for Canada, the rose for England, the shamrock for Ireland, and the thistle for Scotland. Above the north and south faces and over the walks are buffalo heads, emblematic of Western Canada; the whole forming a pedestal of a massive British lion, 13 ft. long by 7 ft. high. The ensemble is symbolical of the permanence and stability of the British Empire supported by its component parts.

The piers are surmounted by slotted battlements treated with steel grill work. The plan of the pier parapet is a half hexagon. Inasmuch as the skew of the bridge is 60° an angle of the hexagon forms a nose or cut-water at the upstream face of the pier, while at the same time presenting a symmetrical elevation to the passing observer.

The illumination of the bridge will be effected through the agency of fluted cast-iron standard on the piers, and four torch bracket lights on each kiosk. All iron work will be painted of a gray color, which will nearly match the concrete.

For the distant observer viewing the bridge as a whole, an attempt has been made to break up the dull flat surfaces which from their extent and from the sameness of color impress one unfavorably. Working from the hypothesis that it is neither expedient nor economical to eliminate board marks from concrete faces, we have adopted the policy of substituting grooves and pilasters which will serve both to withdraw the eye from the necessary minor irregularities of the concrete surfaces, to break up the surfaces, and to heighten the effects aimed at, whether of depth by the use of vertical lines or of breadth by the use of horizontal lines. The faces of the piers have been panelled and grooved; the faces of abutments have been pilastered and the form sheeting has been run up and down to convey an impression of greater height. The arch rings were grooved at regular intervals, serving the double purpose of breaking up the rib face, and of offering suitable locations for construction bulkheads. The face of the north retaining wall was broken up by horizontal grooves and by battered pilasters, marking the locations of the counterforts on the back of the wall, and carried up above the rake of the wall, breaking the skyline.

The 62-ft. arch spanning the boulevard on the north side of the river supported deep spandrel walls, the faces of which were marked with pilasters, and the arch was crowned with a large date stone, and a seal of the city of Calgary 6 ft. high by 4 ft. wide.

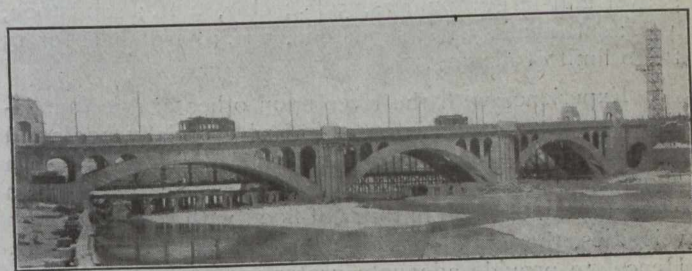
The low-level structure with a roadway 18 ft. wide, consists of a structural steel frame, with a concrete floor slab, and an asphaltic concrete wearing surface. It is suspended by hangers, each consisting of two steel angles engaging a pin, and linked to steel bars with an eye on one end and a thread upon the other. The threaded end passes through a yoke consisting of two 7-in. channels with top and bottom cover plates. These yokes are embedded in the main floor beams with the bottom of the yoke 18 ins. from the bottom of the beam.

The concrete slabs for the low-level consisted of premoulded blocks suitably reinforced, 4 ft. by 3 ft. 8 ins.; each slab was a double T with flanges 3 ins. thick, and the stems projecting 4 ins. below the slab. These blocks rest on the top flanges of the steel I-beam stringers. This unusual type of slab was adopted for two reasons: 1st, to reduce the dead load weight of the structure; 2nd, to permit of the completion of the erection in the dead of winter with a temperature at zero or less.

From the standpoint of economics with cement at $2.40 a barrel and structural steel at $80 a ton, the adopted design cost 40c. per square foot against 58c. per square foot for the standard design, with a 6-in. slab and I-beam stringers.

The spandrel arches were designed as beams continuous over three spans, all moments and shears being worked out for concentrated loads by means of the three-moment equation. Expansion joints have been provided in these spandrel walls, layers of three-ply roofing intervening between adjacent parts.

Joints at the one-third points in the arch spans allow for the opening due to the rise of the arch with a rise in



View from the East, Centre Street Bridge. Photograph, January 15th, 1917.

temperature, and joints at the piers and abutments provide for the fall of the arch with a drop in temperature, and the consequent drawing away of the spandrel walls from the piers.

Economic depths of beams and slabs as determined by the local costs of cement, sand, gravel, lumber and steel have been ascertained by the well-known principles of maxima and minima of differential calculas, the process entailing the writing of an equation for the cost of the material for the beams in terms of money and depth, and solving for the depth which will make the cost a minimum.

The concrete for the arches, beams, slabs and retaining walls was prepared in the proportion of one part of cement, two of sand, and four of gravel; the foundations and all pier and abutment walls 1:2.5:5; the handrail 1 of cement to 2.5 of sand.

The cement was purchased upon the specifications of the Canadian Society of Civil Engineers, with the exception of the tensile strength requirements for 1:3 mortar; these were raised from 150 to 200 lbs. per square inch for 7 days; and from 225 to 275 per square inch for 28 days. The product of the Canada Cement Company met this requirement.

A washed screened sand was required according to the specification with grading clauses, rejecting sand with more than 40%, by weight, passing a No. 30 screen; or more than 3% passing a No. 100 screen. The gravel, washed and screened, was purchased upon a void specification, the maximum not to exceed 40%. The maximum diameter of particles for use in piers, arches and walls was approximately 5 ins., this limitation being due to the efficiency of the mixing machine, not to a probable diminution in the strength of the resulting aggregate. In the floor system, owing to the intricate network of steel, it was necessary to limit the maximum diameter to 2 ins. Whenever expedient, as in piers and abutments, boulders were embedded in the concrete.

Active construction work upon the bridge began in April, 1915; in June the Bow River went into a flood, reaching a peak on the 26th, the highest since 1897. On