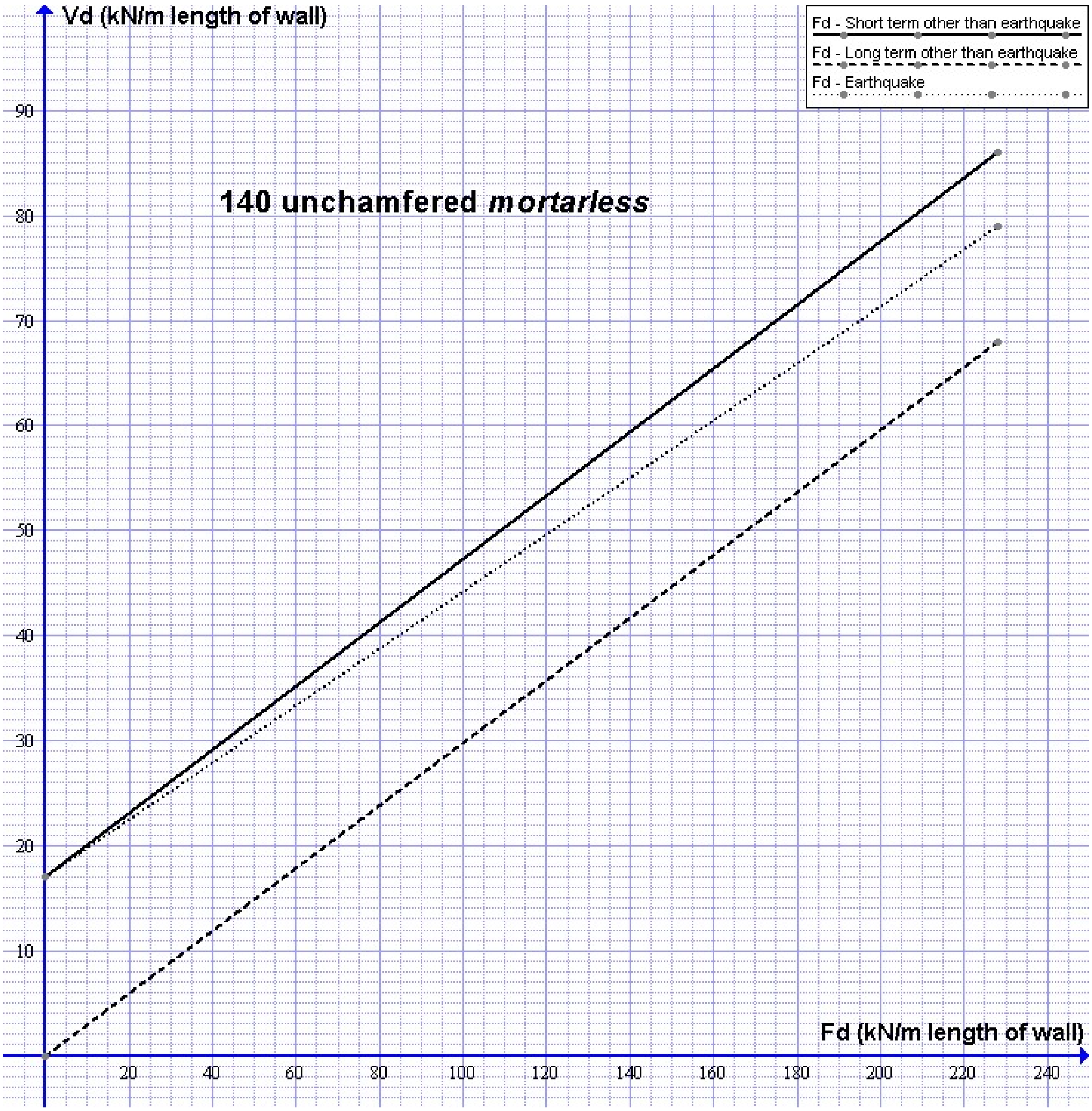
SECTION 5. DESIGN OF WALLS FOR SHEAR

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 and 5.4 make it very easy to check the shear capacity of ***mortarless*** beams.

Diagram 5-1: In-plane shear capacity of 140 *mortarless* walls designed as <u>unreinforced</u> masonry



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	SHEAR WALL CAPACITY V_d (kN/m length of wall) - UNCHAMFERED BLOCKS				
	WALL REINFORCEMENT				
	N12-200	N12-400	N12-600	N12-800	
0.1	289	206	179	165	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 N12-600 (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	285	202	175	161	
0.3	280	198	170	157	
0.4	276	194	166	153	
0.5	272	189	162	148	
0.6	268	185	158	144	
0.7	263	181	153	140	
0.8	259	177	149	135	
0.9	255	172	145	131	
1.0	251	168	140	127	
1.1	231	156	140	127	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 N12-600 (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	214	146	131	119	
1.3	200	136	123	111	
1.4	186	127	115	105	
1.5	174	119	108	98	
1.6	163	111	101	92	
1.7	153	104	94	86	
1.8	143	97	88	80	
1.9	134	90	82	74	
2.0	125	84	76	69	
2.1	117	78	70	63	
2.2	109	72	65	58	
2.3	102	66	59	53	
>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 unless 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 140 *mortarless* shear walls designed as <u>reinforced</u> masonry

140 unchamfered *mortarless* **Out-of-plane shear**	
Vertical reinforcement	Shear capacity (kN/m)
N12-200	17.7
N12-400	14.9
N12-600	13.9
N12-800	13.4

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 without shear reinforcement

140 unchamfered *mortarless*					
	Dimensions *D* x *B*	**Effective Depth** *d*	**Maximum V_u without shear reinforcement (kN)**		
			1N12 btm	1N16 btm	1N20 btm
2 course beam 15MPa blocks	400 x 200	235	8.1	9.9	11.5
2 course beam 20MPa blocks	400 x 200	235	9.0	10.9	12.7
3 course beam 15 MPa blocks	600 x 200	435	12.3	15.0	17.3
3 course beam 20 MPa blocks	600 x 200	435	13.5	16.5	19.1
4 course beam 15 MPa blocks	800 x 200	635		19.3	22.3
4 course beam 20 MPa blocks	800 x 200	635		21.2	24.6
5 course beam 15 MPa blocks	1000 x 200	835		23.2	26.8
5 course beam 20 MPa blocks	1000 x 200	835		25.5	29.5
6 course beam 15 MPa blocks	1200 x 200	1035		26.7	30.9
6 course beam 20 MPa blocks	1200 x 200	1035		29.4	34.0

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

140 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
3 course beam 15 MPa blocks	600 x 200	435	42.8	45.5	47.8
3 course beam 20 MPa blocks	600 x 200	435	44.0	47.0	49.6
4 course beam 15 MPa blocks	800 x 200	635		63.8	66.8
4 course beam 20 MPa blocks	800 x 200	635		65.7	69.1
5 course beam 15 MPa blocks	1000 x 200	835		81.7	85.3
5 course beam 20 MPa blocks	1000 x 200	835		84.0	88.0
6 course beam 15 MPa blocks	1200 x 200	1035		99.2	103.4
6 course beam 20 MPa blocks	1200 x 200	1035		101.9	106.5

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

140 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
5 course beam 15MPa blocks	1000 x 200	835	N/A	52.4	56.0
5 course beam 20MPa blocks	1000 x 200	835	N/A	54.7	58.7
6 course beam 15 MPa blocks	1200 x 200	1035	N/A	62.9	67.1
6 course beam 20 MPa blocks	1200 x 200	1035	N/A	65.6	70.2

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.