TABLE 8.14

MAXIMUM BRACING (LATERAL) CAPACITY OF TIMBER STUMPS

Height of stump (E) above footing mm	Maximum bracing capacity of timber stumps, kN					
	Nominal unseasoned size of stumps, mm × mm					
	100 × 100	125 × 125	150 × 150	175 × 175	200 × 200	250 × 250
200	19	37	50	50	50	50
400	9.6	19	32	50	50	50
600	6.4	12	22	34	50	50
800	2.8	6.9	14	26	38	50
1000	1.4	3.5	7.3	13	23	50
1200	0.8	2.0	4.2	7.8	13	33
1400	0.5	1.3	2.7	4.9	8.4	20
1600	0.4	0.9	1.8	3.3	5.6	14
1800	0.2	0.6	1.3	2.3	4	10

NOTE: The following round timber stump sizes may be used in lieu of the square sizes given above:

(a) 100 mm × 100 mm—125 mm diameter.

(b) 125 mm × 125 mm—150 mm diameter.

(c) 150 mm × 150 mm—175 mm diameter.

(d) 175 mm × 175 mm—200 mm diameter.

(e) 200 mm × 200 mm—225 mm diameter.

(f) 250 mm × 250 mm—275 mm diameter.

8.3.5.7 *Bracing columns*

Timber, steel or concrete posts or columns placed into concrete footings may be used for transferring racking forces to the foundation. The horizontal load can be resisted by adding the capacity of individual stumps to resist the total force. Individual load capacities and details of columns or posts are given in Table 8.15 and Figure 8.4.

Where the column capacity is not adequate to resist the lateral load, additional bracing or cross-bracing shall be used.

All bracing shall be fixed to the floor or footing below and the floor above to enable the transfer of the full bracing capacity of the bracing system.

Steel columns over 900 mm above the ground shall not be used for bracing, unless incorporated in a bracing set.

Footing plan size and depth, as given in Table 8.15, shall apply to soil classifications A, S and M only.

Bracing systems for other soil classifications, materials or sizes shall be designed in accordance with engineering principles.

TABLE 8.15
COLUMN BRACING CAPACITY

Height of column above ground mm	Column details				Footing plan size or diameter mm	Footing depth (*D*) mm	Bracing capacity kN
	Concrete and masonry		Timber diameter mm	Steel mm			
	Plan size mm	Reinforce-ment					
600 or less	M200 × 200	1-Y12	125	76 × 76 × 3.2	350 × 350	900	6
601 to 900	M200 × 200	1-Y12	150	76 × 76 × 4.0	350 × 350	900	4.5
901 to 1800	C200 × 200 M200 × 400 M300 × 300	4-R10	200	—	350 × 350	900	3
1801 to 2400	C200 × 200 M200 × 400 M300 × 300	4-Y12	225	—	400 × 400	900	3
2401 to 3000	C250 × 250 M200 × 400 M300 × 300	4-Y12	250	—	600 × 600	900	2.3

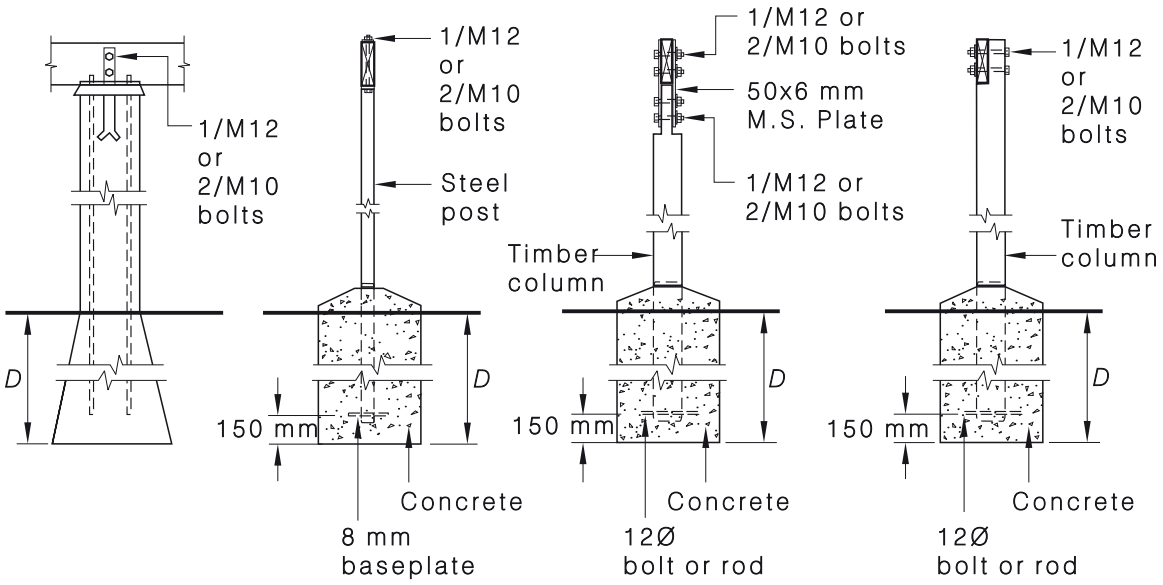
NOTES:

1 C = reinforced concrete column; M = reinforced concrete masonry.

2 Footing depth may be reduced to 600 mm when enclosed by a minimum of 100 mm thick concrete slab cast on the ground and of a minimum size of 6 m^2.

3 For concrete and masonry columns and walls, see AS 3600 and AS 3700, respectively.

4 For bearer tie-down, see Section 9.



No-fines concrete shall be used for external hardwood columns

NOTE: For guidance on durability, see Appendix B.

FIGURE 8.4 CONCRETE, MASONRY AND STEEL BRACING COLUMNS

8.3.5.8 *Unreinforced masonry bracing*

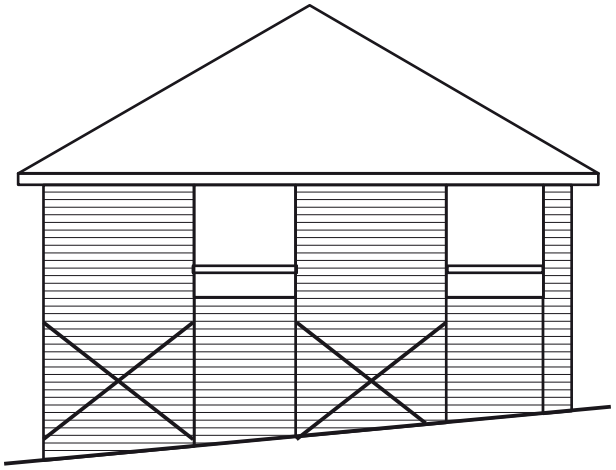
Unreinforced masonry walls may be used to transfer racking forces in the subfloor region. The walls shall be a minimum of 90 mm thick, and engaged-piers shall be regularly spaced. All brickwork shall comply with AS 3700 or the Building Code of Australia.

Table 8.16 gives the capacity of masonry walls in the subfloor region only. The description of single- or two-storey, brick veneer or clad frame refers to the construction above the unreinforced masonry bracing wall under consideration. The bracing capacity of subfloor masonry is not applicable in regions where there are no walls above (for example, under verandah roofs, decks or similar structures).

The total minimum length of unreinforced masonry bracing walls in any full length of wall shall be 3000 mm with the minimum length of individual panels in the wall not less than 900 mm. The bracing capacities given in Table 8.16 are not applicable to stand-alone panels of masonry less than 3000 mm.

TABLE 8.16

UNREINFORCED MASONRY BRACING CAPACITY



Tie-down shall be provided from bearers to footings

Description	Bracing capacity kN/m
Subfloor of single storey with brick veneer over	3
Subfloor of two storeys with brick veneer over	7.5
Subfloor of single storey with clad frame over	1.5
Subfloor of two storeys with clad frame over	3

8.3.5.9 *Spacing of bracing in the lower storey of two-storey construction or the subfloor of single- or two-storey construction*

Bracing in the subfloor or lower storey of two-storey construction shall be evenly distributed. The maximum distance between bracing sets, stumps, piers, wall or posts, and similar constructions, under a strip or sheet timber floor system shall be as follows:

(a) For wind classification C1, 14 000 mm if the minimum width of floor is 4800 mm.

(b) For wind classification C2, 14 000 mm if the minimum width of floor is 6000 mm.

(c) For wind classification C3, 11 500 mm if the minimum width of floor is 6000 mm.

If the width of the floor is less than as given above, the spacing of bracing shall be in accordance with Clause 8.3.6.7, where the width of the floor is considered as the ceiling depth.

NOTE: The minimum width of the floor is measured parallel to the direction of wind under consideration.

8.3.6 Wall bracing

8.3.6.1 *General*

Walls shall be permanently braced to resist horizontal racking forces applied to the building. Wall bracing shall be designed to resist racking forces equal to or greater than the forces calculated from Clause 8.3.4.

The total capacity of bracing walls shall be the sum of the bracing capacities of individual walls. See Table 8.18 for the capacity of structural bracing walls, and see Section 9 for fixing requirements.

NOTE: The nail spacings given in Table 8.18 are nominal maximum spacings.

8.3.6.2 *Nominal wall bracing*

Nominal wall bracing is wall framing lined with sheet materials such as plywood, plasterboard, fibre cement, hardboard, or similar materials, with the wall frames nominally fixed to the floor and the roof or ceiling frame.

The maximum amount that can be resisted by nominal wall bracing is 50% of the total racking forces determined from Clause 8.3.4. Nominal wall bracing shall be evenly distributed throughout the building. If this is not the case, the contribution of nominal bracing shall be ignored.

The minimum length of nominal bracing walls shall be 450 mm.

The bracing capacity of nominal bracing is specified in Table 8.17.

TABLE 8.17

NOMINAL SHEET BRACING WALLS

Method	Bracing capacity, kN/m
Sheeted one side only	0.45
Sheeted two sides	0.75

8.3.6.3 *Structural wall bracing*

Structural wall bracing is purpose-fitted bracing, being either sheet or cross-timber or steel bracing. Table 8.18 gives the specific capacity for each metre length of various structural bracing types.

NOTES:

1 Nominal bracing cannot contribute to bracing resistance where it occurs in the same section of wall as structural bracing, such as where plasterboard lining is fixed over a structural brace.

2 Where applicable, reference to top plate in Table 8.18 may also apply to ring beam.

For sheet-braced walls, the sheeting shall be continuous from the top plate or ring beam to the bottom plate with any horizontal sheet joins made over nogging with fixings the same as required for top and bottom plates.

Unless otherwise specified, sheet-bracing walls shall be a minimum of 900 mm wide to satisfy the requirements of their nominated ratings.

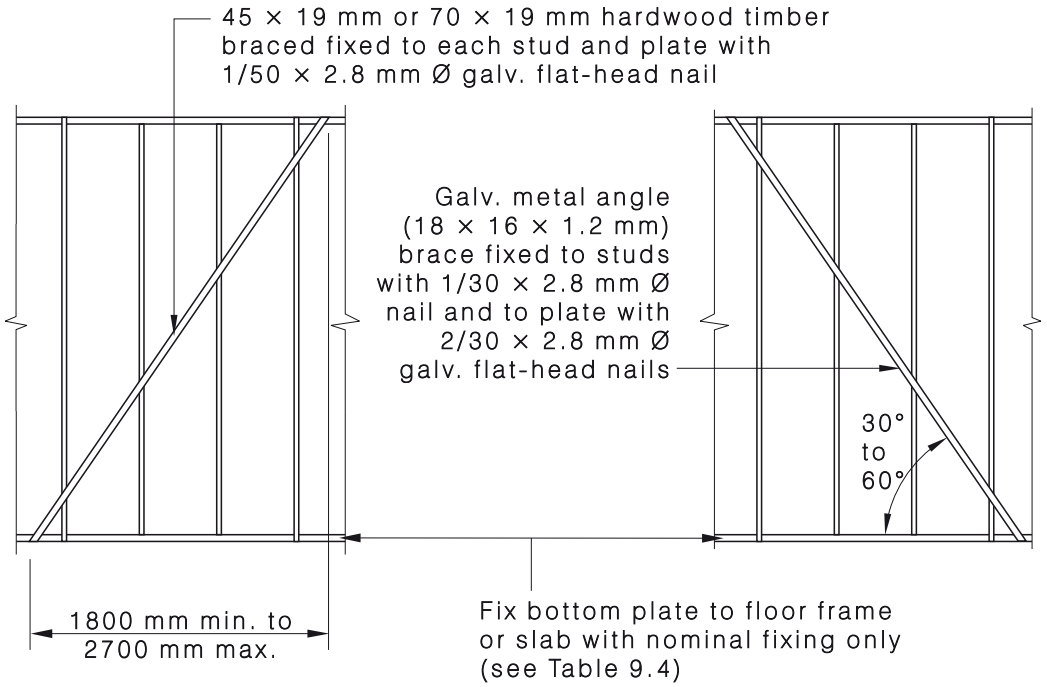
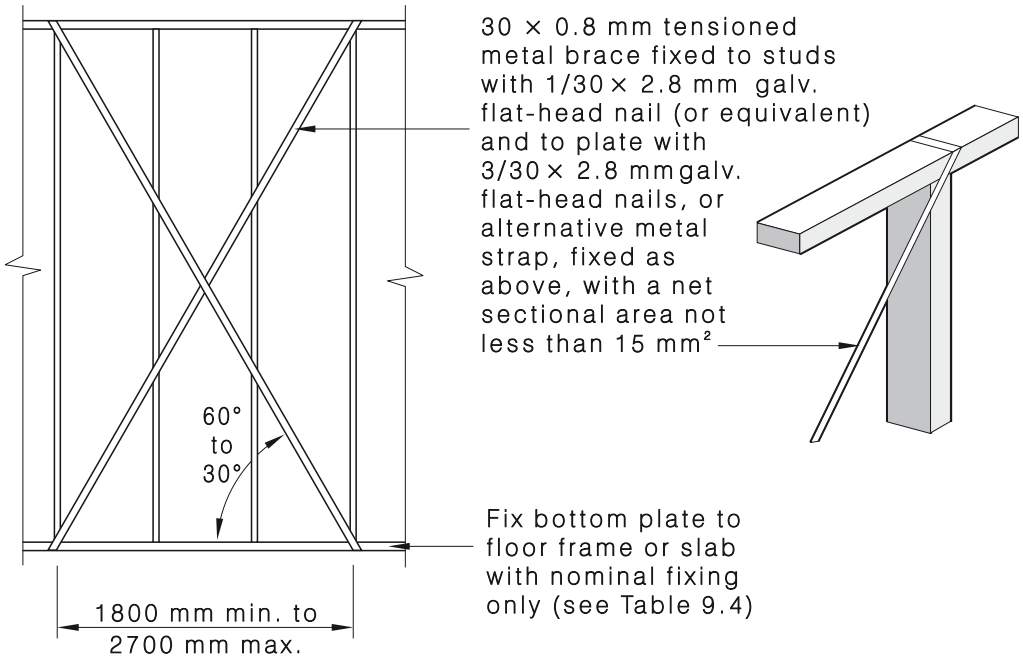
The capacity of sheet bracing given in bracing types (g) to (n) in Table 8.18 is based on fixing the sheeting to framing having a minimum joint strength group of J4 or JD4. If JD5 is used, the bracing capacity given bracing types (g) to (k) in Table 8.18 shall be reduced by 12.5%, and in bracing types (l) to (n), by 16%.

NOTES:

1 Joint groups for commonly available timbers are given in Clause 9.6.5 and Appendix G.

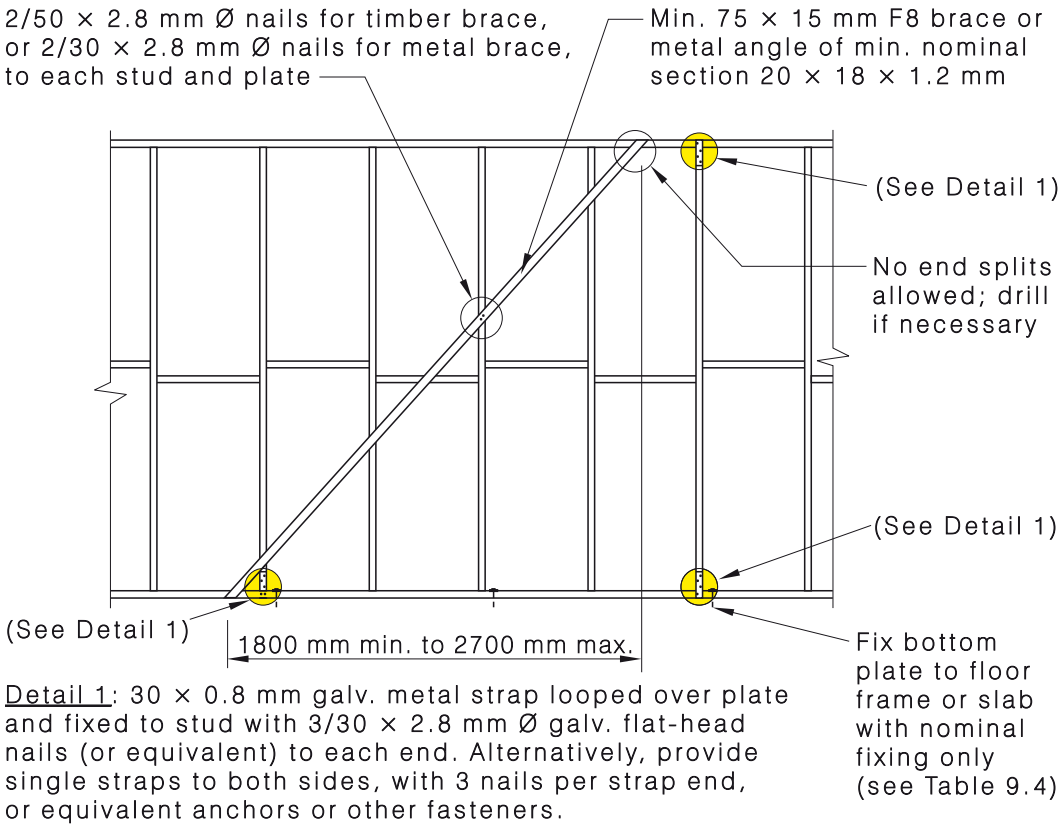
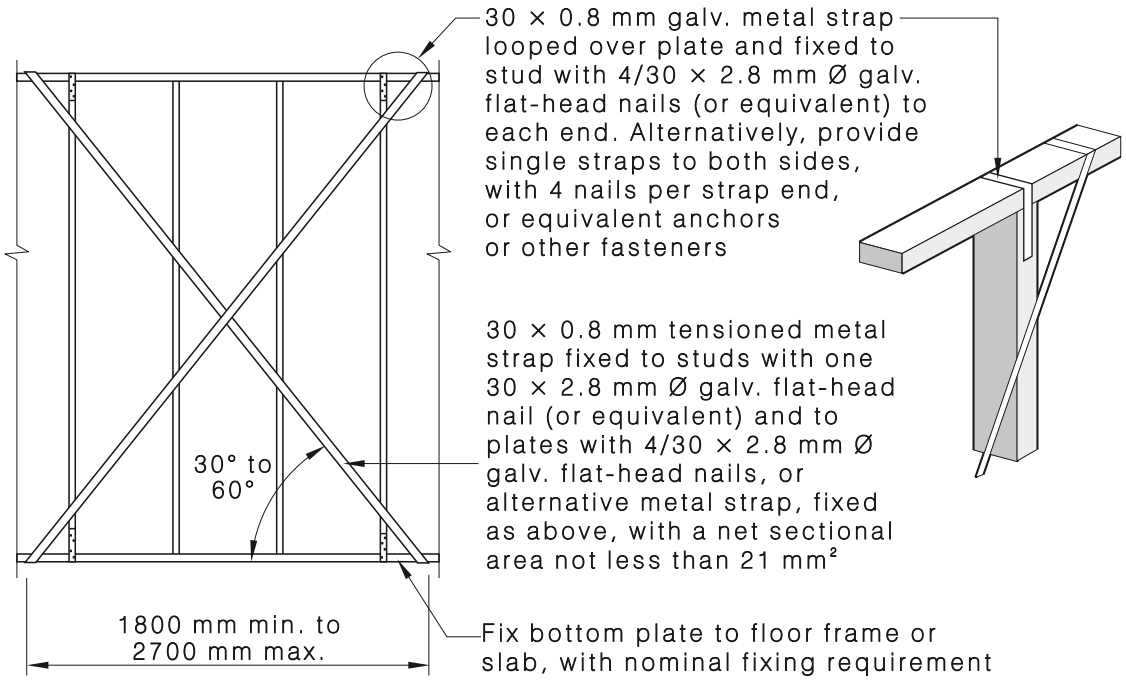
2 For wall heights greater than 2700 mm, the values in Table 8.18 may be proportioned downward relative to the wall heights. For example, for a wall height of 3600 mm multiply the values in the table by 2700/3600 = 0.75 (see Clause 8.3.6.4).

TABLE 8.18
STRUCTURAL WALL BRACING (MAXIMUM WALL HEIGHT 2.7 m)

Type of bracing	Bracing capacity kN/m
(a) *Two diagonally opposed timber or metal angle braces*  NOTE: All flat-head nails shall be galvanized or equivalent.	0.8
(b) *Metal straps—Tensioned*  	1.5

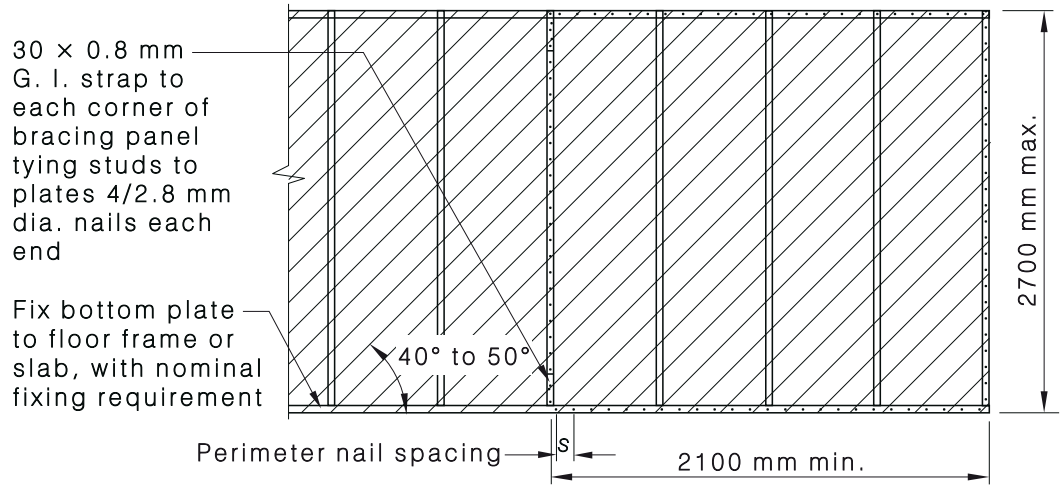
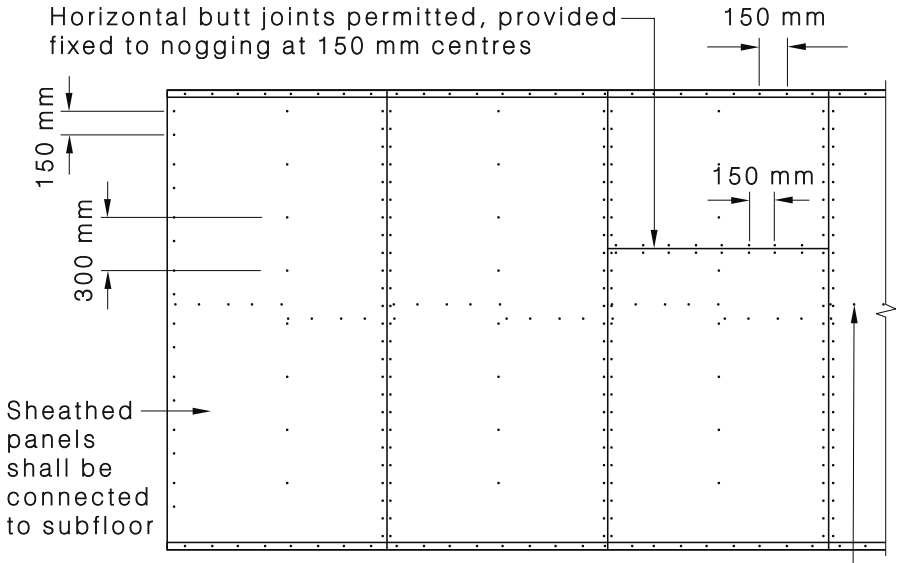
(*continued*)

TABLE 8.18 *(continued)*

Type of bracing	Bracing capacity kN/m
(c) *Timber and metal angle braces* The maximum depth of a notch or saw-cut shall not exceed 20 mm. Saw-cuts studs shall be designed as notched.  Detail 1: 30 × 0.8 mm galv. metal strap looped over plate and fixed to stud with 3/30 × 2.8 mm Ø galv. flat-head nails (or equivalent) to each end. Alternatively, provide single straps to both sides, with 3 nails per strap end, or equivalent anchors or other fasteners.	1.5
(d) *Metal straps—Tensioned—With stud straps* 	3.0

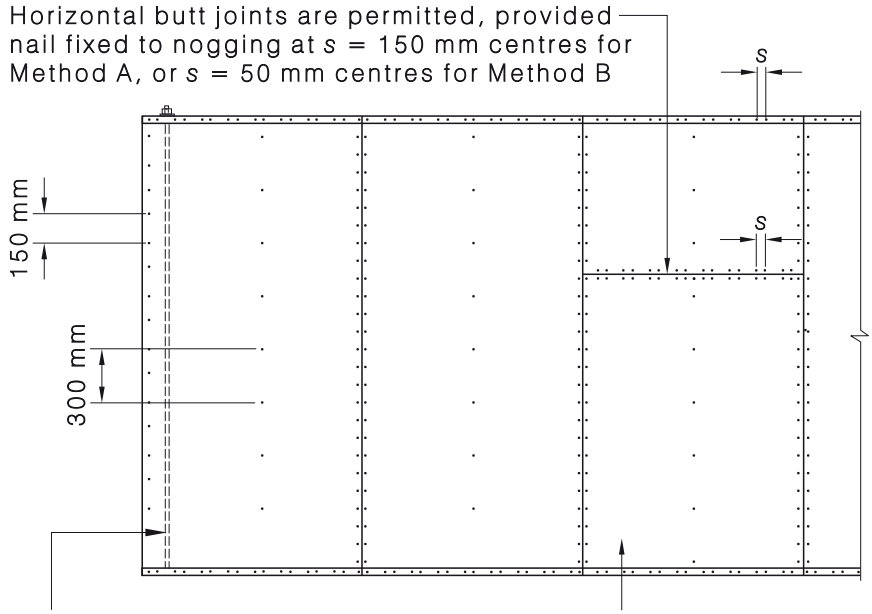
(continued)

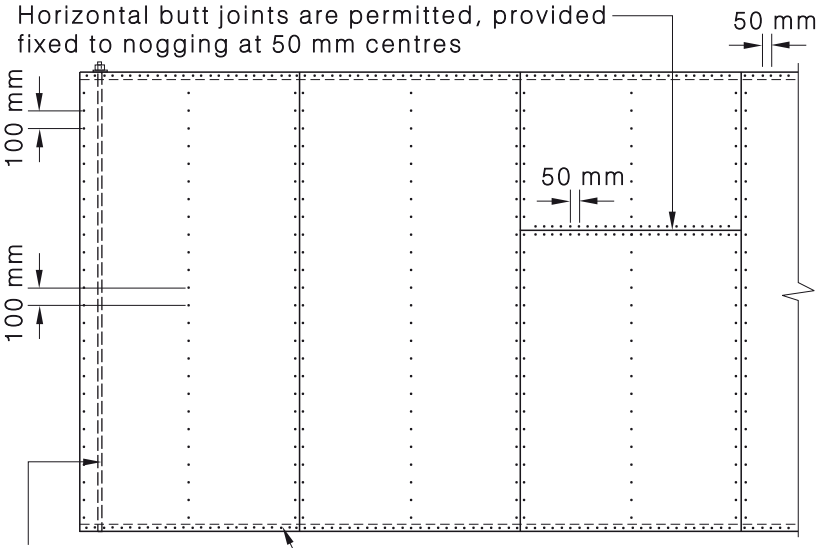
TABLE 8.18 (*continued*)

Type of bracing			Bracing capacity kN/m
(e) *Diagonal timber wall lining or cladding* Minimum thickness of board—12 mm fixed with 2/20 × 50 mm long T-head nails. Intermediate crossings of boards and studs shall be fixed with one nail.  NOTE: Noggings have been omitted for clarity.	*s*, mm	60 40	2.1 3.0
(f) Other timber, metal angle and strap bracing shall be designed and installed in accordance with engineering principles.			
(g) *Plywood* Plywood shall be nailed to frame using 30 mm × 2.8 mm ∅ galvanized flat-head nails or equivalent.  	Minimum plywood thickness, mm Stress grade / Stud spacing mm: 450 / 600 No nogging (except horizontal butt joints) F8: 7 / 9 F11: 4.5 / 7 F14: 4 / 6 F27: 3 / 4.5 One row of nogging F8: 7 / 7 F11: 4.5 / 4.5 F14: 4 / 4 F27: 3 / 3		3.4
NOTES: 1 For plywood fixed to both sides of the wall, see Clauses 8.3.6.5 and 8.3.6.10. 2 No other rods or straps are required between top or bottom plate. 3 Fix bottom plate to floor frame or slab with nominal fixing only (see Table 9.4).			

(*continued*)

TABLE 8.18 (*continued*)

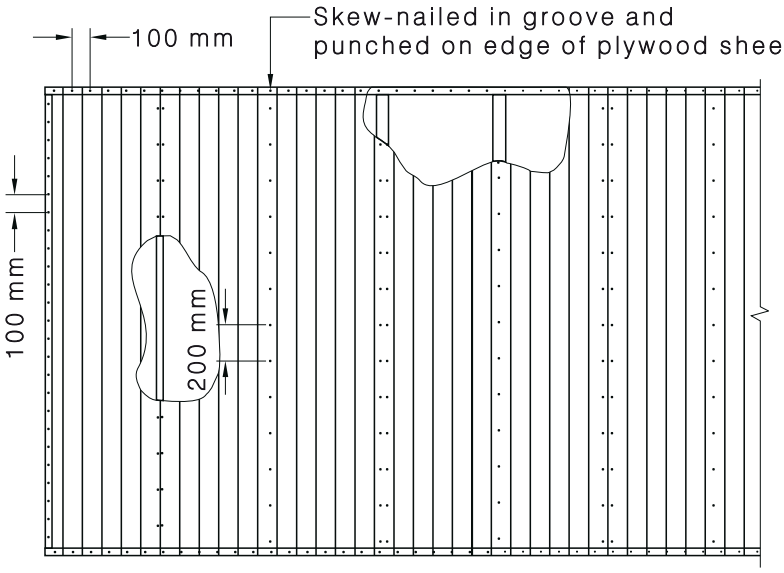
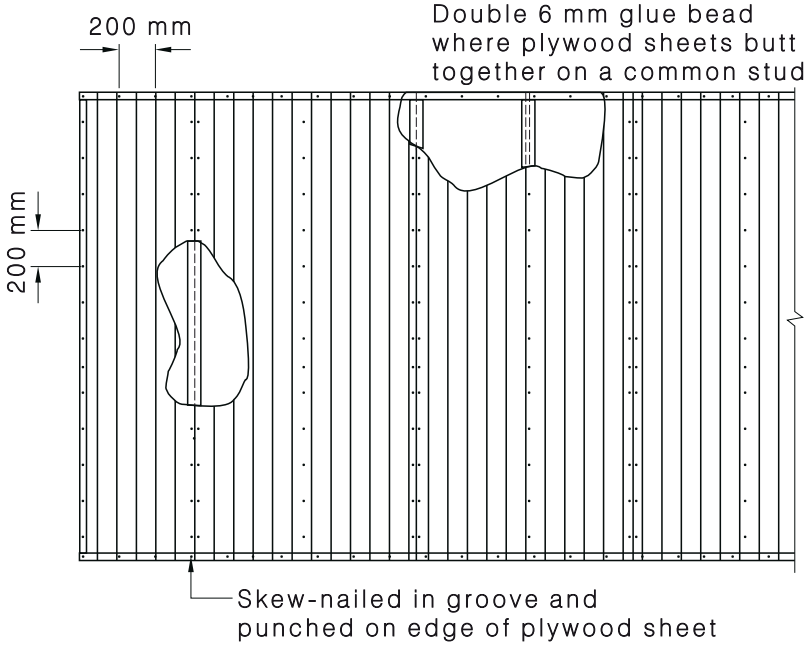
<table>
<tr><th>Type of bracing</th><th>Bracing capacity kN/m</th></tr>
<tr><td>(h) Plywood Plywood shall be nailed to frame using 30 × 2.8 ∅ galvanized flat-head nails or equivalent.
For Method A, M12 rods shall be used at each end of sheathed section top plate to bottom plate/floor frame. Method B has no rods but sheathing shall be nailed to top and bottom plates and any horizontal joints at 50 mm centres.
 

NOTE: For plywood fixed to both sides of the wall, see Clauses 8.3.6.5 and 8.3.6.10.
<table>
<tr><td colspan="3">Minimum plywood thickness, mm</td></tr>
<tr><td rowspan="2">Stress grade</td><td colspan="2">Stud spacing mm</td></tr>
<tr><td>450</td><td>600</td></tr>
<tr><td>F8
F11
F14
F27</td><td>7
6
4
4</td><td>9
7
6
4.5</td></tr>
<tr><td colspan="3">Fastener spacing, (s) mm</td></tr>
<tr><td colspan="2">Top and bottom plate:
— Method A
— Method B</td><td>
150
50</td></tr>
<tr><td colspan="2">Vertical edges</td><td>150</td></tr>
<tr><td colspan="2">Intermediate studs</td><td>300</td></tr>
<tr><td colspan="3">Fixing of bottom plate to floor frame or slab</td></tr>
<tr><td colspan="3">Method A: M12 rods as shown plus a 13 kN capacity connection at max. 1200 mm centres
Method B: A 13 kN capacity connection at each end and intermediately at max. 1200 mm centres</td></tr>
</table>
Method A 6.4
Method B 6.0</td></tr>
<tr><td>(i) Plywood Plywood shall be nailed to frame using 30 × 2.8 mm ∅ galvanized flat-head nails or equivalent.
 

NOTE: For plywood fixed to both sides of the wall, see Clauses 8.3.6.5 and 8.3.6.10.
<table>
<tr><td colspan="3">Minimum plywood thickness, mm</td></tr>
<tr><td rowspan="2">Stress grade</td><td colspan="2">Stud spacing mm</td></tr>
<tr><td>450</td><td>600</td></tr>
<tr><td colspan="3">No nogging (except horizontal butt joints)</td></tr>
<tr><td>F11</td><td>4.5</td><td>4.5</td></tr>
<tr><td>F11</td><td>7.0</td><td>7.0</td></tr>
<tr><td colspan="3">Fastener spacing mm</td></tr>
<tr><td colspan="2">Top and bottom plate</td><td>50</td></tr>
<tr><td colspan="2">Vertical edges</td><td>100</td></tr>
<tr><td colspan="2">Intermediate studs</td><td>100</td></tr>
</table>
7.5
8.7</td></tr>
</table>

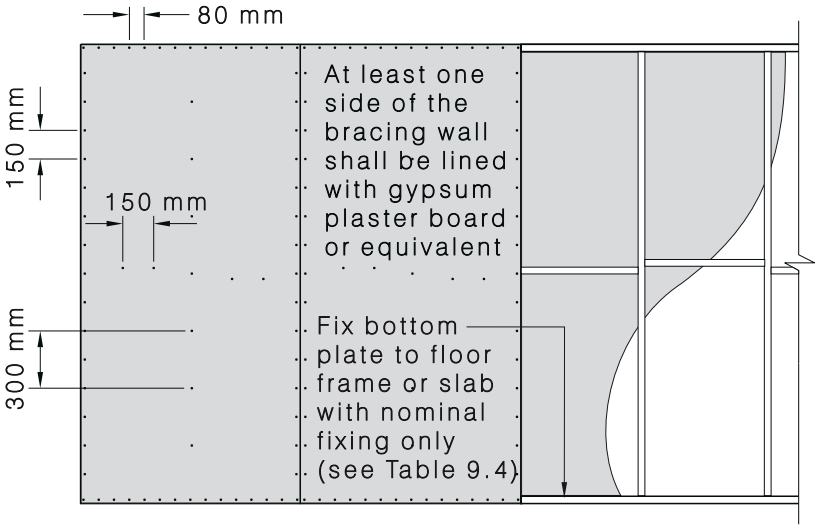
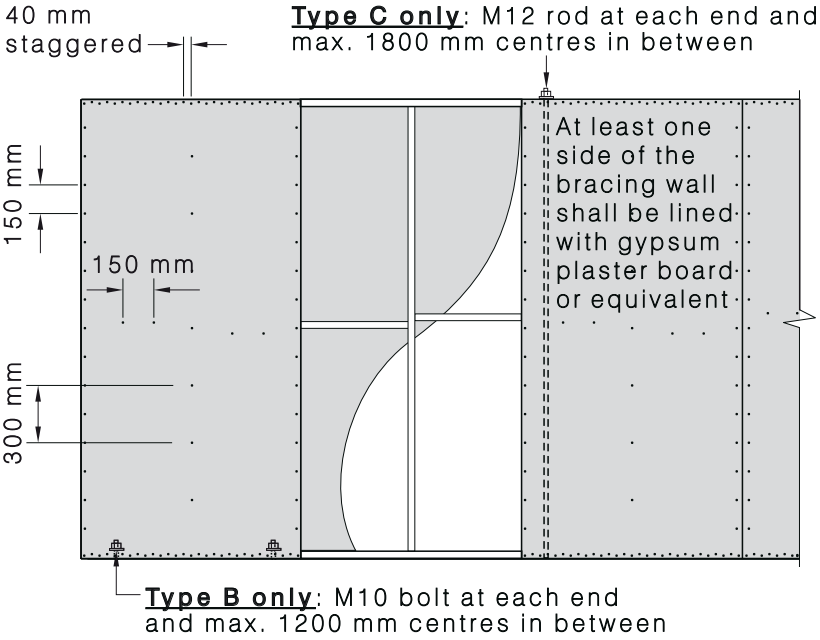
(*continued*)

TABLE 8.18 (*continued*)

Type of bracing			Bracing capacity kN/m
(j) *Decorative plywood—Nailed* Decorative plywood shall be nailed to frame using min. 40 mm × 2.5 mm ∅ bullet-head nails. The depth of groove shall not exceed one-third the nominal thickness.  NOTE: Fix bottom plate to floor frame or slab with nominal fixing only (see Table 9.4).	Minimum nominal thickness of decorative structural plywood, mm		2.1
	Stress grade	Stud spacing mm (600 max.)	
	F11	6	
	Fastener spacing mm		
	Top and bottom plate:	100	
	Vertical edges	100	
	Intermediate studs	200	
(k) *Decorative plywood—Glued and nailed* Decorative plywood shall be nailed to frame using min. 40 × 2.5 mm ∅ bullet-head nails. Continuous 6 mm bead of elastomeric adhesive to studs and plates. Double 6 mm glue bead where plywood sheets butt together on a common stud. The depth of groove shall not exceed one-third the nominal thickness.  NOTE: Fix bottom plate to floor frame or slab with a 13 kN capacity connection at each end of braced panel and at max. 1200 mm centres.	Minimum nominal thickness of decorative structural plywood, mm		5.3
	Stress grade	Stud spacing mm (600 max.)	
	F11	6	
	Fastener spacing mm		
	Top and bottom plates	200	
	Vertical edges	200	
	Intermediate studs	200	

(*continued*)

TABLE 8.18 (*continued*)

Type of bracing			Bracing capacity kN/m
(l) *Hardboard Type A* Hardboard shall comply with AS/NZS 1859.4. Hardboard shall be nailed to frame using minimum 30 × 2.8 mm ∅ galvanized flat-head nails or equivalent. Nails shall be located a minimum of 10 mm from the vertical edges and 15 mm from the top and bottom edges. Maximum stud spacing = 600 mm. Bracing panel minimum width = 900 mm.  	Minimum hardboard thickness 4.8 mm		Type A 3.4
	Fastener spacing, mm		
	Top and bottom plates	80	
	Vertical edges and nogging	150	
	Intermediate studs	300	
	Fixing of bottom plate to floor frame or slab		
	Type A: Fixing bottom plate to floor frame or slab with nominal fixing requirement (see Table 9.4).		
(m) *Hardboard Types B and C* Hardboard shall comply with AS/NZS 1859.4. Hardboard shall be nailed to frame using minimum 30 × 2.8 mm ∅ galvanized flat-head nails or equivalent. Nails shall be located a minimum of 10 mm from the vertical edges and 15 mm from the top and bottom edges. Maximum stud spacing = 600 mm. Bracing panel minimum width = 900 mm.  	Minimum hardboard thickness 4.8 mm		Type B 6.0 Type C 9.0
	Fastener spacing, mm		
	Top and bottom plates	40	
	Vertical edges and nogging	150	
	Intermediate studs	300	
	Fixing of bottom plate to floor frame or slab.		
	Type B: Fix bottom plate to floor frame or slab with M10 bolts each end and intermediately at max. 1200 mm centres Type C: M12 rods at each end and intermediately at max. 1800 mm centres. NOTE: Bolt/rod washer sizes as per Table 9.1.		

(*continued*)