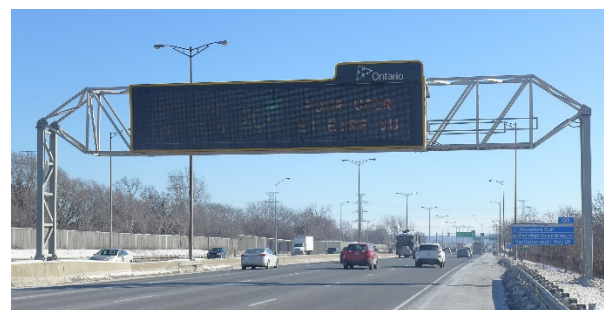


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REVISIONS TO THE SIGN SUPPORT MANUAL

This Sign Support Manual dated **February 15, 2019** includes **Revision #15** and supersedes the previous edition.

If any page of a Section is changed, all dates on pages of that Section are changed as well. However, only the pages listed below are different to the 2015 edition. Major changes from previous edition are summarized as follows.

List of revisions

Section 1 - Introduction

- Page 1-1 : - Sections 1.2 and 1.6 updated

Section 2 - General Information

- Page 2-1 : - Section 2.2 updated
- Page 2-3 : - Table 2.5.2 updated
- Page 2-4 : - Section 2.6 updated

Section 3 – Cantilever Static Sign Supports

- Page 3-1 : - Section 3.1.2 updated
- Page 3-5 : - Section 3.1.8(2) updated
- Page 3-23 : - TABLE 3.2.3(a), note number 4 added
- Page 3-25 : - Section 3.3.1 updated
- Page 3-25,26 : - Structure I.D. number replaced by Site number
- Page 3-32 : - APPENDIX TO SECTION 3 updated
- Standard Drawings replaced with the latest version
- New Standard Drawings SS118-9,10, 46, 47, 48, and 49 added

Section 4 – Tri-Chord Static Sign Supports

- Contents updated to include New Tri-Chord Static Sign Support (Type II) for sign depth between 9 and 13 feet.
- Page 4-24 : - APPENDIX TO SECTION 4 updated
- Standard Drawings replaced with the latest version
- New Standard Drawings SS118-28 and 29 added

Section 5 – Steel Column Sign Supports

- This section has been removed from the Manual

Section 6 – Timber Sign Supports

- This section has been removed from the Manual

Section 7 – Overhead Monotube Sign Supports

- Page 7-1 : - Section 7.1.1(e) updated
- Page 7-5 : - Section 7.1.5, third paragraph updated
- Page 7-6 : - Section 7.1.6 updated
- Page 7-7 : - Section 7.2.2 updated

Section 8 – Variable Message Sign Supports

- VMS overhead truss sign supports redesigned to the requirements of CSA S6-14
- Pole mounted VMS sign support redesigned for sign board size of 3 m depth by 5 m width
- Page 8-11 : - Section 8.3.1 updated
- Page 8-17 : - APPENDIX TO SECTION 8 updated
- Standard Drawings replaced with the latest version
- New Standard Drawings SS118-13 added.

To all users of the: **SIGN SUPPORT MANUAL**

Enquires regarding amendments, suggestions or comments should be directed to:

Ministry of Transportation
Provincial Highways Management Division
Highway Standards Branch
Bridge Office
2nd Floor, 301 St. Paul Street
St. Catharines, Ontario
L2R 7R4

or

Phone: 905 704 2406
Fax: 905 704 2060

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DEFINITIONS

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AASHTO	American Association of State Highway and Transportation Officials
ASTM	American Society for Testing and Materials
BRIDGE MOUNTED SIGN SUPPORT	A static sign support structure attached to the side of a bridge
BUTTERFLY STATIC SIGN SUPPORT	A static sign support for two (2) intermediate size sign boards, consisting of a single vertical structural steel column or leg, and two overhead trusses located on either side of the column or leg
CANTILEVER STATIC SIGN SUPPORT	A static sign support for intermediate size sign boards, consisting of a single vertical structural steel column or leg, and an overhead truss
CANTILEVER TRI-CHORD STATIC SIGN SUPPORT	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
CHBDC	Canadian Highway Bridge Design Code
DAMPER	Damping device attached to the sign board on cantilever sign support structures to suppress vortex shedding and galloping caused by aerodynamic instability

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DEFINITIONS

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ENGINEER	Means a member or licensee of the Professional Engineers Ontario, who carries out the design or checking of rehabilitation, design, or evaluation of a bridge or structure
MAXIMUM ECCENTRICITY	Height from the top of lowest footing to the centre of the sign board
MINISTRY	Means Ministry of Transportation, Ontario
MTO	Means Ministry of Transportation, Ontario
OHBD	Ontario Highway Bridge Design Code
ORDER FORMS	Pre-printed forms containing all information needed to purchase components to assemble a sign support
OVERHEAD MONOTUBE SIGN SUPPORT	A static sign support intended for small sign boards, and consisting of two vertical steel columns spanned by either a single structural steel member or by steel cables
POLE MOUNTED VARIABLE MESSAGE SIGN SUPPORT	An overhead sign support structure consisting of a variable message board centre mounted to a single vertical galvanized steel pole

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SIGN SUPPORT

A structure to support static signs (sign boards) or variable message sign systems

SITE NUMBER

Number assigned to a sign support structure by the Region, to provide a unique identifier for each sign structure

STANDARD DRAWING

A structural drawing as shown on the hardcopies distributed with this Manual. It is available as an electronic CAD file requiring the user to add site specific information

STATIC SIGN (OR SIGN BOARD)

A flat surface displaying permanent visual information

TRI-CHORD STATIC SIGN SUPPORT

A static sign support structure consisting of a galvanized steel overhead truss constructed in the form of a three chord system and having prismatic vertical legs

VARIABLE MESSAGE SIGN (VMS)

Light emitting electronic display system that changes periodically to provide up-to-date information to freeway motorists of traffic conditions ahead, and suggests alternative routing in a timely and safe manner

VARIABLE MESSAGE SIGN SUPPORT

A sign support for variable message sign systems, consisting of two vertical supports or legs (structural steel), and an overhead truss (aluminium)

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DEFINITIONS

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WALKWAY

A permanent platform provided on some sign support structures at the level of the sign board(s), facilitating ease of installation and maintenance of the sign board(s)

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A	spacing of sign support posts, or length of stiffener, or outside diameter of sign support post.
B	width of sign board, or depth of stiffener, or length of panel in VMS end components.
CS	horizontal centroidal axis of sign board.
D	height of sign board
E	horizontal distance from left support to leftmost sign board, or horizontal distance from the centreline of the sign support post to the centre of the sign board, or horizontal distance from the centreline of the sign support leg to the centreline of the end vertical element of the sign component.
EL.CS	elevation of CS.
EL.EP	elevation of EP.
EL.HP	elevation of the highest point on the highway under the sign, including shoulders, curbs, and medians.
EL.Pi	elevation at top of footing Pi.
EP	edge of pavement of travelled portion of highway.
F	horizontal distance from left support to 2 nd leftmost sign board.
G	perpendicular distance from edge of pavement to first column, or horizontal distance from left support to 3 rd leftmost sign board, or horizontal distance from rear face of traffic barrier to the nearest face of support structure footing.
H	lateral sign overhang beyond end T, or horizontal distance from left support to 4 th leftmost sign board, or dimension from centreline of bottom chord to the highest point on the highway for simply supported tri-chord
Hi	vertical distance from Pi to CS.
Hmax	maximum Hi.
J	edge distance of 2 nd lowest bolt group from bottom of member, or horizontal distance from edge of sign board to outside T connector, or horizontal distance from left support to splice location.

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NOTATION

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K	horizontal distance from edge of sign board to inside T connector, or horizontal distance from right support to splice location, or a dimension used to impose a camber on cantilever sign supports to allow for dead load deflections.
L	length of column
Lx	distance of Z-bracket from the end of sign board closest to traffic
Pi	top of footing.
SLS	Serviceability Limit States, as defined in The Canadian Highway Bridge Design Code.
ULS	Ultimate Limit States, as defined in The Canadian Highway Bridge Design Code.
VMS	Variable Message Sign
X	horizontal distance from left footing to control line.
Y	horizontal distance from right footing to control line.

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SECTION 1 – INTRODUCTION

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INTRODUCTION

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1 INTRODUCTION

1.1 GENERAL

The Sign Support Manual has been prepared to assist ministry offices, or others, in procuring and erecting all types of sign supports and for preparing the contract documents.

1.2 SECTIONS

The Manual contains the following sections:

Section 1	Introduction
Section 2	General Information
Section 3	Cantilever Static Sign Supports
Section 4	Tri-Chord Static Sign Supports
Section 5	Steel Column Sign Supports (This section has been removed from the Manual)
Section 6	Timber Post Sign Supports (This section has been removed from the Manual)
Section 7	Overhead Monotube Sign Supports
Section 8	Variable Message Sign Supports
Section 9	Bridge Mounted Sign Supports

The sections of this Manual are self-contained and may be issued and revised at different times.

1.3 NUMBERING SYSTEM

Each section is numbered as shown above. Within the sections, the material is further subdivided into sub-sections, numbered decimally. Reduced copies of standard drawings, which are included in the Manual to explain their use, carry their original numbers and, in some cases, Figure numbers relating to the Manual numbering system. Such drawings also carry their latest revision dates at the time of their preparation.

1.4 REVISIONS

When additions or revisions are necessary, they will be made available through the web site, as detailed in Section 1.6.

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1.5 METRICATION

The supports covered by Section 9 are primarily fabricated from aluminum extruded members which have not been metricated at this time. Thus, supports in this section are detailed in soft converted metric units except as for the drawings detailing the chord clamp, the service walk grating, and the two-post railing, which are detailed in imperial units.

All dimensions are in millimetres unless otherwise stated.

1.6 DISTRIBUTION

Digital copy of the Manual and revisions may be obtained from:

<http://www.rags.mto.gov.on.ca/techpubs/ops.nsf/OPSHomepage>

1.7 STANDARD DRAWINGS

Electronic CAD files containing standard drawings in AutoCAD may be obtained from the CPS.

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SECTION 2 – GENERAL INFORMATION

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2 GENERAL INFORMATION**2.1 SCOPE**

This Manual contains information needed to prepare the contract drawings, tender quantities, and special provisions for sign supports covered in Sections 3, 4, 7, 8 and 9.

2.2 STANDARD SIGN SUPPORTS

Only standard sign supports are described in this Manual and listed within their respective sections.

All non-standard sign supports must be custom designed.

Overhead truss sign supports (Type 1) previously covered in this Manual have been withdrawn and replaced by Tri-chord static sign supports.

Steel column and timber post sign supports previously covered in this Manual have been removed.

2.3 ASSUMPTIONS, CRITERIA AND LIMITATIONS

Design code assumptions, criteria, and limitations for each sign support type is described in the respective sections of this Manual.

Drawings and special provisions for Tri-chord, Cantilever, Monotube, and Variable Message sign supports are sufficiently standardized that Regional Structural Section staff or others may process them. Bridge mounted sign supports must be designed to suit the geometry of the bridge by the Regional Structural Sections or others.

2.4 STANDARD DRAWINGS**2.4.1 INFORMATION TO BE ADDED TO STANDARD DRAWINGS**

Standard drawings shall be reviewed together with the corresponding text in the Manual to determine what information, if any, needs to be added to them.

Where information in tables and dimensions are added to standard drawings for their completion, the drawings shall bear the seal, date and signature of a Professional Engineer. This Engineer accepts full responsibility for the accuracy of the added information only.

Where engineering design changes are made on standard drawings that affect the original design, these drawings shall be identified as

“Modified” and bear the seals, dates, and signatures of two Professional Engineers. These Engineers accept full responsibility for the design that results from these changes.

2.4.2 SCALES FOR ADDED DETAILS

Plan views should normally be drawn at 1:50 scale.

Details should be drawn to a sufficiently large scale to ensure legibility after reduction to contract book size.

2.5 PROCESSING OF DOCUMENTS

2.5.1 PREPARATION OF ELECTRICAL DRAWINGS

In general, supplementary illumination is not required for static signs because of the reflective ability of sign facing materials and, in some cases, the impact of roadway lighting. Regional Traffic Section determines when sites require illumination.

If the sign is to be illuminated, then two copies of the General Arrangement drawing are required to be sent to regional electrical design staff. They will arrange for the preparation of the electrical drawings if they are required.

For the Variable Message Signs (VMS), the Advanced Traffic Management Section should be consulted.

2.5.2 CONTRACT PREPARATION SYSTEM

Capital construction contract tender documents are produced for the ministry by using the Contract Preparation System (CPS). This is an integrated application facility for the preparation of tender item documents, item quantity sheets, modified and fill-in special provisions, etc., for road design, structural, and electrical work. Whenever sign supports are to be supplied and erected as (part of) a contract, applicable tender documents shall be prepared and forwarded to the Regional Planning and Design Office with a covering transmittal letter. The tender items to be used, where applicable, for sign support footings and sign support structures are as shown in Table 2.5.2.

The accompanying transmittal letter shall instruct Regional Planning and Design to complete the following items:

- (i) Traffic Control
- (ii) Supply and erect sign board, for static sign supports

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- (iii) Requirements in the tender documents for the design, supply, installation and testing of the light emitting variable message signs.

TABLE 2.5.2 CPS ITEMS FOR SIGN SUPPORTS

OPSS Spec. No.	ITEM	UNIT
911	Coating New Structural Steel Sign Support Structures	Each
915	Concrete in Ground Mounted Static Sign Support Footings (Tri-Chord and Cantilever)	Each
915	Concrete in Median Mounted Static Sign Support Footings (Tri-Chord and Cantilever)	Each
915	Concrete in Steel Monotube Overhead Sign Support Footings	Each
915	Concrete in Ground Mounted Variable Message Sign Support Footings	Each
915	Concrete in Median Mounted Variable Message Sign Support Footings	Each
915	Steel Monotube Overhead Sign Support Structures	Each
915	Cantilever Tri-chord Static Sign Support Structures, Class (Class 1,2, 3 or 4)	Each
915	Cantilever Static Sign Support Structures, Class (Class 1, 2, 3 or 4)	Each
915	Aluminum Bridge Mounted Sign Support Structures	Each
915	Tri-Chord Static Sign Support Structures, Span (<i>span range to be inserted as per Table</i>) m See SPAN RANGE TABLE below.	Each
915	Variable Message Sign Support Structures, Span (<i>span range to be inserted as per Table</i>) m See SPAN RANGE TABLE below.	Each
915	Pole mounted Variable Message Sign Support Structures	Each

SPAN RANGE TABLE

Spans:	0 – 15.99 *	22.00 – 24.99	31.00 – 33.99
	16.00 – 18.99	25.00 – 27.99	34.00 – 36.00
	19.00 – 21.99	28.00 – 30.99	

* This range does not apply to Variable Message Sign Support Structures.

2.5.3 DISTRIBUTION OF COMPLETED DRAWINGS AND CONTRACT DOCUMENTS

Copies of the completed drawings and applicable contract documents shall be distributed as follows:

REGIONAL PLANNING AND DESIGN (Manager) - 2 copies
(Northwestern Region has requested two additional copies).

ESTIMATING OFFICE (Manager) - 1 copy
For the preparation of the cost estimate.

REGIONAL CONSTRUCTION STAFF (District Engineer) - 1 copy
To make provision for the supply and erection of the sign and to alert District staff of future sign locations.

2.6 TRAFFIC PROTECTION

Columns of non-breakaway sign supports, Monotube sign supports, Tri-chord, VMS, and Cantilever sign supports must be protected from traffic travelling the adjacent roadways. Protection must be provided in the form of guiderail, barrier wall, a retaining wall or some similar feature having at least as much stiffness and strength as a guiderail and presenting a smooth face to traffic.

2.7 SOIL CONDITIONS

Footing proportions provided in this Manual are intended to apply to normal soil conditions; that is, competent soils of uniform composition. Site foundation conditions requiring special design consideration include:

- bedrock is at or near the surface
- footing is located in rock fill
- soil is exceptionally soft or loose.

2.8 FROST DEPTH

Frost layer depths for a specific site location may be obtained from Design Aids DA4-1, DA4-2 and DA4-3. Contours of frost depth for Northern Ontario, Southern Ontario, and List of Towns, respectively, are given in the Appendix of this Section.

These values may be used if the recommendations of a geotechnical engineer are not available.

2.9 REFERENCE WIND PRESSURE

Values for the local reference wind pressure can be obtained from the Tables A2.9(a) to (c) given in the Appendix of this Section. The information shown in these tables were obtained from the CHBDC.

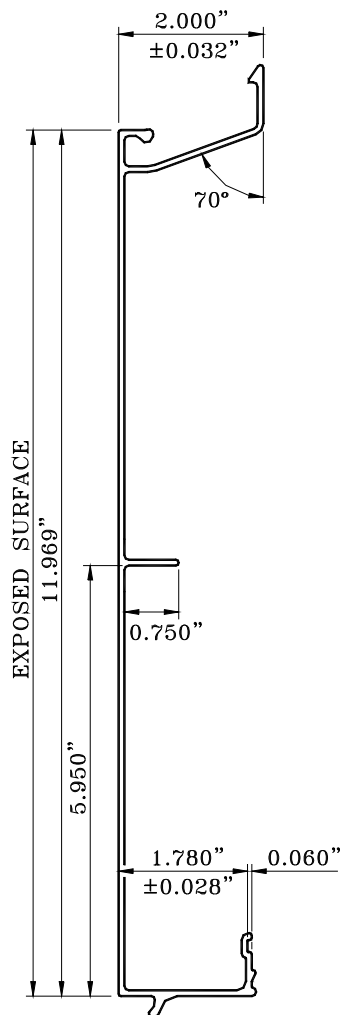
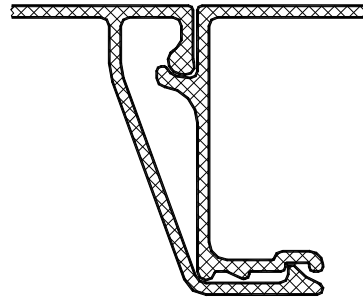
2.10 SIGN BOARDS

All static sign support designs are based on the aluminum Alcan Interlocking Sign Panel, Shape No. 72838, as shown in Figure 2.10. Alcan standard extrusion tolerances and finishes will apply unless otherwise specified.

2.11 VARIABLE MESSAGE SYSTEMS

The requirements for the design, supply, installation, and testing of Light Emitting Variable Message Signs (VMS) are covered by the associated Special Provisions.

The major features of the variable message sign shall consist of: sign case and face, display matrix, driving electronics, photo sensor control, environmental control and protection, mounting hardware, and associated cables and wiring.

SECTIONASSEMBLY DETAIL

NOTES:

- MATERIAL: ALCAN ALLOY 50S.
- METAL THICKNESS 0.080".
- SNAP FIT IN 36 FT LENGTHS.
- SHAPE MUST ASSEMBLE WITH ITSELF.

FIGURE 2.10 ALCAN INTERLOCKING SIGN PANEL – SHAPE No.72838

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APPENDIX TO SECTION 2

GENERAL INFORMATION

TABLES A2.9 REFERENCE WIND PRESSURE FOR ONTARIO
(a), (b) and (c)

DA4-1 CONTOURS OF FROST DEPTHS FOR
NORTHERN ONTARIO

DA4-2 CONTOURS OF FROST DEPTHS FOR
SOUTHERN ONTARIO

DA4-3 TABLE OF FROST DEPTHS FOR ONTARIO
BY LOCATION

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TABLE A2.9(a) REFERENCE WIND PRESSURE FOR ONTARIO

Source: Canadian Highway Bridge Design Code

ONTARIO LOCATION	HOURLY MEAN WIND PRESSURE, (in Pascals) FOR RETURN PERIODS OF:			ONTARIO LOCATION	HOURLY MEAN WIND PRESSURE, (in Pascals) FOR RETURN PERIODS OF:		
	10 yr	25 yr	50 yr		10 yr	25 yr	50 yr
Ailsa Craig	395	480	550	Chatham	320	380	430
Ajax	430	510	570	Chelmsford	285	375	450
Alexandria	305	360	400	Chesley	330	410	475
Alliston	220	280	330	Clinton	375	455	525
Almonte	295	360	410	Coboconk	260	315	350
Ansonville	305	360	400	Cobourg	465	535	595
Armstrong	205	240	260	Cochrane	260	310	350
Arnprior	275	330	370	Colborne	440	510	565
Atikokan	200	235	260	Collingwood	255	325	385
Aurora	305	380	440	Cornwall	300	360	410
Bancroft	230	280	320	Corunna	350	415	465
Barrie	210	280	330	Deep River	260	315	350
Barriefield	350	415	460	Deseronto	320	380	430
Beaverton	240	305	360	Dorchester	330	410	480
Belleville	320	380	430	Dorion	300	355	390
Belmont	350	435	500	Dresden	320	380	430
Bowmanville	460	535	590	Dryden	200	235	260
Bracebridge	260	315	350	Dunbarton	430	510	575
Bradford	240	305	360	Dunnville	335	385	425
Brampton	315	380	430	Durham	310	380	435
Brantford	310	365	400	Dutton	340	410	470
Brighton	415	485	540	Earlton	315	390	450
Brockville	315	380	430	Edison	230	275	310
Brooklin	385	460	520	Elmvale	235	305	365
Burk's Falls	260	315	350	Embro	330	410	475
Burlington	360	415	460	Englehart	290	360	415
Caledonia	315	365	400	Espanola	280	360	420
Cambridge	265	310	350	Exeter	375	455	525
Campbellford	290	360	415	Fenelon Falls	250	310	355
Camp Borden	215	280	335	Fergus	260	310	355
Cannington	245	310	360	Fonthill	335	385	425
Carleton Place	295	360	410	Forest	390	460	520
Cavan	310	380	435	Fort Erie	365	415	460
Centralia	375	455	525	Fort Frances	230	275	310
Chapleau	190	235	270	Gananoque	350	415	465

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TABLE A2.9(b) REFERENCE WIND PRESSURE FOR ONTARIO

Source: Canadian Highway Bridge Design Code

ONTARIO LOCATION	HOURLY MEAN WIND PRESSURE, (in Pascals) FOR RETURN PERIODS OF:			ONTARIO LOCATION	HOURLY MEAN WIND PRESSURE, (in Pascals) FOR RETURN PERIODS OF:		
	10 yr	25 yr	50 yr		10 yr	25 yr	50 yr
Georgetown	275	330	375	Leamington	355	415	465
Geraldton	210	245	275	Lindsay	265	325	380
Glencoe	310	380	435	Lion's Head	330	410	475
Goderich	395	480	550	Listowel	340	410	470
Gore Bay	300	350	390	London	365	455	535
Graham	205	240	260	Lucan	395	480	555
Gravenhurst	260	315	350	Maitland	315	380	430
Grimsby	365	415	460	Markdale	285	360	415
Guelph	250	295	325	Martin	205	240	260
Guthrie	215	280	335	Matheson	300	360	410
Hagersville	335	385	425	Mattawa	245	285	315
Haileybury	315	380	435	Midland	255	325	385
Haliburton	260	315	350	Milton	320	380	430
Hamilton	365	415	460	Milverton	310	380	435
Hanover	335	410	475	Minden	260	315	350
Hastings	290	360	415	Mississauga	370	435	495
Hawkesbury	310	365	405	Mitchell	350	435	505
Hearst	200	245	280	Moosonee	260	315	350
Honey Harbour	255	325	385	Morrisburg	300	360	410
Hornepayne	190	235	270	Mount Forest	290	360	410
Huntsville	260	315	350	Muskoka Airport	260	315	350
Ingersoll	330	410	475	Nakina	210	245	275
Iroquois Falls	300	360	405	Napanee	320	380	430
Jarvis	330	380	425	Newcastle	460	535	595
Jellicoe	200	235	260	New Liskeard	315	380	435
Kapuskasing	230	275	310				
Kemptville	295	360	410	Newmarket	260	325	385
Kenora	230	275	310	Niagara Falls	330	380	425
Killaloe	260	315	350	North Bay	260	300	340
Kincardine	400	480	545	Norwood	290	360	415
Kingston	350	415	465	Oakville	375	435	490
Kinmount	260	315	350	Orangeville	250	310	355
Kirkland Lake	295	360	410	Orillia	260	315	350
Kitchener	275	330	370	Oshawa	430	510	575
Lakefield	265	325	380	Ottawa	295	360	410
Landsdowne	240	285	315	Owen Sound	330	410	475
House							

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TABLE A2.9(c) REFERENCE WIND PRESSURE FOR ONTARIO

Source: Canadian Highway Bridge Design Code

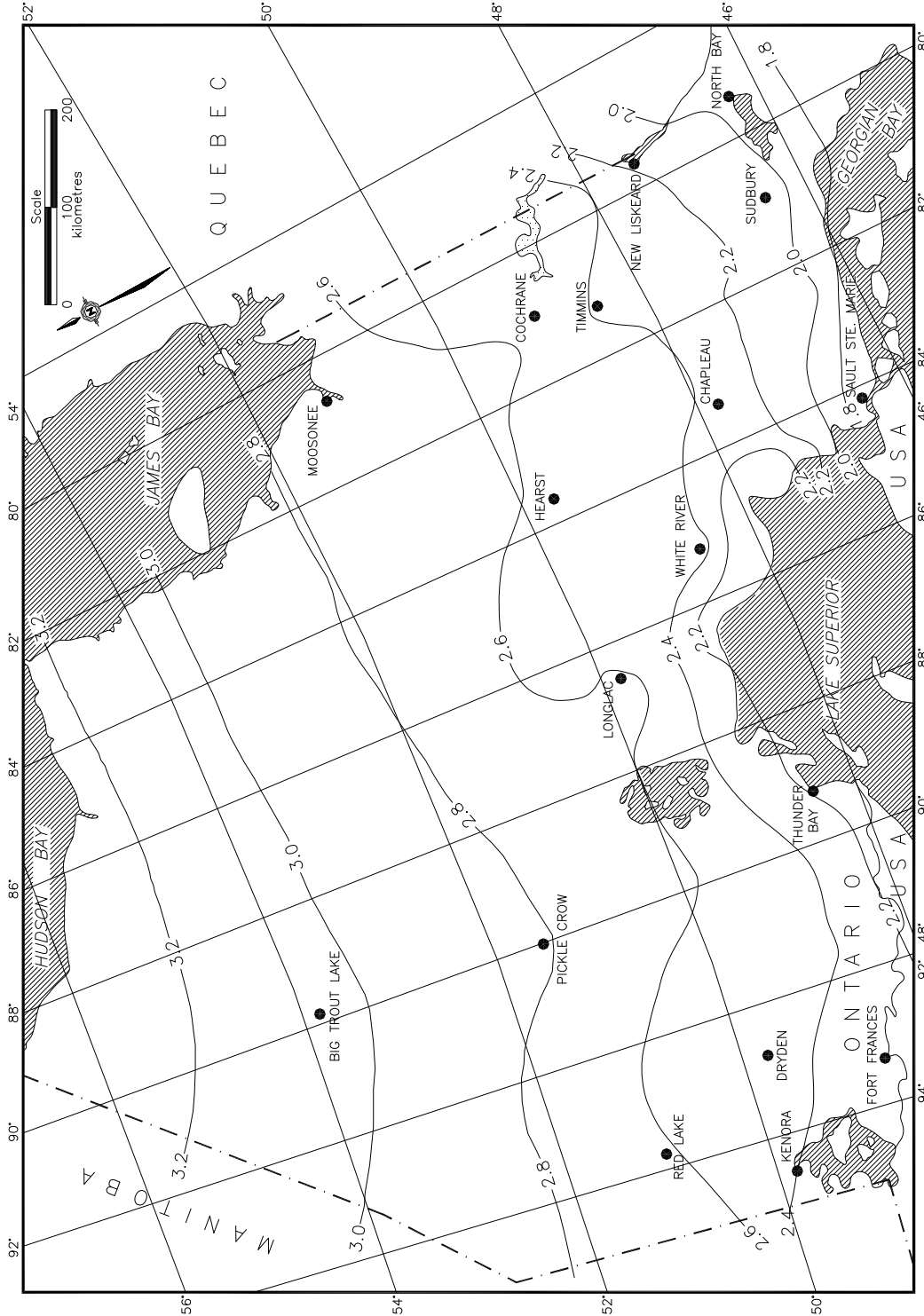
ONTARIO LOCATION	HOURLY MEAN WIND PRESSURE, (in Pascals) FOR RETURN PERIODS OF:			ONTARIO LOCATION	HOURLY MEAN WIND PRESSURE, (in Pascals) FOR RETURN PERIODS OF:		
	10 yr	25 yr	50 yr		10 yr	25 yr	50 yr
Pagwa River	190	240	275	Smooth Rock Falls	235	285	320
Paris	310	365	405	Southampton	380	460	525
Parkhill	400	480	545	South Porcupine	275	330	375
Parry Sound	245	325	395	South River	230	280	325
Pembroke	260	315	350	Stirling	280	345	400
Penetanguishene	255	325	385	Stratford	335	410	475
Perth	295	360	410	Strathroy	355	435	500
Petawawa	260	315	350	Streetsville	350	415	465
Peterborough	290	360	415	Sturgeon Falls	255	310	355
Petrolia	350	415	465	Sudbury	290	390	465
Picton	375	435	490	Sundridge	230	280	325
Plattsville	295	360	410	Tavistock	340	410	475
Point Alexander	260	315	350	Temagami	275	330	375
Porcupine	275	330	375	Thamesford	330	410	475
Port Burwell	345	415	470	Theford	405	485	545
				Thunder Bay	300	355	390
Port Colborne	365	415	455	Tilsonburg	310	380	435
Port Credit	370	435	495	Timmins	255	310	355
Port Dover	360	415	465	Toronto	390	460	520
Port Elgin	395	480	550	Trenton	350	415	465
Port Hope	465	535	595				
Port Perry	310	380	435	Trout Creek	240	285	320
Port Stanley	340	410	470	Trout Lake	335	385	425
Prescott	315	380	430	Uxbridge	285	360	415
Princeton	300	360	410	Vanier	295	360	410
Raith	205	240	260	Vittoria	355	415	465
Red Lake	220	255	285	Walkerton	355	435	500
Renfrew	260	310	350	Wallaceburg	320	380	430
Ridgeway	365	415	455	Waterloo	275	330	370
Rockland	300	360	410	Watford	340	410	470
St. Catharines	365	415	460	Wawa	300	355	390
St. Marys	350	435	505	Welland	330	380	425
St. Thomas	330	410	475	WestLorne	345	415	470
Sarnia	350	415	465	Whitby	430	510	575
Sault Ste. Marie	320	365	400	White River	210	245	275
Schreiber	300	355	390	Warton	330	410	475
Seaforth	375	455	525	Windsor	360	420	470
Simcoe	330	380	425	Wingham	350	435	505
Sioux Lookout	205	240	260	Woodstock	305	380	435
Smiths Falls	295	360	410	Wyoming	350	415	465
Smithville	335	385	425				

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CONTOURS OF FROST DEPTHS FOR NORTHERN ONTARIO

DA 4 - 1



NOTES

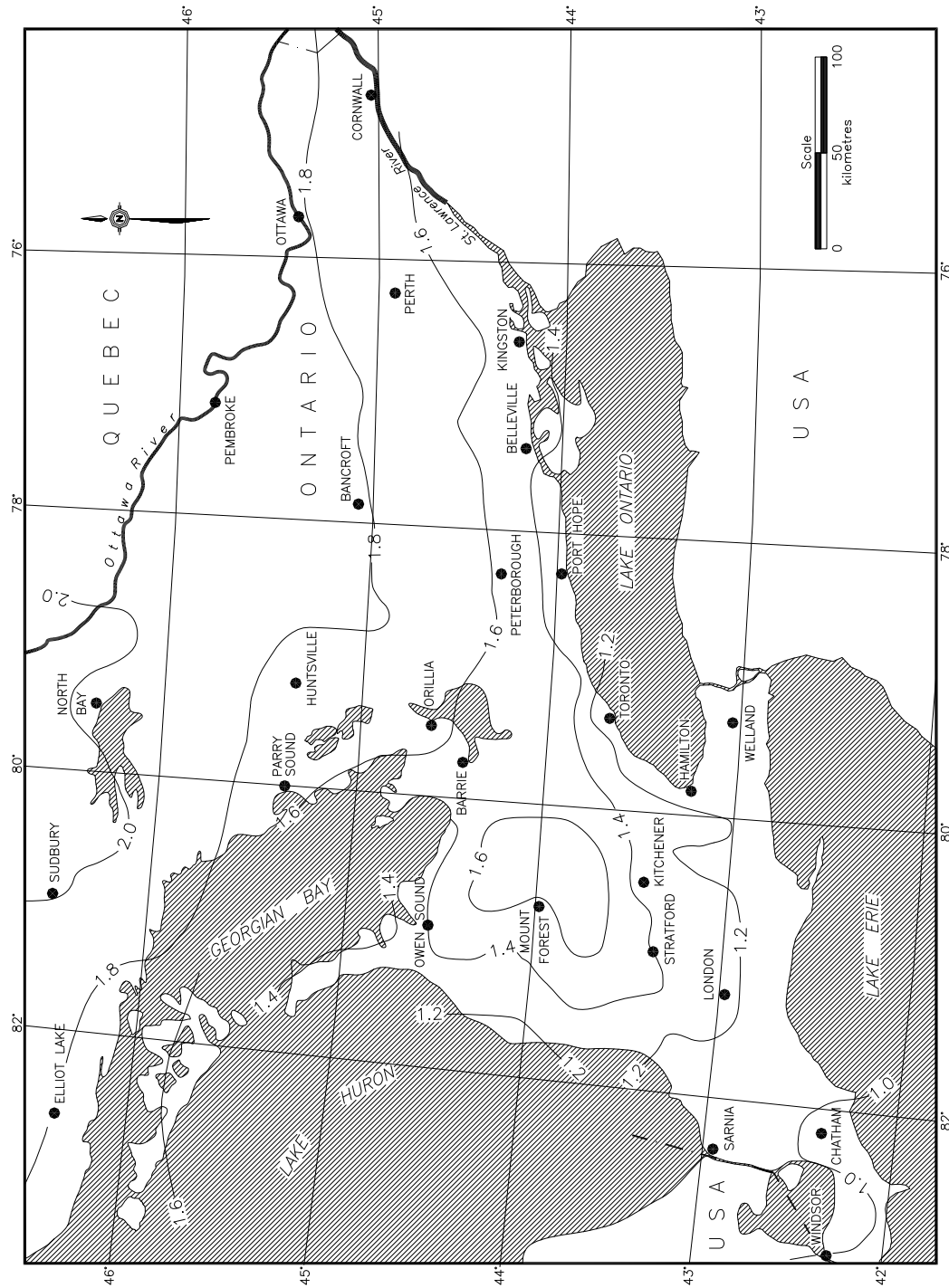
1. THESE VALUES SHOULD ONLY BE USED WHERE THE RECOMMENDATIONS OF A GEOTECHNICAL ENGINEER ARE NOT AVAILABLE.
2. THIS INFORMATION WAS TAKEN FROM THE MINISTRY OF TRANSPORTATION AND COMMUNICATIONS RESEARCH PUBLICATION PR 225 "ASPECTS OF PROLONGED EXPOSURE OF PAVEMENTS TO SUB-ZERO TEMPERATURES" DATED DECEMBER, 1981.
3. VALUES BETWEEN CONTOURS SHOULD BE INTERPOLATED. IF INTERPOLATION IS NOT POSSIBLE, USE THE ADJACENT CONTOUR WITH THE GREATER DEPTH.
4. FROST DEPTHS ARE IN METRES.

SIGN SUPPORT MANUAL

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CONTOURS OF FROST DEPTHS FOR SOUTHERN ONTARIO

DA 4 - 2



NOTES

1. THESE VALUES SHOULD ONLY BE USED WHERE THE RECOMMENDATIONS OF A GEOTECHNICAL ENGINEER ARE NOT AVAILABLE.
2. THIS INFORMATION WAS TAKEN FROM THE MINISTRY OF TRANSPORTATION AND COMMUNICATIONS RESEARCH PUBLICATION PR 225 "ASPECTS OF PROLONGED EXPOSURE OF PAVEMENTS TO SUB-ZERO TEMPERATURES" DATED DECEMBER, 1981.
3. VALUES BETWEEN CONTOURS SHOULD BE INTERPOLATED. IF INTERPOLATION IS NOT POSSIBLE, USE THE ADJACENT CONTOUR WITH THE GREATER DEPTH.
4. FROST DEPTHS ARE IN METRES.

SIGN SUPPORT MANUAL

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TABLE OF FROST DEPTHS FOR ONTARIO BY LOCATION

DA 4 - 3

Actinolite	1.6	Eganville	1.9	Loon	2.2	Ridgetown	1.4
Alexandria	1.8	Elmira	1.5	Lucan	1.3	Rockland	1.8
Algonquin Park		Englehart	2.3	Lucknow	1.2	Sarnia	1.1
Stn.	1.9	English River	2.5	Manitouwadge	2.4	Sault Ste. Marie	1.8
Alliston	1.5	Estaire	2.0	Manotick	1.7	Savant Lake	2.6
Apsley	1.7	Exeter	1.3	Marathon	2.1	Schreiber	2.3
Armstrong	2.7	Foleyet	2.4	Markdale	1.6	Seaforth	1.4
Arnprior	1.8	Forest	1.1	Mattawa	2.0	Shelburne	1.7
Arthur	1.7	Fort Erie	1.2	Mine Centre	2.3	Simcoe	1.2
Atikokan	2.4	Fort Frances	2.3	Montreal river	2.2	Sioux Lookout	2.5
Attawapiskat	2.9	Fort Hope	2.8	Moosonee	2.7	Smiths Falls	1.7
Bancroft	1.8	Gananoque	1.4	Morrisburg	1.6	Smooth Rock	
Bannockburn	1.7	Georgetown	1.4	Mount Forest	1.6	Falls	2.6
Barbers Bay	2.4	Geraldton	2.6	Napanee	1.5	Southampton	1.3
Barkway	1.7	Glencoe	1.1	Nestor Falls	2.4	South River	1.9
Barrie	1.5	Goderich	1.2	New Liskeard	2.1	Spanish	1.8
Barry's Bay	1.9	Gogama	2.3	Niagara Falls	1.1	Stayner	1.5
Beaverton	1.6	Gravenhurst	1.7	Nipigon	2.3	Stratford	1.4
Belleville	1.4	Grimsby	1.0	Noelville	2.0	Strathroy	1.2
Big Trout Lake	3.1	Haliburton	1.8	Norland	1.7	St. Thomas	1.2
Bobcaygeon	1.7	Hamilton	1.2	North Bay	2.0	Sturgeon Falls	2.0
Bond Head	1.5	Havelock	1.6	Oakville	1.2	Sudbury	2.1
Bracebridge	1.7	Hawkesbury	1.8	Oil City	1.1	Sutton	1.5
Bradford	1.5	Hearst	2.6	Orangeville	1.6	Temagami	2.1
Brantford	1.2	Hornepayne	2.5	Orient Bay	2.4	Terrace Bay	2.2
Britt	1.9	Huntsville	1.8	Orillia	1.6	Thessalon	1.7
Brockville	1.5	Hurkett	2.3	Oshawa	1.3	Thornbury	1.6
Burk's Falls	1.8	Ignace	2.5	Ottawa	1.8	Thunder Bay	2.2
Calabogie	1.8	Iroquois Falls	2.4	Owen sound	1.4	Tilbury	1.0
Caledonia	1.2	Kapuskasing	2.5	Pagwa River	2.5	Tillsonburg	1.2
Campbellford	1.5	Kashabowie	2.4	Palmerston	1.6	Timmins	2.4
Carleton Place	1.8	Kemptville	1.7	Parry Sound	1.4	Tobermory	1.4
Cartier	2.1	Kenora	2.4	Pembroke	1.7	Toronto	1.2
Casselman	1.8	Kincardine	1.2	Penetanguishene	1.5	Trenton	1.4
Chapleau	2.4	Kingston	1.5	Perth	1.7	Upsala	2.4
Chatham	1.0	Kiosk	2.0	Peterborough	1.6	Uxbridge	1.5
Cloyne	1.7	Kirkland Lake	2.4	Pickle lake	2.8	Walkerton	1.4
Cochrane	2.5	Kitchener	1.4	Picton	1.4	Wallaceburg	1.0
Colborne	1.4	Lake St. Peter	1.9	Poland	1.8	Wawa	2.1
Crosby		Lansdowne		Pontypool	1.4	Welland	1.1
Deep River	1.9	House	2.9	Port Carling	1.7	West Lorne	1.1
Denbigh	1.8	Leamington	1.0	Port Hope	1.3	White River	2.4
Dorset	1.8	Lindsay	1.6	Powassan	1.9	Whitney	2.0
Dryden	2.5	Listowel	1.6	Rainy River	2.3	Warton	1.4
Dunchurch	1.8	Little Current	1.7	Raith	2.4	Winchester	1.7
Dunnville	1.2	London	1.2	Red Lake	2.6	Windsor	1.0
Durham	1.6	Longlac	2.6	Renfrew	1.8	Wingham	1.4
Ear Falls	2.5	Long point	1.1	Richmond Hill	1.4	Woodstock	1.3

NOTES

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3. FROST DEPTHS ARE IN METRES.

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SIGN SUPPORT MANUAL

SECTION 3 – CANTILEVER STATIC SIGN SUPPORTS

3 CANTILEVER STATIC SIGN SUPPORTS

3.1 GENERAL

3.1.1 TYPES OF SIGN SUPPORTS

There are three types of cantilever sign supports:

- | | |
|--------------------------------|--|
| Single Cantilever: | one sign, mounted to one side of the vertical support member, Figure 3.1.2(a) (see Standard Drawings SS118-24 and SS118-73) |
| Butterfly (Double Cantilever): | two signs, each mounted on opposite sides of the "T" style support, Figure 3.1.2(b). (see Standard Drawings SS118-22 and SS118-71) |
| Centre Mounted: | one sign, mounted over the vertical support member, Figure 3.1.2(c). No standard is currently available. |

3.1.2 STANDARD SIGN SUPPORTS

Standard cantilever sign supports are designed to support static sign boards. The sign supports are fabricated in structural steel and designed to the requirements of the CAN/CSA-S6-06(CHBDC).

The sign supports contained in this Section are designed for sign boards and site conditions that meet the following criteria:

- (a) Maximum sign board area and eccentricity limits based on Figures 3.2.2(a) to (h)
- (b) For the butterfly sign support, the maximum sign area is the total area of both sides. The sign area of one side shall not be greater than two times that of the other side
- (c) Depth of sign board up to 2745 mm (9 ft.)
- (d) All sign boards include an aerodynamic damper attachment (see Figure 3.3.2 and Appendix)
- (e) Reference wind pressure up to 600 Pa for a return period of 50 years. The effect of wind funnelling due to special topographical features such as deep valleys is not considered (CHBDC 3.10.1.2)
- (f) Location of supports and vertical clearances according to the requirements of the CHBDC and MTO Design Supplement for TAC Geometric Design Guide for Canadian Roads (2017)
- (g) Competent soil conditions (as described in Section 3.5.4) excluding rock fill.

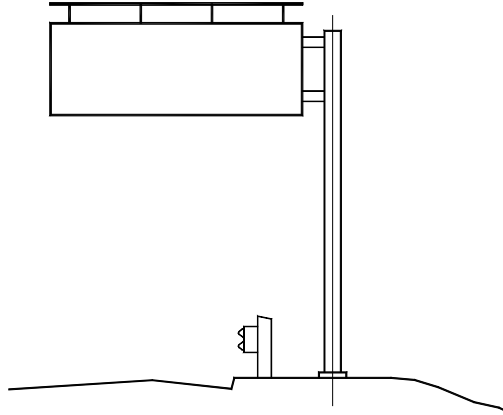


FIGURE 3.1.2(a) SINGLE CANTILEVER SIGN SUPPORT

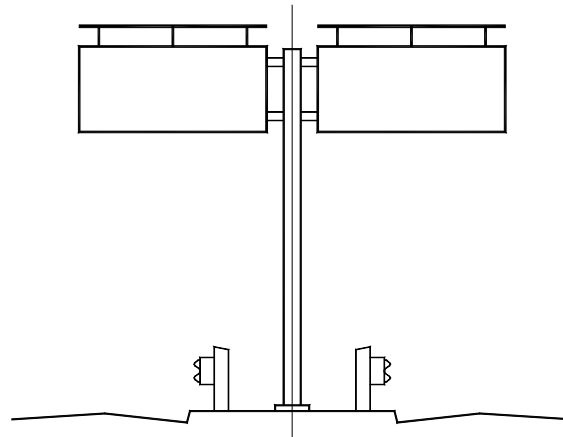


FIGURE 3.1.2(b) BUTTERFLY SIGN SUPPORT

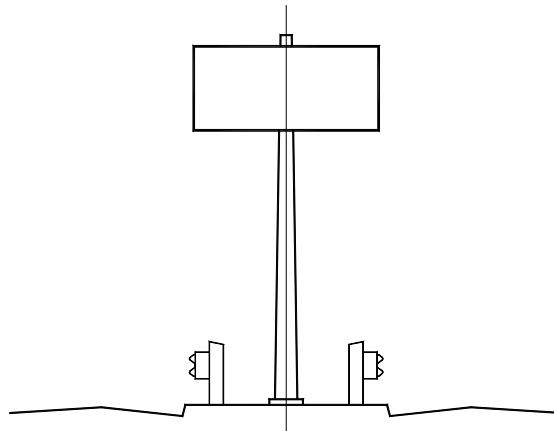


FIGURE 3.1.2(c) CENTRE MOUNTED SIGN SUPPORT
Note: All three types can also be mounted on a barrier wall.

3.1.3 LIMITATIONS

For economic and practical reasons, these supports should be placed as close as possible to the edge of the travelled portion of the highway (see Section 3.1.6). Therefore, these supports will probably be in the Clear Recovery Zone and should be protected as discussed in Section 2.6.

For ground mounted footings, the top of footing elevation shall be a minimum of 300 mm above the finished grade. This could be increased up to 1000 mm in order to limit the leg height. The dimension from the top of the footing to the centreline of the bottom arm shall not exceed 6500 mm. Therefore, the total height from grade to centreline of the bottom arm cannot exceed 7500 mm.

3.1.4 CANTILEVER SIGN SUPPORTS

Cantilever sign supports are fabricated from structural steel and are designed for ground mounting or on concrete median barriers. The typical layout plan and sign support elevation are shown in Figures 3.1.4 (a) through (d).

The vertical support member is straight and made from round or octagonal shape sections. Fabricators may choose to fabricate the octagonal shape from steel plate. Octagonal sections have to meet the requirements shown on Standard Drawings SS118-22, SS118-24, SS118-71 and SS118-73.

The maximum allowable length of the vertical support member is 8500 mm, which is a limit imposed by design. It is connected at the base to a concrete footing by a bolted anchorage system.

The horizontal arms are circular HSS sections inter-connected by verticals and diagonals. These vertical and diagonal members are fabricated from either circular HSS sections with welded connection, or double angles with bolted connection. Sign boards are centered vertically between the horizontal arms, and are attached to these members by means of Z-brackets (see Figure A3.1). The horizontal arms are connected to the vertical support member by a bolted flange welded to the support. For butterfly sign supports, horizontal arms shall be located at the same elevation and extend in both directions.

An aerodynamic damper along the full width of all sign boards is required to suppress vortex shedding and galloping instabilities of the structure under various wind conditions. The damper is attached to each Z-bracket by means of stainless steel bolts. The damper assembly is fabricated from structural aluminum, and is comprised of a damper plate, gusset plates, and support angles (see Figure 3.3.2).

All structural steel components are galvanized after fabrication. The support leg is subsequently coated with an approved paint system.

3.1.5 FOOTINGS

Each sign support footing consists of a reinforced concrete caisson. Details differ according to their location, and generally are of two types, as shown on the standard drawings: ground mounted and median mounted signs (see Standard Drawings SS118-3, SS118-4, and SS118-5).

The indicated footing depths are the minimum required for each support. Footing proportions assume competent soil conditions of uniform composition. Parameters upon which the design is based are given in Section 3.5.4.

Encountered soil conditions such as rock fill, land fill, and soft material are not covered here, and require the footing to be designed by an Engineer.

3.1.6 CLEARANCE

For ground mounted footings, the minimum horizontal clearance 'G' from the back of traffic protection barrier to the nearest face of sign support footing shall not be less than the values specified in Figure A3.2 (see Appendix to Section 3).

The minimum vertical distance from the highest point on the highway, including shoulders, curbs, and medians to the bottom of the deepest sign board (2745 mm) shall not be less than 5300 mm.

The minimum vertical clearance from the highest point on the highway including shoulders, curbs, and medians to the bottom of the lower chord shall not be less than 5600 mm.

Small lane designation sign boards with limited strength connections are allowed to project below the bottom edge of a sign board as long as damage to them does not cause damage to the structure or present a hazard to traffic below (see Figure A4.2).

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CANTILEVER STATIC SIGN SUPPORTS

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3.1.7 DETERMINING ARM LENGTH AND PANEL LENGTHS

The length of the arms shall extend to 50 mm from the end of the sign.

The number and spacing of the panels shall be based on the following criteria (this shall be calculated on both sides for butterfly sign supports):

- (1) A minimum of 2 panels (if it is calculated that only one panel is required, the arms shall be fabricated without verticals/diagonals and installed individually).
- (2) A maximum panel spacing of 2600 mm.
- (3) An equal panel length spacing except as modified in (4) below
- (4) The size of the panel nearest to the leg may be adjusted if there is a conflict between the Z-bracket nearest to a leg and the panel point gusset plate (see also Section 3.1.8).

See Section 3.2.3 and 3.2.4 for examples.

3.1.8 DETERMINING THE LOCATION OF Z-BRACKETS

The number and spacing of Z-brackets for the attachment of the sign board to the structure shall be based on the following criteria (this shall be calculated on both sides for butterfly sign supports):

- (1) Maximum spacing of 1500 mm.
- (2) The number of Z-brackets should be kept to a minimum of three brackets per sign. For small signs of size not larger than 1.5 m wide x 1.8m deep, two Z-brackets may be used.
- (3) The intermediate Z-brackets should be equally spaced where possible.
- (4) A fixed distance of 200 mm from the centre of the Z-bracket to the end of the sign board, except as required in (5).
- (5) If there is conflict between the Z bracket closest to the leg and a panel point connection gusset plate, the location of the Z-bracket can be adjusted as follows:
 - (a) Adjust the distance to the end of the sign board. This shall be a minimum of 125 mm and maximum of 500 mm from the centre of the Z-bracket (see Standard Drawing SS118-25)

AND/OR

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CANTILEVER STATIC SIGN SUPPORTS

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(b) Adjust the length of panel closest to the leg.

- (6) Check for conflict with the diagonal/vertical arm connections when the sign board is in place. Where this occurs, the designer shall move the Z-bracket to avoid the conflict (while maintaining the above limits) and, if necessary, change the size of the truss panel point (see Section 3.1.7) nearest to the leg to cause the gusset plate connection to move away from this location.

See Sections 3.2.3 and 3.2.4 for examples.

Once the number and location of the Z-brackets and panel points have been determined, the designer shall add this information to Tables 1 and 2 on the Standard Drawings.

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CANTILEVER STATIC SIGN SUPPORTS

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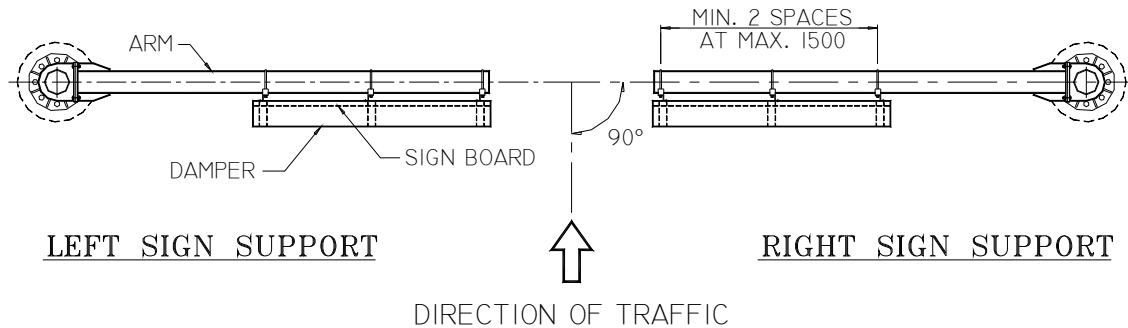


FIGURE 3.1.4(a) TYPICAL SINGLE CANTILEVER LAYOUT PLAN

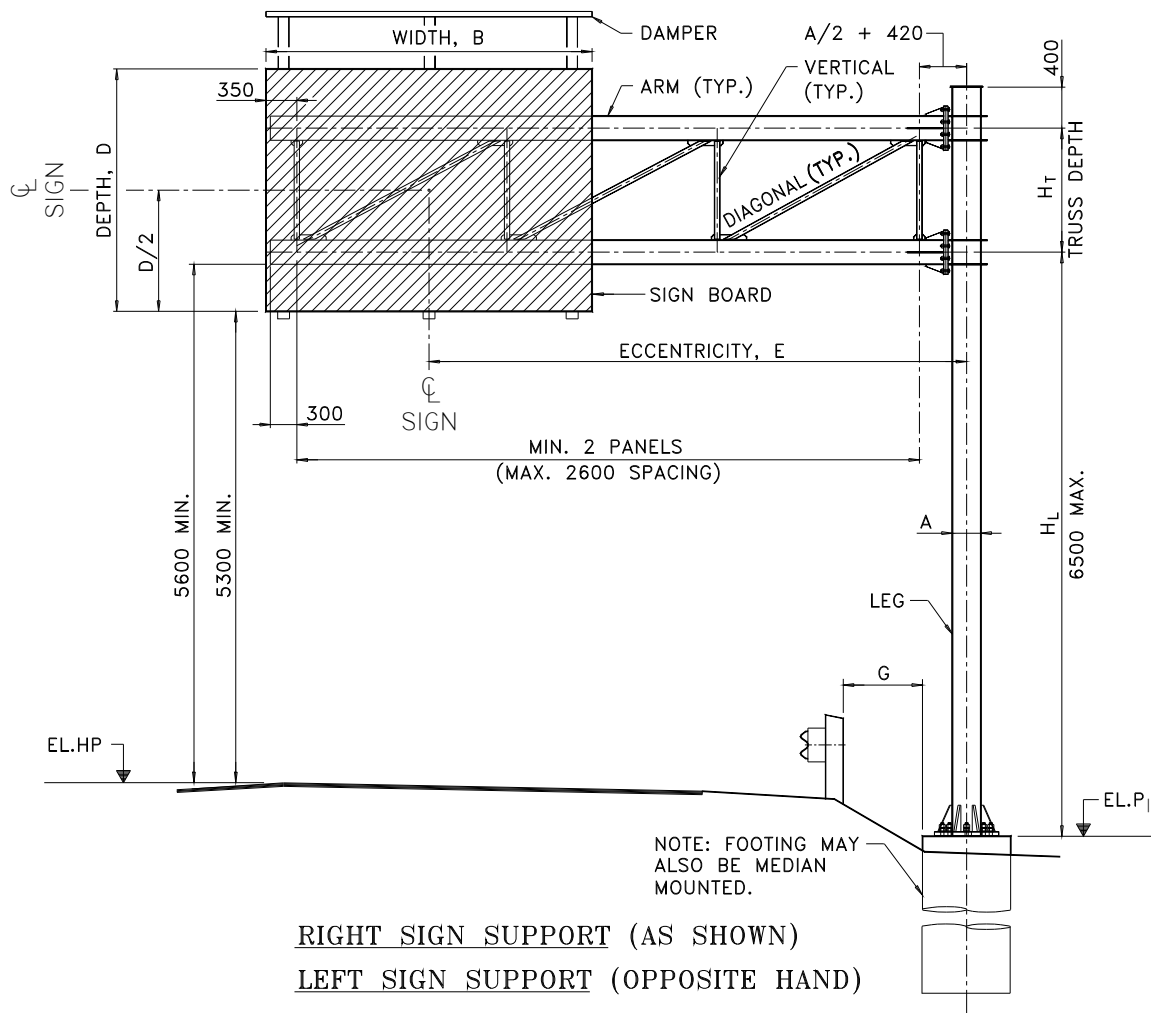


FIGURE 3.1.4(b) TYPICAL SINGLE CANTILEVER SIGN LAYOUT ELEVATION

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CANTILEVER STATIC SIGN SUPPORTS

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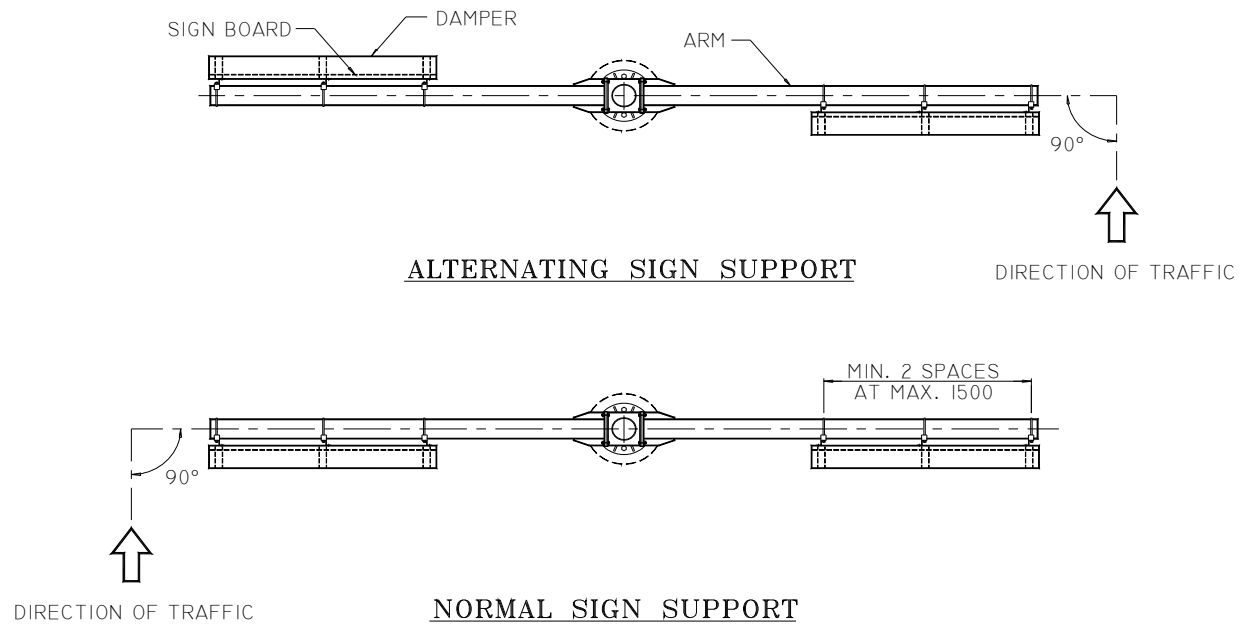


FIGURE 3.1.4(c) TYPICAL BUTTERFLY LAYOUT PLAN

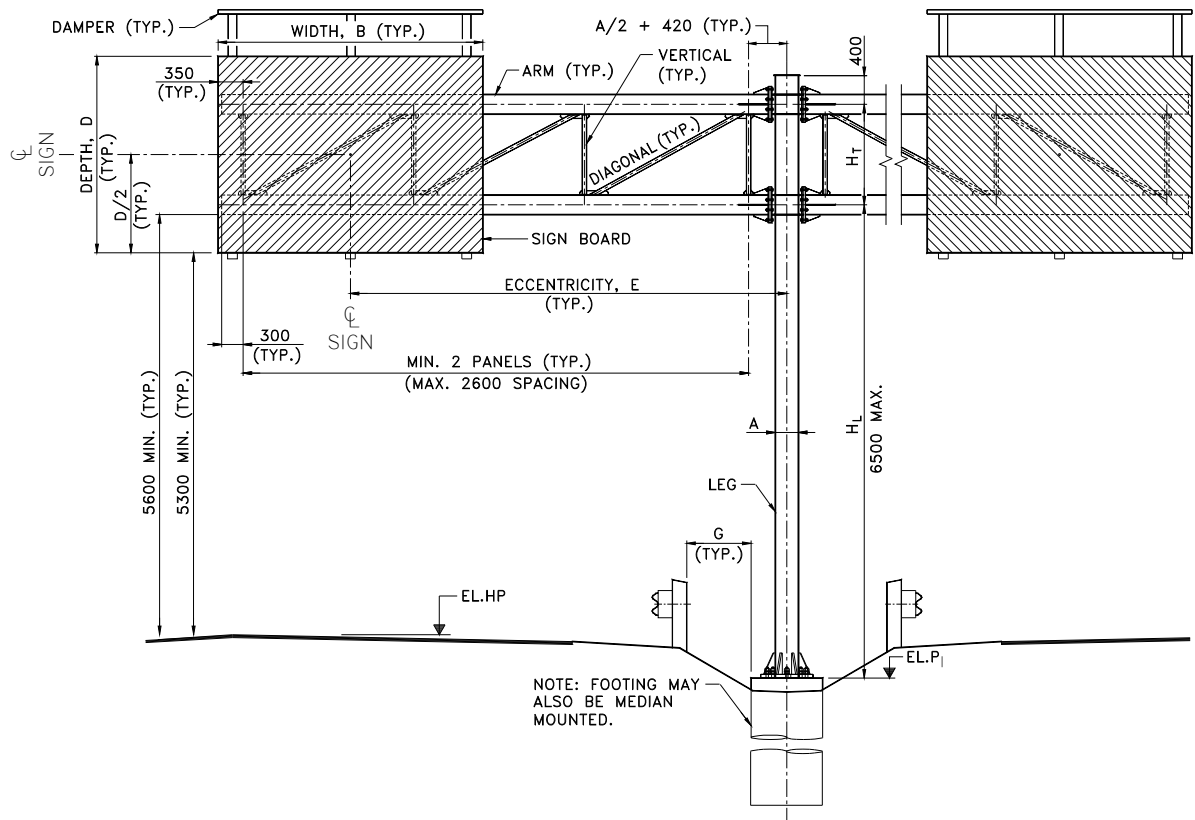


FIGURE 3.1.4(d) TYPICAL BUTTERFLY CANTILEVER SIGN SUPPORT ELEVATION

3.2 PROCEDURES

3.2.1 GENERAL

There are four designs (called Classes) for single cantilever and butterfly sign supports. Each Class has a specified set of member dimensions, resulting in different load carrying capacities, (i.e. a Class 4 support can hold a much larger sign than a Class 1 support). The Class is dependent on the sign area, A , the eccentricity, E , and the 50-year Reference Wind Pressure, q , for the proposed location.

3.2.2 DATA REQUIRED

For each sign support, the following data is required:

- (1) For Single Cantilever Sign Supports:
The sign board dimensions ($D \times B$) and eccentricity, E .
Maximum sign area vs. eccentricity curves are shown in Figures 3.2.2(a) to (d) for four different ranges of reference wind pressure. Only the combinations shown below the upper limit line are permissible
- (2) For Butterfly Sign Supports:
The sign board area (A_{left} and A_{right}) and eccentricities (E_{left} and E_{right}) from both sides.

Maximum total sign area ($A_{\text{left}} + A_{\text{right}}$) vs. eccentricity (maximum of E_{left} and E_{right}) curves are shown in Figures 3.2.2(e) to (h) for four different ranges of reference wind pressure. Only the combinations shown below the upper limit are permissible.
- (3) The 50-year reference wind pressure, q .
This value can be obtained for Ontario from Table A2.9(a) to (c) in the Appendix in Section 2 of the Manual.
- (4) The site location and orientation of the support.
For a proposed highway or a highway under reconstruction, the location should be specified as a station. The orientation or layout shall be as shown in Figures 3.1.4(a) and 3.1.4(c).
- (5) The elevation of the highest point on the highway under the sign board, and the final ground elevations under the sign structure footing, at the sign station.

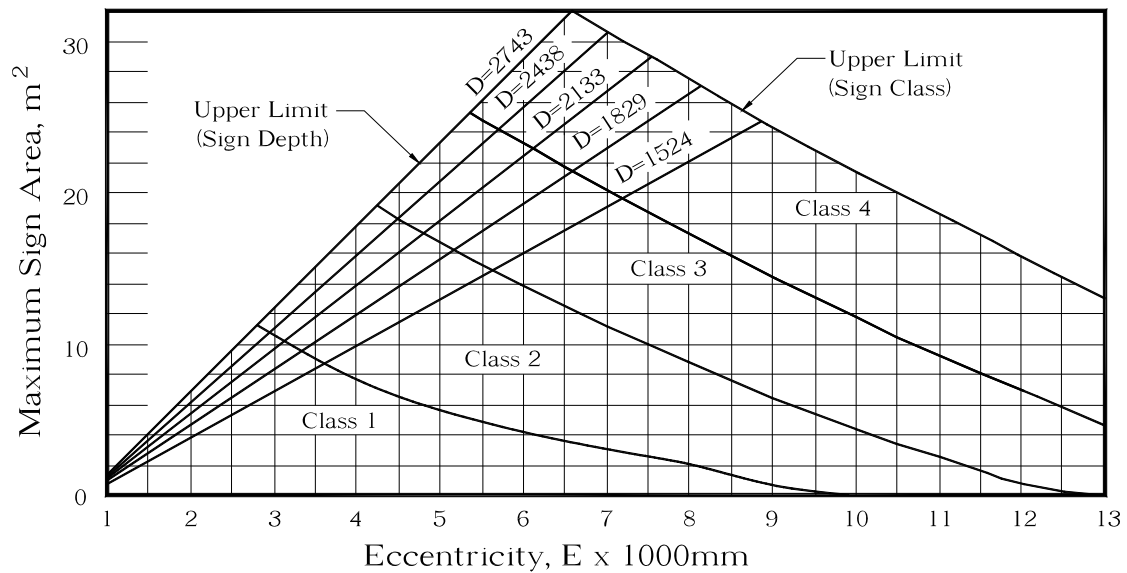


FIGURE 3.2.2(a) CLASS RANGES FOR $q \leq 325$ Pa
(Single Cantilever Sign Support)

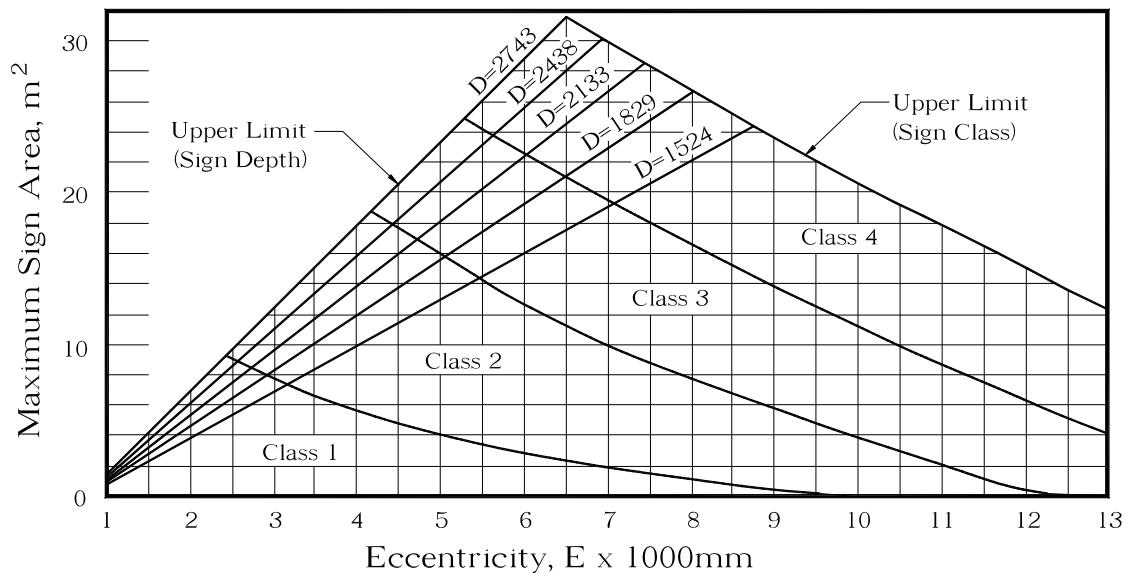


FIGURE 3.2.2(b) CLASS RANGES FOR $325 \text{ Pa} < q \leq 425 \text{ Pa}$
(Single Cantilever Sign Support)

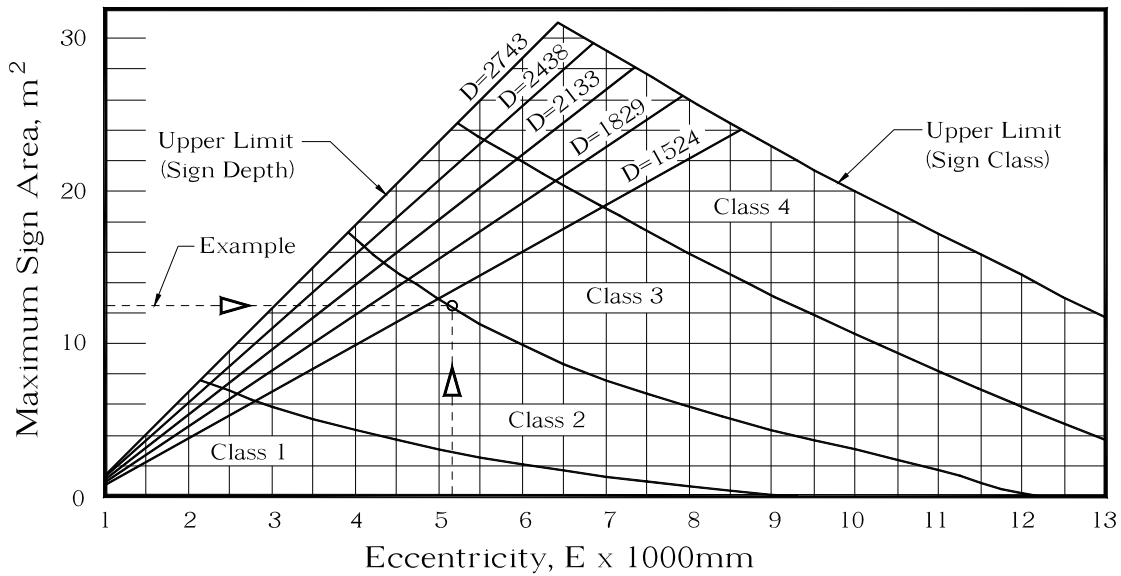


FIGURE 3.2.2(c) CLASS RANGES FOR 425 Pa < q ≤ 525 Pa
(Single Cantilever Sign Support)

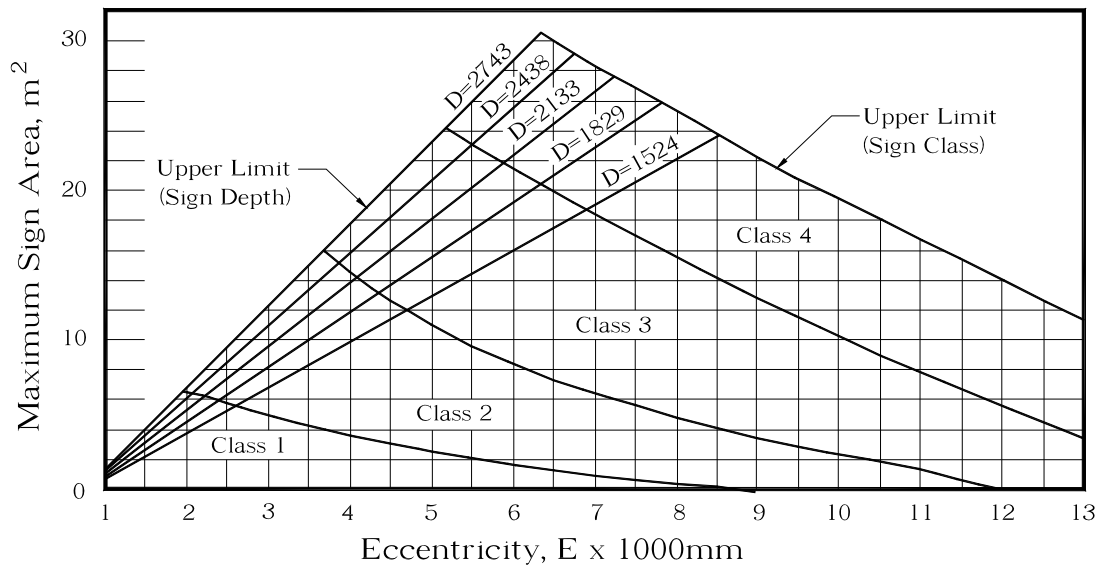


FIGURE 3.2.2(d) CLASS RANGES FOR 525 Pa < q ≤ 600 Pa
(Single Cantilever Sign Support)

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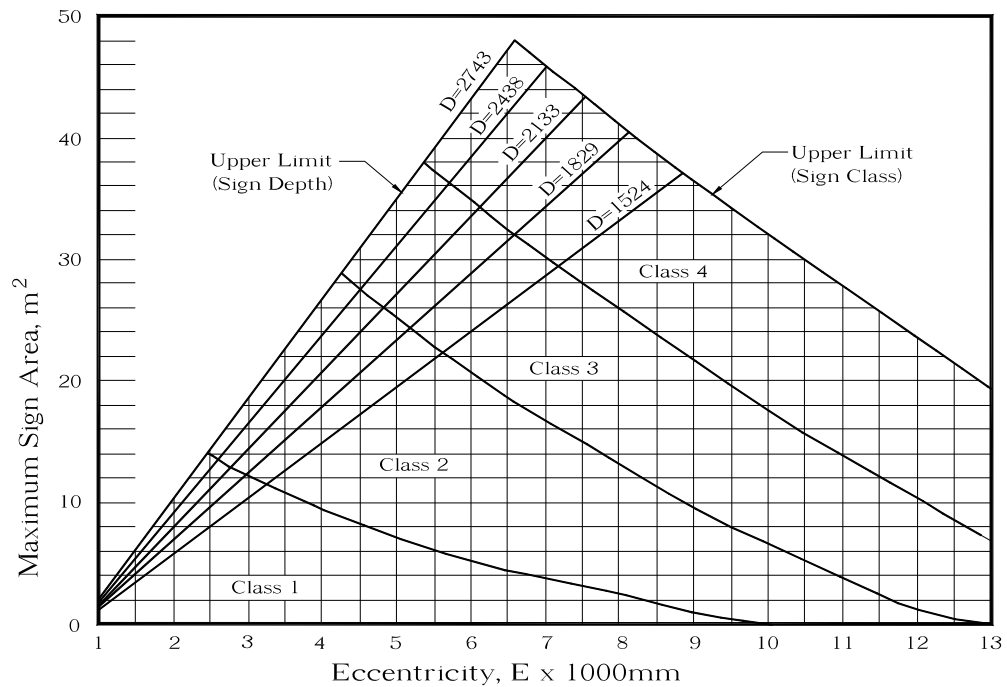


**FIGURE 3.2.2(e) CLASS RANGES FOR $q \leq 325$ Pa
(Butterfly Sign Support)**

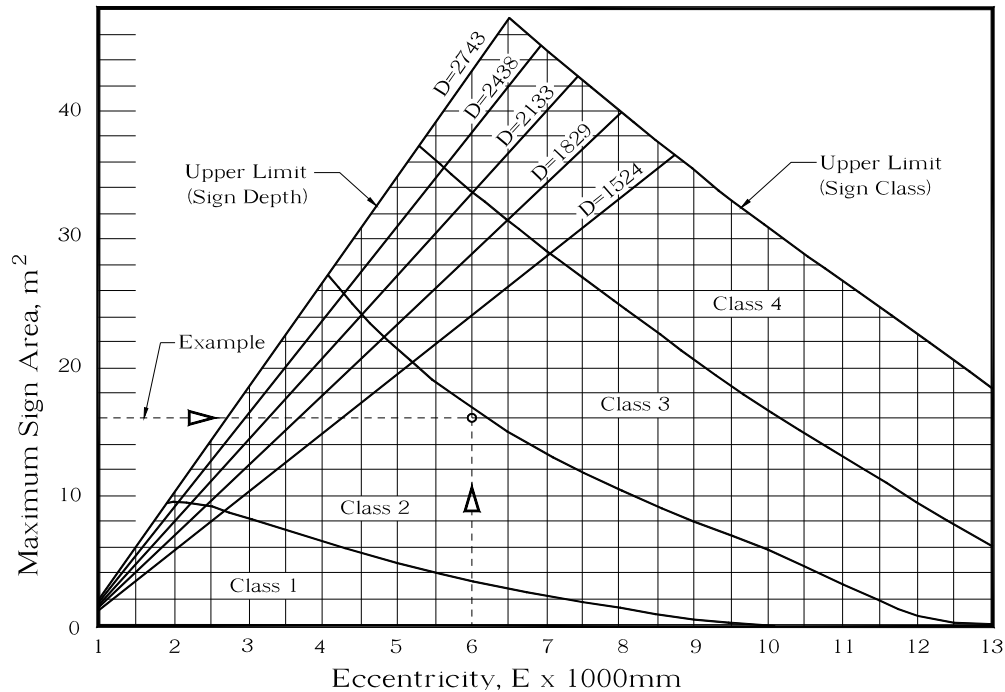


**FIGURE 3.2.2(f) CLASS RANGES FOR $325 \text{ Pa} < q \leq 425 \text{ Pa}$
(Butterfly Sign Support)**

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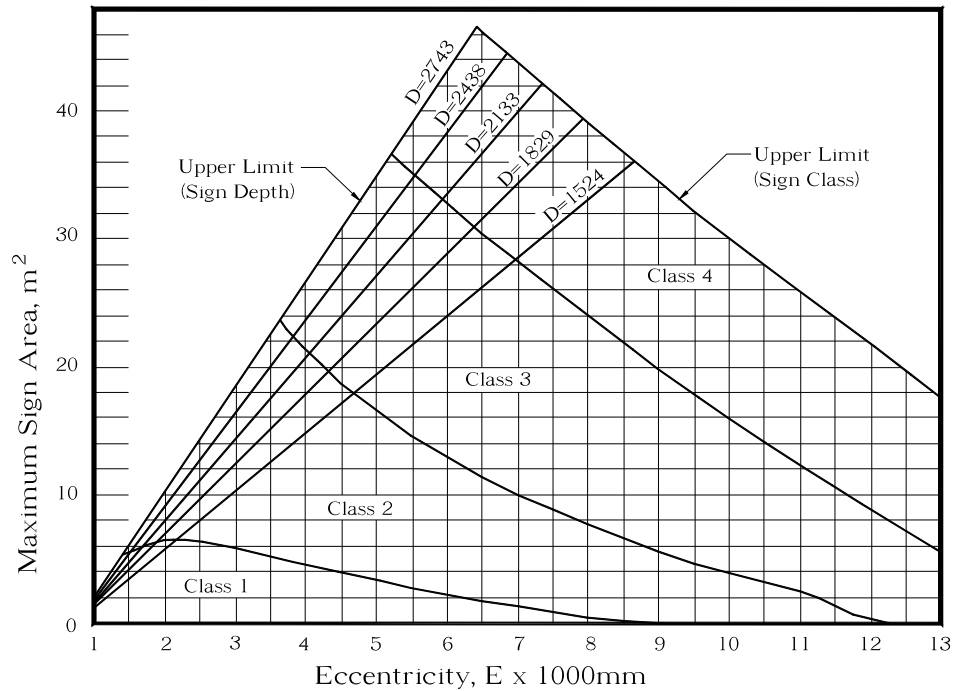


FIGURE 3.2.2(g) CLASS RANGES FOR 425 Pa < q ≤ 525 Pa (Butterfly Sign Support)

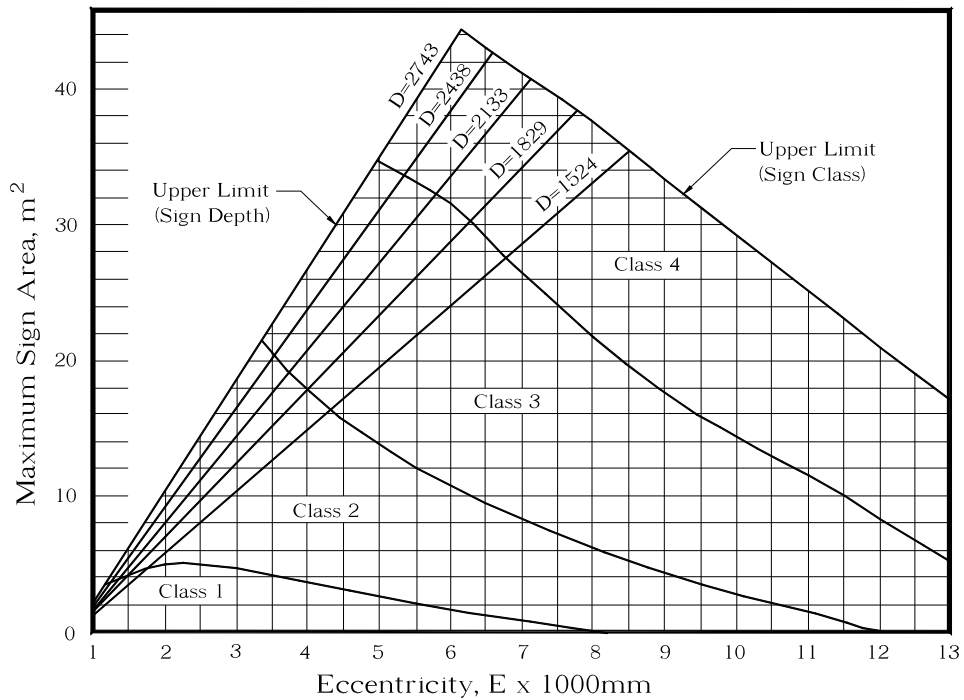


FIGURE 3.2.2(h) CLASS RANGES FOR 525 Pa < q ≤ 600 Pa (Butterfly Sign Support)

3.2.3 PROCEDURE FOR SELECTION OF SINGLE CANTILEVER SIGN SUPPORT

GIVEN: SIGN SIZE AND ECCENTRICITY

Example: 2500 mm x 5000 mm sign board with eccentricity, E, of 5100 mm, and 50-year reference wind pressure, q, of 520 Pa.

STEP 1: OBTAIN THE DESIGN CLASS FOR THE PROPOSED SIGN

E.g. The intersection of the values for sign area of $2.5 \times 5 = 12.5 \text{ m}^2$ and $E = 5100 \text{ mm}$ fall within the Class 2 area of the chart on Figure 3.2.2(c) for $425 \text{ Pa} < q \leq 525 \text{ Pa}$, and below the upper limit for sign depth of 2500 mm. Therefore, the proposed sign requires a Class 2 sign support.

STEP 2: OBTAIN THE DESIGN DIMENSIONS FOR THE CLASS

E.g. From Tables 3.2.3(a) and 3.2.3(b), and a Class 2 sign support obtain the following:

Support Leg:	HSS 406 x 12.7
Arms:	HSS 273 x 8.0
Verticals/Diagonals:	HSS 73 x 4.8 (welded joint option) or 2 No. L 89 x 89 x 9.5 (bolted joint option)
Arm Connection Plate:	Length = 580 mm
Arm Length (E+B/2-50):	= $5100 + 5000/2 - 50 = 7550 \text{ mm}$
Dimension 'K' for Camber:	= 65 mm

CALCULATE PANEL LENGTHS (see Section 3.1.7):

The total length of all panels	= $E + B/2 - A/2 - 350 - 420$
	= $5100 + 5000/2 - 406/2 - 770$
	= 6627 mm

Total number panels required	= $6627/2600$
	= 2.55, say 3 panels

Average panel length	= $6627/3$
	= 2209 mm

$P_1 = 2209 \text{ mm}$, $P_{\text{TYP}} = 2209 \text{ mm}$

LOCATE Z-BRACKETS (see Section 3.1.8):

Let L_x = distance of Z-bracket from end of sign board closest to traffic side.

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- (1) Locate first bracket 200 mm from the end of sign board nearest traffic side
 $L_x = 200 \text{ mm}$
- (2) Locate last bracket 200 mm from the end of sign board nearest leg
 $L_x = 4800 \text{ mm}$
- (3) Check for interference with panel point at last location
 $L_x = 350 + 2209 + 2209 = 4768 \text{ mm}$
Conflict with (2)
- (4) Adjust the last Z-bracket's location to any distance (x) between 125 mm to 500 mm from end of sign board.
Still Interference (see Figure 3.2.3(a))
- (5) Change end panel length and adjust last Z-bracket location.
OK - Satisfies all criteria in Section 3.1.8 and minimizes number of Z-brackets (see Figure 3.2.3(b))

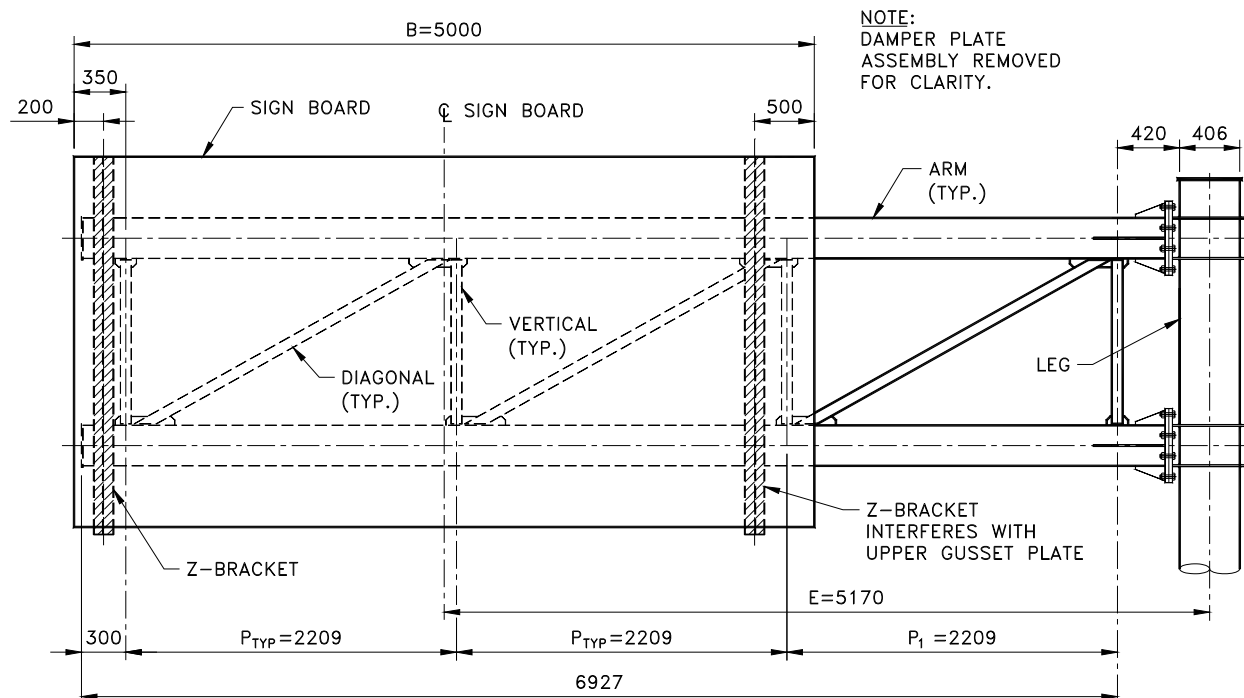
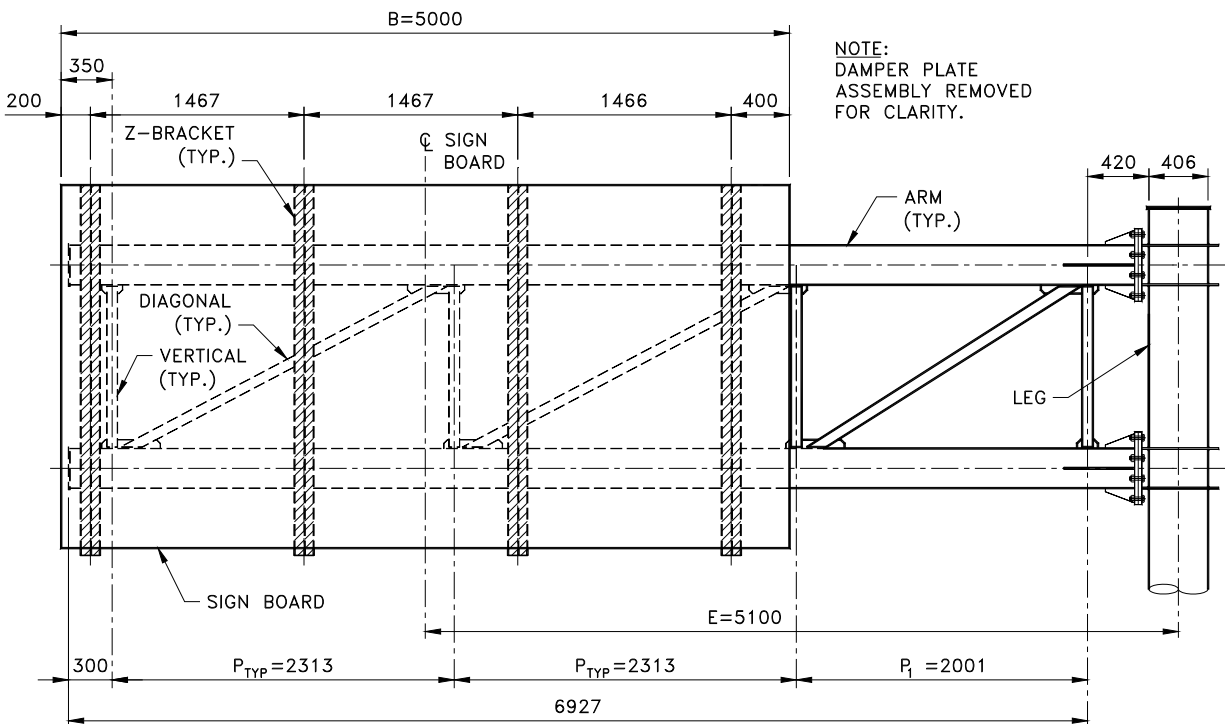


FIGURE 3.2.3(a)

**FIGURE 3.2.3(b)****STEP 3: CHECK BOUNDARY CONDITIONS**

- The maximum length of the vertical support leg from the top of the footing to the centreline of the bottom arm shall be 6500 mm.
- The dimension measured from the highest point on the highway, EL.HP, to the bottom of the sign board shall be at least 5300 mm, and to the bottom of the lower arm at least 5600 mm.
- Check to see if the sign board interferes with the arm to leg connection. To avoid interference, the eccentricity shall be equal to or greater than: $B/2 + A/2 + 500$, where 'B' is the width of the sign board, and 'A' is the outside diameter of the leg.

E.g., $E = 5100 \text{ mm} > 5000/2 + 406/2 + 500 = 3203 \text{ mm}$, OK.

If any of the above conditions are not satisfied, the initial design parameters must be revised.

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STEP 4: COMPLETE THE STANDARD DRAWINGS

On Standard Drawings SS118-24 or SS118-73, and SS118-25,

Enter in Table 1

$P_1 = 2001 \text{ mm}$

$P_{TYP} = 2313 \text{ mm}$

And in Table 2

$Y_1 = 1467 \text{ mm}$

$Y_2 = 1467 \text{ mm}$

$Y_3 = 1466 \text{ mm}$

$X = 400 \text{ mm}$

Refer to 3.3 for Preparation of Drawings.

3.2.4 PROCEDURE FOR SELECTION OF BUTTERFLY SIGN SUPPORT

GIVEN: SIGN SIZE AND ECCENTRICITY

Example: a 2000 mm x 5000 mm sign board with eccentricity, E, of 6000 mm on the left, a 1500 mm x 4000 mm sign board with eccentricity, E, of 4000 mm on the right, and 50-year reference wind pressure, q, of 410 Pa.

STEP 1: OBTAIN THE DESIGN CLASS FOR THE PROPOSED SIGN

E.g. On the left, the sign area (A_L) is $2 \times 5 = 10.0 \text{ m}^2$. On the right, the sign area (A_R) is $1.5 \times 4 = 6.0 \text{ m}^2$. The ratio of areas of larger sign to smaller sign is 1.67. It is less than the design limit of 2 of the design charts. The total area of both signs is 16.0 m^2 . The larger eccentricity is $E = 6000 \text{ mm}$. The intersection of these values fall within the Class 2 area of the chart of Figure 3.2.2(f) for $325 \text{ Pa} < q \leq 425 \text{ Pa}$ and below the upper limit for larger sign depths of 2000 mm. Therefore, the proposed sign requires a Class 2 sign support.

STEP 2: OBTAIN THE DESIGN DIMENSIONS FOR THE CLASS

E.g. From Tables 3.2.3(a) and 3.2.3(b), and a Class 2 sign support obtain the following:

Support Leg: HSS 406 x 12.7

Arms: HSS 273 x 8.0

Verticals/Diagonals: HSS 73 x 4.8 (welded joint option) or
2 No. L 89 x 89 x 9.5 (bolted joint option)

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Arm Connection Plate Length: = 580 mm
Arm Length (left) (E+B/2-50): = 6000+5000/2-50= 8450 mm
Arm Length (right): = 4000+4000/2-50= 5950 mm
Dimension 'K' for Camber (left): = 70 mm
Dimension 'K' for Camber (right): = 65 mm

CALCULATE PANEL LENGTHS (see 3.1.7):

LEFT:

The total length of all panels = $E+B/2-A/2-350-420$
= $6000+5000/2-406/2-770$
= 7527 mm
Total number panels required = $7527/2600$
= 2.90 say 3 panels
Average panel length = $7527/3$
= 2509 mm

$$P_1 = 2509 \text{ mm}, P_{\text{TYP}} = 2509 \text{ mm}$$

RIGHT:

The total length of all panels = $E+B/2-A/2-350-420$
= $4000+4000/2-406/2-770$
= 5027 mm
Total number panels required = $5027/2600$
= 1.93, say 2 panels
Average panel length = $5027/2$
= 2513.5 mm

$$P_1 = 2514 \text{ mm}, P_{\text{TYP}} = 2513 \text{ mm}$$

LOCATE Z-BRACKETS (see 3.1.8):

LEFT:

Let L_x = distance of Z-bracket from end of sign board
closest to traffic.

- (1) Locate first bracket 200 mm from the end of sign board
nearest traffic
 $L_x = 200 \text{ mm}$
- (2) Locate last bracket 200 mm from the end of sign board
nearest leg
 $L_x = 4800 \text{ mm}$

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- (3) Check for interference with panel point at last location
 $L_x = 350 + 2509 + 2509 = 5368 \text{ mm}$
No Conflict with (2), but length between 1st and last bracket of 4600 mm precludes the possibility of minimizing the number of Z-brackets.
- (4) Adjust the last Z-bracket's location to any distance (x) between 125 mm to 500 mm from end of sign board – try 300 mm.
Z-bracket interferes with lower gusset plate (see Figure 3.2.4(a)).
- (5) Keep the Z-bracket locations and change the end panel length (P_1) to 2599 mm. **OK - Satisfies all criteria in Section 3.1.8 and minimizes number of Z-brackets (see Figure 3.2.4(b)).**

RIGHT:

- (6) Locate first bracket 200 mm from the end of sign board nearest traffic (away from leg).
- (7) $L_x = 200 \text{ mm}$
- (8) Locate last bracket 200 mm from the end of sign board nearest leg
 $L_x = 3800 \text{ mm}$
- (9) Check for interference with panel point at last location
 $L_x = 350 + 2513 = 2863 \text{ mm}$
No Conflict with (7)
OK - Satisfies all criteria in Section 3.1.8 and minimizes number of Z-brackets (see Figure 3.2.4(c)).

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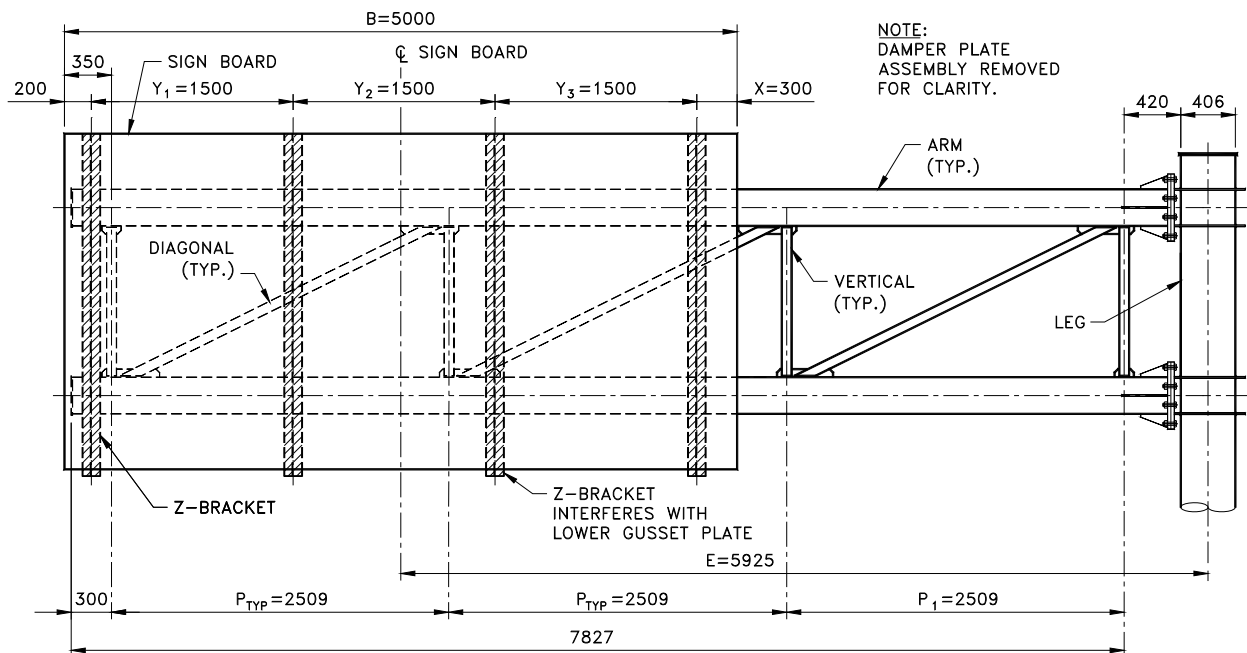


FIGURE 3.2.4(a): Left Arm

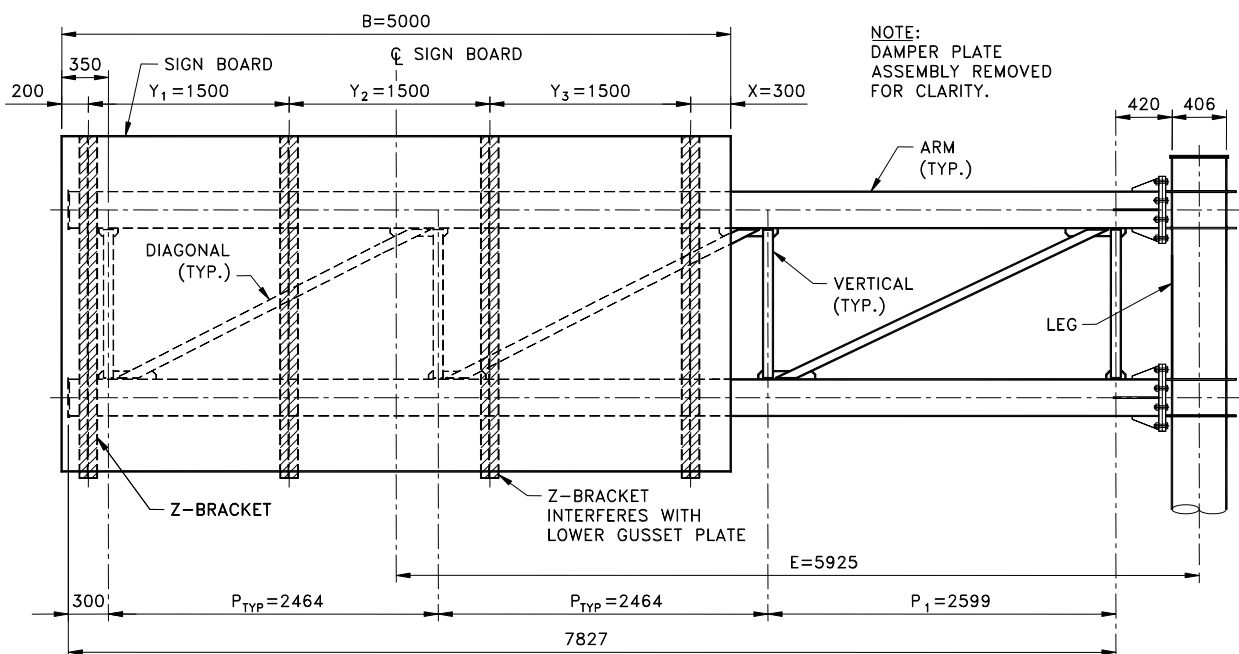


FIGURE 3.2.4(b): Left Arm

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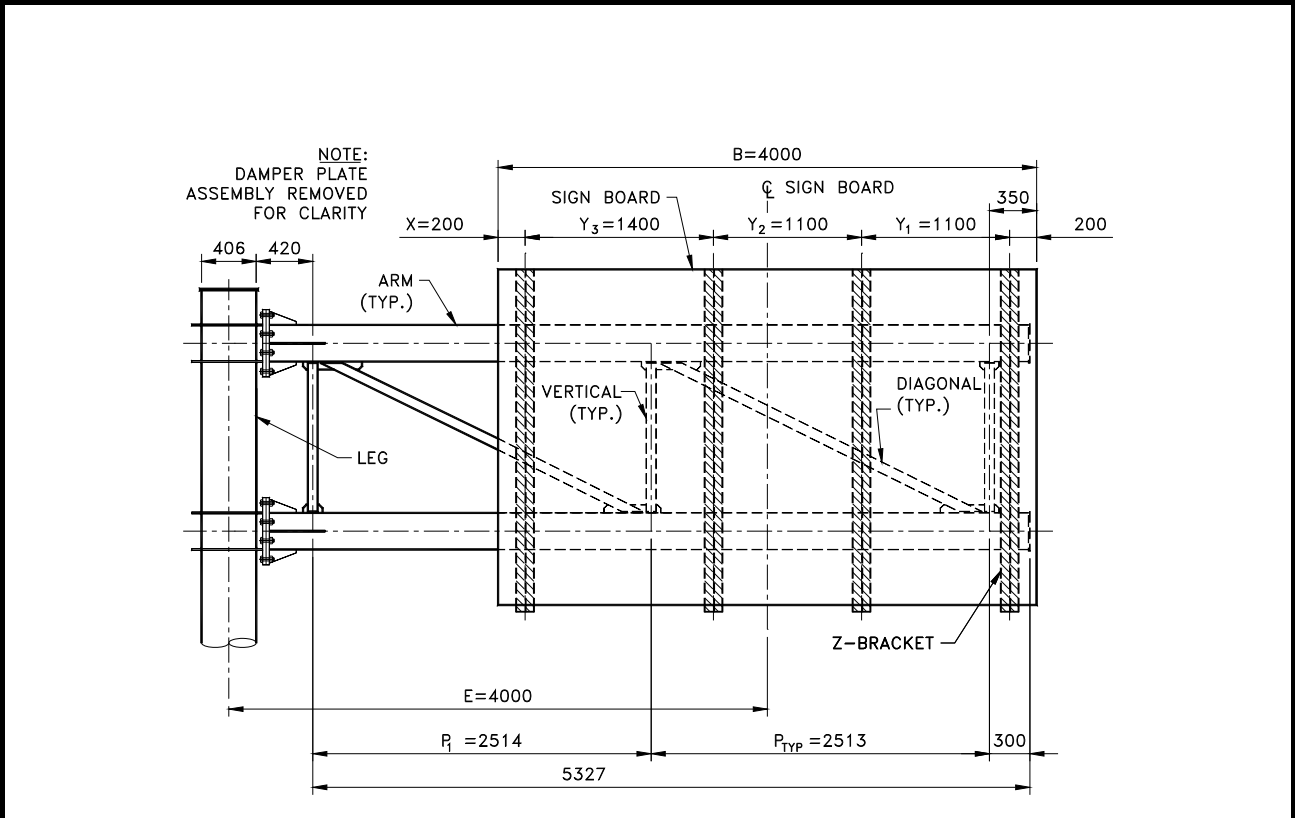


FIGURE 3.2.4(c): Right Arm

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STEP 3: CHECK BOUNDARY CONDITIONS

- (a) The maximum length of the vertical support leg from the top of the footing to the centreline of the bottom arm shall be 6500 mm.
- (b) For both arms, the dimension measured from the highest point on the highway, EL.HP, to the bottom of the sign board shall be at least 5300 mm, and to the bottom of the lower arm at least 5600 mm.
- (c) Check to see if the sign board interferes with the arm to leg connection. To avoid interference, the eccentricity shall be equal to or greater than: $B/2 + A/2 + 500$, where 'B' is the width of the sign board, and 'A' is the outside diameter of the leg.

E.g., Left: $E = 6000 \text{ mm} > 5000/2 + 406/2 + 500 = 3203 \text{ mm}$,
OK.

Right: $E = 4000 \text{ mm} > 4000/2 + 406/2 + 500 = 2703 \text{ mm}$,
OK.

If any of the above conditions are not satisfied, the initial design parameters must be revised.

STEP 4: COMPLETE THE STANDARD DRAWINGS

On Standard Drawings SS118-22 or SS118-71, and SS118-25,

Enter in Table 1

LEFT	$P_1 = 2599 \text{ mm}$ $P_{TYP} = 2464 \text{ mm}$
RIGHT	$P_1 = 2514 \text{ mm}$ $P_{TYP} = 2513 \text{ mm}$

And in Table 2

LEFT	$Y_1 = 1500 \text{ mm}$ $Y_2 = 1500 \text{ mm}$ $Y_3 = 1500 \text{ mm}$ $x = 300 \text{ mm}$
RIGHT	$Y_1 = 1100 \text{ mm}$ $Y_2 = 1100 \text{ mm}$ $Y_3 = 1400 \text{ mm}$ $x = 200 \text{ mm}$

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Refer to 3.3 for Preparation of Drawings.

TABLE 3.2.3(a) DESIGN DIMENSIONS FOR CLASS 1, 2, 3 AND 4

	CLASS 1	CLASS 2	CLASS 3	CLASS 4
LEG OUTSIDE DIAMETER, A (mm) (1)	324	406	508	610
LEG THICKNESS, t (mm) (1)	9.5	12.7	12.7	12.7
ARMS	HSS 168 x 8.0	HSS 273 x 8.0	HSS 356 x 12.7	HSS 508 x 11.0
TRUSS DEPTH, H _T (mm)	1400	1400	1400	1600
VERTICALS/DIAGONALS (for welded joint option) (3)	HSS 73 x 4.8	HSS 73 x 4.8	HSS 89 x 6.4	see note (4)
VERTICALS/DIAGONALS (for bolted joint option) (3)	2 no. L89 x 89 x 9.5	2 no. L89 x 89 x 9.5	2 no. L102 x 102 x 9.5	2 no. L102 x 102 x 9.5
ARM CONNECTION PLATE LENGTH, P (mm) (2)	498	580	682	784
ARM CONNECTION PLATE THICKNESS, T1 (mm) (2)	25	25	30	30
ARM CONNECTION PLATE THICKNESS, T2 (mm) (2)	12	12	15	15
BOLT CIRCLE DIAMETER AT BASE, D1 (mm) (2)	750	750	750	850
BASE PLATE DIAMETER, D2 (mm) (2)	900	900	900	1000
WELD SIZE AT BASE, F (mm) (2)	10	10	13	13

Notes:

- (1) The vertical support legs are fabricated from round or octagonal sections. For octagonal sections, A is measured across the flats. (See Section 3.1.4).
- (2) The dimensions H_T, P, T1, T2, D1, D2 and F are detailed on SS118-22, SS118-24, SS118-71 and SS118-73.
- (3) Joint option(s) shall be determined by the designer.
- (4) Welded joint option shall not be used for CLASS 4 structure

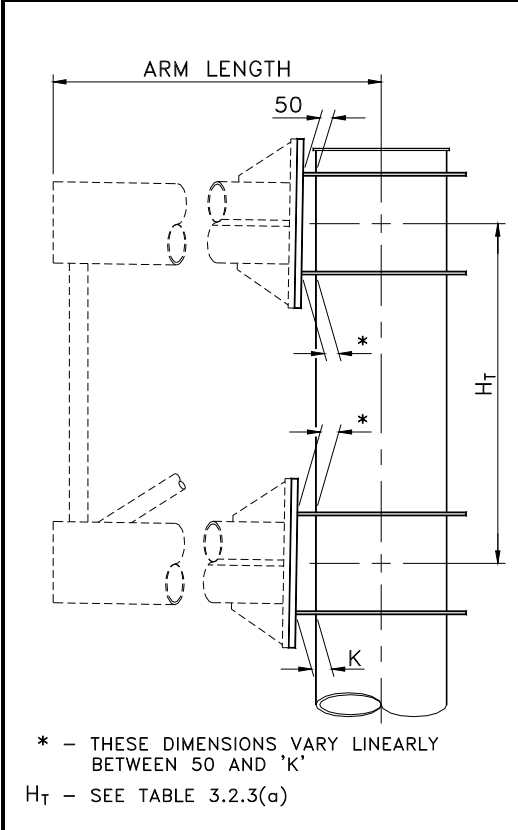
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TABLE 3.2.3(b) DESIGN DIMENSIONS FOR CLASS 1, 2, 3 AND 4

	CLASS OF ARMS	ARM LENGTH (mm)	K
 * - THESE DIMENSIONS VARY LINEARLY BETWEEN 50 AND 'K' H_T - SEE TABLE 3.2.3(a)	1	LESS THAN 3000	50
		3000 TO 4000	55
		GREATER THAN 4000	60
	2	LESS THAN 3000	50
		3000 TO 5500	55
		5501 TO 8000	65
		8001 TO 10000	70
		GREATER THAN 10000	75
	3, 4	LESS THAN 4000	50
		4000 TO 6000	55
		6001 TO 8000	60
		8001 TO 10000	65
		10001 TO 12000	70
		12001 TO 14000	75
		GREATER THAN 14000	80

3.3 PREPARATION OF DRAWINGS**3.3.1 DATA REQUIRED**

The sign support structure designer shall obtain information from the Regional Offices for the location, site number, span length, location, elevations and sizes of sign boards etc. of each sign support to be constructed. The designer shall prepare and complete the design standard drawings for the structures and its foundations that will be part of the contract documents. Design drawings shall show the following information:

- (1) A key plan, indicating the location of each support.
- (2) The Site number (formerly Structure I.D. number).
- (3) The eccentricity, measured from centreline of the sign board to the centreline of support leg. This is required for both signs on butterfly sign supports.
- (4) The control line or the centreline of the roadway, and the offset of the leg from the control line.
- (5) The elevation of the highest point on the roadway surface under the support structure. Consider both sides of leg for butterfly sign supports.
- (6) The height of the supporting leg that is the dimension measured from the top of footing to the centreline of the bottom arm. This height shall not exceed 6500 mm.
- (7) The top of footing elevation. This elevation shall be determined so that the footing projection above finished grade around it is minimum 300 mm and maximum 1000 mm. This will give the designer flexibility to meet the structure leg height as stated in (6) above.
- (8) The elevation of the ground line at the support footing.
- (9) The offset of the centreline of footing from the control line, either as a note or as a dimension.
- (10) The station of the support structure on a designated highway centreline or control line.
- (11) A designation for the sign support as a "Left Sign Support" or "Right Sign Support". Left and Right for this purpose, are defined as if looking

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in the direction of the traffic, as shown in Figure 3.1.4(a) and (b). For butterfly sign supports, a "Normal Sign Support" would have both sign boards facing the same direction for use in gore areas or medians separating core/collectors, while an "Alternating Sign Support" would have the two signs facing opposite directions for use on medians (see Figures 3.1.4(c) and (d)).

- (12) The footing type (see Section 3.1.5). For ground mounted footings, the dimension 'G' from the rear face of the traffic protection barrier to the sign support footing (see Section 3.1.6).
- (13) For the sign board, the following additional information is required:
 - An outline in dashed line showing the sign board(s) to be mounted on the support structure,
 - The dimensions B and D of the sign board(s).

3.3.2 SIGN SUPPORT DRAWINGS

If the supports are to be supplied and erected as part of a contract, appropriate Standard Drawings from SS118-22, SS118-23, SS118-24, SS118-25, SS118-71, SS118-72, SS118-73, SS118-3 and/or SS118-4 and/or SS118-5 must be used. Up to 5 sign supports can be detailed on one sheet.

The Appendix contains reduced prints of these drawings. The Contract and W.P. numbers should be added to the title block. The sheet number is added when the drawings for the entire contract are assembled.

On Standard Drawings SS118-22/23/24/25/71/72/73 there are two tables to be completed on the drawings. In each table, one vertical column of data is used for each sign.

The Standard Drawings shall be sealed, dated and signed according to Section 2.4.1.

The data required to complete Table 1 - General consists of the following:

- (i) Local Reference Wind Pressure, (Pa).
- (ii) Frost Depth. Frost depths are given in the Appendix of Section 2 of this Manual and may be used if the recommendations of a geotechnical engineer are not available.
- (iii) Station.
- (iv) Site number.

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- v) Sign Orientation. Specify **L** for Left Sign or **R** for Right Sign. For butterfly sign supports, specify **N** for normal or **A** for alternating signs (see Figure 3.1.4(a) and Figure 3.1.4(c)).
- (vi) Sign Size(s) (D x B).
- (vii) Sign Class (see Section 3.2).
- (viii) Eccentricity from the centreline of the vertical support leg to the centre of the sign board(s), E.
- (ix) Barrier-to-Support clearance(s), G (see Section 3.1.6).
- (x) Elevation of the highest point on the highway under the sign, including shoulders, curbs, and medians, EL.HP.
- (xi) Elevation at top of the support footing, EL.P₁.
- (xii) Member Dimensions: A, t; arm size, P and K (left and right); tabulated on Table 3.2.3 for all support Classes.
- (xiii) Number of Panels (Zero indicates that arm is so short that verticals/diagonals are not required – see Section 3.1.7(1)).
- (xiv) Length of Panels.
- (xv) Footing Type (see Section 3.1.5).
- (xvi) Design Information H_r, P, D₁, D₂, F, T₁ and T₂ (see Table 3.2.3(a)).

Table 2 – Z-Bracket Locations is to be completed with the dimensions required to locate the Z-brackets for mounting the sign board to the support. The length of the Z-bracket shall also be included.

The following information may be used for the calculation of quantities:

DESCRIPTION	QUANTITY
12.7mm DIA. STAINLESS STEEL U-BOLT	2 per Z-Bracket
STAINLESS STEEL NYLON INSERT STOP NUT	4 per Z-Bracket
STAINLESS STEEL WASHER	8 per Z-Bracket
PROFIED CHANNEL (C130x13)	2 per Z-Bracket
Z-BRACKET	See 3.1.7
ALUMINUM ALCAN SHAPE No.72838	See 2.10
8mm DIA. STAINLESS STEEL CAP BOLT C/W NUT AND WASHER (SIGN BOARD)	(No. of Aluminum Alcan Shapes + 1) per Z-Bracket
DAMPER VERTICAL ANGLE	2 per Z-Bracket
DAMPER GUSSET	1 per Z-Bracket
DAMPER HORIZONTAL ANGLE	2 per Z-Bracket
DAMPER PLATE	1 per Sign board (See Note below)
16mm DIA. STAINLESS STEEL ASTM F593 BOLT C/W NUT AND WASHER (DAMPER)	12 per Z-Bracket

Note: The damper plate may be comprised of two or more plate elements. The length of each component plate shall be at least twice the distance between Z-brackets.

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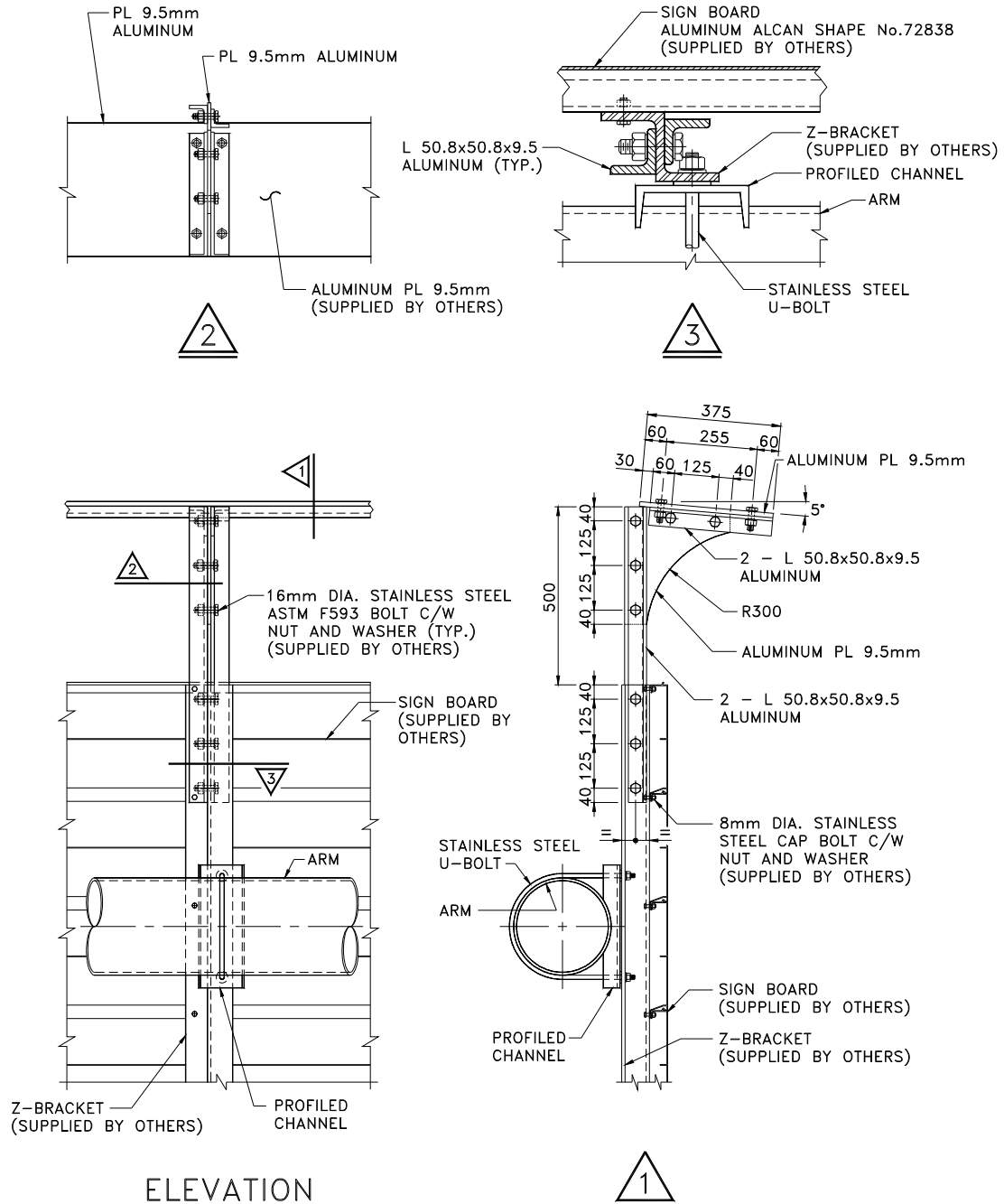


FIGURE 3.3.2 DAMPER INSTALLATION DETAILS

3.4 MAINTENANCE AND INSPECTION

All components must be properly inspected and maintained according to the requirements described in the Sign Support Inspection Guidelines, 2002.

Long term durability of sign supports is dependent on routine maintenance and inspection. In order to prevent corrosion damage and fatigue problems to the anchorage assembly, and to allow for proper inspection of the assembly, the following shall be ensured:

- (i) The base of the vertical support leg shall be kept free from dirt and debris
- (ii) The surrounding ground level shall be a minimum of 300 mm below the top of the footing

The base plate and arm connection welds shall be inspected regularly for fatigue cracking. Check tightening of connection and anchor bolts periodically. Clear vent holes of truss members if there is debris or salt build-up.

3.5 DESIGN INFORMATION**3.5.1 GENERAL**

Design and detailing data contained in this Section conforms to the requirements of the Canadian Highway Bridge Design Code CAN/CSA-S6-06 unless otherwise stated.

Calculations are based on Standard CAN/CSA-G40.20-13/G40.21-13 Grade 300W or ASTM A500 Grade C or API-5L-X46 (for round section of outside diameter equal to or greater than 508mm) for structural steel, and 30 MPa concrete and Grade 400W reinforcing steel for footings.

The total weight of the sign board used in design is 0.169 kN/m² (3.52 psf), including the self-weight of the standard aluminum ALCAN shape No.72838. The total weight of the damper varies between 0.15 and 0.20 kN/m of sign board, depending on the width of sign.

Dead load deflection is compensated by cambering the arms and sign board by means of adjusting the dimension 'K' at the arm to leg connections (see Table 3.2.3(b)).

As specified in CHBDC, the arms and leg are designed for the full wind load applied to all truss members, sign boards and attachments. For the design of

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the leg, this is applied in conjunction with a torsion load obtained by neglecting the wind loading on components that reduce the primary torsion effect. Load combinations considering snow loading on the damping plates and ice accretion have also been included.

The vertical and diagonal member sizes have been upsized for aesthetic reasons. Bolted connection of these members have been designed for the larger of the actual joint force or 75% of the original member (before upsizing) capacity.

Fatigue wind loads were obtained from the AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaries and Traffic Signals 4th Edition, 2001.

In 1998, MTO retained Rowan Williams Davies & Irwin Inc. (RWDI) to conduct an aeroelastic model study of a Single Cantilever Sign Support. The objectives of the study were:

- i) to calculate the natural frequencies for various configurations of the supports,
- ii) to identify any aerodynamic instabilities, such as vortex-induced oscillations and galloping, and
- iii) to provide wind loads and fatigue analysis required to verify the sign support design.

During testing, it became apparent that galloping oscillations of unacceptable amplitude were likely to occur on the signs under certain wind conditions. Investigation of a solution to the galloping problem was then carried out. As a result of this work, a damping device was added to control galloping. All information relating to this wind tunnel test, including conclusions and recommendations, are contained in the publication "Final Report - Aeroelastic Model Study for Cantilever Sign Supports, Ontario, Canada."

3.5.2 DERIVATION OF DESIGN CURVES

The design curves for the cantilever type sign supports found in Figure 3.2.2(a) to (h) were derived by determining the member responses under various sign areas, eccentricities, and wind loads. Member responses were checked for ultimate, serviceability, and fatigue limits states.

3.5.3 DEFLECTIONS

The deflections for the leg and arm members were limited for vertical and horizontal clearances and aesthetic considerations. In addition, the structures were analysed by RWDI to ensure that the deflections under wind loading were not enough to excite large amplitude galloping. The arms were essentially cambered upwards for dead loads by extending the bottom connection to the leg. The lateral deflection of the concrete foundation has been limited to an instantaneous rotation of 0.01 radians (0°30') under wind loading and a rotation of 0.003 radians (0°10') under dead load. The lateral deflection of the top of the leg due to wind load has been limited to a rotation of 0.015 radians (0°50'), or 1.5% of the leg height. The lateral deflection at the tip of the arms due to the wind load, caused by bending of the leg and arms and twisting of the leg, has been limited to 3% of the arm length. The vertical deflection at the tip of the arms due to vertical wind load (truck gusts, galloping, and natural wind), caused by bending of the leg and arms, has been limited to 1.5% of the arm length.

The above limits are within those specified by AASHTO'S Standard Specifications for Structural Supports for Highway Signs, Luminaries and Traffic Signals 4th Edition 2001.

3.5.4 FOUNDATIONS

The caisson foundations were modelled in S-Frame as beam elements with spring constants representing earth pressure. Spring constants in the dead load direction (for sustained load) were assumed to be 1/3 the value of those in the live load direction (for instantaneous load). Any resisting earth pressure in the frost depth layer was discounted.

Assumed minimum soil parameters below the frost layer were as follows:

		CASE 1 (Sand)	CASE 2 (Soft clay)
LENGTH OF CAISSON BELOW FROST LAYER	Upper 2/3	$\phi = 28^\circ$	$C_u = 25 \text{ kPa}$
	Lower 1/3	$\phi = 30^\circ$	$C_u = 50 \text{ kPa}$

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CANTILEVER STATIC SIGN SUPPORTS

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APPENDIX TO SECTION 3

CANTILEVER STATIC SIGN SUPPORTS

FIGURE A3.1	Z-BRACKET DETAIL
FIGURE A3.2	HORIZONTAL CLEARANCE
SS118-9	OVERHEAD SUPPORT STRUCTURE FOR MANAGED LANE TOLL EQUIPMENT FOOTING DETAIL (MEDIAN MOUNTED - SYMETRICAL)
SS118-10	OVERHEAD SUPPORT STRUCTURE FOR MANAGED LANE TOLL EQUIPMENT FOOTING DETAIL (MEDIAN MOUNTED - ASYMMETRICAL)
SS118-22	BUTTERFLY STATIC SIGN SUPPORT GENERAL ARRANGEMENT (FOR CLASS 1, 2, AND 3)
SS118-23	BUTTERFLY STATIC SIGN SUPPORT DETAILS (FOR CLASS 1, 2, AND 3)
SS118-24	SINGLE CANTILEVER STATIC SIGN SUPPORT GENERAL ARRANGEMENT (FOR CLASS 1, 2, AND 3)
SS118-25	CANTILEVER STATIC SIGN SUPPORT SIGN CONNECTION & DAMPER DETAILS
SS118-46	OVERHEAD SUPPORT STRUCTURE FOR MANAGED LANE TOLL EQUIPMENT GENERAL ARRANGEMENT I
SS118-47	OVERHEAD SUPPORT STRUCTURE FOR MANAGED LANE TOLL EQUIPMENT GENERAL ARRANGEMENT II
SS118-48	OVERHEAD SUPPORT STRUCTURE FOR MANAGED LANE TOLL EQUIPMENT DETAILS I
SS118-49	OVERHEAD SUPPORT STRUCTURE FOR MANAGED LANE TOLL EQUIPMENT DETAILS II

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CANTILEVER STATIC SIGN SUPPORTS

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- | | |
|-----------------|--|
| SS118-71 | BUTTERFLY STATIC SIGN SUPPORT
GENERAL ARRANGEMENT
(BOLTED JOINT) |
| SS118-72 | BUTTERFLY STATIC SIGN SUPPORT
DETAILS
(BOLTED JOINT) |
| SS118-73 | SINGLE CANTILEVER STATIC SIGN SUPPORT
GENERAL ARRANGEMENT
(BOLTED JOINT) |

NOTE:

See Appendix to Section 4 for reduced size prints of the following Standard Drawings:

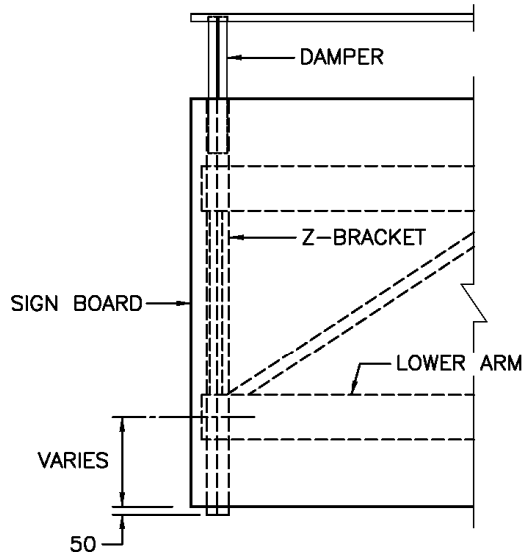
- | | |
|----------------|--|
| SS118-3 | STATIC SIGN SUPPORT – FOOTING DETAILS
(GROUND MOUNTED) |
| SS118-4 | STATIC SIGN SUPPORT – FOOTING DETAILS
(MEDIAN MOUNTED – SYMMETRICAL) |
| SS118-5 | STATIC SIGN SUPPORT – FOOTING DETAILS
(MEDIAN MOUNTED – ASYMMETRICAL) |

SIGN SUPPORT MANUAL

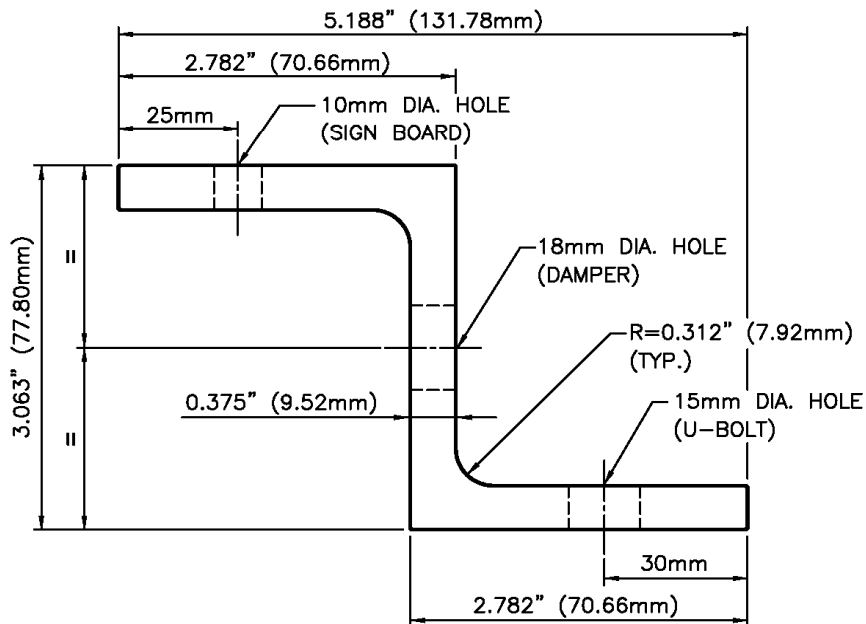
2019 02 15

CANTILEVER STATIC SIGN SUPPORTS

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INSTALLATION DETAIL

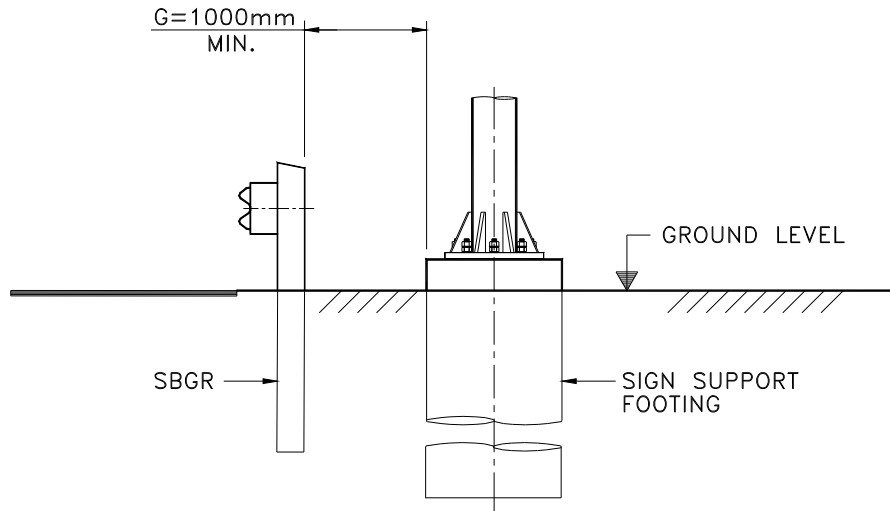


TYPICAL SECTION

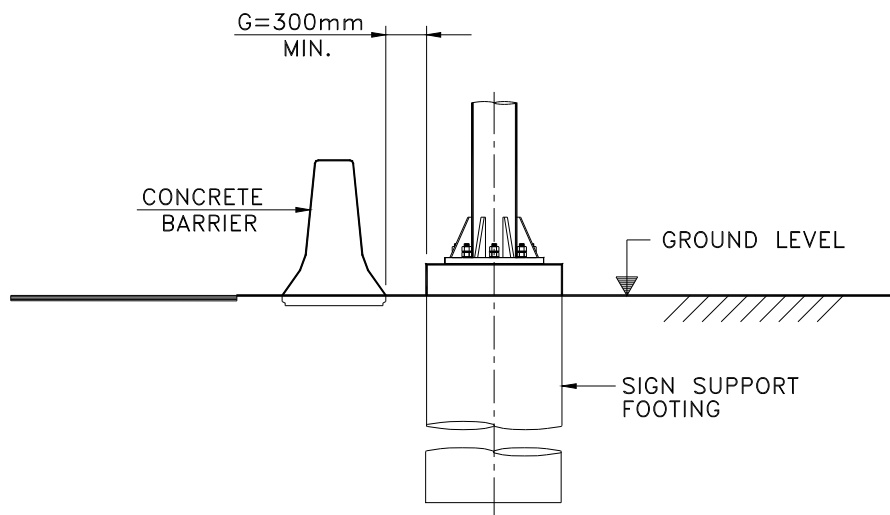
NOTES:

1. ALUMINUM EXTRUSION EXTRUDEX P6544-1 OR APPROVED EQUAL.
2. MATERIAL: ALLOY 6061
3. BREAK CORNERS 0.010" (0.25mm), OUTSIDE CORNERS 0.015" (0.38mm).
4. STANDARD TOLERANCES TO APPLY UNLESS OTHERWISE STATED.
5. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SHOWN.

FIGURE A3.1 Z-BRACKET DETAIL



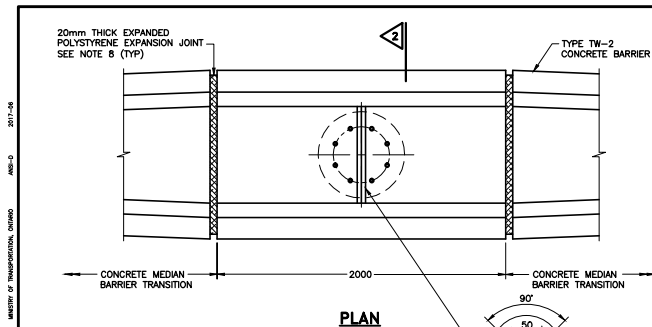
(a) STEEL BEAM GUIDE RAIL



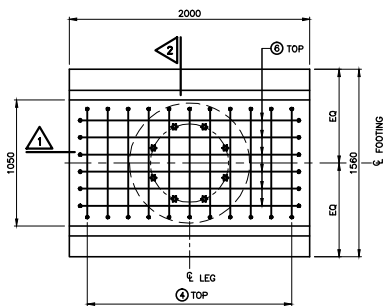
(b) CONCRETE BARRIER

FIGURE A3.2 HORIZONTAL CLEARANCE

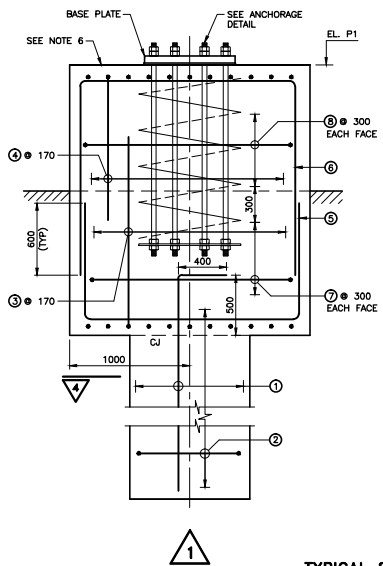
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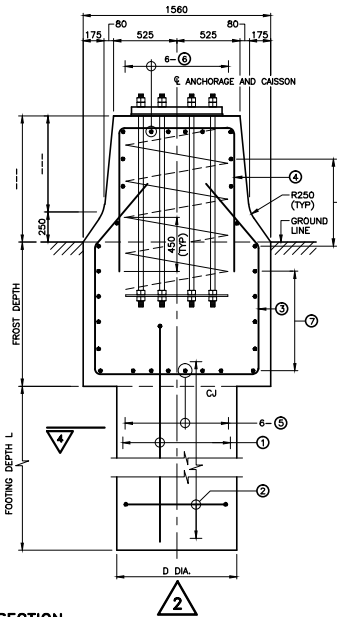
PLAN



PLAN



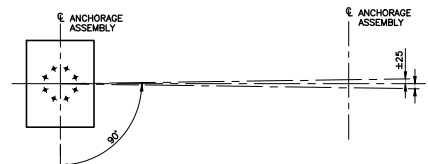
TYPICAL SECTION



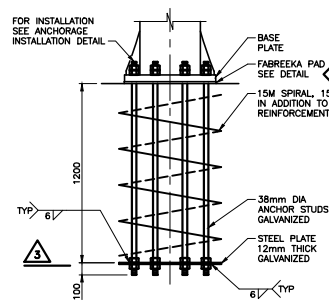
2

NOTES TO DESIGNER:

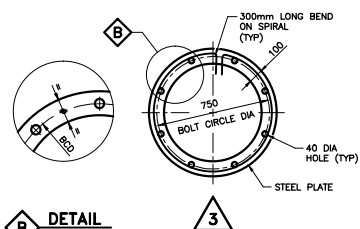
- IF SOUND ROCK IS ENCOUNTERED AT A DEPTH OF $Y < L$ FROM THE BOTTOM OF THE FROST LAYER, THIS DIMENSION CAN BE REDUCED TO: $Y + (L - Y)/2$, UPON MINISTRY'S APPROVAL.
- THE 'NOTES TO DESIGNER' SHALL BE DELETED FROM THIS DRAWING PRIOR TO ISSUING.



TYPICAL PLAN SHOWING TOLERANCE



ANCHORAGE DETAIL



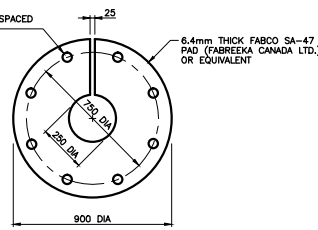
DETAIL

TABLE 1 - FOOTING DIMENSIONS

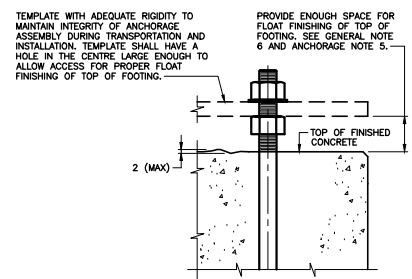
STATION	---	---	---	---
SITE No.	---	---	---	---
STRUCTURE TYPE	---	---	---	---
EL. P1	---	---	---	---
FROST DEPTH	---	---	---	---

METRIC
 DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN
 DRAWING NOT TO BE SCALED
 100mm ON ORIGINAL DRAWING

BAR MARK	SIZE	SHAPE
①	25M	400
②	15M	100
③	20M	100
④	20M	100
⑤	20M	100
⑥	20M	100
⑦	20M	100
⑧	20M	100



DETAIL



ANCHORAGE INSTALLATION DETAIL

FOOTING INFORMATION	DEPTH L	DIAMETER D
STRUCTURAL TYPE	(mm)	(mm)
B1	5500	1000
C1	5000	1000
C2	6000	1200

Ontario Ministry of Transportation

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OVERHEAD SUPPORT STRUCTURE FOR MANAGED LANE TOLL EQUIPMENT FOOTING DETAILS (MEDIAN MOUNTED - SYMMETRICAL)

SHEET

NOTES:

- CLASS OF CONCRETE 30 MPa.
- CLEAR COVER TO REINFORCING STEEL:
 -CAISSON 100±25mm
 -REMAINDER 80±20mm
- REINFORCING STEEL SHALL BE GRADE 400W UNLESS OTHERWISE SPECIFIED.
- STRUCTURAL STEEL PLATE SHALL BE ACCORDING TO CAN/CSA-G40.20-13/G40.21-13, GRADE 300W.
- EXCAVATION TO BE DONE NEAT AND CONCRETE PLACED AGAINST UNDISTURBED GROUND.
- THE TOP OF FOOTINGS SHALL BE FLOAT FINISHED TO A TOLERANCE OF ±0.1 DEGREES IN ANY DIRECTION AND WITHIN ±10mm OF THE ELEVATION SHOWN. SURFACE ROUGHNESS SHALL NOT EXCEED 2mm AMPLITUDE.
- GROUT BEDDING SHALL NOT BE USED.
- EXPANDED POLYSTYRENE IN EXPANSION JOINT SHALL CONFORM TO C588 51.20 AND BE HELD IN PLACE WITH LIGHT GALVANIZED NAILS.
- THIS DRAWING TO BE READ IN CONJUNCTION WITH GENERAL ARRANGEMENT DRAWING.
- THE REINFORCING MAY BE ADJUSTED SLIGHTLY TO ACCOMMODATE THE ANCHOR STUDS.
- ELECTRIC CONDUIT IN FOOTING NOT SHOWN FOR CLARITY. SEE ELECTRICAL DRAWING FOR DETAILS.
- LEGEND: CJ - CONSTRUCTION JOINT

ANCHORAGE NOTES:

- STEEL ANCHOR STUDS, NUTS, AND HARDENED STEEL WASHERS SHALL BE ACCORDING TO ASTM A449.
- THE COMPLETE ANCHORAGE ASSEMBLY INCLUDING ANCHOR STUDS, NUTS, AND WASHERS SHALL BE HOT-DIP GALVANIZED.
- ANCHORING NUTS SHALL BE BROUGHT TO A SNUG TIGHT CONDITION AND THEN FURTHER TIGHTENED 1/3 OF A TURN.
- EXPOSED PORTION OF STUDS SHALL BE COATED WITH WHITE NON-STAINING GREASE.
- ANCHORAGE SETTING TEMPLATE TO BE RIGID AND SECURELY HELD IN PLACE TO MAINTAIN POSITION OF ANCHORAGE AND ALLOW FINISHING OF TOP OF FOOTING.

REFER TO 2.4.1 IN THE SIGN SUPPORT MANUAL FOR PROFESSIONAL ENGINEER STAMPING REQUIREMENTS.

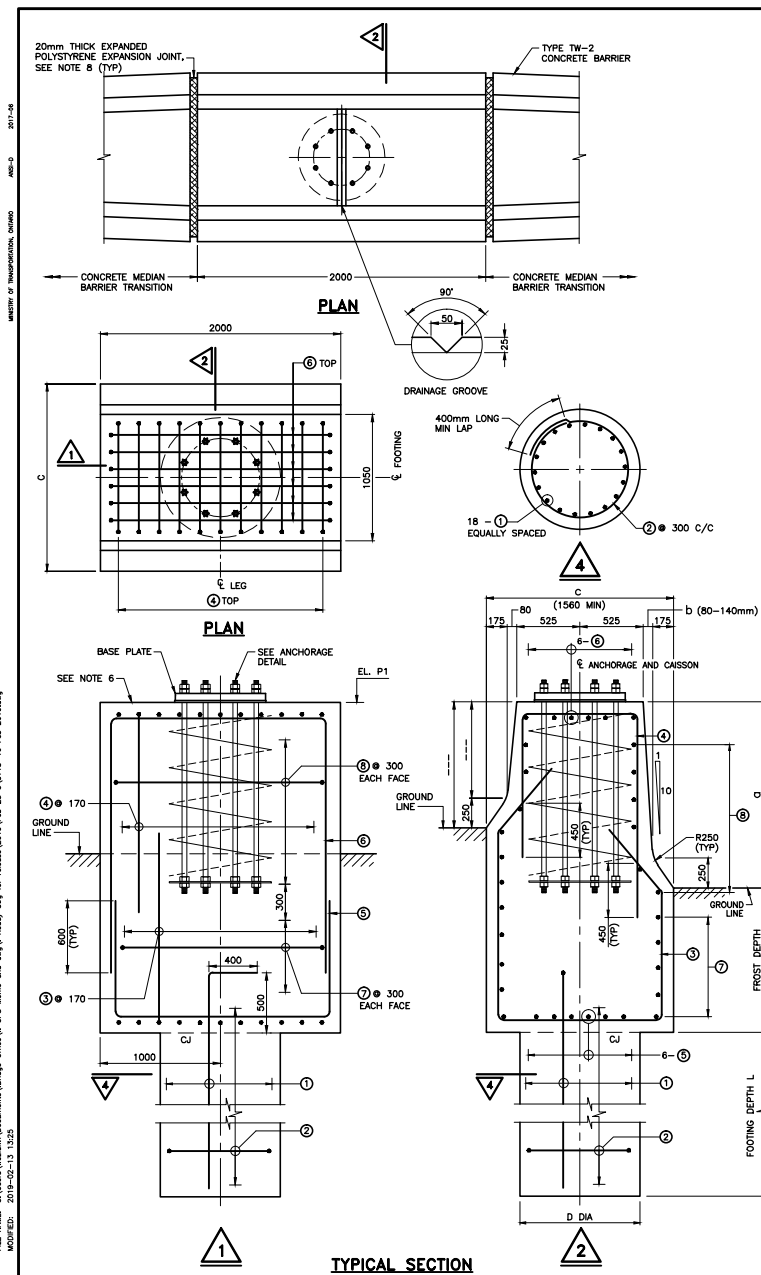
APPLICABLE STANDARD DRAWINGS
 OPD 911.380 GUIDE RAIL SYSTEM, CONCRETE BARRIER PERMANENT TRANSITION INSTALLATION AT PIERS AND POLES

STANDARD DRAWING
 FEBRUARY 2019

SS118-9

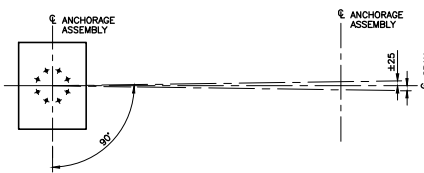
OVERHEAD SUPPORT STRUCTURE FOR MANAGED LANE TOLL EQUIPMENT FOOTING DETAILS (MEDIAN MOUNTED - SYMMETRICAL)

REVISIONS	DATE	BY	DESCRIPTION
DESIGN	CHK	CODE CSA 56-14	LOAD
DRAWN	CHK	SITE	DATE
			DWG

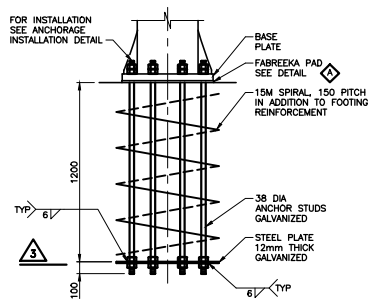


TYPICAL SECTION

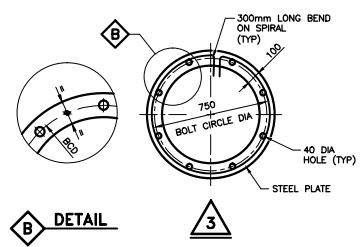
NOTES TO DESIGNER:
 1. IF SOUND ROCK IS ENCOUNTERED AT A DEPTH OF "Y" < L FROM THE BOTTOM OF THE FROST LAYER, THIS DIMENSION CAN BE REDUCED TO: Y + (L - Y)/2, UPON MINISTRY'S APPROVAL.
 2. THE "NOTES TO DESIGNER" SHALL BE DELETED FROM THIS DRAWING PRIOR TO ISSUING.



TYPICAL PLAN SHOWING TOLERANCE



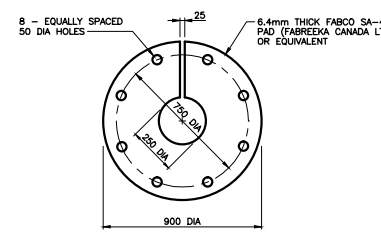
ANCHORAGE DETAIL



DETAIL B

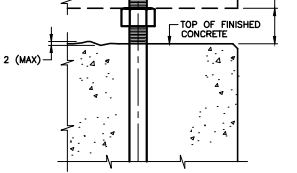
METRIC
 DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN
 DRAWING NOT TO BE SCALED
 100mm ON ORIGINAL DRAWING

BAR MARK	SIZE	SHAPE
①	25M	400
②	15M	100
③	20M	100
④	20M	100
⑤	20M	100
⑥	20M	100
⑦	20M	100
⑧	20M	100



DETAIL A

TEMPLATE WITH ADEQUATE RIGIDITY TO MAINTAIN INTEGRITY OF ANCHORAGE ASSEMBLY DURING TRANSPORTATION AND INSTALLATION. TEMPLATE SHALL HAVE A HOLE IN THE CENTER LARGE ENOUGH TO ALLOW ACCESS FOR PROPER FLOAT FINISHING OF TOP OF FOOTING.



ANCHORAGE INSTALLATION DETAIL

TABLE 1 - FOOTING DIMENSIONS

STATION	---	---	---	---	---
SITE No.	---	---	---	---	---
STRUCTURE TYPE	---	---	---	---	---
a	---	---	---	---	---
b	---	---	---	---	---
c	---	---	---	---	---
EL. P1	---	---	---	---	---
FROST DEPTH	---	---	---	---	---

FOOTING INFORMATION	DEPTH L	DIAMETER D
STRUCTURAL TYPE	(mm)	(mm)
B1	5500	1000
C1	5000	1000
C2	6000	1200

Ministry of Transportation

CONT
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OVERHEAD SUPPORT STRUCTURE FOR
 MANAGED LANE TOLL EQUIPMENT
 FOOTING DETAILS
 (MEDIAN MOUNTED - ASYMMETRICAL)

SHEET

NOTES:

- CLASS OF CONCRETE 30 MPa.
- CLEAR COVER TO REINFORCING STEEL:
 -CAISSON 100±25mm
 -REMAINDER 80±20mm
- REINFORCING STEEL SHALL BE GRADE 400W UNLESS OTHERWISE SPECIFIED.
- STRUCTURAL STEEL PLATE SHALL BE ACCORDING TO CAN/CSA-G40.20-13/G40.21-13, GRADE 300W.
- EXCAVATION TO BE DONE NEAT AND CONCRETE PLACED AGAINST UNDISTURBED GROUND.
- THE TOP OF FOOTINGS SHALL BE FLOAT FINISHED TO A TOLERANCE OF ±0.1 DEGREES IN ANY DIRECTION AND WITHIN ±10mm OF THE ELEVATION SHOWN. SURFACE ROUGHNESS SHALL NOT EXCEED 2mm AMPLITUDE.
- GROUT BEDDING SHALL NOT BE USED.
- EXPANDED POLYSTYRENE IN EXPANSION JOINT SHALL CONFORM TO C95B 51.20 AND BE HELD IN PLACE WITH LIGHT GALVANIZED NAILS.
- THIS DRAWING TO BE READ IN CONJUNCTION WITH GENERAL ARRANGEMENT DRAWING.
- THE REINFORCING MAY BE ADJUSTED SLIGHTLY TO ACCOMMODATE THE ANCHOR STUDS.
- ELECTRIC CONDUIT IN FOOTING NOT SHOWN FOR CLARITY. SEE ELECTRICAL DRAWING FOR DETAILS.
- LEGEND: CJ - CONSTRUCTION JOINT

ANCHORAGE NOTES:

- STEEL ANCHOR STUDS, NUTS, AND HARDENED STEEL WASHERS SHALL BE ACCORDING TO ASTM A449.
- THE COMPLETE ANCHORAGE ASSEMBLY INCLUDING ANCHOR STUDS, NUTS, AND WASHERS SHALL BE HOT-DIP GALVANIZED.
- ANCHORING NUTS SHALL BE BROUGHT TO A SNUG TIGHT CONDITION AND THEN FURTHER TIGHTENED 1/3 OF A TURN.
- EXPOSED PORTION OF STUDS SHALL BE COATED WITH WHITE NON-STAINING GREASE.
- ANCHORAGE SETTING TEMPLATE TO BE RIGID AND SECURELY HELD IN-PLACE TO MAINTAIN POSITION OF ANCHORAGE AND ALLOW FINISHING OF TOP OF FOOTING.

REFER TO 2.4.1 IN THE SIGN SUPPORT MANUAL FOR PROFESSIONAL ENGINEER STAMPING REQUIREMENTS.

APPLICABLE STANDARD DRAWINGS
 OPSD 911.380 GUIDE RAIL SYSTEM, CONCRETE BARRIER PERMANENT TRANSITION INSTALLATION AT PIERS AND POLES

STANDARD DRAWING
 FEBRUARY 2019

SS118-10

OVERHEAD SUPPORT STRUCTURE FOR
 MANAGED LANE TOLL EQUIPMENT
 FOOTING DETAILS
 (MEDIAN MOUNTED - ASYMMETRICAL)

REVISIONS	DATE	BY	DESCRIPTION	DATE
DESIGN	CHK	CODE	CSA S6-14	LOAD
DRAWN	CHK	SITE		DWG

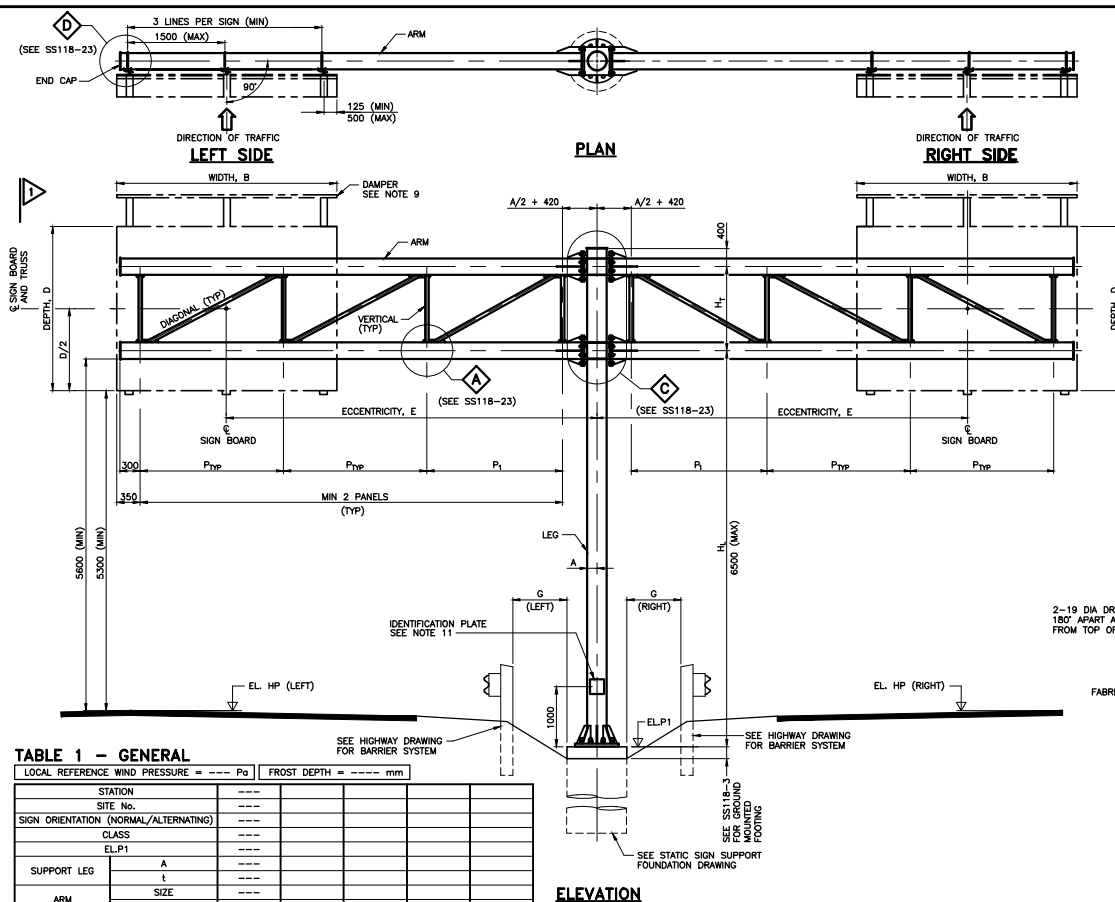
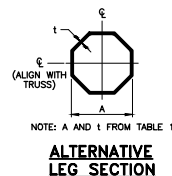


TABLE 1 - GENERAL

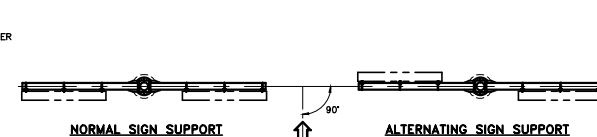
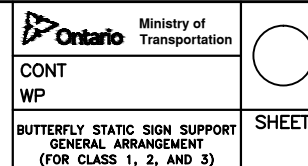
LOCAL REFERENCE WIND PRESSURE = --- Pa		FROST DEPTH = --- mm	
STATION		---	---
SITE No.		---	---
SIGN ORIENTATION (NORMAL/ALTERNATING)		---	---
CLASS		---	---
ELP1		---	---
SUPPORT LEG	A	---	---
	t	---	---
ARM	SIZE	---	---
	P	---	---
TRUSS DEPTH	H _{tr}	---	---
DIAGONAL/VERTICAL SIZE		---	---
FOOTING TYPE (MEDIAN/GROUND)		---	---
H ₁		---	---
LEFT	SIGN SIZE (DxB)	---	---
	E	---	---
	G	---	---
	EL. HP	---	---
	No. OF PANELS	---	---
	P ₁	---	---
	P _{TRIP}	---	---
	K	---	---
RIGHT	SIGN SIZE (DxB)	---	---
	E	---	---
	G	---	---
	EL. HP	---	---
	No. OF PANELS	---	---
	P ₁	---	---
	P _{TRIP}	---	---
	K	---	---
D1		---	---
D2		---	---
F		---	---
T1		---	---
T2		---	---



NOTE: A AND t FROM TABLE 1

ALTERNATIVE LEG SECTION

METRIC
DIMENSIONS ARE IN METRES AND/OR
MILLIMETRES UNLESS OTHERWISE SHOWN
DRAWING NOT TO BE SCALED
100mm ON ORIGINAL DRAWING



TYPICAL LAYOUT PLAN

NOTES:

1. ALL STRUCTURAL STEEL SHALL BE ACCORDING TO CAN/CSA 40A.20-13/40A.21-13 GRADE 300W OR ASTM SPECIFICATION A500 GRADE C OR API-5L-X46 FOR ROUND SECTION OF O.D. $\geq 508\text{mm}$.
2. ALL NON-STAINLESS STEEL BOLTS, NUTS, AND WASHERS SHALL BE ACCORDING TO ASTM A325M AND BE HOT-DIP GALVANIZED UNLESS SPECIFIED OTHERWISE.
3. ASTM A325 (1)"M25.4) BOLTS MAY BE SUBSTITUTED FOR M24 BOLTS AND SHALL BE HOT-DIP GALVANIZED.
4. ALL BOLTS SHALL BE INSTALLED BY TURN-OF-NUT TIGHTENING IN CONFORMANCE WITH CAN/CSA S6-14.
5. ALL STRUCTURAL STEEL SHALL BE HOT-DIP GALVANIZED AFTER FABRICATION. LEGS OR CHANNELS TO BE SUBSTITUTELY COATED WITH AN APPROVED PAINT SYSTEM ACCORDING TO OPSS 911.
6. STRUCTURE SHALL NOT BE ERECTED UNTIL FOUNDATION CONCRETE HAS REACHED 80% OF SPECIFIED STRENGTH.
7. NO SHOP SPICES SHALL BE ALLOWED IN ANY MEMBERS.
8. ELEVATIONS TO BE VERIFIED IN THE FIELD BEFORE SIGN SUPPORT STRUCTURE FABRICATION.
9. NO SIGN BOARDS SHALL BE INSTALLED WITHOUT DAMPER.
10. THIS STANDARD TO BE READ IN CONJUNCTION WITH SS118-3 (FOOTING FOR GROUND MOUNTED SIGNS) AND/OR SS118-4 (FOOTING FOR SYMMETRICAL MEDIAN MOUNTED SIGN) AND/OR SS118-5 (FOOTING FOR ASYMMETRICAL MEDIAN MOUNTED SIGN).
11. EACH SIGN SUPPORT SHALL HAVE AN IDENTIFICATION MARKING SHOWING THE SITE NUMBER, THE DESIGN SIGN AREA, CORRESPONDING ECCENTRICITY, THE LOCAL REFERENCE WIND PRESSURE AS SHOWN IN TABLE 1, THE MANUFACTURER'S NAME OR TRADEMARK, AND THE DATE OF MANUFACTURE. THIS 4mm THICK RECTANGULAR STAINLESS STEEL PLATE SHALL HAVE RUBBER BACKING AND BE OF SUFFICIENT DIMENSIONS TO ACCOMMODATE THE REQUIRED INFORMATION USING 6mm HIGH ALPHABETIC LETTERING. THE PLATE SHALL BE ATTACHED TO THE LEG OF THE STRUCTURE BY MEANS OF STAINLESS STEEL BAND CLAMPS THAT GO THROUGH VERTICAL HOLES AT EACH SIDE OF THE PLATE, PASS BEHIND THE PLATE, AND WRAP AROUND THE LEG. NO DRILLING INTO THE HSS FOR ATTACHMENT OF PLATE IS PERMITTED.
12. REFER TO DWG. SS118-23 FOR SIGN SUPPORT DETAILS.
13. REFER TO DWG. SS118-25 FOR SIGN CONNECTION AND DAMPER DETAILS.
14. LEGEND:
 - DENOTES STAINLESS STEEL

NOTES TO DESIGNER:

1. THIS STANDARD SHALL ONLY BE USED FOR CLASS 1, 2, OR 3.
FOR CLASS 4, STANDARD SHOWN ON SS118-71 SHALL BE USED.
2. FOR DETERMINING NUMBER AND LENGTH OF PANELS
SEE SECTION 3.1.7 OF THE SIGN SUPPORT MANUAL.
3. DIMENSION G IS DEFINED AS THE HORIZONTAL CLEARANCE
FROM THE BACK OF PROTECTIVE BARRIER TO THE NEAREST
FACE OF CONCRETE FOOTING ACCORDING TO THE VALUES BELOW.
THIS DOES NOT APPLY TO TEMPORARY CONCRETE BARRIER
INSTALLATIONS.

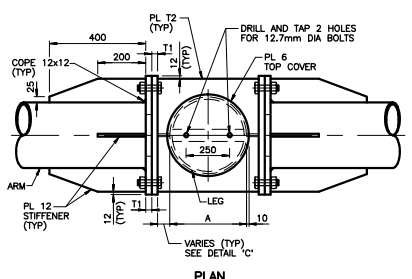
PROTECTIVE BARRIER TYPE	MINIMUM CLEARANCE (ft)
STEEL BEAM GUIDE RAIL	1.0
PERMANENT CONCRETE BARRIER	0.3

4. THE 'NOTES TO DESIGNER' SHALL BE DELETED FROM
THIS DRAWING PRIOR TO ISSUING.

REVISIONS						
	DATE	BY		DESCRIPTION		
DESIGN	CHK		CODE	CSA S6-14	LOAD	- DATE
DRAWN	CHK		SITE			DWG.

FILE NAME: C:\Users\jordan\Documents\Bridges - Office\Manuals\Signs\SS118-23 July 2017.dwg
MODIFIED: 2017-07-17 08:19

MINISTRY OF TRANSPORTATION, ONTARIO
AND-0 2017-08



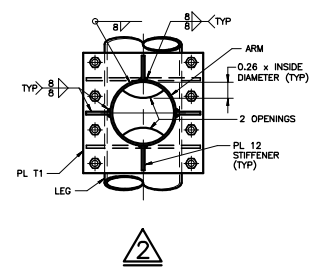
PLAN

METRIC
DIMENSIONS ARE IN METRES AND/OR
MILLIMETRES UNLESS OTHERWISE SHOWN
DRAWING NOT TO BE SCALED
100mm ON ORIGINAL DRAWING

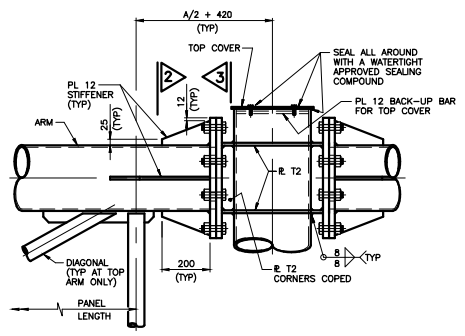
Ministry of Transportation

CONT WP	SHEET
BUTTERFLY STATIC SIGN SUPPORT DETAILS (FOR CLASS 1, 2, AND 3)	

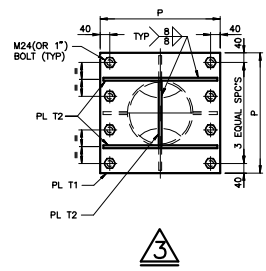
NOTES:
1. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH
STANDARD DRAWING SS118-22.



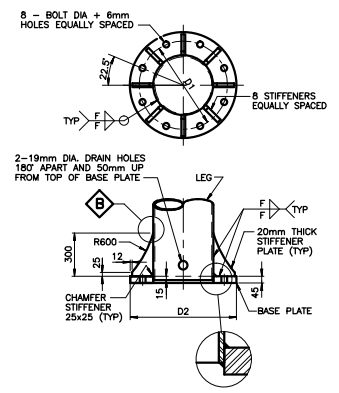
ELEVATION



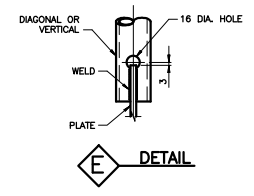
ARM CONNECTION DETAIL



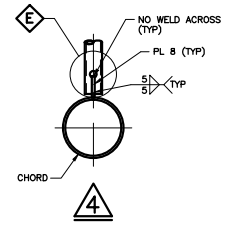
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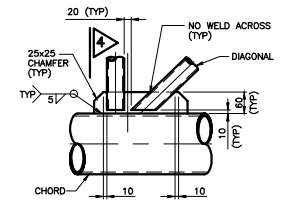
BASE DETAIL



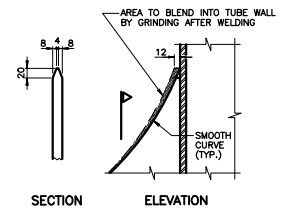
DETAIL E



4

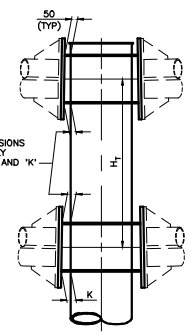


DETAIL A

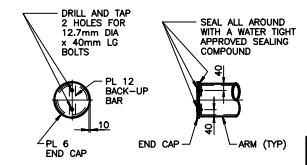


SECTION

DETAIL B



DETAIL C



DETAIL D

STANDARD DRAWING JULY 2017		SS118-23
BUTTERFLY STATIC SIGN SUPPORT DETAILS (FOR CLASS 1, 2, AND 3)		
REFER TO 2.4.1 IN THE SIGN SUPPORT MANUAL FOR PROFESSIONAL ENGINEER STAMPING REQUIREMENTS.		
REVISIONS		
DATE	BY	DESCRIPTION
DESIGN	CHK	CODE CHBDC-14
DRAWN	CHK	DATE

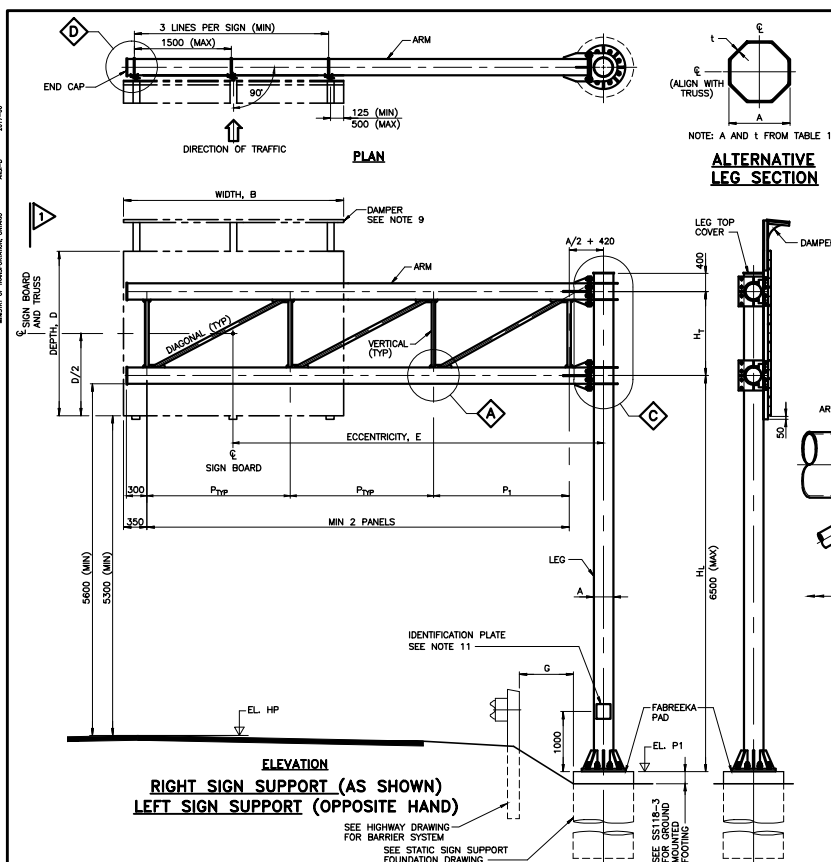
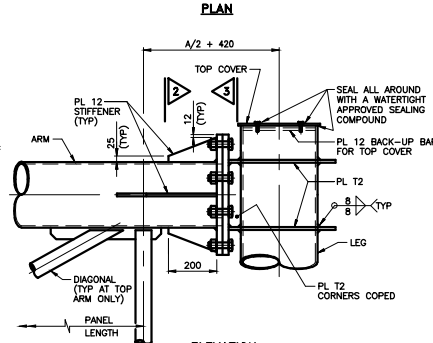
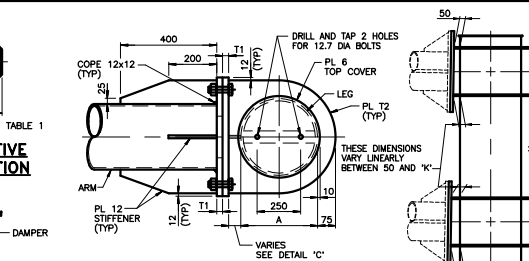
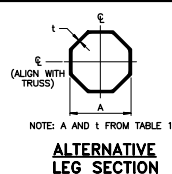
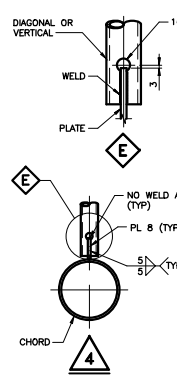


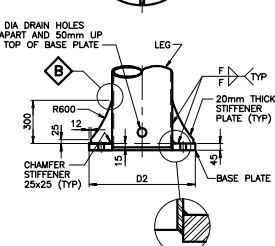
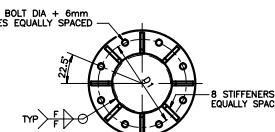
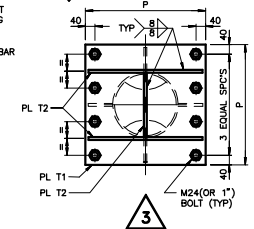
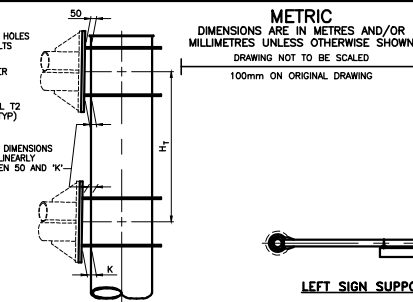
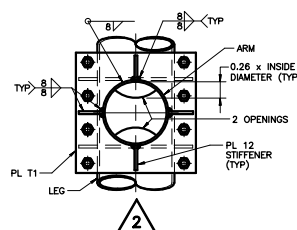
TABLE 1 – GENERAL

LOCAL REFERENCE WIND PRESSURE = ----- Pa		FROST DEPTH = ----- mm	
STATION		-----	-----
SITE No.		-----	-----
SIGN DIRECTION (LEFT/RIGHT)		-----	-----
CLASS		-----	-----
EL. P1		-----	-----
SUPPORT LEG	A	-----	-----
	t	-----	-----
	SIZE	-----	-----
ARM	P	-----	-----
TRUSS DEPTH	H _T	-----	-----
DIAGONAL/VERTICAL SIZE		-----	-----
FOOTING TYPE (MEDIAN/GROUND)		-----	-----
H _L		-----	-----
SIGN SIZE (DxB)		-----	-----
E		-----	-----
G		-----	-----
EL. HP		-----	-----
K		-----	-----
No. OF PANELS		-----	-----
P ₁		-----	-----
P _{TP}		-----	-----
D1		-----	-----
D2		-----	-----
F		-----	-----
T1		-----	-----
T2		-----	-----

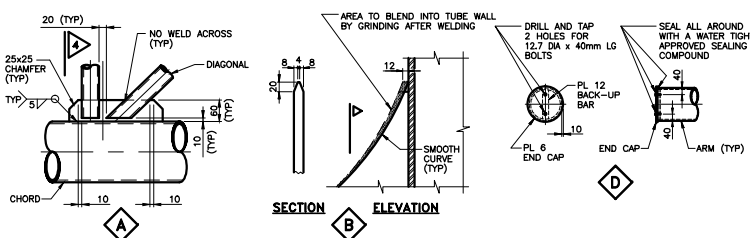


ELEVATION

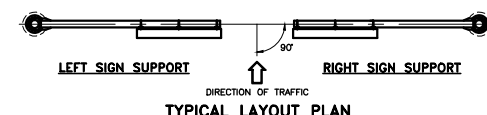
ARM CONNECTION DETAIL



BASE DETAIL



METRIC
DIMENSIONS ARE IN METRES AND/OR
MILLIMETRES UNLESS OTHERWISE SHOWN
DIMENSIONS ARE NOT TO BE SCALED
BASED ON ORIGINAL DRAWING



NOTES:

1. ALL STRUCTURAL STEEL SHALL BE ACCORDING TO CAN/CSA C40.20-13/CSA 40.21-13 (40.21-13 FOR DESIGN 300W OR ASTM SPECIFICATION A500C GRADE C OR A610-54-146 FOR ROUND STEEL) AND TO THE RECOMMENDATIONS OF C.O.B. RESEARCH INC.
2. ALL NON-STAINLESS STEEL BOLTS, NUTS, AND WASHERS SHALL BE ACCORDING TO ASTM A307 AND SHALL BE GALVANNEED OR UNLESS SPECIFIED OTHERWISE.
3. ASTM A325 1/2" (M24.5) BOLTS MAY BE SUBSTITUTED FOR M24 BOLTS AND SHALL BE HOT-DIP GALVANIZED.
4. ALL BOLTS SHALL BE INSTALLED BY TURN-OFF NUT TIGHTENING IN CONFORMANCE WITH CAN/CSA S6-14.
5. ALL BOLTS SHALL BE HOT-DIP GALVANIZED AFTER FABRICATION, LEGS ONLY SHALL BE SUBSEQUENTLY COATED WITH AN APPROVED PAINT SYSTEM ACCORDING TO OPS91 P.91.
6. ALL BOLTS SHALL BE ERECTED UNTIL FOUNDATION CONCRETE HAS REACHED 80% OF SPECIFIED STRENGTH.
7. NO SHOP SPLICES SHALL BE ALLOWED IN ANY MEMBERS.
8. ELEVATIONS TO BE VERIFIED IN THE FIELD BEFORE SIGN SUPPORT STRUCTURE FABRICATION.
9. NO SIGN BOARDS SHALL BE INSTALLED WITHOUT DAMPER-1.
10. THIS STANDARD TO BE READ IN CONJUNCTION WITH SSP18-3 (FOOTING FOR CONCRETE MOUNTED SIGN) AND SSP18-4 (FOOTING FOR CONCRETE MOUNTED SIGN), CONCRETE MOUNTED SIGN) AND/OR SSP18-5 (FOOTING FOR ASYMMETRICAL MOUNTED SIGN SYSTEM).
11. CON SIGN SUPPORT SHALL HAVE AN IDENTIFICATION MARKING SHOWING THE SITE NUMBER, THE DESIGN SIGN AREA, CORRESPONDING ECCENTRICITY, THE LOCAL REFERENCE WIND PRESSURE AS SHOWN IN TABLE 1, THE MANUFACTURER'S NAME, THE DATE OF FABRICATION AND THE MANUFACTURER'S ADDRESS. THIS IDENTIFICATION MARKING SHALL BE MADE BY ENGRAVING OR BY ATTACHING A STAINLESS STEEL PLATE SHALL HAVE A RUBBER BACKING, AND BE OF SUFFICIENT WEIGHT TO ACCOMPANY THE SIGN. THE IDENTIFICATION MARKING SHALL BE ENGRAVED LETTERING. THE PLATE SHALL BE ATTACHED TO THE LEG OF THE STRUCTURE BY MEANS OF STAINLESS STEEL BOLT CLAMPS THAT GO THROUGH THE LEGS OF THE SIGN BOARDS AND BE SECURED TO THE STRUCTURE BY WRAP AROUND THE LEG, NO DRILLING INTO THE HSS FOR ATTACHMENT OF PLATE IS ALLOWED.
12. REFER TO DRAW. SSP18-25 FOR SIGN CONNECTION AND DAMPER DETAILS.
13. LEGEND:
 - SS1 - DENOTES STAINLESS STEEL

NOTES TO DESIGNER:

1. THIS STANDARD SHALL ONLY BE USED FOR CLASS 1, 2, OR 3, FOR CLASS 4, STANDARD SHOWN ON SS118-73 SHALL BE USED.
2. FOR DETERMINING NUMBER AND LENGTH OF PANELS (SEE SECTION 3.1.7 OF THE SIGN SUPPORT MANUAL).
3. DIMENSION 2 IS PERPENDICULAR TO THE HORIZONTAL CLEARANCE FROM THE BACK OF PROTECTIVE BARRIER TO THE NEAREST FACE OF CONCRETE FOOTING ACCORDING TO THE VALUES BELOW. THIS DOES NOT APPLY TO TEMPORARY CONCRETE BARRIER INSTALLATIONS.
- | PROTECTIVE BARRIER TYPE | MINIMUM CLEARANCE (m) |
|----------------------------|-----------------------|
| STEEL BEAM GUIDE RAIL | 1.0 |
| PERMANENT CONCRETE BARRIER | 0.3 |
4. THE NOTES TO DESIGNER SHALL BE DELETED FROM THE DRAWING PRIOR TO ISSUING.

PROTECTIVE BARRIER TYPE	MINIMUM CLEARANCE (m)
STEEL BEAM GUIDE RAIL	1.0
PERMANENT CONCRETE BARRIER	0.3

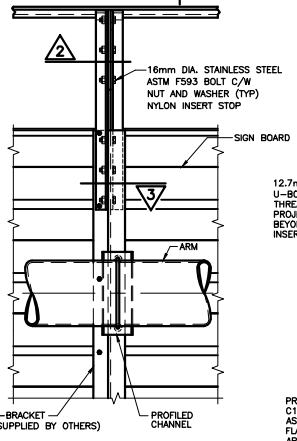
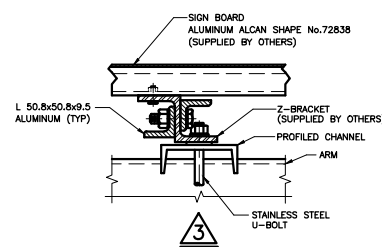
4. THE 'NOTES TO DESIGNER' SHALL BE DELETED FROM THIS DRAWING PRIOR TO ISSUING.

REFER TO 2.4.1 IN THE SIGN SUPPORT MANUAL FOR PROFESSIONAL ENGINEER STAMPING REQUIREMENTS.	
STANDARD DRAWING FEBRUARY 2019	SS118-24
SINGLE CANTILEVER STATIC SIGN SUPPORT GENERAL ARRANGEMENT (FOR CLASS 1, 2, AND 3)	

REVISIONS					
	DATE	BY	DESCRIPTION		
DESIGN	CHK	CODE	CSA S6-14	LOAD	- DATE

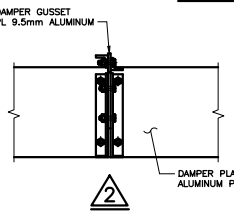
FILE NAME: C:\Users\jordan\Documents\Bridges - Office\Manuals\Sign\SS118-25 July 2017.dwg
MODIFIED: 2017-07-17 08:22

MINISTRY OF TRANSPORTATION, ONTARIO
SS11-08

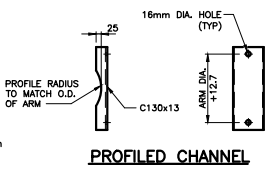


ELEVATION

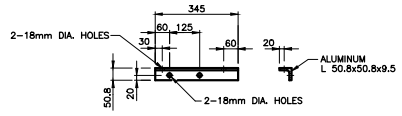
SIGN CONNECTION DETAIL



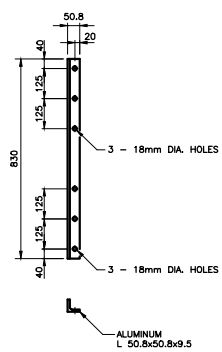
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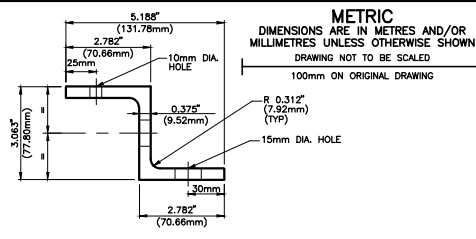
PROFILED CHANNEL



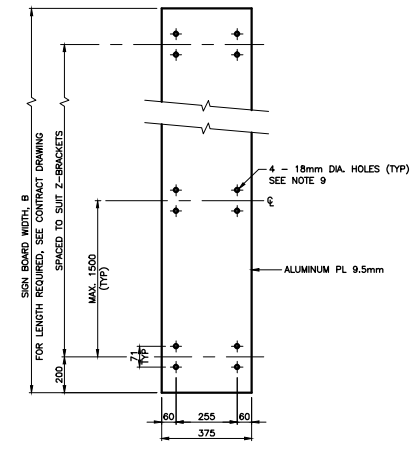
DAMPER HORIZONTAL ANGLES
1 ANGLE PER Z-BRACKET (AS SHOWN)
1 ANGLE PER Z-BRACKET (OPPOSITE HAND)



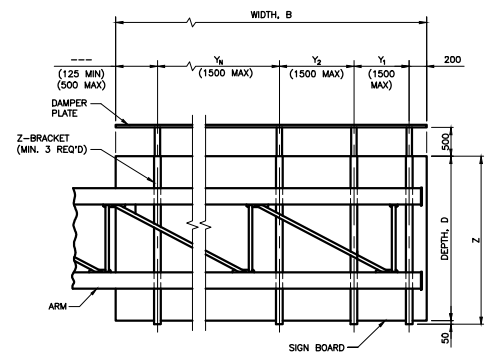
DAMPER VERTICAL ANGLES
2 ANGLES PER Z-BRACKET



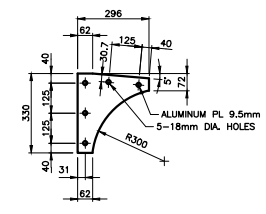
ALUMINUM Z-BRACKET
(SUPPLIED BY OTHERS)



DAMPER PLATE
1 PLATE PER SIGN



Z-BRACKET LOCATIONS



DAMPER GUSSET
1 PLATE PER Z-BRACKET



Ministry of
Transportation

CONT
WP

CANTILEVER STATIC SIGN SUPPORT
SIGN CONNECTION AND
DAMPER DETAILS



SHEET

- NOTES:**
- THIS STANDARD IS APPLICABLE TO CLASS 1, 2, 3 AND 4.
 - ALL STRUCTURAL STEEL SHALL BE ACCORDING TO CAN/CSA G40.20-13/G40.21-13 GRADE 300W OR ASTM SPECIFICATION A500 GRADE C.
 - ALUMINUM DAMPER COMPONENTS SHALL BE ALLOY 6061-T6.
 - ALL STAINLESS STEEL BOLTS, NUTS AND WASHERS SHALL CONFORM TO ASTM F593 ALLOY 304 WITH A MINIMUM YIELD OF 480 MPa AND A MINIMUM TENSILE STRENGTH OF 716 MPa.
 - ALL STRUCTURAL STEEL SHALL BE HOT-DIP GALVANIZED.
 - SIGN BOARDS SHALL BE SUPPLIED BY OTHERS.
 - SIGN BOARDS SHALL BE INSTALLED ON THE STRUCTURE USING U-BOLTS AS SHOWN ON THE DRAWINGS.
 - NO SIGN BOARDS SHALL BE INSTALLED WITHOUT DAMPER.
 - HOLES FOR DAMPER PLATE SHALL BE DRILLED ON SITE AT SPACING DETERMINED BY LOCATION OF Z-BRACKETS ON THE SITE DELIVERED SIGN BOARD.
 - REFER TO DWG. S118-25 FOR GENERAL ARRANGEMENT.
 - LEGEND:
SST DENOTES STAINLESS STEEL

NOTES TO DESIGNER

- FOR DETERMINING NUMBER AND LOCATION OF Z-BRACKETS SEE SECTION 3.1.8 OF THE SIGN SUPPORT MANUAL.
- WHEN THE DESIGN PACKAGE IS COMPLETE, THE DESIGNER SHALL VERIFY WITH THE REGIONAL STRUCTURAL AND TRAFFIC SECTIONS THAT THE SIGN SIZE HAS NOT CHANGED.
- THE "NOTES TO DESIGNER" SHALL BE DELETED FROM THIS DRAWING PRIOR TO ISSUING OF THE CONTRACT.

REFER TO 2.4.1 IN THE SIGN SUPPORT MANUAL FOR PROFESSIONAL ENGINEER STAMPING REQUIREMENTS.

STANDARD DRAWING
JULY 2017

SS118-25

CANTILEVER STATIC SIGN SUPPORT
SIGN CONNECTION AND DAMPER DETAILS

REVISIONS				
NO.	DATE	BY	DESCRIPTION	
DESIGN	CHK	CODE	CHBDC-14	LOAD
DRAWN	CHK	SITE		DWG

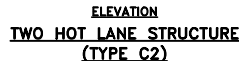
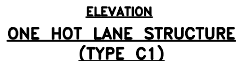
TABLE 2 - SIGN BOARD

STATION		---	---	---	---
STRUCTURE ID No.		---	---	---	---
SIGN SIZE (DxB)		---	---	---	---
LEFT	No. OF Z-BRACKETS	---	---	---	---
	Z-BRACKET LENGTH, Z	---	---	---	---
	Y ₁	---	---	---	---
	Y ₂	---	---	---	---
	Y _N	---	---	---	---
RIGHT	SIGN SIZE (DxB)	---	---	---	---
	No. OF Z-BRACKETS	---	---	---	---
	Z-BRACKET LENGTH, Z	---	---	---	---
	Y ₁	---	---	---	---
	Y ₂	---	---	---	---
	Y _N	---	---	---	---

NOTE: LEFT AND RIGHT SHALL REFER TO THE CENTRELINE OF SUPPORT LEG.

1. ANY CHANGE TO 1.1 SHOWN SHOULDER AND LANE WIDTH RANGES SHALL REQUIRE FULL REDESIGN OF THE STRUCTURE.
2. TABLE 1 SHALL BE FILLED BY THE DESIGNER FOR SITE SPECIFIC INFORMATION.
3. DESIGNER SHOULD CHECK THE VERTICAL CLEARANCES TO THE STEEL TRUSS (5600mm) TO THE SIGN SUPPORT AND ASSOCIATED HARDWARES (5300mm) TO SATISFY THE VERTICAL CLEARANCE REQUIREMENTS.
4. WHEN SIGN BOARD IS REQUIRED TO BE MOUNTED ON THE STRUCTURE, THE STRUCTURE HAS TO BE RE-DESIGNED ACCORDING TO DIVISION 3 OF THE SIGN SUPPORT.
5. THE 'NOTES TO DESIGNER' SHALL BE DELETED FROM THIS DRAWING PRIOR TO ISSUING.

100mm ON ORIGINAL DRAWING



STATION	000 000 000				
SITE No.	000 000 000				
STRUCTURE TYPE	000 000 000				
EL. HP	000 000 000				
EL. P1	000 000 000				
H ₀	000 000 000				

STRUCTURE TYPE	C1	C2
DIAGONAL/VERTICAL SIZE	2 L89x89x9.5 ANGLES	2 L102x102x9.5 ANGLES
ARM SIZE	HSS 273x8.0	HSS 356x12.7
LEG SIZE	HSS 406x12.7	HSS 508x12.7

1. ALL STRUCTURAL STEEL SHALL BE ORDERED OR ASTM SPECIFICATION 640-20/13/640-21-13 GRADE, OR AS PER ASTM SPECIFICATION A500 GRADE C OR API-5L-X48 FOR ROUND SECTION OF SIZE 0.2508mm.
2. ALL BOLTS, NUTS, AND WASHERS SHALL BE ACCORDING TO ASTM SPECIFICATION AND BE HOT-DIP GALVANIZED UNLESS SPECIFIED OTHERWISE.
3. ASTM A325 "1" BOLTS MAY BE SUBSTITUTED FOR M24 BOLT AND NUTS SHALL BE HOT-DIP GALVANIZED.
4. ALL BOLTS SHALL BE INSTALLED BY TURN-OF-NUT TIGHTENING IN CONFORMANCE WITH CAN/CSSA 56-14.
5. ALL STRUCTURAL STEEL SHALL BE HOT-DIP GALVANIZED AFTER FABRICATION. LEADS ONLY SHALL BE SUBSEQUENTLY COATED WITH AN APPROVED COATING SYSTEM ACCORDING TO CPSS 911.
6. STRUCTURE SHALL NOT BE ERECTED UNTIL FOUNDATION CONCRETE HAS REACHED THE REQUIRED STRENGTH.
7. NO SHOP SPICES SHALL BE ALLOWED IN ANY MEMBERS.
8. ELEVATIONS TO BE VERIFIED IN THE FIELD BEFORE SIGN SUPPORT STRUCTURE IS CONSTRUCTED.
9. THIS STANDARD TO BE READ IN CONJUNCTION WITH DRAWING SS118 (FOOTING FOR SYMMETRICAL MEDIAN) AND/OR DRAWING SS118-10 (FOOTING FOR ASYMMETRICAL MEDIAN).
10. EACH SUPPORT SHALL HAVE AN IDENTIFICATION MARKING SHOWING THE SITE NUMBER, THE MANUFACTURER'S NAME OR TRADEMARK, AND THE DATE OF MANUFACTURE. THE IDENTIFICATION MARKING SHALL BE PERMANENTLY ATTACHED. HAVE A RUBBER BACKING, AND BE OF SUFFICIENT DIMENSIONS TO RESIST DEFORMATION. THE IDENTIFICATION MARKING SHALL BE HIGH ENGRAVED LETTERING. THE PLATE SHALL BE ATTACHED TO THE LEG OF THE STRUCTURE BY MEANS OF STAINLESS STEEL CLAMPS. CLAMPS SHALL BE PLACED AT 90 DEGREE ANGLES AT EACH SIDE OF THE PLATE, PASS BEHIND THE PLATE, AND BE SECURED TO THE LEG. NO PLATE IS TO BE ATTACHED TO THE HSS FOR ATTACHMENT OF PLATE, PERMITTED.
11. REFER TO DRAWING SS118-48 FOR CONNECTIONS DETAILS.
12. BOLTED CONNECTION OF DIAGONAL AND VERTICAL MEMBERS HAS BEEN DESIGNED FOR ACTUAL JOINT FORCES.
13. THIS SUPPORT STRUCTURE IS DESIGNED FOR MOUNTING TOLL EQUIPMENT SUCH AS CAMERA AND TRANSPONDER READER ETC. ABOVE HOT LANES. SIGN PANELS ARE NOT PERMITTED TO BE MOUNTED ON THE STRUCTURE.
14. FOR ORIENTATION AND REQUIRED ELECTRICAL WORK SEE DRAWING SS118-49.

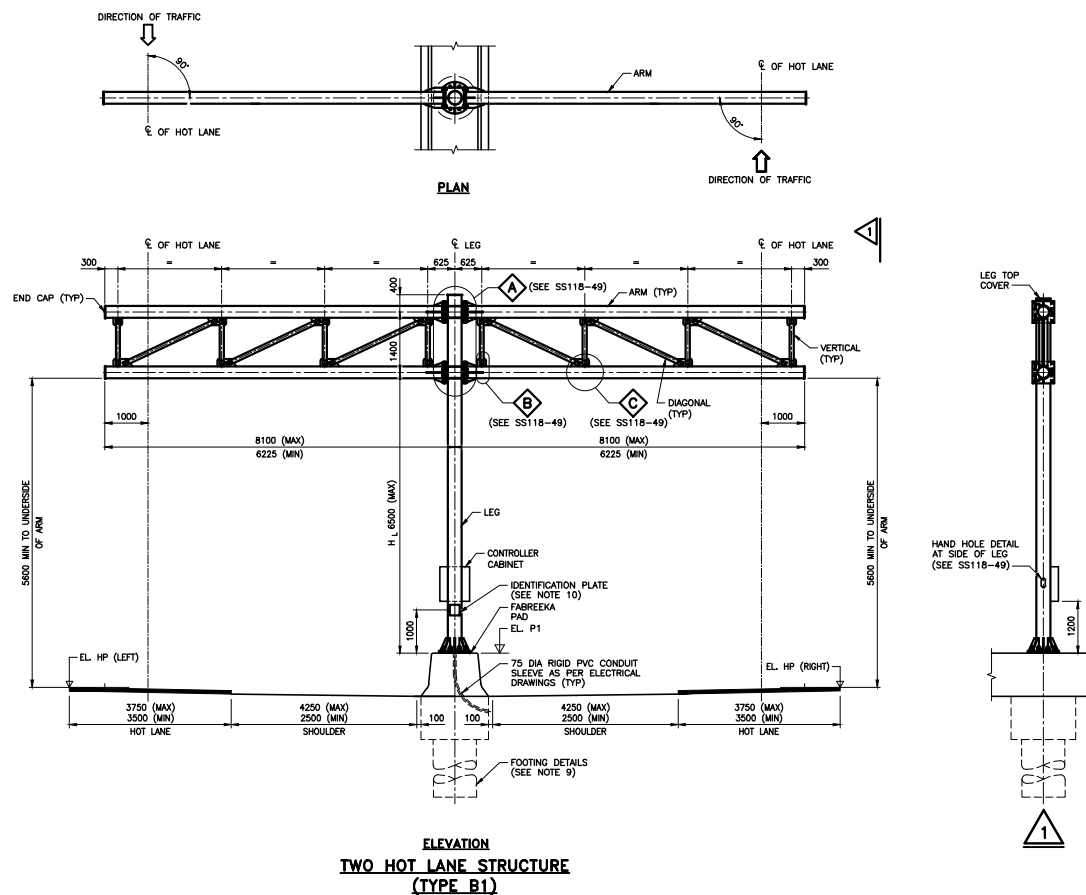
1. THE CONNECTIONS BETWEEN THE TOLL EQUIPMENT AND THE ARMS SHALL BE MADE OF STAINLESS OR GALVANIZED STEEL COMPONENTS.
2. THE MINIMUM VERTICAL CLEARANCE FROM THE HIGHEST POINT ON THE HOT LANES TO THE UNDERSIDE OF THE TOLL EQUIPMENTS SHALL NOT BE LESS THAN 5300mm.

STANDARD DRAWING FEBRUARY 2019	SS118-4
OVERHEAD SUPPORT STRUCTURE FOR MANAGED LANE TOLL EQUIPMENT GENERAL ARRANGEMENT	

REVISIONS						
	DATE	BY		DESCRIPTION		
DESIGN	CHK		CODE	CSA S6-14	LOAD	- DATE
DRAWN	CHK		SITE			DWG.

1. ANY CHANGE TO THE SHOWN SHOULDER AND LANE WIDTH RANGES SHALL REQUIRE FULL REDESIGN OF THE STRUCTURE.
2. TABLE 1 SHALL BE FILLED BY THE DESIGNER FOR SITE SPECIFIC INFORMATION.
3. DESIGNER SHOULD CHECK THE VERTICAL CLEARANCES TO THE STEEL TRUSS (5600mm) AND TO THE TRUSS TO RAIL EQUIPMENT AND ASSOCIATED HARDWARES (5300mm) TO SATISFY THE VERTICAL CLEARANCE REQUIREMENTS.
4. WHEN SIGN BOARD IS REQUIRED TO BE MOUNTED ON THE STRUCTURE, THE STRUCTURE HAS TO BE RE-DESIGNED ACCORDING TO DIVISION 3 OF THE SIGN SUPPORT REQUIREMENTS.
5. THE 'NOTES TO DESIGNER' SHALL BE DELETED FROM THIS DRAWING PRIOR TO ISSUING.

 Ontario Ministry of Transportation	
CONT WP	
OVERHEAD SUPPORT STRUCTURE FOR MANAGED LANE TOLL EQUIPMENT GENERAL ARRANGMENT II	SHEET



ELEVATION
TWO HOT LANE STRUCTURE
(TYPE B1)

STATION	----				
SITE No.	----				
STRUCTURE TYPE					
EL. HP (LEFT)	----				
EL. HP (RIGHT)	----				
EL. P1	----				
H ₁	----				

STRUCTURE TYPE	B1
DIAGONAL/VERTICAL SIZE	2 L89x89x9.5 ANGLES
ARM SIZE	HSS 273x8.0
LEG SIZE	HSS 406x12.7

4. ALL STRUCTURAL STEEL SHALL BE ACCORDING TO CAN/CSA G40.21-13/G40.21-13 GRADE 300W OR ASTM SPECIFICATION A500 GRADE C.
5. ALL BOLTS, NUTS, AND WASHERS SHALL BE ACCORDING TO ASTM A325M AND BE HOT-DIP GALVANIZED UNLESS SPECIFIED OTHERWISE.
6. ASTM A325 "1" BOLTS MAY BE SUBSTITUTED FOR M24 BOLTS AND SHALL BE HOT-DIP GALVANIZED.
7. ALL BOLTS SHALL BE INSTALLED BY TURN-OF-NUT TIGHTENING IN CONFORMANCE WITH CAN/CSA 56-14.
8. ALL STRUCTURAL STEEL SHALL BE HOT-DIP GALVANIZED AFTER FABRICATION. LEADS ONLY MAY BE SUBSEQUENTLY COATED WITH AN APPROVED PAINT SYSTEM ACCORDING TO OPSS 911.
9. STRUCTURE SHALL NOT BE ERECTED UNTIL FOUNDATION CONCRETE HAS REACHED 80% OF SPECIFIED STRENGTH.
10. NO SHOP SPICES SHALL BE ALLOWED IN ANY MEMBERS.
11. ELEVATIONS TO BE VERIFIED IN THE FIELD BEFORE SIGN SUPPORT STRUCTURE FABRICATION.
12. THIS STANDARD TO BE READ IN CONJUNCTION WITH DRAWING SS118-09 (FOOTING FOR SYMMETRICAL MEDIAN) AND/OR DRAWING SS118-10 (FOOTING FOR ASYMMETRICAL MEDIAN).
13. EACH SUPPORT SHALL HAVE AN IDENTIFICATION MARKING SHOWING THE SITE NUMBER, THE MANUFACTURER'S NAME, TRADEMARK, AND THE DATE OF MANUFACTURE. THIS 4mm THICK RECTANGULAR STAINLESS STEEL PLATE SHALL BE ATTACHED TO THE LOWER BOUNDARY OF THE 6mm HIGHS OF STAINLESS STEEL BAND CLAMPS THAT GO THROUGH VERTICAL HOLES AT EACH SIDE OF THE PLATE, PASS BEHIND THE PLATE, AND WELD TO THE END OF THE PLATE. THE PLATE SHALL BE ATTACHED TO THE HSS FOR ATTACHMENT OF PLATE IS PERMITTED.
14. REFER TO DRAWING SS118-49 FOR CONNECTIONS DETAILS.
15. BOLTED CONNECTION OF DIAGONAL AND VERTICAL MEMBERS HAS BEEN DESIGNED FOR ACTUAL JOINT FORCES.
16. THIS SUPPORT STRUCTURE IS DESIGNED FOR MOUNTING TOLL EQUIPMENT SUCH AS CAMERA AND TRANSPONDER READER ETC. ABOVE HOT LANES. SIGN PANELS ARE NOT PERMITTED TO BE MOUNTED ON THE STRUCTURE.
17. FOR ORIENTATION AND REQUIRED ELECTRICAL WORK SEE ELECTRICAL DRAWING.

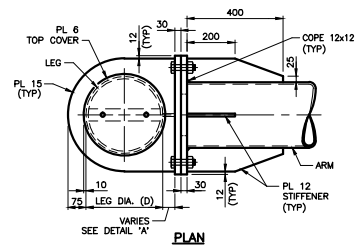
1. THE CONNECTIONS BETWEEN THE TOLL EQUIPMENT AND THE ARMS SHALL BE MADE OF STAINLESS OR GALVANIZED STEEL COMPONENTS.
2. THE MINIMUM VERTICAL CLEARANCE FROM THE HIGHEST POINT ON THE HOT LANES TO THE UNDERSIDE OF THE TOLL EQUIPMENTS SHALL NOT BE LESS THAN 5300mm.

REFER TO 2.4.1 IN THE SIGN SUPPORT MANUAL FOR
PROFESSIONAL ENGINEER STAMPING REQUIREMENTS.

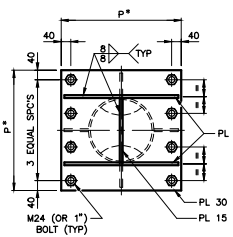
STANDARD DRAWING FEBRUARY 2019	SS118-47
OVERHEAD SUPPORT STRUCTURE FOR MANAGED LANE TOLL EQUIPMENT GENERAL ARRANGEMENT II	

REVISIONS									
	DATE	BY					DESCRIPTION		
DESIGN	CHK		CODE	CSA S6-14	LOAD			DATE	
DEAMN	CHK		STD.					DWG.	

FILE NAME: C:\Users\jordan\Documents\Bridges Office\Documents\Sign\SS118-48 July 2017.dwg
MODIFIED: 2017-07-18 10:26

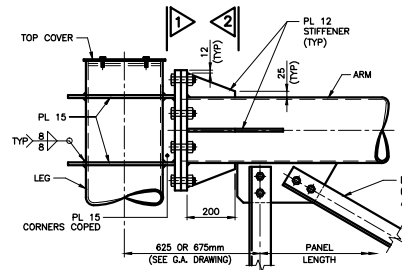


PLAN



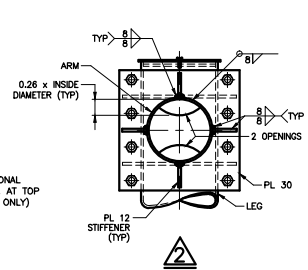
* P = 580mm (FOR TYPE C1)
P = 682mm (FOR TYPE C2)

1

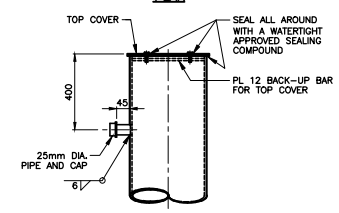


ELEVATION

ARM CONNECTION DETAIL

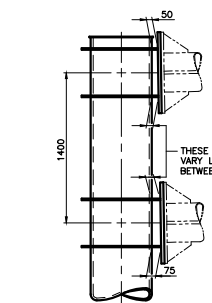


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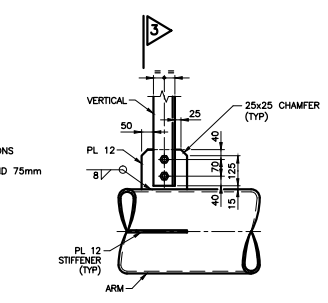


ELEVATION

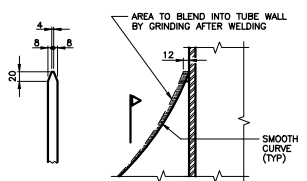
TOP PLATE DETAIL



A



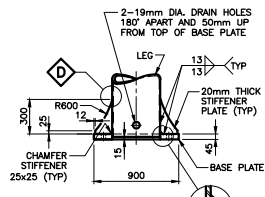
B



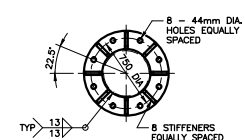
SECTION

ELEVATION

D

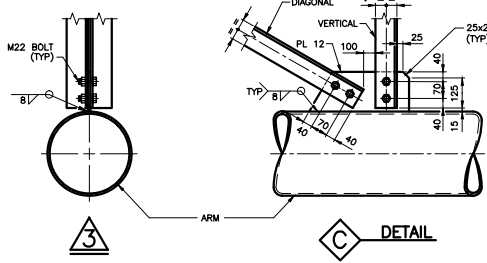


ELEVATION

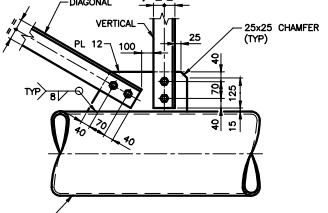


PLAN

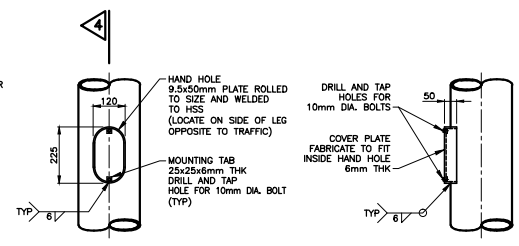
BASE DETAIL



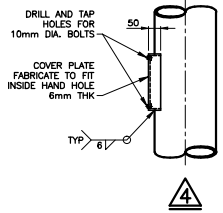
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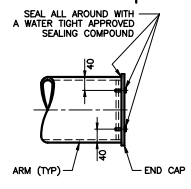
C



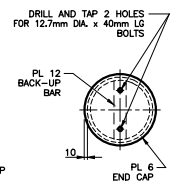
HAND HOLE DETAIL
(NIPPLE NOT SHOWN FOR CLARITY)



4



END CAP DETAIL



5

METRIC
DIMENSIONS ARE IN METRES AND/OR
MILLIMETRES UNLESS OTHERWISE SHOWN
DRAWING NOT TO BE SCALED
100mm ON ORIGINAL DRAWING



Ministry of
Transportation

CONT
WP

OVERHEAD SUPPORT STRUCTURE FOR
MANAGED LANE TOLL EQUIPMENT
DETAILS I


SHEET

NOTE:
THIS DRAWING TO BE READ IN CONJUNCTION WITH STANDARD
DRAWING SS118-46.

REFER TO 2.4.1 IN THE SIGN SUPPORT MANUAL FOR
PROFESSIONAL ENGINEER STAMPING REQUIREMENTS.

STANDARD DRAWING
JULY 2017

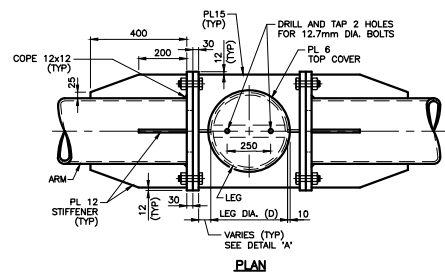
SS118-48

OVERHEAD SUPPORT STRUCTURE FOR
MANAGED LANE TOLL EQUIPMENT
DETAILS I

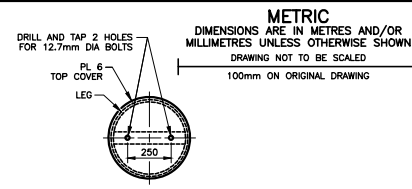
REVISIONS		DATE	BY	DESCRIPTION	DATE
DESIGN	CHK	CODE	CHBDC-14	LOAD	
DRAWN	CHK	SITE			DWG

FILE NAME: C:\Users\jordan\Documents\Bridges - Office\Bridges\Sign\SS118-47 July 2017.dwg
MODIFIED: 2017-07-19 10:26

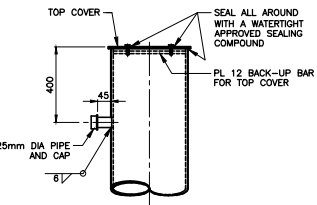
2017-08
MINISTRY OF TRANSPORTATION, ONTARIO



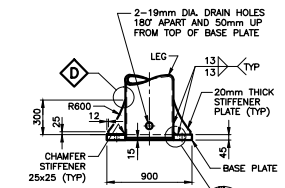
PLAN



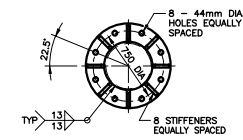
PLAN



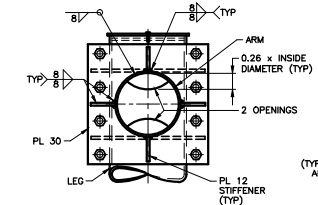
ELEVATION
TOP PLATE DETAIL



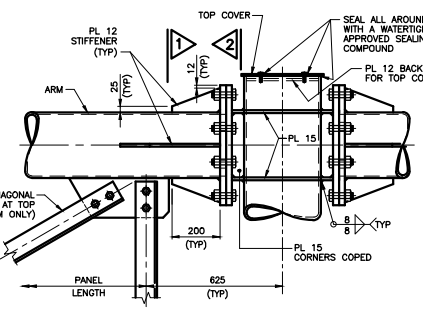
ELEVATION



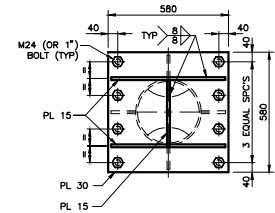
PLAN
BASE DETAIL



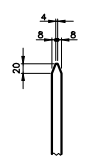
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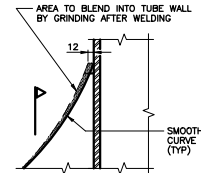
ELEVATION
ARM CONNECTION DETAIL



2

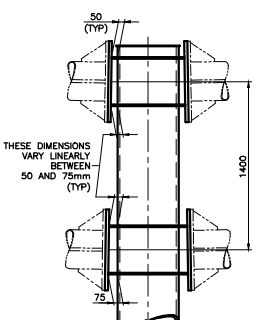


SECTION

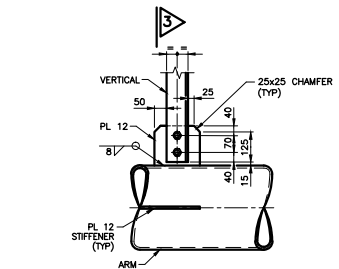


ELEVATION

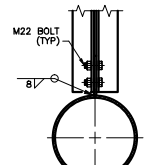
D
DETAIL



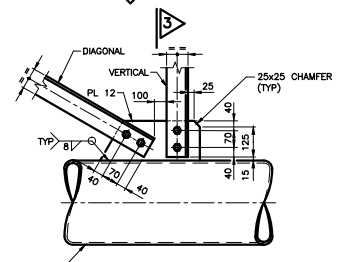
A
DETAIL



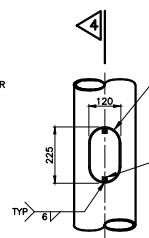
B
DETAIL



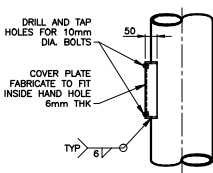
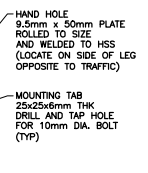
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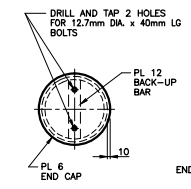
C
DETAIL



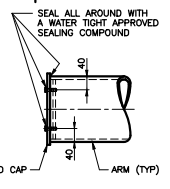
HAND HOLE DETAIL
(NIPPLE NOT SHOWN FOR CLARITY)



4



5



END CAP DETAIL

METRIC
DIMENSIONS ARE IN METRES AND/OR
MILLIMETRES UNLESS OTHERWISE SHOWN
DRAWING NOT TO BE SCALED
100mm ON ORIGINAL DRAWING

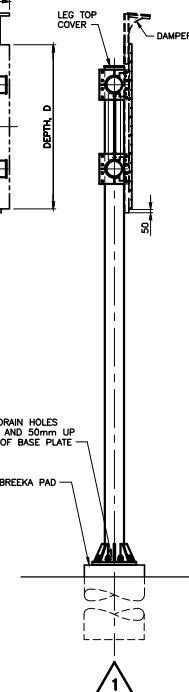
 Ministry of Transportation	
CONT WP	SHEET
OVERHEAD SUPPORT STRUCTURE FOR MANAGED LANE TOLL EQUIPMENT DETAILS II	

NOTE:
THIS DRAWING SHALL BE READ IN CONJUNCTION WITH STANDARD
DRAWING SS118-47.

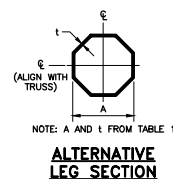
REFER TO 2.4.1 IN THE SIGN SUPPORT MANUAL FOR
PROFESSIONAL ENGINEER STAMPING REQUIREMENTS.

STANDARD DRAWING JULY 2017	SS118-49
OVERHEAD SUPPORT STRUCTURE FOR MANAGED LANE TOLL EQUIPMENT DETAILS II	

REVISIONS				
DATE	BY	DESCRIPTION	DATE	
DESIGN	CHK	CODE	CHBDC-14	LOAD
DRAWN	CHK	ISIT		DWG



LOCAL REFERENCE WIND PRESSURE = ---- Pa		FROST DEPTH = ----- mm	
STATION			
SITE No.			
SIGN ORIENTATION (NORMAL/ALTERNATING)			
CLASS			
ELP1			
SUPPORT LEG	A		
	t		
ARM	SIZE		
	P		
TRUSS DEPTH			
DIAGONAL/VERTICAL SIZE			
FOOTING TYPE (MEDIAN/GROUND)			
H ₁			
LEFT	SIGN SIZE (DxB)		
	E		
	G		
	EL. HP		
	No. OF PANELS		
	P ₁		
	P _{Typ}		
	K		
RIGHT	SIGN SIZE (DxB)		
	E		
	G		
	EL. HP		
	No. OF PANELS		
	P ₁		
	P _{Typ}		
	K		
D1			
D2			
F			
T1			
T2			



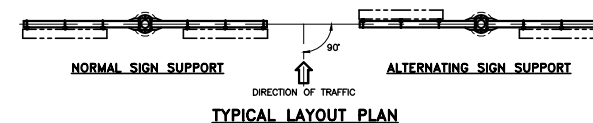
NOTES TO DESIGNER:

1. FOR DETERMINING NUMBER AND LENGTH OF PANELS SEE SECTION 3.1.7 OF THE SIGN SUPPORT MANUAL.
2. DIMENSION G IS DEFINED AS THE HORIZONTAL CLEARANCE FROM THE BACK OF PROTECTIVE BARRIER TO THE NEAREST FACE OF CONCRETE FOOTING, ACCORDING TO THE VALUES BELOW. THIS DOES NOT APPLY TO TEMPORARY CONCRETE BARRIER INSTALLATIONS.

PROTECTIVE BARRIER TYPE	MINIMUM CLEARANCE (m)
STEEL BEAM GUIDE RAIL	1.0
PERMANENT CONCRETE BARRIER	0.3

3. THE "NOTES TO DESIGNER" SHALL BE DELETED FROM THIS DRAWING PRIOR TO ISSUING.

METRIC
DIMENSIONS ARE IN METRES AND/OR
MILLIMETRES UNLESS OTHERWISE SHOWN
DRAWING NOT TO BE SCALED
100mm ON ORIGINAL DRAWING



1. THIS STANDARD IS APPLICABLE TO CLASS 1, 2, 3, AND 4.
2. ALL STRUCTURAL STEEL SHALL BE ACCORDING TO CAN/CSA A40.20-13/A40.21-13 GRADE 300W OR ASTM SPECIFICATION A500 GRADE C OR API-5L-X46 FOR ROUND SECTION OF O.D. ≥ 508 mm.
3. ALL NON-STAINLESS STEEL BOLTS, NUTS, AND WASHERS SHALL BE ACCORDING TO ASTM A325M AND BE HOT-DIP GALVANIZED UNLESS SPECIFIED OTHERWISE.
4. ASTM A325 (M25.4) BOLTS MAY BE SUBSTITUTED FOR M24 BOLTS AND SHALL BE HOT-DIP GALVANIZED.
5. ALL BOLTS SHALL BE INSTALLED BY TURN-OF-NUT TIGHTENING IN CONFORMANCE WITH CAN/CSA S6-14.
6. ALL STRUCTURAL STEEL SHALL BE HOT-DIP GALVANIZED AFTER FABRICATION. LEGS ONLY SHALL BE SUBSEQUENTLY COATED WITH AN APPROVED PAINT SYSTEM, ACCORDING TO OPS-1.
7. STRUCTURE SHALL NOT BE ERECTED UNTIL FOUNDATION CONCRETE HAS REACHED 80% OF SPECIFIED STRENGTH.
8. NO SHOP SPICES SHALL BE ALLOWED IN ANY MEMBERS.
9. ELEVATIONS TO BE VERIFIED IN THE FIELD BEFORE SIGN SUPPORT STRUCTURE FABRICATION.
10. NO SIGN BOARDS SHALL BE INSTALLED WITHOUT A DAMPER.
11. THIS STANDARD TO BE READ IN CONJUNCTION WITH SS118-3 (FOOTING FOR GROUND MOUNTED SIGNS) AND/OR SS118-4 (FOOTING FOR SYMMETRICAL MEDIAN MOUNTED SIGN) AND/OR SS118-5 (FOOTING FOR ASYMMETRICAL MEDIAN MOUNTED SIGN)

13. REFER TO DWG. SS118-72 FOR SIGN SUPPORT DETAILS.
14. REFER TO DWG. SS118-25 FOR SIGN CONNECTION AND DAMPER DETAILS.
15. BOLTED CONNECTION OF DIAGONAL MEMBERS HAS BEEN DESIGNED FOR ACTUAL JOINT FORCES.

	
REFER TO 2.4.1 IN THE SIGN SUPPORT MANUAL FOR PROFESSIONAL ENGINEER STAMPING REQUIREMENTS.	
STANDARD DRAWING FEBRUARY 2019	SS118-71
BUTTERFLY STATIC SIGN SUPPORT GENERAL ARRANGEMENT (BOLTED JOINT)	

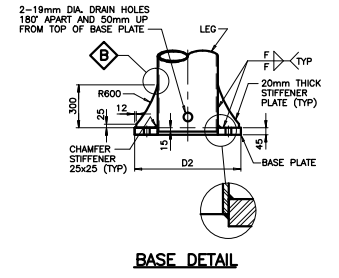
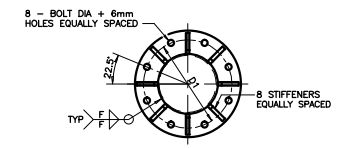
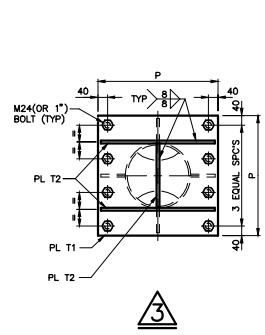
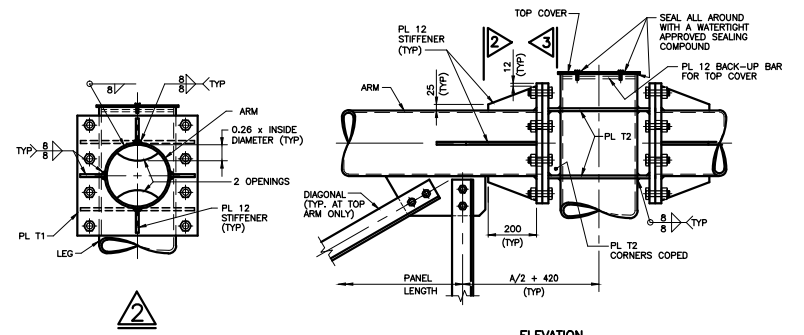
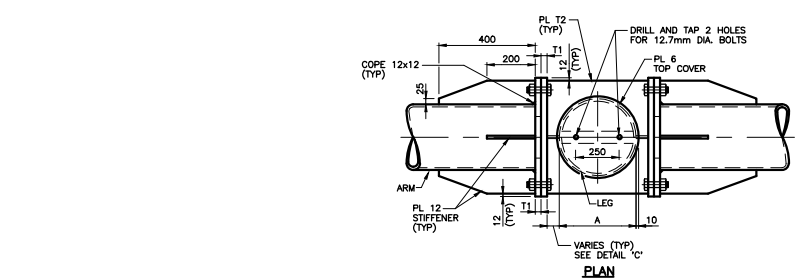
REVISIONS				
	DATE	BY	DESCRIPTION	
DESIGN	CHK	CODE	CSA S6-14	LOAD - DATE

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MODIFIED: 2017-07-18 11:52

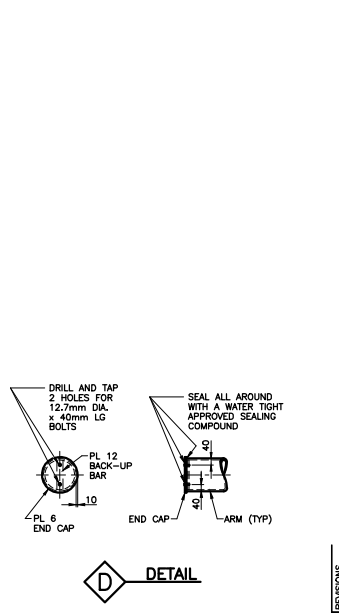
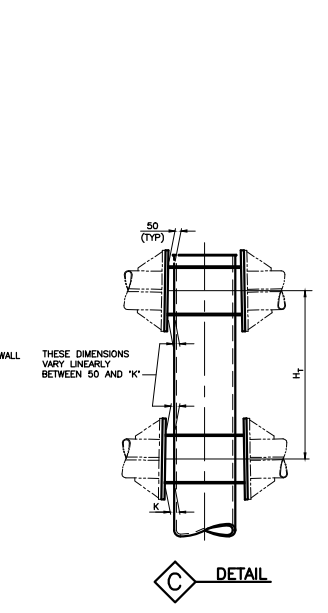
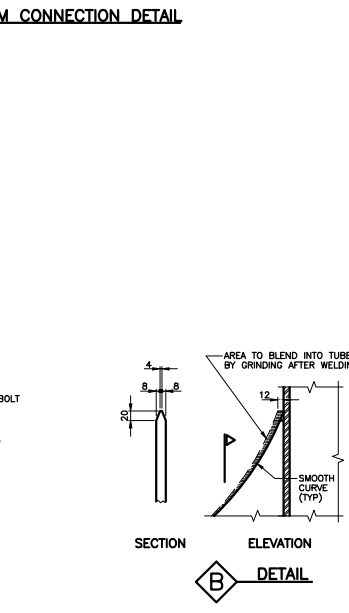
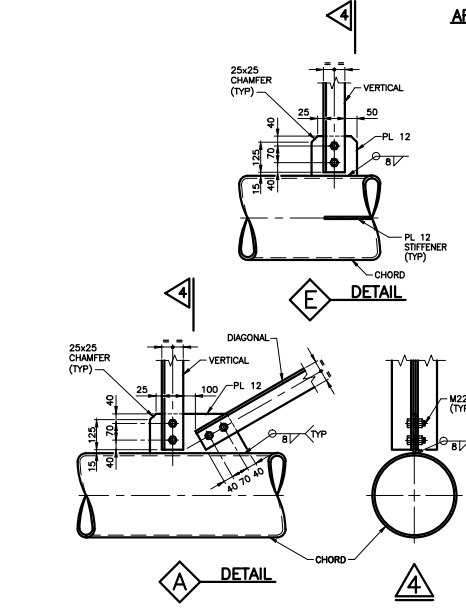
MINISTRY OF TRANSPORTATION, ONTARIO
HW-5 2017-06

METRIC
DIMENSIONS ARE IN METRES AND/OR
MILLIMETRES UNLESS OTHERWISE SHOWN
DRAWING NOT TO BE SCALED
100mm ON ORIGINAL DRAWING

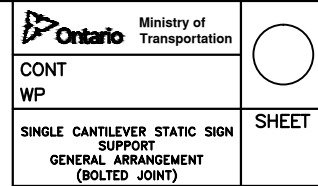
 Ministry of Transportation	
CONT WP	
BUTTERFLY STATIC SIGN SUPPORT DETAILS (BOLTED JOINT)	
SHEET	



NOTES:
1. THIS STANDARD IS APPLICABLE TO CLASS 1, 2, 3 AND 4.
2. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH
STANDARD DRAWING SS118-71.



STANDARD DRAWING JULY 2017		SS118-72	
BUTTERFLY STATIC SIGN SUPPORT DETAILS (BOLTED JOINT)			
REFER TO 2.4.1 IN THE SIGN SUPPORT MANUAL FOR PROFESSIONAL ENGINEER STAMPING REQUIREMENTS.			
REVISIONS			
DATE	BY	DESCRIPTION	
DESIGN	CHK	CODE	CHBDC-14/LOAD
DRAWN	CHK	SITE	DATE
			DWG



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SIGN SUPPORT MANUAL

SECTION 4 – TRI-CHORD STATIC SIGN SUPPORTS

February 2019

4 TRI-CHORD STATIC SIGN SUPPORTS**4.1 GENERAL**

Tri-Chord overhead truss sign supports are used to support static sign boards.

There are two types of Tri-Chord static sign supports, namely 'simply supported' and 'cantilever.'

4.1.1 STANDARD SIGN SUPPORTS**4.1.1.1 SIMPLY SUPPORTED TYPE I**

Simply supported Tri-Chord Type I overhead sign support structures are designed to the requirements of CSA S6-14 (CHBDC).

The sign supports in this section are designed for sign boards and site conditions that meet the following criteria:

- (a) Spans from 14000 to 36000 mm
- (b) Maximum total sign area of 45 square metres for a reference wind pressure of 600 Pa at a return period of 50 years, unless modified as described in Section 4.2.3 (Case 2). The effect of wind funnelling due to special topographical features such as deep valleys is not considered (CHBDC 3.10.1.2)
- (c) Depth of sign board from 1525 mm (5 ft) up to and including 2745 mm (9 ft)
- (d) All sign boards shall be vertically centred on the truss
- (e) Location of supports and vertical clearance according to the requirements of the CHBDC and MTO Design Supplement for TAC Geometric Design Guide for Canadian Roads, 2017
- (f) Competent soil conditions (as described in Section 4.5.4) excluding rock fill

4.1.1.2 SIMPLY SUPPORTED TYPE II

Simply supported Tri-Chord Type II overhead sign support structures are designed to the requirements of the CSA S6-14 (CHBDC).

SIGN SUPPORT MANUAL

2019 02 15

TRI-CHORD STATIC SIGN SUPPORTS

PAGE 4 - 2

The sign supports in this section are designed for sign boards and site conditions that meet the following criteria:

- (a) Spans from 21000 to 36000 mm
- (b) Maximum total sign area of 45 square metres for a reference wind pressure of 600 Pa at a return period of 50 years, unless modified as described in Section 4.2.3 (Case 2). The effect of wind funnelling due to special topographical features such as deep valleys is not considered (CHBDC 3.10.1.2)
- (c) Depth of sign board from 2745 mm (9 ft) up to 3965 mm (13 ft)
- (d) All sign boards shall be vertically centred on the truss
- (e) Location of supports and vertical clearance according to the requirements of the CHBDC and MTO Design Supplement for TAC Geometric Design Guide for Canadian Roads, 2017
- (f) Competent soil conditions (as described in Section 4.5.4) excluding rock fill
- (g) Sign board is located a minimum of 1000 mm from the centreline of the leg

4.1.1.3 CANTILEVER TYPE

Cantilever Tri-Chord overhead sign support structures are designed to the requirements of the CAN/CSA S6-06 (CHBDC).

The sign supports in this section are designed for sign boards and site conditions that meet the following criteria:

- (a) Cantilever span from 12000 to 18000 mm
- (b) Maximum total sign area of 26.7 square metres for a reference wind pressure of 600 Pa at a return period of 50 years. The effect of wind funnelling due to special topographical features such as deep valleys is not considered (CHBDC 3.10.1.2)
- (c) Depth of sign board from 1525 mm (5 ft) up to 2745 mm (9 ft)
- (d) All sign boards shall be vertically centred on the truss

SIGN SUPPORT MANUAL

2019 02 15

TRI-CHORD STATIC SIGN SUPPORTS

PAGE 4 - 3

- (e) Location of supports and vertical clearance according to the requirements of the CHBDC and MTO Design Supplement for TAC Geometric Design Guide for Canadian Roads, 2017
- (f) Competent soil conditions (as described in Section 4.5.4) excluding rock fill

4.1.2 LIMITATIONS

For economic and practical reasons, the structure's vertical support members (legs) should be placed as close as possible to the edge of the travelled portion of the highway (see Section 4.1.5). Therefore, the supports will probably be in the clear recovery zone and should be protected as discussed in Section 2.6. Supports can also be located on median barriers.

For ground mounted footings, the top of footing elevation shall be a minimum of 300 mm above the finished grade. This could be increased up to 1000 mm in order to limit the leg height. The dimension from the top of the footing to the centreline of the bottom chord shall not exceed the dimension indicated in Figures 4.1.3(b) and 4.1.3(d).

4.1.3 DESCRIPTION OF SIGN SUPPORTS

The Tri-Chord sign support system is fabricated from structural steel and is comprised of one or two vertical support legs and a three-chord truss. The system is fabricated based on specific site requirements. It is designed for ground mounting or mounting on concrete median barriers. The typical layout plan and elevation are shown in Figures 4.1.3 (a) to (d).

The legs are straight and made from single circular HSS sections or fabricated from plate to an octagonal shape. They are connected at the base to concrete footings by a bolted anchorage. The leg lengths of the simply supported Tri-Chord are not standard. At a particular location the legs may be of different heights, provided the truss is installed with its centreline oriented in the horizontal direction and the elevations of the top of support footings differ from one another.

The three chords are interconnected by diagonals with welded gusset plate connections, forming a spatial core. All members are fabricated from circular HSS sections. All sign boards are attached to the front top and bottom chords using aluminium Z-brackets. For the simply supported type, the front chords are supported on the leg by corbels. The middle or back chord is connected to the front chords by end diagonals. For the cantilever type, the three chords are bolted to the leg through a gusset plate connection.

All components are hot-dip galvanized after fabrication. The support legs are subsequently coated with an approved paint system.

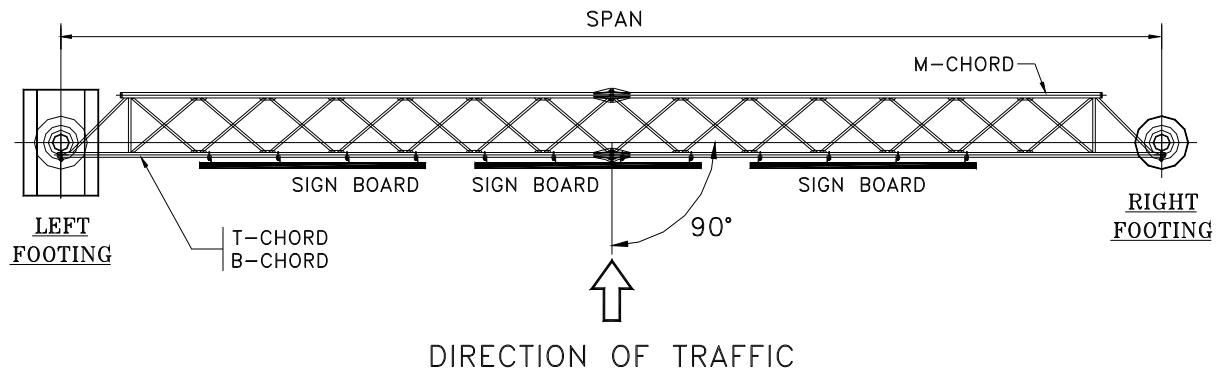


FIGURE 4.1.3(a) TYPICAL LAYOUT PLAN
(SIMPLY SUPPORTED TYPE I AND II)

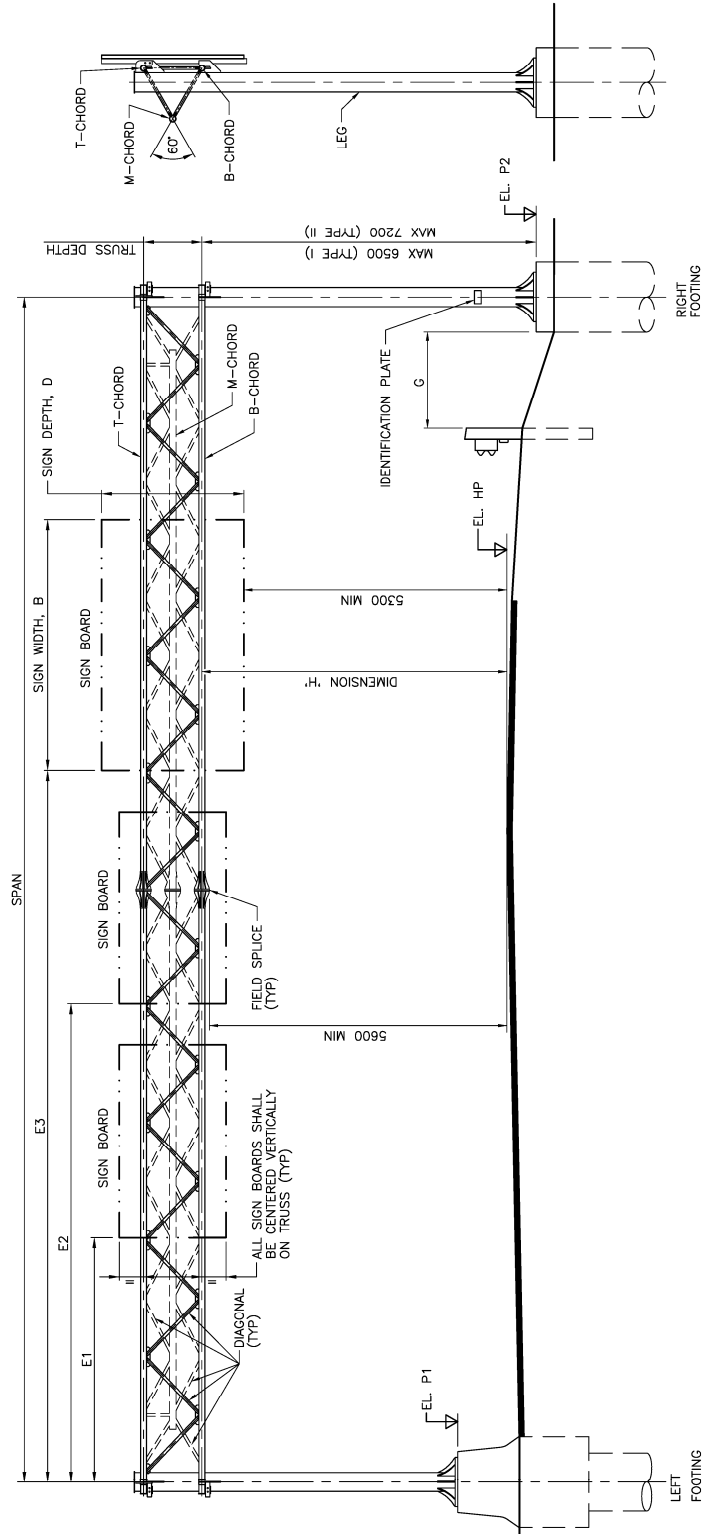


**FIGURE 4.1.3(b) TYPICAL TRI-CHORD SIGN SUPPORT ELEVATION
(SIMPLY SUPPORTED TYPE I AND II)**

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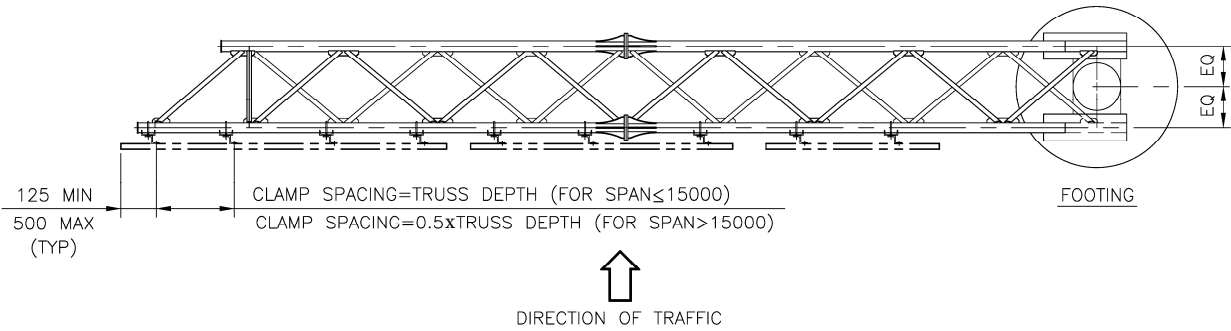


**FIGURE 4.1.3 (c) TYPICAL LAYOUT PLAN
(CANTILEVER TYPE)**

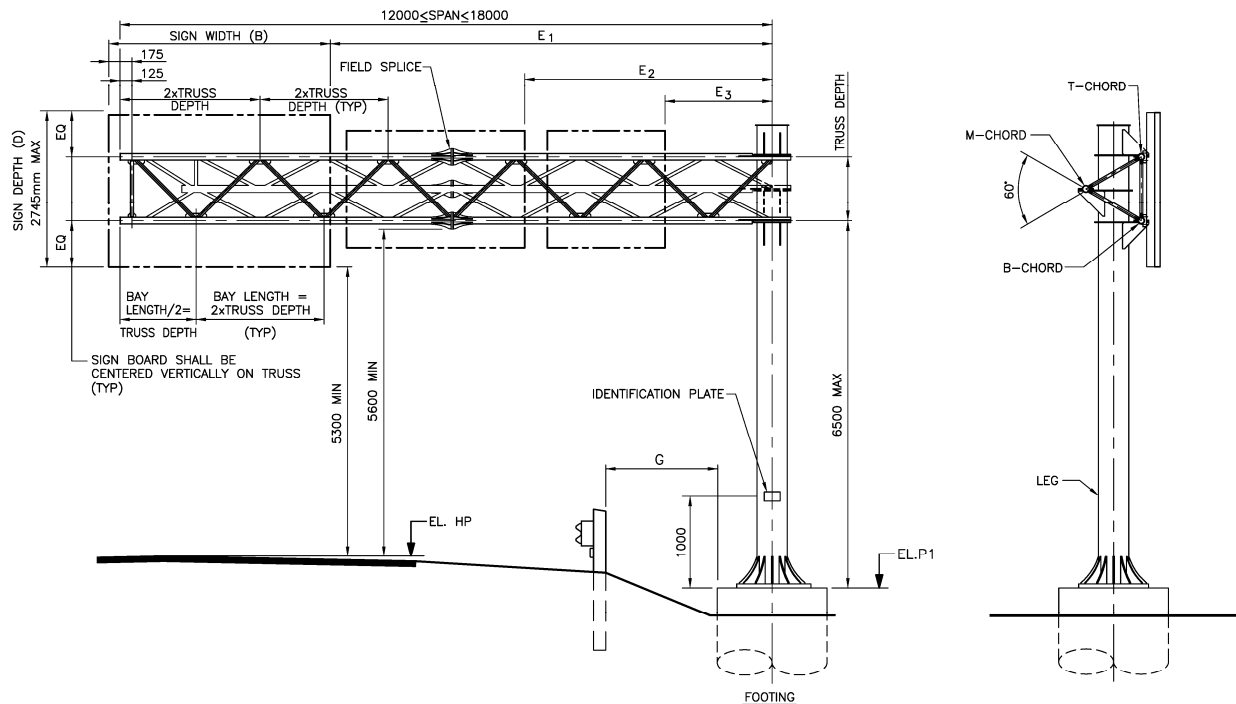


**FIGURE 4.1.3 (d) TYPICAL TRI-CHORD SIGN SUPPORT ELEVATION
(CANTILEVER TYPE)**

4.1.4 FOOTINGS

Each sign support footing consists of a reinforced concrete caisson. Details differ according to their location, and generally are of two types, as shown on the standard drawings: ground mounted signs and median mounted signs (see Standard Drawings SS118-3, SS118-4 and SS118-5).

The indicated footing depths are the minimum required for each support. Footing proportions assume competent soil conditions of uniform composition. Parameters upon which the design is based are given in Section 4.5.4.

Encountered soil conditions such as rock fill, land fill, and soft material are not covered here and require the footing to be designed by an Engineer.

4.1.5 CLEARANCE

For ground mounted footings, the minimum horizontal clearance 'G' from the back of traffic protection barrier to the nearest face of sign support footing shall not be less than the values specified in Figure A3.2 (see Appendix to Section 3).

Dimension 'H' is a characteristic dimension for vertical clearance. The values of dimension 'H' ensure that the following requirements are met:

- Minimum vertical clearance from the highest point on the highway, including shoulders, curbs, and medians, to the bottom of the deepest sign board shall not be less than 5300 mm under dead load deflection.
- Minimum vertical clearance from the highest point on the highway, including shoulders, curbs, and medians, to the bottom of the lowest chord shall not be less than 5600 mm under dead load deflection.
- Small sign boards with limited strength connections are allowed to project below the bottom edge of a sign board, as long as damage to them does not cause damage to the structure or present a hazard to traffic below (see Figure A4.2).

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For simply supported Tri-Chord, dimension 'H' shall be according to the following tables:

TABLE 4.1.5(a) DIMENSION 'H' FOR TYPE I

SPAN (mm)	H (mm)
UP TO 20000	6250
20001 TO 24000	6200
24001 TO 28000	6100
28001 TO 32000	6000
32001 TO 36000	5900

TABLE 4.1.5(b) DIMENSION 'H' FOR TYPE II

SPAN (mm)	H (mm)
21000 TO 26000	6650
26001 TO 31000	6600
31001 TO 36000	6550

4.1.6 TRI-CHORD DEPTH

The Tri-Chord truss depth, measured centreline to centreline of chords, shall be according to Table 4.1.6(a) or 4.1.6(b) for simply supported Types I and II, or one-tenth of the span (SPAN/10) for cantilever type. This depth shall be entered in Table 1 of Standard Drawing SS118-26, SS118-28 or SS118-43.

For simply supported Type I and cantilever Tri-Chord, the calculated truss depth shall not be rounded. In order to obtain an exact integer number of bays of the truss within the desired span length, the truss depth and the

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horizontal distance between nodes (equivalent to half bay length) shall be of equal length. This is achieved by placing the diagonal members at 45 degree angles (see Standard Drawing SS118-26 or SS118-43, ELEVATION).

Note that if the truss depth is rounded, then the horizontal distance between nodes should still be the exact number (before rounding) to achieve the desired span length.

For simply supported Type II Tri-Chord, the truss depth is pre-determined for each span range, so only the bay length requires calculation. As a result, the truss depth and horizontal distance between nodes (equivalent to half bay length) will not necessarily be equal.

TABLE 4.1.6(a) TRUSS DEPTH AND NUMBER OF BAYS

(For Simply Supported Type I)

SPAN (mm)	Truss Depth (mm)	Number of Bays
14000 TO 15999	SPAN/14	7
16000 TO 17999	SPAN/16	8
18000 TO 19999	SPAN/18	9
20000 TO 36000	SPAN/20	10

TABLE 4.1.6(b) TRUSS DEPTH AND NUMBER OF BAYS

(For Simply Supported Type II)

SPAN (mm)	Truss Depth (mm)	Number of Bays
21000 TO 26000	1600	8
26001 TO 31000	1700	9
31001 TO 36000	1800	10

4.1.7 SUPPLY AND ERECTION

Since the support structure may be erected without sign boards, sign boards and Z-brackets (Figure A4.1) are not included in the contract; they are supplied and installed by others. The spacing of Z-brackets for the attachment of the sign boards shall be equal to:

- a) Half bay length (equivalent to full depth of truss) for simply supported Type I with spans less than or equal to 30000 mm; or cantilever span less than or equal to 15000 mm;
- b) Quarter bay length (equivalent to half depth of truss) for simply supported Type I with spans greater than 30000 mm; or cantilever span greater than 15000 mm;
- c) Quarter bay length for all spans of simply supported Type II (as per Standard Drawing SS118-28).

Minimum number of Z-brackets per sign shall be three, except for small signs of size not larger than 1.5 m wide x 1.8 m deep, for which two Z-brackets may be used.

Construction shall meet the requirements of OPSS 915, Construction Specification for Sign Support Structures, and associated Special Provisions.

Each sign support shall have a corrosion-protected identification plate showing the site number (formerly structure I.D. number), the manufacturer's name or the trade mark, the date of manufacture, the maximum allowable sign board area, and the local reference wind pressure.

4.2 PROCEDURES**4.2.1 GENERAL**

The sign supports are fabricated from shop drawings prepared based on the completed contract standard drawings.

The design of the simply supported Tri-Chord overhead sign supports is based on the criteria listed in Section 4.1.1.1 or 4.1.1.2. Based on the required total sign board area ($\leq 45\text{m}^2$), sign depth, and the span, the final design dimensions can be obtained from Table 4.2.1(a) or 4.2.1(b). For required total sign board area greater than 45 m^2 , refer Section 4.2.3 (Case 2). The design of the cantilever Tri-Chord is based on the criteria listed in Section 4.1.1.3. There are four designs (called Classes) for cantilever Tri-Chord sign

supports; the Class is dependent on the length of cantilever span and has a specified set of member dimensions, as shown in Table 4.2.1(c).

4.2.2 DATA REQUIRED

For each Tri-Chord sign support structure, the following data is required:

- (1) The required total sign board area, sign depth, and span
- (2) The location of the structure (note: for a proposed highway or a highway under reconstruction, the location should be specified as a station)
- (3) The elevation of the highest point on the highway under the sign boards, and the final ground elevations at the sign support structure location

4.2.3 PROCEDURE FOR SELECTION OF SIGN SUPPORT

CASE 1 – SIMPLY SUPPORTED TRI-CHORD TYPE I WITH SIGN BOARD AREA LESS THAN OR EQUAL TO 45 m^2 AND SIGN DEPTH $\leq 2745 \text{ mm}$

GIVEN: REQUIRED SIGN BOARD AREA, SIGN DEPTH AND SPAN

Example: a required sign board area of 30 m^2 , sign depth of 2440 mm and a span of 20500 mm.

STEP 1: IDENTIFY THE APPLICABLE TRI-CHORD TYPE AND OBTAIN THE STRUCTURE DESIGN DIMENSIONS FOR THE DESIGN SIGN BOARD AREA

E.g.

For sign depth less than 2745 mm, Tri-chord Type I is selected. From Table 4.2.1(a), for a span of 20500 mm, select the span range of 20001 to 22000 mm. For the given example, the following is obtained:

Top and Bottom Chord:	HSS 102 x 6.4
Middle or Back Chord:	HSS 141 x 6.4
Diagonals:	HSS 48 x 3.2
Support Leg:	HSS 406 x 12.7

Calculate truss depth from Table 4.1.6.

E.g. for span of 20500 mm, truss depth = $20500/20 = 1025 \text{ mm}$.

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STEP 2: CHECK BOUNDARY CONDITIONS

- (a) Based on the elevation of the highest point of the roadway (EL.HP) and dimension 'H' (from Table 4.1.5(a)) corresponding to the span, calculate the elevation of the centreline of the bottom chord of the truss.
- (b) Based on the elevation of the centreline of the bottom chord of the truss and the elevation of the ground at the footing location, calculate the height difference between these two elevations.
- (c) This height difference shall be made up of two components/portions:
 - (1) The leg with a limitation of 6500 mm for Type I
 - (2) The projection of the footing above ground with a limitation of 1000 mm

This means that the above height difference can be as large as 7500 mm for Type I.

STEP 3: COMPLETE THE STANDARD DRAWINGS

Refer to 4.3 for Preparation of Drawings.

CASE 2 – SIMPLY SUPPORTED TYPE WITH SIGN BOARD AREA GREATER THAN 45 m²

If the required sign board area is more than 45 m², the site-specific local reference wind pressure, q , for a return period of 50 years shall be determined from CHBDC Section 3, Table A3.1.1, or from Table A2.9(a) to (c) in the Appendix in Section 2 of the Manual. Then the maximum allowable total sign board area for this specific site will be:

$$45 (600/q) \text{ m}^2 \quad \text{where "q" is given in Pa}$$

E.g., For a local "q" of 430 Pa, the maximum allowable total sign board area is $45 \times 600/430 = 62.7 \text{ m}^2$.

To complete the standard drawings, the maximum allowable total sign board area is required, and is used for the identification plate. See Note 14 on Standard Drawing SS118-26 or Note 13 on Standard Drawing SS118-28.

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CASE 3 – CANTILEVER TYPE

GIVEN: REQUIRED SIGN BOARD AREA AND SPAN

Example: a required sign board area of 20 m² and a span of 16000 mm.

STEP 1: OBTAIN THE STRUCTURE DESIGN DIMENSIONS FOR THE DESIGN SIGN BOARD AREA

E.g. From Table 4.2.1(c), for a span of 16000 mm, select CLASS 3, the span range of 14501 to 16000 mm. For the given example, the following is obtained:

Top and Bottom Chord:	HSS 141 x 8
Middle Chord:	HSS 141 x 8
Diagonals:	HSS 60 x 4.8
Support Leg:	HSS 711 x 12.7

Calculate truss depth = $16000/10 = 1600$ mm.

STEP 2: CHECK BOUNDARY CONDITIONS

- (a) Based on the elevation of the highest point of the roadway (EL.HP) and vertical clearance requirements in Section 4.1.5, calculate the elevation of the lowest edge of the bottom chord of the truss.
- (b) Based on the elevation of the lowest edge of the bottom chord of the truss and the elevation of the ground at the footing location, calculate the height difference between these two elevations.
- (c) This height difference shall be made up of two components/portions:
 - (1) The leg with a limitation of 6500 mm for cantilever
 - (2) The projection of the footing above ground with a limitation of 1000 mm

This means that the above height difference can be as large as 7500 mm for cantilever.

STEP 3: COMPLETE THE STANDARD DRAWINGS

Refer to 4.3 for Preparation of Drawings.

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TABLE 4.2.1(a) SIMPLY SUPPORTED TRI-CHORD (TYPE I) - DESIGN DIMENSIONS
(MAXIMUM ALLOWABLE SIGN BOARD AREA = 45 m²)
(1525 mm ≤ SIGN DEPTH ≤ 2745 mm)
(REFERENCE WIND PRESSURE = 600 Pa)

SPAN (mm)	HSS (O.D. x Thickness in mm)			
	TOP/BOTTOM CHORD	MIDDLE CHORD	DIAGONAL	LEG
14 000 TO 20 000	102 x 6.4	114 x 6.4	48 x 3.2	406 x 12.7
20 001 TO 22 000	102 x 6.4	141 x 6.4	48 x 3.2	406 x 12.7
22 001 TO 24 000	114 x 6.4	141 x 6.4	48 x 3.2	457 x 12.7
24 001 TO 26 000	114 x 6.4	141 x 6.4	60 x 3.2	457 x 12.7
26 001 TO 28 000	141 x 6.4	141 x 6.4	60 x 3.2	457 x 12.7
28 001 TO 30 000	141 x 6.4	168 x 6.4	60 x 3.2	457 x 12.7
30 001 TO 32 000	141 x 6.4	168 x 6.4	60 x 3.2	457 x 12.7
32 001 TO 34 000	141 x 6.4	168 x 6.4	73 x 3.2	508 x 12.7
34 001 TO 36 000	168 x 6.4	168 x 6.4	73 x 3.2	508 x 12.7

NOTE: For sign board areas greater than 45m², see Section 4.2.3, Case 2.

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TABLE 4.2.1(b) SIMPLY SUPPORTED TRI-CHORD (TYPE II)
DESIGN DIMENSIONS
(MAXIMUM ALLOWABLE SIGN BOARD AREA = 45 m²)
(2745 mm < SIGN DEPTH ≤ 3965 mm)
(REFERENCE WIND PRESSURE = 600 Pa)

CLASS	SPAN (mm)	HSS (O.D. x Thickness in mm)			
		TOP/BOTTOM CHORD	MIDDLE CHORD	DIAGONAL	LEG
1	21 000 TO 26 000	114 x 6.4	141 x 6.4	73 x 4.8	508 x 12.7
2	26 001 TO 31 000	141 x 6.4	168 x 6.4	73 x 4.8	559 x 12.7
3	31 001 TO 36 000	168 x 6.4	168 x 6.4	73 x 6.4	559 x 12.7

NOTE: For sign board areas greater than 45m², see Section 4.2.3, Case 2.

TABLE 4.2.1(c) CANTILEVER TRI-CHORD DESIGN DIMENSIONS
(MAXIMUM ALLOWABLE SIGN BOARD AREA = 26.7 m²)
(1525 mm ≤ SIGN DEPTH ≤ 2745 mm)
(REFERENCE WIND PRESSURE = 600 Pa)

CLASS	SPAN (mm)	HSS (O.D. x Thickness in mm)			
		TOP/BOTTOM CHORD	MIDDLE CHORD	DIAGONAL	LEG
1	UP TO 13 000	114 x 8	141 x 8	60 x 4.8	610 x 12.7
2	13 001 TO 14 500	141 x 8	141 x 8	60 x 4.8	660 x 12.7
3	14 501 TO 16 000	141 x 8	141 x 8	60 x 4.8	711 x 12.7
4	16 001 TO 18 000	141 x 8	141 x 8	60 x 6.4	762 x 12.7

4.3 PREPARATION OF DRAWINGS**4.3.1 DATA REQUIRED**

The sign support structure designer shall obtain information from the Regional Offices for the location, site number, span length, location, elevations and sizes of sign boards etc. of each sign support to be constructed. The designer shall prepare and complete the design standard drawings for the structures and its foundations that will be part of the contract documents. Design drawings shall show the following information.

- (1) A key plan, indicating the location of each support.
- (2) The Site number.
- (3) The span.

For simply supported type, the span is measured from centreline to centreline of legs.

For cantilever type, the span is measured from the centreline of the leg to the tip at the free end of the top and bottom chords.

- (4) The control line or the centreline of the roadway, and the offset of the left leg from the control line.
- (5) The elevation of the highest point on the roadway surface under the sign support structure.
- (6) The dimension 'H' measured from the highest point on the roadway surface to the centreline of the lowest chord of the Tri-Chord. For the simply supported Tri-Chord, this dimension shall be as indicated in Tables 4.1.5(a) & (b). For the cantilever Tri-Chord, dimension 'H' shall be calculated based on the clearance requirements stipulated in Section 4.1.5.
- (7) The height of the supporting leg; that is, the dimension measured from the top of footing to the centreline of the bottom chord. This dimension shall not exceed 6500 mm for simply supported Type I Tri-Chord or cantilever Tri-Chord and 7200 mm for simply supported Type II Tri-Chord.
- (8) The top of footing elevation can differ for each leg of simply supported type, if required. This elevation shall be determined so that the footing projection above finished grade around it is minimum 300 mm and

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maximum 1000 mm. This will give the designer flexibility to meet the structure leg height as stated in (7) above.

- (9) The elevation of the ground-line at each footing.
- (10) The offset of each footing from the control line, either as a note or as a dimension.
- (11) The Highway Station of the support structures on the designated highway centreline or control line.
- (12) For simply supported type, a designation for each footing as a "Left Footing" or "Right Footing". Left and Right for this purpose are defined as if looking in the direction of the traffic, as shown in Figure 4.1.3(a).
- (13) The footing type for each sign support footing (see Section 4.1.4). For ground mounted footings, include the dimension 'G' from the rear face of the traffic protection barrier to the sign support footing (see Section 4.1.5).
- (14) For each sign board, the following additional information is required:
 - An outline in dashed lines showing each sign board to be mounted on the support structure,
 - The dimensions B and D of each sign board,
 - The location of each sign board with respect to the centrelines of the legs or, for simply supported type, left leg.

4.3.2 SIGN SUPPORT DRAWINGS

If the supports are to be supplied and erected as part of a contract, appropriate Standard Drawings from SS118-3, SS118-4, SS118-5, SS118-26, SS118-27, SS118-28, SS118-29, SS118-43, SS118-44 and SS110-45 must be used. Up to 10 sign supports can be detailed on one sheet.

The Appendix contains reduced size prints of these drawings, showing what information needs to be added. The Contract and W.P. numbers should be added to the title block. The sheet number is added when the drawings for the entire contract are assembled.

On Standard Drawings SS118-3, SS118-4, SS118-5, SS118-26, SS118-28 and SS118-43, there are tables to be completed on the drawings. In each table, one vertical column of data is used for each sign.

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The Standard Drawings shall be sealed, dated and signed according to Section 2.4.1.

Table 1 - General is to be completed with the following information:

- (i) Station
- (ii) Site Number
- (iii) For simply supported type, the support span measured from centrelines of legs;
For cantilever type, the span measured from the centreline of leg to the tip at the free end of the top (bottom) chord
- (iv) Truss depth measured centre to centre of top and bottom chords
- (v) For simply supported Type II, the number of bays
- (vi) For simply supported Type II, the bay length
- (vii) Dimension 'H' from the centreline of the lowest chord to the highest point on the highway, including shoulders, curbs and median, as specified in Section 4.1.5
- (viii) Local Reference Wind Pressure, in Pa
- (ix) Maximum Allowable Sign Board Area, m² (for simply supported type only)
- (x) Sign Sizes (D x B) for each sign board (sign depth shall not exceed the design limitation stipulated in Section 4.1.1)
- (xi) The location of each sign board, E_i, with respect to the centreline of the leg (measured from left leg for simply supported type)
- (xii) Elevation of the highest point on the highway under the signs, EL.HP, including shoulders, curbs, and medians
- (xiii) Elevation at the top of support footing(s), EL.P1 (and EL.P2)
- (xiv) Member outside diameters and thickness, as obtained from tabulated values in Table 4.2.1(a), 4.2.1(b) or 4.2.1(c)
- (xv) Footing Type (see Section 4.1.4)

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Table 2 - Sign Board: Parts/Hardware is to be completed with quantities for all sign boards. This table shall also include the Z-bracket spacing.

The following table shall be used for the calculation of quantities:

TABLE 4.3.2 PARTS & HARDWARE QUANTITIES

DESCRIPTION	QUANTITY
12.7mm DIA. STAINLESS STEEL U-BOLT	2 per Z-Bracket
STAINLESS STEEL NYLON INSERT LOCK NUT	4 per Z-Bracket
STAINLESS STEEL WASHER	8 per Z-Bracket
PROFIED CHANNEL (C130x13)	2 per Z-Bracket
Z-BRACKET	See Section 4.1.7

4.4 MAINTENANCE AND INSPECTION

All components must be inspected and maintained according to the requirements described in the Sign Support Inspection Guidelines, 2002.

Long term durability of sign supports is dependent on routine maintenance and inspection. In order to prevent corrosion damage and fatigue problems to the base plate and the anchorage assembly, and to allow for proper inspection of the assembly, the following shall be ensured:

- (i) The base of the leg shall be kept free from dirt and debris
- (ii) The surrounding ground level shall be a minimum of 300 mm below the top of the footing

The base plate and weld connections shall be inspected regularly for fatigue cracking.

4.5 DESIGN INFORMATION

4.5.1 GENERAL

Calculations are based on Standard CAN/CSA-G40.20-13/G40.21-13 Grade 300W or ASTM A500 Grade C (or API-5L-X46 for round section of O.D. equal to or greater than 508 mm) structural steel, 30MPa concrete, and Grade 400W reinforcing steel for footings.

The total weight of the sign board used in design is 0.169 kN/m^2 , including the self-weight of the standard aluminum ALCAN shape No.72838.

4.5.1.1 SIMPLY SUPPORTED TRI-CHORD

For the simply supported type Tri-Chord, the design and detailing data conforms to the requirements of the 2014 edition of the CHBDC unless otherwise stated. Fatigue wind loads were obtained from AASHTO LFRD Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals 1st Edition, 2015 with Interim Revisions, 2017.

4.5.1.2 CANTILEVER TRI-CHORD

For the cantilever type Tri-chord, the design and detailing data conforms to the requirements of the 2006 edition of the CHBDC unless otherwise stated. Wind loads, design, and detailing for fatigue are in accordance with AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals, 2013 unless otherwise stated.

The natural wind gust pressure range for the fatigue design of the cantilever Tri-Chord support structures, as specified in AASHTO, is based on a yearly mean wind speed of 5 m/s (18 km/h). To account for the possibility of higher wind speed in some areas of Ontario, the thickness of the most critical member (middle chord) has been increased by one size beyond that required by design.

The fatigue stress category for the connection between the cantilever chord and connection plate is not covered explicitly by the typical examples shown in the code. The Constant-Amplitude Fatigue Limits for this connection is assumed to be the average of the values for detail category E and E'.

CHBDC has provisions for vortex shedding but these were not used since vortex shedding is not a fatigue load case, for these types of structures, according to AASHTO.

In 2013, MTO retained The Boundary Layer Wind Tunnel Laboratory of the University of Western Ontario (UWO) to conduct wind tunnel testing for cantilever Tri-Chord sign support. The main objective of the study was to investigate the aerodynamic stability of the structures. A section model of the cantilever portion of the 18 m long cantilever Tri-Chord was constructed and tested in both smooth and turbulent flow conditions. The Static Section Model Tests indicated that cross-wind galloping oscillation is not likely to occur for the signage arrangements in the range of wind speeds studied. The Dynamic Section Model Tests showed that the sign structure is free of galloping instability up to a wind speed 38 m/s, which is about 25% greater than the

design wind speed of 31 m/s (based on reference wind pressure of 600 Pa at a return period of 50 years) in Ontario. Based on these findings and advice from UWO, the galloping effect is not considered in the fatigue design of the structures. All information relating to this wind tunnel test, including conclusions and recommendations, are contained in the report – ‘A Study of Wind Effects for Cantilever Tri-Chord Sign Support Structures’.

4.5.2 DERIVATION OF DESIGN TABLES

The design dimensions for the Tri-Chord sign supports found in Tables 4.2.1(a), 4.2.1(b) and 4.2.1(c), were developed by determining the member responses under various design sign board areas, spans, and wind loads. Member responses were checked for ultimate, serviceability and fatigue limits states. Member sizes were optimised to limit the variety of section sizes.

4.5.3 DEFLECTIONS

The deflections for both vertical and horizontal members were limited to ensure adequate clearance for serviceability and aesthetic purposes.

For the simply supported type Tri-Chord, the vertical members are restricted to 1% ($\text{LEG HEIGHT}/100$), and horizontal members are restricted to 2% ($\text{SPAN}/50$) lateral movement. Both limitations are within the suggested limits provided in AASHTO LRFD Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals, 1st Edition, 2015 with Interim Revisions, 2017, which allows 2.5% lateral movement or 1°40' angular rotation from the centreline at the top of the structure in relation to the centreline at its base.

For the cantilever type Tri-Chord, the chords were cambered upwards to account for dead loads. The lateral displacement at the top of the leg due to wind load (SLS combination A1) is limited to 1.5% of the leg height. The lateral deflection at the tip of the arms due to the wind load (SLS combination A1) caused by bending of the leg and arms and twisting of the leg, is limited to 3% of the arm length. The vertical deflection at the tip of the arms due to truck gusts and natural wind, caused by bending of the leg and arm, is limited to 1.5% of the arm length. The limits for the cantilever Tri-Chord are within those specified by AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals, 2013.

4.5.4 FOUNDATIONS

The caisson foundations were modelled in S-Frame as beam elements with spring constants representing earth pressure. Any resisting earth pressure in the frost depth layer was not considered.

Assumed soil parameters below the frost layer are as follows:

		CASE 1 (Sand)	CASE 2 (Soft Clay)
LENGTH OF CAISSON BELOW FROST LAYER	Upper 2/3	$\phi' = 28^\circ$	$C_u = 25 \text{ kPa}$
	Lower 1/3	$\phi' = 30^\circ$	$C_u = 50 \text{ kPa}$

4.5.4.1 SIMPLY SUPPORTED TRI-CHORD

The simply supported Tri-Chord foundations are designed by following the principles of the MTO document, "Guidelines for the Design of High Mast Pole Foundations, Fourth Edition (BRO-009), 2004." The foundation rotation limit of 0.005 radians provided in the guideline was adjusted to 0.015 radians to reflect the much lower height of the sign support structures in comparison to the high mast lighting poles.

4.5.4.2 CANTILEVER TRI-CHORD

The cantilever Tri-Chord static sign support foundations are designed to satisfy the following geotechnical requirements.

- Serviceability Limit State (SLS):
- The lateral rotation of the concrete foundation is limited to a rotation of 0.01 radians. The use of this criterion is justified from a long history of satisfactory performances by existing cantilever static sign support structures designed using a similar design criterion. No resistance factor is applied as this rotational limit is considered to be factored.

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TRI-CHORD STATIC SIGN SUPPORTS

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- Ultimate Limit State (ULS):
 - i. The overturning analysis of the footing subjected to lateral component of ULS loading uses the procedure described in the MTO document - "Guidelines for the Design of High Mast Pole Foundations, Fourth Edition (BRO-009), 2004". A geotechnical resistance factor of 0.5 is used;
 - ii. The axial resistance of the shaft is checked against the vertical component of ULS loading. The factored resistance is obtained from the summation of total shaft and toe resistances, multiplied by a geotechnical resistance factor of 0.3;
 - iii. The torsional resistance of the footing is checked against the factored torsional moment, due to factored wind force of ULS combination A1 with a wind gust factor of 1.0, and a geotechnical resistance factor of 0.8 based on the following rationale/assumptions:
- Torsional resistance check is consistent with the Illinois DOT's Design Guide on Shaft Overturning and Torsion Analysis (2011).
- CHBDC doesn't provide clear guidance for torsional resistance.
- Wind gusts are excluded from torsional wind pressure loads, as they are intermittent and do not blow from the same direction all the time.
- This design uses the highest wind pressure in Ontario in combination with very weak soil parameters (sand or soft clay) for all locations.
- Existing cantilever static sign support structures did not use torsion as a design criterion, and there is no report of torsional issues.
- Geotechnical torsional failure will not reduce the geotechnical lateral and axial resistances of the shaft.

SIGN SUPPORT MANUAL

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TRI-CHORD STATIC SIGN SUPPORTS

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APPENDIX TO SECTION 4

TRI-CHORD STATIC SIGN SUPPORTS

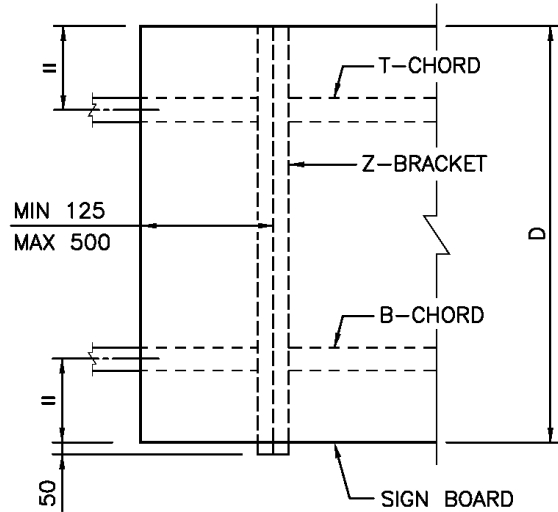
FIGURE A4.1	Z-BRACKET DETAIL
FIGURE A4.2	ARROW BOARD DETAIL
SS118-3	STATIC SIGN SUPPORT - FOOTING DETAILS (GROUND MOUNTED)
SS118-4	STATIC SIGN SUPPORT - FOOTING DETAILS (MEDIAN MOUNTED - SYMMETRICAL)
SS118-5	STATIC SIGN SUPPORT - FOOTING DETAILS (MEDIAN MOUNTED - ASYMMETRICAL)
SS118-26	TRI-CHORD STATIC SIGN SUPPORT (TYPE I) GENERAL ARRANGEMENT
SS118-27	TRI-CHORD STATIC SIGN SUPPORT (TYPE I) STRUCTURE ASSEMBLY DETAILS
SS118-28	TRI-CHORD STATIC SIGN SUPPORT (TYPE II) GENERAL ARRANGEMENT
SS118-29	TRI-CHORD STATIC SIGN SUPPORT (TYPE II) STRUCTURE ASSEMBLY DETAILS
SS118-43	CANTILEVER TRI-CHORD STATIC SIGN SUPPORT GENERAL ARRANGEMENT
SS118-44	CANTILEVER TRI-CHORD STATIC SIGN SUPPORT STRUCTURE ASSEMBLY DETAILS I
SS118-45	CANTILEVER TRI-CHORD STATIC SIGN SUPPORT STRUCTURE ASSEMBLY DETAILS II

SIGN SUPPORT MANUAL

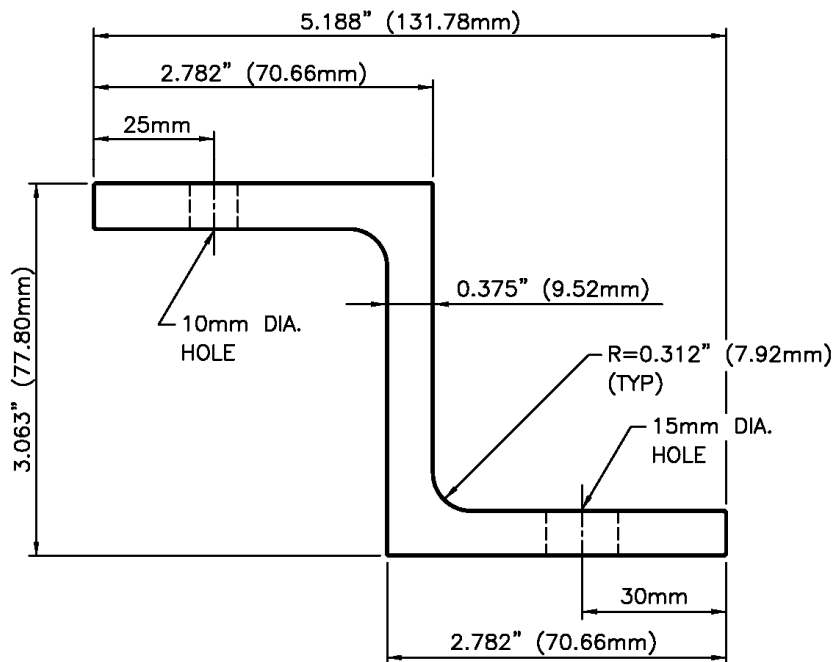
2019 02 15

TRI-CHORD STATIC SIGN SUPPORTS

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INSTALLATION DETAIL

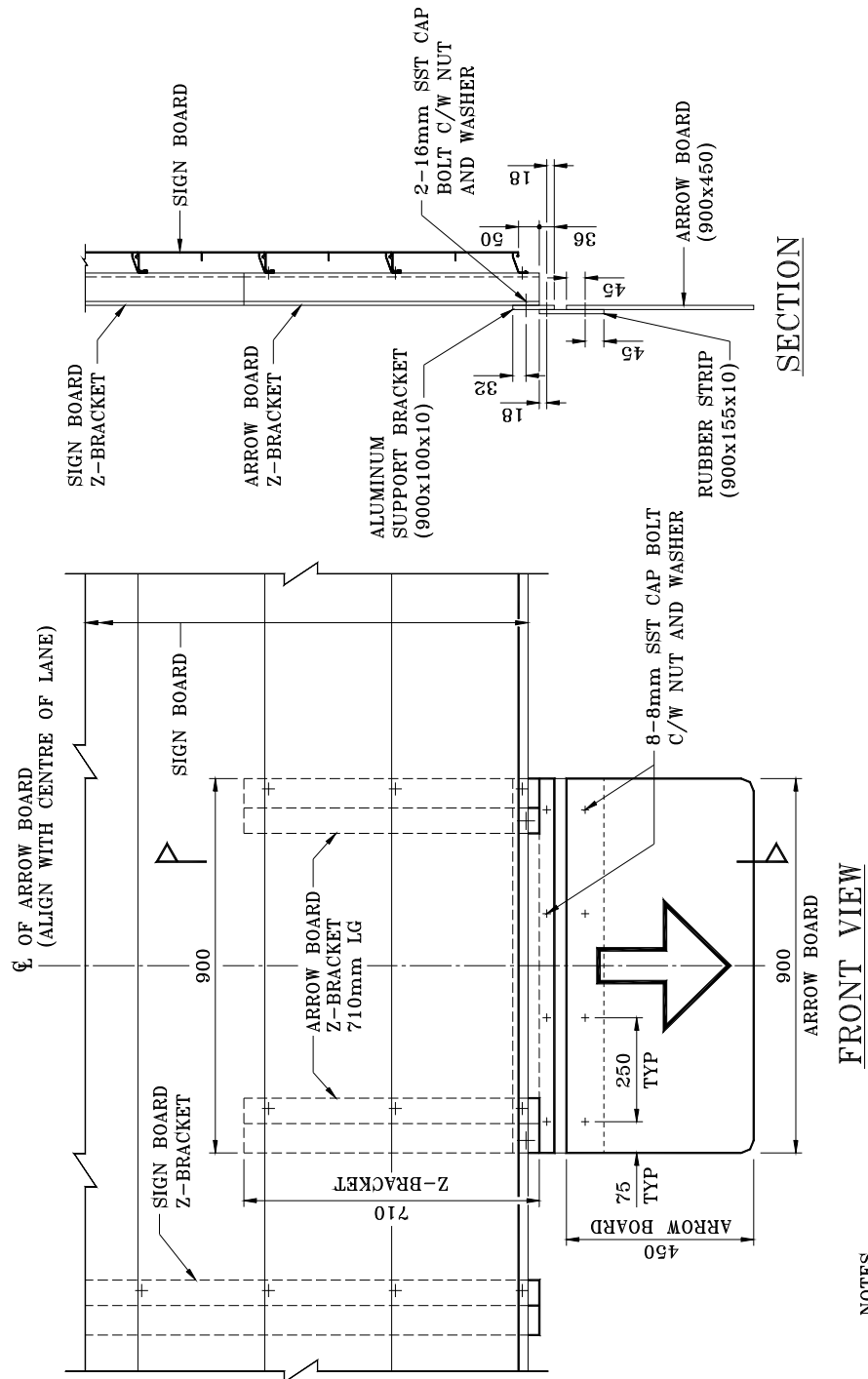


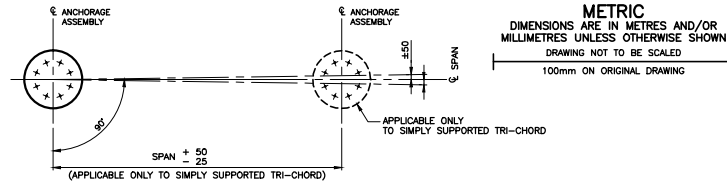
TYPICAL SECTION

NOTES:

1. ALUMINUM EXTRUSION EXTRUDEX P6544-1 OR APPROVED EQUAL.
2. MATERIAL: ALLOY 6061.
3. BREAK CORNERS 0.010" (0.25mm), OUTSIDE CORNERS 0.015" (0.38mm).
4. STANDARD TOLERANCES TO APPLY UNLESS OTHERWISE STATED.
5. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SHOWN.

FIGURE A4.1 Z-BRACKET DETAIL

**FIGURE A4.2 ARROW BOARD DETAIL**



- THE C OF THE CONCRETE CAISSON SHALL BE LOCATED WITHIN 50mm OF SPECIFIED LOCATION.
- THE C OF THE ANCHORAGE ASSEMBLY SHALL BE LOCATED WITHIN 50mm OF THE C OF THE CONCRETE CAISSON.

FOR INSTALLATION SEE ANCHORAGE INSTALLATION DETAIL

BASE PLATE

FABRICKA PAD SEE DETAIL

15M SPIRAL
150mm PITCH
IN ADDITION TO FOOTING REINFORCEMENT

M = Ø3 mm DIA.
ANCHOR STUDS GALVANIZED

STEEL PLATE
t mm THICK GALVANIZED

ANCHOR & EMBEDMENT H

TYP 6/L

100

G

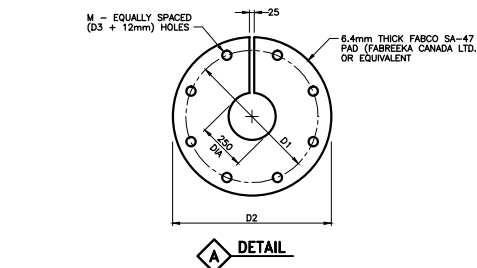
TYP 6/L

(*) 8 ANCHOR STUDS ARRANGEMENT SHOWN. 12 ANCHOR STUDS CASE SIMILAR

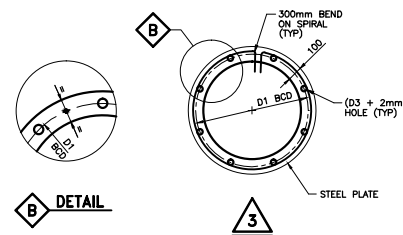
ANCHORAGE NOT SHOWN FOR CLARITY

[illegible]

DESIGN INFORMATION		FOOTING DEPTH L	FOOTING DIAMETER D	NO. OF REBARS N	NO. OF ANCHORS M	BOLT CIRCLE DIA D1	BASE Ø DIAMETER D2	ANCHOR DIAMETER D3	ANCHOR Ø THK. T	ANCHOR Ø EMBED. H	RING SPACING S
TYPE	CLASS	(mm)	(mm)	(no.)	(no.)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)
TRI-CHORD (TYPE I)	—	5000	1200	18	8	750	900	38	12	1200	300
TRI-CHORD (TYPE II)	1	5700	1350	26	8	850	1000	38	12	1200	300
	2	5700	1350	26	8	850	1000	38	12	1200	300
	3	6100	1500	26	8	950	1100	38	12	1500	300
CANTILEVER TRI-CHORD	1	6500	1350	22	12	850	1000	38	15	1200	300
	2	6500	1350	22	12	850	1000	44	15	1500	300
	3	7500	1350	22	12	900	1100	44	15	1500	275
SINGLE CANTILEVER	4	7500	1350	22	12	950	1100	44	15	1500	225
	1	5000	1200	18	8	750	900	38	12	1200	300
	2	5000	1200	18	8	750	900	38	12	1200	300
BUTTERFLY	3	6000	1200	18	8	750	900	38	12	1200	300
	4	6500	1350	22	8	850	1000	44	15	1500	300
	1	5500	1200	18	8	750	900	38	12	1200	300
POLE MOUNTED VMS	2	5500	1200	18	8	750	900	38	12	1200	300
	3	6700	1200	18	8	750	900	38	12	1200	300
POLE MOUNTED VMS	4	7400	1350	22	8	850	1000	44	15	1500	300
	—	6000	1200	15	8	750	900	38	12	1200	300

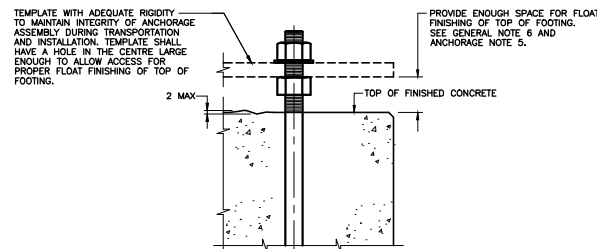


 DETAIL



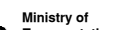
DETAIL

3



ANCHORAGE INSTALLATION DETAIL

METRIC
DIMENSIONS ARE IN METRES AND/OR
MILLIMETRES UNLESS OTHERWISE SHOWN
AND SHALL BE TAKEN AS SUCH
DRAWING NOT TO BE SCALED
BASED ON ORIGINAL DRAWING



CONT
WP

STATIC SIGN SUPPORT – FOOTING
DETAILS (GROUND MOUNTED)



SHEET

GENERAL NOTES:

1. CLASS OF CONCRETE 30 MPa.
2. CLEAR COVER TO REINFORCING STEEL 100±25mm.
3. REINFORCING STEEL SHALL BE GRADE 400W UNLESS OTHERWISE SPECIFIED.
4. STRUCTURAL STEEL PLATE SHALL BE ACCORDING TO ASTM A36/A36M-10 OR A572/A572M-10, GRADE 50W.
5. EXCAVATION TO BE DONE NEAT AND CONCRETE PLACED AGAINST UNDISTURBED GROUND.
6. THE TOP OF FOOTINGS SHALL BE FLAT FINISHED TO A TOLERANCE OF ±0.1 DEGREES IN ANY DIRECTION AND WITHIN ±10mm OF THE ELEVATION SHOWN. SURFACE ROUGHNESS SHALL NOT EXCEED 2mm.
7. GROUT BEDDING SHALL NOT BE USED.
8. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH GENERAL CONTRACT DOCUMENTS.

ANCHORAGE NOTES:

1. STEEL ANCHOR STUDS, NUTS, AND HARDENED STEEL WASHERS SHALL BE ACCORDING TO ASTM A449.
2. THE COMPLETE ANCHORAGE ASSEMBLY INCLUDING ANCHOR STUDS, NUTS, AND WASHERS SHALL BE HOT-DIP GALVANIZED.
3. ANCHORING NUTS SHALL BE BROUGHT TO A SNUG TIGHT CONDITION AND THEN FURTHER TIGHTENED 1/3 OF A TURN.
4. EXPOSED PORTION OF STUDS SHALL BE COATED WITH WHITE NON-STAINING GREASE.
5. ANCHORAGE SETTING TEMPLATE TO BE RIGID AND SECURELY HELD IN PLACE TO MAINTAIN POSITION OF ANCHORAGE AND ALLOW FLOAT FINISHING OF TOP OF FOOTING.

NOTES TO DESIGNER:

1. IF SOUND ROCK IS ENCOUNTERED AT A DEPTH OF $Y < L$ FROM THE BOTTOM OF THE FROST LAYER, THIS DIMENSION CAN BE REDUCED TO: $Y + (L - Y)/2$. UPON MINISTRY'S APPROVAL.
2. THE 'DESIGN INFORMATION' TABLE AND 'NOTES TO DESIGNER' SHALL BE DELETED FROM THIS DRAWING PRIOR TO ISSUING.

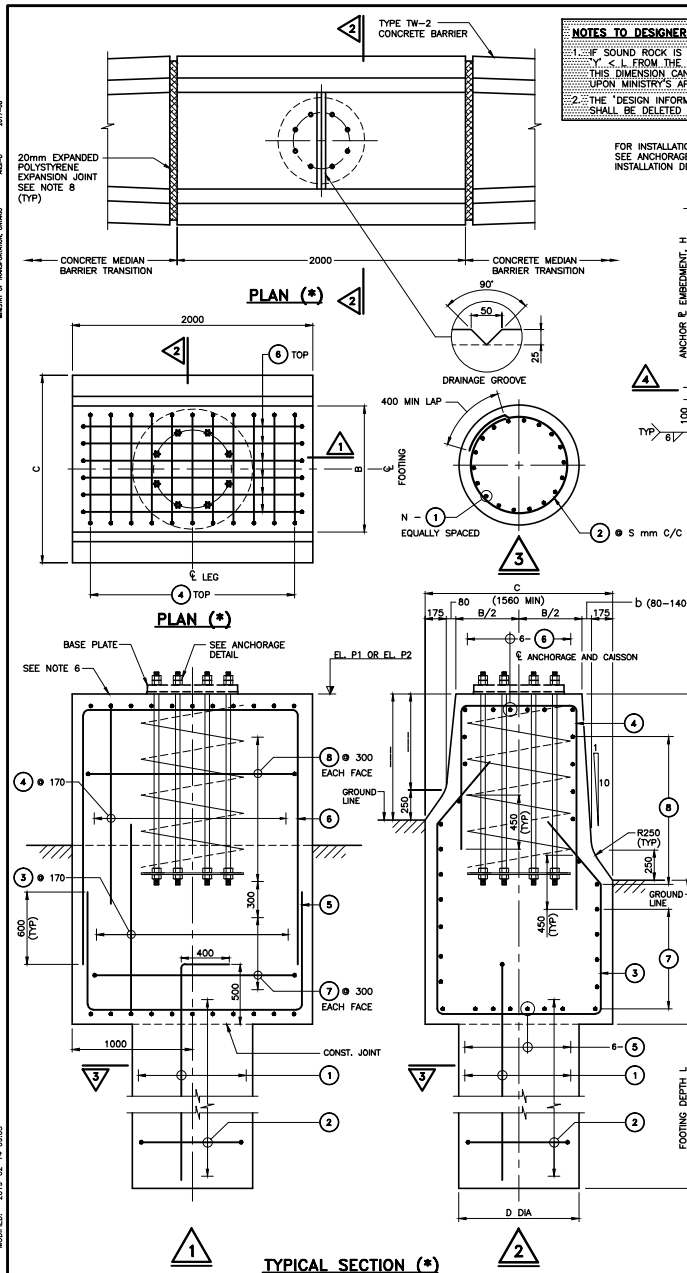
STANDARD DRAWING
FEBRUARY 2019

SS118-3

**STATIC SIGN SUPPORT – FOOTING
DETAILS (GROUND MOUNTED)**

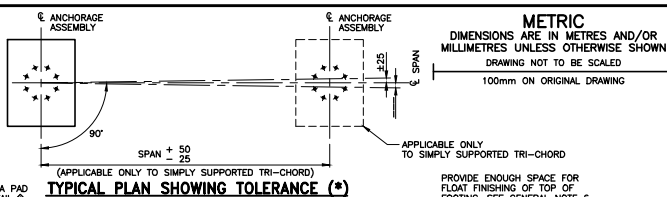
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DESIGN	CHK	CODE	CSA-S6	LOAD	-	DATE
DRAWN	CHK	SITE				DWG.

DATE	BY	DESCRIPTION			
GN	CHK	CODE	CSA-S6	LOAD	DATE

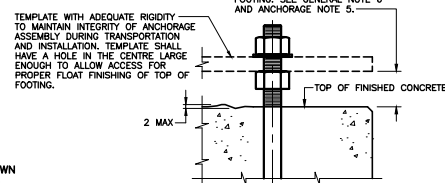


NOTES TO DESIGNER

1. IF SOUND ROCK IS ENCOUNTERED AT A DEPTH OF $Y < L$ FROM THE BOTTOM OF THE FROST LAYER, THIS DIMENSION CAN BE REDUCED TO: $Y + (L - \text{UPON MINISTRY'S APPROVAL})$.
2. THE 'DESIGN INFORMATION' TABLE AND 'NOTES' SHALL BE DELETED FROM THIS DRAWING PRIOR TO



TYPICAL PLAN SHOWING TOLERANCE (*)



ANCHORAGE INSTALLATION DETAIL

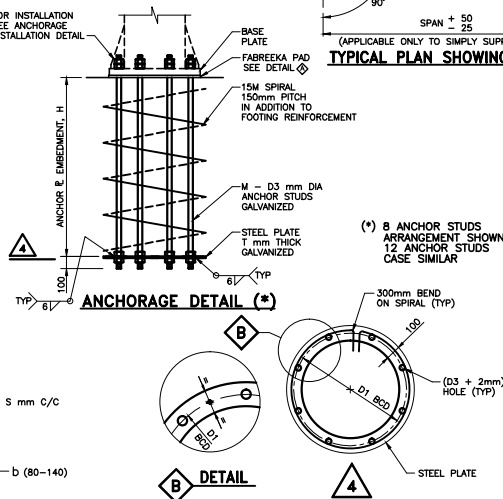


TABLE 1 - FOOTING DIMENSIONS

[illegible]

DESIGN INFORMATION		FOOTING DEPTH L	FOOTING DIAMETER D	No. OF REBARS N	No. OF ANCHORS M	BOLT CIRCLE DIA D1	BASE # DIAMETER D2	ANCHOR DIAMETER D3	ANCHOR # THREADED T	ANCHOR # EMBED. H	RING SPACING S	B
TYPE	CLASS	(mm)	(mm)	(no.)	(no.)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)
TRI-CHORD (TYPE I)	1	5000	1000	18	8	750	900	38	12	1200	300	105
	1	6000	1200	26	8	850	1000	38	12	1200	300	115
TRI-CHORD (TYPE II)	2	6000	1200	26	8	850	1000	38	12	1200	300	115
	3	6400	1200	26	8	950	1100	38	12	1500	300	125
	1	6500	1350	22	12	850	1000	38	15	1200	300	115
CANTILEVER TRI-CHORD	2	6500	1350	22	12	850	1000	44	15	1500	300	115
	3	7500	1350	22	12	900	1100	44	15	1500	275	125
	4	7500	1500	22	12	950	1100	44	15	1500	225	125
	1	5000	1000	18	8	750	900	38	12	1200	300	105
SINGLE CANTILEVER	2	5000	1000	18	8	750	900	38	12	1200	300	105
	3	6000	1200	18	8	750	900	38	12	1200	300	105
	4	6500	1350	22	8	850	1000	44	15	1500	300	115
	1	5500	1000	18	8	750	900	38	12	1200	300	105
BUTTERFLY	2	5500	1000	18	8	750	900	38	12	1200	300	105
	3	6700	1200	18	8	750	900	38	12	1200	300	105
	4	7400	1350	22	8	850	1000	44	15	1500	300	115
POLE MOUNTED VMS	—	6000	1200	15	8	750	900	38	12	1200	300	105

H	 Ministry of Transportation	
	CONT WP	
	STATIC SIGN SUPPORT FOOTING DETAILS (MEDIAN MOUNTED - ASYMMETRICAL)	

GENERAL NOTES:

1. CLASS OF CONCRETE 30 MPa.
2. CLEAR COVER TO REINFORCING STEEL:
 -CAISSON 100±25mm
 -REMAINDER 80±20mm
3. REINFORCING STEEL SHALL BE GRADE 400W UNLESS OTHERWISE SPECIFIED.
4. STRUCTURAL STEEL PLATE SHALL BE ACCORDING TO CAN/CSA-400.20-13/G40.21-13, GRADE 300W.
5. EXCAVATION TO BE DONE NEAT AND CONCRETE PLACED AGAINST UNDISTURBED GROUND.
6. THE TOP OF FOOTINGS SHALL BE FLAT FINISHED TO A TOLERANCE OF ±0.05 DEGREES IN ANY DIRECTION AND WITHIN ±10mm OF THE ELEVATION SHOWN. SURFACE ROUGHNESS SHALL NOT EXCEED 2mm AMPLITUDE.
7. GROUT BEDDING SHALL NOT BE USED.
8. EXPANDED POLYSTYRENE IN EXPANSION JOINT SHALL CONFORM TO C635 51.20 AND BE HELD IN PLACE WITH LIGHT GALVANIZED NAILS.
9. THIS DRAWING TO BE READ IN CONJUNCTION WITH GENERAL ARRANGEMENT DRAWING.
10. THE REINFORCING MAY BE ADJUSTED SLIGHTLY TO ACCOMMODATE THE ANCHOR STUDS.

ANCHORAGE NOTES:

1. STEEL ANCHOR STUDS, NUTS, AND HARDENED STEEL WASHERS SHALL BE ACCORDING TO ASTM A449.
2. THE COMPLETE ANCHORAGE ASSEMBLY INCLUDING ANCHOR STUDS, NUTS, AND WASHERS SHALL BE HOT-DIP GALVANIZED.
3. ANCHORING NUTS SHALL BE BROUGHT TO A SNUG TIGHT CONDITION AND THEN FURTHER TIGHTENED 1/3 OF A TURN.
4. EXPOSED PORTION OF STUDS SHALL BE COATED WITH WHITE NON-STAINING GREASE.
5. ANCHORAGE SETTING TEMPLATE TO BE RIGID AND SECURELY HELD IN PLACE TO MAINTAIN POSITION OF ANCHORAGE AND ALLOW FLOAT FINISHING OF TOP OF FOOTING.

BAR MARK	SIZE	SHAPE
①	25M	400
②	15M	
③	20M	
④	20M	
⑤	20M	
⑥	20M	
⑦	20M	
⑧	20M	

REFER TO 2.4.1 IN THE SIGN SUPPORT MANUAL FOR
PROFESSIONAL ENGINEER STAMPING REQUIREMENTS.

APPLICABLE STANDARD DRAWINGS

OPSD 911.383 GUIDE RAIL SYSTEM, CONCRETE BARRIER PERMANENT
TRANSITION INSTALLATION AT LIGHTING POLE AND
SIGN SUPPORT FOOTINGS

STANDARD DRAWING FEBRUARY 2019	SS118-5
STATIC SIGN SUPPORT - FOOTING DETAILS (MEDIAN MOUNTED - ASYMMETRICAL)	

REVISIONS					
DATE	BY	DESCRIPTION			
DESIGN	CHK	CODE	CSA-S6	LOAD	- DATE
DC-389A	ORIK	COTE.			DWG.

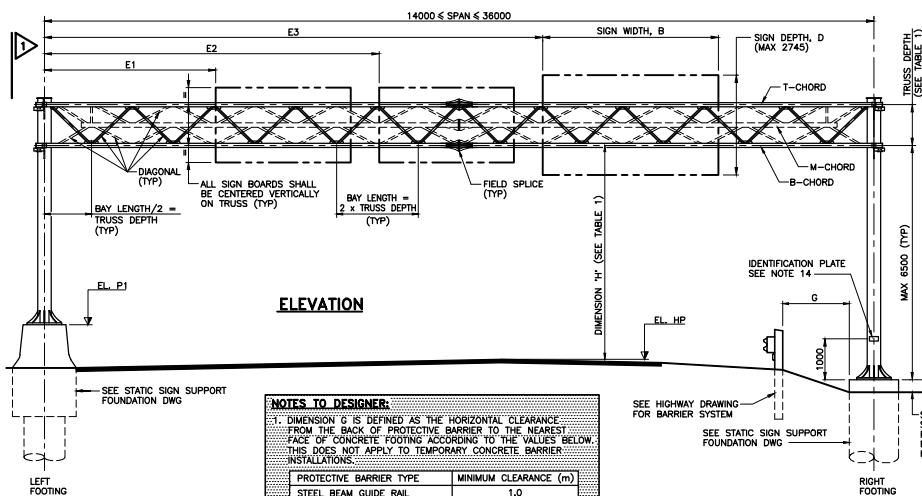
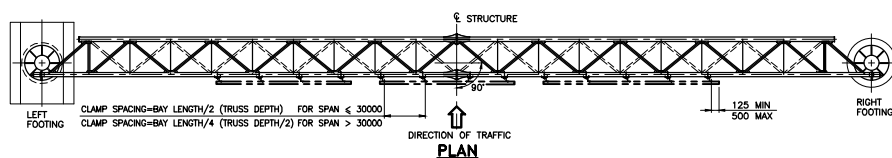
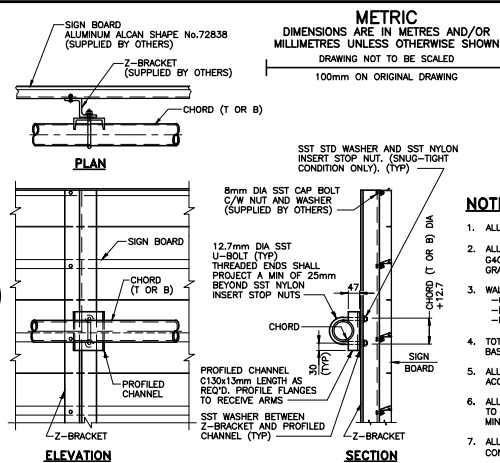


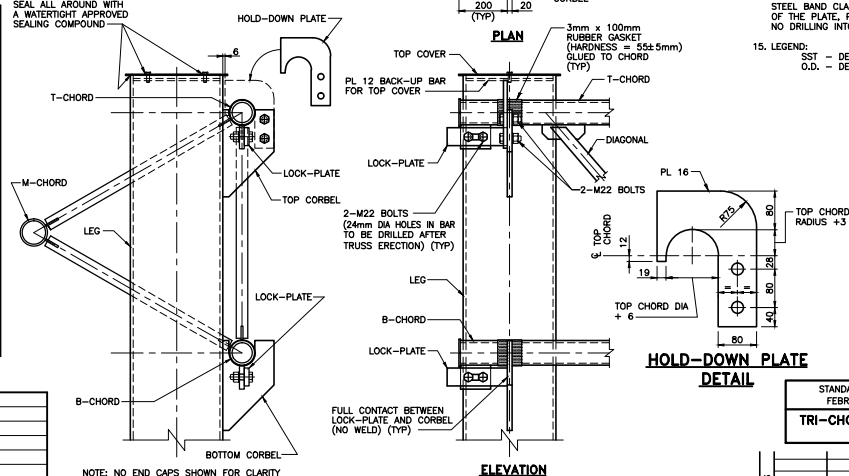
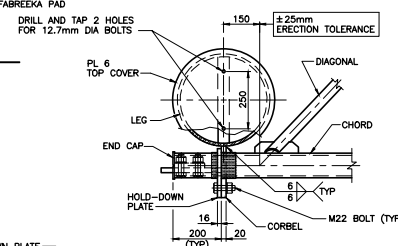
TABLE 1 - GENERAL

[illegible]

TABLE 2 – SIGN BOARD: PARTS/HARDWARE

[illegible]

SIGN CONNECTION DETAIL

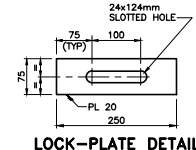


TRUSS TO LEG CONNECTION
TYPICAL DETAIL



NOTES:

1. ALL SECTIONS SHALL BE STRUCTURAL STEEL UNLESS NOTED.
2. ALL STRUCTURAL STEEL SHALL BE ACCORDING TO CAN/CSA C40.21-13 (C40.21-13 GRADE 300I OR ASTM SPECIFICATION A500 GRADE C, OR API-5L-X46 FOR ROUND SECTIONS OF O.D. ≥ 508 mm).
3. WALL THICKNESS OF MEMBERS:
- CHORDS 6.4mm
 - DIAGONALS 3.2mm
 - LEGS 12.7mm
4. TOTAL SIGN BOARD AREA ON STRUCTURE SHALL NOT EXCEED 45m², BASED ON A REFERENCE WIND PRESSURE OF 600 Pa.
5. ALL NON-STAINLESS STEEL BOLTS, NUTS, AND WASHERS SHALL BE ACCORDING TO ASTM A323M AND BE HOT-DIP GALVANIZED UNLESS NOTED.
6. ALL STAINLESS STEEL BOLTS, NUTS, AND WASHERS SHALL BE ACCORDING TO ASTM F593 ALLOY 304 WITH A MINIMUM YIELD OF 480 MPa AND A MINIMUM TENSILE STRENGTH OF 715 MPa.
7. ALL STAINLESS STEEL SHALL BE INSTALLED BY TURN-OF-NUT TIGHTENING IN CONFORMANCE WITH CAN/CSA S6-14.
8. ALL STRUCTURAL STEEL SHALL BE HOT-DIP GALVANIZED AFTER FABRICATION. LEGS ONLY SHALL BE SUBSEQUENTLY COATED WITH AN APPROVED PAINT SYSTEM ACCORDING TO OPS5 911.
9. STRUCTURE SHALL NOT BE ERECTED UNTIL FOUNDATION CONCRETE HAS REACHED 80% OF SPECIFIED STRENGTH.
10. NO SHOP SPICES IN ANY MEMBER. TRUSS FIELD SPICES SHALL BE KEPT TO A MAXIMUM OF 2.
11. CLAMPS SHALL BE POSITIONED NEXT TO NODES.
12. SPAN LENGTHS AND ELEVATIONS TO BE VERIFIED IN THE FIELD BEFORE SIGN SUPPORT STRUCTURE FABRICATION.
13. THIS STANDARD TO BE READ IN CONJUNCTION WITH DRAWINGS SS11B-27, AND/OR SS11B-3, AND/OR SS11B-4, AND/OR SS11B-5.
14. EACH SIGN SUPPORT SHALL HAVE AN IDENTIFICATION MARKING SHOWING THE DATE NUMBER AND THE DATE OF MANUFACTURE. THIS 4mm THICK RECTANGULAR STAINLESS STEEL PLATE SHALL HAVE A RUBBER BACKING, AND BE OF SUFFICIENT DIMENSIONS TO ACCOMMODATE THE REQUIRED INFORMATION. USING THE PLATE MARKING LETTERING, THE PLATE SHALL BE ATTACHED TO THE LEG OF THE STRUCTURE BY MEANS OF STAINLESS STEEL BOLT CLAMPS THAT GO THROUGH VERTICAL HOLES AT EACH SIDE OF THE LEG, PASS BEHIND THE PLATE, AND WRAP AROUND THE LEG. NO DRILLING INTO THE HSS FOR ATTACHMENT OF PLATE IS PERMITTED.
15. LEGEND:
- SS1 - DENOTES STAINLESS STEEL
 - DNVTR - DENOTES

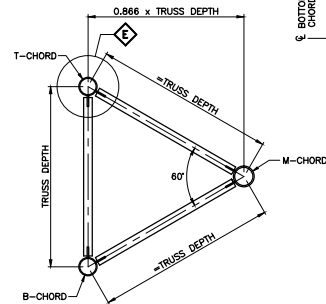
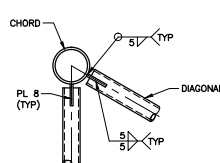


LOCK-PLATE DETAIL

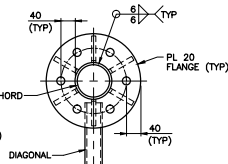
REFER TO 2.4.1 IN THE SIGN SUPPORT MANUAL FOR
PROFESSIONAL ENGINEER STAMPING REQUIREMENTS.

STANDARD DRAWING FEBRUARY 2019	SS118-26
TRI-CHORD STATIC SIGN SUPPORT (TYPE I) GENERAL ARRANGEMENT	

REVISIONS					
	DATE	BY	DESCRIPTION		
DESIGN	CHK	CODE	CSA S6-14 LOAD		- DATE
DRAWN	CHK	STD.			DWG.

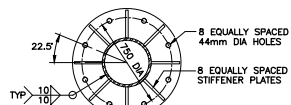
ELEVATION

DETAIL

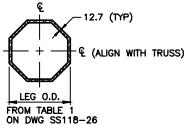


3

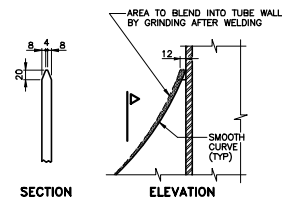
1. TACK WELD STIFFENERS TO CHORDS AND FLANGES INTO POSITION AT EACH CHORD END, IN BOTH TRUSS SEGMENTS.
2. PRE-ASSEMBLE SPLICE CONNECTIONS WITH THE M22 BOLTS, MAINTAINING PROPER ALIGNMENT OF THE TRUSS.
3. WELD STIFFENERS TO CHORDS AND FLANGES. WELDING SHOULD BE BALANCED AROUND THE NEUTRAL AXIS OF THE CHORDS TO MINIMIZE DISTORTION AND SHRINKAGE.



4 BASE DETAIL



ALTERNATIVE LEG SECTION

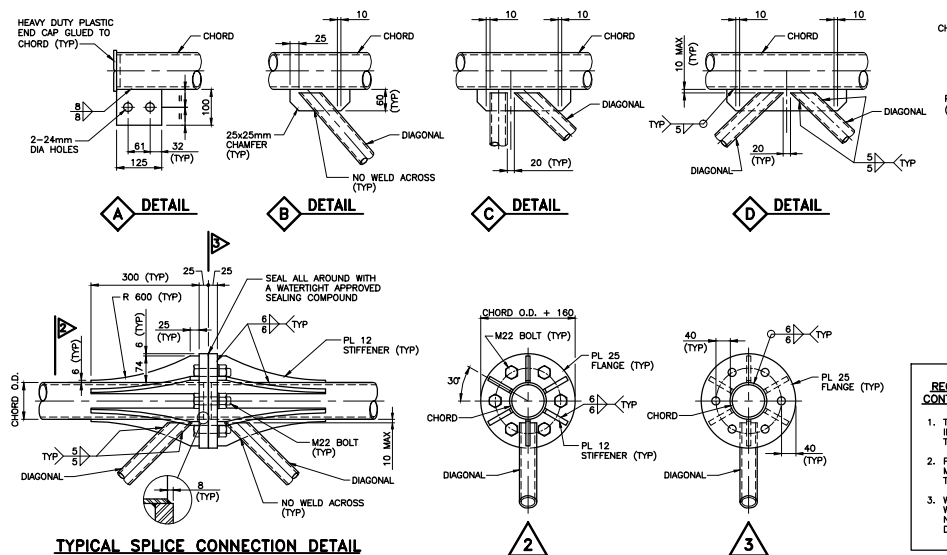


ELEVATION

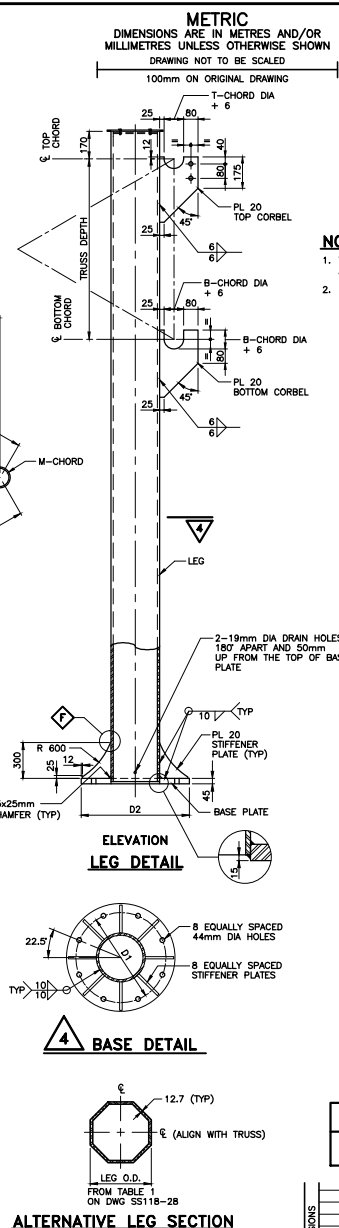
DETAIL

STANDARD DRAWING FEBRUARY 2019	SS118-27
TRI-CHORD STATIC SIGN SUPPORT (TYPE STRUCTURE ASSEMBLY DETAILS	

REVISIONS					
	DATE	BY	DESCRIPTION		
DESIGN	CHK		CODE	CSA S6-14	LOAD - DATE
DRAWN	CHK		SITE		DWG



1. TACK WELD STIFFENERS TO CHORDS AND FLANGES INTO POSITION AT EACH CHORD END, IN BOTH TRUSS SEGMENTS.
2. PRE-ASSEMBLE SPLICE CONNECTIONS WITH THE M22 BOLTS, MAINTAINING PROPER ALIGNMENT OF THE TRUSS.
3. WELD STIFFENERS TO CHORDS AND FLANGES. WELDING SHOULD BE BALANCED AROUND THE NEUTRAL AXIS OF THE CHORDS TO MINIMIZE DISTORTION AND SHRINKAGE.



1. THIS STANDARD TO BE READ IN CONJUNCTION WITH DRAWINGS SS118-28, AND/OR SS118-3, AND/OR SS118-4, AND/OR SS118-5.

2. LEGEND:
SST - DENOTES STAINLESS STEEL

SECTION

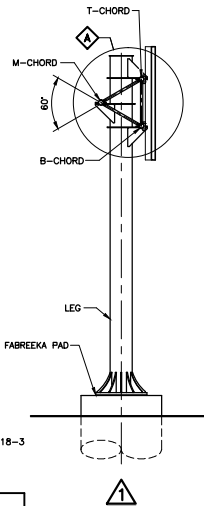
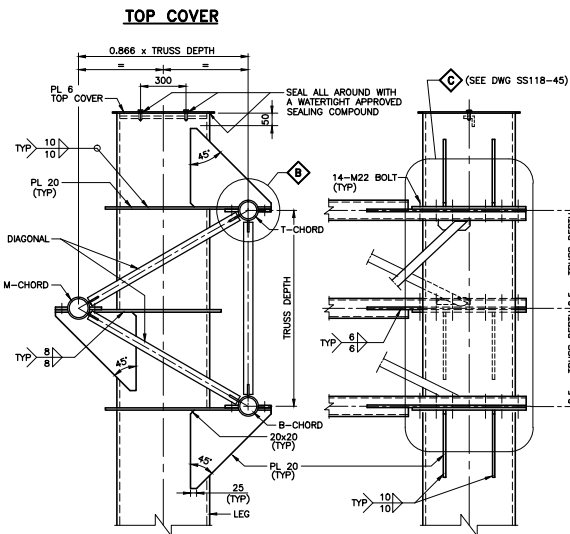
ELEVATION

DETAIL

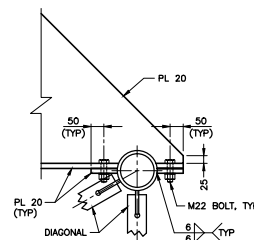
REFER TO 2.4.1 IN THE SIGN SUPPORT MANUAL FOR PROFESSIONAL ENGINEER STAMPING REQUIREMENTS

STANDARD DRAWING FEBRUARY 2019	SS118-29
TRI-CHORD STATIC SIGN SUPPORT (TYPE II) STRUCTURE ASSEMBLY DETAILS	

REVISIONS						
	DATE	BY	DESCRIPTION			
DESIGN	CHK		CODE	CSA S6-14	LOAD	DATE
DRAWN	CHK		SITE			DWG

[illegible][illegible]

A TRUSS TO LEG CONNECTION
DETAIL



DETAIL

 Ontario Ministry of Transportation	
CONT WP	
CANTILEVER TRI-CHORD STATIC SIGN SUPPORT GENERAL ARRANGEMENT	SHEET

1. ALL SECTIONS SHALL BE STRUCTURAL STEEL UNLESS NOTED.

2. ALL STRUCTURAL STEEL SHALL BE ACCORDING TO CAN/CSA-C40-200/13/G40.21-13 GRADE 300W OR ASTM SPECIFICATION A500 GRADE C OR APLI-5X46 FOR ROSTM SECTION OF D.2 508mm.

3. TOTAL SIGN BOARD AREA ON STRUCTURE SHALL NOT EXCEED 26m², BASED ON A REFERENCE WIND PRESSURE OF 600 Pa.

4. ALL NON STAINLESS STEEL BOLTS, NUTS AND WASHERS SHALL BE ACCORDING TO ASTM A325M AND BE HOT-DIP GALVANIZED UNLESS NOTED.

5. ALL STAINLESS STEEL BOLTS, NUTS AND WASHERS SHALL BE ACCORDING TO ASTM A325M AND HAVE A MINIMUM TENSILE STRENGTH OF 480 MPa AND A MINIMUM TENSILE STRENGTH OF 715 MPa.

6. ALL NON STAINLESS STEEL BOLTS SHALL BE INSTALLED BY TURN UP NUT TIGHTENING IN CONFORMANCE WITH CAN/CSA S8-06.

7. ALL STRUCTURAL STEEL SHALL BE ESTIMATED OR PAULVANZATED AFTER FABRICATION, LEGS ONLY SHALL BE SUBSEQUENTLY COATED WITH AN APPROVED PAINT SYSTEM ACCORDING TO OPS3 911.

8. STRUCTURE SHALL NOT BE ERECTED UNTIL FOUNDATION CONCRETE HAS REACHED ITS DESIGN SPECIFIED STRENGTH.

9. NO SHOP SPLICES IN ANY MEMBER, TRUSS FIELD SPLICES SHALL BE KEPT TO A MAXIMUM OF 1.

10. CLAMPS SHALL BE POSITIONED NEXT TO NODES.

11. SPAN LENGTHS AND ELEVATIONS TO BE VERIFIED IN THE FIELD BEFORE SUPPLYING STRUCTURE.

12. THIS STANDARD TO BE READ IN CONJUNCTION WITH SS118-44, AND/ OR SS118-45, AND/OR SS118-3, AND/OR SS118-4, AND/OR SS118-5.

13. EACH SIGN SUPPORT SHALL HAVE AN IDENTIFICATION MARKING SHOWING THE SITE AND THE LOCAL REFERENCE WIND PRESSURE AS SHOWN IN TABLE 1, THE MANUFACTURER'S NAME OR TRADEMARK, AND THE DATE OF MANUFACTURE. THIS IDENTIFICATION MARKING SHALL BE ATTACHED TO THE LEG OF THE STRUCTURE BY MEANS OF SUFFICIENT DIMENSIONS TO ACCOMMODATE THE REQUIRED INFORMATION USING A MINIMUM GALVANIZED STEEL PLATE. THE PLATE SHALL BE ATTACHED TO THE LEG OF THE STRUCTURE BY MEANS OF STAINLESS STEEL BOLT CLAMPS THAT GO THROUGH VERTICAL HOLES AT EACH SIDE OF THE PLATE BEHIND THE STRUCTURE.

14. NO DRILLING INTO THE HSS FOR ATTACHMENT OF PLATE IS PERMITTED.

14. LEGEND:

EST - DENOTES STAINLESS STEEL

O.D. - DENOTES OUTSIDE DIAMETER

T-CHORD - DENOTES TOP-CHORD

M-CHORD - DENOTES MIDDLE-CHORD

B-CHORD - DENOTES BOTTOM-CHORD

1. DIMENSION G IS DEFINED AS THE HORIZONTAL CLEARANCE FROM THE BACK OF PROTECTIVE BARRIER TO THE NEAREST FACE OF CONCRETE FOOTING ACCORDING TO THE VALUES BELOW. THIS DOES NOT APPLY TO TEMPORARY CONCRETE BARRIER INSTALLATIONS.

2. THE 'NOTES TO DESIGNER' SHALL BE DELETED FROM
THIS DRAWING PRIOR TO ISSUING.

REFER TO 2.4.1 IN THE SIGN SUPPORT MANUAL FOR PROFESSIONAL ENGINEER STAMPING REQUIREMENTS.

STANDARD DRAWING FEBRUARY 2019	SS118-43
CANTILEVER TRI-CHORD STATIC SIGN SUPPORT GENERAL ARRANGEMENT	

REVISIONS					
	DATE	BY	DESCRIPTION		
DESIGN	CHK		CODE	CSA S6-06	LOAD - DATE
DRAWN	CHK		SITE		DWG.

DETAIL

DETAIL

DETAIL

DETAIL

E **DETAIL**

1

METRIC
DIMENSIONS ARE IN METRES AND/OR
MILLIMETRES UNLESS OTHERWISE SHOWN
DRAWING NOT TO BE SCALED
100mm ON ORIGINAL DRAWING



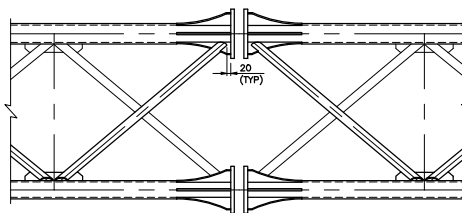
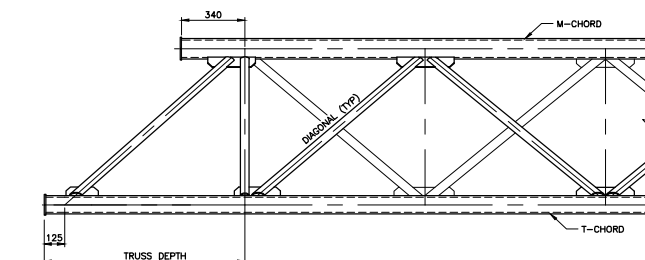
CONT
WP

**CANTILEVER TRI-CHORD STATIC
SIGN SUPPORT
STRUCTURE ASSEMBLY DETAILS**

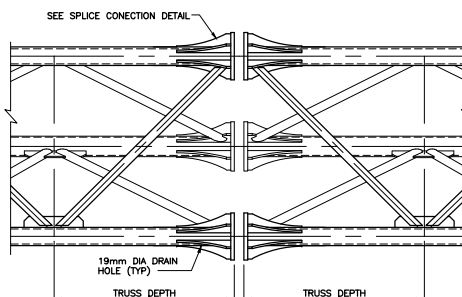
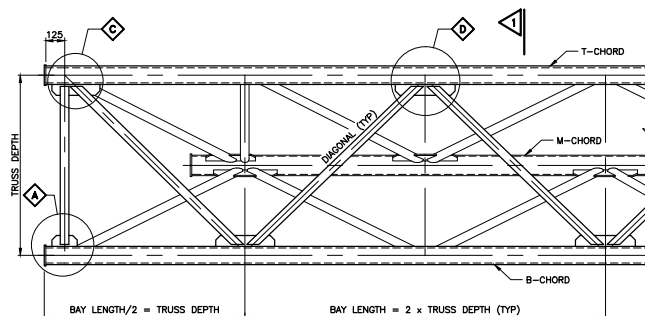
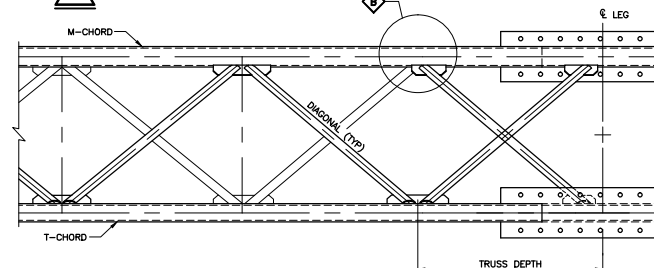
SHEET

NOTES:

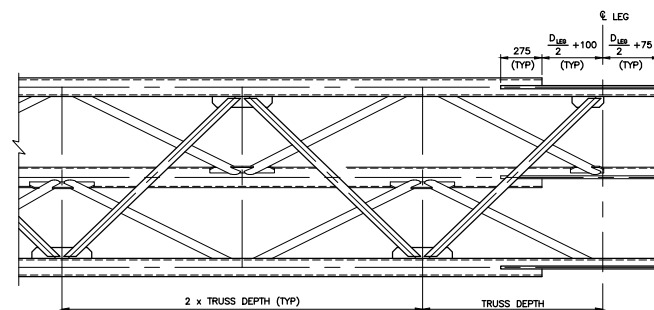
1. THIS STANDARD TO BE READ IN CONJUNCTION WITH DRAWINGS
SS118-43, AND SS118-45, AND/OR SS118-3, AND/OR SS118-4,
AND/OR SS118-5.
2. LEGEND:
- SST - DENOTES STAINLESS STEEL
- D_{LEG} - O.D. OF LEG



PLAN VIEW

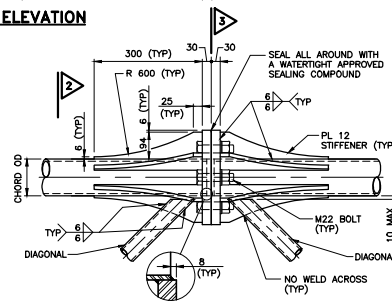


ELEVATION



2

3



TYPICAL SPLICE CONNECTION DETAIL
(SEE RECOMMENDED FABRICATION PROCEDURE)

RECOMMENDED FABRICATION PROCEDURE TO CONTROL DISTORTION AT SPLICE CONNECTIONS:

1. TACK WELD STIFFENERS TO CHORDS AND FLANGES INTO POSITION AT EACH CHORD END, IN BOTH TRUSS SEGMENTS.
2. PRE-ASSEMBLE SPLICE CONNECTIONS WITH THE M22 BOLTS, MAINTAINING PROPER ALIGNMENT OF THE TRUSS.
3. WELD STIFFENERS TO CHORDS AND FLANGES. WELDING SHOULD BE BALANCED AROUND THE NEUTRAL AXIS OF THE CHORDS TO MINIMIZE DISTORTION AND SHRINKAGE.

REFER TO 2.4.1 IN THE SIGN SUPPORT MANUAL FOR PROFESSIONAL ENGINEER STAMPING REQUIREMENTS.

STANDARD DRAWING
FEBRUARY 2019

SS118-44

**CANTILEVER TRI-CHORD STATIC SIGN SUPPORT
STRUCTURE ASSEMBLY DETAILS I**

REVISIONS									
	DATE	BY	DESCRIPTION						
DESIGN	CHK		CODE	CSA	S6-06	LOAD	-	DATE	
DRAWN	CHK		SITE					DWG.	

REVISIONS					
	DATE	BY	DESCRIPTION		
DESIGN	CHK	CODE	CSA S6-06	LOAD	- DATE
DRAWN	CHK	SUT			DWG.

SIGN SUPPORT MANUAL

SECTION 5 – STEEL COLUMN SIGN SUPPORTS

**THIS SECTION HAS BEEN REMOVED
FROM THE MANUAL**

SIGN SUPPORT MANUAL

SECTION 6 – TIMBER SIGN SUPPORTS

**THIS SECTION HAS BEEN REMOVED
FROM THE MANUAL**

SIGN SUPPORT MANUAL

SECTION 7 – OVERHEAD MONOTUBE SIGN SUPPORTS

February 2019

7 OVERHEAD MONOTUBE SIGN SUPPORTS

7.1 GENERAL

7.1.1 STANDARD SIGN SUPPORTS

Standard overhead monotube sign supports are used to support static lane-designation signs. The sign supports are fabricated in galvanized structural steel and designed to the requirements of the CAN/CSA-S6-06 (CHBDC).

The sign supports contained in this Section are designed for sign boards and site conditions that meet the following criteria:

- (a) Maximum sign size to be 1.2 m by 1.2 m.
- (b) Supporting one under mounted sign or up to four evenly spaced front mounted signs.
- (c) Design span length ranging from 13.5 m to and including 24.0 m.
- (d) Maximum allowable column height to be 7.7 m. Since members are custom fabricated for each installation, any span-height combination is allowed.
- (e) Reference wind pressure to be 600 Pa at a return period of 50 years. The effect of wind tunnelling as stated in CHBDC 3.10.1.2 is not considered.
- (f) Competent soil conditions excluding rock fill.

7.1.2 TYPES OF SIGN SUPPORTS

There are two types of steel monotube overhead sign supports:

- TYPE I - Front Mounted Signs, Standard Drawing SS118-40:
For cases where the signs are to be viewed by traffic in one direction only. The signs are attached at their mid height to the horizontal support member.
- TYPE II - Under Mounted Signs, Standard Drawing SS118-41:
For cases where the sign is to be viewed by traffic in both directions, such as a single sign designating a "centre lane for left turns only". This type of sign is suspended below the level of the horizontal support member.

Figures 7.1.2(a) and (b) illustrate these types of sign support structures.

Under mounted signs are more economically supported by cables suspended from guyed poles, rather than by horizontal support members, as illustrated in Figure 7.1.2(c). Therefore, the suspended cable/guyed pole arrangement should be specified, unless:

- (i) The standard monotube design is used for lane designation signs in the same vicinity.

- (ii) Where the guying of poles is not practical.
- (iii) When the monotube support is preferable for aesthetic reasons, and is approved by the Head, Regional Planning and Design.

7.1.3 LIMITATIONS

For economic and practical reasons these supports should be placed as close as possible to the edge of the travelled portion of the roadway (see Section 7.1.6). Therefore, these supports will probably be in the Clear Recovery Zone and should be protected, as discussed in Section 2.6.

Under mounted signs should not be used in combination with front mounted signs. Each structure may support one under mounted sign or up to four front mounted signs.

Unless protected from traffic, overhead monotube sign supports are limited to use on highways where the posted speed does not exceed 70 km/h.

SIGN SUPPORT MANUAL

2019 02 15

OVERHEAD MONOTUBE SIGN SUPPORTS

PAGE 7 - 3

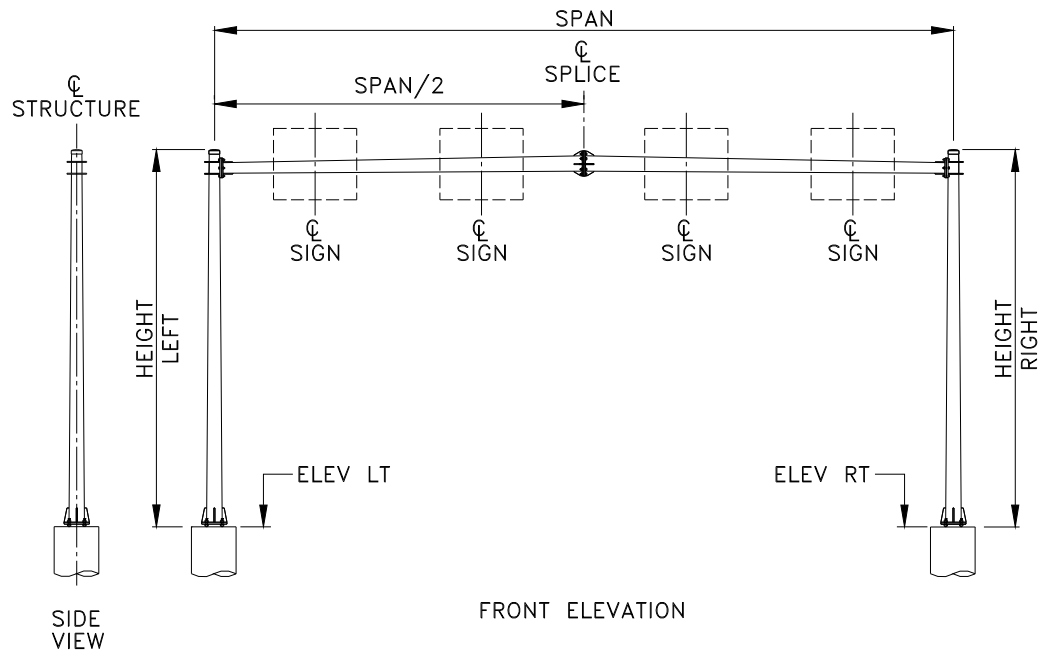


FIGURE 7.1.2(a) TYPE I – FRONT MOUNTED

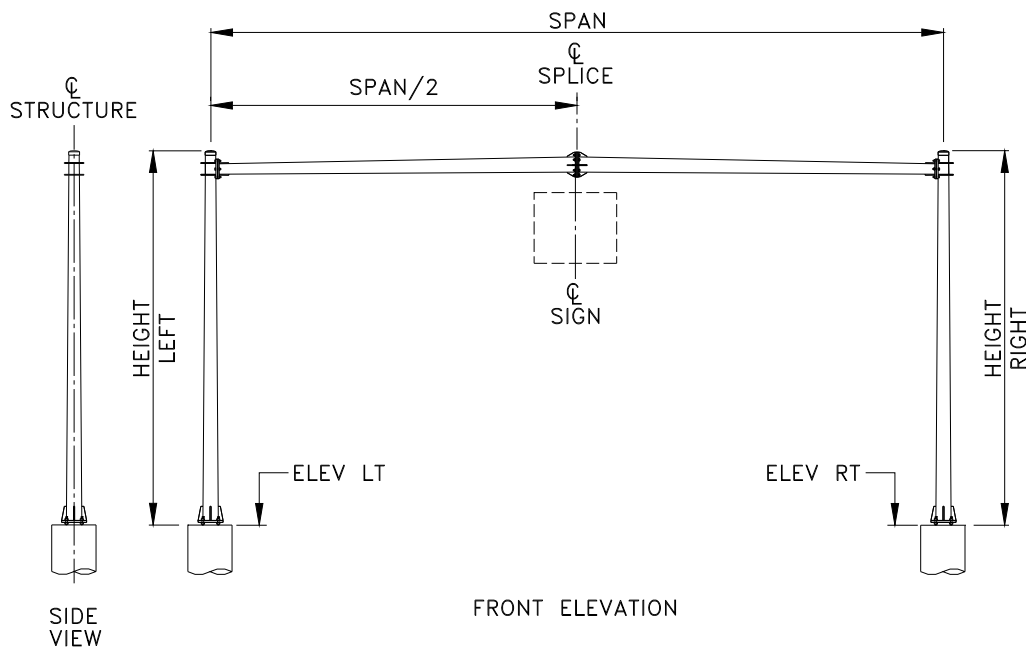


FIGURE 7.1.2(b) TYPE II – UNDER MOUNTED

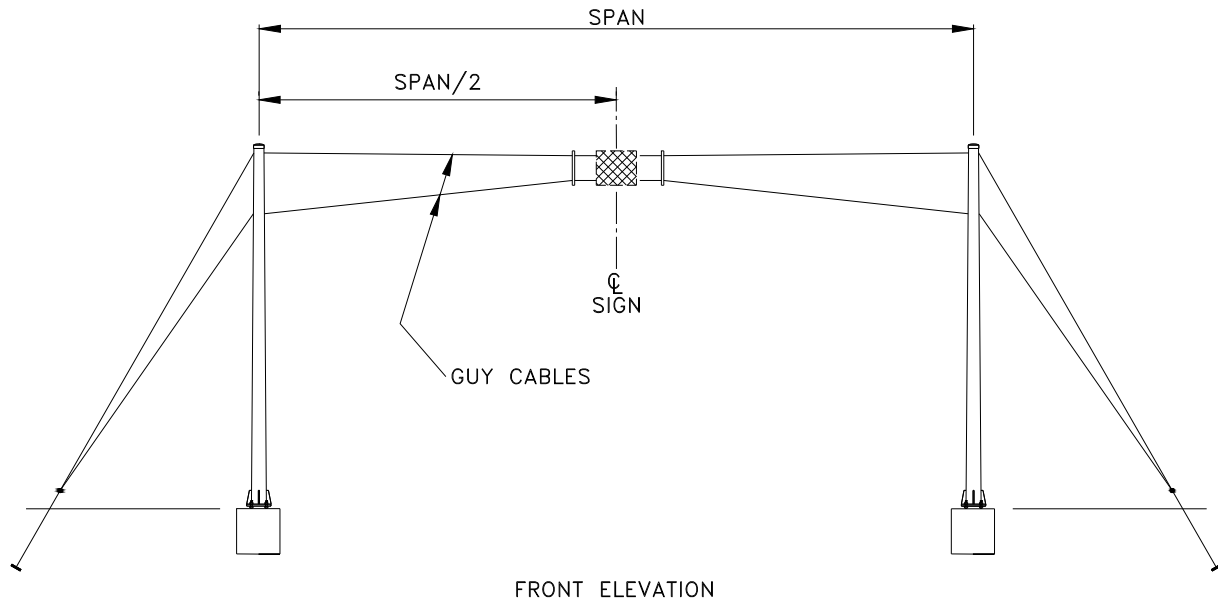


FIGURE 7.1.2(c) SIGN SUPPORT DETAILS

7.1.4 DESCRIPTION OF SIGN SUPPORTS

The supports are made up of four tapered, octagonal, galvanized steel members. Each member tapers uniformly 280 mm to 190 mm, outside face, across flats.

There are three types of connections between sign support members:

- i. Base Plate Connection - connecting the leg to the concrete footing.
- ii. Corner Connection - connecting the horizontal support member to the legs.
- iii. Mid-span Connection - connecting the two components of the horizontal support member at or near midspan.

Each type of connection has been standardized for all spans in the allowable range, and no selection or additional data is necessary.

Signs are attached to supports by means of brackets welded to the horizontal support member.

Horizontal support members are fabricated with lugs along the centre line of the top surface for attaching the aerodynamic device to reduce the occurrences of wind induced vertical vibration.

7.1.5 FOOTINGS

Footings consist of reinforced concrete cast in augered holes. Details of footings are shown on the standard drawings.

The indicated footing depth is based on relatively competent soils of uniform composition. The soil types considered in the design were either cohesionless with a minimum angle of internal friction of 30°, or cohesive with a minimum shear strength of 50 kPa.

Encountered soil conditions such as rock fill, land fill, and soft material are not covered here, and require the footing to be designed by an Engineer.

7.1.6 CLEARANCE

The legs of the sign support structure should be located as close to the traffic barriers as possible, but the minimum horizontal clearance from the back of traffic protection barrier to the nearest face of sign support footing shall not be less than the values specified in Figure A3.2 (see Appendix 3 to Section 3).

SIGN SUPPORT MANUAL

2019 02 15

OVERHEAD MONOTUBE SIGN SUPPORTS

PAGE 7 - 6

When the legs of sign support structures are not protected from traffic, they shall be located beyond the clear recovery zone, as specified in the Roadside Design Manual.

The minimum vertical clearance from the highest point on the highway, including shoulders, curbs, and medians, to the bottom of a signboard shall not be less than 5300 mm, and not less than 5600 mm to the lowest structural member of the sign support structures, as specified in the MTO Design Supplement for TAC Geometric Design Guide for Canadian Roads, 2017.

7.2 PREPARATION OF DRAWINGS**7.2.1 GENERAL**

If the supply and erection of the support is to be part of the contract, Standard Drawings SS118-40 and/or SS118-41 and SS118-42 must be used.

7.2.2 DATA REQUIRED

The sign support structure designer shall obtain information from the Regional Offices for the location, site number, span length, location, elevations and sizes of sign boards etc. of each sign support to be constructed. The designer shall prepare and complete the design standard drawings for the structures and its foundations that will be part of the contract documents. Design drawings shall show the following information.

- (i) A key plan, indicating the approximate location of each support.
- (ii) The Site number.
- (iii) The support span, measured from centreline to centreline of leg; should be rounded up to the nearest half metre unless there is a restriction on the leg location.
- (iv) The control line of the roadway and the offset of the leg from the control line.
- (v) The elevation of the highest point on the roadway surface under the support structure.
- (vi) The location, size, and type of the signs with a clear indication as to whether front mounted signs or a single under mounted sign shall be installed. This information should be shown on a working print since it is not needed on the contract drawings. The vertical and horizontal dimensions of each sign must be shown together with the distance from the centreline of the signs to the centreline of the leg. If the signs are to carry directional arrows, these should be shown diagrammatically on the drawing.
- (vii) The vertical dimension measured from the highest point on the roadway surface to the lowest bottom edge of the signs. This is normally 5300 mm but may be slightly more in order to allow for a future change in pavement elevation.

SIGN SUPPORT MANUAL

2019 02 15

OVERHEAD MONOTUBE SIGN SUPPORTS

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- (viii) The elevation of the ground line at each footing.
- (ix) The top of footing elevation. The footings must be no more than 200 mm above the finished grade for safety reasons, nor less than 75 mm to ensure drainage.
- (x) The offset of the centreline of footing from the control line, either as note or as a dimension.
- (xi) The station of the support structure on a designated highway centreline or control line.
- (xii) A designation for each footing as a "Left footing" or "Right footing". Left and Right for this purpose are defined as if looking in the direction of the traffic that will be viewing the signs. All elevations of the support should be marked "FRONT VIEW" and must be drawn accordingly, with the right footing on the right, etc. When a sign, or signs, on the support are to be read from either side, that is, traffic travelling in both directions passes under the support structure, the view should be drawn looking in the direction of increasing chainage. This should be noted under the title of "FRONT VIEW". In such cases, the footings should also be marked with reference to the north point as a check.
- (xiii) Unusual requirements must be clearly noted; for example, "front mounted" signs which are to be on the back of the support, or signs which are to be asymmetrically positioned in relation to the horizontal centreline.

7.2.3 STRUCTURE DRAWINGS

There are three Standard Drawings for these supports; the Appendix contains reduced size prints of these Standard Drawings, showing what information needs to be added. The Contract and W.P. numbers should be added to the title block. The sheet number is added when the drawings for the entire contract are assembled. Up to 6 sign supports can be detailed on one sheet.

Standard Drawing SS118-40 is for supports carrying front mounted signs. All required data in the tables could generally be obtained directly from the key plan and frame dimension drawing described earlier. The "MESSAGE" column is to show diagrammatically the sign content, such as direction arrows, for the information of the District staff, because the signs are not included in the contracts. The column height is measured from the top of footing to the top of column.

Standard Drawing SS118-41 is for supports carrying an under mounted sign to be seen from either traffic direction. The signboard and the splice joint are generally located at or very close to the middle of the span. There is only one table to be filled in the standard drawing to show all the design information of the sign support structure. The MESSAGE, however, contains two columns to show the content at the front and the rear of the signboard.

When the highway layout is simple, the location of the supports and their footings can be shown adequately on the standard drawing. In this case, it is not necessary to make the key plan and frame dimension drawing part of the contract documents. If this is not the case, add a note referring to that drawing, and cross out the location sketch and the X and Y columns on the standard.

The Standard Drawings shall be sealed, dated, and signed according to Section 2.4.1.

7.3 MAINTENANCE AND INSPECTION

All components shall be inspected and maintained according to the "Sign Supports Inspection Guideline".

Long-term durability of sign supports is dependent on routine maintenance and inspection. In order to prevent corrosion damage and fatigue problems to the anchorage assembly, the following shall be ensured:

- (i) The base of the vertical support leg shall be kept free from dirt and debris
- (ii) The base plate and arm connection welds shall be inspected regularly for fatigue cracking
- (iii) The anchor bolts connection shall be checked periodically for tightening

7.4 DESIGN INFORMATION

Design and detailing data contained in this Section conforms to the requirements of the Canadian Highway Bridge Design Code CAN/CSA-S6-06 unless otherwise stated.

Calculations are based on Standard CAN/CSA-G40.20-13/G40.21-13 Grade 300W for structural steel, 30 MPa for concrete, and Grade 400W reinforcing steel for footings.

Dead load deflection is compensated by cambering the horizontal support as shown in the drawing.

Fatigue wind loads are obtained from AASHTO – Standard Specifications for Structural Supports for Highways Signs, Luminaires and Traffic Signals, 4th Edition, 2001. It is based on NCHRP Report 412, “Fatigue Resistance Design of Cantilever Signal, Sign and Light Supports”.

A baffle plate is mounted on top of the centreline of the Monotube sign support in order to minimize the dynamic effects of across-wind loads induced by vortex shedding excitation.

SIGN SUPPORT MANUAL

2019 02 15

OVERHEAD MONOTUBE SIGN SUPPORTS

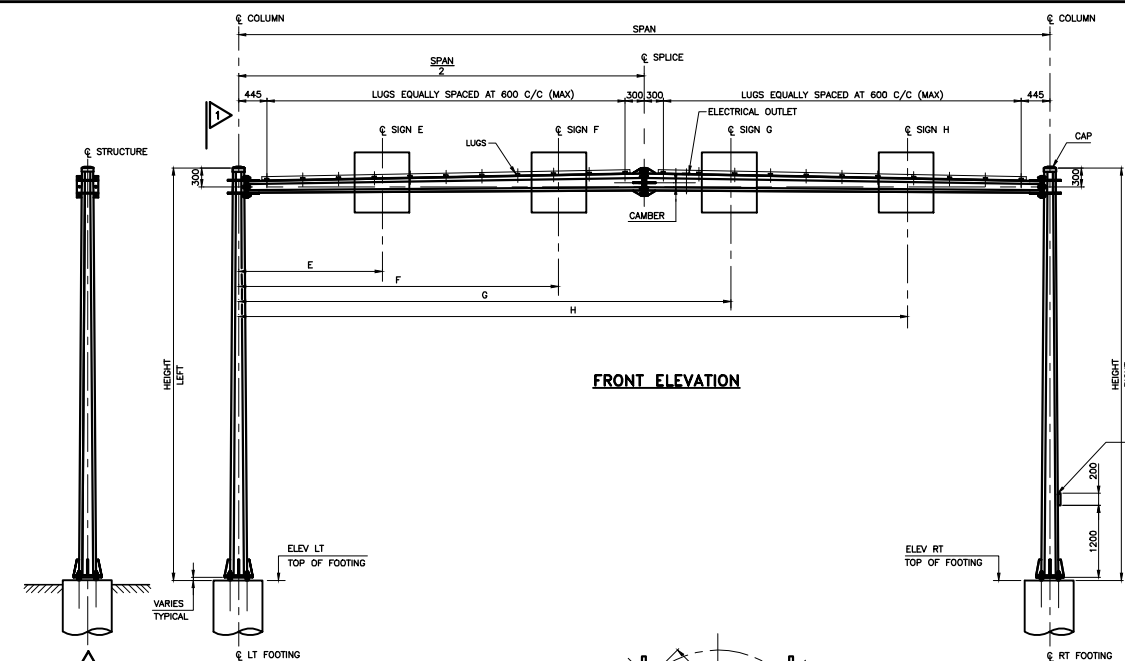
PAGE 7 - 11

APPENDIX TO SECTION 7

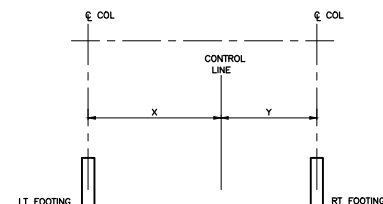
STEEL MONOTUBE SIGN SUPPORTS

SS118-40	STEEL MONOTUBE SIGN SUPPORT – TYPE I GENERAL ARRANGEMENT
SS118-41	STEEL MONOTUBE SIGN SUPPORT – TYPE II GENERAL ARRANGEMENT
SS118-42	STEEL MONOTUBE SIGN SUPPORT DETAILS

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FRONT ELEVATION



FRONT ELEVATION
FOOTING LAYOUT DETAILS

METRIC
DIMENSIONS ARE IN METRES AND/OR
MILLIMETRES UNLESS OTHERWISE SHOWN
DRAWING NOT TO BE SCALED
100mm ON ORIGINAL DRAWING

Ministry of
Transportation

CONT
WP

STEEL MONOTUBE
SIGN SUPPORT - TYPE I
GENERAL ARRANGEMENT

	SHEET
--	-------

GENERAL NOTES:

1. SIGN SUPPORT SHALL BE ERECTED PERPENDICULAR TO CENTRE LINE OF HIGHWAY OR AS DIRECTED BY THE ENGINEER.
2. FOOTING SHALL BE BUILT IN ACCORDANCE WITH OPSS 904, CLASS OF CONCRETE 30MPa, REINFORCING STEEL SHALL BE GRADE 60.
3. CONCRETE SHALL BE PLACED ON UNDISTURBED GROUND IN AN AUGERED HOLE.
4. CLEAR COVER TO REINFORCING STEEL SHALL BE 100±25mm EXCEPT AS NOTED.
5. TOP OF FOOTING SHALL BE STEEL FLOAT FINISH, DEAD LEVEL.
6. SIGN BRACKETS AND ELECTRICAL OUTLETS ARE TYPICAL AT ALL SIGN LOCATIONS.
7. ALL NUTS, INCLUDING UPPER NUTS OF ANCHOR STUDS, SHALL BE TIGHTENED BY TURN-OF-NUT METHOD IN CONFORMANCE WITH CAN/CSA S6-06.
8. THIS DRAWING TO BE READ IN CONJUNCTION WITH DRAWING NOS. SS116-42.
9. CONDUIT SLEEVE SHALL BE RIGID PVC 75mm I.D., 90° BEND SPECIFIED CAT. NO. NSL-3-224 OR EQUAL.
10. STEEL FOR EACH FOOTING TO BE BENDED SEPARATELY AND MARKED WITH STATION NUMBER.

ANCHORAGE NOTES:

1. ANCHORAGE STRUTS AND COILS TO BE SAE STANDARD 1030 STEEL.
2. HIGH TENSILE STUDS TO BE ASTM SPECIFICATION A4140, A193, GRADE B-7 STEEL.
3. STEEL HEXAGON NUTS AND HARDENED STEEL WASHERS SHALL BE IN ACCORDANCE WITH ASTM SPECIFICATION A325.
4. THE COMPLETE ANCHORAGE ASSEMBLY INCLUDING STUDS, NUTS, AND WASHERS SHALL BE HOT-DIP GALVANIZED.
5. EXPOSED PORTION OF STUDS SHALL BE COATED WITH NON-STAINING GREASE.
6. AN 18.5mm THICK FLYWOOD SETTING TEMPLATE SHALL BE PROVIDED FOR AN ACCURATE POSITIONING OF ANCHORAGE WITHIN THE CONCRETE PILE.

TABLE OF SIGN DATA

[illegible]

TABLE OF SUPPORT DIMENSIONS

[illegible]

REFER TO 1.1.8 IN THE STRUCTURAL MANUAL FOR
PROFESSIONAL ENGINEER STAMPING REQUIREMENTS.

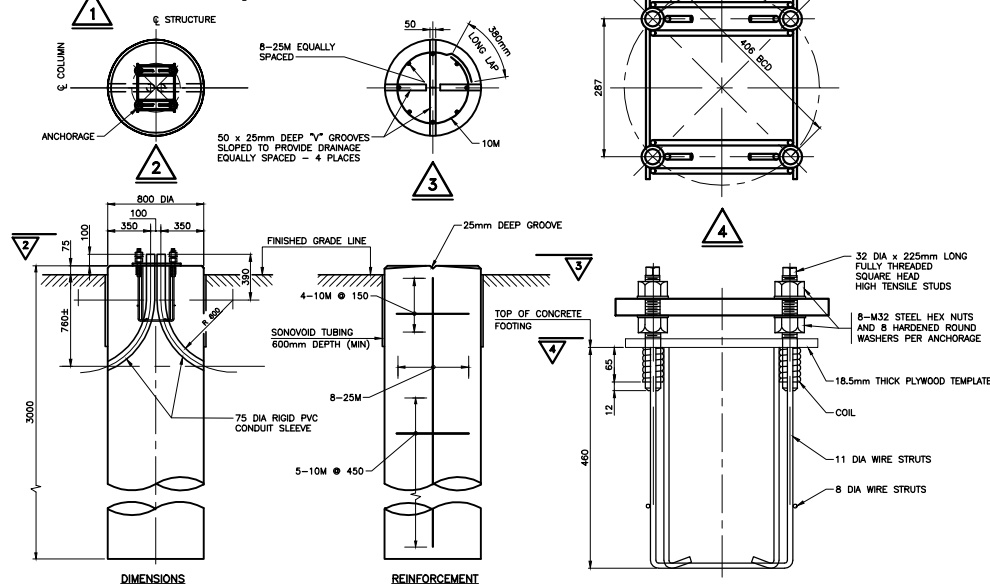
STANDARD DRAWING
FEBRUARY 2019
**STEEL MONOTUBE
GENERA**

SS118-40

**STEEL MONOTUBE SIGN SUPPORT
GENERAL ARRANGEMENT**

QUANTITIES PER FOOTING

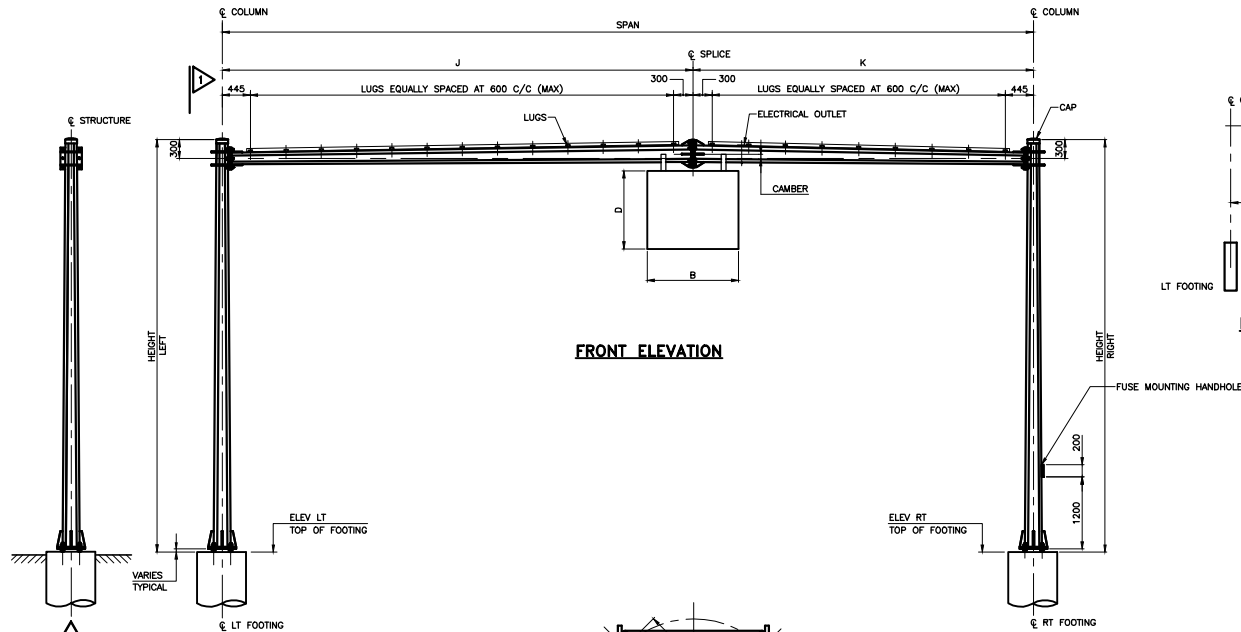
WEIGHT OF REINFORCING STEEL - TONNES	0.09	VOLUME OF CONCRETE CUBIC METRES	1.4
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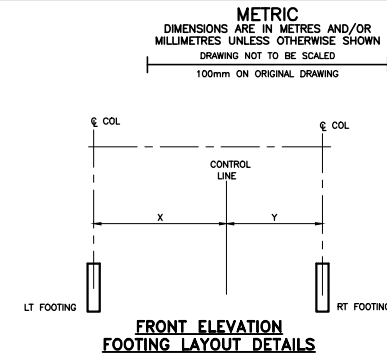
FOOTING DETAILS

ANCHORAGE DETAILS

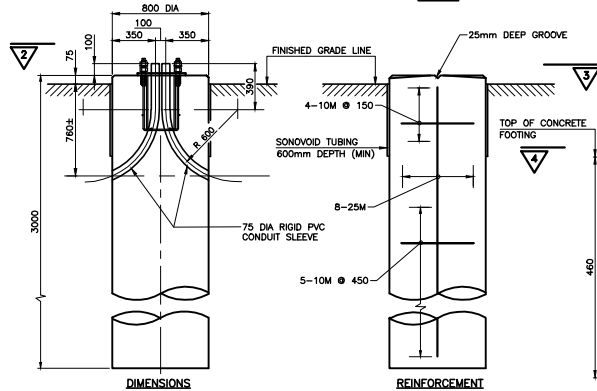
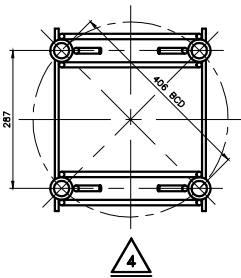
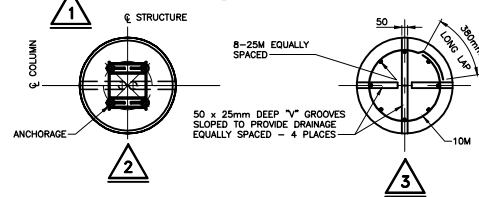
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DESIGN	CHK		CODE	CSA S6-00	LOAD - DATE
DRAWN	CHK		SITE		DWG.



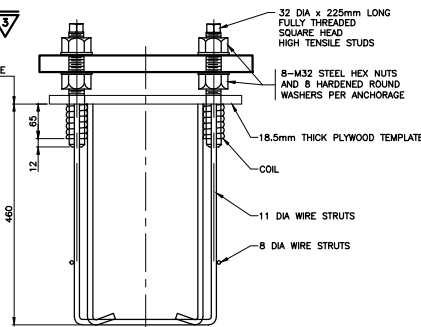
FRONT ELEVATION



FRONT ELEVATION
FOOTING LAYOUT DETAILS



FOOTING DETAILS



ANCHORAGE DETAILS

METRIC
DIMENSIONS ARE IN METRES AND/OR
MILLIMETRES UNLESS OTHERWISE SHOWN
DRAWING NOT TO BE SCALED
100mm ON ORIGINAL DRAWING

Ministry of
TransportationCONT
WP

SHEET

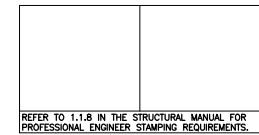
GENERAL NOTES:

3. SIGN SUPPORT SHALL BE ERECTED PERPENDICULAR TO CENTRE LINE OF HIGHWAY OR AS DIRECTED BY THE ENGINEER.
4. FOOTING SHALL BE BUILT IN ACCORDANCE WITH OPSR 904, CLASS OF CONCRETE 30Mpa, REINFORCING STEEL SHALL BE GRADE 400W.
5. CONCRETE SHALL BE PLACED ON UNDISTURBED GROUND IN AN AUGERED HOLE.
6. CLEAR COVER TO REINFORCING STEEL SHALL BE 100±25mm EXCEPT AS NOTED.
7. TOP OF FOOTING SHALL BE STEEL FLOAT FINISH, DEAD LEVEL.
8. SIGN BRACKETS AND ELECTRICAL OUTLETS ARE TYPICAL AT ALL SIGN LOCATIONS.
9. ALL NUTS, INCLUDING UPPER NUTS OF ANCHOR STUDS, SHALL BE TIGHTENED BY TURN-OF-NUT METHOD IN CONFORMANCE WITH CAN/CSA S8-06.
10. THIS DRAWING TO BE READ IN CONJUNCTION WITH DRAWING No. S5118-42.
11. CONDUIT SLEEVE SHALL BE RIGID PVC 75mm I.D., 90° BEND SCEPTER CAT. NO. NISL-33-24 OR EQUIV.
12. STEEL FOR EACH FOOTING TO BE BUNDLED SEPARATELY AND MARKED WITH STATION NUMBER.
13. DIMENSION "J" SHALL BE AT OR CLOSE TO THE MIDDLE OF THE SPAN.

ANCHORAGE NOTES:

1. ANCHORAGE STRUTS AND COILS TO BE SAE STANDARD 1030 STEEL.
2. HIGH TENSILE STUDS TO BE ASTM SPECIFICATION A4140, A193, GRADE 8-7 STEEL.
3. STEEL HEXAGON NUTS AND HARDENED STEEL WASHERS SHALL BE IN ACCORDANCE WITH ASTM SPECIFICATION A325.
4. THE COMPLETE ANCHORAGE ASSEMBLY INCLUDING STUDS, NUTS, AND WASHERS SHALL BE HOT-DIP GALVANIZED.
5. EXPOSED PORTION OF STUDS SHALL BE COATED WITH NON-STAINING GRADE.
6. AN 18.5mm THICK PLYWOOD SETTING TEMPLATE SHALL BE PROVIDED FOR ACCURATE POSITIONING OF ANCHORAGE WITHIN THE CONCRETE FORM.

TABLE OF SUPPORT DIMENSIONS AND SIGN SIZE

[illegible]

REFER TO 1.1.8 IN THE STRUCTURAL MANUAL FOR
PROFESSIONAL ENGINEER STAMPING REQUIREMENTS.

STANDARD DRAWING
FEBRUARY 2019

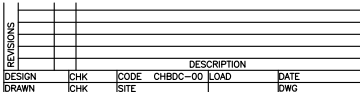
SS118-41

STEEL MONOTUBE SIGN SUPPORT -
GENERAL ARRANGEMENT

QUANTITIES PER FOOTING

WEIGHT OF REINFORCING STEEL - TONNES	0.09	VOLUME OF CONCRETE CUBIC METRES	1.4
--------------------------------------	------	---------------------------------	-----

REVISIONS						
	DATE	BY	DESCRIPTION			
DESIGN	CHK		CODE	CSA S6-00	LOAD	- DATE
DBAWN	CHK		SITE			DWG.



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SIGN SUPPORT MANUAL

SECTION 8 – VARIABLE MESSAGE SIGN SUPPORTS

8 VARIABLE MESSAGE SIGN (VMS) SUPPORT**8.1 GENERAL****8.1.1 STANDARD SIGN SUPPORTS****8.1.1.1 VMS OVERHEAD TRUSS**

Standard VMS overhead truss sign supports are used to support VMS systems. The overhead truss is fabricated in aluminum, and the vertical support legs in galvanized structural steel. They are designed to the requirements of the CSA S6-14 (CHBDC).

The sign supports contained in this Section are designed for VMS components and site conditions that meet the following criteria:

- (a) Spans from 17592 to 34000 mm.
- (b) Maximum total sign area of 40 square metres for a reference wind pressure of 600 Pa at a return period of 50 years. The effect of wind funnelling due to special topographical features such as deep valleys is not considered (CHBDC 3.10.1.2).
- (c) Overall depth of sign component of 3075 mm.
- (d) Overall width of sign component of 13220 mm.
- (e) Maximum weight of sign component is 5000 kg.
- (f) Location of supports and vertical clearances according to the requirements of the CHBDC and MTO Design Supplement for TAC Geometric Design Guide for Canadian Roads (2017).
- (g) Competent soil conditions (as described in Section 8.5.4) excluding rock fill.

8.1.1.2 POLE MOUNTED VMS

Pole mounted VMS supports are used to support portable type VMS boards. The sign supports are fabricated in structural steel, and designed to the requirement of the CSA-S6-14 (CHBDC).

The supports are designed for VMS components and site conditions that meet the following criteria:

- (a) Maximum sign board area of 15 square metres for a reference wind pressure up to 600 Pa at a return period of 50 years.
- (b) Maximum depth of sign component of 3000 mm.
- (c) Maximum width of sign component of 5000 mm.
- (d) Maximum weight of sign component of 1000 kg.
- (e) Location of supports and vertical clearances according to the requirements of the CHBDC and MTO Design Supplement for TAC Geometric Design Guide for Canadian Roads, 2017.
- (f) Competent soil conditions (as described in Section 8.5.4) excluding rock fill.

8.1.2 LIMITATIONS

For economic and practical reasons, these supports should be placed as close as possible to the edge of the travelled portion of the highway. Therefore, the supports will probably be in the clear recovery zone and should be protected as discussed in Section 2.6. They could also be located on median barriers.

For ground mounted footings, the top of footing elevation shall be a minimum of 300 mm above the finished grade. This could be increased up to 1000 mm in order to limit the leg height. The dimensions from the top of the footing to the centreline of the VMS overhead truss shall not exceed 7500 mm, and to the bottom of portable VMS board shall not exceed 6500 mm.

8.1.3 DESCRIPTION OF SIGN SUPPORTS

8.1.3.1 VMS OVERHEAD TRUSS

This VMS sign support structure is comprised of two vertical support legs and a rectangular overhead space truss. The vertical support legs are fabricated from structural steel, and the overhead truss from aluminum. The overhead truss is comprised of two end components (left and right) and one sign component. The system is fabricated based on specific site requirements. These supports are designed for ground mounting or supported on concrete median barriers. The typical layout plan and elevation are shown in Figures 8.1.3(a) and (b), respectively.

The vertical support legs are made of rectangular HSS sections (column shafts) and from square HSS sections (bracing and struts). All components are interconnected by moment and shear welded connections. The column shafts are connected at the base to concrete footings by a bolted anchorage. The column lengths of the supports are not standard. At a particular location the legs may be of different heights to ensure the truss is installed horizontal.

The overhead truss in the span is made of aluminum square tubes. All components are interconnected by moment and shear welded connections. The VMS structure (sign component) is built-in to the overhead truss (walk-in VMS). The aluminum overhead truss ends are connected to the structural steel legs by a hinge type connection with a neoprene pad and stainless steel bolts.

All structural steel components, other than stainless steel bolts, nuts, and washers, are hot-dip galvanized after fabrication. The support legs and base plates are subsequently coated with an approved paint system.

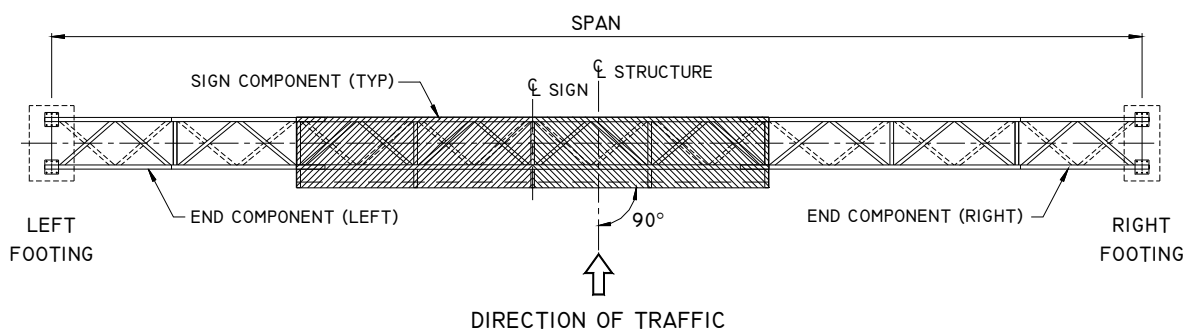


FIGURE 8.1.3(a) TYPICAL VMS OVERHEAD TRUSS LAYOUT PLAN

8.1.3.2 POLE MOUNTED VMS

This sign support is fabricated from structural steel and comprise a single vertical pole. It is designed for ground mounting or supported on concrete median barriers. The typical layout plan and sign support elevation are shown in Figures 8.1.3(c) and (d) respectively.

The vertical support member is straight and made from round HSS or octagonal shape sections. Fabricators may choose to fabricate the octagonal shape from steel plate. Octagonal sections have to meet the requirements shown on Standard Drawings SS118-11 and SS118-13. The maximum allowable length of the vertical support, assumed in design, is 8750 mm. It is connected at the base to a concrete footing by a bolted anchorage system.

The VMS board is mounted to the pole by means of hot-dip galvanized steel brackets attached to the pole. The location and connection details are required to be designed by Fabricator to suit the type of VMS selected.

All structural steel components, other than stainless steel bolts, nuts, and washers, are hot-dip galvanized after fabrication. The pole and base plate are subsequently coated with an approved paint system.

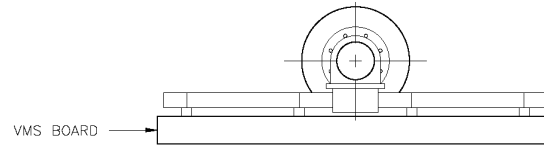


FIGURE 8.1.3(c)
TYPICAL POLE MOUNTED VMS LAYOUT PLAN

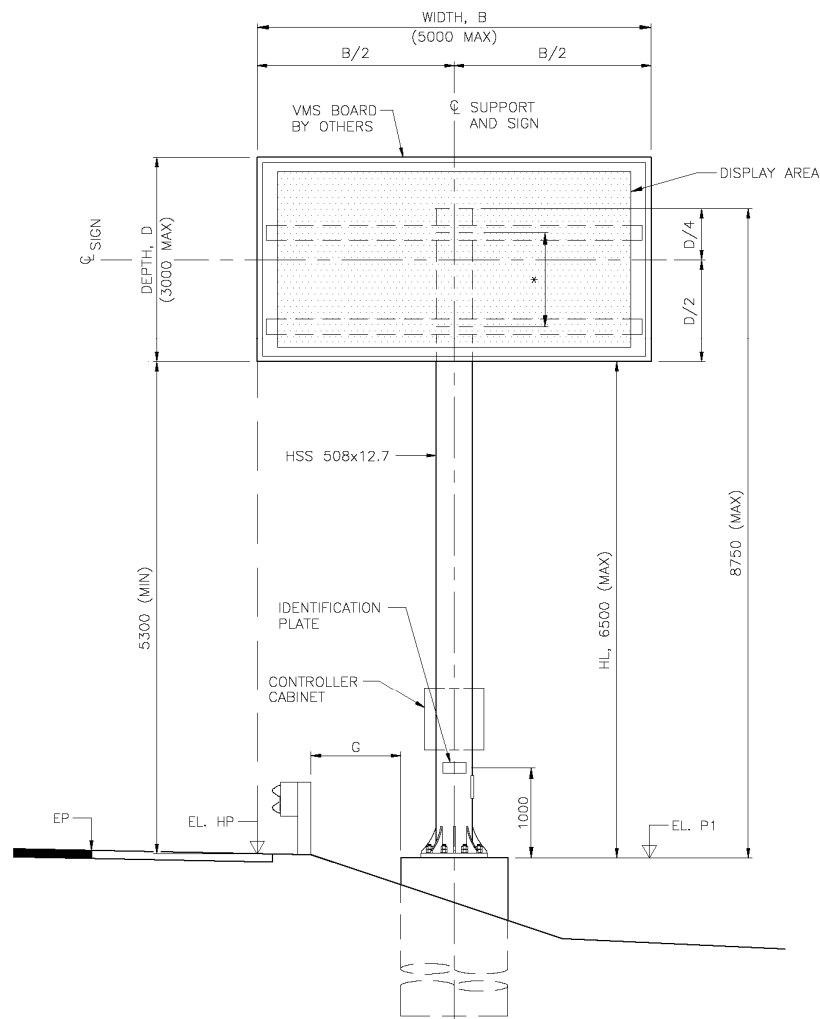


FIGURE 8.1.3 (d)
TYPICAL POLE MOUNTED VMS SUPPORT ELEVATION

8.1.4 FOOTINGS

Each sign support footing consists of a single reinforced concrete caisson. Details differ according to their location, and generally are of two types, as shown on the standard drawings: ground mounted and median mounted. (see Standard Drawings SS118-3, SS118-4, and SS118-5 for pole mounted VMS supports; SS118-6, SS118-7, and SS118-8 for VMS overhead truss supports).

The indicated footing depths are the minimum required for each support. Footing proportions apply to competent soil conditions of uniform composition. Parameters upon which the design is based are given in Section 8.5.4.

Encountered soil conditions such as rock fill, land fill, and soft material are not covered here and require the footing to be designed by an Engineer.

8.1.5 CLEARANCE

For ground mounted footings, the minimum horizontal clearance 'G' from the back of traffic protection barrier to the nearest face of sign support footing shall not be less than the values specified in Figure A3.2 (see Appendix to Section 3).

The minimum vertical clearance from the bottom of the sign component to the highest point on the highway, including shoulders, curbs, and medians, shall not be less than 5600 mm for VMS overhead truss, and 5300 mm for pole mounted VMS under dead load deflection.

8.1.6 SUPPLY AND ERECTION

For a temporary installation, a Tri-Chord overhead truss (Section 4) with the same span as a prospective VMS truss structure could be mounted on the VMS support legs. A connection detail for this assemblage is shown on Standard Drawing SS118-36.

Construction shall meet the requirements of OPSS 915, Construction Specification for Sign Support Structures, and associated Special Provisions.

Each sign support structure shall have a corrosion-protected identification plate showing the site number (formerly structure ID number), the manufacturer's name or the trademark, and the date of manufacture.

8.2 PROCEDURES**8.2.1 GENERAL**

The sign support structures are fabricated from shop drawings based on the standard drawings on a site-specific basis.

The design of the VMS overhead sign support structure is based on a reference wind pressure of 600 Pa. The geometric layout of the overhead truss shall depend on the location of the sign component along the span of the structure, in relation to the travelled portion of the highway (see Standard Drawing SS118-36). Multiple combinations of end components (left/right) and sign components can be obtained, as shown in Figure 8.2.1. The length of panel for the end components will vary, within certain limits, in every structure. The length of panel for the sign component is fixed. Design dimensions (structural sections) for end and sign components are fixed, and are given on the Standard Drawings SS118-37 and SS118-38.

The design of the pole mounted VMS support is based on a reference wind pressure of 600 Pa. Design dimensions are given on the Standard Drawings SS118-11 and SS118-13.

8.2.2 DATA REQUIRED

For each VMS sign support, the following data is required:

- (1) The span (for overhead truss).
- (2) The site location and Site Number of the structure. For a proposed highway or a highway under reconstruction, the location should be specified as a station.
- (3) The location of the sign component along the longitudinal centreline of the structure (for overhead truss).
- (4) The elevation of the highest point on the highway under the sign component, and the final ground elevations under the sign structure.

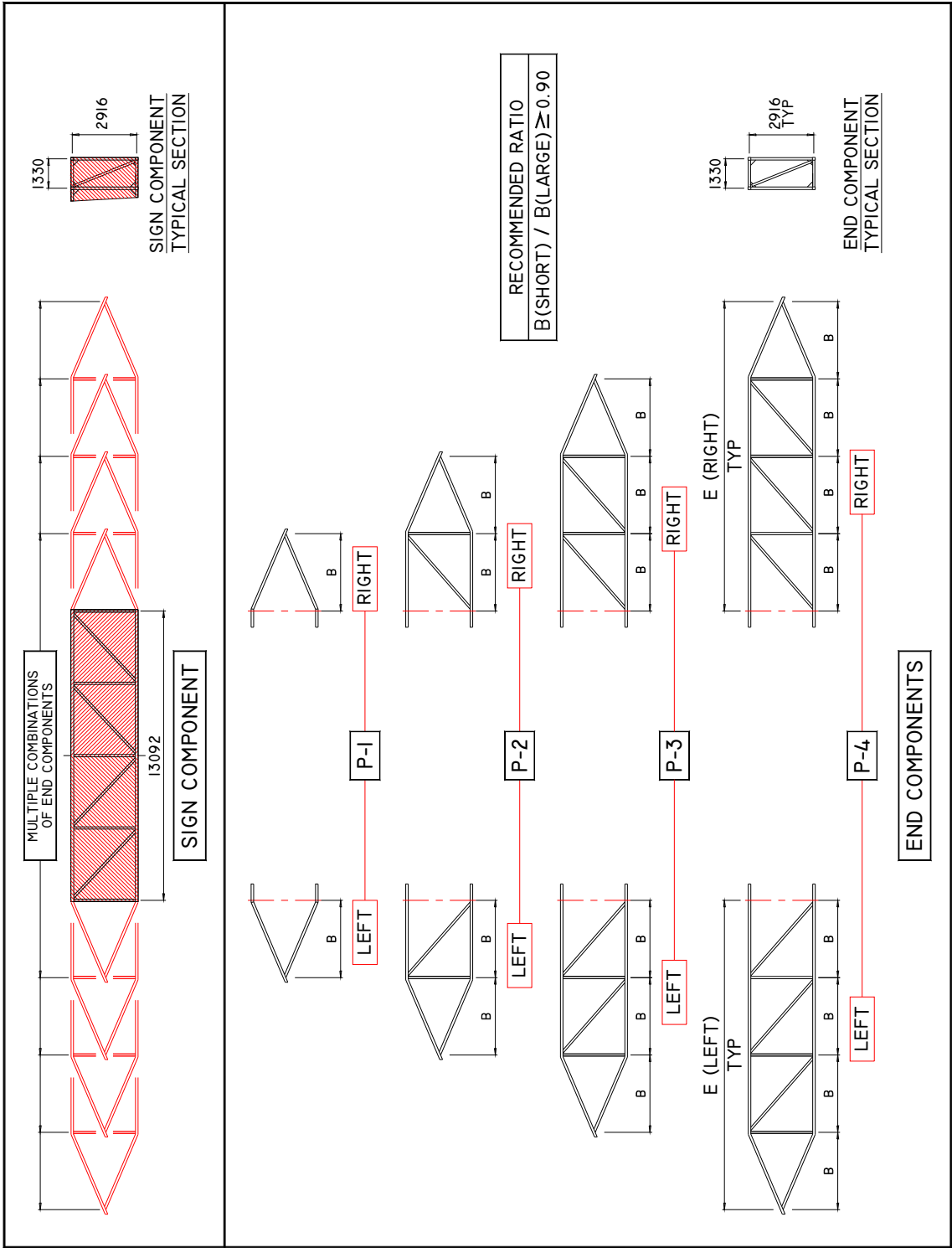


FIGURE 8.2.1 VARIABLE MESSAGE SIGN SUPPORT LAYOUT COMBINATIONS

8.2.3 PROCEDURE FOR DESIGN OF VMS SIGN SUPPORT STRUCTURES**CASE 1 – VMS OVERHEAD TRUSS****GIVEN: SPAN AND LOCATION OF SIGN COMPONENT**

Example: a span of 27990 mm, and a distance of 12138 mm from the centreline of the left leg to the centreline of the sign component.

STEP 1: OBTAIN THE LENGTH OF THE END COMPONENTS.

E.g., The distance between centreline of end verticals of the sign component is 13092 mm. The sign component is centered at 12138 mm from the left leg. Therefore, the dimension from the centreline of the left leg to the left end vertical of the sign component, $E_{(LEFT)}$, is equal to $12138 - 13092/2 = \underline{5592}$ mm. Based on the given span, $E_{(RIGHT)}$ is equal to $27990 - 13092 - 5592 = 9306$ mm.

STEP 2: OBTAIN THE LENGTH OF PANELS

The number of panels for each end component should be kept to a minimum. The length of the panel, b , for a given end component shall be a constant value, and within the following limits: $2250 \leq B \leq 3600$ mm.

E.g., $B_{(LEFT)} = 5592/2 = \underline{2796}$ mm, and $B_{(RIGHT)} = 9306/3 = \underline{3102}$ mm.

STEP 3: CHECK BOUNDARY CONDITIONS

- (a) The maximum length of the vertical support leg from the top of the footing to the centreline of the overhead truss shall be 7500 mm.
- (b) The dimension measured from the highest point on the highway, EL.HP, to the bottom of the sign component shall be equal to or greater than 5600 mm.
- (c) For static and aesthetic reasons, the ratio between the length of panel in both end components should be kept as close to 1 as possible. The minimum recommended value is 0.9. A minor relocation of the sign component may be required.
E.g., $2796/3102 = 0.9$

STEP 4: COMPLETE THE STANDARD DRAWINGS

Refer to 8.3 for Preparation of Drawings.

CASE 2 – POLE MOUNTED VMS

GIVEN: VMS SIZE AND LOCATION OF SIGN COMPONENT

Example: 4000 mm x 2200 mm VMS board.

STEP 1: CHECK BOUNDARY CONDITIONS

- (a) The maximum length of the vertical support leg from the top of the footing to the bottom of VMS board shall not exceed 6500 mm.
- (b) The dimension measured from the highest point on the highway, EL.HP, to the bottom of the sign component shall be equal to or greater than 5300 mm.

If any of the above conditions are not satisfied, the initial design parameters must be revised.

STEP 2: COMPLETE THE STANDARD DRAWINGS

Refer to Section 8.3 for Preparation of Drawings.

8.3 PREPARATION OF DRAWINGS**8.3.1 DATA REQUIRED**

The sign support structure designer shall obtain information from the Regional Offices for the location, site number, span length, location, elevations and sizes of sign boards etc. of each sign support to be constructed. The designer shall prepare and complete the design standard drawings for the structures and its foundations that will be part of the contract documents. Design drawings shall show the following information.

- (1) A key plan, indicating the location of each support.
- (2) The Site Number.
- (3) The support span measured from centreline to centreline of leg (for overhead truss)
- (4) The control line or the centreline of the roadway, and the offset of the left leg from the control line.

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VARIABLE MESSAGE SIGN (VMS) SUPPORTS

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- (5) The elevation of the highest point on the roadway surface under the support structure.
- (6) The dimension measured from the highest point (EL.HP) on the roadway surface to the bottom of the sign component. This height shall not be less than 5600 mm for overhead truss and 5300 mm for pole mounted VMS.
- (7) The dimensions from the top of the footing (EL.P1 or EL.P2) to the centreline of the VMS overhead truss shall not exceed 7500 mm, and to the bottom of portable VMS board shall not exceed 6500 mm
- (8) The top of footing elevation can differ for each leg, if required. This elevation shall be determined so that the footing projection above finished grade around it is minimum 300 mm and maximum 1000 mm. This will give the designer flexibility to meet the structure leg height as stated in (7) above.
- (9) The elevation of the ground line at each footing.
- (10) The offset of the centreline of each footing from the control line, either as a note or as a dimension.
- (11) The station of the support structure on a designated highway centreline or control line.
- (12) A designation for each footing as a "Left Footing" or "Right Footing". Left and Right for this purpose are defined as if looking in the direction of the traffic, as shown in Figure 8.1.3(a).
- (13) The footing type for each sign support footing (see Section 8.1.4). For ground mounted footings, the dimension 'G' from the front face of the traffic protection barrier to the leg or the footing, whichever is closer (see Section 8.1.5).
- (14) For the sign component, the following additional information is required:
 - An outline in dashed line showing the sign component,
 - The requested location of the sign component with respect to the centreline of the left column.

8.3.2 SIGN SUPPORT DRAWINGS

If the supports are to be supplied and erected as part of a contract, the following Standard Drawings must be used: SS118-11, SS118-13, SS118-36, SS118-37 or SS118-38 for the structure; SS118-3, SS118-4, SS118-5, SS118-6, SS118-7 or SS118-8 for the footings. Up to 10 sign supports can be detailed on one sheet.

The Appendix contains reduced prints of these drawings, showing what information needs to be added. The Contract and W.P. numbers should be added to the title block. The sheet number is added when the drawings for the entire contract are assembled.

On Standard Drawings SS118-11, SS118-13, and SS118-36, there is a table to be completed on the drawing. In the table, one vertical column of data is used for each sign.

The Standard Drawings shall be sealed, dated and signed according to 2.4.1.

The data required to complete Table 1 on Standard Drawing SS118-36 consists of the following:

- (i) Station
- (ii) Site Number
- (iii) The support span measured from centrelines of support legs
- (iv) Truss Diagram. The electronic file of the Standard Drawing SS118-36 contains schematic sign and end components drawn on the left border that shall be used to fill this box.
- (v) End Component (Left):
 - Type of Panel (P-1, P-2, P-3 or P-4)
 - E (LEFT): dimension from centreline of left column to left end vertical of sign component.
 - B (LEFT): length of panel
 End Component (Right):
 - Type of Panel (P-1, P-2, P-3 or P-4)
 - E (RIGHT): dimension from centreline of right column to right end vertical of sign component.
 - B (RIGHT): length of panel
- (vi) Elevation of the highest point on the highway under the sign, including shoulders, curbs and median, EL.HP
- (vii) Elevation at top of the left support footing, EL.P₁
- (viii) Elevation at top of the right support footing, EL.P₂
- (ix) Door Side (Left/Right).

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- (x) Left Footing Type (see Section 8.1.4)
- (xi) Right Footing Type (see Section 8.1.4)

The data required to complete Table 1 on Standard Drawings SS118-11 and SS118-13 consist of the following:

- (i) Frost Depth; may be obtained from Appendix to Section 2 in this manual if the recommendations of a geotechnical engineer are not available
- (ii) Station
- (iii) Site Number
- (iv) Sign Size (DxB)
- (v) Footing Type (see Section 8.1.4)
- (vi) Dimension between top of footing and bottom of sign board, H_L
- (vii) Barrier to support clearance, G (see Section 8.1.5)
- (viii) Elevation at top of the support footing, EL.P1
- (ix) Elevation of the highest point on the highway under the sign, including shoulders, curbs, and median, EL.HP

8.4 MAINTENANCE AND INSPECTION

All components must be properly inspected and maintained according to the requirements described in the Sign Support Inspection Guidelines, 2002.

Long term durability of sign supports is dependent on routine maintenance and inspection. In order to prevent corrosion damage and fatigue problems to the base plate and the anchorage assembly, and to allow for proper inspection of the assembly, the following shall be ensured:

- (i) The base of the vertical support leg shall be kept free from dirt and debris.
- (ii) The top of the footing shall be a minimum of 300 mm above the ground surrounding it.
- (iii) The connection welds shall be inspected regularly for fatigue cracking. Check tightening of connection and anchor bolts periodically.

8.5 DESIGN INFORMATION**8.5.1 GENERAL**

Design and detailing data for the VMS Overhead Truss and the Pole Mounted VMS contained in this Section conforms to the requirements of the CSA-S6-14 (CHBDC).

Properties for structural materials used in calculations are based on Standard CSA-G40.20-13/G40.21-13 Grade 300W or 350W structural steel, Alloy 6061-T6 aluminum extruded tube and plates, 30 MPa concrete, and Grade 400W reinforcing steel for footings, as stipulated in the Standard Drawings.

The maximum weight of the overhead sign component, which includes the self-weight of the aluminum truss, shall not exceed 5000 kg. The maximum weight of the portable VMS board shall not exceed 1000 kg.

In the VMS overhead truss, all bolts, nuts, and washers shall be stainless steel and conform to ASTM F593 Alloy 304, with a minimum yield of 480 MPa and a minimum tensile strength of 715 MPa. In the pole mounted VMS, all bolts, nuts, and washers shall conform to ASTM F3125/F3125M and be hot-dip galvanized in accordance with OPSS 911.

Wind loads, design, and detailing for fatigue were in accordance with AASHTO LRFD Specifications for Structural Supports for Highway Signs, Luminaries and Traffic Signals, 2015, including the 2017 Interim Revisions, unless otherwise stated.

8.5.2 DESIGN DIMENSIONS

The design dimensions for the VMS overhead truss sign supports found in the Standard Drawings were developed by determining the member responses under various design spans and wind loads. Member responses were checked for ultimate, serviceability, and fatigue limit states.

8.5.3 DEFLECTIONS

The deflections for both vertical and horizontal members of the VMS overhead truss support system are limited for clearance concerns as well as for aesthetic purposes. The vertical deflection of horizontal supports are limited to 1% (L/100), and horizontal deflection of vertical supports were restricted to 2% (L/50). Both limitations are well within the suggested limits provided in AASHTO's "LRFD Specifications for Structural Supports for

Highway Signs, Luminaries and Traffic Signals", 2015, which allows 2.5% lateral movement or 1°40' angular rotation from the centreline at the top of the structure in relation to the centreline at its base.

The maximum lateral deflection of the pole mounted VMS due to wind load has been limited to 1.5% of pole height. The lateral deflection of the concrete foundation has been limited to an instantaneous rotation of 0.01 radians (0°30') under wind load.

8.5.4 FOUNDATIONS

The caisson foundations were modelled in S-Frame as beam elements with spring constants representing earth pressure. Springs constants in the dead load direction (for sustained load) were assumed to be 1/3 the value of those in the live load direction (for instantaneous load). Any resisting earth pressure in the frost depth layer was discounted.

Assumed soil parameters below the frost layer are as follows:

		CASE 1 (Sand)	CASE 2 (Soft Clay)
LENGTH OF CAISSON BELOW FROST LAYER	Upper 2/3	$\Phi' = 28^{\circ}$	$C_u = 25 \text{ kPa}$
	Lower 1/3	$\Phi' = 30^{\circ}$	$C_u = 50 \text{ kPa}$

APPENDIX TO SECTION 8**VARIABLE MESSAGE SIGN SUPPORTS**

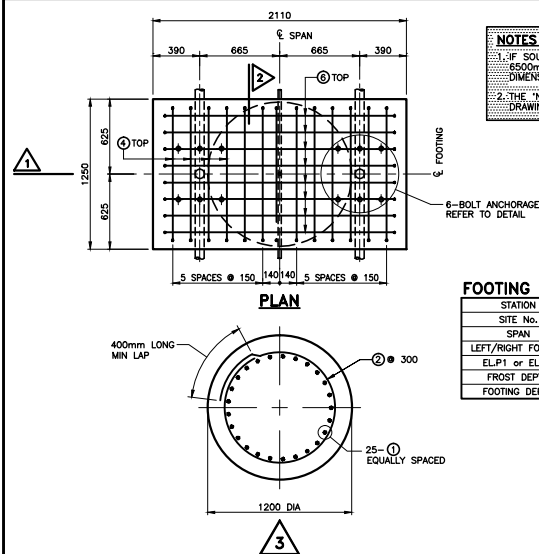
- SS118-6** VARIABLE MESSAGE SIGN (VMS) SUPPORT FOOTING DETAILS (GROUND MOUNTED)
- SS118-7** VARIABLE MESSAGE SIGN (VMS) SUPPORT – FOOTING DETAILS (MEDIAN MOUNTED – SYMMETRICAL)
- SS118-8** VARIABLE MESSAGE SIGN (VMS) SUPPORT – FOOTING DETAILS (MEDIAN MOUNTED – ASYMMETRICAL)
- SS118-11** POLE MOUNTED VARIABLE MESSAGE SIGN SUPPORT GENERAL ARRANGEMENT (GROUND MOUNTED)
- SS118-13** POLE MOUNTED VARIABLE MESSAGE SIGN SUPPORT GENERAL ARRANGEMENT (MEDIAN MOUNTED)
- SS118-36** VARIABLE MESSAGE SIGN (VMS) SUPPORT GENERAL ARRANGEMENT
- SS118-37** VARIABLE MESSAGE SIGN (VMS) SUPPORT END COMPONENT - DETAILS
- SS118-38** VARIABLE MESSAGE SIGN (VMS) SUPPORT SIGN COMPONENT - DETAILS

NOTE:

See Appendix to Section 4 for reduced size prints of the following Standard Drawings for the Pole Mounted VMS support footing details.

- SS118-3** STATIC SIGN SUPPORT - FOOTING DETAILS (GROUND MOUNTED)
- SS118-4** STATIC SIGN SUPPORT - FOOTING DETAILS (MEDIAN MOUNTED – SYMMETRICAL)
- SS118-5** STATIC SIGN SUPPORT - FOOTING DETAILS (MEDIAN MOUNTED – ASYMMETRICAL)

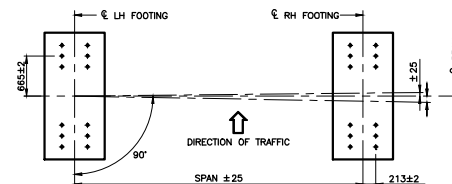
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NOTES TO DESIGNER:

1. IF SOUND ROCK IS ENCOUNTERED AT A DEPTH 'Y' LESS THAN 6500mm FROM THE BOTTOM OF THE FROST LAYER, THIS DIMENSION CAN BE REDUCED TO: $Y + (6500 - Y) / 2$.
2. THE 'NOTES TO DESIGNER' SHALL BE DELETED FROM THIS DRAWING PRIOR TO ISSUING.

FOOTING DIMENSIONS

[illegible]

TYPICAL PLAN SHOWING TOLERANCE

METRIC
DIMENSIONS ARE IN METRES AND/OR
MILLIMETRES UNLESS OTHERWISE SHOWN
DRAWING NOT TO BE SCALED
100mm ON ORIGINAL DRAWING

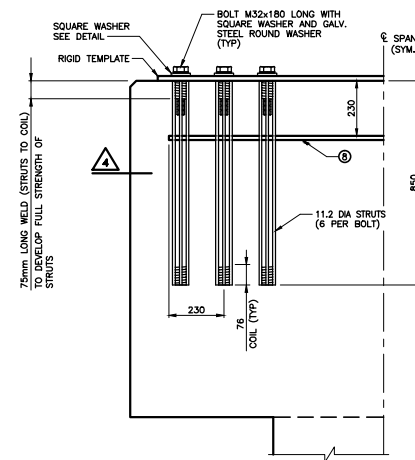


**Ministry of
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CONT
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VARIABLE MESSAGE SIGN (VMS)
SUPPORT
FOOTING DETAILS (GROUND MOUNTED)

	SHEET
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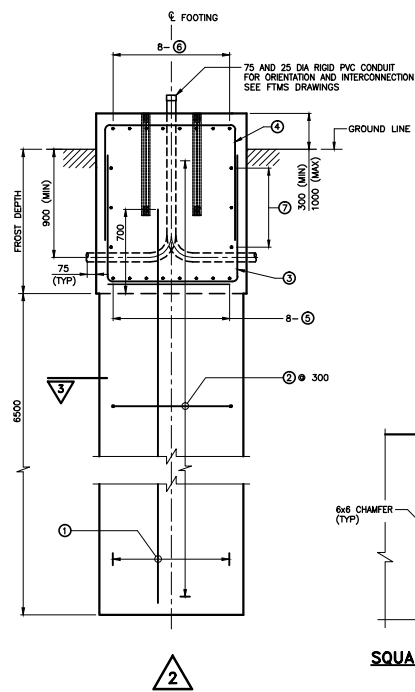
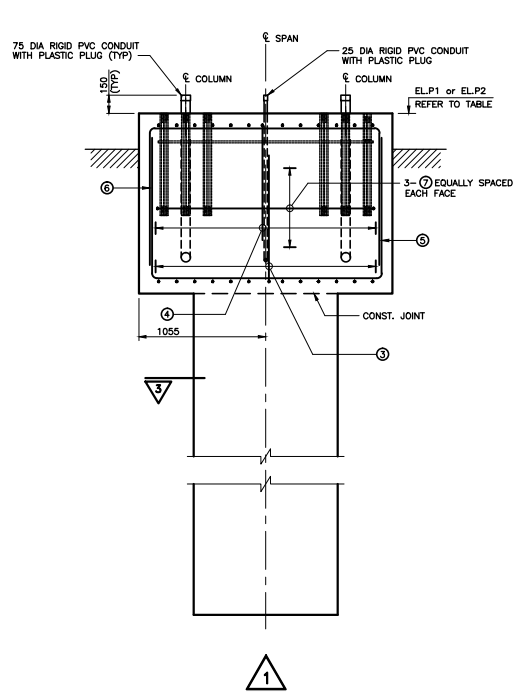


GENERAL NOTES:

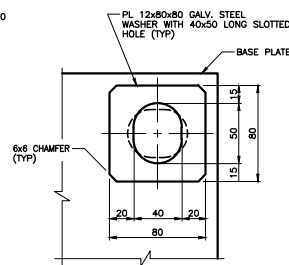
1. CLASS OF CONCRETE 30 MPa.
2. CLEAR COVER TO REINFORCING STEEL:
- CASNOSS 100±25mm
- REMAINDER 80±20mm
3. REINFORCING STEEL SHALL BE GRADE 400N UNLESS OTHERWISE SPECIFIED.
4. FOOTING SHALL BE BUILT ACCORDING TO OPS8 904.
5. EXCAVATION TO BE DONE NEAT AND CONCRETE PLACED AGAINST UNDISTURBED GROUND.
6. THE RIGID TEMPLATE SHALL BE SET TO A TOLERANCE OF ± 0.1 DEGREES IN ANY DIRECTION AND WITHIN $\pm 10\text{mm}$ OF THE ELEVATION SPECIFIED. SPACE BETWEEN BASE PLATE AND TOP OF CONCRETE FOOTING SHALL BE INJECTED WITH AN APPROVED EXPANDING GROUT TO ATTAIN FULL CONTACT. EACH FOOTING SHALL HAVE ONE CONTINUOUS TEMPLATE.
7. RIGID PVC CONDUIT SHALL BE ACCORDING TO OPS8 063.
8. STEEL FOR EACH FOOTING TO BE BUNDLED SEPARATELY AND MARKED WITH STATION NUMBER.

ANCHORAGE NOTES:

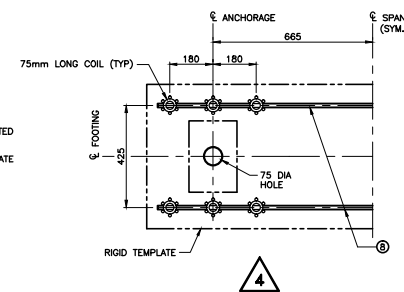
1. ANCHOR STRUTS AND COILS SHALL BE MADE OF SAE 1030 STEEL.
2. ALL BOLTS AND WASHERS SHALL BE ACCORDING TO ASTM F1525/F1525M. BOLTS SHALL BE GRADE A325M.
3. THE COMPLETE ANCHORAGE ASSEMBLY INCLUDING BOLTS, NUTS, AND WASHERS SHALL BE HOT-DIP GALVANIZED.
4. EXPOSED PORTION OF BOLTS SHALL BE COATED WITH WHITE NON-STAINING GREASE.
5. A RIGID SETTING TEMPLATE SHALL BE PROVIDED FOR ACCURATE POSITIONING OF ANCHORAGE WITHIN THE CONCRETE FORM. EACH FOOTING SHALL HAVE A CONTINUOUS TEMPLATE.
6. ANCHOR BOLTS SHALL ENGAGE FULL LENGTH OF UPPER COIL AT THE TIME ON CONCRETE PLACEMENT.
7. ANCHOR BOLTS SHALL BE BROUGHT TO A SNUG-TIGHT CONDITION AND THEN FURTHER TIGHTENED 1/3 OF A TURN.



SQUARE WASHER DETAIL



ANCHORAGE INSTALLATION DETAIL



BAR MARK	SIZE	SHAPE
①	25M	STRAIGHT
②	15M	
③	15M	
④	15M	
⑤	20M	
⑥	20M	
⑦	15M	
⑧	15M	STRAIGHT

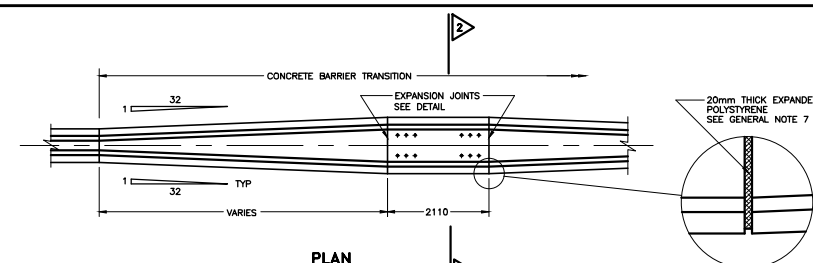
REFER TO 2.4.1 IN THE SIGN SUPPORT MANUAL FOR PROFESSIONAL ENGINEER STAMPING REQUIREMENTS.

STANDARD DRAWING
FEBRUARY 2019

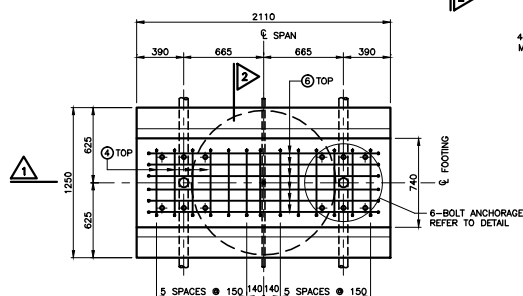
SS118-6

FEBRUARY 2019		CIVIL	
VARIABLE MESSAGE SIGN (VMS) SUPPORT FOOTING DETAILS (GROUND MOUNTED)			

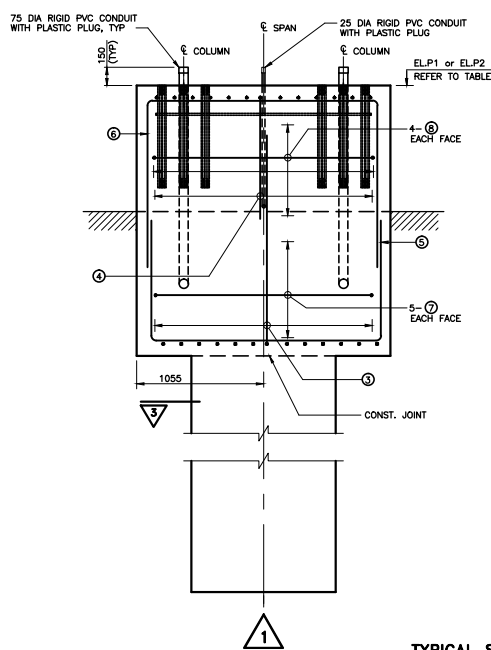
REVISIONS					
	DATE	BY	DESCRIPTION		
DESIGN	CHK		CODE	CSA S6-14	LOAD
DRAWN	CHK		SYE.		DWG.



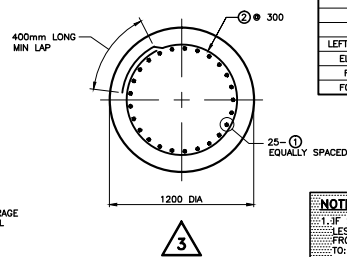
PLAN



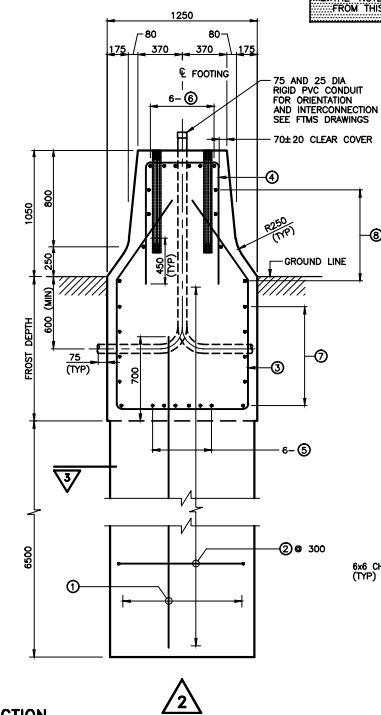
PLAN



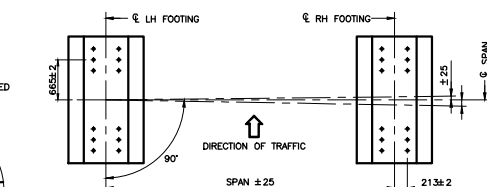
TYPICAL SECTION



3



2



TYPICAL PLAN SHOWING TOLERANCE

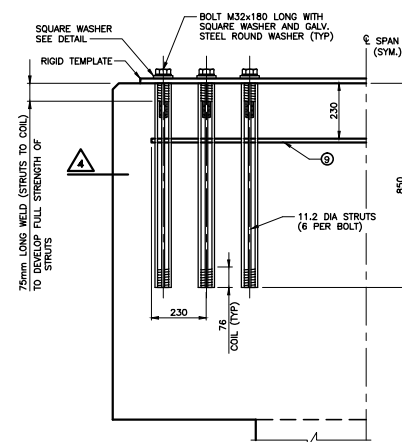
FOOTING DIMENSIONS

[illegible]

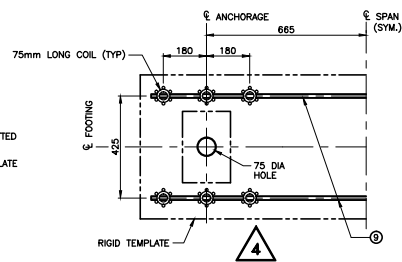
NOTES TO DESIGNER:

1. IF SOUND ROCK IS ENCOUNTERED AT A DEPTH γ LESS THAN 6500mm FROM THE BOTTOM OF THE FROST LAYER, THIS DIMENSION CAN BE REDUCED TO: $\gamma + (6500 - \gamma) / 2$.

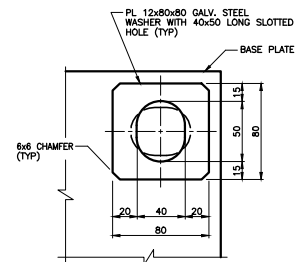
2. THE 'NOTES TO DESIGNER' SHALL BE DELETED FROM THIS DRAWING PRIOR TO ISSUING.



ANCHORAGE INSTALLATION DETAIL



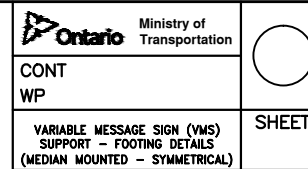
4



SQUARE WASHER DETAIL

REFER TO 2.4.1 IN THE SIGN SUPPORT MANUAL FOR
PROFESSIONAL ENGINEER STAMPING REQUIREMENTS

METRIC
DIMENSIONS ARE IN METRES AND/OR
MILLIMETRES UNLESS OTHERWISE SHOWN
DRAWING NOT TO BE SCALED
100mm ON ORIGINAL DRAWING



GENERAL NOTES:

1. CLASS OF CONCRETE 30 MPa.
2. CLEAR COVER TO REINFORCING STEEL:
GASON 100±20mm
-REMANDER 80±20mm
3. REINFORCING STEEL SHALL BE GRADE 400W UNLESS OTHERWISE SPECIFIED.
4. FOOTING SHALL BE BUILT ACCORDING TO OPSS 904.
5. EXCAVATION TO BE DONE NEAT AND CONCRETE PLACED AGAINST UNDISTURBED GROUND.
6. THE GRID TEMPLATE SHALL BE SET TO A TOLERANCE OF ±0.1 METRE IN ANY DIRECTION AND WITHIN ±10mm OF THE ELEVATION SHOWN. SPACE BETWEEN BASE PLATE AND TOP OF CONCRETE FOOTING SHALL BE INJECTED WITH AN APPROVED POLYURETHANE GROUT TO ACHIEVE FULL CONTACT. EACH FOOTING SHALL HAVE ONE CONTINUOUS TEMPLATE.
7. EXPANDED POLYSTYRENE IN EXPANSION JOINTS SHALL BE ACCORDING TO CAN/JUL-5701 AND BE HELD IN PLACE WITH LIGHT GALVANIZED NAILS.
8. RIGID PVC CONDUIT SHALL BE ACCORDING TO OPSS 603.
9. STEEL FOR EACH FOOTING TO BE BUNDLED SEPARATELY AND MARKED WITH STAINLESS STEEL TAGS.

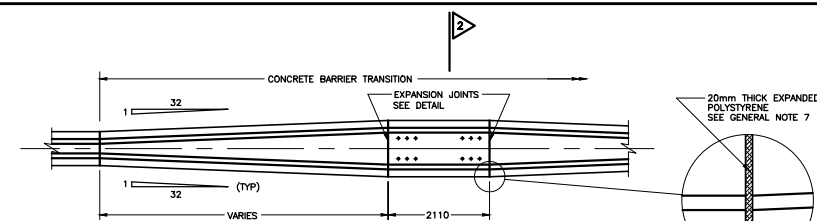
ANCHORAGE NOTES:

1. ANCHORAGE STRUTS AND COILS SHALL BE MADE OF SAE 1030 STEEL.
2. ALL BOLTS AND WASHERS SHALL BE ACCORDING TO ASTM F1521/F1523/12SM. BOLTS SHALL BE GRADE A325M.
3. THE COMPLETE ANCHORAGE ASSEMBLY INCLUDING BOLTS, NUTS, AND WASHERS SHALL BE HOT-DIP GALVANIZED.
4. EXPOSED PORTION OF BOLTS SHALL BE COATED WITH WHITE NON-STAINING GRADE.
5. A RIGID SETTING TEMPLATE SHALL BE PROVIDED FOR ACCURATE POSITIONING OF ANCHORAGE WITHIN THE CONCRETE FORM. EACH FOOTING SHALL HAVE ONE CONTINUOUS TEMPLATE.
6. ANCHOR BOLTS SHALL ENGAGE FULL LENGTH OF UPPER COIL AT THE TIME ON CONCRETE PLACEMENT.
7. ANCHOR BOLTS SHALL BE BROUGHT TO A SNUG-TIGHT TIGHTENING THE FIRST TURN AND A 1/2 TURN.

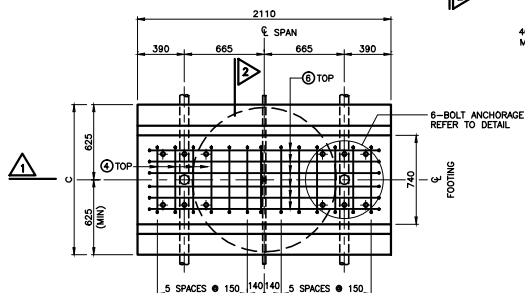
BAR MARK	SIZE	SHAPE
①	25M	STRAIGHT
②	15M	
③	20M	
④	20M	
⑤	20M	
⑥	20M	
⑦	20M	
⑧	20M	
⑨	15M	STRAIGHT

STANDARD DRAWING FEBRUARY 2019	SS118-7
VARIABLE MESSAGE SIGN (VMS) SUPPORT FOOTING DETAILS (MEDIAN MOUNTED - SYMMETRICAL)	

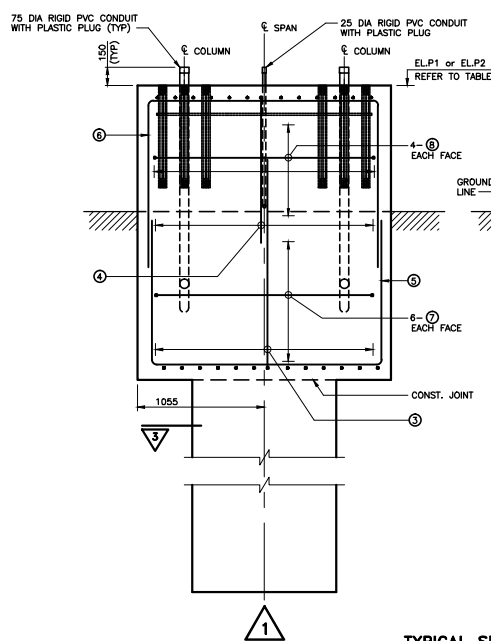
REVISIONS						
	DATE	BY	DESCRIPTION			
DESIGN	CHK		CODE	CSA S6-14	LOAD	- DATE
DRAWN	CHK		SITE			DWG



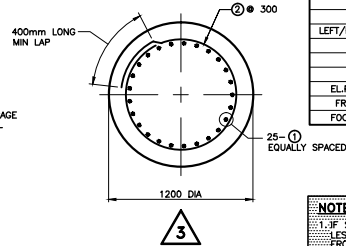
PLAN



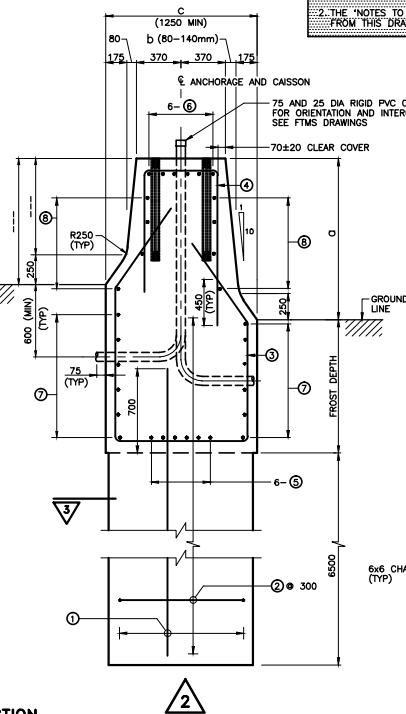
PLAN



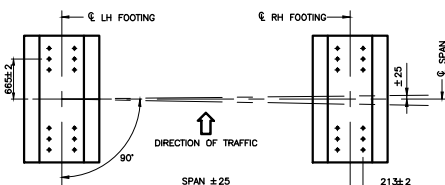
TYPICAL SECTION



3



2



TYPICAL PLAN SHOWING TOLERANCE

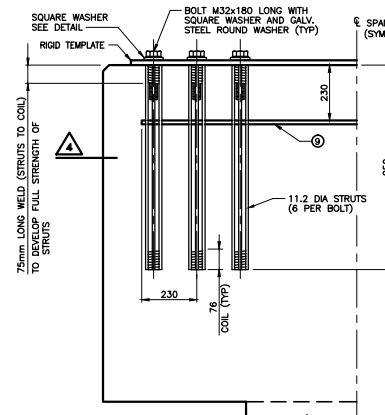
FOOTING DIMENSIONS

STATION	----								
SITE No.	----								
SPAN	----								
LEFT/RIGHT FOOTING	----								
a	----								
b	----								
c	----								
EL.P1 or EL.P2	----								
FROST DEPTH	----								
FOOTING DEPTH	----								

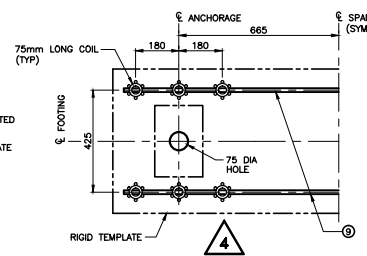
NOTES TO DESIGNER:

1. IF SOUND ROCK IS ENCOUNTERED AT A DEPTH Y LESS THAN 6500mm FROM THE BOTTOM OF THE FROST LAYER, THIS DIMENSION CAN BE REDUCED TO: $Y + (6500 - Y) / 2$.

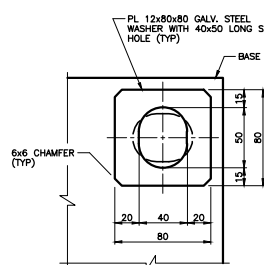
2. THE 'NOTES TO DESIGNER' SHALL BE DELETED FROM THIS DRAWING PRIOR TO ISSUING.



ANCHORAGE INSTALLATION DETAIL



4



SQUARE WASHER DETAIL

REFER TO 2.4.1 IN THE SIGN SUPPORT MANUAL FOR
PROFESSIONAL ENGINEER STAMPING REQUIREMENTS.

METRIC
DIMENSIONS ARE IN METRES AND/OR
MILLIMETRES UNLESS OTHERWISE SHOWN
DRAWING NOT TO BE SCALED
100mm ON ORIGINAL DRAWING

Ministry of
Transportation

CONT
WP

VARIABLE MESSAGE SIGN (VMS)
SUPPORT - FOOTING DETAILS
(MEDIAN MOUNTED - ASYMMETRICAL)

	SHEET
--	-------

GENERAL NOTES:

1. CLASS OF CONCRETE 30 MPa.
2. CLEAR COVER TO REINFORCING STEEL:
CASSION 100±25mm
-REMAINDER 80±20mm
3. REINFORCING STEEL SHALL BE GRADE 400W UNLESS OTHERWISE SPECIFIED.
4. FOOTING SHALL BE BUILT ACCORDING TO OPSS 904.
5. EXCAVATION TO BE DONE NEAT AND CONCRETE PLACED AGAINST UNDISTURBED GROUND.
6. THE GRID TEMPLATE SHALL BE SET TO A TOLERANCE OF ±0.1 DEGREE IN ANY DIRECTION WITHIN ±10mm OF THE ELEVATION SHOWN. SPACE BETWEEN BASE PLATE AND TOP OF CONCRETE FOOTING SHALL BE INJECTED WITH AN APPROVED NON-SHRINK GROUT TO ACHIEVE FULL CONTACT. EACH FOOTING SHALL HAVE ONE CONTINUOUS TEMPLATE.
7. EXPANDED POLYSTYRENE IN EXPANSION JOINTS SHALL BE ACCORDING TO CAN/ULC 5701 AND BE HELD IN PLACE WITH GALV ANODIZED NAILS.
8. RIGID PVC CONDUIT SHALL BE ACCORDING TO OPSS 603.
9. STEEL FOR EACH FOOTING TO BE BUNDLED SEPARATELY AND MARKED WITH STATION NUMBER.

ANCHORAGE NOTES:

1. ANCHORAGE STRUTS AND COILS SHALL BE MADE OF SAE 1030 STEEL.
2. ALL BOLTS AND WASHERS SHALL BE ACCORDING TO F3125/F3125M. BOLTS SHALL BE GRADE A325M.
3. THE COMPLETE ANCHORAGE ASSEMBLY INCLUDING BOLTS, NUTS, AND WASHERS SHALL BE HOT-DIP GALVANIZED.
4. EXPOSED PORTION OF BOLTS SHALL BE COATED WITH WHITE NON-STAINING GREASE.
5. A RIGHT SETTING TEMPLATE SHALL BE PROVIDED FOR ACCURATE POSITIONING OF ANCHORAGE WITHIN THE CONCRETE FORM. EACH FORM SHALL HAVE A CONTINUOUS TEMPLATE.
6. ANCHOR BOLTS SHALL ENGAGE FULL LENGTH OF UPPER COIL AT THE TIME ON CONCRETE PLACEMENT.
7. ANCHOR BOLTS SHALL BE BROUGHT TO A SNUG TIGHT CONDITION AND THEN FURTHER TIGHTENED 1/3 OF A TURN.

BAR MARK	SIZE	SHAPE
①	25M	STRAIGHT
②	15M	
③	20M	
④	20M	
⑤	20M	
⑥	20M	
⑦	20M	
⑧	20M	
⑨	15M	
		STRAIGHT

STANDARD DRAWING
FEBRUARY 2019

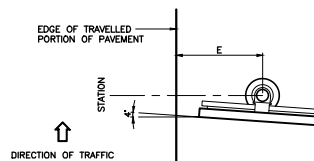
SS118-8

VARIABLE MESSAGE SIGN (VMS) SUPPORT
FOOTING DETAILS
(MEDIAN MOUNTED - ASYMMETRICAL)

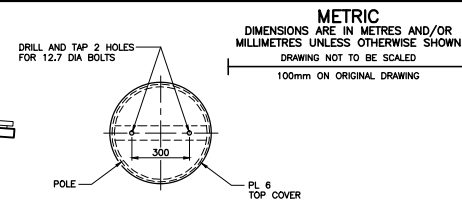
REVISIONS							
	DATE	BY	DESCRIPTION				
DESIGN	CHK		CODE	CSA	S6-14	LOAD	- DATE
DRAWN	CHK		SITE				DW/C



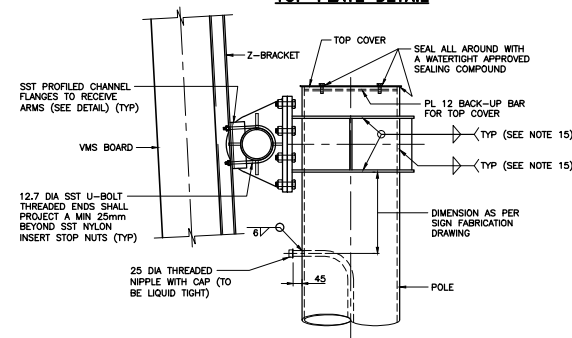
1. DIMENSION 'G' IS THE HORIZONTAL CLEARANCE FROM THE BACK OF A PROTECTIVE BARRIER TO THE NEAREST FACE OF CONCRETE FOOTING. THE MINIMUM CLEARANCE FOR A STEEL BEAM GUIDE RAIL BARRIER SHALL BE 1.0m, AND FOR A PERMANENT CONCRETE BARRIER SHALL BE 0.3m.
2. THE "NOTES TO DESIGNER" SHALL BE DELETED FROM THE DRAWING PRIOR TO ISSUING.



TYPICAL LAYOUT PLAN

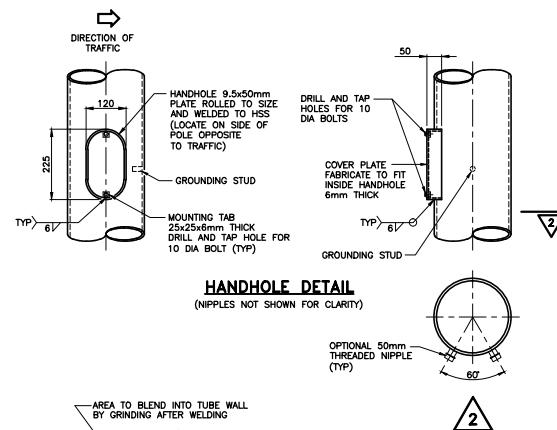


TOP PLATE DETAIL



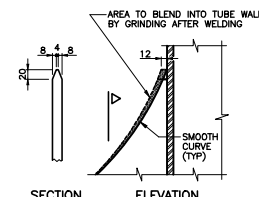
VMS BOARD AND POLE CONNECTION DETAIL

(TO BE DETAILED ON SHOP DRAWINGS)

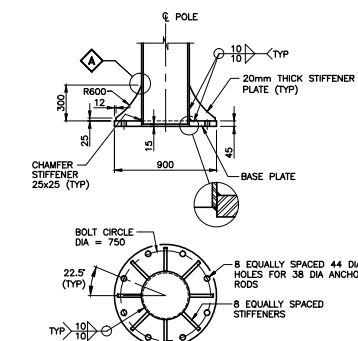
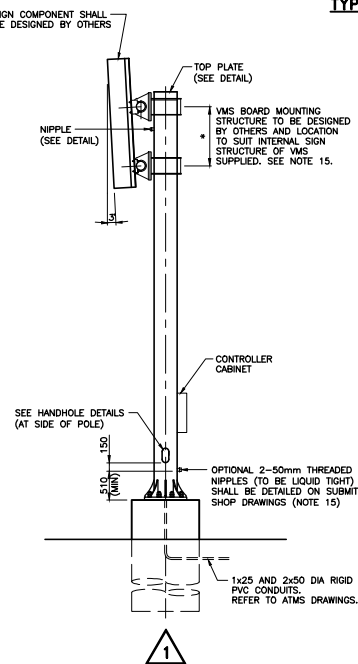


HANDHOLE DETAIL

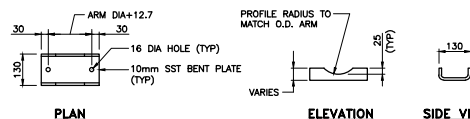
(NIPPLES NOT SHOWN FOR CLARITY)



BASE DETAIL



ELEVATION



SST PROFILED CHANNEL DETAIL

TABLE 1 - GENERAL

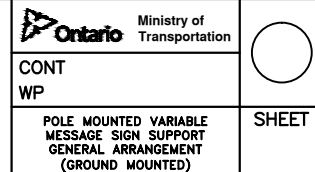
LOCAL REFERENCE WIND PRESSURE = ---- Pa		FROST DEPTH = ---- mm	
STATION	----		
SIGN No.	----		
SIGN SIZE (dx#)	----		
E	----		
H ₁	----		
G	----		
EL. P1	----		
EL. WP	----		

METRIC

DIMENSIONS ARE IN METRES AND/OR
MILLIMETRES UNLESS OTHERWISE SHOWN

DRAWING NOT TO BE SCALED

100mm ON ORIGINAL DRAWING

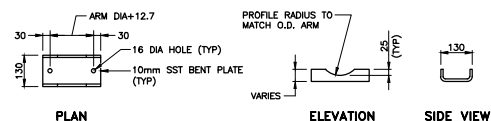
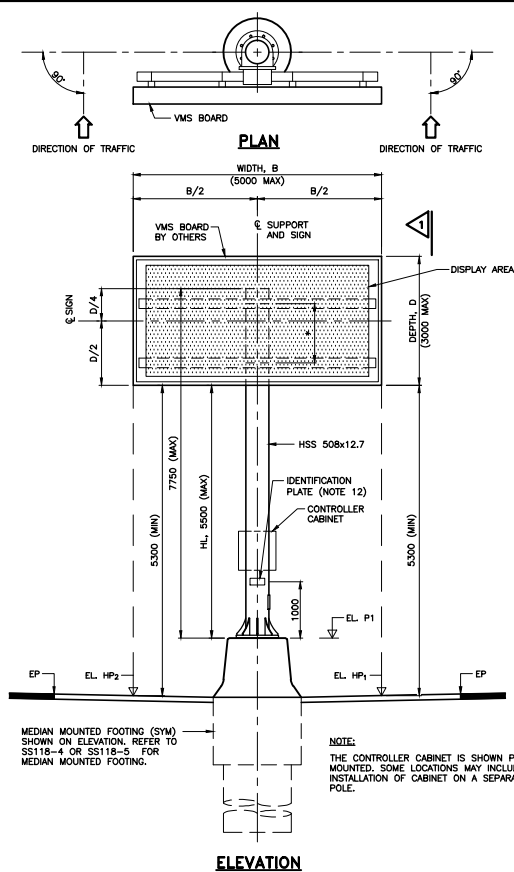


GENERAL NOTES:

1. DESIGN INFORMATION:
 - MAXIMUM SIGN FACE AREA (D_{90}) = 15 SQUARE METERS
 - REFERENCE WIND PRESSURE = 600 Pa
 - TOTAL MASS OF SIGN COMPONENT INCLUDING INTERNAL AND EXTERNAL COMPONENTS SHALL NOT EXCEED 1000 kg.
2. ALL STRUCTURAL STEEL SHALL BE ACCORDING TO CAN/CSA G40.20-13/G40.21-13, GRADE 300M OR ASTM SPECIFICATION A500 GRADE C.
3. ALL NON-STAINLESS STEEL BOLTS, NUTS, AND WASHERS SHALL BE ACCORDING TO ASTM A325M AND BE HOT-DIP GALVANIZED UNLESS SPECIFIED OTHERWISE.
4. ALL BOLTS SHALL BE INSTALLED BY TURN-OFF-NUT TIGHTENING IN CONFORMANCE WITH CAN/CSA 56-14.
5. ALL STRUCTURAL STEEL SHALL BE HOT-DIP GALVANIZED AFTER FABRICATION. LEAD ONLY SHALL BE SUBSEQUENTLY COATED WITH AN APPROVED SYSTEM ACCORDING TO 911.
6. STAINLESS STEEL PLATE SHALL BE TYPE 316, CONFORM TO ASTM SPECIFICATION A167, AND SHALL HAVE A MINIMUM YIELD STRENGTH OF 310 MPa (45,000 PSI).
7. ALL STAINLESS STEEL BOLTS, NUTS, AND WASHERS SHALL CONFORM TO ASTM SPECIFICATION F959 ALLOY 304 WITH MINIMUM YIELD STRENGTH OF 480 MPa AND TENSILE STRENGTH OF 620 MPa (71.6 MPa).
8. POLE SHALL NOT BE EXERCISED UNTIL FOUNDATION CONCRETE HAS REACHED 80% OF SPECIFIED STRENGTH.
9. NO SHOP SPACES SHALL BE ALLOWED IN ANY MEMBERS.
10. ANCHORAGE LAYOUT AND ELEVATIONS TO BE VERIFIED IN THE FIELD BEFORE SIGN SUPPORT STRUCTURE FABRICATION.
11. THIS DRAWING TO BE READ IN CONJUNCTION WITH DRAWING SS110-3 (FOOTING FOR GROUND MOUNTED SIGNS).
12. EACH SIGN SUPPORT SHALL HAVE AN IDENTIFICATION MARKING SHOWING THE SITE NUMBER, THE MAXIMUM ALLOWABLE SIGN BOARD AREA, THE LOCAL REFERENCE WIND PRESSURE AS SHOWN IN TABLE 1, THE MANUFACTURER'S NAME OR TRADEMARK, AND THE DATE OF THE MANUFACTURE. THIS 4mm THICK RECTANGULAR STAINLESS STEEL PLATE SHALL HAVE A RUBBER BACKING AND BE SUFFICIENT DIMENSIONS TO ACCOMMODATE THE DESIGN INFORMATION USING 6mm HIGH ENGRAVED LETTERING. THE PLATE SHALL BE SECURELY ATTACHED TO THE POLE OF STRUCTURE BY FOUR (4) STAINLESS STEEL BOND CLAMPS THAT GO THROUGH VERTICAL HOLES AT EACH SIDE OF THE PLATE, PASS BEHIND THE PLATE, AND WRAP AROUND THE POLE. NO DRILLING INTO THE HSS FOR ATTACHMENT OF PLATE IS PERMITTED.
13. VMS BOARD WITH ATTACHED Z-BRACKETS SHALL BE DESIGNED BY OTHERS.
14. VMS BOARD WITH ATTACHED 2-BRACKETS SHALL BE INSTALLED ON THE STRUCTURE USING U-BOLTS AS SHOWN.
15. THE CONNECTION DETAILS BETWEEN THE VMS BOARD AND THE POLE SHALL BE BY MEANS OF THE STEEL COMPONENTS AND SHALL BE HOT-DIP GALVANIZED AFTER FABRICATION. THE CONNECTION SHALL BE DESIGNED BY THE FABRICATOR TO SUIT THE VMS BOARD DESIGN DRAWINGS. DRAWINGS PREPARED BY A STRUCTURAL ENGINEER LICENSED IN THE PROVINCE OF ONTARIO SHALL BE SUBMITTED FOR REVIEW AND APPROVAL SEVEN DAYS PRIOR TO SHOP DRAWING SUBMISSION.
16. FOR GENERAL LAYOUT AND LOCATION REFER TO ATMS DRAWINGS.
17. LEGEND:
 - EL-HP: - DENOTES ELEVATION OF THE HIGHEST POINT ON THE HIGHWAY UNDER THE SIGN, INCLUDING SHOULDERS, CURB, AND MEDIAN
 - EP - DENOTES THE EDGE OF PAVEMENT OF TRAVELED PORTION OF HIGHWAY
 - SST - DENOTES STAINLESS STEEL

STANDARD DRAWING FEBRUARY 2019	SS118-11
POLE MOUNTED VARIABLE MESSAGE SIGN SUPPORT - GENERAL ARRANGEMENT (GROUND MOUNTED)	

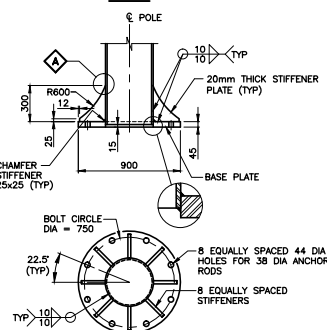
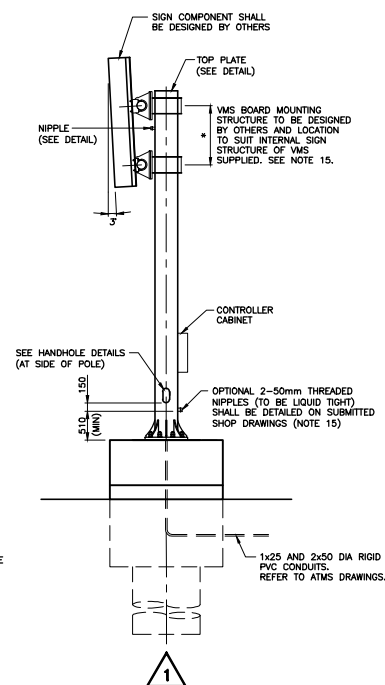
REVISIONS									
	DATE	BY	DESCRIPTION						
DESIGN	CHK		CODE	CSA	S6-14	LOAD	-	DATE	
DRAWN	CHK		SITE					DWG	



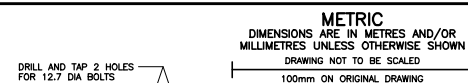
SST PROFILED CHANNEL DETAIL

TABLE 1 - GENERAL

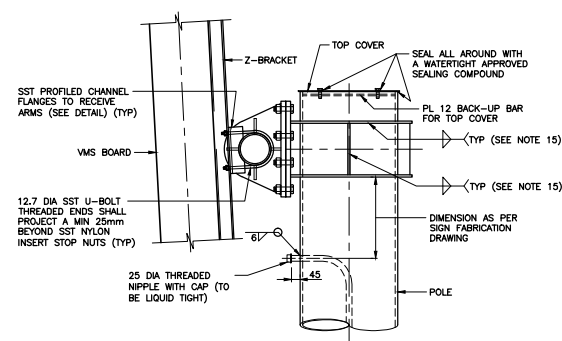
LOCAL REFERENCE WIND PRESSURE = ----- P ₀		FROST DEPTH = ----- mm	
STATION	-----		
SIGN No.	-----		
SIGN SIZE (DxB)	-----		
FOOTING TYPE (SYM./ASYM.)	-----		
H ₁	-----		
EL. P1	-----		
EL. HP1	-----		
EL. HP2	-----		



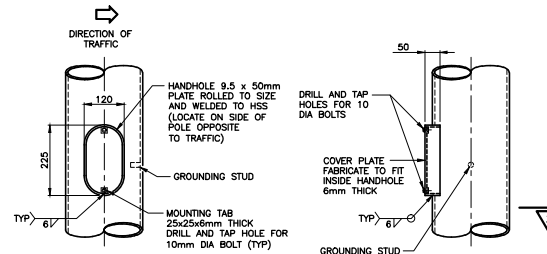
BASE DETAIL



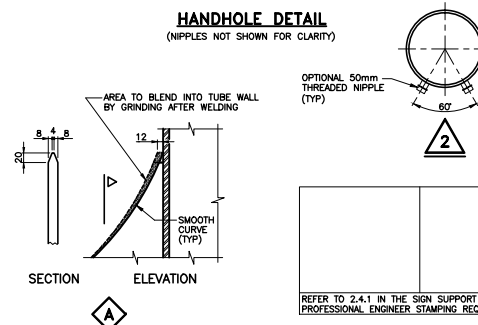
TOP PLATE DETAIL



VMS BOARD AND POLE CONNECTION DETAIL
(TO BE DETAILED ON SHOP DRAWINGS)



HANDHOLE DETAIL
(NIPPLES NOT SHOWN FOR CLARITY)



REFER TO 2.4.1 IN THE SIGN SUPPORT MANUAL FOR
PROFESSIONAL ENGINEER STAMPING REQUIREMENTS.

 Ontario Ministry of Transportation	
CONT WP	
POLE MOUNTED VARIABLE MESSAGE SIGN SUPPORT GENERAL ARRANGEMENT (MEDIAN MOUNTED)	SHEET

GENERAL NOTES:

1. DESIGN INFORMATION:
 - MAXIMUM SIGN FACE AREA (dxb) = 15 SQUARE METERS
 - REFLECTED WIND PRESSURE = 800 Pa
 - TOTAL MASS OF SIGN COMPONENT INCLUDING INTERNAL AND EXTERNAL COMPONENTS SHALL NOT EXCEED 1000 kg.
 2. ALL STRUCTURAL STEEL SHALL BE ACCORDING TO CAN/CSA G40.21-13/G40.21-13, GRADE 300W OR ASTM SPECIFICATION A500 GRADE C.
 3. ALL NON-STAINLESS STEEL BOLTS, NUTS, AND WASHERS SHALL BE CONFORMING TO ASTM A325 TYPE 1 AND BE HOT-DIP GALVANIZED UNLESS SPECIFIED OTHERWISE.
 4. ALL BOLTS SHALL BE INSTALLED BY TURN-OF-NUT TIGHTENING IN CONFORMANCE WITH CAN/CSA S6-14.
 5. ALL STRUCTURAL STEEL SHALL BE HOT-DIP GALVANIZED AFTER FABRICATION. LEG ONLY SHALL BE SUCCESSFULLY COATED WITH AN APPROVED SYSTEM OF PROTECTION.
 6. STAINLESS STEEL PLATE SHALL BE TYPE 316, CONFORM TO ASTM SPECIFICATION A167, AND SHALL HAVE A MINIMUM YIELD STRENGTH OF 310 MPa (45,000 PSI).
 7. ALL STAINLESS STEEL BOLTS, NUTS, AND WASHERS SHALL CONFORM TO ASTM SPECIFICATION F593 ALLOY 304 WITH MINIMUM YIELD STRENGTH OF 480 MPa (69,000 PSI) AND A MINIMUM TENSILE STRENGTH OF 718 MPa.
 8. POLE SHALL NOT BE ERECTED UNTIL FOUNDATION CONCRETE HAS REACHED 80% OF SPECIFIED STRENGTH.
 9. NO SHOP SPACES SHALL BE ALLOWED IN ANY MEMBERS.
 10. ANCHORAGE LAUNCH AND ELEVATIONS TO BE VERIFIED IN THE FIELD BEFORE SIGN SUPPORT FABRICATION.
 11. THIS DRAWING TO BE READ IN CONJUNCTION WITH DRAWING SS18-4 (FOOTING FOR MEDIAN MOUNTED SIGNS - SYMMETRICAL) OR SS18-5 (FOOTING FOR MEDIAN MOUNTED SIGNS - ASYMMETRICAL).
 12. EACH SIGN SUPPORT SHALL HAVE A MANUFACTURER MARKING SHOWING THE SITE NUMBER, THE MANUFACTURER ALLOWING THE MEDIAN ROAD, THE LOCAL REFERENCE WIND PRESSURE, AS SHOWN IN TABLE 1, THE MANUFACTURER'S NAME OR TRADEMARK, AND THE DATE OF MANUFACTURE. THE MARKING FROM THOSE REGULATIONS FOR STEEL PLATE SHALL HAVE A RUBBER BACKING AND BE SUFFICIENT DIMENSIONS TO ACCOMMODATE THE REQUIRED INFORMATION USING 6mm HIGH ENGRAVED LETTERING. THE PLATE SHALL BE SECURELY ATTACHED TO THE POLE OF THE STRUCTURE BY MEANS OF STAINLESS STEEL BAND CLAMPS THAT GO THROUGH VERTICAL HOLES AT EACH SIDE OF THE PLATE, PASS BEHIND THE PLATE, AND WRAP AROUND THE POLE. NO DRILLING INTO THE HSS FOR ATTACHMENT OF PLATE IS PERMITTED.
 13. VMS BOARD WITH ATTACHED Z-BRACKETS SHALL BE DESIGNED BY OTHERS.
 14. VMS BOARD WITH ATTACHED Z-BRACKETS SHALL BE INSTALLED ON THE STRUCTURE USING U-BOLTS AS SHOWN.
 15. THE CONNECTION DETAILS BETWEEN THE VMS BOARD AND THE POLE SHALL BE THE MEANS OF CONNECTION. THE CONNECTION SHALL BE HOT-DIP GALVANIZED AFTER FABRICATION. THE CONNECTION SHALL BE DESIGNED BY THE FABRICATOR TO SUIT THE VMS BOARD. DESIGN DRAWINGS STAMPED AND SIGNED BY A PROFESSIONAL ENGINEER LICENSED IN THE PROVINCE OF ONTARIO SHALL BE SUBMITTED FOR REVIEW AND APPROVAL SEVEN DAYS PRIOR TO SHOP DRAWING SUBMISSION.
 16. FOR GENERAL LAYOUT AND LOCATION REFER TO ATMS DRAWINGS.
17. LEGEND:
- | | |
|---------|--|
| EL.H.P. | - DENOTES ELEVATION OF THE HIGHEST POINT ON THE HIGHWAY UNDER THE SIGN, INCLUDING SHOULDERS, CURBS, AND MEDIAN |
| EP | - DENOTES THE EDGE OF PAVEMENT OF TRAVELED PORTION OF HIGHWAY |
| SST | - DENOTES STAINLESS STEEL |

STANDARD DRAWING FEBRUARY 2019	SS118-13
POLE MOUNTED VARIABLE MESSAGE SIGN SUPPORT - GENERAL ARRANGEMENT (MEDIAN MOUNTED)	

REVISIONS					
	DATE	BY	DESCRIPTION		
DESIGN	CHK		CODE	CSA S6-14	LOAD - DATE
DRAWN	CHK		SITE		DWG.

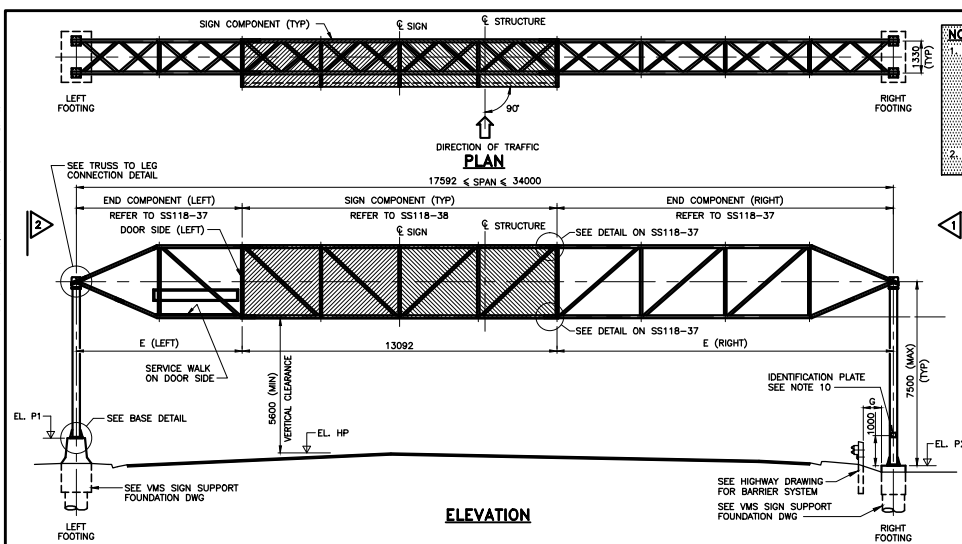
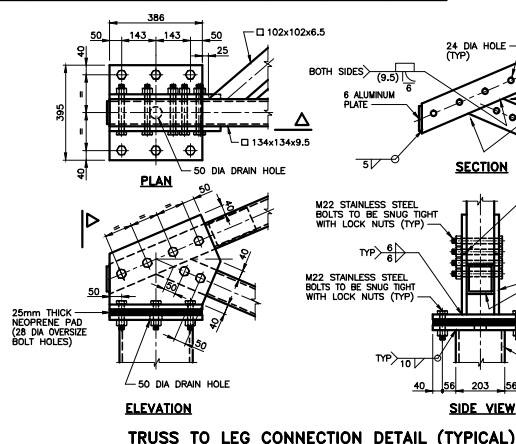
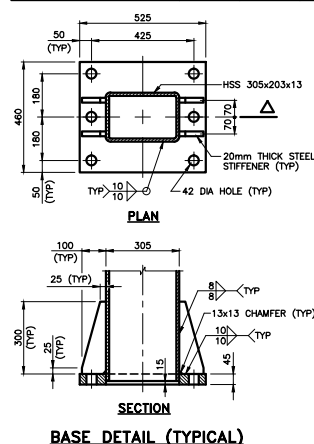


TABLE 1 - GENERAL

TABULACION GENERAL					
STATION					
SITE No.					
SPAN					
TRUSS DIAGRAM					
END COMPONENT (LEFT)	TYPE P-				
	E (LEFT)				
	B (LEFT)				
END COMPONENT (RIGHT)	TYPE P-				
	E (RIGHT)				
	B (RIGHT)				
G					
EL.HP					
EL.P1					
EL.P2					
DOOR SIDE					
FOOTING TYPE (LEFT)					
FOOTING TYPE (RIGHT)					

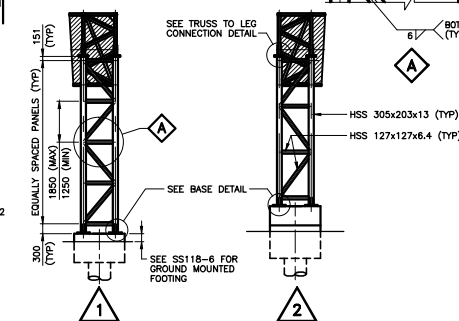


NOTES TO DESIGNER:

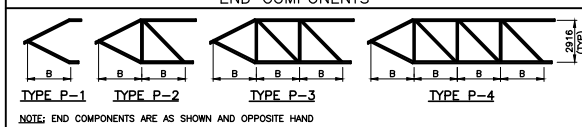
1. DIMENSION G IS DEFINED AS THE HORIZONTAL CLEARANCE FROM THE BACK OF PROTECTIVE BARRIER TO THE NEAREST FACE OF CONCRETE FOOTING ACCORDING TO THE VALUES BELOW. THIS DOES NOT APPLY TO TEMPORARY CONCRETE BARRIER INSTALLATIONS.

PROTECTIVE BARRIER TYPE	MINIMUM CLEARANCE (m)
STEEL BEAM GUIDE RAIL	1.0
PERMANENT CONCRETE BARRIER	0.3

2. THE 'NOTES TO DESIGNER' SHALL BE DELETED FROM THIS DRAWING PRIOR TO ISSUING.

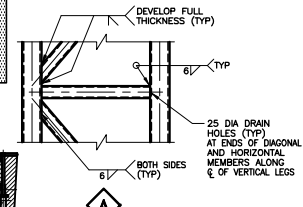


END COMPONENTS



NOTE: END COMPONENTS ARE AS SHOWN AND OPPOSITE HAND

METRIC
DIMENSIONS ARE IN METRES AND/OR
MILLIMETRES UNLESS OTHERWISE SHOWN
DRAWING NOT TO BE SCALED
100mm ON ORIGINAL DRAWING



GENERAL NOTES:

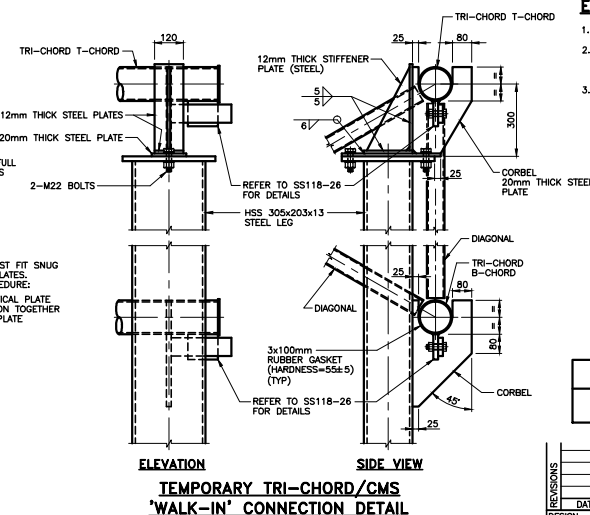
1. ALL ALUMINUM EXTRUDED TUBE SECTIONS SHALL BE ALLOY 6061-T6 UNLESS NOTED.
2. ALUMINUM COMPONENTS SHALL BE MADE OF ALLOY 6061-T6.
3. ALL STRUCTURAL STEEL SHALL BE ACCORDING TO CSA G40.20/G40.21 GRADE 350W.
4. ALL BOLTS, NUTS, AND WASHERS SHALL BE STAINLESS STEEL AND SHALL BE ACCORDING TO ASTM F959 ALLOY 304 WITH A MINIMUM TENSILE FIELD OF 450MPa AND A MINIMUM TENSILE STRENGTH OF 715MPa.
5. STRUCTURE SHALL NOT BE ERECTED UNTIL FOUNDATION HAS REACHED 80% OF SPECIFIED STRENGTH.
6. SPAN LENGTHS AND ELEVATIONS TO BE VERIFIED IN THE FIELD BEFORE SIGN SUPPORT STRUCTURE FABRICATION.
7. ALL STRUCTURAL STEEL SHALL BE HOT-DIP GALVANIZED AFTER FABRICATION. LEGS SHALL BE SUBSEQUENTLY COATED WITH AN APPROVED PAINT SYSTEM ACCORDING TO OPS 911.
8. THIS STANDARD TO BE READ IN CONJUNCTION WITH SS118-37 (END COMPONENT - DETAILS) AND SS118-38 (SIGN COMPONENT - DETAILS).
9. THIS STANDARD TO BE READ IN CONJUNCTION WITH SS118-6 (GROUND MOUNTED FOOTING) AND/OR SS118-7 (MEDIAN MOUNTED FOOTING - SYMMETRICAL) AND/OR SS118-8 (MEDIAN MOUNTED FOOTING - ASYMMETRICAL).
10. EACH SIGN SUPPORT SHALL HAVE AN IDENTIFICATION MARKING SHOWING THE SITE NUMBER, THE MANUFACTURER'S NAME OR TRADEMARK, AND THE DATE OF MANUFACTURE. THIS MARKING SHALL BE A CORNER OR END OF THE STRUCTURE PLATE SECURELY ATTACHED TO THE LEG OF THE STRUCTURE BY MEANS OF STAINLESS STEEL BAND CLAMPS.
11. NO SHOP SPLICES IN ANY MEMBER.
12. LEGEND:
HSS - DENOTES HOLLOW STRUCTURAL STEEL
DENOTES HOLLOW SQUARE TUBE

LEGEND:

- HSS - DENOTES HOLLOW STRUCTURAL STEEL
- - DENOTES ALUMINUM SQUARE TUBE

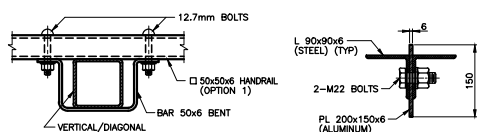
ERECTION NOTES:

1. COMPONENTS ARE ASSEMBLED ON SITE PRIOR TO ERECTION.
2. ALL CHORD SPLICE CONNECTION BOLTS MUST BE PROPERLY TIGHTENED PRIOR TO LIFTING BY TURN-OF-NUT METHOD OR EQUIVALENT.
3. ALL LEG UPPER CONNECTION BOLTS MUST BE SNUG TIGHT WITH LOCK-NUTS AND ALL ANCHOR BOLTS PROPERLY TIGHTENED PRIOR TO RELEASE OF CRANE.

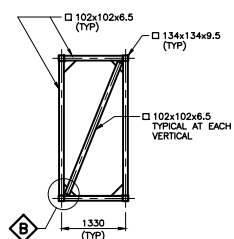


STANDARD DRAWING FEBRUARY 2019	SS118-36
VARIABLE MESSAGE SIGN (VMS) SUPPORT GENERAL ARRANGEMENT	

REVISIONS							
	DATE	BY	DESCRIPTION				
DESIGN	CHK		CODE	CSA 56-14	LOAD		DATE
DRAWN	CHK		SITE				DWG.

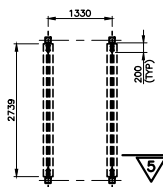


4 SECTION



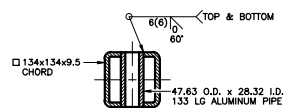
1 SECTION

5 SECTION

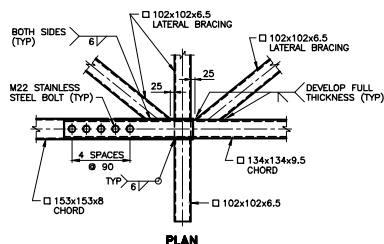


TEMPORARY BRACE
FOR TRANSPORTATION

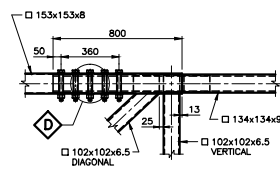
2 SECTION



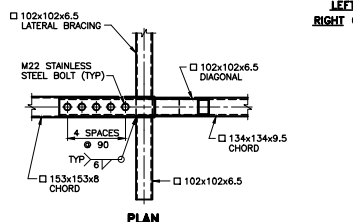
3 SECTION



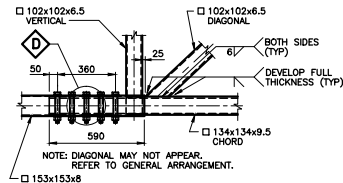
PLAN



ELEVATION
TOP CHORD



PLAN

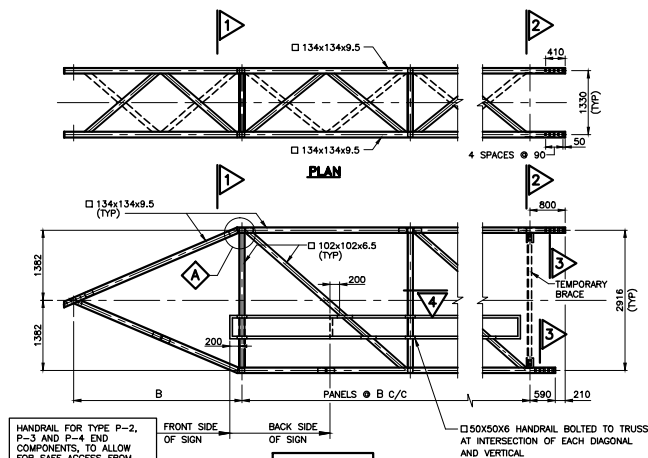


ELEVATION
BOTTOM CHORD

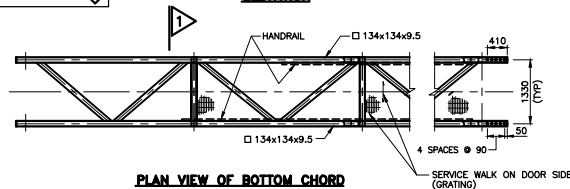
ELEVATION
BOTTOM CHORD

NOTE: CHORD MAY APPEAR SLOPING (FOR TYPE P-1 END COMPONENTS).
REFER TO GENERAL ARRANGEMENT.

END/SIGN COMPONENT CONNECTION DETAIL (TYPICAL)

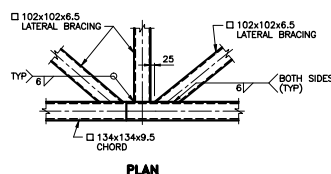


ELEVATION

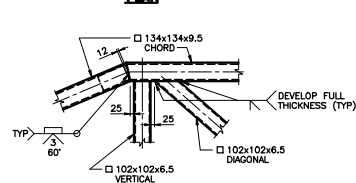


PLAN VIEW OF BOTTOM CHORD
END COMPONENT DETAIL (TYPICAL)

LEFT AS SHOWN
RIGHT OPPOSITE HAND



PLAN



ELEVATION

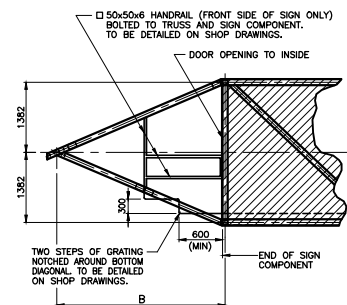
METRIC
DIMENSIONS ARE IN METRES AND/OR
MILLIMETRES UNLESS OTHERWISE SHOWN
DRAWING NOT TO BE SCALED
100mm ON ORIGINAL DRAWING



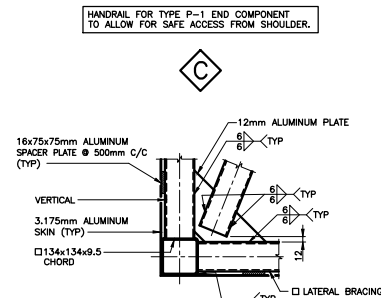
CONT
WP

VARIABLE MESSAGE SIGN (VMS)
SUPPORT
END COMPONENT - DETAILS

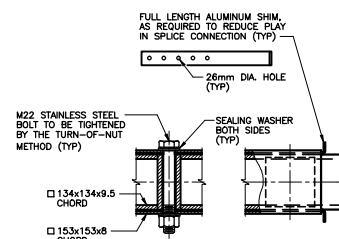
SHEET



ELEVATION



B



◀

NOTES:

1. TOLERANCE SHALL BE $\pm 1\text{mm}$ UNLESS OTHERWISE SPECIFIED.
2. NAMEPLATE STATING FABRICATOR'S IDENTITY AND DATE OF FABRICATION SHALL BE ATTACHED FACING INWARD TO BOTH MAIN CHORDS DIAGONALLY OPPOSITE.
3. THIS STANDARD TO BE READ IN CONJUNCTION WITH SS118-36 (VMS - GENERAL ARRANGEMENT) AND SS118-38 (VMS - SIGN COMPONENT - DETAILS).
4. NO SHOP SPLICES IN ANY MEMBER.
5. LEGEND:
 - ☐ - DENOTES ALUMINUM SQUARE TUBE

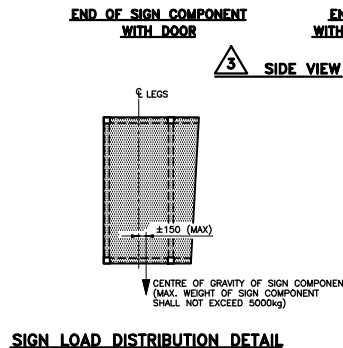
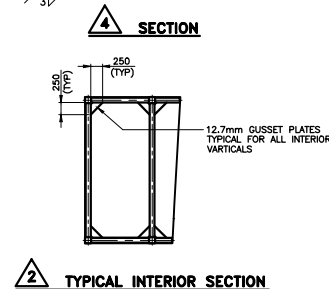
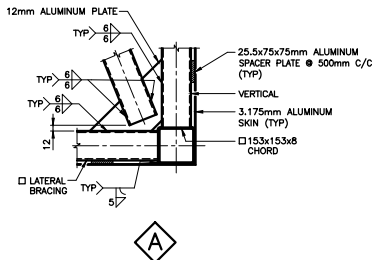
5. LEGEND: □ - DENOTES ALUMINUM SQUARE TUBE

REFER TO 2.4.1 IN THE SIGN SUPPORT MANUAL FOR PROFESSIONAL ENGINEER STAMPING REQUIREMENTS.

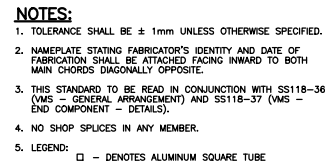
STANDARD DRAWING NOVEMBER 2017	SS118-37
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VARIABLE MESSAGE SIGN (VMS) SUPPORT END COMPONENT - DETAILS

REVISIONS							
	DATE	BY				DESCRIPTION	
	DESIGN	CHK	CODE	CHBDC-14	LOAD	- DATE	
	DRAWN	CHK	SITE			DWG.	



METRIC
DIMENSIONS ARE IN METRES AND/OR
MILLIMETRES UNLESS OTHERWISE SHOWN
DRAWING NOT TO BE SCALED
100mm ON ORIGINAL DRAWING

[illegible]

SIGN SUPPORT MANUAL

SECTION 9 – BRIDGE MOUNTED SIGN SUPPORTS

9 BRIDGE MOUNTED SIGN SUPPORTS

9.1 GENERAL

9.1.1 STANDARD SIGN SUPPORT

Bridge mounted sign supports are used when it is convenient and economical to mount overhead signs on bridges.

For bridges skewed more than 15 degrees, the signs shall be cantilevered from the bridge on a skewed sign support structure to ensure that the sign remains nearly perpendicular to oncoming traffic (Type IV sign support). Generally signboards are kept to within 15 degrees of normal to the direction of oncoming traffic.

9.1.2 DESCRIPTION OF SIGN SUPPORTS

The sign supports main components, the top and bottom chords, the walk arm assembly, the grating and the hinge support pipe are all made of aluminum. To prevent a chemical reaction from occurring between the concrete of the bridge and adjoining aluminum components, neoprene spacers are used. Sign supports are fastened to the bridge using stainless steel anchors.

9.1.3 TYPES OF SIGN SUPPORTS

Four types of bridge mounted sign supports are used:

TYPE I – Standard Drawings SS118-12

This type of sign support requires 2 mounting points and is shown in Figure 9.1.3(a). This support type is generally used when a barrier wall is available and when a walkway is not required. The top chord is mounted directly to the barrier wall. The bottom chord is mounted directly to the curb face. A third connection point is located on the deck soffit.

Note that this arrangement has a minimal clearance of approximately 330 mm between the sign and the bridge face, therefore resulting in a very difficult installation, often requiring lane closures, traffic detours and special equipment.

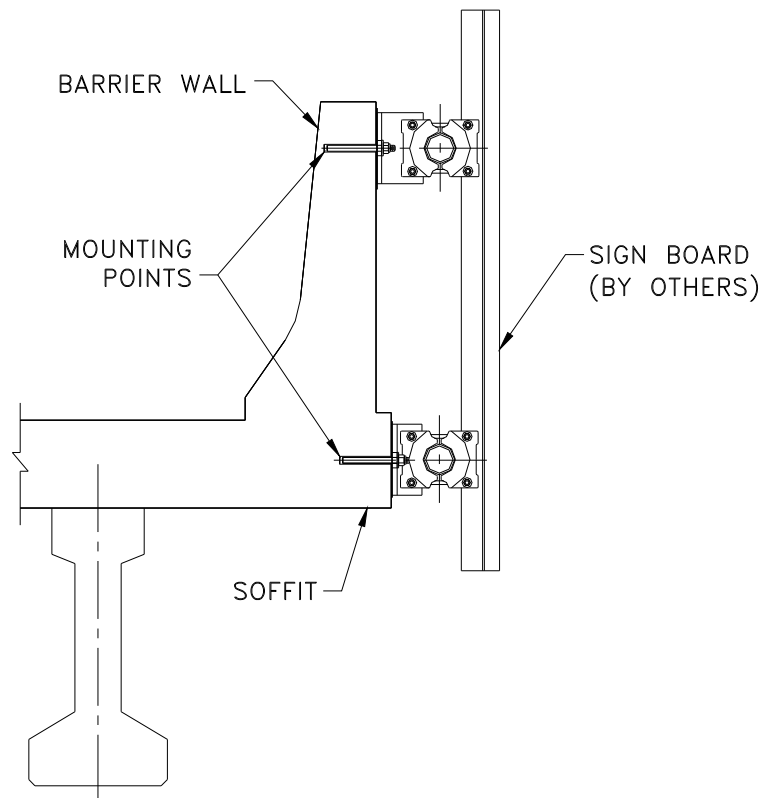
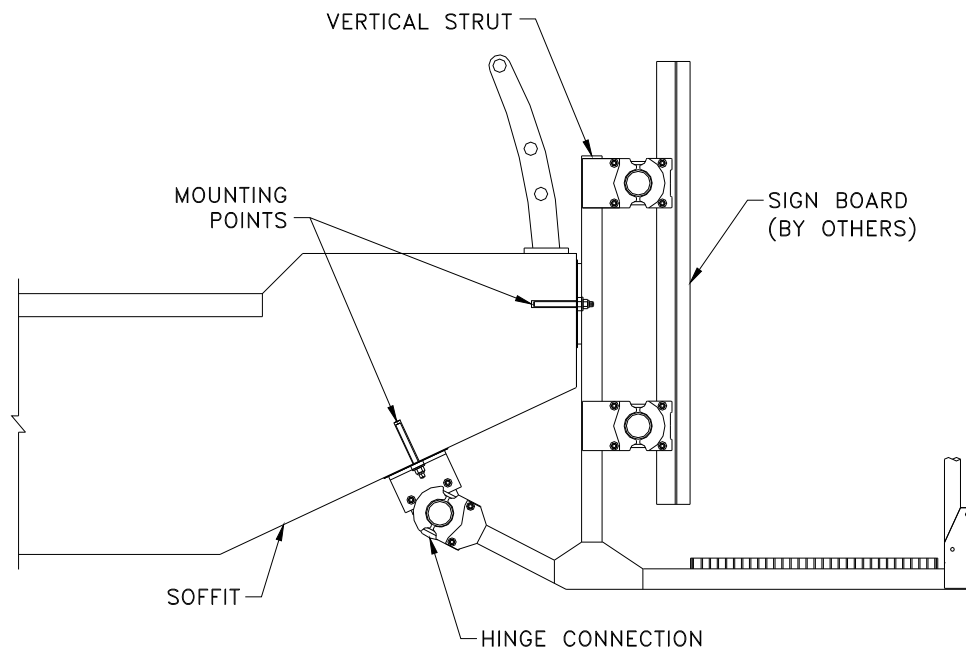


FIGURE 9.1.3(a)

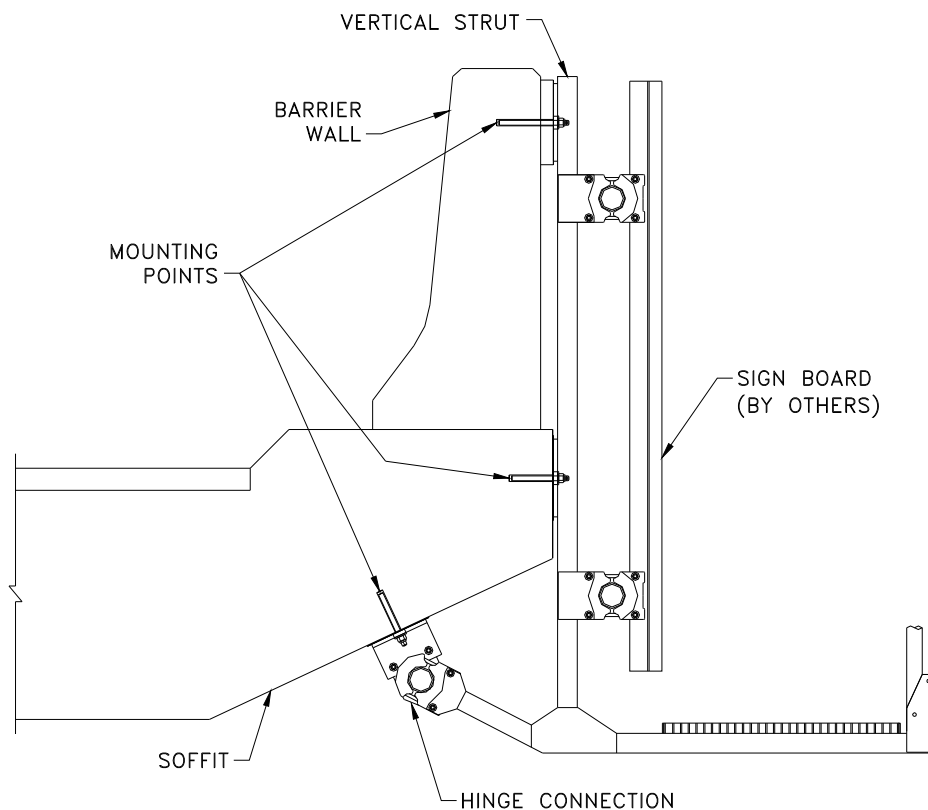
TYPE II- Standard Drawing SS118-14 and SS118-15

This sign support structure requires two mounting points, as shown in Figure 9.1.3(b). This support type is generally used when a barrier wall is not available and when a walkway is required. The top and bottom chords are mounted to a vertical strut, which in turn is anchored to the curb face. The second mounting point is located on the deck soffit.

**FIGURE 9.1.3(b)**

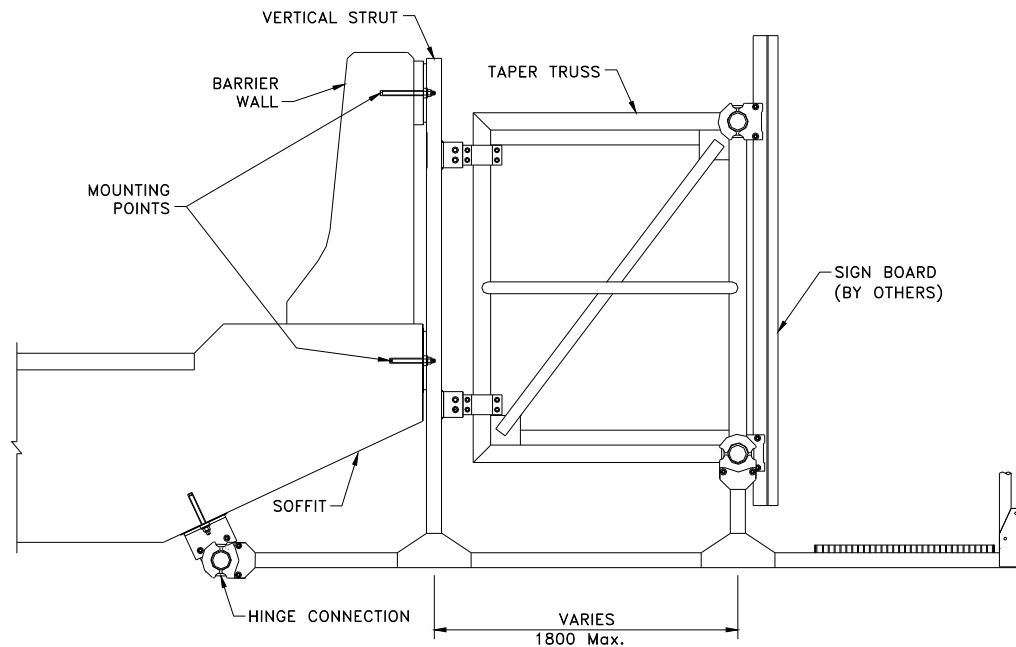
TYPE III -Standard Drawing SS118-16 and SS118-17

Type III bridge mounted sign support structures require three mounting points, as detailed in Figure 9.1.3(c). This support type is generally used when a barrier wall is available and when a walkway is required. The top and bottom chords are fastened to a vertical strut which in turn is attached to the bridge at two mounting points, on the barrier wall and at the level of the curb face. A third mounting point is located on the deck soffit.

**FIGURE 9.1.3(c)**

TYPE IV -Standard Drawing SS118-18 and SS118-19

This type of "tapered" support is used when there is a significant skew angle (bridge skew greater than 15°). The approximate distance between the back of the sign board and the face of the bridge deck may vary up to 1800 mm as shown in Figure 9.1.3(d). Walkways form part of the structure. The tapered truss is fastened to a vertical strut at two points, which itself is anchored to the barrier wall, curb face and deck soffit.

**FIGURE 9.1.3(d)**

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BRIDGE MOUNTED SIGN SUPPORTS

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9.1.4 CLEARANCE

The clearance provided to bridge mounted sign supports must exceed the clearance to the supporting bridge. The roadway clearance to the small lane designation signs (915 mm wide by 610 mm high) attached to the bottom of sign support structures is 4800 mm.

9.2 PREPARATION OF DRAWINGS**9.2.1 DATA REQUIRED**

Before sign supports can be detailed a full cross-section and plan of the bridge is required to show the following data:

- (i) The station of the bridge.
- (ii) The bridge clearance.
- (iii) The bridge drawings.
- (iv) The skew of the bridge.
- (v) Direction of traffic; for sign board(s) to be mounted on the bridge (i.e. North Bound, South Bound, etc.).
- (vi) Dimension from centre line of sign board(s) to fixed point(s) on the bridge or highway (e.g. pier, abutment, painted lane markings, etc.).
- (vii) Dimension of sign board(s).

9.2.2 SUPPORT DRAWINGS

The standard drawings for Types I, II and III sign supports are to be used when the skew of the bridge is less than 15 degrees. Each of these drawings contains one elevation and one detail drawing.

The standard drawings for Type IV sign supports are to be used when the skew of bridge exceeds 15 degrees. These drawings consist of one elevation and one detail drawing. An elevation of the structure must be added by the user.

The elevation must show the relationships between the bridge, the sign and the roadway. A site plan, typical cross-section and an enlarged front elevation showing all components is normally included, as illustrated in Figure 9.2.2(a).

The standard drawings are to be completed in accordance with the following procedure:

- (i) Add the bridge name and/or the intersection, contract number and W. P. number in the title block.

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BRIDGE MOUNTED SIGN SUPPORTS

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- (ii) Show on the front elevation, the outline and dimensions of each sign board. Use broken lines since the signs are not part of the contract. The position of the sign should be dimensioned from the vertical centreline of the sign board to a fixed point, and from the centreline of the lower chord to the bottom of the sign board according to the following table.

<u>SIGN DEPTH</u> (mm)	<u>DIMENSION</u> (mm)
1525	300
1830	350
2130	400
2440	450
2740	500

The dimension between the top of the sign board and the centreline of the upper chord shall be limited to 1100mm. For signs with big depth, the recommended dimension in the table can be increased to suit provided it is not more than 1100mm and the clearance of the bridge mounted sign support(s) still exceed the clearance to the supporting bridge.

Indicate the size of each sign and that they are not part of the contract (1830 x 6400 -SIGN BY OTHERS).

- (iii) Draw the service walkway on the front elevation. Service walkways; allow maintenance staff access; to luminaries and sign boards; without interference to traffic. The service walkway must extend from the shoulder area (usually the right shoulder) to the remote edge of the sign board. The service walkways are composed of 1524 mm (5 foot) long grating units supported by walk arms. The walk arm is part of the "Service Walk Arm Assembly"; other parts of this assembly include the vertical strut and the brace. This assembly is mounted to the face of the bridge deck, soffit and barrier wall, as detailed in Section 9.1.3. Walkways should be extended by at least 750 mm beyond the ends of the sign board for safety and future considerations.
- (iv) The railing should be drawn in the down position on the front elevation. Railings are available in two lengths, 3050 mm (2 posts BD-221-045-8A) and 3810 mm (3 posts, BD-221-045-10A). The two post railing extends over one 1524 mm (5 foot) grating unit and halfway across each of the two adjacent units (do not use this two post railing to end a walkway). The three post railing extends over two 1524 mm (5 foot) grating units and halfway across the right-hand adjacent unit. The three post railing is used only on the left hand end of a service walkway when the service walkway has an even number of grating units. When an uneven number of grating units are used, either add

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BRIDGE MOUNTED SIGN SUPPORTS

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one more 1524 mm (5 foot) grating unit or modify a three post unit into a two post end railing.

- (v) Draw the vertical centre lines of the sign clamps on the front elevation. Print along a dimension line above each sign the number, size and spacing. The spacing is normally 1524 mm (5 feet) to coincide with the spacing of the vertical strut clamps which are normally offset by 762 mm (vary to suit individual situation, minimum 250 mm). The following table gives the limits for overhangs, measured from the centre line of the sign clamp to the edge of the sign board.

<u>SIGN SIZE/TYPE</u>	<u>MAXIMUM</u> (mm)	<u>MINIMUM</u> (mm)
2740 mm deep	750	150
1524 to 2440 mm deep	915	150
2740 mm deep, and bevelled end	150	150
1524 to 2440 mm deep, and bevelled end	450	150

- (vi) To assist the user in the completion of these standard drawings, instructions have been added to the reduced copies included in this Manual. Explanatory notes with arrows indicating the specific area of the drawing to which they apply are provided. These instructions do not appear on the production versions of the standard drawings, and must not appear in the contract.
- (vii) Assign a Figure number from the "Part List" on the "Service Walk Arm Assembly" drawing to all items not already numbered. Show the Figure numbers against the item in an appropriate location with an arrow from the number to the item.

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BRIDGE MOUNTED SIGN SUPPORTS

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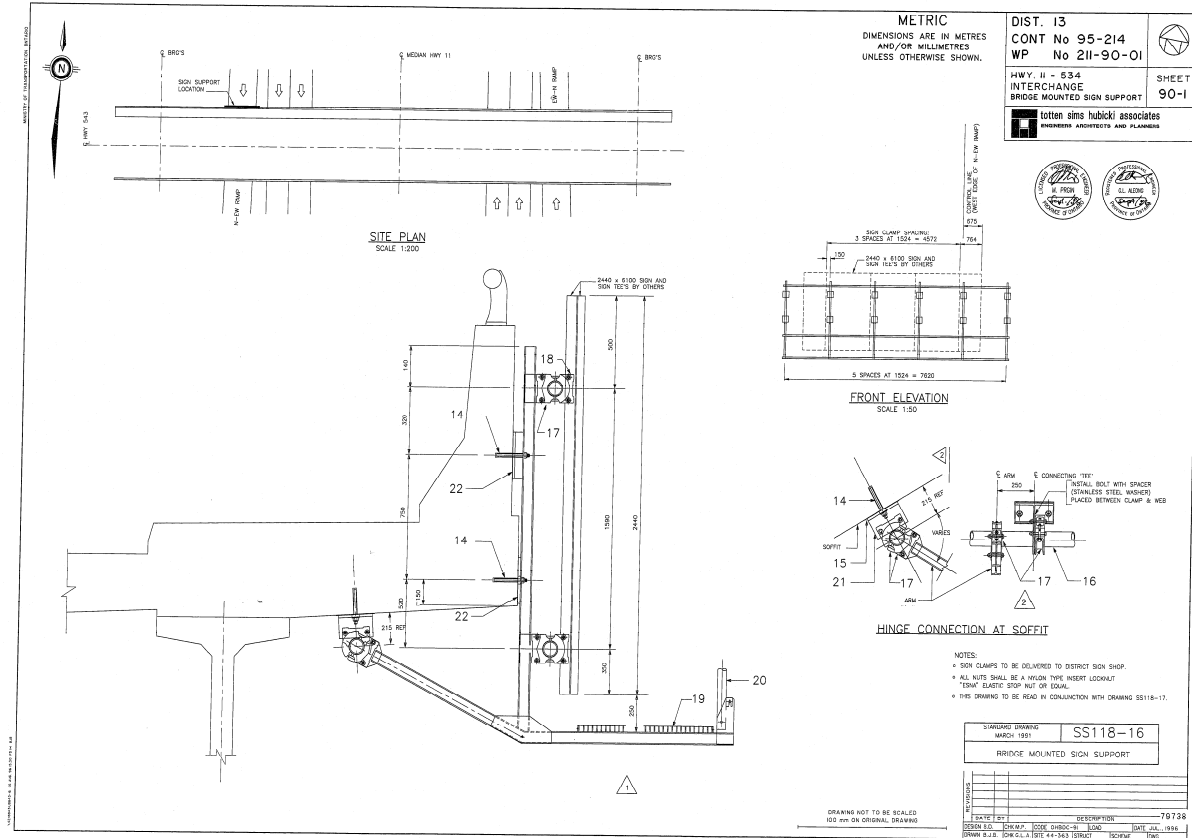


FIGURE 9.2.2(a) GENERAL LAYOUT DRAWING

9.3 PROCESSING

9.3.1 PREPARATION OF ELECTRICAL DRAWINGS

When illumination is required as described in Section 2.5.1, the electrical wiring for the bridge mounted signs is to be supported by the bridge.

For new bridges, it is desirable to have the electrical work embedded in concrete. Therefore it is important that the type and location of the sign support be decided upon in time for inclusion of electrical work in the structural design process.

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2015 04 01

BRIDGE MOUNTED SIGN SUPPORTS

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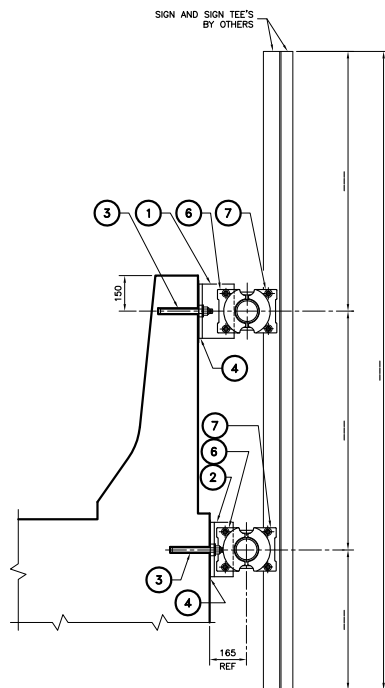
APPENDIX TO SECTION 9

BRIDGE MOUNTED SIGN SUPPORTS

SS118-12	BRIDGE MOUNTED SIGN SUPPORT TYPE I GENERAL LAYOUT AND DETAILS
SS118-14	BRIDGE MOUNTED SIGN SUPPORT TYPE II GENERAL LAYOUT
SS118-15	BRIDGE MOUNTED SIGN SUPPORT TYPE II SERVICE WALK ARM ASSEMBLY
SS118-16	BRIDGE MOUNTED SIGN SUPPORT TYPE III GENERAL LAYOUT
SS118-17	BRIDGE MOUNTED SIGN SUPPORT TYPE III SERVICE WALK ARM ASSEMBLY
SS118-18	BRIDGE MOUNTED SIGN SUPPORT TYPE IV GENERAL LAYOUT
SS118-19	BRIDGE MOUNTED SIGN SUPPORT TYPE IV SERVICE WALK ARM ASSEMBLY

1

1. ANCHORS TO BE DESIGNED AS REQUIRED.
2. THE "NOTES TO DESIGNER" SHALL BE DELETED FROM THIS DRAWING PRIOR TO ISSUING OF THE CONTRACT.



254
32 190
115
230
2-26x40 LG SLOTTED HOLES

105 (2) *
155 (1)
32
40
152
2-15x25 LG SLOTTED HOLES

* WEB TO BE CUT FOR PART NO. 2

1 2 CONNECTING TEE DETAIL

[illegible]

DRAWING NOT TO BE SCALED
100mm ON ORIGINAL DRAWING

STANDARD DRAWING MARCH 2015	SS118-12
BRIDGE MOUNTED SIGN SUPPORT, TYPE I GENERAL LAYOUT AND DETAILS	

REVISIONS							
	DATE	BY	DESCRIPTION				
DESIGN	CHK		CODE	LOAD	DATE		
DRAWN	CHK		SUF	STRUCT	SCHEM	DWG	

METRIC
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

CONT No
WP No

BRIDGE MOUNTED SIGN SUPPORT
TYPE II
GENERAL LAYOUT

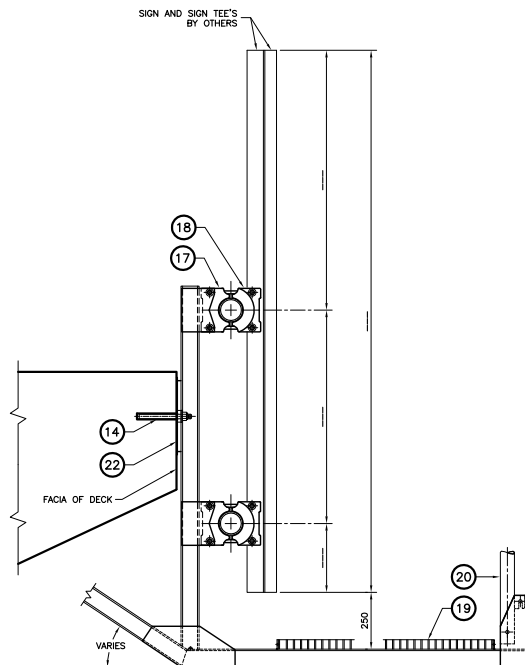


SHEET

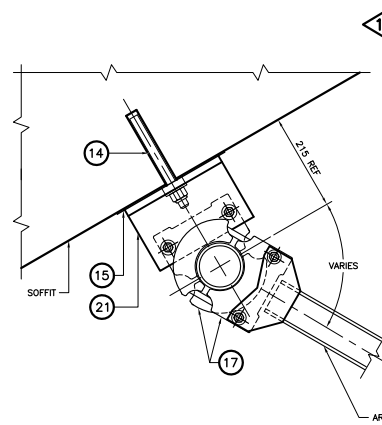
NOTES:

1. SIGN CLAMPS TO BE DELIVERED TO DISTRICT SIGN SHOP.
2. ALL NUTS SHALL BE A NYLON TYPE INSERT LOCKNUT "ESNA" ELASTIC STOP NUT OR EQUAL.
3. THIS DRAWING TO BE READ IN CONJUNCTION WITH DRAWING SS118-15.

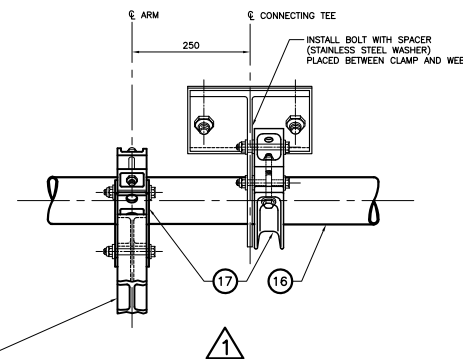
LIST OF DRAWINGS:



TYPICAL SECTION



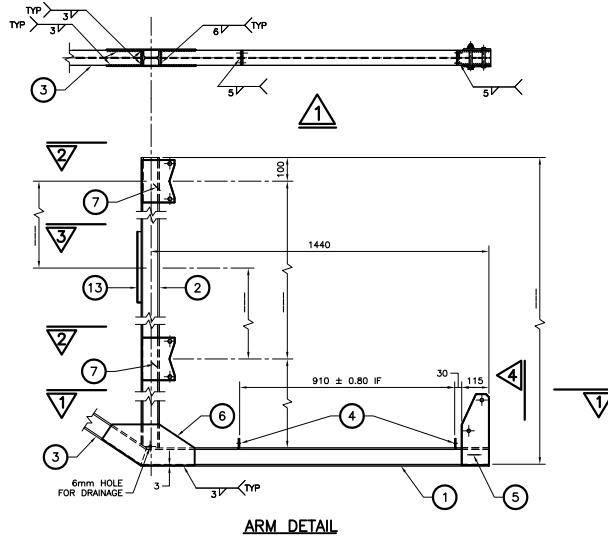
HINGE CONNECTION AT SOFFIT



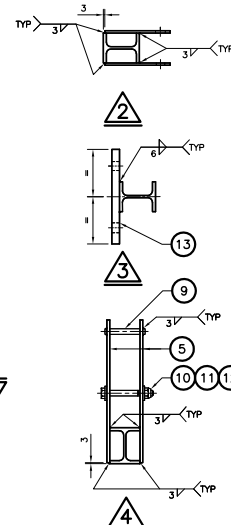
DRAWING NOT TO BE SCALED
100mm ON ORIGINAL DRAWING

STANDARD DRAWING JULY 2014	SS118-14
BRIDGE MOUNTED SIGN SUPPORT, TYPE II	
GENERAL LAYOUT	

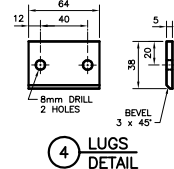
DATE	BY	DESCRIPTION	DATE
DESIGN	CHK	LOAD	
DRAWN	CHK	SITE	
		STRUCT	
		SCHEME	
		DWG	



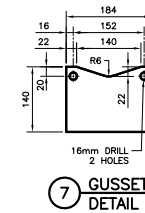
ARM DETAIL



4

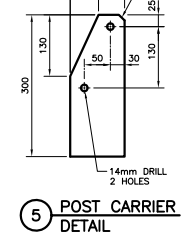


4 LUGS DETAIL

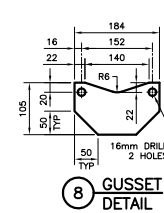


7 GUSSET DETAIL

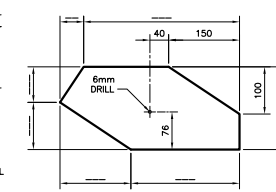
METRIC
 DIMENSIONS ARE IN METRES
 AND/OR MILLIMETRES
 UNLESS OTHERWISE SHOWN



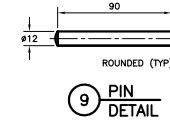
5 POST CARRIER DETAIL



8 GUSSET DETAIL



6 GUSSET DETAIL



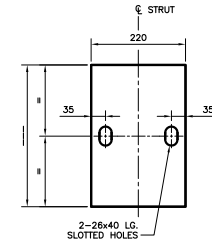
9 PIN DETAIL

NOTES:

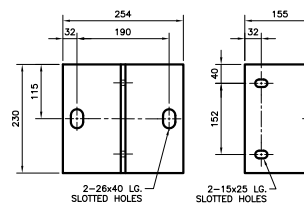
1. ALL STAINLESS STEEL BOLTS, NUTS AND WASHERS TO BE ALLOY 304, COLD FINISH, CENTRELESS GROUND, MIN. YIELD STRESS 304 MPa.
2. STEEL CONNECTING TEE'S SHALL BE HOT DIP GALVANIZED
3. FOR INSPECTION AND DELIVERY ASSEMBLE ALL BOLTS, NUTS AND WASHERS IN PLACE AS SHOWN.
4. TOLERANCE ± 1.5mm UNLESS OTHERWISE SPECIFIED.

NOTES TO DESIGNER

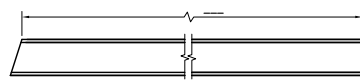
1. ANCHORS TO BE DESIGNED AS REQUIRED.
2. THE "NOTES TO DESIGNER" SHALL BE DELETED FROM THIS DRAWING PRIOR TO ISSUING OF THE CONTRACT.



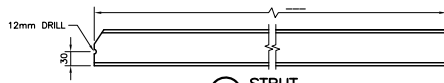
13 CONNECTING PLATE DETAIL



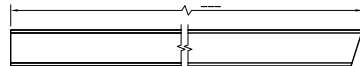
21 CONNECTING TEE DETAIL



1 ARM DETAIL



2 STRUT DETAIL



3 BRACE DETAIL

PARTSLIST					
QTY	NAME	FIG	MTL	ROUGH DIMENSIONS	REMARKS
1	ARM	6061-T6	S76 x 3.21 x	LG	ALCAN 28003
2	STRUT	6061-T6	S76 x 3.21 x	LG	ALCAN 28003
3	BRACE	6061-T6	S76 x 3.21 x	LG	ALCAN 28003
4	LUGS	6061-T6	PL 5 x 38 x 70	LG	ALCAN 12564
5	POST CARRIER	6061-T6	PL 6 x 120 x 310	LG	
6	GUSSET	6061-T6	SH 5 x 185 x	LG	
7	GUSSET	6061-T6	SH 5 x 150 x 200	LG	
8	GUSSET	6061-T6	SH 5 x 110 x 200	LG	
9	PIN	6061-T6	12 DIA x 100	LG	
10	HEX. MACHINE BOLT	M12 x 1.75	100	LG	
11	NYLON INSERT STOP NUT	M12 x 1.75	ESNA 79 NE		OR EQUIVALENT
12	STD. FLAT WASHER	28 OD x 13 ID x 2.5 THK			FOR M12 BOLT
13	CONNECTING PLATE	6061-T6	PL 16 x 220 X	LG	
14	ANCHOR	S ST			
15	NEOPRENE PAD (3mm TH'K)	NEOPRENE	SH 3 x 240 x 285		FOR FIG (2)
16	SUPPORT PIPES WITH PIPE CAPS	6061-T6	NPS 3.5 SCH 40 PIPE		LENGTH=
17	SIZE 3.5 CHORD CLAMP		SEE BD 221-050-3		FOR STRUCTURE
18	SIZE 3.5 CHORD CLAMP		SEE BD 221-050-3		FOR SIGN
19	GRATING		SEE BD 221-045-7		
20	RAILING (2 POST)		SEE BD 221-045-8A		
21	CONNECTING TEE	G40.21	WT 155 x 39 x 230	LG	GALVANIZED
22	NEOPRENE PAD (3mm TH'K)	NEOPRENE	SH 3 x 230 x	LG	FOR FIG (13)

DRAWING NOT TO BE SCALED
 100mm ON ORIGINAL DRAWING

STANDARD DRAWING
 MARCH 2015
SS118-15
 BRIDGE MOUNTED SIGN SUPPORT, TYPE II
 SERVICE WALK ARM ASSEMBLY

REVISIONS	DATE	BY	DESCRIPTION	DATE
DESIGN	CHK	CODE	LOAD	DATE
DRAWN	CHK	SITE	STRUCT	SCHEME
				DWG

METRIC
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

CONT No
WP No

**BRIDGE MOUNTED SIGN SUPPORT
TYPE III
GENERAL LAYOUT**

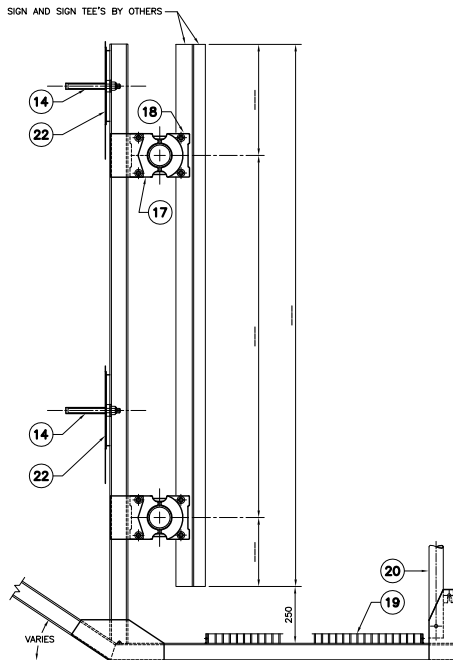


SHEET

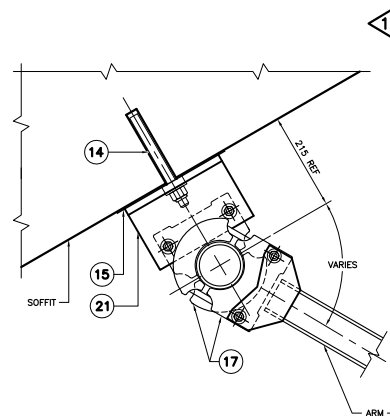
NOTES:

1. SIGN CLAMPS TO BE DELIVERED TO DISTRICT SIGN SHOP.
2. ALL NUTS SHALL BE A NYLON TYPE INSERT LOCKNUT "ESNA" ELASTIC STOP NUT OR EQUAL.
3. THIS DRAWING TO BE READ IN CONJUNCTION WITH DRAWING SS118-17.

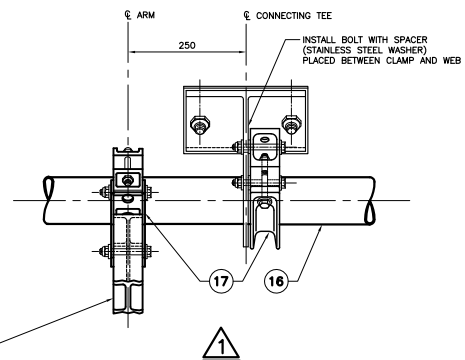
LIST OF DRAWINGS:



TYPICAL SECTION



HINGE CONNECTION AT SOFFIT

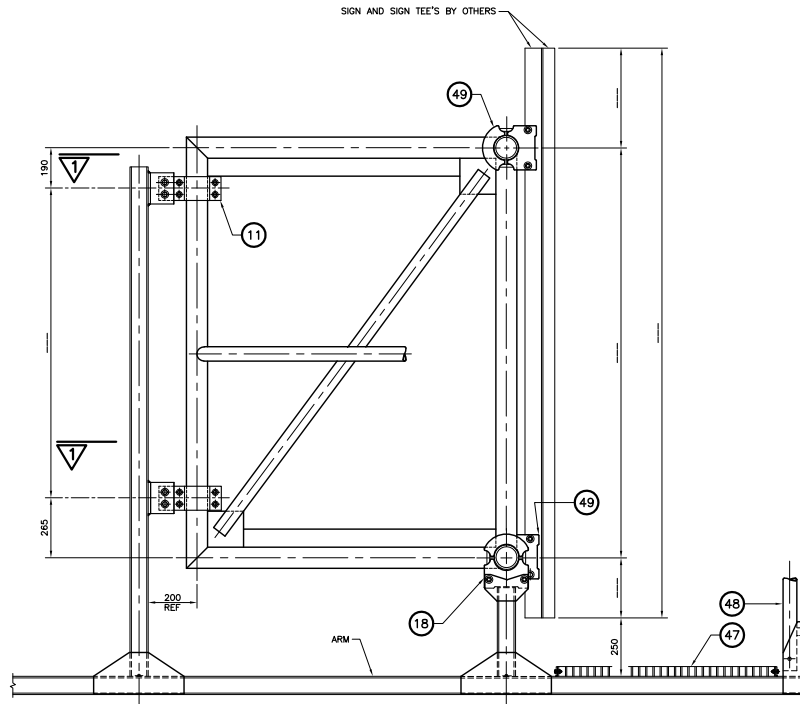
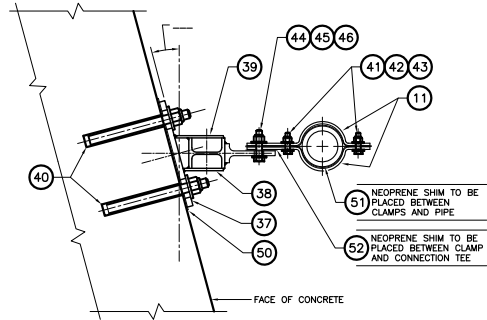


DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

STANDARD DRAWING JULY 2014		SS118-16
BRIDGE MOUNTED SIGN SUPPORT, TYPE III		
GENERAL LAYOUT		

REVISIONS		DATE	BY	DESCRIPTION	DATE
DESIGN	CHK			LOAD	
DRAWN	CHK			SITE	
				STRUCT	
				SCHEME	
				DWG	

DRAWING NOT TO BE SCALED
100mm ON ORIGINAL DRAWING



TYPICAL SECTION

METRIC
 DIMENSIONS ARE IN METRES
 AND/OR MILLIMETRES
 UNLESS OTHERWISE SHOWN

CONT No
 WP No

BRIDGE MOUNTED SIGN SUPPORT
 TYPE IV
 GENERAL LAYOUT



SHEET

NOTES:

1. SIGN CLAMPS TO BE DELIVERED TO DISTRICT SIGN SHOP.
2. ALL NUTS SHALL BE A NYLON TYPE INSERT LOCKNUT "ESNA" ELASTIC STOP NUT OR EQUAL.
3. THIS DRAWING TO BE READ IN CONJUNCTION WITH DRAWING SS118-19.

LIST OF DRAWINGS:

STANDARD DRAWING
 DECEMBER 2014
SS118-18
 BRIDGE MOUNTED SIGN SUPPORT, TYPE IV
 GENERAL LAYOUT

DRAWING NOT TO BE SCALED
 100mm ON ORIGINAL DRAWING

REVISIONS					
DATE	BY	DESCRIPTION		DATE	
DESIGN	CHK	CODE	LOAD		
DRAWN	CHK	SITE	STRUCT	SCHEME	DWG

REVISIONS										
	DATE	BY	DESCRIPTION							
DESIGN	CHK	CODE	LOAD				DATE			
DRAWN	CHK	SITE	STRUCT		SCHEMF		DWG			

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Ministry of Transportation
Ontario
2019

