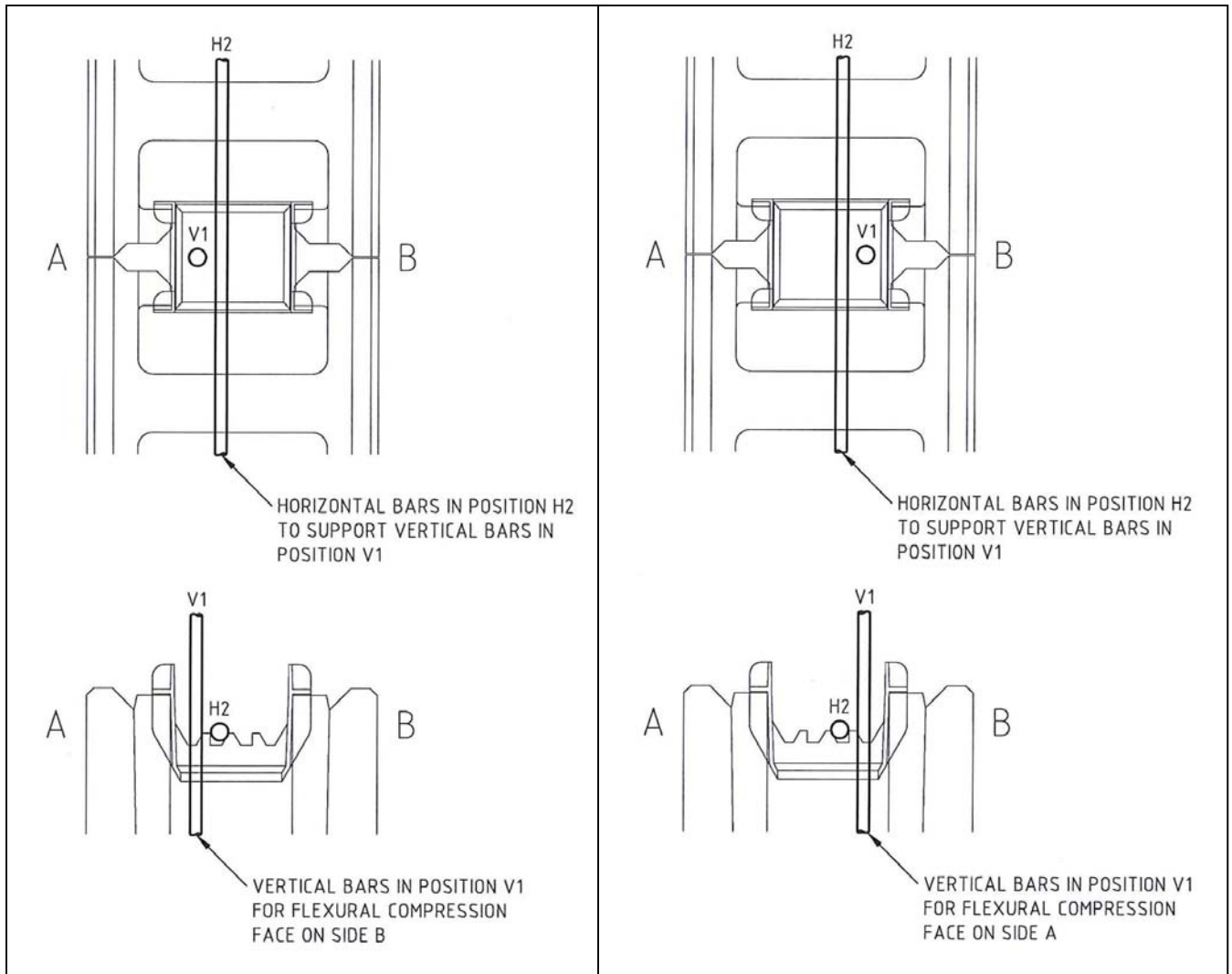


### SECTION 3. DESIGN OF WALLS IN BENDING

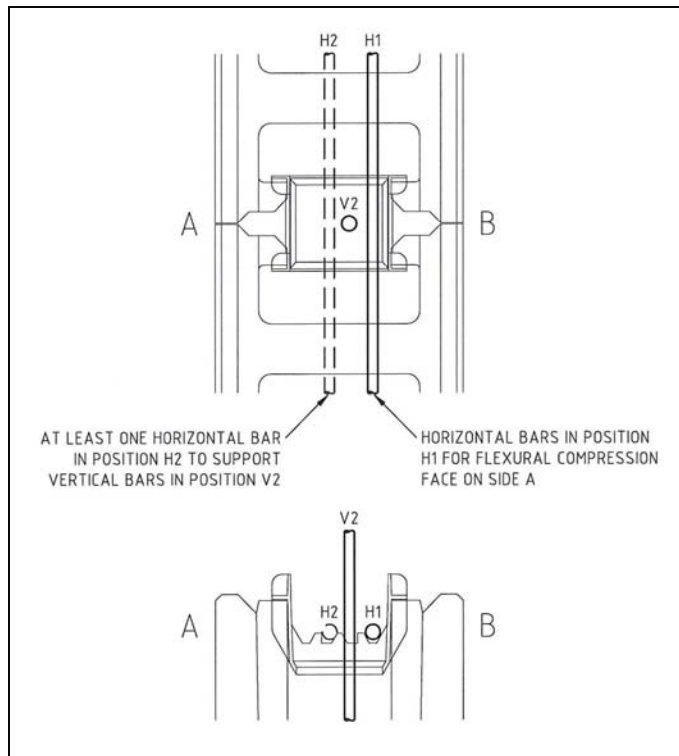
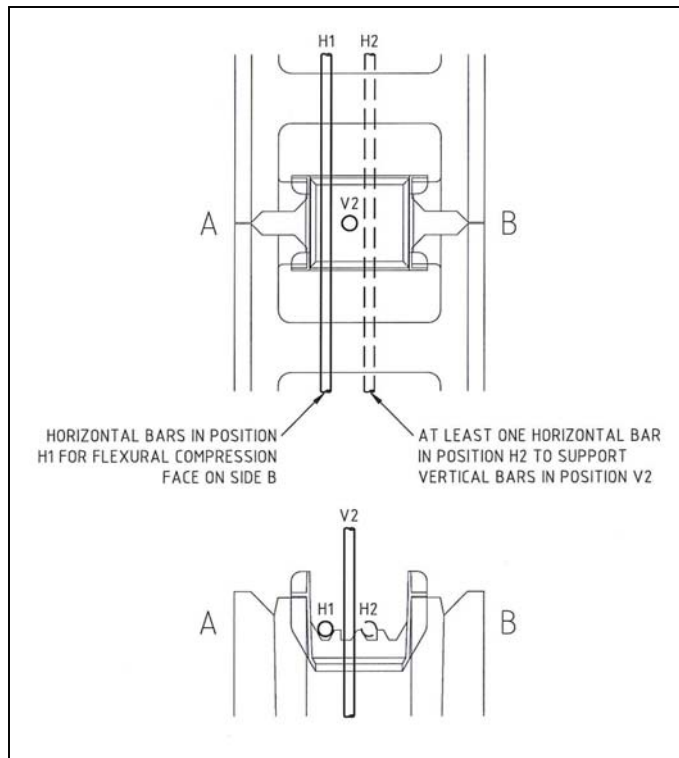
This section is for the design of walls subjected to out-of-plane lateral loads only however it can also be used for the design of walls subjected to only small axial compression loads where the stress at mid-height due to bending and compression does not exceed the lesser of  $0.03f_c$  and 2MPa (Refer Clause 11.1b)

#### Reinforcing bar positions

The location of all reinforcement in **mortarless** walls is controlled by the notches in the connectors that support the horizontal bars. The 200 mortarless connectors have four notches, and the bar positions are described as V1, V2, H1 and H2 as shown in the following sketches. Positions V1 and H1 are located furthest from the neutral axis, while positions V2 and H2 are located closest to the neutral axis. These positions are referred to in the moment capacity tables below.



#### Reinforcing bar positions V1 and H2 for 200 chamfered mortarless



**Reinforcing bar positions V2 and H1 for 200 chamfered *mortarless***

## **DESIGN PROCEDURE: BENDING**

### **Out-of-plane bending (walls):**

**Step 1:** Calculate ultimate limit state design bending moment.

**Step 2:** Select a *mortarless* block size and strength (grade) based on local availability and price, and any other requirements (architect's requirements, fire rating, sound rating, thermal rating etc).

**Step 3:** Using Table 3-1 determine the reinforcement size, spacing and location that will give a bending moment capacity equal to or greater than the design bending moment.

Ensure the bar positions (vertical and/or horizontal) are specified on the drawings. Note that when the vertical bars are required to be in any of the four possible locations it is necessary to specify the appropriate horizontal bar positions. The horizontal bars are used to guide the vertical bars into their correct location and to support them in that location throughout the height of the wall – refer to the sections on pages 1 – 3.

### **In-plane bending (beams):**

**Step 1:** Calculate ultimate limit state design bending moment.

**Step 2:** Using Table 3-2 or 3-3 determine the reinforcement requirement noting that this table can be used for checking both the positive and the negative bending moment reinforcement requirements.

## Bending moment capacities for walls subject to out-of-plane loads

### TABLE 3-1:

200 MORTARLESS WALL - CHAMFERED									
Block Grade & Reinforcement ( $f_y = 500\text{Mpa}$ )	$A_s$ mm <sup>2</sup> /m	BENDING MOMENT CAPACITY $\phi M_u$ (kNm/m)							
		vertical bending				horizontal bending			
		$A_{sd}$ mm <sup>2</sup> /m	bars in position V1 $d = 112$	$A_{sd}$ mm <sup>2</sup> /m	bars in position V2 $d = 93$	$A_{sd}$ mm <sup>2</sup> /m	bars in position H1 $d = 114$	$A_{sd}$ mm <sup>2</sup> /m	bars in position H2 $d = 96$
<b>Grade 15 blocks 20MPa Grout</b>									
N12-200	550	550	15.6	550	12.4	550	15.9	550	12.9
N12-400	275	275	8.4	275	6.8	275	8.5	275	7.1
N12-600	183	183	5.7	183	4.6	183	5.8	183	4.8
N16-200	1000	980	25.8	810	17.5				
N16-400	500	500	14.6	500	11.7				
N16-600	333	333	10.0	333	8.1				
<b>Grade 20 blocks 20MPa Grout</b>									
N12-200	550	550	16.1	550	12.9	550	16.4	550	13.4
N12-400	275	275	8.5	275	6.9	275	8.7	275	7.2
N12-600	183	183	5.7	183	4.7	183	5.8	183	4.8
N16-200	1000	1000	27.7	1000	22.0				
N16-400	500	500	14.9	500	12.1				
N16-600	333	333	10.2	333	8.3				

#### Notes:

All reinforcement to be Grade 500 deformed bars.

The tabulated values have been calculated in accordance with Clause 8.1

$A_s$  is the area of tensile reinforcement installed in the wall

$A_{sd}$  is the area of tensile reinforcement used for design of the section

The tabulated bending moment capacities include all of the capacity reduction factor  $\phi=0.6$ .

## Bending moment capacities for mortarless beams

**TABLE 3-2:** Beams with one bar in the bottom course

<b>15 MPa</b>	<i>D x B</i>	<i>d</i>	Bending moment capacity (kNm)		
			1N12 bottom	1N16 bottom	1N20 bottom
2 course beam	400 x 200	235	7.7**	13.9	21.3
3 course beam	600 x 200	435		25.9	39.9
4 course beam	800 x 200	635		37.9	58.6

**TABLE 3-3:** Beams with one bar in the bottom course

<b>20 MPa</b>	<i>D x B</i>	<i>d</i>	Bending moment capacity (kNm)		
			1N12 bottom	1N16 bottom	1N20 bottom
2 course beam	400 x 200	235	7.7**	13.9	21.4
3 course beam	600 x 200	435		25.9	40.0
4 course beam	800 x 200	635		37.9	58.6

\*\* WARNING - 1N12 in a 400x174 beam does not quite satisfy the minimum reinforcement requirements of Clause 8.1.6