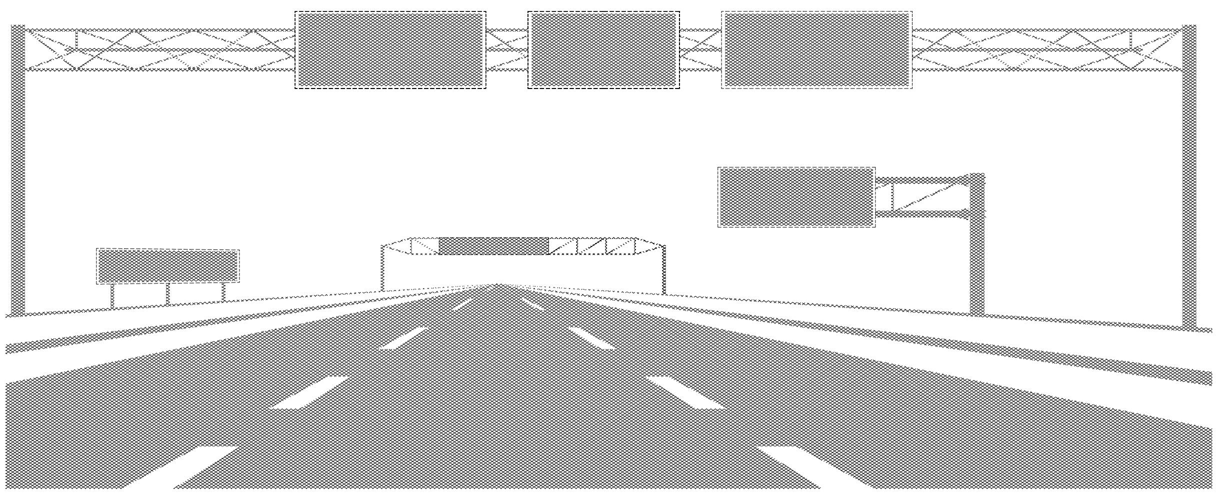
SIGN SUPPORT MANUAL



Ontario

Ministry of Transportation
Provincial Highways Management Division
Highway Standards Branch
Bridge Office
April 2011

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SIGN SUPPORT MANUAL

TABLE OF CONTENTS

April 2011

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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

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 and 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

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
spacing of top crossarm connection plates, or
edge distance of upper column splice bolts, or
length of stiffener or friction plate, or
outside diameter of shear plate, or
horizontal spacing of shear plates for type b supports, or
horizontal edge distance for splice bolt holes, or
outside diameter of sign support post.

B — width of sign board, or
end distance to first crossarm connection plate, or
diameter of shear plate bolt hole, or
depth of stiffener or friction plate, or
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
distance from end of crossarm to exterior sign support post, or
spacing of T connectors on crossarms.

CS — horizontal centroidal axis of sign board.

D — height of sign board, or
depth of shear plate groove, or
spacing of bolt hole cutouts.

E — vertical distance from edge of sign board to first crossarm, or
edge distance to bolt hole cutout, or
Inside depth of shear plate groove, or
horizontal distance from left support to leftmost sign board, or
length of upper post, or
horizontal distance from the centreline of the sign support post to the centre of the sign board, or
horizontal distance from the centreline of the sign support leg to the centreline of the end vertical element of the sign component.

EL.CS — elevation of CS.

EL.EP — elevation of EP.

EL.HP — elevation of the highest point on the highway under the sign, including shoulders, curbs, and medians.

EL.Pi — elevation at top of footing Pi.

EP — edge of pavement of travelled portion of highway.

F	vertical spacing of crossarms, or allowable bending stress in timber post, or inside diameter of shear plate, or horizontal distance from left support to 2nd leftmost sign board.
G	perpendicular distance from edge of pavement to first column, or horizontal distance from left support to 3rd leftmost sign board, or horizontal distance from rear face of traffic barrier to the nearest face of support structure footing.
H	lateral sign overhang beyond end T, or horizontal distance from left support to 4th leftmost sign board.
Hi	vertical distance from Pi to CS.
Hmax	maximum Hi.
J	edge distance of 2nd lowest bolt group from bottom of member, or horizontal distance from edge of sign board to outside T connector, or horizontal distance from left support to splice location.
K	spacing of internal bolt hole groups for crossarms, or horizontal distance from edge of sign board to inside T connector, or horizontal distance from right support to splice location, or a dimension used to impose a camber on cantilever sign supports to allow for dead load deflections.
L	length of top crossarm, or length of column, or length of upper column section, or 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	Service 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.

SIGN SUPPORT MANUAL

DIVISION 1 – INTRODUCTION

April 2011

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

Transparent copies of standard drawings for use in the production of contract documents are not available. Electronic CAD files containing standard drawings in AutoCAD may, however, be obtained from the MTO Bridge Office or the CPS.

SIGN SUPPORT MANUAL

DIVISION 2 – GENERAL INFORMATION

April 2011

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 Static Sign Support Structures, Class …….. (Class 1, 2, 3 or 4)	Each
915	Aluminum Bridge Mounted Sign Support Structures	Each
915	Tri-Chord Static Sign Support Structures, Span (*span range to be inserted as per Table*).m See SPAN RANGE TABLE below.	Each
915	Variable Message Sign Support Structures, Span (*span range to be inserted as per Table*) m See SPAN RANGE TABLE below.	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.

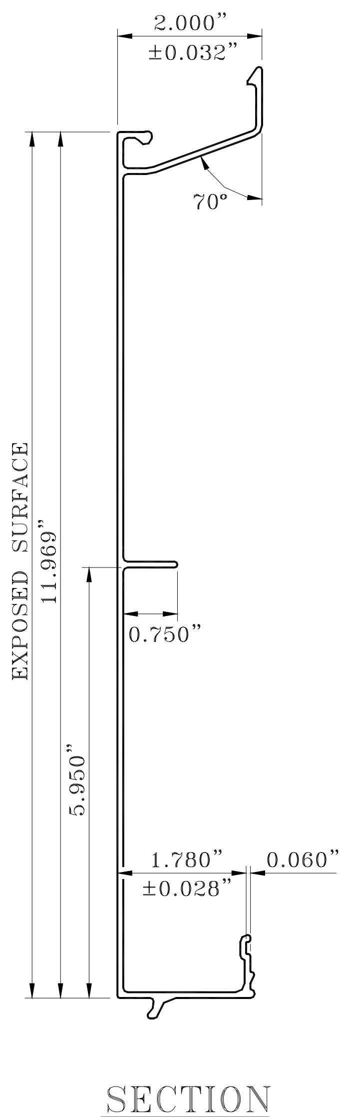
2.10 SIGN BOARDS

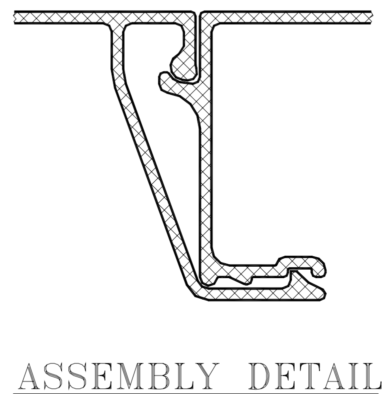
All static sign support designs are based on the aluminum Alcan Interlocking Sign Panel, Shape No. 72838, as shown in Figure 2.10. Alcan standard extrusion tolerances and finishes will apply unless otherwise specified.

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.





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

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

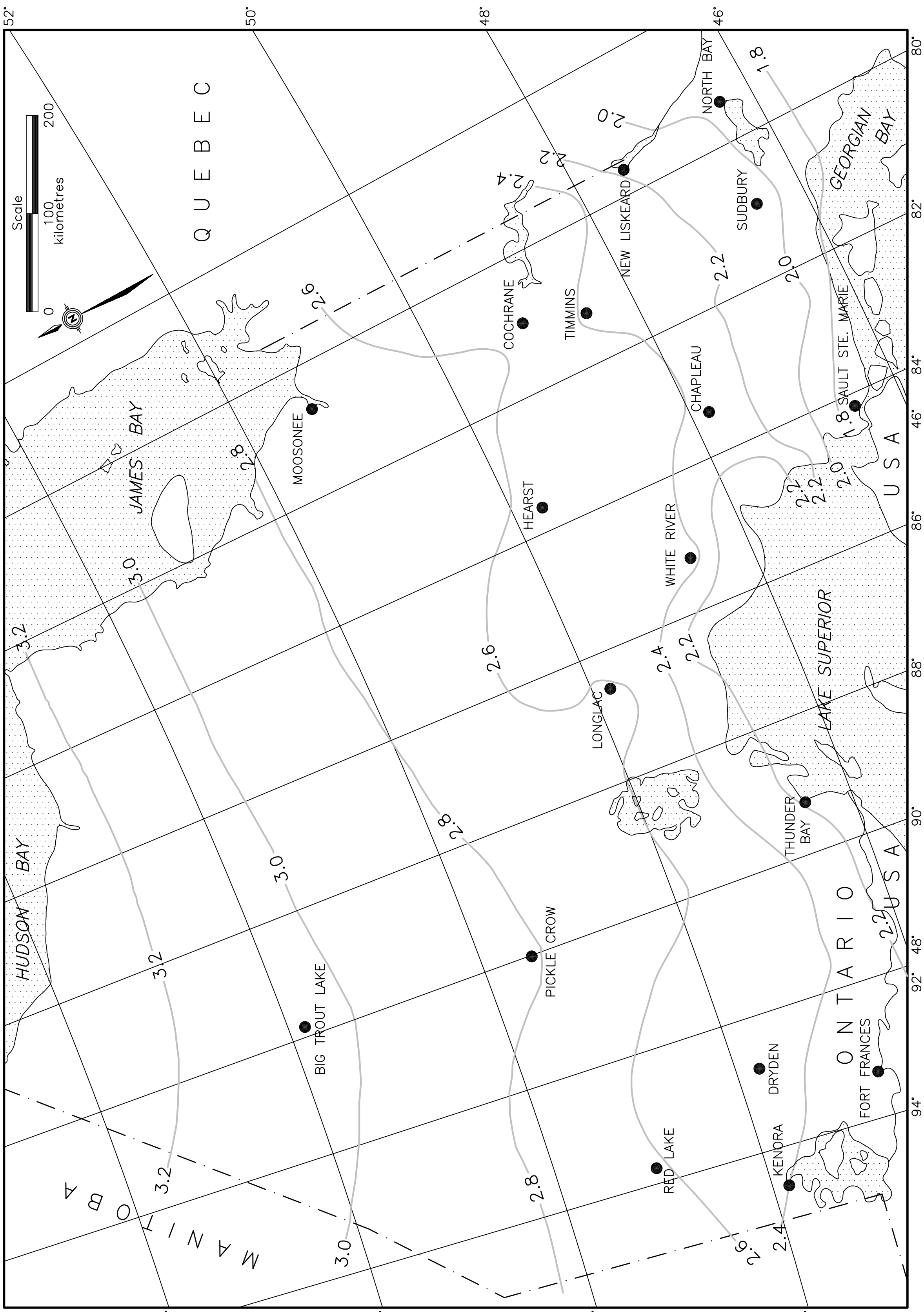
Source: CSA Standard Canadian Highway Bridge Design Code

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

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

Source: CSA Standard Canadian Highway Bridge Design Code

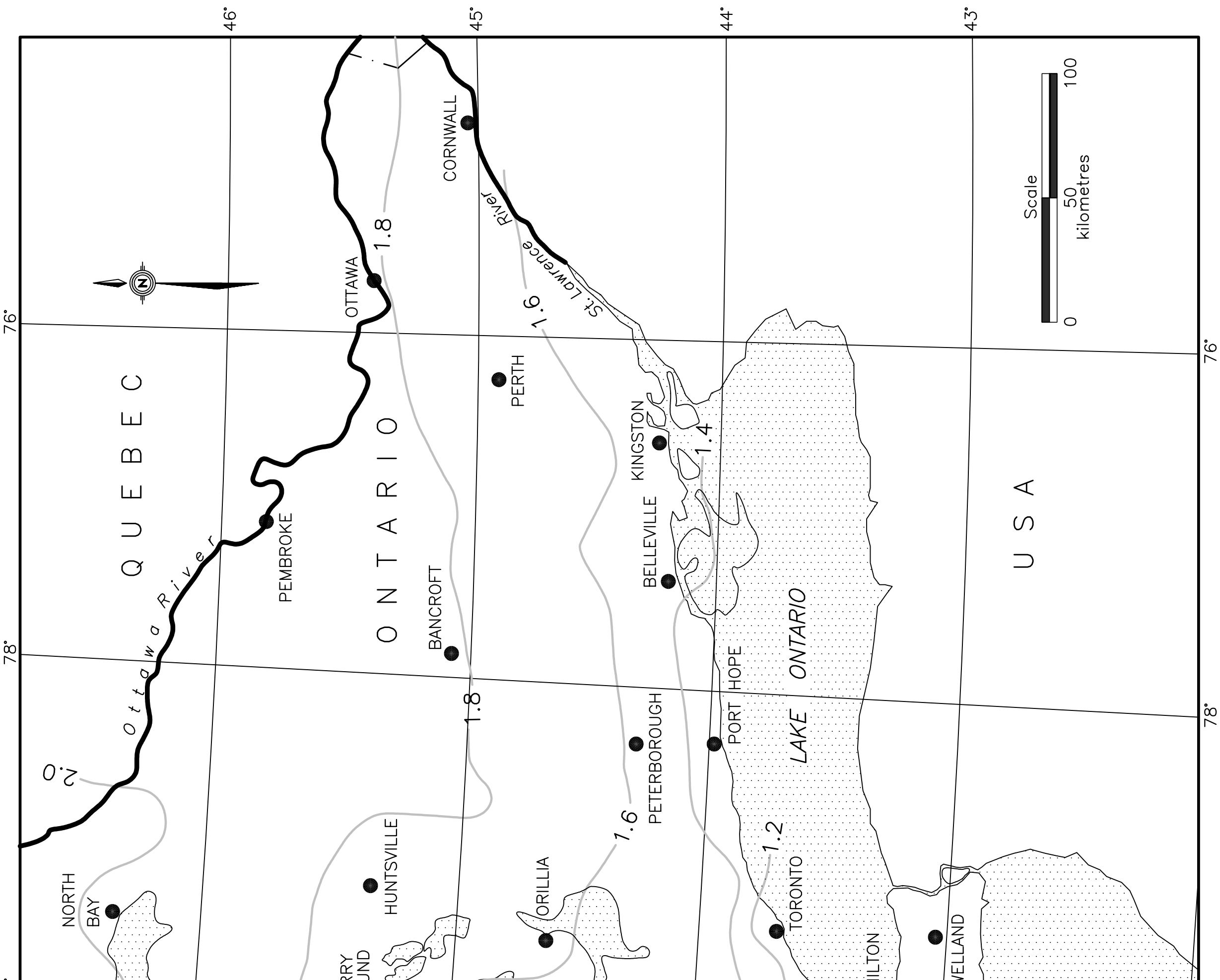
MAY 2000	CONTOURS OF FROST DEPTHS FOR NORTHERN ONTARIO	DA4-1



NOTES

1. THESE VALUES SHOULD ONLY BE USED WHERE THE RECOMMENDATIONS OF A GEOTECHNICAL ENGINEER ARE NOT AVAILABLE.
2. THIS INFORMATION WAS TAKEN FROM THE MINISTRY OF TRANSPORTATION AND COMMUNICATIONS RESEARCH PUBLICATION RR 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.

MAY 2000	CONTOURS OF FROST DEPTHS FOR SOUTHERN ONTARIO	DA4-2



NOTES

1. THESE VALUES SHOULD ONLY BE USED WHERE THE RECOMMENDATIONS OF A GEOTECHNICAL ENGINEER ARE NOT AVAILABLE.
2. THIS INFORMATION WAS TAKEN FROM THE MINISTRY OF TRANSPORTATION AND COMMUNICATIONS RESEARCH PUBLICATION RR 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.

MAY 2000	TABLE OF FROST DEPTHS FOR ONTARIO BY LOCATION	DA4-3

Location	Depth
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	1.7
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 2011

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 SS118-24)
Butterfly (Double Cantilever):	two signs, each mounted on opposite sides of the "T" style support, Figure 3.1.2(b). (See SS118-22)
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 2740 mm

(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.

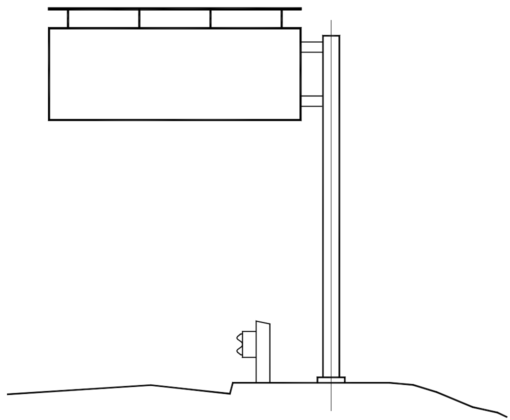


FIGURE 3.1.2(a) SINGLE CANTILEVER SIGN SUPPORT

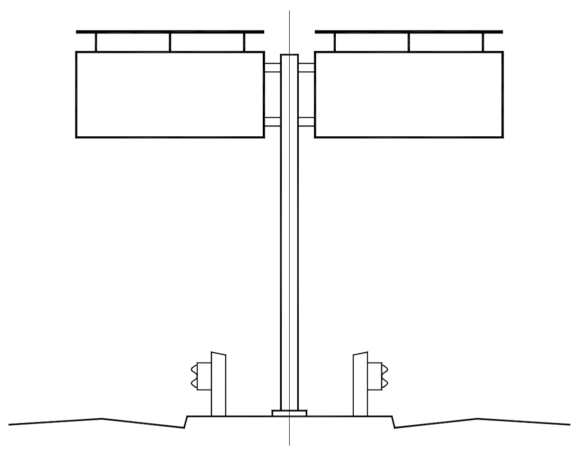


FIGURE 3.1.2(b) BUTTERFLY SIGN SUPPORT

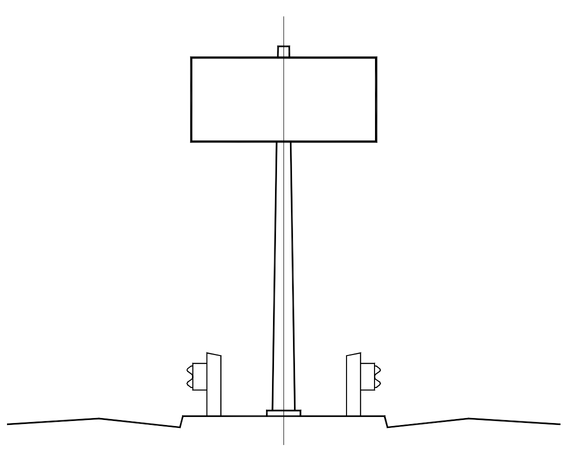


FIGURE 3.1.2(c) CENTRE MOUNTED SIGN SUPPORT

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

For Class 3 and 4 Cantilever sign supports, when the ratio of arm length to column height exceeds 1.5, consideration should be given to the use of a Tri-Chord rather than a Cantilever sign support. Tri-Chord static sign supports are discussed in Division 4 of this Manual.

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 and SS118-24. The maximum allowable length of the vertical support member is 8300 mm, which is a limit imposed by design. It is connected at the base to a concrete footing by a bolted anchorage system.

The horizontal arms are usually interconnected by verticals and diagonals. All of these members are fabricated from circular HSS sections. 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, 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 bottom of the sign board to the highest point on the highway, including shoulders, curbs and medians, shall not be less than 5300 mm and 5600 mm to the lower arm. Small lane designation sign boards with limited strength connections are allowed to project below this level because damage to them does not cause damage to the structure.

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 1500 mm.

(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 200 mm from the centre of the Z-bracket to the end of the sign board except as required in (5).

(5) If there is conflict between the Z bracket closest to the leg and a panel point connection gusset plate, the location of the Z-bracket can be adjusted as follows:

(a) Adjust the distance to the end of the sign board. This shall be a minimum of 125 mm and maximum of 500 mm from the centre of the Z-bracket. (see 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.

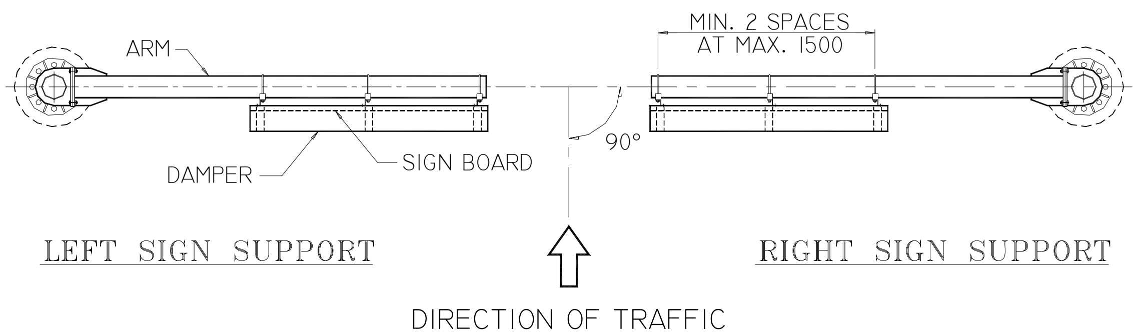


FIGURE 3.1.4(a) TYPICAL SINGLE CANTILEVER LAYOUT PLAN

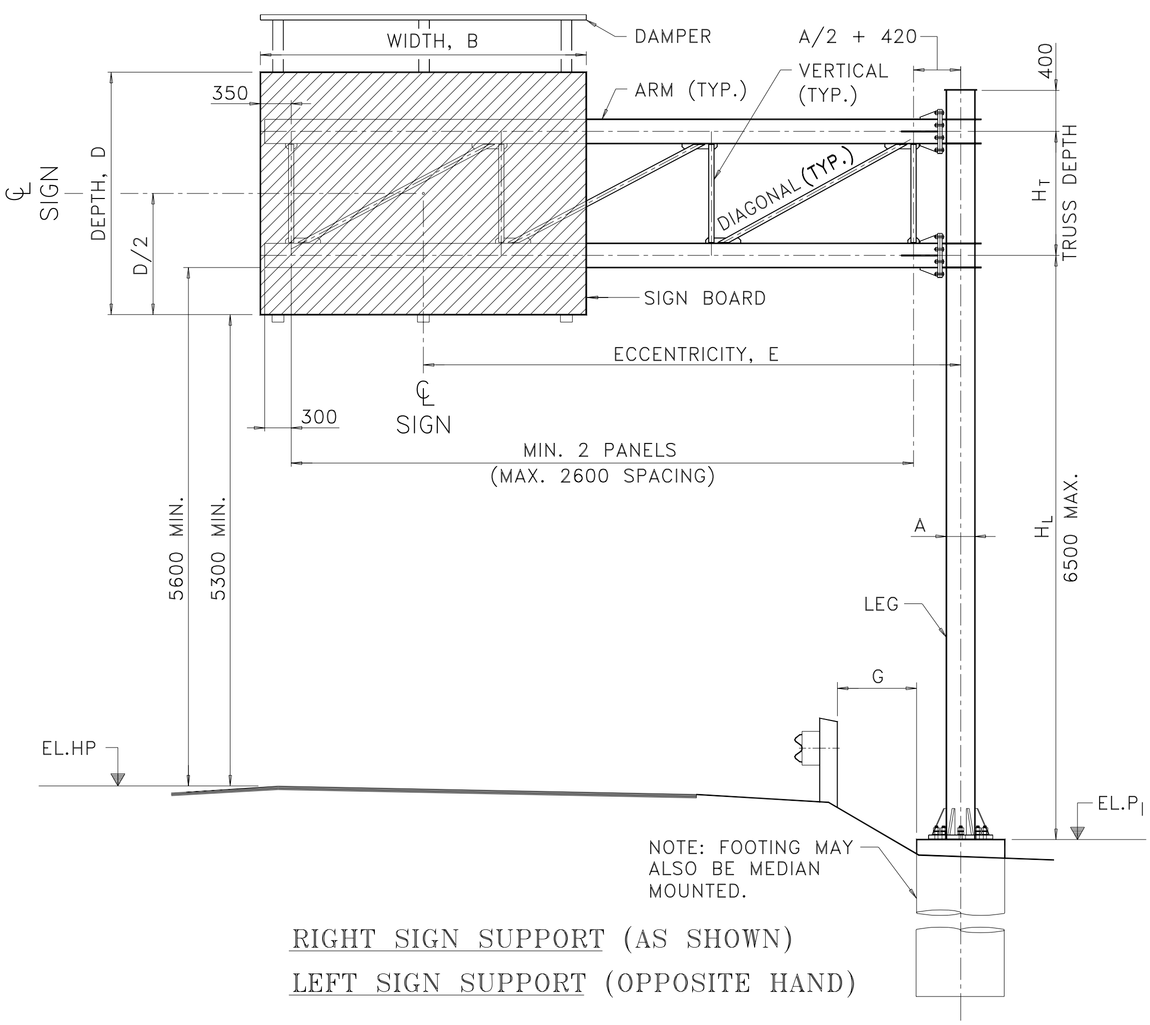


FIGURE 3.1.4(b) TYPICAL SINGLE CANTILEVER SIGN LAYOUT ELEVATION

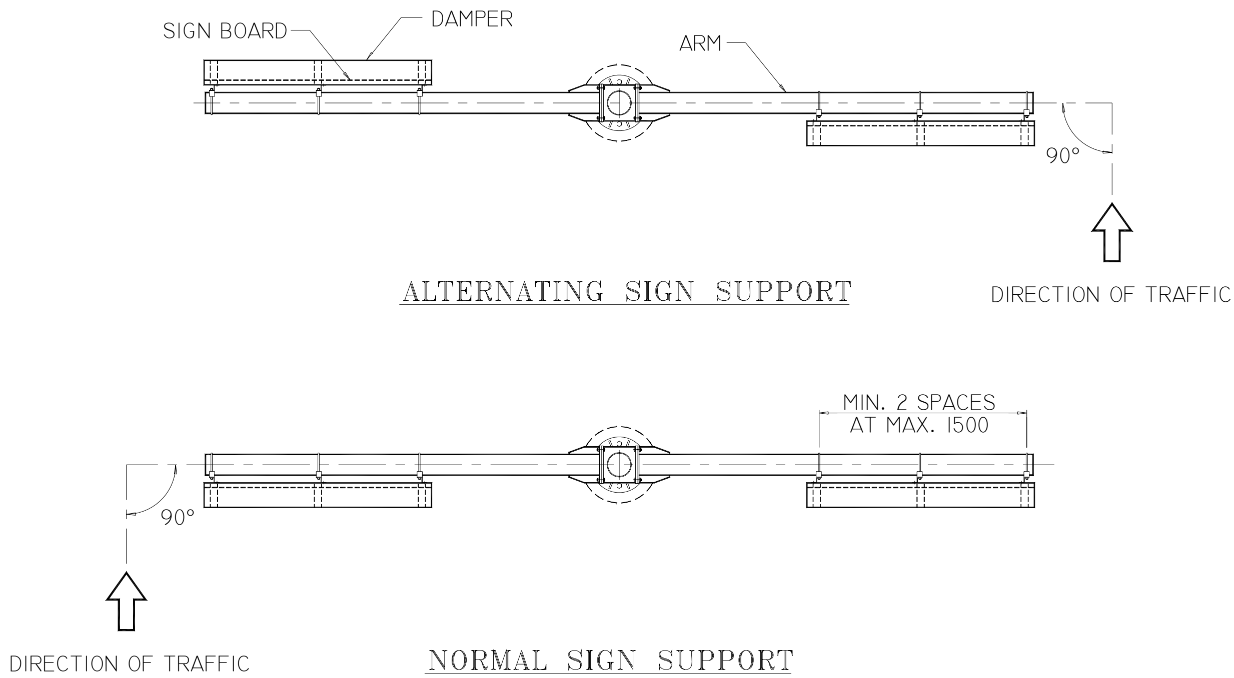


FIGURE 3.1.4(C) TYPICAL BUTTERFLY LAYOUT PLAN

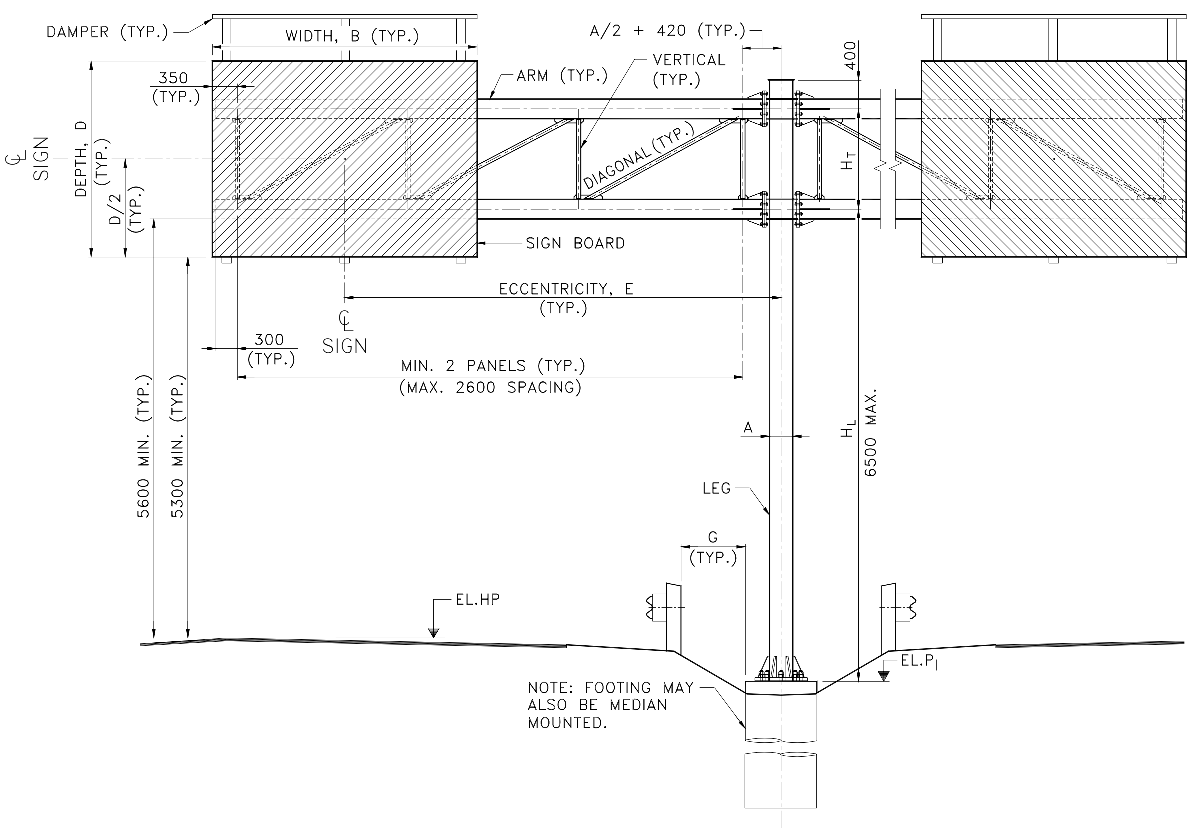


FIGURE 3.1.4(d) TYPICAL BUTTERFLY CANTILEVER SIGN SUPPORT ELEVATION

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 = 5100 mm 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
Arm Connection Plate:	Length = 580 mm
Arm Length (E+B/2-50):	= 5100+5000/2–50 = 7550mm
Dimension 'K' for Camber:	= 65 mm

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
= 6627 mm

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

Average panel length = 6627/3
= 2209

P_1 = 2209, P_{TYP} = 2209

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 200 mm from the end of sign board nearest traffic
$L_x = 200$

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

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

(4) Adjust the last Z-bracket's location to any distance (x) between 125 mm to 500 mm from end of sign board.
Still Interference. (See Figure 3.2.3(a))

(5) Change end panel length and adjust last Z-bracket location.
OK - Satisfies all criteria in 3.1.8 and minimizes number of Z-brackets (See Figure 3.2.3(b))

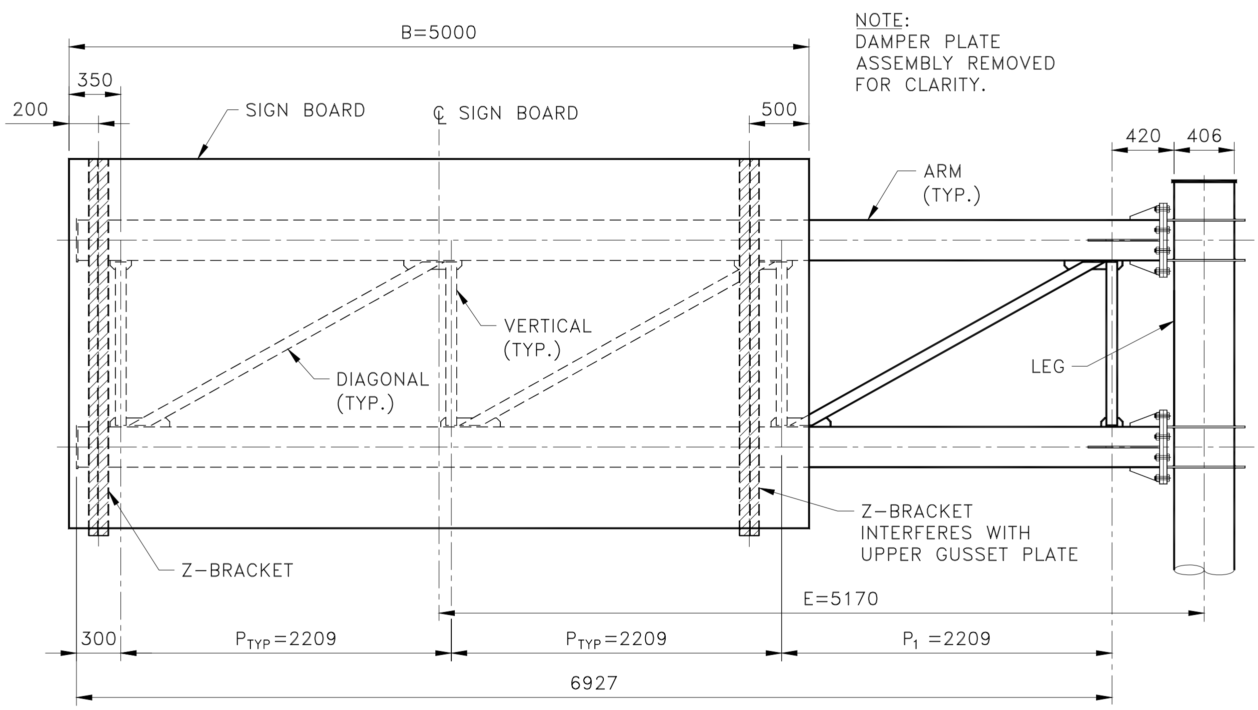


FIGURE 3.2.3(a)

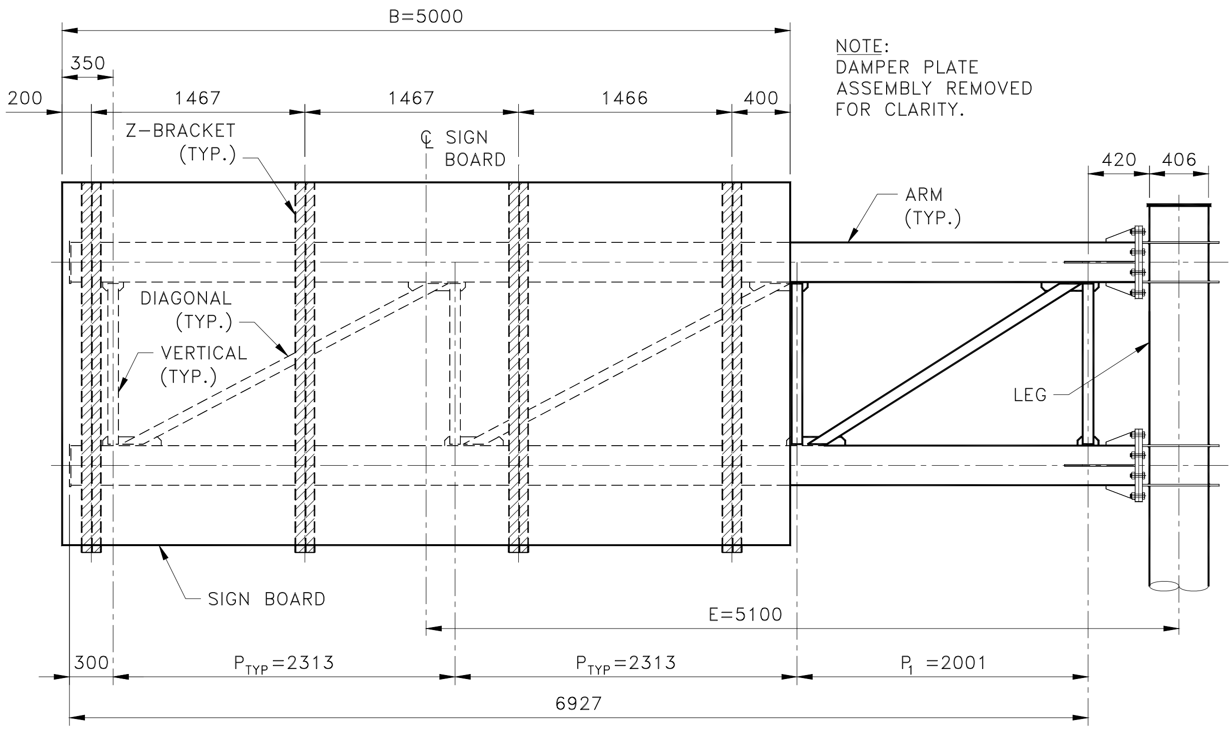


FIGURE 3.2.3(b)

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, and SS118-25,

Enter in Table 1

P_1 = 2001
P_{TYP} = 2313

And in Table 2

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

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
Arm Connection Plate:	Length = 580 mm
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): = 70 mm
Dimension 'K' for Camber (right): = 65 mm

CALCULATE PANEL LENGTHS (see 3.1.7):

LEFT

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

P_1 = 2509, P_{TYP} = 2509

RIGHT

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

P_1 = 2514, P_{TYP} = 2513

LOCATE Z-BRACKETS (see 3.1.8):

LEFT

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

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

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

(3) Check for interference with panel point at last location
L_x = 350+2509+2509 = 5368 mm
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 125 mm to 500 mm 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 2599. **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).

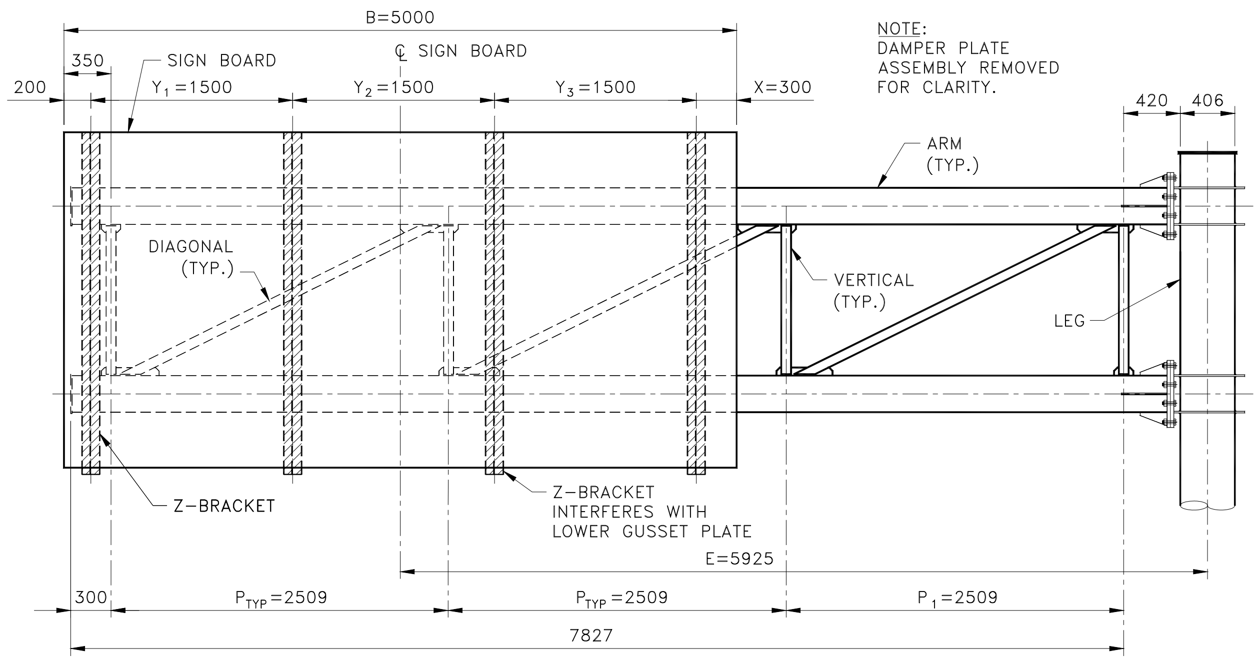


FIGURE 3.2.4(a): Left Arm

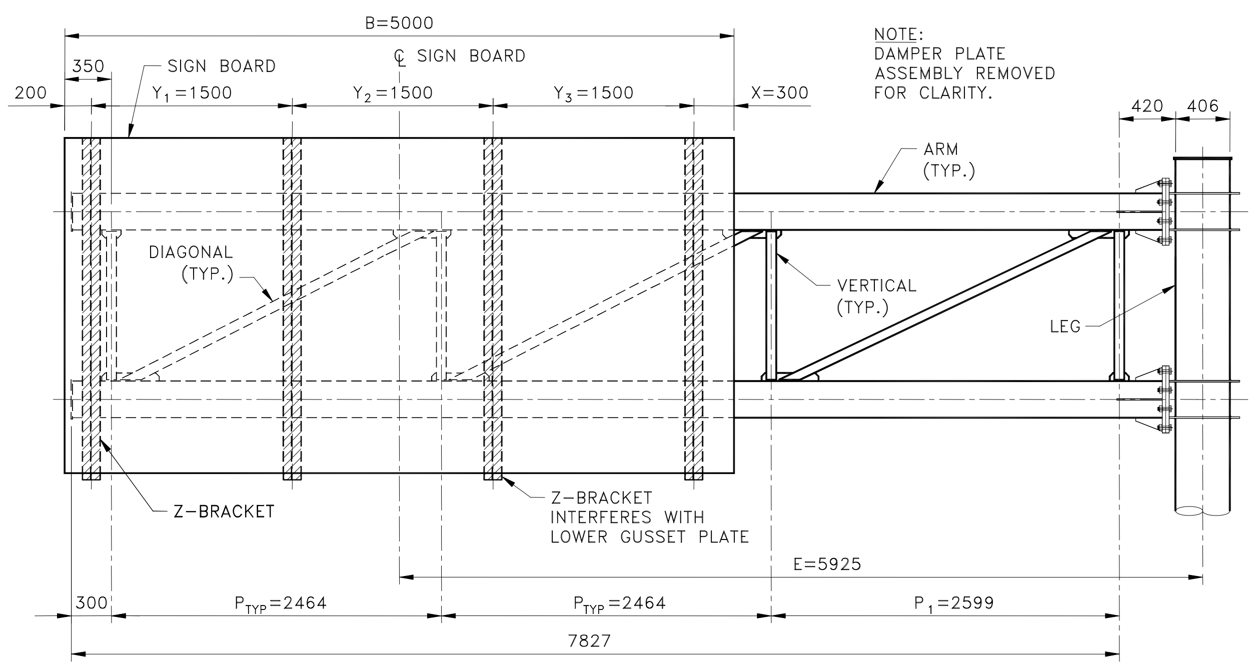


FIGURE 3.2.4(b): Left Arm

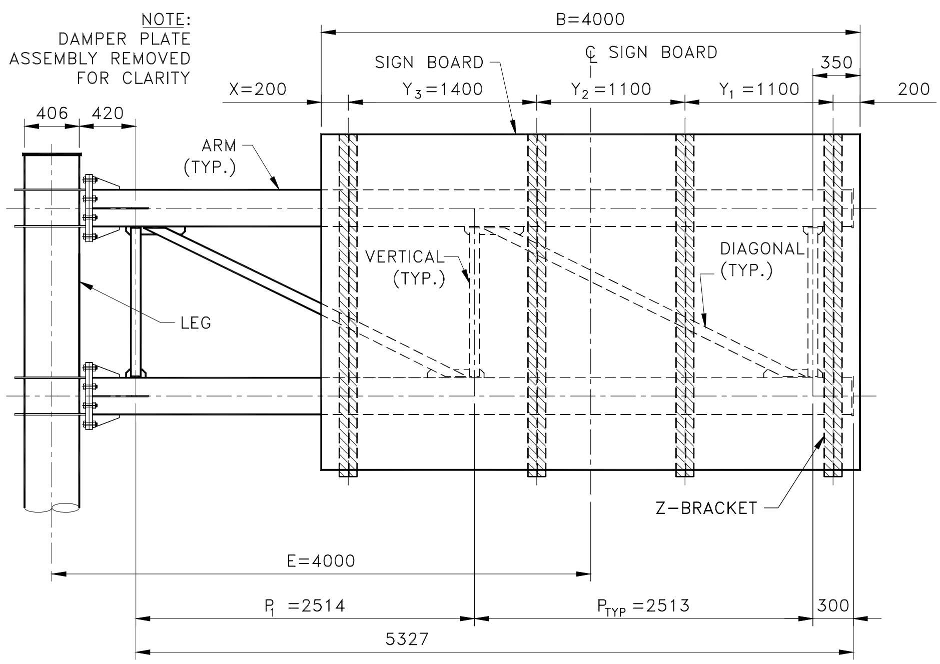


FIGURE 3.2.4(c): Right Arm

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, 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.

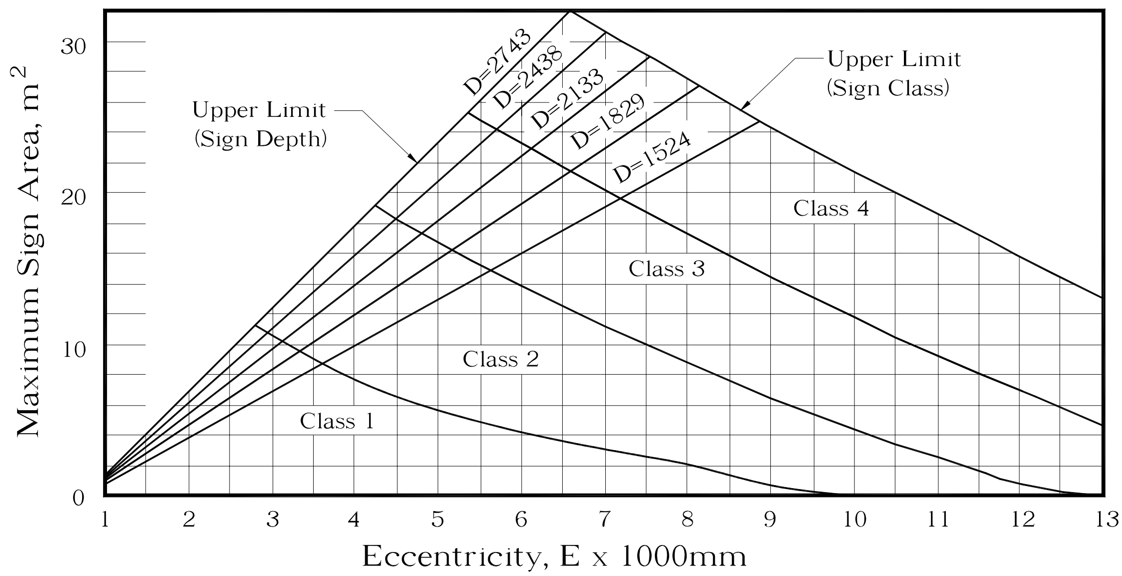


FIGURE 3.2.2(a) CLASS RANGES FOR q ≤ 325 Pa
(Single Cantilever Sign Support)

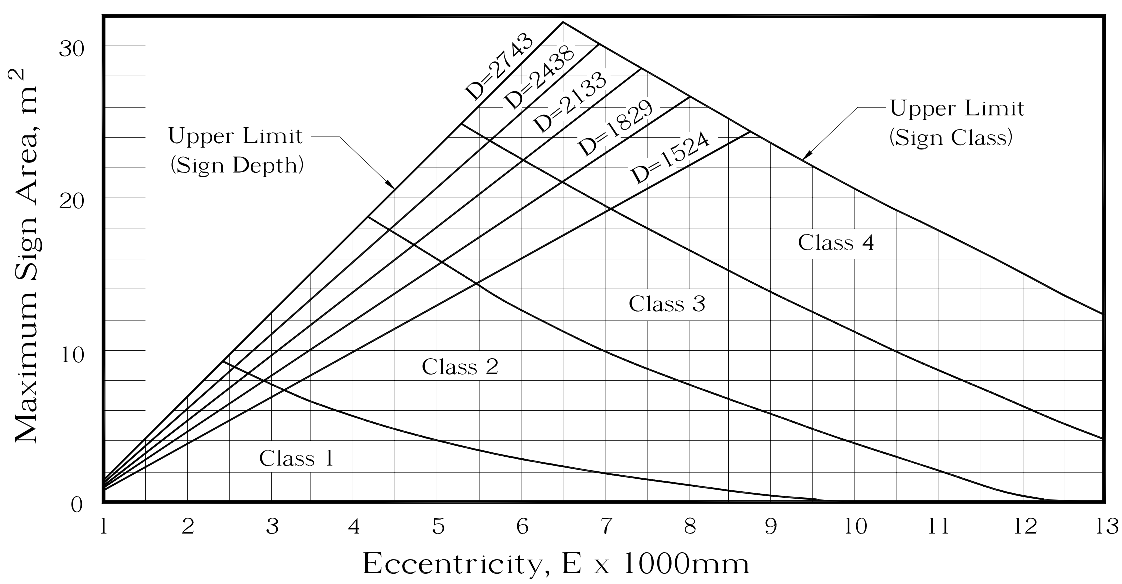


FIGURE 3.2.2(b) CLASS RANGES FOR 325 Pa < q ≤ 425 Pa
(Single Cantilever Sign Support)

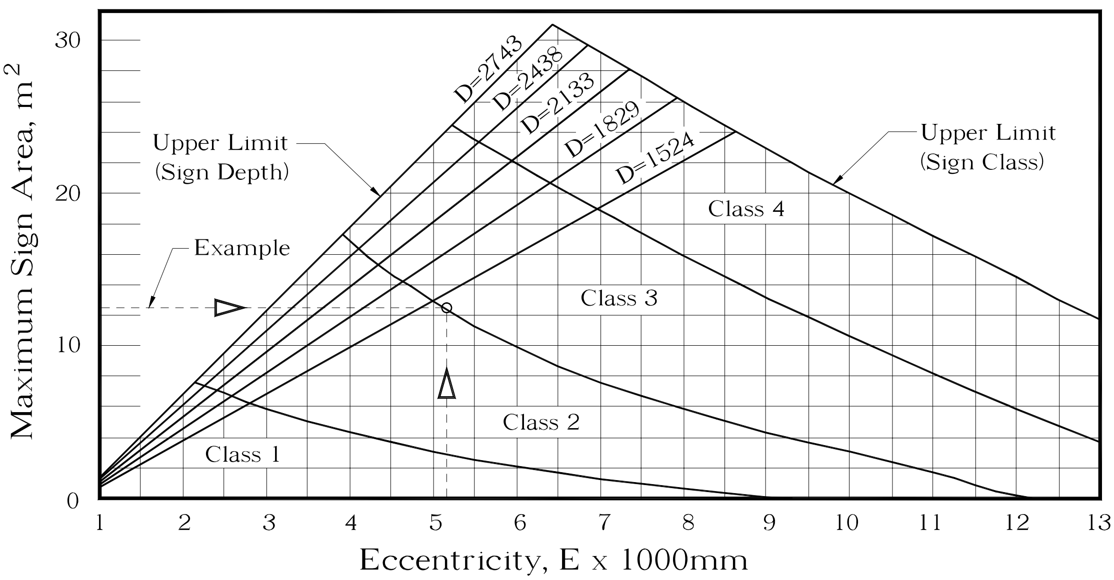


FIGURE 3.2.2(c) CLASS RANGES FOR 425 Pa < q ≤ 525 Pa
(Single Cantilever Sign Support)

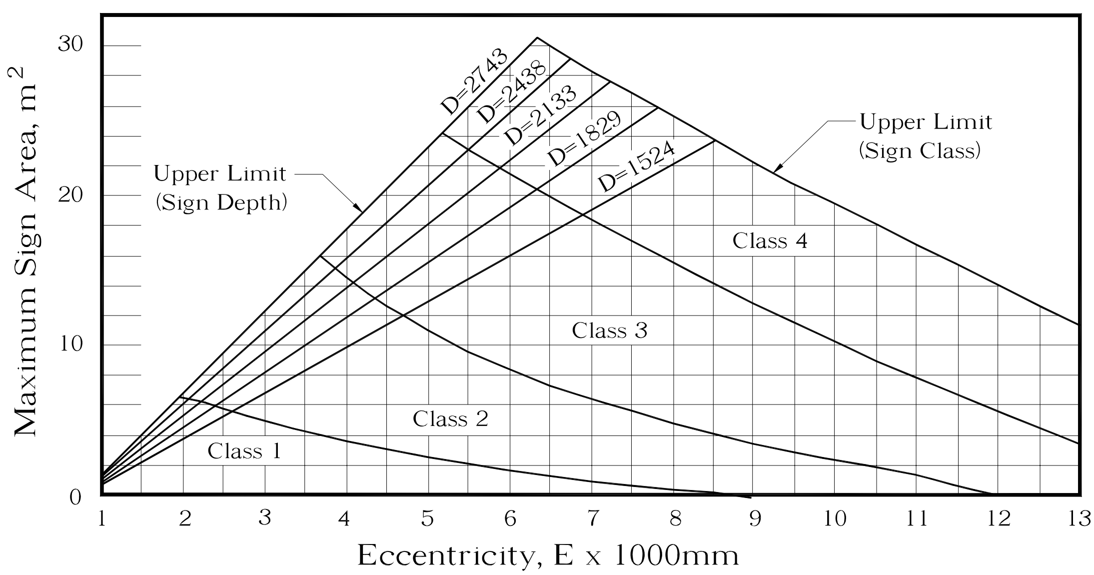


FIGURE 3.2.2(d) CLASS RANGES FOR 525 Pa < q ≤ 600 Pa
(Single Cantilever Sign Support)

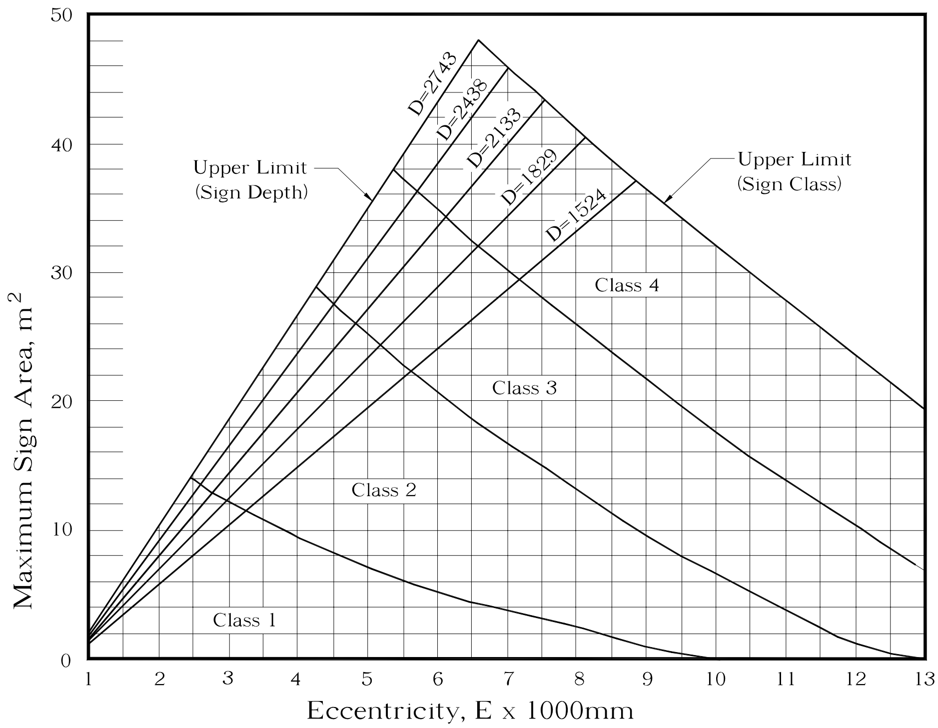


FIGURE 3.2.2(e) CLASS RANGES FOR q ≤ 325 Pa
(Butterfly Sign Support)

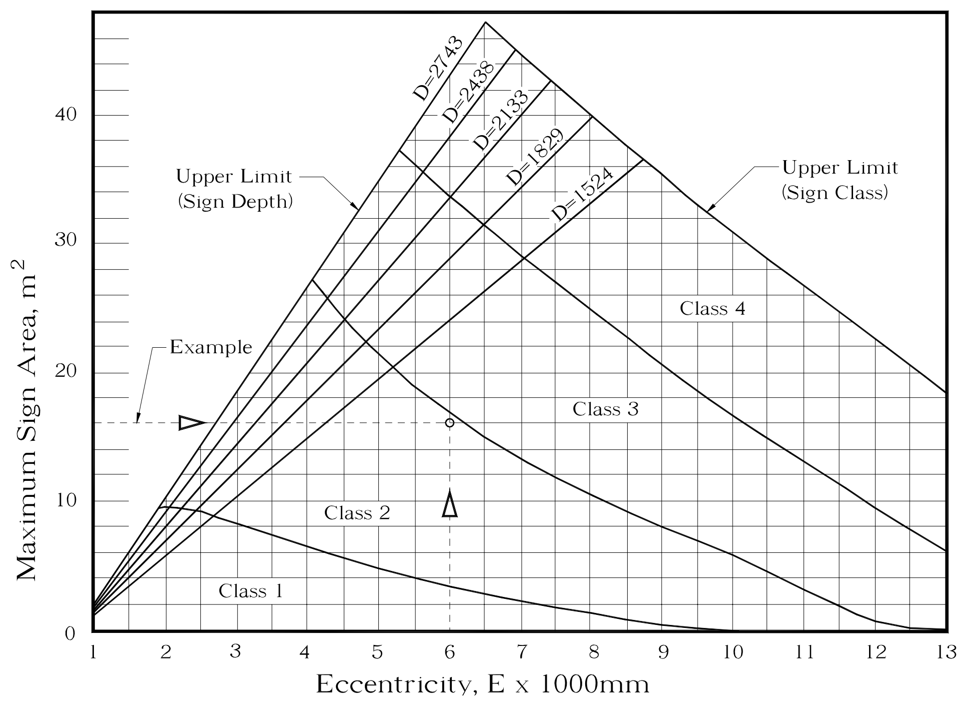


FIGURE 3.2.2(f) CLASS RANGES FOR 325 Pa < q ≤ 425 Pa
(Butterfly Sign Support)

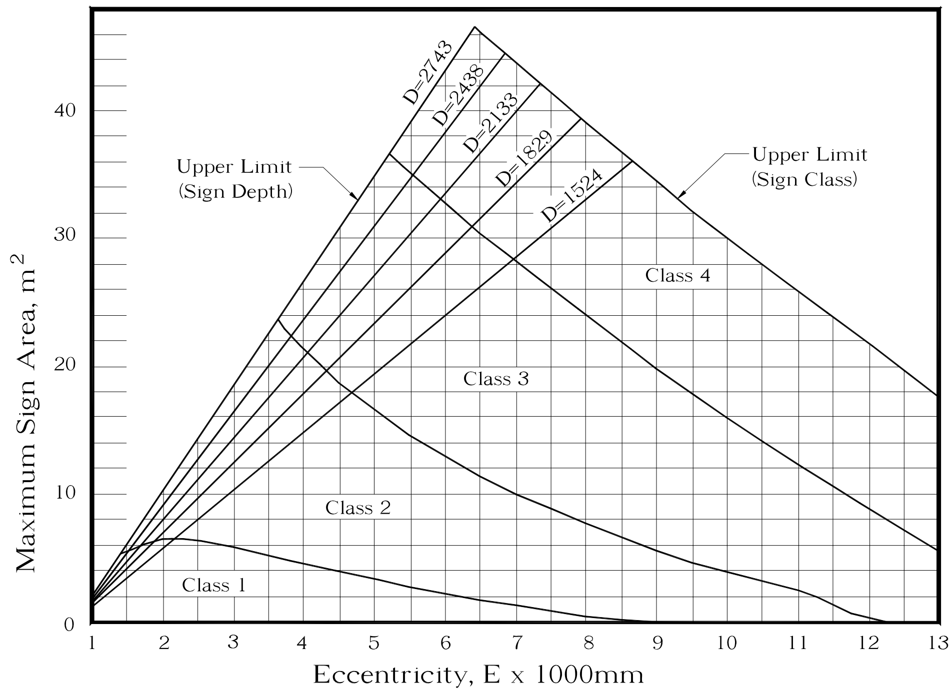


FIGURE 3.2.2(g) CLASS RANGES FOR 425 Pa < q ≤ 525 Pa
(Butterfly Sign Support)

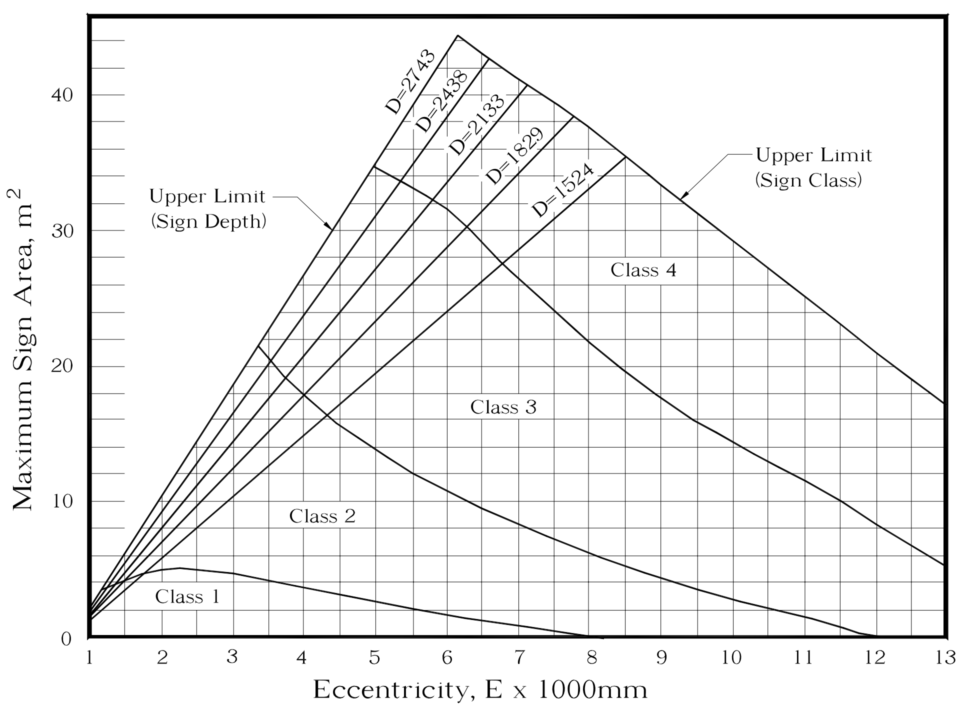


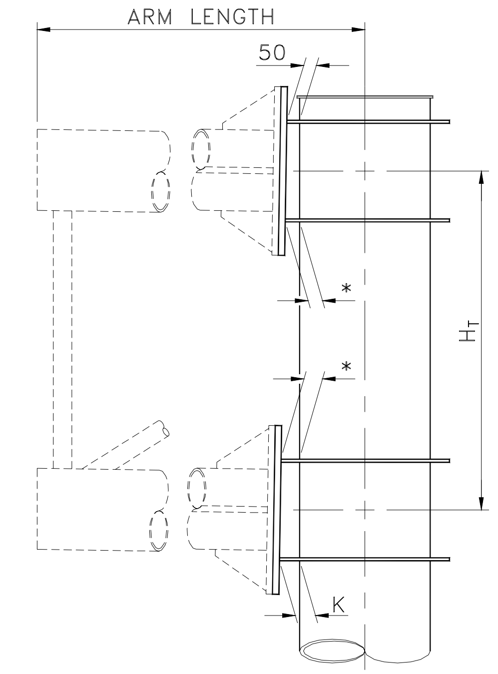
FIGURE 3.2.2(h) CLASS RANGES FOR 525 Pa < q ≤ 600 Pa
(Butterfly Sign Support)

	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	HSS 73 x 4.8	HSS 73 x 4.8	HSS 89 x 6.4	HSS 102 x 8.0
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 and SS118-24.

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 6500 mm.

(7) The top of footing elevation. The elevation shall be a minimum 300 mm above finished grade. This could be increased up to 1000 mm 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, SS118-3 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 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 Table 1 - General 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.

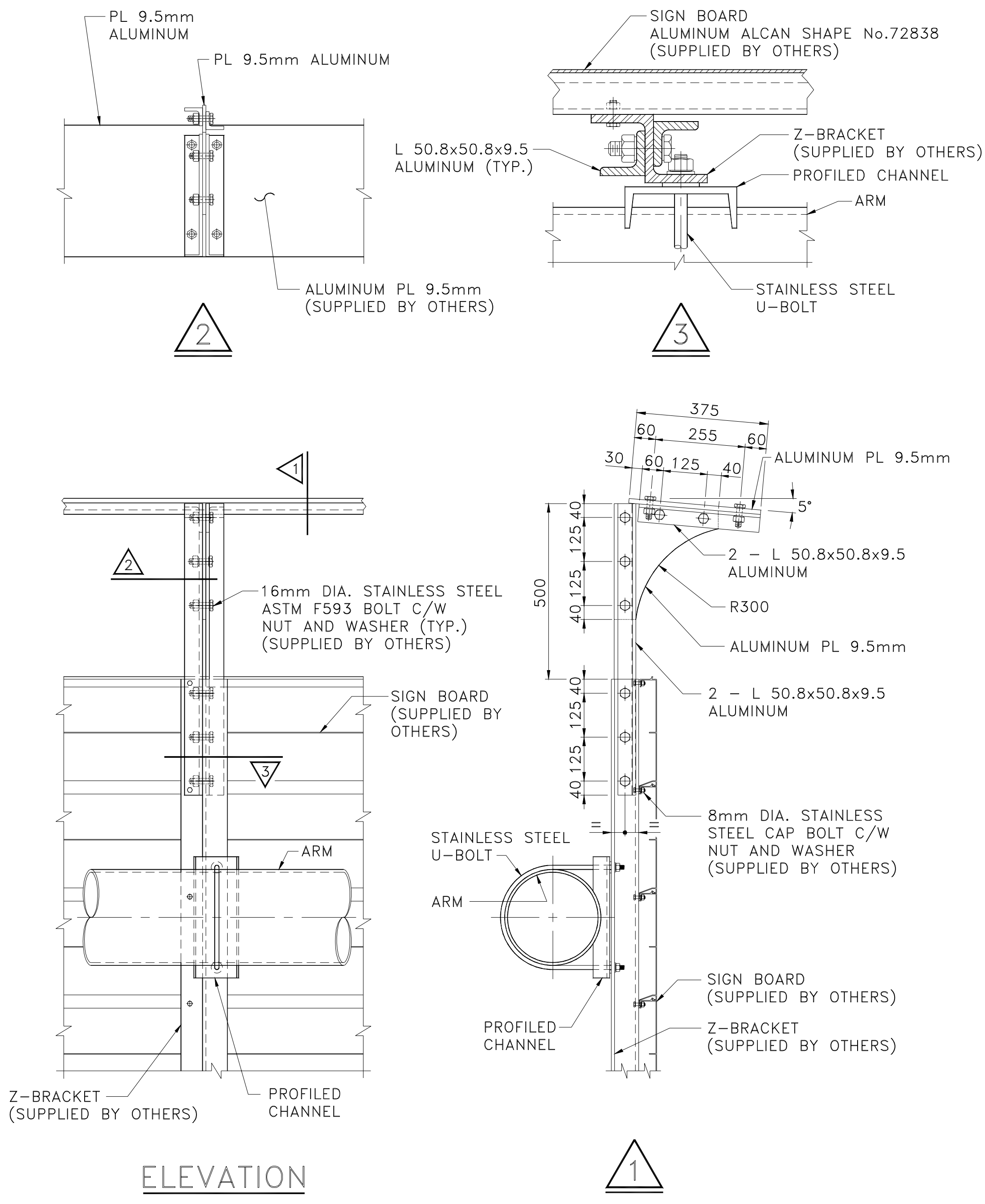


FIGURE 3.3.2 DAMPER INSTALLATION DETAILS

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 300 mm below the top of the footing

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

3.5 DESIGN INFORMATION

3.5.1 GENERAL

Design and detailing data contained in this 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-G40.20-04/G40.21-04 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.

Fatigue wind loads were obtained from the AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaries and Traffic Signals 4th Edition, 2001. These were based on a number of reports including "Fatigue Resistant Design of Cantilevered Signal, Sign and Light Supports." National Cooperative Highway Research Program, NCHRP Report 412.

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.” Copies of this report may be obtained from Rowan Williams Davies & Irwin Inc., Consulting Engineers, 650 Woodlawn Road West, Guelph, Ontario, Canada N1K 1B8.

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 prolonged dead load. The lateral deflection of the top of the leg due to wind load has been limited to a rotation of 0.015 radians (0°50'), or 1.5% of the leg height. The lateral deflection at the tip of the arms due to the wind load caused by bending of the leg and arms and twisting of the leg, has been limited to 3% of the arm length. The vertical deflection at the tip of the arms due to vertical wind load (truck gusts, galloping and natural wind), caused by bending of the leg and arms, has been limited to 1.5% of the arm length.

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

3.5.4 FOUNDATIONS

The caisson foundations were modelled in S-Frame as beam elements with spring constants representing earth pressure. 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:

		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 3

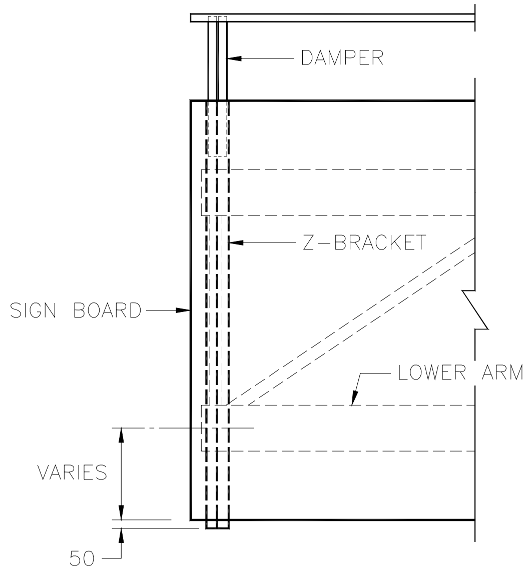
CANTILEVER STATIC SIGN SUPPORTS

FIGURE A3.1	Z-BRACKET DETAIL
FIGURE A3.2	HORIZONTAL CLEARANCE
SS118-22	BUTTERFLY STATIC SIGN SUPPORT GENERAL ARRANGEMENT
SS118-23	BUTTERFLY STATIC SIGN SUPPORT DETAILS
SS118-24	SINGLE CANTILEVER STATIC SIGN SUPPORT GENERAL ARRANGEMENT
SS118-25	CANTILEVER STATIC SIGN SUPPORT SIGN CONNECTION & DAMPER DETAILS

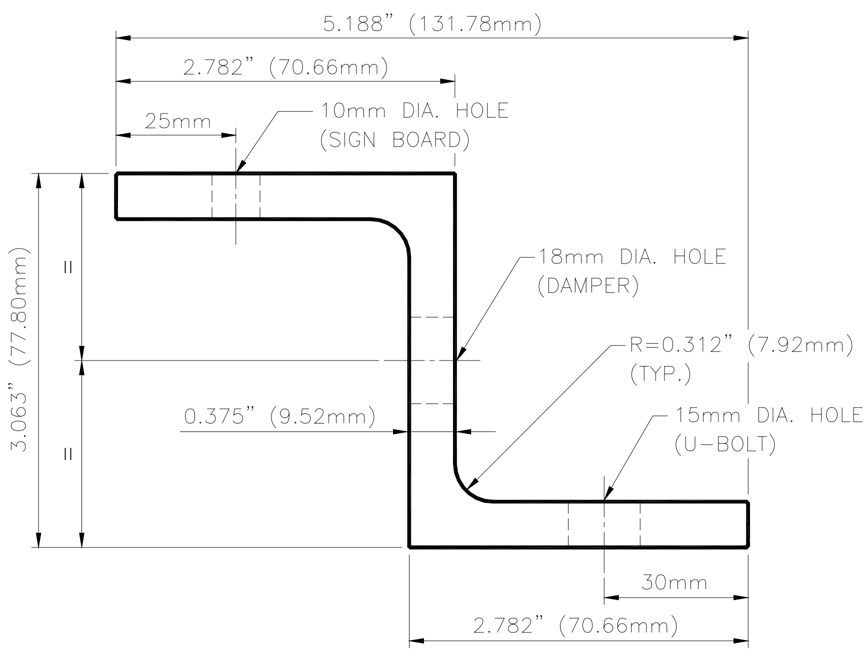
NOTE

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

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



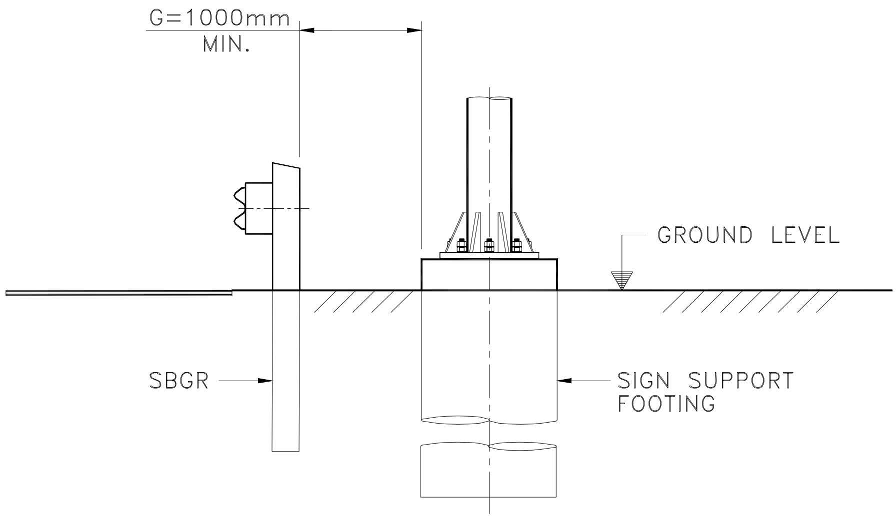
INSTALLATION DETAIL



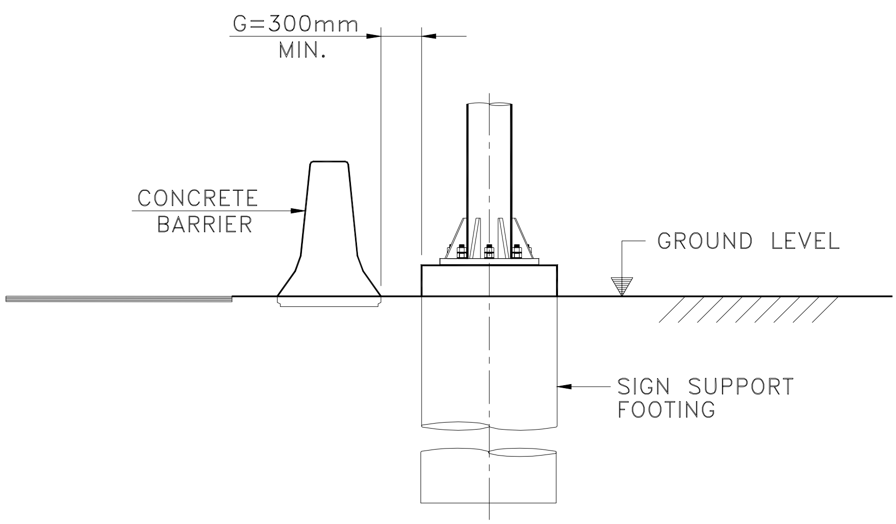
NOTES

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 A3.1 Z-BRACKET DETAIL

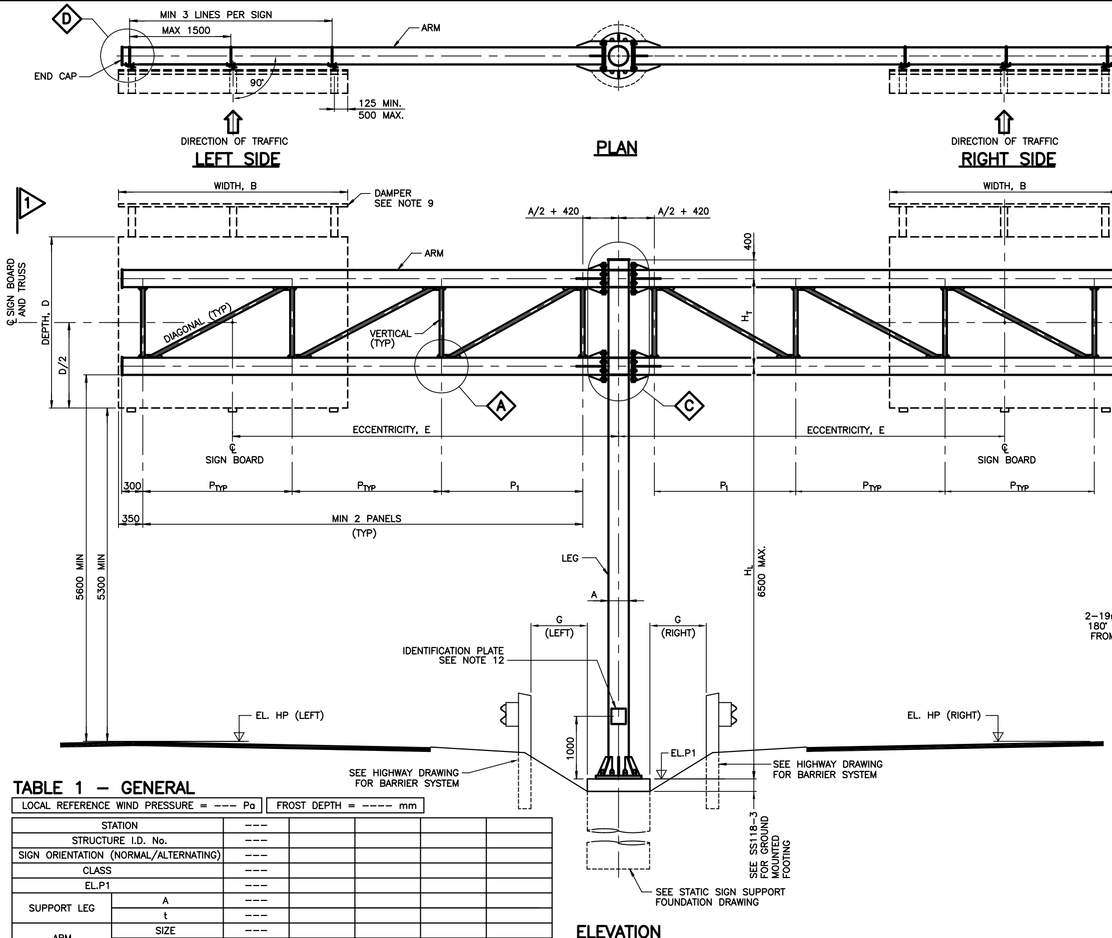


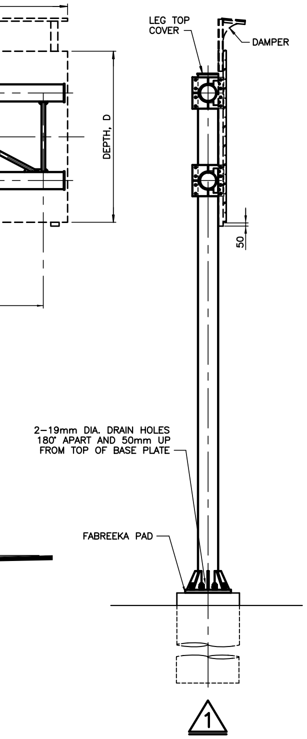
(a) STEEL BEAM GUIDE RAIL

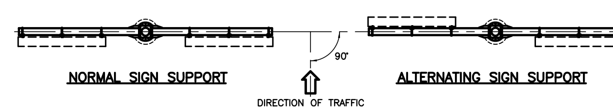


(b) CONCRETE BARRIER

FIGURE A3.2 HORIZONTAL CLEARANCE







TYPICAL LAYOUT PLAN

METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

CONT No
WP No

SHEET

BUTTERFLY STATIC SIGN SUPPORT GENERAL ARRANGEMENT

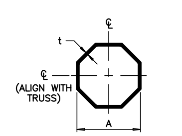
TABLE 1 – GENERAL

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		---				

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 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, CAN/CSA-G164-M92 AND GALVANIZED UNLESS SPECIFIED OTHERWISE.
3. ASTM A325 1"(M25.4) BOLTS MAY BE SUBSTITUTED FOR M24 BOLTS AND GALVANIZED IN ACCORDANCE WITH NOTE 2.
4. ALL BOLTS SHALL BE BROUGHT TO A SNUG TIGHT CONDITION AND THEN FURTHER TIGHTENED 1/3 OF A TURN.
5. ALL STRUCTURAL STEEL SHALL BE ACCORDING TO CAN/CSA-G164-M92 AND GALVANIZED AFTER FABRICATION. LEGS ONLY SHALL BE SUBSEQUENTLY COATED WITH AN APPROVED PAINT SYSTEM.
6. STRUCTURE SHALL NOT BE ERECTED UNTIL FOUNDATION CONCRETE HAS REACHED 80% OF SPECIFIED STRENGTH.
7. ALL WELDING SHALL BE DONE ACCORDING TO CAN/CSA-W59-03.
8. NO SHOP SPLICES SHALL BE ALLOWED IN ANY MEMBERS.
9. ELEVATIONS TO BE VERIFIED IN THE FIELD BEFORE SIGN SUPPORT STRUCTURE FABRICATION.
10. NO SIGN BOARDS SHALL BE INSTALLED WITHOUT DAMPER.
11. THIS STANDARD TO BE READ IN CONJUNCTION WITH SS118-3 (FOOTING FOR GROUND MOUNTED SIGNS) AND/OR SS118-4 (FOOTING FOR SYMMETRICAL MEDIAN MOUNTED SIGN) AND/OR SS118-5 (FOOTING FOR ASYMMETRICAL MEDIAN MOUNTED SIGN).
12. 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.
13. REFER TO DWG. S118-23 FOR SIGN SUPPORT DETAILS.
14. REFER TO DWG. S118-25 FOR SIGN CONNECTION AND DAMPER DETAILS.
15. LEGEND:
    SST DENOTES STAINLESS STEEL



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
APRIL 2011

SS118-22

BUTTERFLY STATIC SIGN SUPPORT GENERAL ARRANGEMENT

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: s118-22.dwg
CREATED: 1997/09/24
MODIFIED: 2011/04/04 10:21:32

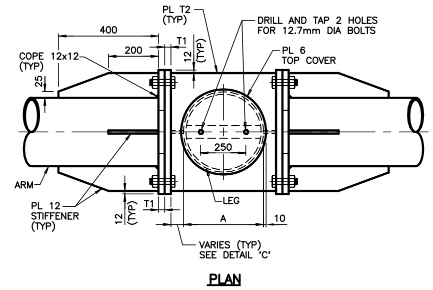
METRIC

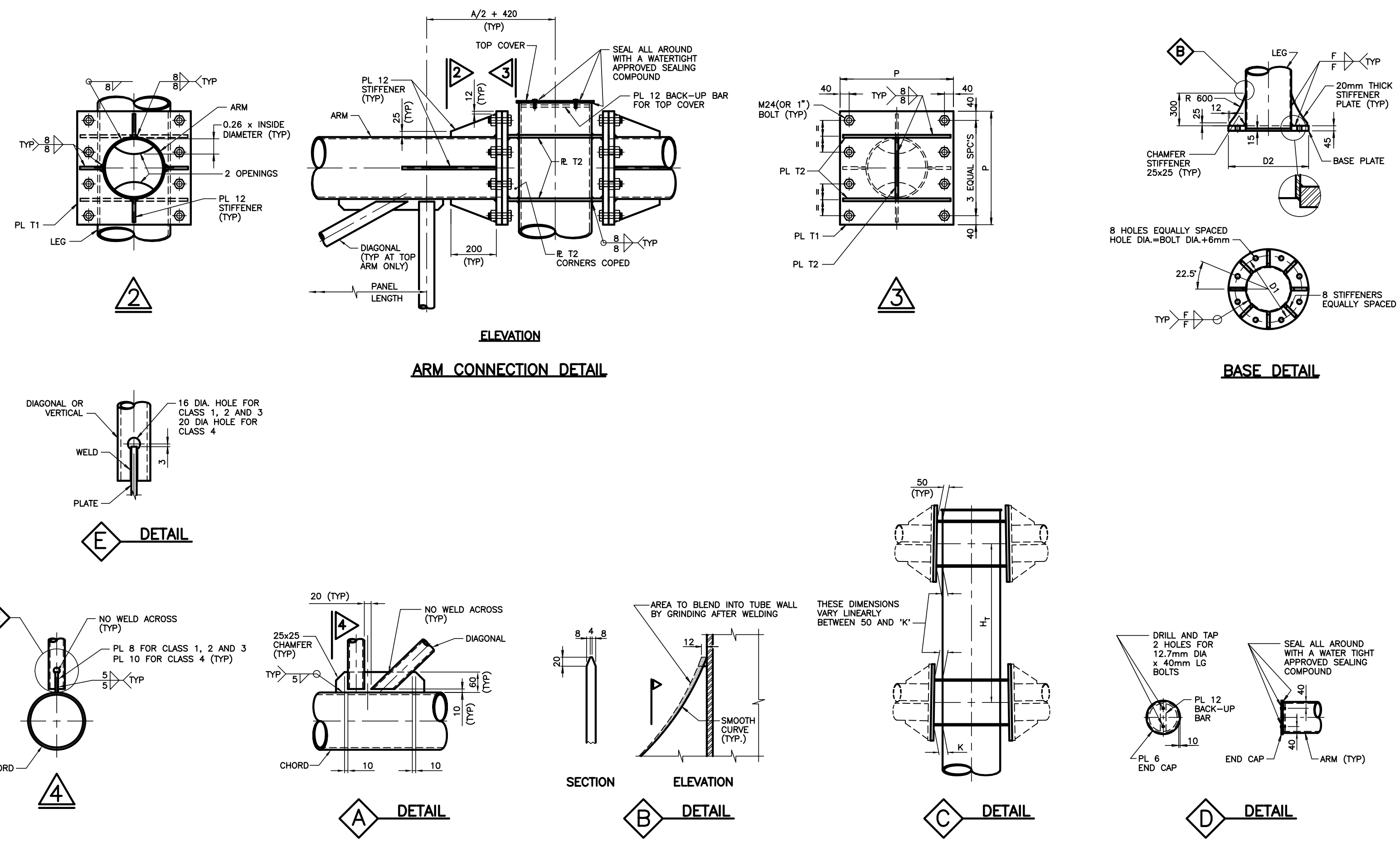
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

CONT No WP No	
BUTTERFLY STATIC SIGN SUPPORT DETAILS	SHEET

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

DRAWING NAME: s118-23.dwg
CREATED: 1997/09/24
MODIFIED: 2011/04/04 10:26:22

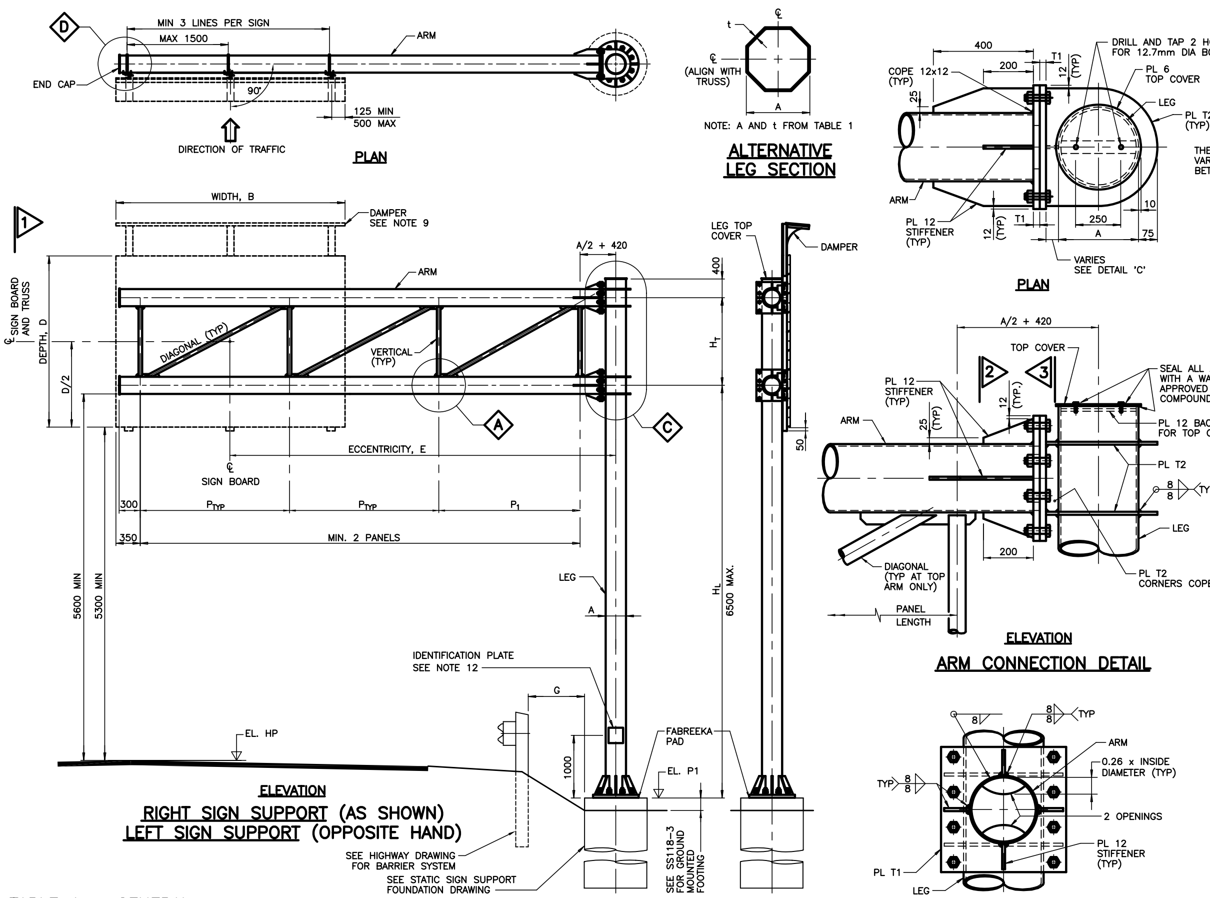
METRIC

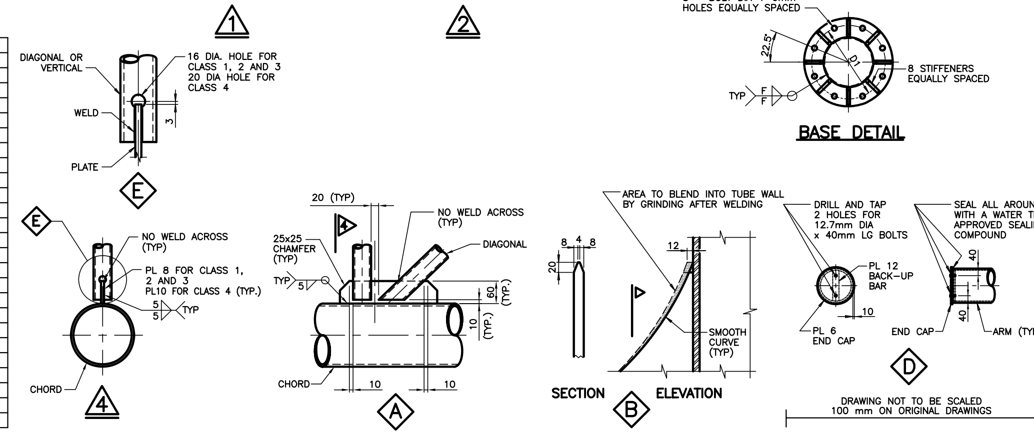
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

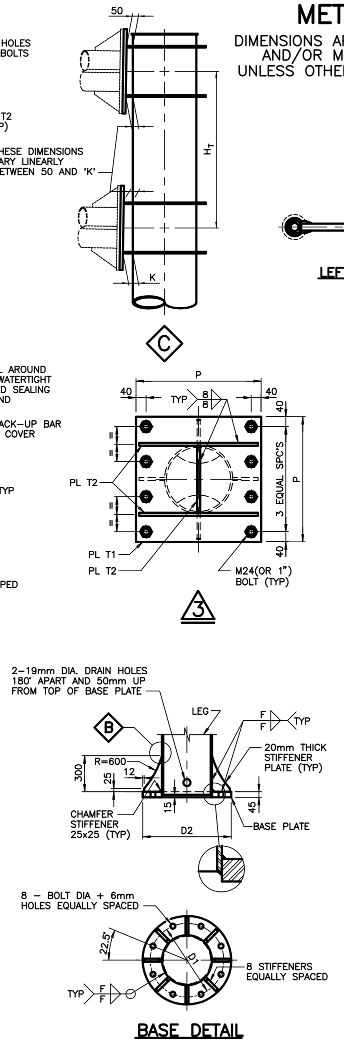
CONT No
WP No

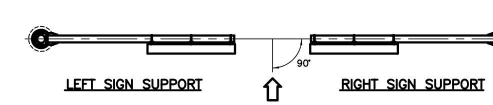
SHEET

SINGLE CANTILEVER STATIC SIGN SUPPORT GENERAL ARRANGEMENT









TYPICAL LAYOUT PLAN

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 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 GALVANIZED IN ACCORDANCE WITH STANDARD CAN/CSA-G164-M92 UNLESS SPECIFIED OTHERWISE.
3. ASTM A325 1"(M25.4) BOLTS MAY BE SUBSTITUTED FOR M24 BOLTS AND GALVANIZED IN ACCORDANCE WITH NOTE 2.
4. ALL BOLTS SHALL BE BROUGHT TO A SNUG TIGHT CONDITION AND THEN FURTHER TIGHTENED 1/3 OF A TURN.
5. ALL STRUCTURAL STEEL SHALL BE GALVANIZED AFTER FABRICATION ACCORDING TO CAN/CSA-G164-M92. LEGS ONLY SHALL BE SUBSEQUENTLY COATED WITH AN APPROVED PAINT SYSTEM.
6. STRUCTURE SHALL NOT BE ERECTED UNTIL FOUNDATION CONCRETE HAS REACHED 80% OF SPECIFIED STRENGTH.
7. ALL WELDING SHALL BE ACCORDING TO CAN/CSA-W59-03.
8. NO SHOP SPLICES SHALL BE ALLOWED IN ANY MEMBERS.
9. ELEVATIONS TO BE VERIFIED IN THE FIELD BEFORE SIGN SUPPORT STRUCTURE FABRICATION.
10. NO SIGN BOARDS SHALL BE INSTALLED WITHOUT DAMPER.
11. THIS STANDARD TO BE READ IN CONJUNCTION WITH SS118-3 (FOOTING FOR GROUND MOUNTED SIGNS) AND/OR SS118-4 (FOOTING FOR SYMMETRICAL MEDIAN MOUNTED SIGN) AND/OR SS118-5 (FOOTING FOR ASYMMETRICAL MEDIAN MOUNTED SIGN).
12. 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.
13. REFER TO DWG. S118-25 FOR SIGN CONNECTION AND DAMPER DETAILS.
14. 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

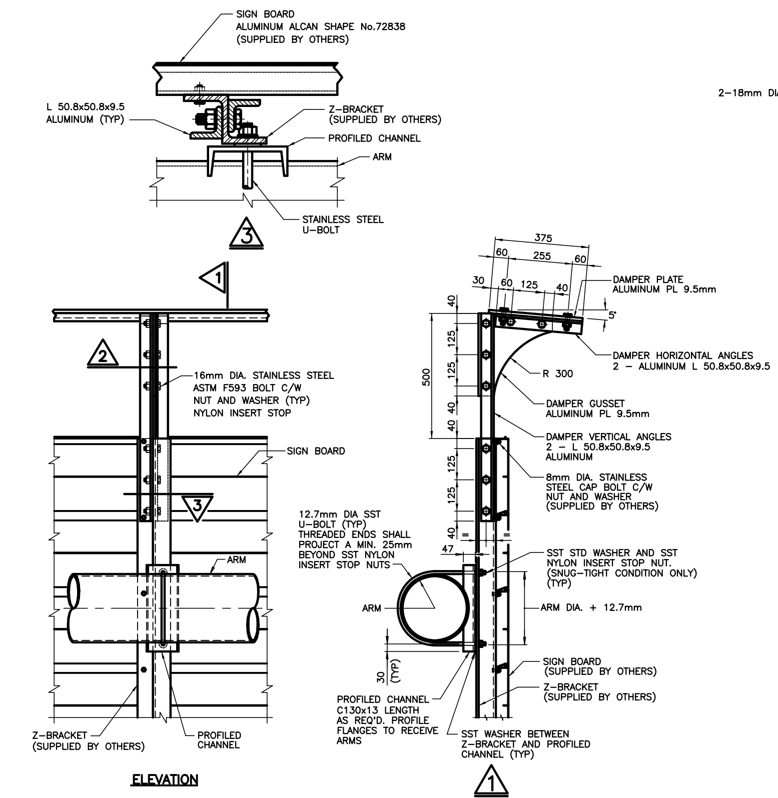
REFER TO 2.4.1 IN THE SIGN SUPPORT MANUAL FOR PROFESSIONAL ENGINEER STAMPING REQUIREMENTS.

STANDARD DRAWING APRIL 2011 | SS118-24

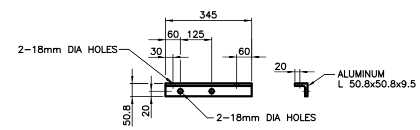
SINGLE CANTILEVER STATIC SIGN SUPPORT GENERAL ARRANGEMENT

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

MINISTRY OF TRANSPORTATION, ONTARIO PR-D-707 88-05
DRAWING NAME: s118-24.dwg
CREATED: 1997/09/24
MODIFIED: 2011/04/04 10:26:38

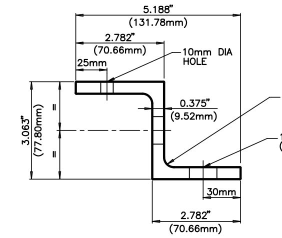


SIGN CONNECTION DETAIL



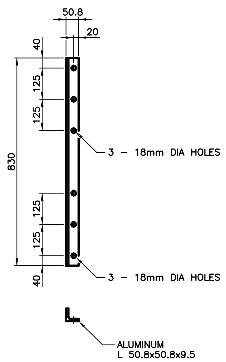
DAMPER HORIZONTAL ANGLES

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



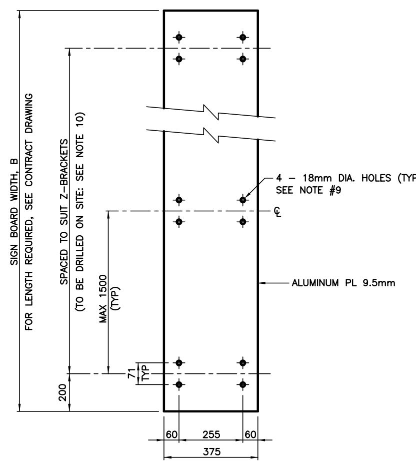
ALUMINUM Z-BRACKET

(SUPPLIED BY OTHERS)



DAMPER VERTICAL ANGLES

2 ANGLES PER Z-BRACKET



DAMPER PLATE

1 PLATE PER SIGN

METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

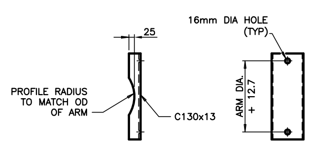
CONT No WP No	
CANTILEVER STATIC SIGN SUPPORT SIGN CONNECTION AND DAMPER DETAILS	SHEET

NOTES:

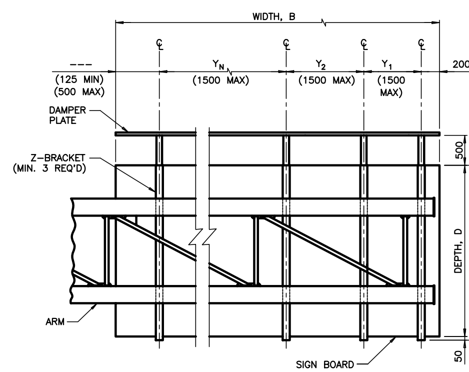
1. ALL STRUCTURAL STEEL SHALL BE ACCORDING TO CAN/CSA-G40.20-04/G40.21-04 GRADE 300W OR ASTM SPECIFICATION A500 GRADE C.
2. ALUMINUM DAMPER COMPONENTS SHALL BE ALLOY 6061-T6.
3. ALL STAINLESS STEEL BOLTS, NUTS AND WASHERS SHALL CONFORM TO ASTM F593 ALLOY 304 WITH A MINIMUM YIELD OF 480 MPa AND A MINIMUM TENSILE STRENGTH OF 716 MPa.
4. ALL STRUCTURAL STEEL SHALL BE GALVANIZED ACCORDING TO CAN/CSA-G164-M92.
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. S118-22 OR S118-24 FOR GENERAL ARRANGEMENT.
10. LEGEND:
    SST DENOTES STAINLESS STEEL

NOTES TO DESIGNER

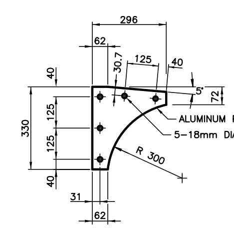
1. FOR DETERMINING NUMBER AND LOCATION OF Z-BRACKETS SEE SECTION 3.1.8 OF THE SIGN SUPPORT MANUAL.
2. WHEN THE DESIGN PACKAGE IS COMPLETE, THE DESIGNER SHALL VERIFY WITH THE REGIONAL STRUCTURAL AND TRAFFIC SECTIONS THAT THE SIGN SIZE HAS NOT CHANGED.
3. THE "NOTES TO DESIGNER" SHALL BE DELETED FROM THIS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



PROFILED CHANNEL



Z-BRACKET LOCATIONS



DAMPER GUSSET

1 PLATE PER Z-BRACKET

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

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.

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWINGS

STANDARD DRAWING APRIL 2011	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

SIGN SUPPORT MANUAL

DIVISION 4 – TRI-CHORD STATIC SIGN SUPPORTS

April 2011

4 TRI-CHORD STATIC SIGN SUPPORTS

4.1 GENERAL

4.1.1 STANDARD SIGN SUPPORTS

Standard Tri-Chord overhead truss sign supports are used to support static sign boards. These trusses are fabricated in galvanized structural steel and designed to the requirements of the Ontario Highway Bridge Design Code.

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 and including 36000 mm

(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 4.2.3 (Case 2)

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

(d) All sign boards shall be 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.

4.1.2 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 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 300 mm above the finished grade. This could be increased up to 1000 mm in order to limit the leg height. The dimension from the top of the footing to the centreline of the bottom chord shall not exceed 6500 mm (see Figure 4.1.3(b)).

4.1.3 DESCRIPTION OF SIGN SUPPORTS

The Tri-Chord sign support system is fabricated from structural steel and is comprised of two vertical support legs and a three-chord truss. The system is non-modular and 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 4.1.3 (a) and (b), respectively.

The vertical support members (legs) are straight and made from single circular HSS sections. They 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 provided the truss is installed with its centreline horizontal.

The three chords are interconnected by diagonals in a gusset type 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 by means of Z-brackets. 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.

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

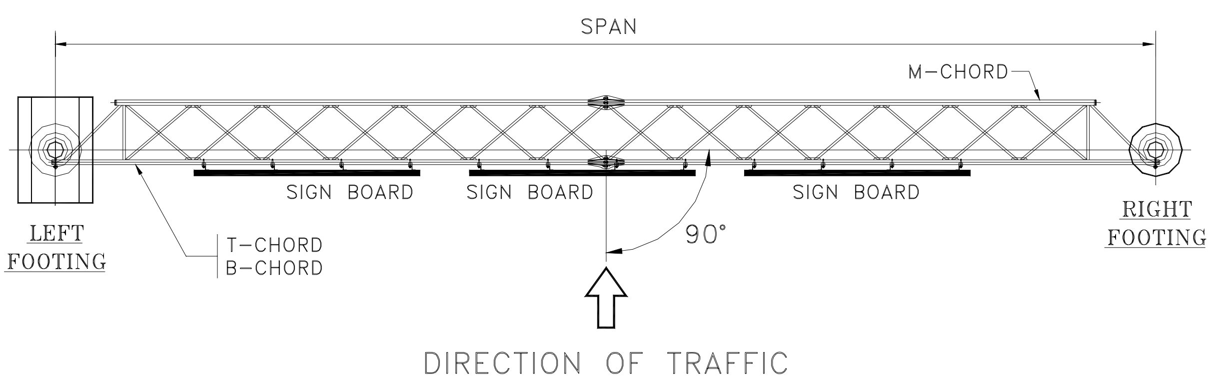


FIGURE 4.1.3(a) TYPICAL LAYOUT PLAN

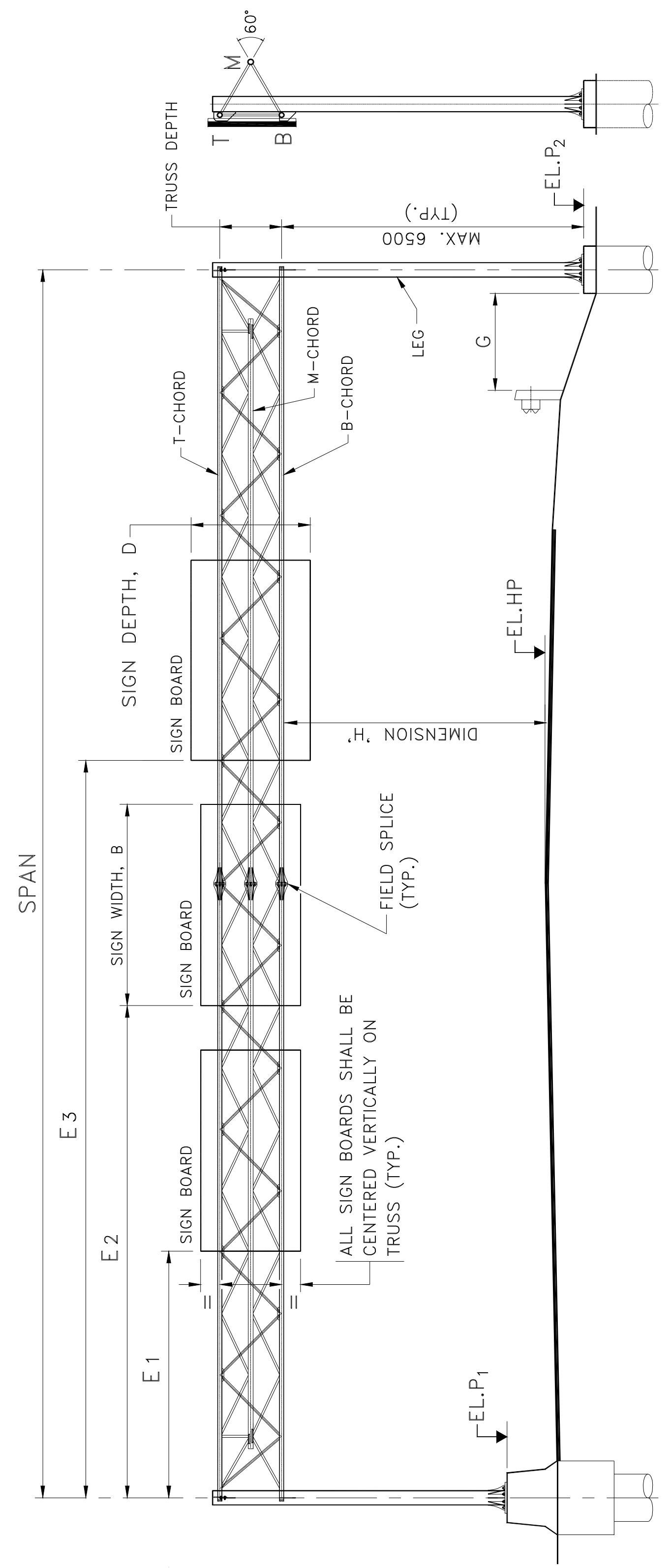


FIGURE 4.1.3(b) TYPICAL TRI-CHORD SIGN SUPPORT ELEVATION

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).

The dimension ‘H’ from the centreline of the bottom chord to the highest point on the highway, including shoulders, curbs and median, shall be according to the following table:

SPAN (mm)	DIMENSION ‘H’ (mm)
SPAN $\leq$ 20000	6250
20000 $<$ SPAN $\leq$ 24000	6200
24000 $<$ SPAN $\leq$ 28000	6100
28000 $<$ SPAN $\leq$ 32000	6000
32000 $<$ SPAN $\leq$ 36000	5900

TABLE 4.1.5 DIMENSION ‘H’

The given values of dimension ‘H’, comply with the requirements for the minimum vertical clearance of 5250 mm from the bottom of the deepest sign board (2743 mm) to the highest point on the highway. 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).

4.1.6 TRI-CHORD DEPTH

The Tri-Chord depth measured centreline to centreline of chords shall be according to Table 4.1.6. This depth shall be entered on Table 1 of the Tri-chord Static Sign Support General Arrangement drawing SS118-26.

The Tri-Chord depth should not be rounded up, as the horizontal distance between nodes is directly related to the truss depth (See DWG.SS 118-26, 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

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 the depth of truss for spans less than or equal to 30000 mm, and depth of truss / 2 for spans greater than 30000 mm. 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 Tri-Chord overhead sign supports is based on a reference wind pressure of 600 Pa. Based on the required total sign board area ($\leq 45m^2$) and the span, the final design dimensions can be obtained from Table 4.2.2. If the required total sign board area is more than $45m^2$, see 4.2.3, Case 2.

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 - SIGN BOARD AREA LESS THAN OR EQUAL TO $45m^2$

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

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

E.g. From Table 4.2.2, for a span of 20500 mm select the span range of 20001 to 22000 mm. For the given example, the following is obtained:

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

Calculate truss depth from Table 4.1.6.
E.g. for span of 20500 mm, truss depth = 20500/20 = 1025 mm.

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 6500 mm

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

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

STEP 3: COMPLETE THE STANDARD DRAWINGS

Refer to 4.3 for Preparation of Drawings.

CASE 2 - SIGN BOARD AREA GREATER THAN 45m^2

If the required sign board area is more than 45 m^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 maximum allowable total sign board area 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 maximum allowable total sign board area is 45 x 600/430 = 62.7 m^2.

To complete the standard drawings, the maximum allowable total sign board area is required, and is used for the identification plate. See Note 15 on S118-26.

SPAN (mm)	HSS (O.D. in mm)			
	TOP/BOTTOM CHORD	MIDDLE CHORD	DIAGONAL	LEG
14000 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 4.2.2 TRI-CHORD DESIGN DIMENSIONS
(MAXIMUM ALLOWABLE SIGN BOARD AREA = 45 m^2)
(REFERENCE WIND PRESSURE = 600 Pa)

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

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) The support span, measured from centreline to centreline of column.

(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 centreline of the bottom chord of the Tri-Chord. This dimension shall be as indicated in Table 4.1.5.

(7) The dimension measured from the top of footing to the centreline of the bottom chord. This dimension 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 finished grade. 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 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 4.1.3(a).

(13) The footing type for each sign support footing (see 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 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 left column.

4.3.2 SIGN SUPPORT DRAWINGS

If the supports are to be supplied and erected as part of a contract, SS118-26, SS118-27, SS118-3 and/or SS118-4 and/or 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 there are two tables to be completed on the drawing. 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 Table 1 - General consists of the following:

(i) Station
(ii) Structure I.D. Number
(iii) The support span measured from centrelines of columns
(iv) Truss depth measured centre to centre of top and bottom chords
(v) Dimension 'H' from the centreline of the bottom chord to the highest point on the highway, including shoulders, curbs and median, as specified in 4.1.5.
(vi) Local Reference Wind Pressure, in Pa
(vii) Maximum Allowable Sign Board Area, m^2
(viii) Sign Sizes (D x B) for each sign board (max. D is 2743 mm)
(ix) The location of each sign board, E_i, with respect to the centreline of the left column
(x) Elevation of the highest point on the highway under the signs, including shoulders, curbs and medians. EL.HP

(xi) Elevation at top of the left support footing, $EL.P_1$
(xii) Elevation at top of the right support footing. $EL.P_2$
(xiii) Member outside diameters tabulated on Table 4.2.2.
(xiv) Left Footing Type (See 4.1.4)
(xv) Right Footing Type (See 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 STOP NUT	4 per Z-Bracket
STAINLESS STEEL WASHER	8 per Z-Bracket
PROFILED CHANNEL (C130x13)	2 per Z-Bracket
Z-BRACKET	See 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 300 mm below the top of the footing

The base plate and corbel connection welds shall be inspected regularly for fatigue cracking.

4.5 DESIGN INFORMATION

4.5.1 GENERAL

Design and detailing data contained in this Division conforms to the requirements of the 1991 edition of the Ontario Highway Bridge Design Code unless otherwise stated.

Calculations are based on Standard CAN/CSA-G40.20-04/G40.21-04 Grade 300W or ASTM A500 Grade C 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 (3.52 psf), including the self-weight of the standard aluminum ALCAN shape No.72838.

Fatigue wind loads were obtained from a revision to AASHTO - 1994 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.

4.5.2 DERIVATION OF DESIGN TABLES

The design dimensions for the Tri-Chord sign supports found in Table 4.2.2, 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. The analysis was then confirmed with the use of a three-dimensional finite element model. Member sizes were optimised to limit the variety of section sizes.

4.5.3 DEFLECTIONS

The deflections for both vertical and horizontal members 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 2.95% lateral movement or 1°40' angular rotation from the centreline at the top of the structure in relation to the centreline at its base.

4.5.4 FOUNDATIONS

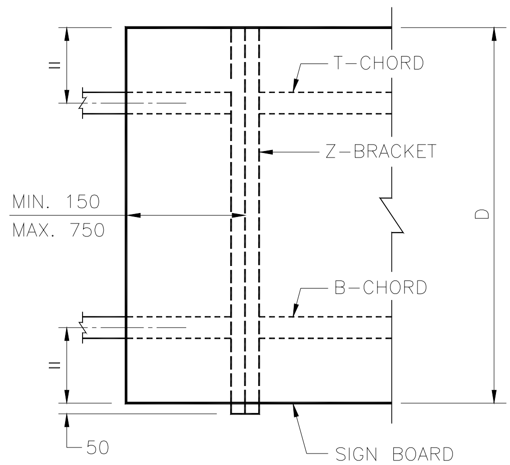
The caisson foundations were modelled in S-Frame as beam elements with spring constants representing earth pressure. Springs constants in the dead load direction (for sustained load) were assumed to be 1/3 the value of those in the live load direction (for instantaneous load). Any resisting earth pressure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

Assumed soil parameters below the frost layer are as follows:

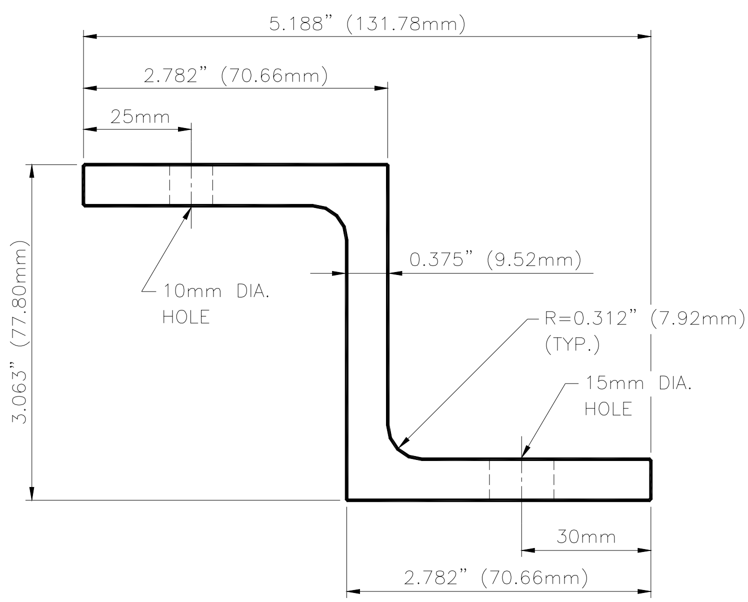
LENGTH OF CAISSON BELOW FROST LAYER		**CASE 1** (Sand)	**CASE 2** (Soft Clay)
	Upper 2/3	$\Phi' = 28^{o}$	C_u = 25 kPa
	Lower 1/3	$\Phi' = 30^{o}$	C_u = 50 kPa

APPENDIX TO DIVISION 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

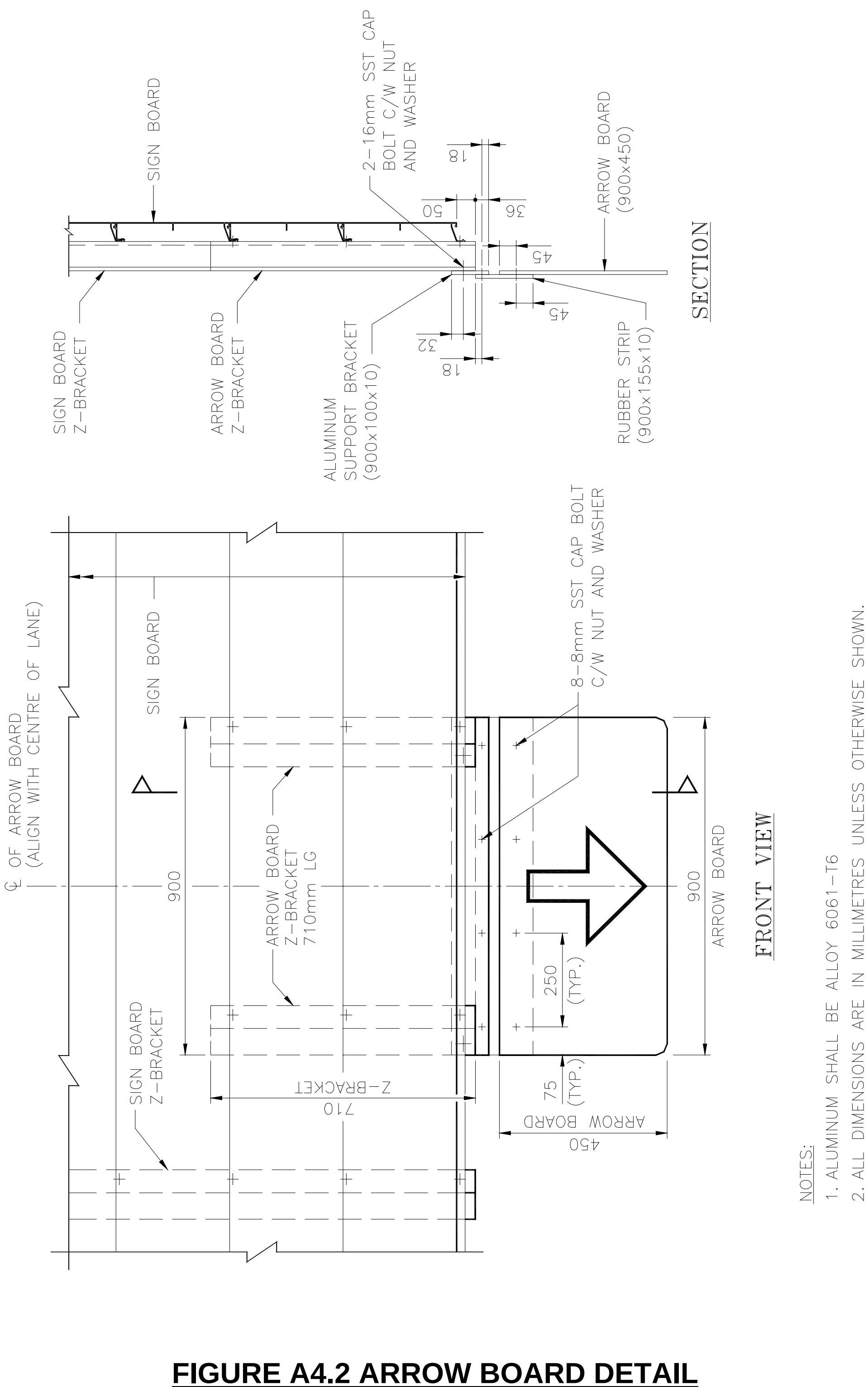


FIGURE A4.2 ARROW BOARD DETAIL

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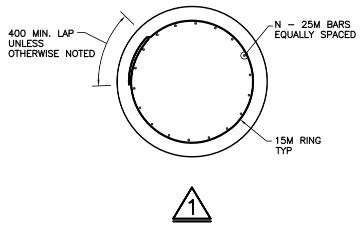
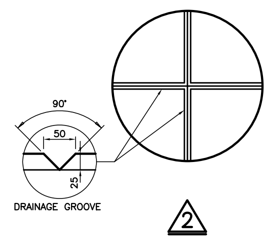
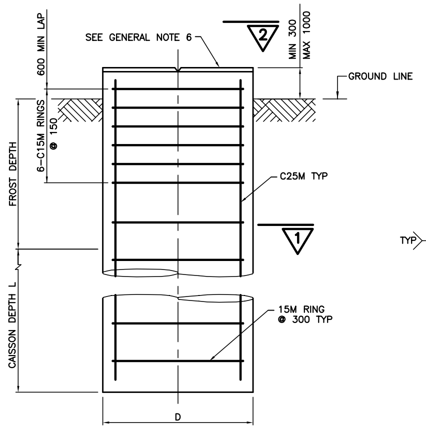
METRIC
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

WP	No
STATIC SIGN SUPPORT – FOOTING DETAILS (GROUND MOUNTED)	SHEET



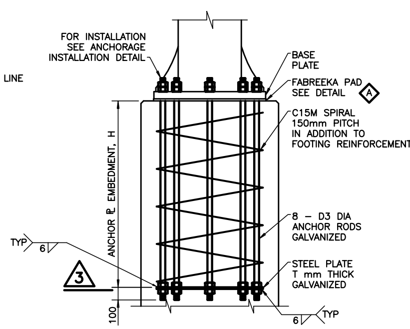


DRAINAGE GROOVES

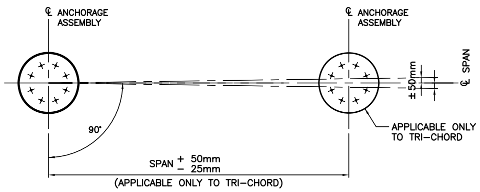


NOTE. ANCHORAGE NOT SHOWN FOR CLARITY.

TYPICAL REINFORCEMENT



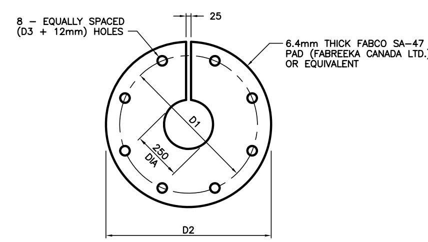
ANCHORAGE DETAIL



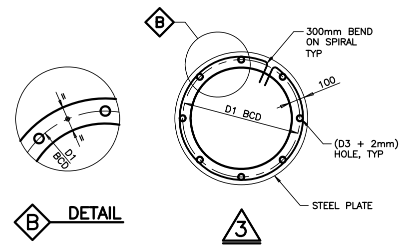
NOTES:

- 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



A DETAIL



B DETAIL

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. BAR MARKS WITH PREFIX 'C' DENOTE COATED BARS.
4. STRUCTURAL STEEL PLATE SHALL BE ACCORDING TO CAN/CSA-G40.20-04/G40.21-04, 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.

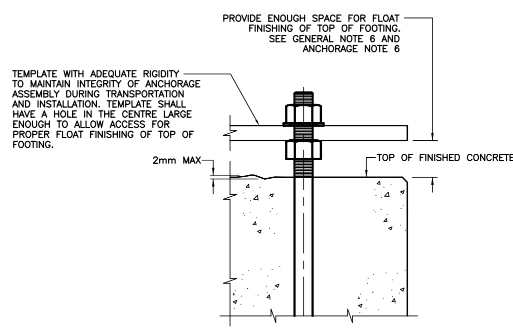
ANCHORAGE NOTES:

1. STEEL STUDS, NUTS AND HARDENED STEEL WASHERS SHALL BE ACCORDING TO ASTM SPECIFICATION A449.
2. ALL WELDING SHALL BE ACCORDING TO CAN/CSA-W59-03.
3. THE COMPLETE ANCHORAGE ASSEMBLY INCLUDING STUDS, NUTS AND WASHERS SHALL BE HOT DIP GALVANIZED ACCORDING TO CAN/CSA-G164-M92.
4. ANCHOR BOLTS SHALL BE BROUGHT TO A SNUG TIGHT CONDITION AND THEN FURTHER TIGHTENED 1/3 OF A TURN.
5. EXPOSED PORTION OF STUDS SHALL BE COATED WITH WHITE NON-STAINING GREASE.
6. 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	---									
D1	---									
D2	---									
D3	---									
T	---									
H	---									

DESIGN INFORMATION		FOOTING DEPTH L	FOOTING DIAMETER D	No. OF REBARS N	BOLT CIRCLE D1	BASE ℙ DIAMETER D2	ANCHOR DIAMETER D3	ANCHOR ℙ THK. T	ANCHOR ℙ EMBED. H
TYPE	CLASS	(mm)	(mm)	(no.)	(mm)	(mm)	(mm)	(mm)	(mm)
TRI-CHORD	–	5000	1200	18	750	900	38	12	1200
SINGLE CANTILEVER	1	5000	1200	18	750	900	38	12	1200
	2	5000	1200	18	750	900	38	12	1200
	3	6000	1200	18	750	900	38	12	1200
	4	6500	1350	22	850	1000	44	15	1500
BUTTERFLY	1	5500	1200	18	750	900	38	12	1200
	2	5500	1200	18	750	900	38	12	1200
	3	6700	1200	18	750	900	38	12	1200
	4	7400	1350	22	850	1000	44	15	1500
POLE MOUNTED VMS	–	4000	1000	15	600	750	32	10	1000



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 APRIL 2011	SS118–3
STATIC SIGN SUPPORT FOOTING DETAILS (GROUND MOUNTED)	

REVISIONS		
DATE	BY	DESCRIPTION

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

DRAWING NAME: s118-3.dwg
CREATED: 1997/09/24
MODIFIED: 2011/04/04 12:46:07
MINISTRY OF TRANSPORTATION, ONTARIO PR-D-707 88-05

METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

CONT No
WP No

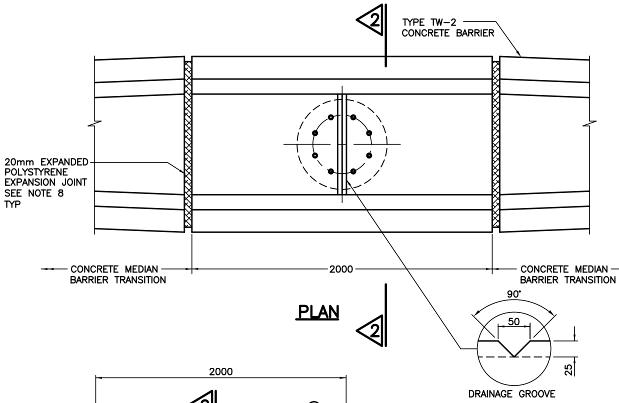
STATIC SIGN SUPPORT FOOTING DETAILS (MEDIAN MOUNTED – SYMMETRICAL)

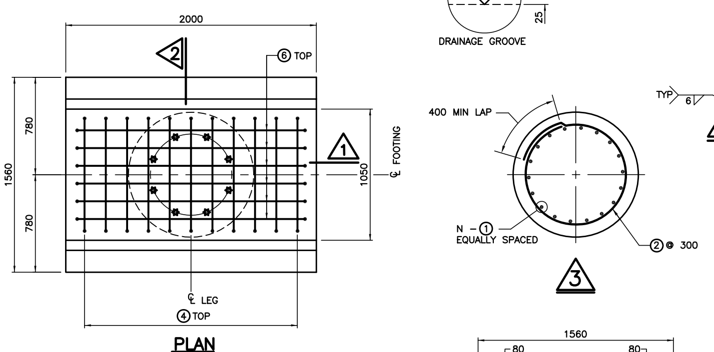
SHEET

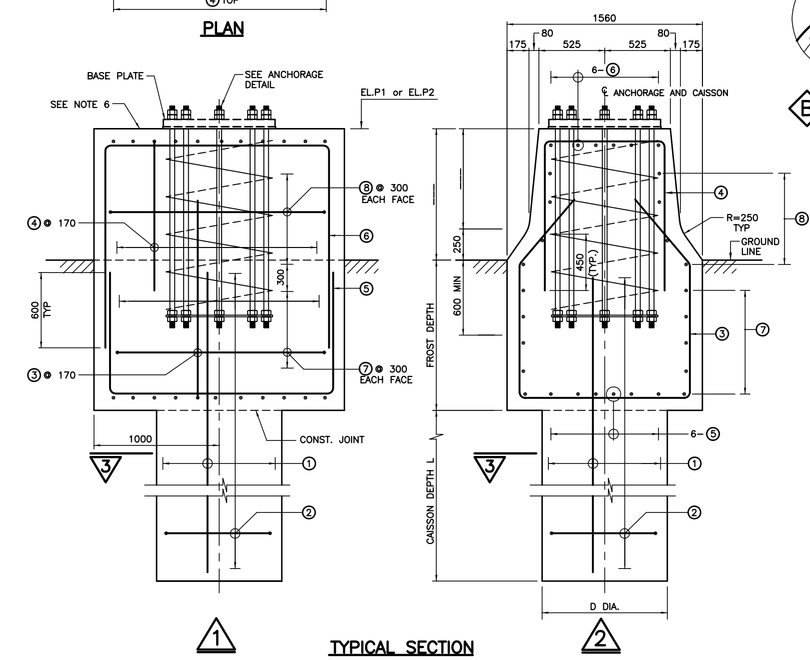
NOTES TO DESIGNER

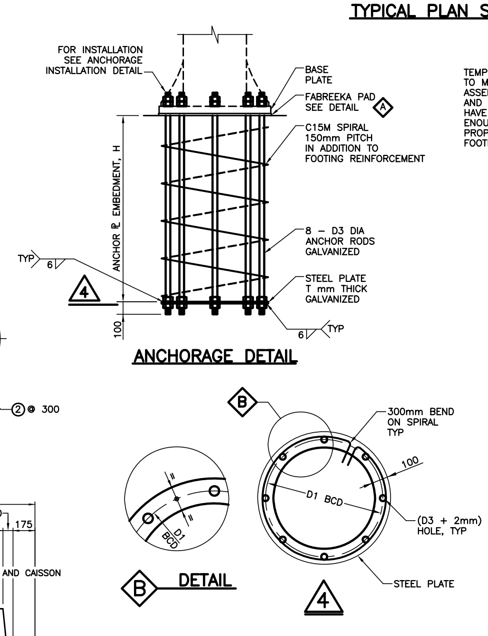
1 IF SOUND ROCK IS ENCOUNTERED AT A DEPTH OF "Y" < L FROM THE BOTTOM OF THE FROST LAYER, THIS DIMENSION CAN BE REDUCED TO: Y + (L – Y)/2, UPON MINISTRY'S APPROVAL.

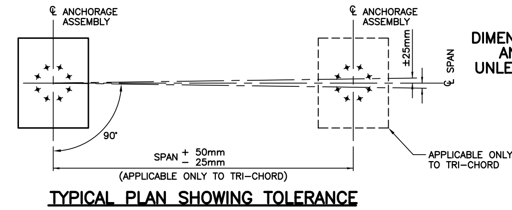
2 THE "DESIGN INFORMATION" TABLE AND "NOTES TO DESIGNER" SHALL BE DELETED FROM THIS DRAWING PRIOR TO ISSUING OF THE CONTRACT.

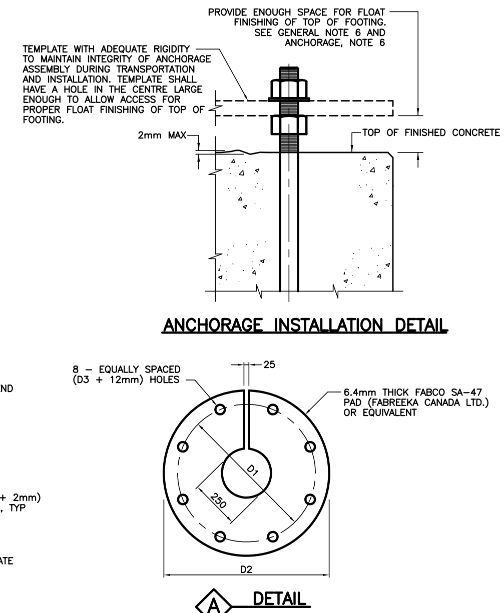












GENERAL NOTES:

1. CLASS OF CONCRETE 30 MPa.
2. CLEAR COVER TO REINFORCING STEEL:
   –CAISSON 100±25mm
   –REMAINDER 70±20mm
3. REINFORCING STEEL SHALL BE GRADE 400W UNLESS OTHERWISE SPECIFIED. BAR MARKS WITH PREFIX 'C' DENOTE COATED BARS.
4. STRUCTURAL STEEL PLATE SHALL BE ACCORDING TO CAN/CSA–G40.20–04/G40.21–04, 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 POLYESTYRENE 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.

ANCHORAGE NOTES:

1. STEEL STUDS, NUTS AND HARDENED STEEL WASHERS SHALL BE ACCORDING TO ASTM SPECIFICATION A449.
2. ALL WELDING SHALL BE ACCORDING TO CAN/CSA–W59–03.
3. THE COMPLETE ANCHORAGE ASSEMBLY INCLUDING STUDS, NUTS AND WASHERS SHALL BE HOT DIP GALVANIZED ACCORDING TO CAN/CSA–G164–M92.
4. ANCHOR BOLTS SHALL BE BROUGHT TO A SNUG TIGHT CONDITION AND THEN FURTHER TIGHTENED 1/3 OF A TURN.
5. EXPOSED PORTION OF STUDS SHALL BE COATED WITH WHITE NON–STAINING GREASE.
6. 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	STRAIGHT
2	15M	
3	C20M	
4	C20M	
5	20M	
6	C20M	
7	20M	
8	C20M	

TABLE 1 – FOOTING DIMENSIONS

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

DESIGN INFORMATION		FOOTING DEPTH L	FOOTING DIAMETER D	No. OF REBARS N	BOLT CIRCLE D1	BASE ℄ DIAMETER D2	ANCHOR DIAMETER D3	ANCHOR ℄ THK. T	ANCHOR ℄ EMBED. H
TYPE	CLASS	(mm)	(mm)	(no.)	(mm)	(mm)	(mm)	(mm)	(mm)
TRI-CHORD	–	5000	1000	18	750	900	38	12	1200
SINGLE CANTILEVER	1	5000	1000	18	750	900	38	12	1200
	2	5000	1000	18	750	900	38	12	1200
	3	6000	1200	18	750	900	38	12	1200
	4	6500	1350	22	850	1000	44	15	1500
BUTTERFLY	1	5500	1000	18	750	900	38	12	1200
	2	5500	1000	18	750	900	38	12	1200
	3	6700	1200	18	750	900	38	12	1200
	4	7400	1350	22	850	1000	44	15	1500
POLE MOUNTED VMS	–	4000	1000	15	600	750	32	10	1000

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 APRIL 2011 — SS118-4

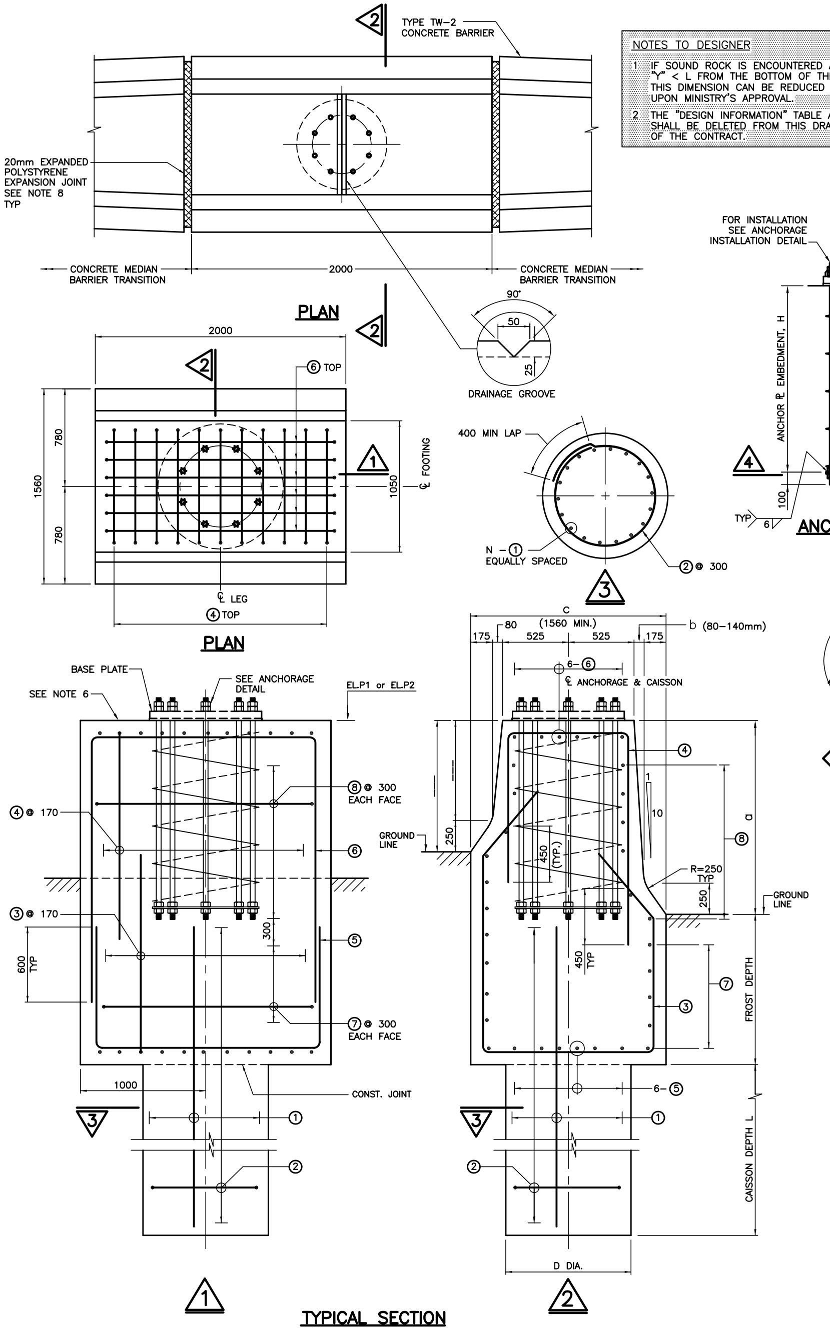
STATIC SIGN SUPPORT – FOOTING DETAILS (MEDIAN MOUNTED – SYMMETRICAL)

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

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

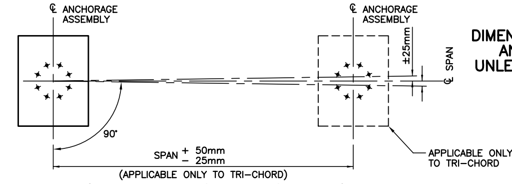
MINISTRY OF TRANSPORTATION, ONTARIO PR-D-707 88-05

DRAWING NAME: s118-4.dwg CREATED: 1997/09/26 MODIFIED: 2011/04/04 10:19:08



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.



TYPICAL PLAN SHOWING TOLERANCE

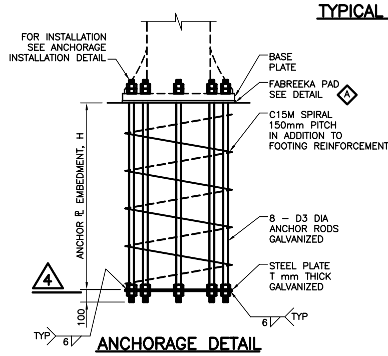
METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

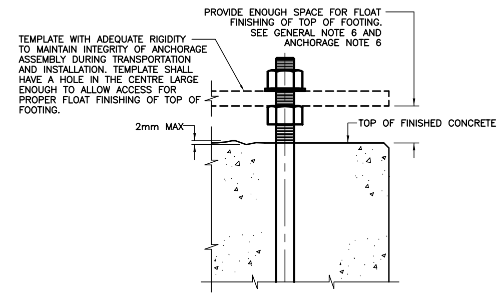
CONT No
WP No

SHEET

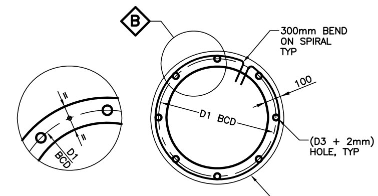
STATIC SIGN SUPPORT
FOOTING DETAILS
(MEDIAN MOUNTED – ASYMMETRICAL)



ANCHORAGE DETAIL

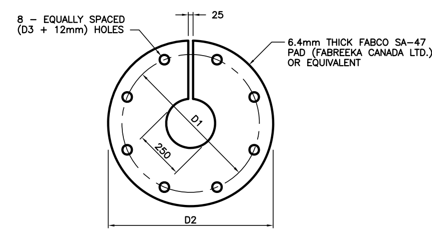


ANCHORAGE INSTALLATION DETAIL



B DETAIL

4



A DETAIL

GENERAL NOTES:

1. CLASS OF CONCRETE 30 MPa.
2. CLEAR COVER TO REINFORCING STEEL:
   –CAISSON 100±25mm
   –REMAINDER 70±20mm
3. REINFORCING STEEL SHALL BE GRADE 400W UNLESS OTHERWISE SPECIFIED. BAR MARKS WITH PREFIX 'C' DENOTE COATED BARS.
4. STRUCTURAL STEEL PLATE SHALL BE ACCORDING TO CAN/CSA-G40.20-04/G40.21-04, 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 POLYESTYRENE 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.

ANCHORAGE NOTES:

1. STEEL STUDS, NUTS AND HARDENED STEEL WASHERS SHALL BE ACCORDING TO ASTM SPECIFICATION A449.
2. ALL WELDING SHALL BE ACCORDING TO CAN/CSA-W59-03.
3. THE COMPLETE ANCHORAGE ASSEMBLY INCLUDING STUDS, NUTS AND WASHERS SHALL BE HOT DIP GALVANIZED ACCORDING TO CAN/CSA-G164-M92.
4. ANCHOR BOLTS SHALL BE BROUGHT TO A SNUG TIGHT CONDITION AND THEN FURTHER TIGHTENED 1/3 OF A TURN.
5. EXPOSED PORTION OF STUDS SHALL BE COATED WITH WHITE NON-STAINING GREASE.
6. 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	STRAIGHT
2	15M	
3	C20M	
4	C20M	
5	20M	
6	C20M	
7	20M	
8	C20M	

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	---									
D1	---									
D2	---									
D3	---									
T	---									
H	---									

DESIGN INFORMATION		FOOTING DEPTH L	FOOTING DIAMETER D	No. OF REBARS N	BOLT CIRCLE D1	BASE ℄ DIAMETER D2	ANCHOR DIAMETER D3	ANCHOR ℄ THK. T	ANCHOR ℄ EMBED. H
TYPE	CLASS	(mm)	(mm)	(no.)	(mm)	(mm)	(mm)	(mm)	(mm)
TRI-CHORD	–	5000	1000	18	750	900	38	12	1200
SINGLE CANTILEVER	1	5000	1000	18	750	900	38	12	1200
	2	5000	1000	18	750	900	38	12	1200
	3	6000	1200	18	750	900	38	12	1200
	4	6500	1350	22	850	1000	44	15	1500
BUTTERFLY	1	5500	1000	18	750	900	38	12	1200
	2	5500	1000	18	750	900	38	12	1200
	3	6700	1200	18	750	900	38	12	1200
	4	7400	1350	22	850	1000	44	15	1500
POLE MOUNTED VMS	–	4000	1000	15	600	750	32	10	1000

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 APRIL 2011 | SS118-5

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

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

REVISIONS		
DATE	BY	DESCRIPTION

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

PR-D-707 88-05
MINISTRY OF TRANSPORTATION, ONTARIO
DRAWING NAME: s118-5.dwg
CREATED: 1997/10/27
MODIFIED: 2011/04/04 10:19:35

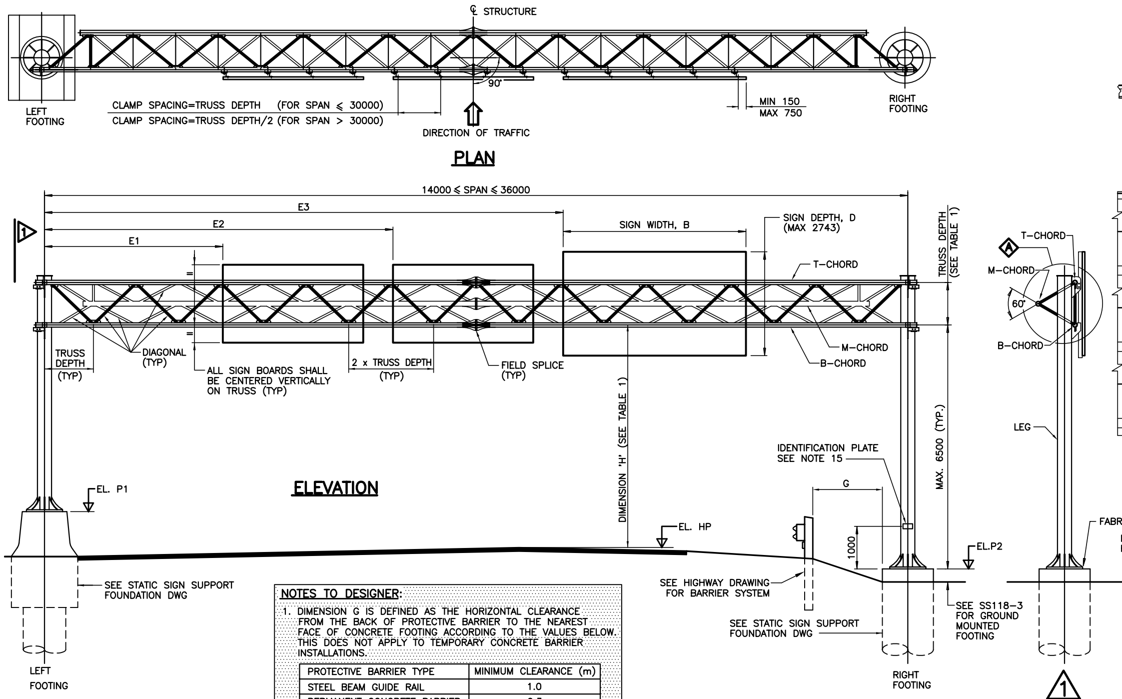
METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

CONT No
WP No

SHEET

TRI-CHORD STATIC SIGN SUPPORT GENERAL ARRANGEMENT

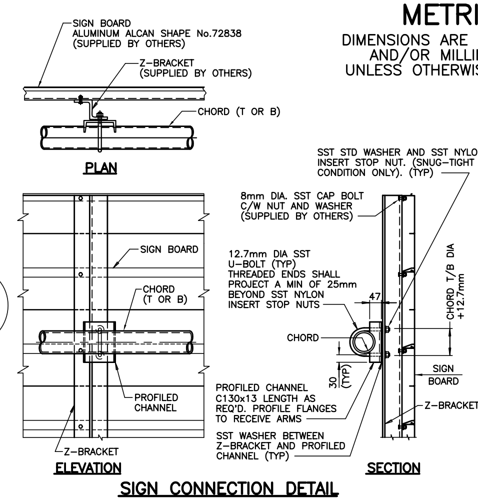


NOTES TO DESIGNER:

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.



NOTES:

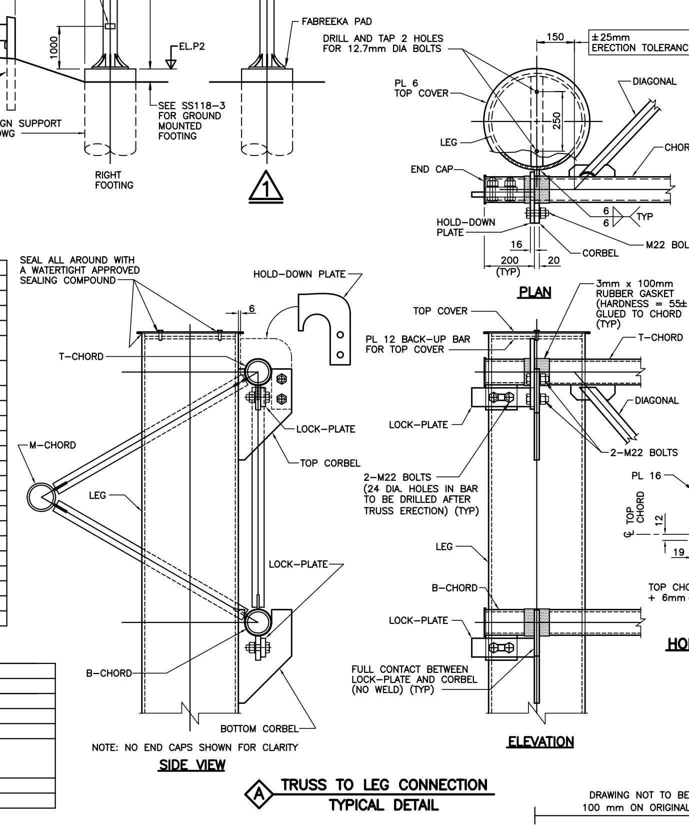
1. ALL SECTIONS SHALL BE STRUCTURAL STEEL UNLESS NOTED.
2. ALL STRUCTURAL STEEL SHALL BE ACCORDING TO CAN/CSA-G40.20-04/G40.21-04, GRADE 300W OR ASTM SPECIFICATION A500 GRADE C, STRUCTURAL TUBING.
3. WALL THICKNESS OF MEMBERS:
   - CHORDS 6.4mm
   - DIAGONALS 3.2mm
   - LEGS 12.7mm
4. TOTAL SIGN BOARD 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 GALVANIZED ACCORDING TO CAN/CSA-G164-M92 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 BROUGHT TO A SNUG TIGHT CONDITION AND THEN FURTHER TIGHTENED 1/3 OF A TURN, UNLESS OTHERWISE NOTED.
8. ALL STRUCTURAL STEEL SHALL BE GALVANIZED AFTER FABRICATION ACCORDING TO CAN/CSA-G164-M92. LEGS ONLY SHALL BE SUBSEQUENTLY COATED WITH AN APPROVED PAINT SYSTEM.
9. STRUCTURE SHALL NOT BE ERECTED UNTIL FOUNDATION CONCRETE HAS REACHED 80% OF SPECIFIED STRENGTH.
10. ALL WELDING SHALL BE ACCORDING TO CAN/CSA-W59-03.
11. NO SHOP SPLICES IN ANY MEMBER. TRUSS FIELD SPLICES SHALL BE KEPT TO A MAXIMUM OF 2.
12. CLAMPS SHALL BE POSITIONED NEXT TO NODES.
13. SPAN LENGTHS AND ELEVATIONS TO BE VERIFIED IN THE FIELD BEFORE SIGN SUPPORT STRUCTURE FABRICATION.
14. 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.).
15. 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.
16. LEGEND:
    SST – DENOTES STAINLESS STEEL
    O.D. – DENOTES OUTSIDE DIAMETER

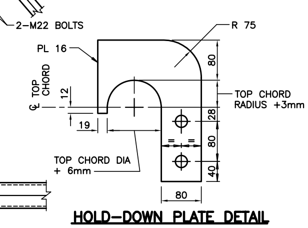
TABLE 1 – GENERAL

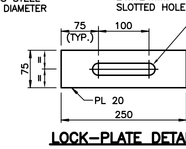
STATION	---
STRUCTURE I.D. No.	---
SPAN	---
TRUSS DEPTH (C/C OF CHORDS)	---
DIMENSION 'H'	---
LOCAL REFERENCE WIND PRESSURE, Pa	---
MAXIMUM ALLOWABLE SIGN BOARD AREA, m2	---
1 SIGN SIZE (DxB)	---
2 SIGN SIZE (DxB)	---
3 SIGN SIZE (DxB)	---
E1	---
E2	---
E3	---
G	---
EL.HP	---
EL.P1	---
EL.P2	---
SUPPORT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







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

SS118-26

TRI-CHORD STATIC 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: s118-26.dwg
CREATED: 1997/09/24
MODIFIED: 2011/04/04 12:33:10

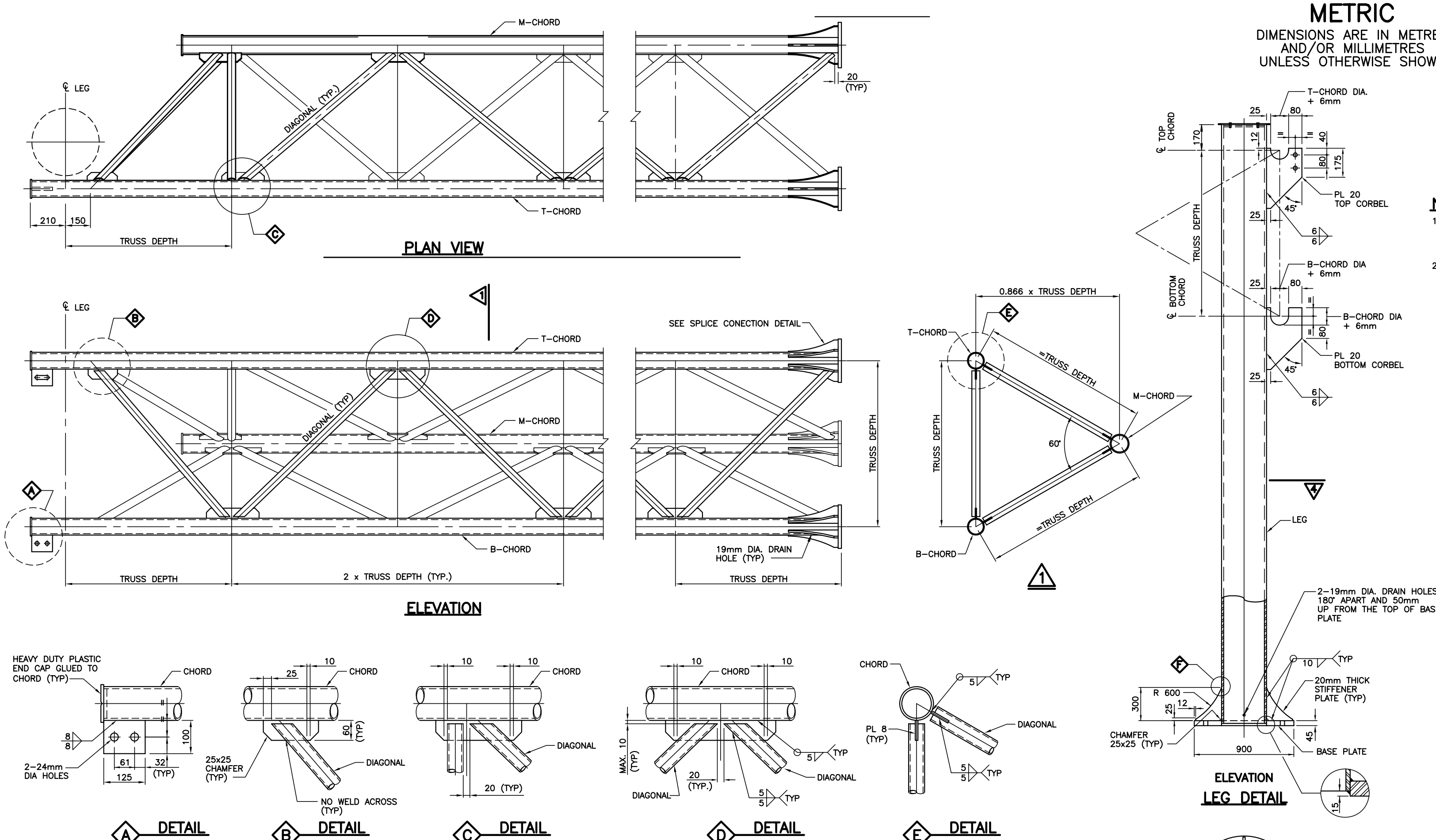
METRIC

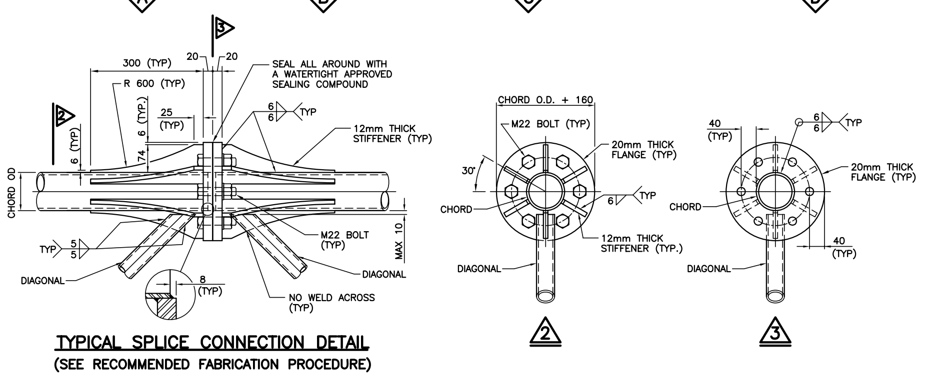
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

CONT No
WP No

SHEET

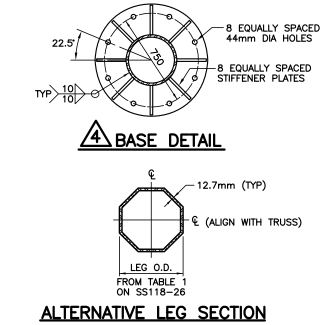
TRI–CHORD STATIC SIGN SUPPORT STRUCTURE ASSEMBLY DETAILS





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.



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

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

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

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.dwg
CREATED: 1997/09/24
MODIFIED: 2011/04/04 10:27:44
MINISTRY OF TRANSPORTATION, ONTARIO PR–D–707 88–05

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SIGN SUPPORT MANUAL

DIVISION 5 – STEEL COLUMN SIGN SUPPORTS

April 2011

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.

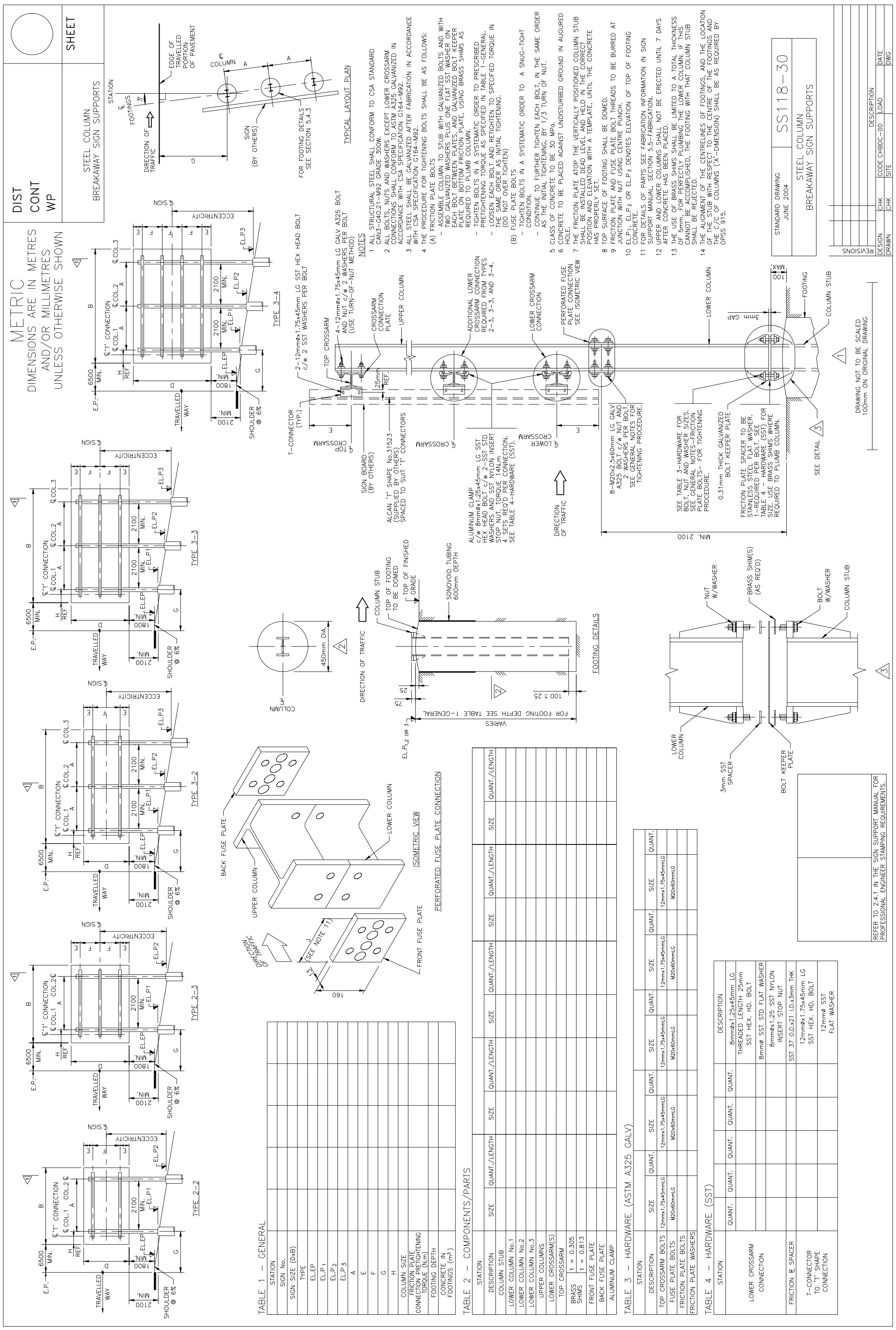


Figure 5.1.2(a) DETAILS OF BREAKAWAY TYPE

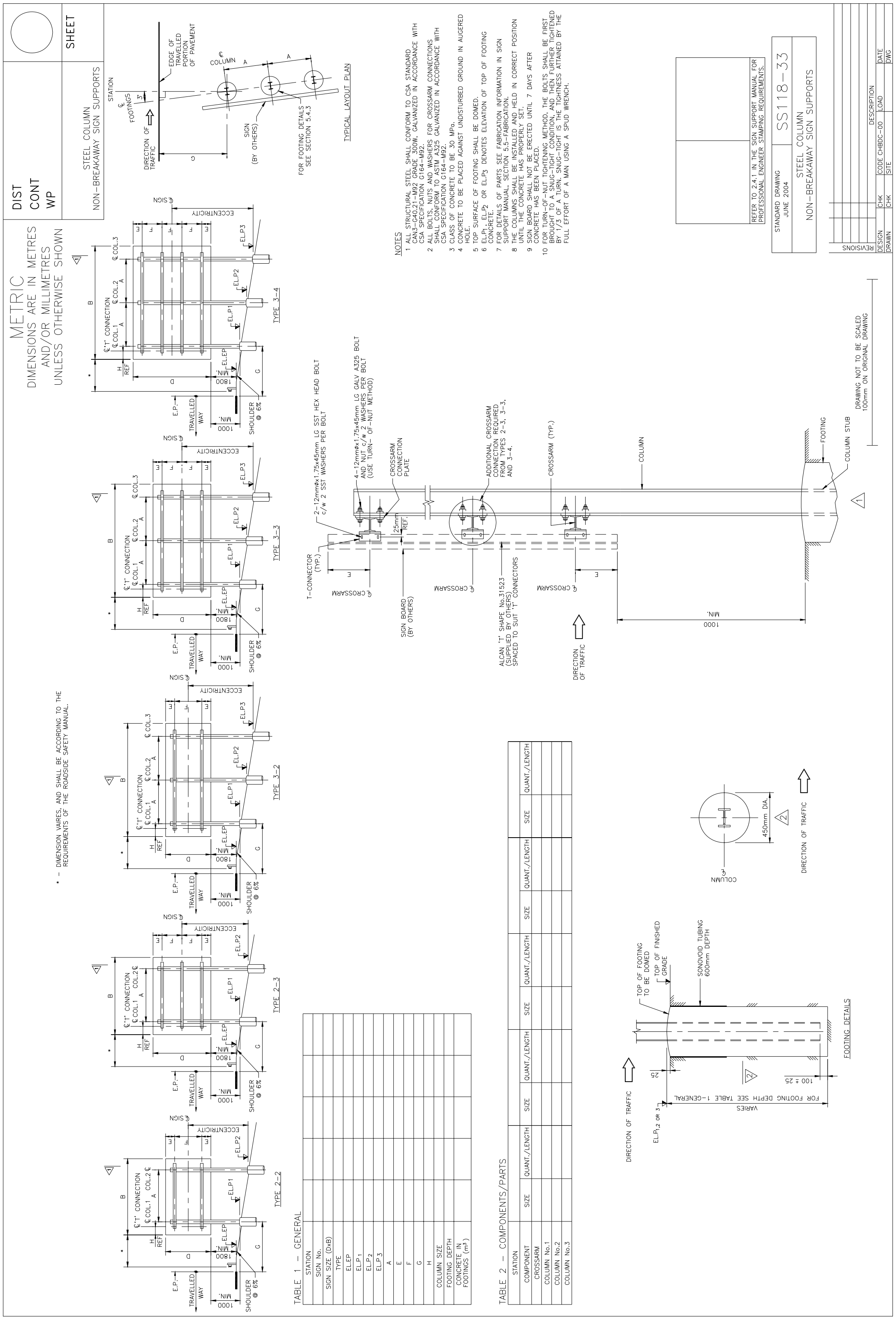


Figure 5.1.2(b) DETAILS OF NON-BREAKAWAY TYPE

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)

WIND PRESSURE (Pa)			**465**		
TYPE	SIGN SIZE (mm)		MAXIMUM ECCENTRICITY, mm		
	DEPTH	WIDTH	**6900**	**5700**	**4500**
3-2	1800	5400	W200X46	W200X42	W200X42
		6000	W200X59		
		6600		W200X46	
		7200			
		7800			
3-3	2100	5400	W200X59	W200X46	W200X42
		6000			
		6600		W200X59	
		7200			
		7800			
	2400	5400	W200X59	W200X46	
		6000		W200X59	
		6600			
		7800			W200X46
	2700	5400	W200X59		W200X42
		7800			W200X46
	3000	5400			W200X42
		7800			W200X59
	3300	5400		W200X59	W200X46
3-4	2400	7200		W200X59	W200X46
		7800			
	2700	6000			
		6600			
		7200			
		7800			
	3000	6000			
		6600			
		7200			W200X59
		7800			
	3300	6000		W200X59	W200X46
		6600			W200x59
		7200			
	3600	5400		W200X59	
		6000			
		6600			

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

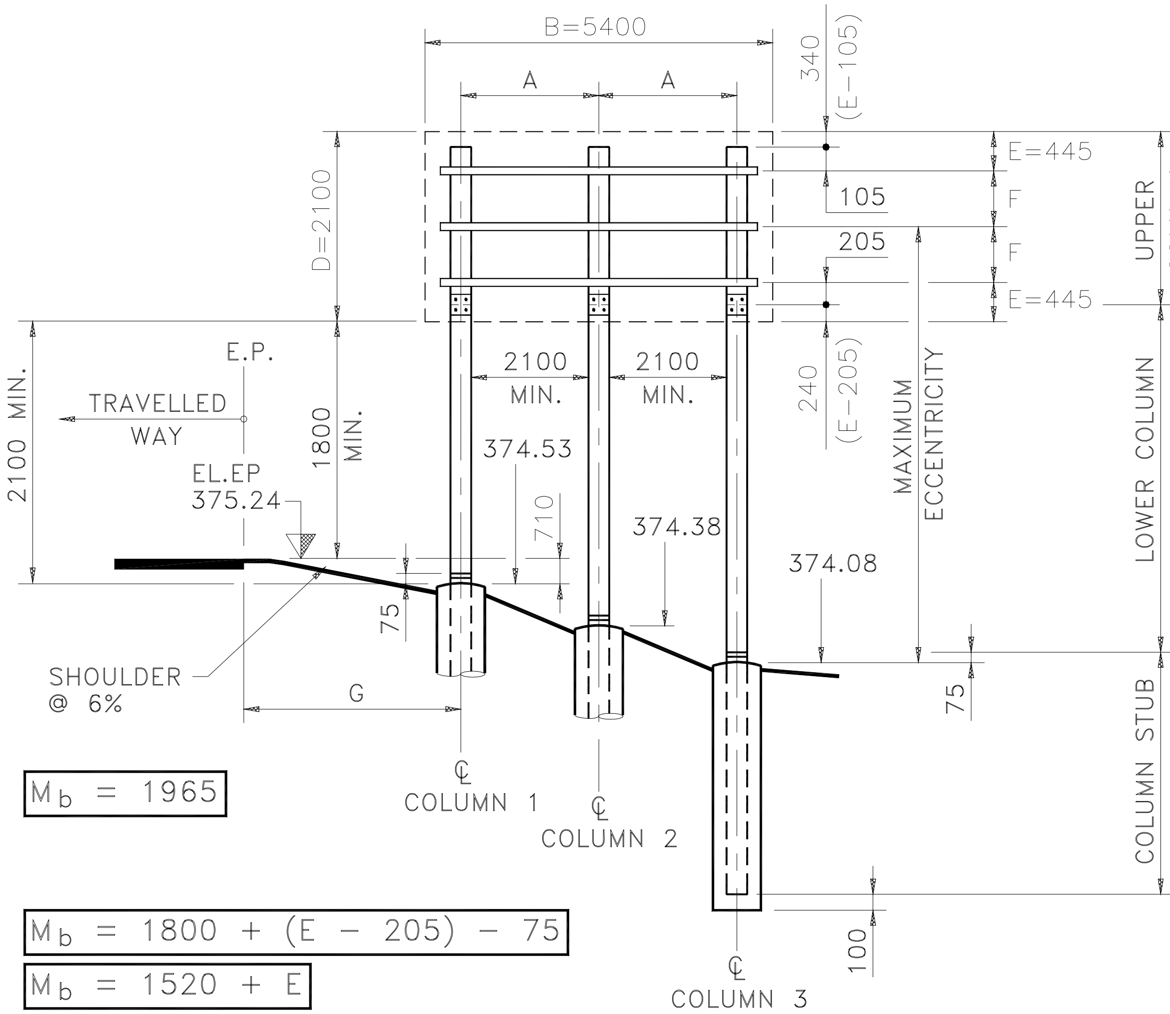
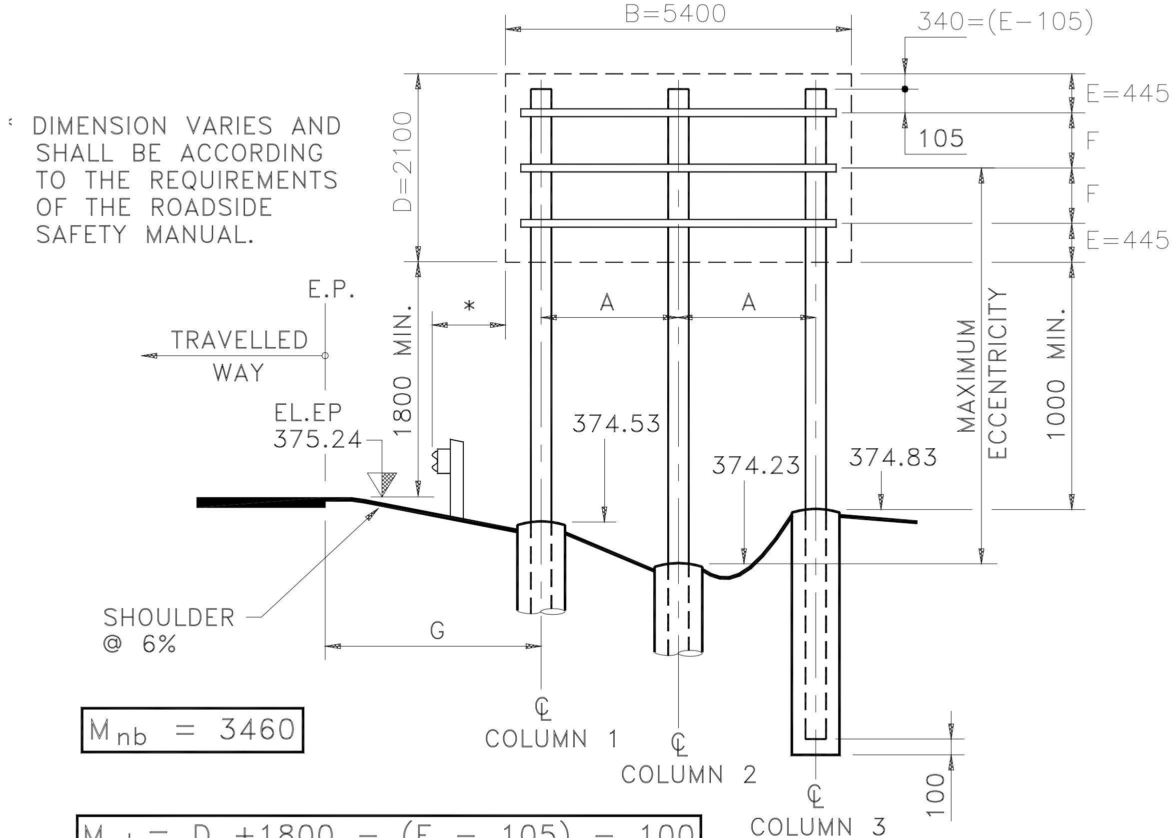


FIGURE 5.3.3(a)

BREAKAWAY

EXAMPLE
TYPE 3-3



$$\boxed{M_{nb} = 3460}$$

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

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

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 (depth = 1700 mm)
  (see Fig 5.4.3) (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 any lower column length is calculated to be less than 2100 mm, then all column lengths shall be increased by the same amount to adjust the smallest (shortest) column length to 2100 mm (minimum)
e.g. If the 3 lower column lengths are calculated to be 1900mm, 2200 mm, and 2500 mm, then all lengths should be increased by 200 mm, (ie 2100 – 1900 = 200). Adjusted lengths would therefore be 2100 mm , 2400 mm, and 2700 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 *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
LOWER CROSSARM CONNECTION	QTY	QTY	QTY	QTY	QTY	8mm x 1.25 x 45mm LG. THREADED LENGTH 25mm SST HEX. HD. BOLT
	24					
	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) = <u>5.87 m</u>

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

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

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] = <u>5315mm</u>

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.

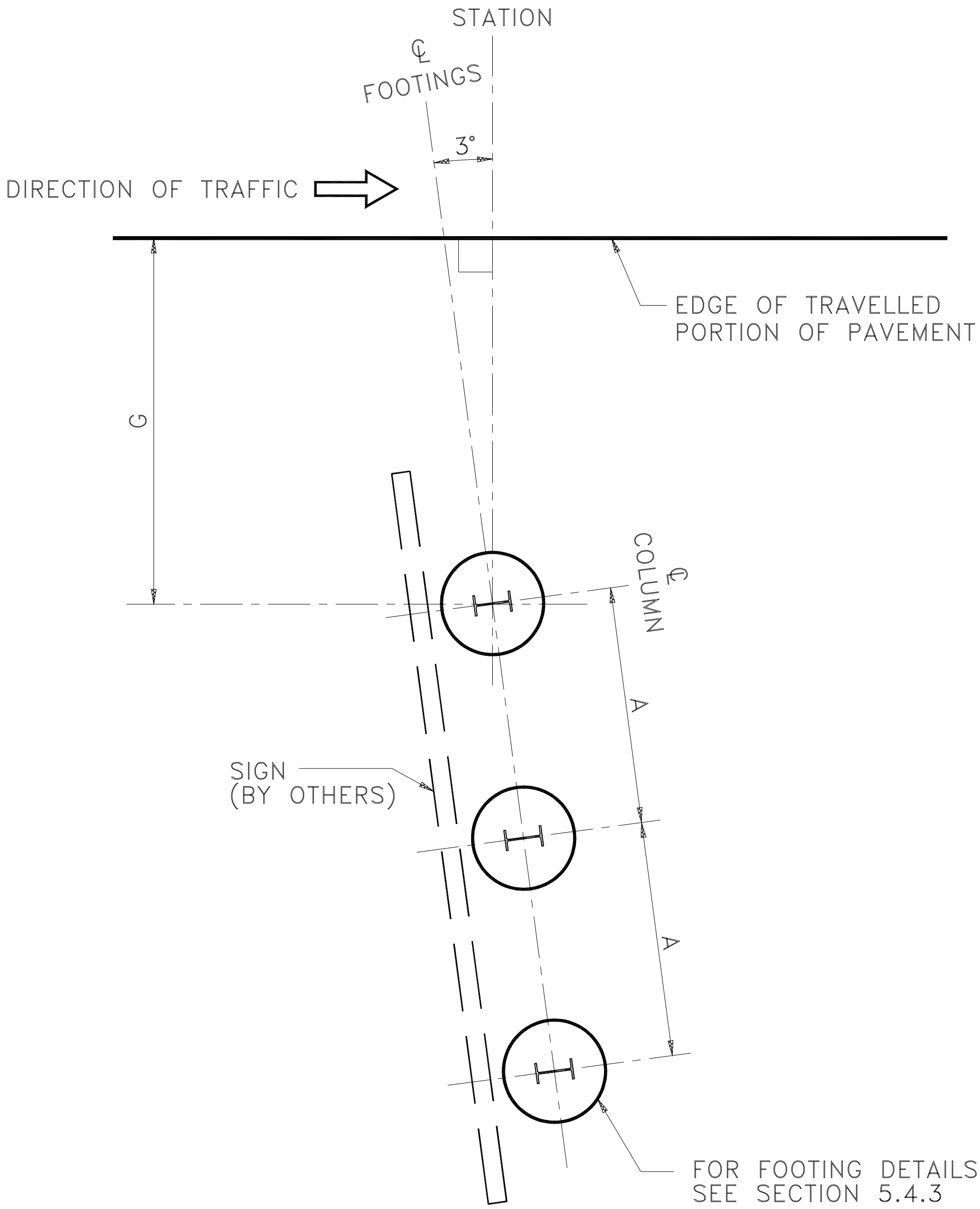
(b) PERFORATED FUSE PLATE BOLTS (M20)

- 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.

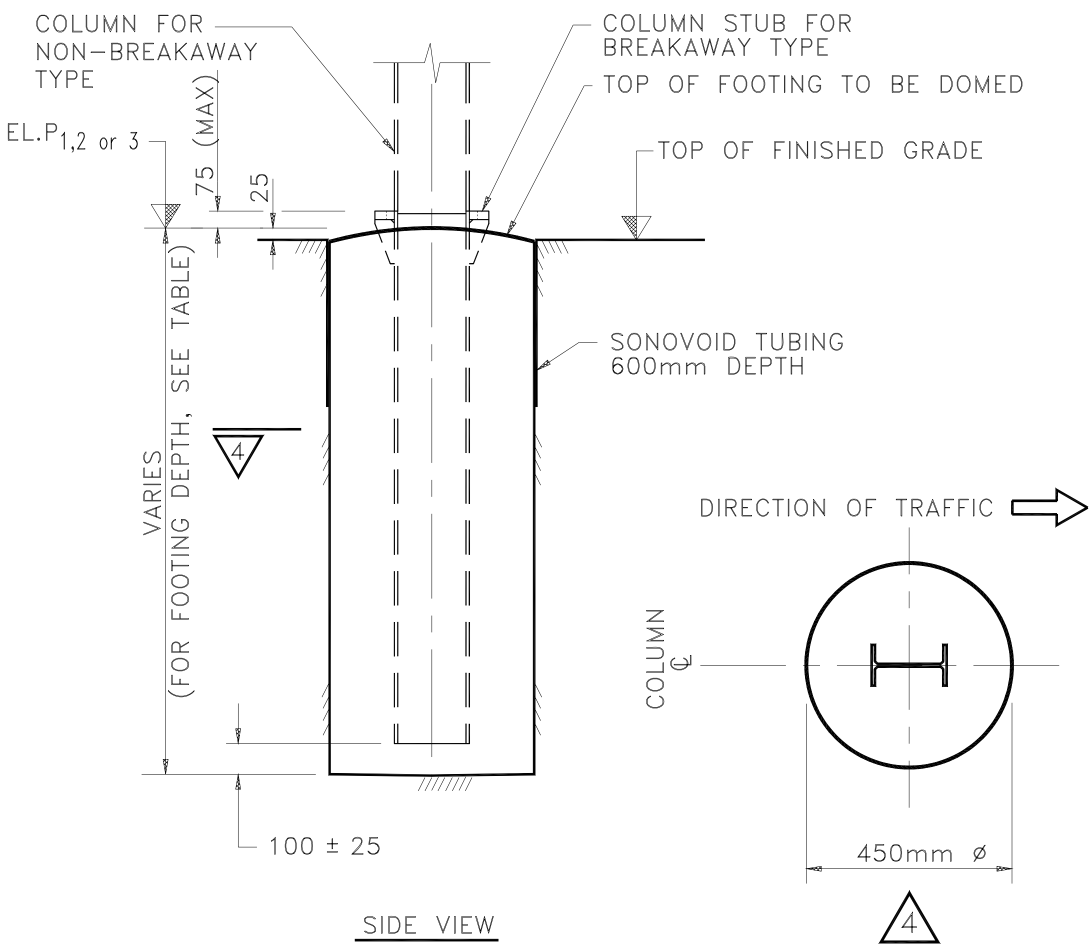


Note – For dimensions A and G see Table, Section 5.4.4.

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

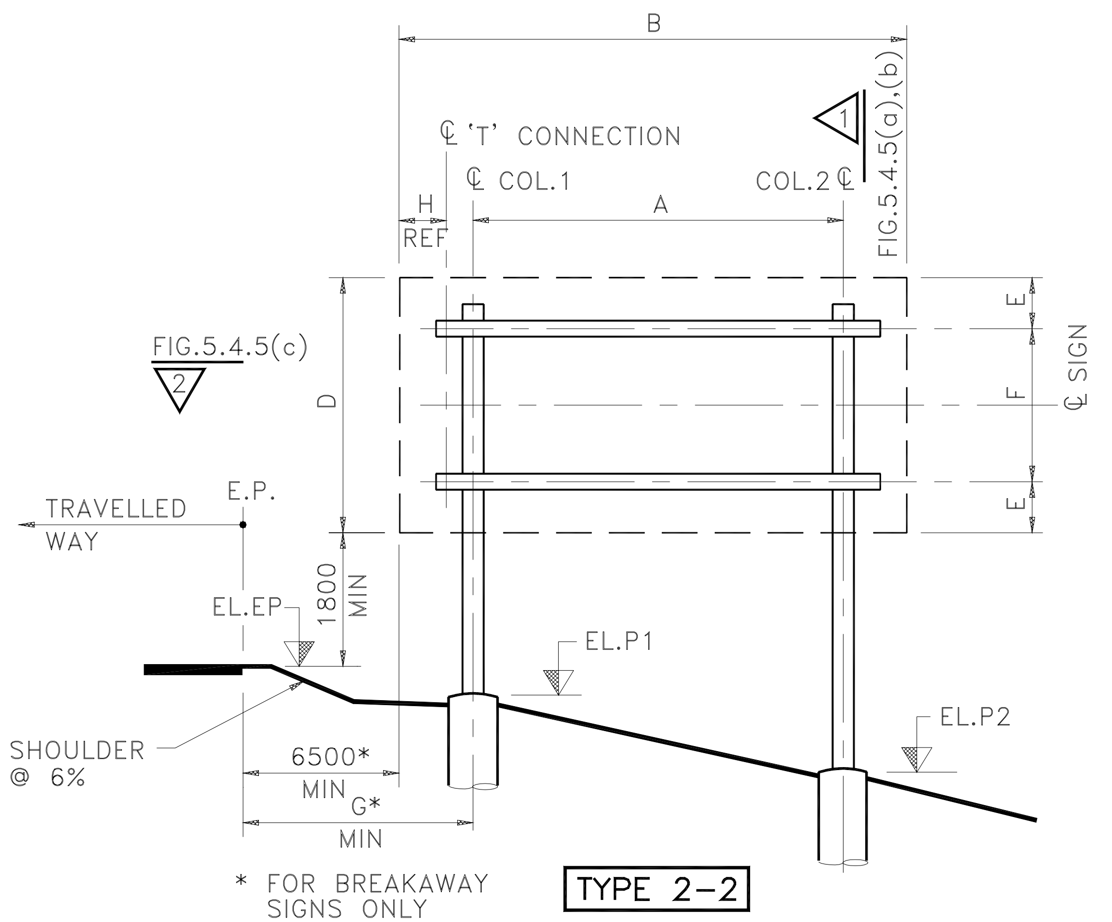
5.4.4 ASSEMBLY

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)

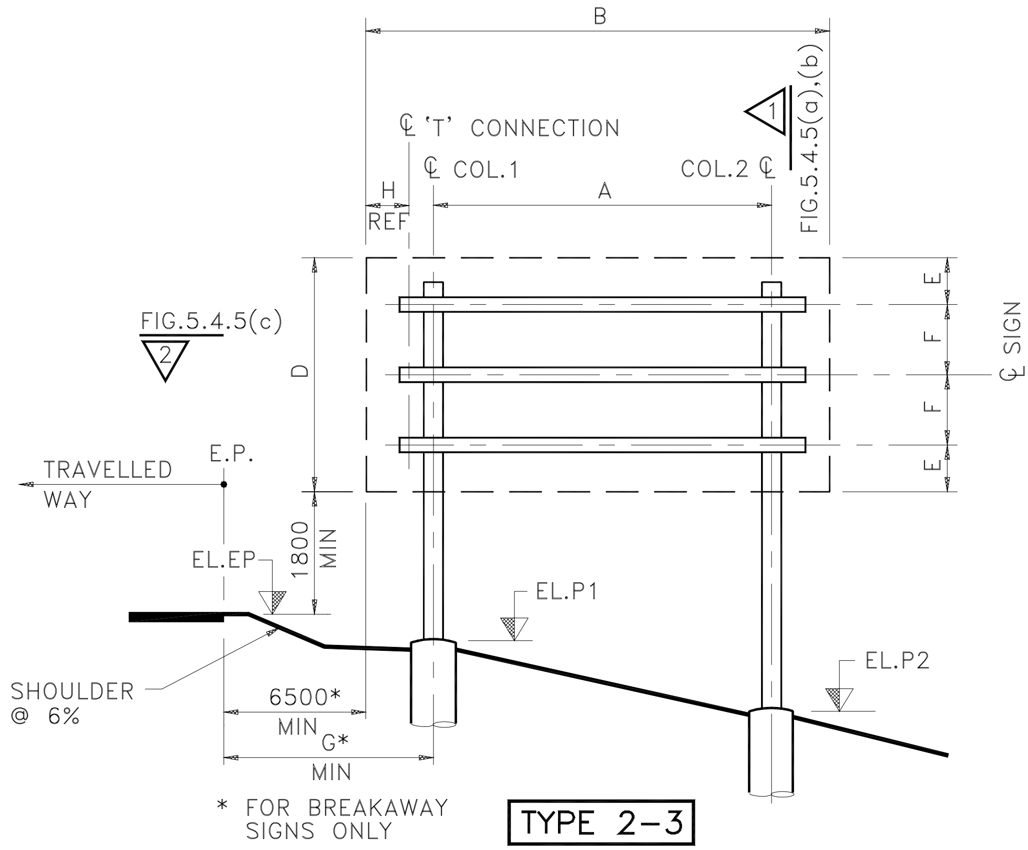
These figures are applicable to both breakaway and non-breakaway sign supports, with the exceptions as noted.

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



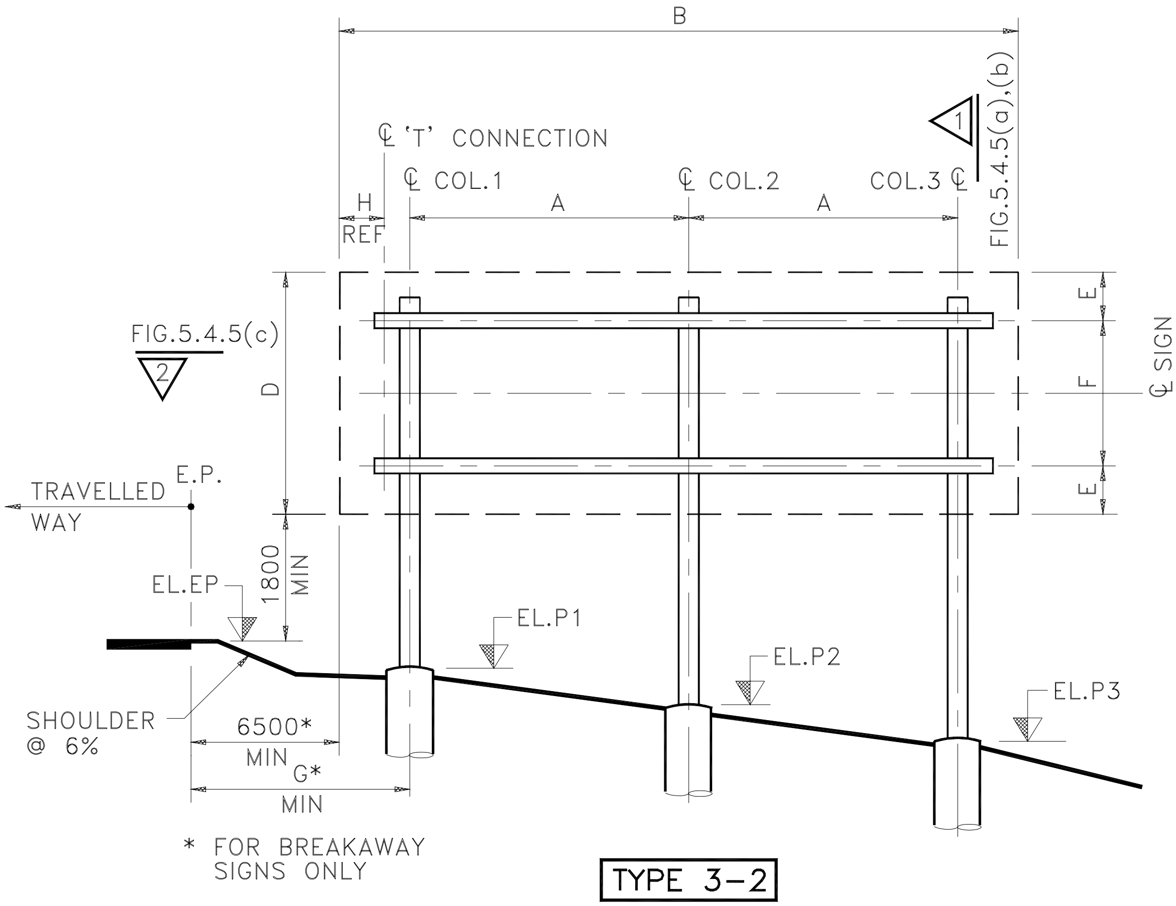
SIGN SIZE DxB, mm	A	E	F	G min.	H	M_b	M_{nb}
1200x3000	2300	230	740	6850	100	1750	2775
1200x3600	2300	230	740	7150	300	1750	2775
1500x3000	2300	330	840	6850	100	1850	2975
1500x3600	2300	330	840	7150	300	1850	2975
1500x4200	2400	330	840	7400	200	1850	2975
1500x4500	2700	330	840	7400	350	1850	2975
1500x4800	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



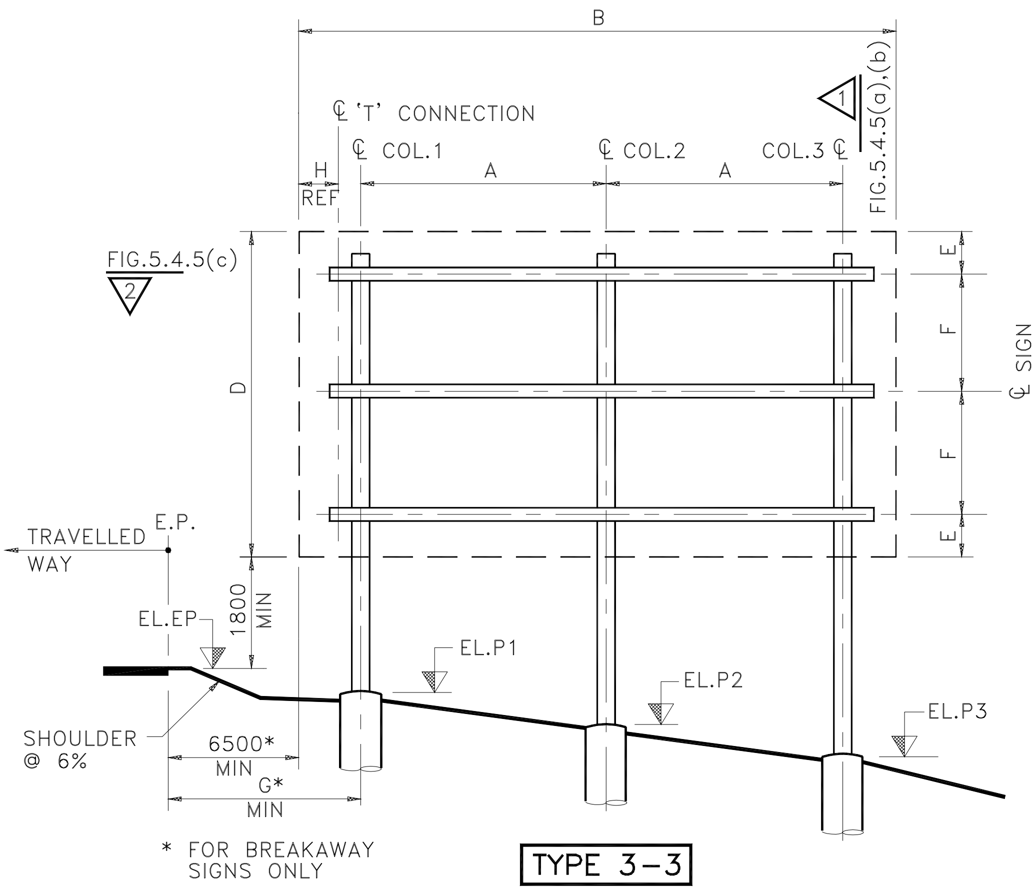
SIGN SIZE DxB, mm	A	E	F	G min.	H	M_b	M_{nb}
2100X3600	2300	445	605	7150	300	1965	3460
2100X4200	2400	445	605	7400	200	1965	3460
2100X4500	2700	445	605	7400	350	1965	3460
2100X4800	3000	445	605	7400	150	1965	3460
2400X4200	2400	480	720	7400	200	2000	3725
2400X4500	2700	480	720	7400	350	2000	3725
2400X4800	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



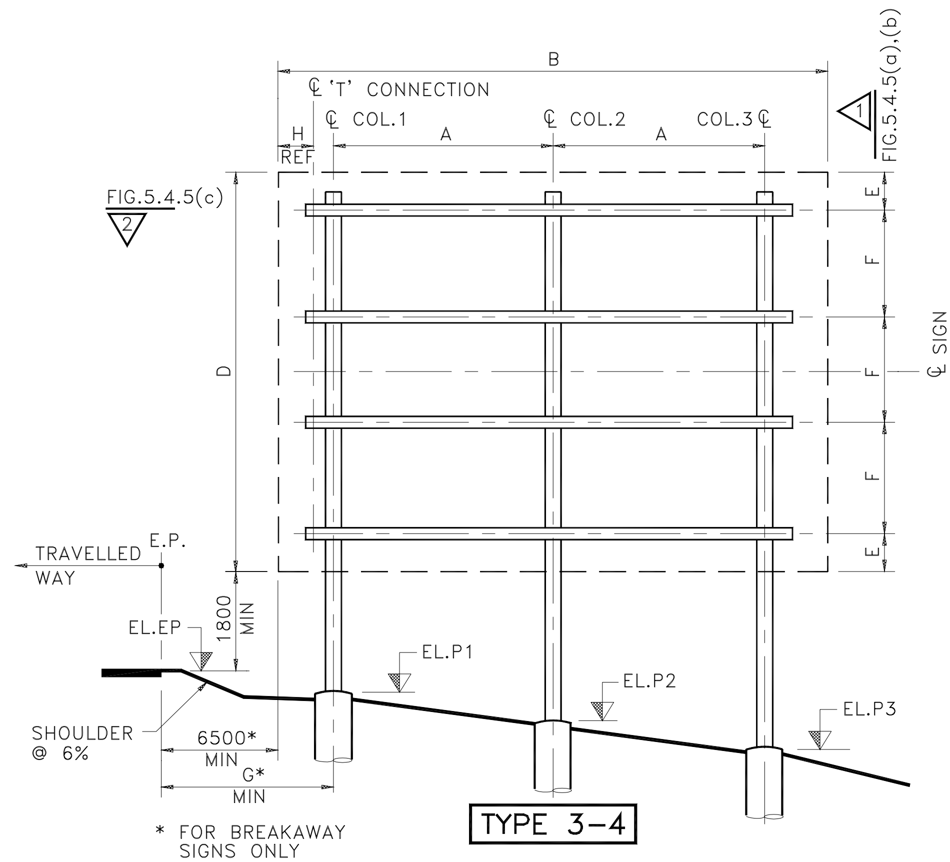
SIGN SIZE DxB, mm	A	E	F	G min.	H	M_b	M_{nb}
1800X5400	2300	405	990	6900	100	1925	3200
1800X6000	2300	405	990	7200	400	1925	3200
1800X6600	2700	405	990	7100	300	1925	3200
1800X7200	2900	405	990	7200	200	1925	3200
1800X7800	3000	405	990	7400	100	1925	3200

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

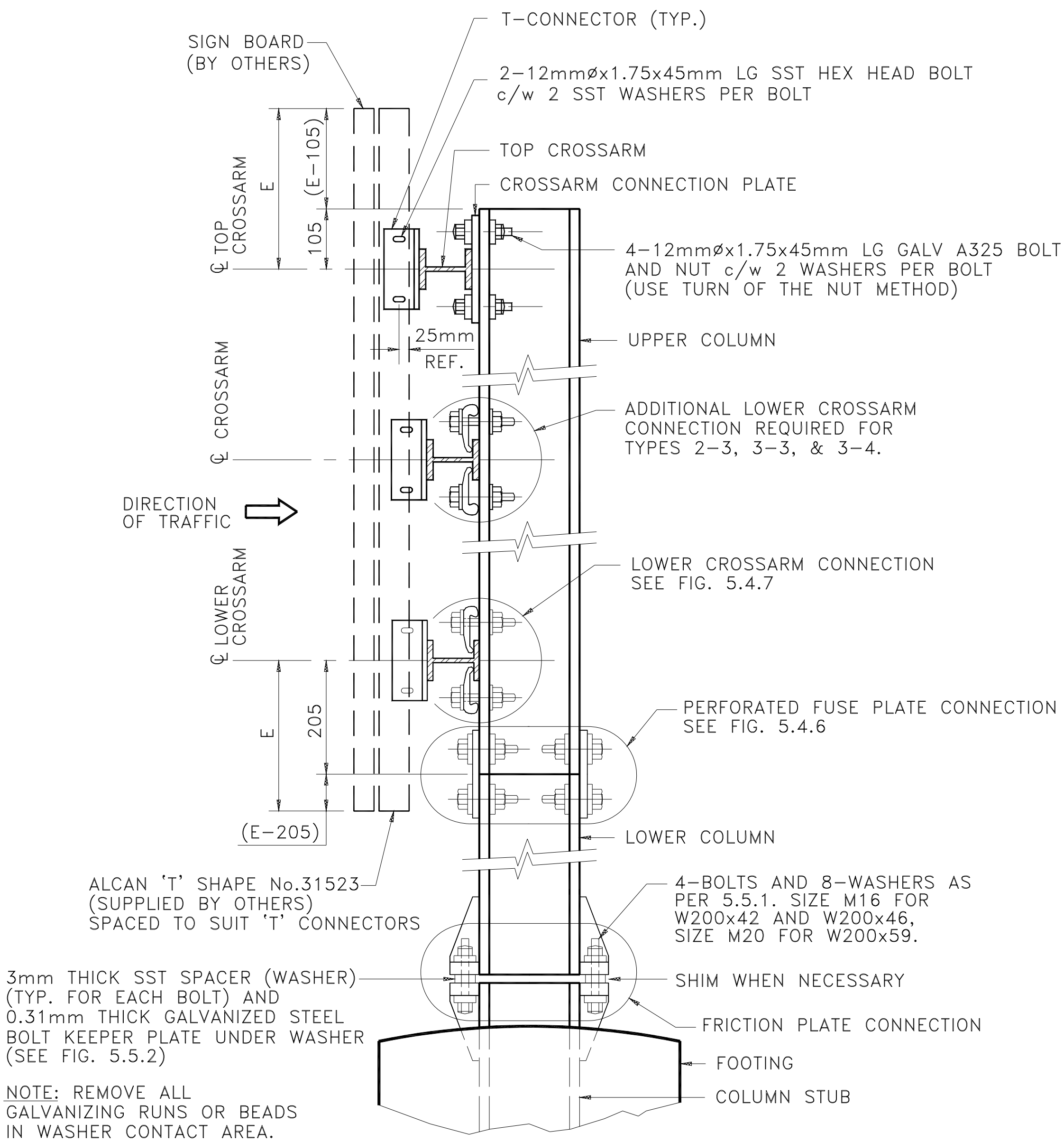
5.4.5 INSTALLATION

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

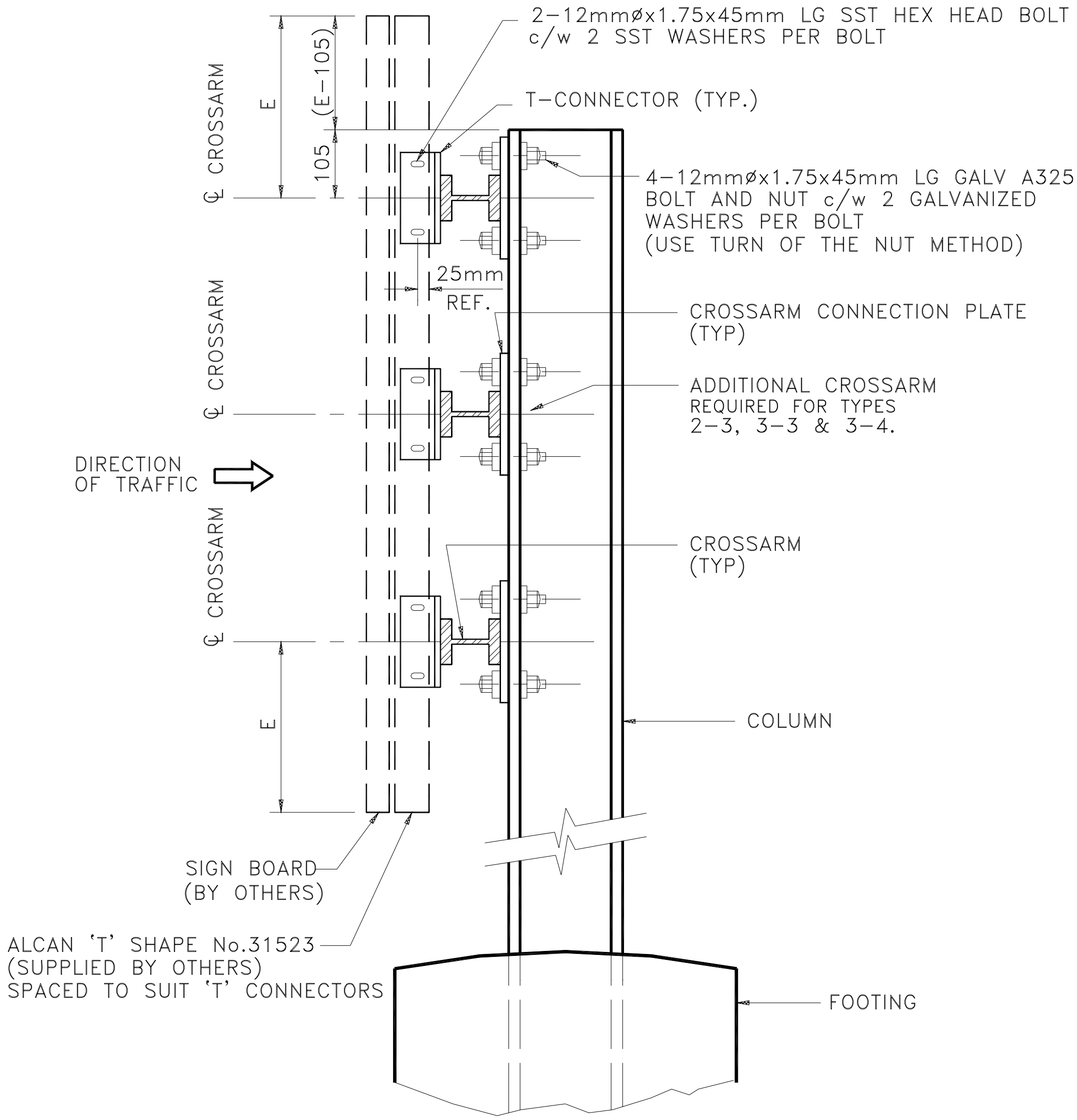
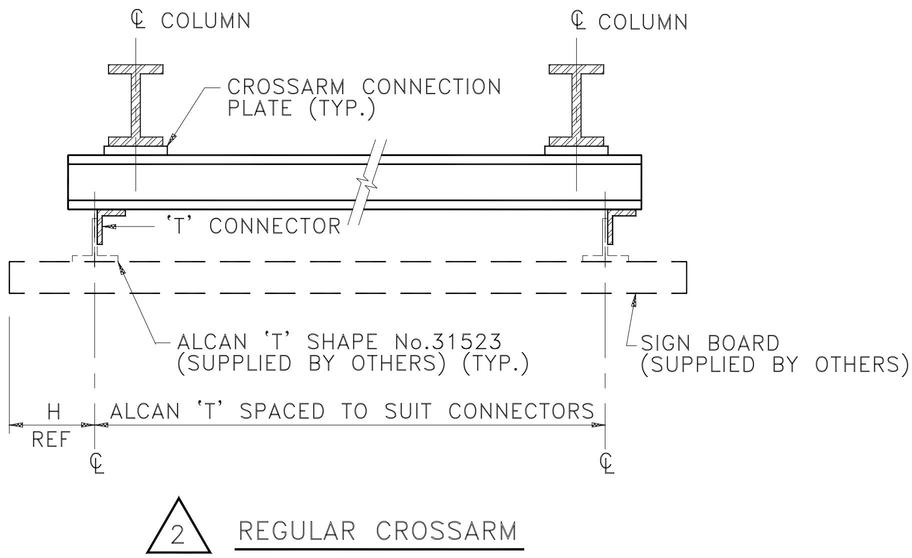


FIGURE 5.4.5 (b) NON-BREAKAWAY TYPE INSTALLATION DETAILS

1



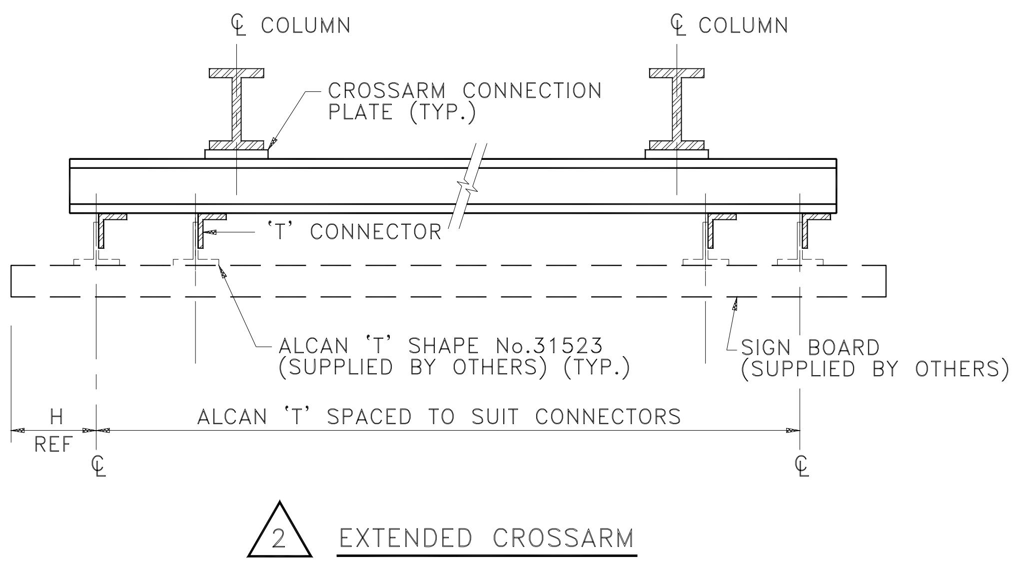


FIGURE 5.4.5 (c) INSTALLATION DETAILS

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”.

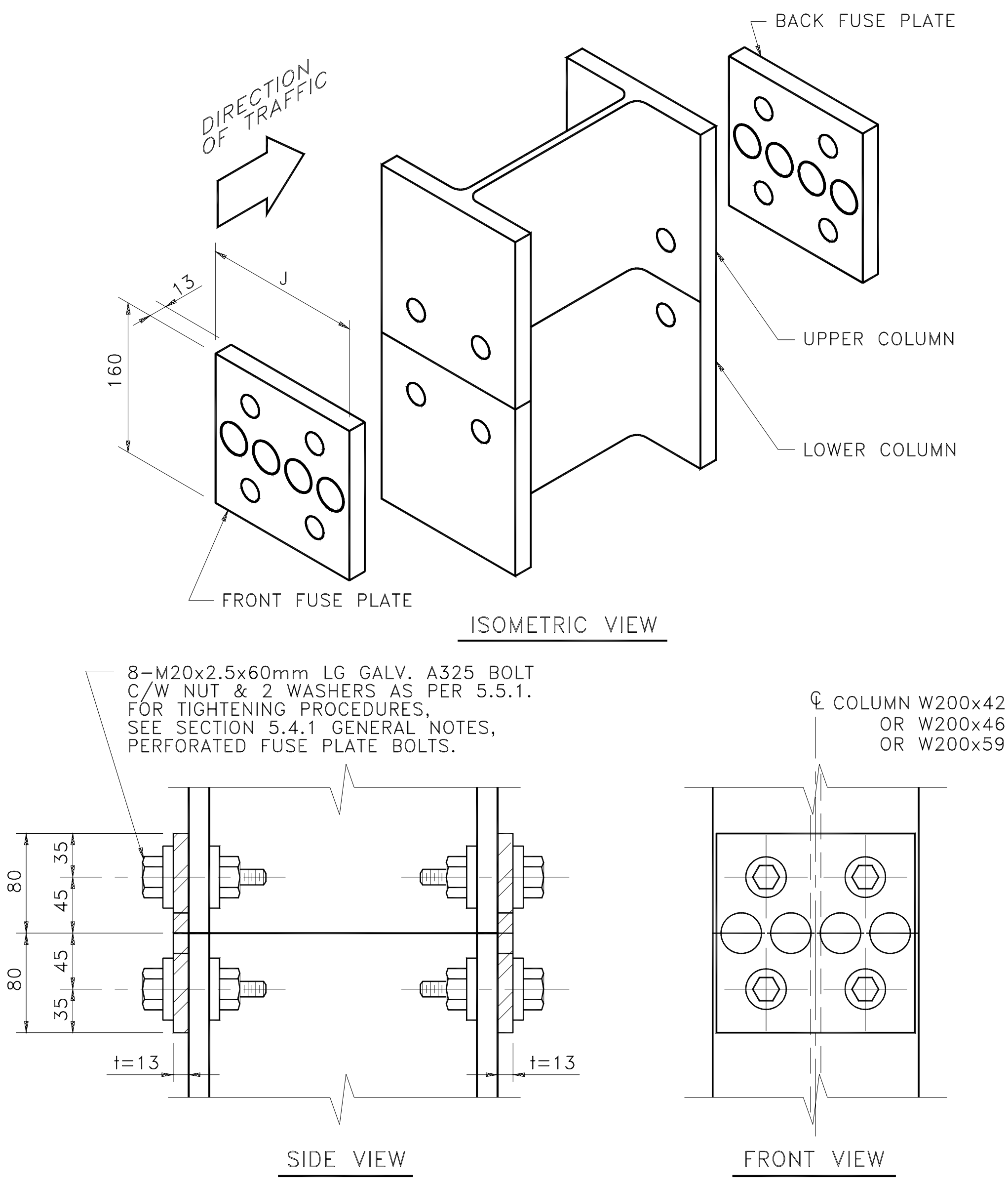


FIGURE 5.4.6 PERFORATED FUSE PLATE DETAILS

NOTE:
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".

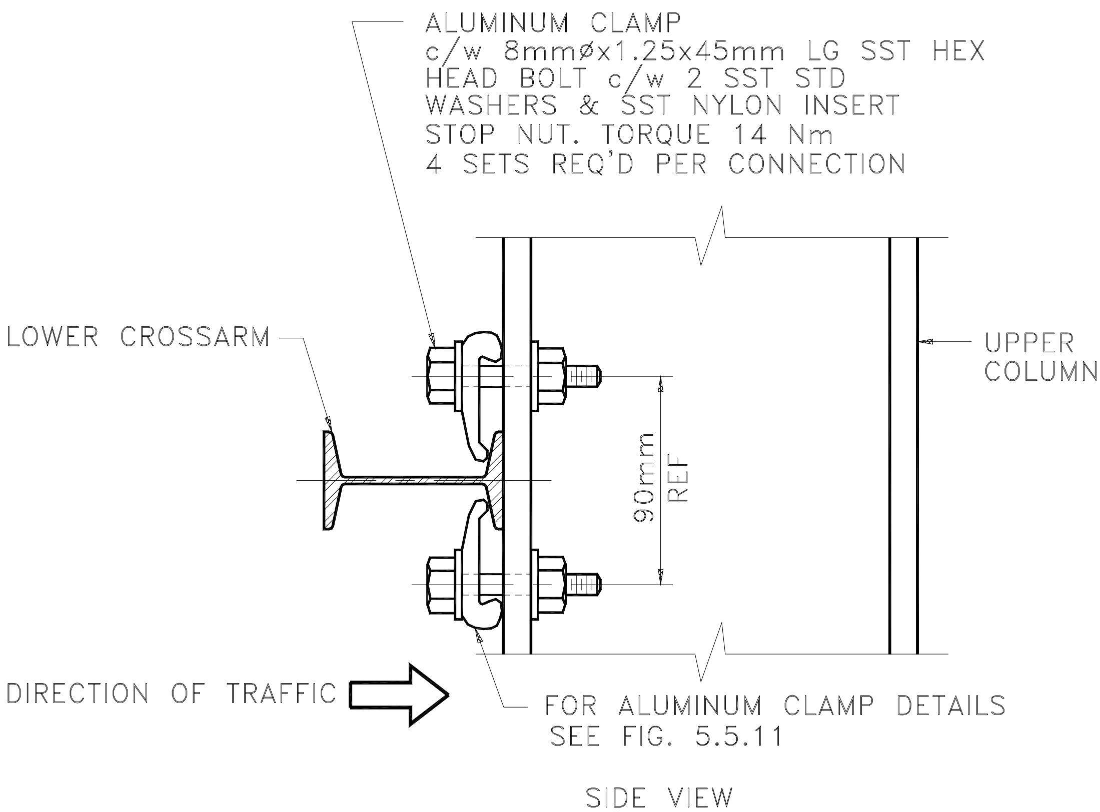


FIGURE 5.4.7 LOWER CROSSARM CONNECTION

5.5 FABRICATION

5.5.1 GENERAL

(i) All structural steel shall conform to CSA Standard CAN3-G40.21 M92 Grade 300W.

(ii) All bolts, nuts and washers, except lower crossarm connections (which are SST) shall conform to ASTM A325 and be galvanized in accordance with CSA Specification G164-M92.

(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 galvanized after fabrication in accordance with CSA Specification G164-M92.

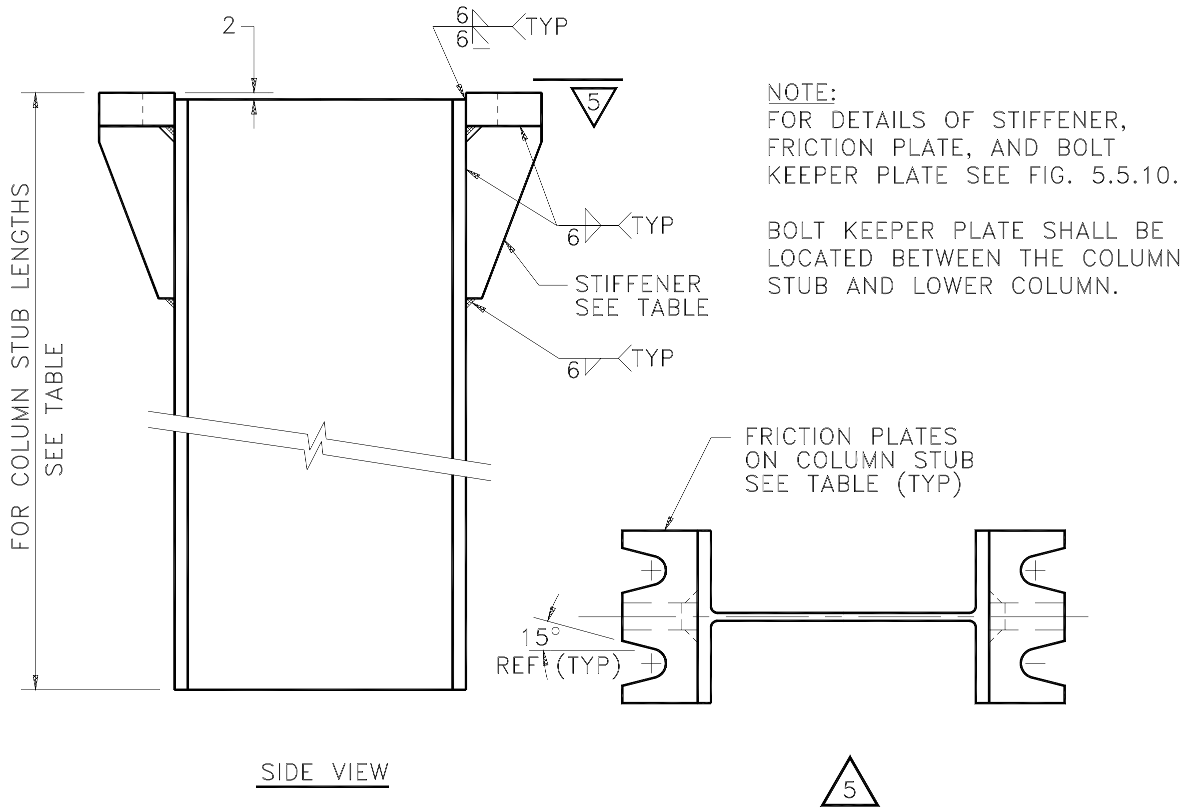
(v) All welding shall be in accordance with CSA Standard W59.

(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”.

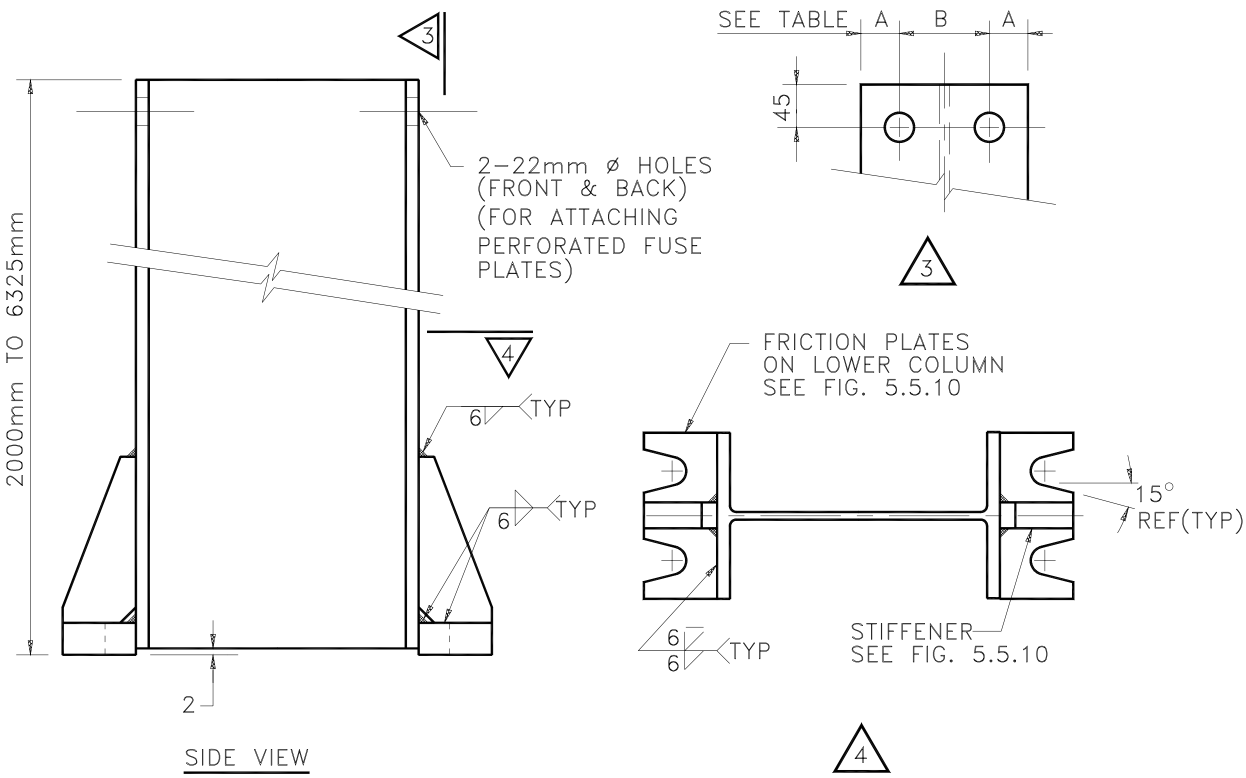


Note that friction plates shall be fabricated perpendicular to the longitudinal axis of the column.

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

<u>FIGURE 5.5.2 COLUMN STUB DETAILS</u>

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

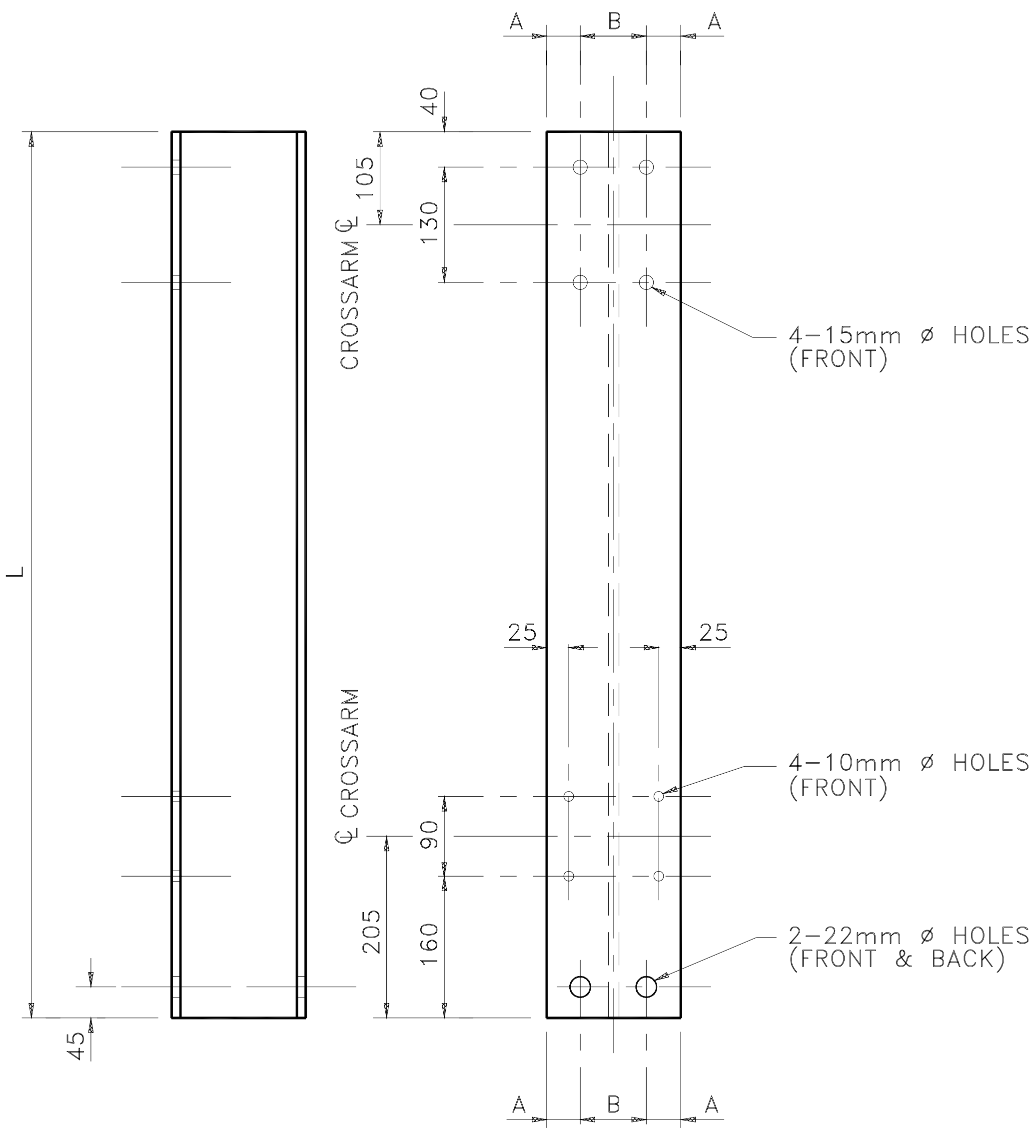
FIGURE 5.5.3 LOWER COLUMN DETAILS

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.

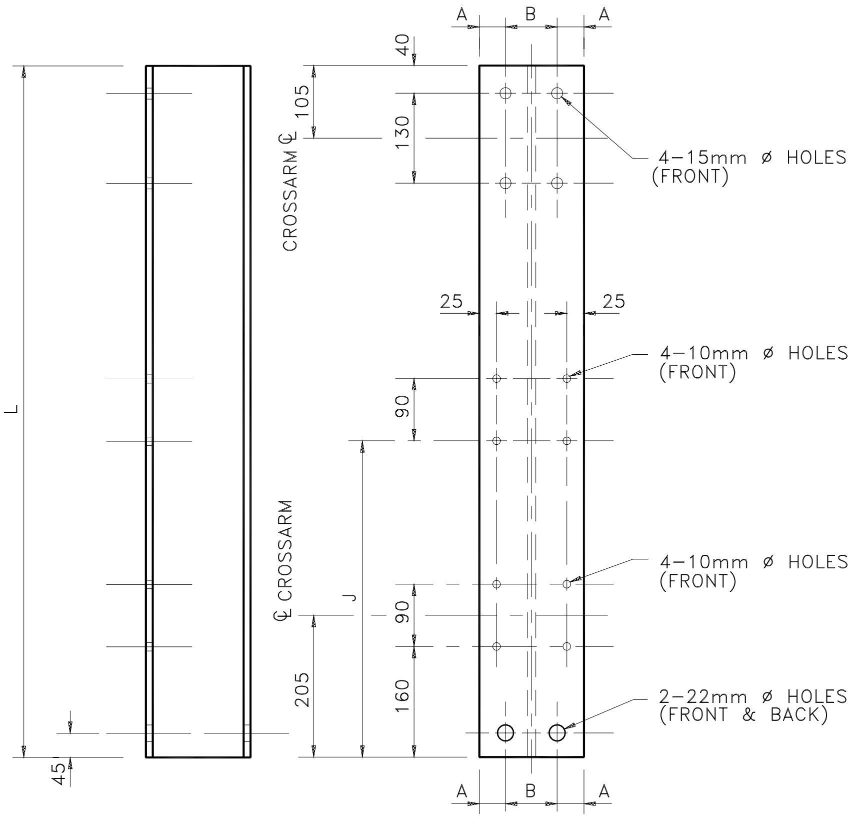
5.5.4 UPPER COLUMN (BREAKAWAY TYPE)

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



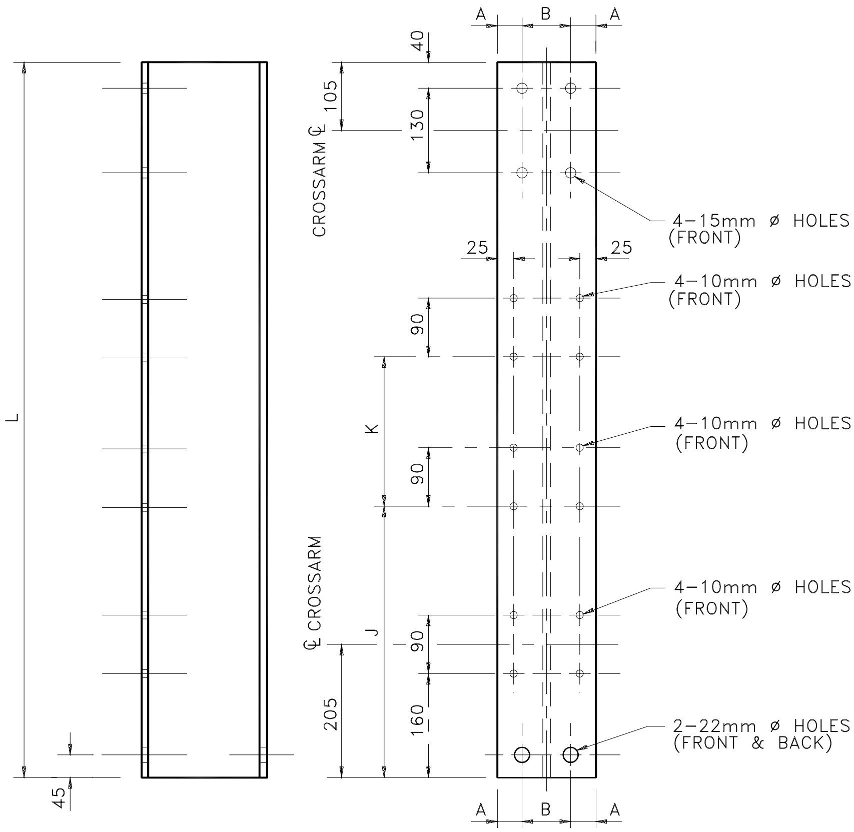
COLUMN SIZE	L (mm)	A (mm)	B (mm)
W200X42	1050	43	80
W200X42	1150	43	80
W200X42	1300	43	80
W200X46	1150	52	100
W200X46	1300	52	100
W200X59	1300	53	100

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)

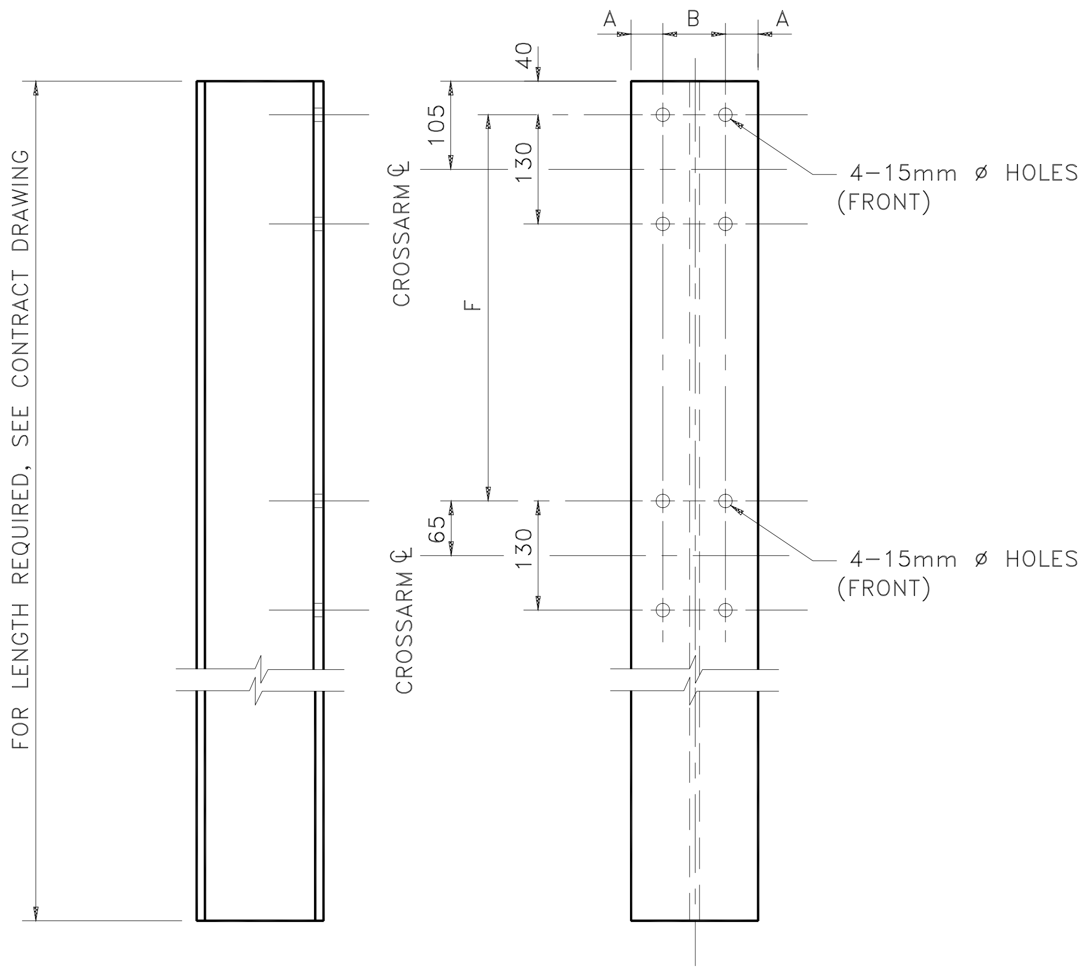


COLUMN SIZE	L (mm)	J (mm)	K (mm)	A (mm)	B (mm)
W200X42	2110	760	600	43	80
	2260	810	650		
	2410	860	700		
	2560	910	750		
	2710	960	800		
W200X46	2110	760	600	52	100
	2260	810	650		
	2410	860	700		
	2560	910	750		
	2710	960	800		
W200X59	2110	760	600	53	100
	2260	810	650		
	2410	860	700		
	2560	910	750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

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

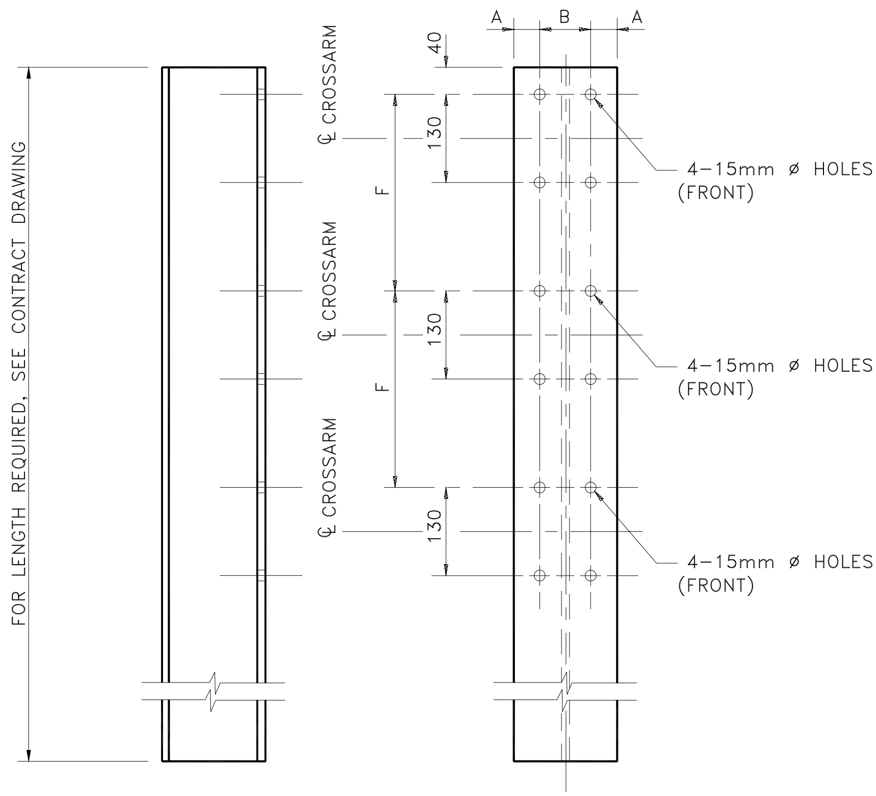
5.5.5 COLUMN (NON-BREAKAWAY TYPE)

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



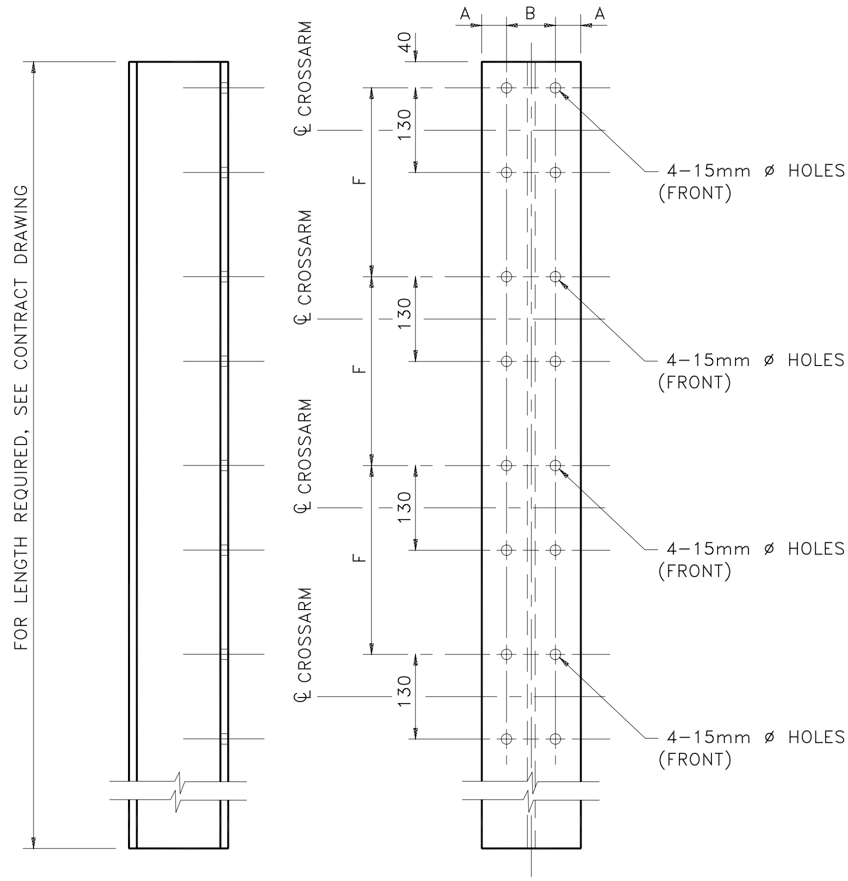
COLUMN SIZE	F (mm)	A (mm)	B (mm)
W200X42	740	43	80
	840		
	990		
W200X46	840	52	100
	990		
W200X59	840	53	100
	990		

<u>FIGURE 5.5.5 (a) COLUMN DETAILS (2 CROSSARMS)</u>
(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)

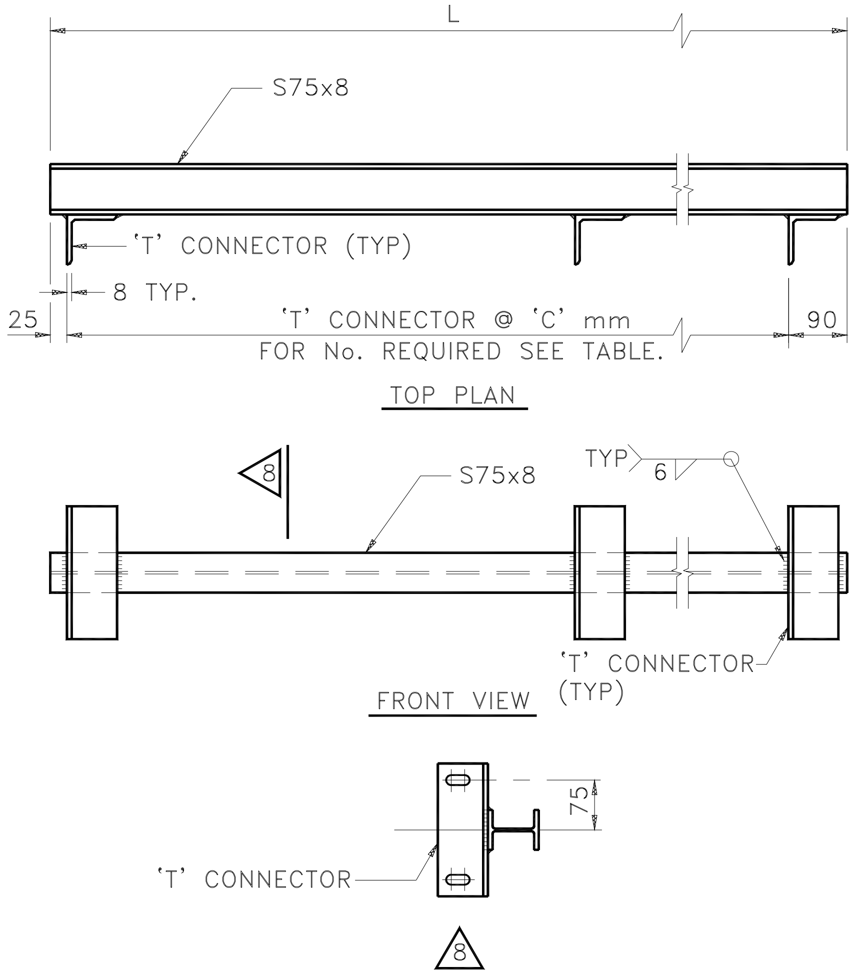


COLUMN SIZE	F (mm)	A (mm)	B (mm)
W200X42	600	43	80
	650		
	700		
	750		
	800		
W200X46	600	52	100
	650		
	700		
	750		
	800		
W200X59	600	53	100
	650		
	700		
	750		
	800		

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

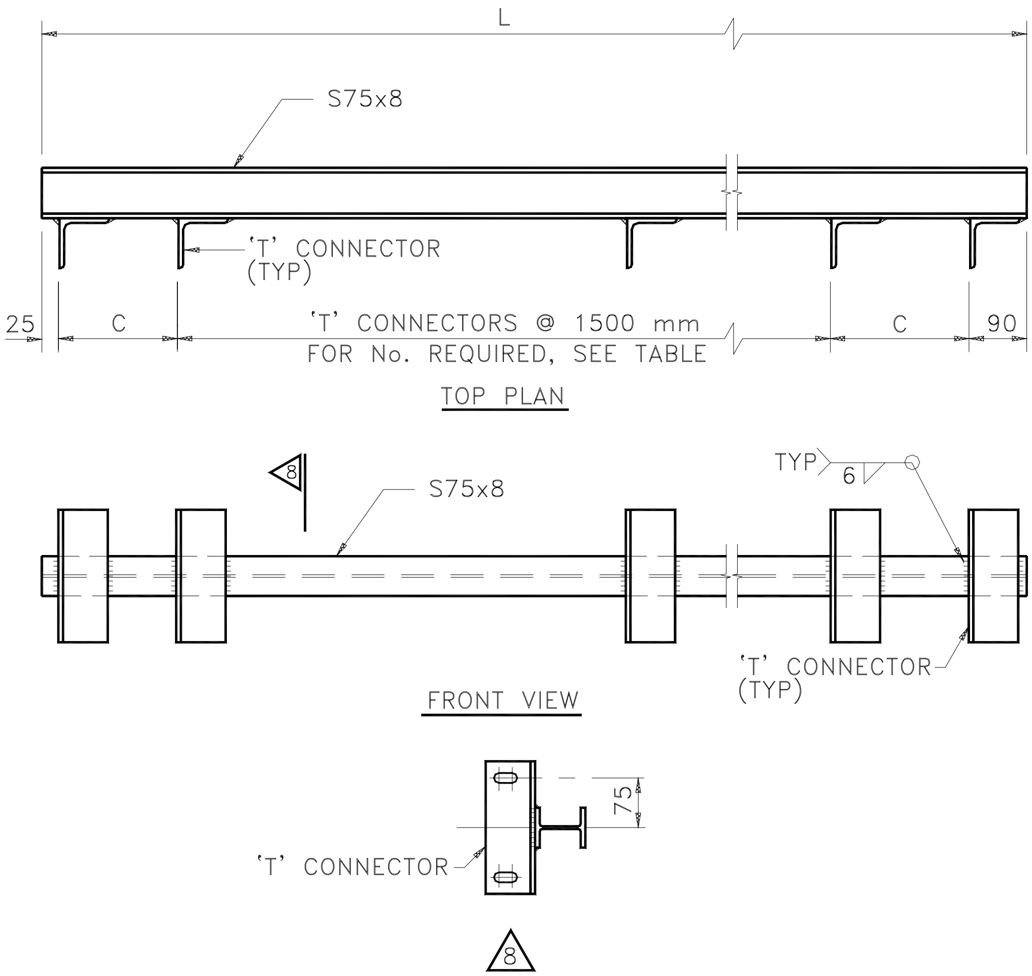
5.5.6 LOWER CROSSARM (BREAKAWAY TYPE)

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

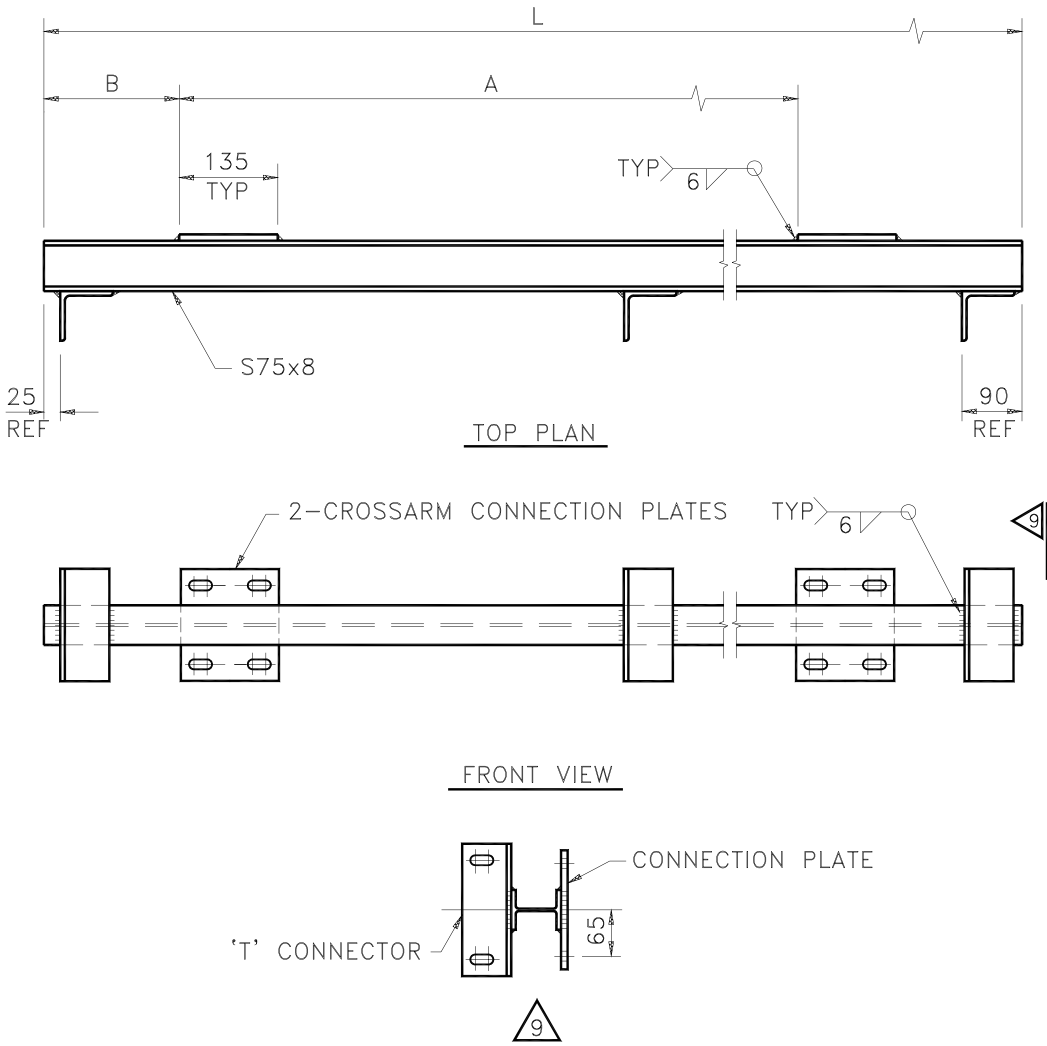


NO. OF T CONNECTORS REQ'D	L (mm)	C (mm)
4	2915	650
5	3915	400
6	5315	350
7	6915	400
8	7715	800

FIGURE 5.5.6 (b) LOWER CROSSARM DETAILS - EXTENDED TYPE

5.5.7 TOP CROSSARM OR CROSSARM

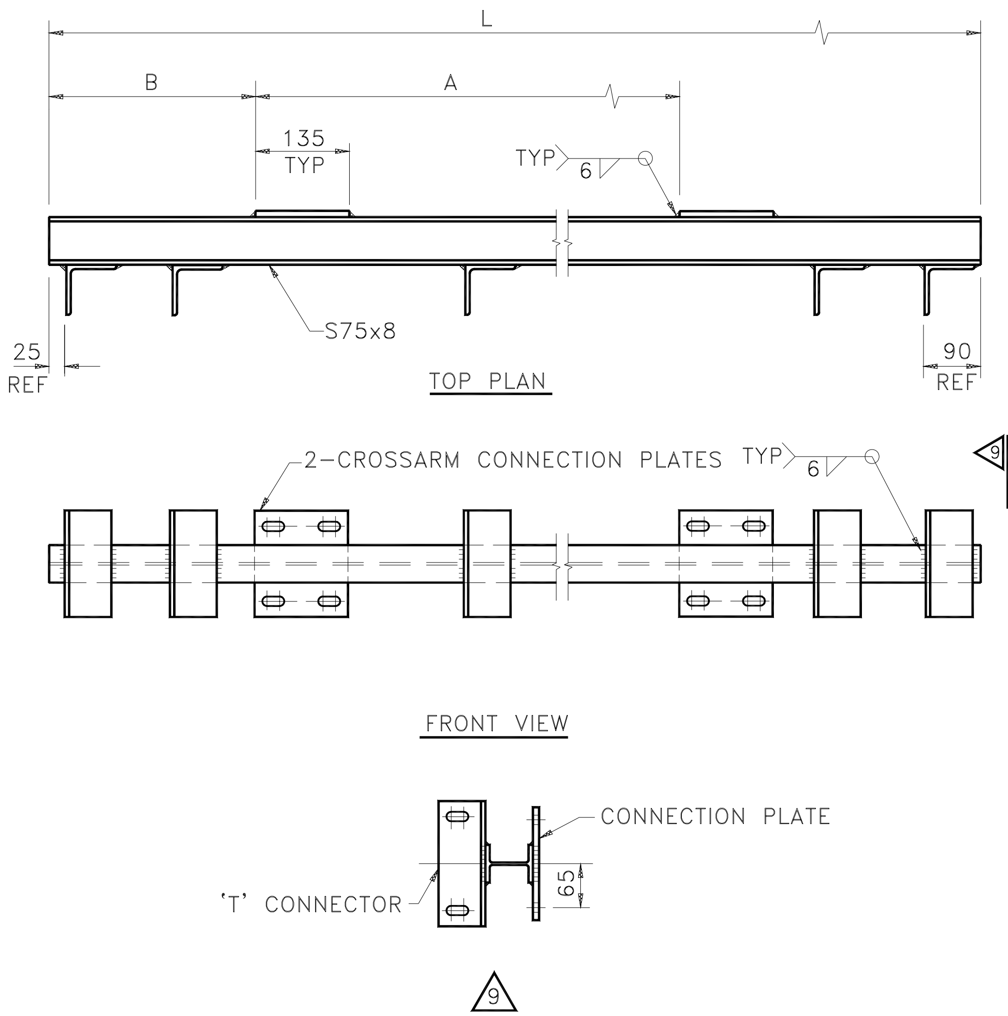
Figures 5.5.7(a) to 5.5.7(e) provide all information necessary for the fabrication of the "Top Crossarm" for breakaway type or "Crossarm" for non-breakaway type.



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)

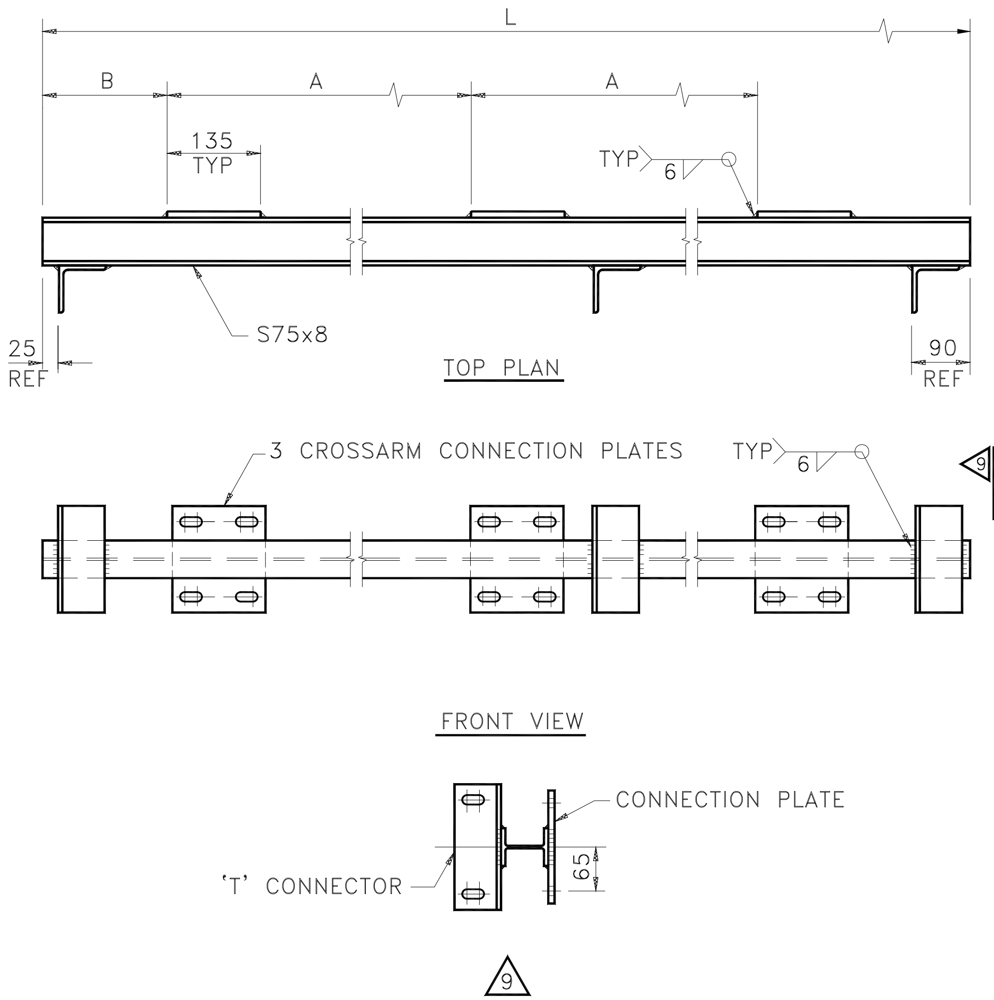
- For 2 – Column Sign Supports (ie. Type 2-2 and 2-3)
- A = Column Spacing
- L = [Sign Width – 2H + 115]
- B = [Sign Horizontal Overhang – (H-20) – 135/2]
- H = Lateral sign overhang beyond end T-Connection



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

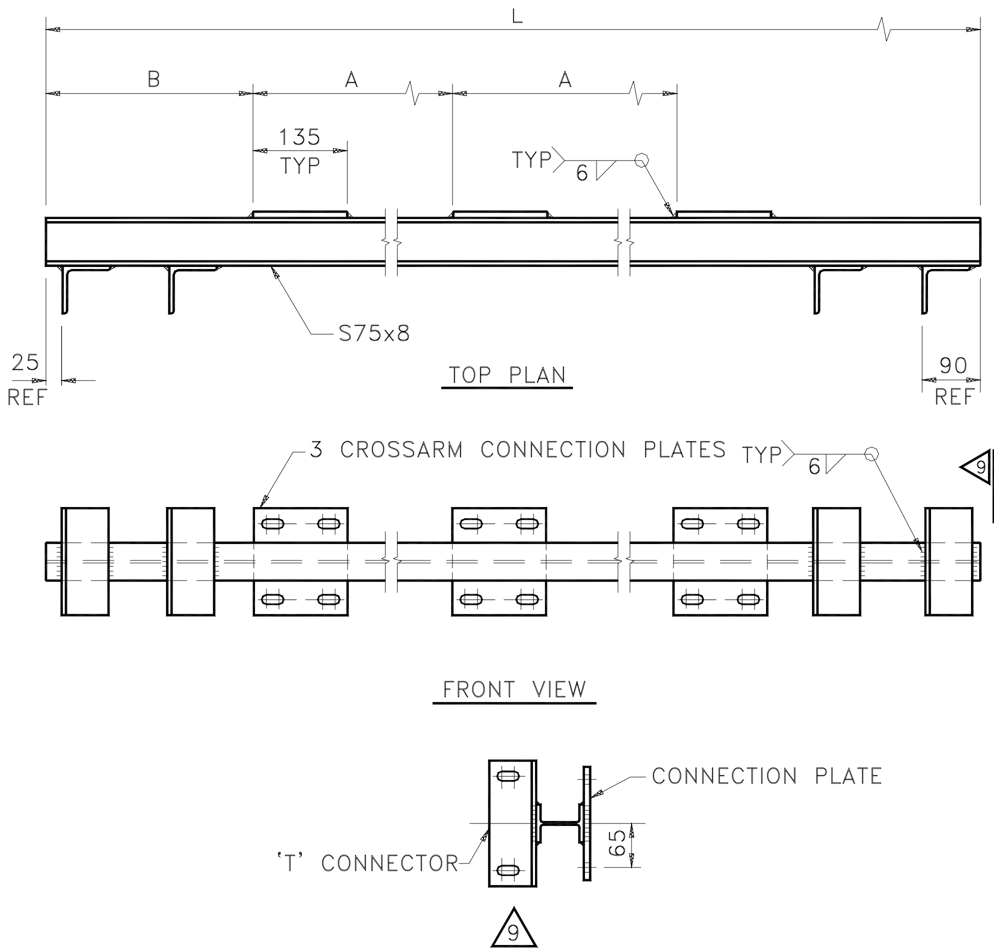


A (mm)	L (mm)	B (mm)
2400	6115	550
2700	6115	250

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

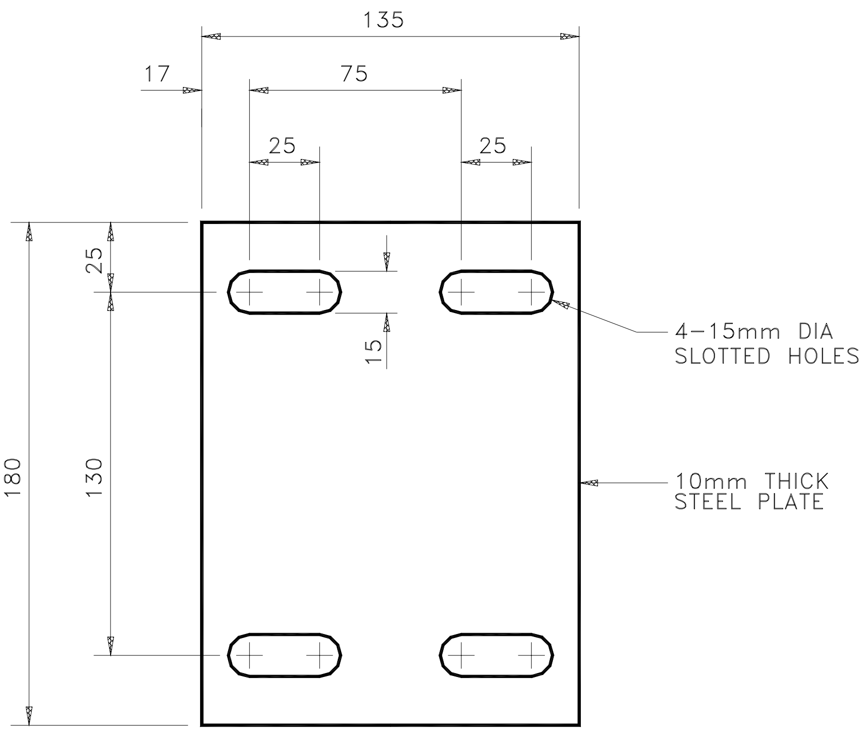


FIGURE 5.5.7 (e) CROSSARM CONNECTION PLATE DETAILS

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).

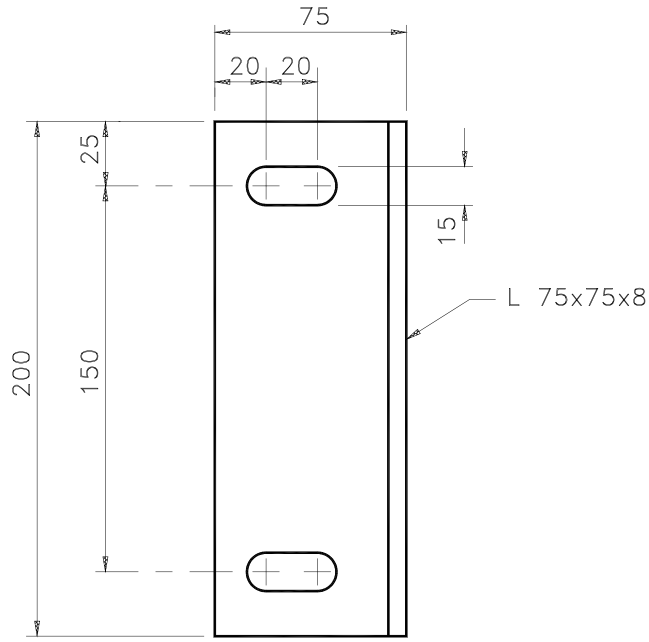
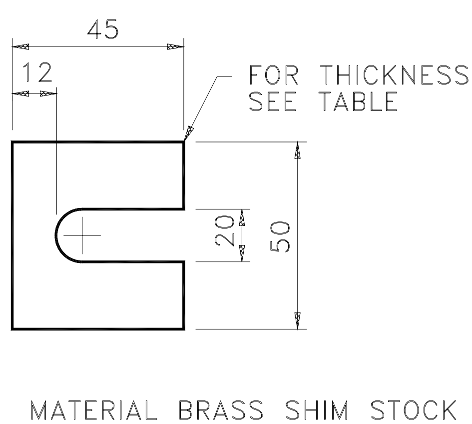


FIGURE 5.5.8(a) T-CONNECTOR

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



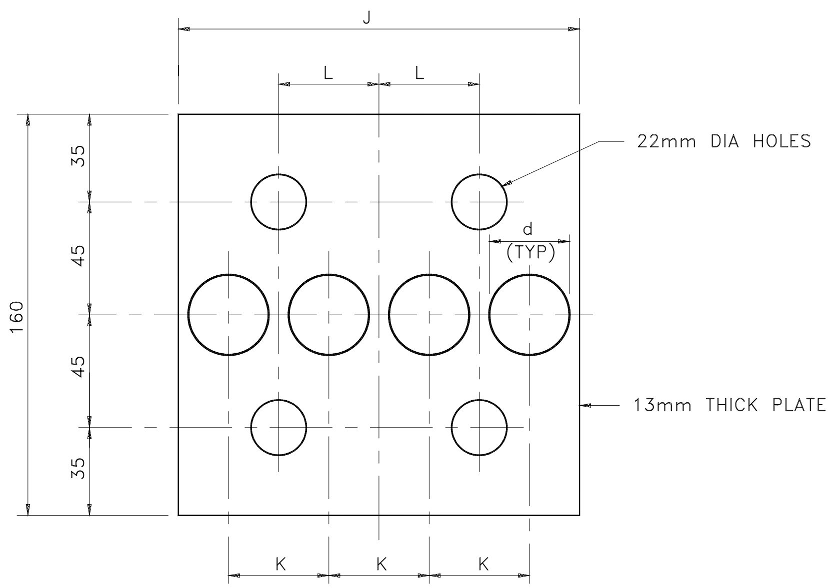
THICKNESS
0.305mm
0.813mm

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.

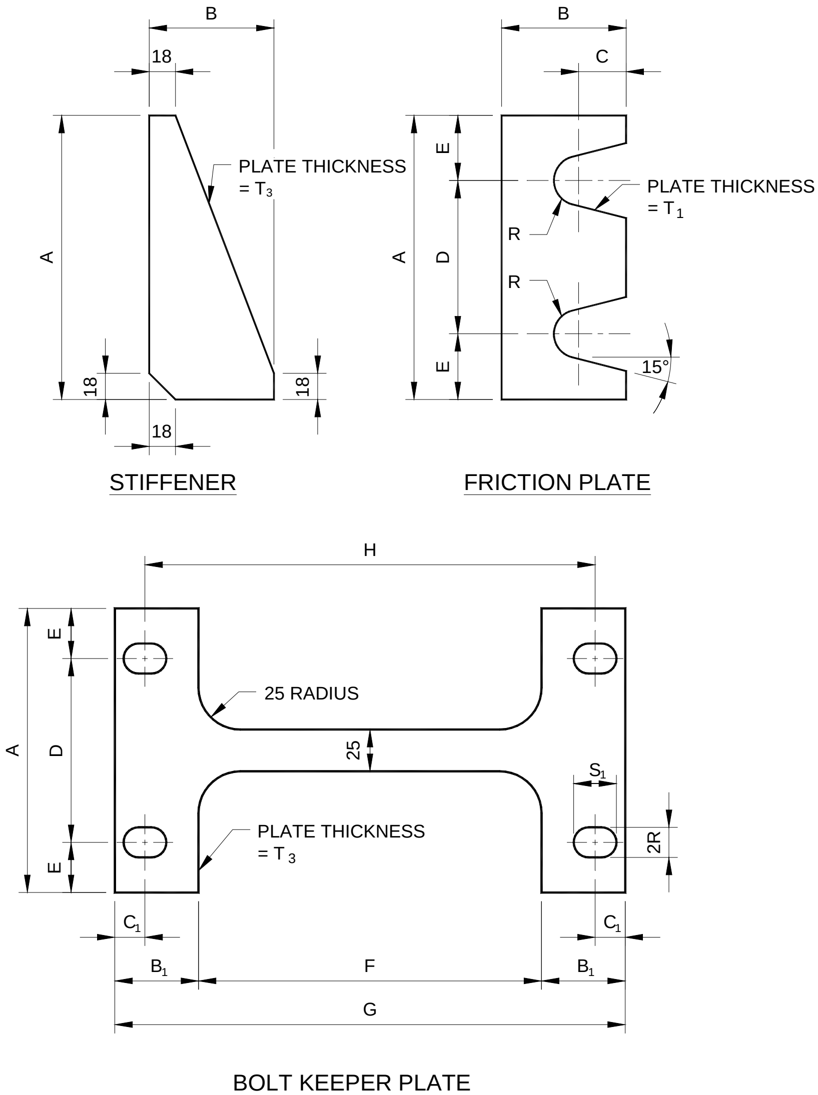


<table>
<tr><th></th><th>J</th><th>K</th><th>L</th><th>d</th></tr>
<tr><td>W200x42</td><td>160</td><td>40</td><td>40</td><td>32</td></tr>
<tr><td>W200x46</td><td rowspan="2">200</td><td rowspan="2">50</td><td rowspan="2">50</td><td rowspan="2">42</td></tr>
<tr><td>W200x59</td></tr>
</table>

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.)

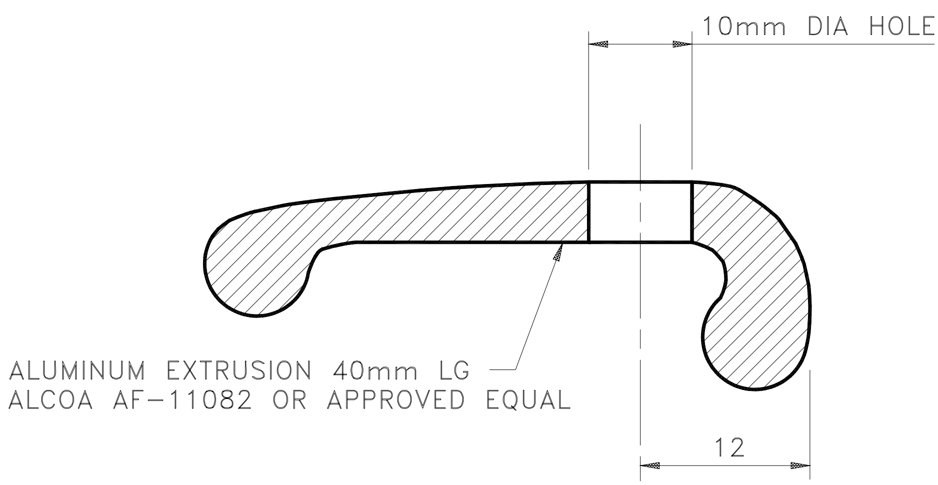


FIGURE 5.5.11 CLAMP DETAILS

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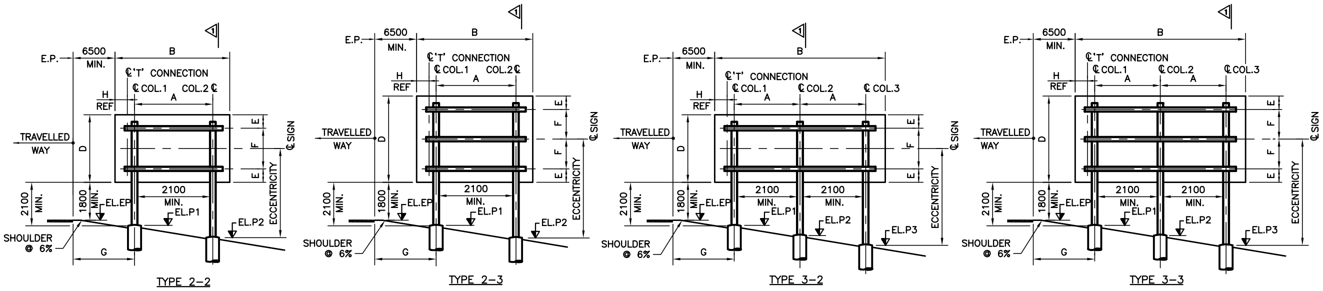
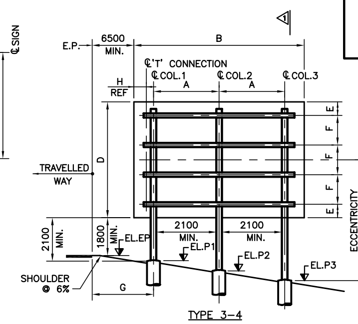
METRIC
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

DIST		SHEET
CONT		
WP		

STEEL COLUMN BREAKAWAY SIGN SUPPORTS





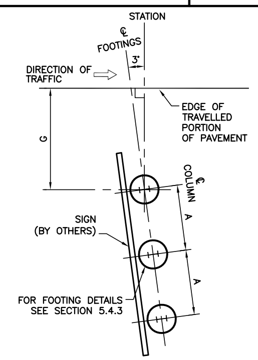
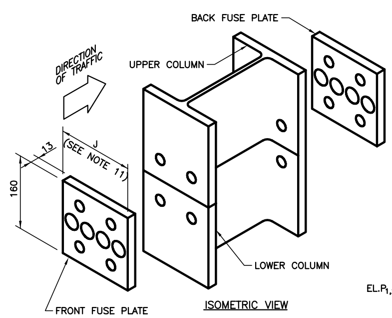
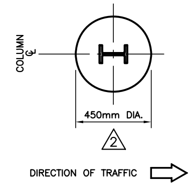


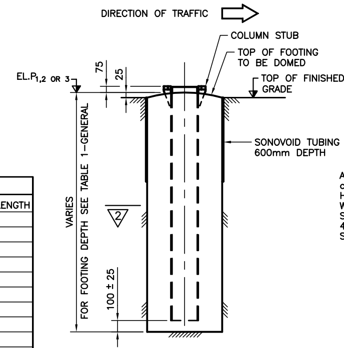
TABLE 1 – GENERAL

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)					



PERFORATED FUSE PLATE CONNECTION





FOOTING DETAILS

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										

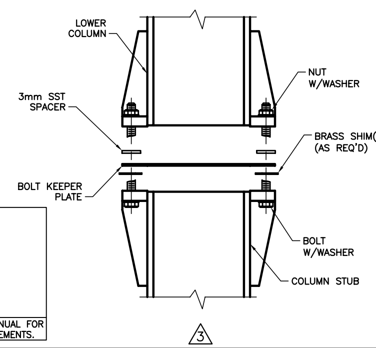
TABLE 3 – HARDWARE (ASTM A325 GALV)

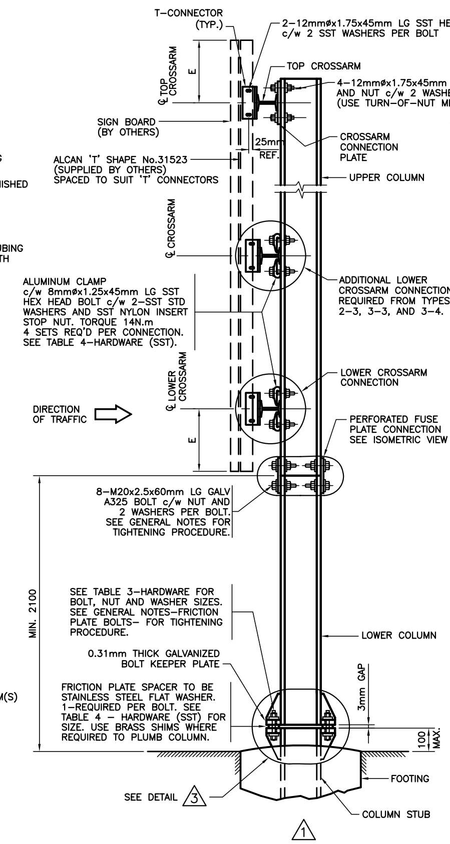
STATION										
DESCRIPTION	SIZE	QUANT.	SIZE	QUANT.	SIZE	QUANT.	SIZE	QUANT.	SIZE	QUANT.
TOP CROSSARM BOLTS	12mmx1.75x45mmLG		12mmx1.75x45mmLG		12mmx1.75x45mmLG		12mmx1.75x45mmLG		12mmx1.75x45mmLG	
FUSE PLATE BOLTS	M20x60mmLG		M20x60mmLG		M20x60mmLG		M20x60mmLG		M20x60mmLG	
FRICTION PLATE BOLTS				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

TABLE 4 – HARDWARE (SST)

STATION	QUANT.	QUANT.	QUANT.	QUANT.	QUANT.	DESCRIPTION
LOWER CROSSARM CONNECTION						8mmøx1.25x45mm LG THREADED LENGTH 25mm SST HEX. HD. BOLT
						8mmø SST STD FLAT WASHER
						8mmøx1.25 SST NYLON INSERT STOP NUT
FRICTION ℞ SPACER						SST 37 O.D.x21 I.D.x3mm THK
T-CONNECTOR TO 'T' SHAPE CONNECTION						12mmøx1.75x45mm 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 CSA STANDARD CAN3-G40.21-M92 GRADE 300W.
2. ALL BOLTS, NUTS AND WASHERS EXCEPT LOWER CROSSARM CONNECTIONS SHALL CONFORM TO ASTM A325 GALVANIZED IN ACCORDANCE WITH CSA SPECIFICATION G164-M92.
3. ALL STEEL SHALL BE GALVANIZED AFTER FABRICATION IN ACCORDANCE WITH CSA SPECIFICATION G164-M92.
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 JUNE 2004	SS118-30
STEEL COLUMN BREAKAWAY SIGN SUPPORTS	

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

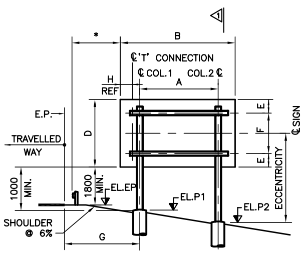
MINISTRY OF TRANSPORTATION, ONTARIO PR-D-707 88-05
DRAWING NAME: s118-30.dwg CREATED: 1994/03/23 MODIFIED: 2004/06/14 09:13:05

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

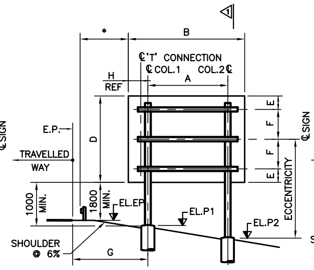
DIST	
CONT	
WP	SHEET

STEEL COLUMN
NON-BREAKAWAY SIGN SUPPORTS

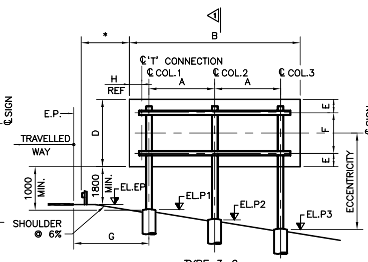
* – DIMENSION VAIRES, AND SHALL BE ACCORDING TO THE REQUIREMENTS OF THE ROADSIDE SAFETY MANUAL.



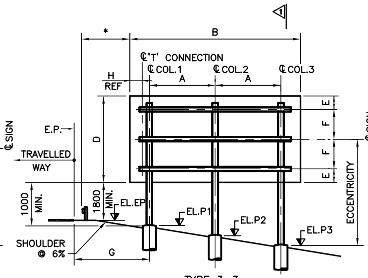
TYPE 2–2



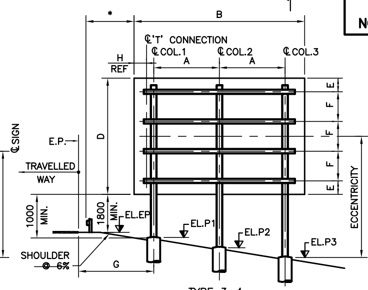
TYPE 2–3



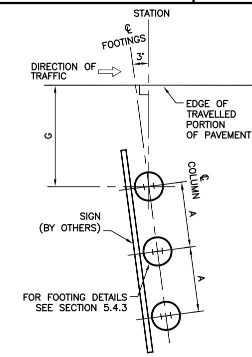
TYPE 3–2



TYPE 3–3



TYPE 3–4



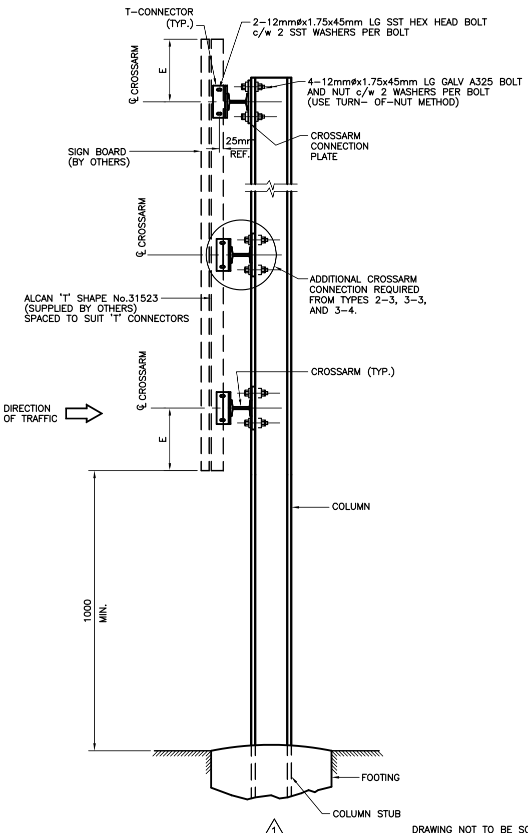
TYPICAL LAYOUT PLAN

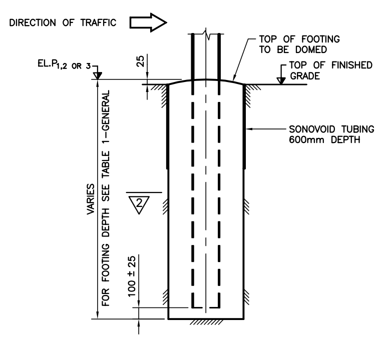
TABLE 1 – GENERAL

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)					

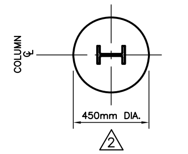
TABLE 2 – COMPONENTS/PARTS

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 CSA STANDARD CAN3–G40.21–M92 GRADE 300W, GALVANIZED IN ACCORDANCE WITH CSA SPECIFICATION G164–M92.
2 ALL BOLTS, NUTS AND WASHERS FOR CROSSARM CONNECTIONS SHALL CONFORM TO ASTM A325 GALVANIZED IN ACCORDANCE WITH CSA SPECIFICATION G164–M92.
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 JUNE 2004 — 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

SIGN SUPPORT MANUAL

DIVISION 6 – TIMBER SIGN SUPPORTS

March 2006

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 (2.88m^2 to 16.2m^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 (2.98m^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.

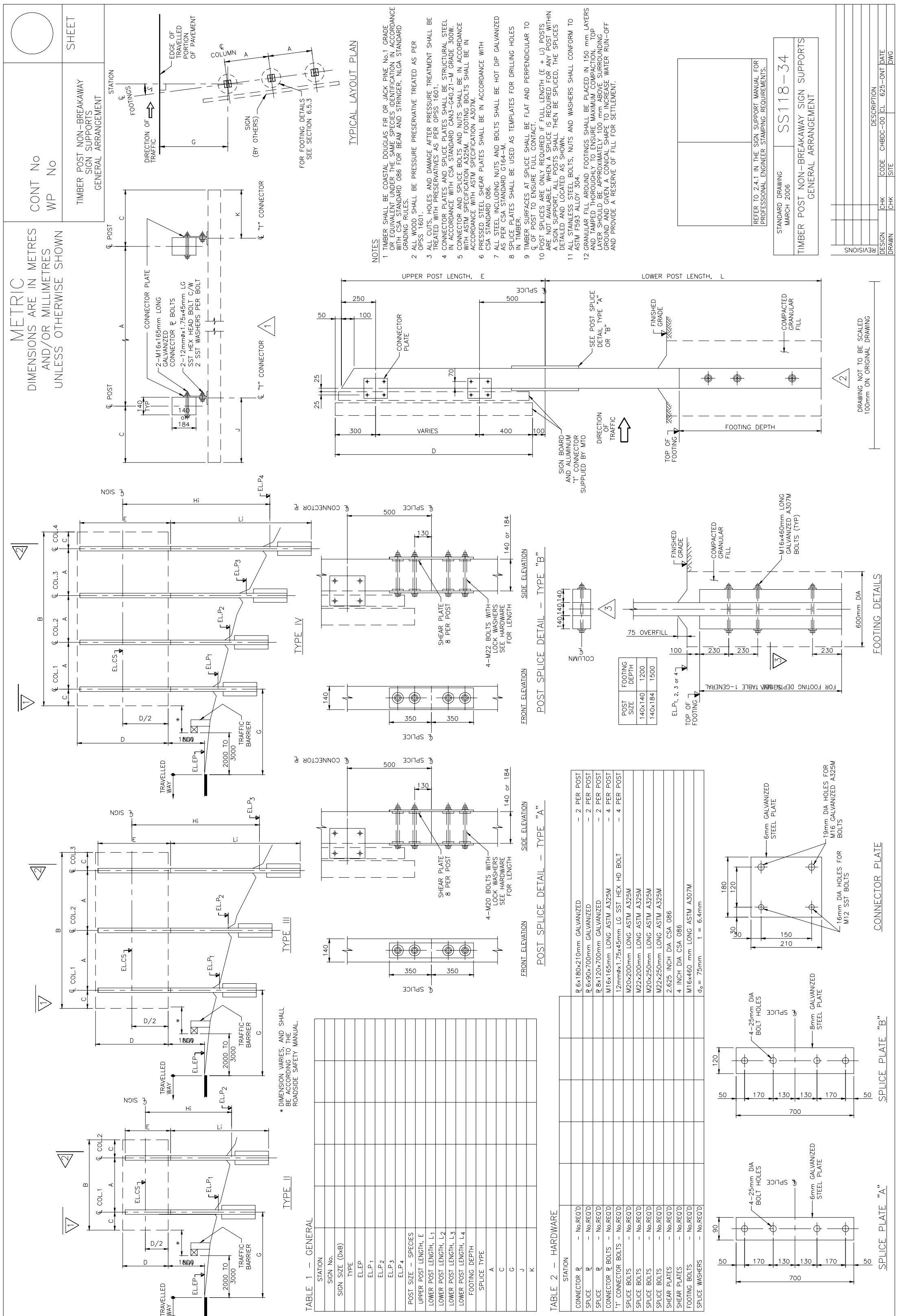


Figure 6.1.2(a) DETAILS OF NON-BREAKAWAY TYPE

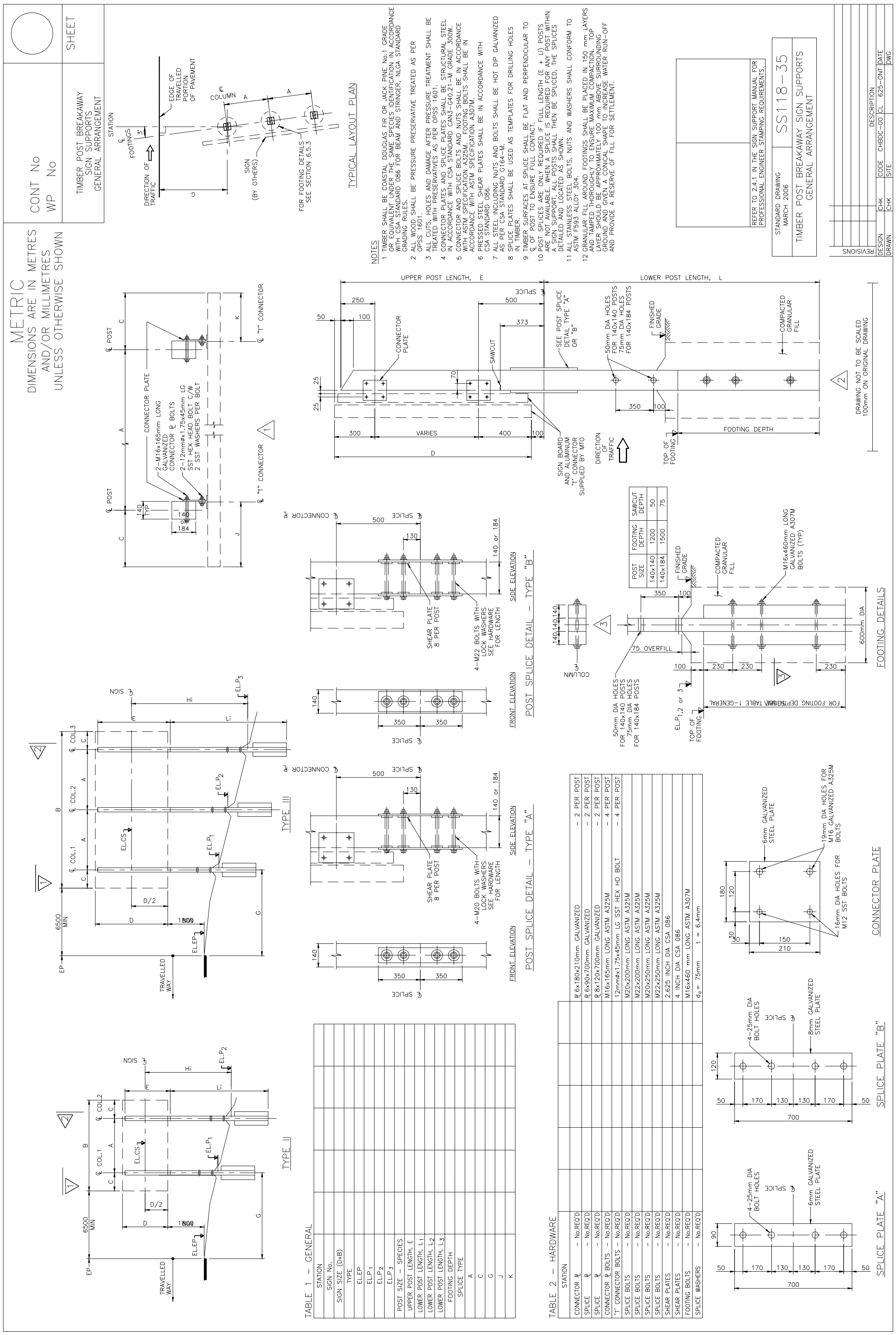


Figure 6.1.2(b) DETAILS OF BREAKAWAY TYPE

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
(mm)</th><th colspan="13">SIGN WIDTH, B (mm)</th></tr>
<tr><th>2400</th><th>2700</th><th>3000</th><th>3300</th><th>3600</th><th>3900</th><th>4200</th><th>4500</th><th>4800</th><th>5100</th><th>5400</th><th>5700</th><th>6000</th></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
(mm)</th><th colspan="13">SIGN WIDTH, B (mm)</th></tr>
<tr><th>2400</th><th>2700</th><th>3000</th><th>3300</th><th>3600</th><th>3900</th><th>4200</th><th>4500</th><th>4800</th><th>5100</th><th>5400</th><th>5700</th><th>6000</th></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)

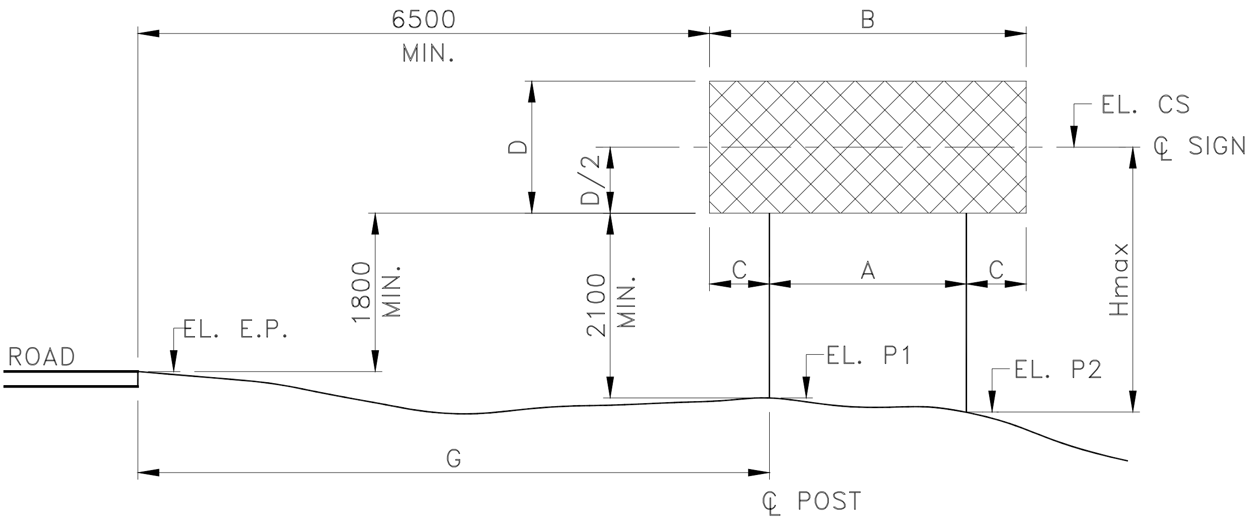


FIGURE 6.3.1 FOOTING LAYOUT
BREAKAWAY TIMBER POST SIGN SUPPORT

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.

<u>EXAMPLE 1</u> 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.

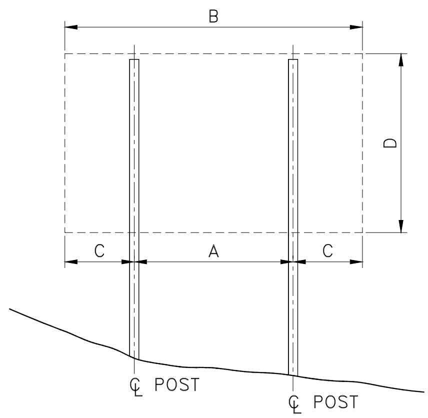


FIGURE 6.4.1(a) TYPE II SIGN SUPPORT

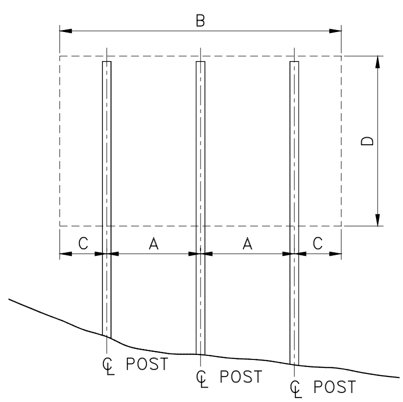


FIGURE 6.4.1(b) TYPE III SIGN SUPPORT

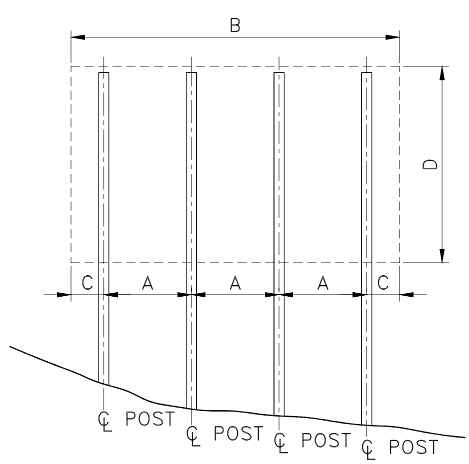
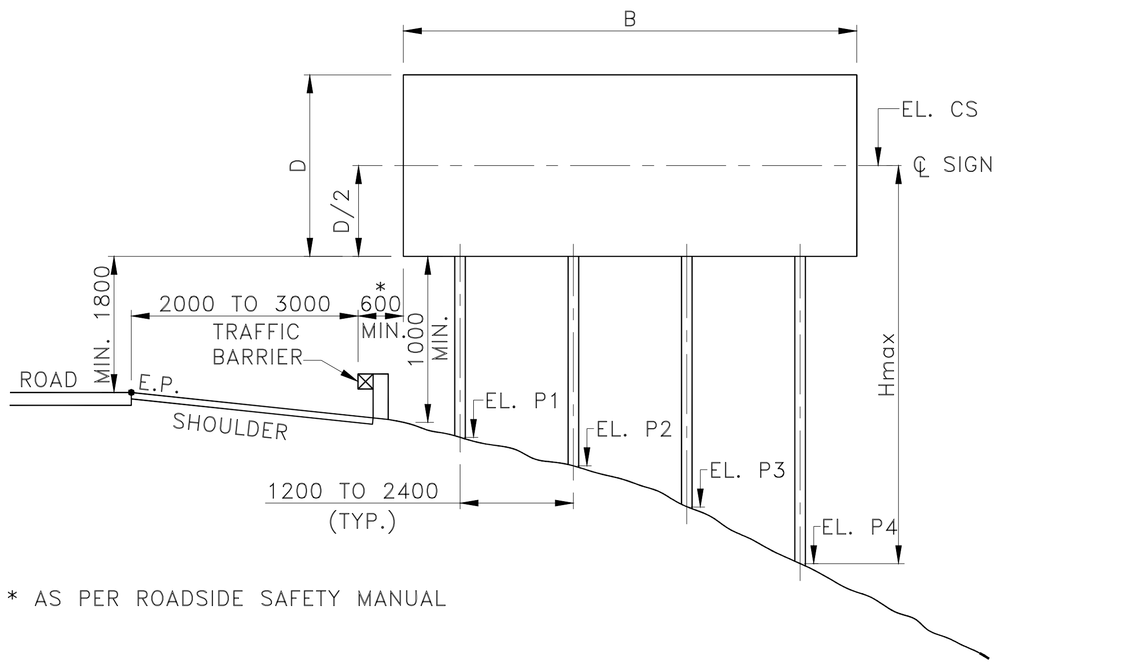
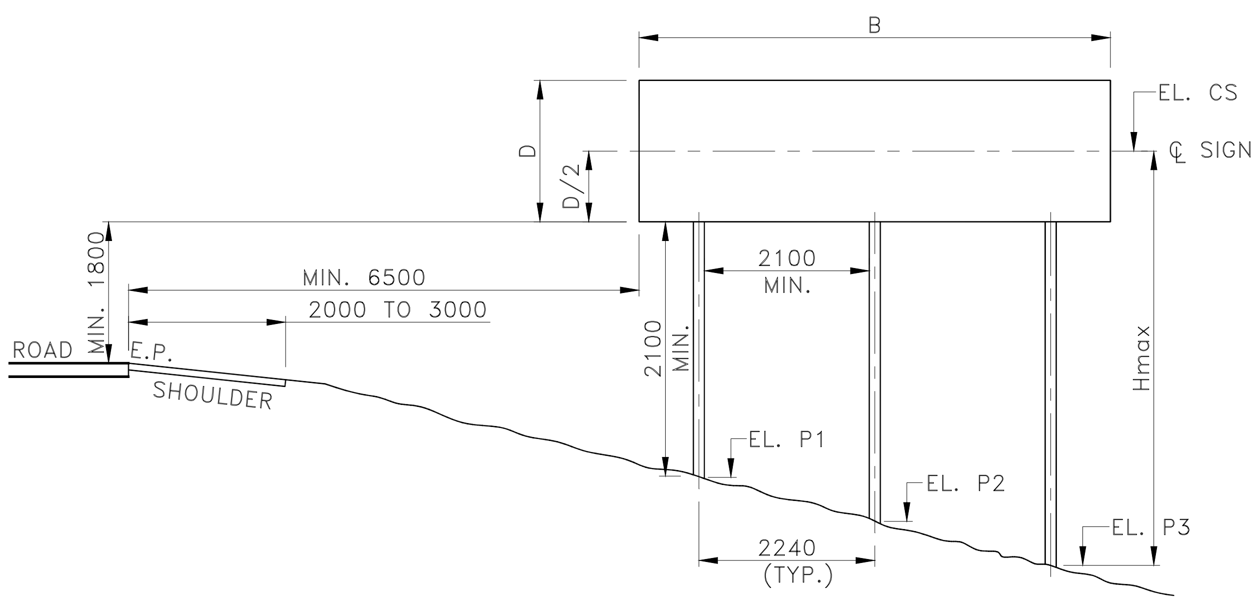


FIGURE 6.4.1(c) TYPE IV SIGN SUPPORT



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

<u>FIGURE 6.4.1(d)</u>
<u>NON-BREAKAWAY TIMBER POST SIGN SUPPORTS</u>



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

<u>FIGURE 6.4.1(e)</u>
<u>BREAKAWAY TIMBER POST SIGN SUPPORTS</u>

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
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**				**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	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**				**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	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 CSA Standard CAN3-G40.21-M Grade 300W.

(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 in accordance with CSA Standard G164-M.

(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.

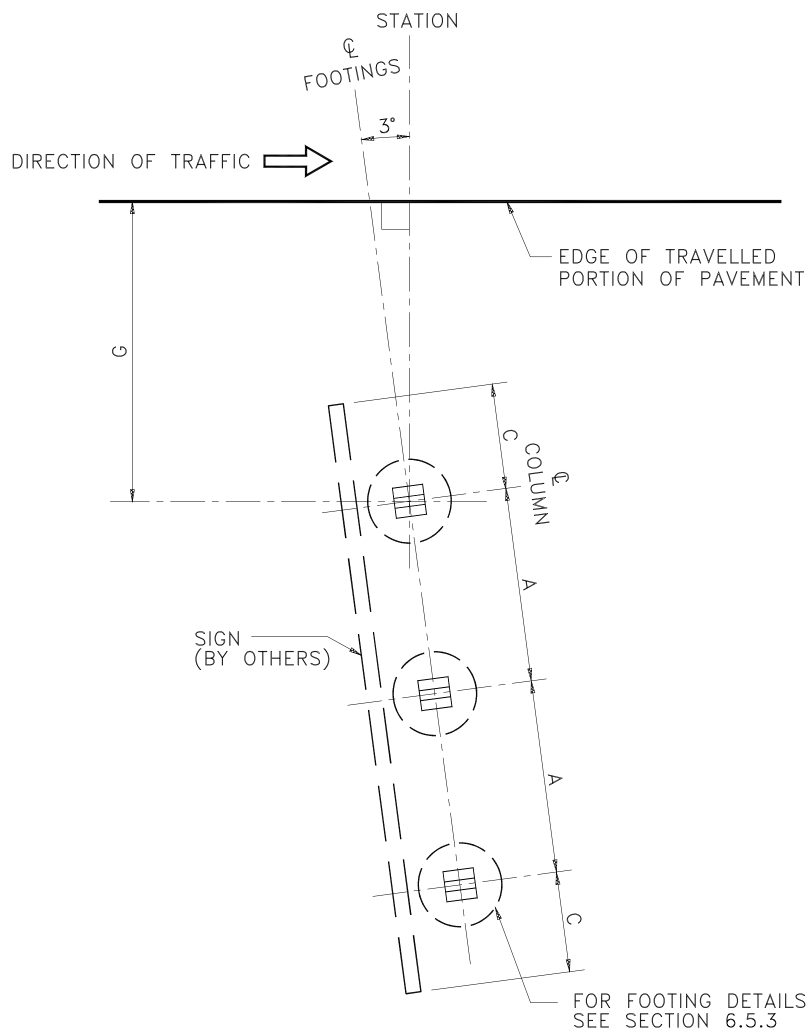
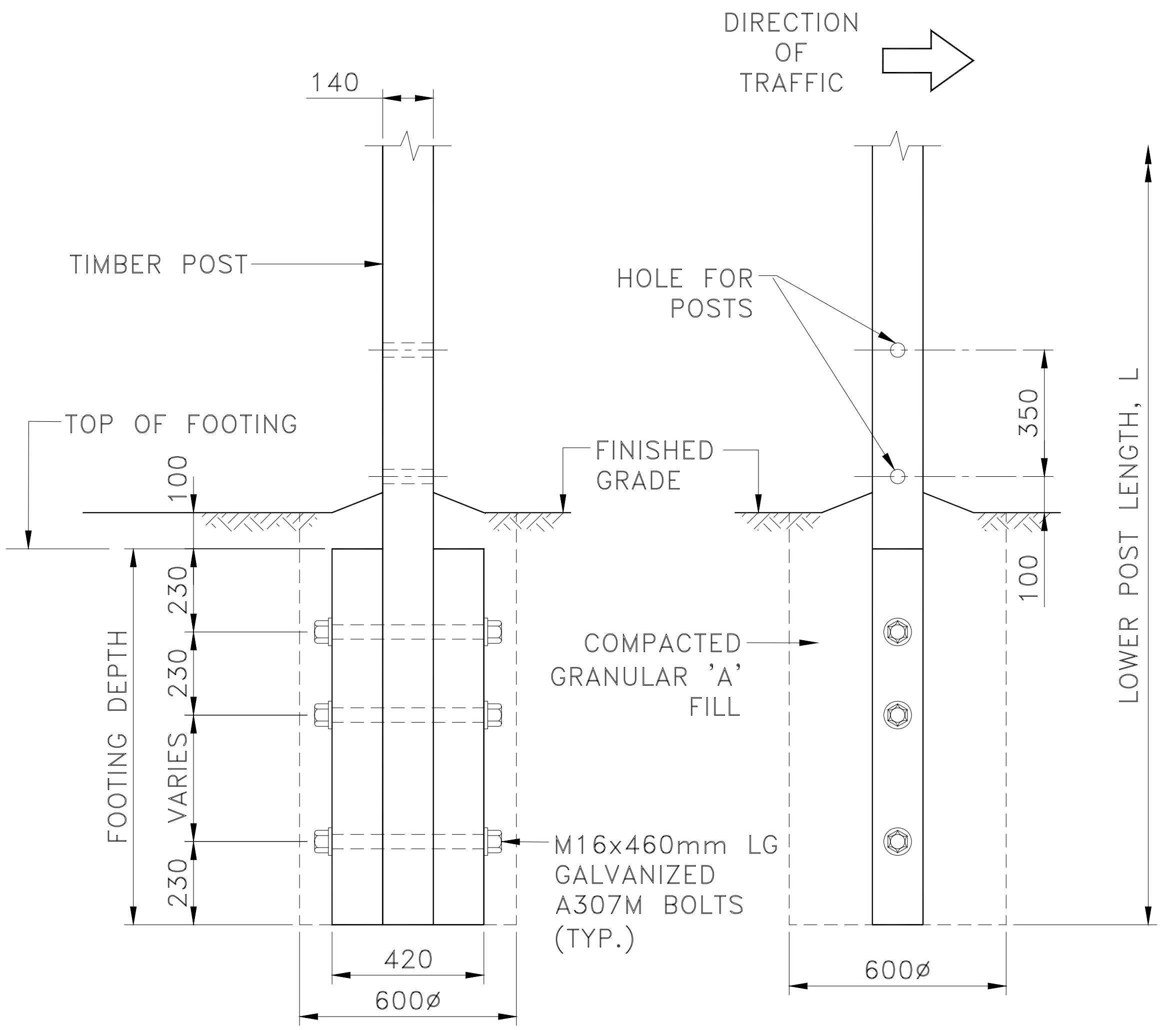


FIGURE 6.5.2 TYPICAL LAYOUT PLAN

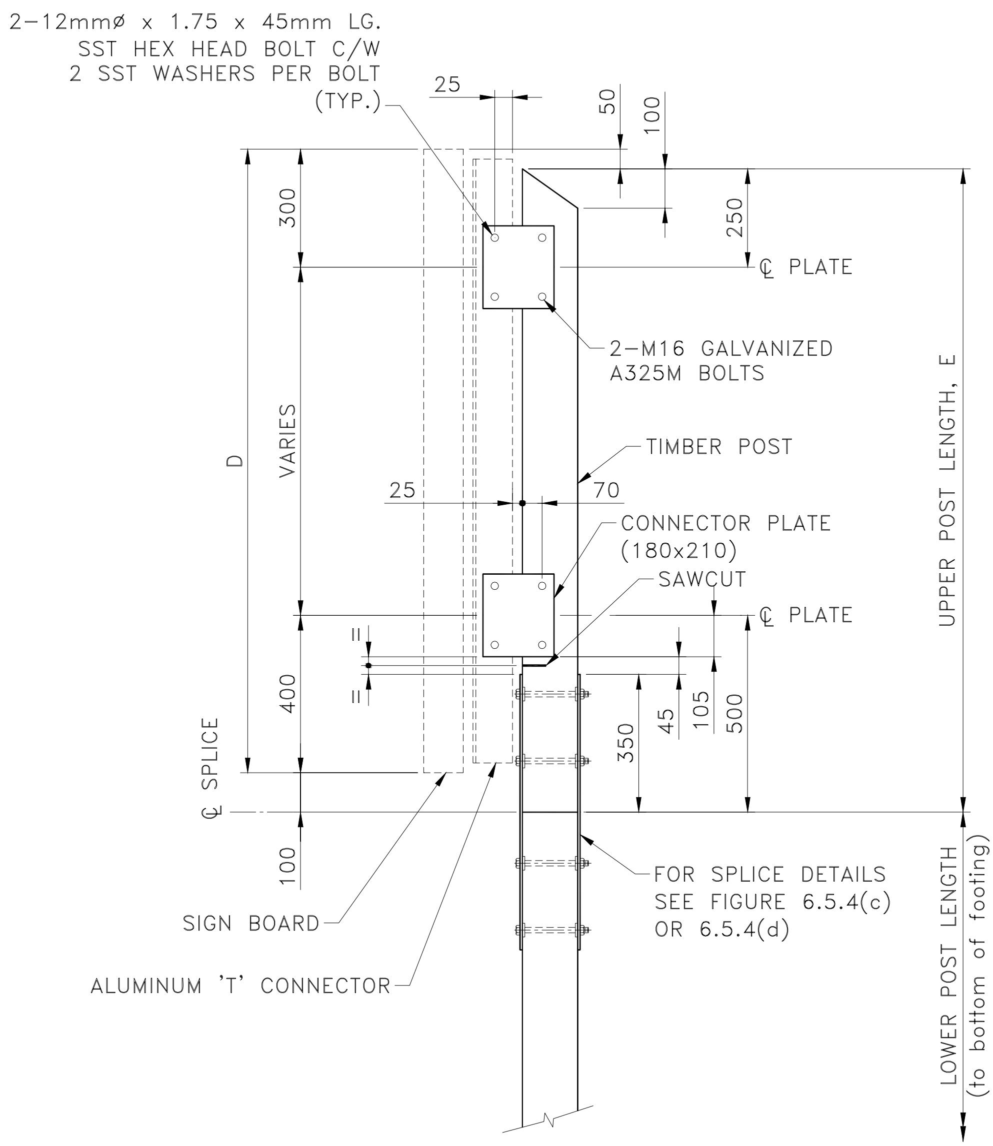
6.5.3 FOOTING



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

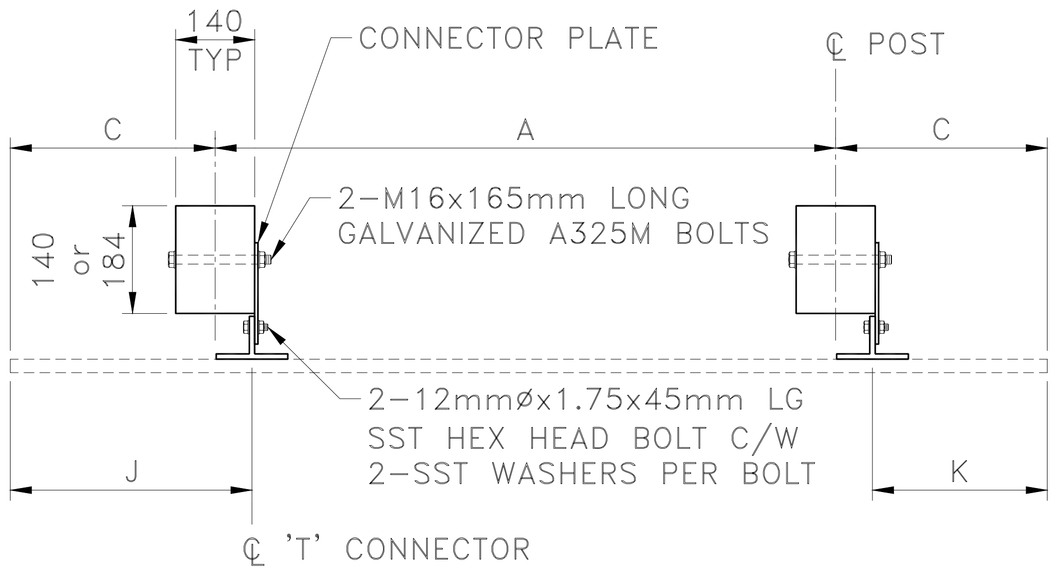
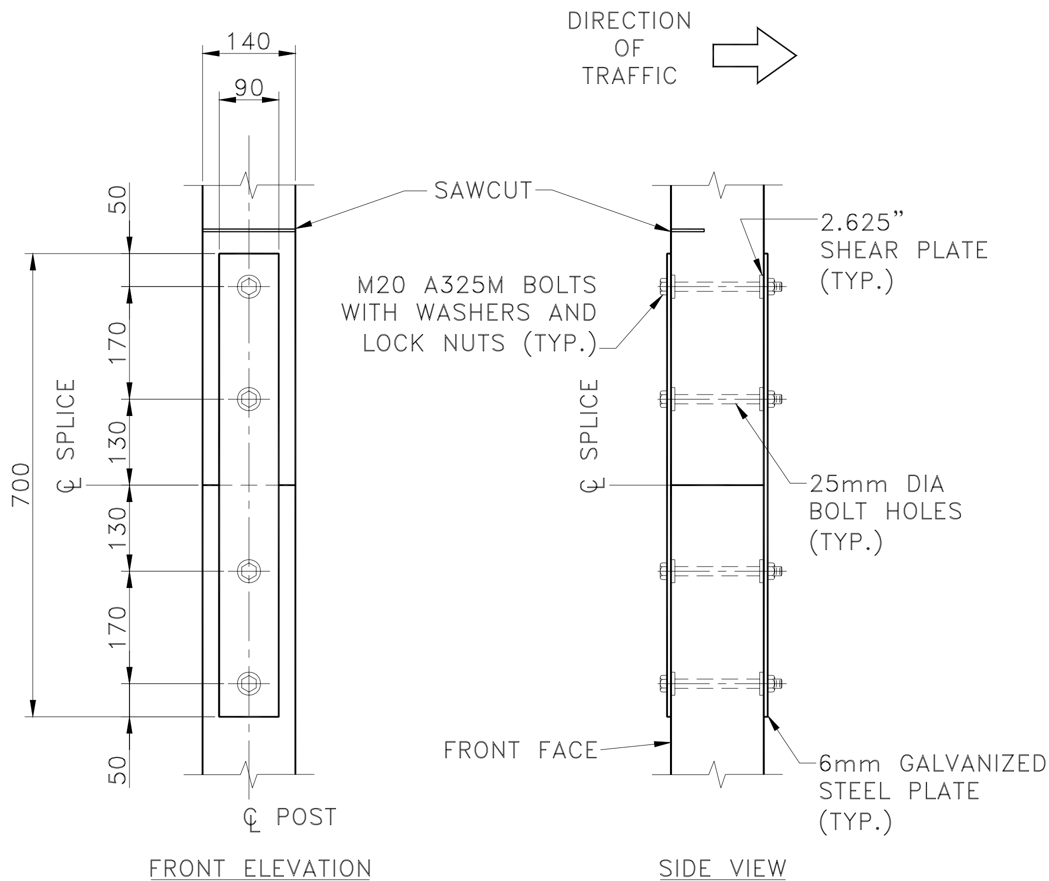


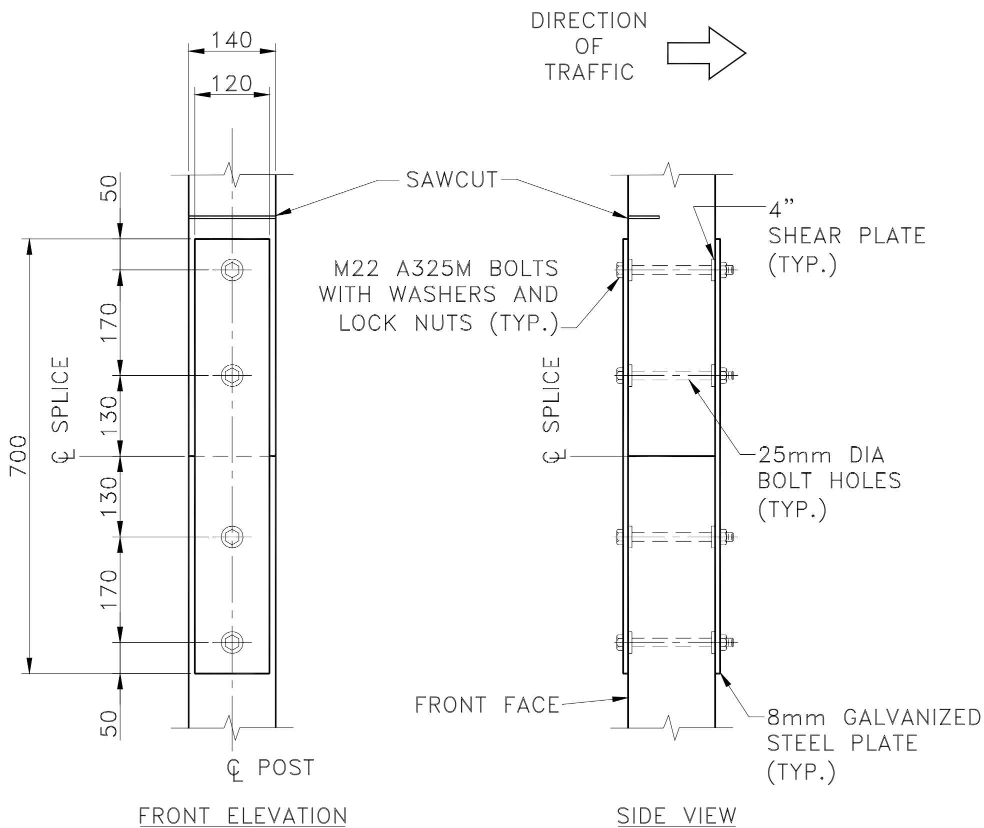
FIGURE 6.5.4(b) TYPICAL CROSS SECTION



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.

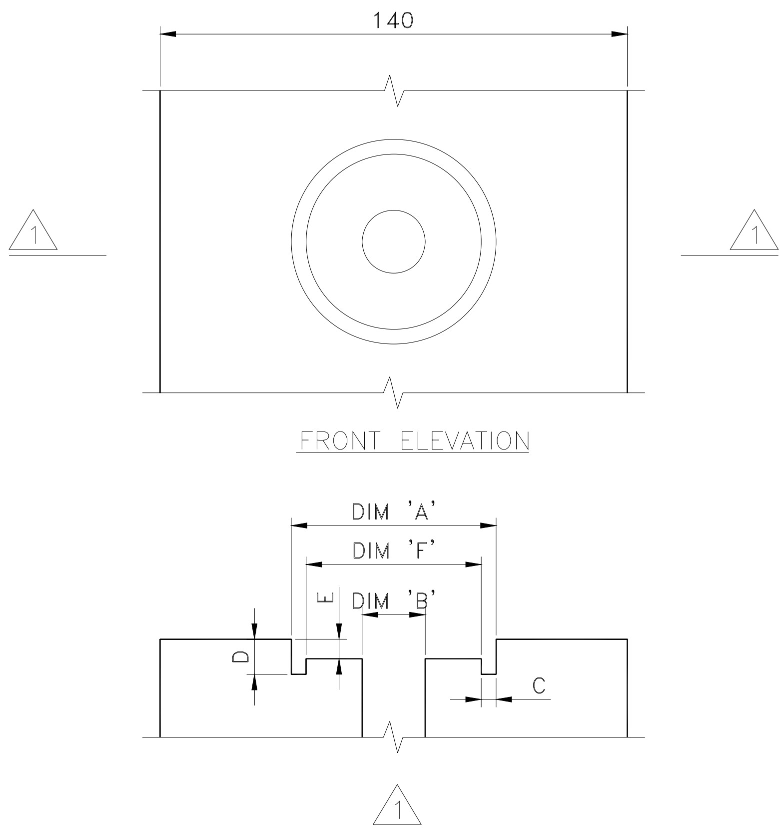
FIGURE 6.5.4(c) POST SPLICE DETAIL – TYPE "A"



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

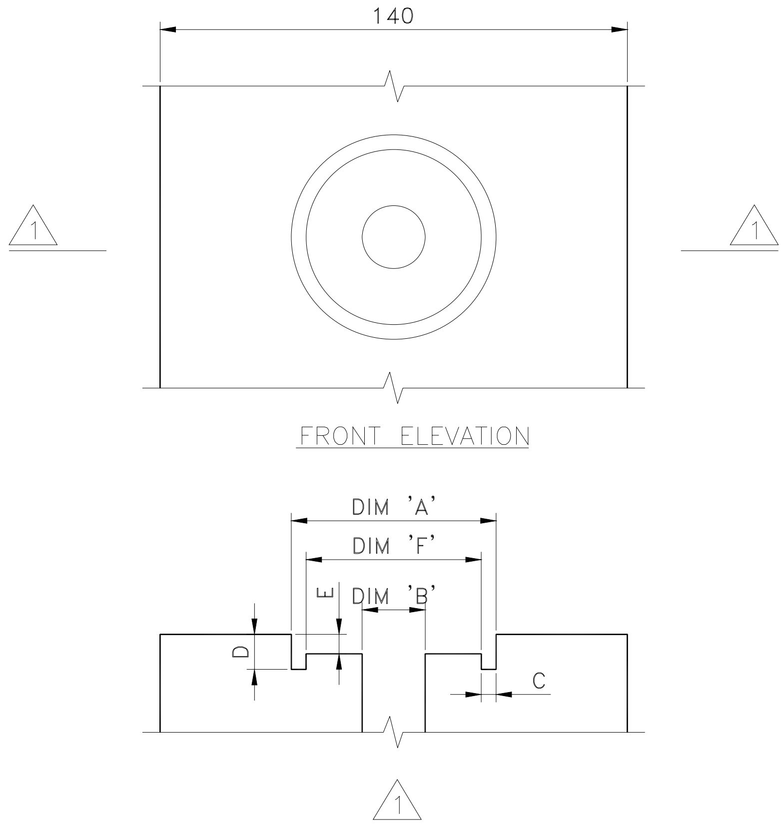
Note that splice surfaces shall be flat and perpendicular to centre-line of the post to ensure full contact.

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



2.625 INCH 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

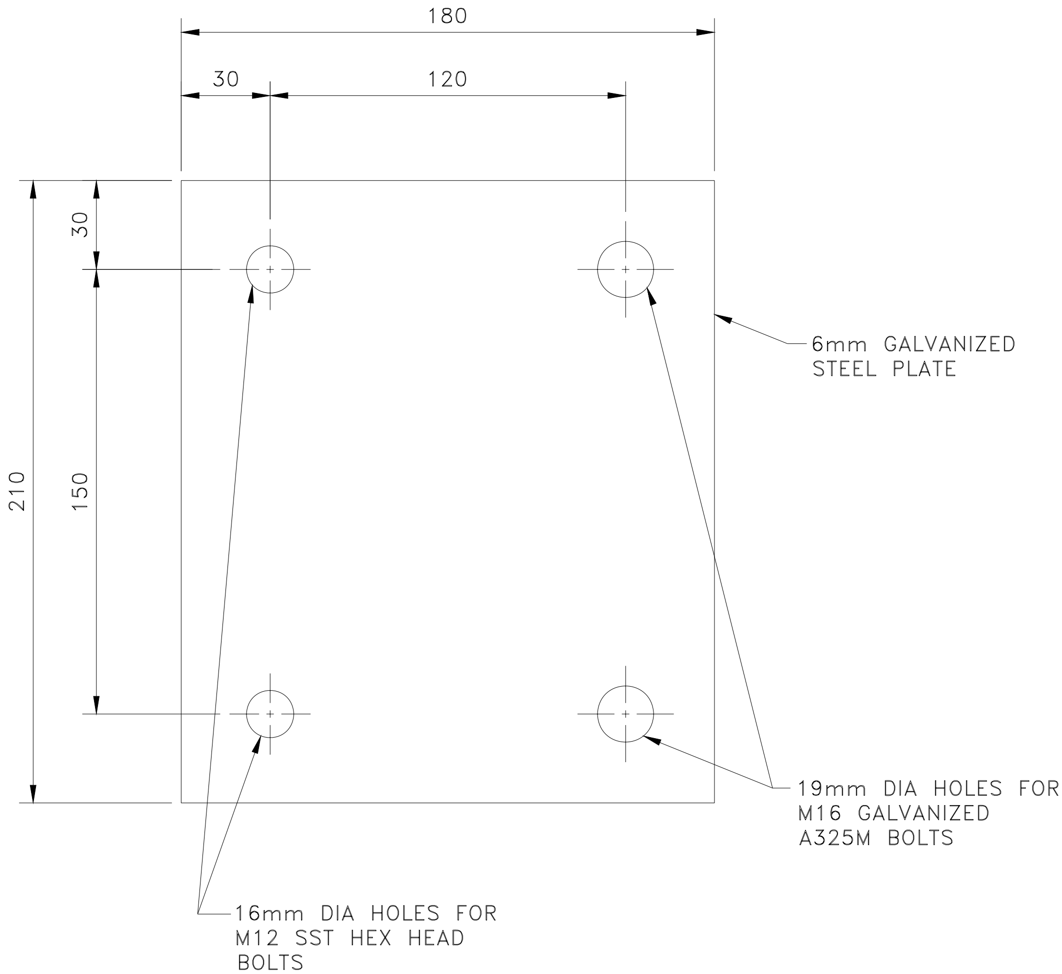


FIGURE 6.5.4(g) CONNECTOR PLATE DETAILS

6.6 WORK SHEETS

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

TIMBER SIGN SUPPORTS SIGN SIZE (DxB) _ _ _ _ _ _ x _ _ _ _ _ _	WP No. _ _ _ _ _ _ _ _ _ _ _ STATION _ _ _ _ _ _ _ _ _ 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} =	–	=

$\geq$ 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

<u>EXAMPLE</u>

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

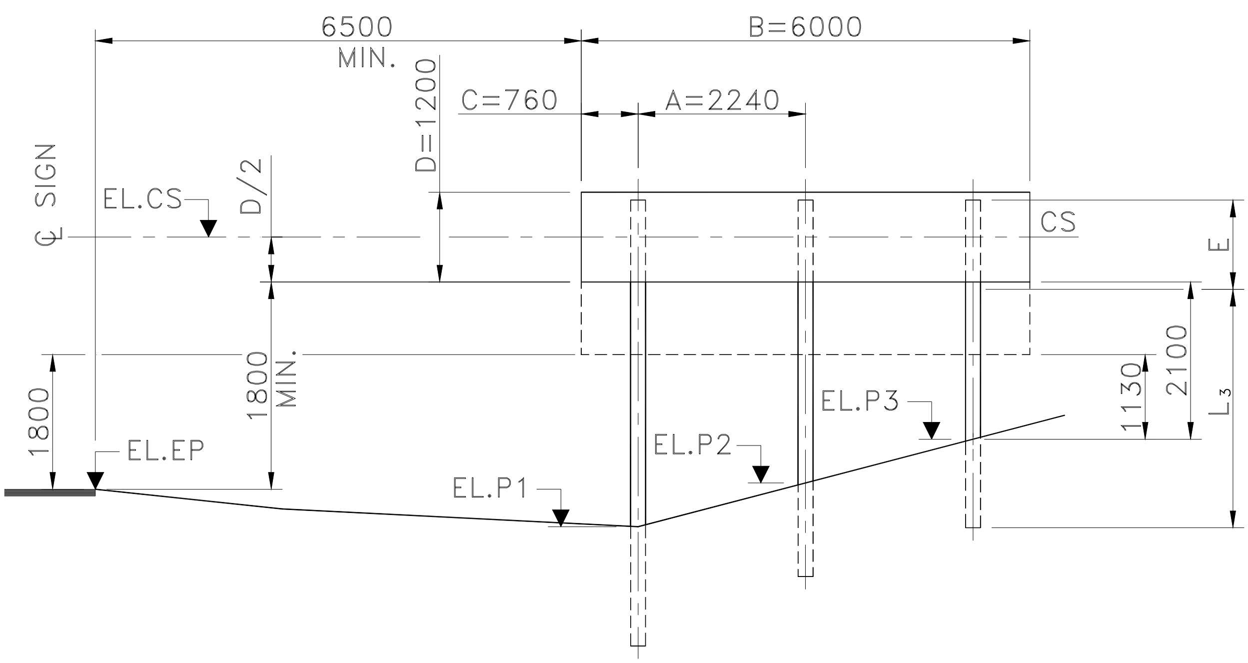


FIGURE EXAMPLE
(BREAKAWAY SIGN SUPPORT)

TIMBER SIGN SUPPORTS	
SIGN SIZE (DxB) 1200 x 6000	WP No. __________ STATION _________ 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 $\mathbf{L}_i$ = 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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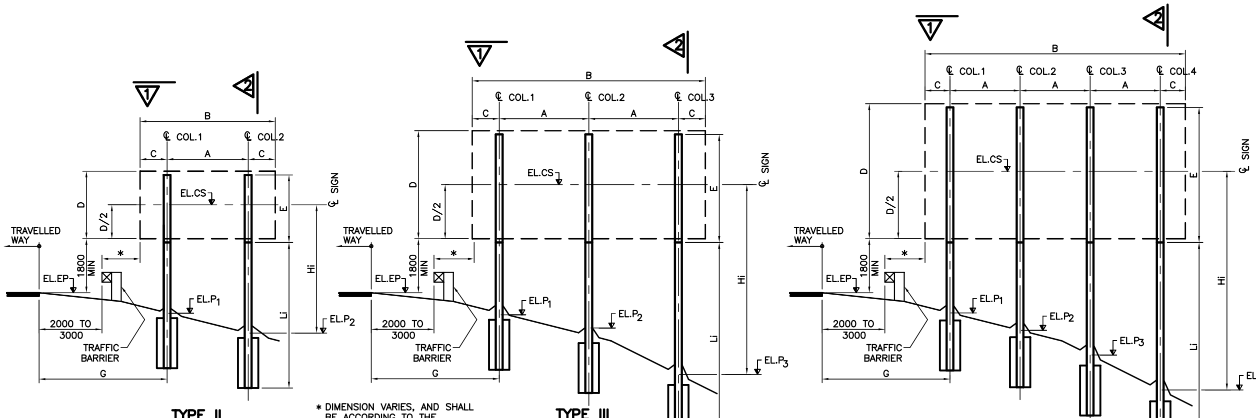
METRIC
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

CONT No
WP No

SHEET

TIMBER POST NON-BREAKAWAY SIGN SUPPORTS GENERAL ARRANGEMENT

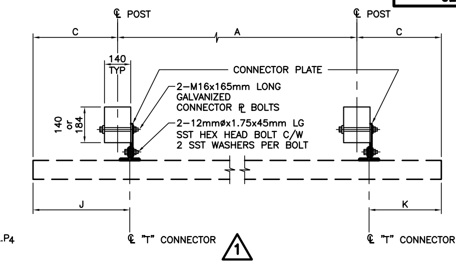


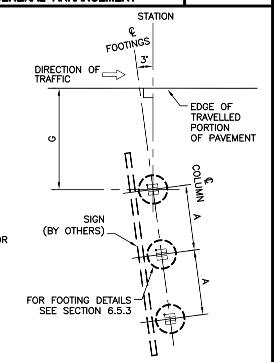
TYPE II

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

TYPE III

TYPE IV

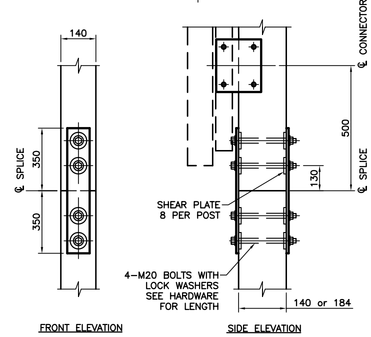




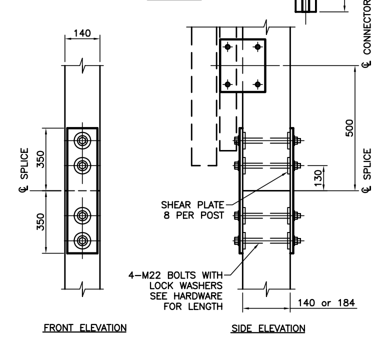
TYPICAL LAYOUT PLAN

TABLE 1 – GENERAL

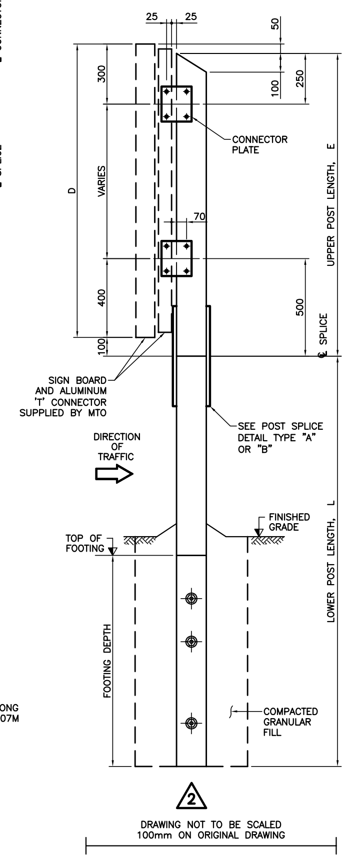
STATION					
SIGN No.					
SIGN SIZE (DxB)					
TYPE					
EL.EP					
$EL.P_1$					
$EL.P_2$					
$EL.P_3$					
$EL.P_4$					
POST SIZE – SPECIES					
UPPER POST LENGTH, E					
LOWER POST LENGTH, L_1					
LOWER POST LENGTH, L_2					
LOWER POST LENGTH, L_3					
LOWER POST LENGTH, L_4					
FOOTING DEPTH					
SPLICE TYPE					
A					
C					
G					
J					
K					



POST SPLICE DETAIL – TYPE "A"



POST SPLICE DETAIL – TYPE "B"



DRAWING NOT TO BE SCALED 100mm ON ORIGINAL DRAWING

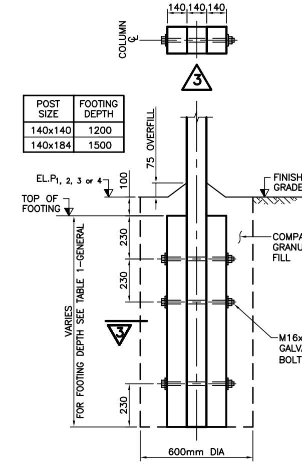
NOTES

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 AS PER CSA STANDARD G164–M.
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 100 mm ABOVE SURROUNDING GROUND AND GIVEN A CONICAL SHAPE TO INCREASE WATER RUN-OFF AND PROVIDE A RESERVE OF FILL FOR SETTLEMENT.

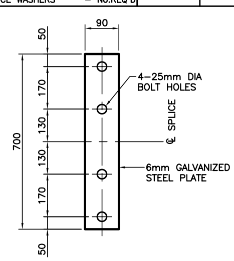
TABLE 2 – HARDWARE

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						12mmø x1.75x45mm 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	

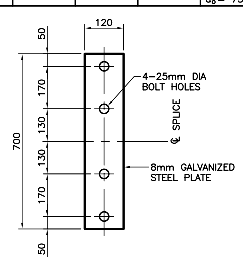
POST SIZE	FOOTING DEPTH
140x140	1200
140x184	1500



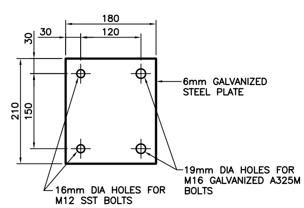
FOOTING DETAILS



SPLICE PLATE "A"



SPLICE PLATE "B"



CONNECTOR PLATE

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

STANDARD DRAWING MARCH 2006 | 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

DRAWING NAME: s118–34.dwg CREATED: 1995/07/11 MODIFIED: 2006/03/23 10:51:11

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

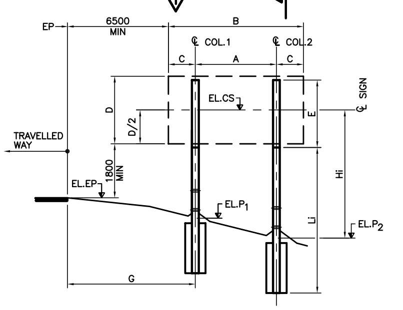
METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

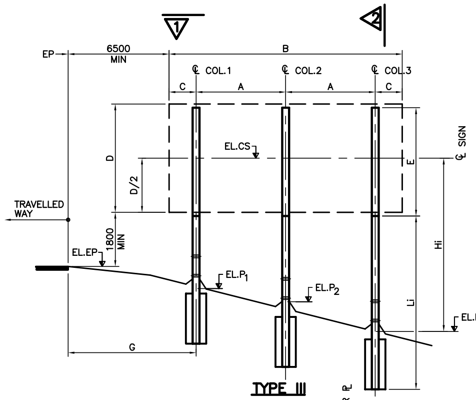
CONT No
WP No

SHEET

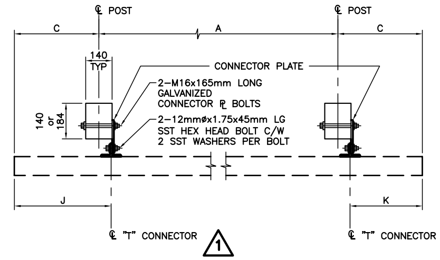
TIMBER POST BREAKAWAY SIGN SUPPORTS GENERAL ARRANGEMENT

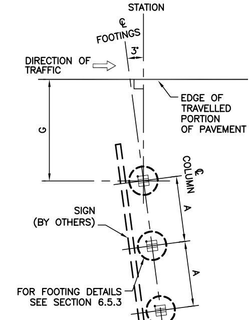


TYPE II



TYPE III





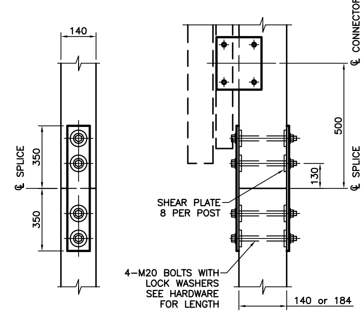
TYPICAL LAYOUT PLAN

NOTES

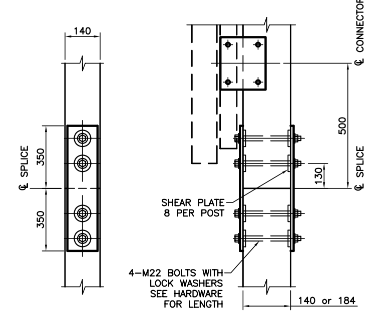
1. TIMBER SHALL BE COASTAL DOUGLAS FIR OR JACK PINE No.1 GRADE OR EQUIVALENT UNDER THE SAME SPECIES IDENTIFICATION IN ACCORDANCE WITH CSA STANDARD O86 FOR BEAM AND STRINGER, NLGA STANDARD GRADING RULES.
2. ALL WOOD SHALL BE PRESSURE PRESERVATIVE TREATED AS PER OPSS 1601.
3. ALL CUTS, HOLES AND DAMAGE 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 O86.
7. ALL STEEL INCLUDING NUTS AND BOLTS SHALL BE HOT DIP GALVANIZED AS PER CSA STANDARD G164–M.
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 100 mm ABOVE SURROUNDING GROUND AND GIVEN A CONICAL SHAPE TO INCREASE WATER RUN–OFF AND PROVIDE A RESERVE OF FILL FOR SETTLEMENT.

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"

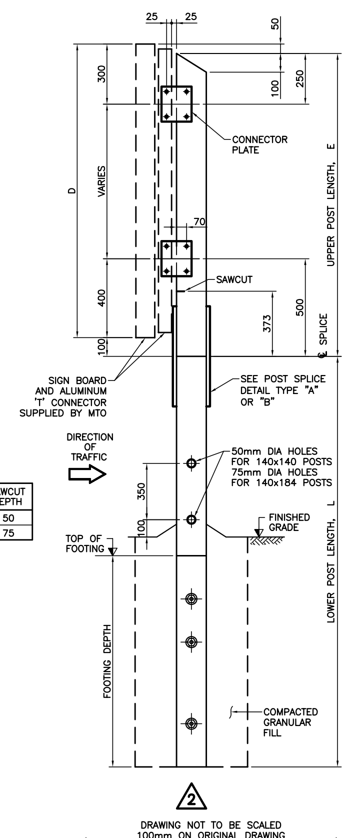
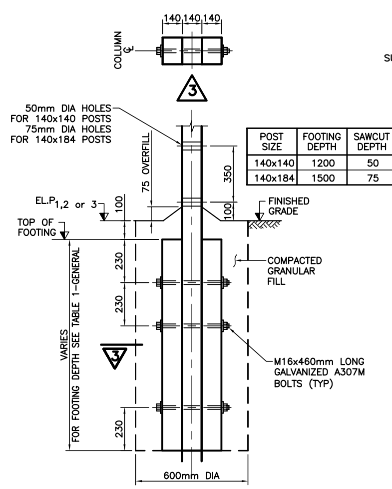


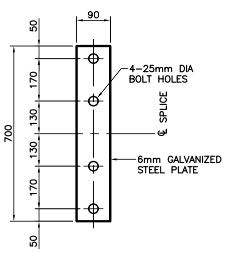
TABLE 2 – HARDWARE

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						12mmø x1.75x45mm 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 O86
SHEAR PLATES – No.REQ'D						4 INCH DIA CSA O86
FOOTING BOLTS – No.REQ'D						M16x460 mm LONG ASTM A307M
SPLICE WASHERS – No.REQ'D						d_o = 75mm t = 6.4mm

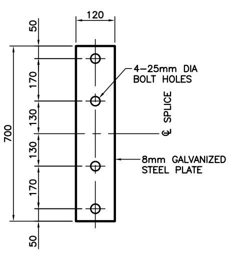


POST SIZE	FOOTING DEPTH	SAWCUT DEPTH
140x140	1200	50
140x184	1500	75

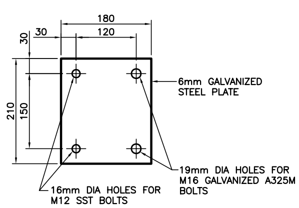
FOOTING DETAILS



SPLICE PLATE "A"



SPLICE PLATE "B"



CONNECTOR PLATE

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

STANDARD DRAWING MARCH 2006

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.dwg CREATED: 1995/07/11 MODIFIED: 2006/03/23 10:49:25

SIGN SUPPORT MANUAL

DIVISION 7 – OVERHEAD MONOTUBE SIGN SUPPORTS

April 2011

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.

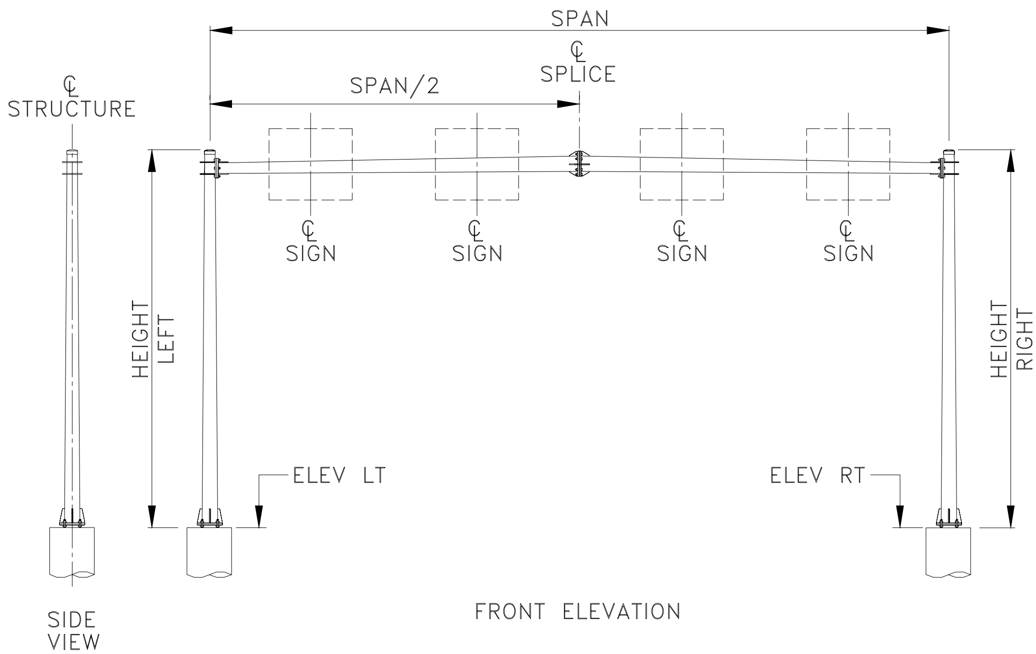


FIGURE 7.1.2(a) TYPE I – FRONT MOUNTED

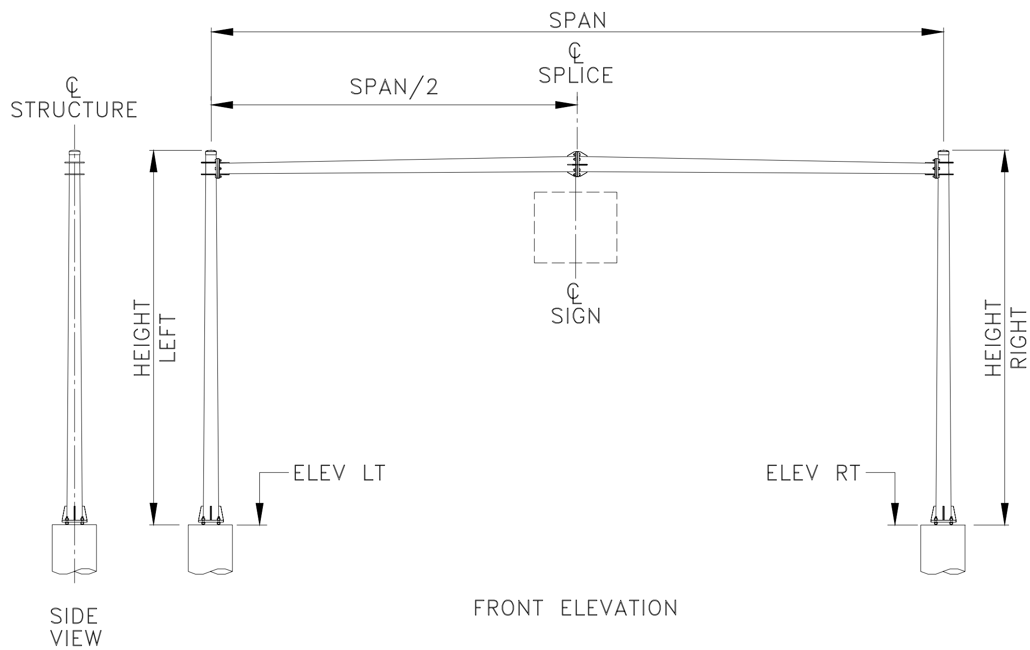


FIGURE 7.1.2(b) TYPE II – UNDER MOUNTED

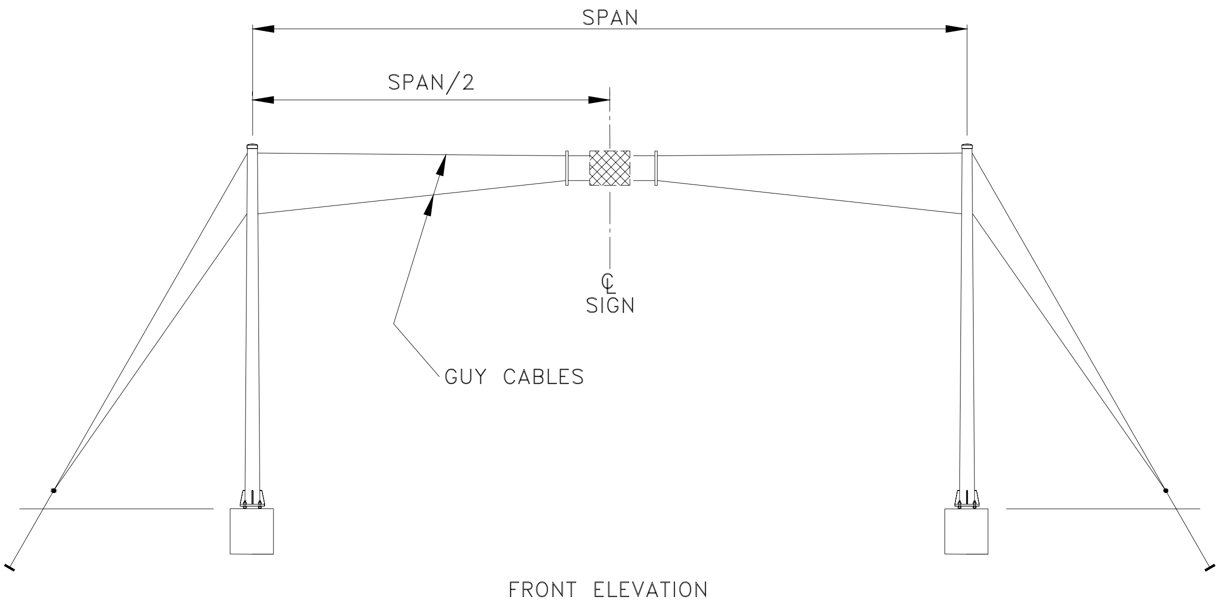


FIGURE 7.1.2(c) SIGN SUPPORT DETAILS

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. If the encountered soil condition is such that the minimum requirements specified above are not satisfied, a site specific footing design must be carried out.

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-G40.21-M Grade 300W for structural steel, 30 MPa for concrete and Grade 400W reinforcing steel for footings.

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

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

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

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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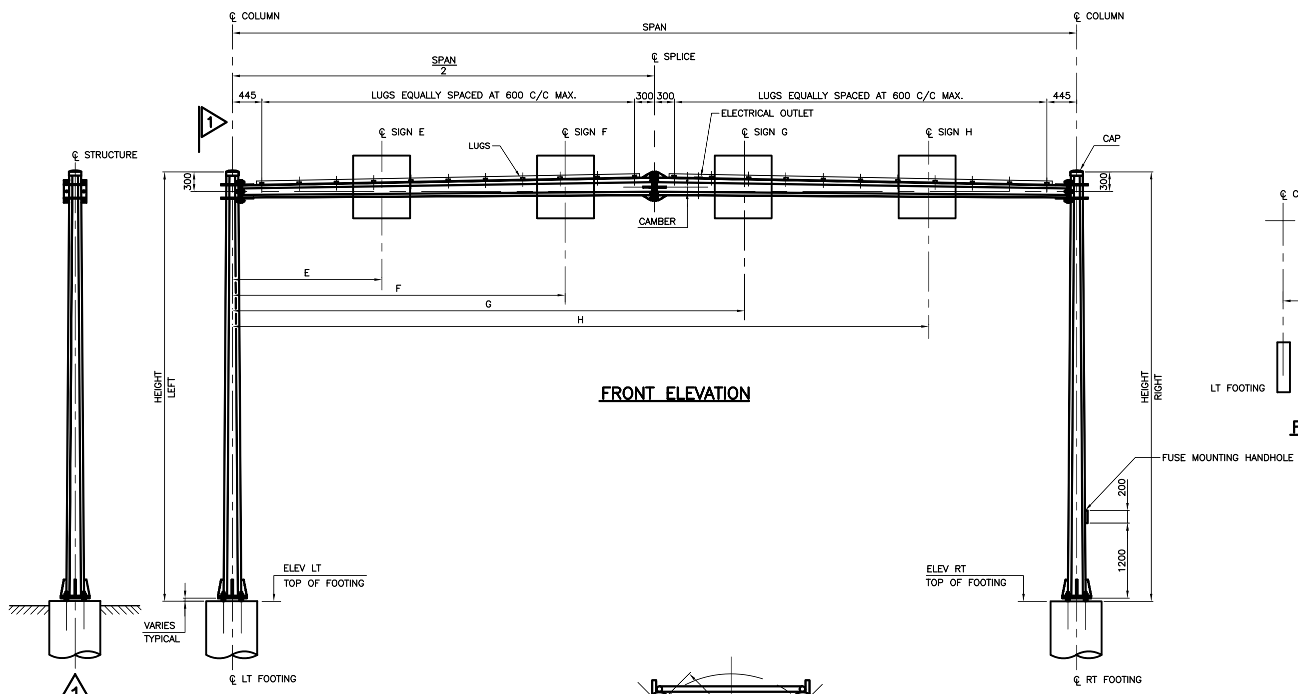
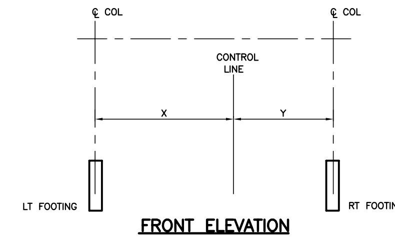
METRIC

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



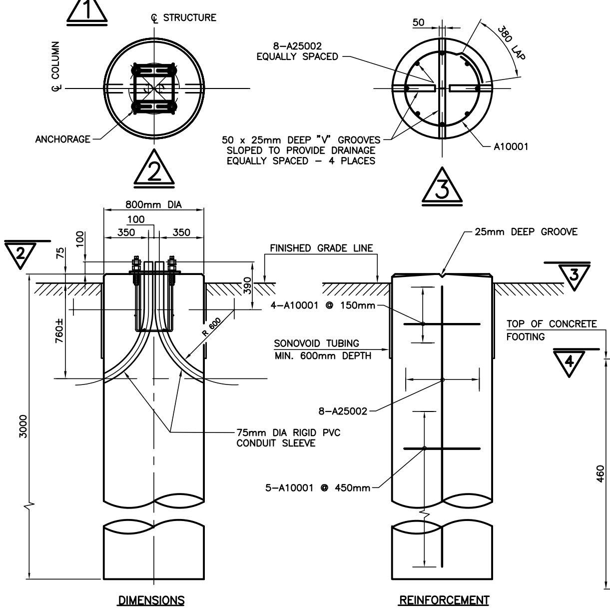
FRONT ELEVATION
FOOTING LAYOUT DETAILS

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 AS SPECIFIED IN ASTM SPECIFICATION A325M.
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:

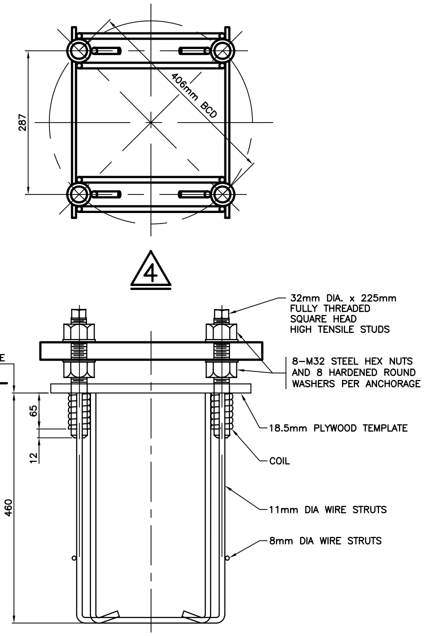
1. ANCHORAGE STRUTS AND COILS TO BE SAE STANDARD 1030 STEEL.
2. HIGH TENSILE STUDS TO BE ASTM SPECIFICATION A4140, A193, GRADE B-7 STEEL.
3. STEEL HEXAGON NUTS AND HARDENED STEEL WASHERS SHALL BE IN ACCORDANCE WITH ASTM SPECIFICATION A325.
4. THE COMPLETE ANCHORAGE ASSEMBLY INCLUDING STUDS, NUTS AND WASHERS SHALL BE HOT DIP GALVANIZED IN ACCORDANCE WITH CSA STANDARD G-164M.
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.



DIMENSIONS

REINFORCEMENT

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

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		

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 APRIL 2011	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

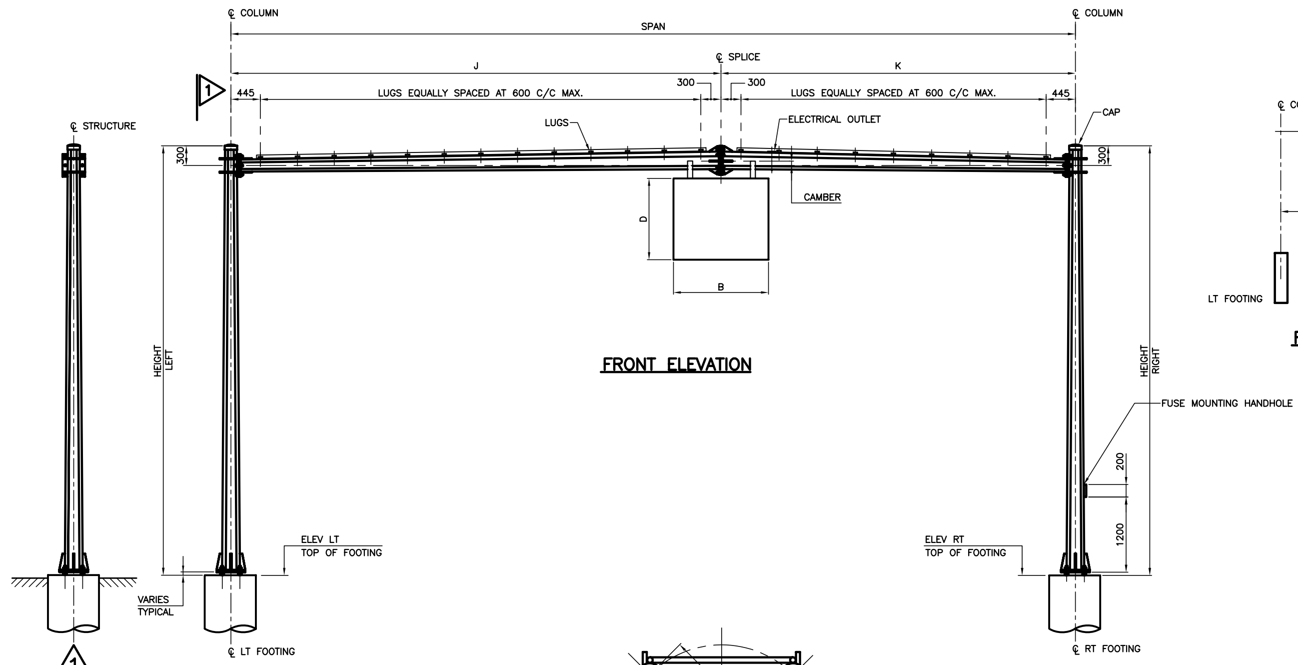
MINISTRY OF TRANSPORTATION, ONTARIO PR-D-707 88-05

DRAWING NAME: s118-40.dwg
CREATED: 1997/09/24
MODIFIED: 2011/04/04 08:48:27

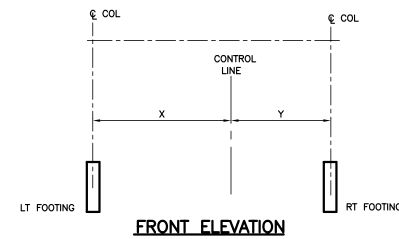
METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

DIST CONT No WP No	
STEEL MONOTUBE SIGN SUPPORT – TYPE II GENERAL ARRANGEMENT	SHEET



FRONT ELEVATION



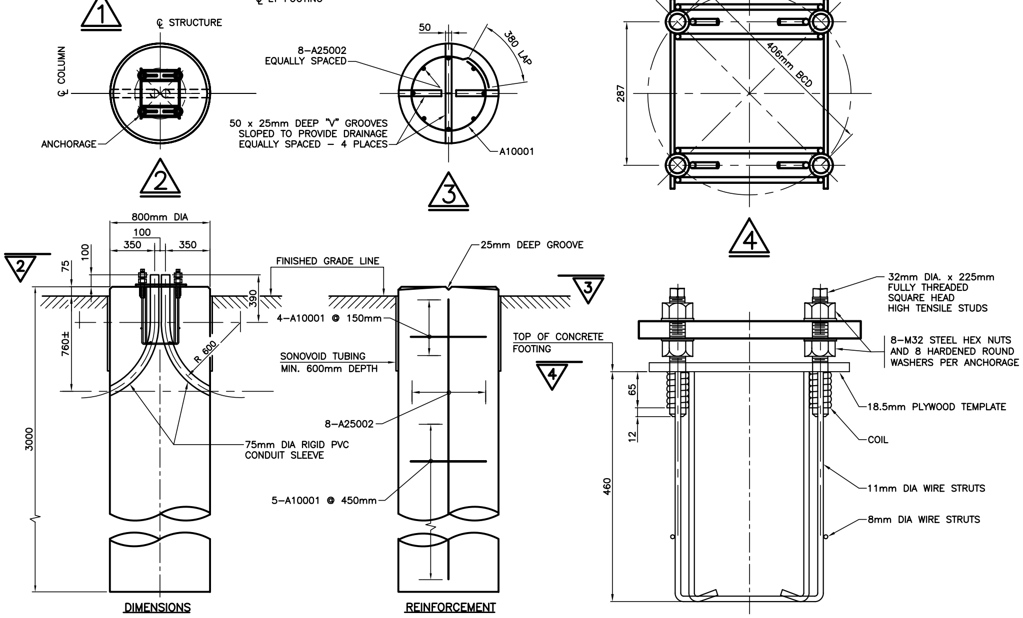
FRONT ELEVATION
FOOTING LAYOUT DETAILS

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 AS SPECIFIED IN ASTM SPECIFICATION A325M.
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 IN ACCORDANCE WITH CSA STANDARD G-164M.
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) LEFT	COL. HT (mm) RIGHT	ELEV. TOP OF FTG. (mm) LEFT	ELEV. TOP OF FTG. (mm) RIGHT	SIGN SIZE D x B (mm)	J (mm)	MESSAGE FRONT	MESSAGE REAR	K (mm)	X (mm)	Y (mm)

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
APRIL 2011

SS118-41

STEEL MONOTUBE SIGN SUPPORT – TYPE II

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: s118-41.dwg
CREATED: 1995/06/22
MODIFIED: 2011/04/04 12:48:10

METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

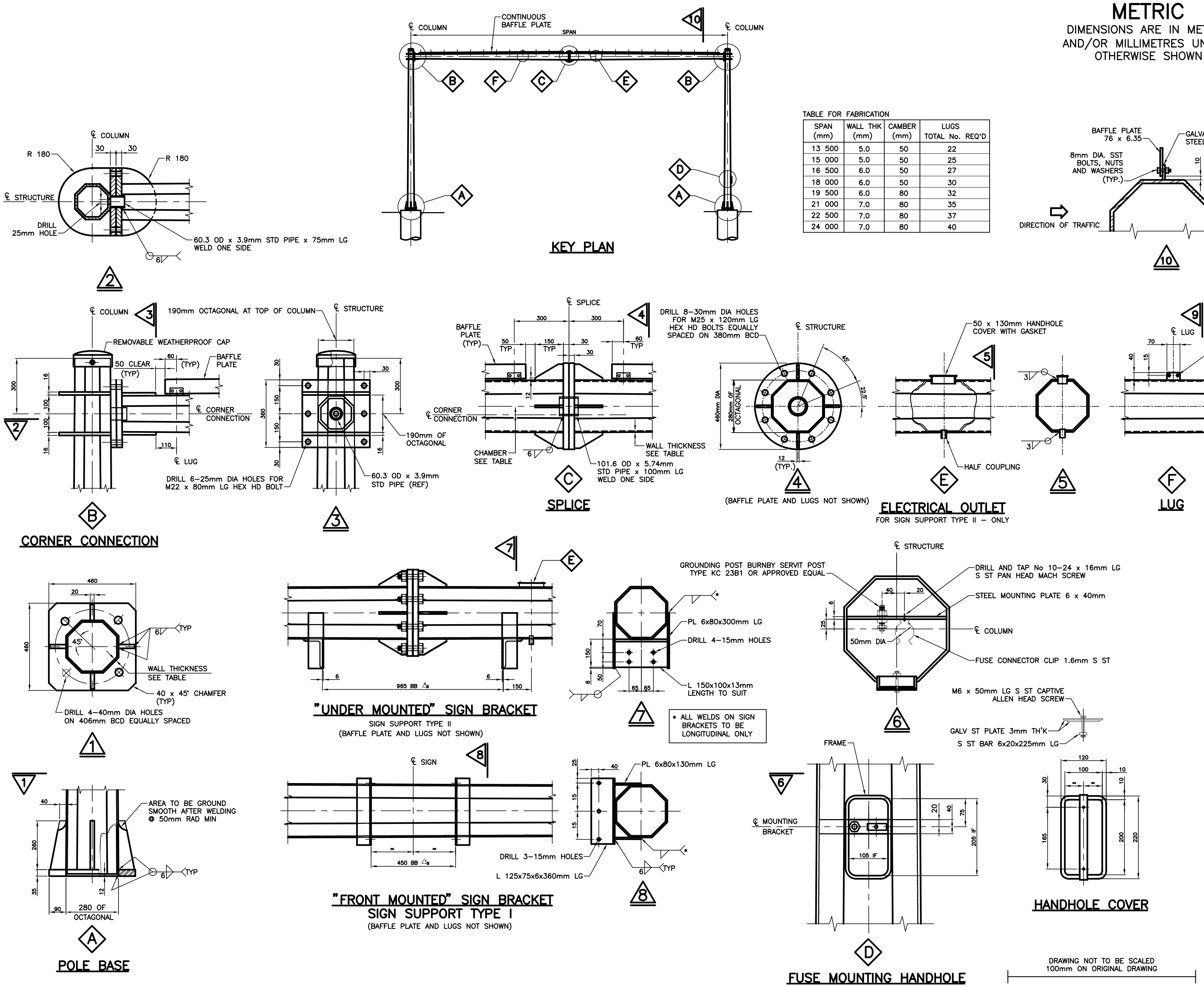
DIST
CONT No
WP No

SHEET

STEEL MONOTUBE SIGN SUPPORT DETAILS

TABLE FOR FABRICATION

SPAN (mm)	WALL THK (mm)	CAMBER (mm)	LUGS TOTAL No. REQ'D
13 500	5.0	50	22
15 000	5.0	50	25
16 500	6.0	50	27
18 000	6.0	50	30
19 500	6.0	80	32
21 000	7.0	80	35
22 500	7.0	80	37
24 000	7.0	80	40



NOTES:

1. ALL STEEL SHALL BE ACCORDING TO CAN/CSA-G40.20-04/G40.21-04, GRADE 300W.
2. ALL WELDING SHALL BE ACCORDING TO CSA STD W59-3, ELECTRODES SHALL BE TO A LOW HYDROGEN SPECIFICATION. ELECTRODES FOR MANUAL WELDING SHALL BE E7015, E7016 OR E7018.
3. ALL BOLTS, NUTS AND WASHERS SHALL BE ACCORDING TO ASTM A325M.
4. ALL STEEL INCLUDING BOLTS, NUTS AND WASHERS SHALL BE HOT DIP GALVANIZED ACCORDING TO CAN/CSA-G164-M92 AFTER FABRICATION.
5. 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.
6. ALL BOLTS SHALL BE BROUGHT TO A SNUG TIGHT CONDITION THEN FURTHER TIGHTENED 1/3 OF A TURN UNLESS OTHERWISE STATED.
7. ALL FILLET WELDS 5mm EXCEPT AS NOTED.
8. THIS DRAWING TO BE READ IN CONJUNCTION WITH DRAWINGS SS118-40 AND/OR SS118-41.

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

STANDARD DRAWING
APRIL 2011

SS118-42

STEEL MONOTUBE SIGN SUPPORT-DETAILS

DRAWING NOT TO BE SCALED
100mm ON ORIGINAL DRAWING

REVISIONS

DESIGN	CHK	CODE CHBDC-00	LOAD	DATE
DRAWN	CHK	SITE		DWG

DESCRIPTION

MINISTRY OF TRANSPORTATION, ONTARIO PR-D-707 88-05
DRAWING NAME: s118-42.dwg
CREATED: 1997/09/24
MODIFIED: 2011/04/04 12:48:29

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SIGN SUPPORT MANUAL

DIVISION 8 – VARIABLE MESSAGE SIGN SUPPORTS

April 2011

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.

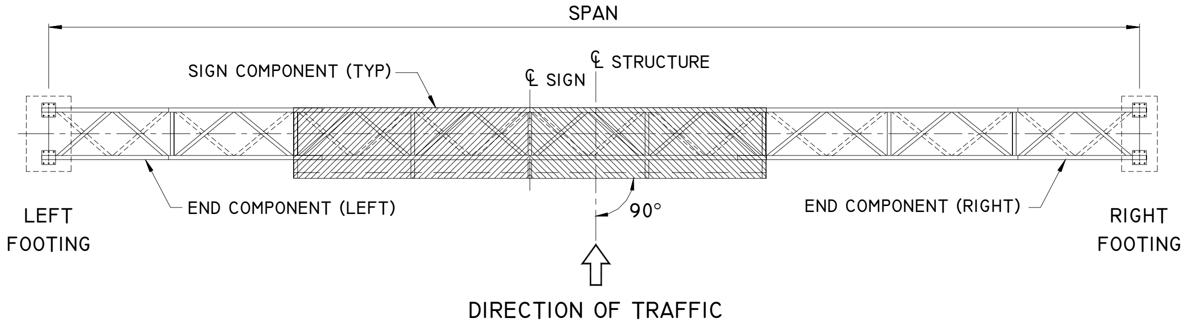

FIGURE 8.1.3(a) TYPICAL VMS OVERHEAD TRUSS LAYOUT PLAN

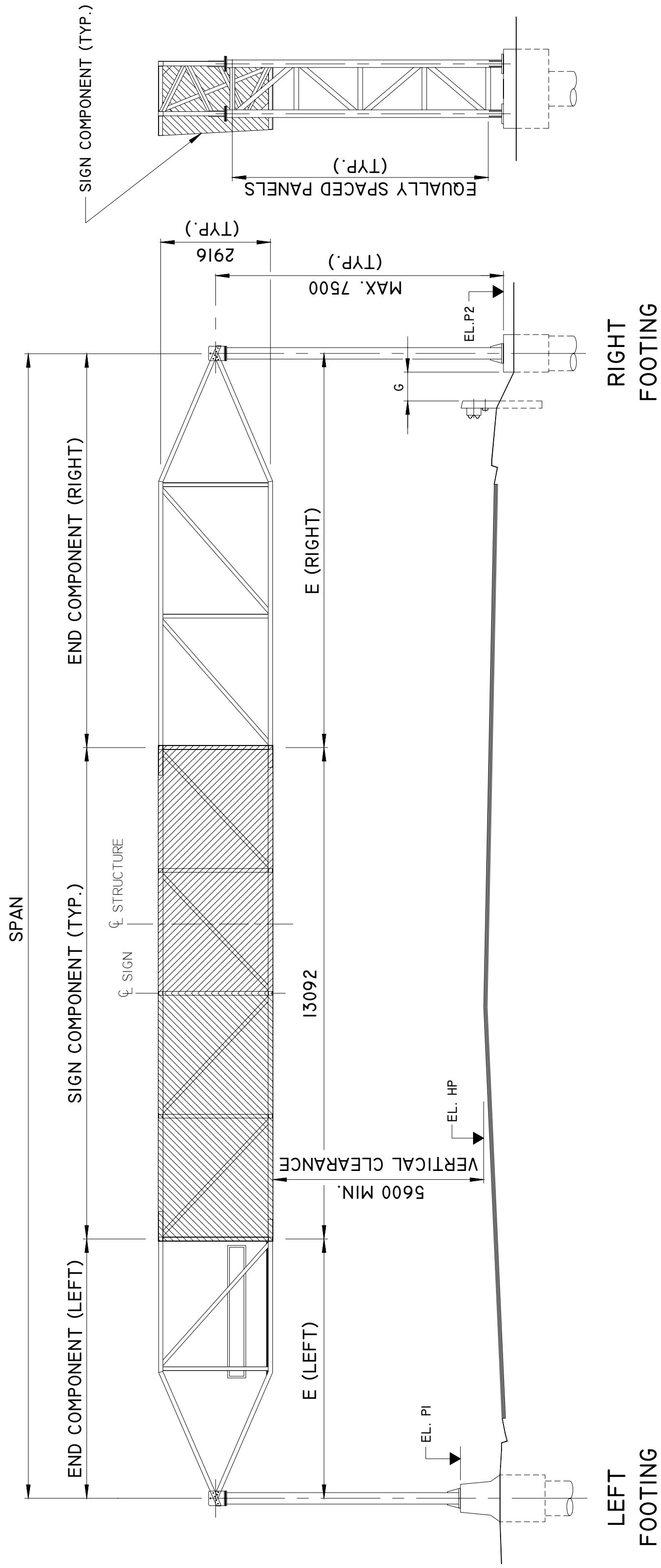

FIGURE 8.1.3(b) TYPICAL VMS OVERHEAD TRUSS SUPPORT ELEVATION

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.

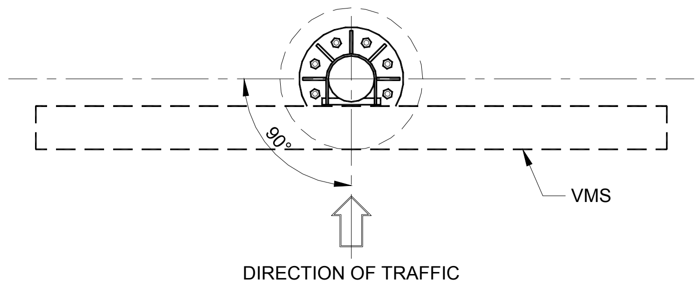

FIGURE 8.1.3(c)
TYPICAL POLE MOUNTED VMS LAYOUT PLAN

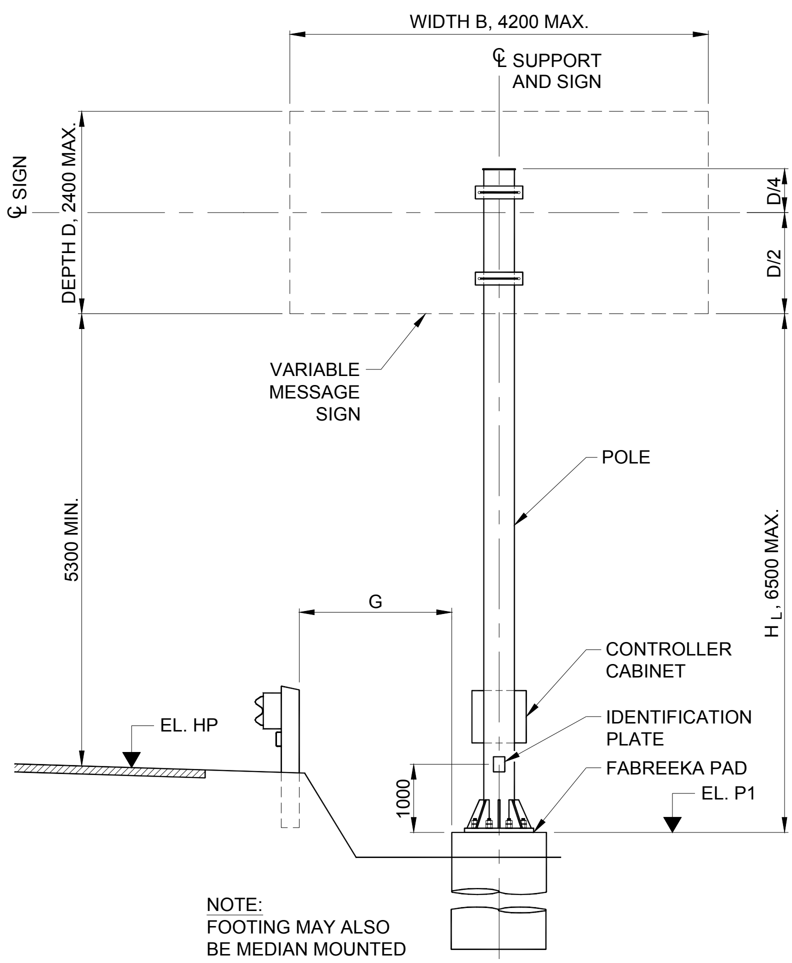

FIGURE 8.1.3 (d)
TYPICAL POLE MOUNTED VMS SUPPORT ELEVATION

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.

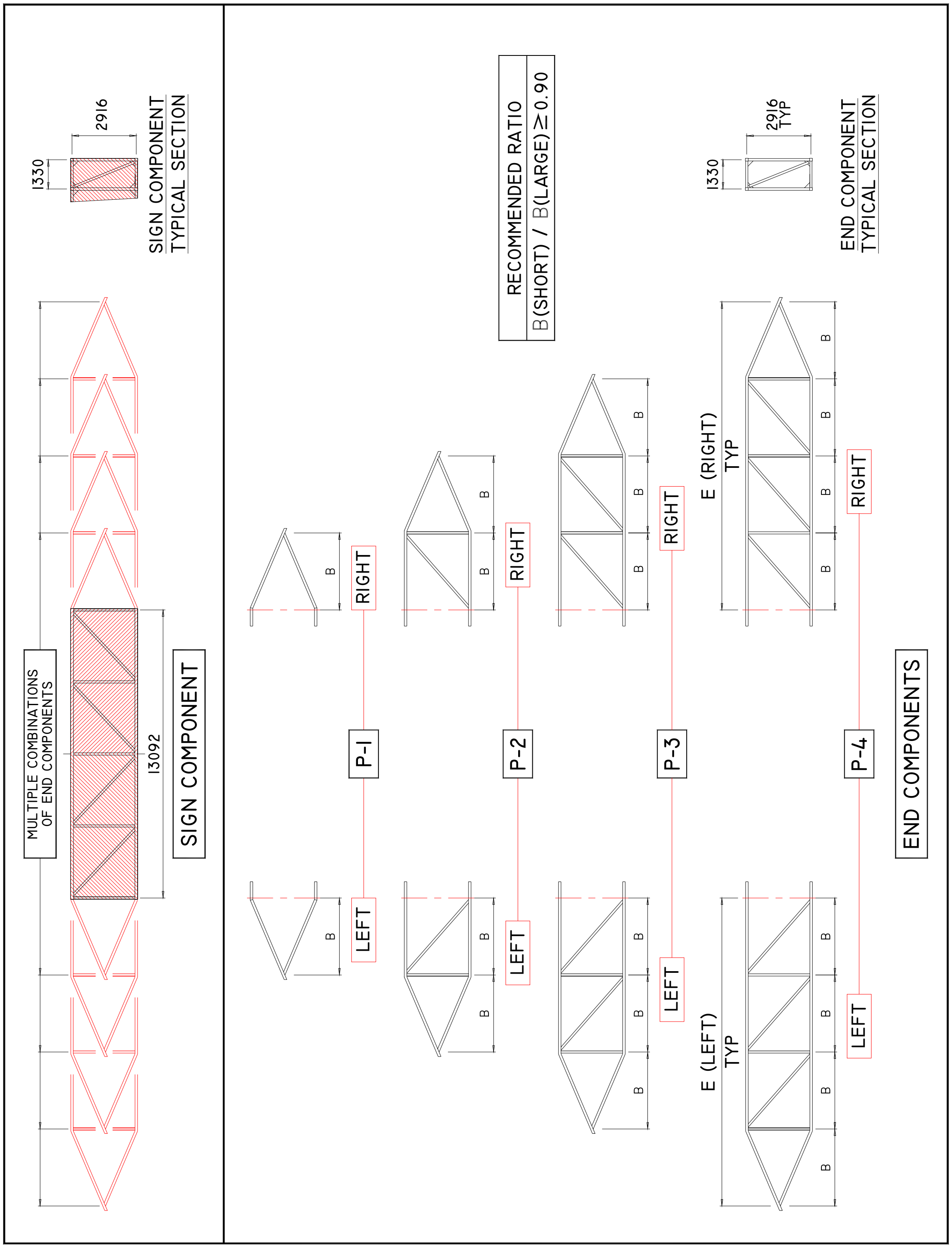

FIGURE 8.2.1 VARIABLE MESSAGE SIGN SUPPORT LAYOUT COMBINATIONS

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: $2250 \leq b \leq 3600$ 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-G40.21-M92 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 galvanized in accordance with standard CAN/CSA-G164-M92.

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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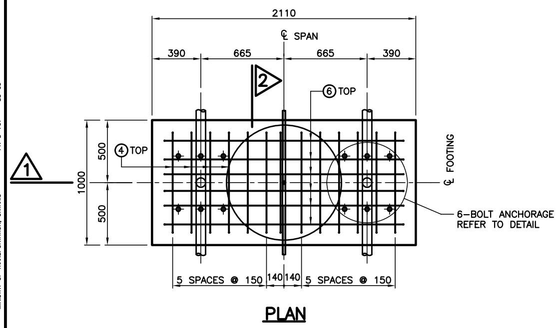
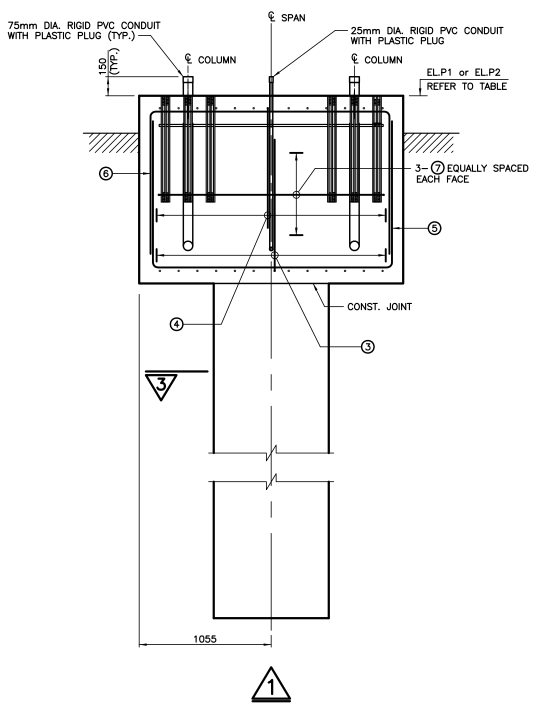
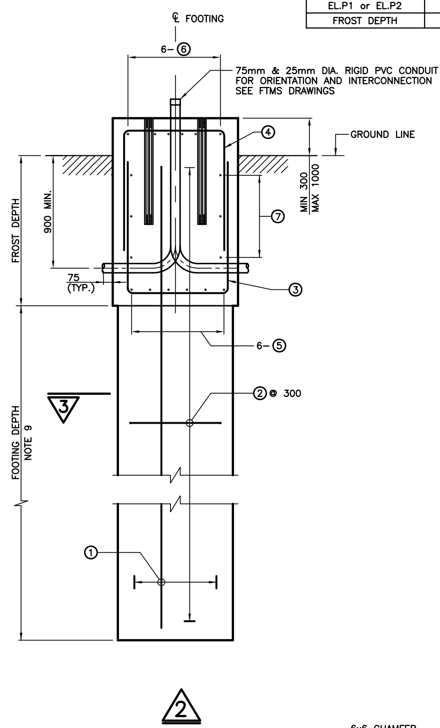
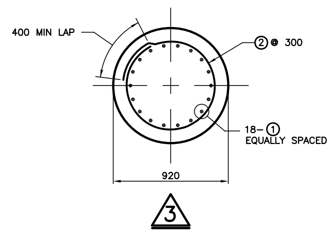


PLAN







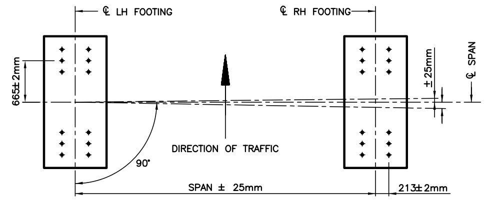
METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

CONT No
WP No

SHEET

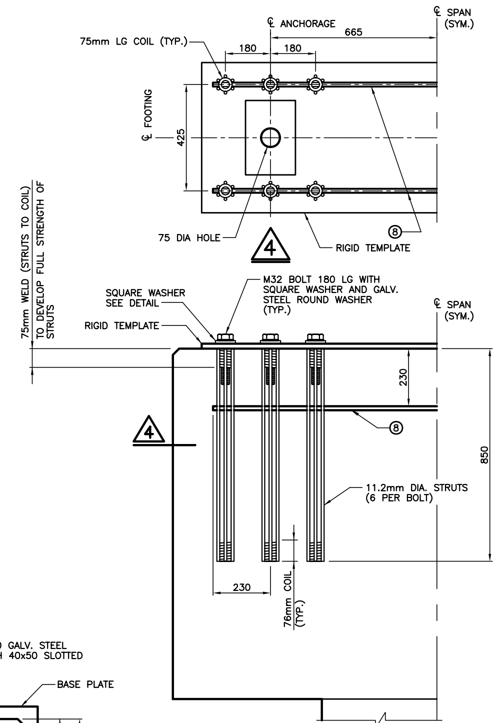
VARIABLE MESSAGE SIGN SUPPORT FOOTING DETAILS–GROUND MOUNTED



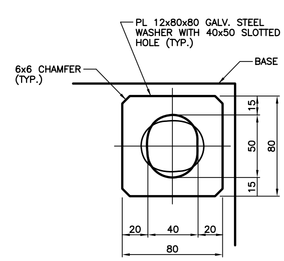
TYPICAL PLAN SHOWING TOLERANCE

FOOTING DIMENSIONS

STATION	---									
STRUCTURE I.D. No.	---									
SPAN	---									
LEFT/RIGHT FOOTING	---									
EL.P1 or EL.P2	---									
FROST DEPTH	---									



ANCHORAGE INSTALLATION DETAIL



SQUARE WASHER DETAIL

GENERAL NOTES:

1. CLASS OF CONCRETE 30 MPa.
2. CLEAR COVER TO REINFORCING STEEL:
   - –CAISSON 100±25mm
   - –REMAINDER 70±20mm
3. REINFORCING STEEL SHALL BE GRADE 400W UNLESS OTHERWISE SPECIFIED. BAR MARKS WITH PREFIX 'C' DENOTE COATED BARS.
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.
9. THIS DIMENSION 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 REDUCED TO: Y + (5000 – Y)/2, UPON MINISTRY'S APPROVAL.

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. ALL WELDING SHALL BE ACCORDING TO CAN/CSA-W59-03.
4. THE COMPLETE ANCHORAGE ASSEMBLY INCLUDING BOLTS, NUTS AND WASHERS SHALL BE HOT DIP GALVANIZED ACCORDING TO CAN/CSA-G164-M92.
5. EXPOSED PORTION OF BOLTS SHALL BE COATED WITH WHITE NON-STAINING GREASE.
6. A RIGID SETTING TEMPLATE SHALL BE PROVIDED FOR ACCURATE POSITIONING OF ANCHORAGE WITHIN THE CONCRETE FORM. EACH FOOTING SHALL HAVE ONE CONTINUOUS TEMPLATE.
7. ANCHOR BOLTS SHALL ENGAGE FULL LENGTH OF UPPER COIL AT THE TIME ON CONCRETE PLACEMENT.
8. 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	C15M	
5	20M	
6	C20M	
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
APRIL 2011

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	

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CREATED: 1997/09/24
MODIFIED: 2011/04/04 12:36:21
MINISTRY OF TRANSPORTATION, ONTARIO PR-D-707 88-05

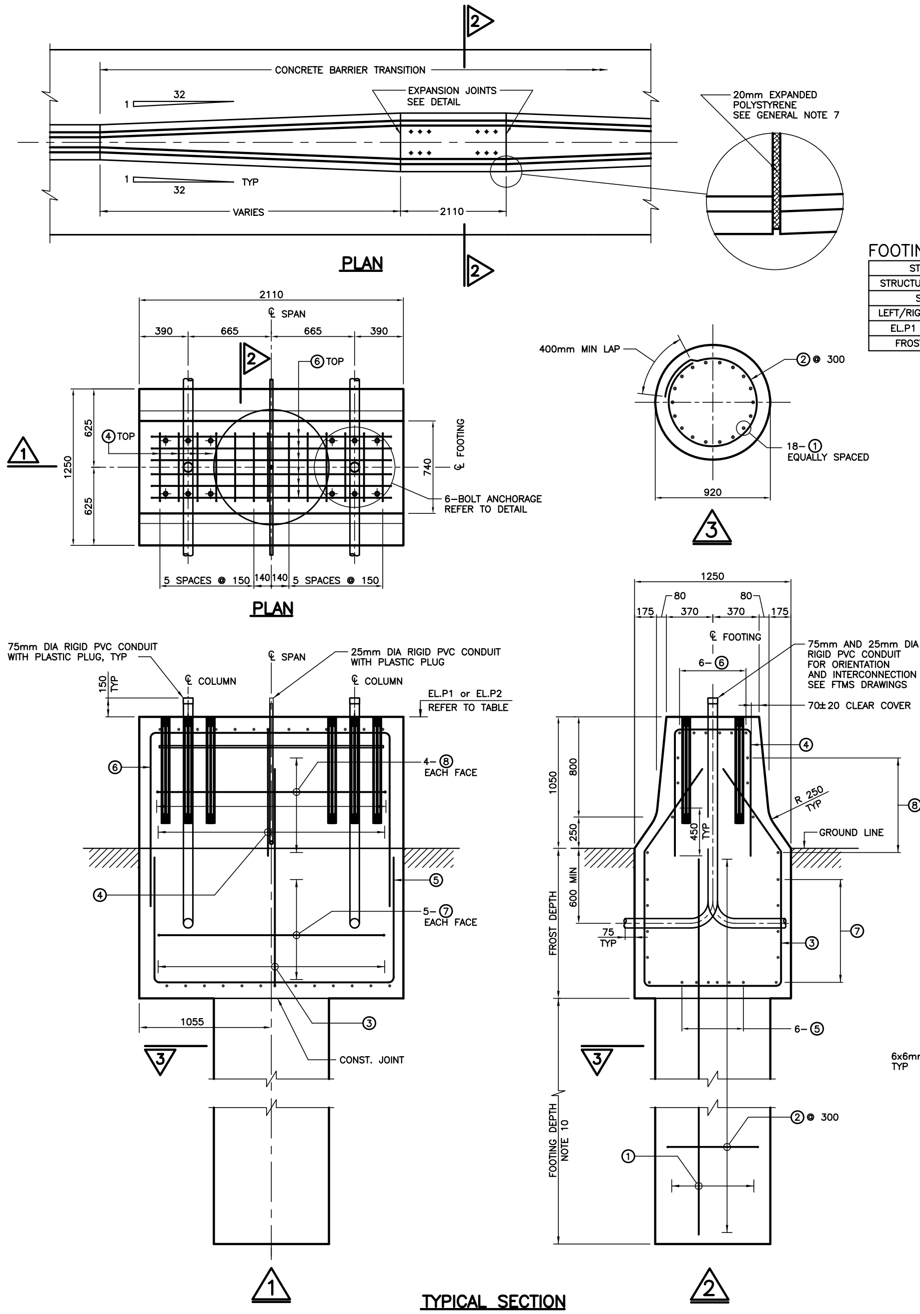
METRIC

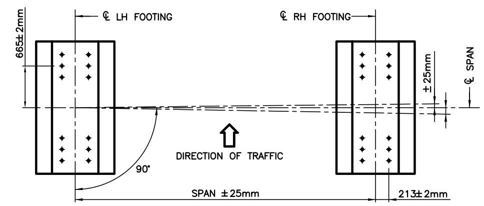
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

CONT No
WP No

VARIABLE MESSAGE SIGN SUPPORT MEDIAN MOUNTED FOOTING SYMMETRICAL

SHEET

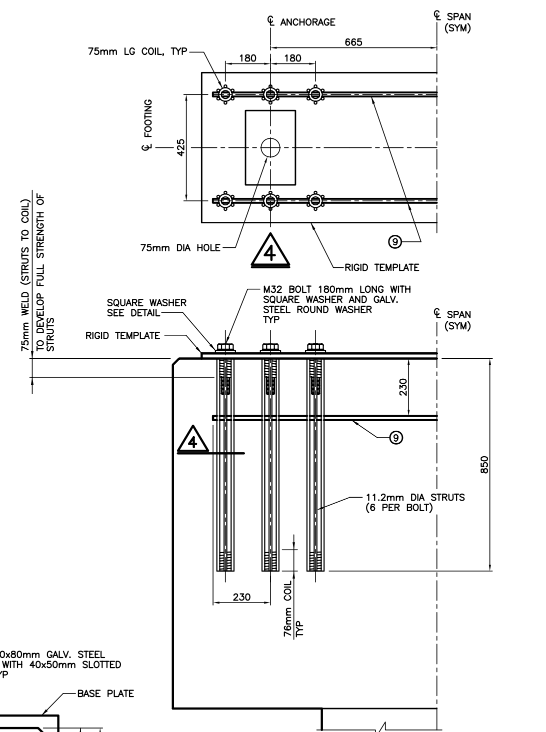




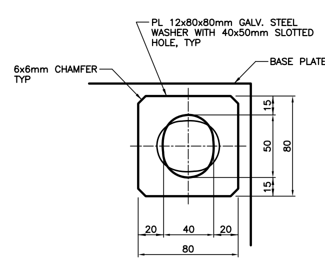
TYPICAL PLAN SHOWING TOLERANCE

FOOTING DIMENSIONS

STATION	---									
STRUCTURE I.D. No.	---									
SPAN	---									
LEFT/RIGHT FOOTING	---									
EL.P1 or EL.P2	---									
FROST DEPTH	---									



ANCHORAGE INSTALLATION DETAIL



SQUARE WASHER DETAIL

GENERAL NOTES:

1. CLASS OF CONCRETE 30 MPa.
2. CLEAR COVER TO REINFORCING STEEL:
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   - –REMAINDER 70±20mm
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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.
10. THIS DIMENSION 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 REDUCED TO: Y + (5000 – Y)/2, UPON MINISTRY'S APPROVAL.

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6. A RIGID SETTING TEMPLATE SHALL BE PROVIDED FOR ACCURATE POSITIONING OF ANCHORAGE WITHIN THE CONCRETE FORM. EACH FOOTING SHALL HAVE ONE CONTINUOUS TEMPLATE.
7. ANCHOR BOLTS SHALL ENGAGE FULL LENGTH OF UPPER COIL AT THE TIME ON CONCRETE PLACEMENT.
8. 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	C20M	
4	C20M	
5	20M	
6	C20M	
7	20M	
8	C20M	
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
APRIL 2011

SS118-7

VARIABLE MESSAGE SIGN SUPPORT
MEDIAN MOUNTED FOOTING – SYMMETRICAL

REVISIONS		
DATE	BY	DESCRIPTION

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DRAWN	CHK	SITE		DWG	

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CREATED: 1997/09/24
MODIFIED: 2011/04/04 12:52:09
MINISTRY OF TRANSPORTATION, ONTARIO PR-D-707 88-05

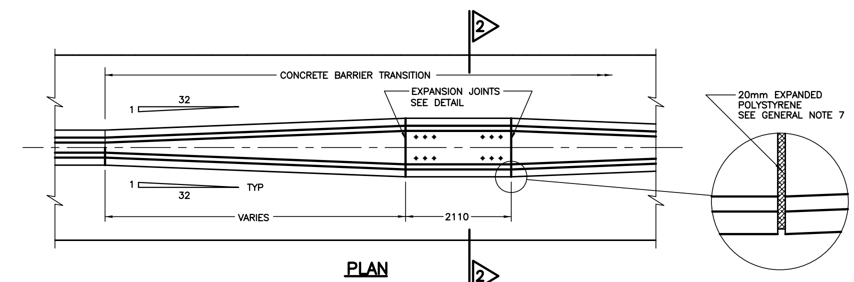
METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

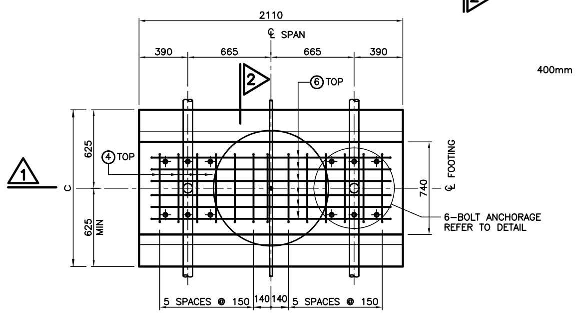
CONT No
WP No

VARIABLE MESSAGE SIGN SUPPORT MEDIAN MOUNTED FOOTING ASYMMETRICAL

SHEET



PLAN



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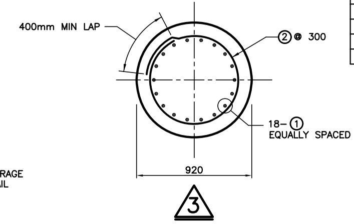
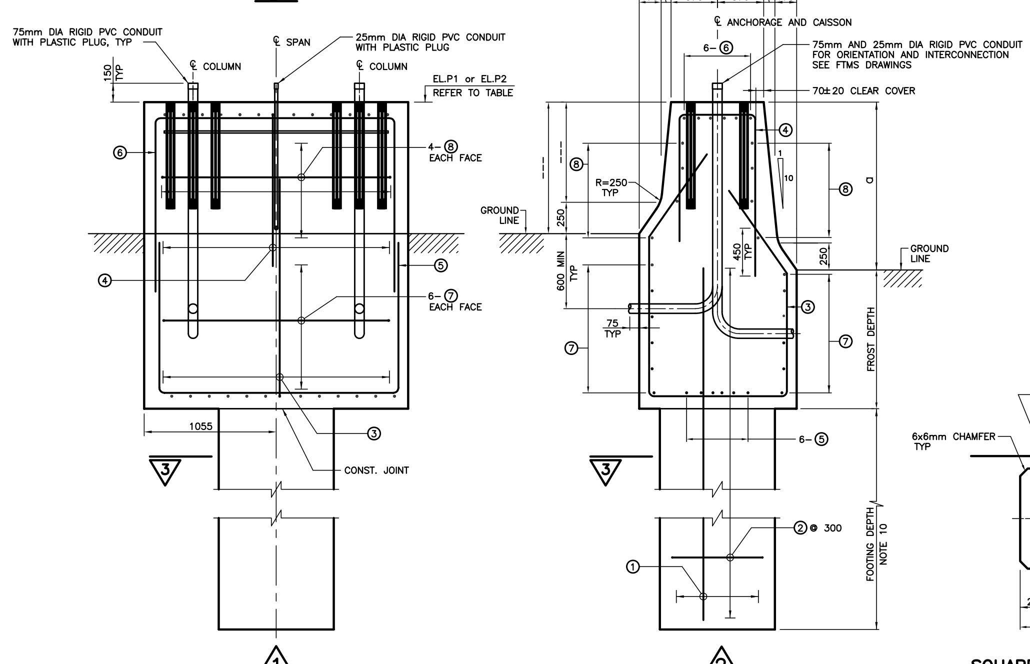
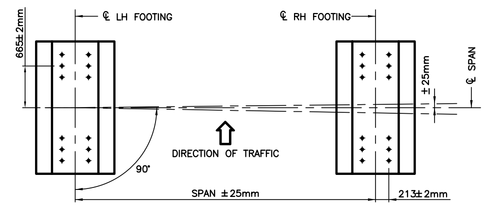




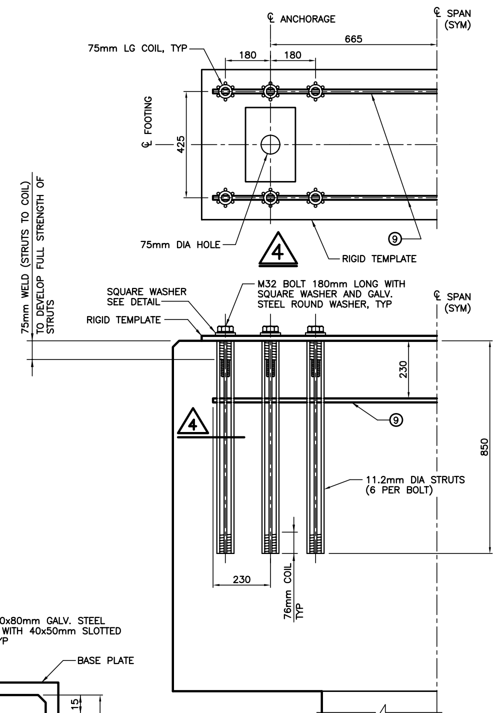
TYPICAL SECTION



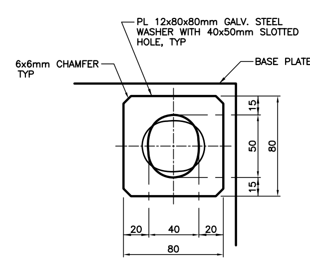
TYPICAL PLAN SHOWING TOLERANCE

FOOTING DIMENSIONS

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



ANCHORAGE INSTALLATION DETAIL



SQUARE WASHER DETAIL

GENERAL NOTES:

1. CLASS OF CONCRETE 30 MPa.
2. CLEAR COVER TO REINFORCING STEEL:
   - –CAISSON 100±25mm
   - –REMAINDER 70±20mm
3. REINFORCING STEEL SHALL BE GRADE 400W UNLESS OTHERWISE SPECIFIED. BAR MARKS WITH PREFIX 'C' DENOTE COATED BARS.
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.
10. THIS DIMENSION 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 REDUCED TO: Y + (5000 – Y)/2, UPON MINISTRY'S APPROVAL.

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. ALL WELDING SHALL BE ACCORDING TO CAN/CSA–W59–03.
4. THE COMPLETE ANCHORAGE ASSEMBLY INCLUDING BOLTS, NUTS AND WASHERS SHALL BE HOT DIP GALVANIZED ACCORDING TO CAN/CSA–G164–M92.
5. EXPOSED PORTION OF BOLTS SHALL BE COATED WITH WHITE NON–STAINING GREASE.
6. A RIGID SETTING TEMPLATE SHALL BE PROVIDED FOR ACCURATE POSITIONING OF ANCHORAGE WITHIN THE CONCRETE FORM. EACH FOOTING SHALL HAVE ONE CONTINUOUS TEMPLATE.
7. ANCHOR BOLTS SHALL ENGAGE FULL LENGTH OF UPPER COIL AT THE TIME ON CONCRETE PLACEMENT.
8. 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	C20M	
4	C20M	
5	20M	
6	C20M	
7	20M	
8	C20M	
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
APRIL 2011

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

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

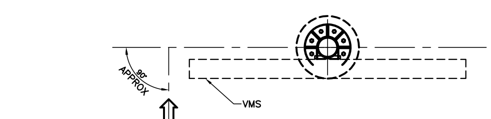
DRAWING NAME: s118–8.dwg
CREATED: 1997/09/24
MODIFIED: 2011/04/04 12:39:48

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

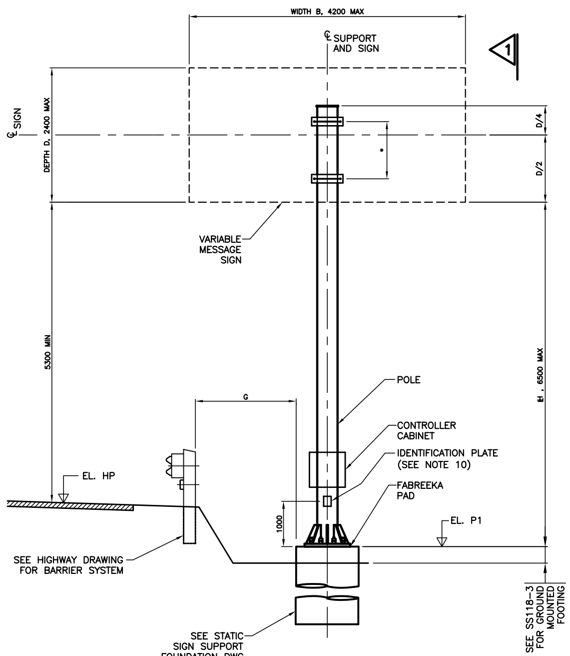
CONT No
WP No

POLE MOUNTED VARIABLE MESSAGE SIGN SUPPORT GENERAL ARRANGEMENT

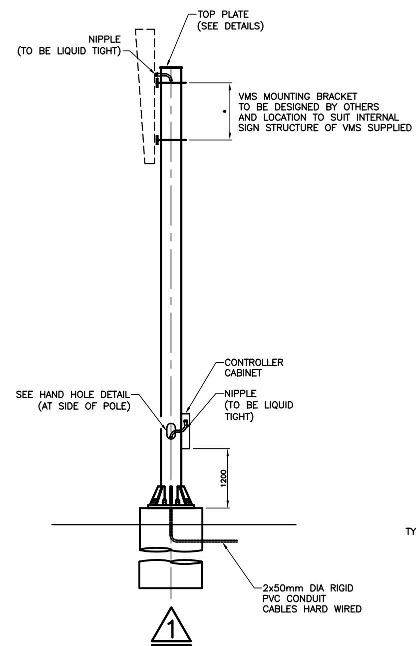
SHEET

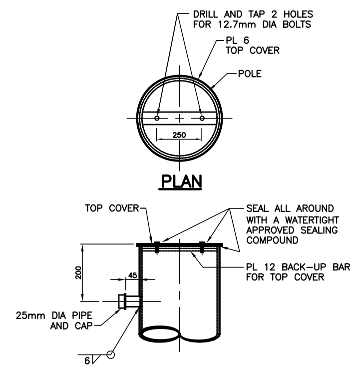


PLAN

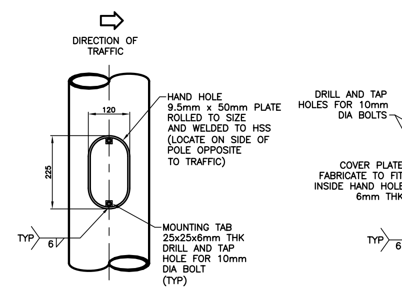


ELEVATION





TOP PLATE DETAIL
SIDE ELEVATION



HAND HOLE DETAIL
(NIPPLE NOT SHOWN FOR CLARITY)

NOTES:

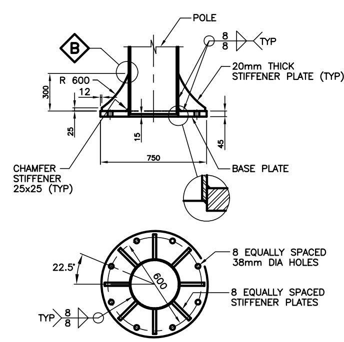
1. ALL STRUCTURAL STEEL SHALL BE ACCORDING TO CAN/CSA-G40.20-04/G40.21-04, GRADE 300W OR ASTM SPECIFICATION A500 GRADE C.
2. ALL BOLTS, NUTS AND WASHERS SHALL BE ACCORDING TO ASTM A325M, CAN/CSA-G164-M92 AND GALVANIZED UNLESS SPECIFIED OTHERWISE.
3. ALL BOLTS SHALL BE BROUGHT TO A SNUG TIGHT CONDITION AND THEN FURTHER TIGHTENED 1/3 OF A TURN, UNLESS OTHERWISE NOTED.
4. ALL STRUCTURAL STEEL SHALL BE ACCORDING TO CAN/CSA-G164-M92 AND GALVANIZED AFTER FABRICATION. POLE SHALL BE SUBSEQUENTLY COATED WITH AN APPROVED PAINT SYSTEM.
5. POLE SHALL NOT BE ERECTED UNTIL FOUNDATION CONCRETE HAS REACHED 80% OF SPECIFIED STRENGTH.
6. ALL WELDING SHALL BE DONE ACCORDING TO CAN/CSA-W59-03.
7. NO SHOP SPLICES IN ANY MEMBERS.
8. ELEVATIONS TO BE VERIFIED IN THE FIELD BEFORE SIGN SUPPORT STRUCTURE FABRICATION.
9. 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).
10. 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.
11. 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:

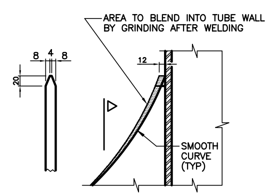
1. DIMENSION G IS DEFINED AS THE HORIZONTAL CLEARANCE FROM THE BACK OF PROTECTIVE BARRIER TO THE NEAREST FACE OF CONCRETE FOOTING ACCORDING TO THE VALUES BELOW. THIS DOES NOT APPLY TO TEMPORARY CONCRETE BARRIER INSTALLATIONS.

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

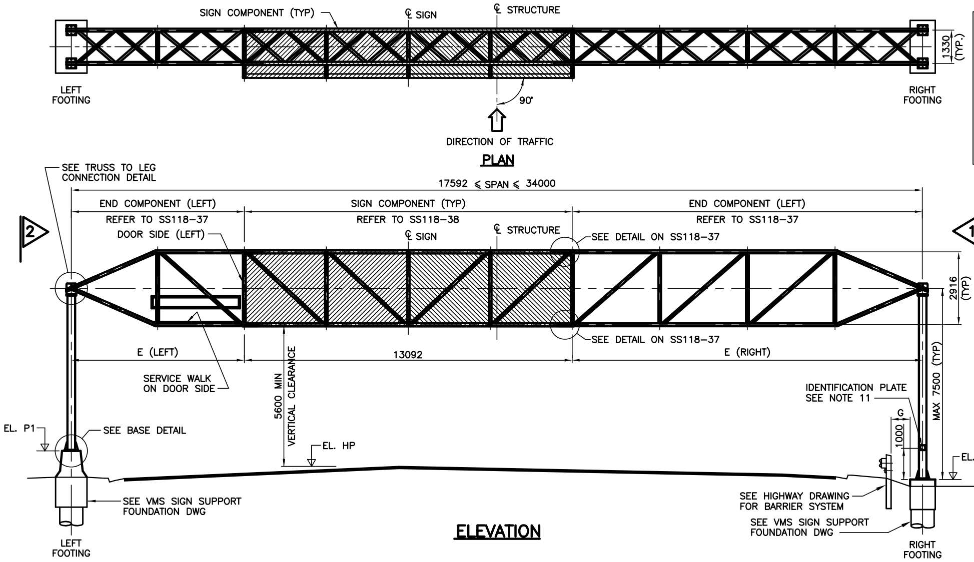
STANDARD DRAWING APRIL 2011

SS118-11

POLE MOUNTED VMS SUPPORT GENERAL ARRANGEMENT

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: s118-11.dwg
CREATED: 2011/03/30
MODIFIED: 2011/04/04 10:21:08



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.

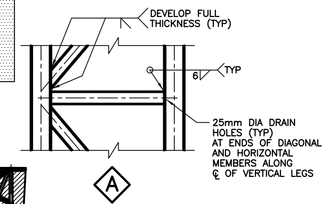
METRIC

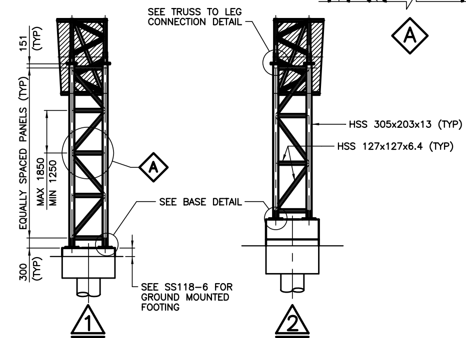
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

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 ACCORDING TO CAN/CSA-G40.20-04/G40.21-04, 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. ALL STRUCTURAL STEEL WELDING SHALL BE ACCORDING TO CAN/CSA-W59-03.
7. ALL ALUMINUM WELDING SHALL BE ACCORDING TO CAN/CSA-W59.2-M1991.
8. SPAN LENGTHS AND ELEVATIONS TO BE VERIFIED IN THE FIELD BEFORE SIGN SUPPORT STRUCTURE FABRICATION.
9. ALL STRUCTURAL NON-STAINLESS STEEL SHALL BE GALVANIZED AFTER FABRICATION ACCORDING TO CAN/CSA-G164-M92. LEGS AND BASE PLATES SHALL BE SUBSEQUENTLY COATED WITH AN APPROVED PAINT SYSTEM.
10. THIS STANDARD TO BE READ IN CONJUNCTION WITH SS118-37 (END COMPONENT – DETAILS) AND SS118-38 (SIGN COMPONENT – DETAILS).
11. 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).
12. 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.
13. NO SHOP SPLICES IN ANY MEMBER.
14. LEGEND:
    HSS – DENOTES HOLLOW STRUCTURAL STEEL
    □ – DENOTES ALUMINUM SQUARE TUBE

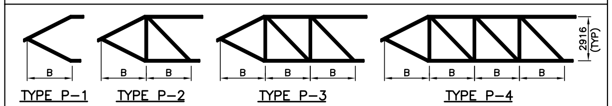
ERECTION NOTES:

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)		---									

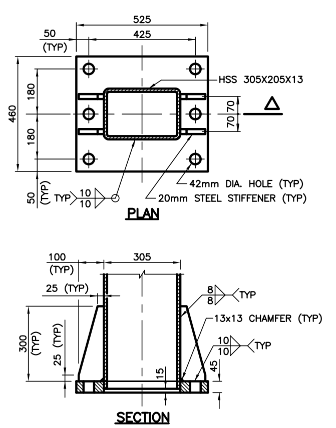
END COMPONENTS



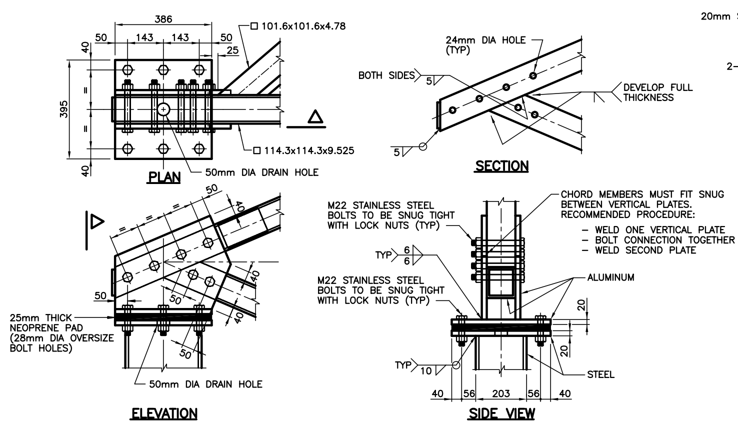
NOTE: END COMPONENTS ARE AS SHOWN AND OPPOSITE HAND

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"

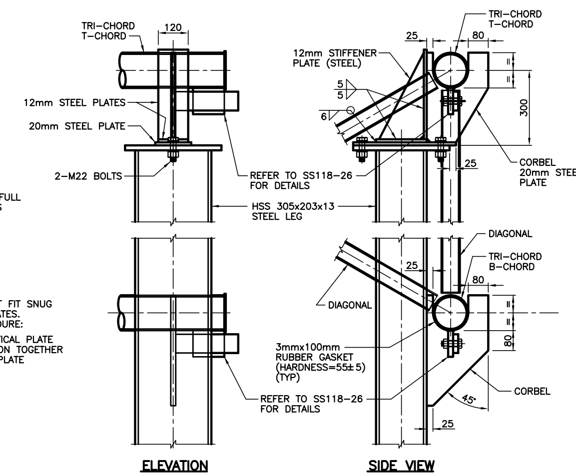
NOTE: DIMENSIONS OF ALUMINUM TUBE SECTIONS TO BE IMPERIAL AS PER TABLE.



BASE DETAIL (TYPICAL)



TRUSS TO LEG CONNECTION DETAIL (TYPICAL)



TEMPORARY TRI-CHORD/CMS "WALK-IN" CONNECTION DETAIL

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

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

STANDARD DRAWING APRIL 2011	SS118-36
VARIABLE MESSAGE SIGN SUPPORT GENERAL ARRANGEMENT	

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

DRAWING NAME: s118-36.dwg
CREATED: 1997/09/24
MODIFIED: 2011/04/04 10:38:30
MINISTRY OF TRANSPORTATION, ONTARIO PR-D-707 88-05

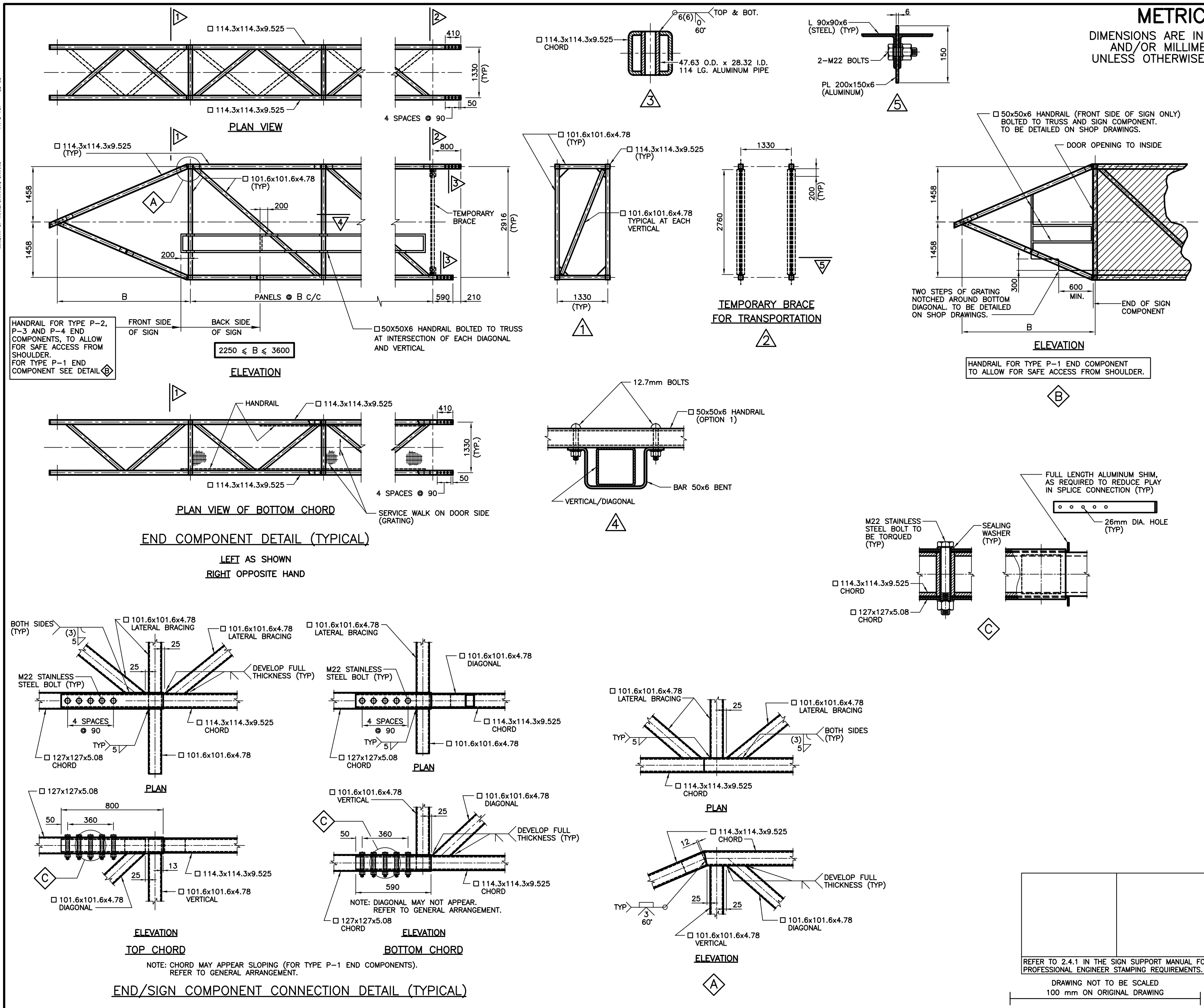
METRIC

DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

CONT No
WP No

SHEET

VARIABLE MESSAGE SIGN SUPPORT
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

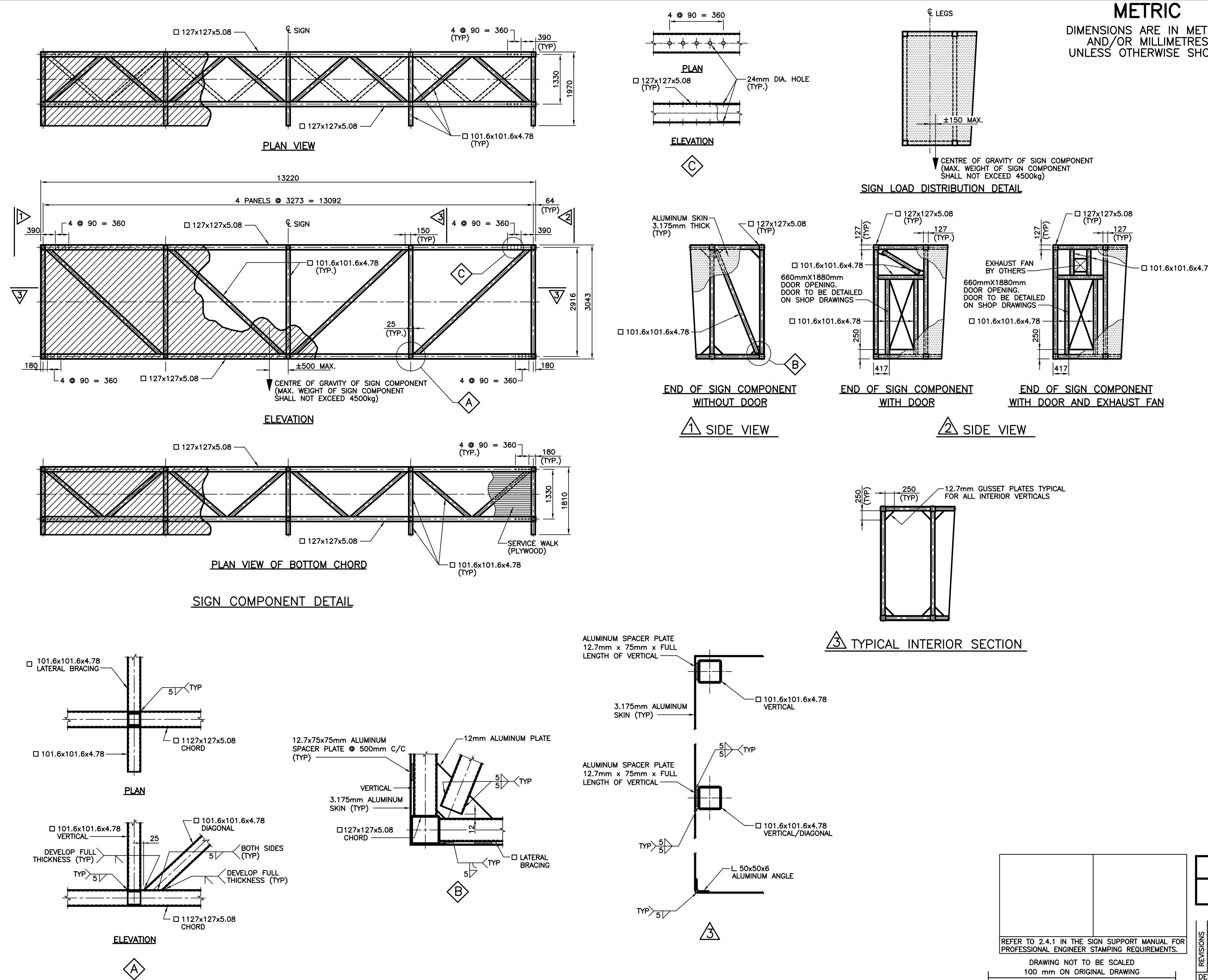
DRAWING NAME: s118–37.dwg
CREATED: 1997/10/27
MODIFIED: 2010/02/09 09:02:21
MINISTRY OF TRANSPORTATION, ONTARIO PR–D–707 88–05

METRIC

DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

CONT No	SHEET
WP No	

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

DRAWING NAME: s118-38.dwg
CREATED: 1997/10/27
MODIFIED: 2010/02/09 09:03:37

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SIGN SUPPORT MANUAL

DIVISION 9 – BRIDGE MOUNTED SIGN SUPPORTS

April 2011

9 BRIDGE MOUNTED SIGN SUPPORTS

9.1 GENERAL

9.1.1 STANDARD SIGN SUPPORT

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

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

9.1.2 DESCRIPTION OF SIGN SUPPORTS

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

9.1.3 TYPES OF SIGN SUPPORTS

Four types of bridge mounted sign supports are used:

TYPE I – Standard Drawings SS118-12

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

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

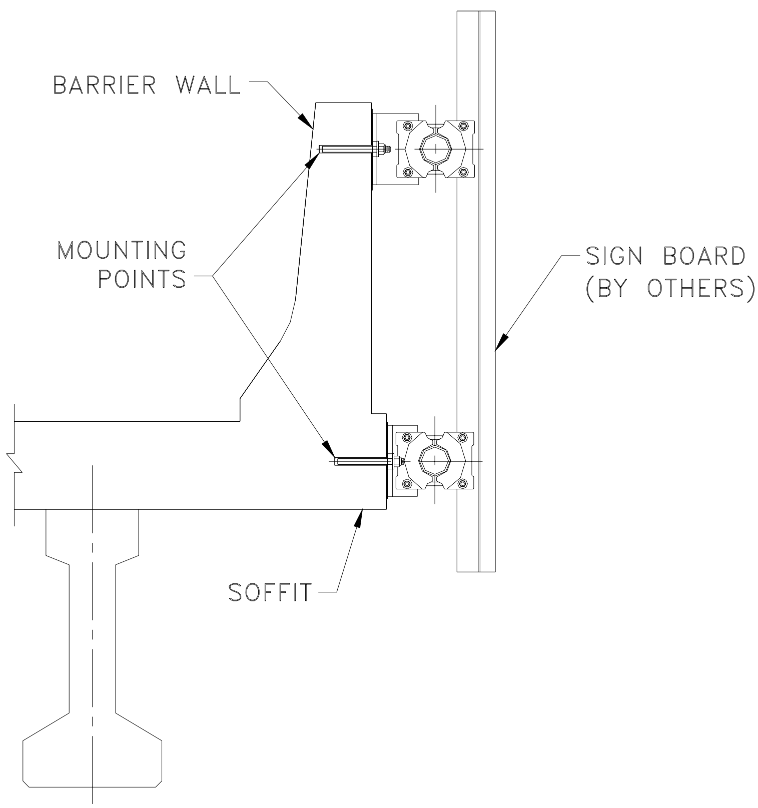


FIGURE 9.1.3(a)

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

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

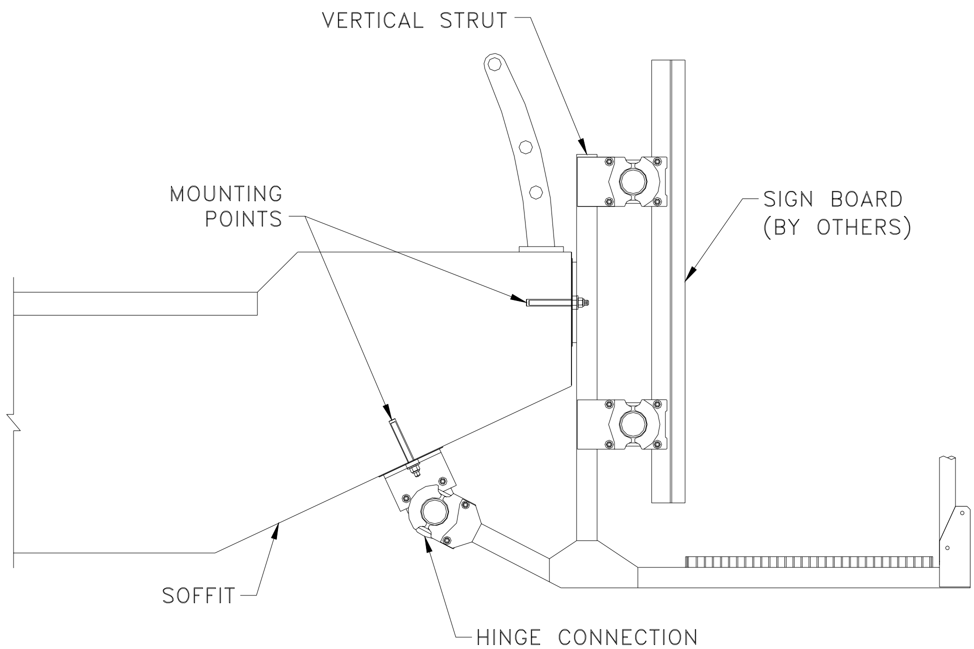


FIGURE 9.1.3(b)

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

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

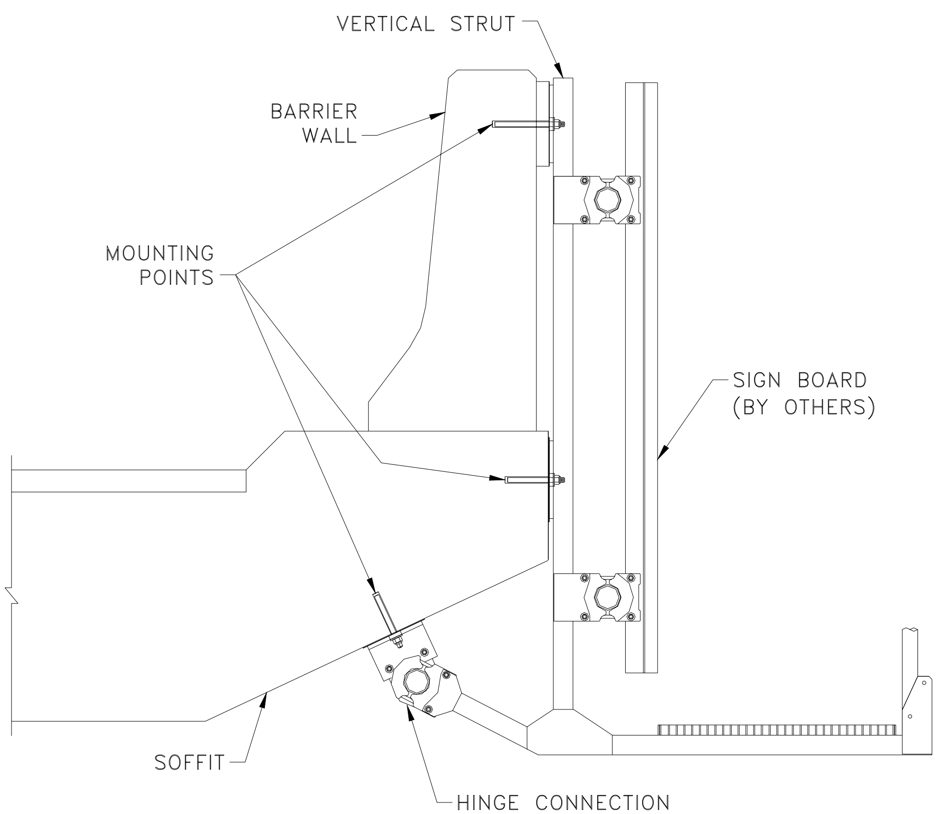


FIGURE 9.1.3(c)

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

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

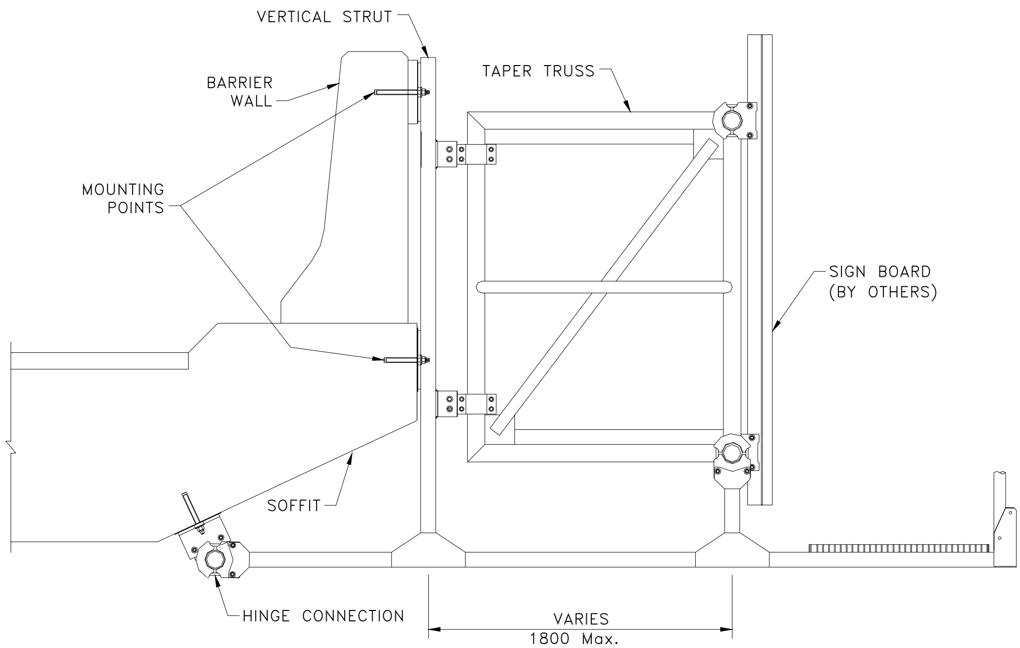


FIGURE 9.1.3(d)

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.

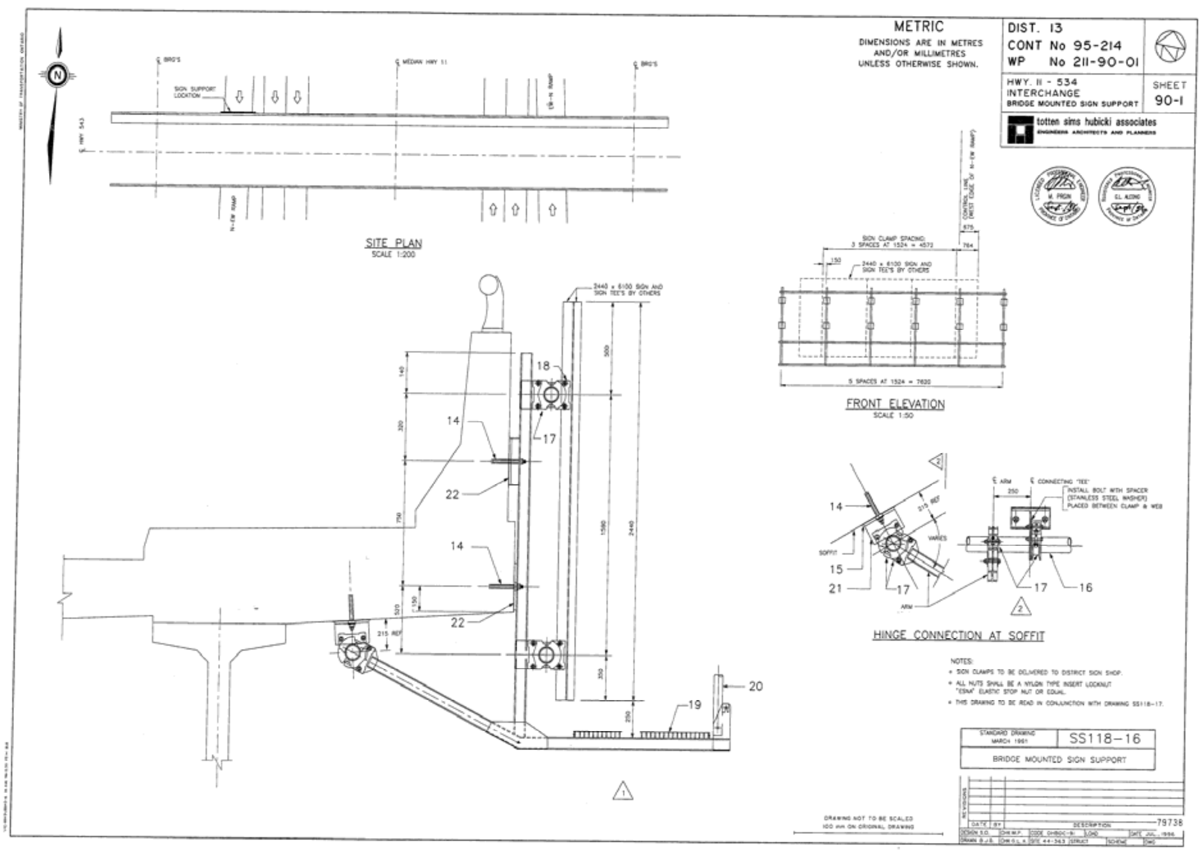


FIGURE 9.2.2(a) GENERAL LAYOUT DRAWING

9.3 PROCESSING

9.3.1 PREPARATION OF ELECTRICAL DRAWINGS

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

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

APPENDIX TO DIVISION 9

BRIDGE MOUNTED SIGN SUPPORTS

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

METRIC

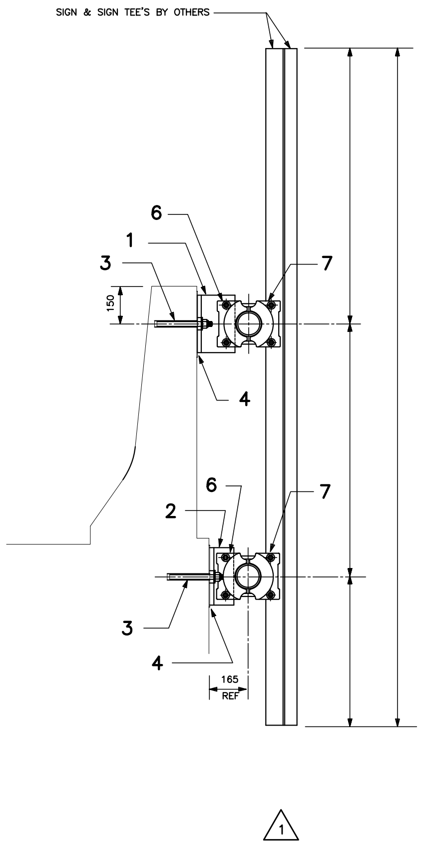
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

CONT No
WP No

BRIDGE MOUNTED SIGN SUPPORT
TYPE I
GENERAL LAYOUT & DETAILS

SHEET

LIST OF DRAWINGS

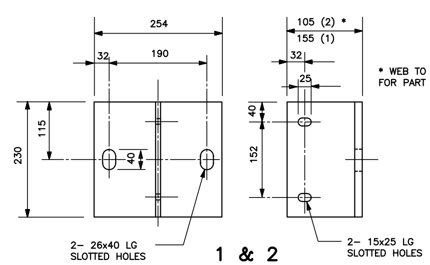


NOTES:

- ALL STAINLESS STEEL BOLTS, NUTS AND WASHERS TO BE ALLOY 304, COLD FINISH, CENTRELESS GROUND, MIN. YIELD STRESS 304 MPa.
- STEEL CONNECTING TEE'S SHALL BE HOT DIP GALVANIZED IN ACCORDANCE WITH CSA SPECIFICATION G164-M.
- FOR INSPECTION & DELIVERY ASSEMBLE ALL BOLTS, NUTS & WASHERS IN PLACE AS SHOWN.
- TOLERANCE +/- 1.5mm UNLESS OTHERWISE SPECIFIED.
- SIGN CLAMPS TO BE DELIVERED TO DISTRICT SIGN SHOP.
- ALL NUTS SHALL BE A NYLON TYPE INSERT LOCKNUT "ESNA" ELASTIC STOP NUT OR EQUAL.

PARTSLIST

QTY	NAME	FIG	MAT'L	ROUGH DIMENSIONS	REMARKS
	CONNECTING TEE	1	G40.12	WT 155 x 39 X 230 LG	GALVANIZED
	CONNECTING TEE	2	G40.12	WT 155 x 39 X 230 LG	GALVANIZED
	STUD ANCHOR, SIZE M20	3	S ST	HILTI HVA M20 x 240 LG	OR EQUIVALENT
	NEOPRENE PAD (3mm TH'K)	4	NEOPRENE	SH 3 x 240 x 265	FOR FIG'S 12 & 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



1 & 2

* WEB TO BE CUT FOR PART NO.2

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

STANDARD DRAWING
MARCH 1991

SS118-12

BRIDGE MOUNTED SIGN SUPPORT

REVISIONS		
DATE	BY	DESCRIPTION

DESIGN	CHK	CODE		LOAD	DATE
DRAWN	CHK	SITE	STRUCT	SCHEME	DWG

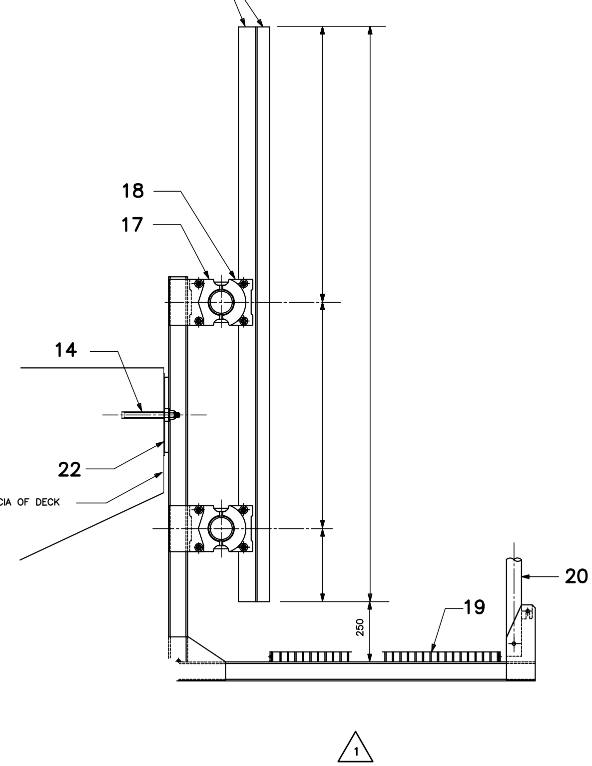
METRIC
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

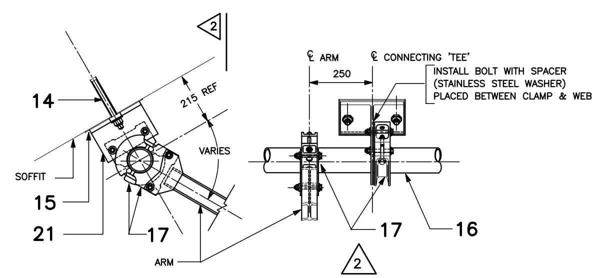
CONT No
WP No

BRIDGE MOUNTED SIGN SUPPORT
TYPE II
GENERAL LAYOUT

SHEET

LIST OF DRAWINGS





HINGE CONNECTION AT SOFFIT

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

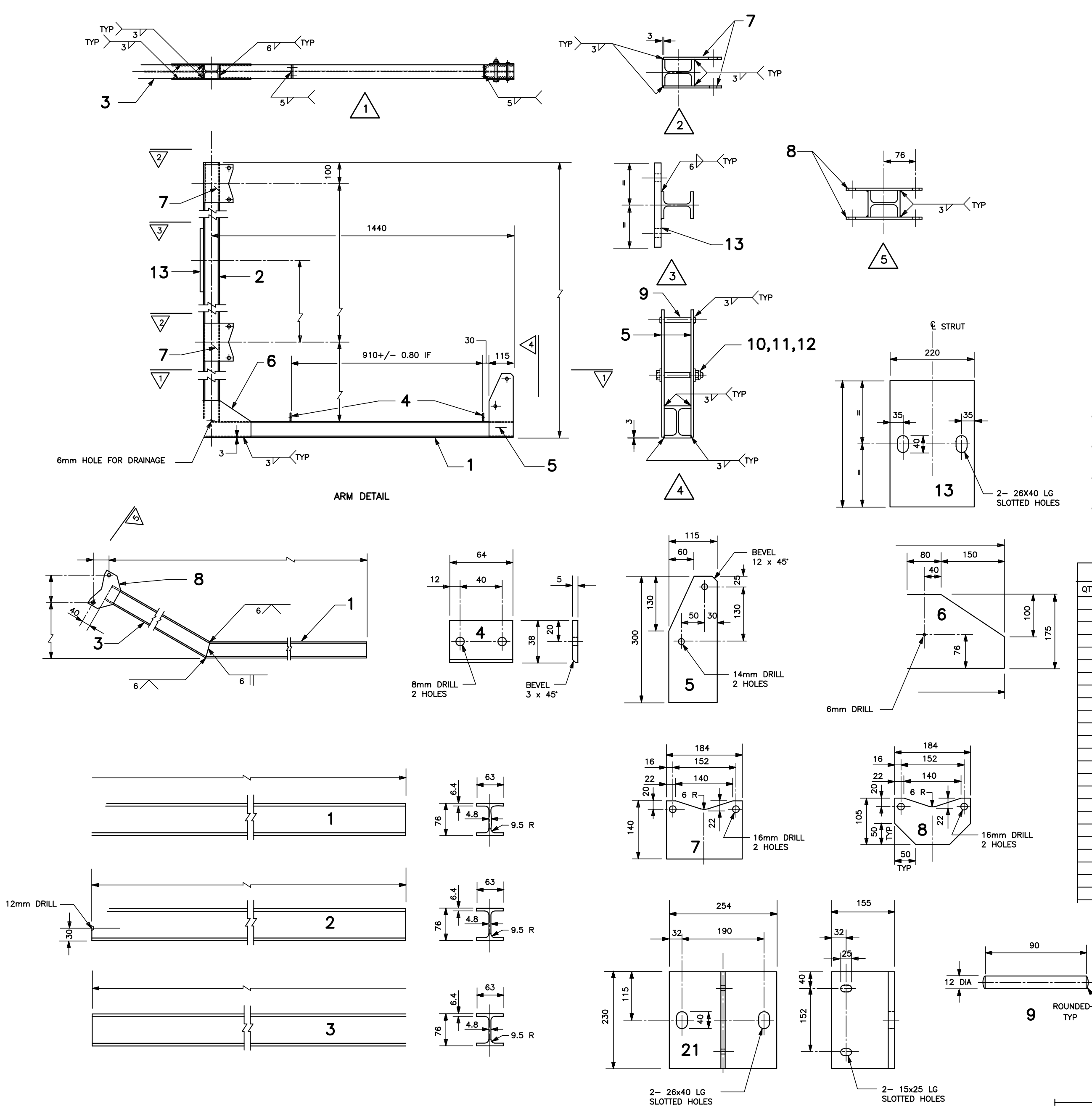
DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

STANDARD DRAWING MARCH 1991	SS118-14
BRIDGE MOUNTED SIGN SUPPORT	

REVISIONS

DATE	BY	DESCRIPTION

DESIGN	CHK	CODE	LOAD	DATE	
DRAWN	CHK	SITE	STRUCT	SCHEME	DWG



METRIC

DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

CONT No
WP No

BRIDGE MOUNTED SIGN SUPPORT
TYPE II
SERVICE WALK ARM ASSEMBLY

SHEET

NOTES:

- ALL STAINLESS STEEL BOLTS, NUTS AND WASHERS TO BE ALLOY 304, COLD FINISH, CENTRELESS GROUND, MIN. YIELD STRESS 304 MPa.
- STEEL CONNECTING TEE'S SHALL BE HOT DIP GALVANIZED IN ACCORDANCE WITH CSA SPECIFICATION G164–M.
- FOR INSPECTION & DELIVERY ASSEMBLE ALL BOLTS, NUTS & WASHERS IN PLACE AS SHOWN.
- TOLERANCE +/– 1.5mm UNLESS OTHERWISE SPECIFIED.

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 x2.5 THK	FOR M12 BOLT
	CONNECTING PLATE	13	6061–T6	PL 16 x 220 X LG	
	STUD ANCHOR, SIZE M20	14	S ST	HILTI HVA M20 x 240 LG	OR EQUIVALENT
	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	G40.12	WT 155 x 39 X 230 LG	GALVANIZED
	NEOPRENE PAD (3mm TH'K)	22	NEOPRENE	SH 3 x 230 x LG	FOR FIG 13

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

STANDARD DRAWING
MARCH 1991

SS118–15

BRIDGE MOUNTED SIGN SUPPORT

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

METRIC

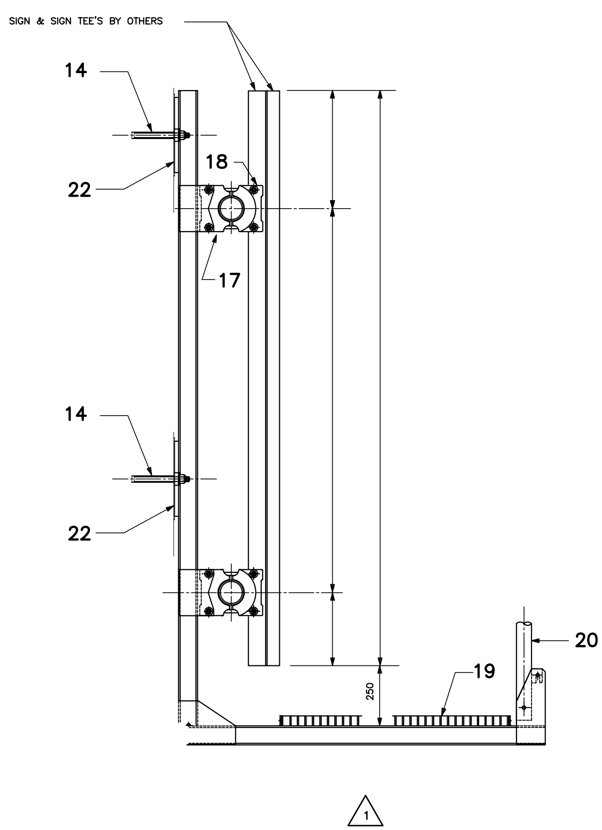
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

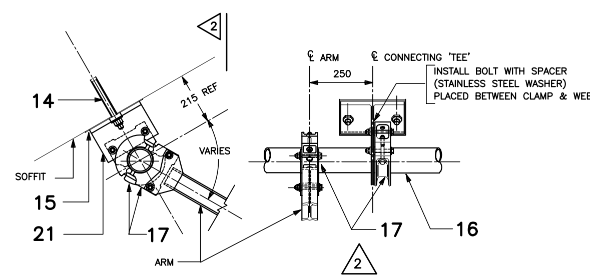
CONT No
WP No

BRIDGE MOUNTED SIGN SUPPORT
TYPE III
GENERAL LAYOUT

SHEET

LIST OF DRAWINGS





HINGE CONNECTION AT SOFFIT

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

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

STANDARD DRAWING MARCH 1991	SS118–16
BRIDGE MOUNTED SIGN SUPPORT	

REVISIONS

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

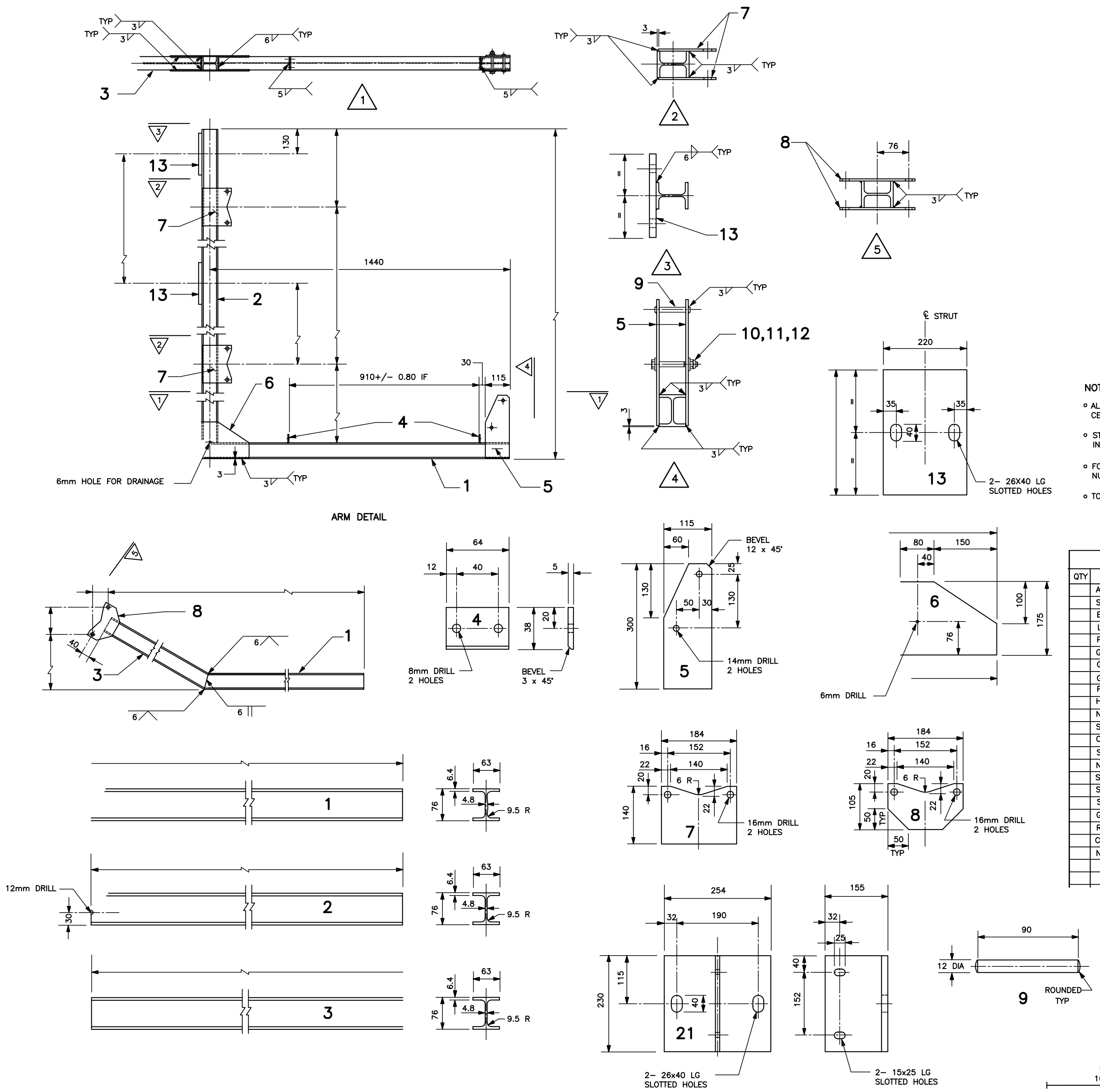
METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

CONT No
WP No

BRIDGE MOUNTED SIGN SUPPORT
TYPE III
SERVICE WALK ARM ASSEMBLY

SHEET



NOTES:

- ALL STAINLESS STEEL BOLTS, NUTS AND WASHERS TO BE ALLOY 304, COLD FINISH, CENTRELESS GROUND, MIN. YIELD STRESS 304 MPa.
- STEEL CONNECTING TEE'S SHALL BE HOT DIP GALVANIZED IN ACCORDANCE WITH CSA SPECIFICATION G164–M.
- FOR INSPECTION & DELIVERY ASSEMBLE ALL BOLTS, NUTS & WASHERS IN PLACE AS SHOWN.
- TOLERANCE +/- 1.5mm UNLESS OTHERWISE SPECIFIED.

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 x2.5 THK	FOR M12 BOLT
	CONNECTING PLATE	13	6061–T6	PL 16 x 220 X LG	
	STUD ANCHOR, SIZE M20	14	S ST	HILTI HVA M20 x 240 LG	OR EQUIVALENT
	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	G40.12	WT 155 x 39 X 230 LG	GALVANIZED
	NEOPRENE PAD (3mm TH'K)	22	NEOPRENE	SH 3 x 230 x LG	FOR FIG 13

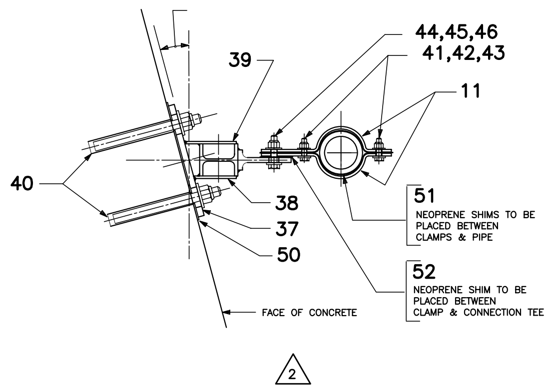
STANDARD DRAWING
MARCH 1991

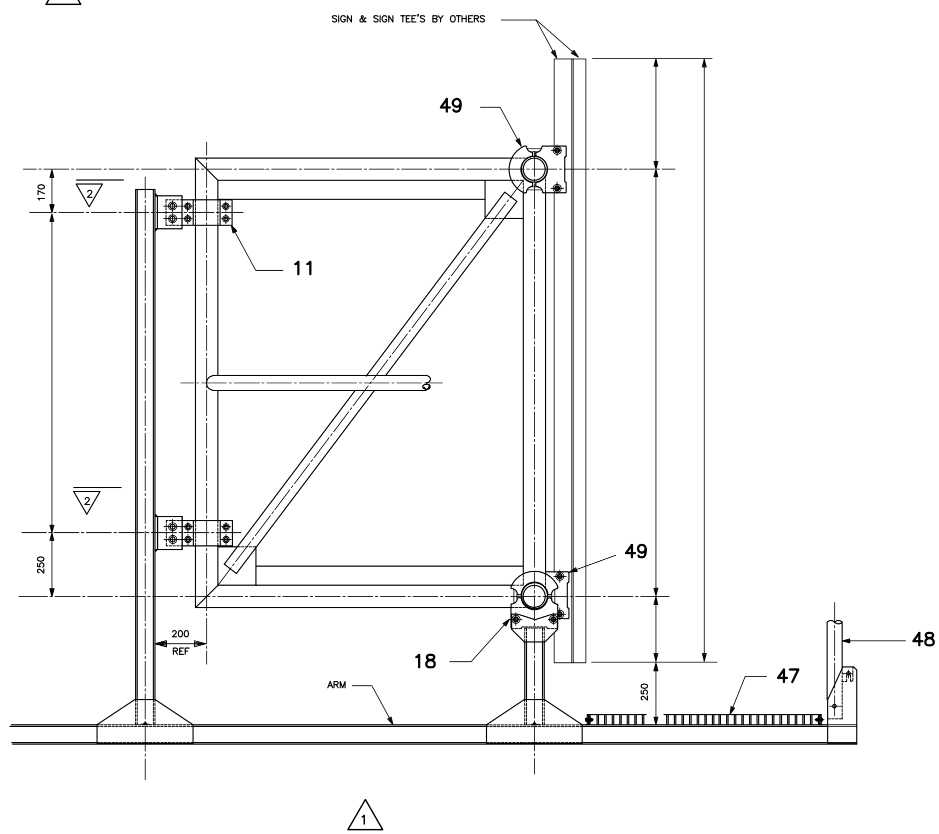
SS118–17

BRIDGE MOUNTED SIGN SUPPORT

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

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





METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

CONT No
WP No

BRIDGE MOUNTED SIGN SUPPORT
TYPE IV
GENERAL LAYOUT

SHEET

LIST OF DRAWINGS

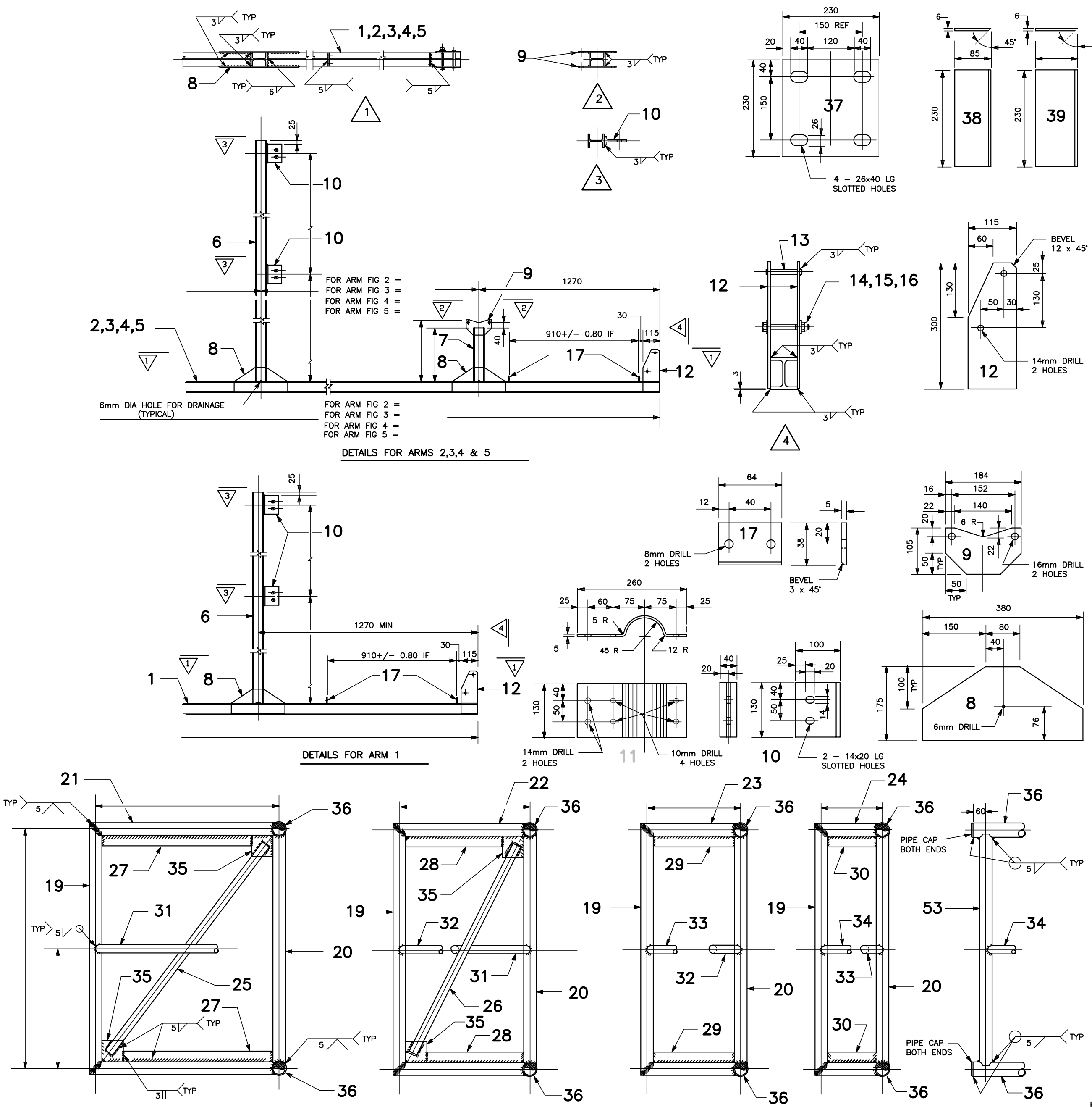
NOTES:
- SIGN CLAMPS TO BE DELIVERED TO DISTRICT SIGN SHOP
- ALL NUTS SHALL BE A NYLON TYPE INSERT LOCKNUT "ESNA" ELASTIC STOP NUT OR EQUAL
- THIS DRAWINGS TO BE READ INCONJUNCTION WITH DRAWING SS118-19.

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

STANDARD DRAWING MARCH 1991	SS118-18
BRIDGE MOUNTED SIGN SUPPORT	

REVISIONS

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



METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

CONT No
WP No

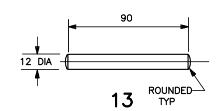
BRIDGE MOUNTED SIGN SUPPORT
TYPE IV
SERVICE WALK ARM ASSEMBLY

SHEET

NOTES:
- ALL STAINLESS STEEL BOLTS, NUTS AND WASHERS TO BE ALLOY 304,COLD FINISH, CENTRELESS GROUND MIN. YIELD STRESS 304 MPa.
- FOR INSPECTON & DELIVERY, ASSEMBLE ALL BOLTS, NUTS & WASHERS IN PLACE AS SHOWN.
- STEEL CLAMPS SHALL BE HOT DIP GALVANIZED IN ACCORDANCE WITH C.S.A. SPECIFICATION G164–M.
- TOLERANCE +/– 1.5mm UNLESS OTHERWISE SPECIFIED

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	G40.8	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 x2.5 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 90 x 240	
	GUSSET	39	6061–T6	SH 6 x x 240	
	STUD ANCHOR, SIZE M20	40	S ST	HILTI HVA M20 x 240 LG	OR EQUIVALENT
	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	



DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

STANDARD DRAWING
MARCH 1991

SS118–19

BRIDGE MOUNTED SIGN SUPPORT

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

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SIGN SUPPORT MANUAL

INDEX

April 2011

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