

## 1 DESCRIPTION

- 1.1 The work shall consist of the design, supply, fabrication and delivery of one (1) monolithic type steel overhead sign bridge conforming to the following specifications and the details on the attached Figure 1.
- 1.2 The work shall include the supply of fasteners, anchor assemblies and the design and fabrication of a framework to support the sign panels. It shall not include the supply of sign panels, aluminium T-Bars, luminaires, or luminaire supports, the erection of the structure, or the design and construction of the foundation.

## 2 DESIGN

- 2.1 The design of the sign bridge shall be done by a Professional Engineer registered in the Province of Saskatchewan.
- 2.2 Overhead sign structures shall be designed in accordance with the requirements of AASHTO *"Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals"* (the AASHTO Standard Specifications), latest edition plus interims and the requirements of CSA Standard, Canadian Highway Bridge Design Code (CSA-S6) and the following additional criteria:
- 2.2.1 Load combinations and load factors shall be in accordance with CSA-S6, Table A3.2.1.
- 2.2.2 Equation 3-1 of AASHTO Clause 3.8.1 shall be modified as follows:
- $$P_z = 2.5 q K_z C_d$$
- where  $q$  shall be taken from CSA-S6, Table A3.1.1.
- 2.2.3 The design wind pressure shall be based on an hourly mean wind pressure for a return period of 50 years (minimum) as given in CSA-S6, Table A3.1.1 for the location nearest to the overhead sign installation.
- 2.2.4 Dead load of sign panels shall be assumed to be 15 kilograms per square metre.
- 2.2.5 The design shall include provision for the weight of luminaires. Each luminaire shall be assumed to have a mass of 45 kilograms, and one luminaire shall be assumed to be located at each T-bar, 1.22 m in front of, and 0.2 m below the sign panels.
- 2.2.6 The design ice thickness for ice accretion shall be the value given in CSA-S6, Figure A3.1.4

- 2.2.7 The Fatigue Importance Factors in Table 11-1 of the AASHTO Standard Specifications shall be based on Fatigue Category I.
- 2.2.8 Further to AASHTO Standard Specifications section 11.7 “Fatigue Design Loads”, a dynamic analysis of the structure will not be accepted in lieu of using the equivalent static pressures provided in the specification.
- 2.2.9 Further to AASHTO Standard Specifications section 11.7.1 “Galloping”, the Ministry will not approve the use of vibration mitigation devices in lieu of designing to resist periodic galloping forces. Furthermore, the Ministry requires that galloping loads be considered for the fatigue design of all overhead cantilevered sign support structures regardless of their configuration.
- 2.2.10 Further to AASHTO Standard Specifications section 11.8 “Deflection”, the vertical deflection for sign structures shall not exceed 200 mm regardless of their configuration.
- 2.2.11 Design sign panel area shall be taken as the largest of:
  - 2.2.11.1 Actual size of site specific sign panels plus future signs shown in the drawing.
  - 2.2.11.2 Area of 3.5 m x 60% of horizontal span length, placed in any position along the span to create the most critical load effects.
- 2.2.12 Sign structures shall have a minimum permanent vertical camber of  $L/200$  where L is the span of the horizontal arm of the sign structure.
- 2.2.13 Vertical deflection in horizontal members due to SLS Combination A1 loading shall be limited to  $L/150$ , where L = the distance between vertical supports. The deflection of cantilevered sign structures shall not exceed 200 mm.
- 2.2.14 Horizontal deflection at the top of vertical supports due to SLS Combination A1 loading shall be limited to  $H/100$ , where H = the height of the vertical support.
- 2.2.15 Cantilever arm lengths shall not exceed 20 m.
- 2.2.16 The sign bridge shall be fabricated from sections of circular, octagon or dodecagon form. One or more of these sections may be used in the plane parallel to the direction of traffic, but only one of these sections shall be visible in the plane perpendicular to the direction of traffic. Two sections may be visible in the plane perpendicular to the direction of traffic for the horizontal member on cantilevered structures.
- 2.2.17 Field splices, if required, shall be by means of bolting.

- 2.2.18 Columns shall be so designed that they may be fastened to the foundations by a minimum of eight (8) bolts per column.
- 2.2.19 Sign structure structural framing shall be typically located at mid-height of sign panels, but in no case shall the structural framing be less than 600 mm above the bottom edge of sign panels.
- 2.2.20 The sign bridge may be fabricated with radiused upper corners, the maximum radius of bend being 3 metres.
- 2.2.21 Sign panels will include 100 mm x 100 mm x 9.5 mm aluminum T-Bars to facilitate the mounting of the sign panels to the sign bridge. Brackets shall be provided for the support and connection of the sign panels to the sign bridge via the T-Bars. The T-Bars shall be connected to the brackets by means of a bolted connection.
- 2.2.22 Provision shall be made for electric wiring including a hole in the column base plate, hand holes in the column and a wiring hole near the sign panels.
- 2.2.23 Hand holes shall be located near the top and bottom of the columns. Hand holes shall be stiffened by providing a reinforcing rim with semi-circular ends. The rim shall be welded to the member with a full penetration groove weld supplemented with an all around fillet weld. Cover plates for the hand holes shall be provided.

### **3 FABRICATION**

- 3.1 Sign bridges shall be fabricated by a fabricator whose normal business is the production of overhead sign bridges or who can demonstrate to the Ministry's satisfaction that they have the ability to do the work.
- 3.2 The sign bridge shall be fabricated at a plant which has been certified by the Canadian Welding Bureau (CWB) to the requirements of CSA Standard W47.1, Division 1 or 2.
- 3.3 Individual sections shall be shop assembled to ensure proper fit and alignment without creating undue stresses or deformations in the structure.

### **4 MATERIALS**

- 4.1 All materials shall be new.
- 4.2 The use of aluminum and aluminum alloy will not be permitted.
- 4.3 The sign bridge shall be fabricated from structural steel conforming to the requirements of CSA Standard G40.21, Grade 350WT, Category 2, and shall be galvanized according to ASTM Specification A123.
  - 4.3.1 Silicon content shall be less than 0.04% for the shafts.

4.3.2 Boron content shall be less than .0008%.

4.4 All steel materials including all hardware and anchor rod assemblies shall be hot-dip galvanized after fabrication.

4.5 Bolts for field splices, if required, shall conform to the requirements of ASTM Specification F3125, Grade A325 and shall be galvanized according to ASTM Specification A153.

4.6 Bolts for supporting sign panels shall conform to the requirements of ASTM Specification A307, Grade A and shall be galvanized according to ASTM Specification A153.

4.7 Anchor rods shall be manufactured from smooth rods conforming to the requirements of ASTM Specification F1554 Grade 55 ( $F_y=380$  MPa). Anchor rod assembly shall consist of but not limited to: anchor rods complete with nuts and washers, top temporary template complete with (c/w) clamping nuts, bottom anchor plate (c/w) anchor nuts and clamping nuts. Anchor rods shall be pretensioned by the turn-of-the-nut method on top of grouted base plates. Base plates shall be grouted with an approved flowable grout on MHI's approved products list.

## **5 SUBMISSIONS**

5.1 The supplier shall submit to the Ministry, two sets of shop drawings for review within 2 weeks of receiving the Purchase Order. One set of which must be reviewed by the Ministry and returned to the supplier with suggestions or revisions before any fabrication can commence. After the review is completed the supplier shall submit four sets of final erection drawings incorporating the Ministry's review comments prior to the commencement of fabrication. These drawings shall include a list of the maximum factored forces and torsional loads that may act in any of the three axes at the base of the columns. The drawings shall also include the size and layout of the anchor bolts.

5.2 The following shall be submitted prior to the commencement of fabrication:

5.2.1 Four sets of final fabrication and erection drawings.

5.2.2 Weld procedures approved by the Canadian Welding Bureau for each type of weld used in the structure

5.2.3 Mill certificates for all materials.

5.2.4 Design notes.

5.3 Design notes and plans for the overhead sign structure design shall be signed and sealed by a professional engineer.

## **6 PAYMENT**

Payment for the DESIGN, SUPPLY, FABRICATION AND, DELIVERY OF THE OVERHEAD SIGN BRIDGE will be at the contract lump sum price for the unit. The lump sum price will be full compensation for the design, supply and fabrication of all materials and delivery of the structure and hardware F.O.B. the destination.