spread over a number of years; the argument for posterity bearing its share in the cost being obvious in the case of permanent improvements of this character.

The second class is the one most frequently met with throughout the west. It is eminently suited to its duties. With rapid settlement it was necessary to adopt some ready method of construction which could keep pace with the rate of settlement and yet not unduly tax it financially. It is quite reasonable to adopt semi-permanent construction at the outset to make possible the settlement of new areas, but such a policy must be followed, as soon as practicable, by one adopting the more permanent forms of construction.

Little need be said concerning the third class; they are, as their name implies, purely for temporary use, and as little as possible should be spent upon them. What follows concerning the precautions to be taken to safeguard semi-permanent bridges applies broadly to temporary ones.

The Steel-on-Concrete Bridge

The permanent bridges built in the west are mostly of the steel-on-concrete type, i.e., steel span on concrete abutments. In Saskatchewan the abutments are almost entirely built of reinforced concrete, with their footings designed to be below the frost line and resting on a series of piles to further ensure an absolutely permanent foundation. Such abutments average between 14 feet and 22 feet high from their footings to the bridge floor level, whilst the piles extend the foundation from 8 to 20 feet below the footings, according to the nature of the ground on which the abutment is built.

The steel spans are usually of the truss variety. Those under 100 feet span are "pony" trusses—having no overhead members; whilst the larger ones are "through" trusses, where each truss is braced against the opposite one above the clearance allowed for traffic, which is about 15 feet high by 16 feet wide.

Owing to the general character of the streams throughout the west, where there are no very deep rivers of great width, it is unnecessary to adopt very long spans. Spans up to 150 feet are most frequently used, though there are a few which exceed this, the longest being 250 feet. In all steel bridges it is necessary to leave one end free to expand and contract in order to accommodate the variation in length due to changes in temperature. Over the prairies a variation of 150 degrees Fah. is the range usually allowed, from 50 degrees below zero to 100 degrees above. In that range every 100 feet of steel varies about one inch in length, hence provision is made to allow one end to slide that amount, whilst the other end is fixed rigidly to the abutment.

The All-Concrete Bridge

Another type of permanent bridge is being increasingly used on account of its absolute permanence: it is the all-concrete bridge. Whilst steel comes under the head of permanent construction, it has, after all, a "life," the duration of which depends largely on the care with which it is preserved by cleaning and painting, and statistics show that the average life of steel bridges is rather under than over 50 years. With the all-concrete type of construction, however, no such life has been determined. Barring accidents it is permanent in every sense of that word; in fact the older it becomes the stronger it gets. Moreover, no periodical maintenance such as is necessary for steel is required in the case of concrete. Provided a concrete structure is built properly in the first instance, with its foundations safe from undermining, with its various members correctly designed and built of sufficient strength to carry the loads required, there is no reason why that structure should not be in service a thousand years hence.

There are several types of the all-concrete bridge being built in the west. One of the finest examples of these is the University bridge at Saskatoon, shown in the illustrations. It was built by the Saskatchewan government across the South Saskatchewan River, and has a total length of over 1,200 feet.

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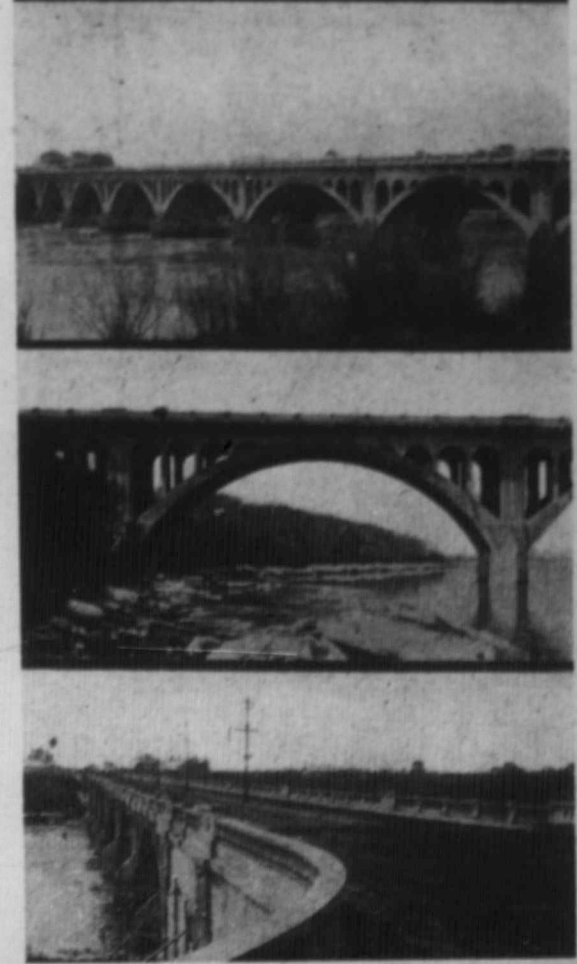
Types of Bridges, Semi-Permanent Construction
From top to bottom: Typical single span pile bridge; multiple span pile bridge; multiple span pile bridge with ice breakers; composite bridge with wooden approach spans to steel span on pile piers.



Types of Bridges, Permanent Construction
Upper scene: 104-ft. steel span on re-inforced concrete abutments; lower three scenes: the 10-arch, re-inforced concrete bridge at Saskatoon, showing view from down stream, the longest arch (span 150 feet, roadbed 70 feet above water) and, at the bottom: the roadway.