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# Guideline

## Sign Structural Design

# Contents

<b>1</b>	<b>INTRODUCTION .....</b>	<b>5</b>
<b>2</b>	<b>SINGLE POST OR MULTIPLE POSTS.....</b>	<b>6</b>
2.1	Flat Unbraced Aluminium Sheet Signs – Single Post.....	6
2.2	Flat Braced Aluminium Sheet Signs – Multiple Posts.....	6
2.3	Flat Braced Aluminium Sheet Signs – Other Means of Support .....	6
<b>3</b>	<b>DESIGN OF POSTS FOR SINGLE POST (UNBRACED) SIGNS .....</b>	<b>7</b>
3.1	Step 1 – Select Post Size.....	7
3.2	Step 2 – Determine Post Length .....	8
3.2.1	Post Length for Single Post Signs with no Supplementary Plates.....	9
3.2.2	Post Length for Single Post Signs with Supplementary Plates.....	10
3.3	Step 3 – Determine Footing Details .....	11
3.4	Step 4 – Record Design Details .....	11
<b>4</b>	<b>POSTS FOR SMALL MULTIPLE POST (BRACED) SIGNS .....</b>	<b>12</b>
<b>5</b>	<b>THE STRUCTURAL DESIGN OF LARGE MULTIPLE POST (BRACED) SIGNS .....</b>	<b>13</b>
5.1	Step 1 – Establish Design Parameters.....	14
5.2	Step 2 – Determine Whether Sign Posts Should be Frangible or Not.....	14
5.2.1	Frangible Post Selection Criteria .....	15
5.3	Step 3 – Structural Design of Posts, Footings and Stiffeners for Large Multiple Signs .....	16
5.3.1	Step 3.1 – Choose Wind Speed Region and Terrain Category .....	17
5.3.2	Step 3.2 – Calculate Area of Sign, Post Spacing and Moment Lever Arm .....	17
5.3.3	Step 3.3 – Determine Wind Force Acting on Sign.....	17
5.3.4	Step 3.4 – Post Size Selection .....	18
5.3.5	Step 3.5 – Determine Footing Details .....	19
5.3.6	Step 3.6 – Determine Sign Outstand and Post Spacing.....	19
5.3.7	Step 3.7 – Determine Stiffener Type and Spacing .....	19
5.4	Step 4 – Recording of Sign Design Information.....	20
5.5	Design Excel Spreadsheet.....	20
<b>6</b>	<b>DESIGN REQUIREMENTS FOR SINGLE POST CANTILEVER SIGNS AND FRAMES ....</b>	<b>21</b>
6.1	Step 1 – Establish Design Parameters.....	21
6.2	Step 2 – Determine Whether Sign Should be Frangible or Not .....	21
6.2.1	Frangible Post Selection Criteria .....	22
6.3	Step 3 – Select Design Concept .....	22
6.4	Step 4 – Structural Design of Sign and Produce Detailed Drawings.....	22
6.4.1	Step 4.1 – Choose Wind Speed Region and Terrain Category .....	24
6.4.2	Step 4.2 – Calculate Area of Sign and Determine Wind Force Acting on Sign .....	24
6.4.3	Step 4.3 – Spacing of the CHS Posts and Outstand Length .....	24
6.4.4	Step 4.4 – Determine Stiffener Type and Spacing .....	24

6.4.5	Step 4.5 – Determine All Loads on Sign and Conduct Structural Analysis .....	25
6.4.6	Step 4.6 – Select Appropriate Post Size .....	25
6.4.7	Step 4.7 – Determine Footing Details .....	25

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## Amendments

Revision Number	Revision Date	Description of Key Changes	Section / Page No.
4	July 2023	Guideline updated to incorporate all of Traffic Control Devices - Chapter 4 in one document. Whole document reviewed/updated to meet current standards.	All
5	August 2024	Whole document reviewed/updated to meet current standards.	All
6	March 2026	Hazard marker sign number references removed to reflect update to standard drawing 9648-0176-6.	3.2
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# 1 INTRODUCTION

This section of the Road & Traffic Engineering Manual provides guidelines on the selection and design of posts to support road traffic signs in Western Australia. This section sets out the Main Roads WA guidelines for:

- The decision whether to use single or multiple post supports.
- The selection of appropriate sections for single sign posts.
- The design of supports for large signs with multiple posts.
- Design requirements for single post cantilever signs and frames.

The guideline contains a series of flow charts and design charts to simplify the post selection and design process. They outline the design of the signs from a Traffic Engineering point of view with respect to the location of the sign, the design of the post(s) and footing size(s) and the need for the sign posts to be frangible. The guideline also outlines the structural design of the sign panel for large signs.

Also contained in this guideline are copies of the Main Roads WA Fabrication Drawings for breakaway universal beam posts (slip base) and a sample sign drawing using the design method. This document does not cover the structural design of overhead signs supported on bridges or gantries since these should be individually designed based on specific site circumstances, however a typical example is given to provide designers with a starting point.

Installation details covering brackets, bolts, washers etc. are given in Main Roads WA [Specification 601: Signs](#).

## 2 SINGLE POST OR MULTIPLE POSTS

The decision whether to use a single post or multiple posts to support a sign depends primarily on whether the sign is braced or unbraced. This, in turn, is based on the width and surface area of the sign. In Western Australia, unbraced signs are supported on a single post. Braced signs are supported on multiple posts, except in restricted conditions where the use of a single post cantilever support may be required.

### 2.1 Flat Unbraced Aluminium Sheet Signs – Single Post

Flat aluminium sheet signs of the following dimensions are unbraced and are supported on single posts.

- Rectangular signs not exceeding 900 mm nominal width and 1200 mm nominal height.
- Triangular signs not exceeding 1200 mm nominal height.
- Diamond signs not exceeding 900 mm x 900 mm square.
- Other shaped signs including circular, octagonal, trapezoidal etc., not exceeding 900 mm in height or width.

The design of posts for unbraced signs supported on a single post is given in [Section 3](#).

### 2.2 Flat Braced Aluminium Sheet Signs – Multiple Posts

Flat aluminium sheet signs, which exceed the dimensions of unbraced signs, are required to be braced and are supported on multiple posts. Some braced signs, supported on multiple posts are required to be mounted at a height lower than is indicated on Drawing [8720-0762](#). These signs generally require smaller posts than the normal Main Roads WA design methodology for multiple posts permits. For this reason, these signs are referred to as Small Multiple Post Signs and are dealt with separately in [Section 4](#).

Braced signs, supported on multiple posts, which are required to be mounted at the minimum height indicated on Drawing [8720-0762](#), are referred to as Large Multiple Post Signs and are dealt with in [Section 5](#).

### 2.3 Flat Braced Aluminium Sheet Signs – Other Means of Support

Braced signs, which due to lateral restrictions cannot be supported on multiple posts, may be installed using a single post cantilever support. The design requirements for single post cantilever signs and frames are given in [Section 6](#).

The structural design of overhead signs supported on bridges or gantries should be individually designed based on specific site circumstances. Drawing [9730-1027](#) provides a typical example of the sign support details for an overhead sign supported on a reinforced concrete bridge structure.

### 3 DESIGN OF POSTS FOR SINGLE POST (UNBRACED) SIGNS

After the decision to use a single post to support the unbraced sign has been made, the design process for single post signs follows the flow chart given in Figure 1.



**Figure 1: Flow Chart for the Design of Posts for Single Post Signs**

#### 3.1 Step 1 – Select Post Size

- The wind speed region where the sign is to be erected is obtained from Drawing [1830-0002](#).
- The sign size is obtained from Table 4 and 5 in Main Roads WA [Sign Standards](#) guideline.

The post sizes for single post (unbraced) signs are given in Table 1 below:

Area	Sign Size	
	A & B	C & D
Metropolitan Perth and Build-up Areas	76 x 38 x 2.0 RHS or 60.3 CHS 2.3 <sup>1,2</sup> if sign area is ≤ 1.00 m <sup>2</sup> 75 x 50 x 2.5 RHS if sign area is > 1.00 m <sup>2</sup>	75 x 50 x 2.5 RHS
Rural Areas subject to tropical cyclones (Regions C and D on Drawing <a href="#">1830-0002</a> )	75 x 50 x 2.5 RHS	75 x 50 x 2.5 RHS
Rural Areas not subject to tropical cyclones (Regions A and B on Drawing <a href="#">1830-0002</a> )	76 x 38 x 2.0 RHS or 60.3 CHS 2.3 <sup>1,2</sup> if sign area is ≤ 1.00 m <sup>2</sup> 75 x 50 x 2.5 RHS if sign area is > 1.00 m <sup>2</sup>	75 x 50 x 2.5 RHS

1. The larger 75 x 50 x 2.5 RHS post may be used for size A & B signs to protect against vandalism.
2. For signs facing oncoming traffic, CHS posts are to be used in conjunction with brackets to secure the sign to the post.

**Table 1: Single Post Sign Post Sizes**

### 3.2 Step 2 – Determine Post Length

The post length for single post signs is a function of:

- The vertical clearance between the bottom of the sign and the ground.
- The bolt hole location.
- The embedment depth.

#### Vertical Clearance

The required vertical clearance between the bottom of the sign and the ground for the majority of single post signs is shown on Drawing [9548-0106](#).

The required vertical clearances for hazard markers are given on Drawing [9648-0176](#).

The required vertical clearances for "Keep Clear" signs (MR-RD-5) are given on Drawing [9731-2493](#).

The required vertical clearances for signs frequently located near the noses of islands ("Keep Left" (MR-RD-6, R2-3(L)), "Keep Right" (R2-3(R)), "Cars Only U-Turn" (MR-GT-15) is 300 to 450 mm.

For the required vertical clearance for Curved Alignment Markers (D4-6), refer to Drawing [9648-0176](#).

#### Bolt Hole Location

Drawing [9220-0180](#) gives the bolt hole locations for the majority of unbraced sign blanks. For some Main Roads WA signs, the bolt hole location is shown on the sign drawing.

#### Embedment Depth

The embedment depth is dependent on how the sign post is fixed in/to the ground.

Typical footing details for single post signs are given in Drawing [9548-0106](#). The standard embedment depth is given as 600 mm. However, some signs, which may be located on the noses of islands (e.g. "Keep Left"), may be mounted using an approved bracket. In this case, the embedment depth may be 0.

### 3.2.1 Post Length for Single Post Signs with no Supplementary Plates

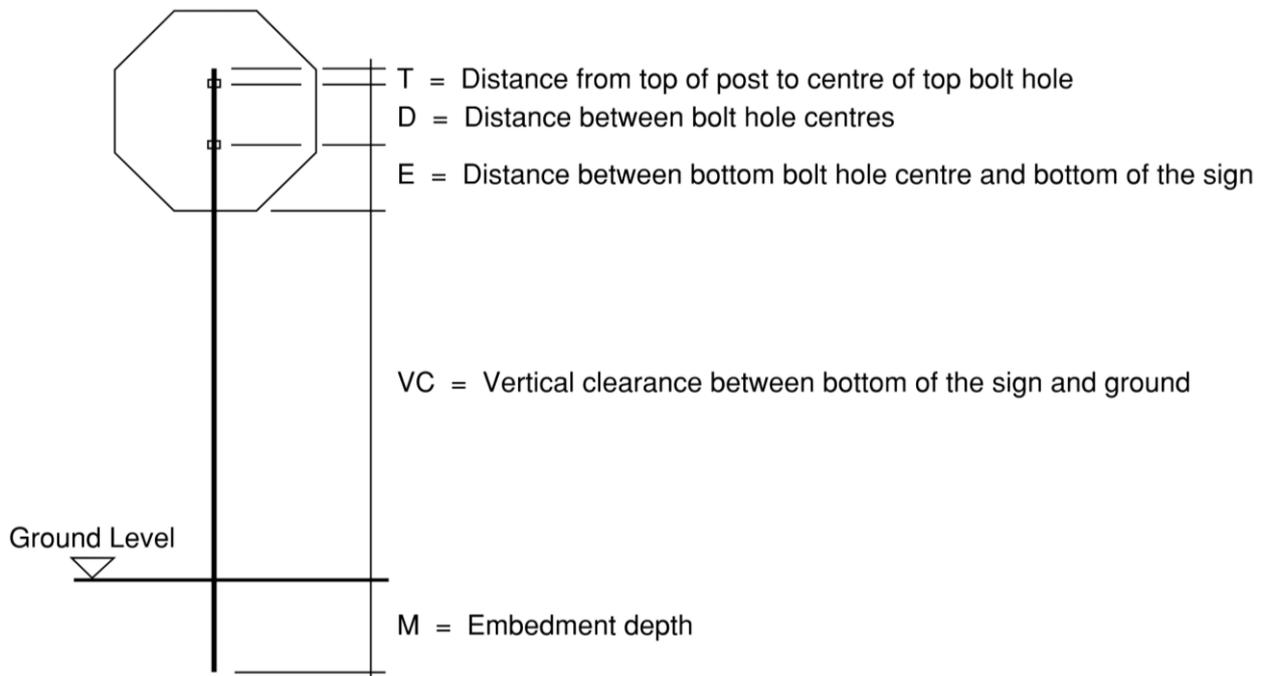
For single post signs with no supplementary plates, the minimum post length is calculated from the formula:

$$PL = (T + D + E + VC + M)$$

Where,

- PL            The minimum post length in mm.
- T             The distance from the top of the post to the centre of the top bolt hole (typically 50 mm).
- D             The vertical distance between the bolt hole centres in mm from Drawing [9220-0180](#), or the Main Roads WA sign drawing, as applicable.
- E             The vertical distance between the centre of the bottom bolt hole to the bottom of the sign in mm from Drawing [9220-0180](#), or the Main Roads WA sign drawing, as applicable.
- VC            The minimum vertical clearance between the ground and the bottom of the sign in mm. Refer to Drawing [9548-0106](#).
- M             The embedment depth (typically 600 mm).

These dimensions are illustrated in Figure 2.



**Figure 2: Dimensions to Determine Minimum Post Length for Single Post Signs with No Supplementary Plates**

Standard post lengths with predrilled holes are available from manufacturers. Drawing [8720-0657](#) details the more commonly used combinations of post lengths with predrilled holes.

### 3.2.2 Post Length for Single Post Signs with Supplementary Plates

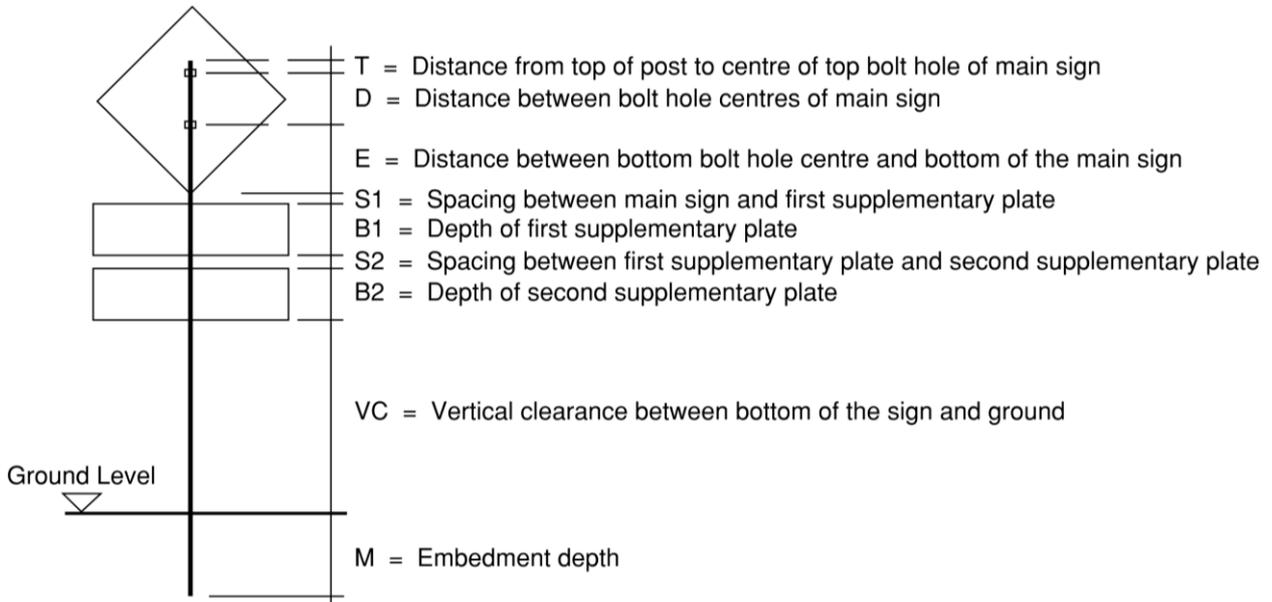
For single post signs with supplementary plates, the minimum post length is calculated from the formula:

$$PL = (T + D + E + VC + M) + (B1 + S1) + (B2 + S2) + \dots + (Bn + Sn)$$

Where,

- PL            The minimum post length in mm.
- T            The distance from the top of the post to the centre of the top bolt hole of the main sign (typically 50 mm).
- D            The vertical distance between the bolt hole centres of the main sign in mm from Drawing [9220-0180](#), or the Main Roads WA sign drawing, as applicable.
- E            The vertical distance between the centre of the bottom bolt hole of the main sign to the bottom of the sign in mm from Drawing [9220-0180](#), or the Main Roads WA sign drawing, as applicable.
- VC           The minimum vertical clearance between the ground and the bottom of the lowest supplementary plate in mm. Refer to Drawing [9548-0106](#).
- M            The embedment depth (typically 600 mm).
- B1, B2, etc.    Depth of each supplementary plate.
- S1, S2, etc.    Minimum spacing between each supplementary plate and the sign/plate above (typically 25 mm).
- n            Number of supplementary plates.

These dimensions are illustrated in Figure 3.



**Figure 3: Dimensions to Determine Minimum Post Length for Single Post Signs with Supplementary Plates**

Standard post lengths with predrilled holes are available from manufacturers. Drawing [8720-0657](#) details the more commonly used combinations of post lengths with predrilled holes.

### 3.3 Step 3 – Determine Footing Details

Footing details for single post signs are given on Drawing [9548-0106](#).

### 3.4 Step 4 – Record Design Details

The design details for single post signs should be recorded on the sign schedule drawing. The following information is to be provided:

- Signs and Pavement Marking drawing number.
- Main Roads WA drawing number (for standard Main Roads WA signs) or a reference to AS 1743 for Australian Standard signs.
- Chainage.
- Position i.e. Left Hand Side (LHS) or Right Hand Side (RHS).
- Sign number, including size (A,B,C etc.).
- Sign Description.
- Main Roads WA Location Number (if applicable).
- Class of retroreflective material used.
- Mounting height.
- Panel section (Distance from bottom of the sign to the top of the post).
- Post Size (from Table 1).
- Footing Diameter.
- Footing Depth.
- Embedment Depth.
- Minimum overall post length.
- Protective overlay film required / not required.

Drawing [200331-0050](#) gives an example of the typical information to be recorded on the sign schedule drawing. It should be noted that the format for this drawing should also be used for small multiple post signs ([Section 4](#)) and standard signs (AS 1743 or in Main Roads WA [Signs Index](#)), which are supported on multiple posts.

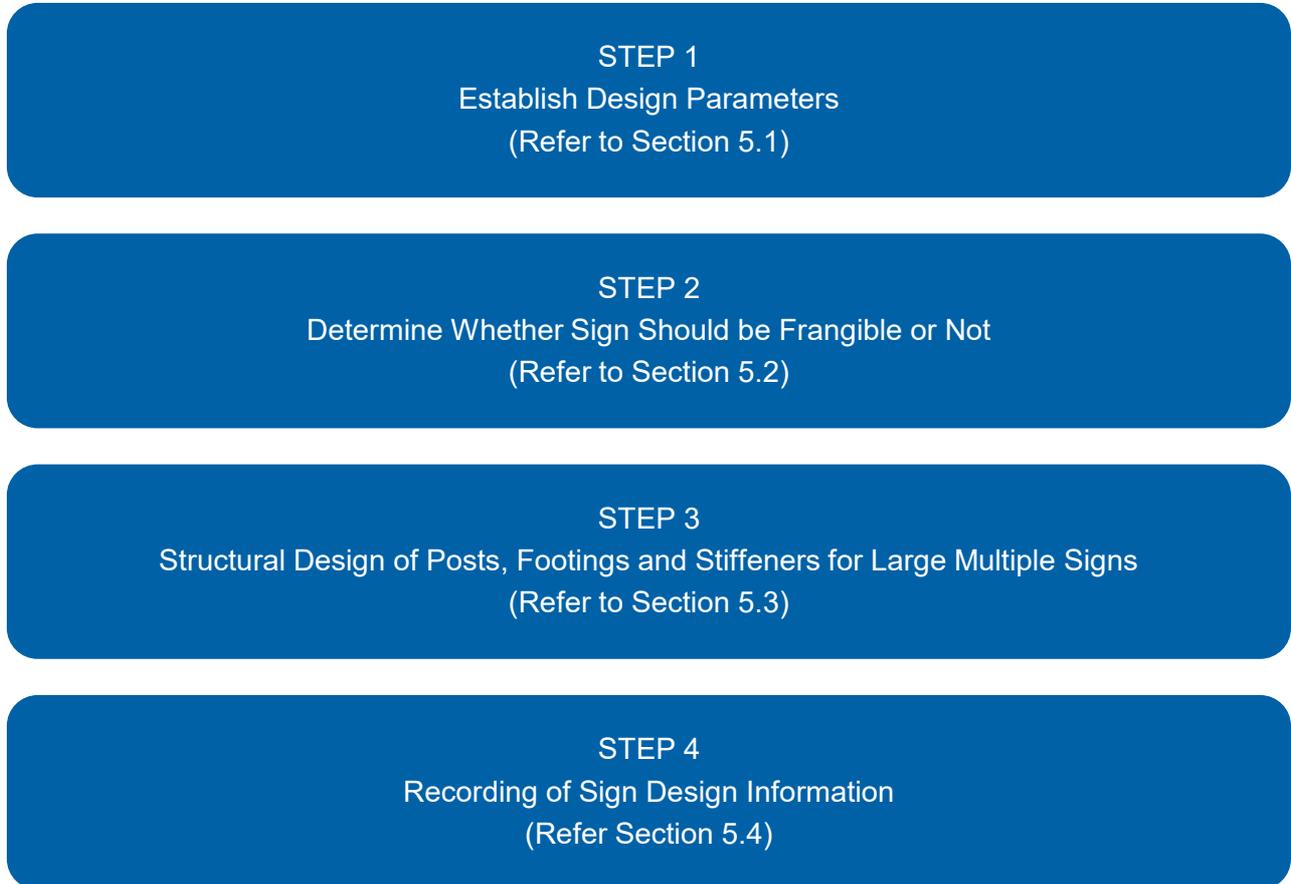
## 4 POSTS FOR SMALL MULTIPLE POST (BRACED) SIGNS

There are a number of multiple post signs, which are required to be mounted at a height lower than those shown on Drawing [8720-0762](#). These signs generally require smaller post sections than a 60.3 CHS 2.9. Typical fixing and installation details have been developed for hazard markers – Drawing [9648-0176](#).

The design details for small multiple post (braced) signs should be recorded on the sign schedule drawing, as indicated in [Section 3.4](#).

## 5 THE STRUCTURAL DESIGN OF LARGE MULTIPLE POST (BRACED) SIGNS

The design process for large multiple post signs follows the flow chart given in Figure 4.



**Figure 4: Flow Chart for the Design of Large Multiple Post Signs**

## 5.1 Step 1 – Establish Design Parameters

The following design parameters are required prior to commencing with the structural design of large multiple post signs. It is imperative that a site investigation be carried out to determine these parameters.

### Sign Size

The required sizes for Australian Standard signs and Main Roads WA Standard signs are given in Table 4 and 5 in Main Roads WA [Sign Standards](#) guideline.

The legend and layout details for Australian Standard signs are available in AS1743 - Road Signs Specification. The legend and layout details for Main Roads WA Standard signs are given in the relevant Main Roads WA drawings and are available on the web site.

Large guide signs shall be designed in accordance with AS1744 - Standard Alphabets for Road Signing and Main Roads WA [Directional Signs - Sign Face Layout Design Guidelines](#).

### Location and Road Type

For the longitudinal location of signs, refer to AS 1742.2 and sign drawings (signs and line marking plan).

For lateral placement and height details, refer to Main Roads WA Drawing [8720-0762](#) and [200231-0054](#).

### Footpaths, Cycle Paths, or Shared Paths

Signs located over a footpath, cycle path or shared path require a greater vertical clearance between the bottom of the sign and the surface of the path than signs located away from these facilities. Refer to Main Roads WA Drawing [8720-0762](#) and [200231-0054](#).

### Ground Slope

The ground slope will affect the length of each of the support posts. Since the length, in turn, affects the bending moment on the posts, the size of the post section is also affected.

For ground slopes of greater than 1 in 10, each post shall be assessed separately with the longest post being used in the design. For ground slopes of less than 1 in 10, an average height of the posts can be used. Refer to Drawing [1830-0003](#) for formulae and diagrams.

## 5.2 Step 2 – Determine Whether Sign Posts Should be Frangible or Not

It is the responsibility of the designer to determine whether the sign posts are required to be frangible or breakaway ([1830-0011](#)) and to determine the most likely direction of impact for breakaway posts. All sign posts located within the clear zone should be frangible or breakaway, unless the sign posts are shielded with a road safety barrier.

Clear zones shall be determined in accordance with [Main Roads WA Supplement to Austroads Guide to Road Design - Part 6](#).

### 5.2.1 Frangible Post Selection Criteria

If it has been determined that the posts are required to be frangible or breakaway posts, it is the responsibility of the designer to determine the most suitable post type. If frangible or breakaway posts are required, the following criteria must be complied with.

- All CHS sections are to be Grade 350 steel and all UB sections are to be Grade AS/NZS 3679.1-300 steel.
- If the speed limit of the road is less than 60 km/h then the size of circular hollow section post used must not be greater than 101.6 CHS 2.6.
- If the speed limit of the road is 60, 70 or 80 km/h then the size of circular hollow section post used must not be greater than 76.1 CHS 2.3.
- If the speed limit of the road is greater than 80 km/h then the size of circular hollow section post used must not be greater than 60.3 CHS 2.9.
- If a three post installation is to be used the two outer posts must be greater than 2.1 metres apart.
- For single post impact posts, the maximum size universal beam considered frangible when fitted with a breakaway base is 410UB59.7.
- For dual impact posts, the maximum size universal beam considered frangible when fitted with a breakaway base is 200UB25.4.
- Signs must not be supported on UB posts where the direction of impact may come from the side or the reverse direction (eg, at intersections, medians, or two-lane two-way roads) and the sign is located within the clear zone of the traffic streams in differing directions.
- The minimum clearance height for signs supported on slip-base (UB) posts should be 2.2 m. This clearance is required to enable a vehicle to pass underneath the unsupported portion of a sign, once the post is struck by an errant vehicle, without the sign penetrating the windscreen. For signs located on a batter, this clearance applies to the post closest to the roadway.
- Approved lattice aluminium masts (Refer to Annexure G of [Specification 601: Signs](#)) are considered to be breakaway posts. The minimum clearance height for lattice sign posts shall be 2.0 m. This clearance is required to enable a vehicle to pass underneath the unsupported portion of a sign, once the post is struck by an errant vehicle, without the sign penetrating the windscreen. For signs located on a batter, this clearance applies to the post closest to the roadway.
- Approved fluted aluminium posts (Refer to Annexure G of [Specification 601: Signs](#)) may be used for small wind forces for frangibility irrespective of speed limits.

### 5.3 Step 3 – Structural Design of Posts, Footings and Stiffeners for Large Multiple Signs

The Main Roads WA design method for designing posts, footings and stiffeners for large multiple post signs throughout Western Australia is shown in Figure 5.



**Figure 5: Flow Chart for the Design of Posts, Footings and Stiffeners for Large Signs**

The design method shown on the flow chart attempts to reduce the danger to motorists by ensuring that the smallest possible posts are used. Three and four post installations are generally not used but may be used as a way of reducing the post size when the two post design would require universal beams exceeding 200UB25 and as long as the spacing between the two outer posts exceeds 2.1 m (to reduce the risk of vehicles striking three posts in the event of a crash).

In determining suitable post types, the following guidelines apply:

- CHS posts are the standard post type and should be considered first. CHS posts are generally cheaper and easier to install and do not rely on a breakaway mechanism.
- If CHS posts are not suitable (eg. in higher speed environments), then approved fluted aluminium posts (eg. Signfix and Optimast posts) should be considered.
- If larger posts are required, then proprietary aluminium posts (eg. Lattix, or similar approved) or UB breakaway posts should be considered.
- If larger sign posts are located behind a barrier (outside of the deflection zone) or outside the clear zone, then any post type is suitable and they do not need to be frangible.
- At intersections where the sign could be hit from different directions, UB breakaway posts must NOT be used since these are designed to be struck from one direction only.
- It should be noted that aluminium posts generally have a lower severity than breakaway UB posts (especially the larger 200UB and 250UB posts).
- For large signs in rural areas, a clearance height of 1.5 m should initially be chosen. If the design process indicates that universal beam section posts with a slip base should be used, then the minimum clearance height should be increased to 2.2 m and the post design process should be repeated.
- The use of two posts over three posts is encouraged in order to minimise costs. It is the responsibility of the designer to ensure that the cheapest safe posts are chosen.

### 5.3.1 Step 3.1 – Choose Wind Speed Region and Terrain Category

The designer is required to examine the map shown on Drawing [1830-0002](#) or refer to AS1170.2, Figure 3.1(A) and to identify the appropriate wind speed region for the sign location.

The terrain category is selected by choosing the photograph that shows terrain most similar to the terrain where the sign is to be located.

Record wind speed region and terrain category on the detailed sign drawing.

### 5.3.2 Step 3.2 – Calculate Area of Sign, Post Spacing and Moment Lever Arm

Sign area and moment lever arm are calculated using the formulae and diagrams shown on Drawing [1830-0003](#). Record the sign area & lever arm on the post schedule.

For ground slopes of greater than 1 in 10, each post shall be assessed separately with the longest post being used in the design. For ground slopes of less than 1 in 10, an average height of the posts can be used. Refer to Drawing [1830-0003](#) for formulae and diagrams.

### 5.3.3 Step 3.3 – Determine Wind Force Acting on Sign

If the area of the sign is between 0 and 10 m<sup>2</sup> the chart shown on Drawing [2330-2234](#) is used to determine the wind force acting on the sign. If the area is between 10 and 60 m<sup>2</sup> then the chart shown on Drawing [2330-2235](#) is used.

The charts are read by starting on the horizontal axis and locating the sign's area. A vertical line is then drawn up until the correct curve for the sign's Wind Speed Region and Terrain Category is intersected. A horizontal line is then drawn to the left and the force acting on the sign is read from the scale.

It should be noted that the wind force is based on the wind speed for a recurrence interval of 200 years. This applies to all signs for with a height of less than 10 m. For signs with a height greater than 10 m, the posts are to be designed by a structural engineer to Australian Standards.

#### 5.3.4 Step 3.4 – Post Size Selection

If the posts are required to be frangible, the designer should ensure that the posts comply with the criteria outlined in [Section 5.2.1](#). If these criteria cannot be met, then the posts should be protected against vehicle impact by some means, e.g. be located behind a barrier, outside of the deflection zone.

If the posts are to have a breakaway or frangible post, and the sign has single impact post spacing (clear spacing between posts greater than 2.1 m), Drawing [1830-0006](#) and [2130-0654](#) are to be used to determine the post size.

If the posts are to have a breakaway or frangible posts, and the sign has dual impact post spacing (clear spacing between posts less than 2.1 m), Drawing [1830-0006](#) and [2130-0654](#) are to be used to determine the post size.

If the posts are protected from vehicle impact and are not required to have breakaway or frangible posts, also Drawing [1830-0006](#) and [2130-0654](#) are to be used to determine the post selection.

If approved Lattix posts are selected (Refer to Annexure G, [Specification 601: Signs](#)), Drawing [201731-0004](#) and [201731-0005](#) are to be used to determine the post selection.

If approved Signfix posts are selected (Refer to Annexure G, [Specification 601: Signs](#)), Drawing [202331-000117](#) is to be used to determine the post selection.

If approved Optimast posts are selected (Refer to Annexure G, [Specification 601: Signs](#)), Drawing [202331-000119](#) is to be used to determine the post selection.

For other approved propriety products, refer to Annexure G of [Specification 601: Signs](#).

The charts are read by starting on the horizontal axis and locating the force acting on the sign. A vertical line is then drawn up until the correct curve for the sign's moment lever arm is intersected. A horizontal line is then drawn to the right and the possible range of sign posts is obtained. It should be borne in mind that for slip-base posts, the minimum clearance should be 2.2 m.

The bending moment required to be resisted by the sign posts is shown on the left vertical scale of the chart, except for Drawing [2130-0654](#). Record post selection on post schedule. If breakaway, record details on post schedule.

It has been noted that the wind force is based on the wind speed for a recurrence interval of 200 years. In the case of temporary signs, should the design process result in a post size that does not meet the frangibility requirements (refer to [Section 5.2](#)), a Contractor may choose, at his own risk, to use a frangible post based on a lower recurrence interval, instead of slip-base posts, subject to the approval of the relevant Main Roads WA Project Manager. Signs located in areas such as footpaths, shared paths etc., which may be hazardous to users should they be pushed over, should not be designed using a lower recurrence interval.

In this regard, temporary signs are defined as:

- Signs used to warn, instruct, and guide road users in the safe negotiation of work sites on roads, including unsealed roads and footpaths.
- Signs used to warn, instruct, and guide road users prior to and during road closures for special events.

For a recurrence interval of 10 years, the following factors may be applied to the wind force obtained from Drawing [2330-2234](#) and [2330-2235](#):

Region	Factor
A	0.63
B	0.40
C	0.41
D	0.36

1. These factors shall not be applied in addition to any factors applied in terms of Clause 5.3.3

**Table 4.2: Factors to be Applied to the Wind Force Obtained from Drawing 2330-2234 and 2330-2235 to Obtain the Wind Force for a 10-Year Recurrence Interval**

For recurrence intervals other than 10 years, the designer is referred to AS/NZS 1170.2.

### 5.3.5 Step 3.5 – Determine Footing Details

Refer to Drawing [2430-0601](#) for footing design details.

Reinforcing details for footings supporting CHS and UB posts are given on Drawing [1830-0013](#) for non-frangible members or [1830-0015](#) for frangible members.

For Lattix post footing details, refer to Drawing [201731-0007](#).

For Signfix post footing details, refer to Drawing [202331-000118](#).

For Optimast post footing details, refer to Drawing [202331-000120](#).

### 5.3.6 Step 3.6 – Determine Sign Outstand and Post Spacing

The spacing of the posts is calculated using the formula and diagrams shown on Drawing [1830-0003](#).

The outstand length is calculated using the formula and diagrams shown on Drawing [1830-0003](#).

### 5.3.7 Step 3.7 – Determine Stiffener Type and Spacing

The chart on Drawing [1830-0016](#) assists the designer to determine the type of stiffener and the required stiffener spacing. Drawing [8820-0354](#) gives details of the types of stiffeners used in Western Australia.

The stiffener spacing is obtained on Drawing [1830-0016](#), determined by the intersection of the outstand length and the sign's Wind Speed Region & Terrain Category.

Stiffener Type A is the preferred stiffener size.

The maximum allowable stiffener spacing is 450 mm for Wind Speed Regions A, B and C and 400 mm for Region D to control deflection of the sheeting between the stiffeners.

The maximum panel overhang between the stiffener and the top or bottom of the sign should be 100 mm.

## 5.4 Step 4 – Recording of Sign Design Information

Data used to design a large multiple post sign shall be recorded on a sign drawing. This is to enable the sign to be manufactured and installed correctly and to provide an as-constructed asset drawing, which will assist in redesigning and replacing signs, if required.

The following information is required to be recorded:

- Sign Location
- Sign Area
- Number of Post
- Number of Panels
- Centreline Spacing of Posts
- Outstand Length
- Speed Limit
- Soil Type
- Mounting Height – Left and Right Post
- Lever Arm
- Footing – Diameter, Depth, Embedment Depth
- Breakaway Requirements – Yes or No

The Main Roads WA location number should be obtained from the relevant regional Asset Manager, or metropolitan Traffic Services Manager.

Drawing [201831-0025](#), [201831-0026](#), [201831-0027](#) and [201831-0028](#) gives an example of the typical information to be recorded on the sign design drawing.

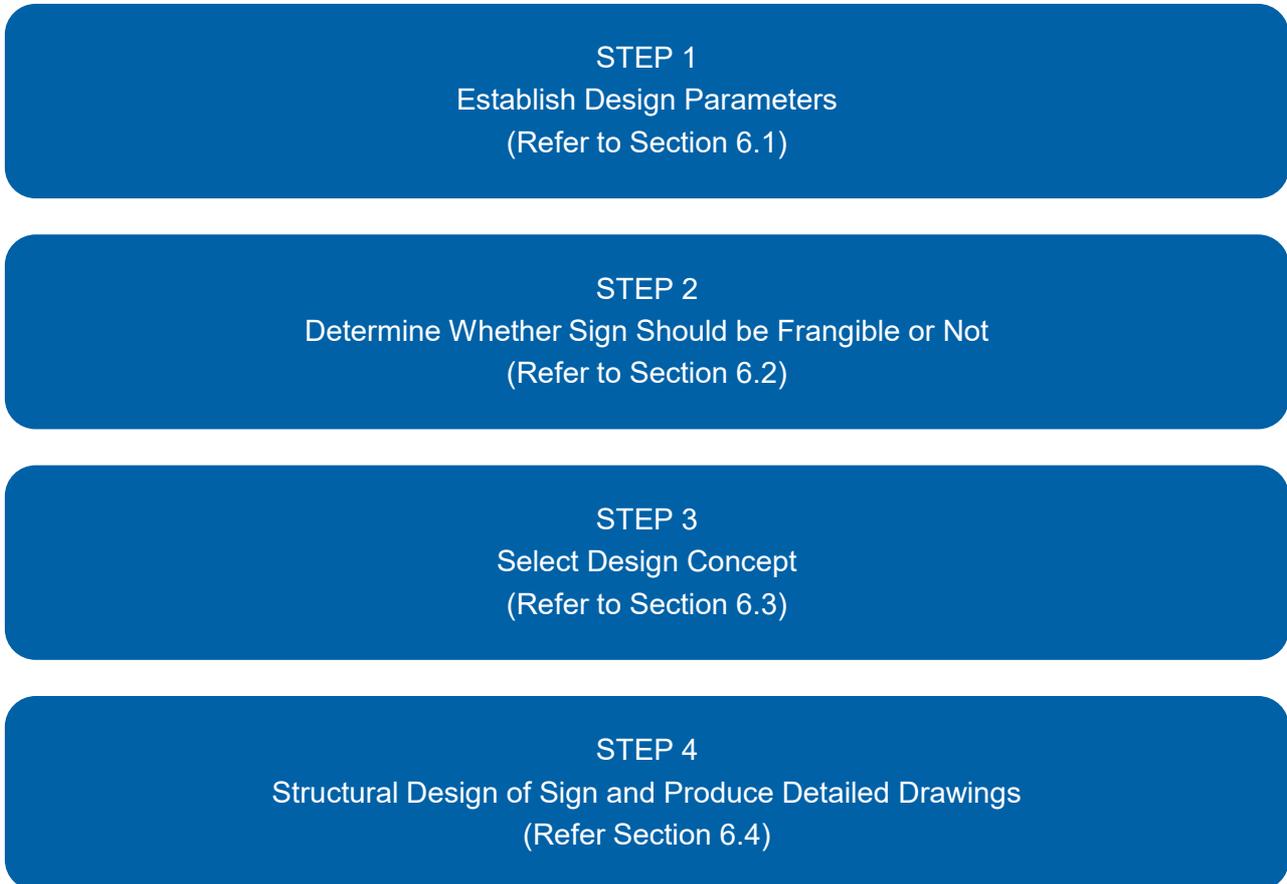
When the sign is a standard sign (included in AS 1743 or in the Main Roads WA [Signs Index](#)), an actual design drawing of the sign is not required. However, the design details (size, post schedule, class of retroreflective material etc.) should be included on a sign schedule drawing since the size and layout of standard signs as well as the post schedule may vary depending on the actual location.

## 5.5 Design Excel Spreadsheet

The Structural Sign Post Design spreadsheet is currently under review and not available.

## 6 DESIGN REQUIREMENTS FOR SINGLE POST CANTILEVER SIGNS AND FRAMES

The design process for single post cantilever signs and frames follows the flow chart given in Figure 6.



**Figure 6: Flow Chart for the Design of Single Post Cantilever Signs and Frames**

### 6.1 Step 1 – Establish Design Parameters

In addition to the design parameters contained in [Section 5.1](#), the location of any underground services, which may affect footing design, should be established. The positions of any power poles or other signs should be noted to ensure the cantilever post is no closer to the road than existing poles and posts. It is preferable that the sign post be away from the edge of the road as indicated by Type 5 on Drawing [200231-0054](#).

### 6.2 Step 2 – Determine Whether Sign Should be Frangible or Not

It is the responsibility of the designer to determine whether the sign post is required to be frangible.

All sign posts located within the clear zone should be frangible, unless the sign posts are shielded with a road safety barrier.

Clear zones shall be determined in accordance with [Main Roads WA Supplement to Austroads Guide to Road Design - Part 6](#).

### 6.2.1 Frangible Post Selection Criteria

The following criteria must be complied with in ensuring that the selected posts are frangible:

- If the speed limit of the road is 60 km/h or less then the Z modulus of the cantilever post should not exceed that of a 114.3 CHS 5.4 post.
- If the speed limit of the road is 70 or 80 km/h then the Z modulus of the cantilever post should not exceed that of an 88.9 CHS 5.0 post.
- If the speed limit of the road is greater than 80 km/h then the Z modulus of the cantilever post should not exceed that of a 60.3 CHS 4.5 post.
- There are no approved breakaway post designs for single post cantilever signs.

The single post should be located to provide the maximum practical lateral clearance from the edge of the roadway, paths and services.

### 6.3 Step 3 – Select Design Concept

To provide uniformity of appearance and aesthetics for large sign design, the use of square hollow section (SHS) and circular hollow section (CHS) posts and frames shall be in accordance with Drawing [200231-0054](#).

### 6.4 Step 4 – Structural Design of Sign and Produce Detailed Drawings

The structural design shall be carried out by a competent structural engineer and shall be submitted to the Main Roads WA Structures Branch for approval. For single post cantilever signs, separate drawings are permitted for the (a) sign layout, (b) post and frame structural drawing and (c) footing details.

The Main Roads WA method for the conceptual design of posts, footings and stiffeners for single post cantilever signs is shown in Figure 7.



**Figure 7: Flow Chart for the Conceptual Design of Single Cantilever Signs and Frames**

### **6.4.1 Step 4.1 – Choose Wind Speed Region and Terrain Category**

#### Wind Speed Region Selection

The designer is required to examine the map shown on Drawing [1830-0002](#). The wind speed region is determined by determining the location of the sign on the map.

#### Terrain Category Selection

The terrain category is selected by choosing the photograph that shows terrain most similar to the terrain where the sign is to be located.

Photographs are provided for Terrain Categories 1, 2, 2.5, 3 and 4.

Record wind speed region and terrain category on the detailed sign drawing.

### **6.4.2 Step 4.2 – Calculate Area of Sign and Determine Wind Force Acting on Sign**

The sign area is calculated from first principles. The area of the square hollow sections may be ignored. Record the sign area on the detailed sign drawing.

If the area of the sign is between 0 and 10 m<sup>2</sup> the chart shown on Drawing [2330-2234](#) is used to determine the wind force acting on the sign. If the area is between 10 and 60 m<sup>2</sup> then the chart shown on Drawing [2330-2235](#) is used.

The charts are read by starting on the horizontal axis and locating the sign's area. A vertical line is then drawn up until the correct curve for the sign's Wind Speed Region and Terrain Category is intersected. A horizontal line is then drawn to the left and the force acting on the sign is read from the scale.

### **6.4.3 Step 4.3 – Spacing of the CHS Posts and Outstand Length**

The sign layout should follow the concept design for a cantilever sign shown on Drawing [200231-0054](#). The sign is attached to Type A or B stiffeners, which in turn are attached to the 60.3CHS posts forming part of the cantilever frame.

The spacing of the CHS posts and outstand length is calculated using the formulae and diagram shown on Drawing [200231-0054](#).

### **6.4.4 Step 4.4 – Determine Stiffener Type and Spacing**

The chart on Drawing [1830-0016](#) assists the designer to determine the type of stiffener and the required stiffener spacing. Drawing [8820-0354](#) gives details of the types of stiffeners used in Western Australia.

The stiffener spacing is obtained on Drawing 1830-0016, determined by the intersection of the outstand length and the sign's Wind Speed Region & Terrain Category.

Stiffener Type A is the preferred stiffener size.

The maximum stiffener spacing is 450 mm for Wind Speed Regions A, B and C and 400 mm for Region D to control deflection of the sheeting between the stiffeners.

The stiffener type and spacing should be recorded on the detailed design drawing.

### **6.4.5 Step 4.5 – Determine All Loads on Sign and Conduct Structural Analysis**

In addition to the loading caused by wind, the following loads should also be included in the structural analysis:

- Dead load caused by the weight of the sign, stiffeners, CHS posts and SHS frame.
- Live load caused by maintenance workers.

The structural analysis is to be carried out in accordance with Australian Standards and Code. The design process is necessarily an iterative one, since initial post and frame sections need to be selected to estimate the dead loads. These are then checked for structural integrity under the design loading conditions.

The sign layout should follow the concept design for a cantilever sign shown on Drawing [200231-0054](#)

### **6.4.6 Step 4.6 – Select Appropriate Post Size**

The sizes of the post and frame square hollow sections are selected to withstand the forces and bending moments determined during the structural analysis.

If the posts are required to be frangible, the designer should ensure that the criteria outlined in [Section 6.2.1](#) are complied with. If the required SHS to support the sign cannot comply with the frangibility requirements of [Section 6.2.1](#), then the designer needs to consider alternatives such that either (a) the post is located outside of the clear zone, or (b) the post is protected by a suitable safety barrier.

Record the post and frame details on the detailed design drawing.

### **6.4.7 Step 4.7 – Determine Footing Details**

The required footing details, including footing size, embedment depth and reinforcing details should be established from first principles. The design process should be clearly documented and contain information on all required inputs and assumptions.

The footing details should be recorded on the detailed design drawing.