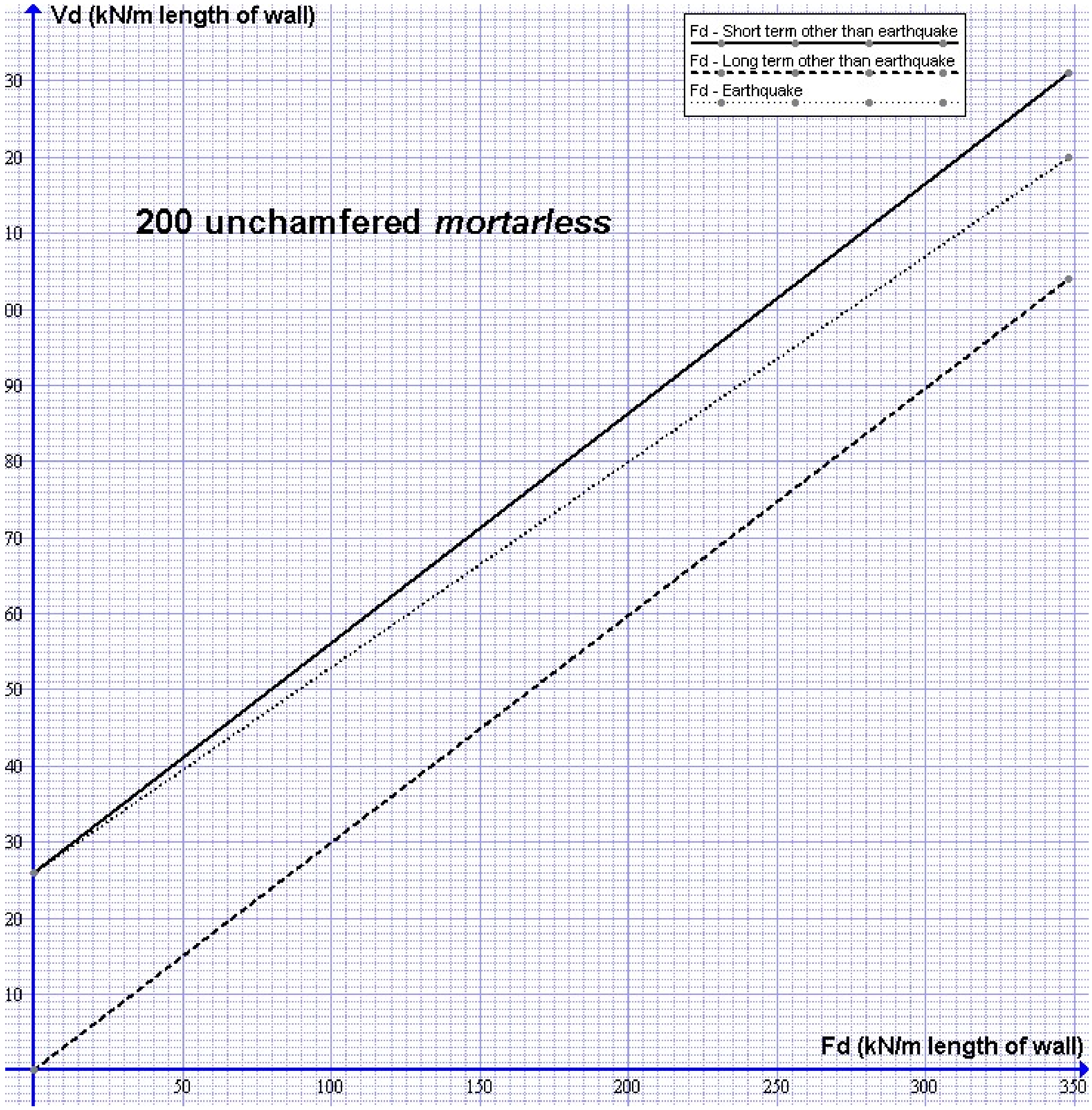
SECTION 5. DESIGN OF WALLS FOR SHEAR

Load-bearing walls are mostly designed to carry axial compression loads however in many load bearing wall structures they are also designed to carry the lateral loads arising from wind, earthquake etc, i.e. they are designed as shear walls. Diagram 5-1 and Table 5.1 provide a means of readily checking the capacity of a wall to take in-plane shear.

Load-bearing walls can also be subjected to out of plane lateral loads, a typical example being a retaining wall designed to carry earth pressure loads. These walls may need to be checked for transverse shear loads at critical sections and Table 5.2 is provided to make this task very easy. It is recommended however that the out-of-plane shear capacity is determined using AS 3600 as the transverse shear capacity increases as the axial load N^* increases and this makes sense.

Reinforced ***mortarless*** is also often used as lintel beams and the like to span across openings. These members need to be designed for shear the same as any reinforced concrete beam and Tables 5.3 to 5.5 make it very easy to check the shear capacity of ***mortarless*** beams.

Diagram 5-1: In-plane shear capacity of <u>unreinforced</u> *mortarless*



Notes:

1. F_d is the <u>minimum</u> design compressive load on the shear wall acting simultaneously with the design shear force.
2. V_d is the design shear capacity of the shear wall in kN per metre length of wall.
3. Linear interpolation is permitted.
4. It is recommended that any shear wall being designed to resist earthquake loads be designed as a reinforced wall and reinforced accordingly.
5. This chart should be used if the reinforcement in the wall does not meet the minimum requirements outlined in Table 5.1 below.

Table 5.1: In-plane shear capacity of reinforced *mortarless*

H/L	**IN-PLANE SHEAR CAPACITY V_d (kN/m length of wall) - UNCHAMFERED BLOCKS**				
	WALL REINFORCEMENT				
	N12-200	N12-400	N12-600	N12-800	
0.1	354	272	244	231	WHEN USING THIS SECTION OF THE TABLE, WALL REINFORCEMENT IS EITHER THE VERTICAL OR THE HORIZONTAL REINFORCEMENT, WHICHEVER IS THE LESS. MINIMUM VERTICAL REINFORCEMENT IS N12-400 (OR N16-800). MINIMUM HORIZONTAL REINFORCEMENT IS N12-800. IF MINIMUM REINFORCEMEMENT REQUIREMENTS ARE NOT MET THEN WALL MUST BE DESIGNED FOR SHEAR AS UNREINFORCED
0.2	348	265	238	224	
0.3	341	259	231	218	
0.4	335	252	225	211	
0.5	328	246	218	205	
0.6	322	239	212	198	
0.7	315	233	205	191	
0.8	309	226	198	185	
0.9	302	220	192	178	
1.0	296	213	185	172	
1.1	274	199	174	162	WHEN USING THIS SECTION OF THE TABLE WALL REINFORCEMENT IS THE HORIZONTAL REINFORCEMENT AND ALL HORIZONTAL BARS ARE TO BE ANCHORED AT THEIR EXTREMITIES. MINIMUM VERTICAL REINFORCEMENT IS N12-400 (OR N16-800). MINIMUM HORIZONTAL REINFORCEMENT IS N12-800. IF MINIMUM REINFORCEMEMENT REQUIREMENTS ARE NOT MET THEN WALL MUST BE DESIGNED FOR SHEAR AS UNREINFORCED.
1.2	255	186	163	152	
1.3	238	174	153	143	
1.4	222	163	144	134	
1.5	208	153	134	125	
1.6	194	143	126	117	
1.7	182	133	117	109	
1.8	170	124	109	101	
1.9	159	115	101	94	
2.0	148	107	93	86	
2.1	137	98	85	78	
2.2	127	90	77	71	
2.3	117	82	70	64	
>2.3	DESIGN USING RULES FOR OUT-OF-PLANE SHEAR				REFER CLAUSE 8.6.3

Notes:

1. *H* is the height of the shear wall and *L* is the length of the shear wall.
2. V_d is the design shear capacity of the shear wall in kN per metre length of wall.
3. The reinforcement must be symmetrical in the cross section.
4. Provide 1-N12 (minimum) within 300mm of each edge parallel to the main reinforcement <u>unless</u> the edge in question is anchored to a reinforced concrete member with starter bars matching or exceeding the area of the main reinforcement.
5. If the wall is not externally supported against overturning, ensure it is anchored such that it meets the requirements of clause 8.6.2 a) (D).
6. The tabulated values apply to both Grade 15 and Grade 20 blocks.
7. Linear interpolation is permitted.

Table 5.2: Out-of-plane shear capacity of reinforced *mortarless*

200 unchamfered *mortarless* Out-of-plane shear	
Vertical reinforcement	Shear capacity (kN/m)
N12-200	24.0
N12-400	21.2
N12-600	20.2
N12-800	19.7
N16-200	28.8
N16-400	23.5
N16-600	21.8
N16-800	20.9

Note:
1. Walls to be designed as reinforced for shear
2. All vertical reinforcement is to be fully anchored beyond top and bottom of wall panel

TABLE 5.3: Shear capacity of beams <u>without</u> shear reinforcement

200 unchamfered *mortarless*						
	Dimensions *D* x *B*	**Effective Depth** *d*	**Maximum V_u without shear reinforcement (kN)**			
			1N12 btm	1N16 btm	1N20 btm	1N24 btm
2 course beam 15MPa blocks	400 x 200	235	10.8	13.2	15.3	17.3
2 course beam 20MPa blocks	400 x 200	235	11.9	14.5	16.8	19.0
3 course beam 15 MPa blocks	600 x 200	435	16.3	19.9	23.0	26.0
3 course beam 20 MPa blocks	600 x 200	435	17.9	21.9	25.3	28.7
4 course beam 15 MPa blocks	800 x 200	635		25.6	29.6	33.5
4 course beam 20 MPa blocks	800 x 200	635		28.1	32.6	36.9
5 course beam 15 MPa blocks	1000 x 200	835		30.7	35.5	40.2
5 course beam 20 MPa blocks	1000 x 200	835		33.8	39.1	44.3
6 course beam 15 MPa blocks	1200 x 200	1035			41.0	46.4
6 course beam 20 MPa blocks	1200 x 200	1035			45.1	51.1

Notes:

1. The tabulated shear capacities have been calculated in accordance with AS 3600
2. Install N12-200 horizontal intermediate bars in all beams fully anchored at both ends.

TABLE 5.4: Shear capacity of beams with R10-200 shear reinforcement

200 unchamfered *mortarless*						
	Dimensions *D* x *B*	**Effective Depth** *d*	**Maximum V_u with shear reinforcement * (kN)** (R10-200 shear reinforcement – single leg)			
			1N12 btm	1N16 btm	1N20 btm	1N24 btm
3 course beam 15 MPa blocks	600 x 200	435	46.8	50.4	53.5	56.5
3 course beam 20 MPa blocks	600 x 200	435	48.4	52.4	55.6	59.2
4 course beam 15 MPa blocks	800 x 200	635		70.1	74.1	78.0
4 course beam 20 MPa blocks	800 x 200	635		72.6	77.1	81.4
5 course beam 15 MPa blocks	1000 x 200	835		89.2	94.0	98.7
5 course beam 20 MPa blocks	1000 x 200	835		92.3	97.6	102.8
6 course beam 15 MPa blocks	1200 x 200	1035			113.5	118.9
6 course beam 20 MPa blocks	1200 x 200	1035			117.6	123.6

Notes:
1. The tabulated shear capacities have been calculated in accordance with AS 3600
2. Install N12-200 horizontal intermediate bars in all beams fully anchored at both ends.

TABLE 5.5: Shear capacity of beams with R10-400 shear reinforcement

200 unchamfered *mortarless*						
	Dimensions *D* x *B*	**Effective Depth** *d*	**Maximum V_u with shear reinforcement * (kN)** (R10-400 shear reinforcement – single leg)			
			1N12 btm	1N16 btm	1N20 btm	1N24 btm
5 course beam 15MPa blocks	1000 x 200	835	N/A	N/A	64.7	69.4
5 course beam 20MPa blocks	1000 x 200	835	N/A	N/A	68.3	73.5
6 course beam 15 MPa blocks	1200 x 200	1035	N/A	N/A	77.2	82.6
6 course beam 20 MPa blocks	1200 x 200	1035	N/A	N/A	81.3	87.3

Notes:
1. The tabulated shear capacities have been calculated in accordance with AS 3600
2. Install N12-200 horizontal intermediate bars in all beams fully anchored at both ends.