



**CONSTRUCTION SPECIFICATION FOR
SIGN SUPPORT STRUCTURES**

TABLE OF CONTENTS

915.01	SCOPE
915.02	REFERENCES
915.03	DEFINITIONS
915.04	DESIGN AND SUBMISSION REQUIREMENTS
915.05	MATERIALS
915.06	EQUIPMENT - Not Used
915.07	CONSTRUCTION
915.08	QUALITY ASSURANCE
915.09	MEASUREMENT FOR PAYMENT
915.10	BASIS OF PAYMENT

APPENDICES

915-A	Commentary
915-B	Supplemental Requirements for Use in Municipal Contracts

915.01 SCOPE

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

915.01.01 Specification Significance and Use

This specification is written as a municipal-oriented specification. Municipal-oriented specifications are developed to reflect the administration, testing, and payment policies, procedures, and practices of many municipalities in Ontario.

Use of this specification or any other specification shall be according to the Contract Documents.

915.01.02 Appendices Significance and Use

Appendices are not for use in provincial contracts as they are developed for municipal use, and then, only when invoked by the Owner.

Appendices are developed for the Owner's use only.

Inclusion of an appendix as part of the Contract Documents is solely at the discretion of the Owner. Appendices are not a mandatory part of this specification and only become part of the Contract Documents as the Owner invokes them.

Invoking a particular appendix does not obligate an Owner to use all available appendices. Only invoked appendices form part of the Contract Documents.

The decision to use any appendix is determined by an Owner after considering their contract requirements and their administrative, payment, and testing procedures, policies, and practices. Depending on these considerations, an Owner may not wish to invoke some or any of the available appendices.

915.02 REFERENCES

When the Contract Documents indicate that municipal-oriented specifications are to be used and there is a municipal-oriented specification of the same number as those listed below, references within this specification to an OPSS shall be deemed to mean OPSS.MUNI, unless use of a provincial-oriented specification is specified in the Contract Documents. When there is not a corresponding municipal-oriented specification, the references below shall be considered to be the OPSS listed, unless use of a provincial-oriented specification is specified in the Contract Documents.

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

CSA Standards

G40.20-04/G40.21-04 (R2009)	General Requirements for Rolled or Welded Structural Quality Steel / Structural Quality Steel
S6-06	Canadian Highway Bridge Design Code
S157-05/S157.1-05 (R2010)	Strength Design in Aluminum / Commentary on CSA S157-05, Strength Design in Aluminum
W47.2-11	Certification of Companies for Fusion Welding of Aluminum
W59-03 (R2008)	Welded Steel Construction (Metal Arc Welding)
W59.2-M1991 (R2008)	Welded Aluminum Construction
W178.1-08	Certification of Welding Inspection Organizations
W178.2-08	Certification of Welding Inspectors

American Association of State Highway and Transportation Officials (AASHTO)

LTS-5-M	Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, 5th Edition, with 2010 Interim Revisions
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ASTM International

A 307-10	Carbon Steel Bolts and Studs 60,000 PSI Tensile Strength
A 325-10	Structural Bolts, Steel, Heat Treated 120/105 ksi Minimum Tensile Strength
A 325M-09	Structural Bolts, Steel Heat Treated 830 MPa Minimum Tensile Strength, Metric
A 500-10a/A500M-10a	Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
B 209M-07	Aluminum and Aluminum Alloy Sheet and Plate, Metric
B 221M-07	Aluminum and Aluminum Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
F 593-02 (2008)e1	Stainless Steel Bolts, Hex Cap Screws, and Studs

Canadian General Standards Board (CGSB)

48.9712-2006	Non-Destructive Testing-Qualification and Certification of Personnel
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International Organization for Standardization/International Electrotechnical Commission (ISO/IEC)

17025-2005, 2 nd Ed.	General Requirements for the Competence of the Testing and Calibration Laboratories
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915.03 DEFINITIONS

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

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.

Certificate of Conformance means a document issued by the Quality Verification Engineer confirming that the specified components of the Work are in general conformance with the requirements of the Contract Documents.

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.

Crank Location means the joint in the end panel of a variable message sign support structure where the horizontal chords meet the sloping chords.

Engineer means a professional engineer licensed by the Professional Engineers Ontario to practice in the Province of Ontario.

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.

Proposal means a Contractor's submission for which engineering design is required that provides a written:

- a) Alternative to requirements specified by the Owner in the Contract Documents.
- b) Course of action or undertaking by the Contractor, as delegated by the Owner in the Contract Documents.

Quality Verification Engineer (QVE) means an Engineer retained by the Contractor qualified to provide the services as specified in the Contract Documents.

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 means a variable message board or a signboard.

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 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.

915.04 DESIGN AND SUBMISSION REQUIREMENTS

915.04.01 Design Requirements

Sign support structure design shall be according to CAN/CSA S6, AASHTO LTS-5-M, the Sign Support Manual, the Structural Manual, and the requirements of this specification.

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

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

915.04.02 Submission Requirements

915.04.02.01 General

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

All submissions shall be according to the appropriate clause.

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 and one additional copy of the required submission shall be provided for each other authority.

915.04.02.02 Working Drawings for Sign Support Structures

The Contractor shall submit 3 sets of Working Drawings to the Contract Administrator at least 7 Days prior to commencement of fabrication of overhead sign support structures, for information purposes only.

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-M for aluminum and CSA W59 for steel.
- d) Fastener torquing values and methods.
- e) For variable message sign support structures, structural details of the sign, including the catwalk, aluminum skin, and attachment to the sign support structure.
- f) Coating requirements.

915.04.02.03 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.

915.04.02.04 Rock Excavation

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

915.04.02.05 Erection Procedures for Overhead Sign Support Structures

The Contractor shall submit 3 copies of the erection procedures to the Contract Administrator at least 7 Days prior to the commencement of overhead sign support structure erection, for information purposes only.

The Contractor shall have a copy of the erection procedures 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.

915.04.02.06 Proposals

The Contractor shall submit 5 copies of any proposal by the Contractor to the Contract Administrator at least 14 Days prior to commencement of the work for review. Proposals shall bear the seals and signatures of a design Engineer and a design-checking Engineer. The Contractor shall not proceed with the changes until the Contract Administrator has accepted the proposal.

915.04.02.07 Mill Test Certificates

Prior to the use of any material in fabrication, 2 copies of the mill test certificates for that material shall be submitted to the Contract Administrator confirming that the material is according to the Contract Documents.

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 also be submitted to the Contract Administrator.

Copies of the mill test certificates for all material to be used in the fabrication shall be available for review at the fabricating plant during fabrication. The certificates shall show that the material is according to the Contract Documents.

If the material cannot be identified by mill test certificates, coupons shall be taken and tested and these test certificates shall be made available.

When mill test certificates originate from a mill outside Canada or the United States of America, the Contractor shall have the information on the mill test certificate verified by testing by a Canadian laboratory. This laboratory shall be certified by an organization accredited by the Standards Council of Canada to comply with the requirements of ISO/IEC 17025 for the specific tests or type of tests required by the material standard specified on the mill test certificate. The mill test certificates shall be stamped with the name of the Canadian laboratory and appropriate wording stating that the material is in conformance with the requirements as specified in the Contract Documents. The stamp shall include the appropriate material specification number, testing date (i.e., yyyy-mm-dd), and the signature of an authorized officer of the Canadian laboratory.

915.04.02.08 Inspection Company and Inspector Information

The Contractor shall submit the names of the inspection company and the inspectors, together with proof of certification, to the Contract Administrator a minimum of 7 Days prior to commencement of fabrication of overhead sign support structures, for information purposes only.

915.05 MATERIALS

915.05.01 General

Material not specified in the Contract Documents 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 B 221M.

Aluminum sheet and plate shall be 6061-T6 alloy according to ASTM B 209M.

Dissimilar metal shall not come in contact with aluminum.

915.05.03 Fasteners

Stainless steel fasteners shall be according to ASTM F 593, Alloy 304 or 316.

Lock nuts shall be nylon insert type.

Galvanized steel fasteners shall be according to ASTM A 307, ASTM A 325, or ASTM A 325M as specified in the Contract Documents and the requirements of the High Strength Bolts, Nuts, and Washers subsection of OPSS 906.

915.05.04 Clamps

Clamps shall be as specified in the Contract Documents.

915.05.05 Steel

Steel shall be according to CSA G40.21, ASTM A 500, OPSS 906, and as specified in the Contract Documents.

915.05.06 Concrete

Concrete shall have a nominal minimum 28-Day compressive strength as specified in the Contract Documents, and shall be according to OPSS 1350.

A superplasticizer shall be used to attain a slump of 150 mm ± 30 mm.

915.05.07 Reinforcing Steel

Reinforcing steel shall be a minimum Grade 400W steel and shall be according to OPSS 1440.

915.05.08 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.

915.05.09 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 Contract Documents. The anchorage assembly shall be supplied with the fasteners installed in a rigid template.

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 locking compound.

915.05.11 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.

915.05.12 Granular Backfill

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

915.05.13 Coatings

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

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 W59.2M.

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.

915.07.01.01.02 Welding

The company performing the welding shall be certified according to CSA W47.2, Division 1 or Division 2.1. Qualification for welding and workmanship shall be according to the requirements of CSA W59.2M.

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 made using MIG process according to CSA S157, Section 26.12. 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 noted 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.

915.07.01.01.03 Bridge Mounted Sign Support Structures

When the location of attachment on a structure is not specified in 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.

For anchors, the Contractor shall prepare, clean, and place adhesive in the drill holes as per the manufacturer's recommendations. Prior to drilling holes, the Contractor shall locate existing steel reinforcement, Utility ducts, post tensioning hardware, and any unsound concrete in the vicinity of the dowel locations. The Contractor's installation operations shall not damage the steel reinforcement, the surrounding concrete, or any other embedments.

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:

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

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 shall be hot dip galvanized according to OPSS 911.

The galvanized surface to receive a subsequent paint coating shall be specified in the Contract Documents. Coating of the components shall be 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.

915.07.01.05 Shipment of Sign Support Structures and Their Components

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.

915.07.01.05.01 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.

The Contractor shall perform all work necessary to ensure safe loading, delivery, unloading, and storage of components at the specified site. 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.

915.07.01.05.02 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 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.

915.07.02 Footings for Overhead Sign Support Structures

915.07.02.01 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 as specified in the Contract Documents.

915.07.02.02 Excavation

The excavation shall be to the lines and grades as 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 soil with unexpected very low bearing capacity or unexpected rock is encountered at a depth less than the full depth of the footing, the excavation shall be stopped and the Contract Administrator shall be notified immediately.

915.07.02.03 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.

915.07.02.04 Reinforcing Steel

Reinforcing steel shall be placed according to OPSS 905.

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

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

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

Bedding grout shall not be used under the base plates for tri-chord, cantilever, or monotube overhead sign support structures.

915.07.02.06 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.

915.07.02.07 Concrete

Concrete work shall be according to OPSS 904.

Concrete shall be placed against undisturbed soil and the top of the footing shall be float finished level to a tolerance of ± 0.1 degree in any direction and within ± 10 mm of the elevation as specified in the Contract Documents. The top surfaces shall be finished free of depressions. The concrete surface in contact with the base plate shall be steel float finished.

Concrete shall be cured according to the following:

- a) Curing of the formed sign support footings shall be a minimum of 96 hours.

- b) Wet burlap shall be applied to the top unformed surface of the footing immediately after completion of the finishing operation without damaging or marring the surface of the concrete and maintained in a wet condition for the minimum curing period.
- c) When the formwork is left in place for 96 hours or more, no additional curing of the formed concrete surface is required.
- d) When the formwork is removed in less than 96 hours, the formed concrete surface shall be cured with burlap and water for the remainder of the minimum curing period.
- e) 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 immediately after completion of the curing cycle for the footing for colour uniformity. Additional curing compound shall be applied, as necessary, to ensure colour uniformity.
- f) The curing compound shall only be used on the exposed surfaces of the footings. No curing compound shall be applied onto construction joints.

Prior to the erection of the sign support structure, curing of the footing shall be complete and the concrete shall be at a minimum compressive strength of 25 MPa.

915.07.03 Erection of Overhead Sign Support Structures

915.07.03.01 General

The Contract Administrator shall be notified in writing a minimum of one week 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.

915.07.03.02 Legs

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

915.07.03.03 Field Cutting

Field cutting of material is not permitted.

915.07.03.04 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.

915.07.03.05 Field Splices

Bolted field splices specified in the Contract Documents shall 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.

915.07.03.06 Fastener Torquing

Fasteners shall be torqued as specified in the Contract Documents.

915.07.04 Breakaway and Non-Breakaway Roadside Sign Support Structures

915.07.04.01 General

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 as 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, concrete placement for steel columns, and installation of the 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 and the excavation shall be inspected and accepted by the Contract Administrator prior to continuing the work.

When soil with unexpected very low bearing capacity or unexpected rock is encountered at a depth less than the full depth of the footing, the excavation shall be stopped and the Contract Administrator shall be notified immediately.

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 ± 50 mm.

Height of signboard attachment holes shall be ± 10 mm.

915.07.04.02 Steel Roadside Sign Support Structures

915.07.04.02.01 Footings

Concrete for the footing 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. The concrete shall be cured with curing compound, except in cold weather. In cold weather concrete shall be placed and protected according to OPSS 904.

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

915.07.04.02.02 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.

915.07.04.02.03 Breakaway Type Columns

The top surface of the friction plate on the column stub shall be installed level at the elevation as 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.

915.07.04.03 Wood Roadside Sign Support Structures

915.07.04.03.01 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.

915.07.04.03.02 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.

915.07.05 Site Trimming Around Footings

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

915.07.06 Attachment of Signboards

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

915.07.07 Quality Control

915.07.07.01 General

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

An inspector performing the visual inspection shall be certified according to CSA W178.2. Certification shall be to either Level II or III for the methods used.

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 by radiographic, ultrasonic, magnetic particle, and liquid penetrant test methods.

Testing shall be done by a non-destructive testing technician certified by the Canadian Welding Bureau according to CAN/CGSB 48.9712. Certification shall be either Level II or III for the methods used.

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

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 W59.2M and as specified in this specification. The acceptance standards of CSA W59.2M for dynamically loaded structures shall apply.

915.07.07.02 Fabrication, Inspection, and Testing

The materials used shall be identified in the fabricator's plant and shall be certified to be according to the requirements in the Material section.

The work shall be inspected and tested to confirm the acceptability of the fabrication, as follows:

- a) On completion of fabrication, all welds shall be visually inspected.
- b) The following connections shall be tested by magnetic particle testing for steel:
 - i. Column to base plate, stiffeners to column, and stiffeners to base plate for the cantilever, tri-chord, variable message and monotube overhead sign support structures.
 - ii. Cantilever sign support arm to leg connection plates, stiffeners to arm connection plate, and stiffeners to leg connection plate.
- c) All longitudinal groove welds shall be tested prior to assembly of any component to the legs using ultrasonic testing methods. The length and location of welds to be tested shall be as follows:
 - i. The first 2 m of the leg measured from the base plate of tri-chord and monotube overhead sign support structures.
 - ii. The full length of the legs of the cantilever sign support structures.
- d) All circumferential welds shall be tested using ultrasonic testing methods.
- e) All full penetration groove welds at the 8-chord crank locations of the aluminum end panels of the variable message sign support structures shall be tested using ultrasonic testing methods.

A written inspection report of the observations and tests shall be issued to the Contractor.

915.07.07.03 Field Inspection

915.07.07.03.01 Erected Sign Structure Inspection

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, including confirmation that the tolerance as specified in the Contract Documents between the first diagonal and the corbel is maintained in the tri-chord sign support structure.

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 issued to the Contractor.

915.07.07.03.02 Concrete Inspection

The concrete shall be according to the submitted mix design and meet the specification requirements for air content, slump, temperature, concrete strength, and delivery time.

Testing of concrete for air content, slump, and temperature; concrete strength; and casting of cylinders shall be carried out according to OPSS 904.

When early strength of the concrete is to be established, additional cylinders shall be cast.

A written inspection report of the observations and tests shall be issued to the Contractor.

915.07.07.04 Coating Inspection

Coating inspection shall be according to OPSS 911.

A written inspection report of the observations and tests shall be issued to the Contractor.

915.07.07.05 Inspection Reports

The Contractor shall submit 4 copies of all inspection reports to the Contract Administrator within 7 Days after inspection.

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

915.07.08 Interim Inspections

915.07.08.01 Interim Inspection After Construction of Footings

Upon completion of the construction of the footings, and prior to erection of overhead sign support structures, an Engineer shall conduct an interim inspection of the work to verify that the footings have been constructed in general conformance with the Working Drawings and as specified in the Contract Documents, including requirements for the location, top of footing elevation, anchorage layout, and surface finished to the specified tolerances, and issue the Contractor written permission to proceed with the work.

915.07.08.02 Interim Inspection After Fabrication of Components

Upon completion of fabrication of overhead sign support structure components, and prior to erection, an Engineer shall conduct an interim inspection of the work to verify that the fabrication of the sign support structure components has been carried out in general conformance with the Working Drawings and as specified in the Contract Documents, and issue the Contractor written permission to proceed with the work.

915.07.09 Repair of Sign Support Structures

915.07.09.01 General

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

915.07.09.02 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.

915.07.09.03 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.

915.07.09.04 Inspection

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

915.07.10 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 final acceptance of the work 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.

915.07.11 Certificate of Conformance Upon Completion of the Work

Upon completion of the erection of the sign support structure, the Contractor shall submit to the Contract Administrator a certificate of conformance sealed, signed, and dated by the Quality Verification Engineer. The certificate shall state that the Work has been completed in general conformance with the Working Drawings and as specified in the Contract Documents.

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, and the erection 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 Signs

For measurement purposes, a count shall be made of the number of signs 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**
- 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**
- 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 Sign - 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.

**Appendix 915-A, November 2014
FOR USE WHILE DESIGNING MUNICIPAL CONTRACTS**

Note: This is a non-mandatory Commentary Appendix intended to provide information to a designer, during the design stage of a contract, on the use of the OPS specification in a municipal contract. This appendix does not form part of the standard specification. Actions and considerations discussed in this appendix are for information purposes only and do not supersede an Owner's design decisions and methodology.

Designer Action/Considerations

The designer should specify the following in the Contract Documents:

- Standard for galvanized fasteners. (915.05.03)
- Clamp details. (915.05.04)
- Standard for steel. (915.05.05)
- Concrete compressive strength. (915.05.06)
- Grade of wood. (915.05.08)
- Anchorage assembly bolt, stud, strut, coil, and galvanizing requirements. (915.05.09)
- Electrical duct and fitting requirements. (915.05.11)
- Granular backfill type. (915.05.12)
- Coating requirements. (915.05.13, 915.07.01.02.04)
- Site identification number, maximum sign area, and design wind pressure for each sign support. (915.07.01.04)
- Footing locations. (915.07.02.01)
- Excavation lines and grades. (915.07.02.02)
- Anchorage assembly level tolerances. (915.07.02.05)
- Rigid duct requirements in footings. (915.07.02.06)
- Concrete footing elevations. (915.07.02.07)
- Bolted field splices. (915.07.03.05)
- Fastener torque requirements. (915.07.03.06)
- Roadside sign support footing locations, dimensions, and elevations. (915.07.04.01)
- Steel column tolerances. (915.07.04.02.02)
- Steel column breakaway type top surface of the friction plate elevation. (915.07.04.02.03)
- Wood column tolerances. (915.07.04.03.01)

Appendix 915-A

- Site trimming and finishing around footings. (915.07.05)
- Locations of signboards to be installed by the Contractor. (915.07.06)
- Drain and vent hole locations. (915.07.07.03.01)
- Use of salvaged steel components. (915.07.09.02)

The designer should determine if the following is required and, if so, specify it in the Contract Documents:

- If ground lugs, fuse clips, and access nipples for wiring are to be installed during shop fabrication. (915.07.01.03)
- Delivery requirements for signboard chord clamps. (915.07.01.05.02)
- Rigid duct sleeves. (915.07.02.06)

OPSS 915 contains information that is not used by municipalities in their Contracts. To ensure completeness of the municipal Contract Documents, the designer should invoke Appendix 915-B. The appendix contains information that modifies OPSS 915 so it can be used by a municipality in its Contracts.

The designer should ensure that the General Conditions of Contract and the 100 Series General Specifications are included in the Contract Documents.

Related Ontario Provincial Standard Drawings

No information provided here.

**Appendix 915-B, November 2014
FOR USE IN MUNICIPAL CONTRACTS, WHEN REFERENCED IN THE CONTRACT DOCUMENTS**

Note: This is a non-mandatory Additional Information Appendix intended to provide supplementary requirements for the OPS specification in a municipal contract, when the appendix is invoked by the Owner. It is written in mandatory language to permit invoking it by reference in the Contract Documents. If the appendix has not been invoked by reference in the Contract Documents, it does not apply.

Supplemental Requirements for Using OPSS 915 in Municipal Contracts

OPSS 915, Sign Support Structures, is amended as follows:

915.03 DEFINITIONS

Section 915.03, the definition for Certificate of Conformance is deleted in its entirety and replaced with the following:

Certificate of Conformance means a document issued by an Engineer confirming that the specified components of the Work are in general conformance with the requirements of the Contract Documents.

Section 915.03, the definition for Quality Verification Engineer is deleted in its entirety.

915.04.02.02 Working Drawings for Sign Support Structures

The first paragraph of clause 915.04.02.02 is deleted in its entirety and replaced by the following:

The Contractor shall submit 5 sets of Working Drawings to the Contract Administrator at least 14 Days prior to commencement of fabrication of overhead sign support structures.

915.04.02.05 Erection Procedures for Overhead Sign Support Structures

The first paragraph of clause 915.04.02.05 is deleted in its entirety and replaced by the following:

The Contractor shall submit 5 copies of the erection procedures to the Contract Administrator at least 14 Days prior to the commencement of overhead sign support structure erection.

915.04.02 Submission Requirements

Clause 915.04.02 is amended by the addition of the following:

915.04.02.09 Return of Submissions - Working Drawings and Erection Procedures

Two copies of each submission shall be returned as one of the following:

- a) Stamped with the wording that allows for permission to construct. In this case, work can commence on receipt of the working drawings or erection procedures by the Contractor.
- b) Stamped with the wording that allows for permission to construct as noted. In this case, work can start on receipt of the working drawings or erection procedures by the Contractor. The working drawings or erection procedures shall be updated as noted and shall be sealed and signed by the design Engineer and the design-checking Engineer stating the drawings have been revised according to the noted comments.
- c) Showing only required changes. In this case, the working drawings or erection procedures shall be updated as required and the submission process repeated.

Appendix 915-B

915.07.11 Certificate of Conformance Upon Completion of the Work

Clause 915.07.11 is deleted in its entirety and replaced by the following:

915.07.11 Certificate of Conformance

Upon completion of the erection of the sign support structure, the Contractor shall submit to the Contract Administrator a certificate of conformance bearing the seal and signature of an Engineer. The certificate shall state that the work has been completed in general conformance with the Working Drawings and as specified in the Contract Documents.