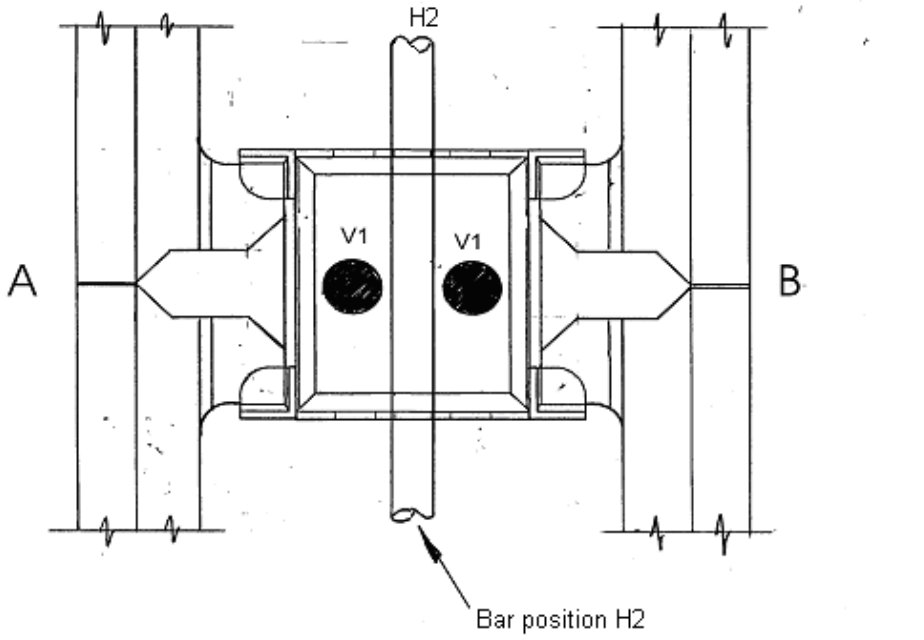
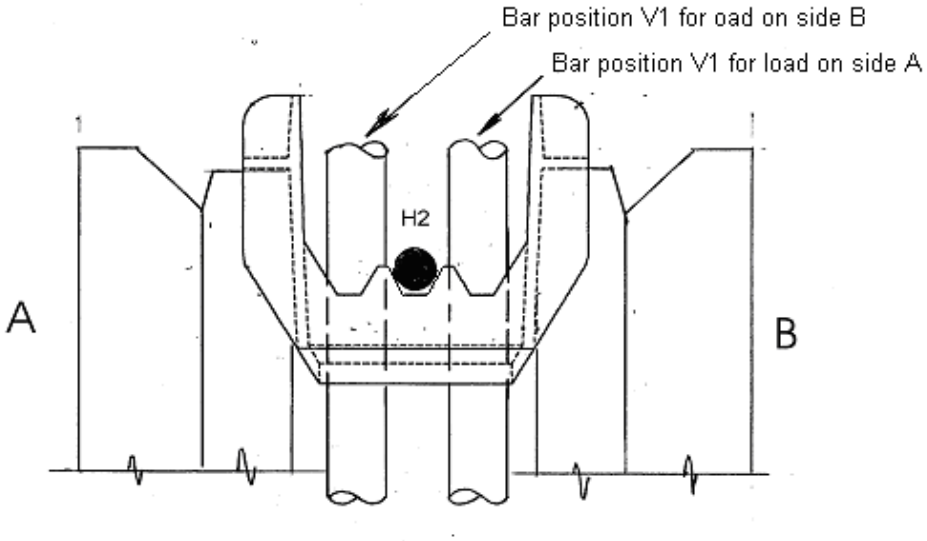
SECTION 3. DESIGN OF WALLS IN BENDING

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 design axial load does not exceed $0.04f_{ck}A_g$

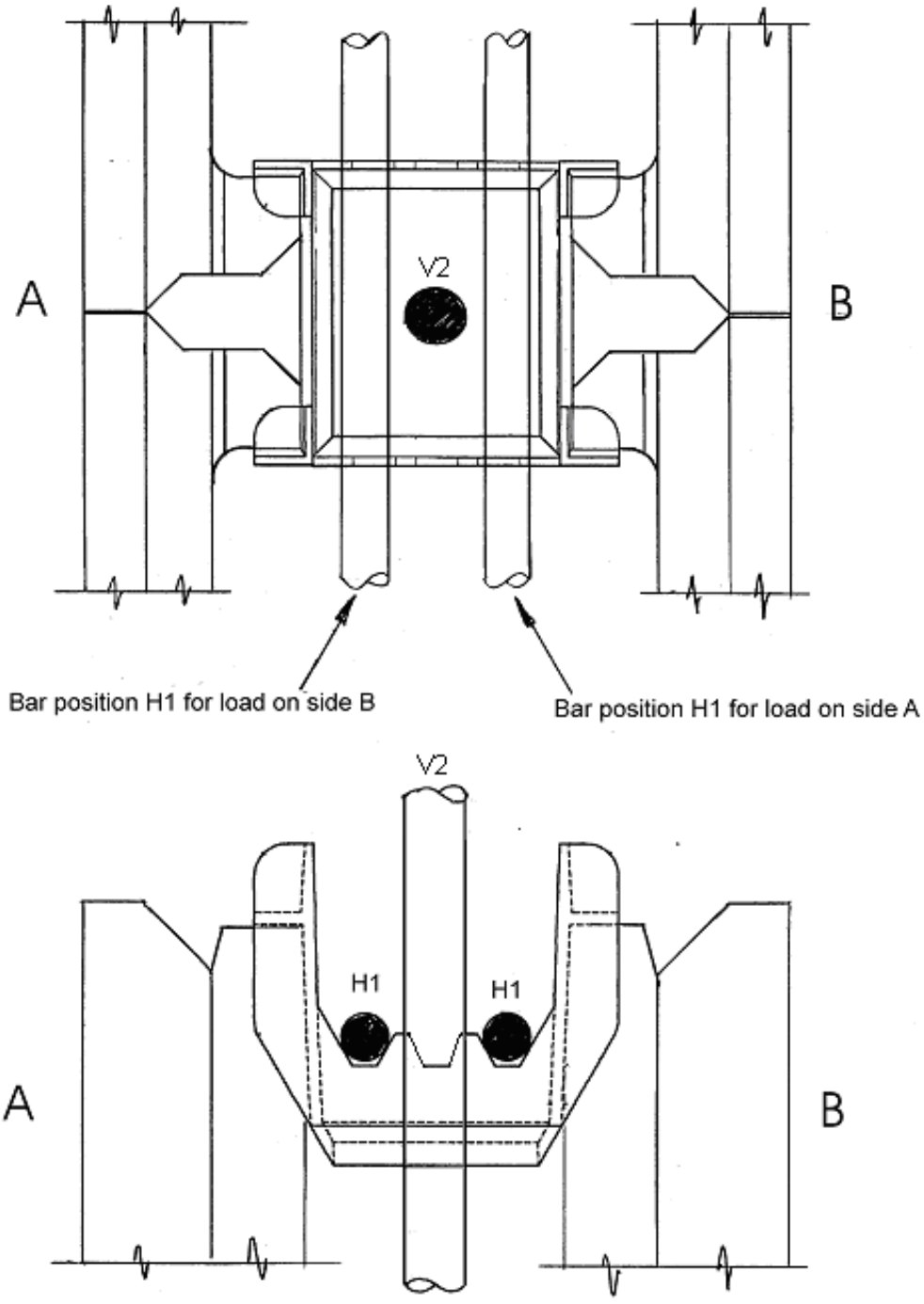
Reinforcing bar positions

The location of all reinforcement in ***mortarless*** walls is controlled by the notches in the connectors that support the horizontal bars. The 140 mortarless connectors have three notches, and the bar positions are described as V1, V2, H1 and H2 as shown in the following skecthes. 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 unchamfered *mortarless*



Reinforcing bar positions H1 and V2 for 140 *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 three 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 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:

140 MORTARLESS WALL - UNCHAMFERED

Block Grade & Reinforcement (f_y = 500Mpa)	A_s mm²/m	BENDING MOMENT CAPACITY (kNm/m)							
		vertical bending				horizontal bending			
		A_{sd} mm²/m	bars in position V1 d = 71	A_{sd} mm²/m	bars in position V2 d = 57	A_{sd} mm²/m	bars in position H1 d = 74	A_{sd} mm²/m	bars in position H2 d = 57
Grade 15 blocks M20 Grout									
T12-200	550	550	13.8	450	10.4	550	14.5	450	10.4
T12-400	275	275	8.8	275	6.9	275	9.3	275	6.9
T12-600	183	183	6.1	183	4.8	183	6.4	183	4.8
T16-200	1000	560	16.1	450	10.4				
T16-400	500	500	14.7	450	10.4				
T16-600	333	333	10.5	333	8.1				
Grade 20 blocks M25 Grout									
T12-200	550	550	14.4	550	11.1	550	15.1	550	11.1
T12-400	275	275	9.0	275	7.1	275	9.4	275	7.1
T12-600	183	183	6.2	183	4.9	183	6.4	183	4.9
T16-200	1000	700	20.1	560	12.9				
T16-400	500	500	15.3	500	11.8				
T16-600	330	330	10.7	330	8.4				

Notes:

All reinforcement to be Grade 500 deformed bars.
The tabulated values have been calculated in accordance with Section 38 - Limit State of Collapse : Flexure
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 applicable partial safety factors.
It is recommended that T16-200 be specified with caution as the sections are over reinforced.

Bending moment capacities for mortarless beams

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

	D x B	*d*	Bending moment capacity (kNm)	
			1T12 bottom	1T16 bottom
2 course beam	400 x 200	230	10.9	19.6
3 course beam	600 x 200	430	20.4	37.0
4 course beam	800 x 200	630	30.0	54.4