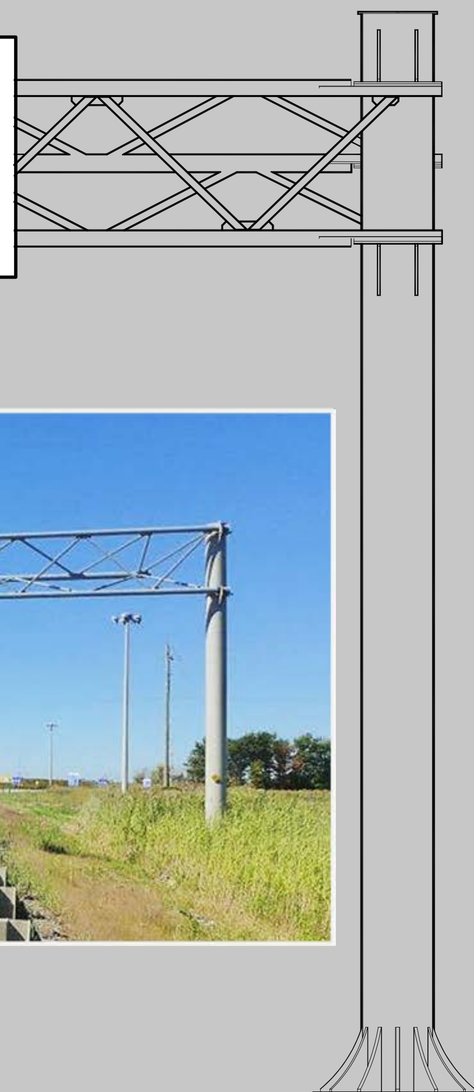

# SIGN SUPPORT MANUAL




Ontario

Ministry of Transportation
Provincial Highways Management Division
Highway Standards Branch
Bridge Office
April 2015

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## REVISIONS TO THE SIGN SUPPORT MANUAL

This Sign Support Manual dated **April 1 2015** includes **Revision 14** and supersedes the previous edition.

If any page of a Division is changed, all dates on pages of that Division are changed as well. However, only the pages listed below are different to the 2011 edition. Changes from previous edition are summarised as follows.

**List of revisions**

**Definitions**

- Page vi :- Text added to include Cantilever Tri-chord Static Sign Support and CHBDC
- Page vii :- Text added to include Pole mounted VMS Support.

**Notations**

- Page x :- Notations ‘H’ and ‘SLS’ updated

**Division 1 - Introduction**

- Page 1-2 :- Section 1.7 updated

**Division 2 - General Information**

- Page 2-3 :- Table 2.5.2 updated to include Cantilever Tri-Chord Sign Support Structures and Pole mounted Variable Messages Sign Support Structures

**Division 3 – Cantilever Static Sign Supports**

- Content updated to include bolted joint option
- Page 3-1 :- Section 3.1.1 updated
- Page 3-3 :- Section 3.1.4 updated
- Page 3-4 :- Section 3.1.6 updated
- Page 3-10 :- Section 3.2.3, STEP 2 updated
- Page 3-13 :- Section 3.2.4, STEP 2 updated
- Page 3-18 :- STEP 4 updated
- Page 3-23 :- TABLE 3.2.3(a) updated
- Page 3-26 :- Section 3.3.2 updated
- Page 3-29 :- Section 3.5.1 updated
- Page 3-32 :- APPENDIX TO DIVISION 3 updated
- Standard Drawings SS118-22, SS118-23, SS118-24 and SS118-25 replaced with the latest version currently available in CPS.
- New Standard Drawings SS118-71, SS118-72 and SS118-73 added

**Division 4 – Tri-Chord Static Sign Supports**

- Content updated to include Cantilever Tri-Chord Static Sign Support
- Standard Drawings SS118-3, SS118-4, and SS118-5 updated.
- Standard Drawings SS-26 and SS118-27 replaced with the latest version currently available in CPS.
- New Standard Drawings SS118-43, SS118-44 and SS118-45 added

**Division 5**

- Page 5-4 :- Figure 5.1.2(a) updated

- Page 5-5 :- Figure 5.1.2(b) updated
- Page 5-23 :- STEP 7  error corrected
- Page 5-44 :- Section 5.5.1 updated
- Standard Drawings SS118-30 and SS118-33 replaced with the latest version currently available in CPS.

**Division 6**

- Page 6-4 :- Figure 6.1.2(a) updated
- Page 6-5 :- Figure 6.1.2(b) updated
- Page 6-36 :- Section 6.5.1 updated
- Standard Drawings SS118-34 and SS118-35 replaced with the latest version currently available in CPS.

**Division 7**

- Page 7-5 :- Section 7.1.5 updated
- Page 7-10 :- Section 7.4 updated
- Standard Drawings SS118-40, SS118-41 and SS118-42 replaced with the latest version currently available in CPS.

**Division 8**

- Page 8-17 :- Section 8.5.1 updated
- Standard Drawings S118-6, SS118-7, SS118-8, SS118-11 and SS118-36 replaced with the latest version currently available in CPS.

**Division 9**

- Standard Drawings S118-12, SS118-14, SS118-15, SS118-16, SS118-17, SS118-18, and SS118-19 replaced with the latest version currently available in CPS.

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

Enquiries regarding the purchase and distribution of this manual should be directed to:

Publications Ontario
880 Bay Street
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Enquires regarding amendments, suggestions or comments should be directed to:

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

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| | |
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# SIGN SUPPORT MANUAL

TABLE OF CONTENTS

April 2015

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AASHTO American Association of State Highway and Transportation Officials

ASTM American Society for Testing and Materials

BREAKAWAY SIGN SUPPORT A static sign support system designed to fail in a predetermined location and mode when impacted upon by a vehicle

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

VARIABLE MESSAGE SIGN (VMS) Light emitting electronic display system to provide up-to-date information that changes periodically, to freeway motorists of traffic conditions ahead and suggest alternative routing in a timely an safe manner

VARIABLE MESSAGE SIGN SUPPORT A sign support for variable message sign systems and consisting of two vertical supports or legs (structural steel), and an overhead truss (aluminum)

DAMPER — Damping device attached to the sign board on cantilever sign support structures to suppress vortex shedding and galloping caused by aerodynamic instability

MAXIMUM ECCENTRICITY — Height from the top of lowest footing to the centre of the sign board

NLGA — National Lumber Grades Authority

OHBDC — Ontario Highway Bridge Design Code

ORDER FORMS — Preprinted 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 a variable message board centre mounted to a single vertical galvanized steel pole

STATIC SIGN (OR SIGN BOARD) — A flat surface displaying permanent visual information

STRUCTURE I.D. NUMBER — Number assigned to a sign support structure by the Region, to provide a unique identifier for each sign structure

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

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

STEEL COLUMN SIGN SUPPORT — A static sign support structure consisting of two or more vertical steel columns, either breakaway or non-breakaway

TIMBER POST SIGN SUPPORT — A static sign support structure consisting of two or more breakaway or non-breakaway vertical timber posts

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

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)

| | |
|---|---|
| A | spacing of sign support posts, or<br>spacing of top crossarm connection plates, or<br>edge distance of upper column splice bolts, or<br>length of stiffener or friction plate, or<br>outside diameter of shear plate, or<br>horizontal spacing of shear plates for type b supports, or<br>horizontal edge distance for splice bolt holes, or<br>outside diameter of sign support post. |
| B | width of sign board, or<br>end distance to first crossarm connection plate, or<br>diameter of shear plate bolt hole, or<br>depth of stiffener or friction plate, or<br>length of panel in VMS end components. |
| C | horizontal distance from exterior sign support post to edge of sign board, or thickness of shear plate groove, or<br>distance from end of crossarm to exterior sign support post, or<br>spacing of T connectors on crossarms. |
| CS | horizontal centroidal axis of sign board. |
| D | height of sign board, or<br>depth of shear plate groove, or<br>spacing of bolt hole cutouts. |
| E | vertical distance from edge of sign board to first crossarm, or<br>edge distance to bolt hole cutout, or<br>Inside depth of shear plate groove, or<br>horizontal distance from left support to leftmost sign board, or<br>length of upper post, or<br>horizontal distance from the centreline of the sign support post to the centre of the sign board, or<br>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 | vertical spacing of crossarms, or<br>allowable bending stress in timber post, or<br>inside diameter of shear plate, or<br>horizontal distance from left support to 2nd leftmost sign board. |
| G | perpendicular distance from edge of pavement to first column, or<br>horizontal distance from left support to 3rd leftmost sign board, or<br>horizontal distance from rear face of traffic barrier to the nearest face of support structure footing. |
| H | lateral sign overhang beyond end T, or<br>horizontal distance from left support to 4th leftmost sign board, or<br>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 2nd lowest bolt group from bottom of member, or<br>horizontal distance from edge of sign board to outside T connector, or<br>horizontal distance from left support to splice location. |
| K | spacing of internal bolt hole groups for crossarms, or<br>horizontal distance from edge of sign board to inside T connector, or<br>horizontal distance from right support to splice location, or<br>a dimension used to impose a camber on cantilever sign supports to allow for dead load deflections. |
| L | length of top crossarm, or<br>length of column, or length of upper column section, or<br>length of lower post. |
| Mb | a parameter used to compute column length for breakaway sign supports. |
| Mnb | a parameter used to compute column length for non-breakaway sign supports. |
| Pi | top of footing. |
| SLS | Serviceability 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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# SIGN SUPPORT MANUAL

DIVISION 1 – INTRODUCTION

April 2015

# 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 DIVISIONS

The Manual contains the following divisions:

| | |
|---|---|
| Division 1 | Introduction |
| Division 2 | General Information |
| Division 3 | Cantilever Static Sign Supports |
| Division 4 | Tri-Chord Static Sign Supports |
| Division 5 | Steel Column Sign Supports (Breakaway and Non-Breakaway) |
| Division 6 | Timber Post Sign Supports (Breakaway and Non-Breakaway) |
| Division 7 | Overhead Monotube Sign Supports |
| Division 8 | Variable Message Sign Supports |
| Division 9 | Bridge Mounted Sign Supports |

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

## 1.3 NUMBERING SYSTEM

Each division is numbered as shown above. Within the divisions, the material is further subdivided into sections and 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 Publications Ontario or the online MTO Research Library, as detailed in Section 1.6.

## 1.5 METRICATION

The supports covered by Division 9 are primarily fabricated from aluminum extruded members which have not been metricated at this time. Thus, supports in this division 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

Copies of the Manual and revisions may be obtained from:

Publications Ontario
800 Bay Street
Toronto, Ontario
Canada, M7A 1N8

| | |
|---|---|
| Tel.: | 416-326-5300 |
| | 800-668-9938 |
| TTY: | 800-268-7095 |
| Fax: | 613-566-2234 |
| Website: | www.publications.gov.on.ca |
| Online: | www.mto.gov.on.ca/english/transrd/ |

## 1.7 STANDARD DRAWINGS

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

# SIGN SUPPORT MANUAL

DIVISION 2 – GENERAL INFORMATION

April 2015

# 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 Division 3 to 9.

## 2.2 STANDARD SIGN SUPPORTS

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

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.

## 2.3 ASSUMPTIONS, CRITERIA AND LIMITATIONS

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

Drawings and special provisions for Tri-chord, cantilever, variable message, steel, and timber breakaway 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

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

| 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 Steel Column Breakaway Sign Support Footings | Each |
| 915 | Concrete in Steel Column Non-Breakaway 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 Structure | Each |
| 915 | Steel Column Breakaway Sign Support Structures | Each |
| 915 | Steel Column Non-Breakaway Sign Support Structures | Each |
| 915 | Timber Post Breakaway Sign Support Structures | Each |
| 915 | Timber Post Non-Breakaway 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,<br>Span (*span range to be inserted as per Table*) m<br>See SPAN RANGE TABLE below. | Each |
| 915 | Variable Message Sign Support Structures,<br>Span (*span range to be inserted as per Table*) m<br>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.

**TABLE 2.5.2 CPS ITEMS FOR SIGN SUPPORTS**

### 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.

Breakaway type sign supports are designed to minimize the effect of vehicle/support impact upon the occupants of the vehicle and so do not require protection. Nevertheless, impact will cause damage and perhaps some injury. This should be considered in determining sign location.

## 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 Division.

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 Division. The information shown in these tables were obtained from the CSA Standard Canadian Highway Bridge Design Code.

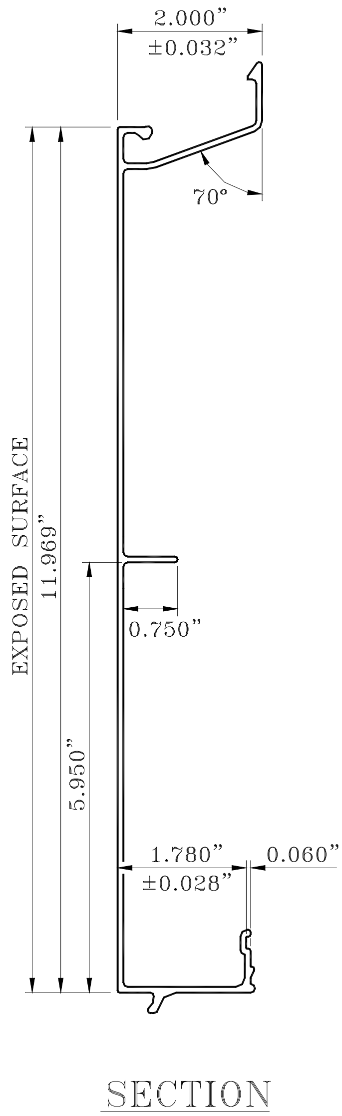
## 2.10 SIGN BOARDS

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.

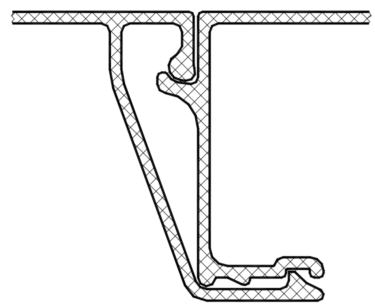
## 2.11 VARIABLE MESSAGE SYSTEMS

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: signcase and face, display matrix, driving electronics, photosensor control, environmental control and protection, mounting hardware, and associated cables and wiring.




SECTION



ASSEMBLY 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**

## APPENDIX TO DIVISION 2

GENERAL INFORMATION

| | |
|---|---|
| TABLE A2.9 | REFERENCE WIND PRESSURE FOR ONTARIO |
| 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 |

| 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 | Exerter | 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 |

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

Source: CSA Standard Canadian Highway Bridge Design Code

| ONTARIO LOCATION | HOURLY MEAN WIND PRESSURE, (in Pascals) FOR RETURN PERIODS OF: | | |
|---|---|---|---|
| | 10 yr | 25 yr | 50 yr |
| Georgetown | 275 | 330 | 375 |
| Geraldton | 210 | 245 | 275 |
| Glencoe | 310 | 380 | 435 |
| Goderich | 395 | 480 | 550 |
| Gore Bay | 300 | 350 | 390 |
| Graham | 205 | 240 | 260 |
| Gravenhurst | 260 | 315 | 350 |
| Grimsby | 365 | 415 | 460 |
| Guelph | 250 | 295 | 325 |
| Guthrie | 215 | 280 | 335 |
| Hagersville | 335 | 385 | 425 |
| Haileybury | 315 | 380 | 435 |
| Haliburton | 260 | 315 | 350 |
| Hamilton | 365 | 415 | 460 |
| Hanover | 335 | 410 | 475 |
| Hastings | 290 | 360 | 415 |
| Hawkesbury | 310 | 365 | 405 |
| Hearst | 200 | 245 | 280 |
| Honey Harbour | 255 | 325 | 385 |
| Hornepayne | 190 | 235 | 270 |
| Huntsville | 260 | 315 | 350 |
| Ingersoll | 330 | 410 | 475 |
| Iroquois Falls | 300 | 360 | 405 |
| Jarvis | 330 | 380 | 425 |
| Jellicoe | 200 | 235 | 260 |
| Kapuskasing | 230 | 275 | 310 |
| Kemptville | 295 | 360 | 410 |
| Kenora | 230 | 275 | 310 |
| Killaloe | 260 | 315 | 350 |
| Kincardine | 400 | 480 | 545 |
| Kingston | 350 | 415 | 465 |
| Kinmount | 260 | 315 | 350 |
| Kirkland Lake | 295 | 360 | 410 |
| Kitchener | 275 | 330 | 370 |
| Lakefield | 265 | 325 | 380 |
| Landsdowne House | 240 | 285 | 315 |

| ONTARIO LOCATION | HOURLY MEAN WIND PRESSURE, (in Pascals) FOR RETURN PERIODS OF: | | |
|---|---|---|---|
| | 10 yr | 25 yr | 50 yr |
| Leamington | 355 | 415 | 465 |
| Lindsay | 265 | 325 | 380 |
| Lion's Head | 330 | 410 | 475 |
| Listowel | 340 | 410 | 470 |
| London | 365 | 455 | 535 |
| Lucan | 395 | 480 | 555 |
| Maitland | 315 | 380 | 430 |
| Markdale | 285 | 360 | 415 |
| Martin | 205 | 240 | 260 |
| Matheson | 300 | 360 | 410 |
| Mattawa | 245 | 285 | 315 |
| Midland | 255 | 325 | 385 |
| Milton | 320 | 380 | 430 |
| Milverton | 310 | 380 | 435 |
| Minden | 260 | 315 | 350 |
| Mississauga | 370 | 435 | 495 |
| Mitchell | 350 | 435 | 505 |
| Moosonee | 260 | 315 | 350 |
| Morrisburg | 300 | 360 | 410 |
| Mount Forest | 290 | 360 | 410 |
| Muskoka Airport | 260 | 315 | 350 |
| Nakina | 210 | 245 | 275 |
| Napanee | 320 | 380 | 430 |
| Newcastle | 460 | 535 | 595 |
| New Liskeard | 315 | 380 | 435 |
| Newmarket | 260 | 325 | 385 |
| Niagara Falls | 330 | 380 | 425 |
| North Bay | 260 | 300 | 340 |
| Norwood | 290 | 360 | 415 |
| Oakville | 375 | 435 | 490 |
| Orangeville | 250 | 310 | 355 |
| Orillia | 260 | 315 | 350 |
| Oshawa | 430 | 510 | 575 |
| Ottawa | 295 | 360 | 410 |
| Owen Sound | 330 | 410 | 475 |

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

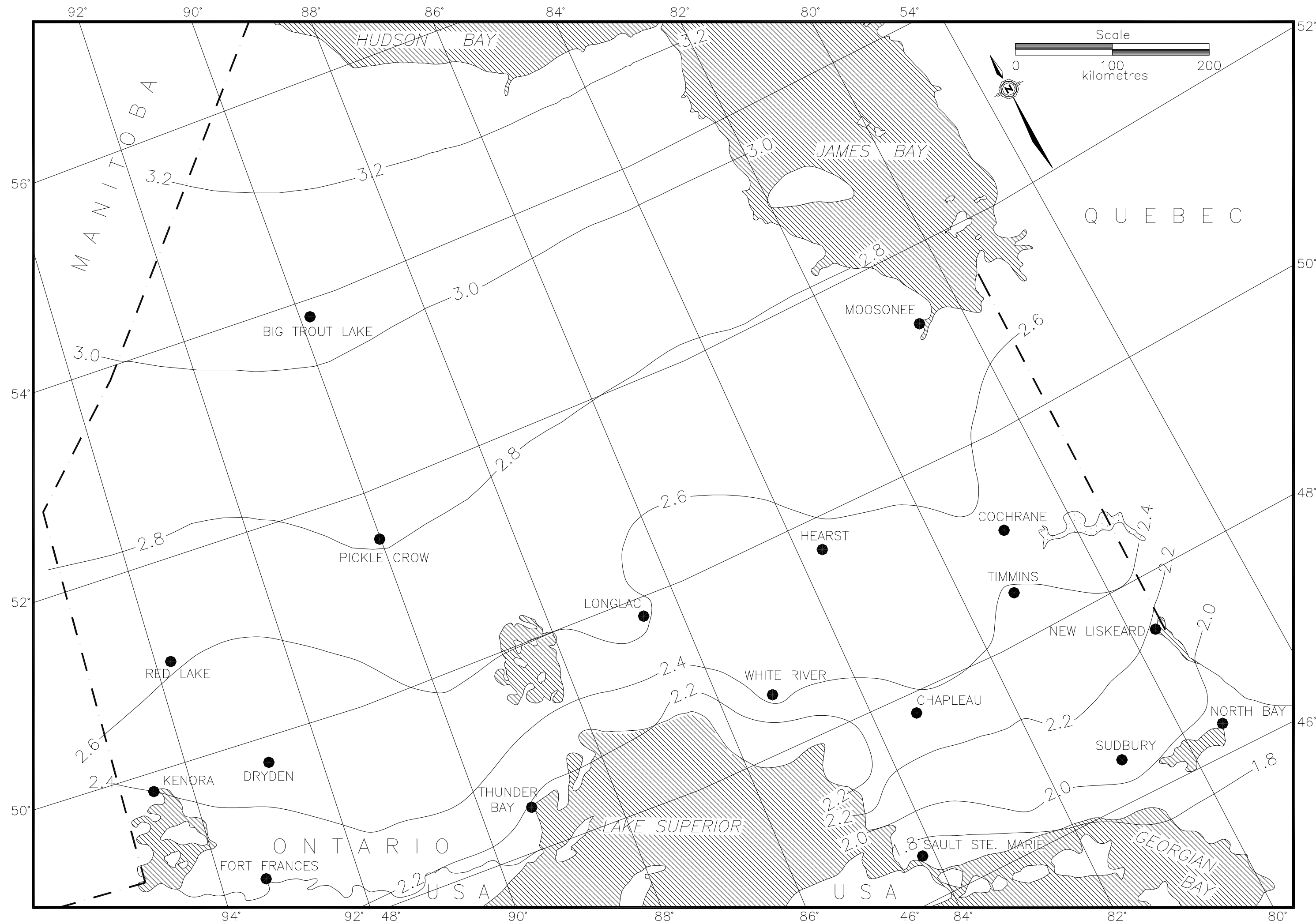
Source: CSA Standard Canadian Highway Bridge Design Code

| ONTARIO LOCATION | HOURLY MEAN WIND PRESSURE, (in Pascals) FOR RETURN PERIODS OF: 10 yr | 25 yr | 50 yr |
|---|---|---|---|
| Pagwa River | 190 | 240 | 275 |
| Paris | 310 | 365 | 405 |
| Parkhill | 400 | 480 | 545 |
| Parry Sound | 245 | 325 | 395 |
| Pembroke | 260 | 315 | 350 |
| Penetanguishene | 255 | 325 | 385 |
| Perth | 295 | 360 | 410 |
| Petawawa | 260 | 315 | 350 |
| Peterborough | 290 | 360 | 415 |
| Petrolia | 350 | 415 | 465 |
| Picton | 375 | 435 | 490 |
| Plattsville | 295 | 360 | 410 |
| Point Alexander | 260 | 315 | 350 |
| Porcupine | 275 | 330 | 375 |
| Port Burwell | 345 | 415 | 470 |
| Port Colborne | 365 | 415 | 455 |
| Port Credit | 370 | 435 | 495 |
| Port Dover | 360 | 415 | 465 |
| Port Elgin | 395 | 480 | 550 |
| Port Hope | 465 | 535 | 595 |
| Port Perry | 310 | 380 | 435 |
| Port Stanley | 340 | 410 | 470 |
| Prescott | 315 | 380 | 430 |
| Princeton | 300 | 360 | 410 |
| Raith | 205 | 240 | 260 |
| Red Lake | 220 | 255 | 285 |
| Renfrew | 260 | 310 | 350 |
| Ridgeway | 365 | 415 | 455 |
| Rockland | 300 | 360 | 410 |
| St. Catharines | 365 | 415 | 460 |
| St. Marys | 350 | 435 | 505 |
| St. Thomas | 330 | 410 | 475 |
| Sarnia | 350 | 415 | 465 |
| Sault Ste. Marie | 320 | 365 | 400 |
| Schreiber | 300 | 355 | 390 |
| Seaforth | 375 | 455 | 525 |
| Simcoe | 330 | 380 | 425 |
| Sioux Lookout | 205 | 240 | 260 |
| Smiths Falls | 295 | 360 | 410 |
| Smithville | 335 | 385 | 425 |

| ONTARIO LOCATION | HOURLY MEAN WIND PRESSURE, (in Pascals) FOR RETURN PERIODS OF: 10 yr | 25 yr | 50 yr |
|---|---|---|---|
| Smooth Rock Falls | 235 | 285 | 320 |
| Southampton | 380 | 460 | 525 |
| South Porcupine | 275 | 330 | 375 |
| South River | 230 | 280 | 325 |
| Stirling | 280 | 345 | 400 |
| Stratford | 335 | 410 | 475 |
| Strathroy | 355 | 435 | 500 |
| Streetsville | 350 | 415 | 465 |
| Sturgeon Falls | 255 | 310 | 355 |
| Sudbury | 290 | 390 | 465 |
| Sundridge | 230 | 280 | 325 |
| Tavistock | 340 | 410 | 475 |
| Temagami | 275 | 330 | 375 |
| Thamesford | 330 | 410 | 475 |
| Thedford | 405 | 485 | 545 |
| Thunder Bay | 300 | 355 | 390 |
| Tilsonburg | 310 | 380 | 435 |
| Timmins | 255 | 310 | 355 |
| Toronto | 390 | 460 | 520 |
| Trenton | 350 | 415 | 465 |
| Trout Creek | 240 | 285 | 320 |
| Trout Lake | 335 | 385 | 425 |
| Uxbridge | 285 | 360 | 415 |
| Vanier | 295 | 360 | 410 |
| Vittoria | 355 | 415 | 465 |
| Walkerton | 355 | 435 | 500 |
| Wallaceburg | 320 | 380 | 430 |
| Waterloo | 275 | 330 | 370 |
| Watford | 340 | 410 | 470 |
| Wawa | 300 | 355 | 390 |
| Welland | 330 | 380 | 425 |
| WestLorne | 345 | 415 | 470 |
| Whitby | 430 | 510 | 575 |
| White River | 210 | 245 | 275 |
| Wiarton | 330 | 410 | 475 |
| Windsor | 360 | 420 | 470 |
| Wingham | 350 | 435 | 505 |
| Woodstock | 305 | 380 | 435 |
| Wyoming | 350 | 415 | 465 |

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

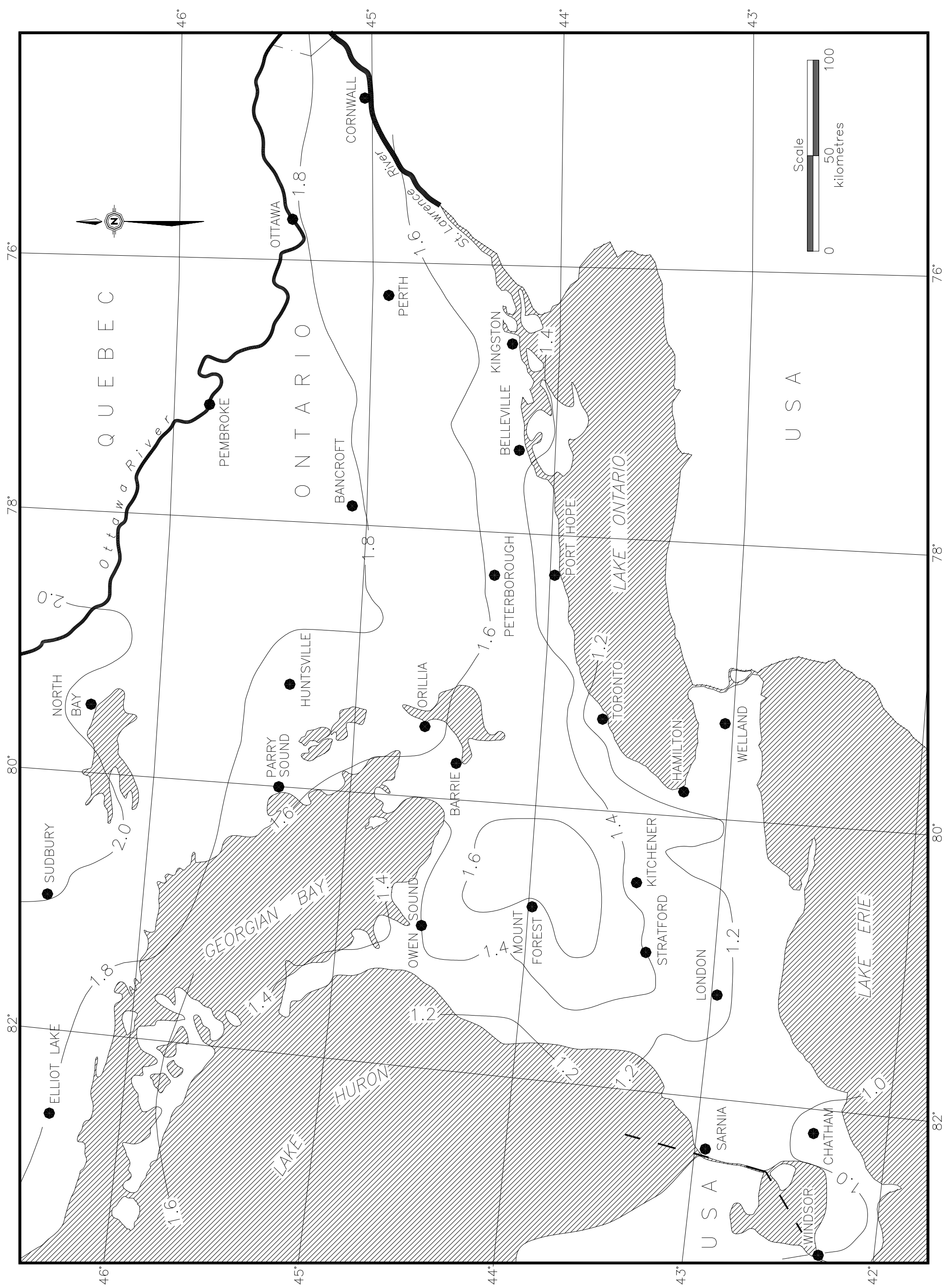
Source: CSA Standard Canadian Highway Bridge Design Code




## 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.

| 2015 04 01 | CONTOURS OF FROST DEPTHS FOR SOUTHERN ONTARIO | DA 4 - 2 |
|---|---|---|

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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.

# TABLE OF FROST DEPTHS FOR ONTARIO BY LOCATION

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

## 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 RR 225 “ASPECTS OF PROLONGED EXPOSURE OF PAVEMENTS TO SUB-ZERO TEMPERATURES” DATED DECEMBER, 1981.
3. FROST DEPTHS ARE IN METRES.

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# SIGN SUPPORT MANUAL

## DIVISION 3 – CANTILEVER STATIC SIGN SUPPORTS

April 2015

# 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 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 Canadian Highway Bridge Design Code CAN/CSA-S6-06 (CHBDC).

The sign supports contained in this Division 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 2 times that of the other side.

(c) Depth of sign board up to 2740mm

(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 (CHBDC 3.10.1.1) is not considered.

(f) Location of supports and vertical clearances that meet the requirements of the CHBDC

(g) Competent soil conditions, excluding rock fill.

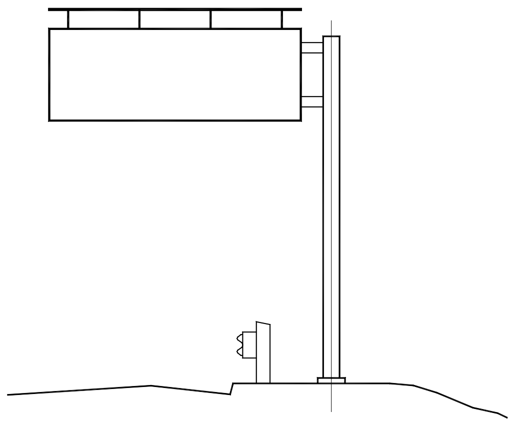


**FIGURE 3.1.2(a) SINGLE CANTILEVER SIGN SUPPORT**

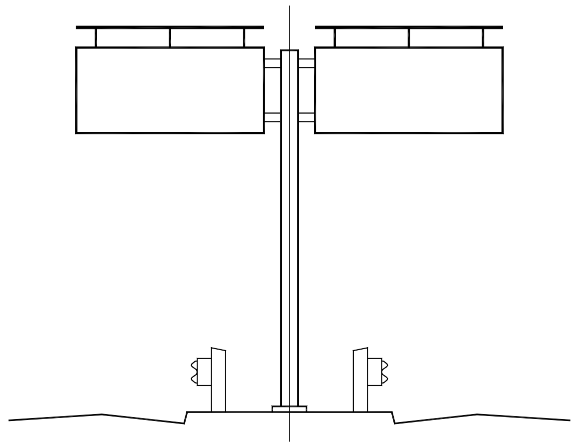


**FIGURE 3.1.2(b) BUTTERFLY SIGN SUPPORT**

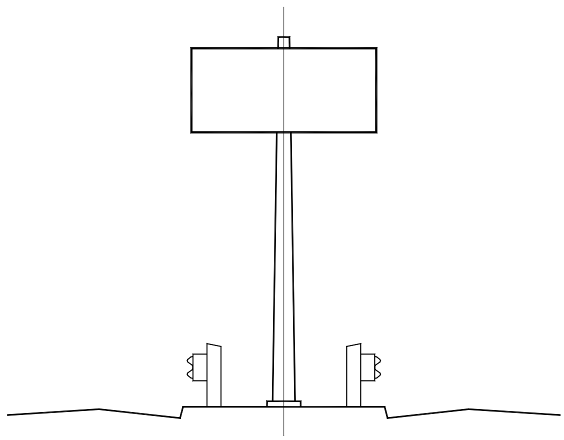


**FIGURE 3.1.2(c) CENTRE MOUNTED SIGN SUPPORT**

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 3.1.6). For this reason 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 300mm above the finished grade. This could be increased up to 1000mm 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 6500mm. Therefore, the total height from grade to centreline of the bottom arm cannot exceed 7500mm.

### 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 SS118-22, SS118-24, SS118-71 and SS118-73. The maximum allowable length of the vertical support member is 8500mm, 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 Fig. 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

Sign support footings consist of a single reinforced concrete caisson. Details differ according to their location, and are of two types, for ground mounted and median mounted signs. (See Standard Drawings SS118-3, SS118-4 and/or SS118-5).

The indicated footing depths are required for each support. Footing proportions apply to normal 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 poor soft material 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 Division 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 (2743mm) shall not be less than 5300mm.

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 5600mm.

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 (see Figure A4.2).

### 3.1.7 DETERMINING ARM LENGTH AND PANEL LENGTHS

The length of the arms shall extend to 50mm 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 2600mm.

(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 1500mm.

(2) The number of Z-brackets should be kept to a minimum but no less than 3 brackets per sign.

(3) The intermediate Z-brackets should be equally spaced where possible.

(4) A fixed distance of 200mm 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 125mm and maximum of 500mm from the centre of the Z-bracket. (see SS118-25).

AND/OR

(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 Section 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.

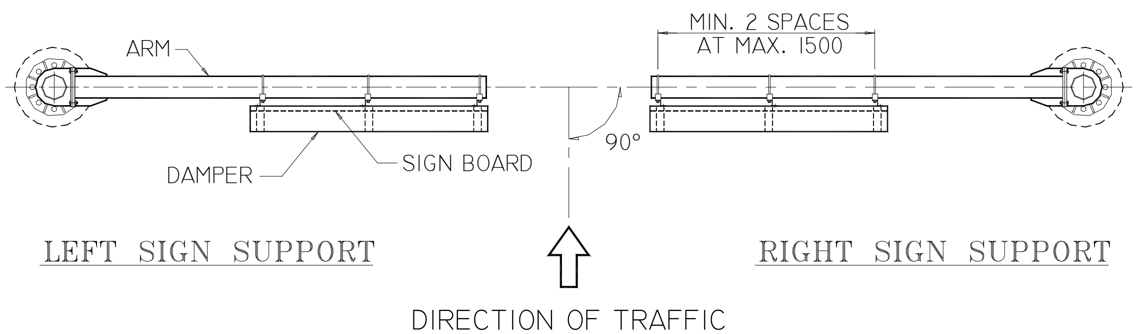



**FIGURE 3.1.4(a) TYPICAL SINGLE CANTILEVER LAYOUT PLAN**

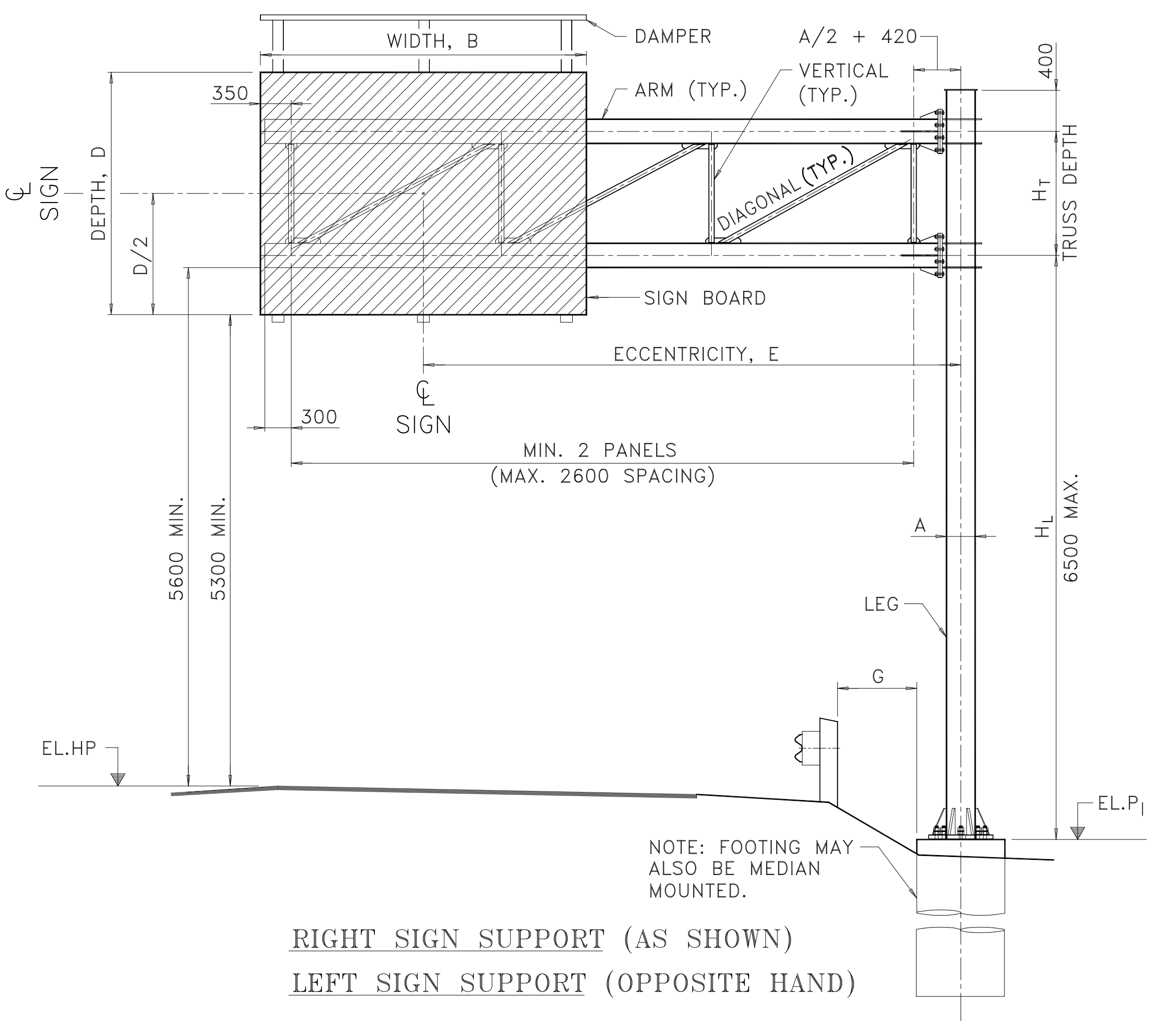



**FIGURE 3.1.4(b) TYPICAL SINGLE CANTILEVER SIGN LAYOUT ELEVATION**

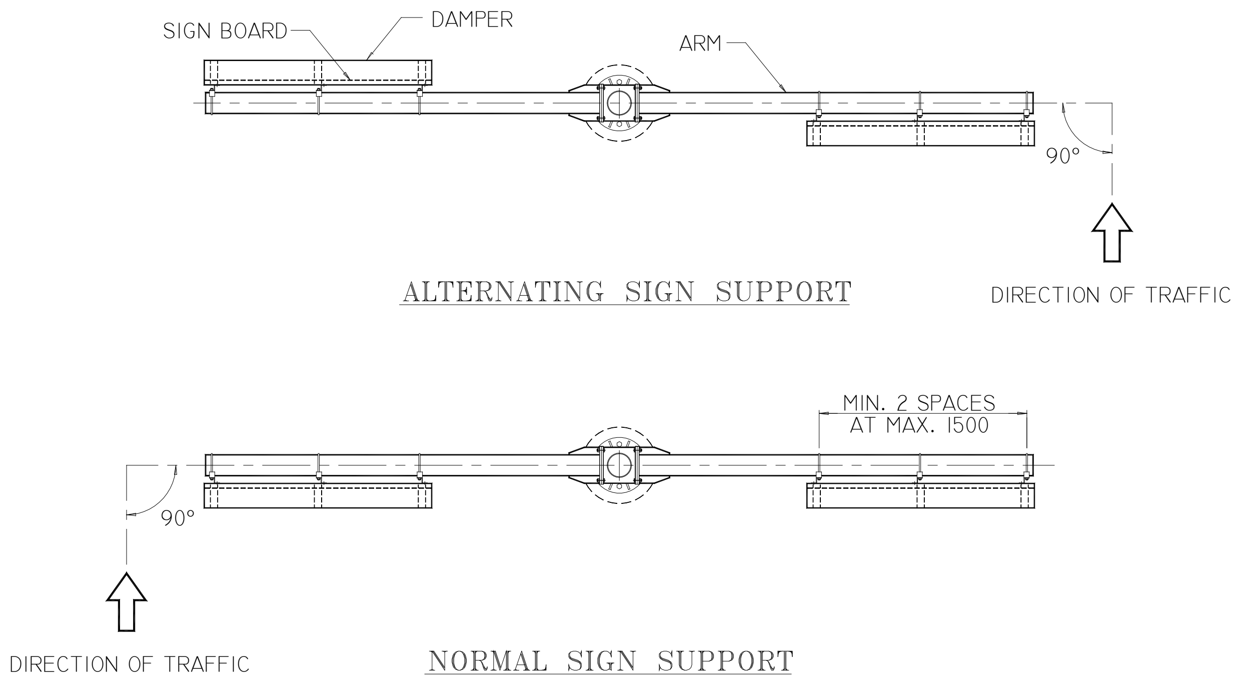



**FIGURE 3.1.4(C) TYPICAL BUTTERFLY LAYOUT PLAN**

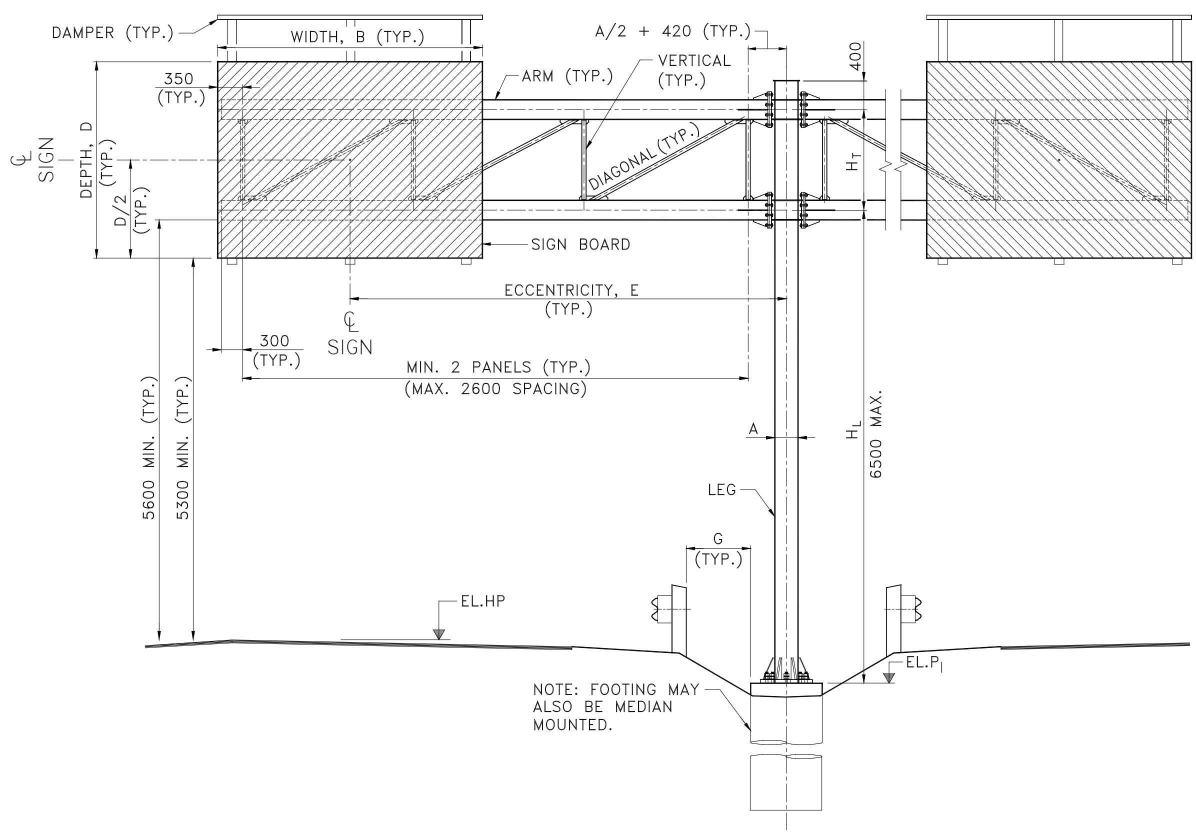



**FIGURE 3.1.4(d) TYPICAL BUTTERFLY CANTILEVER SIGN SUPPORT ELEVATION**

## 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 x 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 ($A_{left}$ + $A_{right}$) 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 Division 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.

### 3.2.3 PROCEDURE FOR SELECTION OF SINGLE CANTILEVER SIGN SUPPORT

GIVEN: SIGN SIZE AND ECCENTRICITY
Example: 2500mm x 5000mm sign board with eccentricity, E, of 5100mm, 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 x 5 = 12.5m$^2$ and E = 5100mm fall within the Class 2 area of the chart on Figure 3.2.2(c) for 425Pa < q ≤ 525Pa, and below the upper limit for sign depth of 2500mm. 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) & 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 = 580mm
Arm Length (E+B/2-50): = 5100+5000/2–50 = 7550mm
Dimension ‘K’ for Camber: = 65mm

CALCULATE PANEL LENGTHS (see 3.1.7):

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

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

Average panel length = 6627/3
= 2209mm

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

LOCATE Z-BRACKETS (see 3.1.8):

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

(1) Locate first bracket 200mm from the end of sign board nearest traffic
$L_x$ = 200mm

(2) Locate last bracket 200mm from the end of sign board nearest leg
$L_x$ = 4800mm

(3) Check for interference with panel point at last location
$L_x$ = 350+2209+2209 = 4768mm
**Conflict with (2)**

(4) Adjust the last Z-bracket's location to any distance (x) between 125mm to 500mm 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 3.1.8 and minimizes number of Z-brackets (See Figure 3.2.3(b))**

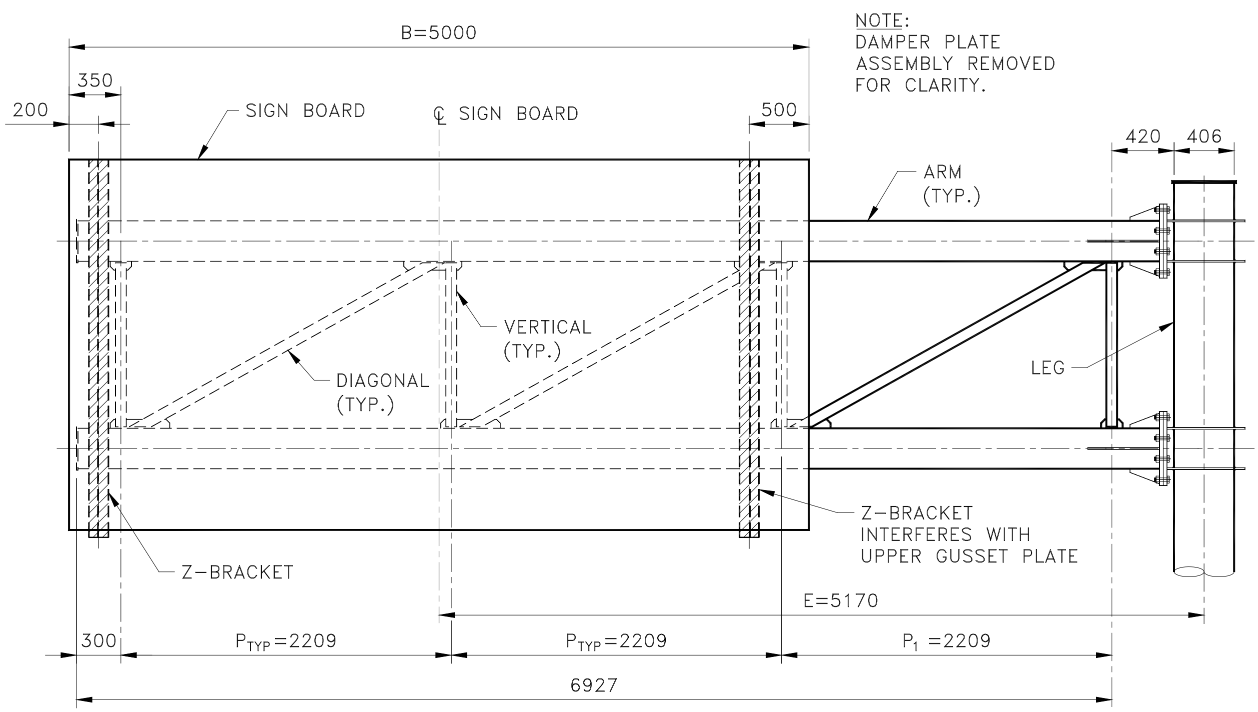



**FIGURE 3.2.3(a)**

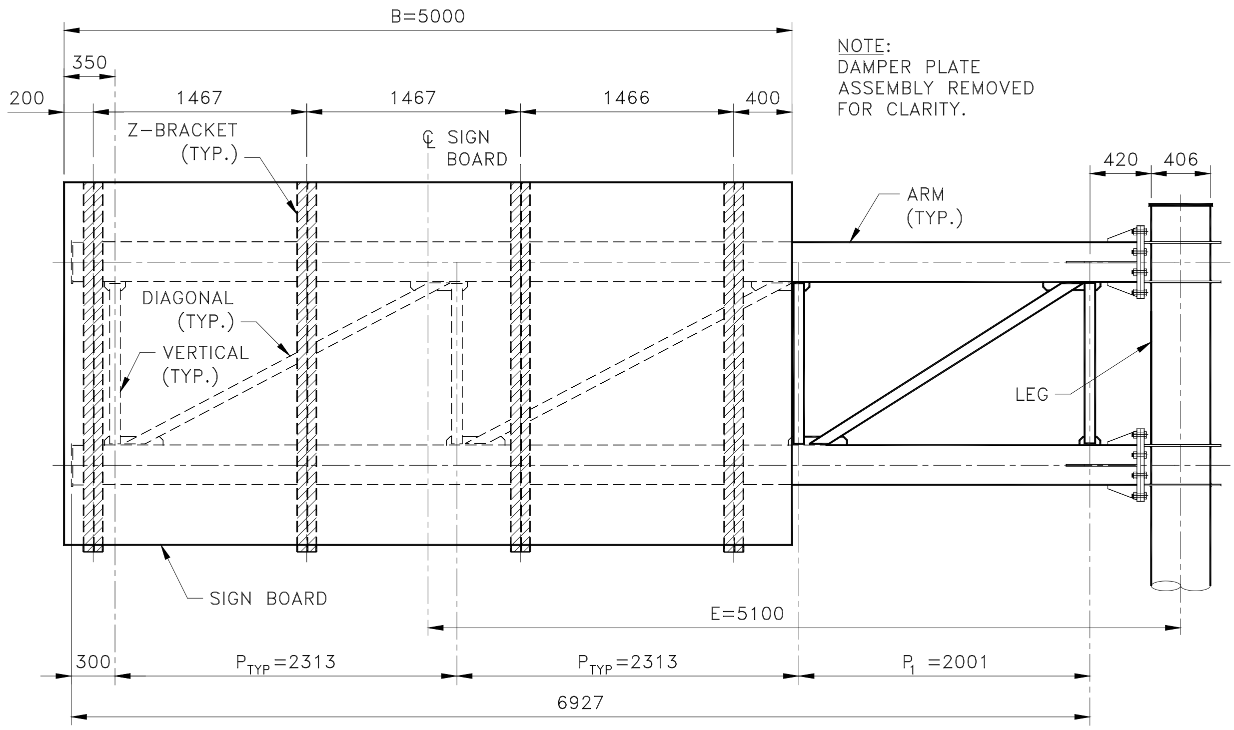



**FIGURE 3.2.3(b)**

STEP 3: CHECK BOUNDARY CONDITIONS

(a) The maximum length of the vertical support leg from the top of the footing to the centreline of the bottom arm shall be 6500mm.

(b) The dimension measured from the highest point on the highway, EL.HP, to the bottom of the sign board shall be at least 5300mm, and to the bottom of the lower arm at least 5600mm.

(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., E = 5100mm > 5000/2+406/2+500 = 3203mm, OK.

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

STEP 4: COMPLETE THE STANDARD DRAWINGS

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

Enter in Table 1

$P_1$ = 2001mm
$P_{TYP}$ = 2313mm

And in Table 2

$Y_1$ = 1467mm
$Y_2$ = 1467mm
$Y_3$ = 1466mm
X = 400mm

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 2000mm x 5000mm sign board with eccentricity, E, of 6000mm on the left, a 1500mm x 4000mm sign board with eccentricity, E, of 4000mm 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 x 5=10.0m$^2$. On the right, the sign area ($A_R$) is 1.5 x 4=6.0m2. 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 16.0m$^2$. The larger eccentricity is E=6000mm. The intersection of these values fall within the Class 2 area of the chart of Figure 3.2.2(f) for 325 Pa < q ≤ 425 Pa and below the upper limit for larger sign depths of 2000mm. 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) & 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<br>2 No. L 89 x 89 x 9.5 (bolted joint option) |

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

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 |
| | = 7527mm |
| Total number panels required | = 7527/2600 |
| | = 2.90 say 3 panels |
| Average panel length | = 7527/3 |
| | = 2509mm |

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

RIGHT:

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

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

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 200mm from the end of sign board nearest traffic
$L_x$ = 200mm
(2) Locate last bracket 200mm from the end of sign board nearest leg
$L_x$ = 4800mm
(3) Check for interference with panel point at last location
$L_x$ = 350+2509+2509 = 5368mm

**No Conflict with (2), but length between 1st and last bracket of 4600mm precludes the possibility of minimizing the number of Z-brackets.**

(4) Adjust the last Z-bracket's location to any distance (x) between 125mm to 500mm from end of sign board – try 300mm.
**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 2599mm. **OK - Satisfies all criteria in 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).
$L_x$ = 200

(7) Locate last bracket 200 mm from the end of sign board nearest leg
$L_x$ = 3800

(8) Check for interference with panel point at last location
$L_x$ = 350+2513 = 2863 mm
**No Conflict with (7)**
**OK - Satisfies all criteria in 3.1.8 and minimizes number of Z-brackets (See Figure 3.2.4(c).**

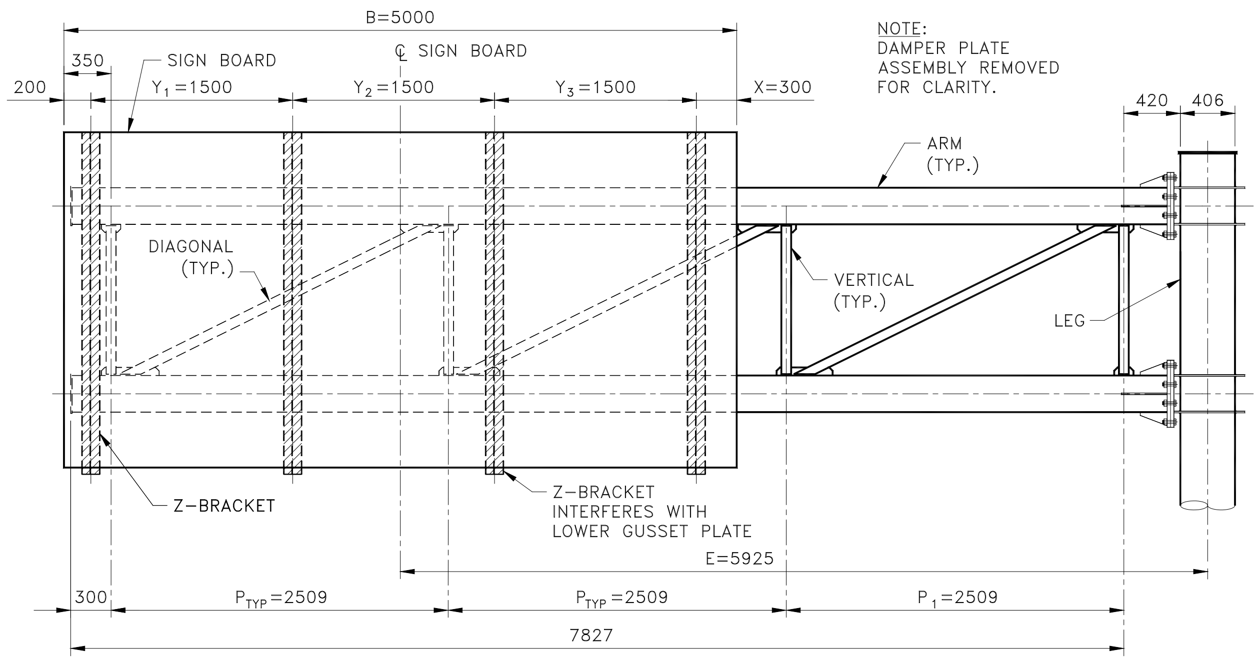



**FIGURE 3.2.4(a): Left Arm**

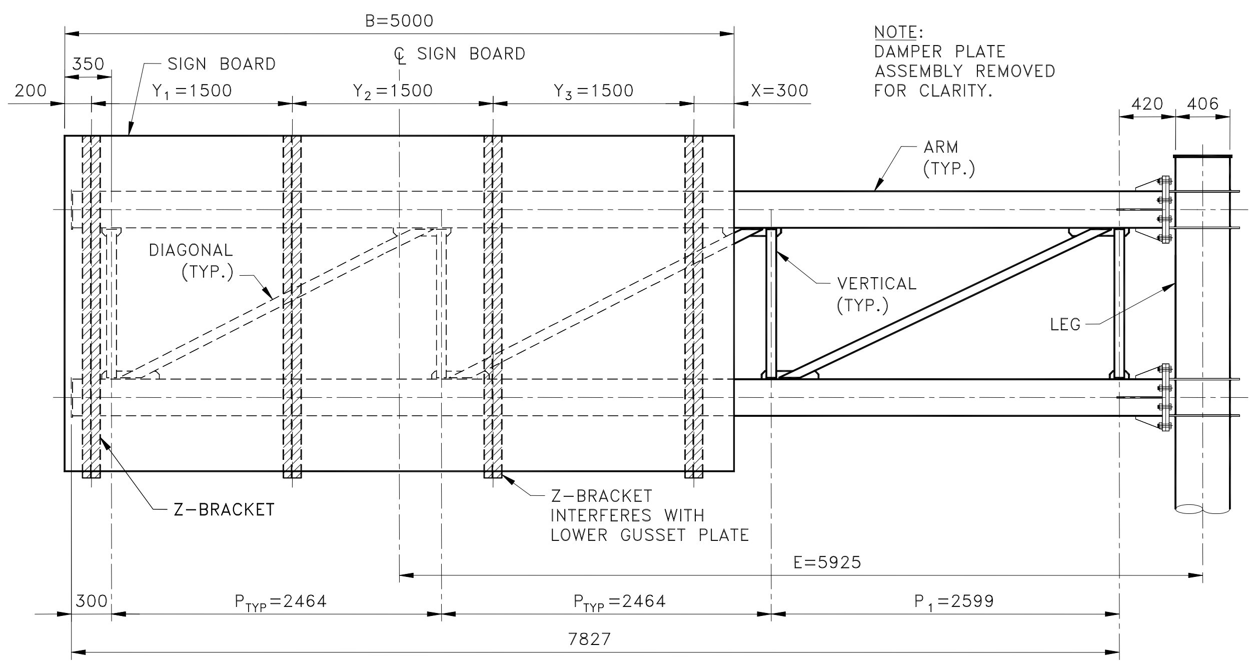



**FIGURE 3.2.4(b): Left Arm**

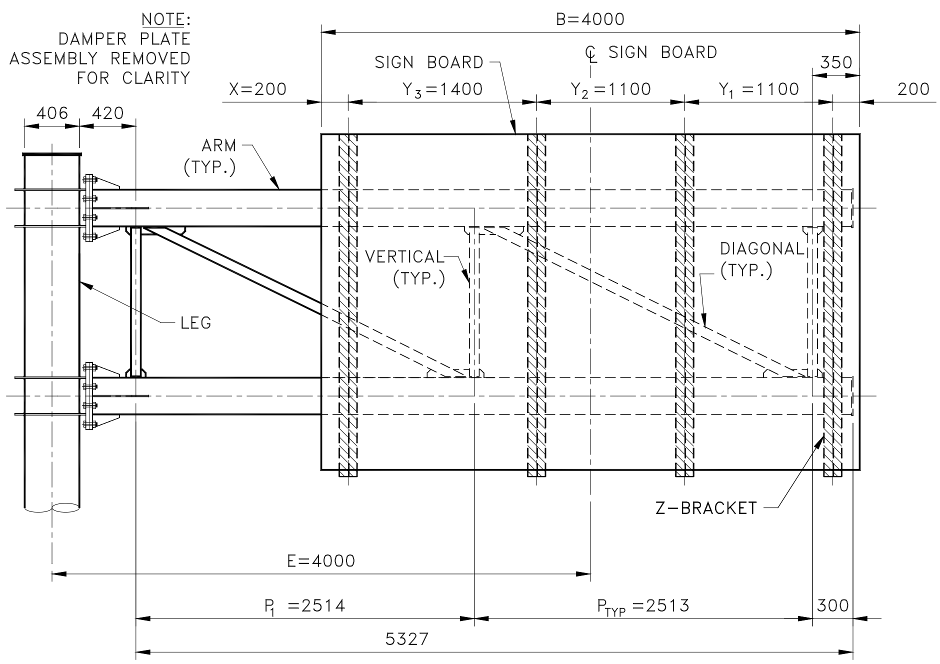



**FIGURE 3.2.4(c): Right Arm**

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 6500mm.

(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 5300mm, and to the bottom of the lower arm at least 5600mm.

(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=6000mm > 5000/2+406/2+500=3203mm, OK.
Right:E=4000mm > 4000/2+406/2+500=2703mm, OK.

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

STEP 4: COMPLETE THE STANDARD DRAWINGS

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

Enter in Table 1

| | |
|---|---|
| LEFT | $P_1$ = 2599 |
| | $P_{TYP}$ = 2464 |
| RIGHT | $P_1$ = 2514 |
| | $P_{TYP}$ = 2513 |

And in Table 2

| | |
|---|---|
| LEFT | $Y_1$ = 1500 |
| | $Y_2$ = 1500 |
| | $Y_3$ = 1500 |
| | x = 300 |
| RIGHT | $Y_1$ = 1100 |
| | $Y_2$ = 1100 |
| | $Y_3$ = 1400 |
| | x = 200 |

Refer to 3.3 for Preparation of Drawings.

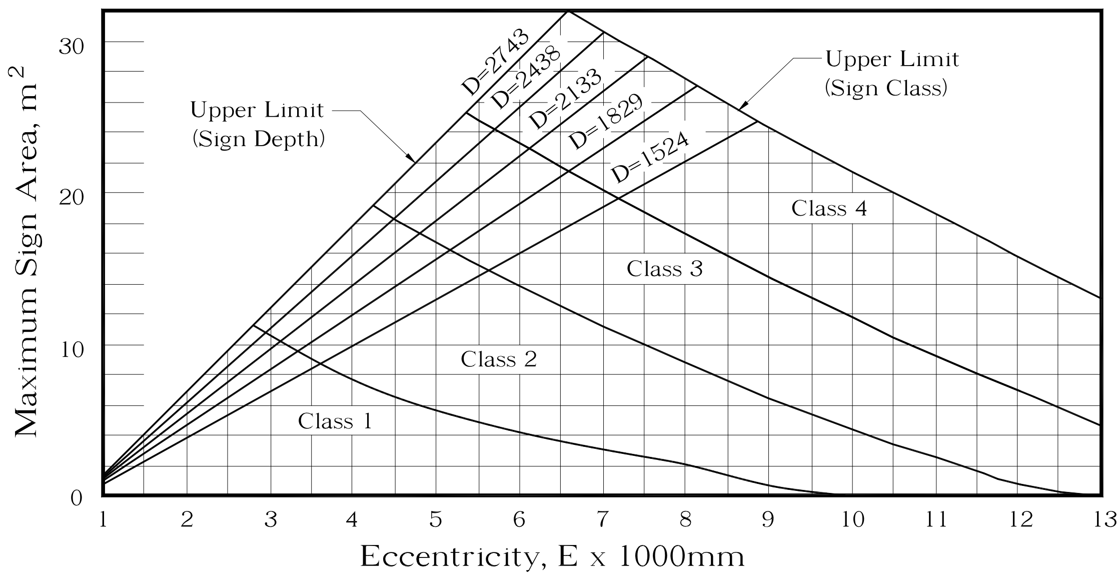



**FIGURE 3.2.2(a) CLASS RANGES FOR q ≤ 325 Pa**
**(Single Cantilever Sign Support)**

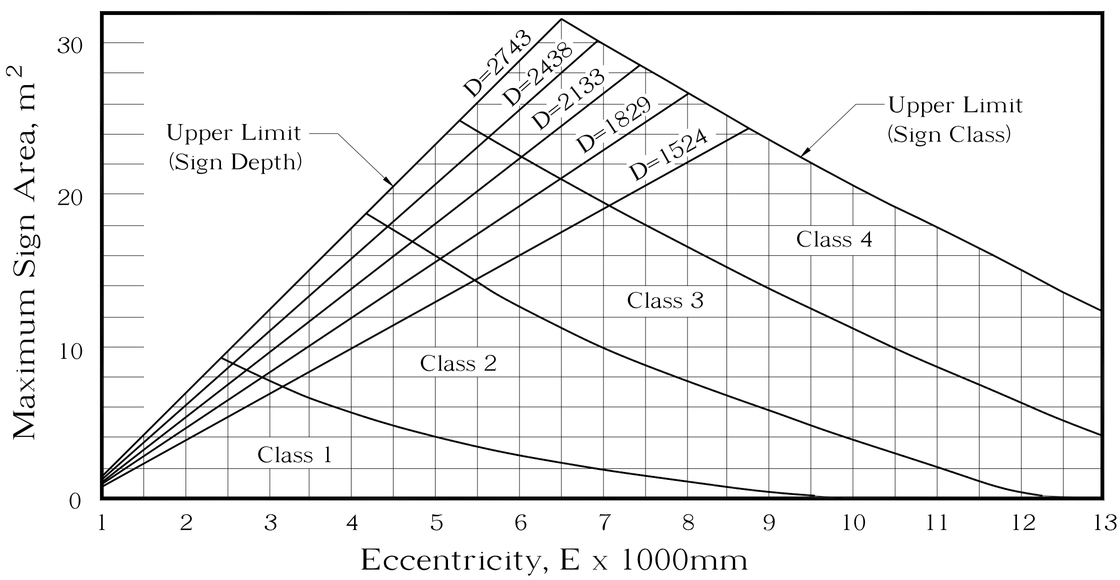



**FIGURE 3.2.2(b) CLASS RANGES FOR 325 Pa < q ≤ 425 Pa**
**(Single Cantilever Sign Support)**

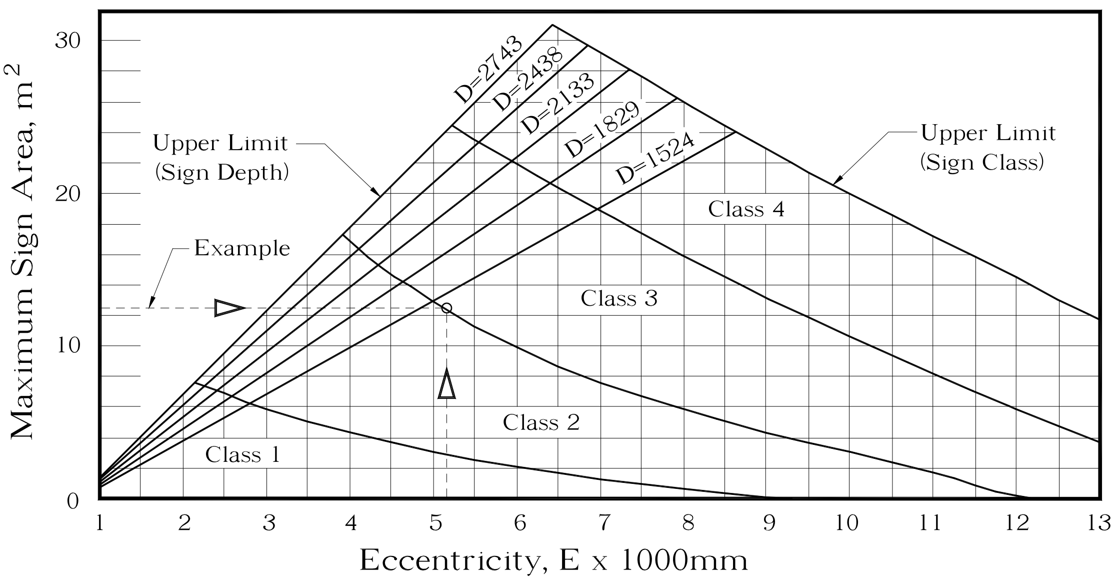



**FIGURE 3.2.2(c) CLASS RANGES FOR 425 Pa < q ≤ 525 Pa**
**(Single Cantilever Sign Support)**

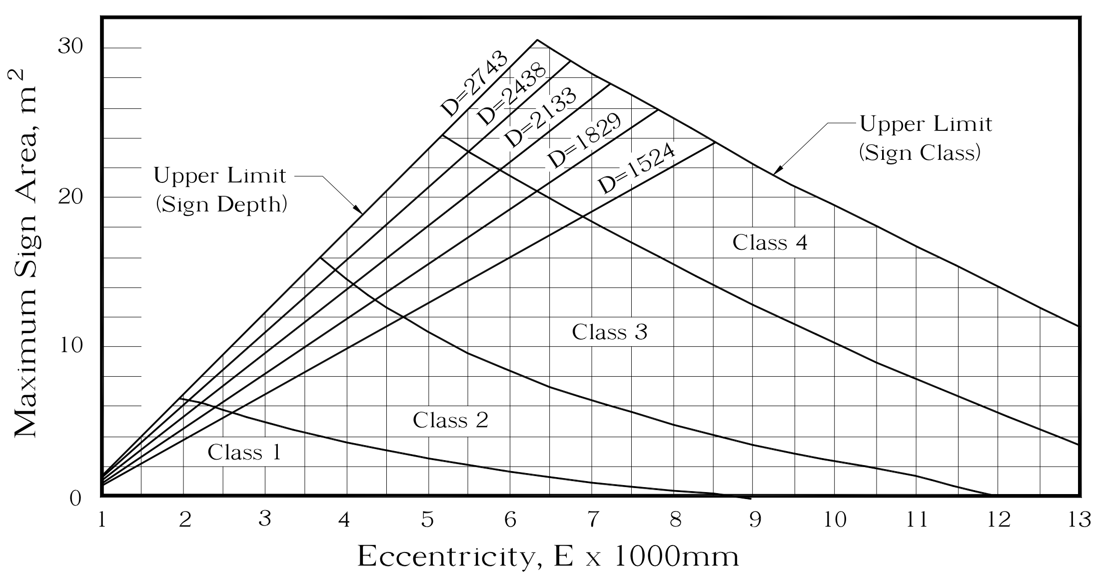



**FIGURE 3.2.2(d) CLASS RANGES FOR 525 Pa < q ≤ 600 Pa**
**(Single Cantilever Sign Support)**

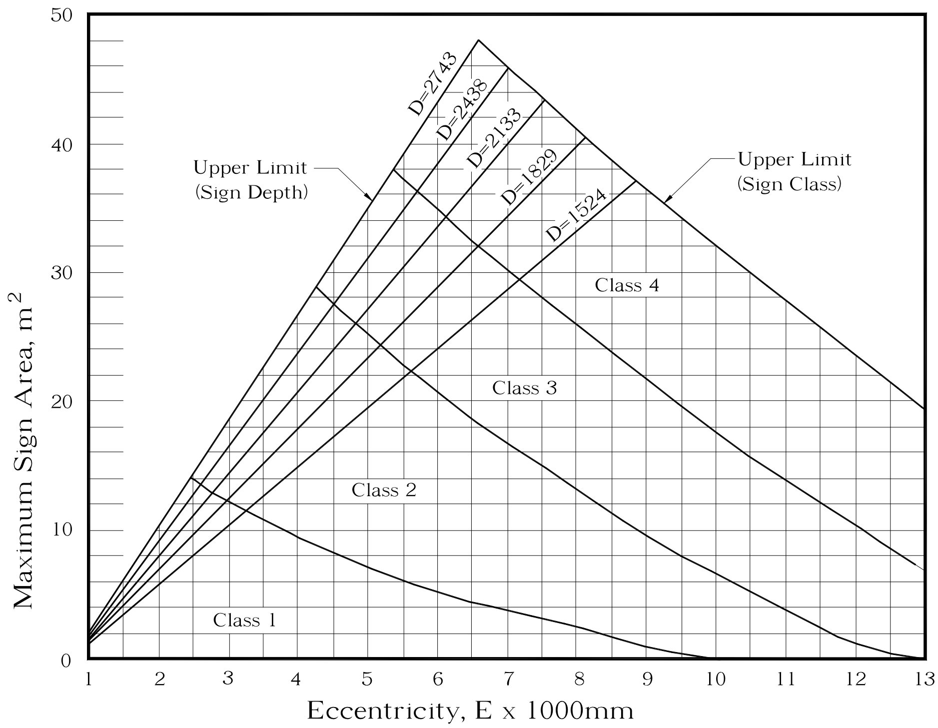



**FIGURE 3.2.2(e) CLASS RANGES FOR q ≤ 325 Pa**
**(Butterfly Sign Support)**

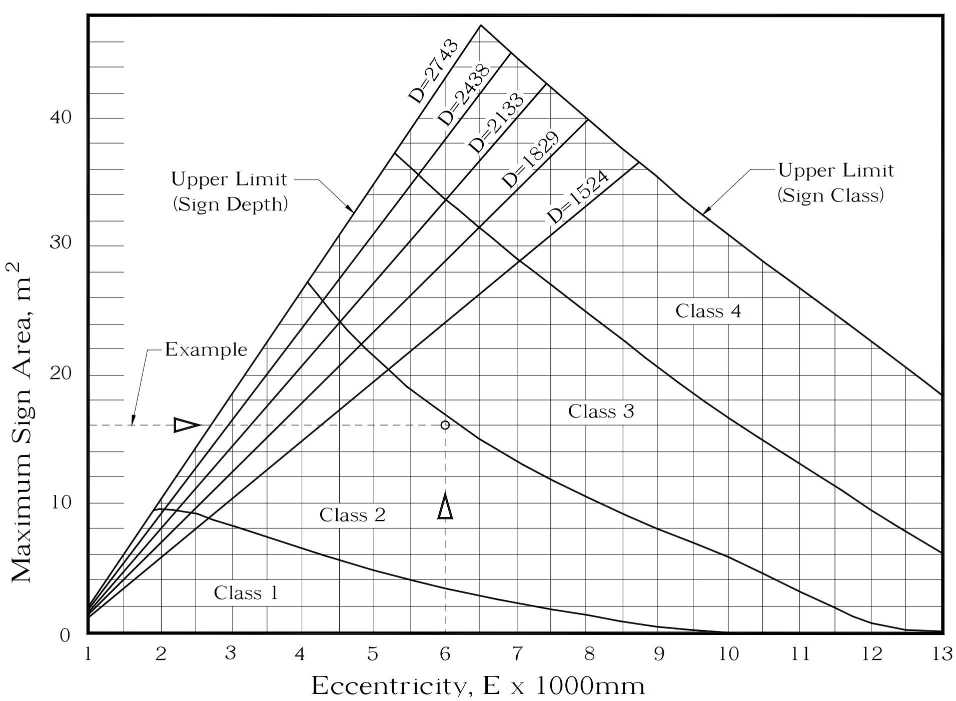
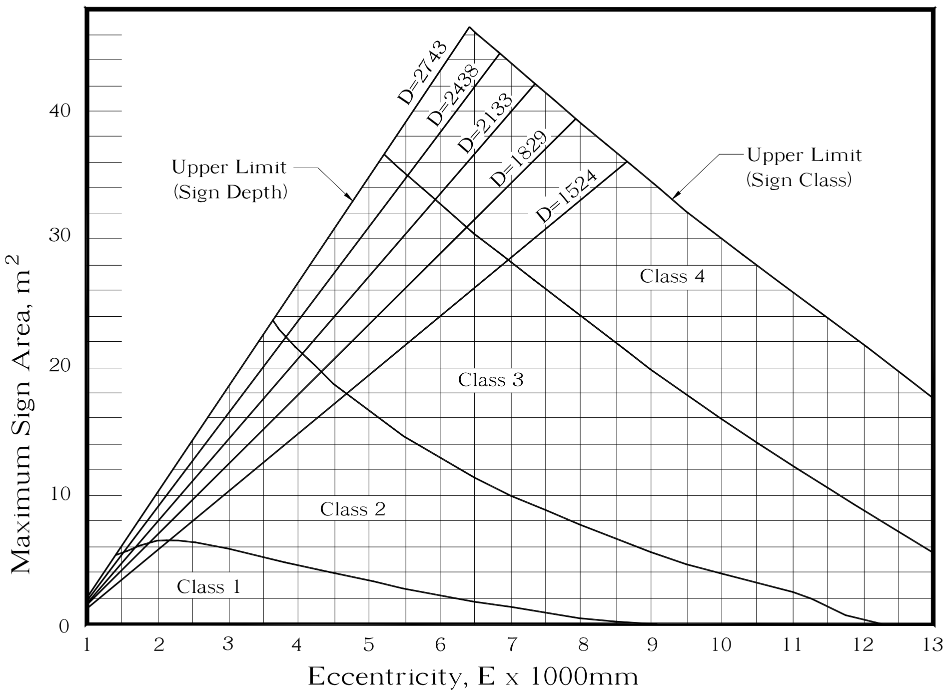
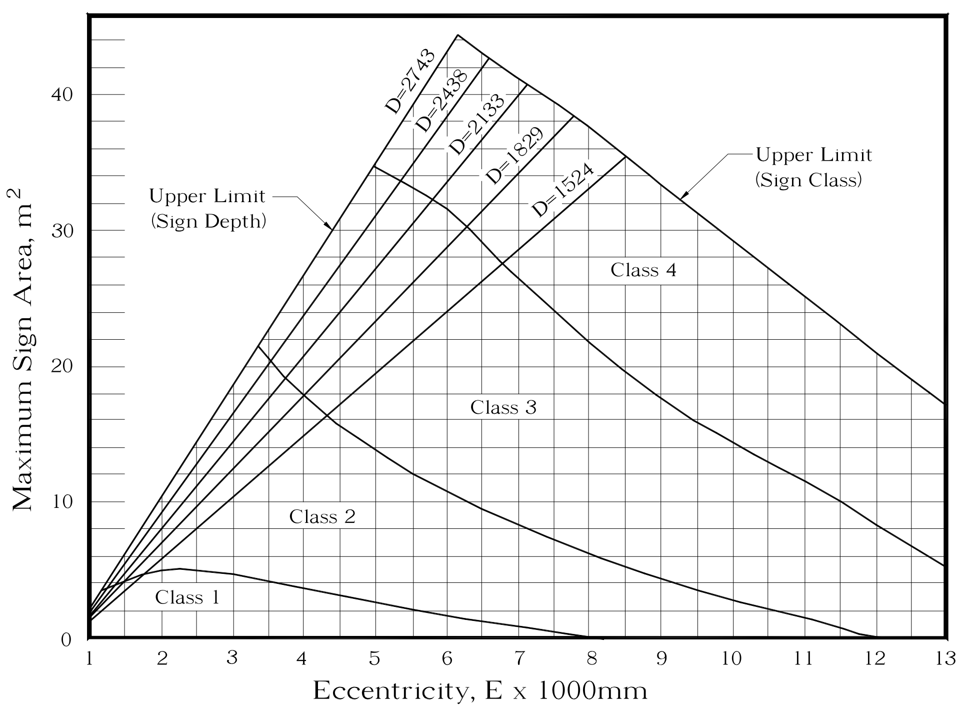



**FIGURE 3.2.2(f) CLASS RANGES FOR 325 Pa < q ≤ 425 Pa**
**(Butterfly Sign Support)**




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




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

| | 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 | HSS 102 x 8.0 |
| VERTICALS/DIAGONALS (for bolted joint option) (3) | 2 no. L 89 x 89 x 9.5 | 2 no. L 89 x 89 x 9.5 | 2 no. L 102 x 102 x 9.5 | 2 no. L 102 x 102 x 9.5 |
| ARM CONNECTION PLATE LENGTH, P (mm) (2) | 498 | 580 | 682 | 784 |
| ARM CONNECTION PLATE THICKNESS, TI (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 |

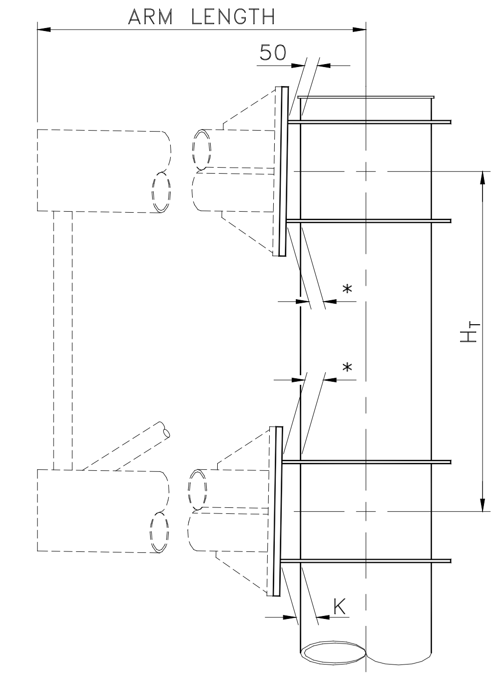
**Notes**:

(1) The vertical support legs are fabricated from round or octagonal sections. For octagonal sections, A is measured across the flats. (See 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.

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




| CLASS OF ARMS | ARM LENGTH (mm) | K |
|---|---|---|
| 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 |

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

## 3.3 PREPARATION OF DRAWINGS

### 3.3.1 DATA REQUIRED

Prior to design, "Key Plan and Frame Dimension" information must be prepared to enable the working drawings to be detailed. This information should form part of the contract document and must show for one or more structures, the following information:

(1) A key plan, indicating the approximate location of each support.

(2) The 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 dimension measured from the top of footing to the centreline of the bottom arm. This height shall not exceed 6500mm.

(7) The top of footing elevation. The elevation shall be a minimum 300mm above finished grade. This could be increased up to 1000mm in order to limit the column leg height as stated in (6).

(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 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 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 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,

- 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, SS118-22, SS118-23, SS118-24, SS118-25, SS118-71, SS118-72, SS118-73, SS118-3 and/or SS118-4 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 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 2.4.1.**

The data required to complete <u>Table 1 - General</u> consists of the following:

(i) Local Reference Wind Pressure, (Pa)
(ii) Frost Depth.
Frost depths are given in the Appendix of Division 2 of this Manual and may be used if the recommendations of a geotechnical engineer are not available.
(iii) Station
(iv) Structure I.D. number
(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 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 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.$P_1$
(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 3.1.7(1).
(xiv) Length of Panels.
(xv) Footing Type (See 3.1.5).
(xvi) Design Information $H_T$, 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 table 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 |
| PROFILED 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.

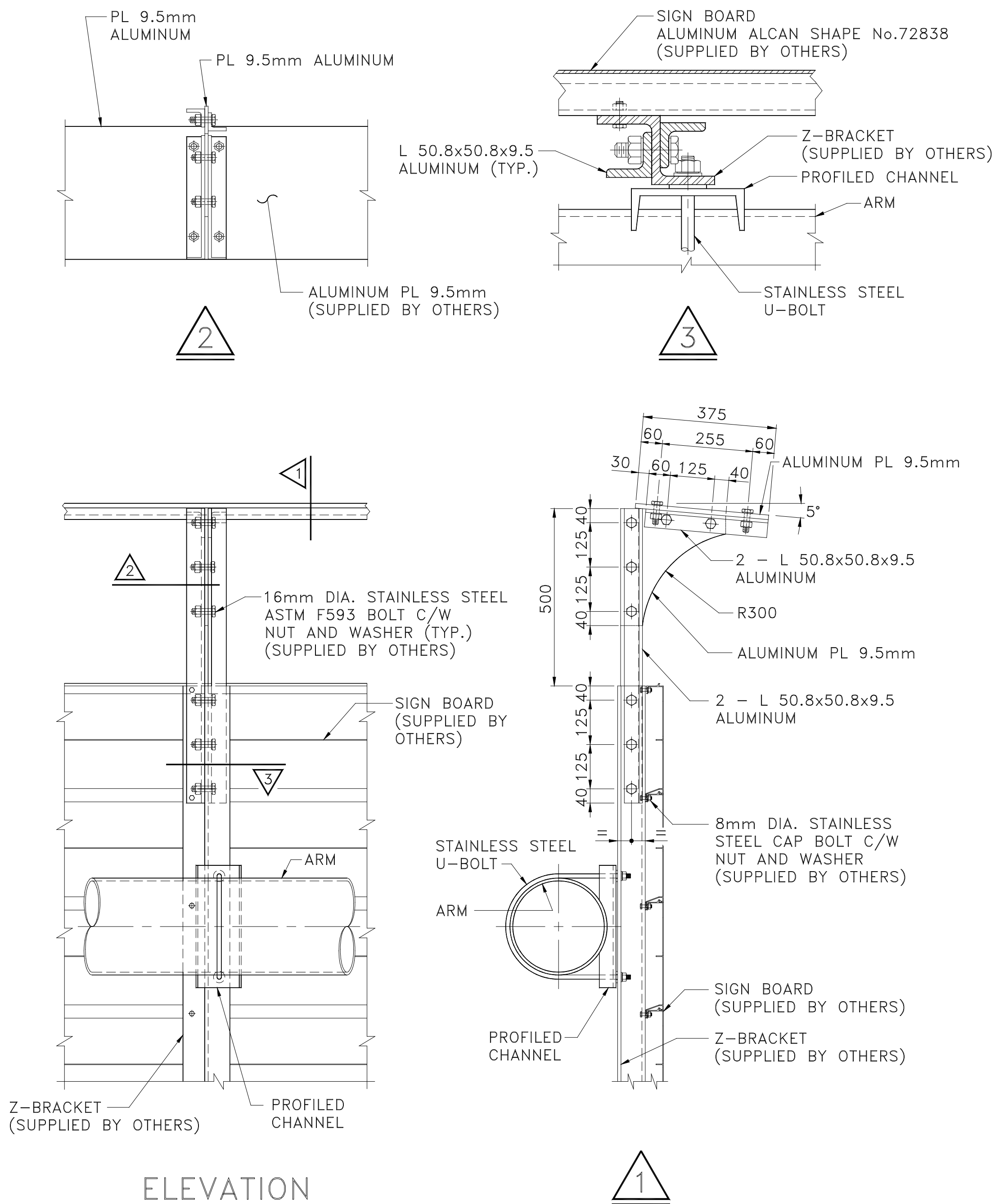



**FIGURE 3.3.2 DAMPER INSTALLATION DETAILS**

## 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 300mm 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 Division 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 30MPa concrete and Grade 400W reinforcing steel for footings.

The total weight of the sign board used in design is 0.169 $kN/m^2$ (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 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. The analysis was then confirmed with the use of a three-dimensional finite element model.

### 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 4$^{th}$ Edition 2001.

### 3.5.4 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 minimum soil parameters below the frost layer were as follows:

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

## APPENDIX TO DIVISION 3

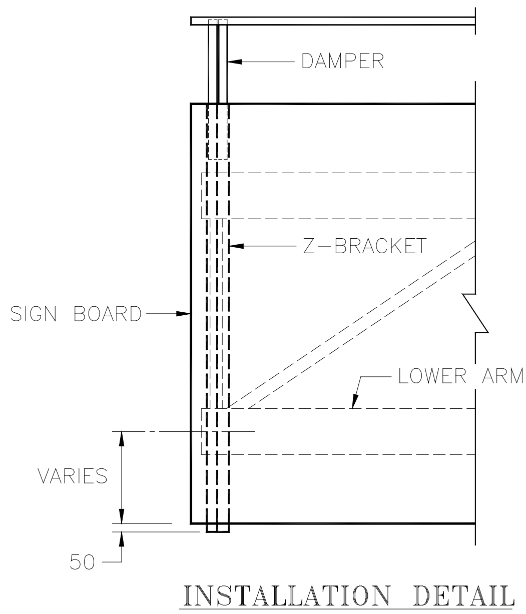
CANTILEVER STATIC SIGN SUPPORTS

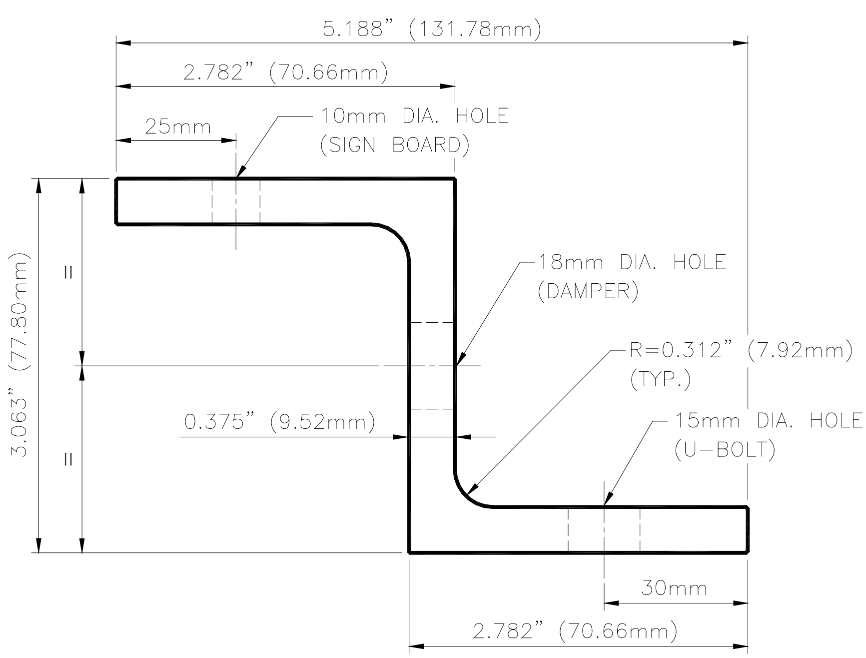
| | |
|---|---|
| **FIGURE A3.1** | Z-BRACKET DETAIL |
| **FIGURE A3.2** | HORIZONTAL CLEARANCE |
| **SS118-22** | BUTTERFLY STATIC SIGN SUPPORT<br>GENERAL ARRANGEMENT |
| **SS118-23** | BUTTERFLY STATIC SIGN SUPPORT<br>DETAILS |
| **SS118-24** | SINGLE CANTILEVER STATIC SIGN SUPPORT<br>GENERAL ARRANGEMENT |
| **SS118-25** | CANTILEVER STATIC SIGN SUPPORT<br>SIGN CONNECTION & DAMPER DETAILS |
| **SS118-71** | BUTTERFLY STATIC SIGN SUPPORT<br>GENERAL ARRANGEMENT<br>(BOLTED JOINT) |
| **SS118-72** | BUTTERFLY STATIC SIGN SUPPORT<br>DETAILS<br>(BOLTED JOINT) |
| **SS118-73** | SINGLE CANTILEVER STATIC SIGN SUPPORT<br>GENERAL ARRANGEMENT<br>(BOLTED JOINT) |

### NOTE

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

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

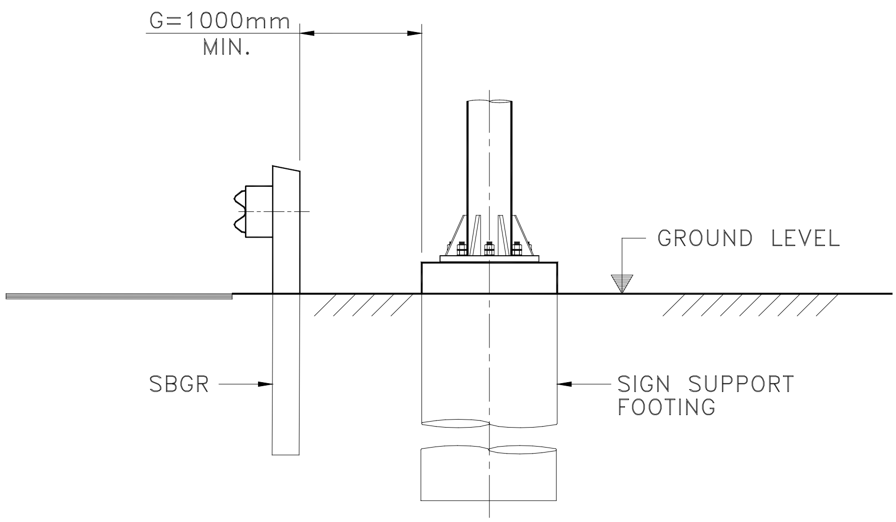


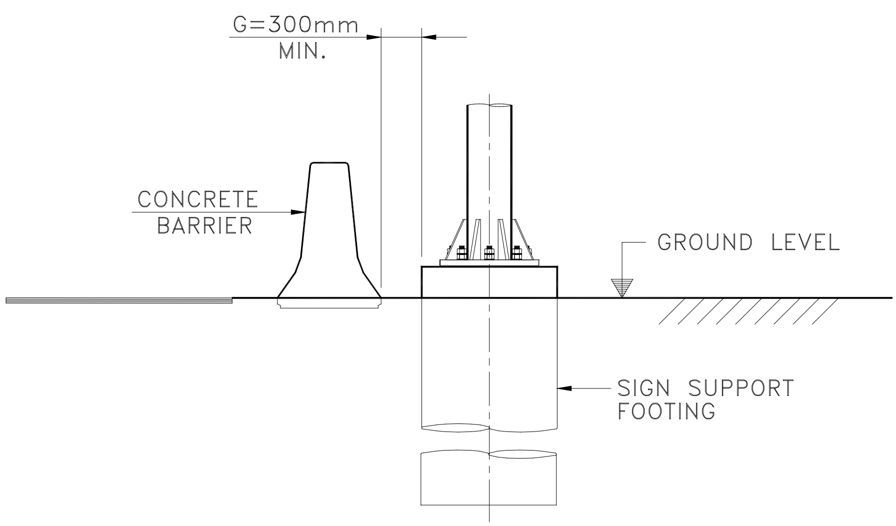

NOTES

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**

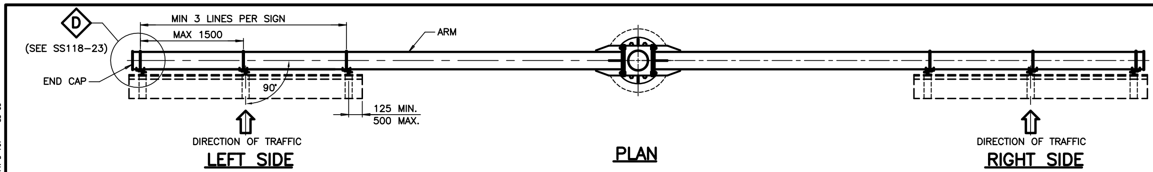
# METRIC

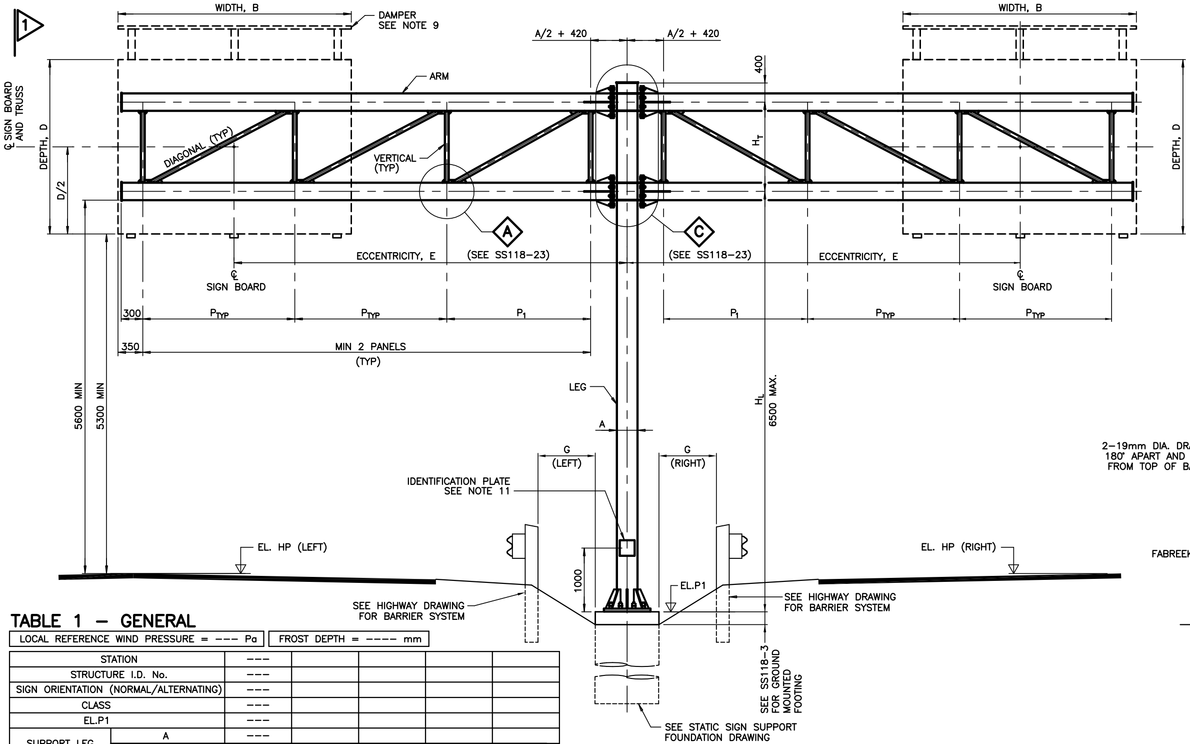
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

CONT No
WP No

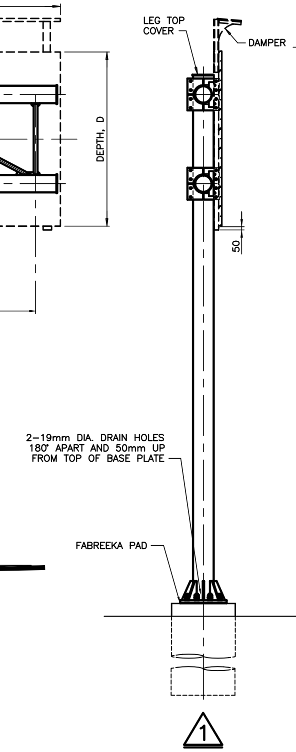
SHEET

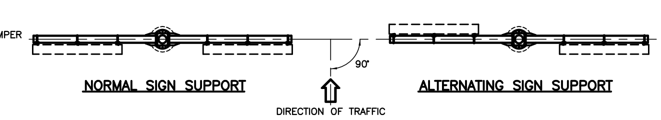
BUTTERFLY STATIC SIGN SUPPORT
GENERAL ARRANGEMENT




ELEVATION




TYPICAL LAYOUT PLAN

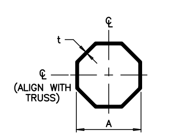
## NOTES:

1. ALL STRUCTURAL STEEL SHALL BE ACCORDING TO CAN/CSA G40.20-13/G40.21-13 GRADE 300W OR ASTM SPECIFICATION A500 GRADE C OR API-5L-X46 FOR ROUND SECTION OF O.D. ≥ 508mm.
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 S6-06.
5. ALL STRUCTURAL STEEL SHALL BE HOT DIP GALVANIZED AFTER FABRICATION. LEGS ONLY SHALL BE SUBSEQUENTLY 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 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.
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 STRUCTURE I.D. 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 A RUBBER BACKING, AND BE OF SUFFICIENT DIMENSIONS TO ACCOMMODATE THE REQUIRED INFORMATION USING 6mm HIGH ENGRAVED 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. S118-23 FOR SIGN SUPPORT DETAILS.
13. REFER TO DWG. S118-25 FOR SIGN CONNECTION AND DAMPER DETAILS.
14. LEGEND:
    SST DENOTES STAINLESS STEEL

## TABLE 1 - GENERAL

LOCAL REFERENCE WIND PRESSURE = --- Pa | FROST DEPTH = ---- mm

| | | | | | | |
|---|---|---|---|---|---|---|
| STATION | | --- | | | | |
| STRUCTURE I.D. No. | | --- | | | | |
| SIGN ORIENTATION (NORMAL/ALTERNATING) | | --- | | | | |
| CLASS | | --- | | | | |
| EL.P1 | | --- | | | | |
| SUPPORT LEG | A | --- | | | | |
| | t | --- | | | | |
| ARM | SIZE | --- | | | | |
| | P | --- | | | | |
| TRUSS DEPTH | $H_T$ | --- | | | | |
| DIAGONAL/VERTICAL SIZE | | --- | | | | |
| FOOTING TYPE (MEDIAN/GROUND) | | --- | | | | |
| $H_L$ | | --- | | | | |
| 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 | | --- | | | | |




NOTE: A AND t FROM TABLE 1

ALTERNATIVE LEG SECTION

**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 OF THE CONTRACT.

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

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWINGS

| STANDARD DRAWING DECEMBER 2014 | SS118-22 |
|---|---|
| BUTTERFLY STATIC SIGN SUPPORT GENERAL ARRANGEMENT | |

| REVISIONS | | | | | |
|---|---|---|---|---|---|
| DATE | BY | DESCRIPTION | | | |
| DESIGN | CHK | CODE CHBDC-06 | LOAD | DATE | |
| DRAWN | CHK | SITE | | DWG | |

PH-D-707 88-05
MINISTRY OF TRANSPORTATION, ONTARIO
DRAWING NAME: s118-22 Dec 2014.dwg MODIFIED: 2015/01/26 13:54:26
CREATED: 1998/03/13

# METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

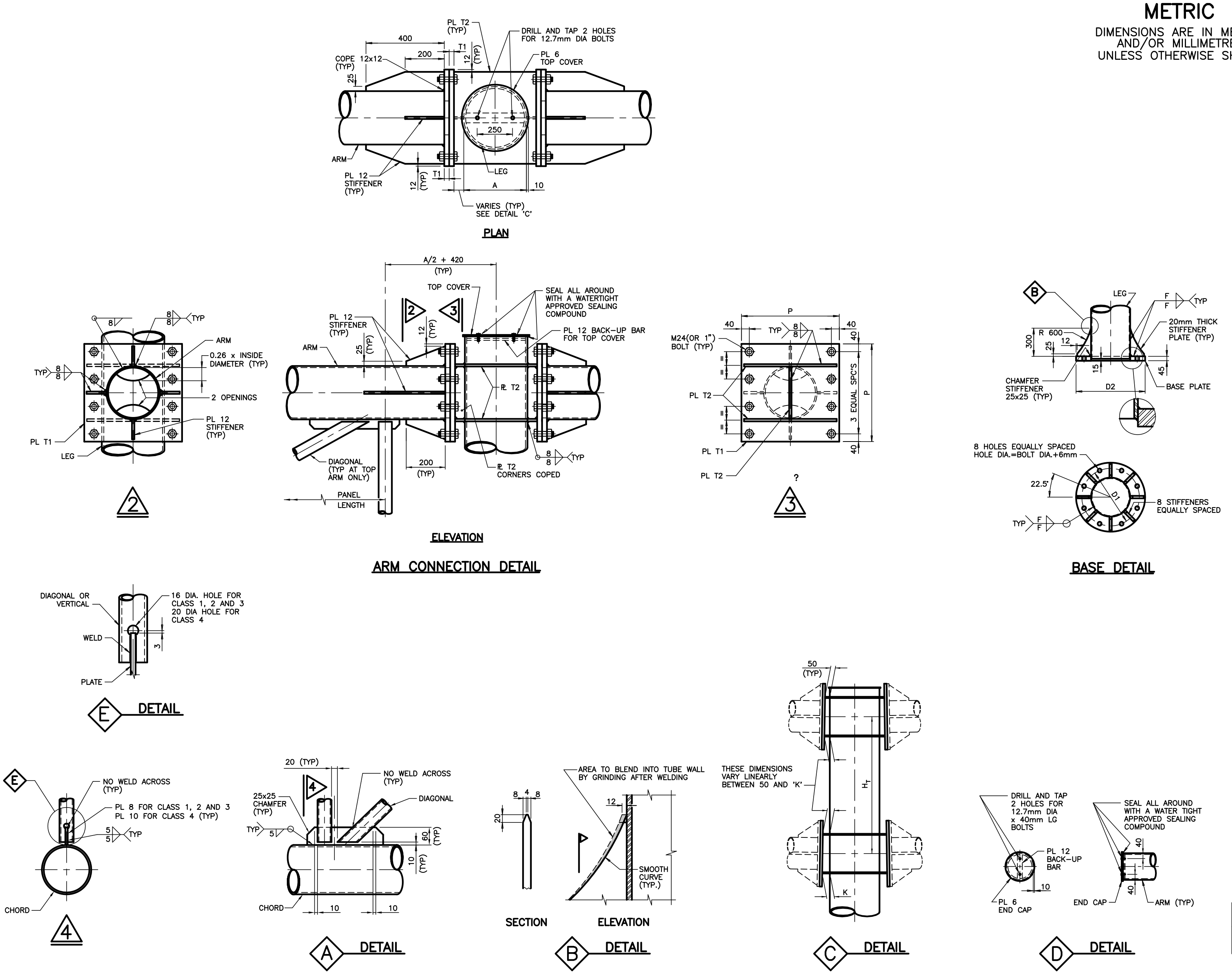
CONT No
WP No

SHEET

BUTTERFLY STATIC SIGN SUPPORT DETAILS

## NOTES:

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




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

| STANDARD DRAWING APRIL 2011 | SS118-23 |
|---|---|
| BUTTERFLY STATIC SIGN SUPPORT DETAILS | |

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWINGS

| REVISIONS | DATE | BY | DESCRIPTION | | |
|---|---|---|---|---|---|
| DESIGN | CHK | CODE CHBDC-06 | LOAD | DATE | |
| DRAWN | CHK | SITE | | DWG | |

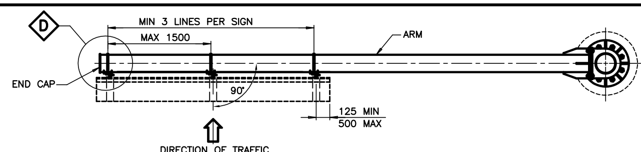
MINISTRY OF TRANSPORTATION, ONTARIO PR-D-707 88-05

DRAWING NAME: s118-23 April 2011.dwg
CREATED: 1998/03/13 MODIFIED: 2015/01/23 12:57:31

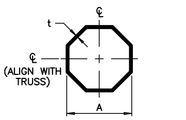
# METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

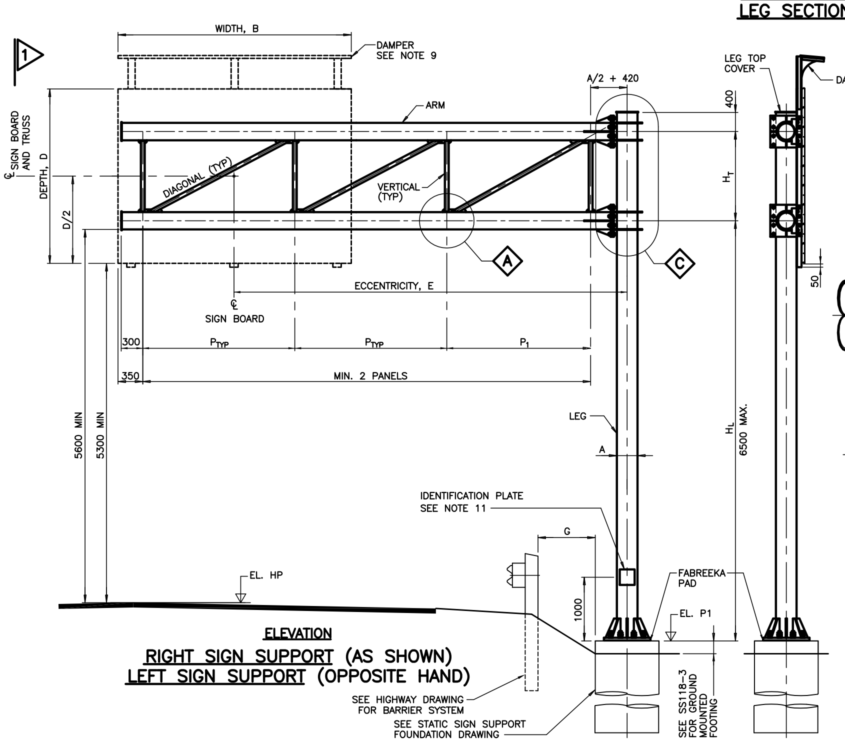
| CONT No | |
|---|---|
| WP No | |
| SINGLE CANTILEVER STATIC SIGN SUPPORT GENERAL ARRANGEMENT | SHEET |




PLAN

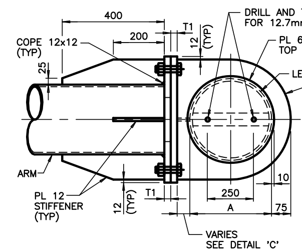



ALTERNATIVE LEG SECTION

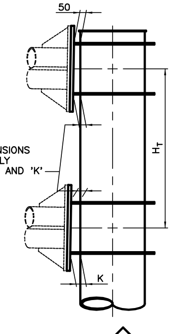


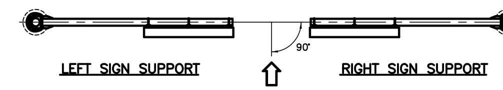

ELEVATION

RIGHT SIGN SUPPORT (AS SHOWN)
LEFT SIGN SUPPORT (OPPOSITE HAND)

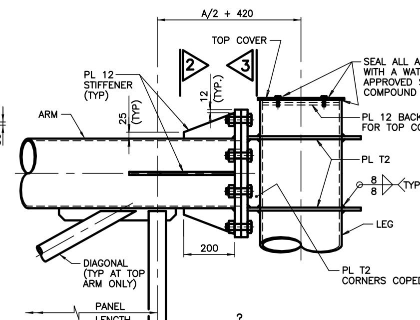



PLAN



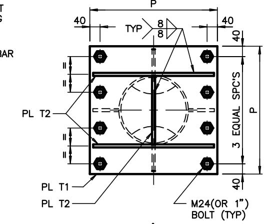


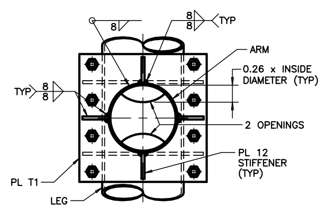

TYPICAL LAYOUT PLAN

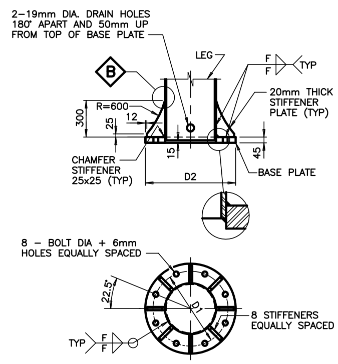



ELEVATION

ARM CONNECTION DETAIL




BASE DETAIL

## NOTES:

1. ALL STRUCTURAL STEEL SHALL BE ACCORDING TO CAN/CSA G40.20-13/G40.21-13 GRADE 300W OR ASTM SPECIFICATION A500 GRADE C OR API-5L-X46 FOR ROUND SECTION OF O.D. ≥ 508mm.
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 S6-06.
5. ALL STRUCTURAL STEEL SHALL BE GALVANIZED AFTER FABRICATION. LEGS ONLY SHALL BE SUBSEQUENTLY 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 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.
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 STRUCTURE I.D. 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 A RUBBER BACKING, AND BE OF SUFFICIENT DIMENSIONS TO ACCOMMODATE THE REQUIRED INFORMATION USING 6mm HIGH ENGRAVED 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. SS118-25 FOR SIGN CONNECTION AND DAMPER DETAILS.
13. LEGEND:
    SST DENOTES STAINLESS STEEL

### 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.

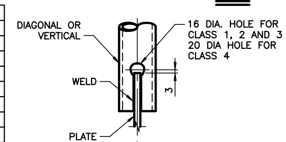
| PROTECTIVE BARRIER TYPE | MINIMUM CLEARANCE (m) |
|---|---|
| STEEL BEAM GUIDE RAIL | 1.0 |
| PERMANENT CONCRETE BARRIER | 0.3 |

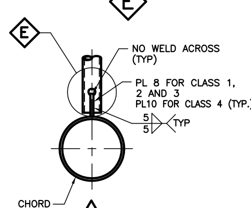
3. THE "NOTES TO DESIGNER" SHALL BE DELETED FROM THIS DRAWING PRIOR TO ISSUING OF THE CONTRACT.

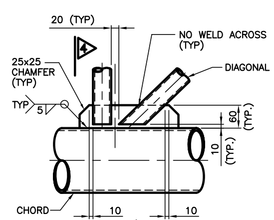
## TABLE 1 - GENERAL

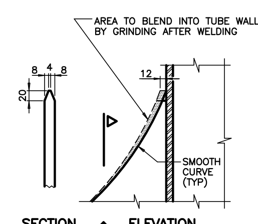
LOCAL REFERENCE WIND PRESSURE = --- Pa | FROST DEPTH = ---- mm

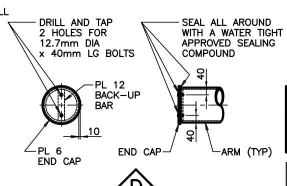
| | | | | | | |
|---|---|---|---|---|---|---|
| STATION | | --- | | | | |
| STRUCTURE I.D. No. | | --- | | | | |
| SIGN ORIENTATION (LEFT/RIGHT) | | --- | | | | |
| CLASS | | --- | | | | |
| EL.P1 | | --- | | | | |
| SUPPORT LEG | A | --- | | | | |
| | t | --- | | | | |
| ARM | SIZE | --- | | | | |
| | 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 | | --- | | | | |
| $P_1$ | | --- | | | | |
| $P_{TYP}$ | | --- | | | | |
| D1 | | --- | | | | |
| D2 | | --- | | | | |
| F | | --- | | | | |
| T1 | | --- | | | | |
| T2 | | --- | | | | |




DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWINGS

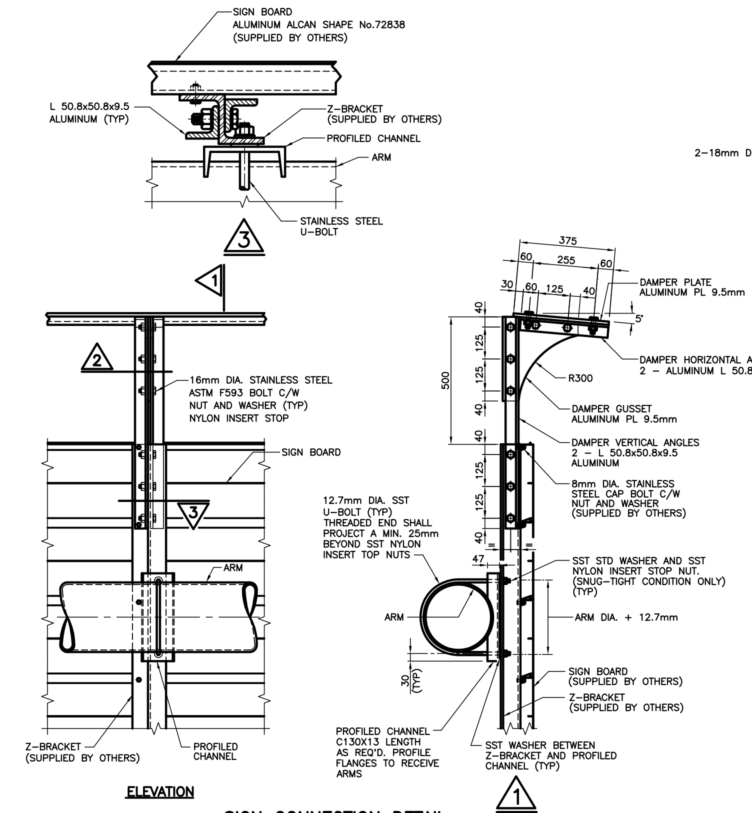
REFER TO 2.4.1 IN THE SIGN SUPPORT MANUAL FOR PROFESSIONAL ENGINEER STAMPING REQUIREMENTS.

| STANDARD DRAWING DECEMBER 2014 | SS118-24 |
|---|---|
| SINGLE CANTILEVER STATIC SIGN SUPPORT GENERAL ARRANGEMENT | |

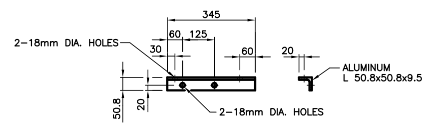
| REVISIONS | DATE | BY | DESCRIPTION | | |
|---|---|---|---|---|---|
| DESIGN | CHK | CODE CHBDC-06 | LOAD | DATE | |
| DRAWN | CHK | SITE | | DWG | |

MINISTRY OF TRANSPORTATION, ONTARIO PH-D-707 88-05

DRAWING NAME: s118-24 Dec 2014.dwg MODIFIED: 2015/01/26 14:01:25
CREATED: 1998/03/13

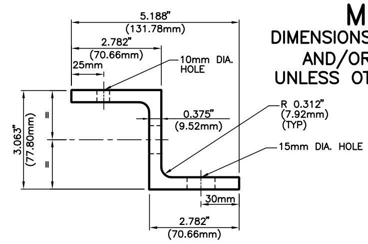



## SIGN CONNECTION DETAIL




## DAMPER HORIZONTAL ANGLES

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




## ALUMINUM Z-BRACKET

(SUPPLIED BY OTHERS)

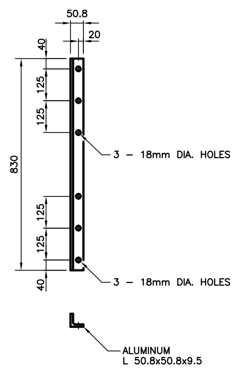
# METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

CONT No
WP No

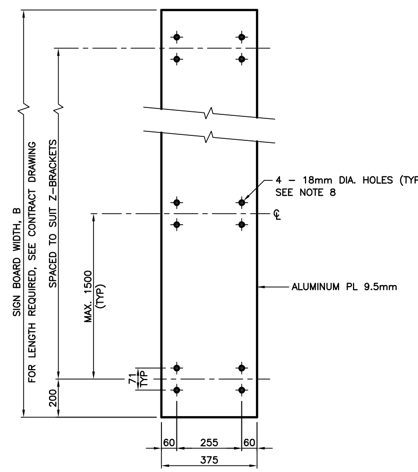
SHEET

CANTILEVER STATIC SIGN SUPPORT
SIGN CONNECTION AND
DAMPER DETAILS




## DAMPER VERTICAL ANGLES

2 ANGLES PER Z-BRACKET




## DAMPER PLATE

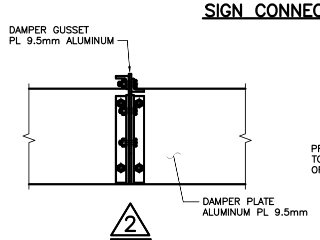
1 PLATE PER SIGN

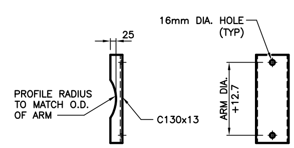
## NOTES:

1. ALL STRUCTURAL STEEL SHALL BE ACCORDING TO CAN/CSA G40.20-13/G40.21-13 GRADE 300W OR ASTM SPECIFICATION A500 GRADE C.
2. ALUMINUM DAMPER COMPONENTS SHALL BE ALLOY 6061-T6.
3. 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.
4. ALL STRUCTURAL STEEL SHALL BE HOT-DIP GALVANIZED.
5. SIGN BOARDS SHALL BE SUPPLIED BY OTHERS.
6. SIGN BOARDS SHALL BE INSTALLED ON THE STRUCTURE USING U-BOLTS AS SHOWN ON THE DRAWINGS.
7. NO SIGN BOARDS SHALL BE INSTALLED WITHOUT DAMPER.
8. HOLES FOR DAMPER PLATE SHALL BE DRILLED ON SITE AT SPACING DETERMINED BY LOCATION OF Z-BRACKETS ON THE SITE DELIVERED SIGN BOARD.
9. REFER TO DWG. S118-__ FOR GENERAL ARRANGEMENT.
10. LEGEND:
    SST DENOTES STAINLESS STEEL

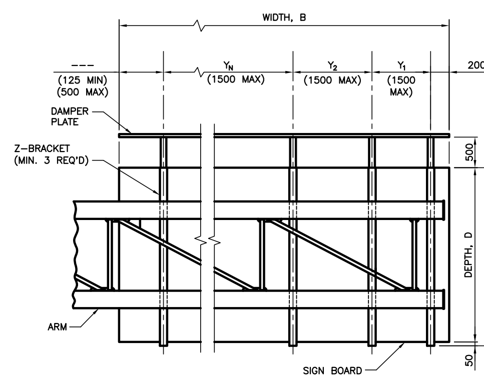
NOTES TO DESIGNER

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

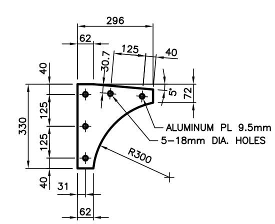



## PROFILED CHANNEL




## Z-BRACKET LOCATIONS




## DAMPER GUSSET

1 PLATE PER Z-BRACKET

## TABLE 2 – SIGN BOARD

| | | | | | | |
|---|---|---|---|---|---|---|
| STATION | | --- | | | | |
| STRUCTURE ID No. | | --- | | | | |
| LEFT | SIGN SIZE (DxB) | --- | | | | |
| | 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.

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

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWINGS

STANDARD DRAWING
DECEMBER 2014

SS118-25

CANTILEVER STATIC SIGN SUPPORT
SIGN CONNECTION AND DAMPER DETAILS

| REVISIONS | DATE | BY | DESCRIPTION | | |
|---|---|---|---|---|---|
| DESIGN | CHK | CODE CHBDC-06 | LOAD | DATE | |
| DRAWN | CHK | SITE | | DWG | |


DRAWING NAME: s118-25 Dec 2014.dwg
CREATED: 1998/03/13 MODIFIED: 2015/01/26 14:06:60
MINISTRY OF TRANSPORTATION, ONTARIO PH-D-707 88-05

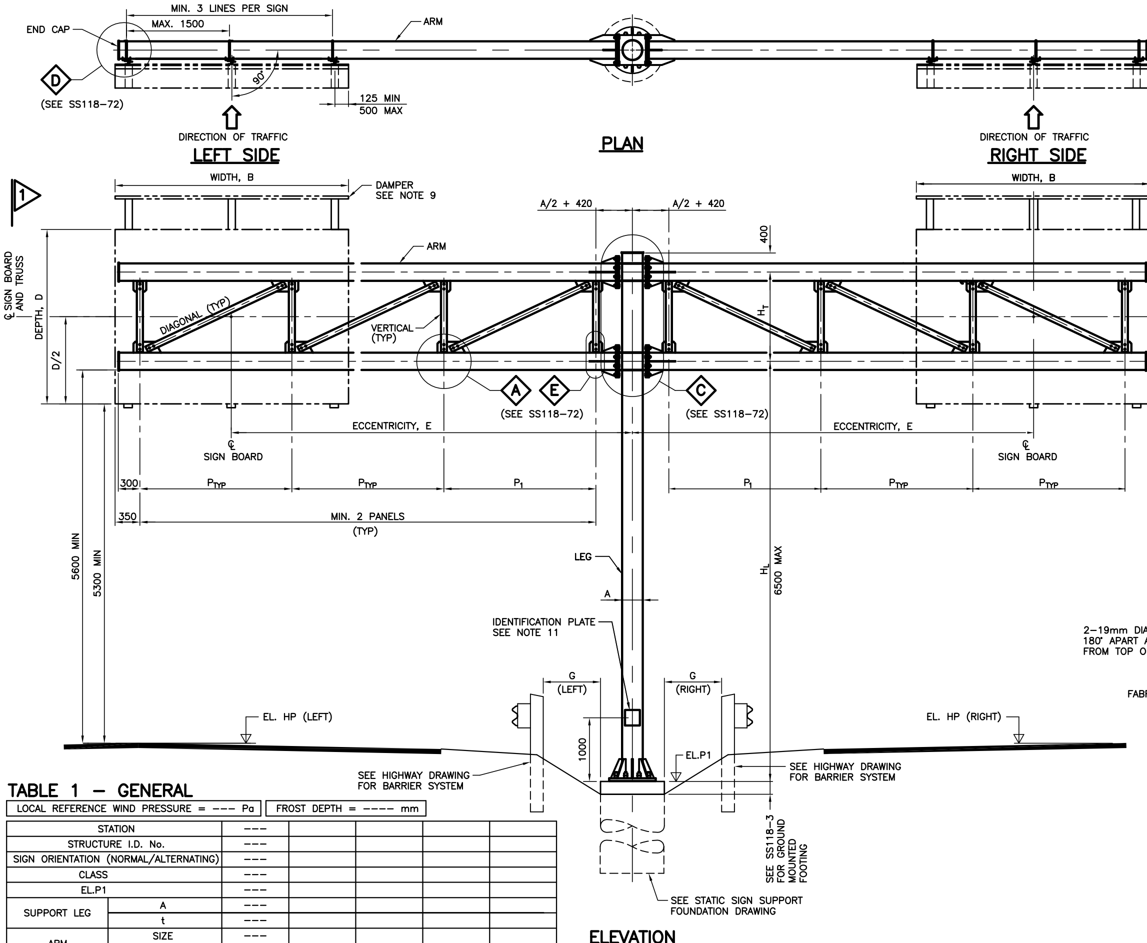
# METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

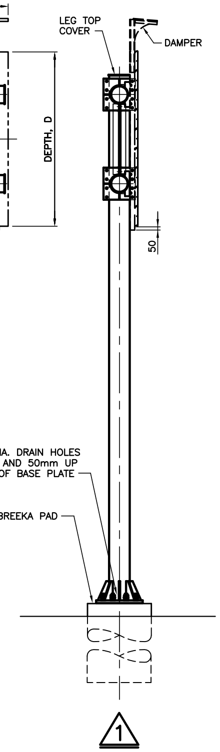
CONT No
WP No

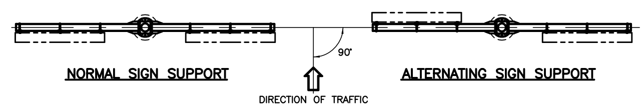
BUTTERFLY STATIC SIGN SUPPORT GENERAL ARRANGEMENT (BOLTED JOINT)

SHEET




ELEVATION




TYPICAL LAYOUT PLAN

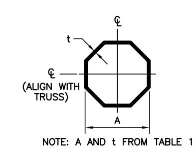
## NOTES:

1. ALL STRUCTURAL STEEL SHALL BE ACCORDING TO CAN/CSA G40.20-13/G40.21-13 GRADE 300W OR ASTM SPECIFICATION A500 GRADE C OR API-5L-X46 FOR ROUND SECTION OF O.D. ≥ 508mm.
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 S6-06.
5. ALL STRUCTURAL STEEL SHALL BE HOT DIP GALVANIZED AFTER FABRICATION. LEGS ONLY SHALL BE SUBSEQUENTLY 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 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.
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 STRUCTURE I.D. 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 A RUBBER BACKING, AND BE OF SUFFICIENT DIMENSIONS TO ACCOMMODATE THE REQUIRED INFORMATION USING 6mm HIGH ENGRAVED 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. S118-72 FOR SIGN SUPPORT DETAILS.
13. REFER TO DWG. S118-25 FOR SIGN CONNECTION AND DAMPER DETAILS.
14. BOLTED CONNECTION OF DIAGONAL AND VERTICAL MEMBERS HAS BEEN DESIGNED FOR ACTUAL JOINT FORCES.

## TABLE 1 – GENERAL

LOCAL REFERENCE WIND PRESSURE = --- Pa | FROST DEPTH = ---- mm

| | | | | | | |
|---|---|---|---|---|---|---|
| STATION | | --- | | | | |
| STRUCTURE I.D. No. | | --- | | | | |
| SIGN ORIENTATION (NORMAL/ALTERNATING) | | --- | | | | |
| CLASS | | --- | | | | |
| EL.P1 | | --- | | | | |
| SUPPORT LEG | A | --- | | | | |
| | t | --- | | | | |
| ARM | SIZE | --- | | | | |
| | P | --- | | | | |
| TRUSS DEPTH | $H_T$ | --- | | | | |
| DIAGONAL/VERTICAL SIZE | | --- | | | | |
| FOOTING TYPE (MEDIAN/GROUND) | | --- | | | | |
| $H_L$ | | --- | | | | |
| 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 | | --- | | | | |




NOTE: A AND t FROM TABLE 1

ALTERNATIVE LEG SECTION

**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 OF THE CONTRACT.

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

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWINGS

| STANDARD DRAWING JAN 2015 | SS118-71 |
|---|---|
| BUTTERFLY STATIC SIGN SUPPORT GENERAL ARRANGEMENT (BOLTED JOINT) | |

REVISIONS

| DATE | BY | DESCRIPTION |
|---|---|---|

| | | | | |
|---|---|---|---|---|
| DESIGN | CHK | CODE CHBDC-06 | LOAD | DATE |
| DRAWN | CHK | SITE | | DWG |

MINISTRY OF TRANSPORTATION, ONTARIO
PH-D-707 88-05
DRAWING NAME: s118-22 [DRAFT][2014-02].dwg
CREATED: 2008/03/26
MODIFIED: 2014/03/31 11:45:04

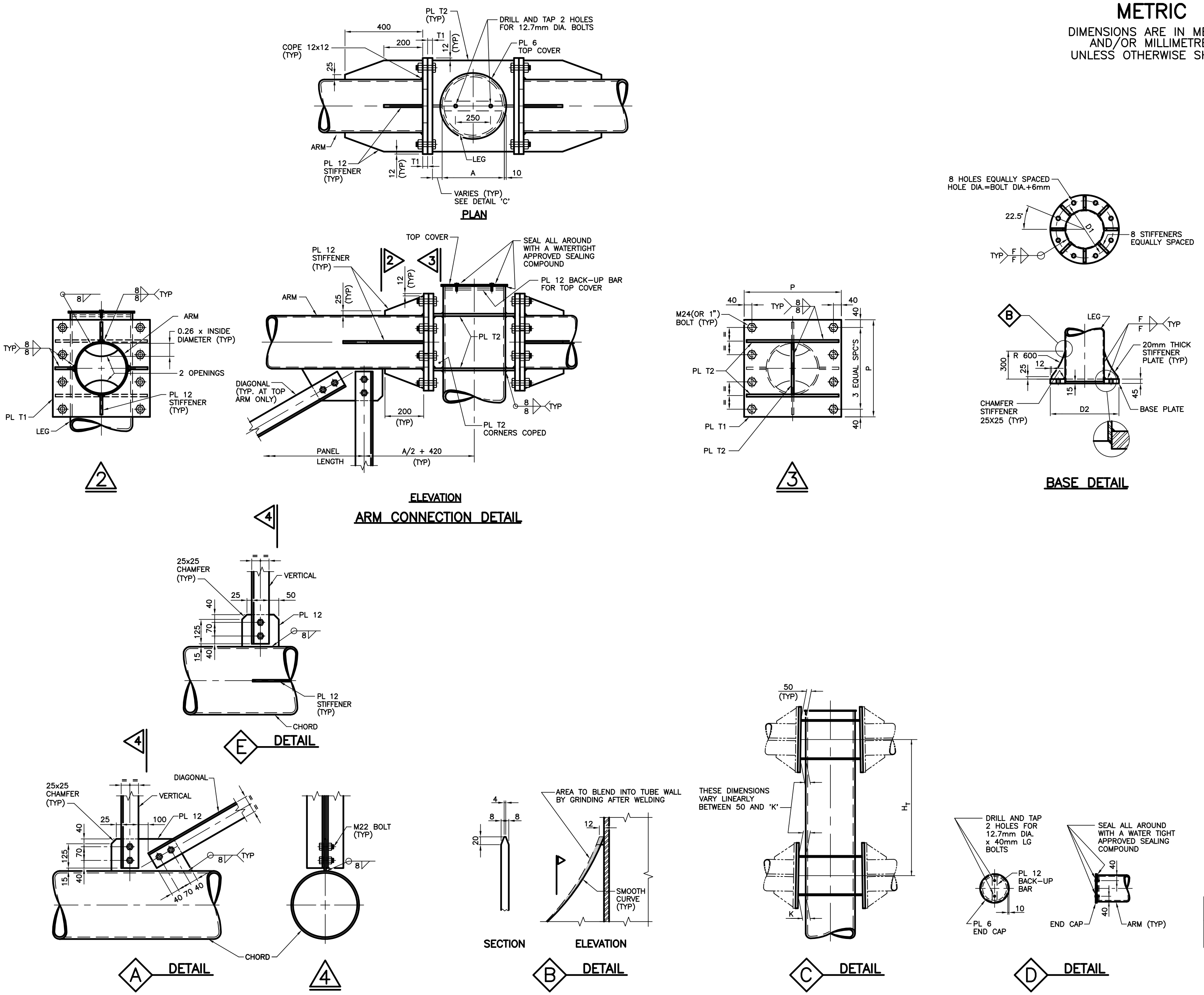
# METRIC

DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

| | |
|---|---|
| CONT No<br>WP No | |
| BUTTERFLY STATIC SIGN SUPPORT DETAILS (BOLTED JOINT) | SHEET |

## NOTES:

1. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH STANDARD DRAWING SS118-71.




DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWINGS

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

| STANDARD DRAWING JAN 2015 | SS118-72 |
|---|---|
| BUTTERFLY STATIC SIGN SUPPORT DETAILS (BOLTED JOINT) | |

| REVISIONS | DATE | BY | DESCRIPTION | | |
|---|---|---|---|---|---|
| DESIGN | CHK | CODE CHBDC-06 | LOAD | DATE | |
| DRAWN | CHK | SITE | | DWG | |

MINISTRY OF TRANSPORTATION, ONTARIO
PR-D-707 88-05
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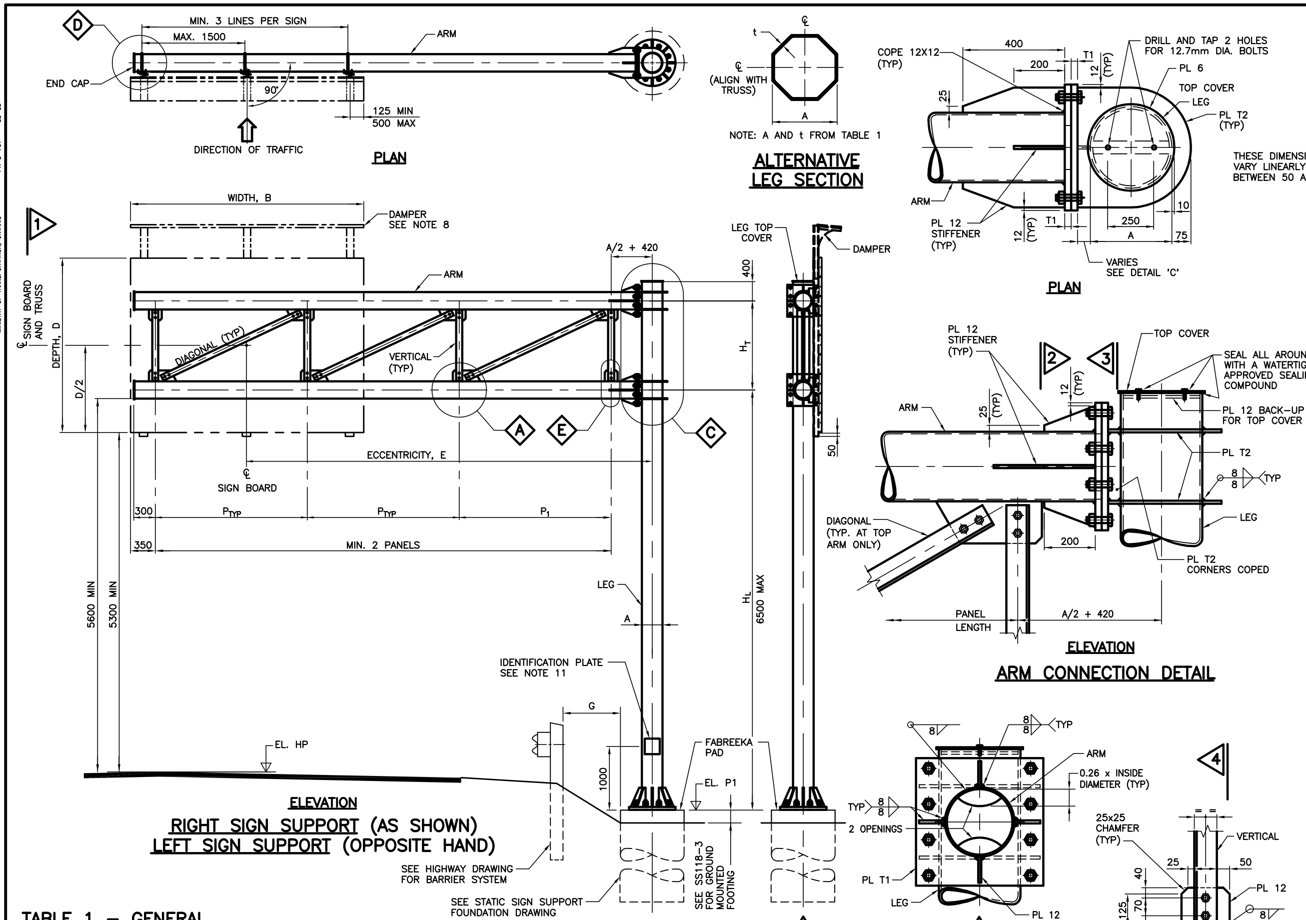
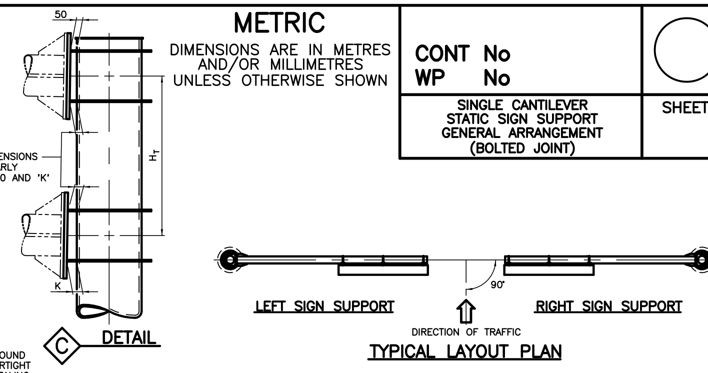
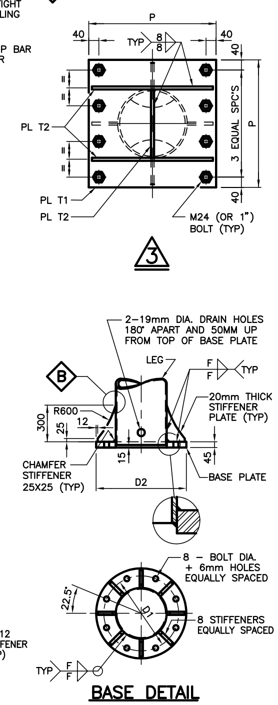
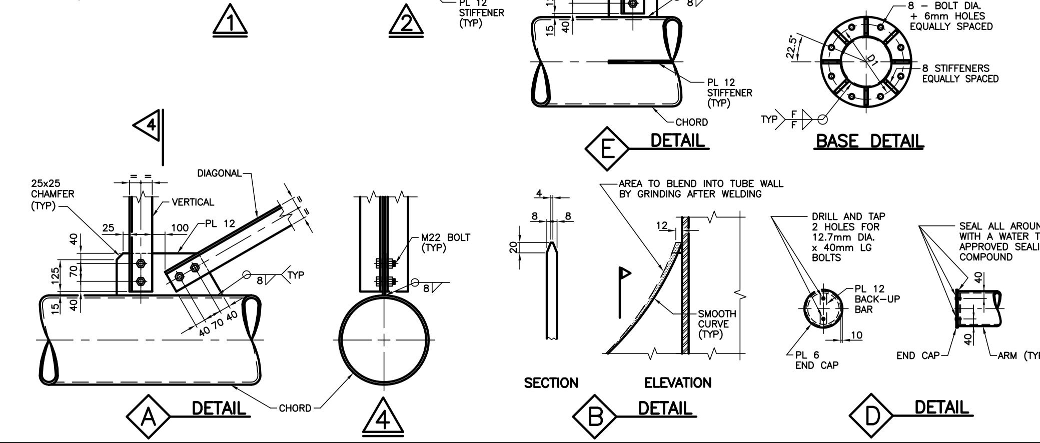
CREATED: 1998/03/13
MODIFIED: 2014/04/09 11:43:09




# METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

## NOTES:

1. ALL STRUCTURAL STEEL SHALL BE ACCORDING TO CAN/CSA G40.20−13/G40.21−13 GRADE 300W OR ASTM SPECIFICATION A500 GRACE C OR API−5L−X46 FOR ROUND SECTION OF O.D. ≥ 508mm.
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 S6−06.
5. ALL STRUCTURAL STEEL SHALL BE GALVANIZED AFTER FABRICATION. LEGS ONLY SHALL BE SUBSEQUENTLY 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 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.
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 STRUCTURE I.D. 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 A RUBBER BACKING, AND BE OF SUFFICIENT DIMENSIONS TO ACCOMMODATE THE REQUIRED INFORMATION USING 6mm HIGH ENGRAVED 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. S118−25 FOR SIGN CONNECTION AND DAMPER DETAILS.
13. BOLTED CONNECTION OF DIAGONAL AND VERTICAL MEMBERS HAS BEEN DESIGNED FOR ACTUAL JOINT FORCES.

### 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 OF THE CONTRACT.

## TABLE 1 − GENERAL

LOCAL REFERENCE WIND PRESSURE = --- Pa | FROST DEPTH = ---- mm

| | | | | | | |
|---|---|---|---|---|---|---|
| STATION | | --- | | | | |
| STRUCTURE I.D. No. | | --- | | | | |
| SIGN ORIENTATION (LEFT/RIGHT) | | --- | | | | |
| CLASS | | --- | | | | |
| EL.P1 | | --- | | | | |
| SUPPORT LEG | A | --- | | | | |
| | t | --- | | | | |
| ARM | SIZE | --- | | | | |
| | 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 | | --- | | | | |
| $P_1$ | | --- | | | | |
| $P_{TYP}$ | | --- | | | | |
| D1 | | --- | | | | |
| D2 | | --- | | | | |
| F | | --- | | | | |
| T1 | | --- | | | | |
| T2 | | --- | | | | |

CONT No
WP No

SINGLE CANTILEVER STATIC SIGN SUPPORT GENERAL ARRANGEMENT (BOLTED JOINT)

SHEET

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

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWINGS

STANDARD DRAWING JAN 2015 | SS118−73

SINGLE CANTILEVER STATIC SIGN SUPPORT GENERAL ARRANGEMENT (BOLTED JOINT)

| REVISIONS | DATE | BY | DESCRIPTION |
|---|---|---|---|

| DESIGN | CHK | CODE CHBDC−06 | LOAD | DATE |
|---|---|---|---|---|
| DRAWN | CHK | SITE | | DWG |

MINISTRY OF TRANSPORTATION, ONTARIO
PR-D-707 88-05
DRAWING NAME: s118-24 [DRAFT][2014-02].dwg
CREATED: 1998/03/13
MODIFIED: 2014/03/31 12:04:29

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# SIGN SUPPORT MANUAL

## DIVISION 4 – TRI-CHORD STATIC SIGN SUPPORTS

April 2015

# 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

Simply supported Tri-Chord overhead truss sign supports are designed to the requirements of the Ontario Highway Bridge Design Code (OHBDC).

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

(a) Spans from 14000 to 36000mm

(b) Maximum total sign board 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 (OHBDC 2-4.5.1.2)

(c) Depth of sign board from 1525mm up to 2740mm

(d) All sign boards vertically centered on the truss

(e) Location of supports and vertical clearance according to the requirements of the OHBDC

(f) Competent soil conditions excluding rock fill.

#### 4.1.1.2 CANTILEVER TYPE

Cantilever Tri-Chord overhead truss sign supports are designed to the requirements of the Canadian Highway Bridge Design Code (CHBDC).

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

(a) Cantilever span from 12000 to 18000mm.

(b) Maximum total sign board area of 26.7m$^2$ 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 3.10.1.1).

(c) Depth of sign board up to 2740mm.

(d) All sign boards vertically centred on the truss.

(e) Location of supports and vertical clearance according to the requirements of the CHBDC and Geometric Design Standard for Ontario Highways.

(f) Competent soil conditions excluding rock fill.

### 4.1.2 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 (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. They could also be located on median barriers.

For ground mounted footings, the top of footing elevation shall be a minimum of 300mm above the finished grade. This could be increased up to 1000mm 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 6500mm (see 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), respectively.

The vertical support members (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 column 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 horizontal.

The three chords are interconnected by diagonals with a welded gusset plate connection, 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 Z-brackets. For the simply supported type, the front chords are connected to the vertical support members 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

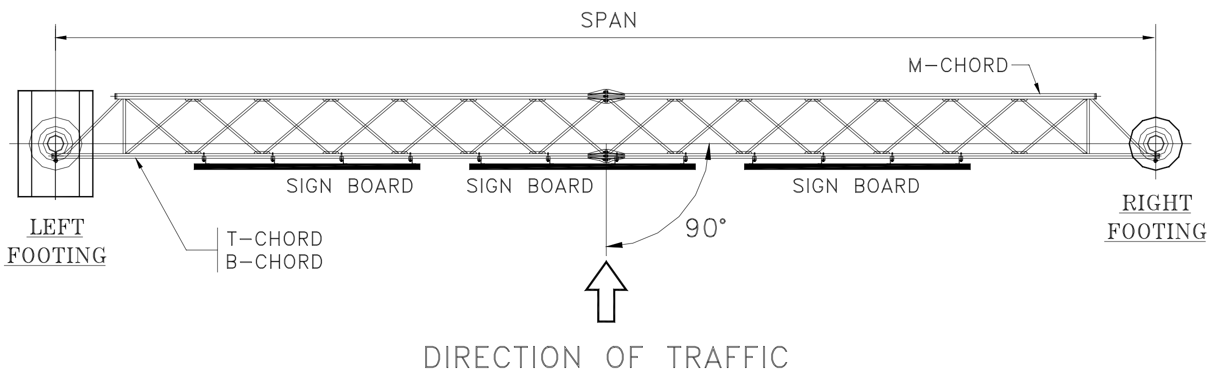



**FIGURE 4.1.3(a) TYPICAL LAYOUT PLAN (SIMPLY SUPPORTED TYPE)**

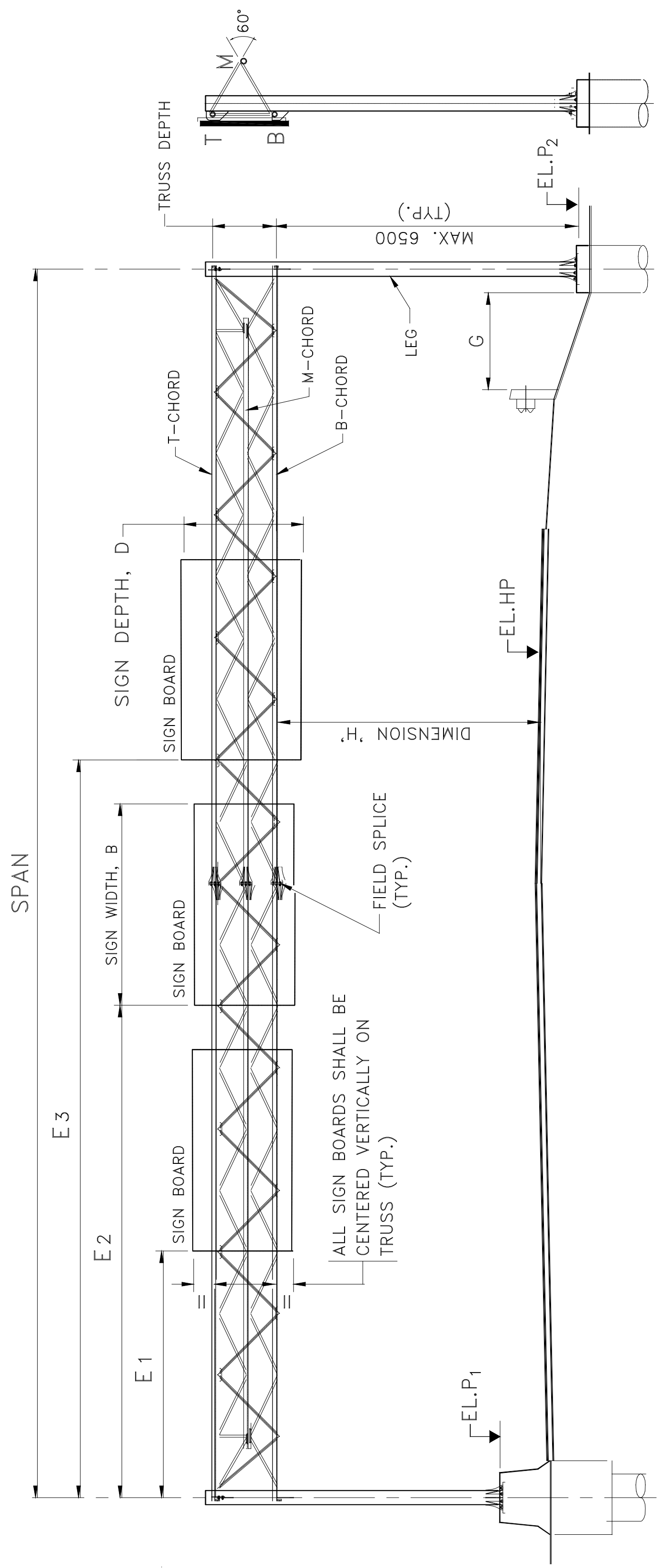



**FIGURE 4.1.3(b) TYPICAL TRI-CHORD SIGN SUPPORT ELEVATION**
**(SIMPLY SUPPORTED TYPE)**

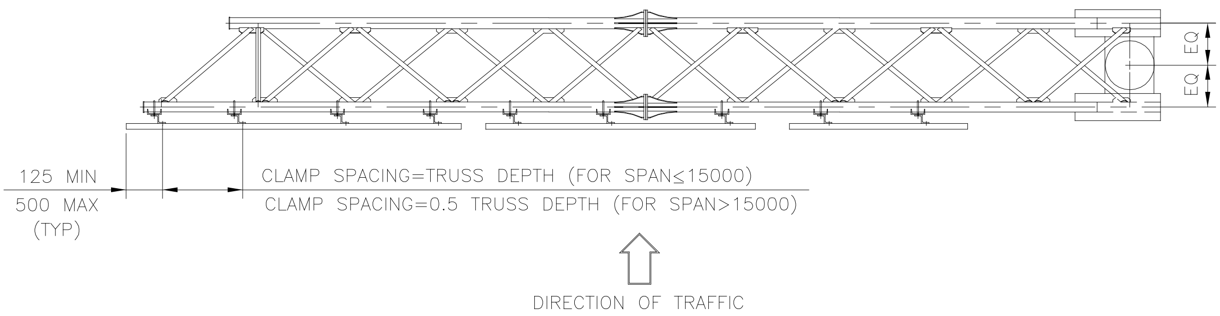



**FIGURE 4.1.3 (c) TYPICAL LAYOUT PLAN**
**(CANTILEVER TYPE)**

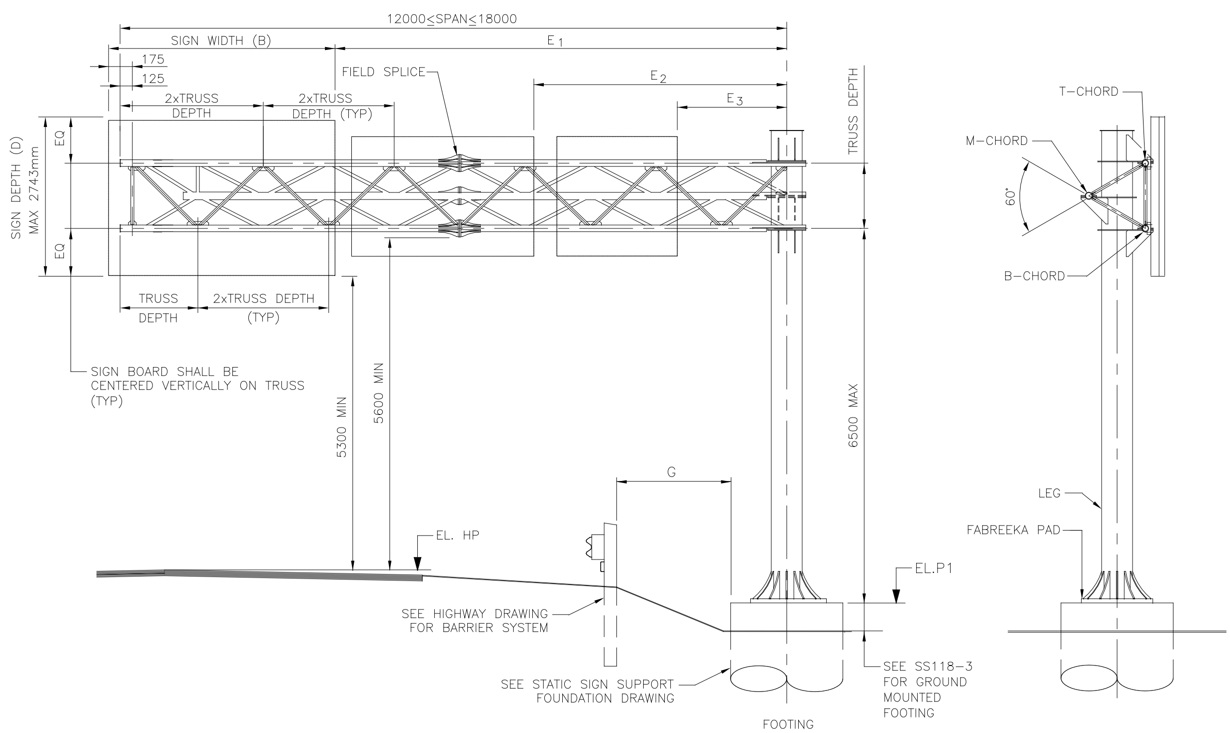



**FIGURE 4.1.3 (d) TYPICAL TRI-CHORD SIGN SUPPORT ELEVATION**
**(CANTILEVER TYPE)**

### 4.1.4 FOOTINGS

Sign support footings consist of a single reinforced concrete caisson. Details differ according to their location, and generally are of two types, as shown on the drawings: for ground mounted signs and for 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 apply to 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 require the footing to be redesigned 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 Division 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 (2743mm) shall not be less than 5300mm
- 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 5600mm.
- 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 (see Figure A4.2).

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

| SPAN (mm) | DIMENSION 'H' (mm) |
|---|---|
| SPAN ≤ 20000 | 6250 |
| 20000 < SPAN ≤ 24000 | 6200 |
| 24000 < SPAN ≤ 28000 | 6100 |
| 28000 < SPAN ≤ 32000 | 6000 |
| 32000 < SPAN ≤ 36000 | 5900 |

**TABLE 4.1.5 DIMENSION 'H'**
(For Simply Supported Type)

### 4.1.6 TRI-CHORD DEPTH

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

The Tri-Chord depth should not be rounded up, as the horizontal distance between nodes is directly related to the truss depth (See Standard Drawing SS118-26 or SS118-43, ELEVATION) in order to get 45 degrees angle and to get an exact integer number of bays so that the multiplication of truss bays is equal to the span.

If the truss depth is rounded up, then the horizontal distance between nodes should still be the exact number (before rounding) to achieve the same span.

| SPAN (mm) | Truss Depth |
|---|---|
| 14000 ≤ SPAN < 16000 | SPAN/14 |
| 16000 ≤ SPAN < 18000 | SPAN/16 |
| 18000 ≤ SPAN < 20000 | SPAN/18 |
| 20000 ≤ SPAN ≤ 36000 | SPAN/20 |

**TABLE 4.1.6 TRUSS DEPTH**
(For Simply Supported Type)

### 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) Full depth of truss for simply supported spans less than or equal to 30000mm; or cantilever span less than or equal to 15000mm;

b) Half depth of truss for simply supported spans greater than 30000mm; or cantilever span greater than 15000mm.

Minimum number of Z-brackets per sign shall be kept to 3.

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 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 based on the standard drawings on a site-specific basis.

The design of the simply supported Tri-Chord overhead sign supports is based the criteria listed in Section 4.1.1.1. Based on the required total sign board area ($\leq 45m^2$) and the span, the final design dimensions can be obtained from Table 4.2.1(a). If the required total sign board area is more than $45m^2$, see Section 4.2.3, Case 2.

The design of the cantilever Tri-Chord is based on the criteria listed in Section 4.1.1.2. 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(b).

### 4.2.2 DATA REQUIRED

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

(1) The required total sign board area and span.

(2) The location of the structure. 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 under the sign structure

### 4.2.3 PROCEDURE FOR SELECTION OF SIGN SUPPORT

CASE 1 – SIMPLY SUPPORTED TYPE WITH SIGN BOARD AREA LESS THAN OR EQUAL TO 45m$^2$

GIVEN: REQUIRED SIGN BOARD AREA AND SPAN
Example: a required sign board area of 30m$^2$ and a span of 20500mm.

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

E.g. From Table 4.2.1(a), for a span of 20500mm select the span range of 20001 to 22000mm. 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 20500mm, truss depth = 20500/20 = 1025mm.

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) 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 6500mm

(2) The projection of the footing above ground with a limitation of 1000mm

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

STEP 3: COMPLETE THE STANDARD DRAWINGS

Refer to 4.3 for Preparation of Drawings.

<u>CASE 2 – SIMPLY SUPPORTED TYPE WITH SIGN BOARD AREA GREATER THAN 45m$^2$</u>

If the required sign board area is more than 45m$^2$, the site-specific local reference wind pressure, q, for a return period of 50 years shall be determined from OHBDC Section 2, Table A2-1.7, or from Table A2.9(a) to (c) in the Appendix in Division 2 of the Manual. Then the <u>maximum allowable total sign board area</u> for this specific site will be

**45 ( 600/q)** m$^2$ where "q" is given in Pa

E.g., For a local "q" of 430 Pa, the <u>maximum allowable total sign board area</u> is 45 x 600/430 = 62.7m$^2$.

To complete the standard drawings, the <u>maximum allowable total sign board area</u> is required, and is used for the identification plate. See <u>Note 14</u> on S118-26.

<u>CASE 3 – CANTILEVER TYPE</u>

GIVEN: REQUIRED SIGN BOARD AREA AND SPAN
Example: a required sign board area of 20m$^2$ and a span of 16000mm.

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

E.g. From Table 4.2.1(b), for a span of 16000mm, select CLASS 3, the span range of 14501 to 16000mm. 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 = 1600mm.

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.

Repeat CASE 1: STEP 2, (c)

STEP 3: COMPLETE THE STANDARD DRAWINGS

Refer to 4.3 for Preparation of Drawings.

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

**WALL THICKNESS OF MEMBERS:**

| | | |
|---|---|---|
| | **CHORDS** | **6.4 mm** |
| | **DIAGONALS** | **3.2 mm** |
| | **LEGS** | **12.7 mm** |

**TABLE 4.2.1(a) SIMPLY SUPPORTED TRI-CHORD DESIGN DIMENSIONS**
**(MAXIMUM ALLOWABLE SIGN BOARD AREA = 45m$^2$)**
**(REFERENCE WIND PRESSURE = 600 Pa)**

NOTE: For sign board areas greater than 45m$^2$, see 4.2.3, Case 2.

| 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 |

**TABLE 4.2.1(b) CANTILEVER TRI-CHORD DESIGN DIMENSIONS**
**(MAXIMUM ALLOWABLE SIGN BOARD AREA = 26.7m$^2$)**
**(REFERENCE WIND PRESSURE = 600 Pa)**

## 4.3 PREPARATION OF DRAWINGS

### 4.3.1 DATA REQUIRED

Prior to design, a "Key Plan and Frame Dimension" drawing(s) must be prepared to enable the working drawings to be detailed. This drawing(s) will form part of the contract document and must show for one or more structures, the following information:

(1) A key plan, indicating the location of each support.

(2) The Structure I.D. number.

(3) For simply supported type, the span is measured from centreline to centreline of column.

For cantilever type, the span is measured from the centreline of column to the tip at the free end of the top (bottom) chord.

(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 support structure.

(6) The dimension ‘H’ measured from the highest point on the roadway surface to the bottom of the lowest chord of the Tri-Chord. For the simply supported Tri-Chord, this dimension shall be as indicated in Table 4.1.5. For the cantilever Tri-Chord, dimension ‘H’ shall be calculated based on the clearance requirements stipulated in Section 4.1.5.

(7) The dimension measured from the top of footing to the centreline of the bottom chord. This dimension shall not exceed 6500mm.

(8) The top of footing elevation. This elevation can differ for each leg of simply supported type, if required. The elevation shall be a minimum of 300mm above the finished grade. This could be increased up to 1000mm in order to limit the column leg height as stated in (7).

(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 station of the support structure on a 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, 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,
- The dimensions B and D of each sign board,
- The location of each sign board with respect to the centrelines of the column or, for simply supported type, left column.

### 4.3.2 SIGN SUPPORT DRAWINGS

If the supports are to be supplied and erected as part of a contract, appropriate standard drawings from SS118-26, SS118-27, SS118-43, SS118-44, SS110-45, SS118-3, SS118-4 and SS118-5 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 SS118-26 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.

**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) Structure I.D. Number

(iii) For simply supported type, the support span measured from centrelines of columns;

For cantilever type, the span measured from the centreline of column 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) Dimension ‘H’ from the bottom of the lowest chord to the highest point on the highway, including shoulders, curbs and median, as specified in Section 4.1.5.

(vi) Local Reference Wind Pressure, in Pa

(vii) Maximum Allowable Sign Board Area, $m^2$ (for simply supported type only)

(viii) Sign Sizes (D x B) for each sign board (max. D is 2743mm)

(ix) The location of each sign board, $E_i$, with respect to the centreline of the column. Left column for simply supported type.

(x) Elevation of the highest point on the highway under the signs, including shoulders, curbs and medians. EL.HP

(xi) Elevation at the top of support footing(s), EL.P1 (and EL.P2)

(xii) Member outside diameters and thickness, as obtained from tabulated values in Table 4.2.1(a) or 4.2.1(b).

(xiii) Footing Type (see Section 4.1.4)

Table 2 - Sign Board: Parts/Hardware is to be completed with quantities for all sign boards.

The following table shall be used for the calculation of 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 |
| PROFILED 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 vertical support leg shall be kept free from dirt and debris

(ii) The surrounding ground level shall be a minimum of 300mm 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 508mm) 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 1991 edition of the Ontario Highways Bridge Design Code unless otherwise stated. Fatigue wind loads were obtained from AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaries and Traffic Signals (1994).

#### 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 Canadian Highways Bridge Design Code unless otherwise stated. Wind loads, design and detailing for fatigue was in accordance with AASHTO Standard Specifications for

Structural Supports for Highway Signs, Luminaries 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 is 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 18m 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) and 4.2.1(b), 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% (SPAN/100), and horizontal members are restricted to 2% (SPAN/50) lateral movement. Both limitations are within the suggested limits provided in AASHTO's "Standard Specifications for Structural Supports for Highway Signs, Luminaries and Traffic Signals-1994”, which allows 2.95% 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 essentially 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’s “Standard Specifications for Structural Supports for Highway Signs, Luminaries 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 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** | $\Phi' = 28^o$ | $C_u = 25$ kPa |
| | **Lower 1/3** | $\Phi' = 30^o$ | $C_u = 50$ kPa |

### 4.5.4.1 SIMPLY SUPPORTED TRI-CHORD

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).

### 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.

- 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)’. 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 consistence with the Illinois DOT’s Design Guide on Shaft Overturning and Torsion Analysis.

     - 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.

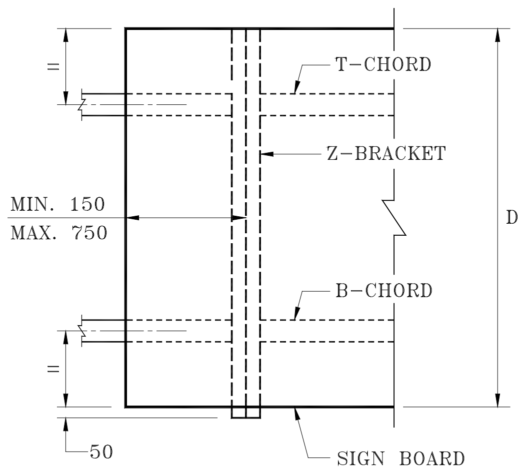
- This design uses the highest wind pressure in Ontario in combination with very weak soil parameters (sand or soft clay) for all locations.

- Existing cantilever static sign support structures did not use torsion as a design criterion and there is no report of torsional issues.

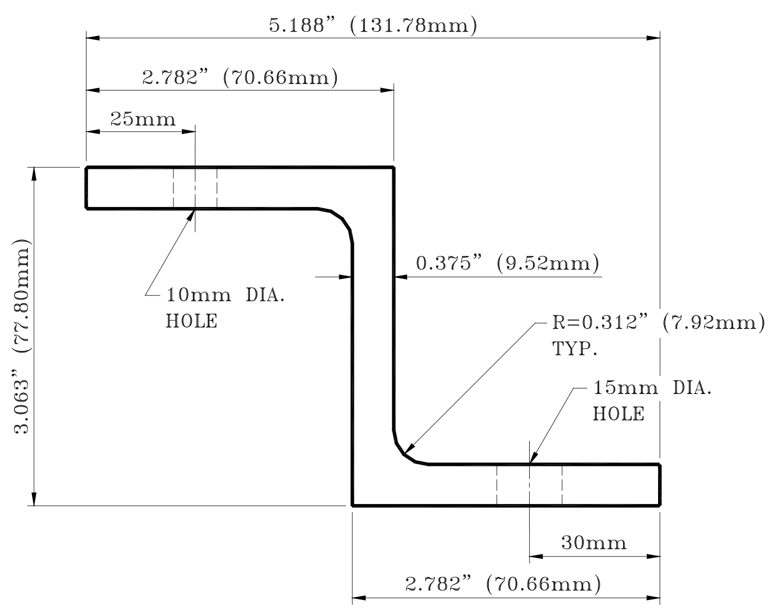
- Geotechnical torsional failure will not reduce the geotechnical lateral and axial resistances of the shaft.

## APPENDIX TO DIVISION 4

TRI-CHORD STATIC SIGN SUPPORTS




INSTALLATION DETAIL




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**

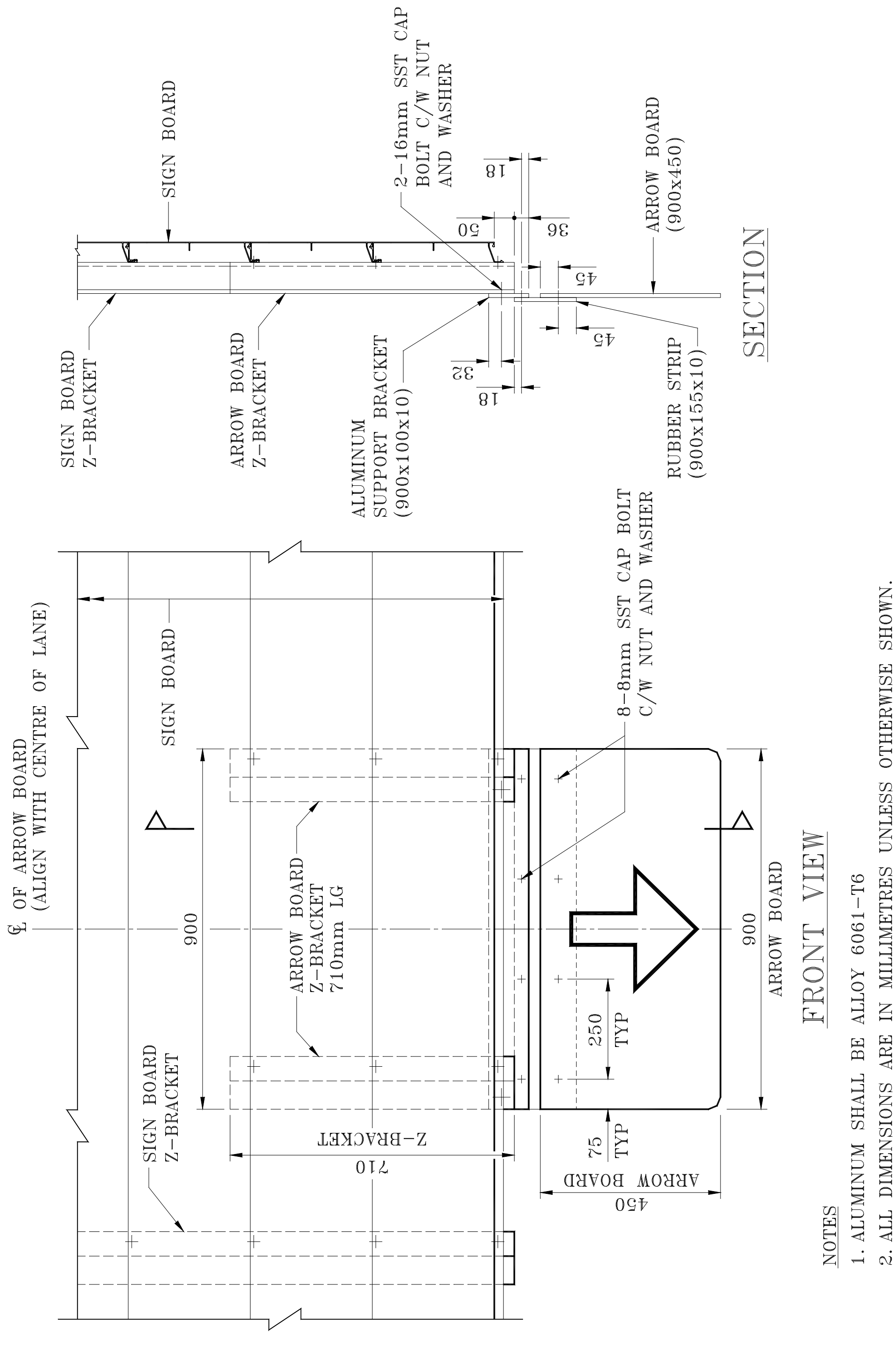



**FIGURE A4.2 ARROW BOARD DETAIL**

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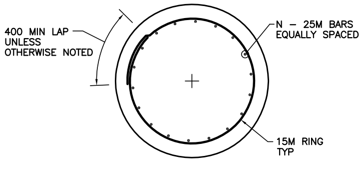
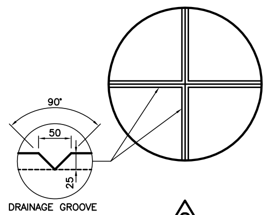
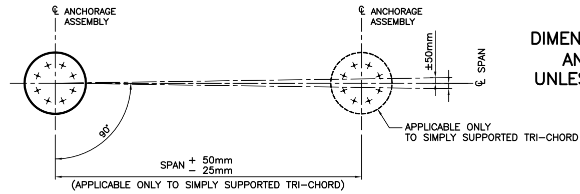



1




2

## DRAINAGE GROOVES




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

## TYPICAL PLAN SHOWING TOLERANCE (*)

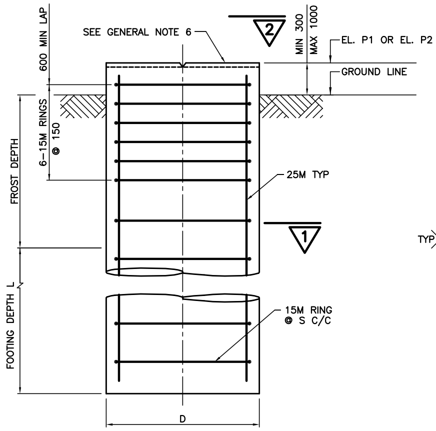
# METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

WP No

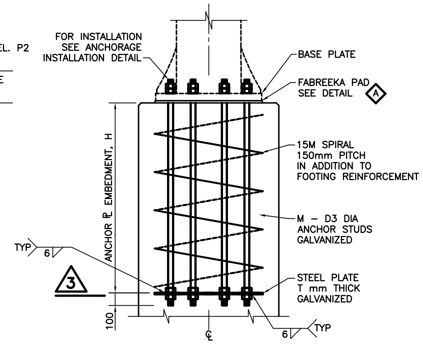
SHEET

STATIC SIGN SUPPORT – FOOTING DETAILS (GROUND MOUNTED)



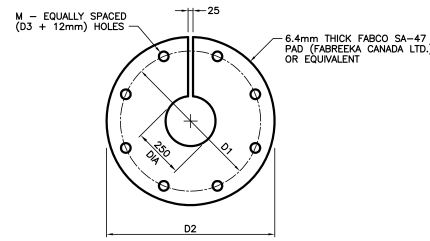

NOTE: ANCHORAGE NOT SHOWN FOR CLARITY.

## TYPICAL REINFORCEMENT

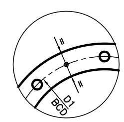



## ANCHORAGE DETAIL (*)

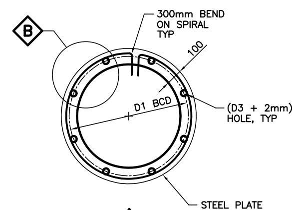
∗ NOTE – 8 ANCHOR STUDS ARRANGEMENT SHOWN. 12 ANCHOR STUDS CASE SIMILAR




A DETAIL




B DETAIL




3

## GENERAL NOTES:

1. CLASS OF CONCRETE 30 MPa.
2. CLEAR COVER TO REINFORCING STEEL 100±25.
3. REINFORCING STEEL SHALL BE GRADE 400W UNLESS OTHERWISE SPECIFIED.
4. STRUCTURAL STEEL PLATE SHALL BE ACCORDING TO CAN/CSA-G40.20-13/G40.21-13, GRADE 300W.
5. EXCAVATION TO BE DONE NEAT AND CONCRETE PLACED AGAINST UNDISTURBED GROUND.
6. THE TOP OF FOOTINGS SHALL BE 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.
7. GROUT BEDDING SHALL NOT BE USED.
8. THIS DRAWING TO BE READ IN CONJUNCTION WITH GENERAL ARRANGEMENT DWG.

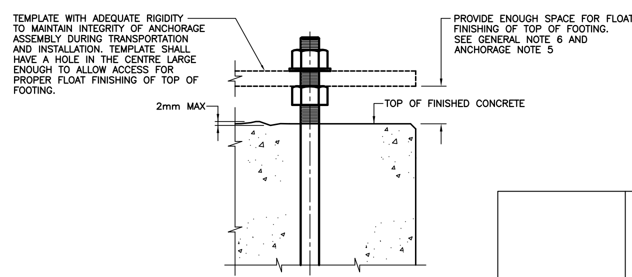
## ANCHORAGE NOTES:

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 FINISHING OF TOP OF FOOTING.

## TABLE 1 – FOOTING DIMENSIONS

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| STATION | --- | | | | | | | | | |
| STRUCTURE I.D. NO. | --- | | | | | | | | | |
| CLASS | --- | | | | | | | | | |
| SPAN | --- | | | | | | | | | |
| LEFT/RIGHT FOOTING | --- | | | | | | | | | |
| EL.P1 OR EL.P2 | --- | | | | | | | | | |
| FROST DEPTH | --- | | | | | | | | | |
| L | --- | | | | | | | | | |
| D | --- | | | | | | | | | |
| N | --- | | | | | | | | | |
| M | --- | | | | | | | | | |
| D1 | --- | | | | | | | | | |
| D2 | --- | | | | | | | | | |
| D3 | --- | | | | | | | | | |
| T | --- | | | | | | | | | |
| H | --- | | | | | | | | | |
| S | --- | | | | | | | | | |

| 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 ℘ THK. T | ANCHOR ℘ EMBED. H | RING SPACING S |
|---|---|---|---|---|---|---|---|---|---|---|---|
| TYPE | CLASS | (mm) | (mm) | (no.) | (no.) | (mm) | (mm) | (mm) | (mm) | (mm) | (mm) |
| TRI-CHORD | – | 5000 | 1200 | 18 | 8 | 750 | 900 | 38 | 12 | 1200 | 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 |
| | 4 | 7500 | 1500 | 22 | 12 | 950 | 1100 | 44 | 15 | 1500 | 225 |
| SINGLE CANTILEVER | 1 | 5000 | 1200 | 18 | 8 | 750 | 900 | 38 | 12 | 1200 | 300 |
| | 2 | 5000 | 1200 | 18 | 8 | 750 | 900 | 38 | 12 | 1200 | 300 |
| | 3 | 6000 | 1200 | 18 | 8 | 750 | 900 | 38 | 12 | 1200 | 300 |
| | 4 | 6500 | 1350 | 22 | 8 | 850 | 1000 | 44 | 15 | 1500 | 300 |
| BUTTERFLY | 1 | 5500 | 1200 | 18 | 8 | 750 | 900 | 38 | 12 | 1200 | 300 |
| | 2 | 5500 | 1200 | 18 | 8 | 750 | 900 | 38 | 12 | 1200 | 300 |
| | 3 | 6700 | 1200 | 18 | 8 | 750 | 900 | 38 | 12 | 1200 | 300 |
| | 4 | 7400 | 1350 | 22 | 8 | 850 | 1000 | 44 | 15 | 1500 | 300 |
| POLE MOUNTED VMS | – | 4000 | 1200 | 15 | 8 | 600 | 750 | 32 | 10 | 1000 | 300 |




## ANCHORAGE INSTALLATION DETAIL

### 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 OF THE CONTRACT.

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

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

STANDARD DRAWING JAN 2015 | SS118-3

STATIC SIGN SUPPORT FOOTING DETAILS (GROUND MOUNTED)

| REVISIONS | DATE | BY | DESCRIPTION | | |
|---|---|---|---|---|---|
| DESIGN | CHK | CODE CHBDC-06 | LOAD | DATE | |
| DRAWN | CHK | SITE | | DWG | |


MINISTRY OF TRANSPORTATION, ONTARIO PR-D-707 88-05
DRAWING NAME: s118-6 July 2014.dwg MODIFIED: 2014/07/16 16:30:28
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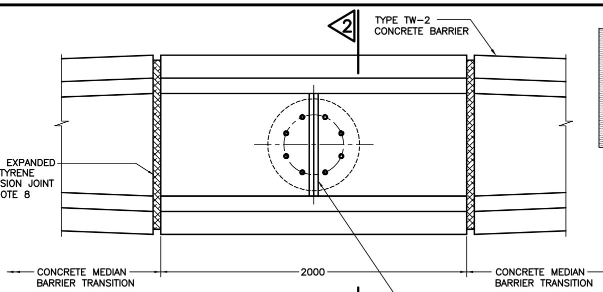
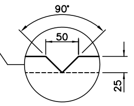
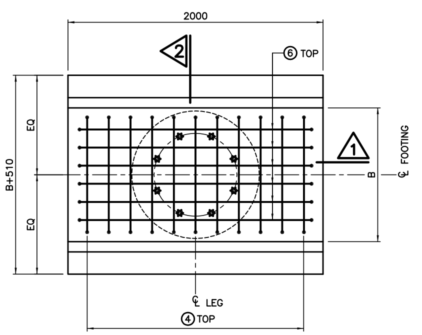


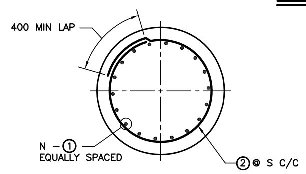

PLAN (*)




DRAINAGE GROOVE




PLAN (*)




3

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.
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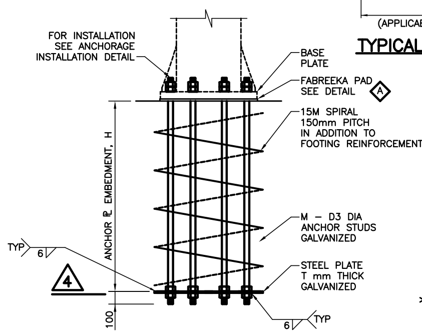
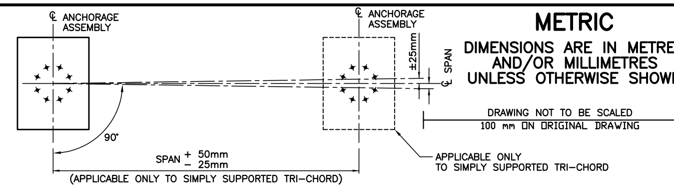



ANCHORAGE DETAIL (*)




TYPICAL PLAN SHOWING TOLERANCE (*)

* NOTE: 8 ANCHOR STUDS ARRANGEMENT SHOWN
12 ANCHOR STUDS CASE SIMILAR

# METRIC

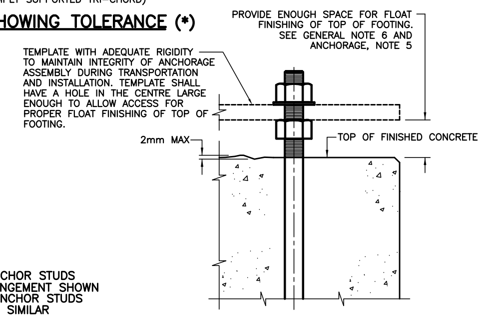
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

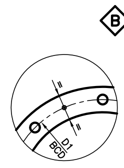
CONT No
WP No

SHEET

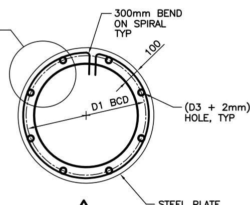
STATIC SIGN SUPPORT
FOOTING DETAILS
(MEDIAN MOUNTED – SYMMETRICAL)




ANCHORAGE INSTALLATION DETAIL




B DETAIL

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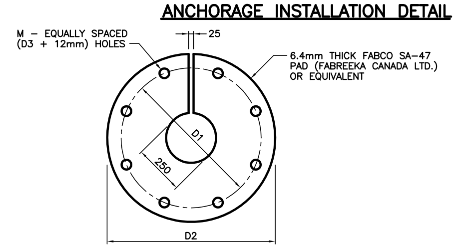



A DETAIL

## GENERAL NOTES:

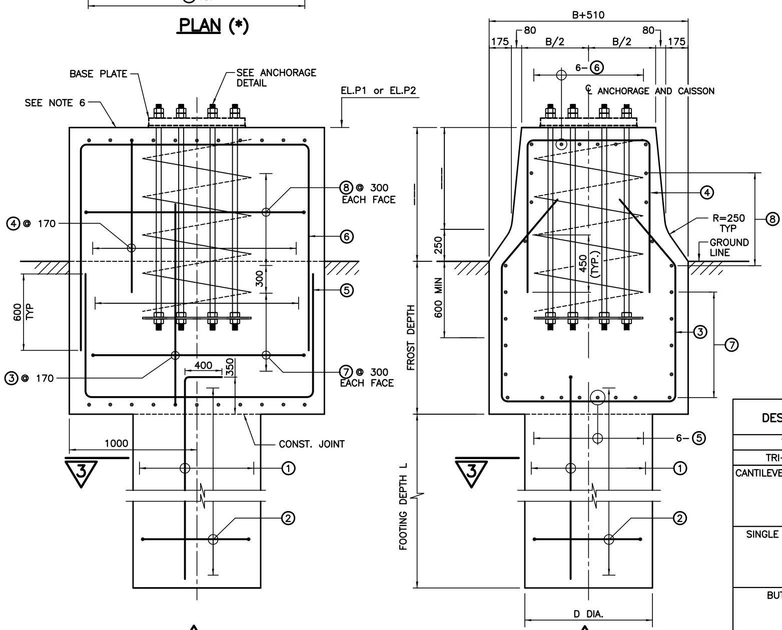
1. CLASS OF CONCRETE 30 MPa.
2. CLEAR COVER TO REINFORCING STEEL:
   - CAISSON 100±25mm
   - REMAINDER 80±20mm
3. REINFORCING STEEL SHALL BE GRADE 400W UNLESS OTHERWISE SPECIFIED.
4. STRUCTURAL STEEL PLATE SHALL BE ACCORDING TO CAN/CSA-G40.20-13/G40.21-13, GRADE 300W.
5. EXCAVATION TO BE DONE NEAT AND CONCRETE PLACED AGAINST UNDISTURBED GROUND.
6. THE TOP OF FOOTINGS SHALL BE 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.
7. GROUT BEDDING SHALL NOT BE USED.
8. EXPANDED POLYSTYRENE IN EXPANSION JOINT SHALL CONFORM TO CGSB 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 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.




1 TYPICAL SECTION (*) 2

TABLE 1 – FOOTING DIMENSIONS

| STATION | --- | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| STRUCTURE I.D. No. | --- | | | | | | | | | |
| CLASS | --- | | | | | | | | | |
| SPAN | --- | | | | | | | | | |
| LEFT/RIGHT FOOTING | --- | | | | | | | | | |
| EL.P1 or EL.P2 | --- | | | | | | | | | |
| FROST DEPTH | --- | | | | | | | | | |
| L | --- | | | | | | | | | |
| D | --- | | | | | | | | | |
| N | --- | | | | | | | | | |
| M | --- | | | | | | | | | |
| D1 | --- | | | | | | | | | |
| D2 | --- | | | | | | | | | |
| D3 | --- | | | | | | | | | |
| T | --- | | | | | | | | | |
| H | --- | | | | | | | | | |
| S | --- | | | | | | | | | |
| B | --- | | | | | | | | | |

| 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 ℄ THK. T | ANCHOR ℄ EMBED. H | RING SPACING S | B |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TYPE | CLASS | (mm) | (mm) | (no.) | (no.) | (mm) | (mm) | (mm) | (mm) | (mm) | (mm) | (mm) |
| TRI-CHORD | – | 5000 | 1000 | 18 | 8 | 750 | 900 | 38 | 12 | 1200 | 300 | 1050 |
| CANTILEVER TRI-CHORD | 1 | 6500 | 1350 | 22 | 12 | 850 | 1000 | 38 | 15 | 1200 | 300 | 1150 |
| | 2 | 6500 | 1350 | 22 | 12 | 850 | 1000 | 44 | 15 | 1500 | 300 | 1150 |
| | 3 | 7500 | 1350 | 22 | 12 | 900 | 1100 | 44 | 15 | 1500 | 275 | 1250 |
| | 4 | 7500 | 1500 | 22 | 12 | 950 | 1100 | 44 | 15 | 1500 | 225 | 1250 |
| SINGLE CANTILEVER | 1 | 5000 | 1000 | 18 | 8 | 750 | 900 | 38 | 12 | 1200 | 300 | 1050 |
| | 2 | 5000 | 1000 | 18 | 8 | 750 | 900 | 38 | 12 | 1200 | 300 | 1050 |
| | 3 | 6000 | 1200 | 18 | 8 | 750 | 900 | 38 | 12 | 1200 | 300 | 1050 |
| | 4 | 6500 | 1350 | 22 | 8 | 850 | 1000 | 44 | 15 | 1500 | 300 | 1150 |
| BUTTERFLY | 1 | 5500 | 1000 | 18 | 8 | 750 | 900 | 38 | 12 | 1200 | 300 | 1050 |
| | 2 | 5500 | 1000 | 18 | 8 | 750 | 900 | 38 | 12 | 1200 | 300 | 1050 |
| | 3 | 6700 | 1200 | 18 | 8 | 750 | 900 | 38 | 12 | 1200 | 300 | 1050 |
| | 4 | 7400 | 1350 | 22 | 8 | 850 | 1000 | 44 | 15 | 1500 | 300 | 1150 |
| POLE MOUNTED VMS | – | 4000 | 1000 | 15 | 8 | 600 | 750 | 32 | 10 | 1000 | 300 | 1050 |

APPLICABLE STANDARD DRAWINGS

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

STANDARD DRAWING
JAN 2015

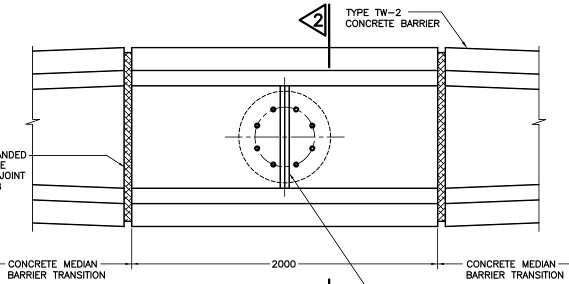
SS118-4

STATIC SIGN SUPPORT – FOOTING DETAILS
(MEDIAN MOUNTED – SYMMETRICAL)

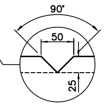
| REVISIONS | | |
|---|---|---|
| DATE | BY | DESCRIPTION |

| DESIGN | CHK | CODE CHBDC-06 | LOAD | DATE |
|---|---|---|---|---|
| DRAWN | CHK | SITE | | DWG |

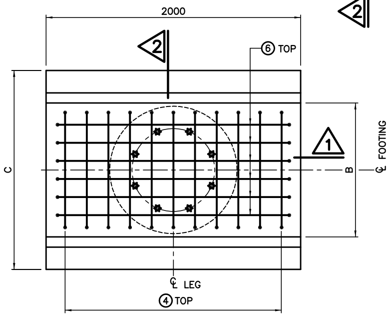
DRAWING NAME: s118-4 Jan 15, 2015.dwg
CREATED: 1998/03/13
MODIFIED: 2015/01/23 12:07:05




PLAN (*)



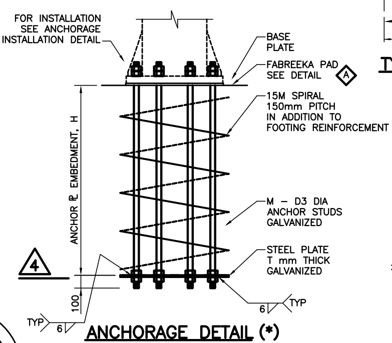

DRAINAGE GROOVE



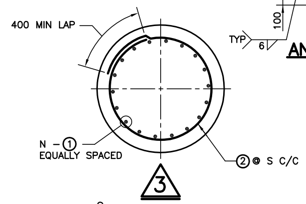

PLAN (*)

**NOTES TO DESIGNER**

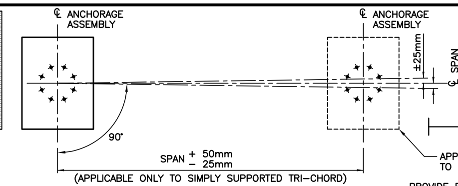
1. IF SOUND ROCK IS ENCOUNTERED AT A DEPTH OF "Y" < L FROM THE BOTTOM OF THE FROST LAYER, THIS DIMENSION CAN BE REDUCED TO: Y + (L − Y)/2, UPON MINISTRY'S APPROVAL.
2. THE "DESIGN INFORMATION" TABLE AND "NOTES TO DESIGNER" SHALL BE DELETED FROM THIS DRAWING PRIOR TO ISSUING OF THE CONTRACT.




ANCHORAGE DETAIL (*)




* NOTE: 8 ANCHOR STUDS ARRANGEMENT SHOWN 12 ANCHOR STUDS CASE SIMILAR



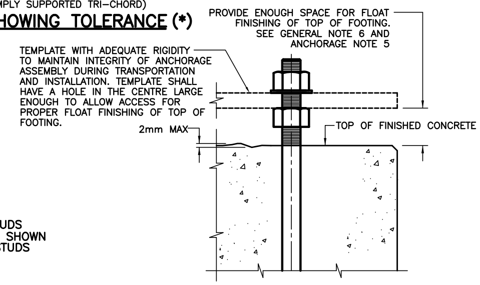

(APPLICABLE ONLY TO SIMPLY SUPPORTED TRI-CHORD)

TYPICAL PLAN SHOWING TOLERANCE (*)

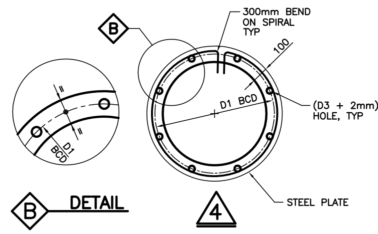
# METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

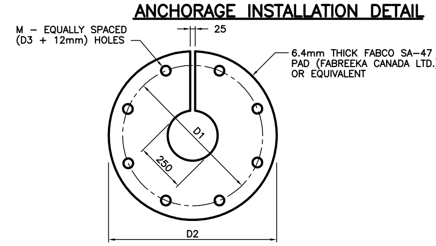



ANCHORAGE INSTALLATION DETAIL

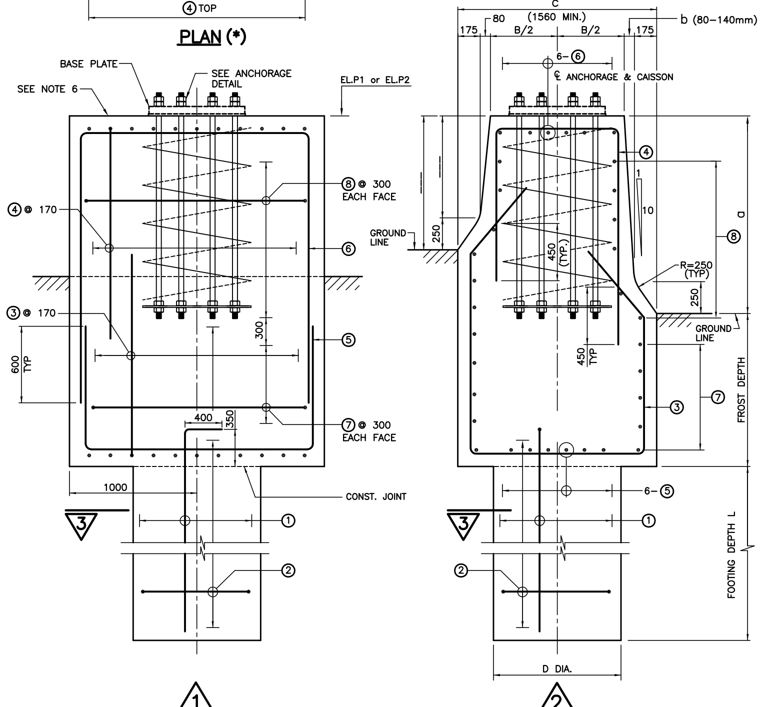



B DETAIL

4




A DETAIL




TYPICAL SECTION (*)

## TABLE 1 – FOOTING DIMENSIONS

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| STATION | --- | | | | | | | | | |
| STRUCTURE I.D. No. | --- | | | | | | | | | |
| CLASS | --- | | | | | | | | | |
| SPAN | --- | | | | | | | | | |
| LEFT/RIGHT FOOTING | --- | | | | | | | | | |
| a | | | | | | | | | | |
| b | | | | | | | | | | |
| c | | | | | | | | | | |
| EL.P1 or EL.P2 | --- | | | | | | | | | |
| FROST DEPTH | --- | | | | | | | | | |
| L | --- | | | | | | | | | |
| D | --- | | | | | | | | | |
| N | --- | | | | | | | | | |
| M | --- | | | | | | | | | |
| D1 | --- | | | | | | | | | |
| D2 | --- | | | | | | | | | |
| D3 | --- | | | | | | | | | |
| T | --- | | | | | | | | | |
| H | --- | | | | | | | | | |
| S | --- | | | | | | | | | |
| B | --- | | | | | | | | | |

| DESIGN INFORMATION | | FOOTING DEPTH L | FOOTING DIAMETER D | No. OF REBARS N | No. OF ANCHORS M | BOLT CIRCLE DIA D1 | BASE ℙ DIAMETER D2 | ANCHOR DIAMETER D3 | ANCHOR ℙ THK. T | ANCHOR ℙ EMBED. H | RING SPACING S | B |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TYPE | CLASS | (mm) | (mm) | (no.) | (no.) | (mm) | (mm) | (mm) | (mm) | (mm) | (mm) | (mm) |
| TRI-CHORD | – | 5000 | 1000 | 18 | 8 | 750 | 900 | 38 | 12 | 1200 | 300 | 1050 |
| CANTILEVER TRI-CHORD | 1 | 6500 | 1350 | 22 | 12 | 850 | 1000 | 38 | 15 | 1200 | 300 | 1150 |
| | 2 | 6500 | 1350 | 22 | 12 | 850 | 1000 | 44 | 15 | 1500 | 300 | 1150 |
| | 3 | 7500 | 1350 | 22 | 12 | 900 | 1100 | 44 | 15 | 1500 | 275 | 1250 |
| | 4 | 7500 | 1500 | 22 | 12 | 950 | 1100 | 44 | 15 | 1500 | 225 | 1250 |
| SINGLE CANTILEVER | 1 | 5000 | 1000 | 18 | 8 | 750 | 900 | 38 | 12 | 1200 | 300 | 1050 |
| | 2 | 5000 | 1000 | 18 | 8 | 750 | 900 | 38 | 12 | 1200 | 300 | 1050 |
| | 3 | 6000 | 1200 | 18 | 8 | 750 | 900 | 38 | 12 | 1200 | 300 | 1050 |
| | 4 | 6500 | 1350 | 22 | 8 | 850 | 1000 | 44 | 15 | 1500 | 300 | 1150 |
| BUTTERFLY | 1 | 5500 | 1000 | 18 | 8 | 750 | 900 | 38 | 12 | 1200 | 300 | 1050 |
| | 2 | 5500 | 1000 | 18 | 8 | 750 | 900 | 38 | 12 | 1200 | 300 | 1050 |
| | 3 | 6700 | 1200 | 18 | 8 | 750 | 900 | 38 | 12 | 1200 | 300 | 1050 |
| | 4 | 7400 | 1350 | 22 | 8 | 850 | 1000 | 44 | 15 | 1500 | 300 | 1150 |
| POLE MOUNTED VMS | – | 4000 | 1000 | 15 | 8 | 600 | 750 | 32 | 10 | 1000 | 300 | 1050 |

CONT No
WP No

SHEET

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-G40.20-13/G40.21-13, GRADE 300W.
5. EXCAVATION TO BE DONE NEAT AND CONCRETE PLACED AGAINST UNDISTURBED GROUND.
6. THE TOP OF FOOTINGS SHALL BE 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.
7. GROUT BEDDING SHALL NOT BE USED.
8. EXPANDED POLYSTYRENE IN EXPANSION JOINT SHALL CONFORM TO CGSB 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:

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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 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 911.380 GUIDE RAIL SYSTEM, CONCRETE BARRIER PERMANENT TRANSITION INSTALLATION AT PIERS AND POLES

STANDARD DRAWING JAN 2015 — SS118-5

STATIC SIGN SUPPORT – FOOTING DETAILS (MEDIAN MOUNTED – ASYMMETRICAL)

| REVISIONS | | |
|---|---|---|
| DATE | BY | DESCRIPTION |

| | | | | | |
|---|---|---|---|---|---|
| DESIGN | CHK | CODE CHBDC-06 | LOAD | | DATE |
| DRAWN | CHK | SITE | | | DWG |

DRAWING NAME: s118-5 Jan 15, 2015.dwg
CREATED: 1998/03/13
MODIFIED: 2015/01/23 12:13:32
MINISTRY OF TRANSPORTATION, ONTARIO
PR-D-707 88-05

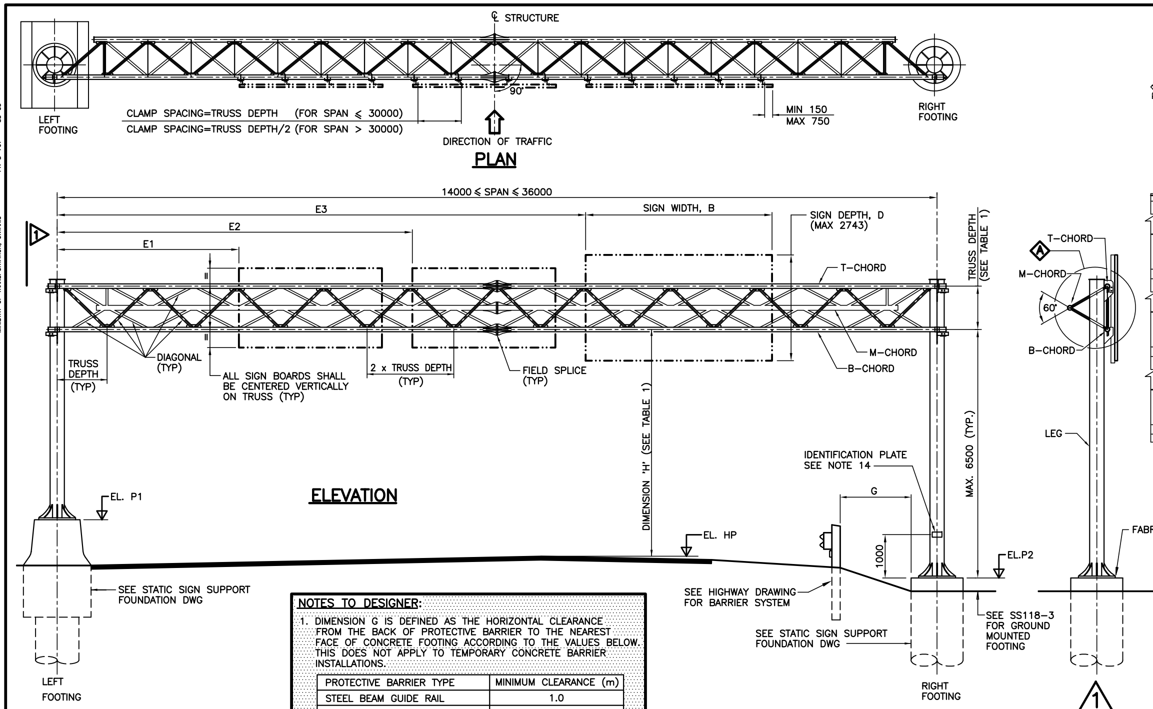
# METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

CONT No
WP No

SHEET

TRI-CHORD STATIC SIGN SUPPORT
GENERAL ARRANGEMENT

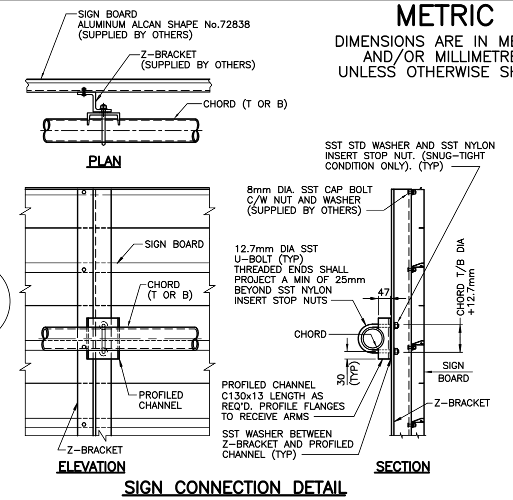



**NOTES TO DESIGNER:**

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 OF THE CONTRACT.




SIGN CONNECTION DETAIL

## NOTES:

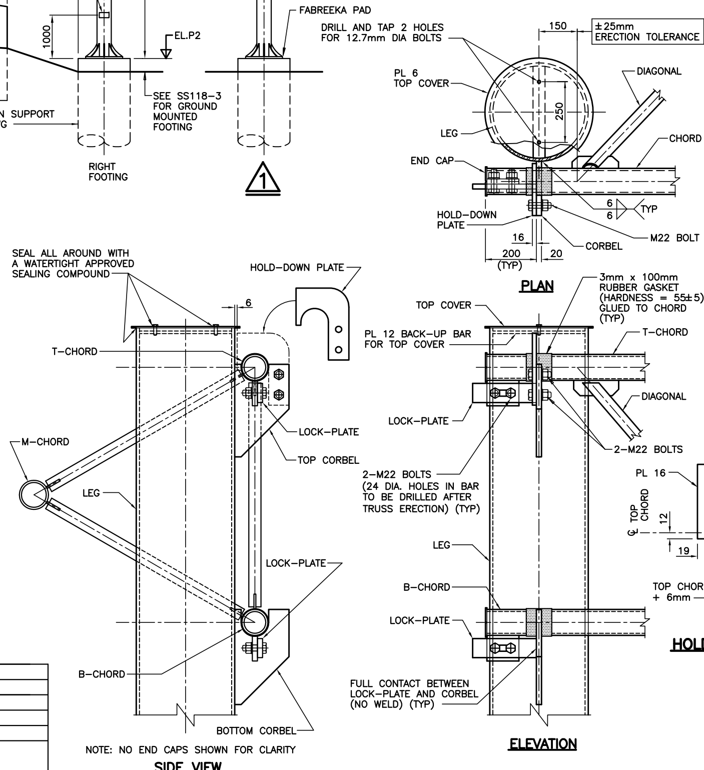
1. ALL SECTIONS SHALL BE STRUCTURAL STEEL UNLESS NOTED.
2. ALL STRUCTURAL STEEL SHALL BE ACCORDING TO CAN/CSA G40.20-04/G40.21-04 GRADE 300W OR ASTM SPECIFICATION A500 GRADE C, STRUCTURAL TUBING.
3. WALL THICKNESS OF MEMBERS:
   - CHORDS 6.4mm
   - DIAGONALS 3.2mm
   - LEGS 12.7mm
4. TOTAL SIGN BOARD AREA ON STRUCTURE SHALL NOT EXCEED 45m$^2$, BASED ON A REFERENCE WIND PRESSURE OF 600Pa.
5. ALL NON-STAINLESS STEEL BOLTS, NUTS, AND WASHERS SHALL BE ACCORDING TO ASTM A325M 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 BOLTS SHALL BE INSTALLED BY TURN OF NUT TIGHTENING IN CONFORMANCE WITH CAN/CSA S6-06.
8. ALL STRUCTURAL STEEL SHALL BE HOT-DIP GALVANIZED AFTER FABRICATION. LEGS ONLY SHALL 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 SPLICES IN ANY MEMBER. TRUSS FIELD SPLICES 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 SS118-27 (STRUCTURE ASSEMBLY DETAILS), SS118-3 (GROUND MOUNTED FOOTING), AND/OR SS118-4 (MEDIAN MOUNTED FOOTING – SYMM.), AND/OR SS118-5 (MEDIAN MOUNTED FOOTING – ASYMM.).
14. EACH SIGN SUPPORT SHALL HAVE AN IDENTIFICATION MARKING SHOWING THE STRUCTURE I.D. NUMBER, THE SIGN AREA AND 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 A RUBBER BACKING, AND BE OF SUFFICIENT DIMENSIONS TO ACCOMMODATE THE REQUIRED INFORMATION USING 6mm HIGH ENGRAVED 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.
15. LEGEND:
    SST – DENOTES STAINLESS STEEL
    O.D. – DENOTES OUTSIDE DIAMETER

## TABLE 1 – GENERAL

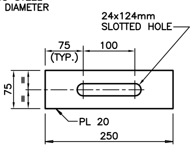
| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| STATION | | --- | | | | | | | | | |
| STRUCTURE I.D. No. | | --- | | | | | | | | | |
| SPAN | | --- | | | | | | | | | |
| TRUSS DEPTH (C/C OF CHORDS) | | --- | | | | | | | | | |
| DIMENSION 'H' | | --- | | | | | | | | | |
| LOCAL REFERENCE WIND PRESSURE, Pa | | --- | | | | | | | | | |
| MAXIMUM ALLOWABLE SIGN BOARD AREA, m2 | | --- | | | | | | | | | |
| 1 SIGN SIZE (DxB) | | --- | | | | | | | | | |
| 2 SIGN SIZE (DxB) | | --- | | | | | | | | | |
| 3 SIGN SIZE (DxB) | | --- | | | | | | | | | |
| E1 | | --- | | | | | | | | | |
| E2 | | --- | | | | | | | | | |
| E3 | | --- | | | | | | | | | |
| G | | --- | | | | | | | | | |
| EL.HP | | --- | | | | | | | | | |
| EL.P1 | | --- | | | | | | | | | |
| EL.P2 | | --- | | | | | | | | | |
| SUPPORT LEG | O.D. | --- | | | | | | | | | |
| CHORDS | T/B O.D. | --- | | | | | | | | | |
| | M O.D. | --- | | | | | | | | | |
| DIAGONALS | O.D. | --- | | | | | | | | | |
| FOOTING TYPE (LEFT) | | --- | | | | | | | | | |
| FOOTING TYPE (RIGHT) | | --- | | | | | | | | | |

## TABLE 2 – SIGN BOARD: PARTS/HARDWARE

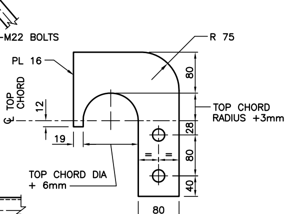
| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| STATION | --- | | | | | | | | | |
| DESCRIPTION | QUANT. | | | | | | | | | |
| 12.7mm DIA. SST U-BOLT | --- | | | | | | | | | |
| SST NYLON INSERT STOP NUTS | --- | | | | | | | | | |
| SST WASHERS | --- | | | | | | | | | |
| PROFILED CHANNEL (C130x13. LENGTH AS REQ'D PROFILE FLANGES TO RECEIVE ARMS). | --- | | | | | | | | | |
| Z-BRACKET (SUPPLIED BY OTHERS) | --- | | | | | | | | | |
| Z-BRACKET SPACING | --- | | | | | | | | | |




TRUSS TO LEG CONNECTION TYPICAL DETAIL




LOCK-PLATE DETAIL




HOLD-DOWN PLATE DETAIL

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

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

STANDARD DRAWING JULY 2014

SS118-26

TRI-CHORD STATIC SIGN SUPPORT
GENERAL ARRANGEMENT

| REVISIONS | DATE | BY | DESCRIPTION | | |
|---|---|---|---|---|---|
| DESIGN STD | CHK | CODE OHBDC '91 | LOAD | DATE | |
| DRAWN | CHK | SITE | | DWG | |

DRAWING NAME: ss118-26 July 2104.dwg
CREATED: 1998/03/13
MODIFIED: 2014/07/16 16:49:14

MINISTRY OF TRANSPORTATION, ONTARIO PR-D-707 88-05

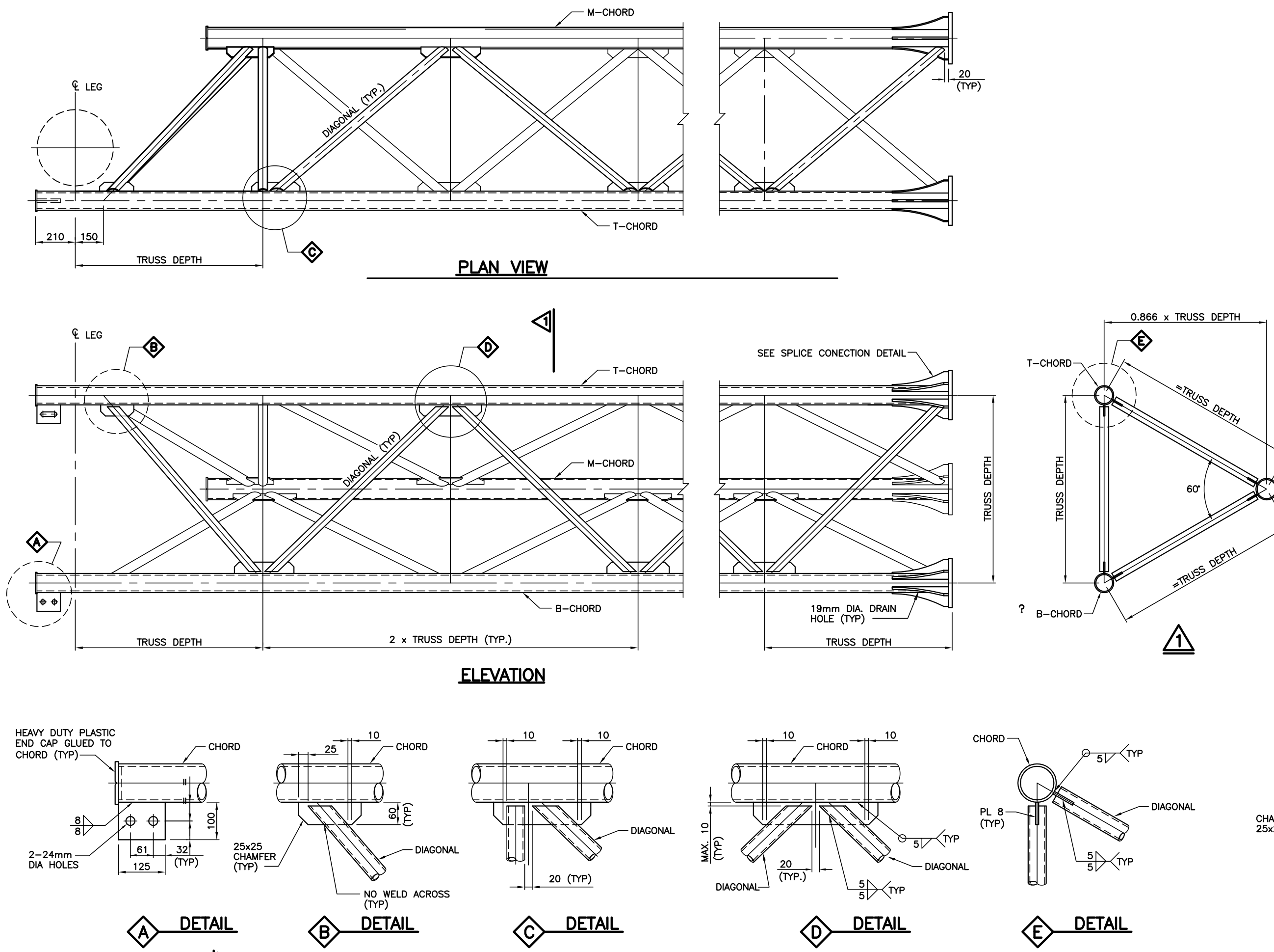
# METRIC

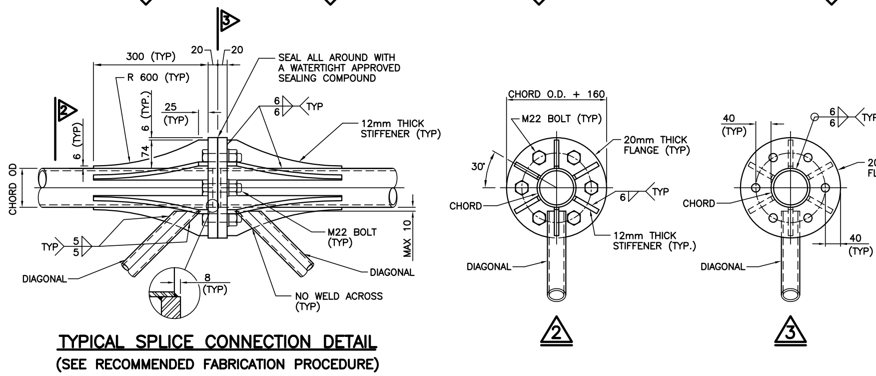
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

CONT No
WP No

SHEET

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

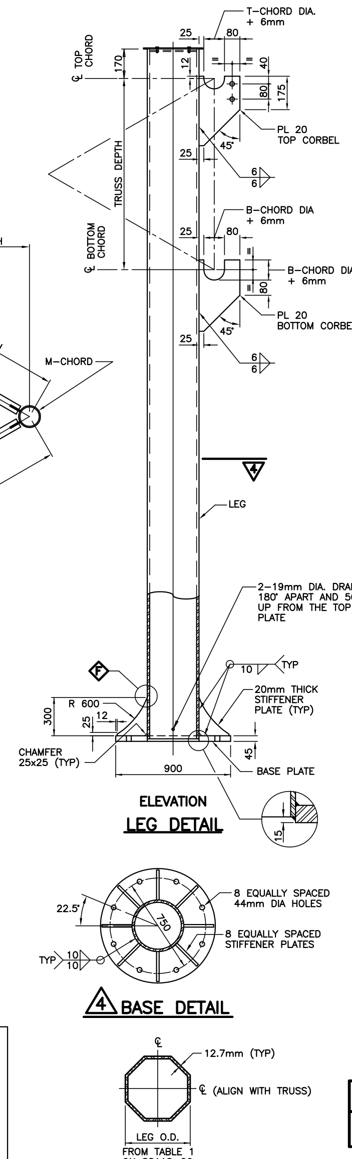



**TYPICAL SPLICE CONNECTION DETAIL**
**(SEE RECOMMENDED FABRICATION PROCEDURE)**

**RECOMMENDED FABRICATION PROCEDURE TO CONTROL DISTORTION AT SPLICE CONNECTIONS:**

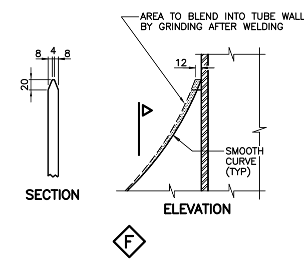
1. TACK WELD STIFFENERS TO CHORDS AND FLANGES INTO POSITION AT EACH CHORD END, IN BOTH TRUSS SEGMENTS.
2. PRE-ASSEMBLE SPLICE CONNECTIONS WITH THE M22 BOLTS, MAINTAINING PROPER ALIGNMENT OF THE TRUSS.
3. WELD STIFFENERS TO CHORDS AND FLANGES. WELDING SHOULD BE BALANCED AROUND THE NEUTRAL AXIS OF THE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




**ALTERNATIVE LEG SECTION**

## NOTES:

1. THIS STANDARD TO BE READ IN CONJUNCTION WITH SS118-26 (GENERAL ARRANGEMENT), SS118-3 (GROUND MOUNTED FOOTING) AND/OR SS118-4 (MEDIAN MOUNTED FOOTING – SYMM.) AND/OR SS118-5 (MEDIAN MOUNTED FOOTING – ASYMM.).
2. LEGEND:
   SST – DENOTES STAINLESS STEEL




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

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

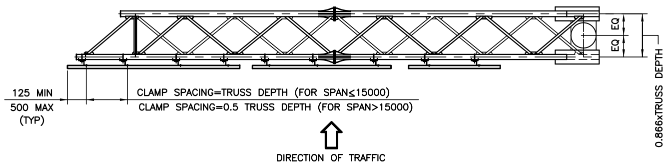
STANDARD DRAWING APRIL 2011 | SS118-27

TRI-CHORD STATIC SIGN SUPPORT STRUCTURE ASSEMBLY DETAILS

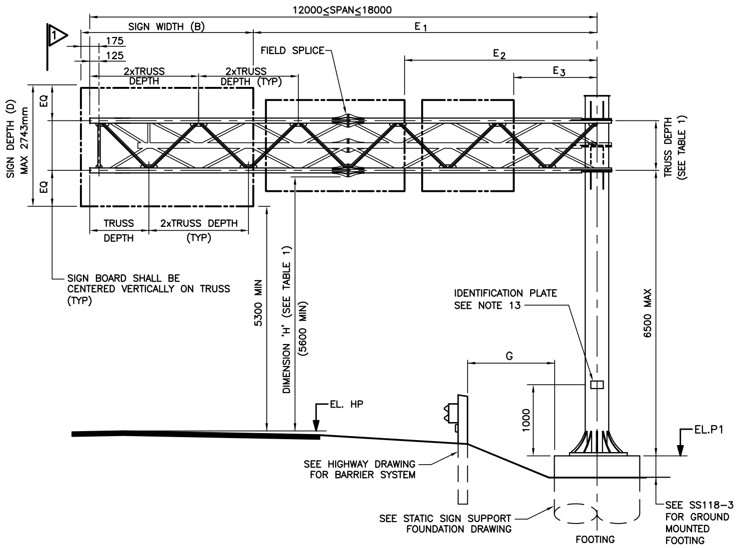
| REVISIONS | DATE | BY | DESCRIPTION | | |
|---|---|---|---|---|---|
| DESIGN STD | CHK | CODE OHBDC '91 | LOAD | | DATE |
| DRAWN | CHK | SITE | | | DWG |

DRAWING NAME: s118-27 April 2011.dwg MODIFIED: 2015/01/23 12:22:51
CREATED: 1998/03/13

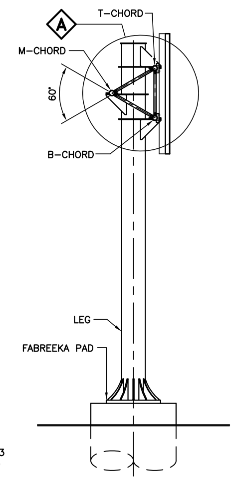
MINISTRY OF TRANSPORTATION, ONTARIO PH-D-707 88-05




**PLAN**




**ELEVATION**

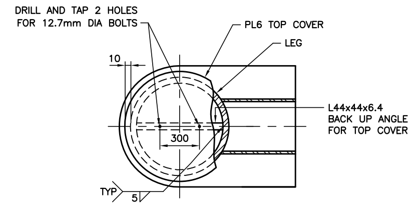



1

# METRIC

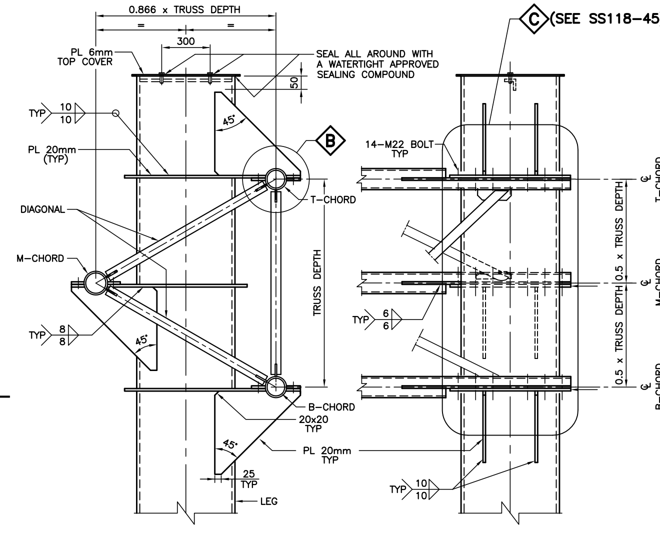
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING




**PLAN**

**TOP COVER**




**SIDE VIEW**

**ELEVATION**

A **TRUSS TO LEG CONNECTION DETAIL**

## NOTES:

1. ALL SECTIONS SHALL BE STRUCTURAL STEEL UNLESS NOTED.
2. ALL STRUCTURAL STEEL SHALL BE ACCORDING TO CAN/CSA-G40.20-13/G40.21-13 GRADE 300W OR ASTM SPECIFICATION A500 GRADE C OR API-5L-X46 FOR ROUND SECTION OF O.D. 508mm.
3. TOTAL SIGN BOARD AREA ON STRUCTURE SHALL NOT EXCEED 26.7m$^2$, BASED ON A REFERENCE WIND PRESSURE OF 600Pa.
4. ALL NON STAINLESS STEEL BOLTS, NUTS AND WASHERS SHALL BE ACCORDING TO ASTM A325M AND BE GALVANIZED HOT-DIP UNLESS NOTED.
5. ALL STAINLESS STEEL BOLTS, NUTS AND WASHERS SHALL BE ACCORDING TO ASTM F593 ALLOY 304 WITH A MINIMUM YIELD STRESS OF 480 MPa AND A MINIMUM TENSILE STRENGTH OF 715 MPa.
6. ALL NON STAINLESS STEEL BOLTS SHALL BE INSTALLED BY TURN OF NUT TIGHTENING IN CONFORMANCE WITH CAN/CSA S6-06.
7. ALL STRUCTURAL STEEL SHALL BE HOT-DIP GALVANIZED AFTER FABRICATION. LEGS ONLY SHALL BE SUBSEQUENTLY COATED WITH AN APPROVED PAINT SYSTEM ACCORDING TO OPSS 911.
8. STRUCTURE SHALL NOT BE ERECTED UNTIL FOUNDATION CONCRETE HAS REACHED 80% OF 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 SIGN SUPPORT STRUCTURE FABRICATION.
12. THIS STANDARD TO BE READ IN CONJUNCTION WITH SS118-44, AND 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 STRUCTURE I.D. NUMBER, THE SIGN AREA AND 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 A RUBBER BACKING, AND BE OF SUFFICIENT DIMENSIONS TO ACCOMMODATE THE REQUIRED INFORMATION USING 6mm HIGH ENGRAVED 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.
14. LEGEND:
    - SST - DENOTES STAINLESS STEEL
    - O.D. - DENOTES OUTSIDE DIAMETER
    - T-CHORD - DENOTES TOP CHORD
    - M-CHORD DENOTES MIDDLE - CHORD
    - B-CHORD DENOTES BOTTOM - CHORD

### 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 |

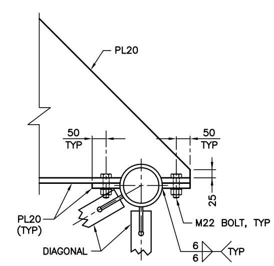
2 THE "NOTES TO DESIGNER" SHALL BE DELETED FROM THIS DRAWING PRIOR TO ISSUING OF THE CONTRACT.

## TABLE 1 - GENERAL

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| STATION | | --- | | | | | | | | | |
| STRUCTURE I.D. No. | | --- | | | | | | | | | |
| SPAN | | --- | | | | | | | | | |
| TRUSS DEPTH (C/C OF CHORDS) | | --- | | | | | | | | | |
| DIMENSION 'H' | | --- | | | | | | | | | |
| LOCAL REFERENCE WIND PRESSURE, Pa | | --- | | | | | | | | | |
| 1 SIGN SIZE (DxB) | | --- | | | | | | | | | |
| 2 SIGN SIZE (DxB) | | --- | | | | | | | | | |
| 3 SIGN SIZE (DxB) | | --- | | | | | | | | | |
| E1 | | --- | | | | | | | | | |
| E2 | | --- | | | | | | | | | |
| E3 | | --- | | | | | | | | | |
| G | | --- | | | | | | | | | |
| EL.HP | | --- | | | | | | | | | |
| EL.P1 | | --- | | | | | | | | | |
| SUPPORT LEG | O.D. x thickness | --- | | | | | | | | | |
| T & B-CHORD | O.D. x thickness | --- | | | | | | | | | |
| M-CHORD | O.D. x thickness | --- | | | | | | | | | |
| DIAGONALS | O.D. x thickness | --- | | | | | | | | | |
| FOOTING TYPE (MEDIAN/GROUND) | | --- | | | | | | | | | |

## TABLE 2 - SIGN BOARD: PARTS/HARDWARE

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| STATION | --- | | | | | | | | | |
| DESCRIPTION | QUANTITY | | | | | | | | | |
| 12.7mm DIA SST U-BOLT | --- | | | | | | | | | |
| SST NYLON INSERT STOP NUTS | --- | | | | | | | | | |
| SST WASHERS | --- | | | | | | | | | |
| PROFILED CHANNEL (C130x13. LENGTH AS REQ'D) PROFILE FLANGES TO RECEIVE ARMS | --- | | | | | | | | | |
| Z-BRACKET (SUPPLIED BY OTHERS) | --- | | | | | | | | | |
| Z-BRACKET SPACING | --- | | | | | | | | | |




B

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

CONT No
WP No

SHEET

**CANTILEVER TRI-CHORD STATIC SIGN SUPPORT GENERAL ARRANGEMENT**

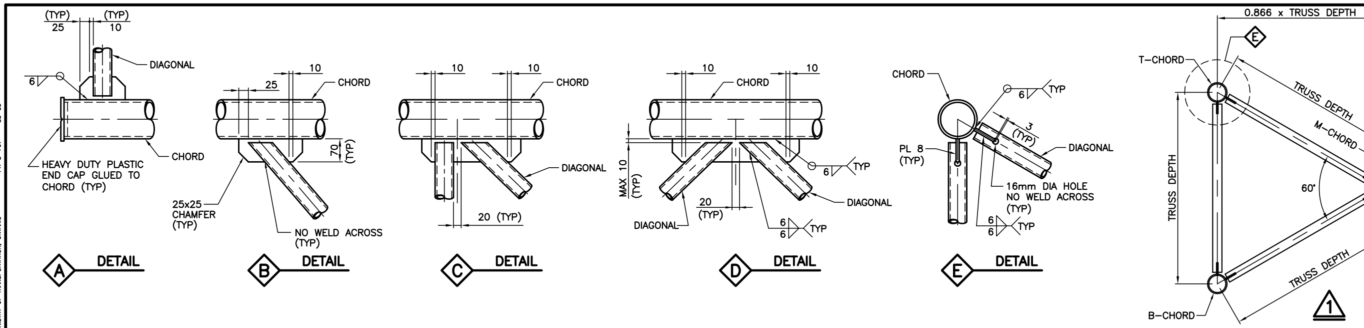
STANDARD DRAWING JAN 2015 | **SS118-43**

**CANTILEVER TRI-CHORD STATIC SIGN SUPPORT GENERAL ARRANGEMENT**

| REVISIONS | | |
|---|---|---|
| DATE | BY | DESCRIPTION |

| | | | | | |
|---|---|---|---|---|---|
| DESIGN | CHK | CODE CHBDC-06 | LOAD | | DATE |
| DRAWN | CHK | SITE | | | DWG |


DRAWING NAME: s118-43 Jan 15, 2015n.dwg
CREATED: 1998/03/13
MODIFIED: 2015/01/23 12:27:47
MINISTRY OF TRANSPORTATION, ONTARIO
PR-D-707 88-05




# METRIC

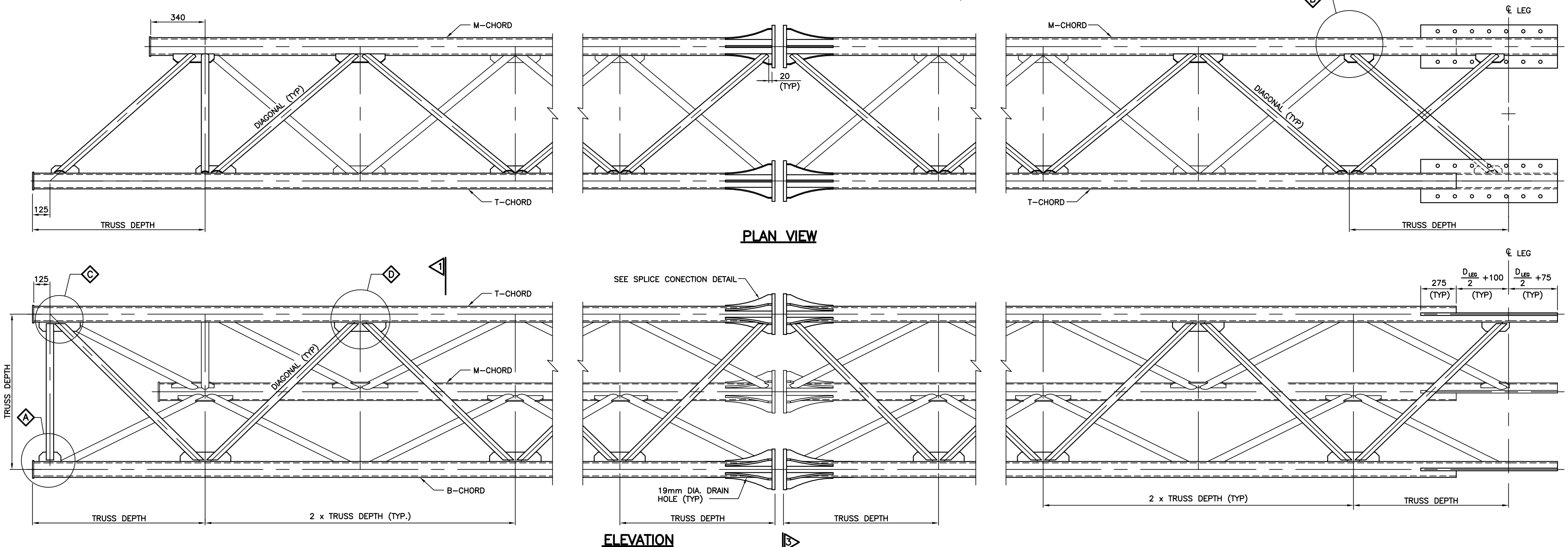
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

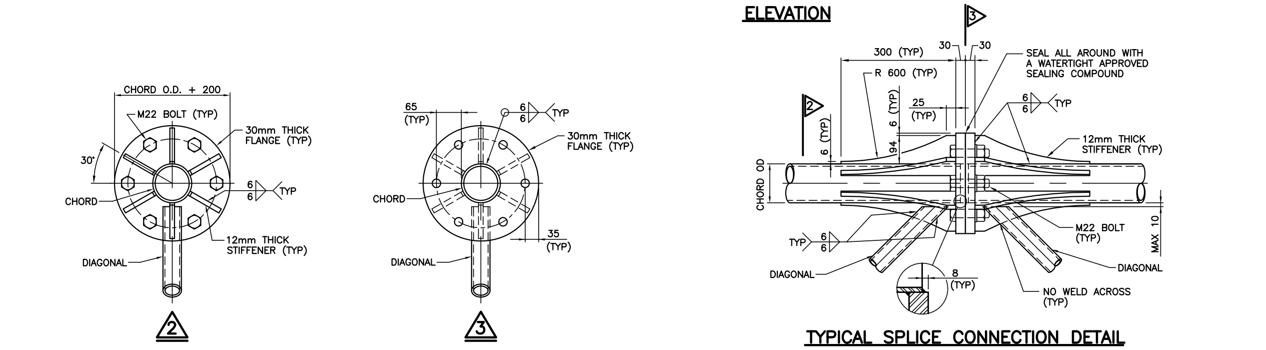
DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

| CONT No | |
|---|---|
| WP No | SHEET |
| CANTILEVER TRI-CHORD STATIC SIGN SUPPORT STRUCTURE ASSEMBLY DETAILS I | |

## NOTES:

1. THIS STANDARD TO BE READ IN CONJUNCTION WITH 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




TYPICAL SPLICE CONNECTION DETAIL
(SEE RECOMMENDED FABRICATION PROCEDURE)

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

### 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.

| STANDARD DRAWING JAN 2015 | SS118-44 |
|---|---|
| CANTILEVER TRI-CHORD STATIC SIGN SUPPORT STRUCTURE ASSEMBLY DETAILS I | |

| REVISIONS | | | |
|---|---|---|---|
| DATE | BY | DESCRIPTION | |
| DESIGN | CHK | CODE CHBDC-06 LOAD | DATE |
| DRAWN | CHK | SITE | DWG |

MINISTRY OF TRANSPORTATION, ONTARIO PR-D-707 88-05

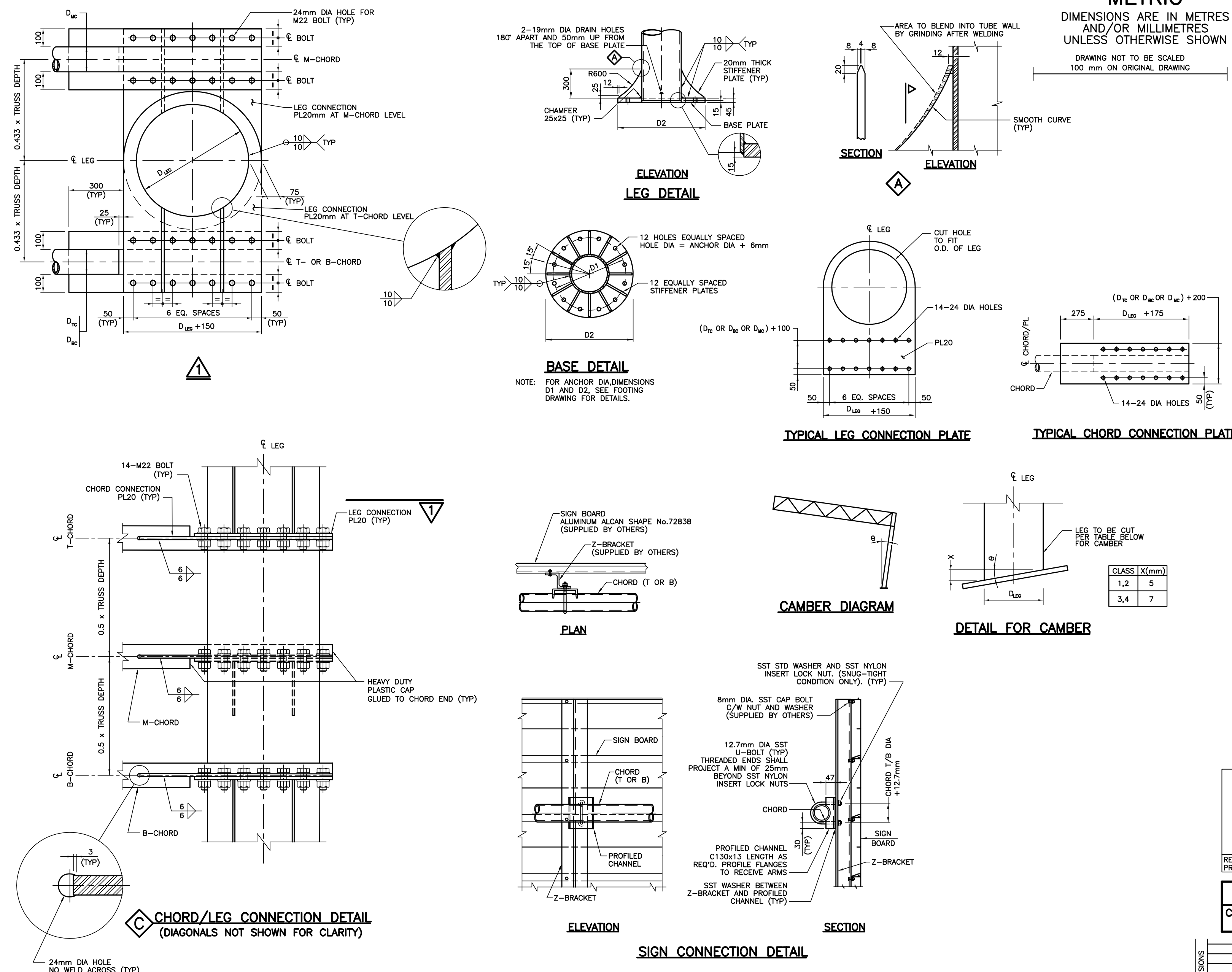
DRAWING NAME: s118-44 Jan 15, 2015n.dwg MODIFIED: 2015/01/23 12:31:05
CREATED: 1998/03/13

# METRIC

DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

| CONT No<br>WP No | |
|---|---|
| CANTILEVER TRI–CHORD STATIC SIGN SUPPORT STRUCTURE ASSEMBLY DETAILS II | SHEET |




| CLASS | X(mm) |
|---|---|
| 1,2 | 5 |
| 3,4 | 7 |

## NOTES:

1. THIS STANDARD TO BE READ IN CONJUNCTION WITH SS118–43, AND SS118–44, AND/OR SS118–3, AND/OR SS118–4, AND/OR SS118–5.
2. LEGEND:
   - SST – DENOTES STAINLESS STEEL
   - T–CHORD – DENOTES TOP CHORD
   - M–CHORD – DENOTES MIDDLE CHORD
   - B–CHORD – DENOTES BOTTOM CHORD
   - O.D. – DENOTES OUTSIDE DIAMETER
   - $D_{LEG}$ – DENOTES O.D. OF LEG
   - $D_{TC}$ – DENOTES O.D. OF T–CHORD
   - $D_{MC}$ – DENOTES O.D. OF M–CHORD
   - $D_{BC}$ – DENOTES O.D. OF B–CHORD

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

| STANDARD DRAWING JAN 2015 | SS118–45 |
|---|---|
| CANTILEVER TRI–CHORD STATIC SIGN SUPPORT STRUCTURE ASSEMBLY DETAILS II | |

| REVISIONS | DATE | BY | DESCRIPTION |
|---|---|---|---|

| DESIGN | CHK | CODE CHBDC–06 | LOAD | DATE |
|---|---|---|---|---|
| DRAWN | CHK | SITE | | DWG |

DRAWING NAME: s118–45 Jan 15, 2015n.dwg
CREATED: 1998/03/13 MODIFIED: 2015/01/23 12:34:01

MINISTRY OF TRANSPORTATION, ONTARIO PR–D–707 88–05

# SIGN SUPPORT MANUAL

DIVISION 5 – STEEL COLUMN SIGN SUPPORTS

April 2015

# 5 STEEL COLUMN SIGN SUPPORTS (BREAKAWAY AND NON-BREAKAWAY TYPE)

## 5.1 GENERAL

Steel Column Sign Supports that are currently covered under the Sign Support Manual will be, in the near future, the responsibility of the MTO Traffic Section. Until such time as the Traffic Office publishes its own structural requirements for these sign supports, the Sign Support Manual shall continue to be used.

### 5.1.1 STANDARD SIGN SUPPORTS

These galvanized steel supports have been designed to the requirements of the Canadian Highway Bridge Design Code CAN/CSA-S6-06 (CHBDC), for an hourly mean reference wind pressure with a return period of 10 years. They can be used for roadside signs ranging in depth from 1200 to 3600 mm and in width from 3000 to 7800 mm as listed in Table 5.2.2(a) to (f). For descriptions of definitions and notations see pages iv to ix of this manual.

Clause 3.10.1.1 of the CHBDC requires that roadside sign structures be designed for a 10-year hourly mean reference wind pressure where, generally, a long life expectancy is not required. In addition the consequence of their collapse due to wind is less serious than overhead type of sign structures, including luminaires and traffic signals. The design for a higher reference wind pressure, therefore, is not considered to be cost effective. There is no suggestion in CHBDC that a 25 year reference wind pressure should be used. AASHTO's 2001 Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals also directs the designer to consider a 10 year design life and recurrence interval for the design of roadside sign structures.

Clause 3.10.1.1 further states that if the topography at the structure site can cause funnelling of the wind, the reference wind pressure should be increased by 20%. Since roadside sign supports in Ontario are built off to the side of highways in relatively smooth topography (in non-urban, open terrain), and predominantly not in the close vicinity of other signs or structures, funnelling of wind is not considered to be a criteria to be included for design.

In summary, this manual considers a 10 year reference wind pressure, and no effect of funnelling in the design of roadside sign structures. If designers choose to use an increased reference wind pressure by either using the 25 year return, or include funnelling, or both, they could use this manual for the higher wind pressure if applicable.

The design of the roadside sign supports given in this manual, while meeting the requirements of the CHBDC, is generally based on those of the Texas Department of Transportation. There is great similarity in details between the Texas and MTO standards. In particular, the new MTO standards in this manual no longer use slotted fuse plates but have adopted the Texas detail at the fuse plate connection (just under the signboard) of breakaway signs which utilize perforated fuse plates. Another adopted detail is the introduction of the bolt keeper plate added to the friction plate connection at the breakaway base, to prevent the column from "walking".

Clause 12.6.3.1 of the CHBDC requires that breakaway supports shall be crash tested in accordance with the requirements of NCHRP 230 (now 350). MTO has not done its own crash testing, but relies on results of tests conducted by the Texas Transportation Institute for the Texas DOT. The original crash testing was done in the 1960's, but TTI staff has reviewed the past data, and are satisfied that the details on the Texas standard drawing meet the requirements of NCHRP 350. Because of the very close similarity in details between MTO's standards and those of the Texas DOT, we have reasonably concluded that the breakaway sign supports detailed in this manual also meet the requirements of NCHRP 350.

In the 1994 edition of the Sign Support Manual, the Steel Column Roadside Sign Supports were required to be angled towards the traffic by 5 to 15 degrees, which although good for legibility, caused a harmful glare to the motorist when his vehicle's lights were reflected from the sign's surface. The present manual follows the recommendations of the 2001 edition of the Ontario Traffic Manual which states that ground-mounted signs should be angled horizontally slightly away from traffic, by about 3 degrees, so that glare is reduced. This layout, unfortunately, causes reduced legibility. The benefits of reduced glare, however, seem to outweigh the negative result of slightly decreased night legibility. For this reason the angling of ground-mounted signs slightly away from traffic is adopted.

### 5.1.2 DESCRIPTION OF SIGN SUPPORTS

The supports consist of 2 or 3 vertical steel columns connected by 2, 3 or 4 horizontal steel crossarms. The details are shown in Figure 5.1.2(a) for Breakaway type (SS118-30) and Figure 5.1.2(b) for Non-Breakaway type (SS118-33).

For breakaway type sign supports the sign boards and crossarms are set at a height greater than that of a passenger car. If the columns are struck, they shear off at the footing and bend upwards at the fuse plate hinges, located just above the lower edge of the sign. For the Friction Plate connection, located just above the footing, the shearing action caused by vehicular impact is ensured because of bolts in open-ended slots. Correctly torqued, the bolts resist normal wind forces but allow slippage upon impact. For the fuse plate connection, the perforations in both front and back fuse plates allow the following predicted behaviour to take place. Under normal conditions, the perforated plates have enough cross-section to resist wind forces. During vehicular impact, they have enough perforations to allow the front fuse plate to yield and tear while the back fuse plate forms a hinge at the connection, allowing the lower column to rotate upwards along with the sign. The column section below the hinge (the lower column) remains attached to the rest of the sign support.

For both connections, it is important that bolts of the correct size and tightened to the correct torque be used. For the friction plate connection, the sliding surface must be smooth, clean and free of imperfections. For the fuse plate connection, the front and back fuse plates are identical, and therefore cannot be accidentally reversed. An incorrectly installed support may fail under wind loading, or may not fail properly upon impact, perhaps causing serious injury.

As an additional safety feature and to minimize possible damage to the sign, all crossarms except the top one are attached to the columns with ductile aluminum clamps, so that if the fuse plate hinge fails to actuate, the clamps will fail, permitting separation of the lower crossarms from the column.

Sometimes, a sign will remain standing and readable despite the removal by impact of one column of the support. A strong wind however, can destroy a sign support in such a condition so repairs should be carried out as soon as possible. Except for the front and back fuse plates, the salvaged parts can generally be used again.

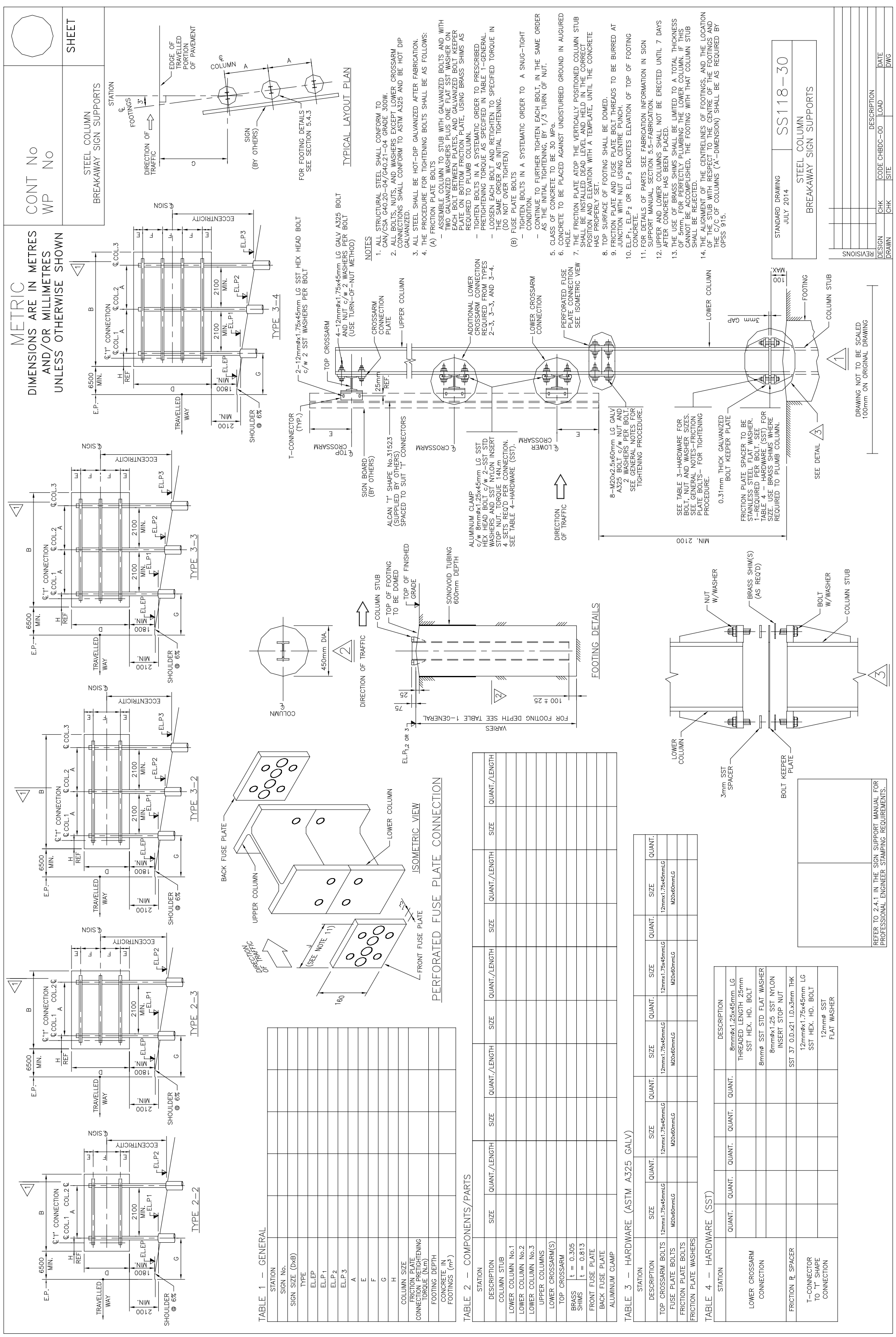



**FIGURE 5.1.2(a) DETAILS OF BREAKAWAY TYPE**

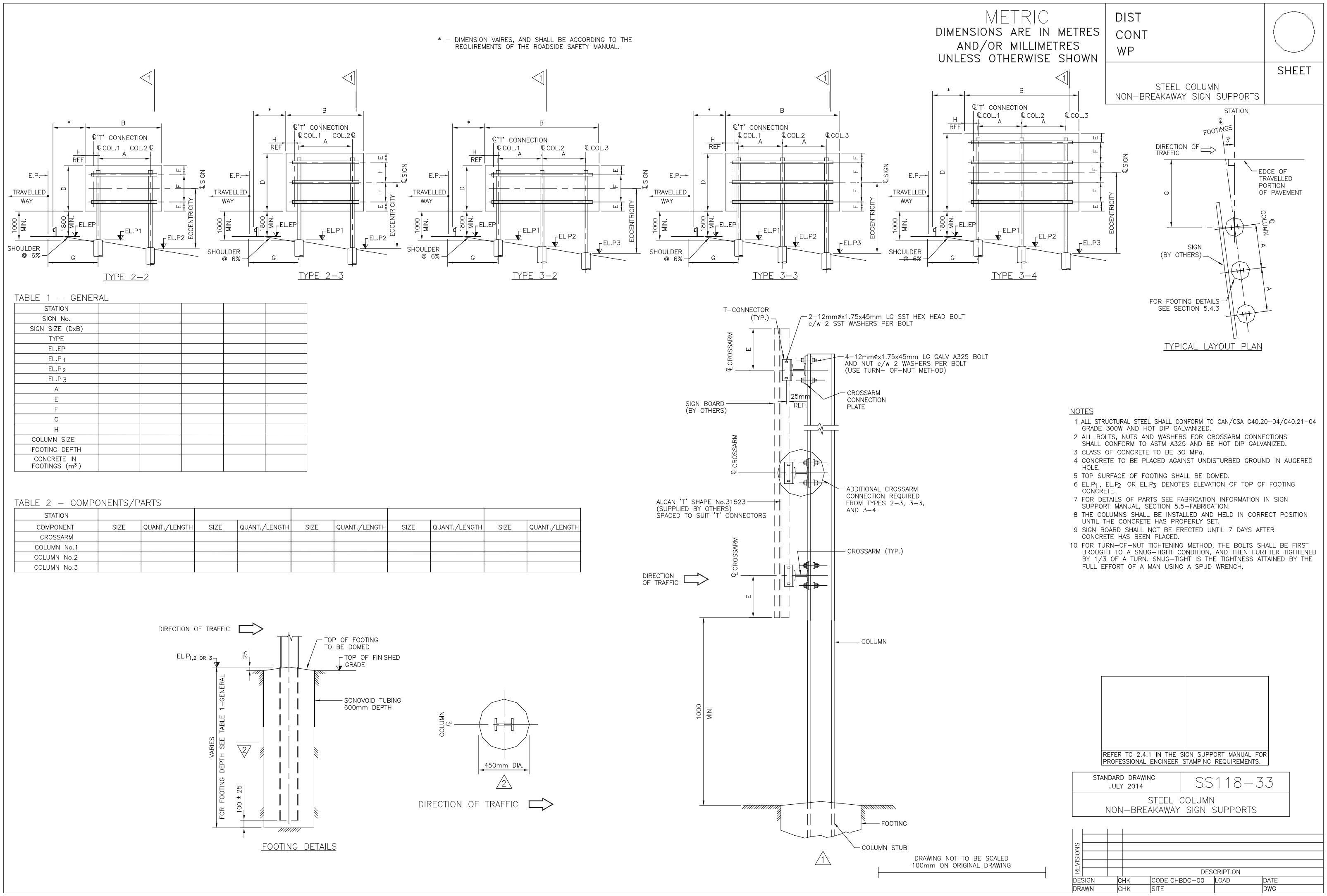



**FIGURE 5.1.2(b) DETAILS OF NON-BREAKAWAY TYPE**

### 5.1.3 LIMITATIONS

Steel breakaway supports are considerably more expensive than timber supports, and the latter should be considered as an alternative, especially for the smaller signs. Timber supports are discussed in Division 6 of this Manual.

Steel non-breakaway type sign supports are only intended for use behind barriers, as discussed in Section 2.6.

### 5.1.4 TYPES OF SUPPORTS

The supports are divided into types according to the number of columns and crossarms as follows:

Type 2-2 (2 columns and 2 crossarms)
Type 2-3 (2 columns and 3 crossarms)
Type 3-2 (3 columns and 2 crossarms)
Type 3-3 (3 columns and 3 crossarms)
Type 3-4 (3 columns and 4 crossarms)

The general arrangement of columns and crossarms for the five types can be seen in Figure 5.1.2(a) for breakaway type and Figure 5.1.2(b) for non-breakaway type.

The type of support is determined by the size of the sign to be supported.

### 5.1.5 FOOTINGS

Footings are built by placing the steel columns in concrete filled holes.

The indicated footings depths (in Section 5.4.3) are the absolute minimum required for each support based on a passive earth pressure of 68 kPa (1400 psf) at SLS. (The 68 kPa is derived from the modified Brom's equation for pole foundations in cohesive soils, and is conservative since it is based on a cohesive soil with a shear strength of 50 kPa.)

The tabulated required footing depth assumes that lateral soil resistance is based on full depth, without reduction for frost depth of soil. (This assumption is reasonable, given the size of the footing for this type of sign.)

If it is deemed that for a specific site the soil strength parameters for a particular site are less than those noted above, a site specific footing design must be carried out.

### 5.1.6 CLEARANCE

The columns for breakaway sign supports should be located to result in a minimum horizontal clearance of 6500 mm from the edge of the travelled portion of pavement to the edge of the sign. A minimum vertical distance of 1800 mm from the edge of pavement elevation to the bottom edge of the sign shall be provided for both types of sign supports.

These clearances are provided automatically when the procedures (Section 5.3) described later are adhered to.

For non-breakaway sign supports, the minimum horizontal clearance of the sign board from the face of the protective barrier shall be as required by the Roadside Safety Manual.

For breakaway sign supports, the minimum height of column from ground elevation to the underside of the sign shall be 2100mm, and the minimum clear distance between columns shall be 2100mm.

For non-breakaway sign supports, if any portion of the sign is less than 1000mm above the ground level immediately below the sign, the sign shall be raised to ensure this minimum 1000mm clearance. This requirement is for summer and winter maintenance purposes.

### 5.1.7 SUPPLY AND ERECTION

For steel column sign supports to be included as part of a contract, the relevant standard drawing(s) shall be completed by the designer and inserted into the contract documents.

The signboard and backing T’s are supplied and fully assembled by the MTO, but are attached to the sign support by the contractor.

The attachment of the signboard to the support shall be covered by a separate item in the contract documents.

## 5.2 PREPARATION OF DRAWINGS

### 5.2.1 GENERAL

If the supply and erection of the support is to be part of a contract, Standard Drawing SS118-30 and/or SS118-33 must be used, as described in Section 5.1.2. Up to 5 sign supports can be detailed on one drawing.

### 5.2.2 DATA REQUIRED

For each type of sign support, the following data is required:

(1) The sign size.

This must be one of the combinations of sign depth (D), and sign width (B) shown in Tables 5.2.2 (a) to (f) for three different values of reference wind pressure (465, 390 and 300 Pa) and maximum eccentricities (6900, 5700 and 4500 mm). See Figures 5.3.3(a) and (b). Only the combinations shown within shaded areas are permissible. See Section 5.1.4 for types of support.

Table A3.1.7 of the CHBDC gives the 10 year return Reference Wind Pressures for all locations in the province of Ontario.

(2) The location of the support.

For a proposed highway or a highway under reconstruction, the location should be specified as a station. For an existing highway the location may be determined at the site and marked with a peg.

(3) The edge of pavement elevation at the sign station, and the final ground elevations under the sign.

For a proposed highway or highway reconstruction project this information may be obtained from profiles, cross sections or contour plans. In the case of an existing facility, elevations may be taken at the site. Since only approximate and relative elevations or differences in height are required they can be obtained with a string level or hand level.

### 5.2.3 FOOTING LOCATIONS AND ELEVATIONS

First the type of support required must be determined. This is obtained from Table 5.2.2(a) to (f) for the given sign size.

From Section 5.4.2 and the appropriate figure from Section 5.4.4 for the support type, the information can be readily extracted which is required for laying out the column footings on a cross section, a contour plan, or on the ground. Except for the exceptions noted, the figures in Section 5.4.4 apply for Breakaway and also Non-Breakaway sign supports. Section 5.3.3 gives step by step procedure for detailing footings.

The G-dimensions given in the tables of Figures 5.4.4 are a minimum, based on the minimum 6500mm horizontal offset (from edge of travelled portion of pavement to the edge of the signboard), and apply to the breakaway sign supports only. For both breakaway and non-breakaway sign supports, the footings should be located so that no footing is placed at the centreline of a ditch (drainage channel). Where the footings would fall at the ditch centreline based on tabulated G-dimensions, the designer should increase the G-dimension by 300 to 600mm, as required. In no case should the top of footing be allowed to extend above the top of grade (except by the 25mm dome), in order to ensure that the 100mm maximum allowable projection of the column stub of breakaway sign supports in not exceeded. (see Fig 5.4.3) This is a safety requirement.

The angle of the sign to the roadway, as shown in Figure 5.4.2, is normally 3 degrees away from traffic. This is desirable because the reflective surface used on the signs works only for small angles of reflection.

### 5.2.4 COLUMN LENGTHS

For breakaway type sign supports, the lower column must be selected with lengths to suit the footing elevations and the edge of pavement elevation. Section 5.3.4 gives step by step procedures for obtaining this information.

This procedure ensures that for breakaway type supports, the column length from ground elevation to the underside of sign shall be minimum 2100mm, and for non-breakaway type this shall be minimum 1000mm. For both types, the minimum 1800mm vertical distance requirement from the edge of pavement elevation to the bottom edge of the sign shall also be satisfied.

The permissible maximum eccentricities are 6900, 5700 and 4500 mm, as shown in Tables 5.2.2(a) to (f). If these eccentricities and/or the above column length requirements can not be met, then either the sign must be relocated locally, or the site must be regarded.

The preferred option would always be to relocate the sign, but if this is not possible, the designer should detail the necessary regrading as follows: Compacted Granular ‘B’ material should be used, and the thickness of the fill shall be limited to 1/3 of the required footing depth given in Figure 5.4.3. (At least 2/3 of the footing depth must be in the existing ground). The (minimum) lateral dimension of the fill (including the footing) shall be 3.0m, and have side slopes of 2:1. The Granular ‘B’ material shall be placed in maximum lifts of 300mm, compacted to 100% of the maximum dry density. The compacted fill shall be placed around the already-constructed footing.

If neither option is possible, the Regional Traffic Office should be contacted.

| WIND PRESSURE (Pa) | | | 465 | | |
|---|---|---|---|---|---|
| TYPE | SIGN SIZE (mm) | | MAXIMUM ECCENTRICITY, mm | | |
| | DEPTH | WIDTH | **6900** | **5700** | **4500** |
| **2-2** | 1200 | 3000 | W200X42 | W200X42 | W200X42 |
| | | 3600 | | | |
| | 1500 | 3000 | | | |
| | | 3600 | | | |
| | | 4200 | W200X46 | | |
| | | 4500 | | | |
| | | 4800 | | | |
| | | 5400 | W200X59 | | |
| | 1800 | 3600 | W200X46 | | |
| | | 4200 | | | |
| | | 4500 | W200X59 | | |
| | | 4800 | | | |
| **2-3** | 2100 | 3600 | W200X59 | W200X42 | W200X42 |
| | | 4200 | | W200X46 | |
| | | 4500 | | | |
| | | 4800 | | | |
| | 2400 | 4200 | | | |
| | | 4500 | | | |
| | | 4800 | | W200X59 | |
| | 2700 | 4200 | | | |
| | | 4500 | | | |
| | | 4800 | | | |
| | 3000 | 4200 | | | |
| | | 4500 | | | W200X46 |
| | | 4800 | | | |
| | 3300 | 4200 | | | |
| | | 4500 | | | |
| | | 4800 | | | |
| | 3600 | 4800 | | | |

**TABLE 5.2.2(a) PERMISSIBLE SIGN SIZES & SUPPORT STRUCTURE TYPES**
**(2 COLUMNS / WIND PRESSURE = 465 Pa)**

<table>
<tr><th colspan="3">WIND PRESSURE (Pa)</th><th colspan="3">465</th></tr>
<tr><th rowspan="2">TYPE</th><th colspan="2">SIGN SIZE (mm)</th><th colspan="3">MAXIMUM ECCENTRICITY, mm</th></tr>
<tr><th>DEPTH</th><th>WIDTH</th><th>6900</th><th>5700</th><th>4500</th></tr>
<tr><td rowspan="5">3-2</td><td rowspan="5">1800</td><td>5400</td><td>W200X46</td><td rowspan="2">W200X42</td><td rowspan="5">W200X42</td></tr>
<tr><td>6000</td><td rowspan="4">W200X59</td></tr>
<tr><td>6600</td><td rowspan="3">W200X46</td></tr>
<tr><td>7200</td></tr>
<tr><td>7800</td></tr>
<tr><td rowspan="14">3-3</td><td rowspan="5">2100</td><td>5400</td><td rowspan="4">W200X59</td><td rowspan="2">W200X46</td><td rowspan="8">W200X42</td></tr>
<tr><td>6000</td></tr>
<tr><td>6600</td><td rowspan="3">W200X59</td></tr>
<tr><td>7200</td></tr>
<tr><td>7800</td><td></td></tr>
<tr><td rowspan="4">2400</td><td>5400</td><td rowspan="2">W200X59</td><td>W200X46</td></tr>
<tr><td>6000</td><td rowspan="6">W200X59</td></tr>
<tr><td>6600</td><td rowspan="2"></td></tr>
<tr><td>7800</td><td>W200X46</td></tr>
<tr><td rowspan="2">2700</td><td>5400</td><td>W200X59</td><td>W200X42</td></tr>
<tr><td>7800</td><td rowspan="4"></td><td>W200X46</td></tr>
<tr><td rowspan="2">3000</td><td>5400</td><td>W200X42</td></tr>
<tr><td>7800</td><td></td><td>W200X59</td></tr>
<tr><td>3300</td><td>5400</td><td>W200X59</td><td>W200X46</td></tr>
<tr><td rowspan="16">3-4</td><td rowspan="2">2400</td><td>7200</td><td rowspan="16"></td><td rowspan="9">W200X59</td><td rowspan="8">W200X46</td></tr>
<tr><td>7800</td></tr>
<tr><td rowspan="4">2700</td><td>6000</td></tr>
<tr><td>6600</td></tr>
<tr><td>7200</td></tr>
<tr><td>7800</td></tr>
<tr><td rowspan="4">3000</td><td>6000</td></tr>
<tr><td>6600</td></tr>
<tr><td>7200</td><td rowspan="2">W200X59</td></tr>
<tr><td>7800</td><td></td></tr>
<tr><td rowspan="3">3300</td><td>6000</td><td>W200X59</td><td>W200X46</td></tr>
<tr><td>6600</td><td rowspan="2"></td><td rowspan="5">W200x59</td></tr>
<tr><td>7200</td></tr>
<tr><td rowspan="3">3600</td><td>5400</td><td>W200X59</td></tr>
<tr><td>6000</td><td rowspan="2"></td></tr>
<tr><td>6600</td></tr>
</table>

**TABLE 5.2.2(b) PERMISSIBLE SIGN SIZES & SUPPORT STRUCTURE TYPES (3 COLUMNS / WIND PRESSURE = 465 Pa)**

| WIND PRESSURE (Pa) | | | **390** | | |
|---|---|---|---|---|---|
| TYPE | SIGN SIZE (mm) | | MAXIMUM ECCENTRICITY, mm | | |
| | DEPTH | WIDTH | **6900** | **5700** | **4500** |
| **2-2** | 1200 | 3000 | W200X42 | W200X42 | W200X42 |
| | | 3600 | | | |
| | 1500 | 3000 | | | |
| | | 3600 | | | |
| | | 4200 | | | |
| | | 4500 | | | |
| | | 4800 | W200X46 | | |
| | | 5400 | | | |
| | 1800 | 3600 | W200X42 | | |
| | | 4200 | W200X46 | | |
| | | 4500 | | | |
| | | 4800 | | | |
| **2-3** | 2100 | 3600 | W200X46 | W200X42 | W200X42 |
| | | 4200 | W200X59 | | |
| | | 4500 | | | |
| | | 4800 | | W200X46 | |
| | 2400 | 4200 | | | |
| | | 4500 | | | |
| | | 4800 | | | |
| | 2700 | 4200 | | | |
| | | 4500 | | | |
| | | 4800 | | W200X59 | |
| | 3000 | 4200 | | W200X46 | |
| | | 4500 | | W200X59 | |
| | | 4800 | | | |
| | 3300 | 4200 | W200X59 | | |
| | | 4500 | | | |
| | | 4800 | | | W200X46 |
| | 3600 | 4800 | | | |

**TABLE 5.2.2(c) PERMISSIBLE SIGN SIZES & SUPPORT STRUCTURE TYPES (2 COLUMNS / WIND PRESSURE = 390 Pa)**

| WIND PRESSURE (Pa) | | | 390 | | |
|---|---|---|---|---|---|
| TYPE | SIGN SIZE (mm) | | MAXIMUM ECCENTRICITY, mm | | |
| | DEPTH | WIDTH | **6900** | **5700** | **4500** |
| **3-2** | 1800 | 5400 | W200X46 | W200X42 | W200X42 |
| | | 6000 | | | |
| | | 6600 | W200X59 | | |
| | | 7200 | | | |
| | | 7800 | | W200X46 | |
| **3-3** | 2100 | 5400 | W200X59 | W200X42 | W200X42 |
| | | 6000 | | W200X46 | |
| | | 6600 | | | |
| | | 7200 | | | |
| | | 7800 | | W200X59 | |
| | 2400 | 5400 | | W200X46 | |
| | | 6000 | | | |
| | | 6600 | | | |
| | | 7800 | | W200X59 | |
| | 2700 | 5400 | W200X59 | W200X46 | |
| | | 7800 | | W200X59 | W200X46 |
| | 3000 | 5400 | W200X59 | | W200X42 |
| | | 7800 | | | W200X46 |
| | 3300 | 5400 | W200X59 | | W200X42 |
| **3-4** | 2400 | 7200 | W200X59 | W200X59 | W200X42 |
| | | 7800 | | | |
| | 2700 | 6000 | W200X59 | | |
| | | 6600 | | | |
| | | 7200 | | | W200X46 |
| | | 7800 | | | |
| | 3000 | 6000 | | | W200X42 |
| | | 6600 | | | W200X46 |
| | | 7200 | | | |
| | | 7800 | | | |
| | 3300 | 6000 | | | |
| | | 6600 | | | |
| | | 7200 | | | |
| | 3600 | 5400 | | | |
| | | 6000 | | | |
| | | 6600 | | | |

**TABLE 5.2.2(d) PERMISSIBLE SIGN SIZES & SUPPORT STRUCTURE TYPES**
**(3 COLUMNS / WIND PRESSURE = 390 Pa)**

| WIND PRESSURE (Pa) | | | 300 | | |
|---|---|---|---|---|---|
| TYPE | SIGN SIZE (mm) | | MAXIMUM ECCENTRICITY, mm | | |
| | DEPTH | WIDTH | **6900** | **5700** | **4500** |
| **2-2** | 1200 | 3000 | W200X42 | W200X42 | W200X42 |
| | | 3600 | | | |
| | 1500 | 3000 | | | |
| | | 3600 | | | |
| | | 4200 | | | |
| | | 4500 | | | |
| | | 4800 | | | |
| | | 5400 | | | |
| | 1800 | 3600 | | | |
| | | 4200 | | | |
| | | 4500 | | | |
| | | 4800 | | | |
| **2-3** | 2100 | 3600 | W200X42 | W200X42 | W200X42 |
| | | 4200 | W200X46 | | |
| | | 4500 | | | |
| | | 4800 | | | |
| | 2400 | 4200 | | | |
| | | 4500 | | | |
| | | 4800 | W200x59 | | |
| | 2700 | 4200 | | | |
| | | 4500 | | | |
| | | 4800 | | W200X46 | |
| | 3000 | 4200 | | | |
| | | 4500 | | | |
| | | 4800 | | | |
| | 3300 | 4200 | | | |
| | | 4500 | | | |
| | | 4800 | | | |
| | 3600 | 4800 | | W200x59 | |

**TABLE 5.2.2(e) PERMISSIBLE SIGN SIZES & SUPPORT STRUCTURE TYPES (2 COLUMNS / WIND PRESSURE = 300 Pa)**

| WIND PRESSURE (Pa) | | | 300 | | |
|---|---|---|---|---|---|
| TYPE | SIGN SIZE (mm) | | MAXIMUM ECCENTRICITY, mm | | |
| | DEPTH | WIDTH | **6900** | **5700** | **4500** |
| **3-2** | 1800 | 5400 | W200X42 | W200X42 | W200X42 |
| | | 6000 | | | |
| | | 6600 | W200x46 | | |
| | | 7200 | | | |
| | | 7800 | | | |
| **3-3** | 2100 | 5400 | W200X46 | W200X42 | W200X42 |
| | | 6000 | | | |
| | | 6600 | | | |
| | | 7200 | W200X59 | | |
| | | 7800 | | W200X46 | |
| | 2400 | 5400 | W200X46 | W200X42 | |
| | | 6000 | W200X59 | | |
| | | 6600 | | | |
| | | 7800 | | W200X46 | |
| | 2700 | 5400 | | W200X42 | |
| | | 7800 | | W200X59 | |
| | 3000 | 5400 | | W200X46 | |
| | | 7800 | | W200X59 | |
| | 3300 | 5400 | | W200X46 | |
| **3-4** | 2400 | 7200 | W200X59 | W200X46 | W200X42 |
| | | 7800 | | | |
| | 2700 | 6000 | | | |
| | | 6600 | | | |
| | | 7200 | | | |
| | | 7800 | | W200X59 | |
| | 3000 | 6000 | | W200X46 | |
| | | 6600 | | | |
| | | 7200 | | W200X59 | |
| | | 7800 | | | |
| | 3300 | 6000 | W200X59 | W200X46 | |
| | | 6600 | | W200X59 | |
| | | 7200 | | | |
| | 3600 | 5400 | W200X59 | W200X46 | |
| | | 6000 | | W200X59 | |
| | | 6600 | | | |

**TABLE 5.2.2(f) PERMISSIBLE SIGN SIZES & SUPPORT STRUCTURE TYPES**
**(3 COLUMNS / WIND PRESSURE = 300 Pa)**

### 5.2.5 COMPLETE STANDARD DRAWING

If the supports are to be supplied and erected as part of a contract, SS118-30 or SS118-33 must be used. Due to space limitations, up to 5 sign supports can be detailed on one sheet.

The drawings indicate 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 SS118-30 there are several tables to be completed on the drawing. SS118-33 also has tables requiring completion. In each table one vertical column of data is used for each sign.

The data required to complete Table 1 on these standard drawings consists of the sign size, the footing elevations established earlier, as well as the values of A, E, F, G and H tabulated on whichever figure in Section 5.4.4 is appropriate to the type of sign support required.

The information required to complete the remaining tables on these drawings can be obtained from other sections of this Section 5.

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

## 5.3 PROCEDURES

### 5.3.1 GENERAL

Sections 5.3 to 5.5 contain all data necessary to complete the Standard Drawing SS118-30 or SS118-33.

### 5.3.2 PROCEDURE FOR SELECTION OF SIGN SUPPORT

GIVEN: SIGN SIZE
(2100 mm x 5400 mm size, breakaway type with wind pressure of 465 Pa, is used as an example. See Figure 5.3.3 (a)).

STEP 1: DETERMINE SIGN SUPPORT TYPE
From Table 5.2.2(b), a 2100 x 5400 mm sign requires a Type 3-3 support.

STEP 2: OBTAIN
- DISTANCE FROM EP TO FIRST FOOTING (G)
- CENTRE/CENTRE DISTANCE BETWEEN FOOTINGS (A)

NOTE: Layout Dimensions A & G are obtained from Figure 5.4.4 (d) for sample 2100 mm x 5400 mm sign.
dimension A = 2300 mm
dimension G = 6900 mm

STEP 3: ESTABLISH ELEVATION P1* (EL.P1) AT GROUND LEVEL ON SITE AS DATUM (actual elevation need not be determined)

*Elevation referred to is elevation at top of footing.

STEP 4: OBTAIN DIFFERENCE IN ELEVATION BETWEEN EP AND TOP OF FOOTING NEAREST EP (ELP1)
This measured difference (above or below) need not be precise. A tolerance of 50 mm is acceptable.

STEP 5: ESTABLISH EL.P2* AND EL.P3* ON SITE

> NOTE: Actual elevations need not be determined but DIFFERENCE in elevation relative to EL.P1 should be established. If top of footing is more than 25 mm above or below ground, grade around footing with earth or by excavation.

STEP 6: DETERMINE MAXIMUM ECCENTRICTY

Determine the maximum dimension measured from top of footing to centreline of sign board using dimensions A and G, and values obtained in steps 3, 4 and 5. Specify a dimension from EP to bottom of sign board of 1800 mm.
E.g. For sample 2100 mm x 5400 mm sign, maximum eccentricity = 4010 mm.

STEP 7: DETERMINE IF A SOLUTION IS AVAILABLE

From Table 5.2.2(b) verify if a solution is available. This must be confirmed on steps 4 of Section 5.3.4 when checking boundary conditions.
e.g. For sample, there is a solution for a maximum eccentricity of 4500 mm with the column sizes as W200x42.

### 5.3.3 PROCEDURE FOR DETAILING FOOTINGS

GIVEN: SIGN SIZE
(Sample 2100 mm x 5400 mm - Type 3-3 for a wind pressure of 465 Pa, maximum eccentricity of 4500 mm and column size as W200x42 - See Figure 5.3.3(a)).

STEP 1: DETERMINE COLUMN STUBS REQUIRED (For breakaway supports).
A 2100 x 5400 mm - sign, Type 3-3 support with column size as W200x42 requires 3 column stubs.

STEP 2: ADD DIMENSIONS A AND G TO STANDARD DRAWING
(Table 1).

STEP 3: DETERMINE FOOTING DETAILS

Footing layout plan is given on Figures 5.4.2. Footing depth and details are given on Figure 5.4.3. These include column stub length (for breakaway supports), concrete dimensions and quantity per footing.
e.g. For sample 2100 mm x 5400 mm sign, footing depth = 1700 mm
Concrete in footings = 3 (0.27) = 0.81m$^3$ (for 3 footings)

> NOTE: Column stub length and concrete quantities are given here for the convenience of the footing installer. Footing depth and concrete quantities should be added to the drawing. Column stub length need not be added to the drawing.

In any given breakaway support the column stubs, lower columns and upper columns always have the same cross-section e.g. for the sample sign the column stub is made from W200x42. Thus both the lower and upper columns are W200x42 also.

## EXAMPLE
## TYPE 3-3

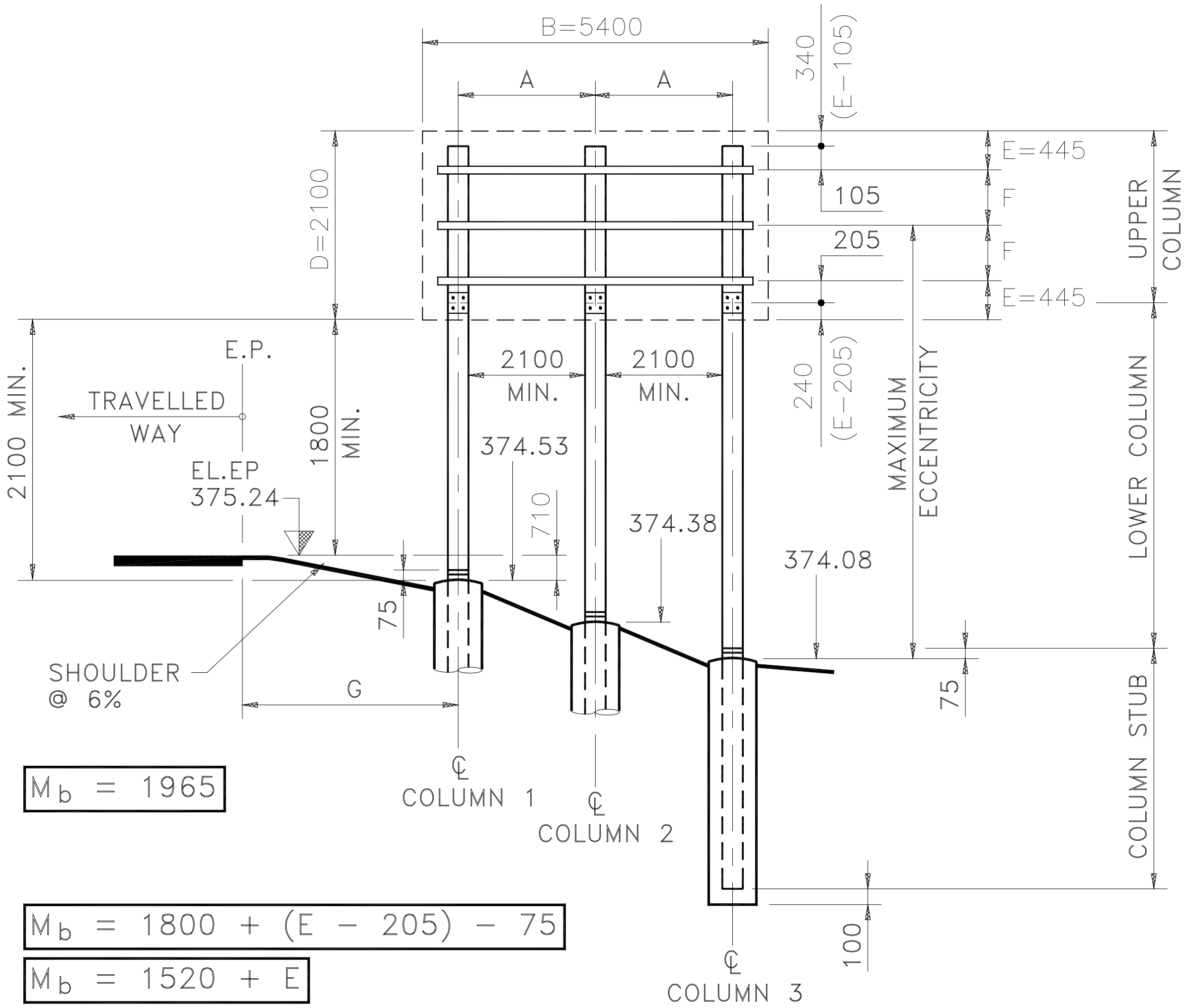
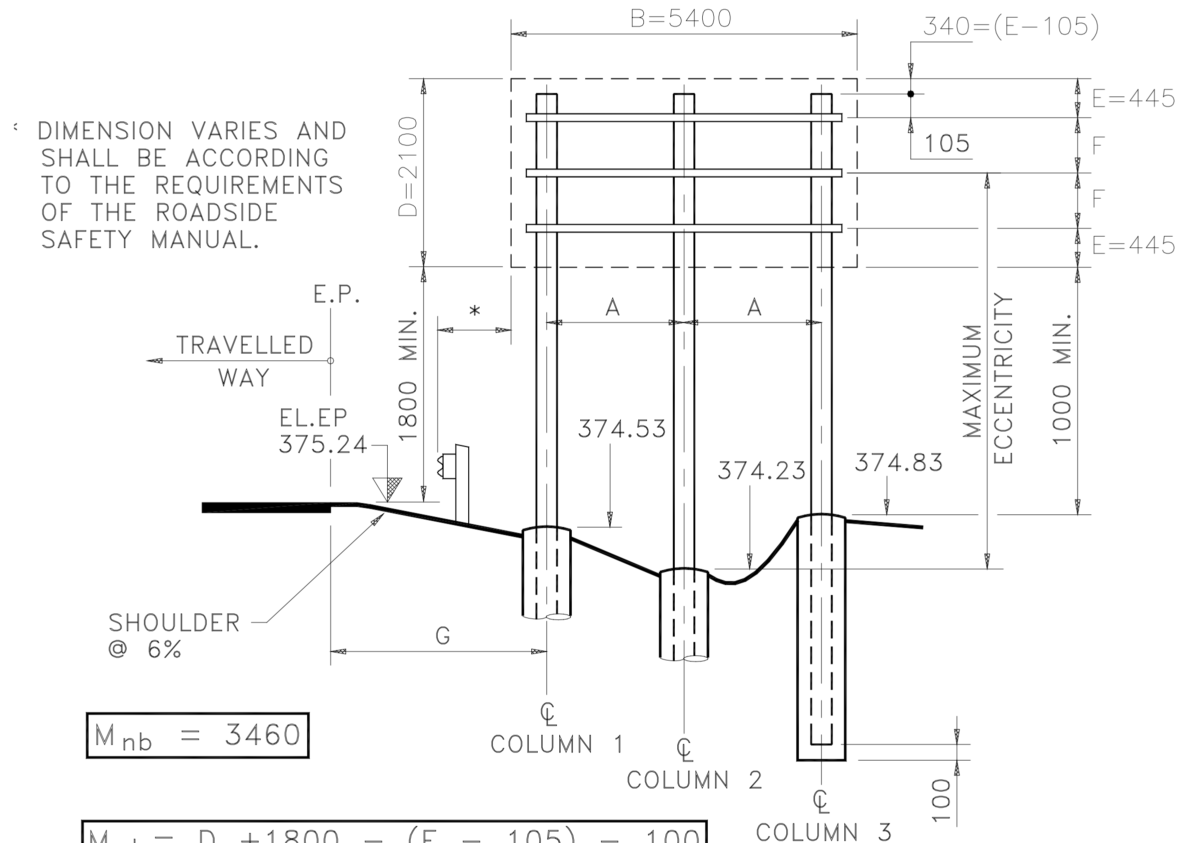



**FIGURE 5.3.3(a)**

**BREAKAWAY**

**EXAMPLE**
**TYPE 3-3**




$$M_{nb} = D + 1800 - (E - 105) - 100$$

$$M_{nb} = 1805 + D - E$$

**FIGURE 5.3.3(b)**

**NON-BREAKAWAY**

## 5.3.4 PROCEDURE FOR DETAILING SUPPORTS ON CONTRACT DRAWING

CASE 1 - BREAKAWAY SIGN SUPPORT (See Fig. 5.3.3(a))

GIVEN: SIGN SIZE
(Sample 2100 mm x 5400 mm; Type 3-3; Wind pressure = 465 Pa;
Maximum eccentricity = 4500 mm.)

STEP 1: OBTAIN PARTS AND QUANTITIES REQUIRED.
For this example, Column size required is W200 x 42:

E.g. 2100 mm x 5400 mm sign requires:

- 3 Column stubs
- 3 Lower Columns
- 3 Upper Columns
- 2 Lower Crossarms
- 1 Top Crossarm
- 12 Friction Plate Bolts (M16 x 70 mm long)
- 24 Fuse Plate Bolts (M20 x 60mm long)
- 3 Concrete Footings (see Fig 5.4.3) (depth = 1700 mm) (volume = 3(0.270) = 0.81 $m^3$)

STEP 2: OBTAIN 3 COLUMN STUBS

Column Stub size required = W200 x 42
Footing Depth = 1700 mm
Breakaway column stub length = 1700 mm (Fig. 5.4.3)

STEP 3: OBTAIN 3 LOWER COLUMNS

Lower Column size required = W200 x 42
E = 445mm Mb = 1965 (Fig. 5.4.4(d))

Lengths of Lower Columns:

$L_1 = M_b + (EL.EP – ELP_1) = 1.965 + (375.24 – 374.53) = \underline{2.675\ m}$

$L_2 = M_b + (EL.EP – ELP_2) = 1.965 + (375.24 – 374.38) = \underline{2.825\ m}$

$L_3 = M_b + (EL.EP – ELP_3) = 1.965 + (375.24 – 374.08) = \underline{3.125\ m}$

Note: If top of footing elevations are higher than EP elevation, the "difference" becomes negative and the lower column lengths become shorter than $M_b$.

If all footings are at the same elevation, then all lower column lengths are equal.

STEP 4: OBTAIN 3 UPPER COLUMNS:

Upper Column size required = W200 x 42
All 3 columns are equal length.
L = D – (E – 105) – (E – 205) (constants based on Fig. 5.5.4(b))
= 2100 – 2E + 310
= 2410 – 2E
= 2410 – 2(445) = 1520 mm = 1.520 m

STEP 5: OBTAIN 2 LOWER CROSSARMS: (size S75 x 8)

Length = B – 2H + 115 (Fig. 5.4.4(d) & Fig. 5.5.6 a&b)
= 5400 – 2(100) + 115
= 5315mm = 5.315m*

Note: Lower Crossarms don't have Connection Plates because they have Aluminum Clamps (for release).

T-Connector spacing = [1500mm(typ)] or [equal end spac. + x@1500]
T-Connector end dist. = 20mm & 95mm
Therefore [20 + 350 + (3 spac. @ 1500) + 350 + 95] = 5315mm*

Note: When 1500 spacing doesn't divide equally into (Length – 2 end distances), use Extended Lower Crossarms (Fig. 5.5.6(b)) Otherwise use Regular Crossarms (Fig. 5.5.6 (a))

STEP 6: OBTAIN 1 TOP CROSSARM ( size S75 x 8)

Length = B – 2H + 115
= 5400 – 2(100) + 115 = 5315mm = 5.315m

Note: Top Crossarms have Connection Plates (Fig.'s 5.5.7)

T-Connector spacing = same as for lower crossarms.

STEP 7: CHECK BOUNDARY CONDITIONS

(a) If the clearance (C) between the underside of sign and ground elevation at the shortest column location is calculated to be less than 2100 mm, then **all** column lengths shall be increased by the **same amount** equal to the difference between (2100-C) to satisfy the minimum clearance requirement.
e.g. If the 3 lower column lengths are calculated to be 1900mm, 2200 mm, and 2500 mm, and the clearance of the shortest column is equal to C=1900+100-(E-205)=1760 mm where E is 445 mm in this example. Then all lengths should be increased by 340 mm, (i.e. 2100 – 1760 = 340). Adjusted lengths would therefore be 2240 mm, 2540 mm, and 2840 mm.

(b) The dimension measured from top of lowest footing to centreline of signboard shall be less than or equal to the maximum eccentricity used in Tables 5.2.2 for the design.

STEP 8: INSERT ALL RESULTING SIZES, DIMENSIONS AND QUANTITIES CALCULATED ABOVE, INTO RELEVANT TABLES ON DWG. SS 118-30.

**SS118-30 BREAKAWAY SIGN SUPPORTS**

Note: All tables are completed for Example given in Section 5.3.

TABLE 1 - GENERAL

| STATION | 0+00 | | | | |
|---|---|---|---|---|---|
| SIGN No. | 1 | | | | |
| SIGN SIZE (DxB) | 2100x5400 | | | | |
| TYPE | 3-3 | | | | |
| EL. $P_1$ | 374.53 | | | | |
| EL. $P_2$ | 374.38 | | | | |
| EL. $P_3$ | 374.08 | | | | |
| A | 2300 | | | | |
| E | 445 | | | | |
| F | 605 | | | | |
| G | 6900 | | | | |
| H | 100 | | | | |
| COLUMN SIZE | W200x42 | | | | |
| FRICTION PLATE CONNECTION PRE-TIGHTENEING TORQUE (Nm) | 67 (for M16 bolt) | | | | |
| FOOTING DEPTH | 1700 | | | | |
| CONCRETE IN FOOTINGS ($m^3$) | 0.81 | | | | |

TABLE 2 – COMPONENTS/PARTS

| STATION | 0 + 00 | | | | | |
|---|---|---|---|---|---|---|
| COMPONENT | SIZE | QTY/LENGTH | | | | |
| COLUMN STUBS | W200x42 | 3 x 1700 | | | | |
| LOWER COLUMN #1 | W200x42 | 1 x 2675 | | | | |
| LOWER COLUMN #2 | W200x42 | 1 x 2825 | | | | |
| LOWER COLUMN #3 | W200x42 | 1 x 3125 | | | | |
| UPPER COLUMNS | W200x42 | 3 x 1520 | | | | |
| LOWER CROSSARM(S) | S75x8 | 2 x 5315 | | | | |
| TOP CROSSARM | S75x8 | 1 x 5315 | | | | |
| BRASS SHIMS | *t*=0.305mm<br>*t*=0.813mm | As req'd for plumbing lower column | | | | |
| FRONT FUSE PLATE | *t*=13mm | 3 | | | | |
| BACK FUSE PLATE | *t*=13mm | 3 | | | | |
| ALUMINUM CLAMP | SEE DETAILS | 24 | | | | |

TABLE 3 – HARDWARE (ASTM A325M GALV.)

| STATION | 0 + 00 | | | | | |
|---|---|---|---|---|---|---|
| DESCRIPTION | SIZE | QUANTITY | | | | |
| TOP CROSSARM BOLTS | 12mmx1.75x 45mm LG. | 12 | | | | |
| FUSE PLATE BOLTS | M20x60mm LG | 24 | | | | |
| FRICTION PLATE BOLTS | M16x70mm LG | 12 | | | | |
| FRICTION PLATE WASHERS | M16 FLAT | 24 | | | | |

Note: Top Crossarm Bolts are 12mm dia. x 1.75 x 45mm long, A325M bolts, c/w 2 washers per bolt.
4 sets required per connection.
Therefore for Type 3-3, Quantity = 3(4) = 12.

Fuse Plate Bolts for perforated fuse plate are M20 x 60mm long, A325, c/w 2 flat washers per bolt.
8 sets required per connection.
Therefore for Type 3-3, Quantity = 3(8) = 24.

Friction Plate Bolts for columns W200x42 and W200x46 shall be M16 x 70mm long; For W200x59 they shall be M20 x 90mm long. The bolts shall be A325M, complete with 2 galvanized and one SST washer.
Therefore for Type 3-3, Quantity = 3(4) = 12 bolts
Quantity = 3(8) = 24 washers (galv.)

TABLE 4 – HARDWARE (SST)

| STATION | 0+00 | | | | | DESCRIPTION |
|---|---|---|---|---|---|---|
| | QTY | QTY | QTY | QTY | QTY | |
| LOWER CROSSARM CONNECTION | 24 | | | | | 8mm x 1.25 x 45mm LG. THREADED LENGTH 25mm SST HEX. HD. BOLT |
| | 48 | | | | | 8mm SST STD FLAT WASHER |
| | 24 | | | | | 8mm x 1.25 SST NYLON INSERT STOP NUT |
| FRICTION PLATE SPACER | 12 | | | | | SST 37 O.D. x 21 I.D. x 3mm THICK |
| T-CONNECTOR TO 'T' SHAPE CONNECTION | 36 | | | | | 12mm x 1.75 x 45mm LG. SST HEX. HD. BOLT |
| | 72 | | | | | 12mm SST FLAT WASHER |

Note: Lower Crossarm Connection uses 8mm dia. bolts to connect the Aluminum Clamp to the upper column. The clamps secure the lower crossarm to the upper column.
4 sets required per connection.
Therefore for Type 3-3, Quantity = 6(4) = 24 bolts.
Quantity = 6(8) = 48 washers.
Quantity = 6(4) = 24 nuts.

Friction Plate Spacers: 1 required per bolt in each friction plate connection.
Therefore for Type 3-3, Quantity = 3(4) = 12 spacers.

For 2100 x 5400 sign, (Type 3-3):

$$L = 5400 - 2H + 115$$
$$= 5400 - 2(100) + 115$$
$$= 5315\text{mm}$$

Therefore the number of T-connectors required per crossarm:
Quantity = 6 (from Fig. 5.5.6)

Therefore the number of SST bolts required for T-connector to T-shape connection:
Quantity = 2 (6x3) = 36 bolts

Therefore the number of SST washers required:
Quantity = 2 (36) = 72 washers

The following components are Supplied by Others (MTO).
- sign board
- Alcan T-Shapes No. 31523

CASE 2 – NON-BREAKAWAY SIGN SUPPORT (See Fig. 5.3.3(b))

GIVEN: SIGN SIZE
(Sample 2100 mm x 5400 mm; Type 3-3; Wind pressure = 465 Pa; Maximum eccentricity = 4500 mm.)

STEP 1: OBTAIN PARTS AND QUANTITIES REQUIRED.
For this example, Column size required is W200 x 42:

e.g. 2100 mm x 5400 mm sign requires:

- 3 Columns
- 3 Crossarms
- 3 Concrete Footings (depth = 1700 mm)
(volume = 3(0.270) = 0.81 $m^3$)

STEP 2: OBTAIN COLUMN LENGTHS FOR $P_1$, $P_2$ and $P_3$

For sample 2100 mm x 5400 mm sign, (Type 3-3),
$M_{nb}$=3460 mm and E=445mm. (from Fig. 5.4.4(b))

Lengths of Columns:
$L_1$ = $M_{nb}$ + Footing Depth + (EL E.P. – EL $P_1$)
= 3.460 + 1.700 + (375.24 – 374.53) = 5.87 m

$L_2$ = $M_{nb}$ + Footing Depth + (EL E.P. – EL $P_2$)
= 3.460 + 1.700 + (375.24 – 374.23) = 6.17 m

$L_3$ = $M_{nb}$ + Footing Depth + (EL E.P. – EL $P_3$)
= 3.460 + 1.700 + (375.24 – 374.83) = 5.57 m

Note: If all footings are at the same elevation, then all column lengths are equal.

If elevations for $P_1$, $P_2$ or $P_3$ are higher than for E.P., then the bracketed dimension in the column length formula becomes negative.

STEP 3: OBTAIN 3 CROSSARMS: (size S75 x 8)

Length = B – 2H + 115 (Fig. 5.4.4(d) & Fig. 5.5.7 c&d)
= 5400 – 2(100) + 115 = 5315mm

Obtain T-connector spacing same as for Lower Crossarm in CASE (1).

T-Connector spacing = [1500mm(typ)] or [equal end spac. + x@1500]
T-Connector end dist. = 20mm & 95mm
Therefore [20 + 350 + (3 spac. @ 1500) + 350 + 95] = 5315mm

Note: When 1500 spacing doesn't divide equally into (Length – 2 end distances), use Extended Lower Crossarms (Fig. 5.5.6(b)) Otherwise use Regular Crossarms (Fig. 5.5.6 (a))

STEP 4: CHECK BOUNDARY CONDITIONS

a) In severe cut situations, dimension "$M_{nb}$" shall be increased to suit.

b) The dimension measured from top of the lowest footing to centreline of sign board shall be less than or equal to the maximum eccentricity used in Tables 5.2.2 for the design.

c) Ensure that minimum 1000mm vertical clearance is provided from the underside of sign to the ground level.

STEP 5: INSERT ALL RESULTING SIZES, DIMENSIONS AND QUANTITIES CALCULATED ABOVE, INTO RELEVANT TABLES ON DWG. SS118-33.

Note:

1) Table 1 – GENERAL is filled in similar to that table for breakaway sign supports, with the only exception that non-breakaway sign supports don’t have friction plate connections.
2) Table 2 – COMPONENTS/PARTS is given as follows:

| STATION | 0 + 00 | | | | | |
|---|---|---|---|---|---|---|
| COMPONENT | SIZE | QTY/LENGTH | | | | |
| COLUMN #1 | W200x42 | 1 x 5870 | | | | |
| COLUMN #2 | W200x42 | 1 x 6170 | | | | |
| COLUMN #3 | W200x42 | 1 x 5570 | | | | |
| CROSSARM(S) | S75 x 8 | 3 x 5315 | | | | |

## 5.4 ASSEMBLY AND INSTALLATION

### 5.4.1 GENERAL

The following requirements must be met during the construction of steel sign supports.

(i) For breakaway supports, the friction plate atop the vertically positioned column stub shall be installed dead level and held in the correct position and elevation with a template, until the concrete has properly set.

For non-breakaway supports, install and hold column dead plumb until concrete has properly set.

(ii) Concrete to be placed against undisturbed ground in augered hole.

(iii) Class of concrete to be 30 MPa.

(iv) Top surface of footings shall be domed.

(v) For breakaway supports, components above ground level shall not be erected until 7 days after concrete has been placed.

(vi) The procedure for tightening bolts of breakaway signs shall be as follows:

(a) FRICTION PLATE BOLTS (M16 or M20)

- Assemble column to stub with galvanized bolts and with two galvanized washers plus one SST flat washer on each bolt between friction plates, and galvanized bolt keeper plate.
- Use brass shims as required to plumb column.
- Tighten bolts in a systematic order to a torque specified in Table of Figure 5.4.5(a).
- Loosen each bolt and retighten to specified torque in the same order as initial tightening.

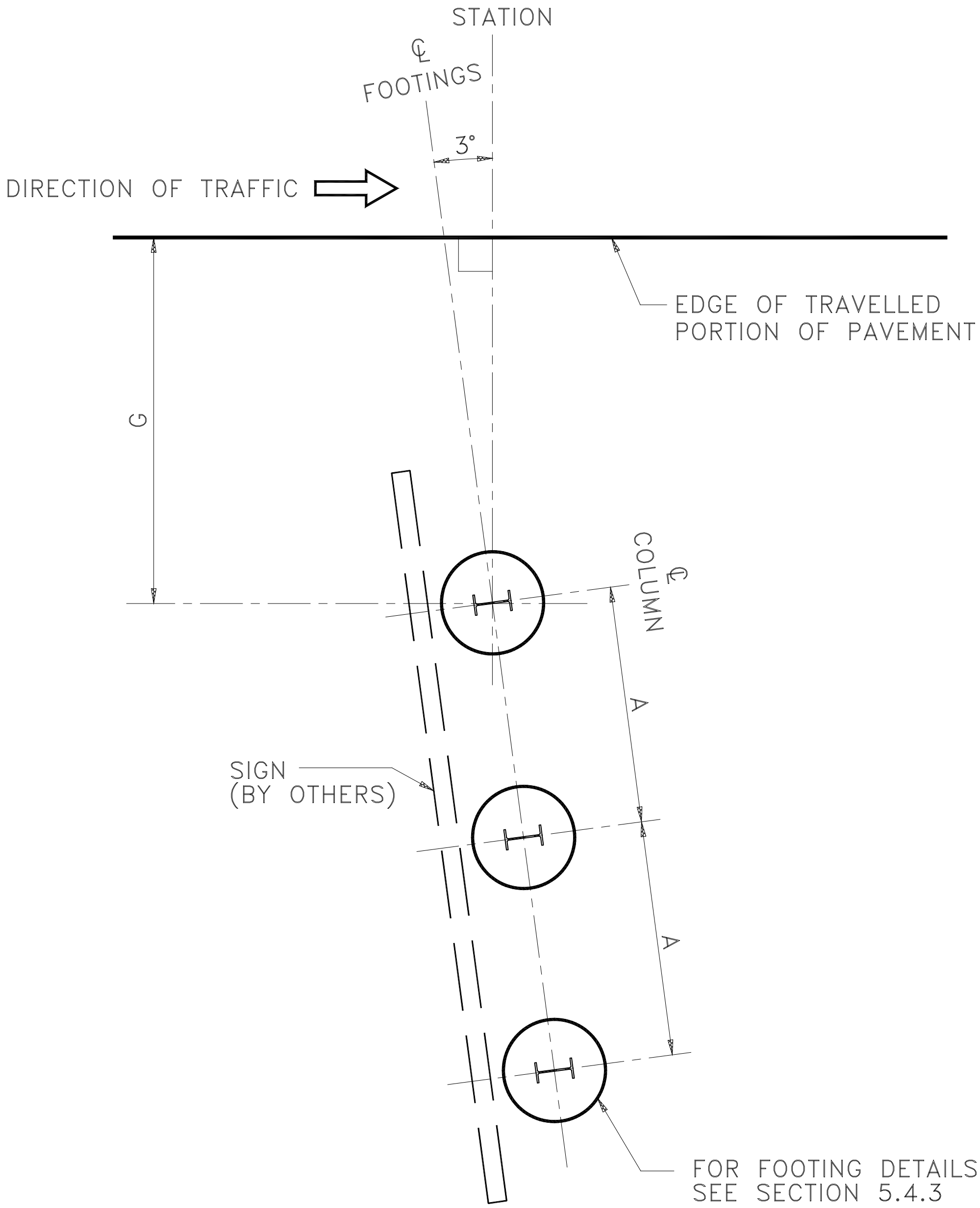
(b) PERFORATED FUSE PLATE BOLTS (M20)

- Tighten bolts in a systematic order to a snug tight condition.
- Continue to further tighten each bolt, in the same order as the initial tightening, by 1/3 of a turn.

(vii) Friction plate and fuse plate bolt threads to be burred at junction with nut, using centre punch.

### 5.4.2 TYPICAL LAYOUT PLAN

Figure 5.4.2 is for use in installing steel column sign supports.

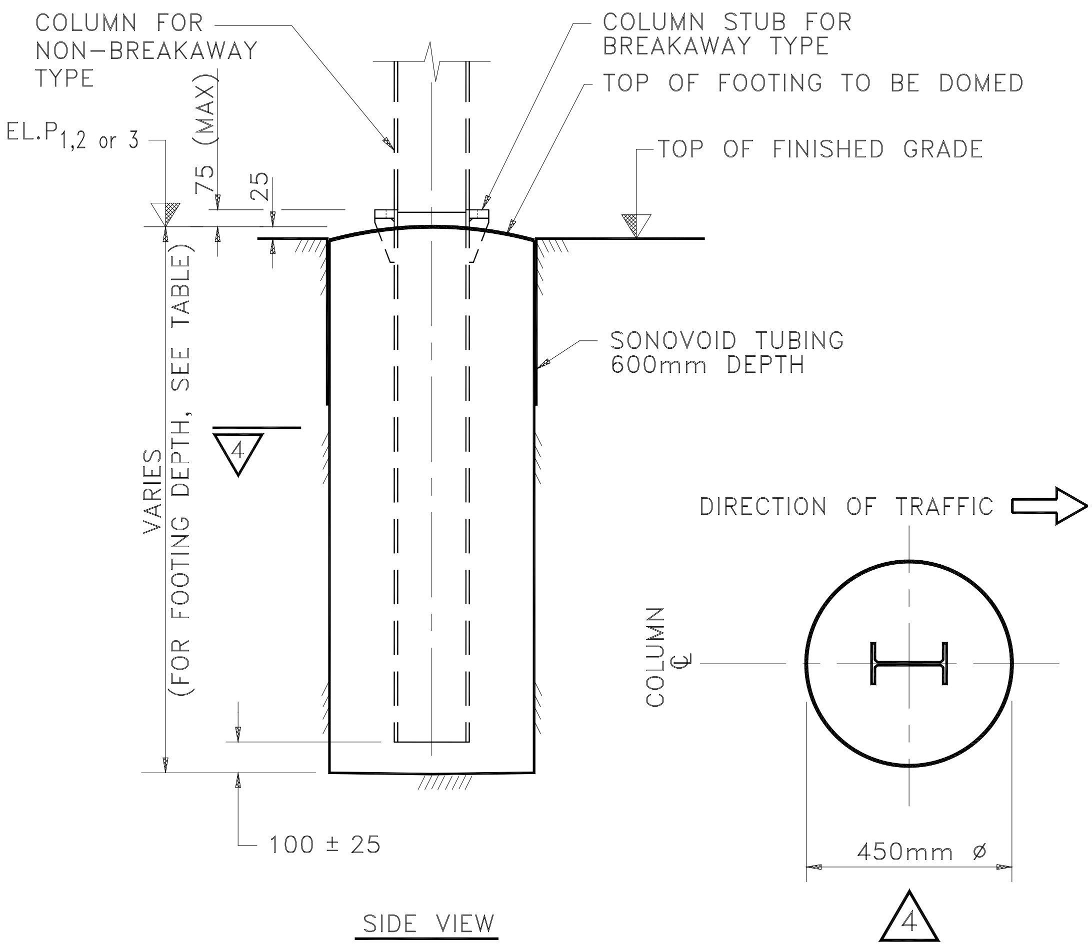



Note – For dimensions A and G see Table, Section 5.4.4.

**FIGURE 5.4.2 TYPICAL LAYOUT PLAN**

### 5.4.3 FOOTING DETAILS

Figure 5.4.3 is for use in installing steel sign support footings.




| No. OF COLUMNS | SIGN AREA ($m^2$) | * FOOTING DEPTH (mm) W200 X42 | W200 X46 | W200 X59 |
|---|---|---|---|---|
| 2 | 0 – 6.0 | 1600 | 1600 | N/A |
| | 6.1-12.0 | 2000 | 2200 | 2500 |
| | 12.1-18.0 | 2100 | 2500 | 2800 |
| 3 | 9.0-13.0 | 1700 | 1900 | 2000 |
| | 13.1-18.0 | 1900 | 2000 | 2200 |
| | 18.1-24.0 | 1900 | 2100 | 2400 |

* Footing depth required assumes that lateral soil resistance is based on full depth, without reduction for frost depth of soil.

| BREAKAWAY COLUMN STUB LENGTH (mm) | 1600 | 1700 | 1900 | 2000 | 2100 | 2200 | 2400 | 2500 | 2800 |
|---|---|---|---|---|---|---|---|---|---|
| FOOTING DEPTH (mm) | 1600 | 1700 | 1900 | 2000 | 2100 | 2200 | 2400 | 2500 | 2800 |
| CONCRETE QUANTITY ($m^3$) | 0.254 | 0.270 | 0.302 | 0.318 | 0.334 | 0.350 | 0.382 | 0.398 | 0.445 |

**FIGURE 5.4.3 FOOTING DETAILS**

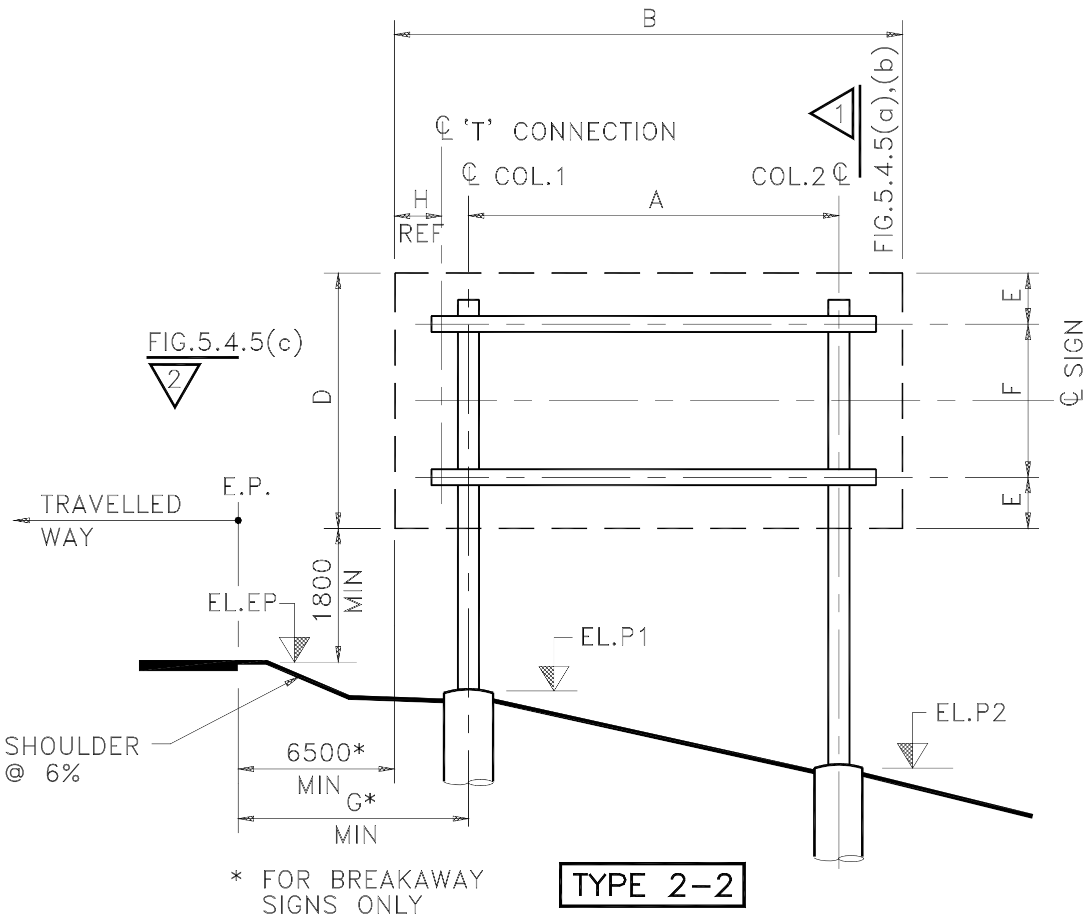
## 5.4.4 ASSEMBLY

The following illustrations provide dimensions for assembly and installation of sign supports.

| TYPE OF SIGN SUPPORT | FIGURE |
|---|---|
| 2-2 | 5.4.4(a) |
| 2-3 | 5.4.4(b) |
| 3-2 | 5.4.4(c) |
| 2-3 | 5.4.4(d) |
| 3-4 | 5.4.4(e) |

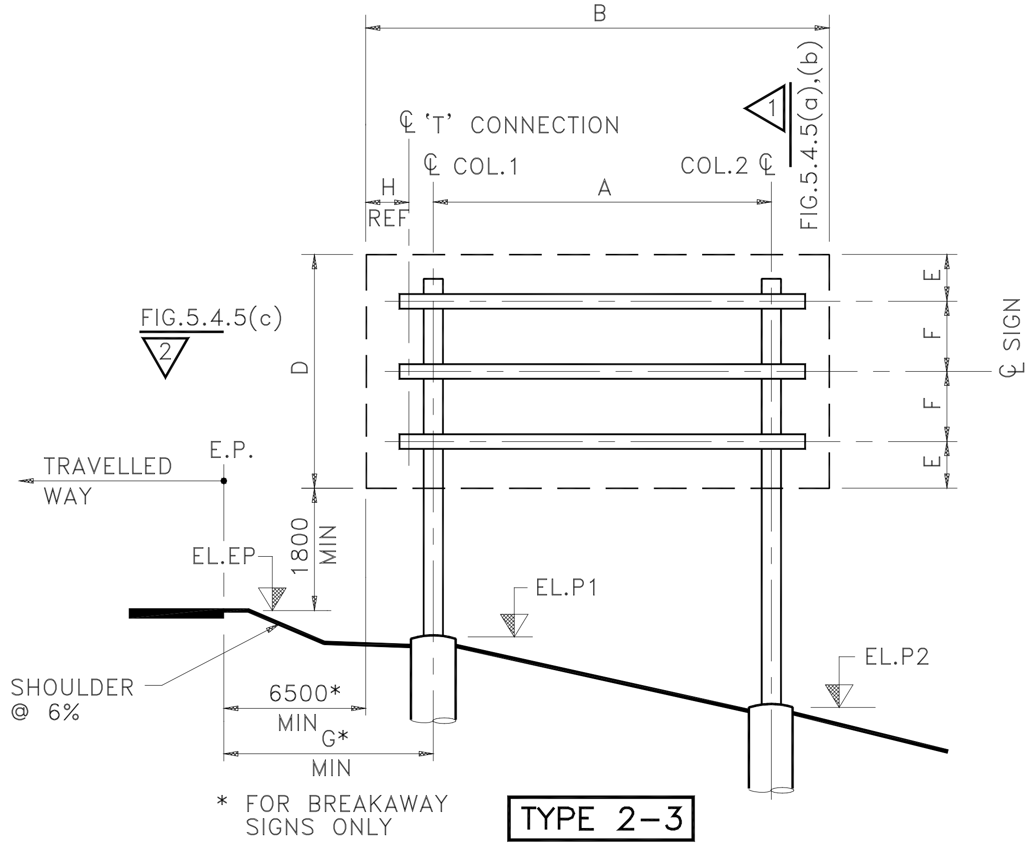
These figures are applicable to both breakaway and non-breakaway sign supports, with the exceptions as noted.

For clarity, traffic barrier for non-breakaway sign supports in not shown.



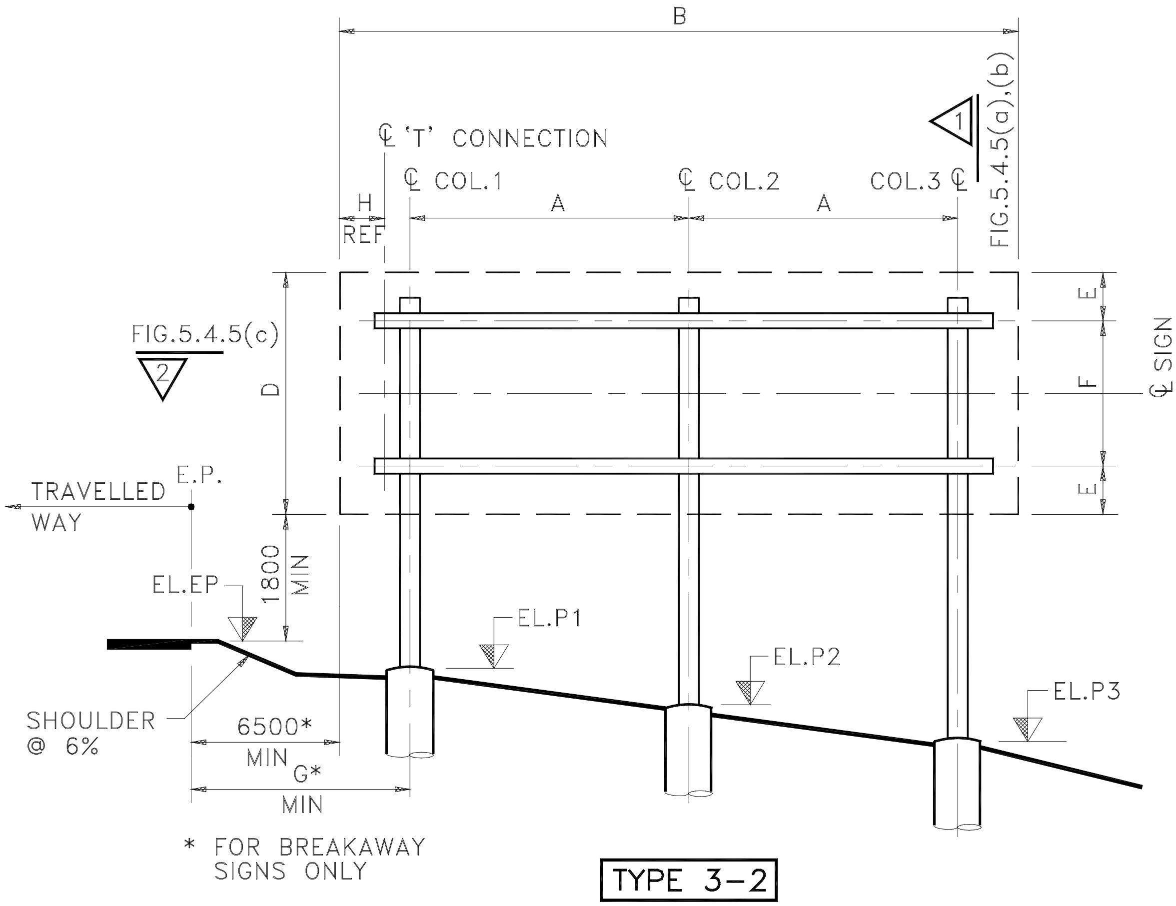

| SIGN SIZE DxB, mm | A | E | F | G min. | H | $M_b$ | $M_{nb}$ |
|---|---|---|---|---|---|---|---|
| 1200x3000 | 2300 | 230 | 740 | 6850 | 100 | 1750 | 2775 |
| 1200x3600 | 2300 | 230 | 740 | 7150 | 300 | 1750 | 2775 |
| 1500x3000 | 2300 | 330 | 840 | 6850 | 100 | 1850 | 2975 |
| 1500x3600 | 2300 | 330 | 840 | 7150 | 300 | 1850 | 2975 |
| 1500x4200 | 2400 | 330 | 840 | 7400 | 200 | 1850 | 2975 |
| 1500x4500 | 2700 | 330 | 840 | 7400 | 350 | 1850 | 2975 |
| 1500x4800 | 3000 | 330 | 840 | 7400 | 150 | 1850 | 2975 |
| 1500x5400 | 3000 | 330 | 840 | 7700 | 450 | 1850 | 2975 |
| 1800x3600 | 2300 | 405 | 990 | 7150 | 300 | 1925 | 3200 |
| 1800x4200 | 2400 | 405 | 990 | 7400 | 200 | 1925 | 3200 |
| 1800x4500 | 2700 | 405 | 990 | 7400 | 350 | 1925 | 3200 |
| 1800x4800 | 3000 | 405 | 990 | 7400 | 150 | 1925 | 3200 |

**FIGURE 5.4.4(a) ASSEMBLY AND INSTALLATION DIMENSIONS**



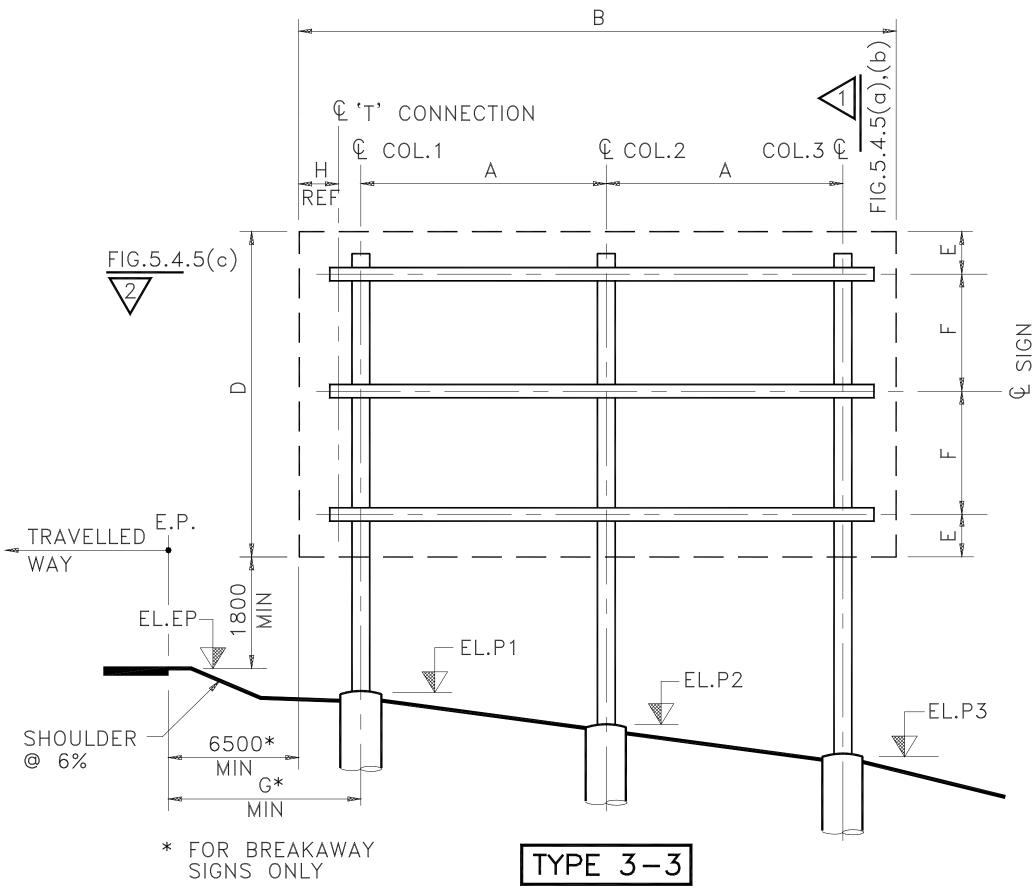

| SIGN SIZE DxB, mm | A | E | F | G min. | H | $M_b$ | $M_{nb}$ |
|---|---|---|---|---|---|---|---|
| 2100X3600 | 2300 | 445 | 605 | 7150 | 300 | 1965 | 3460 |
| 2100X4200 | 2400 | 445 | 605 | 7400 | 200 | 1965 | 3460 |
| 2100X4500 | 2700 | 445 | 605 | 7400 | 350 | 1965 | 3460 |
| 2100X4800 | 3000 | 445 | 605 | 7400 | 150 | 1965 | 3460 |
| 2400X4200 | 2400 | 480 | 720 | 7400 | 200 | 2000 | 3725 |
| 2400X4500 | 2700 | 480 | 720 | 7400 | 350 | 2000 | 3725 |
| 2400X4800 | 3000 | 480 | 720 | 7400 | 150 | 2000 | 3725 |
| 2700X4200 | 2400 | 580 | 770 | 7400 | 200 | 2100 | 3925 |
| 2700X4500 | 2700 | 580 | 770 | 7400 | 350 | 2100 | 3925 |
| 2700X4800 | 3000 | 580 | 770 | 7400 | 150 | 2100 | 3925 |
| 3000X4200 | 2400 | 635 | 865 | 7400 | 200 | 2155 | 4170 |
| 3000X4500 | 2700 | 635 | 865 | 7400 | 350 | 2155 | 4170 |
| 3000X4800 | 3000 | 635 | 865 | 7400 | 150 | 2155 | 4170 |
| 3300X4200 | 2400 | 675 | 975 | 7400 | 200 | 2195 | 4430 |
| 3300X4500 | 2700 | 675 | 975 | 7400 | 350 | 2195 | 4430 |
| 3300X4800 | 3000 | 675 | 975 | 7400 | 150 | 2195 | 4430 |
| 3600X4800 | 3000 | 730 | 1070 | 7400 | 150 | 2250 | 4675 |

**FIGURE 5.4.4(b) ASSEMBLY AND INSTALLATION DIMENSIONS**



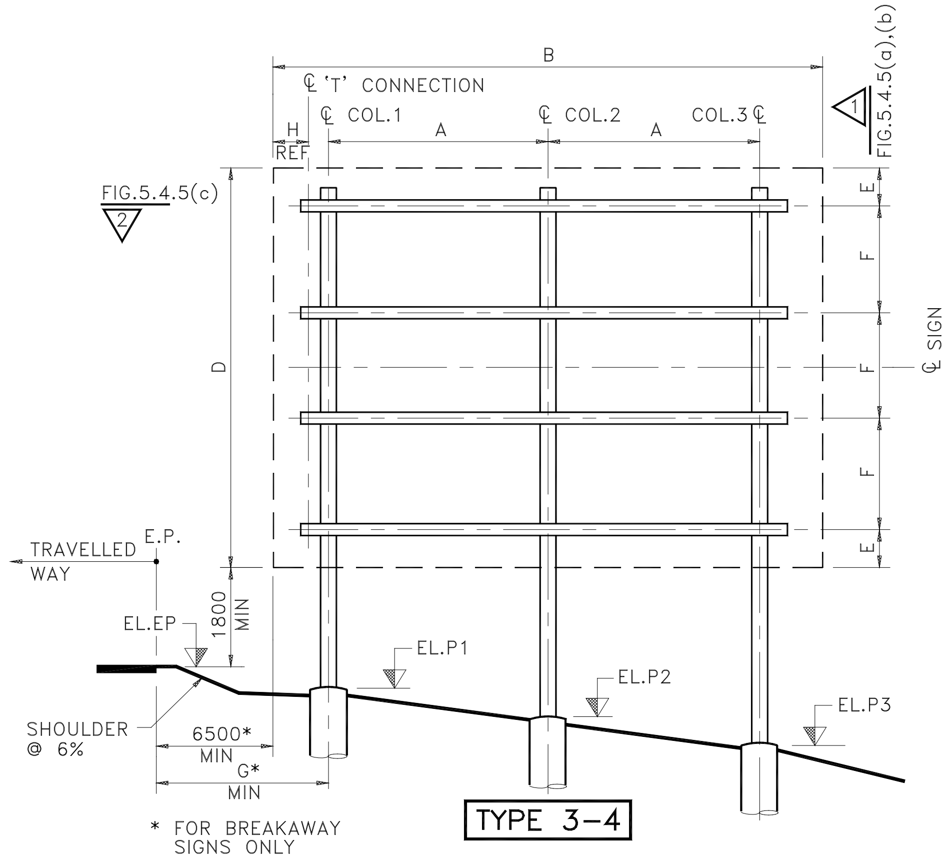

| SIGN SIZE DxB, mm | A | E | F | G min. | H | $M_b$ | $M_{nb}$ |
|---|---|---|---|---|---|---|---|
| 1800X5400 | 2300 | 405 | 990 | 6900 | 100 | 1925 | 3200 |
| 1800X6000 | 2300 | 405 | 990 | 7200 | 400 | 1925 | 3200 |
| 1800X6600 | 2700 | 405 | 990 | 7100 | 300 | 1925 | 3200 |
| 1800X7200 | 2900 | 405 | 990 | 7200 | 200 | 1925 | 3200 |
| 1800X7800 | 3000 | 405 | 990 | 7400 | 100 | 1925 | 3200 |

**FIGURE 5.4.4(c) ASSEMBLY AND INSTALLATION DIMENSIONS**




| SIGN SIZE DxB, mm | A | E | F | G min. | H | $M_b$ | $M_{nb}$ |
|---|---|---|---|---|---|---|---|
| 2100X5400 | 2300 | 445 | 605 | 6900 | 100 | 1965 | 3460 |
| 2100X6000 | 2300 | 445 | 605 | 7200 | 400 | 1965 | 3460 |
| 2100X6600 | 2400 | 445 | 605 | 7400 | 300 | 1965 | 3460 |
| 2100X7200 | 2900 | 445 | 605 | 7200 | 200 | 1965 | 3460 |
| 2100X7800 | 3000 | 445 | 605 | 7400 | 100 | 1965 | 3460 |
| 2400X5400 | 2300 | 480 | 720 | 6900 | 100 | 2000 | 3725 |
| 2400X6000 | 2300 | 480 | 720 | 7200 | 400 | 2000 | 3725 |
| 2400X6600 | 2400 | 480 | 720 | 7400 | 300 | 2000 | 3725 |
| 2400X7800 | 3000 | 480 | 720 | 7400 | 100 | 2000 | 3725 |
| 2700X5400 | 2300 | 580 | 770 | 6900 | 100 | 2100 | 3925 |
| 2700X7800 | 3000 | 580 | 770 | 7400 | 100 | 2100 | 3925 |
| 3000X5400 | 2300 | 635 | 865 | 6900 | 100 | 2155 | 4170 |
| 3000X7800 | 3000 | 635 | 865 | 7400 | 100 | 2155 | 4170 |
| 3300X5400 | 2300 | 675 | 975 | 6900 | 100 | 2195 | 4430 |

**FIGURE 5.4.4(d) ASSEMBLY AND INSTALLATION DIMENSIONS**




| SIGN SIZE DxB, mm | A | E | F | G min. | H | $M_b$ | $M_{nb}$ |
|---|---|---|---|---|---|---|---|
| 2400X7200 | 2900 | 300 | 600 | 7200 | 200 | 1820 | 3905 |
| 2400X7800 | 3000 | 300 | 600 | 7400 | 100 | 1820 | 3905 |
| 2700X6000 | 2300 | 375 | 650 | 7200 | 400 | 1895 | 4130 |
| 2700X6600 | 2700 | 375 | 650 | 7100 | 300 | 1895 | 4130 |
| 2700X7200 | 2900 | 375 | 650 | 7200 | 200 | 1895 | 4130 |
| 2700X7800 | 3000 | 375 | 650 | 7400 | 100 | 1895 | 4130 |
| 3000X6000 | 2300 | 450 | 700 | 7200 | 400 | 1970 | 4355 |
| 3000X6600 | 2700 | 450 | 700 | 7100 | 300 | 1970 | 4355 |
| 3000X7200 | 2900 | 450 | 700 | 7200 | 200 | 1970 | 4355 |
| 3000X7800 | 3000 | 450 | 700 | 7400 | 100 | 1970 | 4355 |
| 3300X6000 | 2300 | 525 | 750 | 7200 | 400 | 2045 | 4580 |
| 3300X6600 | 2700 | 525 | 750 | 7100 | 300 | 2045 | 4580 |
| 3300X7200 | 2900 | 525 | 750 | 7200 | 200 | 2045 | 4580 |
| 3600X5400 | 2300 | 600 | 800 | 6900 | 100 | 2120 | 4805 |
| 3600X6000 | 2300 | 600 | 800 | 7200 | 400 | 2120 | 4805 |
| 3600X6600 | 2700 | 600 | 800 | 7100 | 300 | 2120 | 4805 |

**FIGURE 5.4.4(e) ASSEMBLY AND INSTALLATION DIMENSIONS**

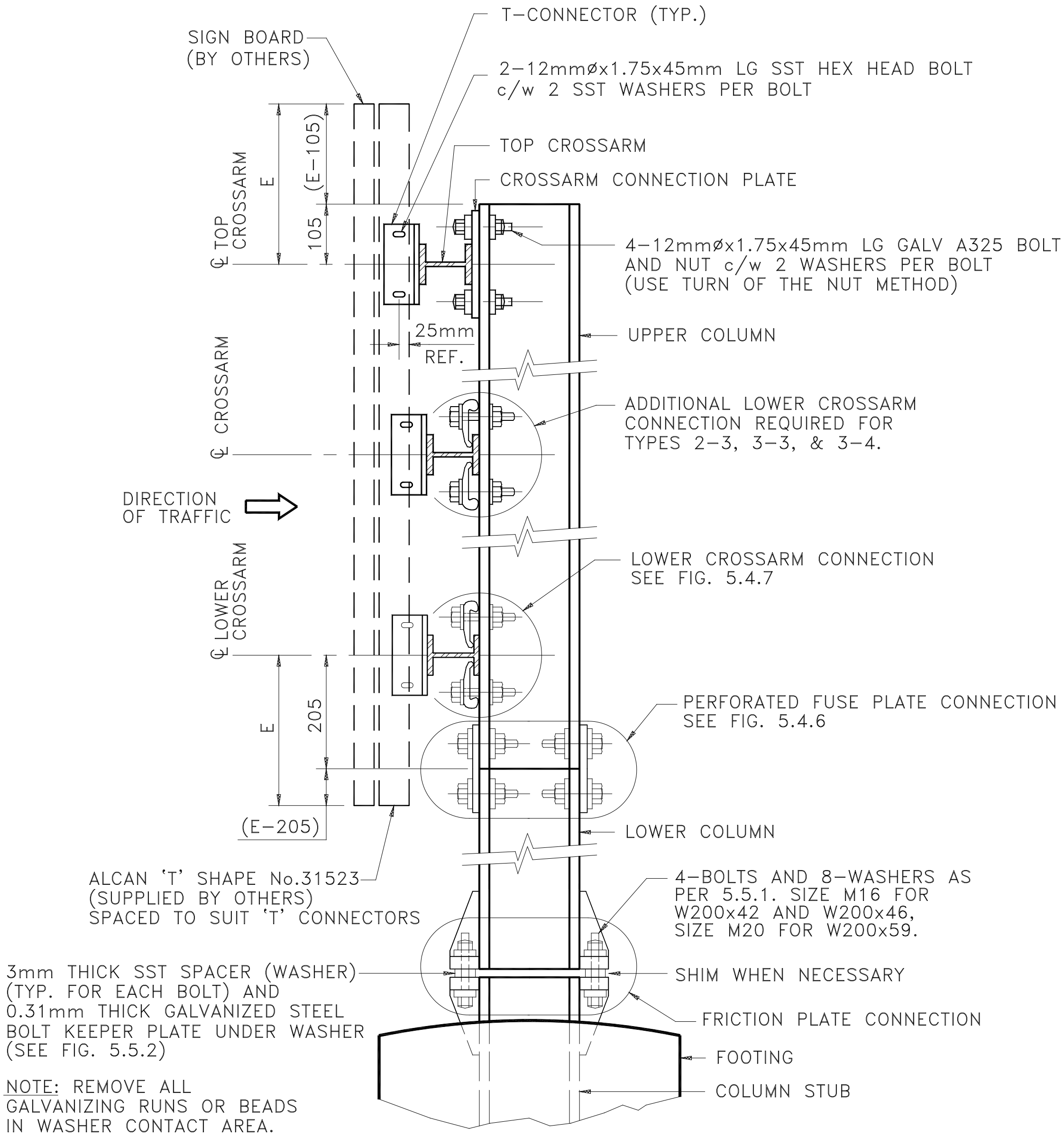
### 5.4.5 INSTALLATION

Figure 5.4.5(a), 5.4.5(b) and 5.4.5(c) provide information for the installation of steel column sign supports.

Figure 5.4.5 (a) – Breakaway Type Installation Details

Figure 5.4.5 (b) – Non-Breakaway Type Installation Details

Figure 5.4.5 (c) – Installation Details




| COLUMN SIZE | FRICTION PLATE BOLT SIZE | TORQUE Nm |
|---|---|---|
| W200x42 | M16 x 70 mm LG | 67 |
| W200x46 | M16 x 70 mm LG | 67 |
| W200x59 | M20 x 90 mm LG | 85 |

**FIGURE 5.4.5 (a) BREAKAWAY TYPE INSTALLATION DETAILS**

1

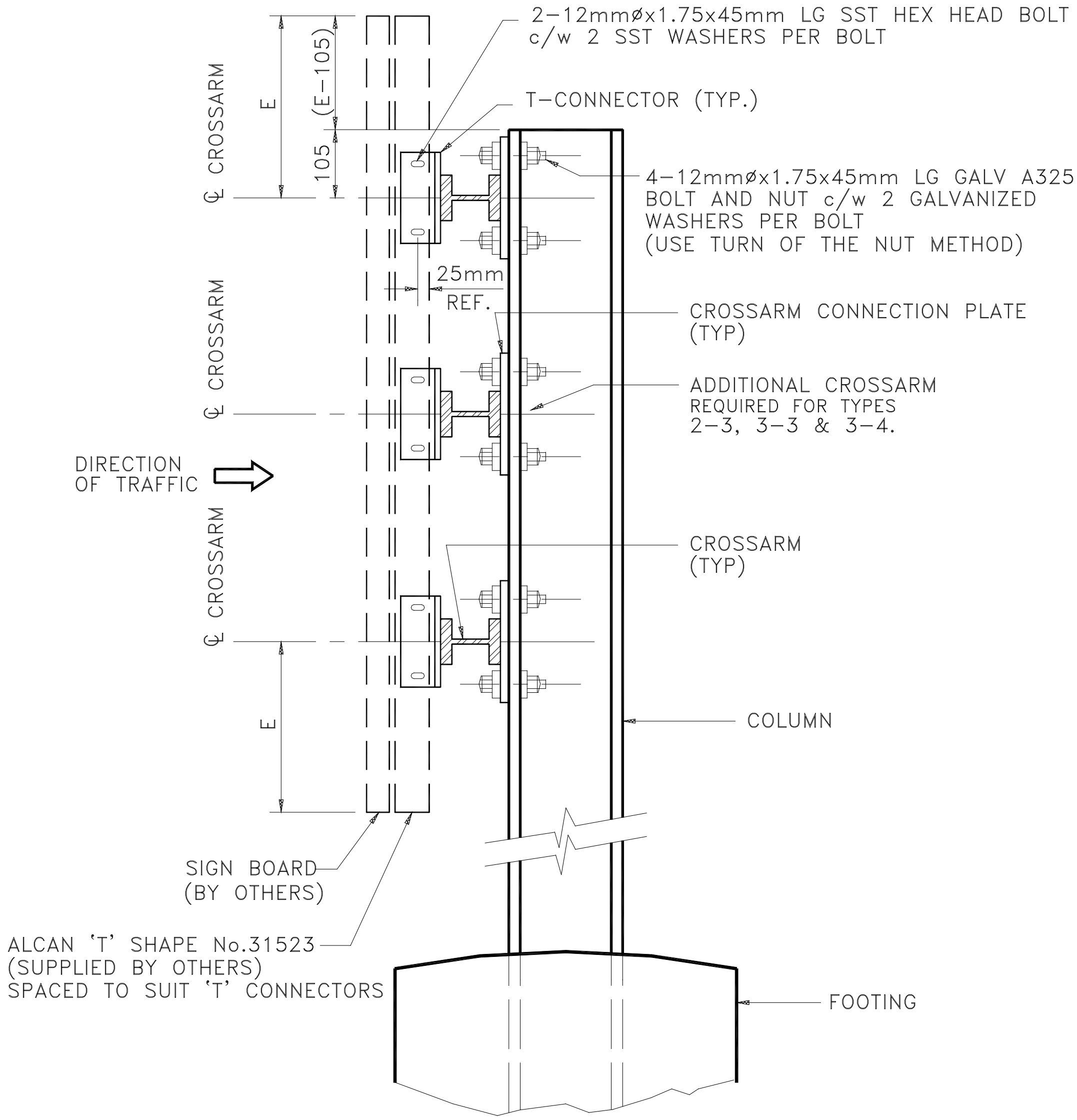
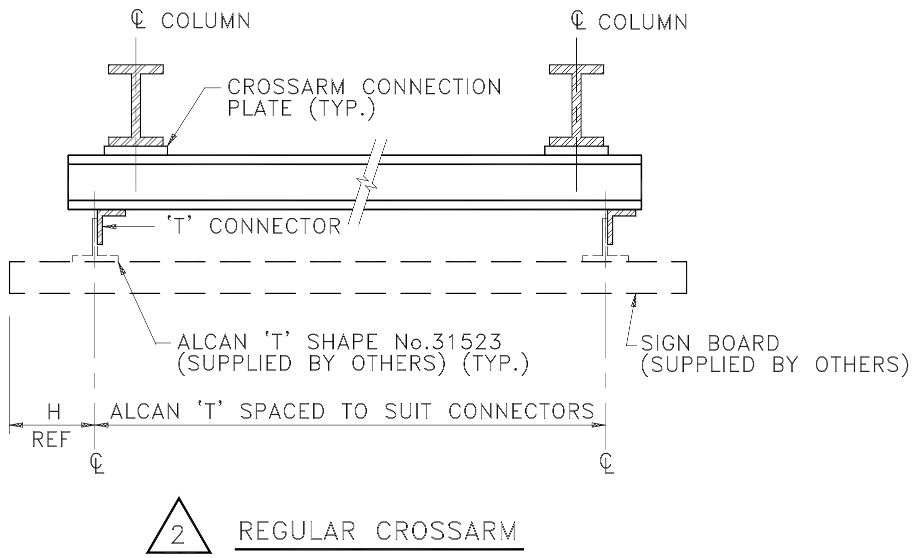



**FIGURE 5.4.5 (b) NON-BREAKAWAY TYPE INSTALLATION DETAILS**

1



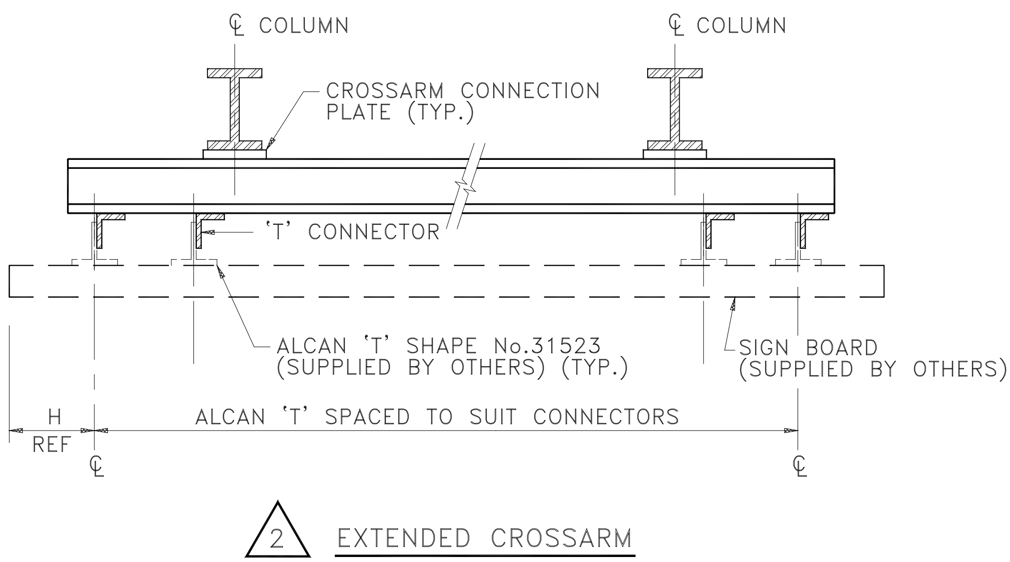




**FIGURE 5.4.5 (c) INSTALLATION DETAILS**

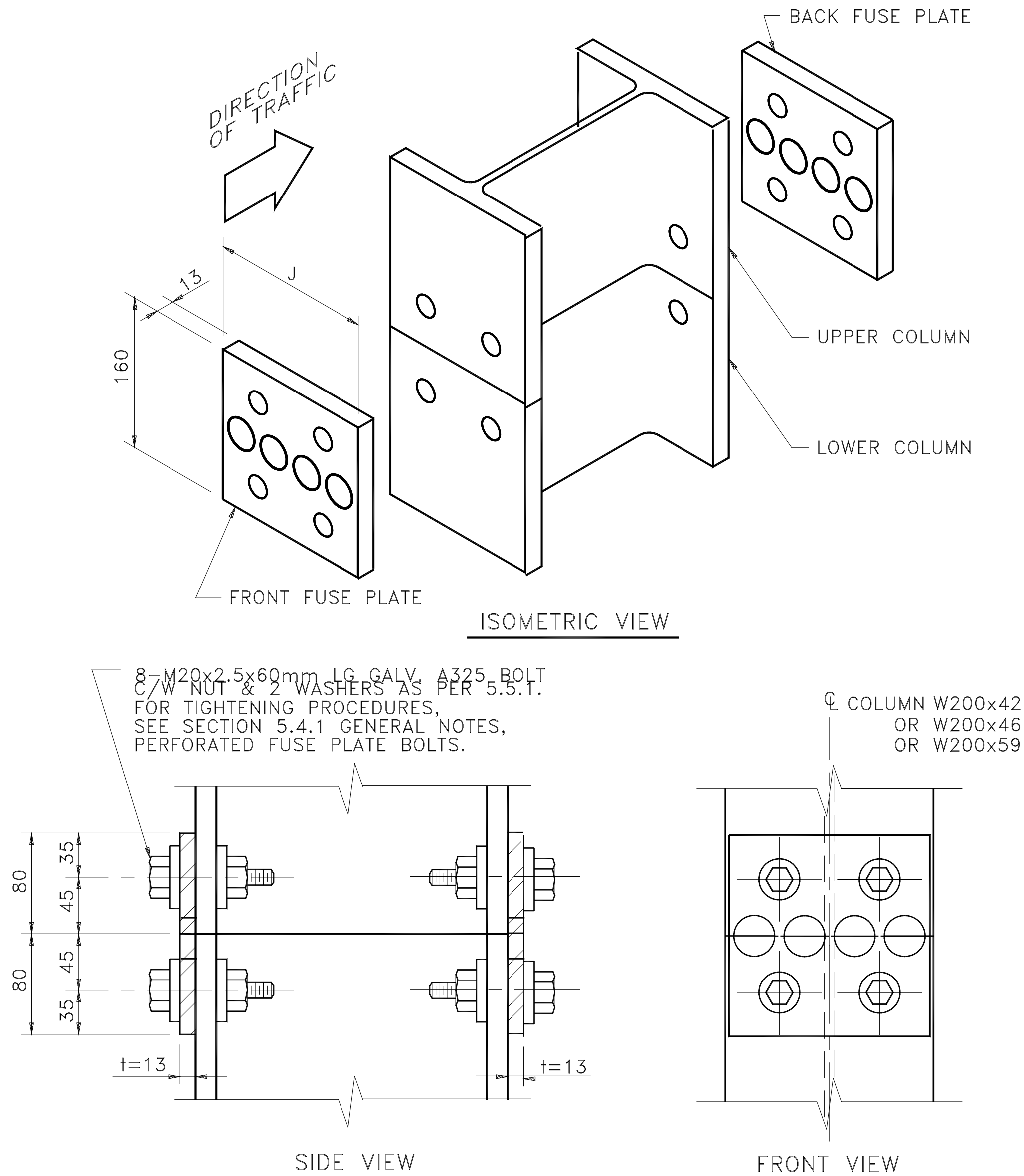
2

NOTE:

- Regular Crossarms are used when spacing of T-connectors is exactly 1500mm.
- Extended Crossarms are used when equal spacing of interior T-connectors of 1500mm is not enough, but lengths of crossarm require additional smaller spacing of exterior T-connectors.

## 5.4.6 PERFORATED FUSE PLATE CONNECTION (BREAKAWAY TYPE)

Figure 5.4.6 provides information for the assembly of the “Perforated Fuse Plates”.




**<u>FIGURE 5.4.6 PERFORATED FUSE PLATE DETAILS</u>**

<u>NOTE:</u>
For Details of Perforated Fuse Plates, see Figures 5.5.9(a) and 5.5.9(b).

## 5.4.7 LOWER CROSSARM CONNECTION (BREAKAWAY TYPE)

Figure 5.4.7 provides details for the assembly of the connection of the “Lower Crossarm” to the “Upper Column”.

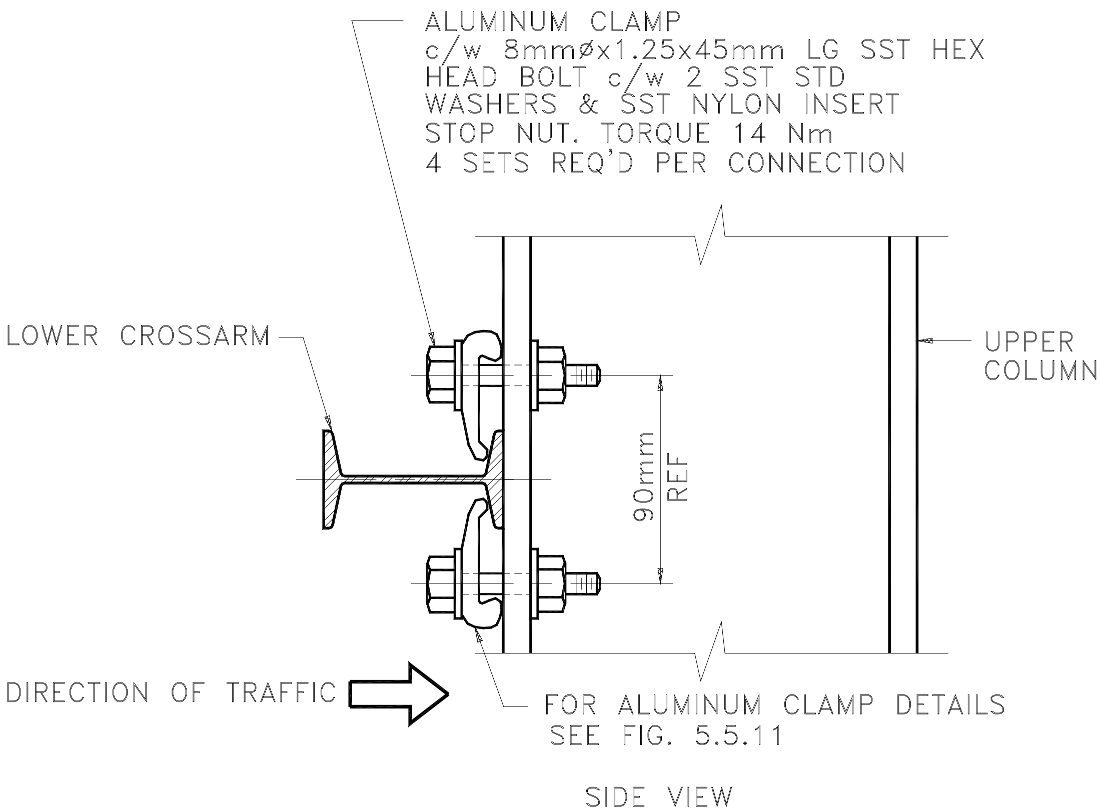



**FIGURE 5.4.7 LOWER CROSSARM CONNECTION**

## 5.5 FABRICATION

### 5.5.1 GENERAL

(i) All structural steel shall conform to CAN/CSA G40.20-13/G40.21-13 Grade 300W.

(ii) All bolts, nuts and washers, except lower crossarm connections (which are SST) shall conform to ASTM A325 and be hot-dip galvanized.

(iii) All contact areas of friction plates, perforated fuse plates and column flanges shall be free of galvanizing beads or runs.

(iv) All steel shall be hot-dip galvanized after fabrication..

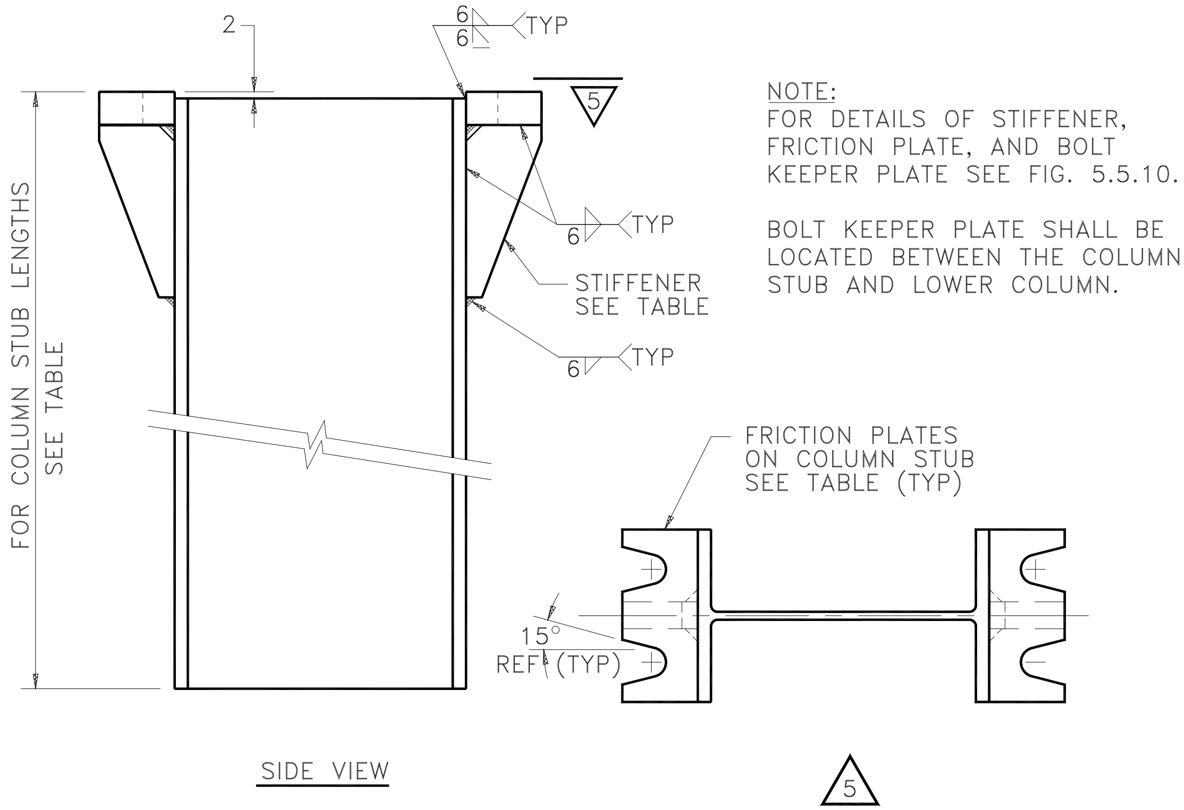
(v) All welding shall be in accordance with CSA Standard W59.

(vi) Electrodes shall be to a low hydrogen specification. Electrodes for manual welding shall be E7015, E7106 or E7018.

(vii) For inspection and delivery, assemble all bolts, nuts and washers in place as required.

## 5.5.2 COLUMN STUB (BREAKAWAY TYPE)

Figure 5.5.2 provides all necessary information for the fabrication of the “Column Stubs”.

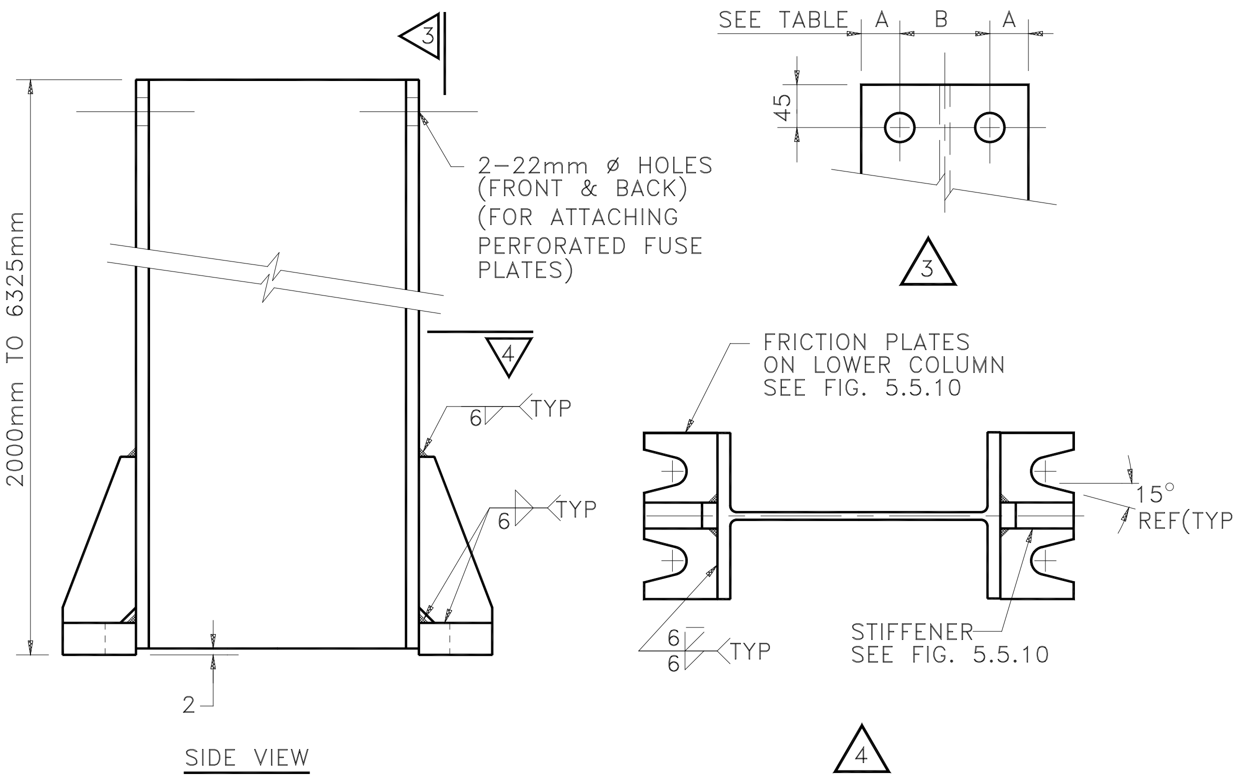



Note that friction plates shall be fabricated perpendicular to the longitudinal axis of the column.

| COLUMN SIZE | COLUMN STUB LENGTH | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| W200x42 | 1600 | 1700 | 1900 | 2000 | 2100 | - | - | - | - |
| W200x46 | 1600 | - | 1900 | 2000 | 2100 | 2200 | - | 2500 | - |
| W200x59 | - | - | - | 2000 | - | 2200 | 2400 | 2500 | 2800 |

**FIGURE 5.5.2 COLUMN STUB DETAILS**

### 5.5.3 LOWER COLUMN (BREAKAWAY TYPE)




- Note that friction plates shall be fabricated perpendicular to the longitudinal axis of the column.
- Obtain length from Standard Drawing SS118-30 in contract.

| COLUMN SIZE | A (mm) | B (mm) |
|---|---|---|
| W200x42 | 43 | 80 |
| W200x46 | 52 | 100 |
| W200x59 | 53 | 100 |

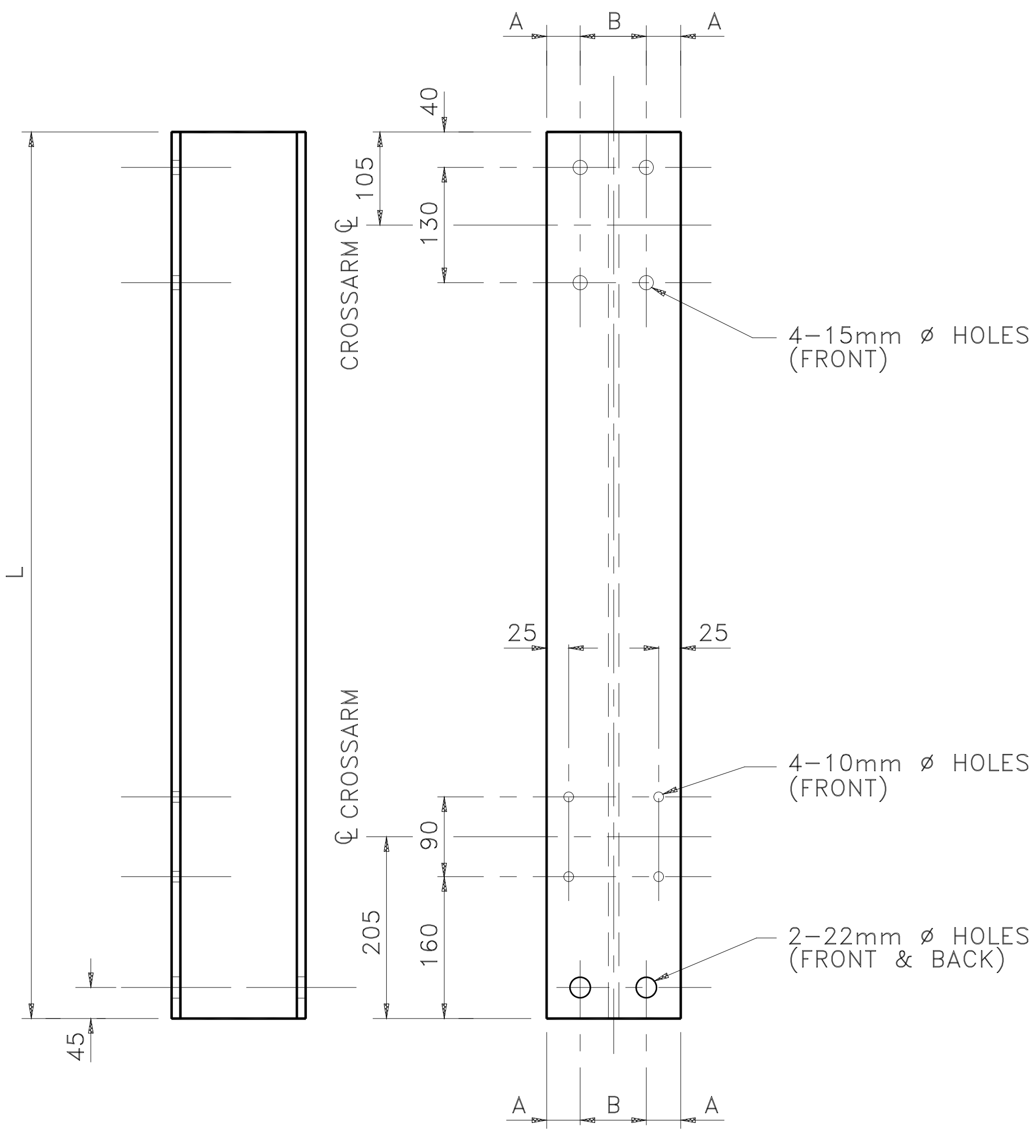
**FIGURE 5.5.3 LOWER COLUMN DETAILS**

NOTE:

- For Details of Stiffener, Friction Plate, and Bolt Keeper Plate, see Figure 5.510.
- Bolt Keeper Plate shall be located between the Column Stub and Lower Column.

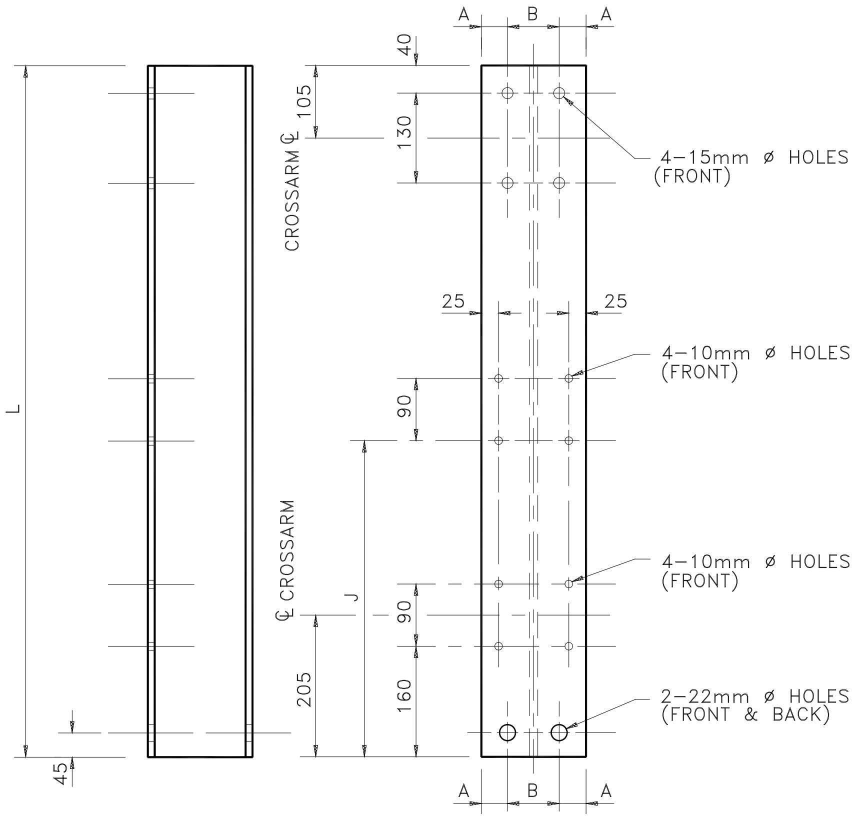
### 5.5.4 UPPER COLUMN (BREAKAWAY TYPE)

Figures 5.5.4(a) to 5.5.4(c) provide all information necessary for fabrication of the "Upper Columns".



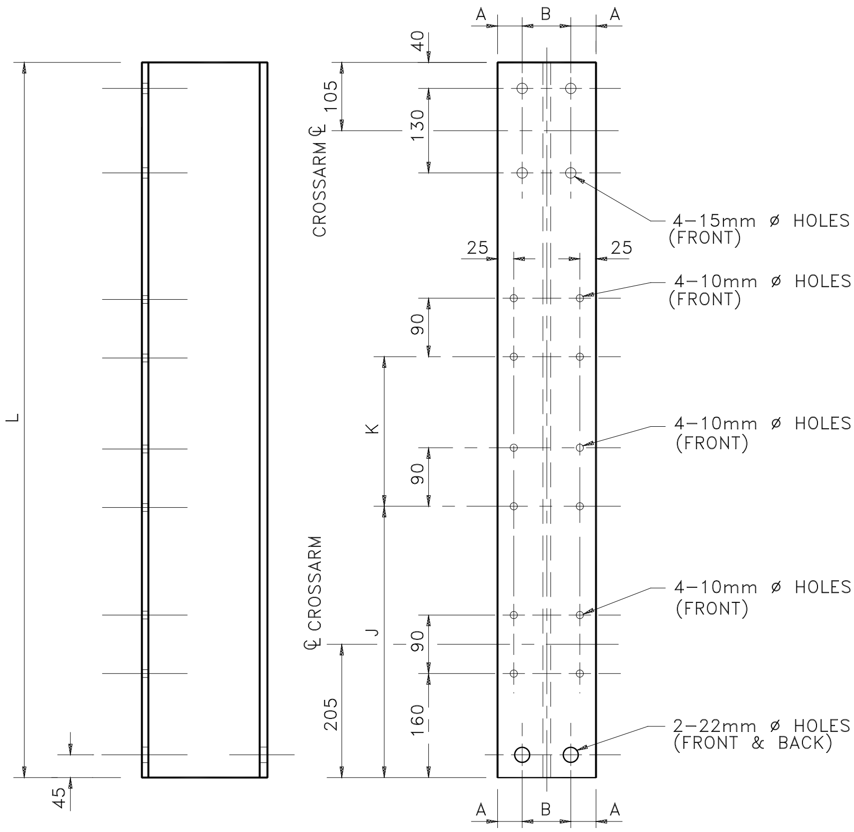

| COLUMN SIZE | L (mm) | A (mm) | B (mm) |
|---|---|---|---|
| W200X42 | 1050 | 43 | 80 |
| W200X42 | 1150 | 43 | 80 |
| W200X42 | 1300 | 43 | 80 |
| W200X46 | 1150 | 52 | 100 |
| W200X46 | 1300 | 52 | 100 |
| W200X59 | 1300 | 53 | 100 |

**FIGURE 5.5.4 (a) UPPER COLUMN DETAILS (2 CROSSARMS)**




| COLUMN SIZE | L (mm) | J (mm) | A (mm) | B (mm) |
|---|---|---|---|---|
| W200X42 | 1520 | 765 | 43 | 80 |
| | 1750 | 880 | | |
| | 1850 | 930 | | |
| | 2040 | 1025 | | |
| | 2260 | 1135 | | |
| | 2450 | 1230 | | |
| W200X46 | 1520 | 765 | 52 | 100 |
| | 1750 | 880 | | |
| | 1850 | 930 | | |
| | 2040 | 1025 | | |
| | 2260 | 1135 | | |
| | 2450 | 1230 | | |
| W200X59 | 1520 | 765 | 53 | 100 |
| | 1750 | 880 | | |
| | 1850 | 930 | | |
| | 2040 | 1025 | | |
| | 2260 | 1135 | | |
| | 2450 | 1230 | | |

**FIGURE 5.5.4 (b) UPPER COLUMN DETAILS (3 CROSSARMS)**

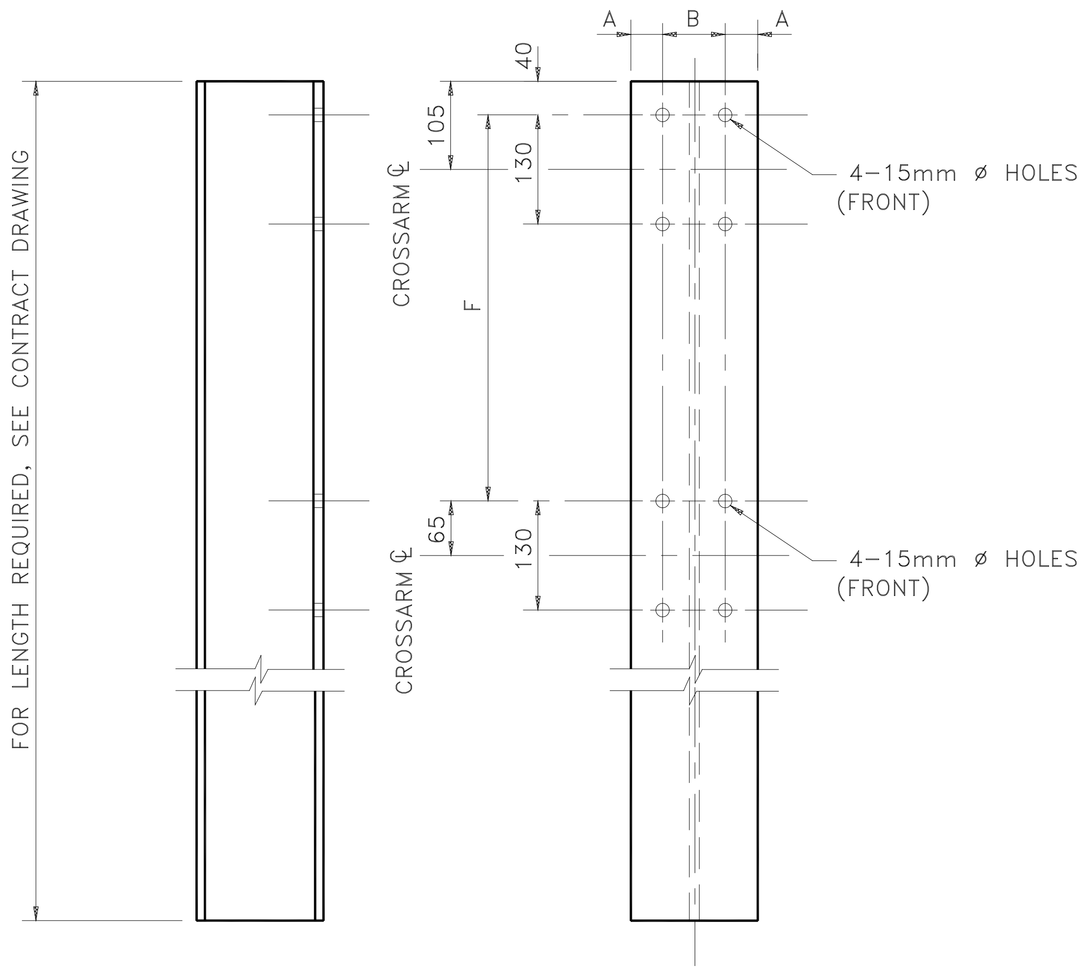



| COLUMN SIZE | L (mm) | J (mm) | K (mm) | A (mm) | B (mm) |
|---|---|---|---|---|---|
| W200X42 | 2110 | 760 | 600 | 43 | 80 |
| | 2260 | 810 | 650 | | |
| | 2410 | 860 | 700 | | |
| | 2560 | 910 | 750 | | |
| | 2710 | 960 | 800 | | |
| W200X46 | 2110 | 760 | 600 | 52 | 100 |
| | 2260 | 810 | 650 | | |
| | 2410 | 860 | 700 | | |
| | 2560 | 910 | 750 | | |
| | 2710 | 960 | 800 | | |
| W200X59 | 2110 | 760 | 600 | 53 | 100 |
| | 2260 | 810 | 650 | | |
| | 2410 | 860 | 700 | | |
| | 2560 | 910 | 750 | | |
| | 2710 | 960 | 800 | | |

**FIGURE 5.5.4 (c) UPPER COLUMN DETAILS (4 CROSSARMS)**

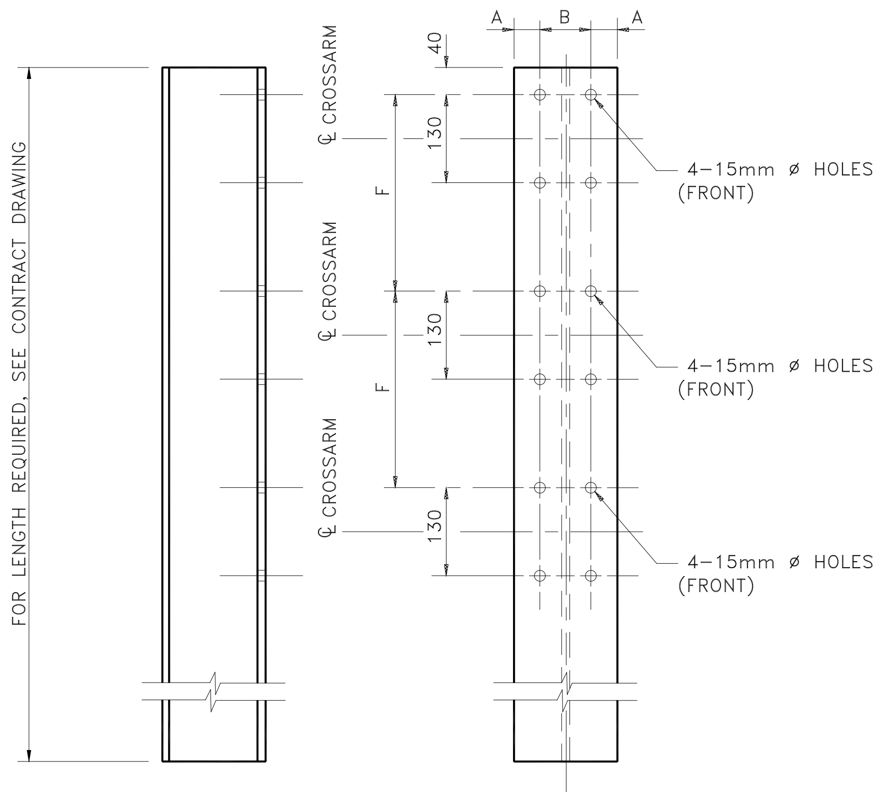
### 5.5.5 COLUMN (NON-BREAKAWAY TYPE)

Figures 5.5.5(a), (b) and (c) provide all information necessary to fabricate the columns for non-breakaway steel column sign supports.



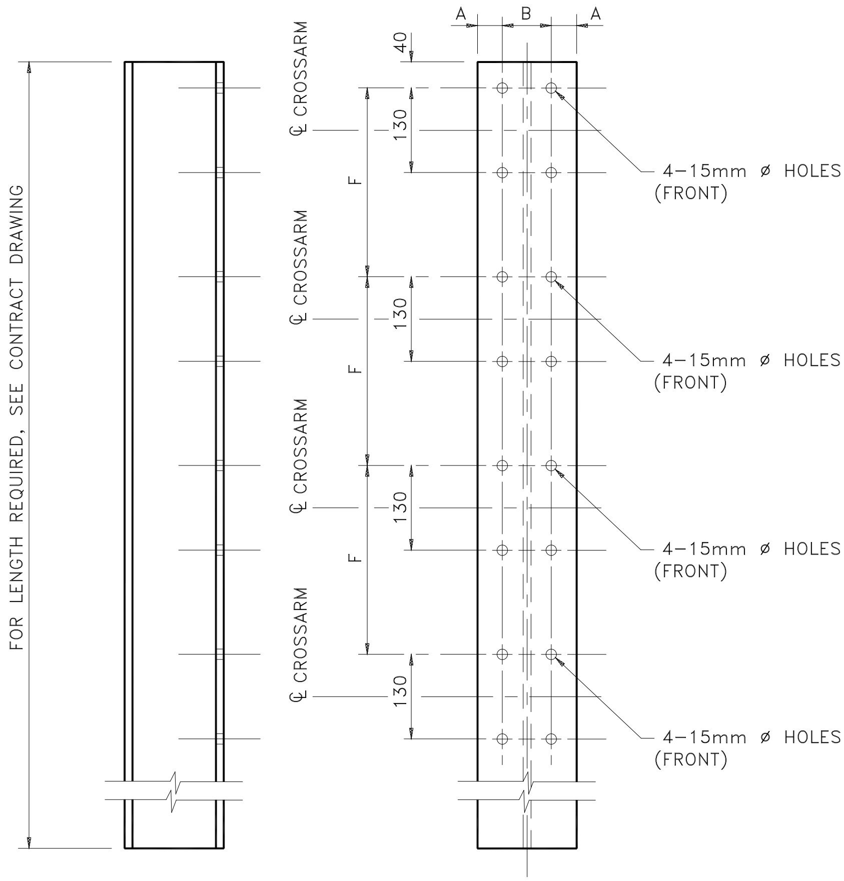

| COLUMN SIZE | F (mm) | A (mm) | B (mm) |
|---|---|---|---|
| W200X42 | 740 | 43 | 80 |
| | 840 | | |
| | 990 | | |
| W200X46 | 840 | 52 | 100 |
| | 990 | | |
| W200X59 | 840 | 53 | 100 |
| | 990 | | |

**FIGURE 5.5.5 (a) COLUMN DETAILS (2 CROSSARMS)**
**(NON-BREAKAWAY)**




| COLUMN SIZE | F (mm) | A (mm) | B (mm) |
|---|---|---|---|
| W200X42 | 605 | 43 | 80 |
| | 720 | | |
| | 770 | | |
| | 865 | | |
| | 975 | | |
| | 1070 | | |
| W200X46 | 605 | 52 | 100 |
| | 720 | | |
| | 770 | | |
| | 865 | | |
| | 975 | | |
| | 1070 | | |
| W200X59 | 605 | 53 | 100 |
| | 720 | | |
| | 770 | | |
| | 865 | | |
| | 975 | | |
| | 1070 | | |

**FIGURE 5.5.5(b) COLUMN DETAILS (3 CROSSARMS)**
**(NON-BREAKAWAY)**

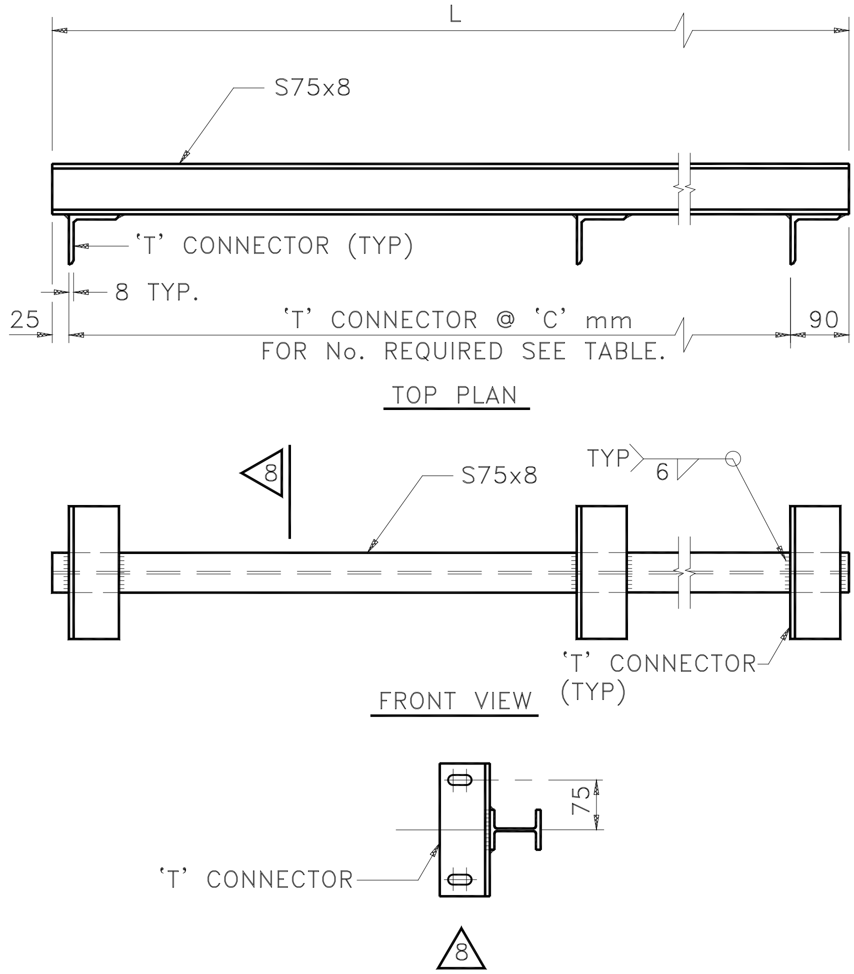



| COLUMN SIZE | F (mm) | A (mm) | B (mm) |
|---|---|---|---|
| W200X42 | 600 | 43 | 80 |
| | 650 | | |
| | 700 | | |
| | 750 | | |
| | 800 | | |
| W200X46 | 600 | 52 | 100 |
| | 650 | | |
| | 700 | | |
| | 750 | | |
| | 800 | | |
| W200X59 | 600 | 53 | 100 |
| | 650 | | |
| | 700 | | |
| | 750 | | |
| | 800 | | |

**FIGURE 5.5.5(c) COLUMN DETAILS (4 CROSSARMS)**
**(NON-BREAKAWAY)**

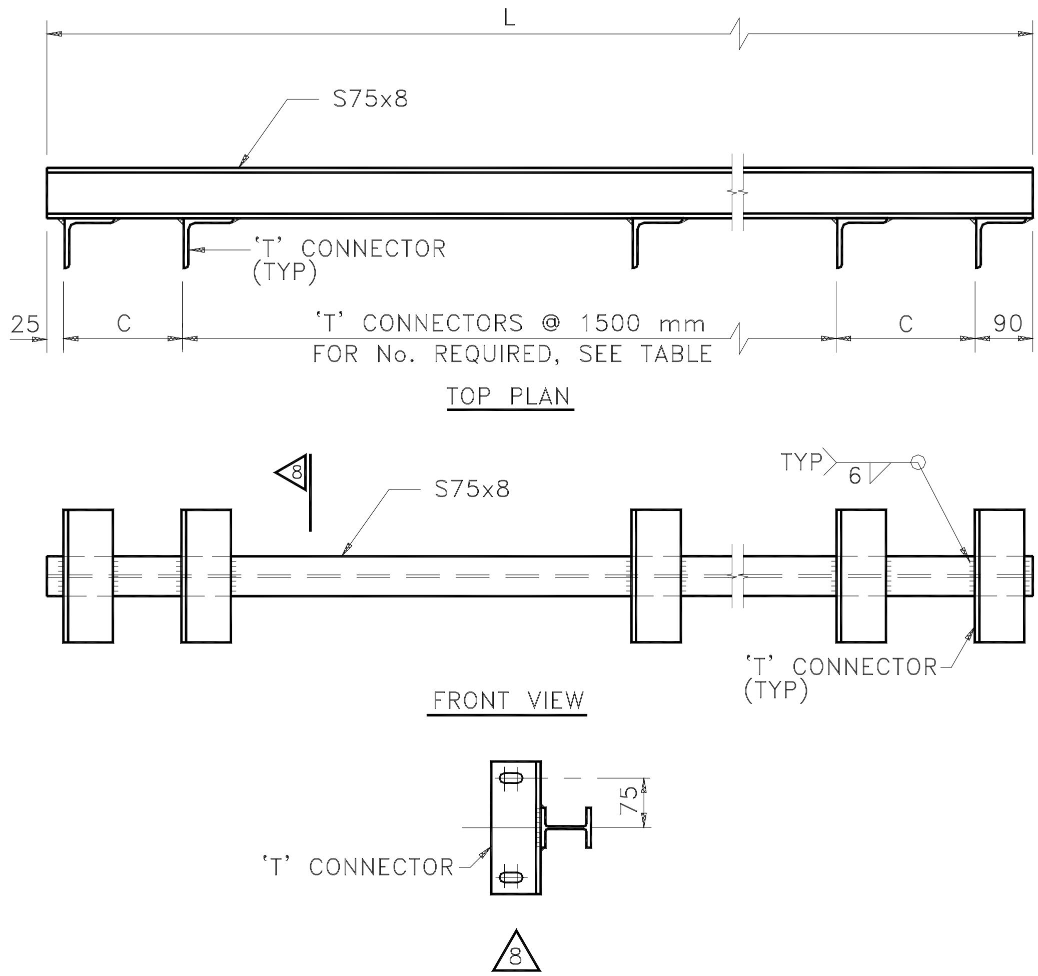
### 5.5.6 LOWER CROSSARM (BREAKAWAY TYPE)

Figures 5.5.6(a) and 5.5.6(b) provide all information necessary for the fabrication of the "Lower Crossarms".




| NO. OF T CONNECTORS REQ'D | L (mm) | C (mm) |
|---|---|---|
| 3 | 3115 | 1500 |
| 4 | 4615 | 1500 |
| 5 | 6115 | 1500 |

**FIGURE 5.5.6 (a) LOWER CROSSARM DETAILS - REGULAR TYPE**

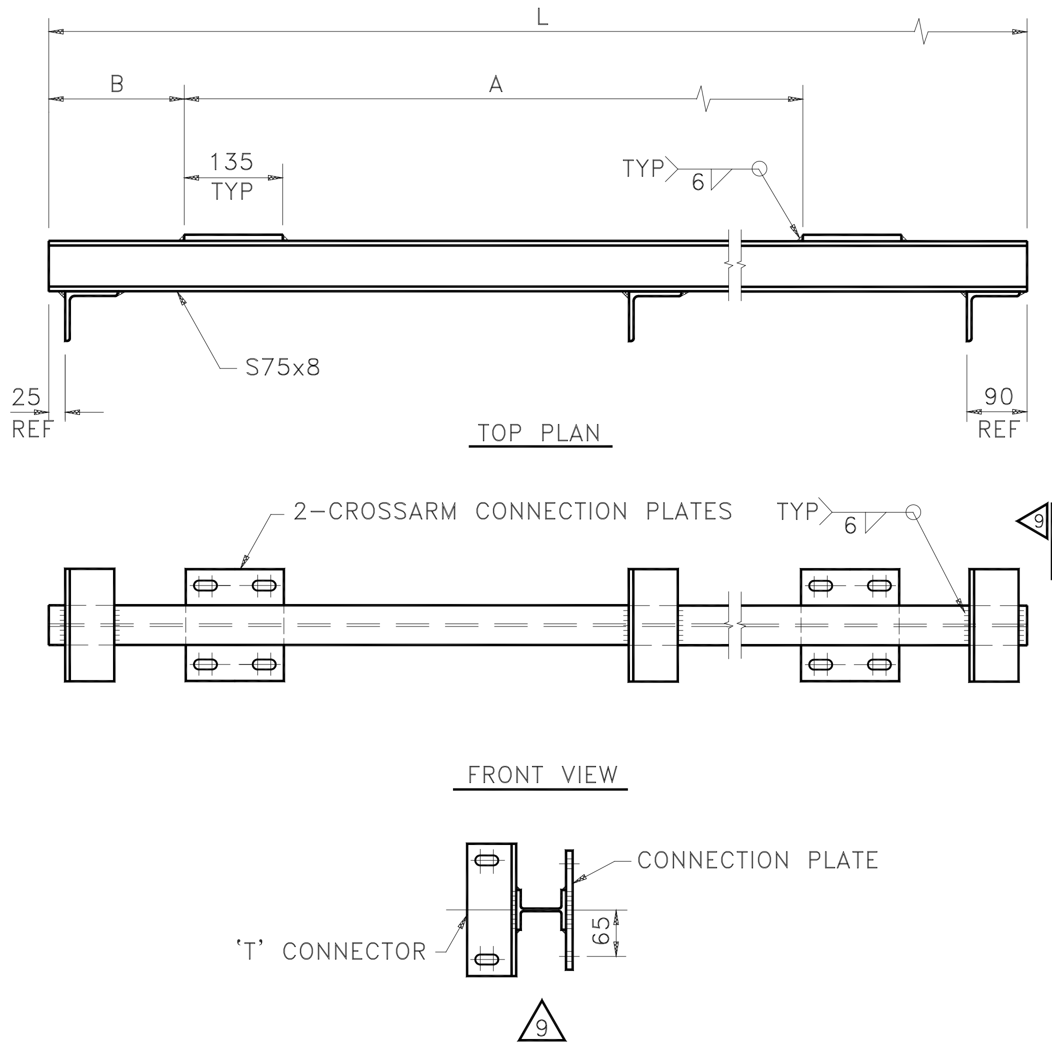



| NO. OF T CONNECTORS REQ'D | L (mm) | C (mm) |
|---|---|---|
| 4 | 2915 | 650 |
| 5 | 3915 | 400 |
| 6 | 5315 | 350 |
| 7 | 6915 | 400 |
| 8 | 7715 | 800 |

**FIGURE 5.5.6 (b) LOWER CROSSARM DETAILS - EXTENDED TYPE**

### 5.5.7 TOP CROSSARM OR CROSSARM

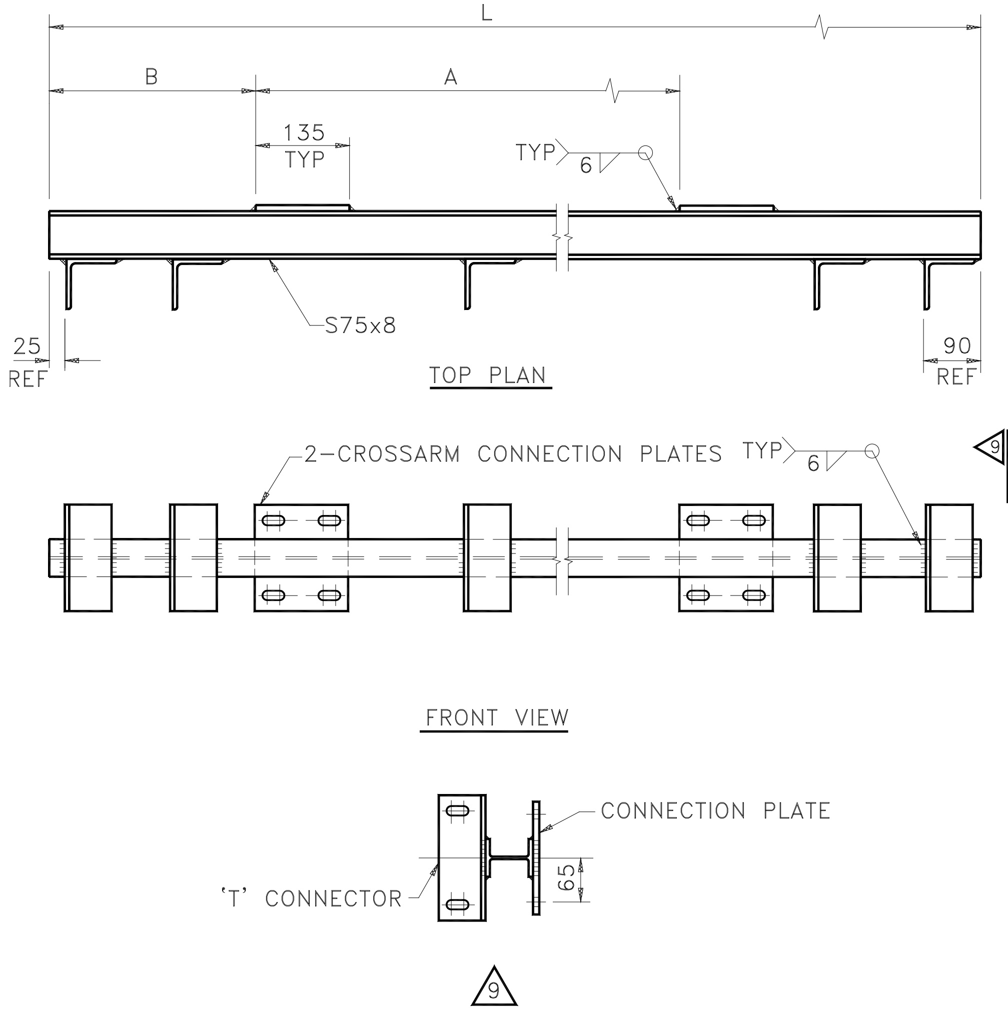
Figures 5.5.7(a) to 5.5.7(e) provide all information necessary for the fabrication of the "Top Crossarm" for breakaway type or "Crossarm" for non-breakaway type.




| A (mm) | L (mm) | B (mm) |
|---|---|---|
| 2300 | 3115 | 300 |
| 3000 | 4615 | 700 |

**FIGURE 5.5.7(a) TOP CROSSARM OR CROSSARM DETAILS (REGULAR)**
(Two connection plates)

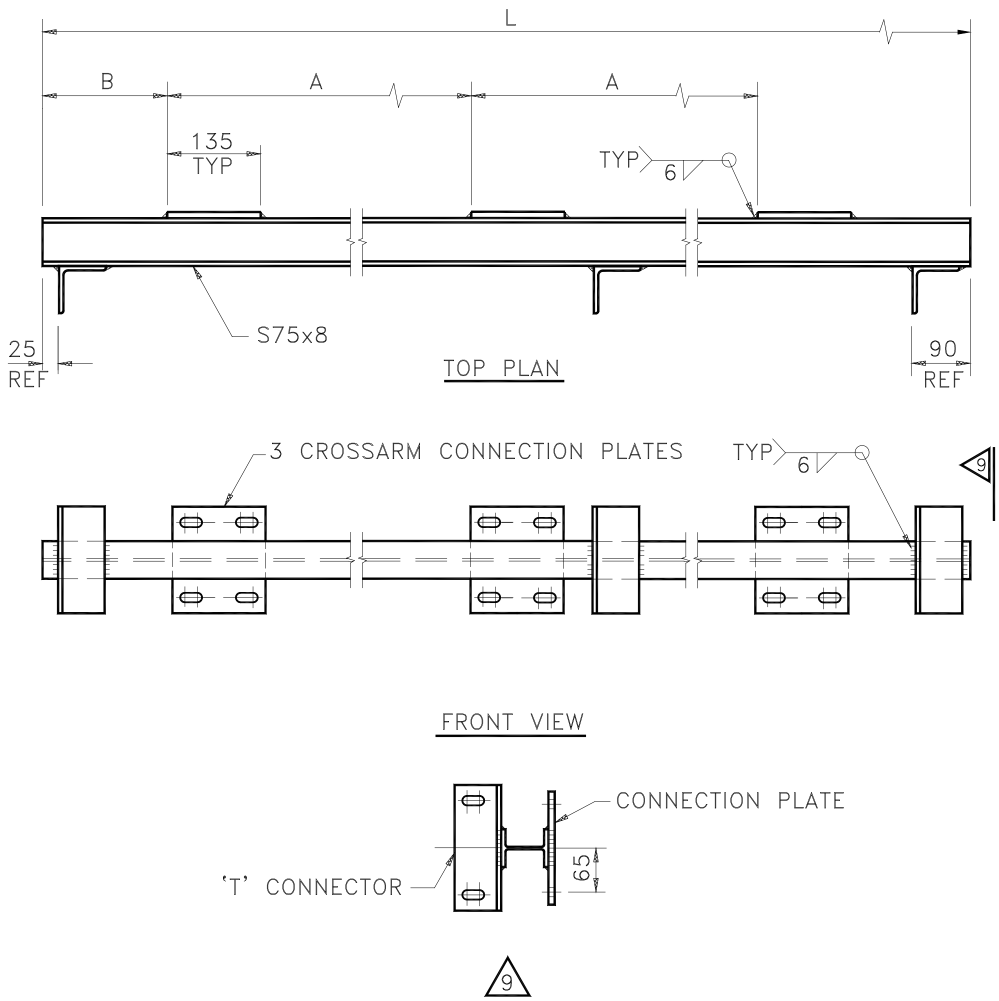
- For 2 – Column Sign Supports (ie. Type 2-2 and 2-3)
- A = Column Spacing
- L = [Sign Width – 2H + 115]
- B = [Sign Horizontal Overhang – (H-20) – 135/2]
- H = Lateral sign overhang beyond end T-Connection




| A (mm) | L (mm) | B (mm) |
|---|---|---|
| 2300 | 2915 | 200 |
| 2400 | 3915 | 650 |
| 2700 | 3915 | 500 |

**FIGURE 5.5.7(b) TOP CROSSARM OR CROSSARM DETAILS (EXTENDED)**
(Two connection plates)

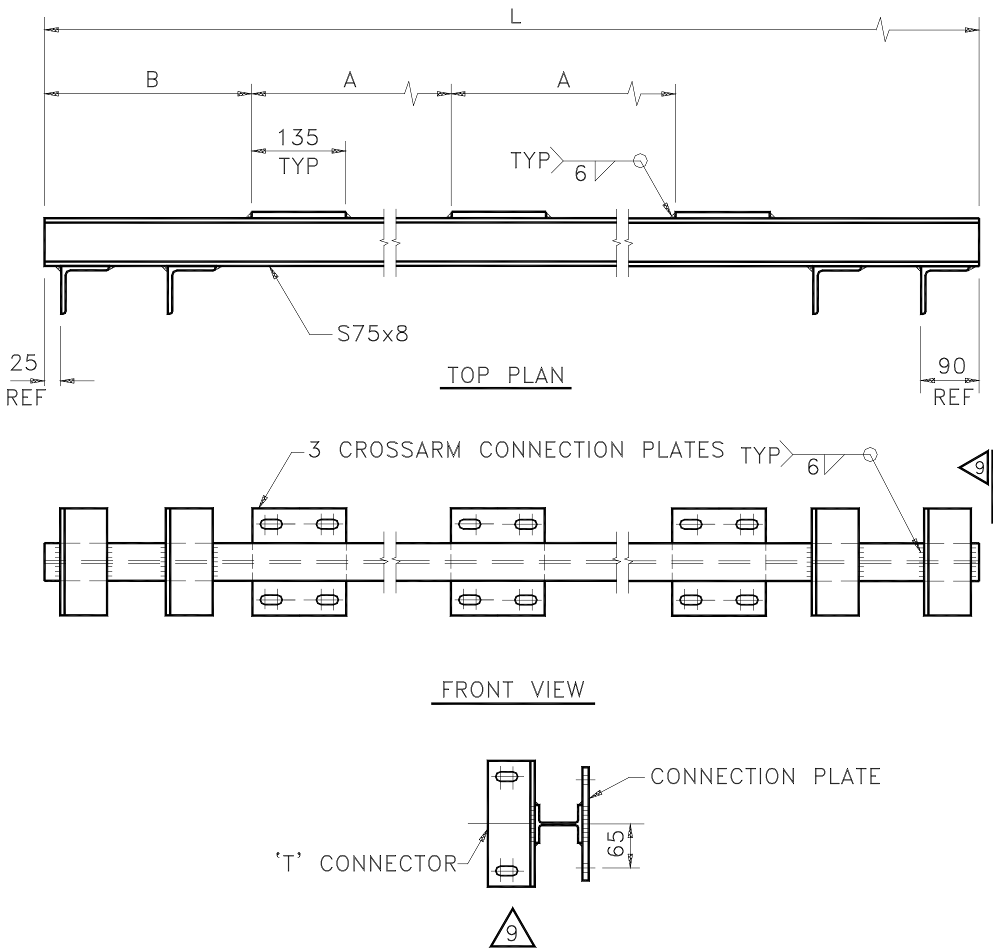
- For 2 – Column Sign Supports (ie. Type 2-2 and 2-3)
- A = Column Spacing
- L = [Sign Width – 2H + 115]
- B = [Sign Horizontal Overhang – (H-20) – 135/2]
- H = Lateral sign overhang beyond end T-Connection




| A (mm) | L (mm) | B (mm) |
|---|---|---|
| 2400 | 6115 | 550 |
| 2700 | 6115 | 250 |

**FIGURE 5.5.7(c) TOP CROSSARM OR CROSSARM DETAILS (REGULAR)**
(Three connection plates)

- For 3– Column Sign Supports (ie. Type 3-2, 3-3 and 3-4)
- A = Column Spacing
- L = [Sign Width – 2H + 115]
- B = [Sign Horizontal Overhang – (H-20) – 135/2]
- H = Lateral sign overhang beyond end T-Connection




| A (mm) | L (mm) | B (mm) |
|---|---|---|
| 2300 | 5315 | 250 |
| 2900 | 6915 | 450 |
| 3000 | 7715 | 750 |

**FIGURE 5.5.7(d) TOP CROSSARM OR CROSSARM DETAILS (EXTENDED)**

(Three connection plates)

- For 3– Column Sign Supports (ie. Type 3-2, 3-3 and 3-4)
- A = Column Spacing
- L = [Sign Width – 2H + 115]
- B = [Sign Horizontal Overhang – (H-20) – 135/2]
- H = Lateral sign overhang beyond end T-Connection

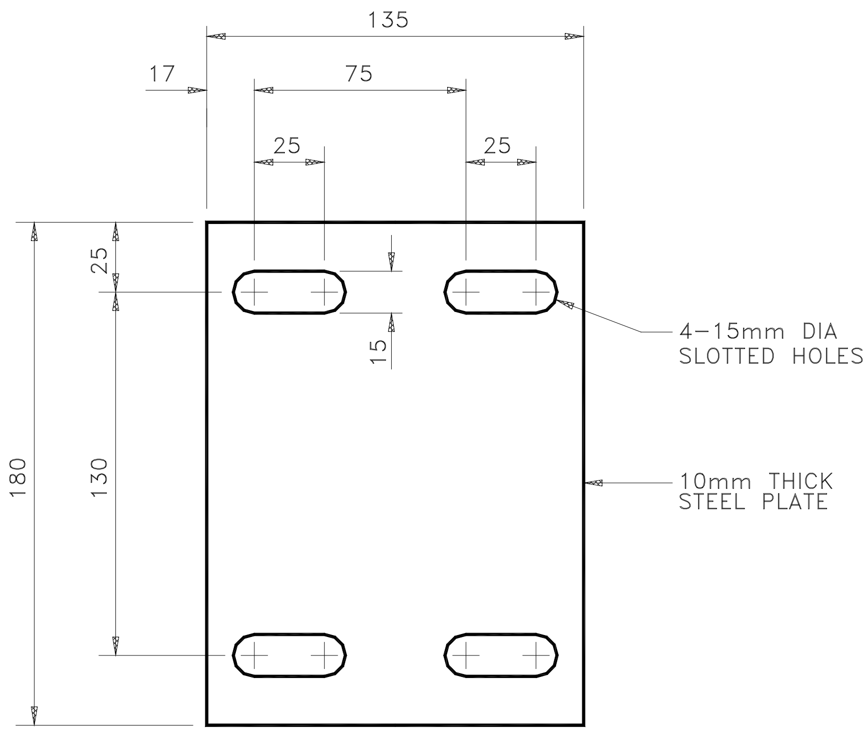



**FIGURE 5.5.7 (e) CROSSARM CONNECTION PLATE DETAILS**

### 5.5.8 "T" CONNECTOR AND BRASS SHIM

Figure 5.5.8(a) provides all information necessary for fabrication of the "T" connectors used for the upper and lower crossarms (for Breakaway and Non-Breakaway sign supports).

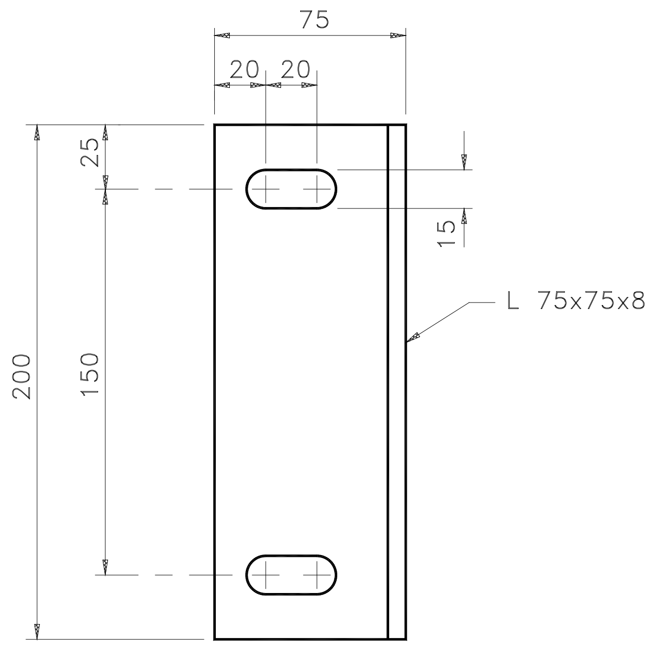



**FIGURE 5.5.8(a) T-CONNECTOR**

Figure 5.5.8(b) details the "Brass Shims" used to shim the friction plates (for Breakaway sign supports).

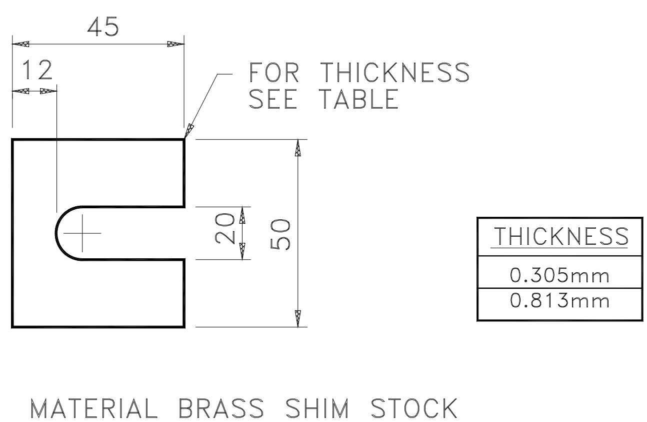
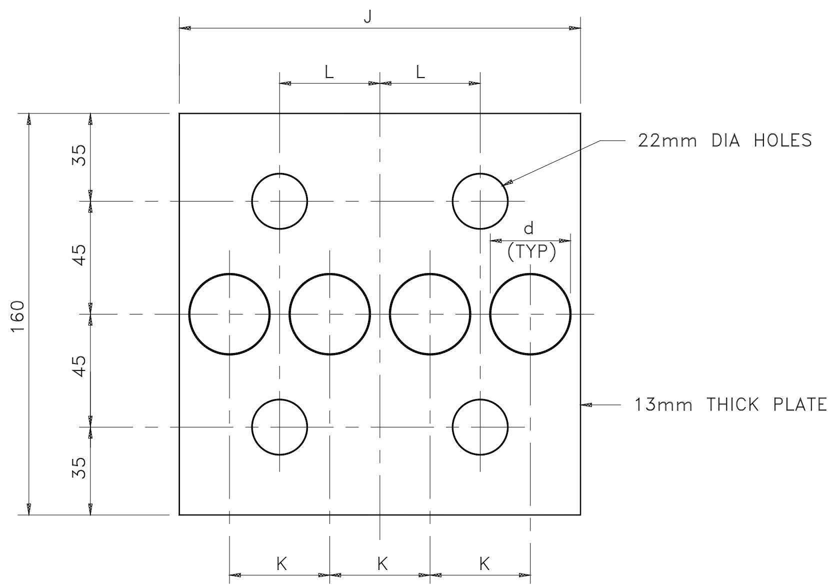



**FIGURE 5.5.8(b) SHIM**

## 5.5.9 FUSE PLATES (BREAKAWAY TYPE)

Figure 5.5.9 provides the information necessary to fabricate the Front and Back Fuse Plates.

Note: Front and back fuse plates are identical.

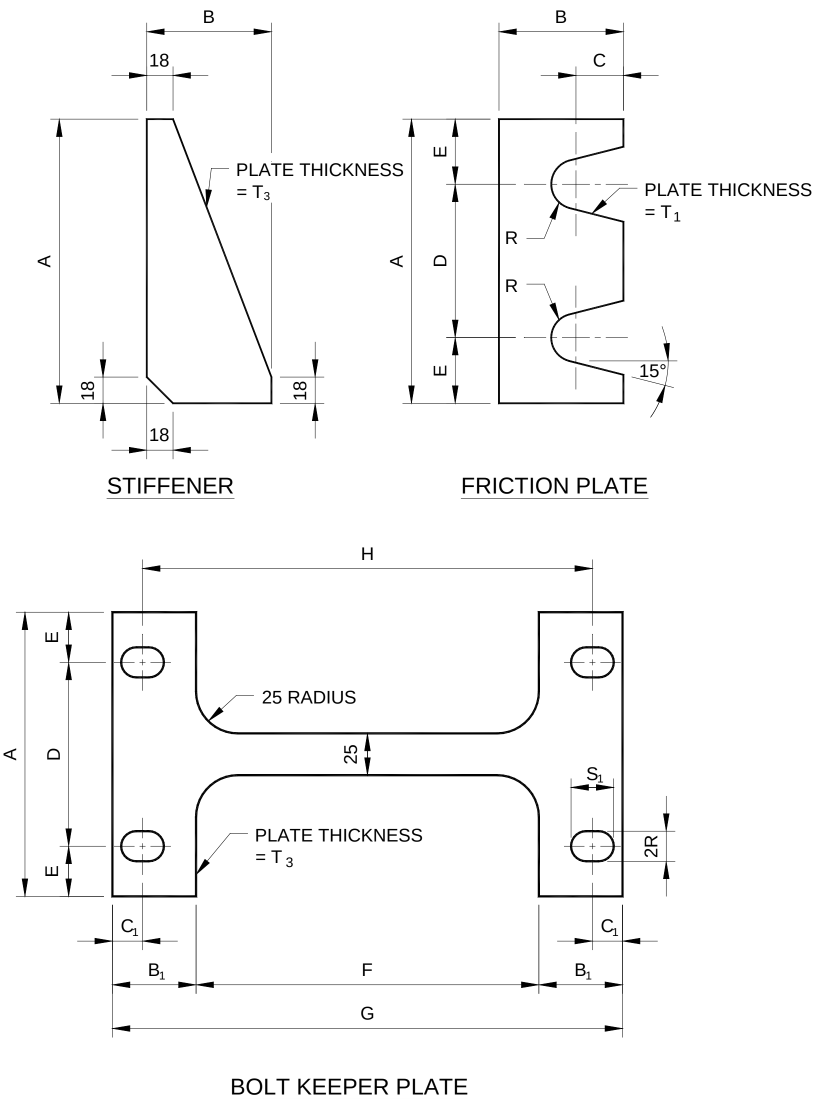



| | J | K | L | d |
|---|---|---|---|---|
| W200x42 | 160 | 40 | 40 | 32 |
| W200x46<br>W200x59 | 200 | 50 | 50 | 42 |

**FIGURE 5.5.9 FRONT AND BACK FUSE PLATE DETAILS**

## 5.5.10 FRICTION PLATE, STIFFENERS, AND BOLT KEEPER PLATE (BREAKAWAY TYPE)

Figure 5.5.10 provides details for the fabrication of the Friction Plates, Stiffener Plates, and Bolt Keeper Plates.




| COLUMN SIZE | A | B | $B_1$ | C | $C_1$ | D | E | F | G | H | R | $S_1$ | $T_1$ | $T_2$ | $T_3$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| W200x42 | 170 | 50 | 60 | 18 | 28 | 110 | 30 | 205 | 325 | 269 | 9 | 28 | 20 | 15 | 0.31 |
| W200x46 | 200 | 60 | 70 | 18 | 28 | 140 | 30 | 203 | 343 | 287 | 9 | 28 | 25 | 20 | 0.31 |
| W200x59 | 200 | 60 | 70 | 22 | 32 | 140 | 30 | 210 | 350 | 286 | 11 | 32 | 25 | 20 | 0.31 |

**FIGURE 5.5.10 FRICTION PLATE, STIFFENER, AND BOLT KEEPER PLATE DETAILS**

### 5.5.11 ALUMINUM CLAMP (BREAKAWAY TYPE)

The aluminum clamp shown in Figure 5.5.11 is used to connect the lower croassarm to the upper column. (Depending on the Type, each sign support upper column may have 1, 2, or 3 lower crossarm connections.)

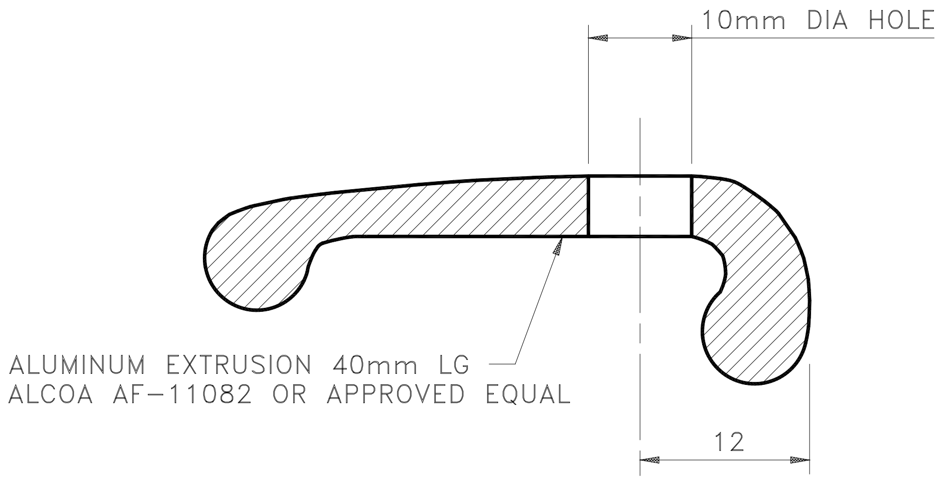



**FIGURE 5.5.11 CLAMP DETAILS**

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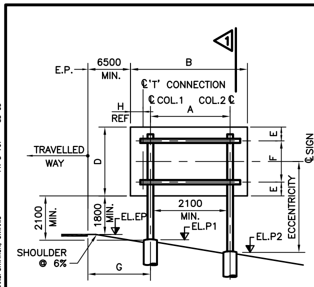
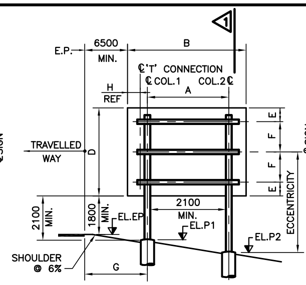
# METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

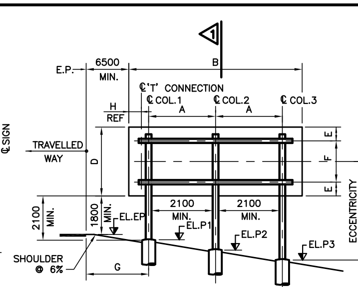
| | |
|---|---|
| CONT No<br>WP No | SHEET |
| STEEL COLUMN<br>BREAKAWAY SIGN SUPPORTS | |



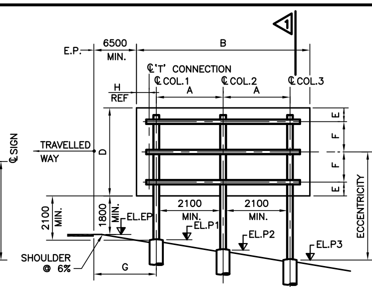

TYPE 2-2



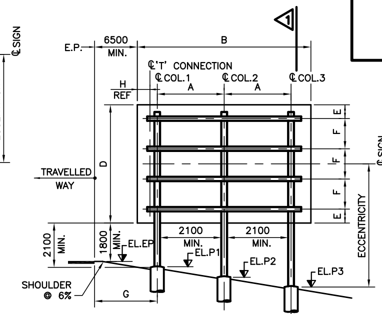

TYPE 2-3




TYPE 3-2




TYPE 3-3

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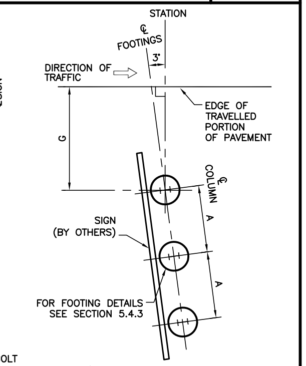
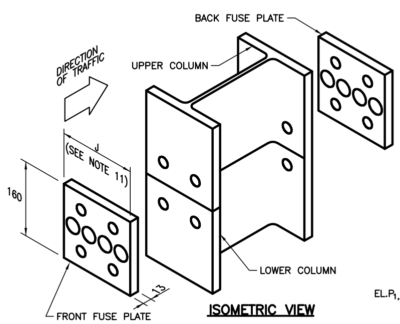
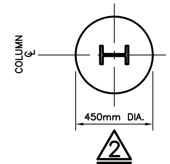


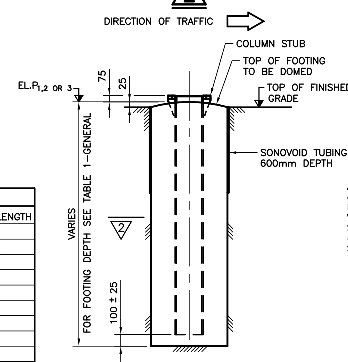

TYPICAL LAYOUT PLAN




ISOMETRIC VIEW

PERFORATED FUSE PLATE CONNECTION




FOOTING DETAILS

## TABLE 1 – GENERAL

| STATION | | | | | |
|---|---|---|---|---|---|
| SIGN No. | | | | | |
| SIGN SIZE (DxB) | | | | | |
| TYPE | | | | | |
| EL.EP | | | | | |
| $EL.P_1$ | | | | | |
| $EL.P_2$ | | | | | |
| $EL.P_3$ | | | | | |
| A | | | | | |
| E | | | | | |
| F | | | | | |
| G | | | | | |
| H | | | | | |
| COLUMN SIZE | | | | | |
| FRICTION PLATE CONNECTION PRETIGHTENING TORQUE (N.m) | | | | | |
| FOOTING DEPTH | | | | | |
| CONCRETE IN FOOTINGS ($m^3$) | | | | | |

## TABLE 2 – COMPONENTS/PARTS

| STATION | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| DESCRIPTION | SIZE | QUANT./LENGTH | SIZE | QUANT./LENGTH | SIZE | QUANT./LENGTH | SIZE | QUANT./LENGTH | SIZE | QUANT./LENGTH |
| COLUMN STUB | | | | | | | | | | |
| LOWER COLUMN No.1 | | | | | | | | | | |
| LOWER COLUMN No.2 | | | | | | | | | | |
| LOWER COLUMN No.3 | | | | | | | | | | |
| UPPER COLUMNS | | | | | | | | | | |
| LOWER CROSSARM(S) | | | | | | | | | | |
| TOP CROSSARM | | | | | | | | | | |
| BRASS SHIMS t = 0.305 | | | | | | | | | | |
| BRASS SHIMS t = 0.813 | | | | | | | | | | |
| FRONT FUSE PLATE | | | | | | | | | | |
| BACK FUSE PLATE | | | | | | | | | | |
| ALUMINUM CLAMP | | | | | | | | | | |

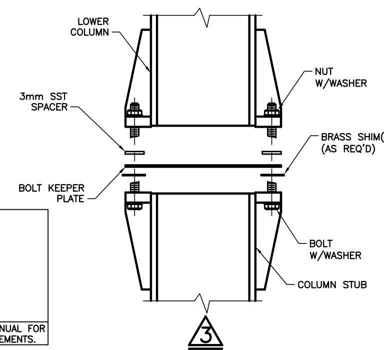
## TABLE 3 – HARDWARE (ASTM A325 GALV)

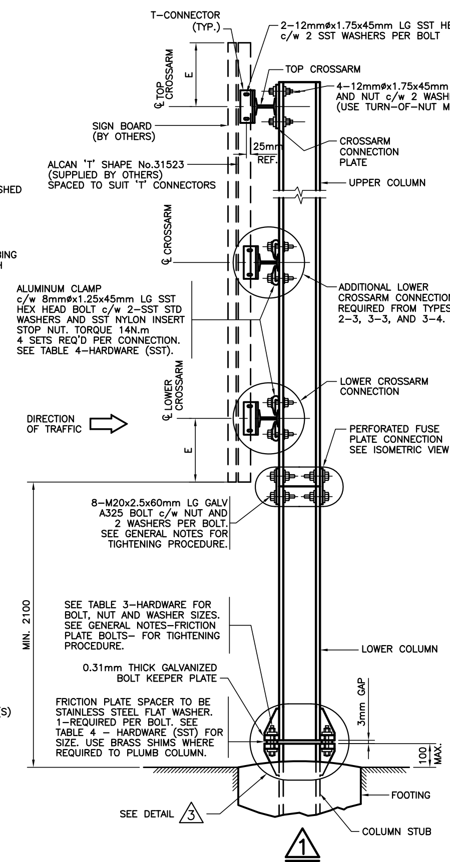
| STATION | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| DESCRIPTION | SIZE | QUANT. | SIZE | QUANT. | SIZE | QUANT. | SIZE | QUANT. | SIZE | QUANT. |
| TOP CROSSARM BOLTS | 12mmx1.75x45mmLG | | 12mmx1.75x45mmLG | | 12mmx1.75x45mmLG | | 12mmx1.75x45mmLG | | 12mmx1.75x45mmLG | |
| FUSE PLATE BOLTS | M20x60mmLG | | M20x60mmLG | | M20x60mmLG | | M20x60mmLG | | M20x60mmLG | |
| FRICTION PLATE BOLTS | | | | | | | | | | |
| FRICTION PLATE WASHERS | | | | | | | | | | |

## TABLE 4 – HARDWARE (SST)

| STATION | | | | | | DESCRIPTION |
|---|---|---|---|---|---|---|
| | QUANT. | QUANT. | QUANT. | QUANT. | QUANT. | |
| LOWER CROSSARM CONNECTION | | | | | | 8mmø x1.25x45mm LG THREADED LENGTH 25mm SST HEX. HD. BOLT |
| | | | | | | 8mmø SST STD FLAT WASHER |
| | | | | | | 8mmø x1.25 SST NYLON INSERT STOP NUT |
| FRICTION ℙ SPACER | | | | | | SST 37 O.D.x21 I.D.x3mm THK |
| T-CONNECTOR TO 'T' SHAPE CONNECTION | | | | | | 12mmø x1.75x45mm LG SST HEX. HD. BOLT |
| | | | | | | 12mmø SST FLAT WASHER |

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




DRAWING NOT TO BE SCALED
100mm ON ORIGINAL DRAWING

## NOTES

1. ALL STRUCTURAL STEEL SHALL CONFORM TO CAN/CSA G40.20-04/G40.21-04 GRADE 300W.
2. ALL BOLTS, NUTS, AND WASHERS EXCEPT LOWER CROSSARM CONNECTIONS SHALL CONFORM TO ASTM A325 AND BE HOT DIP GALVANIZED.
3. ALL STEEL SHALL BE HOT-DIP GALVANIZED AFTER FABRICATION.
4. THE PROCEDURE FOR TIGHTENING BOLTS SHALL BE AS FOLLOWS:
   (A) FRICTION PLATE BOLTS
   - ASSEMBLE COLUMN TO STUB WITH GALVANIZED BOLTS AND WITH TWO GALVANIZED WASHERS PLUS ONE FLAT SST WASHER ON EACH BOLT BETWEEN PLATES, AND GALVANIZED BOLT KEEPER PLATE ON BOTTOM FRICTION PLATE, USING BRASS SHIMS AS REQUIRED TO PLUMB COLUMN.
   - TIGHTEN BOLTS IN A SYSTEMATIC ORDER TO PRESCRIBED PRETIGHTENING TORQUE AS SPECIFIED IN TABLE 1-GENERAL.
   - LOOSEN EACH BOLT AND RETIGHTEN TO SPECIFIED TORQUE IN THE SAME ORDER AS INITIAL TIGHTENING. (DO NOT OVER TIGHTEN)

   (B) FUSE PLATE BOLTS
   - TIGHTEN BOLTS IN A SYSTEMATIC ORDER TO A SNUG-TIGHT CONDITION.
   - CONTINUE TO FURTHER TIGHTEN EACH BOLT, IN THE SAME ORDER AS THE INITIAL TIGHTENING, BY 1/3 TURN OF NUT.
5. CLASS OF CONCRETE TO BE 30 MPa.
6. CONCRETE TO BE PLACED AGAINST UNDISTURBED GROUND IN AUGURED HOLE.
7. THE FRICTION PLATE ATOP THE VERTICALLY POSITIONED COLUMN STUB SHALL BE INSTALLED DEAD LEVEL AND HELD IN THE CORRECT POSITION AND ELEVATION WITH A TEMPLATE, UNTIL THE CONCRETE HAS PROPERLY SET.
8. TOP SURFACE OF FOOTING SHALL BE DOMED.
9. FRICTION PLATE AND FUSE PLATE BOLT THREADS TO BE BURRED AT JUNCTION WITH NUT USING CENTRE PUNCH.
10. $EL.P_1$, $EL.P_2$ OR $EL.P_3$ DENOTES ELEVATION OF TOP OF FOOTING CONCRETE.
11. FOR DETAILS OF PARTS SEE FABRICATION INFORMATION IN SIGN SUPPORT MANUAL, SECTION 5.5-FABRICATION.
12. UPPER AND LOWER COLUMNS SHALL NOT BE ERECTED UNTIL 7 DAYS AFTER CONCRETE HAS BEEN PLACED.
13. THE USE OF BRASS SHIMS SHALL BE LIMITED TO A TOTAL THICKNESS OF 5mm, FOR PERFECTLY PLUMBING THE LOWER COLUMN. IF THIS CANNOT BE ACCOMPLISHED, THE FOOTING WITH THAT COLUMN STUB SHALL BE REJECTED.
14. THE ALIGNMENT OF THE CENTRELINES OF FOOTINGS, AND THE LOCATION OF THE STUB WITH RESPECT TO THE CENTRE OF THE FOOTINGS AND THE C/C OF COLUMNS ('A'-DIMENSION) SHALL BE AS REQUIRED BY OPSS 915.

| STANDARD DRAWING<br>JULY 2014 | SS118-30 |
|---|---|
| STEEL COLUMN<br>BREAKAWAY SIGN SUPPORTS | |

| REVISIONS | | | | | |
|---|---|---|---|---|---|
| | | | DESCRIPTION | | |
| DESIGN | CHK | CODE CHBDC-00 | LOAD | | DATE |
| DRAWN | CHK | SITE | | | DWG |

DRAWING NAME: s118-30 July 2014.dwg MODIFIED: 2014/07/16 16:49:48
CREATED: 1998/03/13

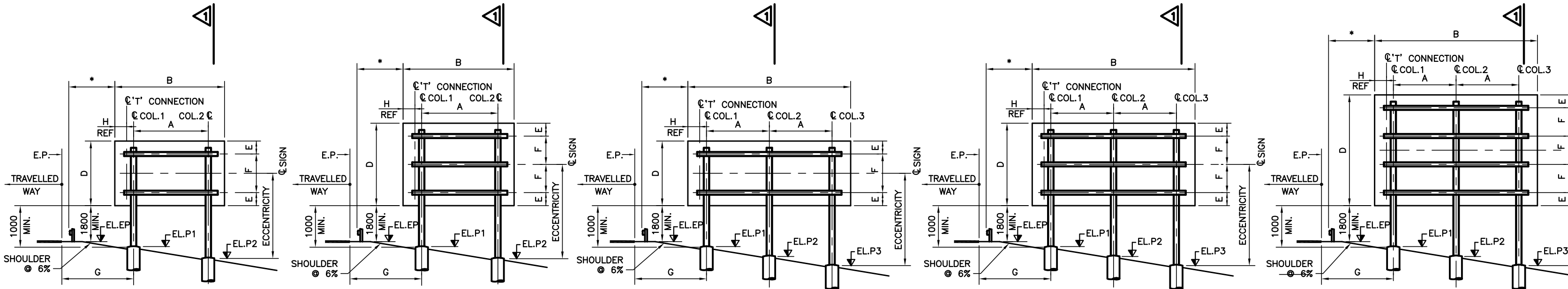
# METRIC
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

DIST
CONT
WP

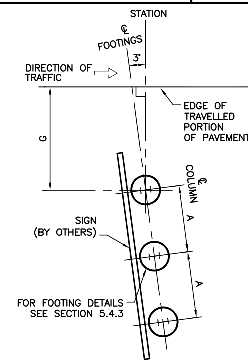
SHEET

STEEL COLUMN NON-BREAKAWAY SIGN SUPPORTS

* – DIMENSION VAIRES, AND SHALL BE ACCORDING TO THE REQUIREMENTS OF THE ROADSIDE SAFETY MANUAL.




TYPE 2–2 TYPE 2–3 TYPE 3–2 TYPE 3–3 TYPE 3–4



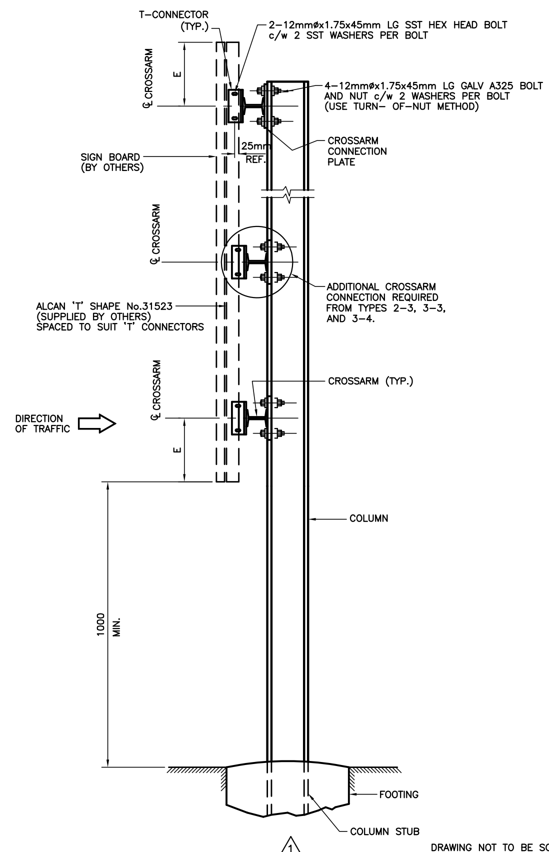

TYPICAL LAYOUT PLAN

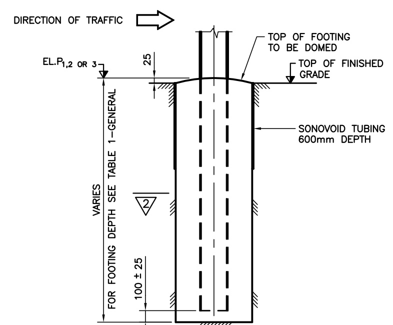
TABLE 1 – GENERAL

| | | | | | |
|---|---|---|---|---|---|
| STATION | | | | | |
| SIGN No. | | | | | |
| SIGN SIZE (DxB) | | | | | |
| TYPE | | | | | |
| EL.EP | | | | | |
| $EL.P_1$ | | | | | |
| $EL.P_2$ | | | | | |
| $EL.P_3$ | | | | | |
| A | | | | | |
| E | | | | | |
| F | | | | | |
| G | | | | | |
| H | | | | | |
| COLUMN SIZE | | | | | |
| FOOTING DEPTH | | | | | |
| CONCRETE IN FOOTINGS ($m^3$) | | | | | |

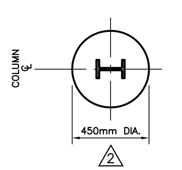
TABLE 2 – COMPONENTS/PARTS

| STATION | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| COMPONENT | SIZE | QUANT./LENGTH | SIZE | QUANT./LENGTH | SIZE | QUANT./LENGTH | SIZE | QUANT./LENGTH | SIZE | QUANT./LENGTH |
| CROSSARM | | | | | | | | | | |
| COLUMN No.1 | | | | | | | | | | |
| COLUMN No.2 | | | | | | | | | | |
| COLUMN No.3 | | | | | | | | | | |




FOOTING DETAILS




DIRECTION OF TRAFFIC

NOTES

1 ALL STRUCTURAL STEEL SHALL CONFORM TO CAN/CSA G40.20–04/G40.21–04 GRADE 300W AND HOT DIP GALVANIZED.
2 ALL BOLTS, NUTS AND WASHERS FOR CROSSARM CONNECTIONS SHALL CONFORM TO ASTM A325 AND BE HOT DIP GALVANIZED.
3 CLASS OF CONCRETE TO BE 30 MPa.
4 CONCRETE TO BE PLACED AGAINST UNDISTURBED GROUND IN AUGERED HOLE.
5 TOP SURFACE OF FOOTING SHALL BE DOMED.
6 $EL.P_1$, $EL.P_2$ OR $EL.P_3$ DENOTES ELEVATION OF TOP OF FOOTING CONCRETE.
7 FOR DETAILS OF PARTS SEE FABRICATION INFORMATION IN SIGN SUPPORT MANUAL, SECTION 5.5–FABRICATION.
8 THE COLUMNS SHALL BE INSTALLED AND HELD IN CORRECT POSITION UNTIL THE CONCRETE HAS PROPERLY SET.
9 SIGN BOARD SHALL NOT BE ERECTED UNTIL 7 DAYS AFTER CONCRETE HAS BEEN PLACED.
10 FOR TURN–OF–NUT TIGHTENING METHOD, THE BOLTS SHALL BE FIRST BROUGHT TO A SNUG–TIGHT CONDITION, AND THEN FURTHER TIGHTENED BY 1/3 OF A TURN. SNUG–TIGHT IS THE TIGHTNESS ATTAINED BY THE FULL EFFORT OF A MAN USING A SPUD WRENCH.

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

| STANDARD DRAWING JULY 2014 | SS118–33 |
|---|---|
| STEEL COLUMN NON–BREAKAWAY SIGN SUPPORTS | |

DRAWING NOT TO BE SCALED 100mm ON ORIGINAL DRAWING

| REVISIONS | | | | |
|---|---|---|---|---|
| | | DESCRIPTION | | |
| DESIGN | CHK | CODE CHBDC–00 | LOAD | DATE |
| DRAWN | CHK | SITE | | DWG |


MINISTRY OF TRANSPORTATION, ONTARIO
PR–D–707 88–05
DRAWING NAME: s118–33 July 2014.dwg MODIFIED: 2014/07/16 16:50:22
CREATED: 1998/03/13

# SIGN SUPPORT MANUAL

## DIVISION 6 – TIMBER SIGN SUPPORTS

April 2015

# 6 TIMBER POST SIGN SUPPORTS

## 6.1 GENERAL

Timber Sign Supports that are currently covered under the Sign Support Manual will be, in the near future, the responsibility of the MTO Traffic Section. Until such time as the Traffic Office publishes its own structural requirements for these sign supports, the Sign Support Manual shall continue to be used.

### 6.1.1 STANDARD SIGN SUPPORTS

The design tables in this division cover sign sizes from 1200 mm x 2400 mm to 2700 mm x 6000 mm (2.88$m^2$ to 16.2$m^2$). For small ground mounted signs, design information may be found in the Highway Design Office Bulletin 2006 – "Small Ground Mounted Signs and Support Systems". The design information in this bulletin covers sign sizes of 1220 mm x 2440 mm (2.98$m^2$) and smaller.

The wood species specified in this manual are Douglas Fir and Jack Pine, which are the species suitable for preservative pressure treatment. Other species under the same species identification category as shown in Table 5.2.1.2 of CSA Standard 086 may be considered as an equivalent.

The design data is based on the requirements of the Canadian Highway Bridge Design Code (CAN/CSA-S6-06).

Timber posts not larger than 140 mm x 184 mm will meet the requirements of breakaway supports, if they have been provided with planes of weakness close to the ground line and near the lower edge of the sign, to facilitate failure by shearing and flexure respectively under impact loading. They are much less expensive than steel breakaway supports and should be seriously considered for the smaller sign sizes.

The design tables are intended to serve as a guide for the preparation of standard drawings SS118-34 (Timber Post Non-Breakaway Sign Supports) and SS118-35 (Timber Post Breakaway Sign Supports), which are shown on Figures 6.1.2(a) and 6.1.2(b). This division is intended for use in the preparation of contract drawings.

### 6.1.2 DESCRIPTION OF SIGN SUPPORTS

The supports consist of two, three or four timber posts embedded in augered holes, to which signs are connected by steel connector plates (2 per post). Layout and details are given on Figure 6.1.2(a) and 6.1.2(b).

In each post two horizontal holes are drilled along the centreline of post parallel to the sign board. These holes, which are located 100 mm and 450 mm above finished grade, are intended to reduce the resistance of the posts to shear at the location where the impact of an errant vehicle is likely to occur, without substantially reducing the resistance of the posts to the high bending moments induced at this location by wind forces.

A horizontal sawcut is provided on the front face of each post just below the lower connector plate. This sawcut is intended to reduce the resistance of the post to bending at that location, thus permitting the portion of the post below the sawcut to rotate about the sawcut after impact.
If splices are required for the posts due to available timber length limitations, they shall be provided just below the lower edge of sign panel.

Nominal post sizes used are 6x6 (140x140) and 6x8 (140x184) inches. In these sizes, availability is very limited for lengths over 16 feet (4880 mm). Since the posts are embedded in the ground and the required clearance under the sign is 1800 mm from edge of pavement elevation, most posts will require a splice due to length availability limitations. The type of splice shown is designed for relatively small bending moments near the lower edge of the sign and is therefore much weaker than the post which is designed for much larger bending moments at ground level.

It is imperative that the splices be located directly (100 mm) below the lower edge of the sign as shown on Figure 6.5.4(a) because:

(i) The splice is not strong enough to be used in a lower location.

(ii) The low bending resistance of the splice might tend to initiate the breakaway action of the post after impact.

(iii) The portion of the splice protruding below the sign must be minimized.

The connection of the posts to the signs is rigid in design and does not contribute to the breakaway function.

Due to the simplicity of timber support details and the ease with which members can be cut to required length, a parts-number system is not required.

### 6.1.3 LIMITATIONS

The lower strength of timber makes it a suitable material for support structures for a limited range of sign sizes. Supports for sign sizes larger than those listed in Table 6.2.2 should be designed in steel.

### 6.1.4 TYPES OF SUPPORTS

The two types of supports covered in this section are:

(a) Timber Post Breakaway Sign Supports (not protected from traffic).

(b) Timber Post Non-Breakaway Sign Supports (protected by traffic barrier).

The supports are divided into types according to the number of posts as follows:

Type II - 2 posts

Type III - 3 posts
Type IV - 4 posts

The type of support is determined by the size of the sign to be supported and by the permissible post height $H_{max}$ as described in Section 6.3.3.

Supports with single wooden posts (i.e. Type I) are not covered in this manual.

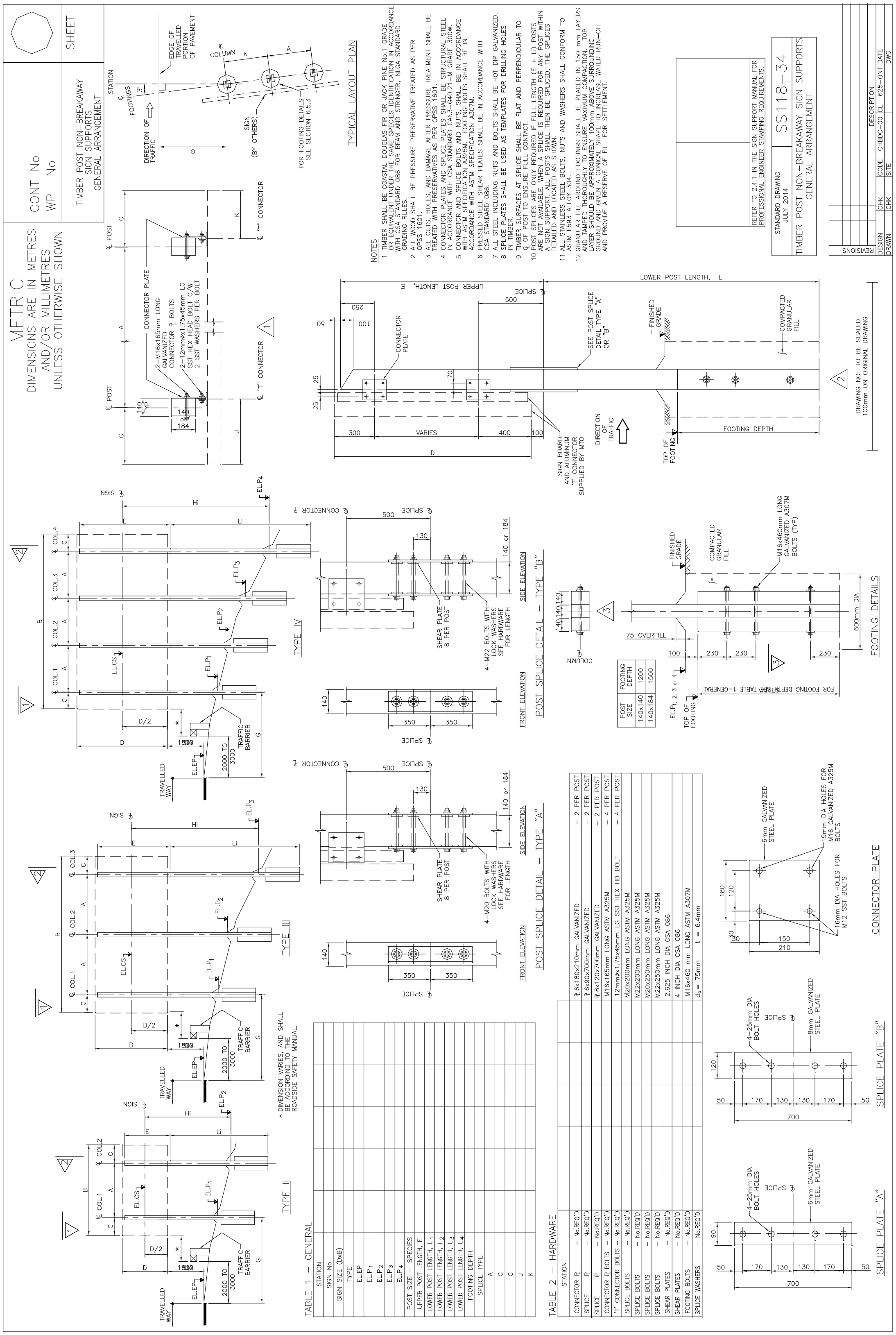



**FIGURE 6.1.2 (a) DETAILS OF NON-BREAKAWAY TYPE**

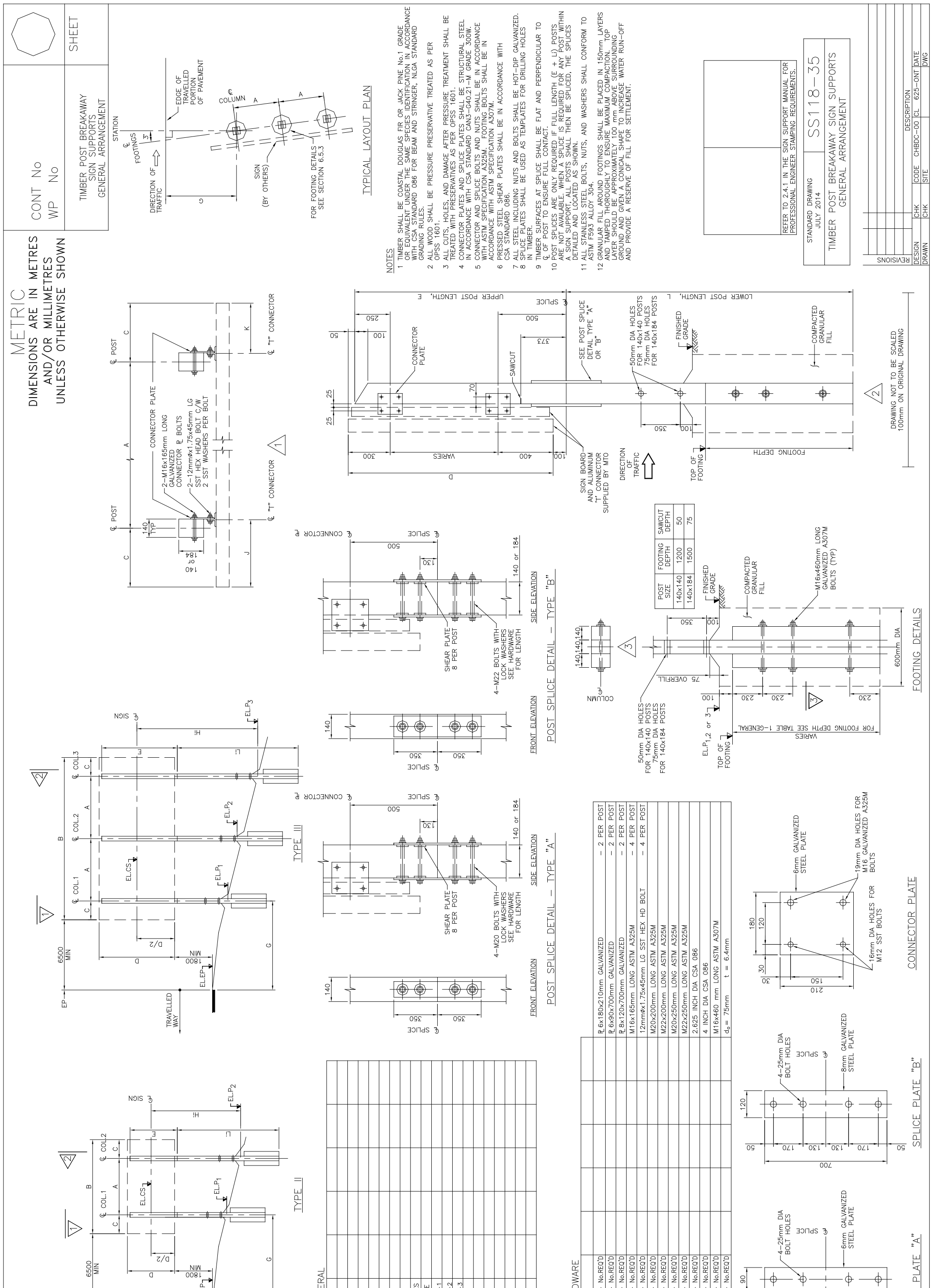



FIGURE 6.1.2 (b) DETAILS OF BREAKAWAY TYPE

### 6.1.5 FOOTINGS

Posts are embedded in holes augered in earth. Lengths of timber are bolted to the sides of the embedded portion of the post to provide a greater contact area between timber and earth, to resist the overturning moments (caused by wind on the sign) through passive pressure against the adjacent earth.

The hole is then filled with tamped (compacted) Granular ‘A’ material and overfilled by approximately 75 mm to allow for settlement and to promote water runoff.

The indicated footing depths (given in Figure 6.5.3) are the absolute minimum for each post size based on a passive earth pressure of 68 kPa (1400 psf) at SLS. If the soil strength parameters for a particular site are not known, then a site specific soil investigation should be initiated. For soils not able to sustain the above noted pressure, a site specific footing design must be carried out.

Treated timber in these sizes is generally available in lengths of 12, 14 and 16 feet. If it happens that the calculated dimensions for lower post length necessitate cutting relatively short pieces from standard lengths of timber, it is preferable to increase the embedment depth to avoid cutting the treated timber; however care must be taken that the drilled holes in the lower posts will be installed at the proper elevation relative to ground level. Since the timber in the footing has been drilled (and possibly cut) after pressure treating, and will be buried at or near ground level, it is essential that the utmost care be taken to ensure that holes and sawcuts and any damaged areas be thoroughly treated as specified on Figures 6.1.2(a) and 6.1.2(b).

Footing hardware must be hot dip galvanized and the bolts or studs must be properly tightened to ensure an intimate connection between the faces of the footing timbers and the lower post.

### 6.1.6 CLEARANCE

The supports should be located to result in the following minimum horizontal clearance from the edge of the travelled portion of pavement to the edge of the sign panel. For Breakaway sign supports, the required minimum horizontal clearance is 6500 mm. For Non-Breakaway sign supports, the required minimum horizontal clearance is as per the requirements of the Roadside Safety Manual. The minimum vertical distance shall be 1800 mm from the edge of pavement elevation to the bottom edge of the sign panel.

For breakaway sign supports, the minimum height of column from ground elevation to the underside of the sign shall be 2100 mm, and the minimum clear distance between columns should be 2100 mm.

For non-breakaway sign supports, if any portion of the sign is less than 1000 mm above the ground level immediately below the sign, the sign shall be raised to ensure this minimum 1000 mm clearance. This requirement is for summer and winter maintenance purposes.

Refer to Figures 6.4.1(d) and 6.4.1(e) for clarification of these clearance requirements.

### 6.1.7 SUPPLY AND ERECTION

For timber column sign supports to be included as part of a contract, the relevant standard drawing(s) shall be completed by the designer and inserted into the contract documents.

All metal parts are standardized and timber parts are cut, drilled and touched-up to suit the individual support.

Timber post sign supports may be included in a contract provided standard drawing(s) SS118-34 and/or SS118-35 is completed and included in the contract documents.

Since the sign panels are necessary for the proper installation of the supports, contracts containing timber post sign supports should also include the erection of the sign panels and backing "T"s.

The sign panels are supplied fully assembled with backing "T"s by the MTO, but are attached to the sign support by the contractor.

The attachment of the signboard to the support shall be covered by a separate item in the contract documents.

### 6.1.8 DESIGN CRITERIA

The Breakaway Timber Post Sign Supports given in this section, with post sizes 140x140 and 140x184, meet the requirements of NCHRP 350 crash testing. All timber posts are designed for wind load, according to the requirements of Section 3 of the CHBDC. Design tables have been prepared for Reference Wind Pressures (based on Return Periods of 10 years) of 465 Pa, 390 Pa, and 300 Pa, covering all possible wind pressures associated with the Ontario cities given in Appendix 3 of the code. Each design table (6.4.1(a) to 6.4.1(o)) gives the allowable Hmax for the two post cross-sections, using either Jack Pine or Douglas Fir, based on resisting moments calculated according to Section 9 of the CHBDC.

Post spacing (c/c) for Non-Breakaway Timber Post Sign Supports vary from 1200mm to 2400mm, with horizontal sign overhangs ranging from 300mm to 750mm.

Post spacing (c/c) for Breakaway Timber Post Sign Supports is a constant 2240mm (because of the clear horizontal spacing requirement of 2100mm), with horizontal sign overhangs ranging from 80mm to 1130mm.

## 6.2 DETAILING OF SUPPORTS

### 6.2.1 GENERAL

Since the supply and erection of the support is always part of a contract, Standard Drawings SS118-34 and/or SS8118-35 shall be used.

### 6.2.2 DATA REQUIRED

For each sign support, the following data is required:

1. The sign size.

   This must be one of the combinations of sign depth (D), and sign width (B) shown in the design tables and in Table 6.2.2.
   Sign depths shown in the tables are given in increments of 300 mm whereas actual sign depths are multiples of 304.8 mm (12 in). This difference may be disregarded when using the tables (i.e. a 2743 mm deep sign can be read as 2700 mm).

2. The location of the support.

   For a new or proposed highway or a highway under reconstruction, the location should be specified as a station. For an existing highway, the location of the centreline of the sign may be determined at the site and marked with a peg.

3. The edge of pavement elevation at the sign station and the finished grade elevations under the sign.

   For a proposed highway or highway reconstruction project, this information may, be obtained from profiles, cross sections or contour plans. In the case of an existing facility, elevations may be taken at the site. Since only approximate and relative elevations are required they can be obtained with a string level or hand level.

<table>
<tr><th colspan="14">NON-BREAKAWAY</th></tr>
<tr><th rowspan="2">SIGN DEPTH, D<br><br>(mm)</th><th colspan="13">SIGN WIDTH, B (mm)</th></tr>
<tr><td>2400</td><td>2700</td><td>3000</td><td>3300</td><td>3600</td><td>3900</td><td>4200</td><td>4500</td><td>4800</td><td>5100</td><td>5400</td><td>5700</td><td>6000</td></tr>
<tr><td>1200</td><td colspan="5" rowspan="6">Type II</td><td colspan="4" rowspan="6">Type III</td><td colspan="4" rowspan="6">Type IV</td></tr>
<tr><td>1500</td></tr>
<tr><td>1800</td></tr>
<tr><td>2100</td></tr>
<tr><td>2400</td></tr>
<tr><td>2700</td></tr>
</table>

<table>
<tr><th colspan="14">BREAKAWAY</th></tr>
<tr><th rowspan="2">SIGN DEPTH, D<br><br>(mm)</th><th colspan="13">SIGN WIDTH, B (mm)</th></tr>
<tr><td>2400</td><td>2700</td><td>3000</td><td>3300</td><td>3600</td><td>3900</td><td>4200</td><td>4500</td><td>4800</td><td>5100</td><td>5400</td><td>5700</td><td>6000</td></tr>
<tr><td>1200</td><td colspan="8" rowspan="6">Type II</td><td colspan="5" rowspan="6">Type III</td></tr>
<tr><td>1500</td></tr>
<tr><td>1800</td></tr>
<tr><td>2100</td></tr>
<tr><td>2400</td></tr>
<tr><td>2700</td></tr>
</table>

**TABLE 6.2.2 PERMISSIBLE SIGN SIZES AND SUPPORT STRUCTURE TYPES**

### 6.2.3 FOOTING LOCATIONS AND ELEVATION

From Figure 6.1.2(a) and (b) and the appropriate Design Table for the support type, including spacing of posts and type of timber, information which is required for laying out the footings on a cross section, a contour plan, or on the ground can be readily extracted.

For orientation of the sign relative to the highway the present manual follows the recommendations of the 2001 edition of the Ontario Traffic Manual which states that ground-mounted signs should be angled horizontally slightly away from traffic, by about 3 degrees, so that glare is reduced. This layout, unfortunately, causes slightly reduced legibility. The benefits of reduced glare, however, seem to outweigh the negative result of slightly decreased night legibility. For this reason the angling of ground-mounted signs slightly away from traffic is adopted.

## 6.3 PROCEDURES

### 6.3.1 FOOTING LAYOUT

GIVEN: Example sign size (1500 x 3300 mm), Breakaway Type

ASSUME: EL.EP = 10000 mm (DATUM)

STEP 1: DETERMINE SUPPORT TYPE

From Table 6.2.2 for 1500 x 3300 mm
Support is TYPE II

STEP II: DETERMINE DIMENSION C

For Type II, C = 530 mm (Table 6.4.1 (j))

NOTE: Dimension C is same whether Jack Pine or Douglas Fir is used, and whatever the wind pressure is. Spacing of posts (A) is available from the same tables as dimension (C) but is not required till support type has been established.

STEP III: DETERMINE GROUND ELEV. AT LONGEST POST

Based on Type II support:

In the sign installation shown in Figure 6.3.1, the support is on a "FILL" slope and the longest post is the most remote from edge of pavement (EP).

DISTANCE FROM EP TO LONGEST POST = (6500 + SIGN WIDTH "B" - C):

i.e. 6500 + 3300 - 530 = 9270 mm from EP
Ground Level (EL P2) = 9000 mm (SAY)

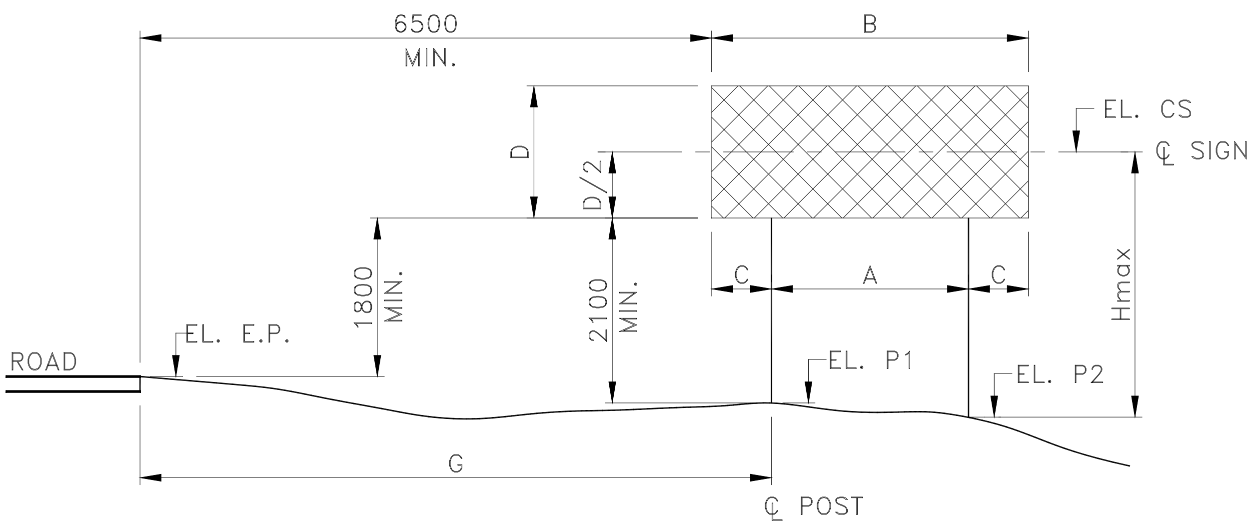



**FIGURE 6.3.1 FOOTING LAYOUT**
**BREAKAWAY TIMBER POST SIGN SUPPORT**

### 6.3.2 DETERMINATION OF POST DESIGN HEIGHT (Hmax)

Determine elevation of centre line of sign (EL.CS).

EL.CS = EL.EP + 1800 + 0.5 x SIGN DEPTH

Post Design Height (Hmax) at longest post location "**i**" is:

$H_{max}$ = EL.CS -EL.Pi

but not less than 1800 + 0.5 D

<u>For 1500 x 3300 Sign</u>

Determine EL.CS:

EL.CS = 10000 + 1800 + 0.5 x 1500
= 12550 mm
= 12.55 m

Determine Hmax:

Hmax = EL.CS - EL.P2 but not less than (1800 + 0.5 D) = 2550 mm
Hmax = 12550 – 9000
= 3550 mm (greater than 2550 mm)

For Breakaway Sign Supports, if the minimum height of column from ground elevation to the underside of the sign is less than 2100 mm, then EL. CS and Hmax shall be increased to adjust that dimension to 2100 mm minimum.

For Non-Breakaway Sign Supports, if any portion of the sign is less than 1000 mm above the ground, then EL. CS and Hmax shall be increased to adjust that dimension to 1000 mm minimum.

### 6.3.3 SELECTION OF SUPPORT TYPE, POST SIZE AND SPLICE TYPE

For Breakaway supports, because of safety reasons, it is desirable to have the smallest post cross-section possible. Complete design tables have been provided for both Jack Pine and Douglas Fir in order that Regional Staff (or any designer) will have complete data from which to select the proper post size. Splice type is also given in the design table.

The following rules must be adhered to in selecting the support type and post size:

RULE 1: The smaller of the two available post cross-sections shall be used when possible.

RULE 2: The support type with the least number of posts shall be used provided that a decrease in the number of posts does not result in an increase in post cross-section.

RULE 3: Where the smallest post cross-section can be of either species, Jack Pine shall be used.

EXAMPLE 1 SIGN SIZE: 1500 x 3300 mm, Hmax = 3550 mm;
Basic Wind Pressure = q = 300Pa

From the design tables the following post sizes are structurally adequate (Hmax refers to the maximum allowable value of design height which the post size will accommodate in the species and support type shown):

| TABLE | TYPE | SPECIES | POST SIZE | H max | SPLICE |
|---|---|---|---|---|---|
| 6.4.1(j) | II | J.P. | 140 x 140 | - | - |
| 6.4.1(j) | II | J.P. | 140 x 184 | 3840 | A |
| 6.4.1(j) | II | D.F. | 140 x 140 | 3150 | A |
| 6.4.1(j) | II | D.F. | 140 x 184 | 4130 | A |

∴ 140x184 Jack Pine and 140x184 Douglas Fir, for sign size as given, has sufficient resisting moment to permit an Hmax greater than 3550.

Select: Post Size - 140x184
Type II
Species – Jack Pine (Rule 3)
Splice Type A

Note: For Hmax < 3550, the tabulated solution is inadequate.

### 6.3.4 SUPPORTS ON NON-LEVEL GROUND

Since the type of support is probably not known when elevations are established, the exact location of each post cannot be determined when the site is being examined.

It is recommended that a cross-section at the sign station be taken showing the EP as datum and the ground level under the full width(B) of the sign. If a Type III support is required where a Type II support was anticipated it will then be a simple matter to determine $H_1$, $H_2$ and $H_3$.

Regardless of the number of posts required, the post cross-section shall be designed for the largest H value for that support, consistent with reaction due to tributary area and continuity reaction.

For example: If, $H_1 = 2600$, $H_2 = 3200$, $H_3 = 3800$
Design all 3 post sizes for $H_3 = 3800$
(see Section 6.4.2 for design philosophy)

It should be noted that on foreslopes, the ground line to centre line of sign dimension "Hmax" becomes very large for long signs and may rule out the use of timber breakaway supports.

### 6.3.5 DETERMINING POST SPACING AND POST LENGTHS

Once the type of support and size of post is determined as described in Section 6.3.3, the exact values of A & C can be obtained from the appropriate design table.

E.g. Example 1: For Breakaway Sign 1500 x 3300
$H_1$ = 3550 mm
q = 300 Pa
Post size – 140 x 184
Type – II
Species – Jack Pine

Appropriate design table is 6.4.1(j)
For 1500 x 3300 sign: A = 2240, C = 530
Distance from EP to 1st Post = 6500 + C = 7030
2nd Post = 6500 + C + A = 9270

EL.P1 and EL.P2 can be determined from cross-section.

Note that although dimensions A & C are not actually perpendicular to highway, they can be assumed to be so in determining distances for the purpose of calculating ground elevations. When laying out the footings however, A and C must be measured at the proper angle as shown on Figures 6.1.2(a) & (b) (SS118-34 & SS118-35).

LOWER POST LENGTH (L):

L = [EL.CS - EL.P(1 or 2)] + [Footing Depth]
- [0.5 x Sign Depth] - [100] + [100]

UPPER POST LENGTH (E):

E = [Sign Depth + 50]

## 6.4 DESIGN TABLES

### 6.4.1 GENERAL

This section contains the following design tables:

| Table | Structure | Type/ # of Posts | q (Pa) | Jack Pine Post Size | | Douglas Fir Post Size | |
|---|---|---|---|---|---|---|---|
| 6.4.1 (a) | Non-Breakaway | II (2 posts) | 300 | 140x140 | 140x184 | 140x140 | 140x184 |
| 6.4.1 (b) | Non-Breakaway | II (2 posts) | 390 | 140x140 | 140x184 | 140x140 | 140x184 |
| 6.4.1 (c) | Non-Breakaway | II (2 posts) | 465 | 140x140 | 140x184 | 140x140 | 140x184 |
| 6.4.1 (d) | Non-Breakaway | III (3 posts) | 300 | 140x140 | 140x184 | 140x140 | 140x184 |
| 6.4.1 (e) | Non-Breakaway | III (3 posts) | 390 | 140x140 | 140x184 | 140x140 | 140x184 |
| 6.4.1 (f) | Non-Breakaway | III (3 posts) | 465 | 140x140 | 140x184 | 140x140 | 140x184 |
| 6.4.1 (g) | Non-Breakaway | IV (4 posts) | 300 | 140x140 | 140x184 | 140x140 | 140x184 |
| 6.4.1 (h) | Non-Breakaway | IV (4 posts) | 390 | 140x140 | 140x184 | 140x140 | 140x184 |
| 6.4.1 (i) | Non-Breakaway | IV (4 posts) | 465 | 140x140 | 140x184 | 140x140 | 140x184 |
| 6.4.1 (j) | Breakaway | II (2 posts) | 300 | 140x140 | 140x184 | 140x140 | 140x184 |
| 6.4.1 (k) | Breakaway | II (2 posts) | 390 | 140x140 | 140x184 | 140x140 | 140x184 |
| 6.4.1 (l) | Breakaway | II (2 posts) | 465 | 140x140 | 140x184 | 140x140 | 140x184 |
| 6.4.1 (m) | Breakaway | III (3 posts) | 300 | 140x140 | 140x184 | 140x140 | 140x184 |
| 6.4.1 (n) | Breakaway | III (3 posts) | 390 | 140x140 | 140x184 | 140x140 | 140x184 |
| 6.4.1 (o) | Breakaway | III (3 posts) | 465 | 140x140 | 140x184 | 140x140 | 140x184 |

In the design tables, a dash shown in the Hmax column indicates that the post size and species is not to be used for that sign size, because of inadequate flexural strength.

Figures 6.4.1 (a), (b) and (c) illustrate the various post arrangements.

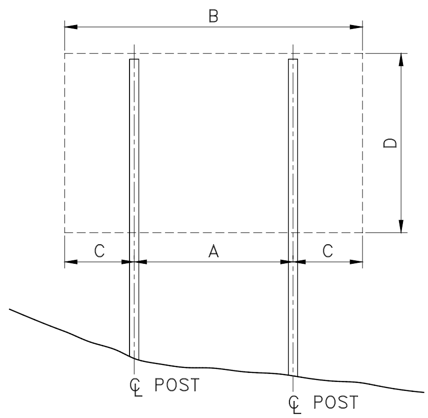



**FIGURE 6.4.1(a) TYPE II SIGN SUPPORT**

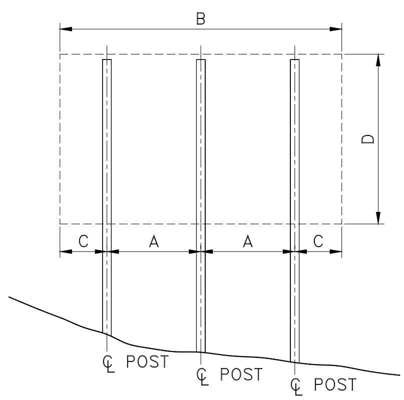



**FIGURE 6.4.1(b) TYPE III SIGN SUPPORT**

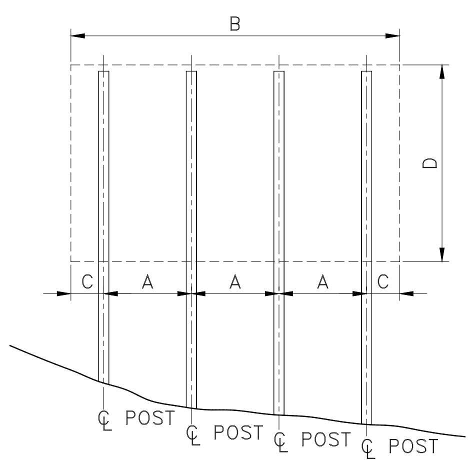
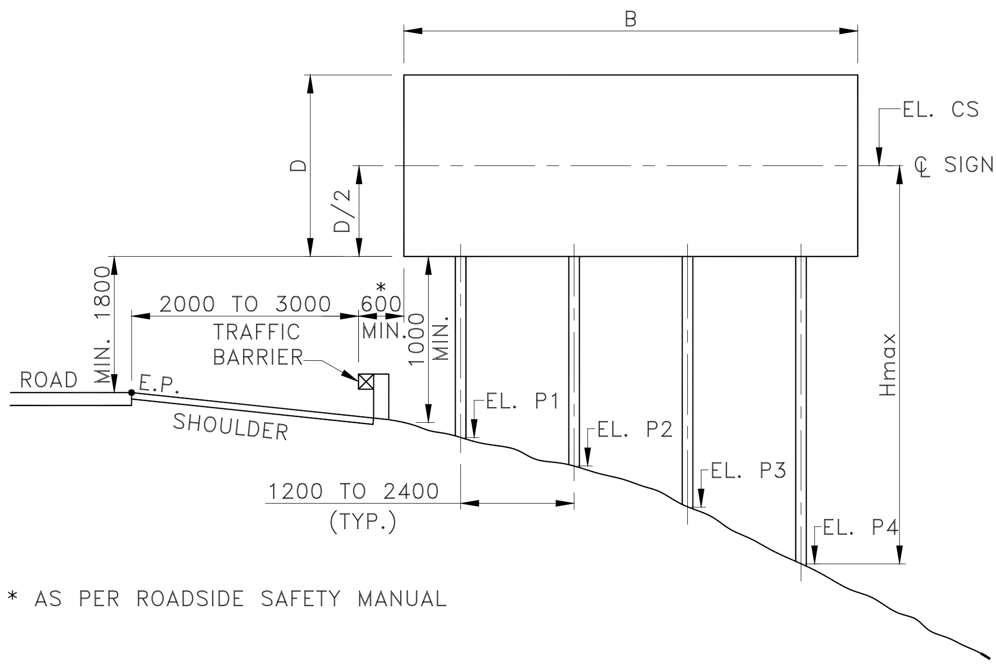
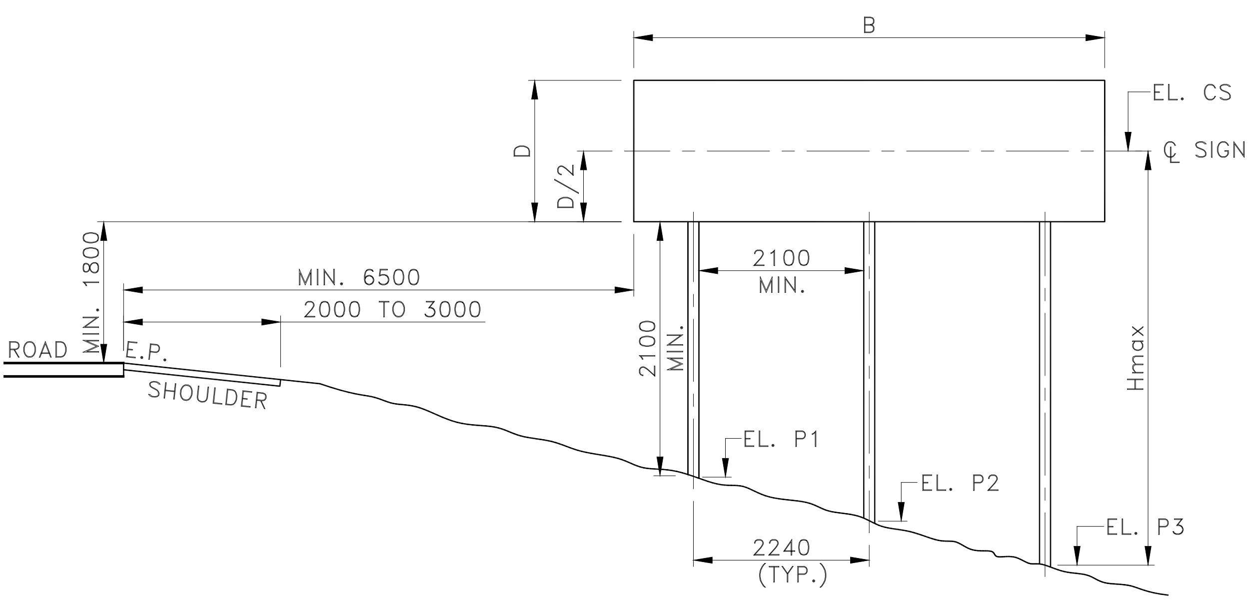



**FIGURE 6.4.1(c) TYPE IV SIGN SUPPORT**




Hmax = Maximum allowable post height, measured from ground level to mid-height of sign (based on bending strength of posts).

**FIGURE 6.4.1(d)**
**NON-BREAKAWAY TIMBER POST SIGN SUPPORTS**




Hmax = Maximum allowable post height, measured from ground level to mid-height of sign (based on bending strength of posts).

**FIGURE 6.4.1(e)**
**BREAKAWAY TIMBER POST SIGN SUPPORTS**

| WIND PRESSURE (q) = 300 Pa | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SIGN SIZE DxB (mm x mm) | POSTS | A (m) | C (m) | **JACK PINE** | | | | **DOUGLAS FIR** | | | |
| | | | | Hmax (mm) | | | | Hmax (mm) | | | |
| | | | | POST SIZE (mm) & SPLICE TYPE | | | | POST SIZE (mm) & SPLICE TYPE | | | |
| | | | | 140x140 | TYPE | 140x184 | TYPE | 140x140 | TYPE | 140x184 | TYPE |
| 1200x2400 | 2 | 1.2 | 0.6 | 3840 | A | 3980 | A | 4280 | A | 3980 | A |
| 1200x2700 | 2 | 1.5 | 0.6 | 3390 | A | 3980 | A | 4280 | A | 3980 | A |
| 1200x3000 | 2 | 1.8 | 0.6 | 3030 | A | 3980 | A | 4280 | A | 3980 | A |
| 1200x3300 | 2 | 2.1 | 0.6 | 2740 | A | 3980 | A | 3990 | A | 3980 | A |
| 1200x3600 | 2 | 2.4 | 0.6 | 2490 | A | 3980 | A | 3640 | A | 3980 | A |
| 1500x2400 | 2 | 1.2 | 0.6 | 3030 | A | 4130 | A | 4410 | A | 4130 | A |
| 1500x2700 | 2 | 1.5 | 0.6 | 2670 | A | 4130 | A | 3890 | A | 4130 | A |
| 1500x3000 | 2 | 1.8 | 0.6 | 2380 | A | 4130 | A | 3480 | A | 4130 | A |
| 1500x3300 | 2 | 2.1 | 0.6 | 2150 | A | 3840 | A | 3150 | A | 4130 | A |
| 1500x3600 | 2 | 2.4 | 0.6 | 1950 | A | 3500 | A | 2870 | A | 4130 | A |
| 1800x2400 | 2 | 1.2 | 0.6 | 2490 | A | 4280 | A | 3640 | A | 4280 | A |
| 1800x2700 | 2 | 1.5 | 0.6 | 2190 | A | 3920 | A | 3210 | A | 4280 | A |
| 1800x3000 | 2 | 1.8 | 0.6 | 1950 | A | 3500 | A | 2870 | A | 4280 | A |
| 1800x3300 | 2 | 2.1 | 0.6 | --- | --- | 3170 | A | 2590 | A | 4280 | A |
| 1800x3600 | 2 | 2.4 | 0.6 | --- | --- | 2890 | A | 2360 | A | 4230 | A |
| 2100x2400 | 2 | 1.2 | 0.6 | 2110 | A | 3770 | A | 3090 | A | 4430 | A |
| 2100x2700 | 2 | 1.5 | 0.6 | --- | --- | 3330 | A | 2720 | A | 4430 | A |
| 2100x3000 | 2 | 1.8 | 0.6 | --- | --- | 2970 | A | 2430 | A | 4360 | A |
| 2100x3300 | 2 | 2.1 | 0.6 | --- | --- | 2690 | A | 2190 | B | 3940 | A |
| 2100x3600 | 2 | 2.4 | 0.6 | --- | --- | 2450 | B | --- | --- | 3600 | A |
| 2400x2400 | 2 | 1.2 | 0.6 | --- | --- | 3270 | A | 2680 | B | 4580 | A |
| 2400x2700 | 2 | 1.5 | 0.6 | --- | --- | 2890 | B | 2360 | B | 4230 | A |
| 2400x3000 | 2 | 1.8 | 0.6 | --- | --- | 2580 | B | --- | --- | 3790 | A |
| 2400x3300 | 2 | 2.1 | 0.6 | --- | --- | 2330 | B | --- | --- | 3430 | B |
| 2400x3600 | 2 | 2.4 | 0.6 | --- | --- | --- | --- | --- | --- | 3120 | B |
| 2700x2400 | 2 | 1.2 | 0.6 | --- | --- | 2890 | B | 2360 | B | 4230 | A |
| 2700x2700 | 2 | 1.5 | 0.6 | --- | --- | 2540 | B | --- | --- | 3740 | B |
| 2700x3000 | 2 | 1.8 | 0.6 | --- | --- | --- | --- | --- | --- | 3350 | B |
| 2700x3300 | 2 | 2.1 | 0.6 | --- | --- | --- | --- | --- | --- | 3020 | B |
| 2700x3600 | 2 | 2.4 | 0.6 | --- | --- | --- | --- | --- | --- | 2750 | B |

**TABLE 6.4.1(a) TYPE II**

**NON-BREAKAWAY**

| WIND PRESSURE (q) = 390 Pa | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SIGN SIZE DxB (mm x mm) | POSTS | A (m) | C (m) | **JACK PINE** | | | | **DOUGLAS FIR** | | | |
| | | | | Hmax (mm) | | | | Hmax (mm) | | | |
| | | | | POST SIZE (mm) & SPLICE TYPE | | | | POST SIZE (mm) & SPLICE TYPE | | | |
| | | | | 140x140 | TYPE | 140x184 | TYPE | 140x140 | TYPE | 140x184 | TYPE |
| 1200x2400 | 2 | 1.2 | 0.6 | 2900 | A | 3980 | A | 4230 | A | 3980 | A |
| 1200x2700 | 2 | 1.5 | 0.6 | 2560 | A | 3980 | A | 3740 | A | 3980 | A |
| 1200x3000 | 2 | 1.8 | 0.6 | 2280 | A | 3980 | A | 3340 | A | 3980 | A |
| 1200x3300 | 2 | 2.1 | 0.6 | 2060 | A | 3690 | A | 3020 | A | 3980 | A |
| 1200x3600 | 2 | 2.4 | 0.6 | 1870 | A | 3360 | A | 2750 | A | 3980 | A |
| 1500x2400 | 2 | 1.2 | 0.6 | 2280 | A | 4070 | A | 3340 | A | 4130 | A |
| 1500x2700 | 2 | 1.5 | 0.6 | 2010 | A | 3600 | A | 2950 | A | 4130 | A |
| 1500x3000 | 2 | 1.8 | 0.6 | 1790 | A | 3220 | A | 2630 | A | 4130 | A |
| 1500x3300 | 2 | 2.1 | 0.6 | --- | --- | 2910 | A | 2380 | A | 4130 | A |
| 1500x3600 | 2 | 2.4 | 0.6 | --- | --- | 2650 | A | 2160 | A | 3890 | A |
| 1800x2400 | 2 | 1.2 | 0.6 | --- | --- | 3360 | A | 2750 | A | 4280 | A |
| 1800x2700 | 2 | 1.5 | 0.6 | --- | --- | 2970 | A | 2420 | A | 4280 | A |
| 1800x3000 | 2 | 1.8 | 0.6 | --- | --- | 2650 | A | 2160 | A | 3890 | A |
| 1800x3300 | 2 | 2.1 | 0.6 | --- | --- | 2390 | A | 1950 | B | 3520 | A |
| 1800x3600 | 2 | 2.4 | 0.6 | --- | --- | 2170 | B | --- | --- | 3210 | A |
| 2100x2400 | 2 | 1.2 | 0.6 | --- | --- | 2850 | A | 2330 | B | 4180 | A |
| 2100x2700 | 2 | 1.5 | 0.6 | --- | --- | 2510 | B | --- | --- | 3700 | A |
| 2100x3000 | 2 | 1.8 | 0.6 | --- | --- | 2240 | B | --- | --- | 3310 | A |
| 2100x3300 | 2 | 2.1 | 0.6 | --- | --- | --- | --- | --- | --- | 2990 | B |
| 2100x3600 | 2 | 2.4 | 0.6 | --- | --- | --- | --- | --- | --- | 2720 | B |
| 2400x2400 | 2 | 1.2 | 0.6 | --- | --- | 2470 | B | --- | --- | 3640 | A |
| 2400x2700 | 2 | 1.5 | 0.6 | --- | --- | --- | --- | --- | --- | 3210 | B |
| 2400x3000 | 2 | 1.8 | 0.6 | --- | --- | --- | --- | --- | --- | 2870 | B |
| 2400x3300 | 2 | 2.1 | 0.6 | --- | --- | --- | --- | --- | --- | 2590 | B |
| 2400x3600 | 2 | 2.4 | 0.6 | --- | --- | --- | --- | --- | --- | 2360 | B |
| 2700x2400 | 2 | 1.2 | 0.6 | --- | --- | --- | --- | --- | --- | 3210 | B |
| 2700x2700 | 2 | 1.5 | 0.6 | --- | --- | --- | --- | --- | --- | 2830 | B |
| 2700x3000 | 2 | 1.8 | 0.6 | --- | --- | --- | --- | --- | --- | 2530 | B |
| 2700x3300 | 2 | 2.1 | 0.6 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2700x3600 | 2 | 2.4 | 0.6 | --- | --- | --- | --- | --- | --- | --- | --- |

**TABLE 6.4.1(b) TYPE II**

**NON-BREAKAWAY**

| WIND PRESSURE (q) = 465 Pa | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SIGN SIZE DxB (mm x mm) | POSTS | A (m) | C (m) | **JACK PINE** | | | | **DOUGLAS FIR** | | | |
| | | | | Hmax (mm) | | | | Hmax (mm) | | | |
| | | | | POST SIZE (mm) & SPLICE TYPE | | | | POST SIZE (mm) & SPLICE TYPE | | | |
| | | | | 140x140 | TYPE | 140x184 | TYPE | 140x140 | TYPE | 140x184 | TYPE |
| 1200x2400 | 2 | 1.2 | 0.6 | 2400 | A | 3980 | A | 3510 | A | 3980 | A |
| 1200x2700 | 2 | 1.5 | 0.6 | 2110 | A | 3780 | A | 3100 | A | 3980 | A |
| 1200x3000 | 2 | 1.8 | 0.6 | 1880 | A | 3380 | A | 2770 | A | 3980 | A |
| 1200x3300 | 2 | 2.1 | 0.6 | 1690 | A | 3060 | A | 2500 | A | 3980 | A |
| 1200x3600 | 2 | 2.4 | 0.6 | --- | --- | 2790 | A | 2280 | A | 3980 | A |
| 1500x2400 | 2 | 1.2 | 0.6 | 1880 | A | 3380 | A | 2770 | A | 4130 | A |
| 1500x2700 | 2 | 1.5 | 0.6 | --- | --- | 2990 | A | 2440 | A | 4130 | A |
| 1500x3000 | 2 | 1.8 | 0.6 | --- | --- | 2670 | A | 2180 | A | 3920 | A |
| 1500x3300 | 2 | 2.1 | 0.6 | --- | --- | 2410 | A | 1960 | A | 3540 | A |
| 1500x3600 | 2 | 2.4 | 0.6 | --- | --- | 2190 | A | 1780 | A | 3230 | A |
| 1800x2400 | 2 | 1.2 | 0.6 | --- | --- | 2790 | A | 2280 | A | 4090 | A |
| 1800x2700 | 2 | 1.5 | 0.6 | --- | --- | 2450 | A | 2000 | B | 3610 | A |
| 1800x3000 | 2 | 1.8 | 0.6 | --- | --- | 2190 | A | --- | --- | 3230 | A |
| 1800x3300 | 2 | 2.1 | 0.6 | --- | --- | 1970 | B | --- | --- | 2920 | A |
| 1800x3600 | 2 | 2.4 | 0.6 | --- | --- | --- | --- | --- | --- | 2660 | B |
| 2100x2400 | 2 | 1.2 | 0.6 | --- | --- | 2360 | B | --- | --- | 3480 | A |
| 2100x2700 | 2 | 1.5 | 0.6 | --- | --- | 2080 | B | --- | --- | 3070 | B |
| 2100x3000 | 2 | 1.8 | 0.6 | --- | --- | --- | --- | --- | --- | 2740 | B |
| 2100x3300 | 2 | 2.1 | 0.6 | --- | --- | --- | --- | --- | --- | 2470 | B |
| 2100x3600 | 2 | 2.4 | 0.6 | --- | --- | --- | --- | --- | --- | 2250 | B |
| 2400x2400 | 2 | 1.2 | 0.6 | --- | --- | --- | --- | --- | --- | 3020 | B |
| 2400x2700 | 2 | 1.5 | 0.6 | --- | --- | --- | --- | --- | --- | 2660 | B |
| 2400x3000 | 2 | 1.8 | 0.6 | --- | --- | --- | --- | --- | --- | 2370 | B |
| 2400x3300 | 2 | 2.1 | 0.6 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2400x3600 | 2 | 2.4 | 0.6 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2700x2400 | 2 | 1.2 | 0.6 | --- | --- | --- | --- | --- | --- | 2660 | B |
| 2700x2700 | 2 | 1.5 | 0.6 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2700x3000 | 2 | 1.8 | 0.6 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2700x3300 | 2 | 2.1 | 0.6 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2700x3600 | 2 | 2.4 | 0.6 | --- | --- | --- | --- | --- | --- | --- | --- |

**TABLE 6.4.1(c) TYPE II**

**NON-BREAKAWAY**

WIND PRESSURE (q) = 300 Pa

| SIGN SIZE DxB (mm x mm) | POSTS | A (m) | C (m) | JACK PINE Hmax (mm) POST SIZE (mm) & SPLICE TYPE | | | | DOUGLAS FIR Hmax (mm) POST SIZE (mm) & SPLICE TYPE | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 140x140 | TYPE | 140x184 | TYPE | 140x140 | TYPE | 140x184 | TYPE |
| 1200x3900 | 3 | 1.5 | 0.45 | 2690 | A | 3980 | A | 3920 | A | 3980 | A |
| 1200x4200 | 3 | 1.5 | 0.6 | 2990 | A | 3980 | A | 4280 | A | 3980 | A |
| 1200x4500 | 3 | 1.5 | 0.75 | 2850 | A | 3980 | A | 4150 | A | 3980 | A |
| 1200x4800 | 3 | 1.8 | 0.6 | 2300 | A | 3980 | A | 3360 | A | 3980 | A |
| 1500x3900 | 3 | 1.5 | 0.45 | 2110 | A | 3780 | A | 3100 | A | 4130 | A |
| 1500x4200 | 3 | 1.5 | 0.6 | 2350 | A | 4130 | A | 3440 | A | 4130 | A |
| 1500x4500 | 3 | 1.5 | 0.75 | 2240 | A | 4000 | A | 3280 | A | 4130 | A |
| 1500x4800 | 3 | 1.8 | 0.6 | 1800 | A | 3240 | A | 2650 | A | 4130 | A |
| 1800x3900 | 3 | 1.5 | 0.45 | --- | --- | 3110 | A | 2550 | A | 4280 | A |
| 1800x4200 | 3 | 1.5 | 0.6 | 1920 | A | 3450 | A | 2830 | A | 4280 | A |
| 1800x4500 | 3 | 1.5 | 0.75 | --- | --- | 3300 | A | 2700 | A | 4280 | A |
| 1800x4800 | 3 | 1.8 | 0.6 | --- | --- | 2660 | A | 2180 | A | 3910 | A |
| 2100x3900 | 3 | 1.5 | 0.45 | --- | --- | 2640 | A | 2150 | B | 3880 | A |
| 2100x4200 | 3 | 1.5 | 0.6 | --- | --- | 2930 | A | 2400 | A | 4300 | A |
| 2100x4500 | 3 | 1.5 | 0.75 | --- | --- | 2800 | A | 2290 | B | 4100 | A |
| 2100x4800 | 3 | 1.8 | 0.6 | --- | --- | 2260 | B | --- | --- | 3330 | A |
| 2400x3900 | 3 | 1.5 | 0.45 | --- | --- | 2280 | B | --- | --- | 3370 | B |
| 2400x4200 | 3 | 1.5 | 0.6 | --- | --- | 2540 | B | --- | --- | 3740 | A |
| 2400x4500 | 3 | 1.5 | 0.75 | --- | --- | 2420 | B | --- | --- | 3570 | B |
| 2400x4800 | 3 | 1.8 | 0.6 | --- | --- | --- | --- | --- | --- | 2890 | B |
| 2700x3900 | 3 | 1.5 | 0.45 | --- | --- | --- | --- | --- | --- | 2970 | B |
| 2700x4200 | 3 | 1.5 | 0.6 | --- | --- | --- | --- | --- | --- | 3300 | B |
| 2700x4500 | 3 | 1.5 | 0.75 | --- | --- | --- | --- | --- | --- | 3150 | B |
| 2700x4800 | 3 | 1.8 | 0.6 | --- | --- | --- | --- | --- | --- | 2540 | B |

**TABLE 6.4.1(d) TYPE III**

**NON-BREAKAWAY**

| WIND PRESSURE (q) = 390 Pa | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SIGN SIZE DxB (mm x mm) | POSTS | A (m) | C (m) | **JACK PINE** | | | | **DOUGLAS FIR** | | | |
| | | | | Hmax (mm) | | | | Hmax (mm) | | | |
| | | | | POST SIZE (mm) & SPLICE TYPE | | | | POST SIZE (mm) & SPLICE TYPE | | | |
| | | | | 140x140 | TYPE | 140x184 | TYPE | 140x140 | TYPE | 140x184 | TYPE |
| 1200x3900 | 3 | 1.5 | 0.45 | 2020 | A | 3620 | A | 2970 | A | 3980 | A |
| 1200x4200 | 3 | 1.5 | 0.6 | 2250 | A | 3980 | A | 3300 | A | 3980 | A |
| 1200x4500 | 3 | 1.5 | 0.75 | 2150 | A | 3840 | A | 3150 | A | 3980 | A |
| 1200x4800 | 3 | 1.8 | 0.6 | 1720 | A | 3110 | A | 2540 | A | 3980 | A |
| 1500x3900 | 3 | 1.5 | 0.45 | --- | A | 2860 | A | 2340 | A | 4130 | A |
| 1500x4200 | 3 | 1.5 | 0.6 | 1760 | A | 3170 | A | 2600 | A | 4130 | A |
| 1500x4500 | 3 | 1.5 | 0.75 | --- | --- | 3030 | A | 2480 | A | 4130 | A |
| 1500x4800 | 3 | 1.8 | 0.6 | --- | --- | 2440 | A | 1990 | A | 3600 | A |
| 1800x3900 | 3 | 1.5 | 0.45 | --- | --- | 2350 | A | 1910 | B | 3460 | A |
| 1800x4200 | 3 | 1.5 | 0.6 | --- | --- | 2610 | A | 2130 | A | 3840 | A |
| 1800x4500 | 3 | 1.5 | 0.75 | --- | --- | 2490 | A | 2030 | A | 3660 | A |
| 1800x4800 | 3 | 1.8 | 0.6 | --- | --- | 2000 | B | --- | --- | 2960 | A |
| 2100x3900 | 3 | 1.5 | 0.45 | --- | --- | --- | --- | --- | --- | 2940 | B |
| 2100x4200 | 3 | 1.5 | 0.6 | --- | --- | 2210 | B | --- | --- | 3260 | A |
| 2100x4500 | 3 | 1.5 | 0.75 | --- | --- | 2110 | B | --- | --- | 3110 | B |
| 2100x4800 | 3 | 1.8 | 0.6 | --- | --- | --- | --- | --- | --- | 2510 | B |
| 2400x3900 | 3 | 1.5 | 0.45 | --- | --- | --- | --- | --- | --- | 2540 | B |
| 2400x4200 | 3 | 1.5 | 0.6 | --- | --- | --- | --- | --- | --- | 2830 | B |
| 2400x4500 | 3 | 1.5 | 0.75 | --- | --- | --- | --- | --- | --- | 2700 | B |
| 2400x4800 | 3 | 1.8 | 0.6 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2700x3900 | 3 | 1.5 | 0.45 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2700x4200 | 3 | 1.5 | 0.6 | --- | --- | --- | --- | --- | --- | 2490 | B |
| 2700x4500 | 3 | 1.5 | 0.75 | --- | --- | --- | --- | --- | --- | 2380 | B |
| 2700x4800 | 3 | 1.8 | 0.6 | --- | --- | --- | --- | --- | --- | --- | --- |

**TABLE 6.4.1(e) TYPE III**

**NON-BREAKAWAY**

| WIND PRESSURE (q) = 465 Pa | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SIGN SIZE DxB (mm x mm) | POSTS | A (m) | C (m) | **JACK PINE** | | | | **DOUGLAS FIR** | | | |
| | | | | Hmax (mm) | | | | Hmax (mm) | | | |
| | | | | POST SIZE (mm) & SPLICE TYPE | | | | POST SIZE (mm) & SPLICE TYPE | | | |
| | | | | 140x140 | TYPE | 140x184 | TYPE | 140x140 | TYPE | 140x184 | TYPE |
| 1200x3900 | 3 | 1.5 | 0.45 | 1660 | A | 3010 | A | 2460 | A | 3980 | A |
| 1200x4200 | 3 | 1.5 | 0.6 | 1860 | A | 3340 | A | 2730 | A | 3980 | A |
| 1200x4500 | 3 | 1.5 | 0.75 | 1770 | A | 3180 | A | 2610 | A | 3980 | A |
| 1200x4800 | 3 | 1.8 | 0.6 | --- | --- | 2570 | A | 2100 | A | 3780 | A |
| 1500x3900 | 3 | 1.5 | 0.45 | --- | --- | 2360 | A | 1930 | A | 3480 | A |
| 1500x4200 | 3 | 1.5 | 0.6 | --- | --- | 2630 | A | 2150 | A | 3860 | A |
| 1500x4500 | 3 | 1.5 | 0.75 | --- | --- | 2510 | A | 2040 | A | 3690 | A |
| 1500x4800 | 3 | 1.8 | 0.6 | --- | --- | 2020 | A | --- | --- | 2980 | A |
| 1800x3900 | 3 | 1.5 | 0.45 | --- | --- | 1940 | B | --- | --- | 2870 | A |
| 1800x4200 | 3 | 1.5 | 0.6 | --- | --- | 2160 | B | --- | --- | 3190 | A |
| 1800x4500 | 3 | 1.5 | 0.75 | --- | --- | 2060 | B | --- | --- | 3040 | A |
| 1800x4800 | 3 | 1.8 | 0.6 | --- | --- | --- | --- | --- | --- | 2450 | B |
| 2100x3900 | 3 | 1.5 | 0.45 | --- | --- | --- | --- | --- | --- | 2430 | B |
| 2100x4200 | 3 | 1.5 | 0.6 | --- | --- | --- | --- | --- | --- | 2700 | B |
| 2100x4500 | 3 | 1.5 | 0.75 | --- | --- | --- | --- | --- | --- | 2580 | B |
| 2100x4800 | 3 | 1.8 | 0.6 | --- | --- | --- | --- | --- | --- | 2070 | B |
| 2400x3900 | 3 | 1.5 | 0.45 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2400x4200 | 3 | 1.5 | 0.6 | --- | --- | --- | --- | --- | --- | 2340 | B |
| 2400x4500 | 3 | 1.5 | 0.75 | --- | --- | --- | --- | --- | --- | 2230 | B |
| 2400x4800 | 3 | 1.8 | 0.6 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2700x3900 | 3 | 1.5 | 0.45 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2700x4200 | 3 | 1.5 | 0.6 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2700x4500 | 3 | 1.5 | 0.75 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2700x4800 | 3 | 1.8 | 0.6 | --- | --- | --- | --- | --- | --- | --- | --- |

**TABLE 6.4.1(f) TYPE III**

**NON-BREAKAWAY**

| WIND PRESSURE (q) = 300 Pa | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SIGN SIZE DxB (mm x mm) | POSTS | A (m) | C (m) | **JACK PINE** | | | | **DOUGLAS FIR** | | | |
| | | | | Hmax (mm) | | | | Hmax (mm) | | | |
| | | | | POST SIZE (mm) & SPLICE TYPE | | | | POST SIZE (mm) & SPLICE TYPE | | | |
| | | | | 140x140 | TYPE | 140x184 | TYPE | 140x140 | TYPE | 140x184 | TYPE |
| 1200x5100 | 4 | 1.5 | 0.3 | 2810 | A | 3980 | A | 4090 | A | 3980 | A |
| 1200x5400 | 4 | 1.5 | 0.45 | 2880 | A | 3980 | A | 4200 | A | 3980 | A |
| 1200x5700 | 4 | 1.5 | 0.6 | 3010 | A | 3980 | A | 4280 | A | 3980 | A |
| 1200x6000 | 4 | 1.5 | 0.75 | 2870 | A | 3980 | A | 4180 | A | 3980 | A |
| 1500x5100 | 4 | 1.5 | 0.3 | 2200 | A | 3940 | A | 3230 | A | 4130 | A |
| 1500x5400 | 4 | 1.5 | 0.45 | 2270 | A | 4040 | A | 3320 | A | 4130 | A |
| 1500x5700 | 4 | 1.5 | 0.6 | 2370 | A | 4130 | A | 3460 | A | 4130 | A |
| 1500x6000 | 4 | 1.5 | 0.75 | 2260 | A | 4020 | A | 3300 | A | 4130 | A |
| 1800x5100 | 4 | 1.5 | 0.3 | --- | --- | 3250 | A | 2660 | A | 4280 | A |
| 1800x5400 | 4 | 1.5 | 0.45 | --- | --- | 3340 | A | 2730 | A | 4280 | A |
| 1800x5700 | 4 | 1.5 | 0.6 | 1940 | A | 3480 | A | 2850 | A | 4280 | A |
| 1800x6000 | 4 | 1.5 | 0.75 | --- | --- | 3320 | A | 2720 | A | 4280 | A |
| 2100x5100 | 4 | 1.5 | 0.3 | --- | --- | 2750 | A | 2250 | B | 4040 | A |
| 2100x5400 | 4 | 1.5 | 0.45 | --- | --- | 2830 | A | 2310 | B | 4150 | A |
| 2100x5700 | 4 | 1.5 | 0.6 | --- | --- | 2950 | A | 2410 | A | 4330 | A |
| 2100x6000 | 4 | 1.5 | 0.75 | --- | --- | 2820 | A | 2300 | B | 4130 | A |
| 2400x5100 | 4 | 1.5 | 0.3 | --- | --- | 2390 | B | --- | --- | 3510 | B |
| 2400x5400 | 4 | 1.5 | 0.45 | --- | --- | 2450 | B | --- | --- | 3610 | A |
| 2400x5700 | 4 | 1.5 | 0.6 | --- | --- | 2560 | B | --- | --- | 3760 | A |
| 2400x6000 | 4 | 1.5 | 0.75 | --- | --- | 2440 | B | --- | --- | 3590 | B |
| 2700x5100 | 4 | 1.5 | 0.3 | --- | --- | --- | --- | --- | --- | 3100 | B |
| 2700x5400 | 4 | 1.5 | 0.45 | --- | --- | --- | --- | --- | --- | 3180 | B |
| 2700x5700 | 4 | 1.5 | 0.6 | --- | --- | --- | --- | --- | --- | 3320 | B |
| 2700x6000 | 4 | 1.5 | 0.75 | --- | --- | --- | --- | --- | --- | 3170 | B |

**TABLE 6.4.1(g) TYPE IV**

**NON-BREAKAWAY**

| WIND PRESSURE (q) = 390 Pa | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SIGN SIZE DxB (mm x mm) | POSTS | A (m) | C (m) | **JACK PINE** | | | | **DOUGLAS FIR** | | | |
| | | | | Hmax (mm) | | | | Hmax (mm) | | | |
| | | | | POST SIZE (mm) & SPLICE TYPE | | | | POST SIZE (mm) & SPLICE TYPE | | | |
| | | | | 140x140 | TYPE | 140x184 | TYPE | 140x140 | TYPE | 140x184 | TYPE |
| 1200x5100 | 4 | 1.5 | 0.3 | 2110 | A | 3780 | A | 3100 | A | 3980 | A |
| 1200x5400 | 4 | 1.5 | 0.45 | 2170 | A | 3880 | A | 3180 | A | 3980 | A |
| 1200x5700 | 4 | 1.5 | 0.6 | 2270 | A | 3980 | A | 3320 | A | 3980 | A |
| 1200x6000 | 4 | 1.5 | 0.75 | 2160 | A | 3860 | A | 3170 | A | 3980 | A |
| 1500x5100 | 4 | 1.5 | 0.3 | --- | --- | 2980 | A | 2440 | A | 4130 | A |
| 1500x5400 | 4 | 1.5 | 0.45 | --- | --- | 3060 | A | 2510 | A | 4130 | A |
| 1500x5700 | 4 | 1.5 | 0.6 | 1770 | A | 3200 | A | 2610 | A | 4130 | A |
| 1500x6000 | 4 | 1.5 | 0.75 | --- | --- | 3050 | A | 2490 | A | 4130 | A |
| 1800x5100 | 4 | 1.5 | 0.3 | --- | --- | 2450 | A | 2000 | B | 3610 | A |
| 1800x5400 | 4 | 1.5 | 0.45 | --- | --- | 2520 | A | 2050 | A | 3700 | A |
| 1800x5700 | 4 | 1.5 | 0.6 | --- | --- | 2630 | A | 2150 | A | 3860 | A |
| 1800x6000 | 4 | 1.5 | 0.75 | --- | --- | 2510 | A | 2050 | A | 3690 | A |
| 2100x5100 | 4 | 1.5 | 0.3 | --- | --- | 2070 | B | --- | --- | 3060 | B |
| 2100x5400 | 4 | 1.5 | 0.45 | --- | --- | 2130 | B | --- | --- | 3150 | B |
| 2100x5700 | 4 | 1.5 | 0.6 | --- | --- | 2230 | B | --- | --- | 3280 | A |
| 2100x6000 | 4 | 1.5 | 0.75 | --- | --- | 2120 | B | --- | --- | 3130 | B |
| 2400x5100 | 4 | 1.5 | 0.3 | --- | --- | --- | --- | --- | --- | 2660 | B |
| 2400x5400 | 4 | 1.5 | 0.45 | --- | --- | --- | --- | --- | --- | 2730 | B |
| 2400x5700 | 4 | 1.5 | 0.6 | --- | --- | --- | --- | --- | --- | 2850 | B |
| 2400x6000 | 4 | 1.5 | 0.75 | --- | --- | --- | --- | --- | --- | 2720 | B |
| 2700x5100 | 4 | 1.5 | 0.3 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2700x5400 | 4 | 1.5 | 0.45 | --- | --- | --- | --- | --- | --- | 2400 | B |
| 2700x5700 | 4 | 1.5 | 0.6 | --- | --- | --- | --- | --- | --- | 2510 | B |
| 2700x6000 | 4 | 1.5 | 0.75 | --- | --- | --- | --- | --- | --- | 2390 | B |

**TABLE 6.4.1(h) TYPE IV**

**NON-BREAKAWAY**

WIND PRESSURE (q) = 465 Pa

| SIGN SIZE DxB (mm x mm) | POSTS | A (m) | C (m) | JACK PINE | | | | DOUGLAS FIR | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Hmax (mm) | | | | Hmax (mm) | | | |
| | | | | POST SIZE (mm) & SPLICE TYPE | | | | POST SIZE (mm) & SPLICE TYPE | | | |
| | | | | 140x140 | TYPE | 140x184 | TYPE | 140x140 | TYPE | 140x184 | TYPE |
| 1200x5100 | 4 | 1.5 | 0.3 | 1740 | A | 3140 | A | 2570 | A | 3980 | A |
| 1200x5400 | 4 | 1.5 | 0.45 | 1790 | A | 3220 | A | 2640 | A | 3980 | A |
| 1200x5700 | 4 | 1.5 | 0.6 | 1870 | A | 3360 | A | 2750 | A | 3980 | A |
| 1200x6000 | 4 | 1.5 | 0.75 | 1780 | A | 3210 | A | 2620 | A | 3980 | A |
| 1500x5100 | 4 | 1.5 | 0.3 | --- | --- | 2470 | A | 2010 | A | 3630 | A |
| 1500x5400 | 4 | 1.5 | 0.45 | --- | --- | 2540 | A | 2070 | A | 3730 | A |
| 1500x5700 | 4 | 1.5 | 0.6 | --- | --- | 2650 | A | 2160 | A | 3890 | A |
| 1500x6000 | 4 | 1.5 | 0.75 | --- | --- | 2530 | A | 2060 | A | 3710 | A |
| 1800x5100 | 4 | 1.5 | 0.3 | --- | --- | 2020 | B | --- | --- | 2990 | A |
| 1800x5400 | 4 | 1.5 | 0.45 | --- | --- | 2080 | B | --- | --- | 3080 | A |
| 1800x5700 | 4 | 1.5 | 0.6 | --- | --- | 2170 | B | --- | --- | 3210 | A |
| 1800x6000 | 4 | 1.5 | 0.75 | --- | --- | 2070 | B | --- | --- | 3060 | A |
| 2100x5100 | 4 | 1.5 | 0.3 | --- | --- | --- | --- | --- | --- | 2540 | B |
| 2100x5400 | 4 | 1.5 | 0.45 | --- | --- | --- | --- | --- | --- | 2610 | B |
| 2100x5700 | 4 | 1.5 | 0.6 | --- | --- | --- | --- | --- | --- | 2720 | B |
| 2100x6000 | 4 | 1.5 | 0.75 | --- | --- | --- | --- | --- | --- | 2600 | B |
| 2400x5100 | 4 | 1.5 | 0.3 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2400x5400 | 4 | 1.5 | 0.45 | --- | --- | --- | --- | --- | --- | 2260 | B |
| 2400x5700 | 4 | 1.5 | 0.6 | --- | --- | --- | --- | --- | --- | 2360 | B |
| 2400x6000 | 4 | 1.5 | 0.75 | --- | --- | --- | --- | --- | --- | 2250 | B |
| 2700x5100 | 4 | 1.5 | 0.3 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2700x5400 | 4 | 1.5 | 0.45 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2700x5700 | 4 | 1.5 | 0.6 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2700x6000 | 4 | 1.5 | 0.75 | --- | --- | --- | --- | --- | --- | --- | --- |

**TABLE 6.4.1(i) TYPE IV**

**NON-BREAKAWAY**

WIND PRESSURE (q) = 300 Pa

| SIGN SIZE DxB (mm x mm) | POSTS | A (m) | C (m) | **JACK PINE** Hmax (mm) | | | | **DOUGLAS FIR** Hmax (mm) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | POST SIZE (mm) & SPLICE TYPE | | | | POST SIZE (mm) & SPLICE TYPE | | | |
| | | | | 140x140 | TYPE | 140x184 | TYPE | 140x140 | TYPE | 140x184 | TYPE |
| 1200x2400 | 2 | 2.24 | 0.08 | 3840 | A | 3980 | A | 4280 | A | 3980 | A |
| 1200x2700 | 2 | 2.24 | 0.23 | 3390 | A | 3980 | A | 4280 | A | 3980 | A |
| 1200x3000 | 2 | 2.24 | 0.38 | 3030 | A | 3980 | A | 4280 | A | 3980 | A |
| 1200x3300 | 2 | 2.24 | 0.53 | 2740 | A | 3980 | A | 3990 | A | 3980 | A |
| 1200x3600 | 2 | 2.24 | 0.68 | --- | --- | 3980 | A | 3640 | A | 3980 | A |
| 1200x3900 | 2 | 2.24 | 0.83 | --- | --- | 3980 | A | 3340 | A | 3980 | A |
| 1200x4200 | 2 | 2.24 | 0.98 | --- | --- | 3770 | A | 3090 | A | 3980 | A |
| 1200x4500 | 2 | 2.24 | 1.13 | --- | --- | 3500 | A | 2870 | A | 3980 | A |
| 1500x2400 | 2 | 2.24 | 0.08 | 3030 | A | 4130 | A | 4410 | A | 4130 | A |
| 1500x2700 | 2 | 2.24 | 0.23 | --- | --- | 4130 | A | 3890 | A | 4130 | A |
| 1500x3000 | 2 | 2.24 | 0.38 | --- | --- | 4130 | A | 3480 | A | 4130 | A |
| 1500x3300 | 2 | 2.24 | 0.53 | --- | --- | 3840 | A | 3150 | A | 4130 | A |
| 1500x3600 | 2 | 2.24 | 0.68 | --- | --- | 3500 | A | 2870 | A | 4130 | A |
| 1500x3900 | 2 | 2.24 | 0.83 | --- | --- | 3220 | A | --- | --- | 4130 | A |
| 1500x4200 | 2 | 2.24 | 0.98 | --- | --- | 2970 | A | --- | --- | 4130 | A |
| 1500x4500 | 2 | 2.24 | 1.13 | --- | --- | --- | --- | --- | --- | 4050 | A |
| 1800x2400 | 2 | 2.24 | 0.08 | --- | --- | 4280 | A | 3640 | A | 4280 | A |
| 1800x2700 | 2 | 2.24 | 0.23 | --- | --- | 3920 | A | 3210 | A | 4280 | A |
| 1800x3000 | 2 | 2.24 | 0.38 | --- | --- | 3500 | A | --- | --- | 4280 | A |
| 1800x3300 | 2 | 2.24 | 0.53 | --- | --- | 3170 | A | --- | --- | 4280 | A |
| 1800x3600 | 2 | 2.24 | 0.68 | --- | --- | --- | --- | --- | --- | 4230 | A |
| 1800x3900 | 2 | 2.24 | 0.83 | --- | --- | --- | --- | --- | --- | 3890 | A |
| 1800x4200 | 2 | 2.24 | 0.98 | --- | --- | --- | --- | --- | --- | 3600 | A |
| 1800x4500 | 2 | 2.24 | 1.13 | --- | --- | --- | --- | --- | --- | 3350 | A |
| 2100x2400 | 2 | 2.24 | 0.08 | --- | --- | 3770 | A | --- | --- | 4430 | A |
| 2100x2700 | 2 | 2.24 | 0.23 | --- | --- | 3330 | A | --- | --- | 4430 | A |
| 2100x3000 | 2 | 2.24 | 0.38 | --- | --- | --- | --- | --- | --- | 4360 | A |
| 2100x3300 | 2 | 2.24 | 0.53 | --- | --- | --- | --- | --- | --- | 3940 | A |
| 2100x3600 | 2 | 2.24 | 0.68 | --- | --- | --- | --- | --- | --- | 3600 | A |
| 2100x3900 | 2 | 2.24 | 0.83 | --- | --- | --- | --- | --- | --- | 3310 | A |
| 2100x4200 | 2 | 2.24 | 0.98 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2100x4500 | 2 | 2.24 | 1.13 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2400x2400 | 2 | 2.24 | 0.08 | --- | --- | --- | --- | --- | --- | 4580 | A |
| 2400x2700 | 2 | 2.24 | 0.23 | --- | --- | --- | --- | --- | --- | 4230 | A |
| 2400x3000 | 2 | 2.24 | 0.38 | --- | --- | --- | --- | --- | --- | 3790 | A |
| 2400x3300 | 2 | 2.24 | 0.53 | --- | --- | --- | --- | --- | --- | 3430 | B |
| 2400x3600 | 2 | 2.24 | 0.68 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2400x3900 | 2 | 2.24 | 0.83 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2400x4200 | 2 | 2.24 | 0.98 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2400x4500 | 2 | 2.24 | 1.13 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2700x2400 | 2 | 2.24 | 0.08 | --- | --- | --- | --- | --- | --- | 4230 | A |
| 2700x2700 | 2 | 2.24 | 0.23 | --- | --- | --- | --- | --- | --- | 3740 | B |
| 2700x3000 | 2 | 2.24 | 0.38 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2700x3300 | 2 | 2.24 | 0.53 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2700x3600 | 2 | 2.24 | 0.68 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2700x3900 | 2 | 2.24 | 0.83 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2700x4200 | 2 | 2.24 | 0.98 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2700x4500 | 2 | 2.24 | 1.13 | --- | --- | --- | --- | --- | --- | --- | --- |

**TABLE 6.4.1(j) TYPE II – BREAKAWAY**

WIND PRESSURE (q) = 390 Pa

| SIGN SIZE DxB (mm x mm) | POSTS | A (m) | C (m) | JACK PINE Hmax (mm) POST SIZE (mm) & SPLICE TYPE | | | | DOUGLAS FIR Hmax (mm) POST SIZE (mm) & SPLICE TYPE | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 140x140 | TYPE | 140x184 | TYPE | 140x140 | TYPE | 140x184 | TYPE |
| 1200x2400 | 2 | 2.24 | 0.08 | 2900 | A | 3980 | A | 4230 | A | 3980 | A |
| 1200x2700 | 2 | 2.24 | 0.23 | --- | --- | 3980 | A | 3740 | A | 3980 | A |
| 1200x3000 | 2 | 2.24 | 0.38 | --- | --- | 3980 | A | 3340 | A | 3980 | A |
| 1200x3300 | 2 | 2.24 | 0.53 | --- | --- | 3690 | A | 3020 | A | 3980 | A |
| 1200x3600 | 2 | 2.24 | 0.68 | --- | --- | 3360 | A | 2750 | A | 3980 | A |
| 1200x3900 | 2 | 2.24 | 0.83 | --- | --- | 3090 | A | --- | --- | 3980 | A |
| 1200x4200 | 2 | 2.24 | 0.98 | --- | --- | 2850 | A | --- | --- | 3980 | A |
| 1200x4500 | 2 | 2.24 | 1.13 | --- | --- | --- | --- | --- | --- | 3890 | A |
| 1500x2400 | 2 | 2.24 | 0.08 | --- | --- | 4070 | A | 3340 | A | 4130 | A |
| 1500x2700 | 2 | 2.24 | 0.23 | --- | --- | 3600 | A | 2950 | A | 4130 | A |
| 1500x3000 | 2 | 2.24 | 0.38 | --- | --- | 3220 | A | --- | --- | 4130 | A |
| 1500x3300 | 2 | 2.24 | 0.53 | --- | --- | 2910 | A | --- | --- | 4130 | A |
| 1500x3600 | 2 | 2.24 | 0.68 | --- | --- | --- | --- | --- | --- | 3890 | A |
| 1500x3900 | 2 | 2.24 | 0.83 | --- | --- | --- | --- | --- | --- | 3580 | A |
| 1500x4200 | 2 | 2.24 | 0.98 | --- | --- | --- | --- | --- | --- | 3310 | A |
| 1500x4500 | 2 | 2.24 | 1.13 | --- | --- | --- | --- | --- | --- | 3070 | A |
| 1800x2400 | 2 | 2.24 | 0.08 | --- | --- | 3360 | A | --- | --- | 4280 | A |
| 1800x2700 | 2 | 2.24 | 0.23 | --- | --- | --- | --- | --- | --- | 4280 | A |
| 1800x3000 | 2 | 2.24 | 0.38 | --- | --- | --- | --- | --- | --- | 3890 | A |
| 1800x3300 | 2 | 2.24 | 0.53 | --- | --- | --- | --- | --- | --- | 3520 | A |
| 1800x3600 | 2 | 2.24 | 0.68 | --- | --- | --- | --- | --- | --- | 3210 | A |
| 1800x3900 | 2 | 2.24 | 0.83 | --- | --- | --- | --- | --- | --- | --- | --- |
| 1800x4200 | 2 | 2.24 | 0.98 | --- | --- | --- | --- | --- | --- | --- | --- |
| 1800x4500 | 2 | 2.24 | 1.13 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2100x2400 | 2 | 2.24 | 0.08 | --- | --- | --- | --- | --- | --- | 4180 | A |
| 2100x2700 | 2 | 2.24 | 0.23 | --- | --- | --- | --- | --- | --- | 3700 | A |
| 2100x3000 | 2 | 2.24 | 0.38 | --- | --- | --- | --- | --- | --- | 3310 | A |
| 2100x3300 | 2 | 2.24 | 0.53 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2100x3600 | 2 | 2.24 | 0.68 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2100x3900 | 2 | 2.24 | 0.83 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2100x4200 | 2 | 2.24 | 0.98 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2100x4500 | 2 | 2.24 | 1.13 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2400x2400 | 2 | 2.24 | 0.08 | --- | --- | --- | --- | --- | --- | 3640 | A |
| 2400x2700 | 2 | 2.24 | 0.23 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2400x3000 | 2 | 2.24 | 0.38 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2400x3300 | 2 | 2.24 | 0.53 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2400x3600 | 2 | 2.24 | 0.68 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2400x3900 | 2 | 2.24 | 0.83 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2400x4200 | 2 | 2.24 | 0.98 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2400x4500 | 2 | 2.24 | 1.13 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2700x2400 | 2 | 2.24 | 0.08 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2700x2700 | 2 | 2.24 | 0.23 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2700x3000 | 2 | 2.24 | 0.38 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2700x3300 | 2 | 2.24 | 0.53 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2700x3600 | 2 | 2.24 | 0.68 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2700x3900 | 2 | 2.24 | 0.83 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2700x4200 | 2 | 2.24 | 0.98 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2700x4500 | 2 | 2.24 | 1.13 | --- | --- | --- | --- | --- | --- | --- | --- |

**TABLE 6.4.1(k) TYPE II – BREAKAWAY**

WIND PRESSURE (q) = 465 Pa

| SIGN SIZE DxB (mm x mm) | POSTS | A (m) | C (m) | JACK PINE | | | | DOUGLAS FIR | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Hmax (mm) | | | | Hmax (mm) | | | |
| | | | | POST SIZE (mm) & SPLICE TYPE | | | | POST SIZE (mm) & SPLICE TYPE | | | |
| | | | | 140x140 | TYPE | 140x184 | TYPE | 140x140 | TYPE | 140x184 | TYPE |
| 1200x2400 | 2 | 2.24 | 0.08 | --- | --- | 3980 | A | 3510 | A | 3980 | A |
| 1200x2700 | 2 | 2.24 | 0.23 | --- | --- | 3780 | A | 3100 | A | 3980 | A |
| 1200x3000 | 2 | 2.24 | 0.38 | --- | --- | 3380 | A | 2770 | A | 3980 | A |
| 1200x3300 | 2 | 2.24 | 0.53 | --- | --- | 3060 | A | --- | --- | 3980 | A |
| 1200x3600 | 2 | 2.24 | 0.68 | --- | --- | 2790 | A | --- | --- | 3980 | A |
| 1200x3900 | 2 | 2.24 | 0.83 | --- | --- | --- | --- | --- | --- | 3760 | A |
| 1200x4200 | 2 | 2.24 | 0.98 | --- | --- | --- | --- | --- | --- | 3480 | A |
| 1200x4500 | 2 | 2.24 | 1.13 | --- | --- | --- | --- | --- | --- | 3230 | A |
| 1500x2400 | 2 | 2.24 | 0.08 | --- | --- | 3380 | A | --- | --- | 4130 | A |
| 1500x2700 | 2 | 2.24 | 0.23 | --- | --- | 2990 | A | --- | --- | 4130 | A |
| 1500x3000 | 2 | 2.24 | 0.38 | --- | --- | --- | --- | --- | --- | 3920 | A |
| 1500x3300 | 2 | 2.24 | 0.53 | --- | --- | --- | --- | --- | --- | 3540 | A |
| 1500x3600 | 2 | 2.24 | 0.68 | --- | --- | --- | --- | --- | --- | 3230 | A |
| 1500x3900 | 2 | 2.24 | 0.83 | --- | --- | --- | --- | --- | --- | 2970 | A |
| 1500x4200 | 2 | 2.24 | 0.98 | --- | --- | --- | --- | --- | --- | --- | --- |
| 1500x4500 | 2 | 2.24 | 1.13 | --- | --- | --- | --- | --- | --- | --- | --- |
| 1800x2400 | 2 | 2.24 | 0.08 | --- | --- | --- | --- | --- | --- | 4090 | A |
| 1800x2700 | 2 | 2.24 | 0.23 | --- | --- | --- | --- | --- | --- | 3610 | A |
| 1800x3000 | 2 | 2.24 | 0.38 | --- | --- | --- | --- | --- | --- | 3230 | A |
| 1800x3300 | 2 | 2.24 | 0.53 | --- | --- | --- | --- | --- | --- | --- | --- |
| 1800x3600 | 2 | 2.24 | 0.68 | --- | --- | --- | --- | --- | --- | --- | --- |
| 1800x3900 | 2 | 2.24 | 0.83 | --- | --- | --- | --- | --- | --- | --- | --- |
| 1800x4200 | 2 | 2.24 | 0.98 | --- | --- | --- | --- | --- | --- | --- | --- |
| 1800x4500 | 2 | 2.24 | 1.13 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2100x2400 | 2 | 2.24 | 0.08 | --- | --- | --- | --- | --- | --- | 3480 | A |
| 2100x2700 | 2 | 2.24 | 0.23 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2100x3000 | 2 | 2.24 | 0.38 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2100x3300 | 2 | 2.24 | 0.53 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2100x3600 | 2 | 2.24 | 0.68 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2100x3900 | 2 | 2.24 | 0.83 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2100x4200 | 2 | 2.24 | 0.98 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2100x4500 | 2 | 2.24 | 1.13 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2400x2400 | 2 | 2.24 | 0.08 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2400x2700 | 2 | 2.24 | 0.23 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2400x3000 | 2 | 2.24 | 0.38 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2400x3300 | 2 | 2.24 | 0.53 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2400x3600 | 2 | 2.24 | 0.68 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2400x3900 | 2 | 2.24 | 0.83 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2400x4200 | 2 | 2.24 | 0.98 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2400x4500 | 2 | 2.24 | 1.13 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2700x2400 | 2 | 2.24 | 0.08 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2700x2700 | 2 | 2.24 | 0.23 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2700x3000 | 2 | 2.24 | 0.38 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2700x3300 | 2 | 2.24 | 0.53 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2700x3600 | 2 | 2.24 | 0.68 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2700x3900 | 2 | 2.24 | 0.83 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2700x4200 | 2 | 2.24 | 0.98 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2700x4500 | 2 | 2.24 | 1.13 | --- | --- | --- | --- | --- | --- | --- | --- |

**TABLE 6.4.1(l) TYPE II – BREAKAWAY**

| WIND PRESSURE (q) = 300 Pa | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SIGN SIZE DxB (mm x mm) | POSTS | A (m) | C (m) | **JACK PINE** | | | | **DOUGLAS FIR** | | | |
| | | | | Hmax (mm) | | | | Hmax (mm) | | | |
| | | | | POST SIZE (mm) & SPLICE TYPE | | | | POST SIZE (mm) & SPLICE TYPE | | | |
| | | | | 140x140 | TYPE | 140x184 | TYPE | 140x140 | TYPE | 140x184 | TYPE |
| 1200x4800 | 3 | 2.24 | 0.16 | --- | --- | 2790 | A | --- | --- | 3980 | A |
| 1200x5100 | 3 | 2.24 | 0.31 | --- | --- | 2840 | A | --- | --- | 3980 | A |
| 1200x5400 | 3 | 2.24 | 0.46 | --- | --- | 2940 | A | --- | --- | 3980 | A |
| 1200x5700 | 3 | 2.24 | 0.61 | --- | --- | 3050 | A | --- | --- | 3980 | A |
| 1200x6000 | 3 | 2.24 | 0.76 | --- | --- | 3240 | A | --- | --- | 3980 | A |
| 1500x4800 | 3 | 2.24 | 0.16 | --- | --- | --- | --- | --- | --- | 3240 | A |
| 1500x5100 | 3 | 2.24 | 0.31 | --- | --- | --- | --- | --- | --- | 3290 | A |
| 1500x5400 | 3 | 2.24 | 0.46 | --- | --- | --- | --- | --- | --- | 3400 | A |
| 1500x5700 | 3 | 2.24 | 0.61 | --- | --- | --- | --- | --- | --- | 3530 | A |
| 1500x6000 | 3 | 2.24 | 0.76 | --- | --- | --- | --- | --- | --- | 3750 | A |
| 1800x4800 | 3 | 2.24 | 0.16 | --- | --- | --- | --- | --- | --- | --- | --- |
| 1800x5100 | 3 | 2.24 | 0.31 | --- | --- | --- | --- | --- | --- | --- | --- |
| 1800x5400 | 3 | 2.24 | 0.46 | --- | --- | --- | --- | --- | --- | --- | --- |
| 1800x5700 | 3 | 2.24 | 0.61 | --- | --- | --- | --- | --- | --- | --- | --- |
| 1800x6000 | 3 | 2.24 | 0.76 | --- | --- | --- | --- | --- | --- | 3090 | A |
| 2100x4800 | 3 | 2.24 | 0.16 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2100x5100 | 3 | 2.24 | 0.31 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2100x5400 | 3 | 2.24 | 0.46 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2100x5700 | 3 | 2.24 | 0.61 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2100x6000 | 3 | 2.24 | 0.76 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2400x4800 | 3 | 2.24 | 0.16 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2400x5100 | 3 | 2.24 | 0.31 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2400x5400 | 3 | 2.24 | 0.46 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2400x5700 | 3 | 2.24 | 0.61 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2400x6000 | 3 | 2.24 | 0.76 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2700x4800 | 3 | 2.24 | 0.16 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2700x5100 | 3 | 2.24 | 0.31 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2700x5400 | 3 | 2.24 | 0.46 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2700x5700 | 3 | 2.24 | 0.61 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2700x6000 | 3 | 2.24 | 0.76 | --- | --- | --- | --- | --- | --- | --- | --- |

**TABLE 6.4.1(m) TYPE III**

**BREAKAWAY**

| WIND PRESSURE (q) = 390 Pa | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SIGN SIZE DxB (mm x mm) | POSTS | A (m) | C (m) | **JACK PINE** | | | | **DOUGLAS FIR** | | | |
| | | | | Hmax (mm) | | | | Hmax (mm) | | | |
| | | | | POST SIZE (mm) & SPLICE TYPE | | | | POST SIZE (mm) & SPLICE TYPE | | | |
| | | | | 140x140 | TYPE | 140x184 | TYPE | 140x140 | TYPE | 140x184 | TYPE |
| 1200x4800 | 3 | 2.24 | 0.16 | --- | --- | --- | --- | --- | --- | 3110 | A |
| 1200x5100 | 3 | 2.24 | 0.31 | --- | --- | --- | --- | --- | --- | 3150 | A |
| 1200x5400 | 3 | 2.24 | 0.46 | --- | --- | --- | --- | --- | --- | 3260 | A |
| 1200x5700 | 3 | 2.24 | 0.61 | --- | --- | --- | --- | --- | --- | 3390 | A |
| 1200x6000 | 3 | 2.24 | 0.76 | --- | --- | --- | --- | --- | --- | 3600 | A |
| 1500x4800 | 3 | 2.24 | 0.16 | --- | --- | --- | --- | --- | --- | --- | --- |
| 1500x5100 | 3 | 2.24 | 0.31 | --- | --- | --- | --- | --- | --- | --- | --- |
| 1500x5400 | 3 | 2.24 | 0.46 | --- | --- | --- | --- | --- | --- | --- | --- |
| 1500x5700 | 3 | 2.24 | 0.61 | --- | --- | --- | --- | --- | --- | --- | --- |
| 1500x6000 | 3 | 2.24 | 0.76 | --- | --- | --- | --- | --- | --- | --- | --- |
| 1800x4800 | 3 | 2.24 | 0.16 | --- | --- | --- | --- | --- | --- | --- | --- |
| 1800x5100 | 3 | 2.24 | 0.31 | --- | --- | --- | --- | --- | --- | --- | --- |
| 1800x5400 | 3 | 2.24 | 0.46 | --- | --- | --- | --- | --- | --- | --- | --- |
| 1800x5700 | 3 | 2.24 | 0.61 | --- | --- | --- | --- | --- | --- | --- | --- |
| 1800x6000 | 3 | 2.24 | 0.76 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2100x4800 | 3 | 2.24 | 0.16 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2100x5100 | 3 | 2.24 | 0.31 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2100x5400 | 3 | 2.24 | 0.46 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2100x5700 | 3 | 2.24 | 0.61 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2100x6000 | 3 | 2.24 | 0.76 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2400x4800 | 3 | 2.24 | 0.16 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2400x5100 | 3 | 2.24 | 0.31 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2400x5400 | 3 | 2.24 | 0.46 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2400x5700 | 3 | 2.24 | 0.61 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2400x6000 | 3 | 2.24 | 0.76 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2700x4800 | 3 | 2.24 | 0.16 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2700x5100 | 3 | 2.24 | 0.31 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2700x5400 | 3 | 2.24 | 0.46 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2700x5700 | 3 | 2.24 | 0.61 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2700x6000 | 3 | 2.24 | 0.76 | --- | --- | --- | --- | --- | --- | --- | --- |

**TABLE 6.4.1(n) TYPE III**

**BREAKAWAY**

| WIND PRESSURE (q) = 465 Pa | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SIGN SIZE DxB (mm x mm) | POSTS | A (m) | C (m) | **JACK PINE** | | | | **DOUGLAS FIR** | | | |
| | | | | Hmax (mm) | | | | Hmax (mm) | | | |
| | | | | POST SIZE (mm) & SPLICE TYPE | | | | POST SIZE (mm) & SPLICE TYPE | | | |
| | | | | 140x140 | TYPE | 140x184 | TYPE | 140x140 | TYPE | 140x184 | TYPE |
| 1200x4800 | 3 | 2.24 | 0.16 | --- | --- | --- | --- | --- | --- | --- | --- |
| 1200x5100 | 3 | 2.24 | 0.31 | --- | --- | --- | --- | --- | --- | --- | --- |
| 1200x5400 | 3 | 2.24 | 0.46 | --- | --- | --- | --- | --- | --- | 2710 | A |
| 1200x5700 | 3 | 2.24 | 0.61 | --- | --- | --- | --- | --- | --- | 2810 | A |
| 1200x6000 | 3 | 2.24 | 0.76 | --- | --- | --- | --- | --- | --- | 2980 | A |
| 1500x4800 | 3 | 2.24 | 0.16 | --- | --- | --- | --- | --- | --- | --- | --- |
| 1500x5100 | 3 | 2.24 | 0.31 | --- | --- | --- | --- | --- | --- | --- | --- |
| 1500x5400 | 3 | 2.24 | 0.46 | --- | --- | --- | --- | --- | --- | --- | --- |
| 1500x5700 | 3 | 2.24 | 0.61 | --- | --- | --- | --- | --- | --- | --- | --- |
| 1500x6000 | 3 | 2.24 | 0.76 | --- | --- | --- | --- | --- | --- | --- | --- |
| 1800x4800 | 3 | 2.24 | 0.16 | --- | --- | --- | --- | --- | --- | --- | --- |
| 1800x5100 | 3 | 2.24 | 0.31 | --- | --- | --- | --- | --- | --- | --- | --- |
| 1800x5400 | 3 | 2.24 | 0.46 | --- | --- | --- | --- | --- | --- | --- | --- |
| 1800x5700 | 3 | 2.24 | 0.61 | --- | --- | --- | --- | --- | --- | --- | --- |
| 1800x6000 | 3 | 2.24 | 0.76 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2100x4800 | 3 | 2.24 | 0.16 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2100x5100 | 3 | 2.24 | 0.31 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2100x5400 | 3 | 2.24 | 0.46 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2100x5700 | 3 | 2.24 | 0.61 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2100x6000 | 3 | 2.24 | 0.76 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2400x4800 | 3 | 2.24 | 0.16 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2400x5100 | 3 | 2.24 | 0.31 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2400x5400 | 3 | 2.24 | 0.46 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2400x5700 | 3 | 2.24 | 0.61 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2400x6000 | 3 | 2.24 | 0.76 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2700x4800 | 3 | 2.24 | 0.16 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2700x5100 | 3 | 2.24 | 0.31 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2700x5400 | 3 | 2.24 | 0.46 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2700x5700 | 3 | 2.24 | 0.61 | --- | --- | --- | --- | --- | --- | --- | --- |
| 2700x6000 | 3 | 2.24 | 0.76 | --- | --- | --- | --- | --- | --- | --- | --- |

**TABLE 6.4.1(o) TYPE III**

**BREAKAWAY**

### 6.4.2 Design Philosophy

The design tables have been developed for the two structure types, namely Non-Breakaway and Breakaway structures. The maximum allowable heights (Hmax) provided in the tables are established based on two criteria. The bending strength of the timber post and the lower post length restricted to 16 feet (4.88m) because availability in these post sizes is limited for lengths over 16 feet. Particular cross section ground profile is not considered in the design. The general layout of the roadside sign supports shall be established according to the site ground profile and the design criteria specified in the Roadside Safety Manual for the required minimum horizontal and vertical clearances as shown in Figures 6.4.1(d) and 6.4.1(e).

Seventy-eight sign sizes are given, ranging from the minimum of 1200 x 2400 to maximum size of 2700 x 6000.

For Non-Breakaway structures, the number of posts used can be 2, 3 or 4. For Breakaway structures (that are not protected by a traffic barrier), the number of posts used is 2 or 3; 4 posts cannot be used because of the minimum clear horizontal spacing requirements between posts of 2100mm.

Each sign is designed for 3 possible 10-year return Reference Wind Pressures (without any increase for funnelling) of 300, 390, and 465 Pa, according to CHBDC. At any particular site, where the local wind pressure is greater than one of the above, the sign structure shall be designed for the next-higher wind pressure grouping.

Jack Pine and Douglas Fir are the two species used in establishing the design table.

Post size cross-sections are 140x140 and 140x184, limited to these because larger sizes were <u>not</u> crash-tested (for use with breakaway sign supports).

For design purposes, the post height used in flexure calculations, was 200mm below ground surface, to allow for post flexibility within the soil.

Signs with 2 posts were designed using corresponding tributary sign area. For signs with 3 or 4 posts, the distribution of wind reactions on the posts were analysed using continuous beam theory. The governing limiting Hmax is based on the maximum wind load acting on either the exterior or interior post.

Where Hmax > Hi (i = 1,2,3,4), the post size (based on structure type, wind load, and timber species) would be adequate.

There are two post splice details, namely “ Type A” and “Type B”, are given in this manual. The post splice is designed according to CSA 086-01 (2005).

## 6.5 FABRICATION AND INSTALLATION

### 6.5.1 GENERAL

(i) Timber shall be Coastal Douglas Fir or Jack Pine No.1 Grade, S4S, in accordance with CSA Standard 086 for beams and stringers, NLGA grading rules.

(ii) All wood shall be pressure preservative treated in accordance with OPSS 1601.

(iii) All cuts, holes and damage after pressure treatment shall be treated with preservatives as per OPSS 1601.

(iv) Connector plates and splice plates shall be structural steel in accordance with CAN/CSA G40.20-13/G40.21-13.

(v) Connector and splice bolts and nuts shall be in accordance with ASTM Specification A325M. Footing bolts shall be in accordance with ASTM Specification A307M.

(vi) Pressed steel shear plates shall be in accordance with CSA Standard 086.

(vii) All steel including nuts and bolts shall be hot dip galvanized.

(viii) Stainless steel bolts, nuts and washers shall conform to ASTM F593 Alloy 304.

(ix) Splice plates shall be used as templates for drilling holes in timber.

(x) Timber surfaces at splice shall be flat and perpendicular to centre line of post to ensure full contact.

(xi) Earth fill around footings shall be placed in 150 mm lifts and tamped thoroughly to ensure maximum compaction. Top layer should be approximately 100 mm above surrounding ground and given a conical shape to facilitate water run-off and provide a reserve of fill for settlement.

## 6.5.2 TYPICAL LAYOUT PLAN

Figure 6.5.2 is for use in installing timber sign supports.

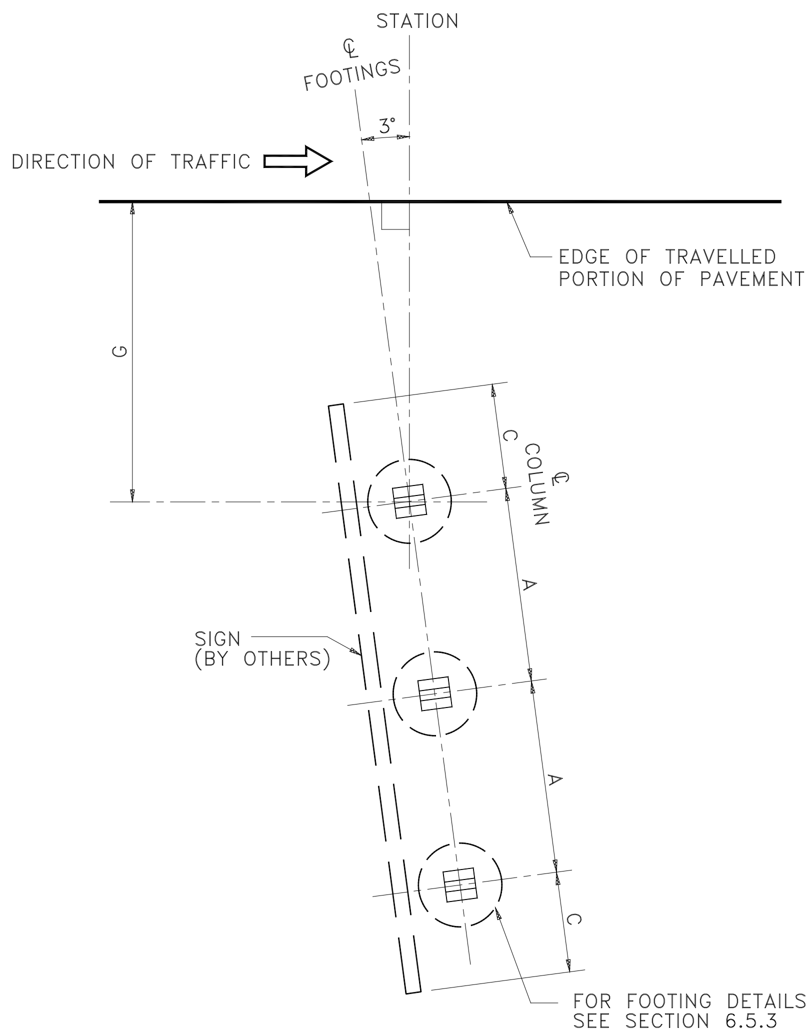
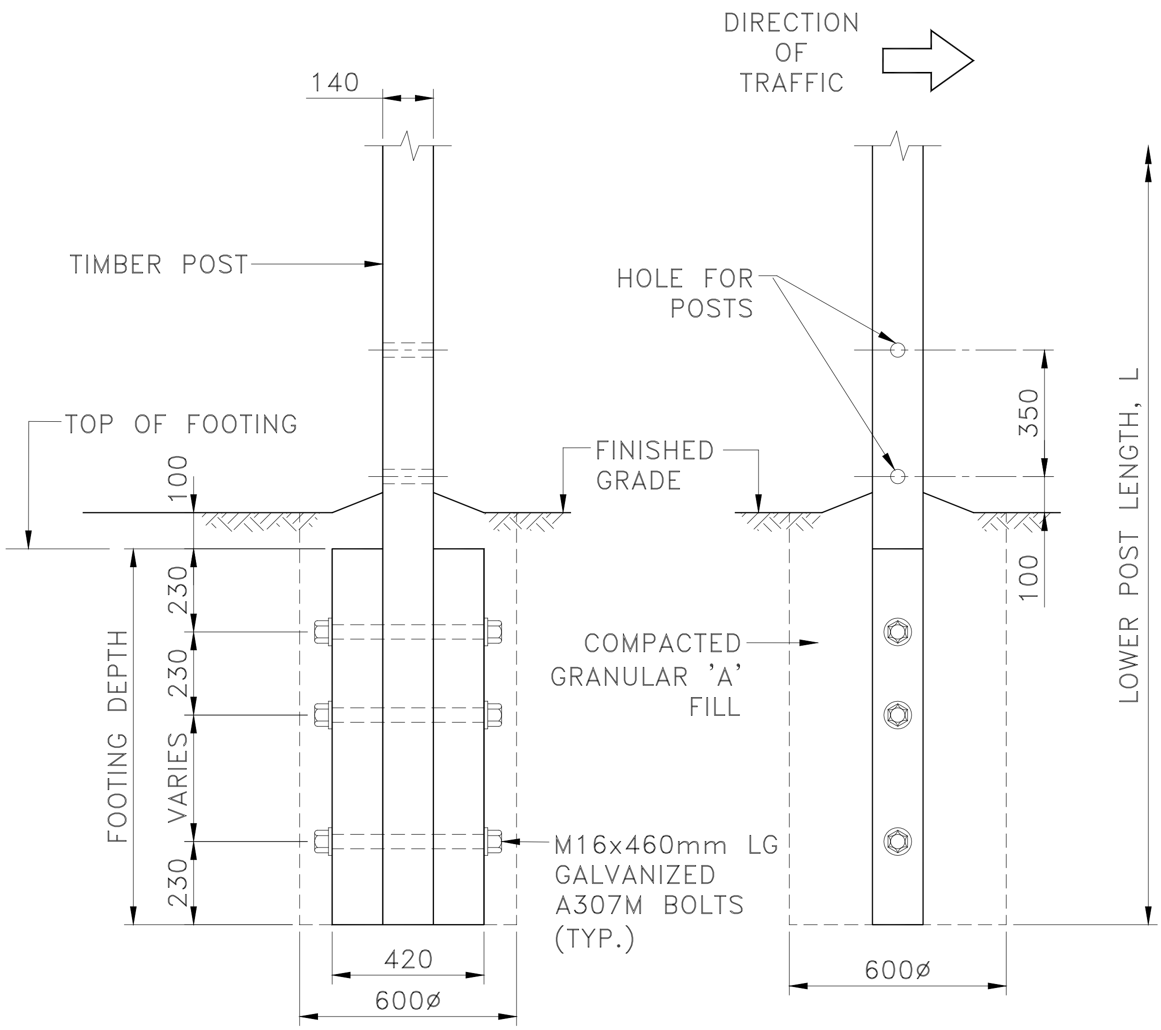



**FIGURE 6.5.2 TYPICAL LAYOUT PLAN**

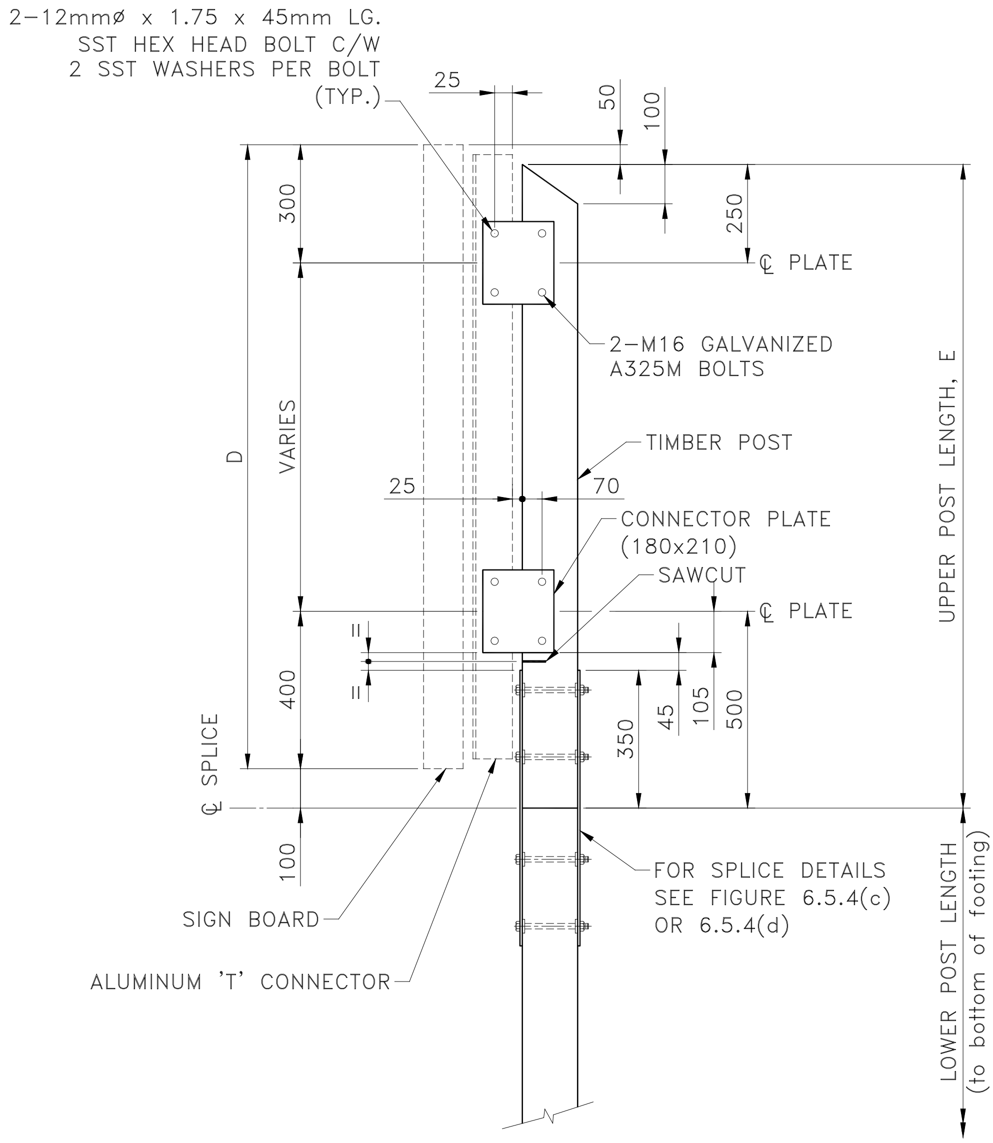
### 6.5.3 FOOTING




| POST SIZE (mm) | FOOTING DEPTH (mm) | HOLES DIA. (mm) |
|---|---|---|
| 140 x 140 | 1200 | 50 |
| 140 x 184 | 1500 | 75 |

**FIGURE 6.5.3 FOOTING DETAILS**

### 6.5.4 SIGN DETAILS




Note that sign board and aluminium 'T' connector are supplied by MTO.

| SAWCUT DEPTH (mm) | POST SIZE |
|---|---|
| 50 | 140x140 |
| 75 | 140x184 |

**FIGURE 6.5.4(a) SIGN CONNECTION**

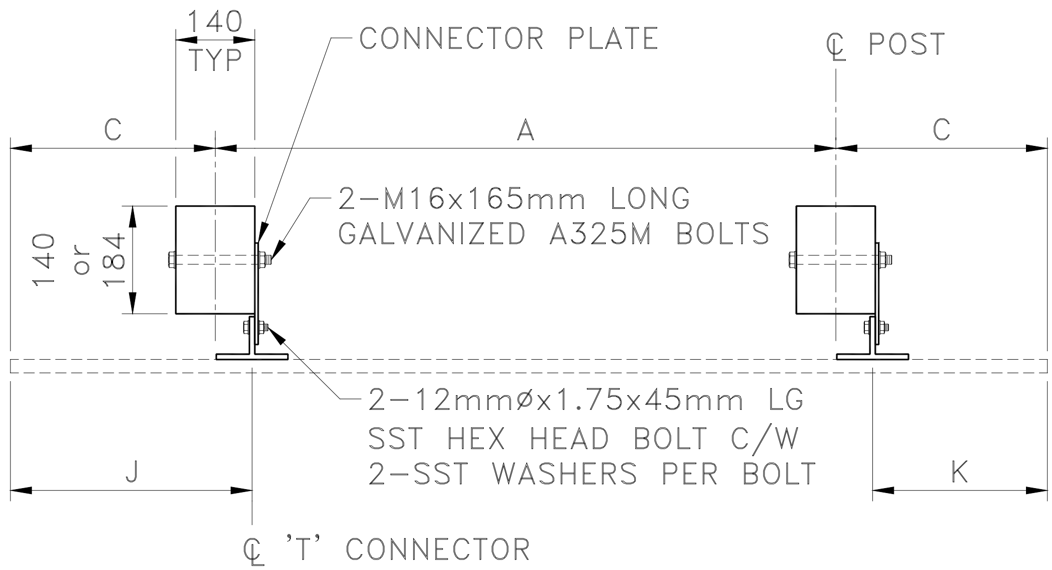
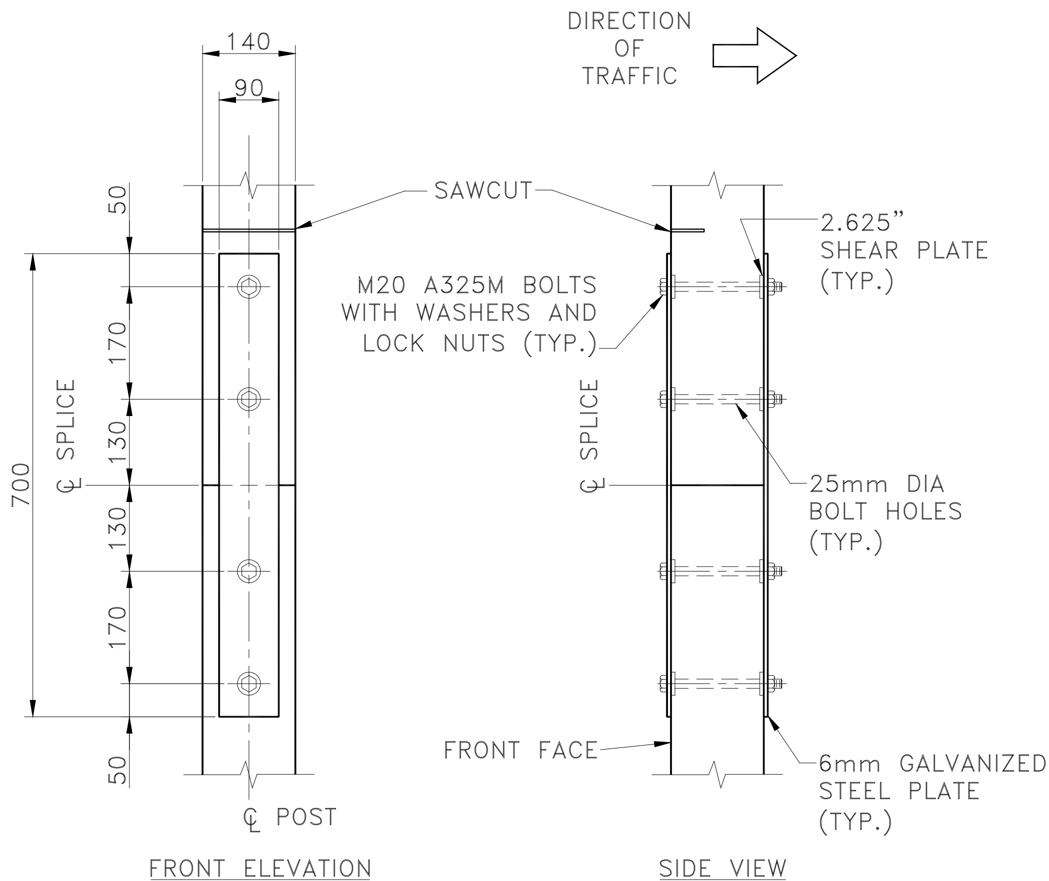


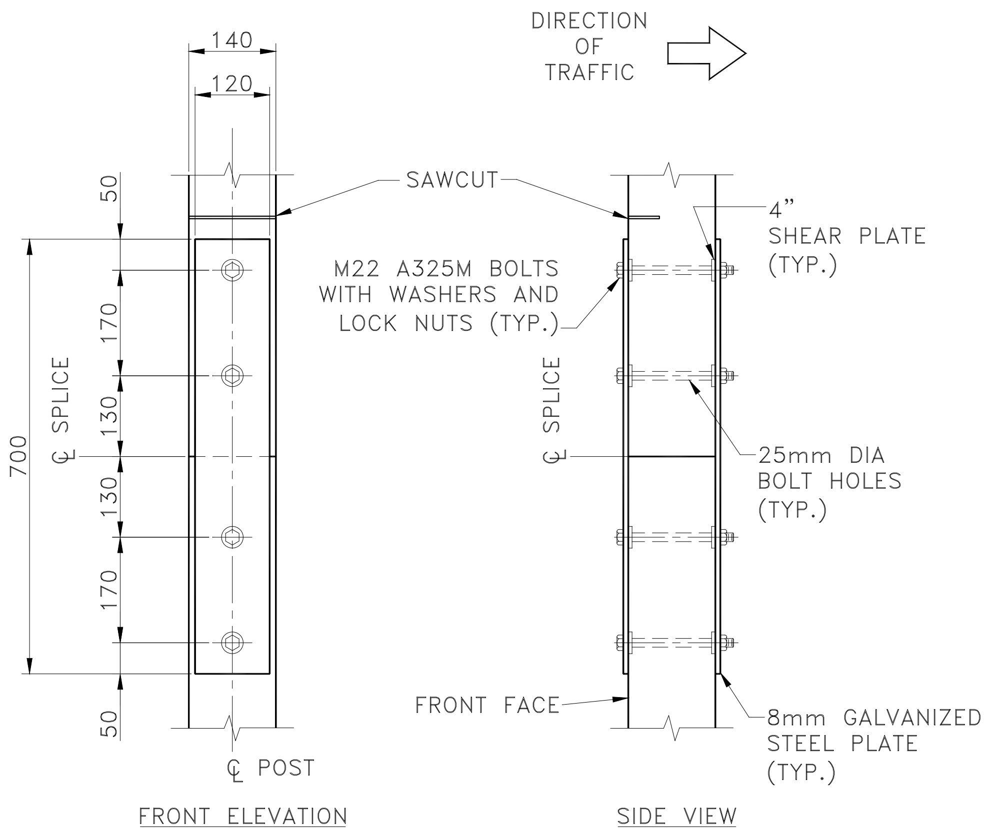

**FIGURE 6.5.4(b) TYPICAL CROSS SECTION**




| POST SIZE (mm) | BOLT SIZE |
|---|---|
| 140 x 140 | M20 x 200 mm long |
| 140 x 184 | M20 x 250 mm long |

Note that splice surfaces shall be flat and perpendicular to centre-line of the post to ensure full contact.

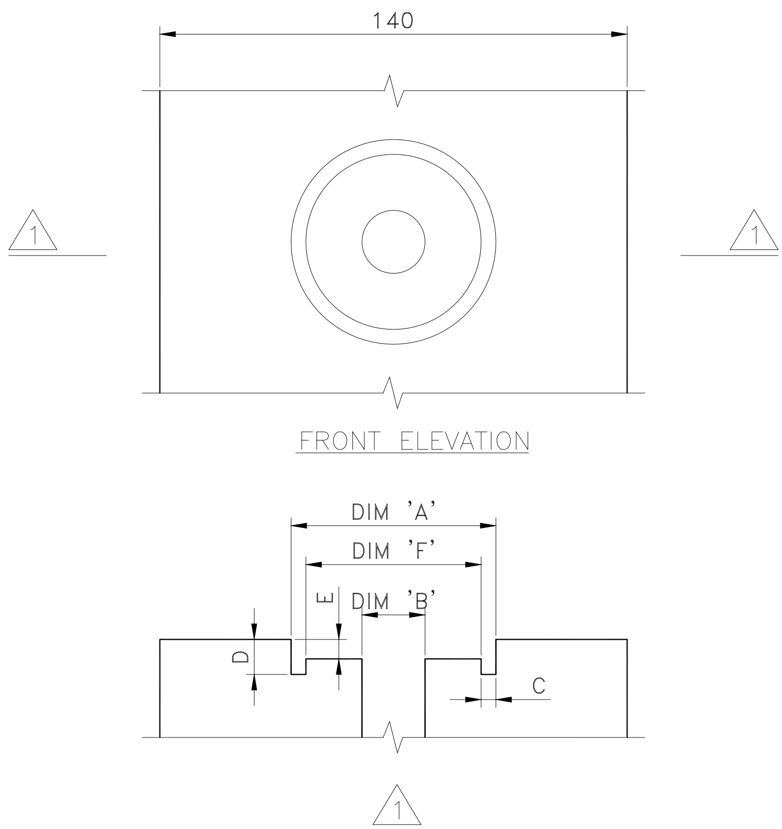
**FIGURE 6.5.4(c) POST SPLICE DETAIL – TYPE "A"**




| POST SIZE (mm) | BOLT SIZE |
|---|---|
| 140 x 140 | M22 x 200 mm long |
| 140 x 184 | M22 x 250 mm long |

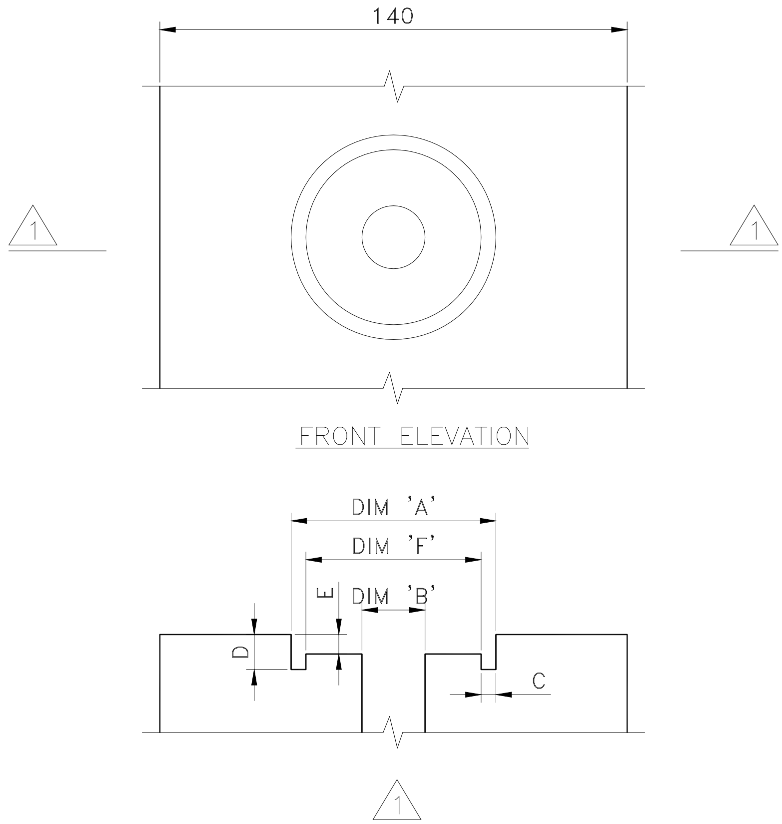
Note that splice surfaces shall be flat and perpendicular to centre-line of the post to ensure full contact.

**FIGURE 6.5.4(d) POST SPLICE DETAIL – TYPE "B"**




| 2.625 INCH<br>SHEAR PLATE GROOVE | | |
|---|---|---|
| DIM | INCHES | mm |
| A | 2.63 | 66.8 |
| B | 0.81 | 20.6 |
| C | 0.19 | 4.5 |
| D | 0.45 | 11.4 |
| E | 0.25 | 6.4 |
| F | 2.25 | 57.2 |

**FIGURE 6.5.4(e) 2.625 INCH SHEAR PLATE GROOVE DETAIL**




| 4 INCH SHEAR PLATE GROOVE | | |
|---|---|---|
| DIM | INCHES | mm |
| A | 4.00 | 102.4 |
| B | 0.94 | 23.8 |
| C | 0.21 | 5.3 |
| D | 0.64 | 16.3 |
| E | 0.22 | 5.6 |
| F | 3.49 | 88.6 |

**FIGURE 6.5.4(f) 4 INCH SHEAR PLATE GROOVE DETAIL**

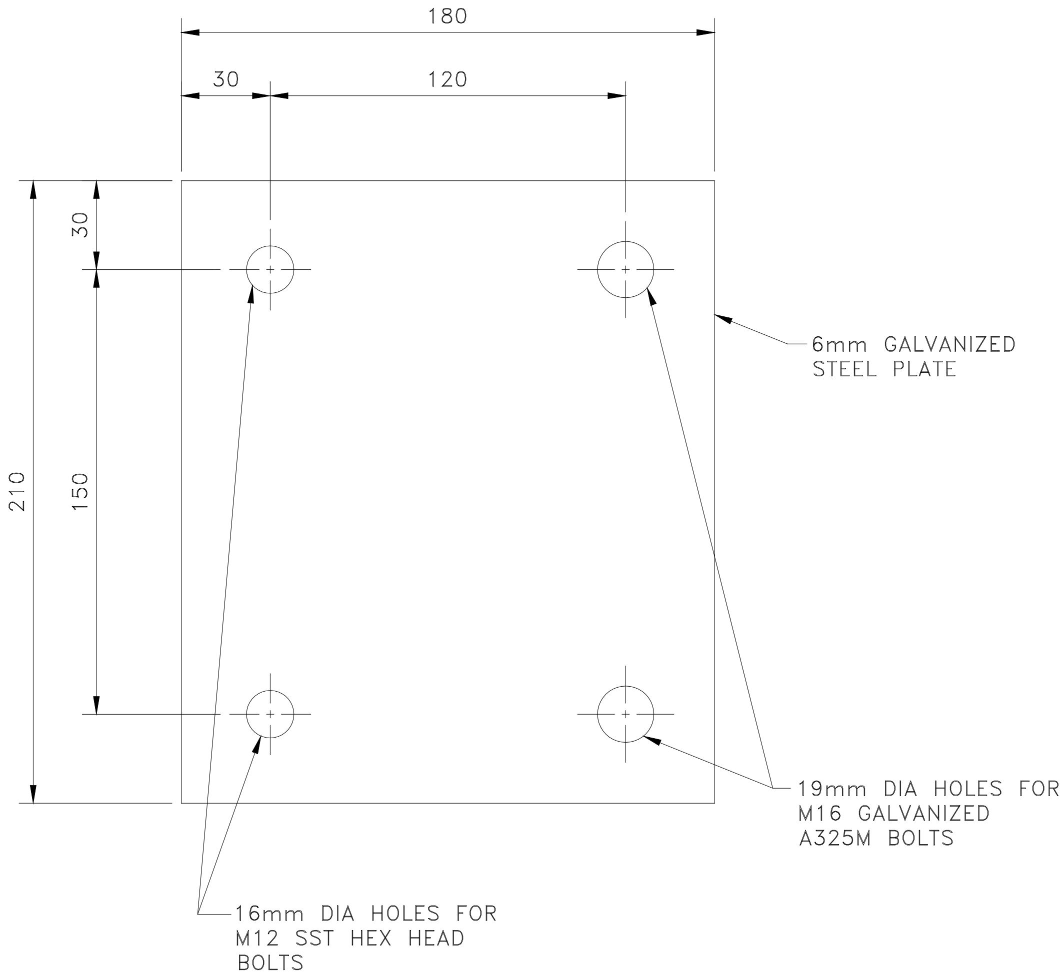



**FIGURE 6.5.4(g) CONNECTOR PLATE DETAILS**

## 6.6 WORK SHEETS

The following “Work Sheets” are for your convenience when designing timber sign supports.

| TIMBER SIGN SUPPORTS<br><br>SIGN SIZE (DxB) _ _ _ _ _ x _ _ _ _ _ | WP No. _ _ _ _ _ _ _ _ _ _<br>STATION _ _ _ _ _ _ _ _ _<br>DATE _ _ _ _ _ _ _ _ _ _ _ |
|---|---|

FROM TABLE 6.2.2, Figures 6.4.1 (a) to (c); and Tables 6.4.1(a) to (o):

| | | | | |
|---|---|---|---|---|
| NON-BREAKAWAY SIGN SUPPORT TYPE | **II** | **III** | **IV** | Tables 6.4.1(a) to (i) |
| BREAKAWAY SIGN SUPPORT TYPE | **II** | **III** | | Tables 6.4.1(j) to (o) |
| DIMENSION 'C' (overhang) | | | | |
| SPACING OF POSTS 'A' | | | | |

ASSUME SIGN SUPPORT TYPE WITH THE GREATER NUMBER OF POSTS:

| | |
|---|---|
| EL. EP (Datum) = | |
| DISTANCE FROM EP TO LONGEST POST | |
| EP.Pi (at longest post i) = | |

ELEVATION AT CENTRE LINE OF SIGN: (EL.CS = EL.EP + 1800 + 0.5 D)

| | | |
|---|---|---|
| EL.CS= | + 1800 + | = |

POST DESIGN HEIGHT ($H_{max}$) AT LONGEST POST LOCATION I :

($H_{max}$ = EL.CS – El.$P_i$)

| | | |
|---|---|---|
| $H_{max}$ = | – | = |

≥ 1800 + 0.5 D | = |   $H_{max}$ | |

If the sign is less than the minimum vertical clearance requirement above the ground level immediately below the sign then EL.CS and Hmax shall be increased to suit. The minimum vertical clearance requirement for breakaway and non-breakaway sign support is 2100mm and 1000mm respectively.

| EL. CS | $H_{max}$ |
|---|---|
| | |

| | TABLE | TYPE | SPECIES | POST SIZE | $H_{max}$ | SPLICE |
|---|---|---|---|---|---|---|
| BREAKAWAY | 6.4.1( ) | | | 140 x | | |
| | 6.4.1( ) | | | 140 x | | |
| | 6.4.1( ) | | | 140 x | | |
| | 6.4.1( ) | | | 140 x | | |
| | 6.4.1( ) | | | 140 x | | |
| | 6.4.1( ) | | | 140 x | | |

| | |
|---|---|
| POST SIZE 140 x | |
| TYPE | |
| SPECIES | |
| SPLICE TYPE | |
| FOOTING DEPTH | |

DETERMINE POST SPACING AND POST LENGTHS:

| POST # | EL.Pi | DISTANCE FROM EP TO Pi | LOWER POST LENGTH $\mathbf{L}_i$ = EL.CS – EL.$P_i$ – 0.5 D + FOOTING DEPTH |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |

| | |
|---|---|
| UPPER POST LENGTH = **E** = D + 50 | = |

All dimensions are in millimetres.

## APPENDIX TO DIVISION 6

EXAMPLE

SIGN SIZE: 1200 mm x 6000 mm

q: 300 Pa

GIVEN: EL.EP = 10000 mm
EL.P1 = 9500 mm
EL.P2 = 10000 mm
EP.P3 = 10500 mm

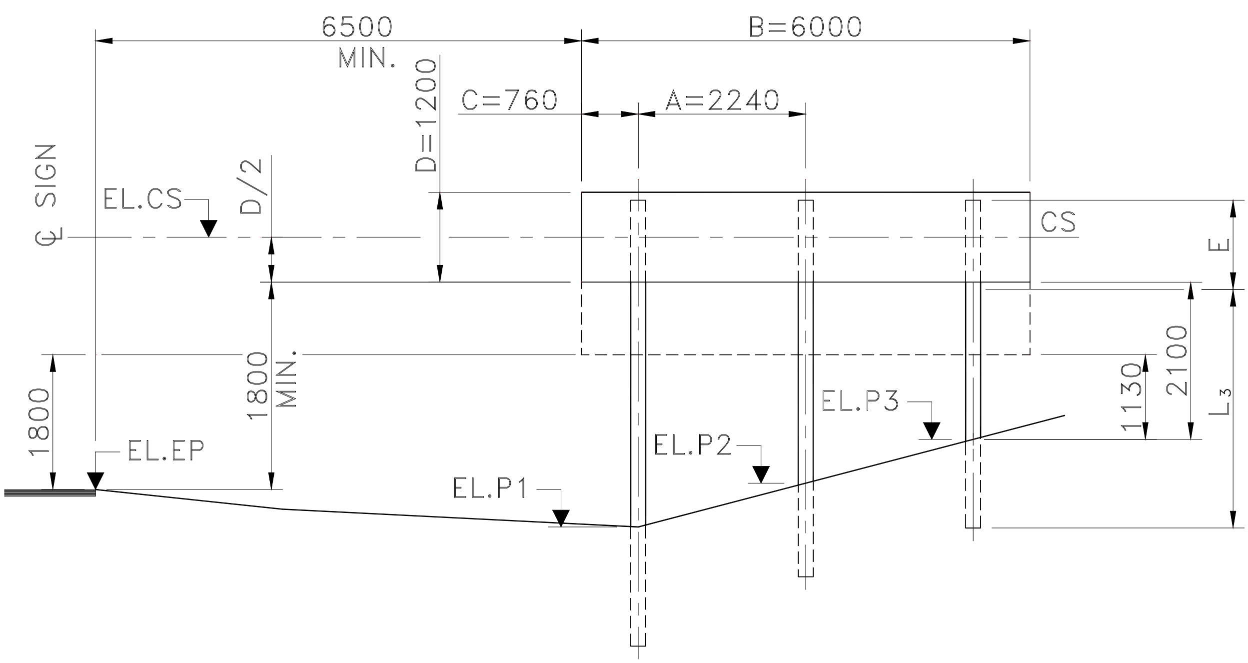



**FIGURE EXAMPLE**
**(BREAKAWAY SIGN SUPPORT)**

| TIMBER SIGN SUPPORTS<br>**SIGN SIZE (DxB)** 1200 x 6000 | WP No. _ _ _ _ _ _ _ _ _ _<br>STATION _ _ _ _ _ _ _ _ _<br>DATE _ _ _ _ _ _ _ _ _ _ _ |
|---|---|

FROM TABLE 6.2.2, Figures 6.4.1 (a) to (c); and Tables 6.4.1(a) to (o):

| | | | | |
|---|---|---|---|---|
| NON-BREAKAWAY SIGN SUPPORT TYPE | **II** | **III** | **IV** | Tables 6.4.1(a) to (i) |
| BREAKAWAY SIGN SUPPORT TYPE | **II** | **III** | — | Tables 6.4.1(j) to (o) |
| DIMENSION ‘C’ (overhang) | — | 760 | — | |
| SPACING OF POSTS ‘A’ | — | 2240 | — | |

ASSUME SIGN SUPPORT TYPE WITH THE GREATER NUMBER OF POSTS:

| | |
|---|---|
| EL. EP (Datum) = | 10000 |
| DISTANCE FROM EP TO LONGEST POST | 7260 |
| EP.Pi (at longest post i) = | 9500 |

ELEVATION AT CENTRE LINE OF SIGN: (EL.CS = EL.EP + 1800 + 0.5 D)

| | | |
|---|---|---|
| EL.CS= | 10000 + 1800 + 600 | = 12400 |

POST DESIGN HEIGHT ($H_{max}$) AT LONGEST POST LOCATION I :

($H_{max}$ = EL.CS – $El.P_i$)

| | | |
|---|---|---|
| $H_{max}$ = | 12400 – 9500 | = 2900 |

≥ 1800 + 0.5 D = 2400

$H_{max}$ 2900

If the sign is less than the minimum vertical clearance requirement above the ground level immediately below the sign then EL.CS and Hmax shall be increased to suit. The minimum vertical clearance requirement for breakaway and non-breakaway sign support is 2100mm and 1000mm respectively.

AT FARTHEST POST, SIGN IS
1130mm ABOVE THE GOUND LEVEL,
THEN 2100 – 1130 = 970
NEW EL.CS=12400 + 970 = 13370
NEW Hmax=2900 + 970 = 3870

| EL. CS | $H_{max}$ |
|---|---|
| 13370 | 3870 |

| | TABLE | TYPE | SPECIES | POST SIZE | $H_{max}$ | SPLICE |
|---|---|---|---|---|---|---|
| BREAKAWAY | 6.4.1(m ) | III | J.P. | 140 x 184 | 3240 | A |
| | 6.4.1(m ) | III | D.F. | 140 x 184 | 3980 | A |
| | 6.4.1( ) | — | — | 140 x — | — | — |
| | 6.4.1( ) | — | — | 140 x — | — | — |
| | 6.4.1( ) | — | — | 140 x — | — | — |
| | 6.4.1( ) | — | — | 140 x — | — | — |

NO TYPE II POST SIZE
STRUCTURALLY ADEQUATE
AVAILABLE.

C = 760 A = 2240

| | |
|---|---|
| POST SIZE 140 x | 184 |
| TYPE | III |
| SPECIES | D.F. |
| SPLICE TYPE | A |
| FOOTING DEPTH | 1500 |

DETERMINE POST SPACING AND POST LENGTHS:

| POST # | EL.Pi | DISTANCE FROM EP TO Pi | LOWER POST LENGTH **L**$_i$ = EL.CS – EL.P$_i$ – 0.5 D + FOOTING DEPTH |
|---|---|---|---|
| 1 | 9500 | 7260 | 4770 |
| 2 | 10000 | 9500 | 4270 |
| 3 | 10500 | 11740 | 3770 |
| 4 | — | — | — |

| | |
|---|---|
| UPPER POST LENGTH = **E** = D + 50 | = 1250 |

All dimensions are in millimetres

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# METRIC

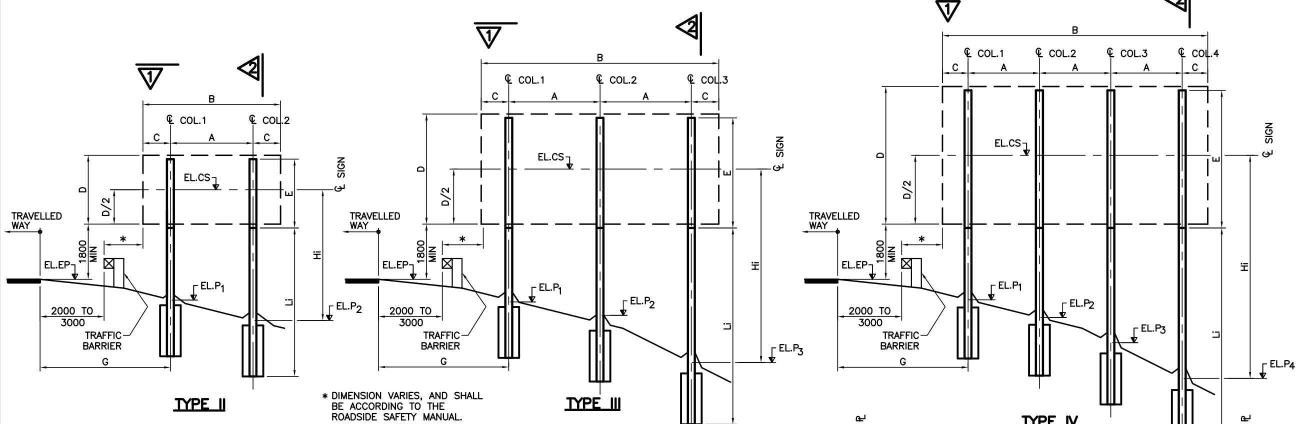
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

CONT No

WP No

SHEET

TIMBER POST NON-BREAKAWAY SIGN SUPPORTS GENERAL ARRANGEMENT

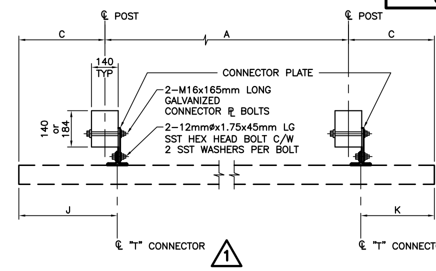


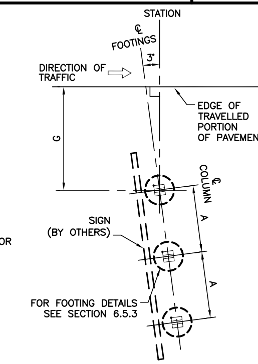

TYPE II

TYPE III

TYPE IV

* DIMENSION VARIES, AND SHALL BE ACCORDING TO THE ROADSIDE SAFETY MANUAL.

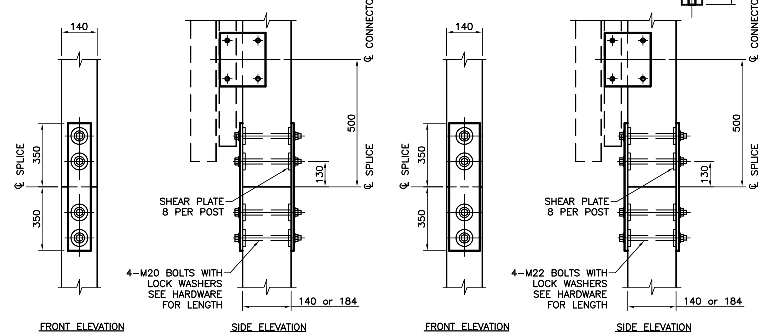



TYPICAL LAYOUT PLAN

TABLE 1 – GENERAL

| | | | | | |
|---|---|---|---|---|---|
| STATION | | | | | |
| SIGN No. | | | | | |
| SIGN SIZE (DxB) | | | | | |
| TYPE | | | | | |
| EL.EP | | | | | |
| EL.P1 | | | | | |
| EL.P2 | | | | | |
| EL.P3 | | | | | |
| EL.P4 | | | | | |
| POST SIZE – SPECIES | | | | | |
| UPPER POST LENGTH, E | | | | | |
| LOWER POST LENGTH, L1 | | | | | |
| LOWER POST LENGTH, L2 | | | | | |
| LOWER POST LENGTH, L3 | | | | | |
| LOWER POST LENGTH, L4 | | | | | |
| FOOTING DEPTH | | | | | |
| SPLICE TYPE | | | | | |
| A | | | | | |
| C | | | | | |
| G | | | | | |
| J | | | | | |
| K | | | | | |

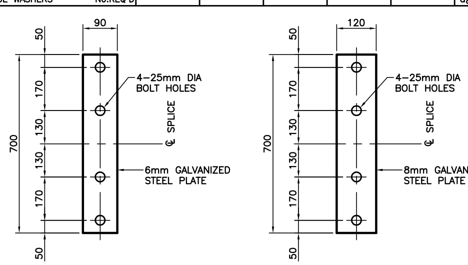



POST SPLICE DETAIL – TYPE "A"

POST SPLICE DETAIL – TYPE "B"

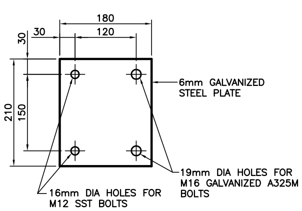
TABLE 2 – HARDWARE

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| STATION | | | | | | | |
| CONNECTOR ℞ – No.REQ'D | | | | | | ℞ 6x180x210mm GALVANIZED | – 2 PER POST |
| SPLICE ℞ – No.REQ'D | | | | | | ℞ 6x90x700mm GALVANIZED | – 2 PER POST |
| SPLICE ℞ – No.REQ'D | | | | | | ℞ 8x120x700mm GALVANIZED | – 2 PER POST |
| CONNECTOR ℞ BOLTS – No.REQ'D | | | | | | M16x165mm LONG ASTM A325M | – 4 PER POST |
| 'T' CONNECTOR BOLTS – No.REQ'D | | | | | | 12mmøx1.75x45mm LG SST HEX HD BOLT | – 4 PER POST |
| SPLICE BOLTS – No.REQ'D | | | | | | M20x200mm LONG ASTM A325M | |
| SPLICE BOLTS – No.REQ'D | | | | | | M22x200mm LONG ASTM A325M | |
| SPLICE BOLTS – No.REQ'D | | | | | | M20x250mm LONG ASTM A325M | |
| SPLICE BOLTS – No.REQ'D | | | | | | M22x250mm LONG ASTM A325M | |
| SHEAR PLATES – No.REQ'D | | | | | | 2.625 INCH DIA CSA 086 | |
| SHEAR PLATES – No.REQ'D | | | | | | 4 INCH DIA CSA 086 | |
| FOOTING BOLTS – No.REQ'D | | | | | | M16x460 mm LONG ASTM A307M | |
| SPLICE WASHERS – No.REQ'D | | | | | | $d_o$ = 75mm t = 6.4mm | |



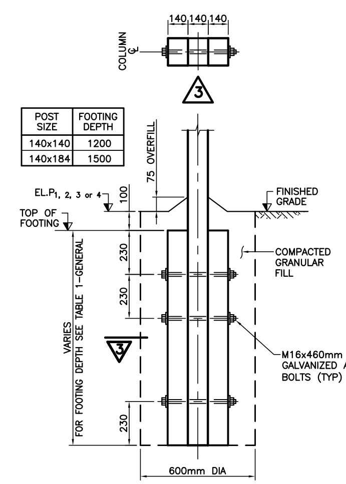

SPLICE PLATE "A"

SPLICE PLATE "B"

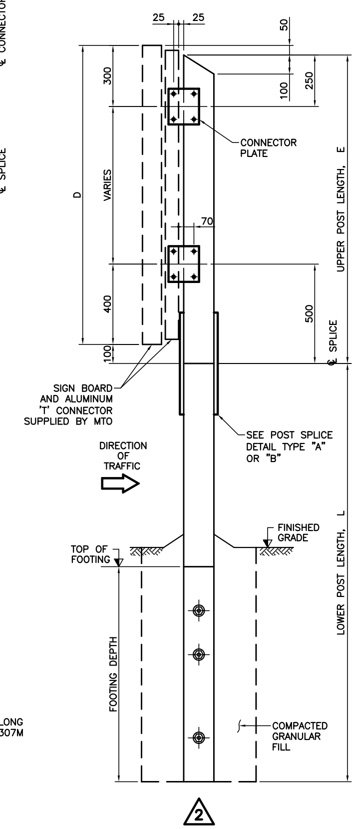



CONNECTOR PLATE

| POST SIZE | FOOTING DEPTH |
|---|---|
| 140x140 | 1200 |
| 140x184 | 1500 |




FOOTING DETAILS




DRAWING NOT TO BE SCALED 100mm ON ORIGINAL DRAWING

NOTES

1. TIMBER SHALL BE COASTAL DOUGLAS FIR OR JACK PINE No.1 GRADE OR EQUIVALENT UNDER THE SAME SPECIES IDENTIFICATION IN ACCORDANCE WITH CSA STANDARD 086 FOR BEAM AND STRINGER, NLGA STANDARD GRADING RULES.
2. ALL WOOD SHALL BE PRESSURE PRESERVATIVE TREATED AS PER OPSS 1601.
3. ALL CUTS, HOLES, AND DAMAGE AFTER PRESSURE TREATMENT SHALL BE TREATED WITH PRESERVATIVES AS PER OPSS 1601.
4. CONNECTOR PLATES AND SPLICE PLATES SHALL BE STRUCTURAL STEEL IN ACCORDANCE WITH CSA STANDARD CAN3-G40.21-M GRADE 300W.
5. CONNECTOR AND SPLICE BOLTS AND NUTS, SHALL BE IN ACCORDANCE WITH ASTM SPECIFICATION A325M. FOOTING BOLTS SHALL BE IN ACCORDANCE WITH ASTM SPECIFICATION A307M.
6. PRESSED STEEL SHEAR PLATES SHALL BE IN ACCORDANCE WITH CSA STANDARD 086.
7. ALL STEEL INCLUDING NUTS AND BOLTS SHALL BE HOT DIP GALVANIZED.
8. SPLICE PLATES SHALL BE USED AS TEMPLATES FOR DRILLING HOLES IN TIMBER.
9. TIMBER SURFACES AT SPLICE SHALL BE FLAT AND PERPENDICULAR TO ℄ OF POST TO ENSURE FULL CONTACT.
10. POST SPLICES ARE ONLY REQUIRED IF FULL LENGTH (E + Li) POSTS ARE NOT AVAILABLE. WHEN A SPLICE IS REQUIRED FOR ANY POST WITHIN A SIGN SUPPORT, ALL POSTS SHALL THEN BE SPLICED, THE SPLICES DETAILED AND LOCATED AS SHOWN.
11. ALL STAINLESS STEEL BOLTS, NUTS AND WASHERS SHALL CONFORM TO ASTM F593 ALLOY 304.
12. GRANULAR FILL AROUND FOOTINGS SHALL BE PLACED IN 150 mm LAYERS AND TAMPED THOROUGHLY TO ENSURE MAXIMUM COMPACTION. TOP LAYER SHOULD BE APPROXIMATELY 100mm ABOVE SURROUNDING GROUND AND GIVEN A CONICAL SHAPE TO INCREASE WATER RUN-OFF AND PROVIDE A RESERVE OF FILL FOR SETTLEMENT.

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

STANDARD DRAWING JULY 2014 | SS118–34

TIMBER POST NON-BREAKAWAY SIGN SUPPORTS GENERAL ARRANGEMENT

REVISIONS | DESCRIPTION

DESIGN | CHK | CODE CHBDC–00 | CL 625–ONT | DATE

DRAWN | CHK | SITE | DWG

MINISTRY OF TRANSPORTATION, ONTARIO PR–D–707 88–05

DRAWING NAME: s118–34 July 2014.dwg MODIFIED: 2014/07/16 16:50:48

CREATED: 1998/03/13

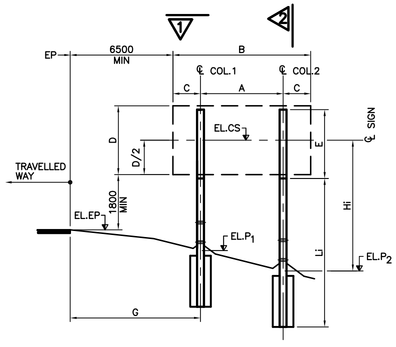
MINISTRY OF TRANSPORTATION, ONTARIO PR-D-707 88-05

# METRIC

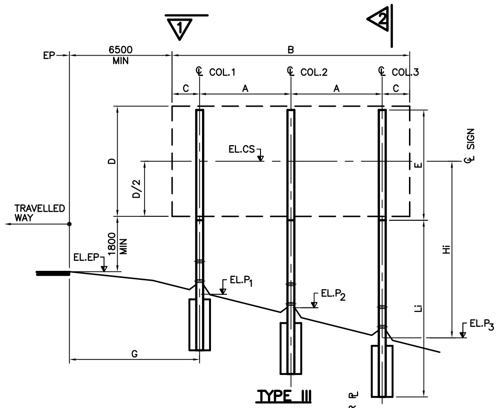
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

| CONT No | |
|---|---|
| WP No | SHEET |

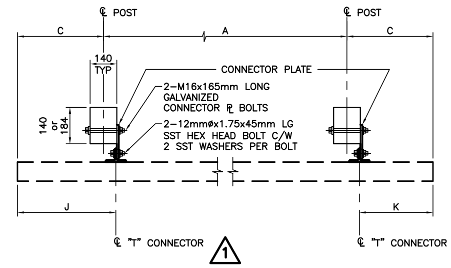
**TIMBER POST BREAKAWAY SIGN SUPPORTS GENERAL ARRANGEMENT**

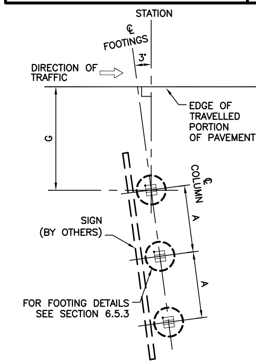



TYPE II




TYPE III

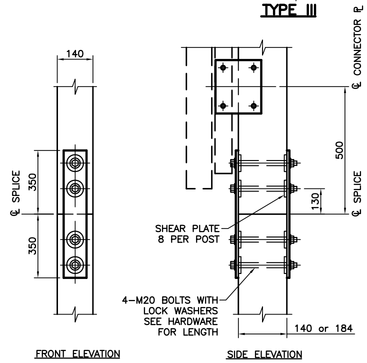


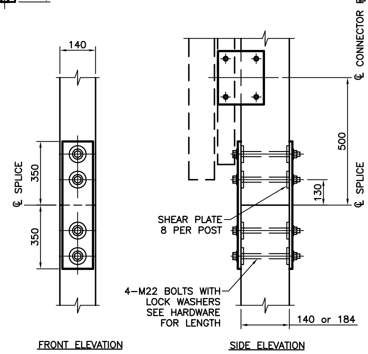

TYPICAL LAYOUT PLAN

TABLE 1 – GENERAL

| STATION | | | | | |
|---|---|---|---|---|---|
| SIGN No. | | | | | |
| SIGN SIZE (DxB) | | | | | |
| TYPE | | | | | |
| EL.EP | | | | | |
| EL.P1 | | | | | |
| EL.P2 | | | | | |
| EL.P3 | | | | | |
| POST SIZE – SPECIES | | | | | |
| UPPER POST LENGTH, E | | | | | |
| LOWER POST LENGTH, L1 | | | | | |
| LOWER POST LENGTH, L2 | | | | | |
| LOWER POST LENGTH, L3 | | | | | |
| FOOTING DEPTH | | | | | |
| SPLICE TYPE | | | | | |
| A | | | | | |
| C | | | | | |
| G | | | | | |
| J | | | | | |
| K | | | | | |




POST SPLICE DETAIL – TYPE "A"




POST SPLICE DETAIL – TYPE "B"

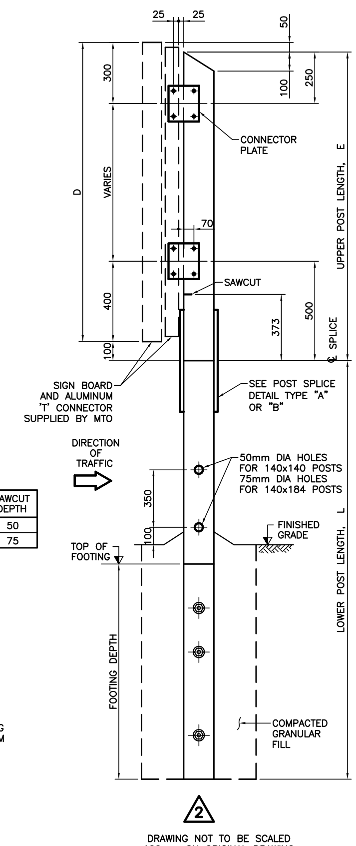
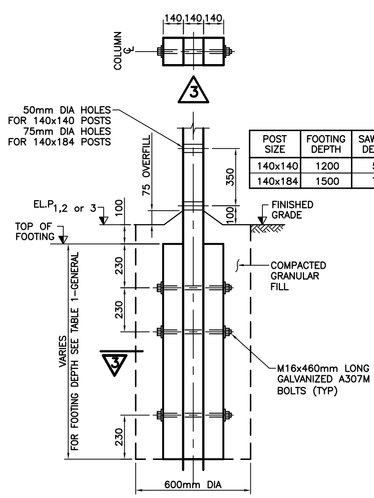


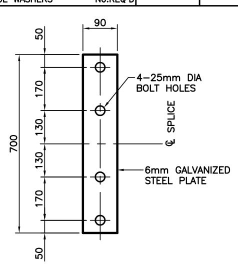

TABLE 2 – HARDWARE

| STATION | | | | | | | |
|---|---|---|---|---|---|---|---|
| CONNECTOR ℄ – No.REQ'D | | | | | | ℄ 6x180x210mm GALVANIZED | – 2 PER POST |
| SPLICE ℄ – No.REQ'D | | | | | | ℄ 6x90x700mm GALVANIZED | – 2 PER POST |
| SPLICE ℄ – No.REQ'D | | | | | | ℄ 8x120x700mm GALVANIZED | – 2 PER POST |
| CONNECTOR ℄ BOLTS – No.REQ'D | | | | | | M16x165mm LONG ASTM A325M | – 4 PER POST |
| 'T' CONNECTOR BOLTS – No.REQ'D | | | | | | 12mmøx1.75x45mm LG SST HEX HD BOLT | – 4 PER POST |
| SPLICE BOLTS – No.REQ'D | | | | | | M20x200mm LONG ASTM A325M | |
| SPLICE BOLTS – No.REQ'D | | | | | | M22x200mm LONG ASTM A325M | |
| SPLICE BOLTS – No.REQ'D | | | | | | M20x250mm LONG ASTM A325M | |
| SPLICE BOLTS – No.REQ'D | | | | | | M22x250mm LONG ASTM A325M | |
| SHEAR PLATES – No.REQ'D | | | | | | 2.625 INCH DIA CSA 086 | |
| SHEAR PLATES – No.REQ'D | | | | | | 4 INCH DIA CSA 086 | |
| FOOTING BOLTS – No.REQ'D | | | | | | M16x460 mm LONG ASTM A307M | |
| SPLICE WASHERS – No.REQ'D | | | | | | $d_o$ = 75mm t = 6.4mm | |

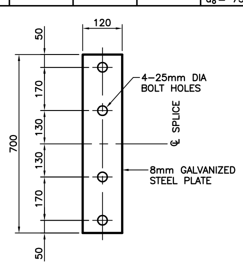



| POST SIZE | FOOTING DEPTH | SAWCUT DEPTH |
|---|---|---|
| 140x140 | 1200 | 50 |
| 140x184 | 1500 | 75 |

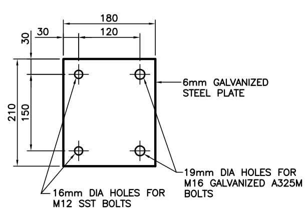
FOOTING DETAILS




SPLICE PLATE "A"




SPLICE PLATE "B"




CONNECTOR PLATE

## NOTES

1 TIMBER SHALL BE COASTAL DOUGLAS FIR OR JACK PINE No.1 GRADE OR EQUIVALENT UNDER THE SAME SPECIES IDENTIFICATION IN ACCORDANCE WITH CSA STANDARD 086 FOR BEAM AND STRINGER, NLGA STANDARD GRADING RULES.
2 ALL WOOD SHALL BE PRESSURE PRESERVATIVE TREATED AS PER OPSS 1601.
3 ALL CUTS, HOLES, AND DAMAGE AFTER PRESSURE TREATMENT SHALL BE TREATED WITH PRESERVATIVES AS PER OPSS 1601.
4 CONNECTOR PLATES AND SPLICE PLATES SHALL BE STRUCTURAL STEEL IN ACCORDANCE WITH CSA STANDARD CAN3–G40.21–M GRADE 300W.
5 CONNECTOR AND SPLICE BOLTS AND NUTS SHALL BE IN ACCORDANCE WITH ASTM SPECIFICATION A325M. FOOTING BOLTS SHALL BE IN ACCORDANCE WITH ASTM SPECIFICATION A307M.
6 PRESSED STEEL SHEAR PLATES SHALL BE IN ACCORDANCE WITH CSA STANDARD 086.
7 ALL STEEL INCLUDING NUTS AND BOLTS SHALL BE HOT–DIP GALVANIZED.
8 SPLICE PLATES SHALL BE USED AS TEMPLATES FOR DRILLING HOLES IN TIMBER.
9 TIMBER SURFACES AT SPLICE SHALL BE FLAT AND PERPENDICULAR TO ℄ OF POST TO ENSURE FULL CONTACT.
10 POST SPLICES ARE ONLY REQUIRED IF FULL LENGTH (E + Li) POSTS ARE NOT AVAILABLE. WHEN A SPLICE IS REQUIRED FOR ANY POST WITHIN A SIGN SUPPORT, ALL POSTS SHALL THEN BE SPLICED, THE SPLICES DETAILED AND LOCATED AS SHOWN.
11 ALL STAINLESS STEEL BOLTS, NUTS, AND WASHERS SHALL CONFORM TO ASTM F593 ALLOY 304.
12 GRANULAR FILL AROUND FOOTINGS SHALL BE PLACED IN 150mm LAYERS AND TAMPED THOROUGHLY TO ENSURE MAXIMUM COMPACTION. TOP LAYER SHOULD BE APPROXIMATELY 100 mm ABOVE SURROUNDING GROUND AND GIVEN A CONICAL SHAPE TO INCREASE WATER RUN–OFF AND PROVIDE A RESERVE OF FILL FOR SETTLEMENT.

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

| STANDARD DRAWING JULY 2014 | SS118–35 |
|---|---|
| TIMBER POST BREAKAWAY SIGN SUPPORTS GENERAL ARRANGEMENT | |

| REVISIONS | | | | |
|---|---|---|---|---|
| | | DESCRIPTION | | |
| DESIGN | CHK | CODE CHBDC–00 | CL 625–ONT | DATE |
| DRAWN | CHK | SITE | | DWG |

DRAWING NAME: s118-35 July 2014.dwg
CREATED: 1998/03/13 MODIFIED: 2014/07/16 16:51:11

# SIGN SUPPORT MANUAL

## DIVISION 7 – OVERHEAD MONOTUBE SIGN SUPPORTS

April 2015

# 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 Canadian Highway Bridge Design Code 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 1.2m by 1.2m.
(b) Supporting one under mounted sign or up to four evenly spaced front mounted signs.
(c) Design span length ranging from 13.5m to and including 24.0m.
(d) Maximum allowable column height to be 7.7m. Since members are custom fabricated for each installation, any span-height combination is allowed.
(e) Reference wind pressure to be 595 Pa at a return period of 50 years. The effect of wind tunnelling as stated in CHBDC 3.10.1.1 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, 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, 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 7.1.6). For this reason 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.

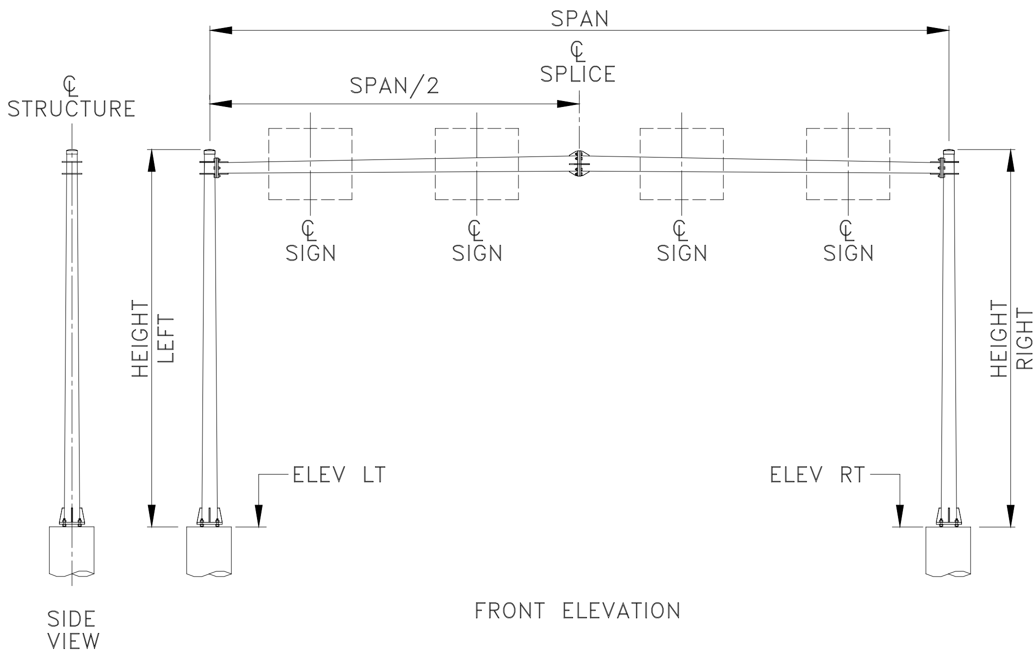



**FIGURE 7.1.2(a) TYPE I – FRONT MOUNTED**

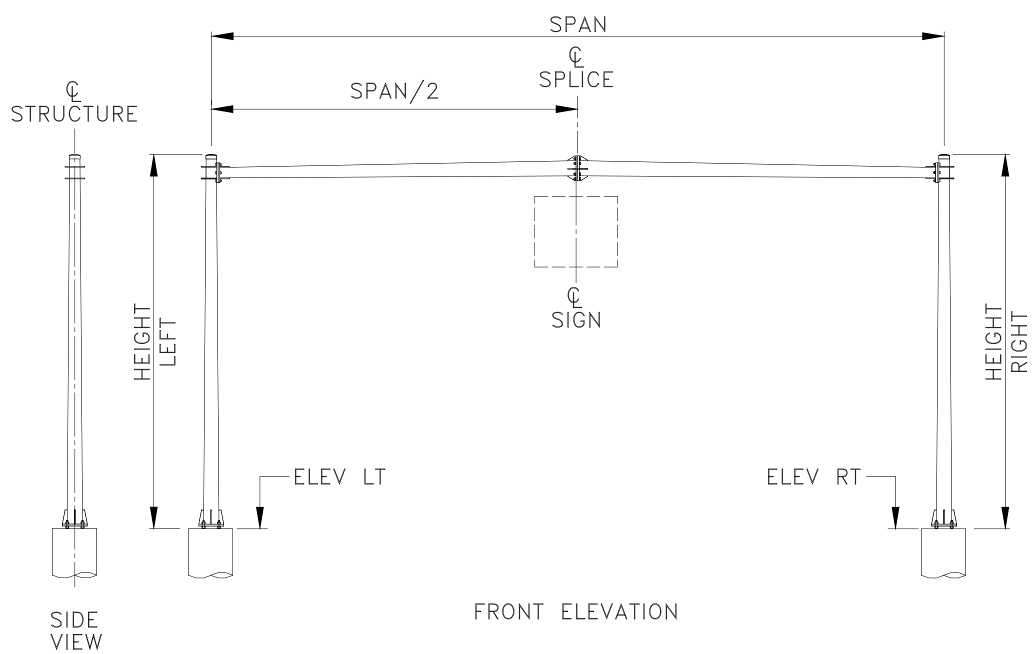



**FIGURE 7.1.2(b) TYPE II – UNDER MOUNTED**

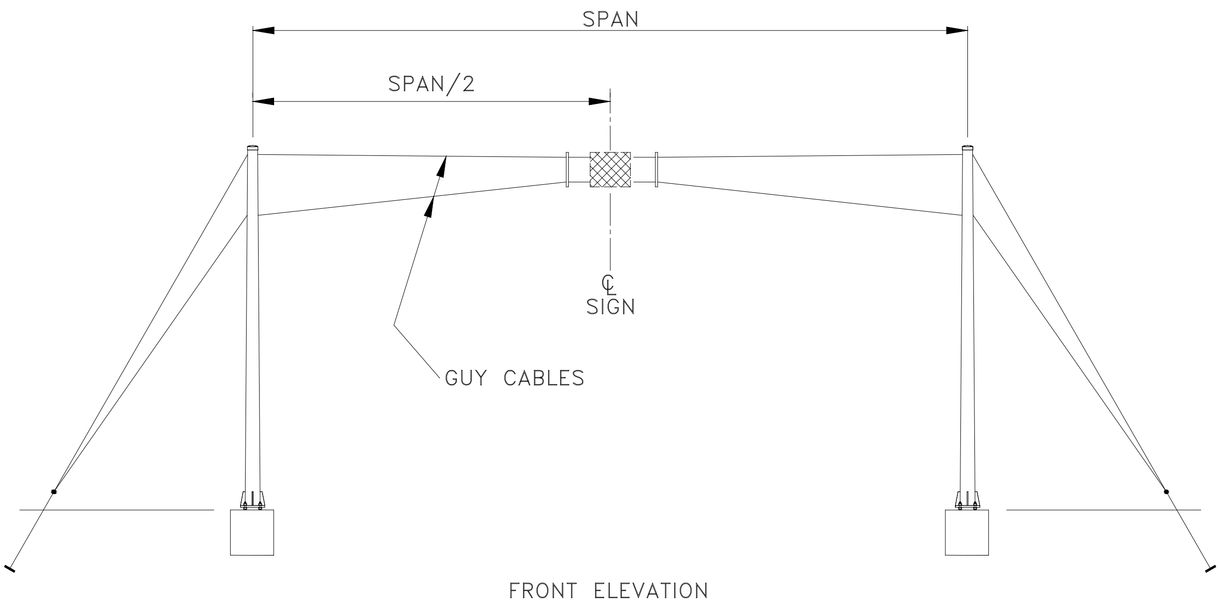



**FIGURE 7.1.2(c) SIGN SUPPORT DETAILS**

### 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 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 30º or cohesive with a minimum shear strength of 50 kPa.

Encountered soil conditions such as rock fill, land fill and poor soft material 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 Division 3).

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 Safety 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 5300mm and not less than 5600mm to the lowest structural member of the sign support structures as specified in the Geometric Design Standards for Ontario Highways.

## 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

Prior to design, a “Key Plan and Frame Dimension” drawing(s) must be prepared to enable the working drawings to be detailed. This drawing(s) will form part of the contract documents and must show, for one or more structures, the following information.

(i) A key plan, indicating the approximate location of each support.

(ii) The Structure I.D. 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 5300mm but may be slightly more in order to allow for a future change in pavement elevation.

(viii) The elevation of the ground line at each footing.

(ix) The top of footing elevation. The footings must neither be more than 200mm above finished grade for safety reasons nor less than 75mm 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 finally 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 and 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, 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 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 Division 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, 4$^{th}$ 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.

APPENDIX TO DIVISION 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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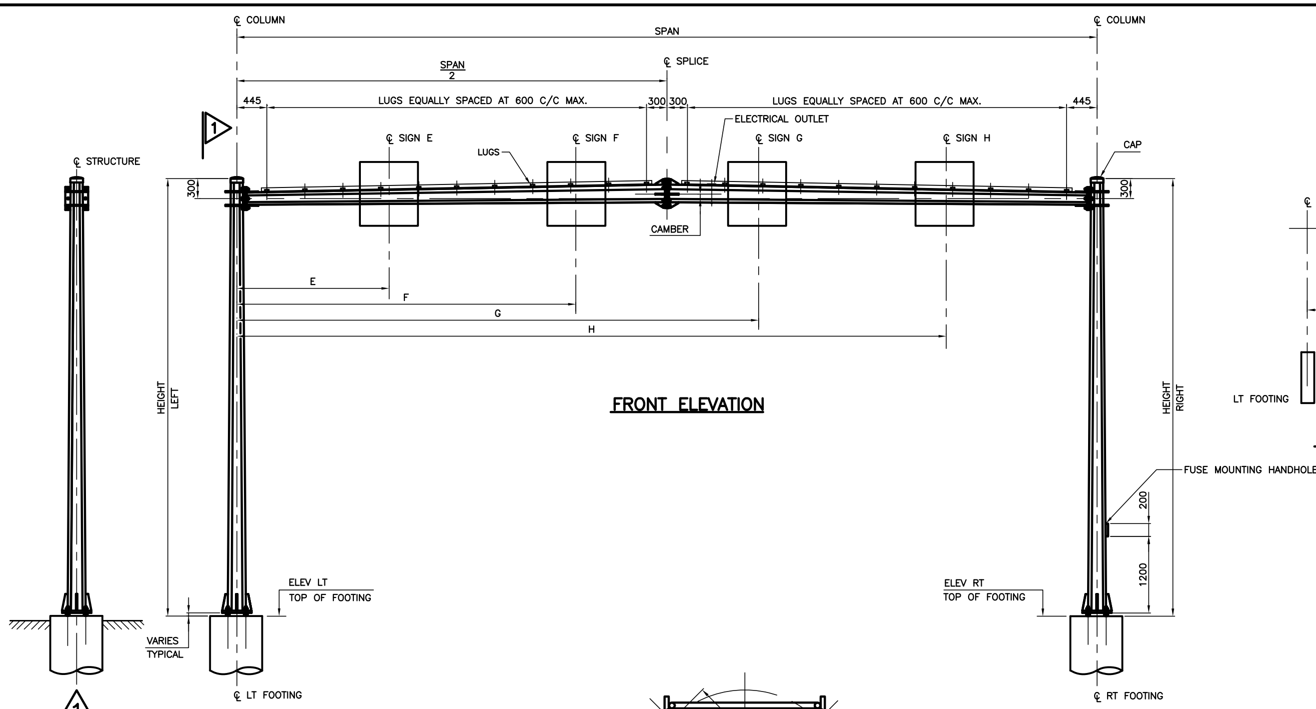
# METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

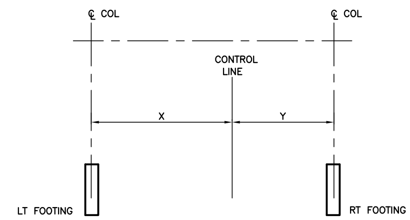
DIST
CONT No
WP No

STEEL MONOTUBE SIGN SUPPORT – TYPE I GENERAL ARRANGEMENT

SHEET




FRONT ELEVATION



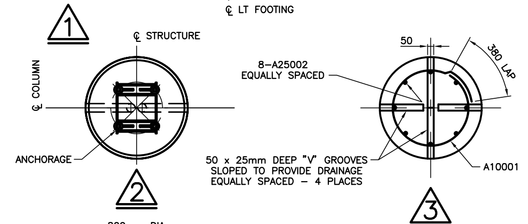

FRONT ELEVATION FOOTING LAYOUT DETAILS

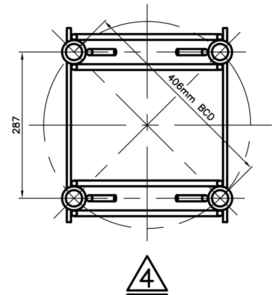
## GENERAL NOTES:

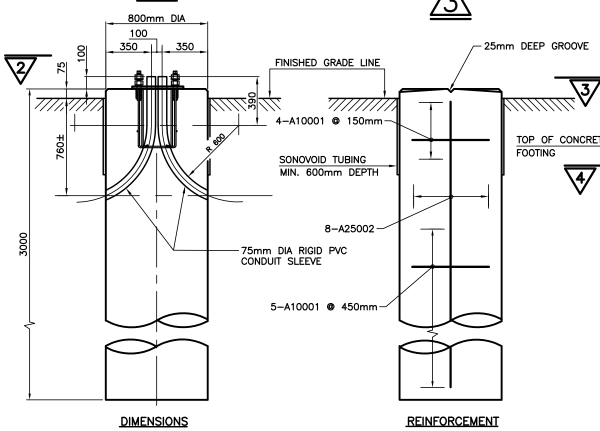
1. SIGN SUPPORT SHALL BE ERECTED PERPENDICULAR TO CENTRE LINE OF HIGHWAY OR AS DIRECTED BY THE ENGINEER.
2. FOOTING SHALL BE BUILT IN ACCORDANCE WITH OPSS 904, CLASS OF CONCRETE 30MPa, REINFORCING STEEL SHALL BE GRADE 400W.
3. CONCRETE SHALL BE PLACED ON UNDISTURBED GROUND IN AN AUGERED HOLE.
4. CLEAR 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 No. SS118–42.
9. CONDUIT SLEEVE SHALL BE RIGID PVC 75mm I.D., 90° BEND SCEPTER CAT. No. NSL–3–24 OR EQUAL.
10. STEEL FOR EACH FOOTING TO BE BUNDLED SEPARATELY AND MARKED WITH STATION NUMBER.

## ANCHORAGE NOTES:

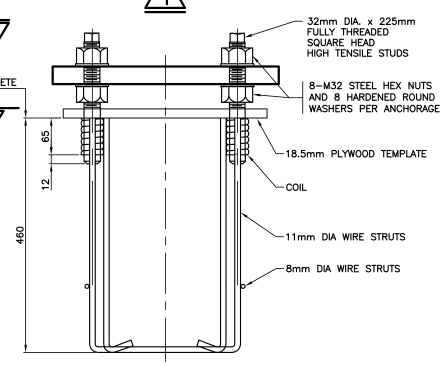
1. ANCHORAGE STRUTS AND COILS TO BE SAE STANDARD 1030 STEEL.
2. HIGH TENSILE STUDS TO BE ASTM SPECIFICATION A4140, A193, GRADE B–7 STEEL.
3. STEEL HEXAGON NUTS AND HARDENED STEEL WASHERS SHALL BE IN ACCORDANCE WITH ASTM SPECIFICATION A325.
4. THE COMPLETE ANCHORAGE ASSEMBLY INCLUDING STUDS, NUTS AND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




FOOTING DETAILS




ANCHORAGE DETAILS

TABLE OF SIGN DATA

| SUPPORT No. | SIGN E (mm) | | | SIGN F (mm) | | | SIGN G (mm) | | | SIGN H (mm) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | DIM E | D X B | MESSAGE | DIM F | D X B | MESSAGE | DIM G | D X B | MESSAGE | DIM H | D X B | MESSAGE |
| | | | | | | | | | | | | |
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| | | | | | | | | | | | | |

TABLE OF SUPPORT DIMENSIONS

| SUPPORT No. | STATION | SPAN (mm) | COL. HT (mm) | | ELEV. TOP OF FTG. (mm) | | X (mm) | Y (mm) |
|---|---|---|---|---|---|---|---|---|
| | | | LEFT | RIGHT | LEFT | RIGHT | | |
| | | | | | | | | |
| | | | | | | | | |
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| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

QUANTITIES PER FOOTING

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

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

STANDARD DRAWING JULY 2014

SS118–40

STEEL MONOTUBE SIGN SUPPORT – TYPE I

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

REVISIONS

DESCRIPTION

| DESIGN | CHK | CODE CHBDC–00 | LOAD | DATE |
|---|---|---|---|---|
| DRAWN | CHK | SITE | | DWG |

MINISTRY OF TRANSPORTATION, ONTARIO PR–D–707 88–05

DRAWING NAME: s118–40 July 2014.dwg 2014/07/16 16:52:35
CREATED: 1998/03/13 MODIFIED:

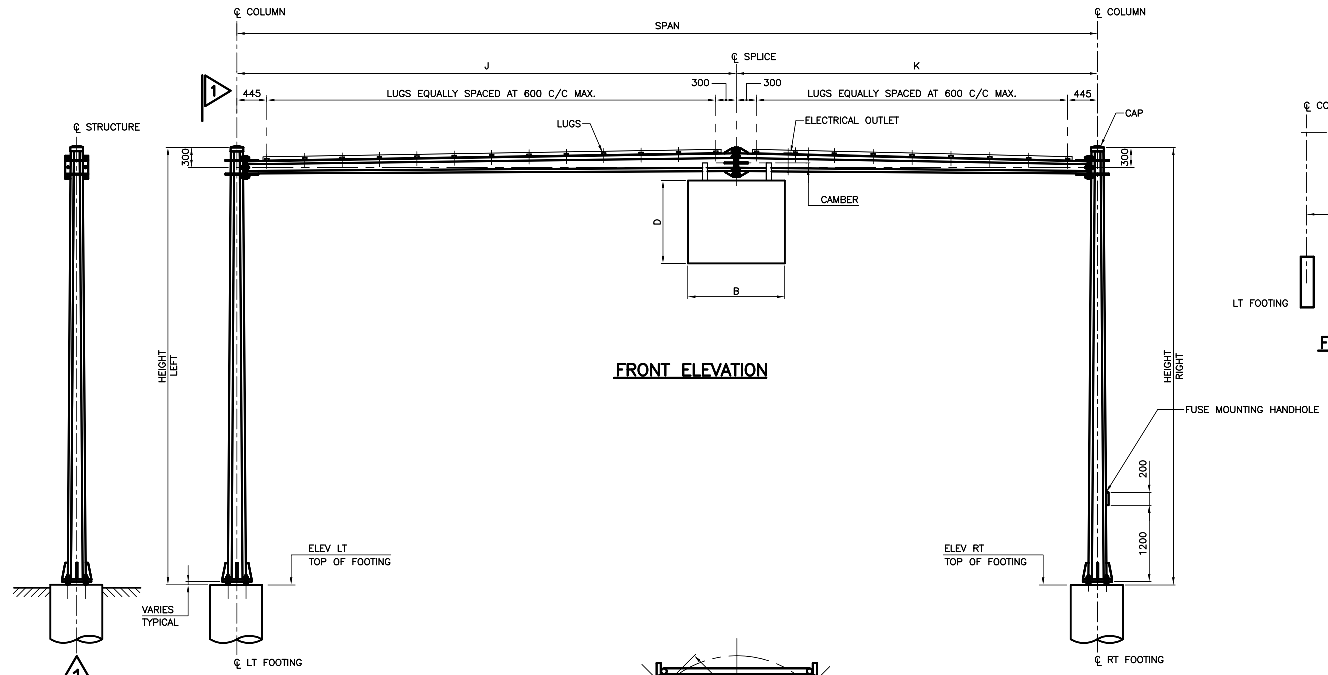
# METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

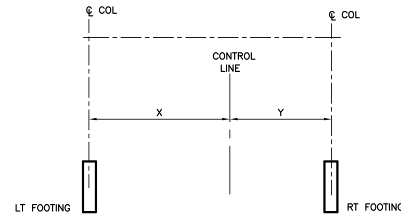
DIST
CONT No
WP No

SHEET

STEEL MONOTUBE SIGN SUPPORT – TYPE II GENERAL ARRANGEMENT




## FRONT ELEVATION



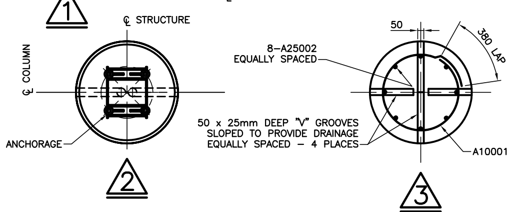

## FRONT ELEVATION FOOTING LAYOUT DETAILS

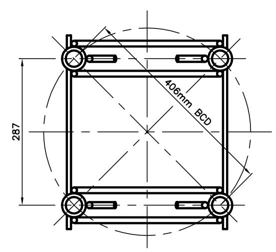
## GENERAL NOTES:

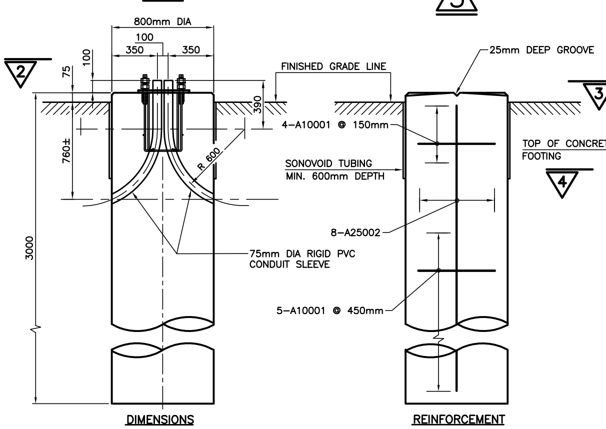
1. SIGN SUPPORT SHALL BE ERECTED PERPENDICULAR TO CENTRE LINE OF HIGHWAY OR AS DIRECTED BY THE ENGINEER.
2. FOOTING SHALL BE BUILT IN ACCORDANCE WITH OPSS 904, CLASS OF CONCRETE 30MPa, REINFORCING STEEL SHALL BE GRADE 400W.
3. CONCRETE SHALL BE PLACED ON UNDISTURBED GROUND IN AN AUGERED HOLE.
4. CLEAR 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 No. SS118–42.
9. CONDUIT SLEEVE SHALL BE RIGID PVC 75mm I.D., 90° BEND SCEPTER CAT. No. NSL–3–24 OR EQUAL.
10. STEEL FOR EACH FOOTING TO BE BUNDLED SEPARATELY AND MARKED WITH STATION NUMBER.
11. DIMENSION "J" SHALL BE AT OR CLOSE TO THE MIDDLE OF THE SPAN.

## ANCHORAGE NOTES:

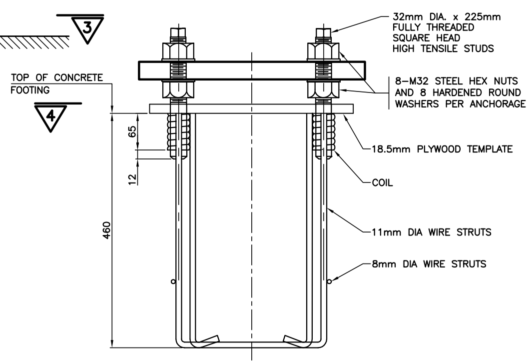
1. ANCHORAGE STRUTS AND COILS TO BE SAE STANDARD 1030 STEEL.
2. HIGH TENSILE STUDS TO BE ASTM SPECIFICATION A4140, A193, GRADE B–7 STEEL.
3. STEEL HEXAGON NUTS AND HARDENED STEEL WASHERS SHALL BE IN ACCORDANCE WITH ASTM SPECIFICATION A325.
4. THE COMPLETE ANCHORAGE ASSEMBLY INCLUDING STUDS, NUTS, AND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




## FOOTING DETAILS




## ANCHORAGE DETAILS

TABLE OF SUPPORT DIMENSIONS AND SIGN SIZE

| SUPPORT No. | STATION | SPAN (mm) | COL. HT (mm) | | ELEV. TOP OF FTG. (mm) | | SIGN SIZE D x B (mm) | J (mm) | MESSAGE | | K (mm) | X (mm) | Y (mm) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | LEFT | RIGHT | LEFT | RIGHT | | | FRONT | REAR | | | |
| | | | | | | | | | | | | | |
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| | | | | | | | | | | | | | |

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

QUANTITIES PER FOOTING

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

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

STANDARD DRAWING JULY 2014 | SS118–41

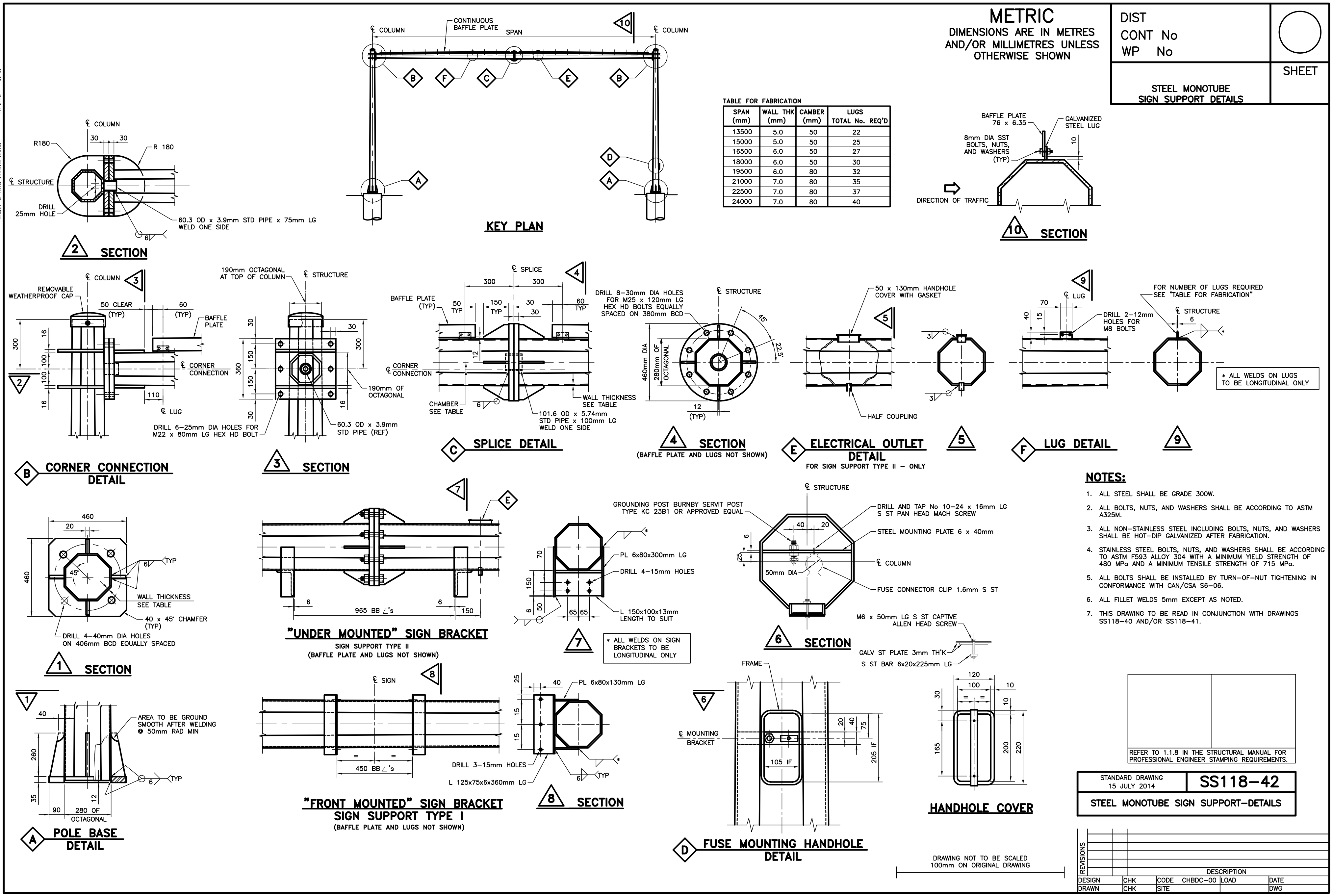
STEEL MONOTUBE SIGN SUPPORT – TYPE II

REVISIONS

DESCRIPTION

| DESIGN | CHK | CODE CHBDC–00 | LOAD | DATE |
|---|---|---|---|---|
| DRAWN | CHK | SITE | | DWG |

DRAWING NAME: s118–41 July 2014.dwg
CREATED: 1998/03/13 MODIFIED: 2014/07/16 16:53:02
MINISTRY OF TRANSPORTATION, ONTARIO PR–D–707 88–05




# METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

TABLE FOR FABRICATION

| SPAN (mm) | WALL THK (mm) | CAMBER (mm) | LUGS TOTAL No. REQ'D |
|---|---|---|---|
| 13500 | 5.0 | 50 | 22 |
| 15000 | 5.0 | 50 | 25 |
| 16500 | 6.0 | 50 | 27 |
| 18000 | 6.0 | 50 | 30 |
| 19500 | 6.0 | 80 | 32 |
| 21000 | 7.0 | 80 | 35 |
| 22500 | 7.0 | 80 | 37 |
| 24000 | 7.0 | 80 | 40 |

## NOTES:

1. ALL STEEL SHALL BE GRADE 300W.
2. ALL BOLTS, NUTS, AND WASHERS SHALL BE ACCORDING TO ASTM A325M.
3. ALL NON-STAINLESS STEEL INCLUDING BOLTS, NUTS, AND WASHERS SHALL BE HOT-DIP GALVANIZED AFTER FABRICATION.
4. STAINLESS STEEL BOLTS, NUTS, AND WASHERS SHALL BE ACCORDING TO ASTM F593 ALLOY 304 WITH A MINIMUM YIELD STRENGTH OF 480 MPa AND A MINIMUM TENSILE STRENGTH OF 715 MPa.
5. ALL BOLTS SHALL BE INSTALLED BY TURN-OF-NUT TIGHTENING IN CONFORMANCE WITH CAN/CSA S6-06.
6. ALL FILLET WELDS 5mm EXCEPT AS NOTED.
7. THIS DRAWING TO BE READ IN CONJUNCTION WITH DRAWINGS SS118-40 AND/OR SS118-41.

DIST
CONT No
WP No
SHEET

STEEL MONOTUBE SIGN SUPPORT DETAILS

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

STANDARD DRAWING 15 JULY 2014 | SS118–42

STEEL MONOTUBE SIGN SUPPORT–DETAILS

DRAWING NOT TO BE SCALED 100mm ON ORIGINAL DRAWING

REVISIONS | DESCRIPTION

DESIGN | CHK | CODE CHBDC–00 | LOAD | DATE
DRAWN | CHK | SITE | | DWG

DRAWING NAME: s118-42 July 2014.dwg MODIFIED: 2014/07/16 16:53:48
CREATED: 1998/03/13

MINISTRY OF TRANSPORTATION, ONTARIO PH–D–707 88–05

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# SIGN SUPPORT MANUAL

DIVISION 8 – VARIABLE MESSAGE SIGN SUPPORTS

April 2015

# 8 VARIABLE MESSAGE SIGN SUPPORT (VMS)

## 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 variable message sign 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 Ontario Highway Bridge Design Code.

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

(a) Spans from 17592 to 34000mm.

(b) Maximum total sign area of 40 square metres for a reference wind pressure of 600 Pa at a return period of 50 years.

(c) Overall depth of sign component of 3043 mm.

(d) Overall width of sign component of 13220 mm.

(e) Competent soil conditions excluding rock fill.

#### 8.1.1.2 POLE MOUNTED VMS

Pole mounted VMS supports are used to support portable type VMS board. The sign supports are fabricated in structural steel and designed to the requirement of the Canadian Highway Bridge Design Code CAN/CSA-S6-06 (CHBDC).

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

(a) Maximum sign board area of 10 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 2400mm.

(c) Maximum width of sign component of 4200mm.

(d) Maximum weight of the sign component of 500 kg.

(e) Location of supports and vertical clearances that meet the requirements of the CHBDC.

(f) Competent soil conditions 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 system 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 variable message sign structure (sign component) is built-into 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 galvanized after fabrication. The support legs and base plates are subsequently coated with an approved paint system.

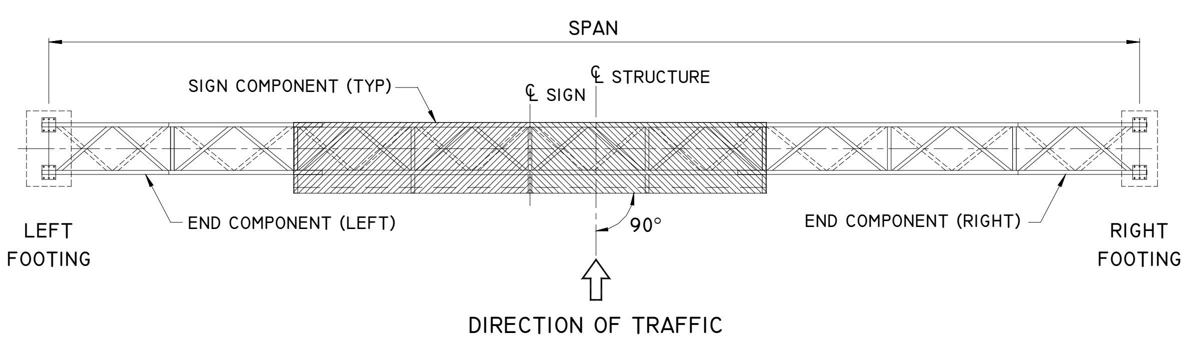


**FIGURE 8.1.3(a) TYPICAL VMS OVERHEAD TRUSS LAYOUT PLAN**

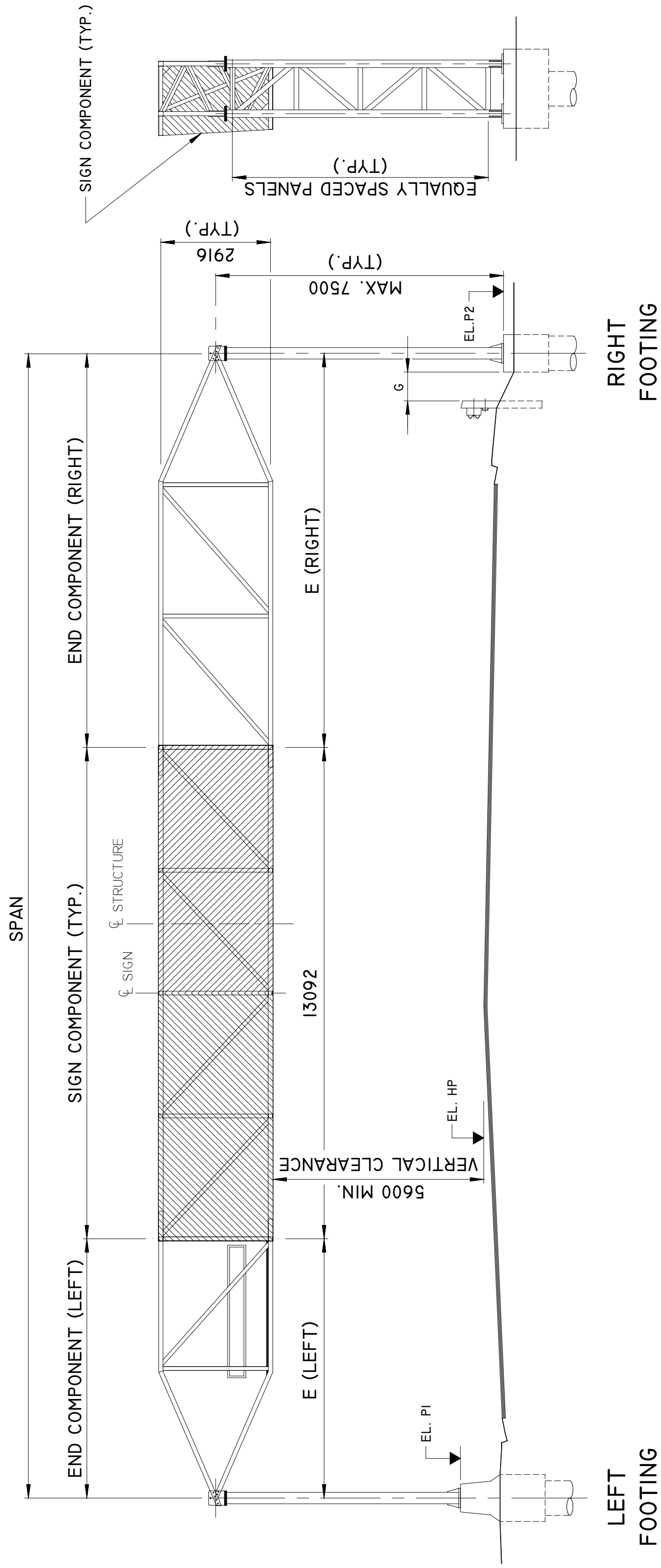


**FIGURE 8.1.3(b) TYPICAL VMS OVERHEAD TRUSS SUPPORT ELEVATION**

### 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 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 SS118-11. The maximum allowable length of the vertical support is 8300mm, which is a limit imposed by design. 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 galvanized steel brackets attached to the pole. The connection details and its location are required to be designed by Fabricators to suit the type of VMS selected.

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

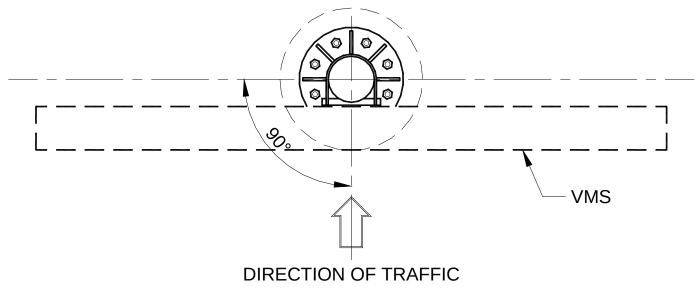


**FIGURE 8.1.3(c)**
**TYPICAL POLE MOUNTED VMS LAYOUT PLAN**

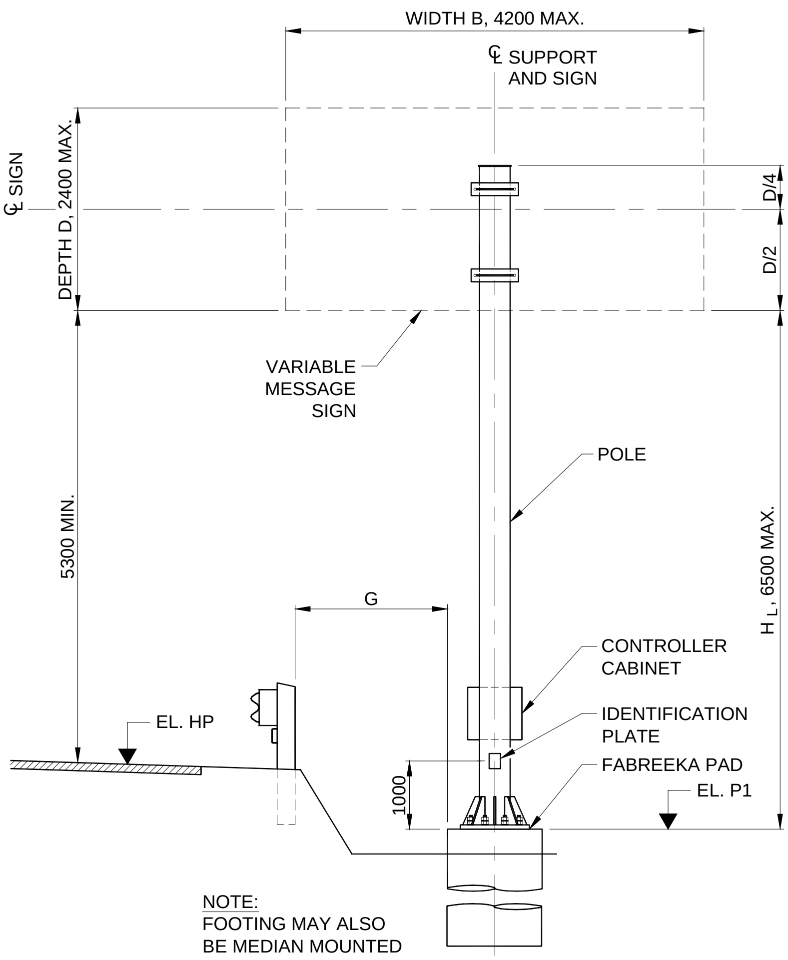


**FIGURE 8.1.3 (d)**
**TYPICAL POLE MOUNTED VMS SUPPORT ELEVATION**

### 8.1.4 FOOTINGS

Sign support footings consist of a single reinforced concrete caisson. Details differ according to their location, and generally are of two types, as shown on the 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 require the footing to be redesigned 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 Division3).

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.

### 8.1.6 SUPPLY AND ERECTION

For a temporary installation, a Tri-Chord overhead truss (Division 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 SS118-36.

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 structure ID number, the manufacturer’s name or the trademark, and the date of manufacture.

## 8.2 PROCEDURES

### 8.2.1 GENERAL

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

The design of the variable message sign overhead truss supports (VMS) 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 component 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 supports is based on 4 different reference wind pressure (325, 425, 525 and 600 Pa). Pole size can be selected from Table 8.2.1 and is dependent on the 50-year reference wind pressure, q, for the proposed location.

| Reference Wind Pressure, q (Pa) | Pole Section |
|---|---|
| $q \leq 325$ | HSS 273 x 8.0 |
| $325 < q \leq 425$ | HSS 324 x 8.0 |
| $425 < q \leq 525$ | HSS 324 x 8.0 |
| $525 < q \leq 600$ | HSS 324 x 9.5 |

**TABLE 8.2.1 POLE DESIGN DIMENSIONS**
**(Maximum allowable VMS board area = 10 $m^2$)**

### 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 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.

(5) The 50-year reference wind pressure, q. (For pole mounted VMS)
This value can be obtained for Ontario from Table A2.9(a) to (c) in Appendix to Division 2 in this Manual.

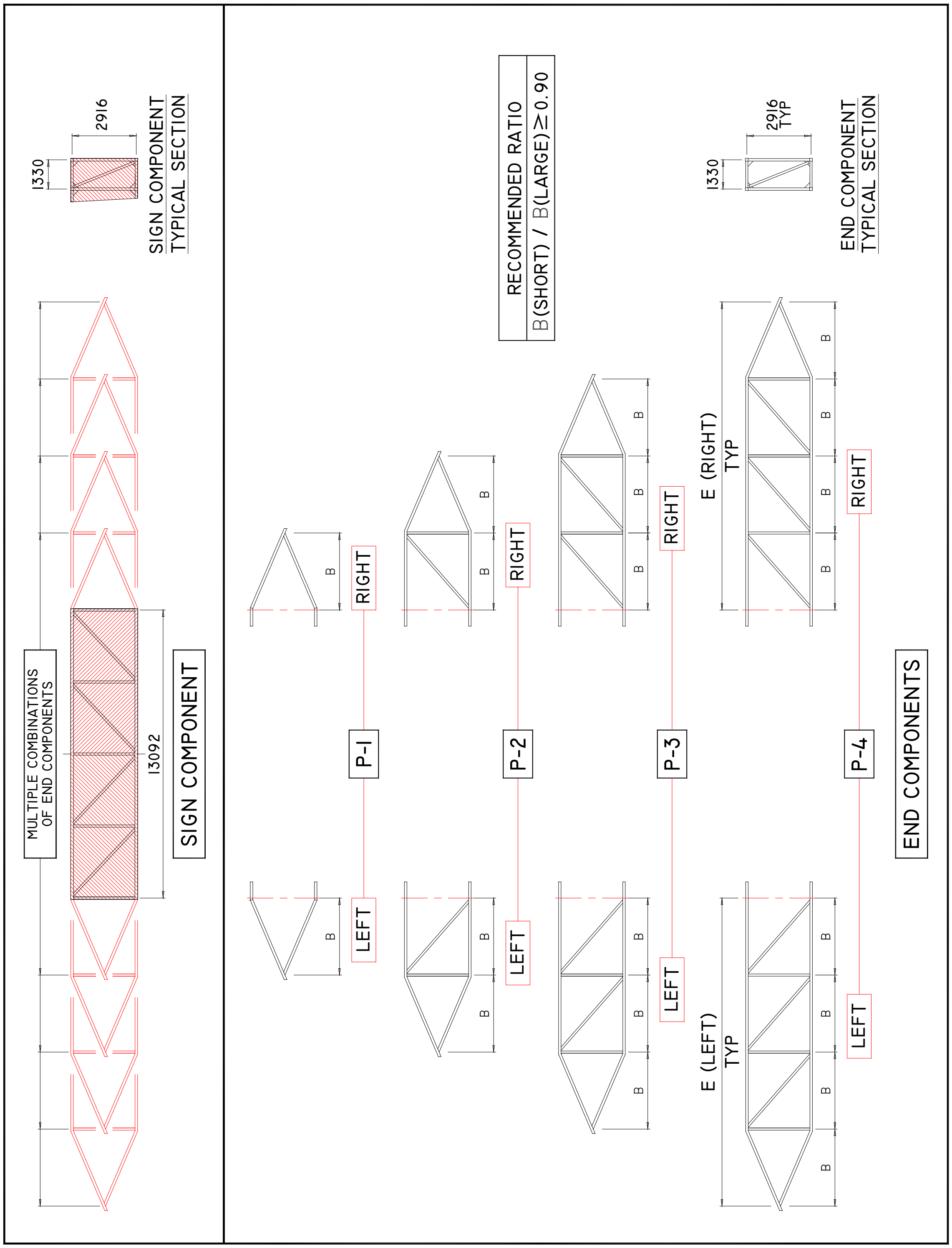


**FIGURE 8.2.1 VARIABLE MESSAGE SIGN SUPPORT LAYOUT COMBINATIONS**

## 8.2.3 PROCEDURE FOR DESIGN OF SIGN SUPPORT

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 = 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 ≤ b ≤ 3600 mm.
E.g., B (LEFT) = 5592/2 = 2796 mm, and B (RIGHT) = 9306/3 = 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 statics and aesthetics 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: 4000mm x 2200 mm VMS board and 50-year reference wind pressure, q, of 520 Pa.

STEP 1: OBTAIN THE DESIGN DIMENSION OF POLE
From Table 8.2.1, the required pole size is HSS 324x9.5

STEP 2: 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 3: COMPLETE THE STANDARD DRAWINGS

Refer to 8.3 for Preparation of Drawings.

## 8.3 PREPARATION OF DRAWINGS

### 8.3.1 DATA REQUIRED

Prior to design, a "Key Plan and Frame Dimension" drawing(s) must be prepared to enable the working drawings to be detailed. This drawing(s) will form part of the contract document and must show for one or more structures, the following information:

(1) A key plan, indicating the approximate location of each support.

(2) The Structure ID 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.

(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 5300mm 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. This elevation can differ for each leg, if required. The elevation shall be a minimum of 300 mm above the ground line. This could be increased up to 1000 mm in order to limit the column leg height as stated in (7).

(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 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 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, SS118-36, SS118-37 or SS118-38 for the structure; SS118-3, SS118-4, SS18-5, 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 SS118-11 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 SS118-36 consists of the following:

(i) Station
(ii) Structure ID 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, $EL.P_1$

(viii) Elevation at top of the right support footing, $EL.P_2$

(ix) Door Side (Left/Right).

(x) Left Footing Type (See 8.1.4)

(xi) Right Footing Type (See 8.1.4)

The data required to complete Table 1 on SS118-11 consists of the following:

(i) Local Reference Wind Pressure, (Pa)

(ii) Frost Depth (may be obtained from Appendix to Division 2 in this manual if the recommendations of a geotechnical engineer are not available)

(iii) Station

(iv) Structure ID Number

(v) Sign Size (DxB)

(vi) Pole Size

(vii) Footing Type (See 8.1.4)

(viii) Dimension between top of footing and bottom of sign board, $H_L$

(ix) Barrier to support clearance, G (See 8.1.5)

(x) Elevation at top of the support footing, EL.P1

(xi) 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 surrounding ground level shall be a minimum of 300 mm below the top of the footing
(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 contained in this Division conforms to the requirements of the 1991 edition of the Ontario Highway Bridge Design Code unless otherwise stated.

Design and detailing data for the Pole Mounted VMS contained in this Division 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 350W structural steel, Alloy 6061-T6 aluminum extruded tube and plates, 30MPa 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 4500 kg. The maximum weight of the portable VMS board shall not exceed 500 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 be conform to ASTM A325M and be hot-dip galvanized.

Wind loads for fatigue design were obtained from a revision to AASHTO – Standard Specifications for Structural Supports for Highway Signs, Luminaries and Traffic Signals. These amendments were based on a number of reports including “Fatigue Resistant Design of Cantilevered Signal, Sign and Light Supports.” National Cooperative Highway Research Program. Final Report – NCHRP Project 10-38 (published as NCHRP Report 412).

### 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. The analysis was then confirmed with the use of a three-dimensional finite element model.

## 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. Vertical members are restricted to 1% (L/100), and horizontal members are restricted to 2% (L/50) lateral movement. Both limitations are well within the suggested limits provided in AASHTO's "Standard Specifications for Structural Supports for Highway Signs, Luminaries and Traffic Signals", 1994, which allows 2.5% lateral movement or 1º40' 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 (0º30') 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** | $\Phi' = 28^{o}$ | $C_u = 25$ kPa |
| | **Lower 1/3** | $\Phi' = 30^{o}$ | $C_u = 50$ kPa |

## APPENDIX TO DIVISION 8

VARIABLE MESSAGE SIGN SUPPORTS

**SS118-6** VARIABLE MESSAGE SIGN SUPPORT FOOTING DETAILS - GROUND MOUNTED

**SS118-7** VARIABLE MESSAGE SIGN SUPPORT MEDIAN MOUNTED FOOTING - SYMMETRICAL

**SS118-8** VARIABLE MESSAGE SIGN SUPPORT MEDIAN MOUNTED FOOTING - ASYMMETRICAL

**SS118-11** POLE MOUNTED VARIABLE MESSAGE SIGN SUPPORT GENERAL ARRANGEMENT

**SS118-36** VARIABLE MESSAGE SIGN SUPPORT GENERAL ARRANGEMENT

**SS118-37** VARIABLE MESSAGE SIGN SUPPORT END COMPONENT - DETAILS

**SS118-38** VARIABLE MESSAGE SIGN SUPPORT SIGN COMPONENT - DETAILS

**Note**

See Appendix to Division 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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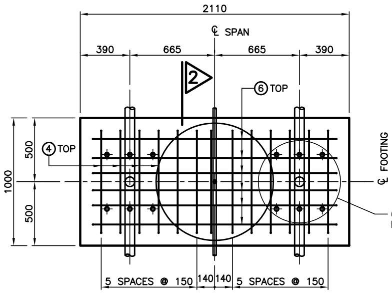
# METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

CONT No
WP No

SHEET

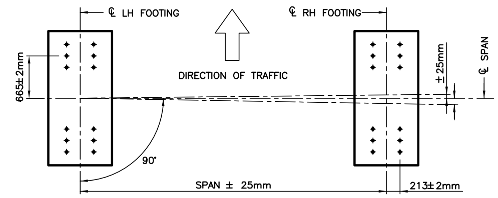
VARIABLE MESSAGE SIGN SUPPORT FOOTING DETAILS–GROUND MOUNTED




PLAN

NOTES TO DESIGNER

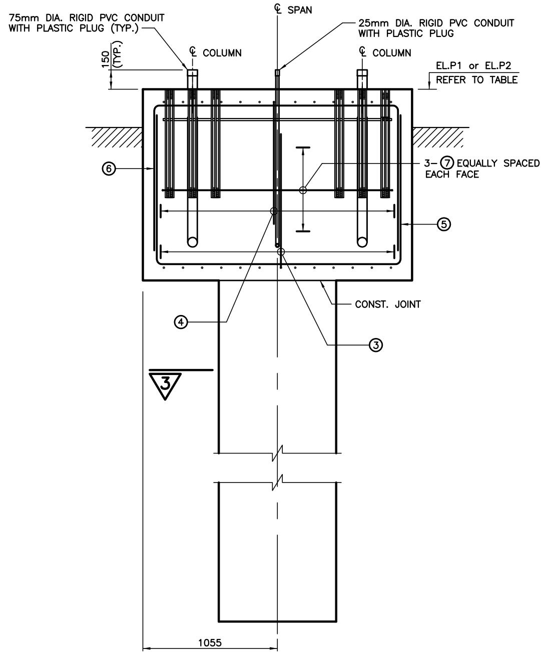
1. FOOTING DEPTH SHALL BE 5000mm. IF SOUND ROCK IS ENCOUNTERED AT A DEPTH 'Y' LESS THAN 5000mm FROM THE BOTTOM OF THE FROST LAYER, THIS DIMENSION CAN BE REDUSED TO: Y+(5000–Y)/2.
2. THE "NOTES TO DESIGNER" SHALL BE DELETED FROM THIS DRAWING PRIOR TO ISSUING OF CONTRACT.



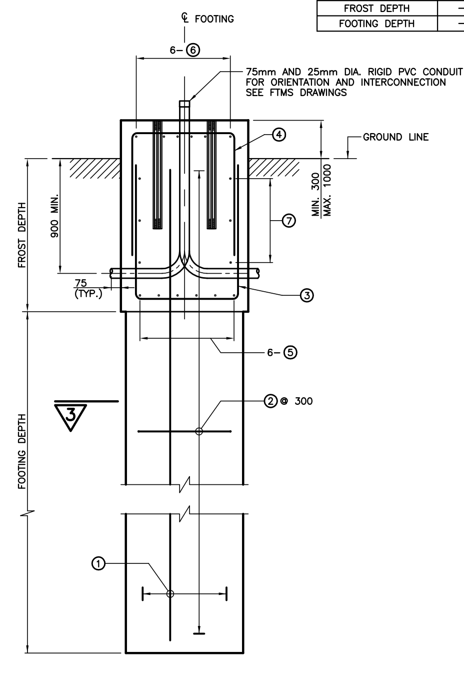

TYPICAL PLAN SHOWING TOLERANCE

## FOOTING DIMENSIONS

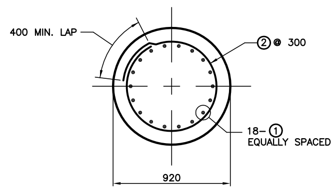
| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| STATION | --- | | | | | | | | | |
| STRUCTURE I.D. No. | --- | | | | | | | | | |
| SPAN | --- | | | | | | | | | |
| LEFT/RIGHT FOOTING | --- | | | | | | | | | |
| EL.P1 or EL.P2 | --- | | | | | | | | | |
| FROST DEPTH | --- | | | | | | | | | |
| FOOTING DEPTH | --- | | | | | | | | | |




1




2

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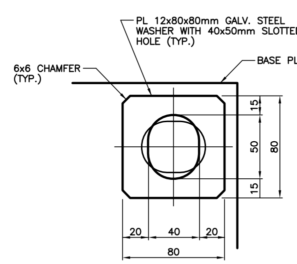
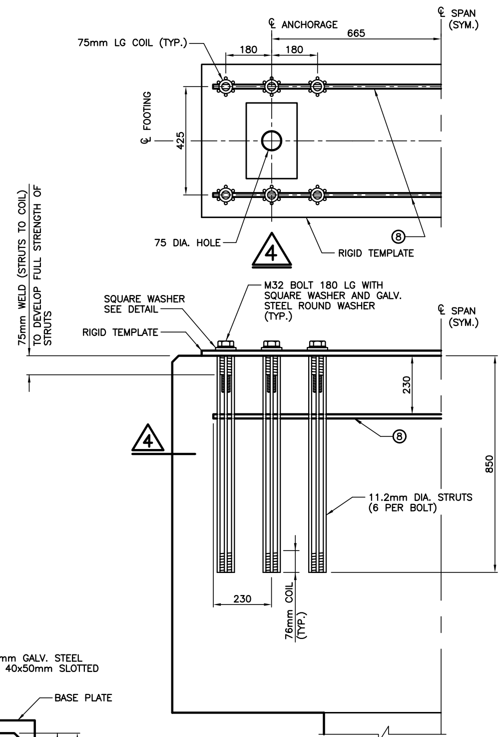



SQUARE WASHER DETAIL




ANCHORAGE INSTALLATION DETAIL

## 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. FOOTING SHALL BE BUILT ACCORDING TO OPSS 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 ±10mm OF THE ELEVATION SPECIFIED. SPACE BETWEEN BASE PLATE AND TOP OF CONCRETE FOOTING SHALL BE INJECTED WITH AN APPROVED NON–SHRINK GROUT TO ATTAIN FULL CONTACT. EACH FOOTING SHALL HAVE ONE CONTINUOUS TEMPLATE.
7. RIGID PVC CONDUIT SHALL BE ACCORDING TO OPSS 603.
8. 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 ASTM SPECIFICATION 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 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 CONDITION AND THEN FURTHER TIGHTENED 1/3 OF A TURN.

| 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.

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

STANDARD DRAWING
JULY 2014

SS118–6

VARIABLE MESSAGE SIGN SUPPORT FOOTING DETAILS – GROUND MOUNTED

| REVISIONS | DATE | BY | DESCRIPTION | | |
|---|---|---|---|---|---|
| DESIGN | CHK | CODE OHBDC '91 | LOAD | | DATE |
| DRAWN | CHK | SITE | | | DWG |

MINISTRY OF TRANSPORTATION, ONTARIO   PR–D–707   88–05

DRAWING NAME: s118–6 July 2014.dwg   2014/07/16   16:30:28
CREATED: 1998/03/13   MODIFIED:

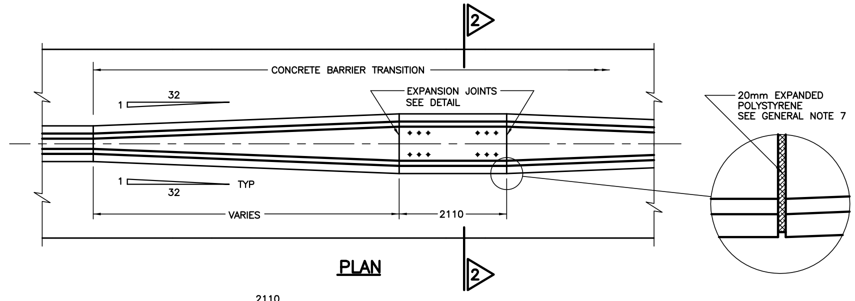
# METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

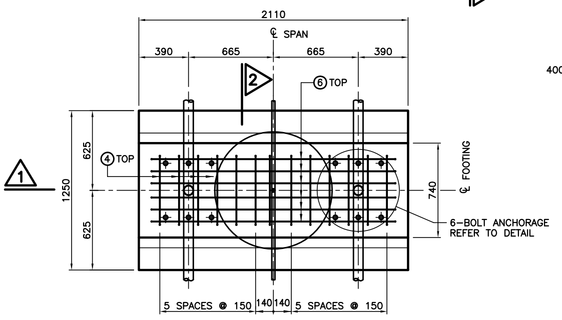
CONT No
WP No

SHEET

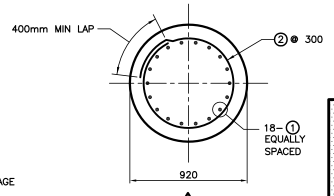
**VARIABLE MESSAGE SIGN SUPPORT MEDIAN MOUNTED FOOTING SYMMETRICAL**

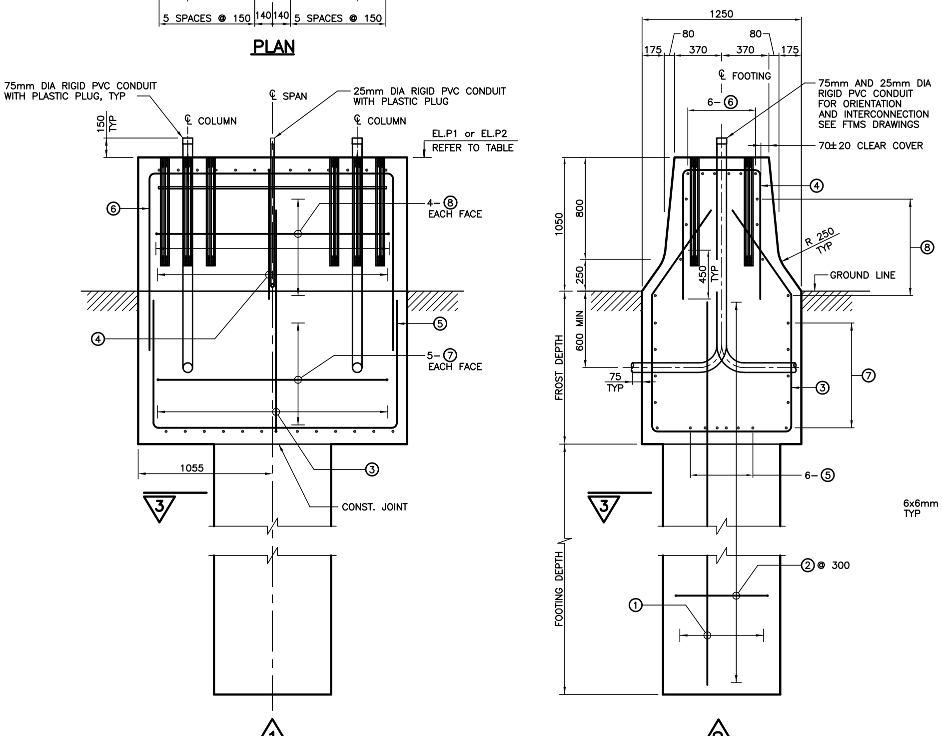



PLAN

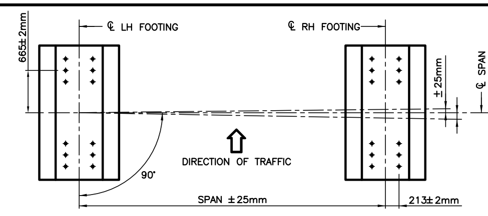



PLAN




TYPICAL SECTION




TYPICAL PLAN SHOWING TOLERANCE

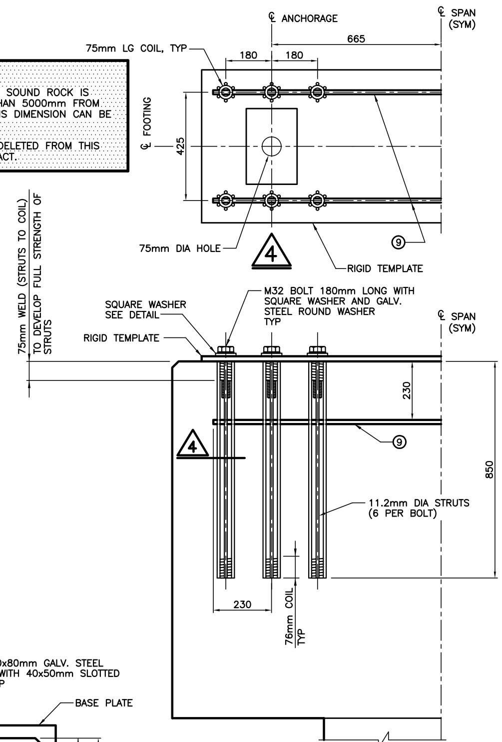
FOOTING DIMENSIONS

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| STATION | --- | | | | | | | | | |
| STRUCTURE I.D. No. | --- | | | | | | | | | |
| SPAN | --- | | | | | | | | | |
| LEFT/RIGHT FOOTING | --- | | | | | | | | | |
| EL.P1 or EL.P2 | --- | | | | | | | | | |
| FROST DEPTH | --- | | | | | | | | | |
| FOOTING DEPTH | --- | | | | | | | | | |

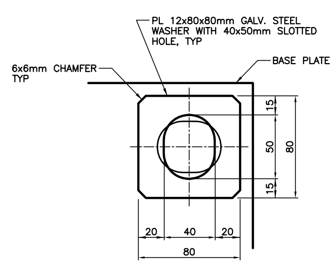
NOTES TO DESIGNER

1 FOOTING DEPTH SHALL BE 5000mm. IF SOUND ROCK IS ENCOUNTERED AT A DEPTH 'Y' LESS THAN 5000mm FROM THE BOTTOM OF THE FROST LAYER, THIS DIMENSION CAN BE REDUSED TO: Y+(5000–Y)/2.

2 THE "NOTES TO DESIGNER" SHALL BE DELETED FROM THIS DRAWING PRIOR TO ISSUING OF CONTRACT.




ANCHORAGE INSTALLATION DETAIL




SQUARE WASHER DETAIL

## 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. FOOTING SHALL BE BUILT ACCORDING TO OPSS 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 ± 10mm OF THE ELEVATION SHOWN. SPACE BETWEEN BASE PLATE AND TOP OF CONCRETE FOOTING SHALL BE INJECTED WITH AN APPROVED NON–SHRINK GROUT TO ATTAIN FULL CONTACT. EACH FOOTING SHALL HAVE ONE CONTINUOUS TEMPLATE.
7. EXPANDED POLYSTYRENE IN EXPANSION JOINTS SHALL BE ACCORDING TO CGSB 51.20 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 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 ASTM SPECIFICATION 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.
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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 |

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

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

STANDARD DRAWING JULY 2014

**SS118–7**

**VARIABLE MESSAGE SIGN SUPPORT MEDIAN MOUNTED FOOTING – SYMMETRICAL**

| REVISIONS | DATE | BY | DESCRIPTION | | |
|---|---|---|---|---|---|
| DESIGN | CHK | CODE OHBDC '91 | LOAD | DATE | |
| DRAWN | CHK | SITE | | DWG | |

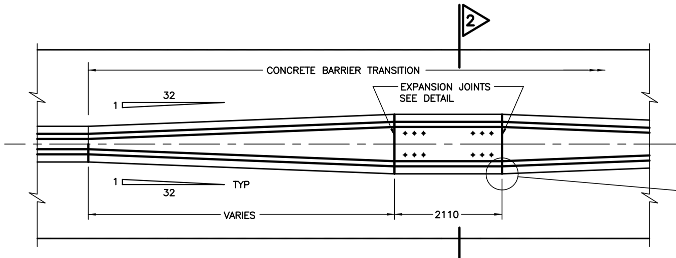
MINISTRY OF TRANSPORTATION, ONTARIO
PR–D–707 88–05

DRAWING NAME: s118–7 July 2014.dwg
CREATED: 1998/03/13
MODIFIED: 2014/07/16 16:31:03

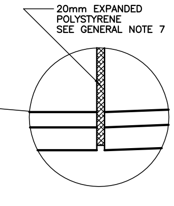
# METRIC

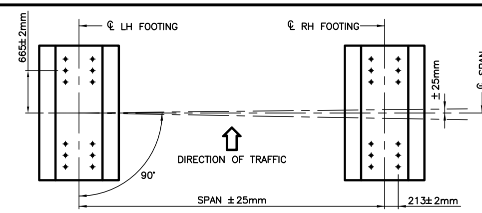
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

| CONT No | |
|---|---|
| WP No | |
| VARIABLE MESSAGE SIGN SUPPORT MEDIAN MOUNTED FOOTING ASYMMETRICAL | SHEET |




PLAN




TYPICAL PLAN SHOWING TOLERANCE

FOOTING DIMENSIONS

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| STATION | --- | | | | | | | | | |
| STRUCTURE I.D. No. | --- | | | | | | | | | |
| SPAN | --- | | | | | | | | | |
| LEFT/RIGHT FOOTING | --- | | | | | | | | | |
| a | --- | | | | | | | | | |
| b | --- | | | | | | | | | |
| c | --- | | | | | | | | | |
| EL.P1 or EL.P2 | --- | | | | | | | | | |
| FROST DEPTH | --- | | | | | | | | | |
| FOOTING DEPTH | --- | | | | | | | | | |

## GENERAL NOTES:

1. CLASS OF CONCRETE 30 MPa.
2. CLEAR COVER TO REINFORCING STEEL:
   - –CAISSON 100±25mm
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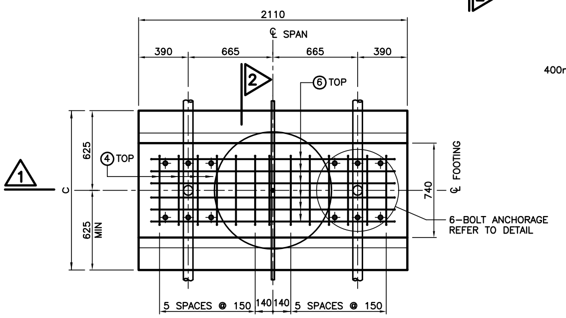
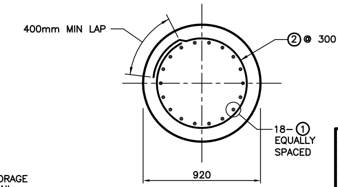



PLAN




3

NOTES TO DESIGNER

1 FOOTING DEPTH SHALL BE 5000mm. IF SOUND ROCK IS ENCOUNTERED AT A DEPTH 'Y' LESS THAN 5000mm FROM THE BOTTOM OF THE FROST LAYER, THIS DIMENSION CAN BE REDUSED TO: Y+(5000–Y)/2.

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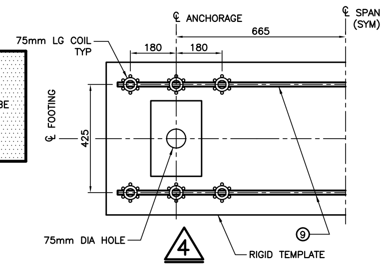
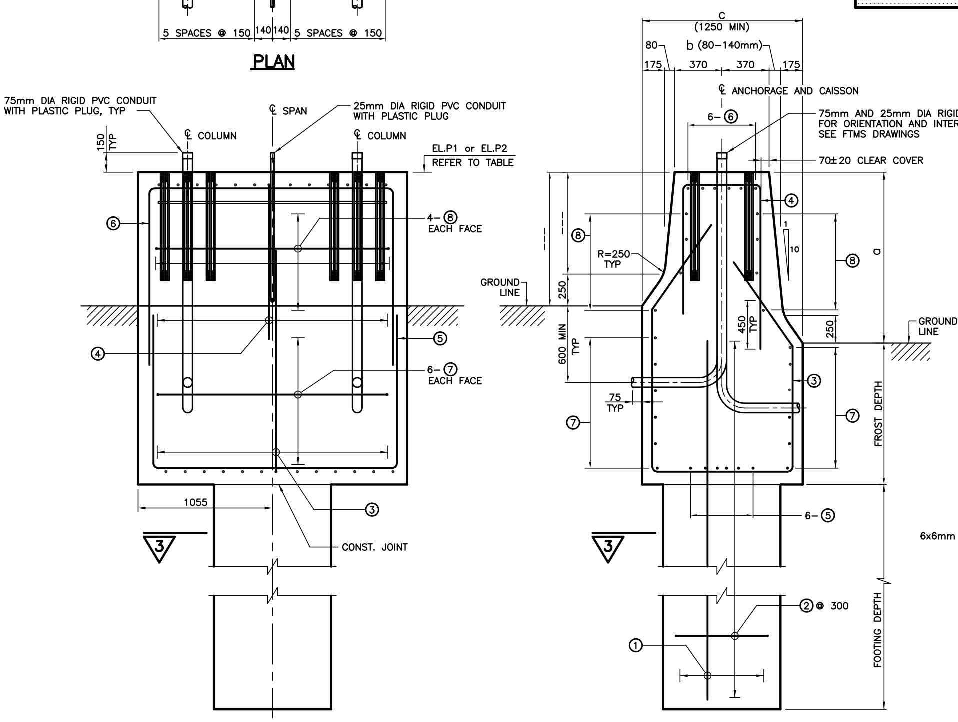
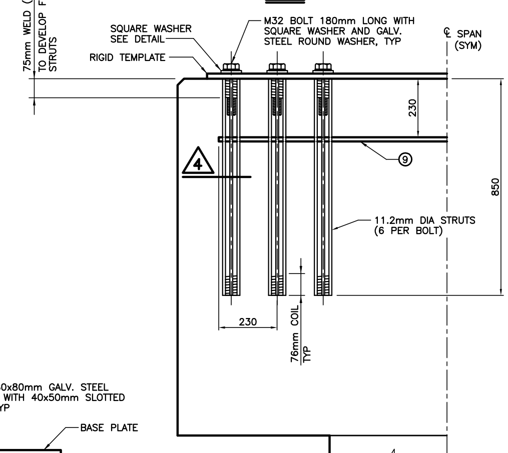



TYPICAL SECTION




ANCHORAGE INSTALLATION DETAIL

## ANCHORAGE NOTES:

1. ANCHORAGE STRUTS AND COILS SHALL BE MADE OF SAE 1030 STEEL.
2. ALL BOLTS AND WASHERS SHALL BE ACCORDING TO ASTM SPECIFICATION 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.
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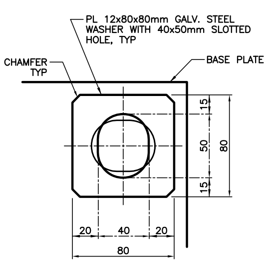
|---|---|---|
| 1 | 25M | STRAIGHT |
| 2 | 15M | |
| 3 | 20M | |
| 4 | 20M | |
| 5 | 20M | |
| 6 | 20M | |
| 7 | 20M | |
| 8 | 20M | |
| 9 | 15M | STRAIGHT |




SQUARE WASHER DETAIL

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

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

| STANDARD DRAWING JULY 2014 | SS118–8 |
|---|---|
| VARIABLE MESSAGE SIGN SUPPORT MEDIAN MOUNTED FOOTING – ASYMMETRICAL | |

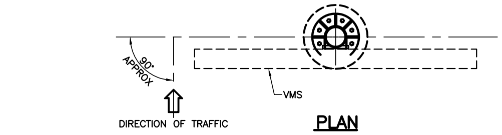
| REVISIONS | DATE | BY | DESCRIPTION | | |
|---|---|---|---|---|---|
| DESIGN | CHK | CODE OHBDC '91 | LOAD | DATE | |
| DRAWN | CHK | SITE | | DWG | |

DRAWING NAME: s118–8 July 2014.dwg
CREATED: 1998/03/13
MODIFIED: 2014/07/16 16:31:36

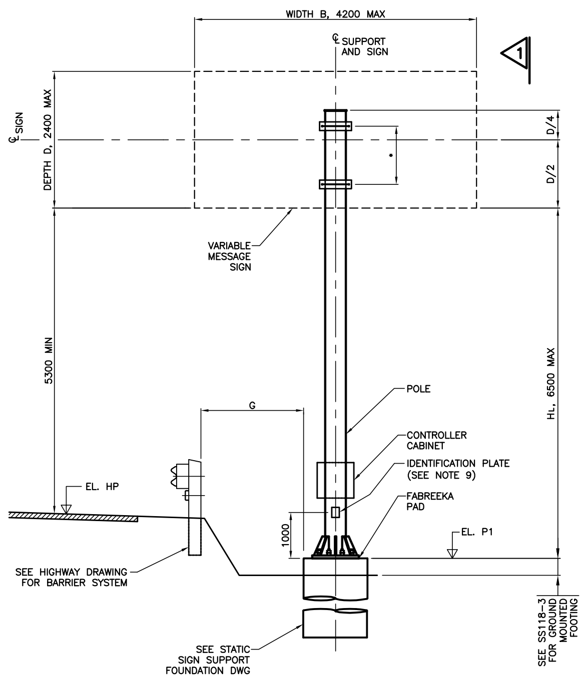
# METRIC

DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

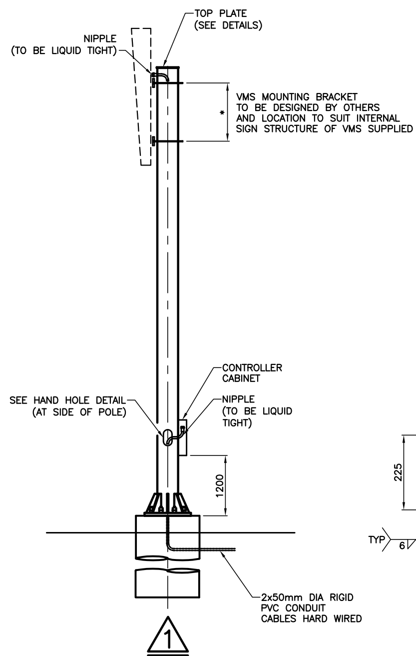
| | |
|---|---|
| CONT No<br>WP No | SHEET |
| POLE MOUNTED VARIABLE MESSAGE SIGN SUPPORT GENERAL ARRANGEMENT | |

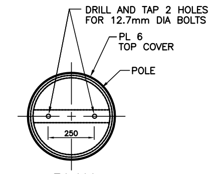



PLAN

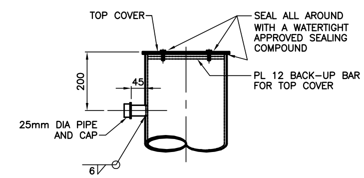



ELEVATION

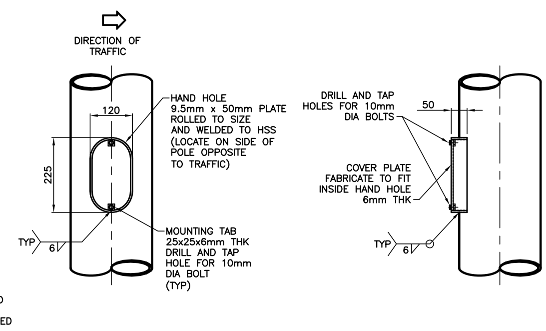



PLAN




TOP PLATE DETAIL
SIDE ELEVATION




HAND HOLE DETAIL
(NIPPLE NOT SHOWN FOR CLARITY)

## NOTES:

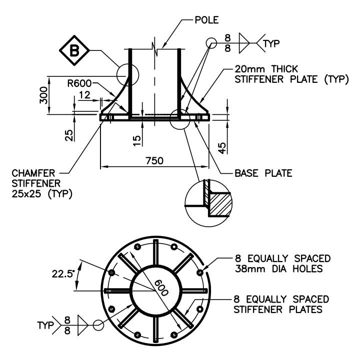
1. ALL STRUCTURAL STEEL SHALL BE ACCORDING TO CAN/CSA G40.20-04/ G40.21-04, GRADE 300W OR ASTM SPECIFICATION A500 GRADE C.
2. ALL NON-STAINLESS STEEL BOLTS, NUTS AND WASHERS SHALL BE ACCORDING TO ASTM A325M AND BE HOT DIP GALVANIZED UNLESS SPECIFIED OTHERWISE.
3. ALL BOLTS SHALL BE INSTALLED BY TURN OF NUT TIGHTENING IN CONFORMANCE WITH CAN/CSA S6-06.
4. ALL STRUCTURAL STEEL SHALL BE HOT DIP GALVANIZED AFTER FABRICATION. LEG ONLY SHALL BE SUBSEQUENTLY COATED WITH AN APPROVED SYSTEM ACCORDING TO OPSS 911.
5. POLE SHALL NOT BE ERECTED UNTIL FOUNDATION CONCRETE HAS REACHED 80% OF SPECIFIED STRENGTH.
6. NO SHOP SPLICES IN ANY MEMBERS.
7. ELEVATIONS TO BE VERIFIED IN THE FIELD BEFORE SIGN SUPPORT STRUCTURE FABRICATION.
8. THIS STANDARD TO BE READ IN CONJUNCTION WITH DRAWING SS118-3 (FOOTING FOR GROUND MOUNTED SIGNS) AND/OR SS118-4 (FOOTING FOR SYMMETRIC MEDIAN MOUNTED SIGN) AND/OR SS118-5 (FOOTING FOR ASYMMETRICAL MEDIAN MOUNTED SIGNS).
9. EACH SIGN SUPPORT SHALL HAVE AN IDENTIFICATION MARKING SHOWING THE STRUCTURE I.D. 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 MANUFACTURE. THIS 4mm THICK RECTANGULAR STAINLESS 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.
10. THE CONNECTION DETAILS BETWEEN THE VMS BOARD AND THE POLE SHALL BE BY MEANS OF GALVANIZED STEEL COMPONENTS AND DESIGNED BY THE FABRICATOR. DESIGN DRAWINGS STAMPED BY A PROFESSIONAL ENGINEER LICENSED IN THE PROVINCE OF ONTARIO SHALL BE SUBMITTED FOR REVIEW AND APPROVAL SEVEN DAYS PRIOR TO SHOP DRAWING SUBMISSION.

### NOTES TO DESIGNER:

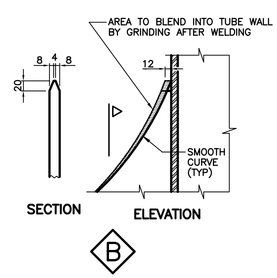
1. DIMENSION G IS DEFINED AS THE HORIZONTAL CLEARANCE FROM THE BACK OF PROTECTIVE BARRIER TO THE NEAREST FACE OF CONCRETE FOOTING ACCORDING TO THE VALUES BELOW. THIS DOES NOT APPLY TO TEMPORARY CONCRETE BARRIER INSTALLATIONS.

| 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 OF THE CONTRACT.




BASE DETAIL




SECTION ELEVATION

B

TABLE 1 — GENERAL

| LOCAL REFERENCE WIND PRESSURE = --- Pa | FROST DEPTH = ---- mm |
|---|---|

| | | | | | | |
|---|---|---|---|---|---|---|
| STATION | --- | | | | | |
| STRUCTURE I.D. No. | --- | | | | | |
| SIGN SIZE (DxB) | --- | | | | | |
| POLE SIZE | --- | | | | | |
| FOOTING TYPE (MEDIAN/GROUND) | --- | | | | | |
| $H_L$ | --- | | | | | |
| G | --- | | | | | |
| EL. $P_1$ | --- | | | | | |
| EL. HP | --- | | | | | |

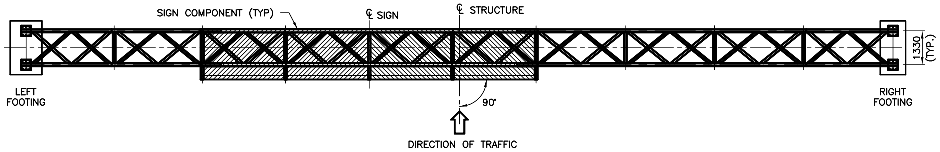
REFER TO 2.4.1 IN THE SIGN SUPPORT MANUAL FOR PROFESSIONAL ENGINEER STAMPING REQUIREMENTS.

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

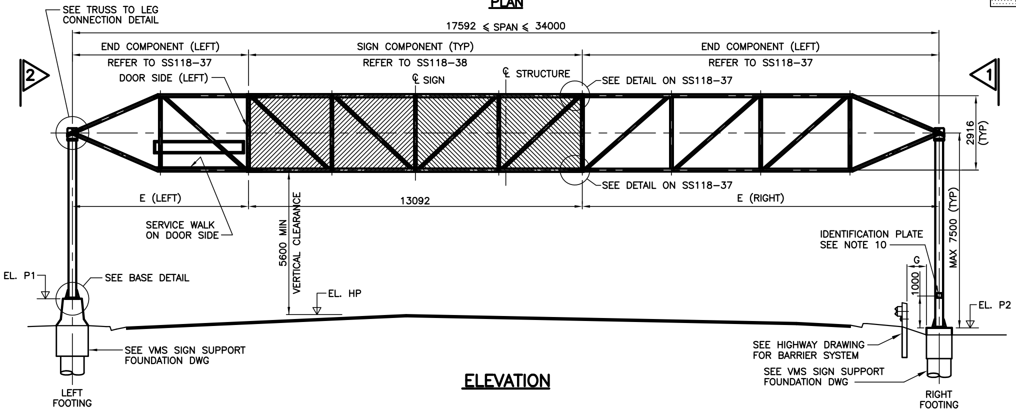
| STANDARD DRAWING JULY 2014 | SS118-11 |
|---|---|
| POLE MOUNTED VMS SUPPORT GENERAL ARRANGEMENT | |

| REVISIONS | DATE | BY | DESCRIPTION | | |
|---|---|---|---|---|---|
| DESIGN | CHK | CODE CHBDC-06 | LOAD | DATE | |
| DRAWN | CHK | SITE | | DWG | |

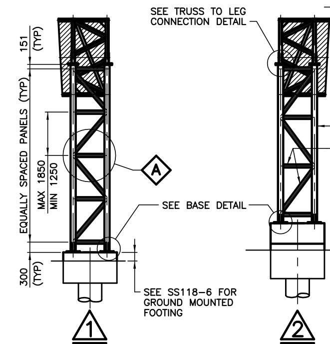

DRAWING NAME: s118-11 July 2014.dwg MODIFIED: 2014/07/16 16:32:18
CREATED: 1998/03/13
MINISTRY OF TRANSPORTATION, ONTARIO PH-D-707 88-05




PLAN




ELEVATION




NOTES TO DESIGNER:

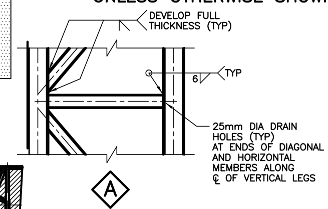
1. DIMENSION G IS DEFINED AS THE HORIZONTAL CLEARANCE FROM THE BACK OF PROTECTIVE BARRIER TO THE NEAREST FACE OF CONCRETE FOOTING ACCORDING TO THE VALUES BELOW. THIS DOES NOT APPLY TO TEMPORARY CONCRETE BARRIER INSTALLATIONS.

| 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 OF THE CONTRACT.

# METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN




CONT No
WP No

SHEET

VARIABLE MESSAGE SIGN SUPPORT GENERAL ARRANGEMENT

## GENERAL NOTES:

1. ALL ALUMINUM EXTRUDED TUBE SECTIONS SHALL BE ALLOY 6061–T6 UNLESS NOTED.
2. ALUMINUM COMPONENTS MADE OF ALLOY 6061–T6.
3. ALL STRUCTURAL STEEL SHALL BE GRADE 350W.
4. ALL BOLTS, NUTS, AND WASHERS SHALL BE STAINLESS STEEL, AND SHALL BE ACCORDING TO ASTM F593 ALLOY 304 WITH A MINIMUM YIELD OF 480MPa 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 NON–STAINLESS STEEL SHALL BE HOT–DIP GALVANIZED AFTER FABRICATION. LEGS AND BASE PLATES SHALL BE SUBSEQUENTLY COATED WITH AN APPROVED PAINT SYSTEM ACCORDING TO OPSS 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 MEDIAN MOUNTED FOOTING – ASYMMETRICAL).
10. EACH SIGN SUPPORT SHALL HAVE AN IDENTIFICATION MARKING SHOWING THE STRUCTURE I.D. NUMBER, THE MANUFACTURER'S NAME OR TRADEMARK, AND THE DATE OF MANUFACTURE. THIS MARKING SHALL BE ON A CORROSION PROTECTED 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 ALUMINUM SQUARE TUBE

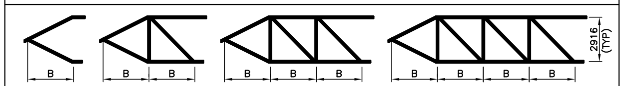
## ERECTION NOTES:

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

TABLE 1 – GENERAL

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| STATION | | --- | | | | | | | | | |
| STRUCTURE I.D. 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) | | --- | | | | | | | | | |

END COMPONENTS

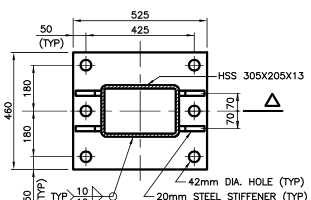



TYPE P–1 TYPE P–2 TYPE P–3 TYPE P–4

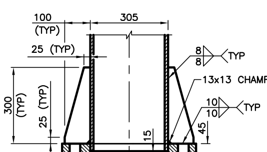
NOTE: END COMPONENTS ARE AS SHOWN AND OPPOSITE HAND

| ALUMINUM TUBE SECTIONS | |
|---|---|
| SIGN AND END COMPONENTS | |
| METRIC SIZE | IMPERIAL SIZE |
| □ 101.6x101.6x4.78 | □ 4"x4"x0.188" |
| □ 114.3x114.3x9.525 | □ 4.5"x4.5"x0.375" |
| □ 127x127x5.08 | □ 5"x5"x0.20" |

NOTE: DIMENSIONS OF ALUMINUM TUBE SECTIONS TO BE IMPERIAL AS PER TABLE.

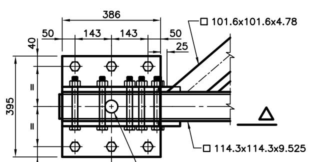



PLAN

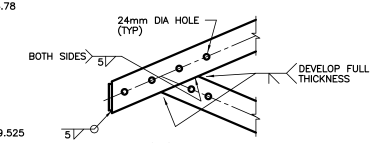



SECTION

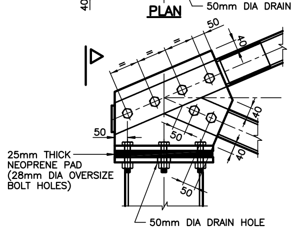
BASE DETAIL (TYPICAL)



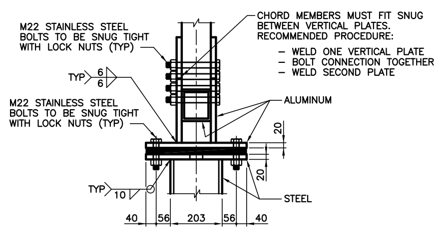

PLAN




SECTION

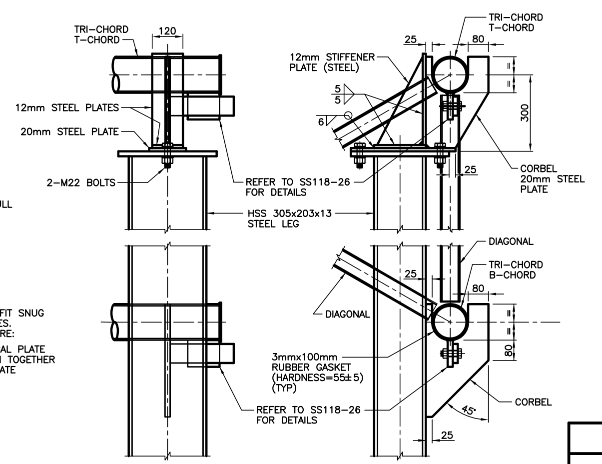



ELEVATION




SIDE VIEW

TRUSS TO LEG CONNECTION DETAIL (TYPICAL)




ELEVATION

SIDE VIEW

TEMPORARY TRI–CHORD/CMS "WALK–IN" CONNECTION DETAIL

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

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

STANDARD DRAWING JULY 2014 | SS118–36

VARIABLE MESSAGE SIGN SUPPORT GENERAL ARRANGEMENT

| REVISIONS | DATE | BY | DESCRIPTION | | |
|---|---|---|---|---|---|
| DESIGN STD | CHK | CODE OHBDC '91 | LOAD | DATE | |
| DRAWN | CHK | SITE | | DWG | |

MINISTRY OF TRANSPORTATION, ONTARIO PR–D–707 88–05

DRAWING NAME: s118–36 July 2014.dwg MODIFIED: 2014/07/16 16:52:03
CREATED: 1998/03/13

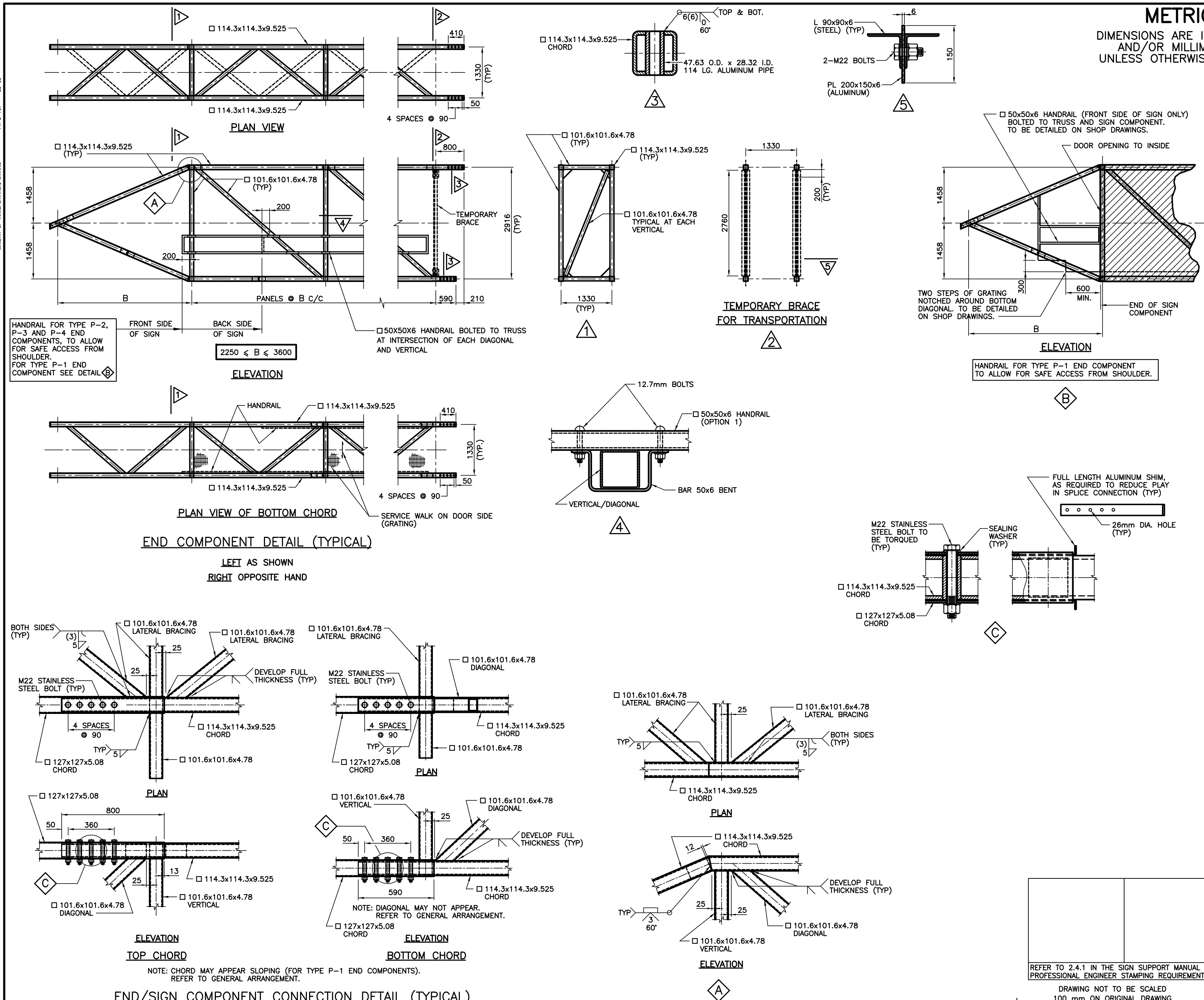
# METRIC

DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

CONT No
WP No

SHEET

VARIABLE MESSAGE SIGN SUPPORT
END COMPONENT – DETAILS




## NOTES:

1. TOLERANCE SHALL BE ± 1mm 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

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

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

STANDARD DRAWING
JUNE 2010

SS118–37

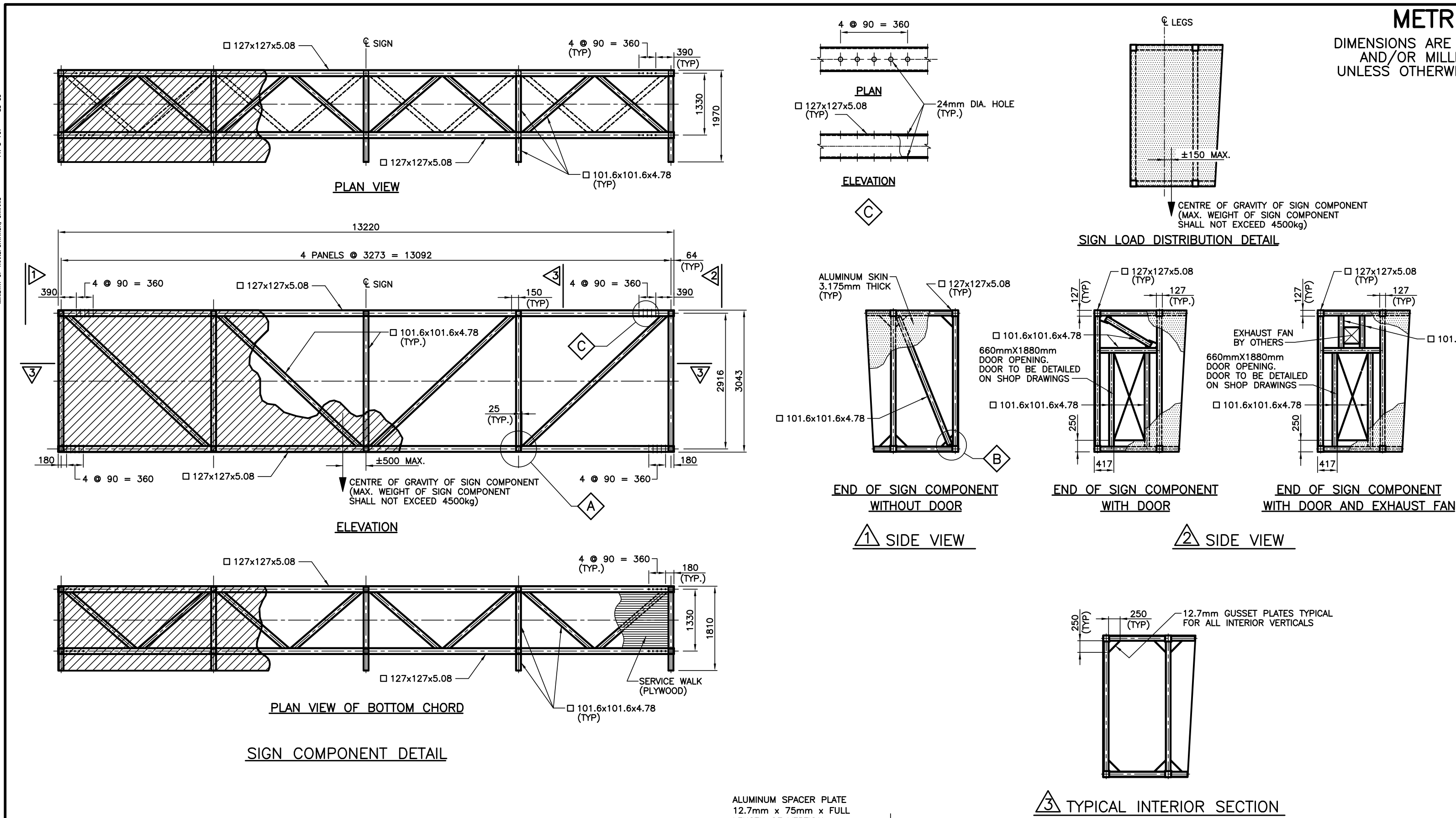
VARIABLE MESSAGE SIGN SUPPORT
END COMPONENT – DETAILS

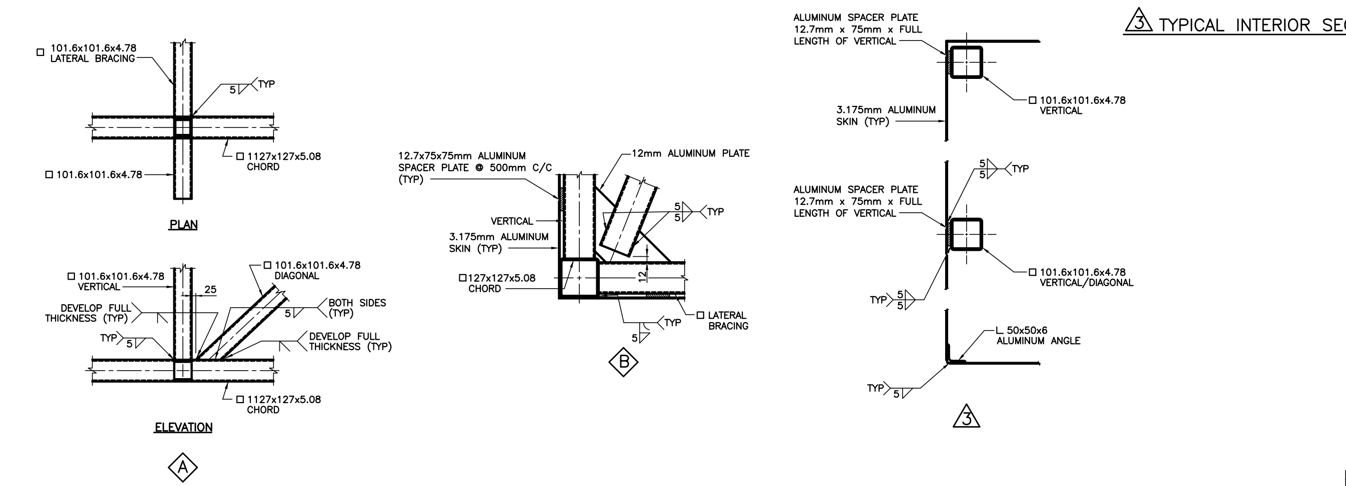
| REVISIONS | | |
|---|---|---|
| DATE | BY | DESCRIPTION |

| | | | | |
|---|---|---|---|---|
| DESIGN STD | CHK | CODE OHBDC '91 | LOAD | DATE |
| DRAWN | CHK | SITE | | DWG |

DRAWING NAME: s118-37.dwg
CREATED: 1997/10/27
MODIFIED: 2010/02/09 09:02:21

MINISTRY OF TRANSPORTATION, ONTARIO PR-D-707 88-05




# METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

CONT No
WP No

SHEET

VARIABLE MESSAGE SIGN SUPPORT
SIGN COMPONENT – DETAILS

## NOTES:

1. TOLERANCE SHALL BE ± 1mm 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 SS118-37 (VMS – END COMPONENT – DETAILS).
4. NO SHOP SPLICES IN ANY MEMBER.
5. LEGEND:
   □ – DENOTES ALUMINUM SQUARE TUBE

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

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

STANDARD DRAWING
JUNE 2010

SS118–38

VARIABLE MESSAGE SIGN SUPPORT
SIGN COMPONENT – DETAILS

| REVISIONS | | |
|---|---|---|
| DATE | BY | DESCRIPTION |

| | | | | | |
|---|---|---|---|---|---|
| DESIGN STD | CHK | CODE OHBDC '91 | LOAD | | DATE |
| DRAWN | CHK | SITE | | | DWG |

MINISTRY OF TRANSPORTATION, ONTARIO    PH–D–707    88–05

DRAWING NAME: s118–38.dwg    MODIFIED: 2010/02/09 09:03:37
CREATED: 1997/10/27

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# SIGN SUPPORT MANUAL

DIVISION 9 – BRIDGE MOUNTED SIGN SUPPORTS

April 2015

# 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.

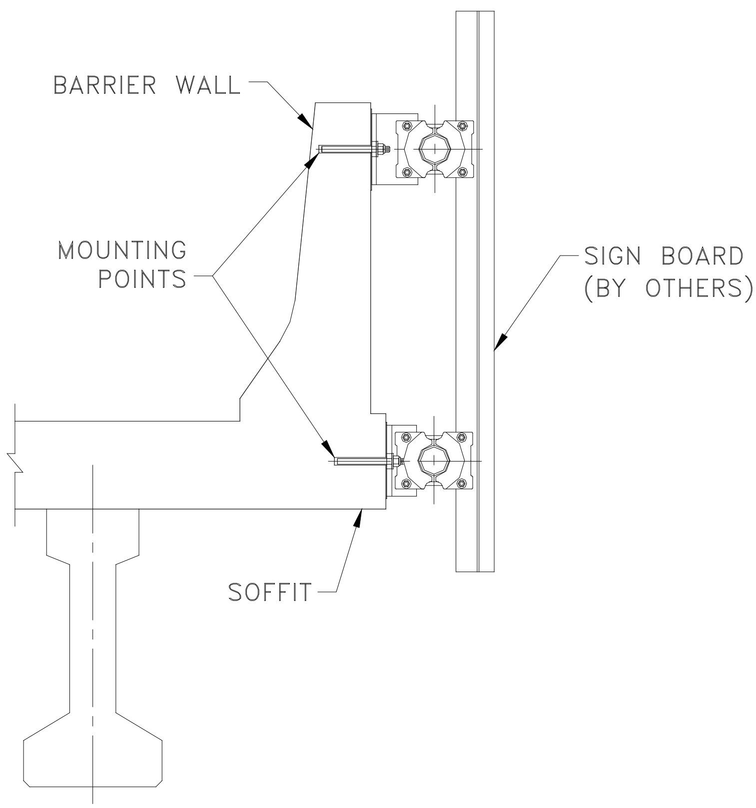



**FIGURE 9.1.3(a)**

<u>TYPE II- Standard Drawing SS118-14 and SS118-15</u>

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.

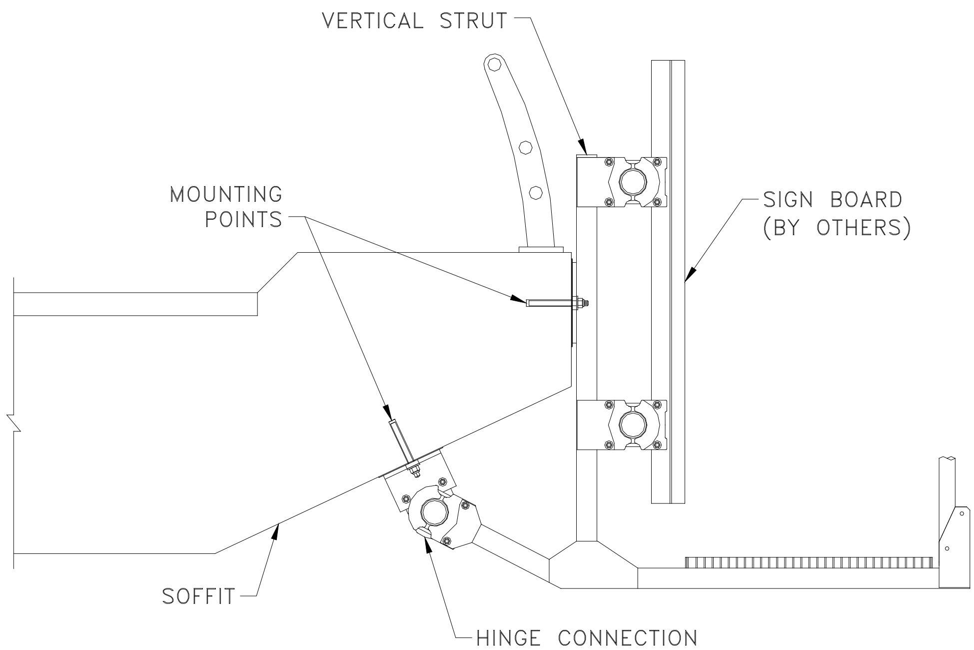



**FIGURE 9.1.3(b)**

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.

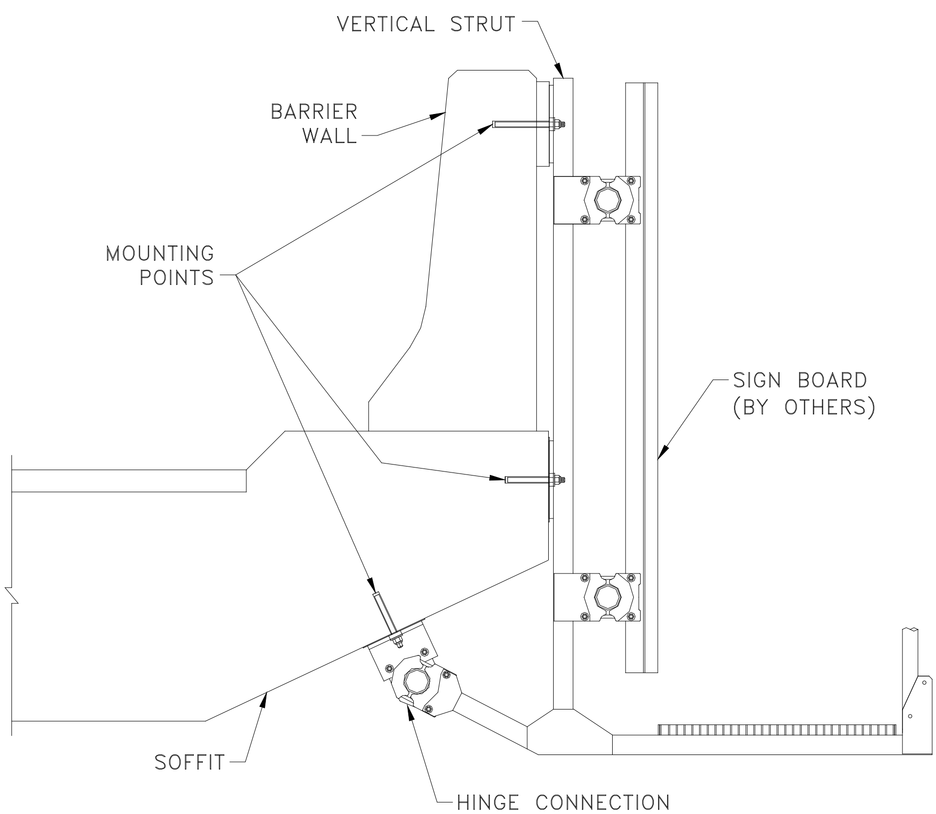



**FIGURE 9.1.3(c)**

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.

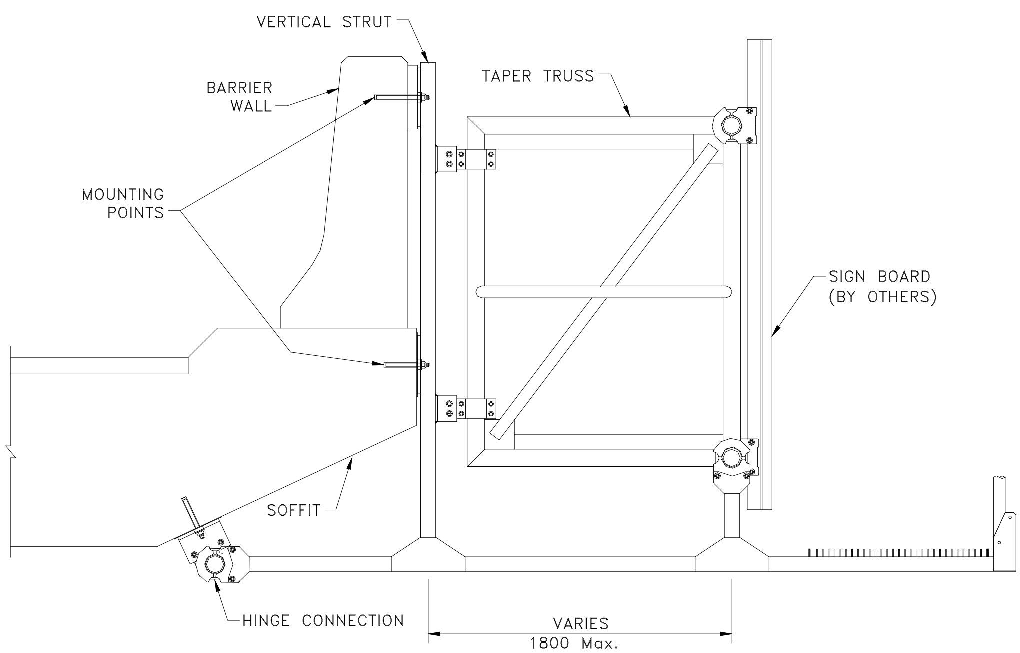



**FIGURE 9.1.3(d)**

### 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 drawings. 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.

(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.

| SIGN DEPTH (mm) | DIMENSION (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.

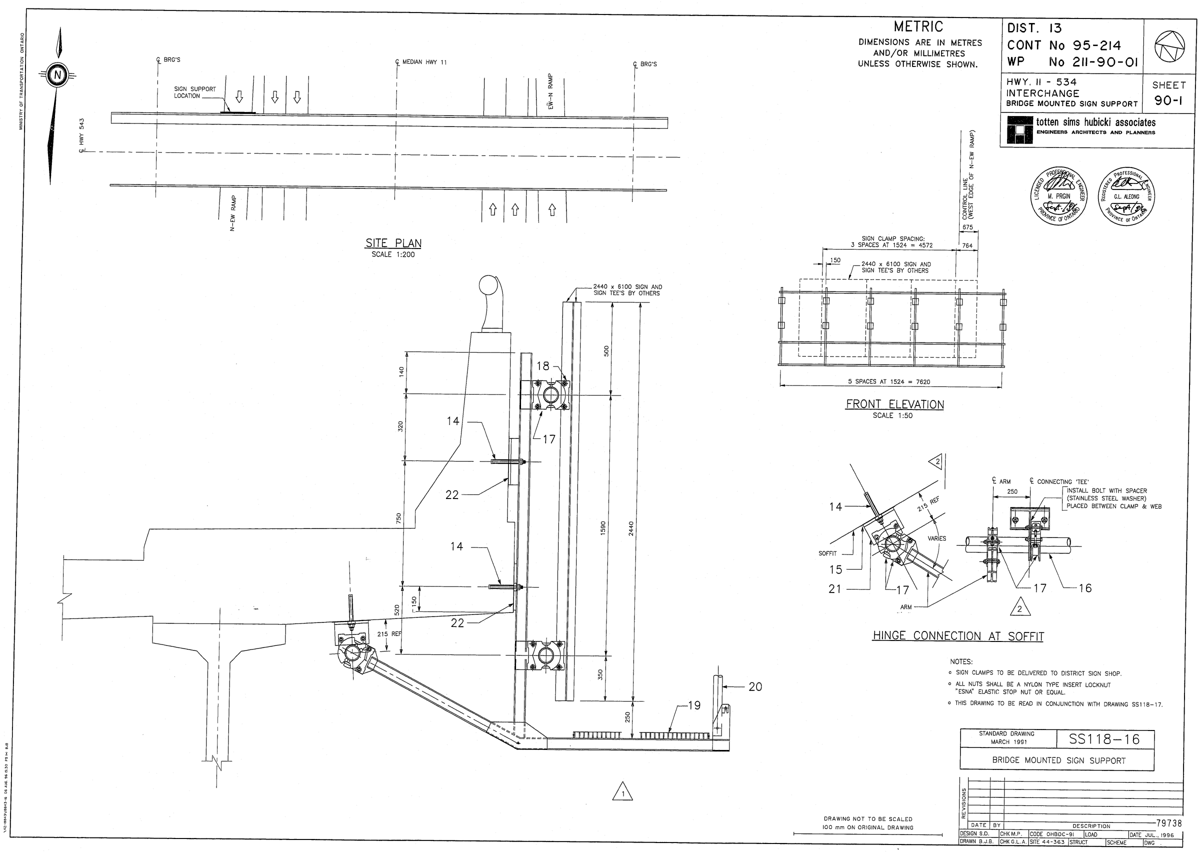
(iv) The railing should be drawn in the down position on the front elevation. Railings are available in two lengths, 3050 mm (2 posts BD-221-045-8A) and 3810 mm (3 posts, BD-221-045-10A). The two post railing extends over one 1524 mm (5 foot) grating unit and halfway across each of the two adjacent units (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 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.

| SIGN SIZE/TYPE | MAXIMUM (mm) | MINIMUM (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.




<u>**FIGURE 9.2.2(a) GENERAL LAYOUT DRAWING**</u>

## 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.

## APPENDIX TO DIVISION 9

BRIDGE MOUNTED SIGN SUPPORTS

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

CONT No
WP No

BRIDGE MOUNTED SIGN SUPPORT
TYPE I
GENERAL LAYOUT AND DETAILS

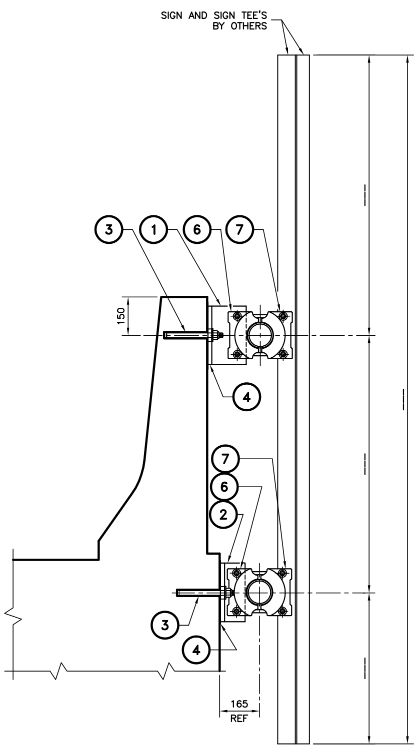
SHEET

## NOTES:

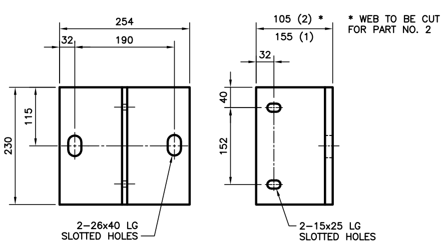
1. ALL STAINLESS STEEL BOLTS, NUTS AND WASHERS TO BE ALLOY 304, COLD FINISH, CENTRELESS GROUND, MIN. YIELD STRESS 304 MPa.
2. STEEL CONNECTING TEE'S SHALL BE HOT-DIP GALVANIZED.
3. FOR INSPECTION AND DELIVERY ASSEMBLE ALL BOLTS, NUTS, AND WASHERS IN PLACE AS SHOWN.
4. TOLERANCE ± 1.5mm UNLESS OTHERWISE SPECIFIED.
5. SIGN CLAMPS TO BE DELIVERED TO DISTRICT SIGN SHOP.
6. ALL NUTS SHALL BE A NYLON TYPE INSERT LOCKNUT "ESNA" ELASTIC STOP NUT OR EQUAL.

## LIST OF DRAWINGS:

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.




TYPICAL SECTION




1 2 CONNECTING TEE DETAIL

PARTSLIST

| QTY | NAME | FIG | MAT'L | ROUGH DIMENSIONS | REMARKS |
|---|---|---|---|---|---|
| | CONNECTING TEE | 1 | G40.21 | WT 155 x 39 X 230 LG | GALVANIZED |
| | CONNECTING TEE | 2 | G40.21 | WT 155 x 39 X 230 LG | GALVANIZED |
| | ANCHOR | 3 | S ST | | |
| | NEOPRENE PAD (3mm TH'K) | 4 | NEOPRENE | SH 3 x 240 x 265 | FOR FIG'S 12 AND 13 |
| | SUPPORT PIPES WITH PIPE CAPS | 5 | 6061-T6 | NPS 3.5 SCH 40 PIPE | LENGTH= |
| | SIZE 3.5 CHORD CLAMP | 6 | | SEE BD 221-050-3 | FOR STRUCTURE |
| | SIZE 3.5 CHORD CLAMP | 7 | | SEE BD 221-050-3 | FOR SIGN |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

STANDARD DRAWING
MARCH 2015

SS118-12

BRIDGE MOUNTED SIGN SUPPORT, TYPE I
GENERAL LAYOUT AND DETAILS

DRAWING NOT TO BE SCALED
100mm ON ORIGINAL DRAWING

| REVISIONS | | |
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|---|---|---|---|---|---|
| DESIGN | CHK | CODE | LOAD | DATE | |
| DRAWN | CHK | SITE | STRUCT | SCHEME | DWG |

MINISTRY OF TRANSPORTATION, ONTARIO PH-D-707 88-05
DRAWING NAME: s118-12 March 2015.dwg MODIFIED: 2015/03/26 09:45:34
CREATED: 1998/03/13

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

CONT No
WP No

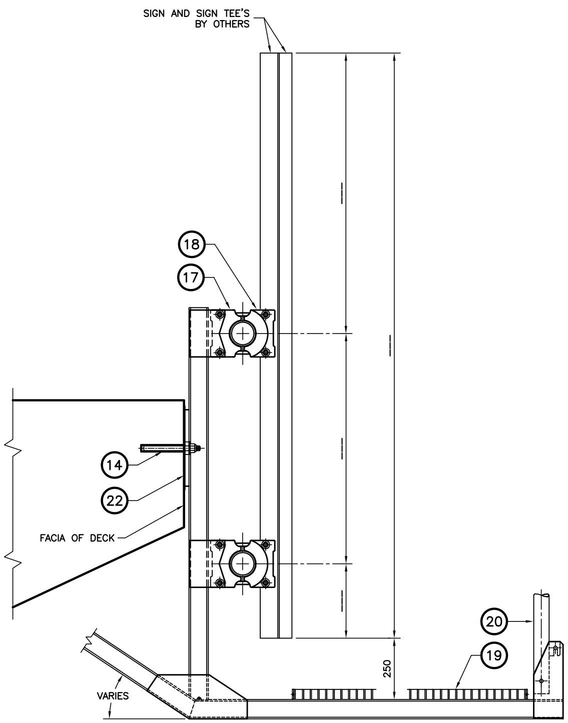
BRIDGE MOUNTED SIGN SUPPORT
TYPE II
GENERAL LAYOUT

SHEET

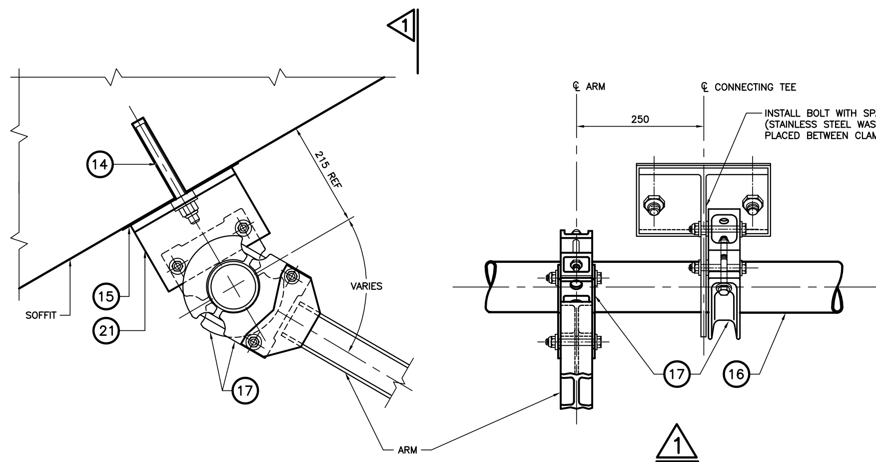
## NOTES:

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

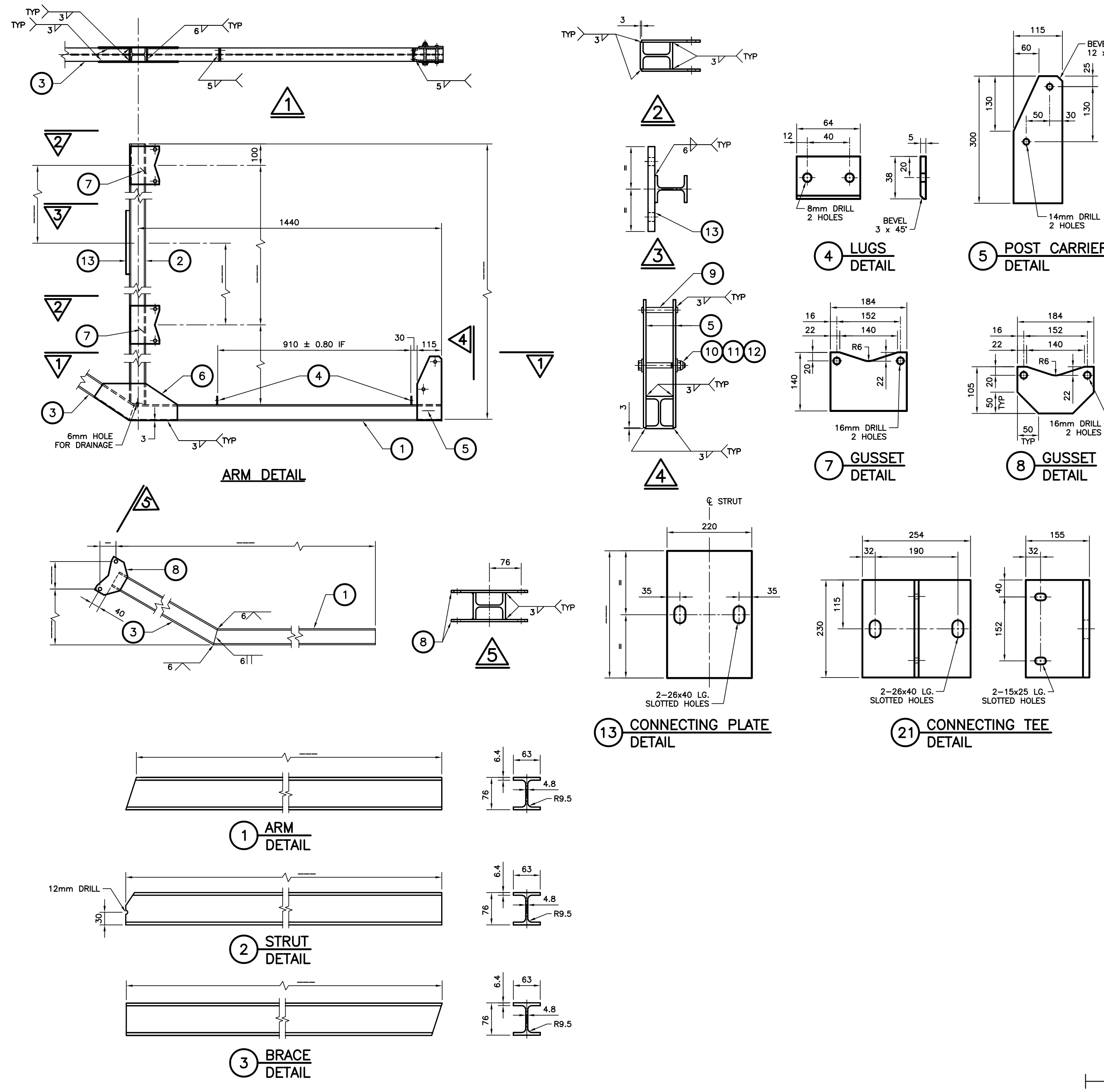
| | |
|---|---|
| STANDARD DRAWING<br>JULY 2014 | SS118–14 |
| BRIDGE MOUNTED SIGN SUPPORT, TYPE II<br>GENERAL LAYOUT | |

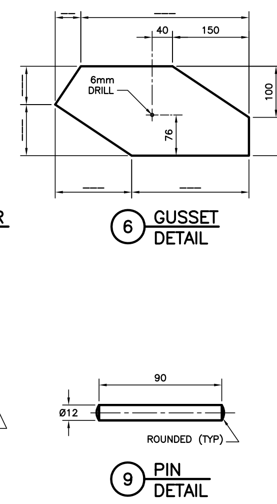
REVISIONS

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

DRAWING NAME: s118-14 July 2014.dwg MODIFIED: 2014/07/16 16:35:04
CREATED: 1998/03/13

MINISTRY OF TRANSPORTATION, ONTARIO PR-D-707 88-05





# METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

CONT No
WP No

BRIDGE MOUNTED SIGN SUPPORT TYPE II
SERVICE WALK ARM ASSEMBLY

SHEET

## 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.

PARTSLIST

| QTY | NAME | FIG | MAT'L | ROUGH DIMENSIONS | REMARKS |
|---|---|---|---|---|---|
| | ARM | 1 | 6061–T6 | S76 x 3.21 x LG | ALCAN 28003 |
| | STRUT | 2 | 6061–T6 | S76 x 3.21 x LG | ALCAN 28003 |
| | BRACE | 3 | 6061–T6 | S76 x 3.21 x LG | ALCAN 28003 |
| | LUGS | 4 | 6061–T6 | PL 5 x 38 x 70 LG | ALCAN 12564 |
| | POST CARRIER | 5 | 6061–T6 | PL 6 x 120 x 310 LG | |
| | GUSSET | 6 | 6061–T6 | SH 5 x 185 x LG | |
| | GUSSET | 7 | 6061–T6 | SH 5 x 150 x 200 LG | |
| | GUSSET | 8 | 6061–T6 | SH 5 x 110 x 200 LG | |
| | PIN | 9 | 6061–T6 | 12 DIA x 100 LG | |
| | HEX. MACHINE BOLT M12 x 1.75 | 10 | S ST | 100 LG | |
| | NYLON INSERT STOP NUT M12 x 1.75 | 11 | S ST | ESNA 79 NE | OR EQUIVALENT |
| | STD. FLAT WASHER | 12 | S ST | 28 OD x 13 ID x 2.5 THK | FOR M12 BOLT |
| | CONNECTING PLATE | 13 | 6061–T6 | PL 16 x 220 X LG | |
| | ANCHOR | 14 | S ST | | |
| | NEOPRENE PAD (3mm TH'K) | 15 | NEOPRENE | SH 3 x 240 x 265 | FOR FIG 21 |
| | SUPPORT PIPES WITH PIPE CAPS | 16 | 6061–T6 | NPS 3.5 SCH 40 PIPE | LENGTH= |
| | SIZE 3.5 CHORD CLAMP | 17 | | SEE BD 221–050–3 | FOR STRUCTURE |
| | SIZE 3.5 CHORD CLAMP | 18 | | SEE BD 221–050–3 | FOR SIGN |
| | GRATING | 19 | | SEE BD 221–045–7 | |
| | RAILING (2 POST) | 20 | | SEE BD 221–045–8A | |
| | CONNECTING TEE | 21 | G40.21 | WT 155 x 39 X 230 LG | GALVANIZED |
| | NEOPRENE PAD (3mm TH'K) | 22 | NEOPRENE | SH 3 x 230 x LG | FOR FIG 13 |
| | | | | | |
| | | | | | |

STANDARD DRAWING MARCH 2015 | SS118–15

BRIDGE MOUNTED SIGN SUPPORT, TYPE II
SERVICE WALK ARM ASSEMBLY

DRAWING NOT TO BE SCALED
100mm ON ORIGINAL DRAWING

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

DRAWING NAME: s118–15 March 2015.dwg
CREATED: 2014/04/07
MODIFIED: 2015/03/26 09:46:18

MINISTRY OF TRANSPORTATION, ONTARIO PR–D–707 88–05

# METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

CONT No
WP No

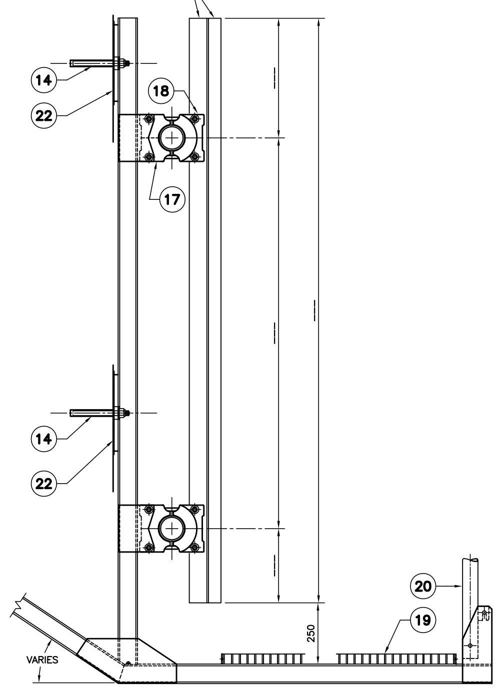
BRIDGE MOUNTED SIGN SUPPORT TYPE III GENERAL LAYOUT

SHEET

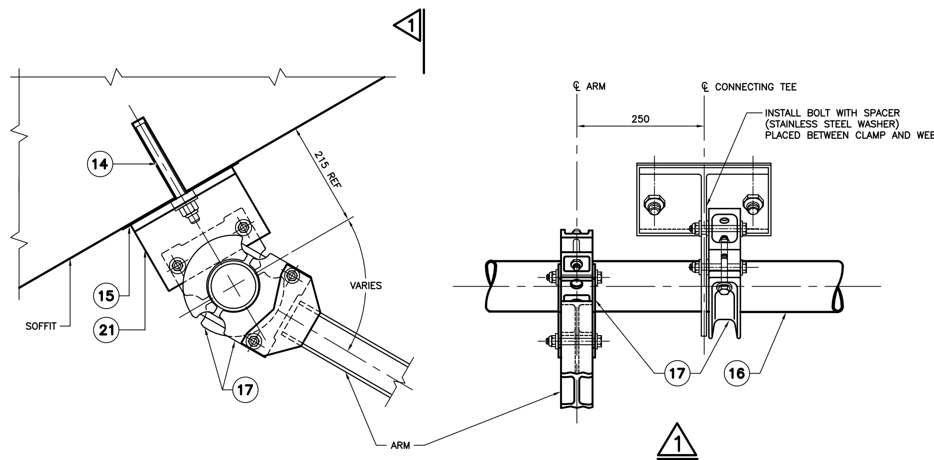
## NOTES:

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

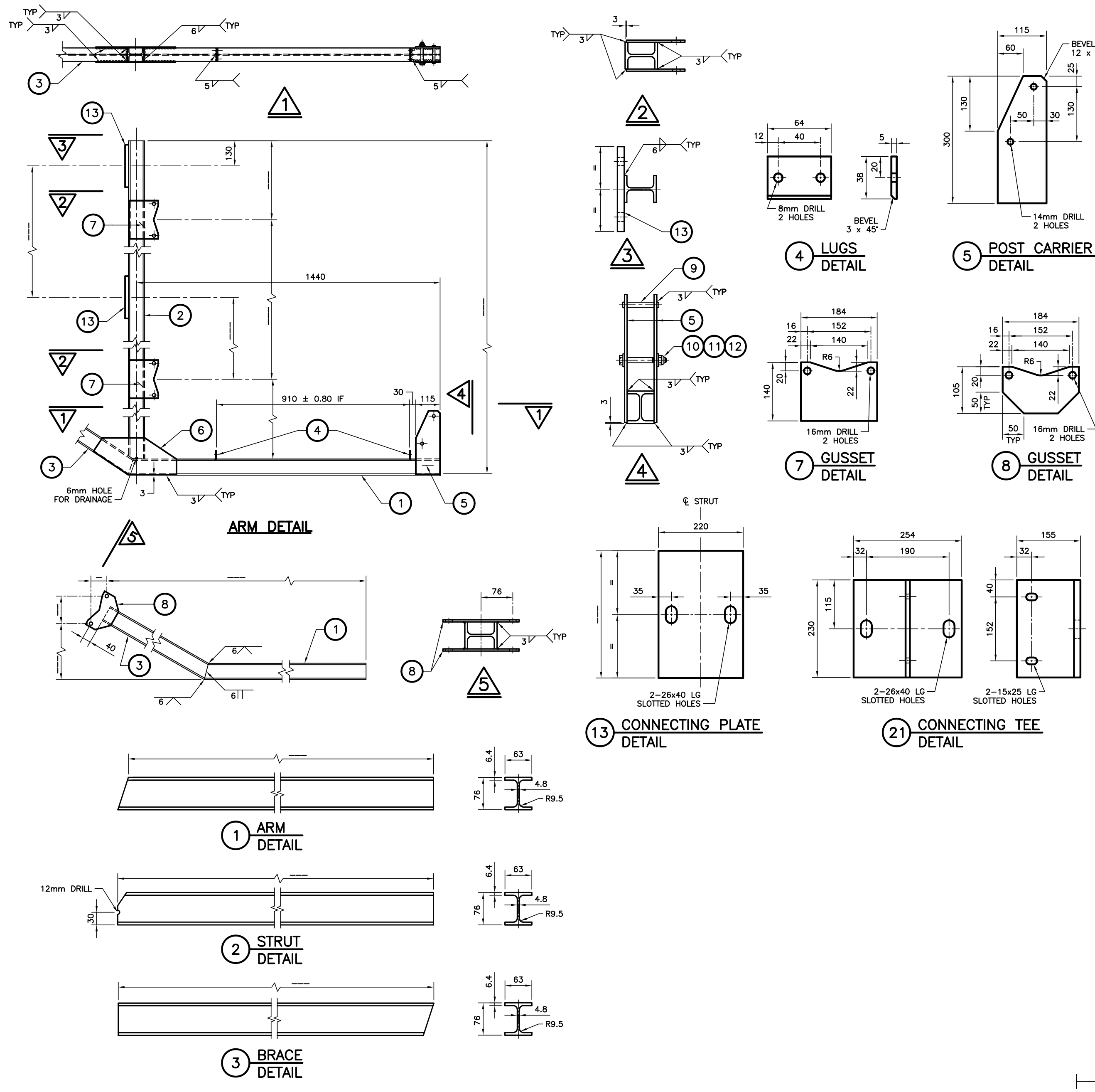
| STANDARD DRAWING JULY 2014 | SS118–16 |
|---|---|
| BRIDGE MOUNTED SIGN SUPPORT, TYPE III GENERAL LAYOUT | |

| REVISIONS | DATE | BY | DESCRIPTION |
|---|---|---|---|

| DESIGN | CHK | CODE | LOAD | DATE | |
|---|---|---|---|---|---|
| DRAWN | CHK | SITE | STRUCT | SCHEME | DWG |

MINISTRY OF TRANSPORTATION, ONTARIO PH–D–707 88–05

DRAWING NAME: s118–16 July 2014.dwg MODIFIED: 2014/07/16 16:41:04
CREATED: 1998/03/13




# METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

CONT No

WP No

BRIDGE MOUNTED SIGN SUPPORT TYPE III

SERVICE WALK ARM ASSEMBLY

SHEET

## 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.

### PARTSLIST

| QTY | NAME | FIG | MAT'L | ROUGH DIMENSIONS | REMARKS |
|---|---|---|---|---|---|
| | ARM | 1 | 6061–T6 | S76 x 3.21 x LG | ALCAN 28003 |
| | STRUT | 2 | 6061–T6 | S76 x 3.21 x LG | ALCAN 28003 |
| | BRACE | 3 | 6061–T6 | S76 x 3.21 x LG | ALCAN 28003 |
| | LUGS | 4 | 6061–T6 | PL 5 x 38 x 70 LG | ALCAN 12564 |
| | POST CARRIER | 5 | 6061–T6 | PL 6 x 120 x 310 LG | |
| | GUSSET | 6 | 6061–T6 | SH 5 x 185 x LG | |
| | GUSSET | 7 | 6061–T6 | SH 5 x 150 x 200 LG | |
| | GUSSET | 8 | 6061–T6 | SH 5 x 110 x 200 LG | |
| | PIN | 9 | 6061–T6 | 12 DIA x 100 LG | |
| | HEX. MACHINE BOLT M12 x 1.75 | 10 | S ST | 100 LG | |
| | NYLON INSERT STOP NUT M12 x 1.75 | 11 | S ST | ESNA 79 NE | OR EQUIVALENT |
| | STD. FLAT WASHER | 12 | S ST | 28 OD x 13 ID x 2.5 THK | FOR M12 BOLT |
| | CONNECTING PLATE | 13 | 6061–T6 | PL 16 x 220 X LG | |
| | ANCHOR | 14 | S ST | | |
| | NEOPRENE PAD (3mm TH'K) | 15 | NEOPRENE | SH 3 x 240 x 265 | FOR FIG 21 |
| | SUPPORT PIPES WITH PIPE CAPS | 16 | 6061–T6 | NPS 3.5 SCH 40 PIPE | LENGTH= |
| | SIZE 3.5 CHORD CLAMP | 17 | | SEE BD 221–050–3 | FOR STRUCTURE |
| | SIZE 3.5 CHORD CLAMP | 18 | | SEE BD 221–050–3 | FOR SIGN |
| | GRATING | 19 | | SEE BD 221–045–7 | |
| | RAILING (2 POST) | 20 | | SEE BD 221–045–8A | |
| | CONNECTING TEE | 21 | G40.21 | WT 155 x 39 X 230 LG | GALVANIZED |
| | NEOPRENE PAD (3mm TH'K) | 22 | NEOPRENE | SH 3 x 230 x LG | FOR FIG 13 |
| | | | | | |
| | | | | | |

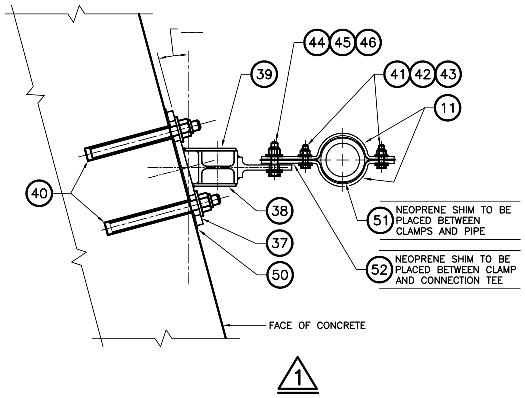
STANDARD DRAWING MARCH 2015 — SS118–17

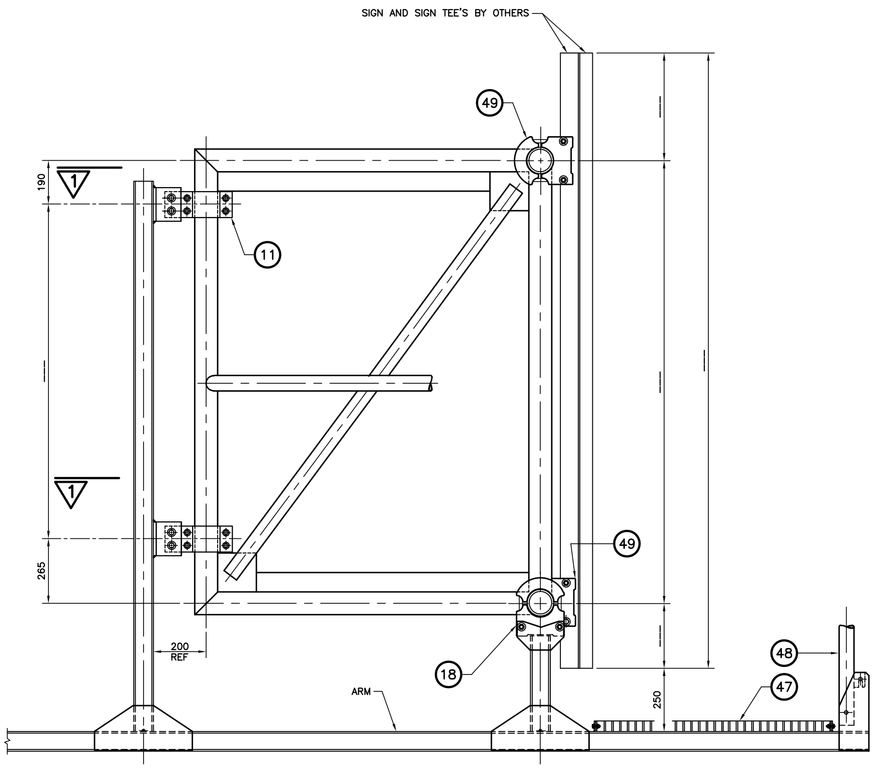
BRIDGE MOUNTED SIGN SUPPORT, TYPE III SERVICE WALK ARM ASSEMBLY

DRAWING NOT TO BE SCALED 100mm ON ORIGINAL DRAWING

| REVISIONS | DATE | BY | DESCRIPTION |
|---|---|---|---|

| DESIGN | CHK | CODE | LOAD | DATE |
|---|---|---|---|---|
| DRAWN | CHK | SITE | STRUCT | SCHEME | DWG |




TYPICAL SECTION

# METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

| | |
|---|---|
| CONT No<br>WP No | |
| BRIDGE MOUNTED SIGN SUPPORT<br>TYPE IV<br>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:

DRAWING NOT TO BE SCALED
100mm ON ORIGINAL DRAWING

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

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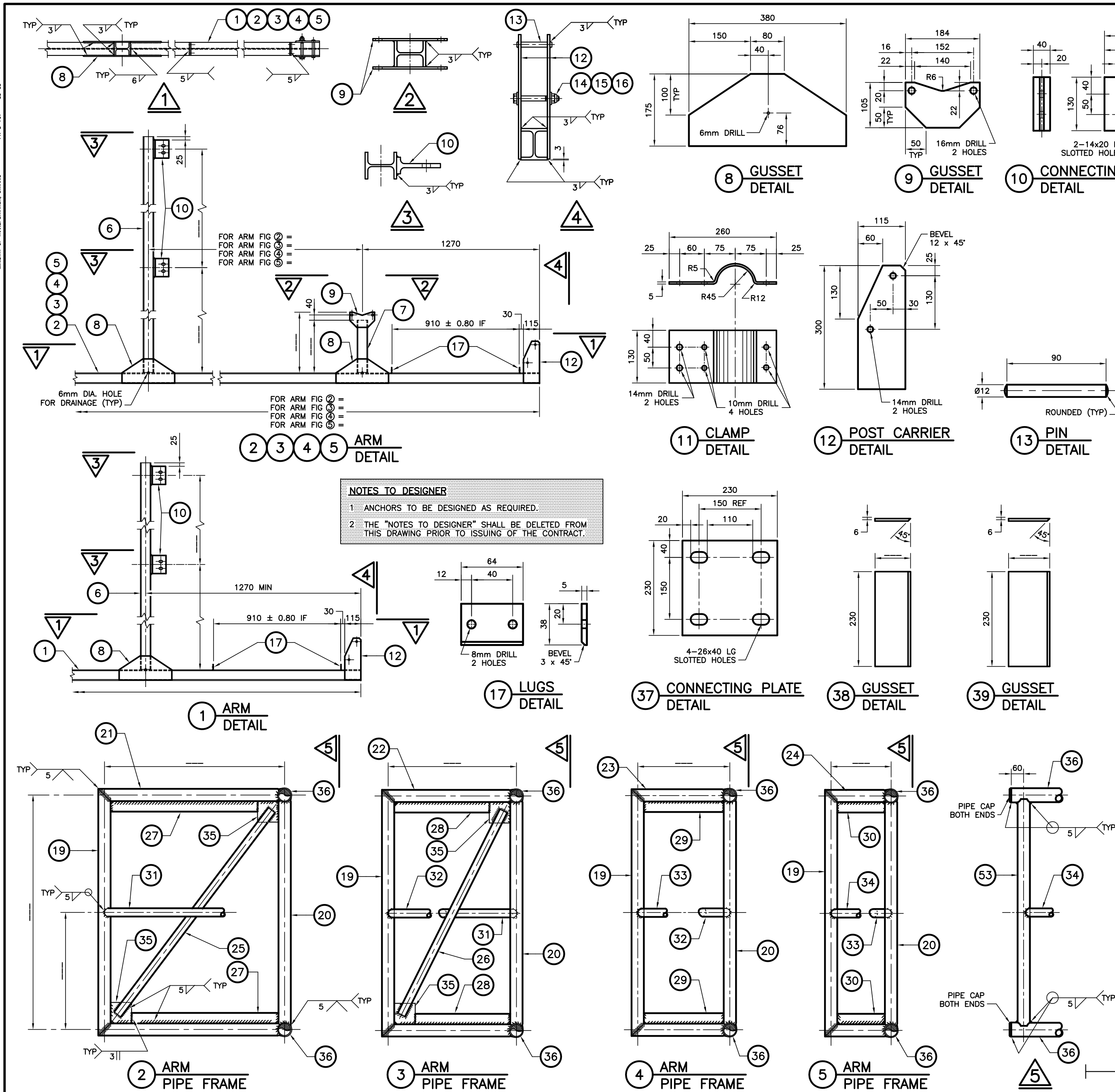
| DESIGN | CHK | CODE | LOAD | DATE | |
| DRAWN | CHK | SITE | STRUCT | SCHEME | DWG |

MINISTRY OF TRANSPORTATION, ONTARIO PR-D-707 88-05
DRAWING NAME: s118-18 Dec 2014.dwg MODIFIED: 2014/12/08 08:32:32
CREATED: 2014/04/25




DRAWING NOT TO BE SCALED
100mm ON ORIGINAL DRAWING

# METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

## NOTES:

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

| CONT No | | SHEET |
|---|---|---|
| WP No | | |
| BRIDGE MOUNTED SIGN SUPPORT TYPE IV SERVICE WALK ARM ASSEMBLY | | |

PARTSLIST

| QTY | NAME | | FIG | MAT'L | ROUGH DIMENSIONS | REMARKS |
|---|---|---|---|---|---|---|
| | ARM | | 1 | 6061–T6 | S76 x 3.21 x LG | ALCAN 28003 |
| | ARM | | 2 | 6061–T6 | S76 x 3.21 x LG | ALCAN 28003 |
| | ARM | | 3 | 6061–T6 | S76 x 3.21 x LG | ALCAN 28003 |
| | ARM | | 4 | 6061–T6 | S76 x 3.21 x LG | ALCAN 28003 |
| | ARM | | 5 | 6061–T6 | S76 x 3.21 x LG | ALCAN 28003 |
| | STRUT | | 6 | 6061–T6 | S76 x 3.21 x LG | ALCAN 28003 |
| | STRUT | | 7 | 6061–T6 | S76 x 3.21 x LG | ALCAN 28003 |
| | GUSSET | | 8 | 6061–T6 | SH 5 x 185 x 390 LG | |
| | GUSSET | | 9 | 6061–T6 | SH 5 x 110 x 200 LG | |
| | CONNECTING TEE | | 10 | 6061–T6 | 130 LG | ALCAN 31522 |
| | CLAMP | | 11 | G40.21 | SH 5 x 140 x 320 LG | GALVANIZED |
| | POST CARRIER | | 12 | 6061–T6 | PL 6 x 120 x 310 LG | |
| | PIN | | 13 | 6061–T6 | 12 DIA x 100 LG | |
| | HEX. MACHINE BOLT | M12 x 1.75 | 14 | S ST | 100 LG | |
| | NYLON INSERT STOP NUT | M12 x 1.75 | 15 | S ST | M12 ESNA 79 NE | OR EQUIVALENT |
| | STD. FLAT WASHER | | 16 | S ST | 28 OD x 13 ID x 2.5 THK | FOR M12 BOLT |
| | LUGS | | 17 | 6061–T6 | PL 5 x 38 x 70 LG | ALCAN 12564 |
| | SIZE 3.5 CHORD CLAMP | | 18 | 6061–T6 | SEE BD 221–050–3 | FOR STRUCTURE |
| | PIPE FRAME VERTICAL | | 19 | 6061–T6 | NPS 3.0 SCH 40 PIPE | |
| | PIPE FRAME VERTICAL | | 20 | 6061–T6 | NPS 3.0 SCH 40 PIPE | |
| | PIPE FRAME HORIZONTAL | | 21 | 6061–T6 | NPS 3.0 SCH 40 PIPE | |
| | PIPE FRAME HORIZONTAL | | 22 | 6061–T6 | NPS 3.0 SCH 40 PIPE | |
| | PIPE FRAME HORIZONTAL | | 23 | 6061–T6 | NPS 3.0 SCH 40 PIPE | |
| | PIPE FRAME HORIZONTAL | | 24 | 6061–T6 | NPS 3.0 SCH 40 PIPE | |
| | PIPE FRAME DIAGONAL | | 25 | 6061–T6 | NPS 2.0 SCH 40 PIPE | |
| | PIPE FRAME DIAGONAL | | 26 | 6061–T6 | NPS 2.0 SCH 40 PIPE | |
| | STIFFENER | | 27 | 6061–T6 | PL 6 x 75 x LG | |
| | STIFFENER | | 28 | 6061–T6 | PL 6 x 75 x LG | |
| | STIFFENER | | 29 | 6061–T6 | PL 6 x 75 x LG | |
| | STIFFENER | | 30 | 6061–T6 | PL 6 x 75 x LG | |
| | PIPE | | 31 | 6061–T6 | NPS 2.0 SCH 40 PIPE | |
| | PIPE | | 32 | 6061–T6 | NPS 2.0 SCH 40 PIPE | |
| | PIPE | | 33 | 6061–T6 | NPS 2.0 SCH 40 PIPE | |
| | PIPE | | 34 | 6061–T6 | NPS 2.0 SCH 40 PIPE | |
| | GUSSET | | 35 | 6061–T6 | PL 6 x 150 x 150 LG | |
| | MAIN PIPE WITH PIPE CAPS | | 36 | 6061–T6 | NPS 3.5 SCH 40 PIPE | |
| | CONNECTING PLATE | | 37 | 6061–T6 | PL 12 x 230 x 230 LG | |
| | GUSSET | | 38 | 6061–T6 | SH 6 x x 230 | |
| | GUSSET | | 39 | 6061–T6 | SH 6 x x 230 | |
| | ANCHOR | | 40 | S ST | | |
| | HEX. MACHINE BOLT | M10 x 1.75 | 41 | S ST | 40 LG | |
| | NYLON INSERT STOP NUT | M10 x 1.75 | 42 | S ST | M10 ESNA 79 NE | OR EQUIVALENT |
| | STD. FLAT WASHER | | 43 | S ST | 21 OD x 11 ID x2.0 THK | FOR M10 BOLT |
| | HEX. MACHINE BOLT | M12 x 1.75 | 44 | S ST | 50 LG | |
| | NYLON INSERT STOP NUT | M12 x 1.75 | 45 | S ST | M12 ESNA 79 NE | OR EQUIVALENT |
| | STD. FLAT WASHER | | 46 | S ST | 28 OD x 13 ID x2.5 THK | FOR M12 BOLT |
| | GRATING | | 47 | | SEE BD 221–045–7 | |
| | RAILING (2 POST) | | 48 | | SEE BD 221–045–8A | |
| | SIZE 3.5 CHORD CLAMP | | 49 | 6061–T6 | SEE BD 221–050–3 | FOR SIGN |
| | NEOPRENE PAD (3mm TH'K) | | 50 | NEOPRENE | SH 3 x 240 x 265 | FOR FIG 37 |
| | NEOPRENE SHIM (1.5mm TH'K) | | 51 | NEOPRENE | SH 1.5 x 140 x 350 | FOR FIG 11 |
| | NEOPRENE SHIM (1.5mm TH'K) | | 52 | NEOPRENE | SH 1.5 x 140 x 100 | FOR FIG 10 |
| | PIPE FRAME VERTICAL | | 53 | 6061–T6 | NPS 3.0 SCH 40 PIPE | |
| | | | | | | |

| STANDARD DRAWING MARCH 2015 | SS118–19 |
|---|---|
| BRIDGE MOUNTED SIGN SUPPORT, TYPE IV SERVICE WALK ARM ASSEMBLY | |

| REVISIONS | | |
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| DATE | BY | DESCRIPTION |

| DESIGN | CHK | CODE | LOAD | DATE | |
|---|---|---|---|---|---|
| DRAWN | CHK | SITE | STRUCT | SCHEME | DWG |

MINISTRY OF TRANSPORTATION, ONTARIO PR–D–707 88–05
DRAWING NAME: s118–19 March 2015.dwg
CREATED: 2014/04/08
MODIFIED: 2015/03/26 09:43:43

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# SIGN SUPPORT MANUAL

INDEX

April 2015

Ministry of Transportation
Ontario
2015

Ontario