

Part 6

BASE PLATES

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Part 6

BASE PLATES

6.1 General

The base plate connections considered in this section are suitable for the LSB used in applications such as portal frame structures. The base plate connections are designed as “pinned” bases, with axial compression or axial tension in the LSB being the primary design action at the base, often with a smaller coincident shear force component. The connection configuration is very similar to that used for parallel flange channels.

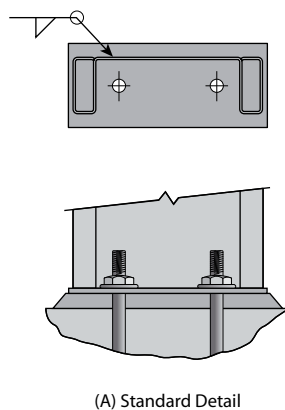


Figure 6.1: Standard LSB Base Plate Configuration

Tables 6.1 and 6.2 provide connection capacities for the standard 2 bolt base plate shown in Figure 6.1 for M12 and M16 holding down bolts respectively. Table 6.3 provides connection capacities for the 150 LSB with this base plate configuration.

Any structure using these 2 bolt base plate configurations must be adequately braced during construction. If this can not be achieved, then it is recommended that a 4 bolt base plate configuration as shown in Figure 6.2 be used.

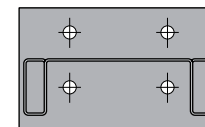


Figure 6.2: Alternative 4 Bolt Base Plate Configuration

There are many types of holding down bolts (anchor bolts) which can be used with the base plates for the LSB. These include:

- Cast-in place bolts
- Expanding anchors
- Chemical anchors
- Screw bolts

The connection capacity tables for tension in the LSB assume that cast-in place anchor bolts are used, and that the anchorage of the bolts in the concrete is sufficient to allow the full tension capacity of the bolts to be achieved. If sufficient anchorage is not available, and if other anchor bolts are used, then the capacities given in the Tables must be reduced accordingly.

The designer must also be aware that the capacity of the anchor bolts will be reduced if they are in close proximity to the edge of a footing or slab.

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BASE PLATES

6.2 Design Method

6.2.1 Design Model

The design model used for the LSB column base plate connection is adopted from Section 4.12 of Hogan and Thomas (1994), as applied to parallel flange channels. The base plates are designed for axial compression or axial tension in the LSB column as the primary design action, and also for coincident shear.

6.2.2 Axial Compression in Column

In the calculation of the base plate connection capacities given in Tables 6.1 to 6.3, the following assumptions have been made:

- The characteristic compression strength of the concrete footing $f_c = 25$ MPa
- The edge of the concrete footing is at least 50 mm from the edge of the base plate
- The welds are designed to transfer the axial compression force from the LSB column to the base plate (the end of the column does not need to be prepared for full contact)

6.2.3 Axial Tension in Column

When the primary design action in the column is axial tension, the base plate connection capacities given in Tables 6.1 to 6.3 are based on the following assumptions:

- The cast-in anchor bolts are grade 4.6
- The embedment of the anchor bolts in the concrete is capable of achieving the full tension capacity of the bolts
- The base plate is a minimum grade 250 plate

In determining the pull-out capacity of the anchor bolts in the concrete, the designer must consider the length of embedment, the detail at the bottom end of the bolt, the bolt spacing, and the edge distance.

Table 6.3 gives the connection capacities for the 150 LSB with the alternative detail in Figure 6.1(B). The design of this detail is outlined on page 239 of Hogan and Thomas (1994). This method assumes that the tension in the anchor bolts spreads out over an effective width of plate so that the effective width of plate acts as a cantilever in bending.

6.2.4 Shear

Base plates are commonly subject to shear forces in either principal axis directions, in conjunction with the column axial forces. The shear capacities of the base plate connections, independent of axial forces, are given in Tables 6.1 to 6.3. These are limited to 50% of the total shear capacity of the anchor bolts. If the shear forces are higher than this, then it is recommended that a shear key be used. The design of shear keys is also given in Hogan and Thomas (1994).

The designer must ensure that the shear capacity is not reduced by the edge distance of the bolt in the concrete footing.

6.2.5 Combined Actions

This base plate connection shear capacity can be used in combination with axial compression because the bolts are not in tension, and because part or all of this shear force may be taken by friction between the base plate and the concrete, depending on the magnitude of the axial compression.

Tables 6.1 to 6.3 also give the maximum tension capacity of the connection coincident with this shear force. If the design shear force is lower than that given in the tables, then the tension capacity will be larger, and may be determined by calculation. Similarly when the design tension force is lower, the shear capacity is larger, although it is recommended that a shear key be provided to transmit the higher shear forces.

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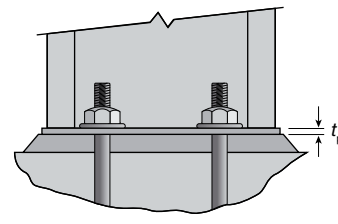
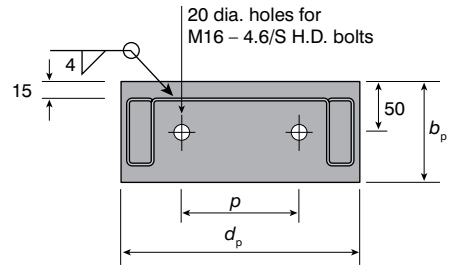
TABLE 6.1

Base Plates

300 LSB, 250 LSB AND 200 LSB

Bolts: M16

Base Plates											
Designation			Base Plate			Bolt Pitch P	Design Capacities				
			Length d_p	Width b_p	Thickness t_p		Strength Limit State			Combined Actions	
d	b_p	t	mm	mm	mm	mm	Compression kN	Tension kN	Shear kN	Tension kN	Shear kN
300 × 75 × 3.0 LSB	75	3.0	330	100	12	150	254	100	28.6	87.5	28.6
		2.5	330	100	12	150	254	100	28.6	87.5	28.6
300 × 60 × 2.0 LSB	60	2.0	330	100	12	150	250	100	27.4	88.1	27.4
250 × 75 × 3.0 LSB	75	3.0	280	100	12	100	226	100	28.6	87.5	28.6
		2.5	280	100	12	100	226	100	28.6	87.5	28.6
250 × 60 × 2.0 LSB	60	2.0	280	100	12	100	220	100	28.6	87.5	28.6
200 × 60 × 2.5 LSB	60	2.5	230	90	12	100	187	100	28.6	87.5	28.6
		2.0	230	90	12	100	187	100	28.6	87.5	28.6
200 × 45 × 1.6 LSB	45	1.6	230	90	12	100	170	100	21.7	92.9	21.7



Notes:

1. Welding consumables E48XX or W50X.
2. Base plate grade 250 minimum.
3. Concrete base $f'_c = 25$ MPa minimum.
4. The tabulated tension capabilities assume that the embedment of the anchor bolts in the concrete is capable of achieving these values.

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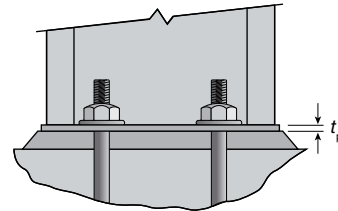
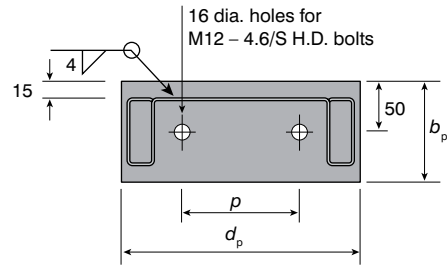
TABLE 6.2

Base Plates

300 LSB, 250 LSB, 200 LSB AND 150 LSB

Bolts: M12

Base Plates												
Designation		Base Plate			Bolt Pitch <i>P</i>	Design Capacities						
		Length <i>d_p</i>	Width <i>b_p</i>	Thickness <i>t_p</i>		Strength Limit State			Combined Actions			
						Compression	Tension	Shear	Tension	Shear		
<i>d</i>	<i>b_t</i>	<i>t</i>	mm	mm	mm	mm	kN	kN	kN	kN	kN	
300 × 75 × 3.0 LSB			330	100	12	150	254	54.0	15.1	46.8	15.1	
		2.5 LSB	330	100	12	150	254	54.0	15.1	46.8	15.1	
300 × 60 × 2.0 LSB			330	100	12	150	250	54.0	15.1	46.8	15.1	
250 × 75 × 3.0 LSB			280	100	12	100	226	54.0	15.1	46.8	15.1	
		2.5 LSB	280	100	12	100	226	54.0	15.1	46.8	15.1	
250 × 60 × 2.0 LSB			280	100	12	100	220	54.0	15.1	46.8	15.1	
200 × 60 × 2.5 LSB			230	90	12	100	187	54.0	15.1	46.8	15.1	
		2.0 LSB	230	90	12	100	187	54.0	15.1	46.8	15.1	
200 × 45 × 1.6 LSB			230	90	12	100	170	54.0	15.1	46.8	15.1	
150 × 45 × 2.0 LSB			180	90	12	70	135	54.0	15.1	46.8	15.1	
		1.6 LSB	180	90	12	70	135	54.0	15.1	46.8	15.1	



Notes:

1. Welding consumables E48XX or W50X.
2. Base plate grade 250 minimum.
3. Concrete base *f_c* = 25 MPa minimum.
4. The tabulated tension capacities assume that the embedment of the anchor bolts in the concrete is capable of achieving these values.

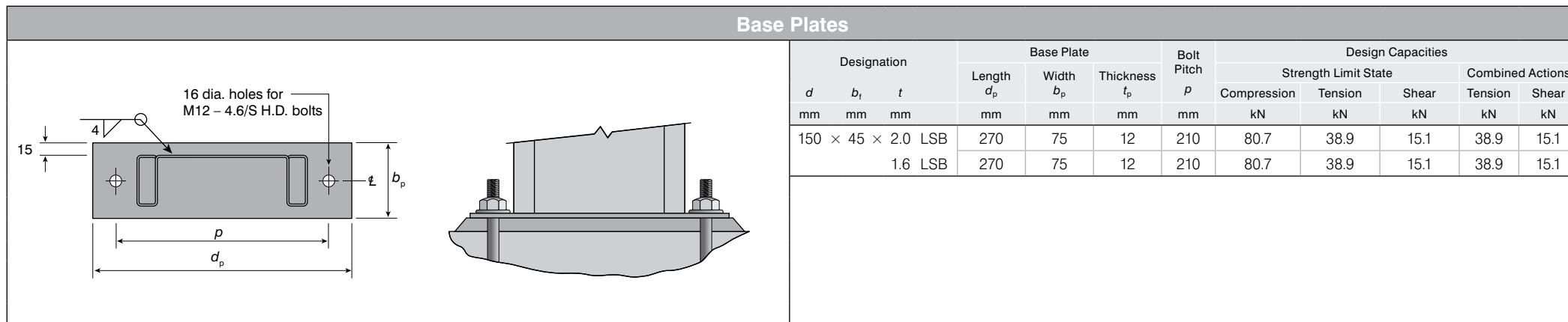
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TABLE 6.3

Base Plates

150 LSB

Bolts: M12



Notes:

1. Welding consumables E48XX or W50X.
2. Base plate grade 250 minimum.
3. Concrete base $f'_c = 25$ MPa minimum.
4. The tabulated tension capacities assume that the embedment of the anchor bolts in the concrete is capable of achieving these values.

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