



**CONSTRUCTION SPECIFICATION FOR  
SIGN SUPPORT STRUCTURES**

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**915.01 SCOPE**

This specification covers the requirements for the design and construction of the tri-chord, cantilever tri-chord, cantilever, variable message, pole mounted variable message, monotube overhead, bridge mounted, and roadside breakaway and non-breakaway sign support structures, including their footings.

**915.02 REFERENCES**

This specification refers to the following standards, specifications, or publications:

**Ontario Provincial Standard Specifications, Construction**

OPSS 501	Compacting
OPSS 603	Installation of Ducts
OPSS 609	Grounding
OPSS 902	Excavating and Backfilling - Structures
OPSS 903	Deep Foundations
OPSS 904	Concrete Structures
OPSS 905	Steel Reinforcement for Concrete
OPSS 906	Structural Steel for Bridges
OPSS 907	Structural Wood Systems

OPSS 911 Coating Structural Steel Systems  
OPSS 919 Formwork and Falsework

### **Ontario Provincial Standard Specifications, Material**

OPSS 1010 Aggregates - Base, Subbase, Select Subgrade, and Backfill Material  
OPSS 1350 Concrete - Materials and Production  
OPSS 1440 Steel Reinforcement for Concrete  
OPSS 1601 Wood - Preservative Treatment and Shop Fabrication

### **Ontario Ministry of Transportation Publications**

Sign Support Manual  
Structural Manual

MTO Forms:  
PH-CC-701 Request to Proceed  
PH-CC-702 Notice to Proceed

### **CSA Standards**

G40.20-13/G40.21-13 (R2018) General Requirements for Rolled or Welded Structural Quality Steel / Structural Quality Steel  
S6-19 Canadian Highway Bridge Design Code  
S157-17/S157.1-17 Strength Design in Aluminum / Commentary on CSA S157-17, Strength Design in Aluminum  
W47.2-11 (R2020) Certification of Companies for Fusion Welding of Aluminum  
W59-18 Welded Steel Construction  
W59.2-18 Welded Aluminum Construction  
W178.1-18 Certification of Welding Inspection Organizations  
W178.2-18 Certification of Welding Inspectors

### **American Association of State Highway and Transportation Officials (AASHTO)**

LRFDLTS-1 LRFD Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, 1<sup>st</sup> Edition and Interim Revisions

### **ASTM International**

A307-21 Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength  
A500/A500M-21a Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes  
A563/A563M-21ae1 Carbon and Alloy Steel Nuts (Inch and Metric)  
B209/209M-21a Aluminum and Aluminum-Alloy Sheet and Plate  
B221M-21 Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)  
F436/F436M-19 Hardened Steel Washers Inch and Metric Dimensions  
F593-17 Stainless Steel Bolts, Hex Cap Screws, and Studs  
F3125/F3125M-22 High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength

### **Canadian General Standards Board (CGSB)**

48.9712-2014 Non-Destructive Testing - Qualification and Certification of NDT Personnel

## Canadian Geotechnical Society

Canadian Foundation Engineering Manual, 4<sup>th</sup> Edition

## International Organization for Standardization/International Electrotechnical Commission (ISO/IEC)

17025:2017 General Requirements for the Competence of the Testing and Calibration Laboratories

### 915.03 DEFINITIONS

For the purpose of this specification, the following definitions apply:

**Bridge Mounted Sign Support Structure** means a static sign support structure attached to the side of a bridge.

**Cantilever Sign Support Structure** means an overhead sign support structure consisting of horizontal members mounted to one side, both sides, or centre mounted, to a single vertical leg.

**Cantilever Tri-Chord Sign Support Structure** means a static sign support structure consisting of a galvanized steel overhead truss constructed in the form of a three-chord system mounted to a single vertical leg.

**Column** means the vertical member of a roadside sign support structure that has the base section of the member buried below grade and the upper section connected to a sign or sign support.

**Leg** means the vertical member of an overhead sign support structure that connects to the sign support footing.

**Overhead Monotube Sign Support Structure** means an overhead sign support structure consisting of two vertical single steel tubing legs spanned by a single steel tubing member.

**Overhead Sign Support Structure** means a structure for supporting signs over a roadway.

**Pole Mounted Variable Message Sign Support Structure** means an overhead sign support structure consisting of a variable message board centre mounted to a single vertical galvanized steel pole.

**Roadside Sign Support Structure** means a timber or steel, breakaway or non-breakaway, sign support structure, consisting of two or more columns on the side of the roadway.

**Sign and Sign Board** means a traffic control device mounted on a fixed support that conveys a specific message by means of symbols and/or words, and is officially installed for the purpose of regulating, warning, informing, and guiding traffic.

**Sign Support Structure** means an overhead sign support structure or a roadside sign support structure.

**Sweep** means the deviation from straightness of a member or any portion of a member with respect to its minor axis.

**Tri-Chord Sign Support Structure** means a static sign support structure consisting of a galvanized steel overhead truss constructed in the form of a three-chord system and having two tubular legs.

**Variable Message Sign Support Structure** means an overhead sign support structure with two steel legs, consisting of a pair of trussed members, and an aluminum truss spanning the roadway.

**Variable Message Sign (VMS)** means a Variable Message Sign that includes display elements, sign case, VMS controller, controller enclosure and all other mechanisms and equipment required to enable placement of the VMS on the support structure.

## **915.04 DESIGN AND SUBMISSION REQUIREMENTS**

### **915.04.01 Design Requirements**

Sign support structure design shall be according to the Sign Support Manual, Structural Manual, CSA S6, AASHTO LRFDLTS-1, and the requirements of this specification. In addition, aluminum components shall also be designed according to CSA S157.

The catwalk grating shall be designed for a live load of 5 kPa.

Welding design shall be according to CSA W59.2 for aluminum and CSA W59 for steel.

### **915.04.02 Submission Requirements**

#### **915.04.02.01 General**

When other authorities are involved in the approval of the design or construction of a highway structure, the submission shall be made at least 5 weeks prior to commencement of work.

#### **915.04.02.02 Working Drawings for Sign Support Structures**

Working Drawings shall be submitted to the Contract Administrator at least 7 Days prior to commencement of fabrication of overhead sign support structures, for information purposes only.

Working Drawings shall be according to the Contract Documents. An Engineer's seal and signature shall be affixed on the Working Drawings verifying that they are consistent with the requirements of the Contract Documents.

The fabricator shall have a sealed and signed copy of the Working Drawings at the manufacturing facility during fabrication. Working Drawings shall include at least the following information:

- a) Fabrication details.
- b) Specifications of the material to be used.
- c) Design, assembly, and detail drawings including welding procedures according to CSA W59.2 for aluminum and CSA W59 for steel.
- d) Fastener torquing values and methods.
- e) For variable message sign support structures, structural details including the catwalk, aluminum skin, and attachment of the VMS to the sign support structure.
- f) Coating requirements.

#### **915.04.02.03 Mill Test Certificates**

Mill test certificates shall be according to OPSS 906.

**915.04.02.04 Verification of Fasteners**

Verification that bolts, nuts, and washers meet the chemical composition, mechanical properties, dimensions, workmanship, and head burst as required by the appropriate ASTM specification specified in the Contract Documents shall be submitted to the Contract Administrator.

**915.04.02.05 Delivery Schedule for Overhead Sign Support Structures**

The delivery schedule of overhead sign support structures and their components to the galvanizing or painting facility or both, and to the site, shall be provided to the Contract Administrator not less than 7 Days before shipping begins.

**915.04.02.06 Rock Excavation Plan**

If rock is present within the depth of the footing as specified in the Contract Documents a proposed method of rock excavation shall be submitted to the Contract Administrator at least 14 Days prior to the commencement of excavation, for information purposes only.

**915.04.02.07 Erection Procedures for Overhead Sign Support Structures**

Erection procedures shall be submitted to the Contract Administrator at least 7 Days prior to the commencement of overhead sign support structure erection, for information purposes only.

Erection procedures shall be according to the Contract Documents. An Engineer's seal and signature shall be affixed on the erection procedures verifying that they are consistent with the requirements of the Contract Documents.

A copy of the erection procedures shall be at the site during erection. The erection procedures shall include at least the following:

- a) Proposed method and sequence of erection.
- b) Weight and lifting points of the members.
- c) Locations and lifting capacities of the cranes to be used to lift the members.
- d) Details of temporary bracing and temporary supports used during construction, including time and sequence of removal.
- e) Calculations.
- f) Fastener torquing values and methods.
- g) Method of maintaining the columns and anchorages vertical and in the specified location in the footings until the concrete has set.
- h) Erection tolerance between the end diagonal and the corbel for the tri-chord sign support structure truss.

**915.04.02.08 Inspection Company and Inspector Information**

The names of the inspection company, inspectors, and non-destructive testing technicians, together with proof of certification, shall be submitted to the Contract Administrator a minimum of 7 Days prior to commencement of fabrication of overhead sign support structures, for information purposes only.

**915.04.02.09 Signboards**

**915.04.02.09.01 Sign Ordering**

A list of required signboards and tabs shall be submitted to the Contract Administrator a minimum of 12 weeks prior to the date of installation and shall contain the quantity, sign details, and the date for pick-up.

**915.04.02.09.02 Sign Confirmation and Inspection**

Confirmation in writing shall be provided to the Contract Administrator within 5 Business Days stating that all the supplied signs were received according to the list of required signboards and tabs. The Owner shall be responsible for the cost of replacing any incorrect signs identified prior to the confirmation. Once the confirmation has been received the Owner shall not be responsible for the cost of replacing any damaged, missing, and incorrect signs.

**915.05 MATERIALS**

**915.05.01 General**

All material used shall be appropriate for its end use and shall be compatible with the sign structure metal.

**915.05.02 Aluminum**

Extruded aluminum tubing shall be 6061-T6 alloy according to ASTM B221M.

Aluminum sheet and plate shall be 6061-T6 alloy according to ASTM B209.

Dissimilar metal shall not come in contact with aluminum.

**915.05.03 Anchorage Assembly**

Bolts, studs, struts, and coils shall be as specified in the Contract Documents. The anchorage assembly shall be hot dip galvanized according to the Coating clause. The anchorage assembly shall be supplied with the fasteners installed in a rigid template.

**915.05.04 Clamps**

Clamps shall be as specified in the Contract Documents.

**915.05.05 Coatings**

Paint and metallic coatings shall be as specified in the Contract Documents and according to OPSS 911.

**915.05.06 Concrete**

Concrete shall be according to OPSS 1350. Compressive strength shall be as specified in the Contract Documents.

**915.05.07 Electrical**

Ducts and fittings for electrical work shall be as specified in the Contract Documents and according to OPSS 603.

Electrical grounding posts at handholes shall be according to OPSS 609.

**915.05.08                      Fasteners**

Stainless steel fasteners shall be alloy 304 or 316 according to ASTM F593.

Lock nuts shall be nylon insert type.

Galvanized steel fasteners shall be according to ASTM A307 or ASTM F3125, grade A325 or grade A325M, Type 1 as specified in the Contract Documents.

High strength nuts, and hardened washers shall be suitable for use with the types of bolts being specified and shall be according to ASTM A563 and ASTM F436.

The nuts, bolts, and washers shall be supplied and shipped together as an assembly from the same manufacturer.

**915.05.09                      Granular Backfill**

Granular backfill shall be as specified in the Contract Documents and according to OPSS 1010.

**915.05.10                      Primer and Locking Compound**

The thread-locking compound shall be a removable medium strength, single component anaerobic thread locking material that allows disassembly with hand tools. The primer shall be as recommended by the manufacturer of the thread-locking compound.

**915.05.11                      Reinforcing Steel**

Reinforcing steel shall be according to OPSS 1440 and as specified in the Contract Documents.

**915.05.12                      Steel**

Steel shall be according to CSA G40.20/G40.21, ASTM A500, OPSS 906, and as specified in the Contract Documents.

**915.05.13                      Wood**

Wood shall be grade No. 1 Coast Douglas Fir, or grade No. 1 Jack Pine - Beam and Stringer grade, or Post and Timber grade categories as specified in the Contract Documents and shall be according to OPSS 1601.

Wood shall be pressure preservative treated according to OPSS 1601.

**915.07                              CONSTRUCTION**

**915.07.01                      Fabrication**

**915.07.01.01                  Aluminum Sign Support Structures**

**915.07.01.01.01              General**

The aluminum fabrication shall be according to CSA W59.2.

Cutting shall be done by shearing, sawing, milling, or plasma arc. Flame cutting of components is not permitted. In straightening out parts, only plastic or rubber hammers shall be used. All sharp edges and burrs shall be removed. Components cracked or ruptured at any time shall be replaced and not be used in the work.

#### **915.07.01.01.02 Welding**

All welding shall be according to CSA W59.2.

The company performing the welding shall be certified according to CSA W47.2, Division 1 or Division 2.

All welding shall be carried out by welders having a CSA W47.2 identification card valid for the type of welding to be done and for the duration of the welding work. Prior to commencement of welding, the identification cards for each tack welder, welder, or welding operator to be employed on the work shall be made available to the Contract Administrator. Identification cards shall be currently valid and shall indicate the welding processes and the welding positions for which the personnel are qualified to weld.

Welding jigs and fixtures shall be used to hold the connector assemblies in position during fabrication.

All areas to be welded shall be free of grease and cleaned with grease free aluminum or stainless steel brushes. All welds shall be according to CSA W59.2 and made using an inert-gas shielded arc process. All welds shall be cleaned of soot.

Components to be joined by fillet welding shall have a separation no greater than 1.5 mm.

Unless specified on the Working Drawings or otherwise approved in writing by the Contract Administrator, field welding shall not be permitted. When field welding is permitted, it shall be done by a welder certified for all position welding according to CSA W47.2.

#### **915.07.01.02 Steel Sign Support Structures**

##### **915.07.01.02.01 General**

The steel fabrication shall be according to the Working Drawings and OPSS 906, except as specified in this specification.

Circular structural tubing shall have no more than one longitudinal weld. Octagonal legs shall have no more than two longitudinal welds. Longitudinal welds in legs shall be full penetration and done using an automatic welding process. Longitudinal welds in legs shall be in a plane through the centroid of the section that is parallel to the signboard.

If an octagonal cross section is used for the legs, it shall be produced by mechanically bending the material. The centroid of the octagonal section shall be coincident with the specified circular shape.

##### **915.07.01.02.02 Welding**

Welding shall be according to CSA W59. All accessible welds, except fillet welds, shall be ground smooth.

##### **915.07.01.02.03 Steel Monotube Overhead Sign Support Structures**

The members shall be octagonal in cross-section and when tapered, the taper shall be uniform. Legs shall have one or two longitudinal automated electrically welded joints along their full length.

Circumferential welds shall be full penetration welds and shall be ground flush on the exterior face. The maximum permitted number of circumferential welded joints in a member length, as measured between the connections shall be as follows:



- a) Up to and including 9 m - one weld.
- b) Greater than 9 m - two welds.

Circumferential welds shall not be located less than 2.7 m from a bolted connection and all welding shall be carried out prior to galvanizing.

Sweep, in millimetres, shall not exceed:

$$\text{Sweep} \leq (\text{Total Length of Member in Metres} / 15) \times 10.4 \text{ mm}$$

All welding at flange plates shall develop the full strength of the adjacent shaft section.

The column base plates shall be flush with the bottom of the columns. The base plates shall be positioned perpendicular to the centreline of the columns. The flange plates shall be positioned to provide the specified camber of the horizontal member after erection. After fabrication, the faces of the base plates and flange plates shall be true and free from distortion.

A waterproof removable galvanized steel top cap shall be furnished with each leg. The caps shall blend with the general column design to present a neat overall appearance. Each cap shall be rigidly secured to the column by a hexagonal head stainless steel set screw. The flange plates, handholes, access nipples for wiring, grounding lugs, and mounting brackets shall be accurately positioned on the members. The wiring apertures shall provide a smooth cable entrance into the members.

#### **915.07.01.02.04 Coating**

All steel components of steel sign support structures, including the anchorage assembly, shall be hot dip galvanized according to OPSS 911.

Legs of sign supports, shall be subsequently coated with an approved paint system according to OPSS 911.

#### **915.07.01.03 Mechanical Access for Electrical Work**

Legs adjacent to the power source shall be fabricated with handhole frames complete with covers and gaskets. The strength of the leg at the section through the handhole shall not be less than the original section. When specified in the Contract Documents, grounding lugs, fuse clips, and access nipples for wiring shall be installed during shop fabrication.

#### **915.07.01.04 Identification of Overhead Sign Support Structures**

Each sign support structure shall have a site identification marking located approximately 1 m above the footing showing the following information:

- a) Site identification number.
- b) Manufacturer's name or trademark.
- c) Date of manufacture.
- d) Maximum sign area.
- e) Design wind pressure.

The marking shall be on a corrosion resistant plate securely attached by means of stainless steel band clamps. The plate shall be attached on the right leg viewed in the direction of traffic. The maximum size of plate shall be 150 x 150 mm.

The site identification number, maximum sign area, and design wind pressure for each sign support structure shall be as specified in the Contract Documents.

## **915.07.02 Shipment of Sign Support Structures and Their Components**

### **915.07.02.01 General**

Each sign support structure shall be shipped, complete with hardware, suitably packaged to ensure that all components are delivered together with tags attached noting the site identification number. The fuse connector clip and grounding post shall be assembled inside the leg before shipment.

### **915.07.02.02 Transporting, Unloading, Storing, and Handling Components**

The components shall only be handled at the lifting points shown in the Working Drawings using non-metallic lifting slings.

The components that are to receive a paint coating after galvanizing shall be identified when delivered to the galvanizing plant.

All work necessary to ensure safe loading, delivery, unloading, and storage of components at the specified site shall be performed. Components shall be loaded for shipping in a manner that they can be transported and unloaded at its destination without being overstressed or damaged. When stored, components shall be stockpiled to avoid permanent deformation or damage.

Advertising by means of removable signing is permitted on elements only while in transit to the specified site. Painting of advertisements directly on elements is not permitted.

### **915.07.02.03 Storage of Signboard Chord Clamps**

When the Contract Documents do not include the installation of the signboard for each overhead sign structure, the chord clamps required for fastening the sign shall be placed in burlap bags with tags. The tags shall be marked with the size of clamps and the identification number of the sign structure on which they are to be used. Chord clamps prepared in this manner shall be delivered to the Owner for storage as specified in the Contract Documents.

## **915.07.03 Footings for Overhead Sign Support Structures**

### **915.07.03.01 General**

The footings shall be constructed plumb to within 1H:100V.

The tolerance for the location of the centre of the constructed footing shall be 75 mm from the location specified in the Contract Documents.

### **915.07.03.02 Excavation**

The excavation shall be to the lines and grades specified in the Contract Documents and according to OPSS 902.

Cylindrical shaft footings for overhead sign support structures shall be constructed as caisson piles according to OPSS 903.

When the following conditions are encountered the excavation shall be stopped, observations shall be recorded, and the Contract Administrator shall be notified immediately:

- a) Different subsurface conditions and/or unexpected conditions such as obstructions within the foundations; or
- b) Unexpected rock is encountered at a depth less than the full depth of the footing; or
- c) Soil with unexpectedly lower strengths that compromise the bearing capacity.

**915.07.03.03 Formwork**

Formwork shall be according to OPSS 919.

The footing shall be formed to a minimum of 150 mm below finish grade. Formwork shall be removed to a minimum depth of 150 mm below finished grade prior to placing granular backfill.

**915.07.03.04 Reinforcing Steel**

Reinforcing steel shall be placed according to OPSS 905.

**915.07.03.05 Anchorage Assembly**

The anchorage assembly shall be installed level to the tolerances as specified in the Contract Documents. The tolerance for the location of the centre of the anchorage assembly shall be 50 mm from the centre of the footing. Anchorage assemblies shall be securely tied to the reinforcing steel and provided with supports to maintain its position during the placing of concrete. The anchorage assembly shall not be welded to the reinforcing cage and shall remain plumb to within 1H:200V. The anchorage assembly setting templates shall remain in place until after the curing period of the concrete.

The centre to centre tolerance of the anchorage assemblies for the following structure types shall be:

- Tri-chord sign support structure: - 25 mm to + 50 mm
- Variable message sign support structure:  $\pm 25$  mm
- Monotube overhead sign support structure:  $\pm 25$  mm

Bedding grout shall not be used under the base plates of tri-chord, cantilever tri-chord, cantilever, pole mounted variable message, and monotube overhead sign support structures.

**915.07.03.06 Electrical Ducts and Fittings**

All work for electrical ducts and fittings shall be according to OPSS 603.

When rigid duct sleeves in footings are specified in the Contract Documents, they shall be located to suit incoming duct or cable systems and shall be securely tied to steel reinforcement, prior to placing concrete.

All rigid duct sleeves shall be cut off cleanly above the footing ensuring a minimum projection of 150 mm above the base plates. Rigid duct sleeves shall be temporarily plugged or sealed until the ducts or cable systems are installed.

**915.07.03.07 Concrete**

**915.07.03.07.01 General**

Concrete shall be according to OPSS 904, with the following additions:

- a) All loosed, softened, and deleterious material within the foundation shall be removed prior to concreting.
- b) The foundation shall be inspected by the Contract Administrator prior to concreting.

- c) Concrete shall be placed against undisturbed soil and the top of the footing shall be float finished level within  $\pm 10$  mm of the elevation specified in the Contract Documents.
- d) When white-pigmented membrane is used as a curing compound on an adjacent concrete barrier, a minimum of one coat of the curing compound shall be applied to the concrete footing after completion of the curing with burlap and water of the footing, for colour uniformity. Additional curing compound shall be applied, as necessary, to ensure colour uniformity. The curing compound shall only be used on the exposed surfaces of the footings. No curing compound shall be applied to construction joints.

#### **915.07.03.07.02 Early Loading of Sign Support Structure Concrete**

Early erection of the sign support structure shall be according to the Early Loading of Structural Concrete subsection of OPSS 904 with the following exception:

- a) Prior to any early loading, it shall be demonstrated that the concrete has reached a compressive strength of 25 MPa by preparing, curing, and transporting early strength cylinders according to the Testing for Early Strength subsection of OPSS 904.

#### **915.07.03.08 Inspection after Construction of the Footings**

An Owner standard form PH-CC-701, Request to Proceed, shall be submitted to the Contract Administrator upon completion of the construction of the footing, and prior to the installation of the overhead sign support structure.

The installation of overhead sign support structure shall not proceed until an Owner standard form PH-CC-702, Notice to Proceed, has been received from the Contract Administrator.

#### **915.07.04 Erection of Overhead Sign Support Structures**

##### **915.07.04.01 General**

The Contract Administrator shall be notified in writing a minimum of 7 Days prior to the commencement of field operations and erection work.

Components shall be erected using appropriate lifting equipment, temporary bracing, guys, and stiffening devices so that the components are at no time overstressed, unstable, unsafe, or damaged.

The fully assembled truss of the variable message sign support structure shall be erected in one lift.

Legs of structures with rigid corners shall not be forced into position on to the anchorage bolts.

A primer and locking compound shall be applied to the anchor bolts during erection of the overhead sign structure.

##### **915.07.04.02 Legs**

Legs of structures shall be erected plumb to within a tolerance of 1H:200V.

##### **915.07.04.03 Field Cutting**

Field cutting of material is not permitted.

##### **915.07.04.04 Attachments to Sign Support Structures**

Attachments to the sign support structure shall only be made with clamps. Welding shall not be used for any attachment to the sign support structure.

#### **915.07.04.05 Field Splices**

Bolted field splices shall be as specified in the Contract Documents, have full contact bearing when assembled and shall not have a separation exceeding 0.5 mm for at least 75% of the entire contact area. The separation of any remaining portion shall not exceed 1 mm.

#### **915.07.04.06 Fastener Torquing**

Fasteners shall be torqued as specified in the Contract Documents.

#### **915.07.05 Breakaway and Non-Breakaway Roadside Sign Support Structures**

##### **915.07.05.01 General**

##### **915.07.05.01.01 Excavation**

The excavation for the footings of the steel columns and the installation of the wood columns shall be augered in undisturbed soil to the dimensions and at the locations specified in the Contract Documents. The elevation of the bottom of the excavation shall be as specified in the Contract Documents or as determined by the Contract Administrator. Sidewall stability shall be maintained throughout the excavation and concrete placement for steel columns, and installation of wood columns. The formation of cavities in the wall and the flow of soil or water into the excavation shall be prevented. All loose material shall be removed from the bottom of the excavation.

The MTO form PH-CC-701, Request to Proceed, shall be submitted to the Contract Administrator upon completion of the excavation. The work shall not proceed until the Contract Administrator has inspected the excavation and issued the MTO form PH-CC-702, Notice to Proceed.

When the following conditions are encountered the excavation shall be stopped, observations shall be recorded, and the Contract Administrator shall be notified immediately:

- a) Different subsurface conditions and/or unexpected conditions such as obstructions within the foundations; or,
- b) Unexpected rock is encountered at a depth less than the full depth of the footing; or,
- c) Soil with unexpectedly lower strengths that comprise the bearing capacity.

##### **915.07.05.01.02 Tolerances**

Centreline of the columns and column stubs shall be within 50 mm of the centreline of the as-built footing.

Centre to centre spacing of columns, column stubs, or column assemblies shall be  $\pm 50$  mm.

Height of signboard attachment holes shall be  $\pm 10$  mm.

#### **915.07.05.02 Steel Roadside Sign Support Structures**

##### **915.07.05.02.01 Footings**

Concrete shall be according to OPSS 904. Concrete for footings shall be placed against undisturbed soil.

The top of the footing shall be shaped to a dome with the top of the dome a minimum of 25 mm above the surrounding ground.

Minimum edge distance of the column components from the edge of concrete footing shall be 75 mm.

#### **915.07.05.02.02 Column Erection**

The columns shall be maintained vertical to within a tolerance of 1H:200V and oriented within the tolerances as specified in the Contract Documents until the concrete has set.

For the transverse alignment of the columns, the column components shall be installed so that the faces in contact with the cross-arms shall line up and be coplanar. The cross-arms and sign panels shall not be distorted.

The assembled elements constituting the column shall be straight and concentric with a maximum offset from the vertical axis of 5 mm at any joint.

Shims shall not be used in the assembly of the columns and joints, except at the column stub to lower column connection.

#### **915.07.05.02.01 Breakaway Type Columns**

The top surface of the friction plate on the column stub shall be installed level at the elevation specified in the Contract Documents and maintained in this position during the placing and setting of the concrete. The contact areas of the friction plate, fuse plate, and column flange shall be; smooth; clean; and free of galvanized beads, runs, and other imperfections that may impair the sliding action.

#### **915.07.05.03 Wood Roadside Sign Support Structures**

##### **915.07.05.03.01 Footings**

The columns shall be maintained vertical to within a tolerance of 1H:200V and within the tolerances as specified in the Contract Documents until the backfill has been completed.

Granular backfill shall be compacted according to OPSS 501. The top layer shall extend 100 mm above the surrounding ground and shall be sloped away from the column to provide water run off.

The backfill operation shall be completed prior to the attachment of the signs.

##### **915.07.05.03.02 Field Installation**

Field erection and cut surface treatment shall be according to OPSS 907.

The pressed steel shear plates shall be installed in grooves according to manufacturer's recommendations.

The splice surfaces shall be flat and perpendicular to the centreline of the post to ensure full plate contact and shall be used as templates for drilling the holes.

#### **915.07.06 Site Trimming Around Footings**

The area surrounding the footing shall be trimmed and finished as specified in the Contract Documents.

#### **915.07.07 Bridge Mounted Sign Support Structures**

When the location of attachment on a structure is not specified in the Contract Documents, the attachment to the structure shall be located to minimize the fatigue affects on the support structure as determined by the Contract Administrator.

The Contract Administrator shall be notified in writing a minimum of 7 Days prior to the commencement of field operations and erection work.

Components shall be erected using appropriate lifting equipment, temporary bracing, guys, and stiffening devices so that the components are at no time overstressed, unstable, unsafe, or damaged.

Installation of anchors shall be according to the Contract Documents.

**915.07.08 Attachment of New Signboards**

**915.07.08.01 General**

The signboards shall be installed at the locations as specified in the Contract Documents using fasteners appropriate for the application.

All new signboards and tabs to be installed on all new sign support structures will be supplied by the Owner.

Tabs placed on signboards shall be installed with self-tapping screws, #3 Teks screws, with a minimum distance between screws of 300 mm.

**915.07.08.02 Sign Pick-Up**

All ordered signboards and tabs shall be picked up at the location provided in the "Schedule of Materials to be Supplied by the Owner" within 10 Business Days of receiving notice from the Contract Administrator that the signs are ready for pick-up.

**915.07.09 Quality Control**

**915.07.09.01 General**

The quality control of all fabrication processes shall be according to OPSS 906, except as modified in this specification.

Visual inspection and non-destructive testing of steel components shall be according to CSA W59 and as specified in this specification. The acceptance standards of CSA W59 for dynamically loaded structures shall apply.

Visual inspection and non-destructive testing of aluminum components shall be according to CSA W59.2 and as specified in this specification. The acceptance standards of CSA W59.2 for dynamically loaded structures shall apply.

**915.07.09.02 Certification of Testing Company, Inspectors and Technicians**

An inspector performing the visual inspection shall be certified according to CSA W178.2. Certification shall be to either CWB Level 2 or CWB Level 3.

A testing company shall be employed by the Contractor to do the non-destructive testing of welds and shall be an independent testing organization that is certified by the Canadian Welding Bureau to the requirements of CSA W178.1 for testing of industrial structures. Certification shall include all non-destructive testing methods required to fulfill the inspection and testing requirements of this specification.

Non-destructive testing shall be done by a technician certified in accordance with CGSB 48.9712. Certification shall be to either CGSB Level 2 or CGSB Level 3 for the method used.

The technician and the testing company shall not be changed without the prior approval of the Contract Administrator.

### **915.07.09.03                    Inspection and Testing Reports**

A copy of all inspection and testing reports shall be submitted to the Contract Administrator within 7 Days after inspection.

Inspection reports shall bear the seal and signature of an Engineer.

### **915.07.09.04                    Material Certification**

Prior to fabrication, the materials used shall be certified to be according to the requirements specified in the Material section.

### **915.07.09.05                    Inspection of Welds**

Upon completion of fabrication, all welds in the structure shall be visually inspected and the following welds and connections shall be tested to confirm the acceptability of the fabrication:

- a) The following steel connections shall be tested by magnetic particle testing:
  - i. All column to base plate, stiffeners to column, and stiffeners to base plate for the cantilever, tri-chord, cantilever tri-chord, variable message, pole mounted variable message, and overhead monotube sign support structures.
  - ii. All arm to leg connection plates, stiffeners to arm connection plate, and stiffeners to leg connection plate for cantilever and cantilever tri-chord sign support structures.
  
- b) The following welds shall be tested using ultrasonic testing methods:
  - i. All longitudinal groove welds in the first 2 m of the leg measured from the base plate of the tri-chord, pole mounted variable message, and overhead monotube sign support structures.
  - ii. All longitudinal groove welds along the full length of the legs of cantilever tri-chord and cantilever sign support structures.
  - iii. All circumferential welds.
  - iv. All full penetration groove welds at the eight inclined chord / horizontal aluminum chord node locations of the end panels of variable message sign support structures.

### **915.07.09.06                    Inspection of Galvanizing**

Upon completion of the galvanizing of tri-chord, cantilever tri-chord, and cantilever sign support structures; the truss portion of the structure shall be visually inspected to confirm that the elements have not been damaged due to the galvanization process.

A written inspection and testing report shall be prepared.

### **915.07.09.07                    Inspection of Coating**

Coating inspection shall be according to OPSS 911.

A written inspection report of the observations shall be prepared.

### **915.07.09.08                    Inspection after the Fabrication and Coating of the Overhead Sign Support Structure**

A Manufacturer's Certificate of Conformance and an Owner standard form PH-CC-701, Request to Proceed, shall be submitted to the Contract Administrator upon completion of the fabrication and coating of the overhead sign support structure.



The overhead sign support structure shall not be shipped from the plant until the Contract Administrator has issued an Owner standard form PH-CC-702, Notice to Proceed.

**915.07.09.09 Inspection of Erected Sign Structure**

**915.07.09.09.01 General**

An inspector shall be provided and in attendance to observe the erection operation and to report on compatibility of anchor layout and holes in the base plate and the general alignment, fit up, and bolting.

Bolted construction shall be according to the Bolted Construction General clause in OPSS 906.

The inspector shall visually inspect all components for dents, cracks, ruptures, and loose or improperly fitted clamps and fasteners, including tensioning of fasteners, as well as the presence of all drain and vent holes as specified in the Contract Documents.

A written inspection report of the observations shall be prepared.

**915.07.09.09.02 Inspection of Tri-Chord and Cantilever Tri-Chord**

An inspector shall confirm that the tolerance is as specified in the Contract Documents between the first diagonal and the corbel is maintained in the tri-chord sign support structure.

**915.07.10 Repair of Sign Support Structures**

**915.07.10.01 General**

Repair of sign support structures shall only apply to rehabilitation and refurbishment of existing sign support structures.

**915.07.10.02 Steel**

Salvaged steel components may be used as specified in the Contract Documents. A written certification bearing the seal and signature of an Engineer shall be submitted to the Contract Administrator certifying that salvaged components are defect free and are according to the Contract Documents.

**915.07.10.03 Aluminum**

Cracked or ruptured welds may be repaired. Distorted, cracked, or ruptured members or components shall be replaced subject to approval by the Contract Administrator as specified in the Contract Documents. Salvaged members shall not be used.

**915.07.10.04 Inspection of Repairs**

An inspection of the repairs and replaced components shall be completed as specified in the Quality Control subsection.

**915.07.11 As-Built Drawings**

For overhead sign support structures, as-built drawings shall be prepared and submitted to the Contract Administrator in a reproducible format prior to Contract Completion and shall include the following information:

- a) All work incorporated in the completed structure that required the submission of Working Drawings.
- b) All changes that have been made from the original Contract Documents.

The as-built drawings shall bear the seal and signature of an Engineer.

**915.07.12 Management of Excess Material**

Management of excess material shall be according to the Contract Documents.

**915.08 QUALITY ASSURANCE**

**915.08.01 General**

The Owner, at its discretion, may choose to do inspection, testing, and sampling in the fabricating shop and field to confirm that the materials supplied, the fabrication of sign support structures, and the erection of sign support structures have been completed as specified in the Contract Documents.

The Contractor shall provide a free and safe access, and protection from the weather for inspection and testing of materials and structural components, during all aspects of the fabrication, delivery, and erection of the sign support structures, at no additional cost to the Owner.

**915.09 MEASUREMENT FOR PAYMENT**

**915.09.01 Actual Measurement**

**915.09.01.01 Sign Support Footings**

For measurement purposes, a count shall be made of the number of sign support footings installed.

**915.09.01.02 Sign Support Structures**

For measurement purposes, a count shall be made of the number of sign support structures installed.

**915.09.01.03 Attachment of New Signboards**

For measurement purposes, a count shall be made of the number of signboards and tabs installed.

**915.09.02 Plan Quantity Measurement**

When measurement is by Plan Quantity, such measurement shall be based on the units shown in the clauses under Actual Measurement.

**915.10 BASIS OF PAYMENT**

- 915.10.01 Concrete in Ground Mounted Static Sign Support Footings, Tri-Chord and Cantilever - Item**
- Concrete in Median Mounted Static Sign Support Footings Tri-Chord and Cantilever - Item**
- Cantilever Tri-Chord Static Sign Support Structures, Class - Item**
- Concrete in Ground Mounted Variable Message Sign Support Footings - Item**
- Concrete in Median Mounted Variable Message Sign Support Footings - Item**
- Concrete in Steel Monotube Overhead Sign Support Footings - Item**
- Concrete in Steel Column Breakaway Sign Support Footings - Item**
- Concrete in Steel Column Non-Breakaway Sign Support Footings - Item**
- Tri-Chord Static Sign Support Structures, Span in Metres - Item**
- Cantilever Static Sign Support Structures, Class - Item**

**Pole Mounted Variable Message Sign Support Structures - Item**  
**Steel Monotube Overhead Sign Support Structures, Span in Metres - Item**  
**Variable Message Sign Support Structures, Span in Metres - Item**  
**Steel Column Breakaway Sign Support Structures - Item**  
**Steel Column Non-Breakaway Sign Support Structures - Item**  
**Wood Column Breakaway Sign Support Structures - Item**  
**Wood Column Non-Breakaway Sign Support Structures - Item**  
**Aluminum Bridge Mounted Sign Support Structures - Item**  
**Repair of Existing Structure - Item**  
**Attachment of New Signboards - Item**

Payment at the Contract price for the above tender items shall be full compensation for all labour, Equipment, and Material to do the work.

For payment purposes, the fabrication and delivery of the sign support structures to the work site shall constitute 60% of the work of the tender item.

Replacement of aluminum components that were cracked, ruptured, or damaged during fabrication or erection shall be at no additional cost to the Owner.