SECTION FOUR

WALL REINFORCEMENT

SECTION FOUR : WALL REINFORCEMENT

This Section enables engineer to specify from the design tables, a new range of WWF for various sizes of reinforced concrete walls. Only 10mm and 13mm diameter of bars with 150mm and 200mm spacing in either main, cross or both directions of the welded wire fabric series are considered in the design.

Other mesh series if required may be used subject to the engineer's requirement.

To achieve high load capacity, engineer may install additional vertical reinforcement bars to the mesh and/or use higher grades of concrete.

4.1 Design Considerations

1. Annotation for wall reference number with its specific mesh are shown in the following examples.

   Example (1): WA125-A10 from Building Wall Design Table 'WA1', where,
   W – Denotes reinforced concrete wall
   A – Denotes wall design based on Grade 30 concrete
   125 – Denotes 125mm thick reinforced concrete wall
   A10 – Denotes A10 Standard WWF is used for both sides of wall

   Example (2): WB300-DA13d/10 from Building Wall Design Table 'WB5', where,
   W – Denotes reinforced concrete wall
   B – Denotes wall design based on Grade 35 concrete
   300 – Denotes 300mm thick reinforced concrete wall
   DA13d/10 – Denotes DA13d/10 Designer WWF is used for both sides of wall

2. Nominal concrete cover of 25mm is used in the design unless otherwise specified by engineer.

3. Concrete characteristic strength of 30 N/mm^2 and 35 N/mm^2 are adopted in the Design Table 'WA1' to Table 'WA8' and Table 'WB1' to Table 'WB8' respectively.

4. The derivation of Design Ultimate Vertical Load, N (in kN) in the design table is in accordance to Clause (3.9.3.6.1) in BS 8110: Part 1: 1985: Section Three for stocky braced reinforced wall supporting approximately symmetrical arrangement of slabs and beams, and assumed to be pinned at each floor. Engineer shall exercise his own judgement when using the design tables such as when bending or unbraced condition is to be taken into consideration.

   $$\mathbf{N\ (in\ kN) = 0.35\ f_{cu}\ A_c + 0.67\ A_{sc}\ f_y}$$

   where,
   f_{cu} – Denotes characteristic strength of concrete used (N/mm^2)
   A_c – Denotes net cross-section area of concrete in a column (mm^2)
   A_{sc} – Denotes area of main vertical reinforcement bars (mm^2)
   f_y – Denotes characteristic strength of welded wire fabric wires (485 N/mm^2)

5. "C" links are to be provided and specified by Engineer whenever necessary.

6. Steel/Concrete content (in kg/m^3) and its percentage are an estimated values without taking into account of lapping zone.

7. Engineer shall consider and liaise with fabricators, whenever necessary, for any other available mesh, and to verify the necessary lapping and lifting requirements.

4.2 Wall Design Tables

Building Wall Design Table: WA1		Thickness: 125 mm Concrete Grade : 30 N/mm^2		
Wall Ref No.	**WWF Size**	**Ult Vert Load Capacity (KNm)**	**% of Vertical Reinf** **% of Horizontal Reinf**	**Steel/Concrete (kg/m^3)**
WA125-A10	A10	1560	0.63 0.63	99
WA125-AA13/10	AA13/10	1730	1.06 0.63	133
WA125-DA10/10	DA10/10	1810	1.26 0.63	148
WA125-EA13/10	EA13/10	1900	1.49 0.63	160
WA125-EA10d/10	EA10d/10	2000	1.76 0.63	181
WA125-B13	B13	2150	2.12 0.63	216
WA125-DA10d/10	DA10d/10	2300	2.51 0.63	247
WA125-EA13d/10	EA13d/10	2480	2.97 0.63	271
WA125-DA13d/10	DA13d/10	2980	4.25 0.63	382

Building Wall Design Table: WA2		Thickness: 150 mm Concrete Grade : 30 N/mm^2		
Wall Ref No.	**WWF Size**	**Ult Vert Load Capacity (KNm)**	**% of Vertical Reinf** **% of Horizontal Reinf**	**Steel/Concrete (kg/m^3)**
WA150-A10	A10	1820	0.52 0.52	82
WA150-AA13/10	AA13/10	1990	0.88 0.52	110
WA150-DA10/10	DA10/10	2070	1.05 0.52	123
WA150-EA13/10	EA13/10	2160	1.24 0.52	134
WA150-EA10d/10	EA10d/10	2270	1.47 0.52	151
WA150-B13	B13	2410	1.77 0.52	180
WA150-DA10d/10	DA10d/10	2560	2.09 0.52	206
WA150-EA13d/10	EA13d/10	2740	2.48 0.52	226
WA150-DA13d/10	DA13d/10	3240	3.54 0.52	318

Building Wall Design Table: **WA3**		Thickness: 175 mm		
		Concrete Grade : 30 N/mm^2		
Wall Ref No.	**WWF Size**	**Ult Vert Load Capacity (KNm)**	**% of Vertical Reinf** / **% of Horizontal Reinf**	**Steel/Concrete (kg/m^3)**
WA175-A10	A10	2080	0.45 / 0.45	71
WA175-AA13/10	AA13/10	2250	0.76 / 0.45	95
WA175-DA10/10	DA10/10	2330	0.90 / 0.45	106
WA175-EA13/10	EA13/10	2420	1.06 / 0.45	114
WA175-EA10d/10	EA10d/10	2530	1.26 / 0.45	129
WA175-B13	B13	2670	1.52 / 0.45	154
WA175-DA10d/10	DA10d/10	2830	1.80 / 0.45	176
WA175-EA13d/10	EA13d/10	3010	2.12 / 0.45	194
WA175-DA13d/10	DA13d/10	3510	3.03 / 0.45	273

Building Wall Design Table: **WA4**		Thickness: 200 mm		
		Concrete Grade : 30 N/mm^2		
Wall Ref No.	**WWF Size**	**Ult Vert Load Capacity (KNm)**	**% of Vertical Reinf** / **% of Horizontal Reinf**	**Steel/Concrete (kg/m^3)**
WA200-AA13/10	AA13/10	2520	0.66 / 0.39	83
WA200-DA10/10	DA10/10	2590	0.79 / 0.39	93
WA200-EA13/10	EA13/10	2680	0.93 / 0.39	100
WA200-EA10d/10	EA10d/10	2790	1.10 / 0.39	113
WA200-B13	B13	2930	1.33 / 0.39	135
WA200-DA10d/10	DA10d/10	3090	1.57 / 0.39	154
WA200-EA13d/10	EA13d/10	3270	1.86 / 0.39	170
WA200-DA13d/10	DA3d/10	3770	2.65 / 0.39	239

Building Wall Design Table: **WA5**		Thickness: 225 mm		
		Concrete Grade : 30 N/mm^2		
Wall Ref No.	**WWF Size**	**Ult Vert Load Capacity (KNm)**	**% of Vertical Reinf** / **% of Horizontal Reinf**	**Steel/Concrete (kg/m^3)**
WA225-EA10/10	EA10/10	2710	0.49 / 0.35	64
WA225-AA13/10	AA13/10	2780	0.59 / 0.35	74
WA225-DA10/10	DA10/10	2860	0.70 / 0.35	82
WA225-EA13/10	EA13/10	2950	0.83 / 0.35	89
WA225-EA10d/10	EA10d/10	3050	0.98 / 0.35	101
WA225-B13	B13	3200	1.18 / 0.35	120
WA225-DA10d/10	DA10d/10	3350	1.40 / 0.35	137
WA225-EA13d/10	EA13d/10	3530	1.65 / 0.35	151
WA225-DA13d/10	DA13d/10	4030	2.36 / 0.35	212

Building Wall Design Table: **WA6**		Thickness: 250 mm		
		Concrete Grade : 30 N/mm^2		
Wall Ref No.	**WWF Size**	**Ult Vert Load Capacity (KNm)**	**% of Vertical Reinf** / **% of Horizontal Reinf**	**Steel/Concrete (kg/m^3)**
WA250-EA10/10	EA10/10	2970	0.44 / 0.31	58
WA250-AA13/10	AA13/10	3040	0.53 / 0.31	66
WA250-DA10/10	DA10/10	3120	0.63 / 0.31	74
WA250-EA13/10	EA13/10	3210	0.74 / 0.31	80
WA250-EA10d/10	EA10d/10	3320	0.88 / 0.31	90
WA250-B13	B13	3460	1.06 / 0.31	108
WA250-DA10d/10	DA10d/10	3610	1.26 / 0.31	123
WA250-EA13d/10	EA13d/10	3790	1.49 / 0.31	136
WA250-DA13d/10	DA13d/10	4290	2.12 / 0.31	191

Building Wall Design Table: **WA7**		Thickness: 275 mm Concrete Grade : 30 N/mm^2		
Wall Ref No.	**WWF Size**	**Ult Vert Load Capacity (KNm)**	**% of Vertical Reinf** **% of Horizontal Reinf**	**Steel/Concrete (kg/m^3)**
WA275-EA10/10	EA10/10	3230	0.40 0.29	52
WA275-AA13/10	AA13/10	3300	0.48 0.29	60
WA275-DA10/10	DA10/10	3380	0.57 0.29	67
WA275-EA13/10	EA13/10	3470	0.68 0.29	73
WA275-EA10d/10	EA10d/10	3580	0.80 0.29	82
WA275-B13	B13	3720	0.97 0.29	98
WA275-DA10d/10	DA10d/10	3880	1.14 0.29	112
WA275-EA13d/10	EA13d/10	4060	1.35 0.29	123
WA275-DA13d/10	DA13d/10	4560	1.93 0.29	174

Building Wall Design Table: **WA8**		Thickness: 300 mm Concrete Grade : 30 N/mm^2		
Wall Ref No.	**WWF Size**	**Ult Vert Load Capacity (KNm)**	**% of Vertical Reinf** **% of Horizontal Reinf**	**Steel/Concrete (kg/m^3)**
WA300-AA13/10	AA13/10	3570	0.44 0.26	55
WA300-DA10/10	DA10/10	3640	0.52 0.26	62
WA300-EA13/10	EA13/10	3730	0.62 0.26	67
WA300-EA10d/10	EA10d/10	3840	0.73 0.26	75
WA300-B13	B13	3980	0.88 0.26	90
WA300-DA10d/10	DA10d/10	4140	1.05 0.26	103
WA300-EA13d/10	EA13d/10	4320	1.24 0.26	113
WA300-DA13d/10	DA13d/10	4820	1.77 0.26	159

Building Wall Design Table: **WB1**		Thickness: 125 mm Concrete Grade : **35** N/mm^2		
Wall Ref No.	**WWF Size**	**Ult Vert Load Capacity (KNm)**	**% of Vertical Reinf** **% of Horizontal Reinf**	**Steel/Concrete (kg/m^3)**
WB125-A10	A10	1780	0.63 0.63	99
WB125-AA13/10	AA13/10	1950	1.06 0.63	133
WB125-DA10/10	DA10/10	2020	1.26 0.63	148
WB125-EA13/10	EA13/10	2110	1.49 0.63	160
WB125-EA10d/10	EA10d/10	2220	1.76 0.63	181
WB125-B13	B13	2360	2.12 0.63	216
WB125-DA10d/10	DA10d/10	2510	2.51 0.63	247
WB125-EA13d/10	EA13d/10	2690	2.97 0.63	271
WB125-DA13d/10	DA13d/10	3190	4.25 0.63	382

Building Wall Design Table: **WB2**		Thickness: 150 mm Concrete Grade : 35 N/mm^2		
Wall Ref No.	**WWF Size**	**Ult Vert Load Capacity (KNm)**	**% of Vertical Reinf** **% of Horizontal Reinf**	**Steel/Concrete (kg/m^3)**
WB150-A10	A10	2080	0.52 0.52	82
WB150-AA13/10	AA13/10	2250	0.88 0.52	110
WB150-DA10/10	DA10/10	2330	1.05 0.52	123
WB150-EA13/10	EA13/10	2420	1.24 0.52	134
WB150-EA10d/10	EA10d/10	2530	1.47 0.52	151
WB150-B13	B13	2670	1.77 0.52	180
WB150-DA10d/10	DA10d/10	2820	2.09 0.52	206
WB150-EA13d/10	EA13d/10	3000	2.48 0.52	226
WB150-DA13d/10	DA13d/10	3500	3.54 0.52	318

Building Wall Design Table: **WB3**	Thickness: 175 mm			
	Concrete Grade : 35 N/mm^2			
Wall Ref No.	**WWF Size**	**Ult Vert Load Capacity (KNm)**	**% of Vertical Reinf** / **% of Horizontal Reinf**	**Steel/Concrete (kg/m^3)**
WB175-A10	A10	2390	0.45 / 0.45	71
WB175-AA13/10	AA13/10	2560	0.76 / 0.45	95
WB175-DA10/10	DA10/10	2630	0.90 / 0.45	106
WB175-EA13/10	EA13/10	2720	1.06 / 0.45	114
WB175-EA10d/10	EA10d/10	2830	1.26 / 0.45	129
WB175-B13	B13	2970	1.52 / 0.45	154
WB175-DA10d/10	DA10d/10	3130	1.80 / 0.45	176
WB175-EA13d/10	EA13d/10	3310	2.12 / 0.45	194
WB175-DA13d/10	DA13d/10	3800	3.03 / 0.45	273

Building Wall Design Table: **WB 4**	Thickness: 200 mm			
	Concrete Grade : 35 N/mm^2			
Wall Ref No.	**WWF Size**	**Ult Vert Load Capacity (KNm)**	**% of Vertical Reinf** / **% of Horizontal Reinf**	**Steel/Concrete (kg/m^3)**
WB200-AA13/10	AA13/10	2870	0.66 / 0.39	83
WB200-DA10/10	DA10/10	2940	0.79 / 0.39	93
WB200-EA13/10	EA13/10	3030	0.93 / 0.39	100
WB200-EA10d/10	EA10d/10	3140	1.10 / 0.39	113
WB200-B13	B13	3280	1.33 / 0.39	135
WB200-DA10d/10	DA10d/10	3430	1.57 / 0.39	154
WB200-EA13d/10	EA13d/10	3610	1.86 / 0.39	170
WB200-DA13d/10	**DA13d/10**	4110	2.65 / 0.39	239

Building Wall Design Table: **WB5**		Thickness: 225 mm		
		Concrete Grade : 35 N/mm^2		
Wall Ref No.	**WWF Size**	**Ult Vert Load Capacity (KNm)**	**% of Vertical Reinf** / **% of Horizontal Reinf**	**Steel/Concrete (kg/m^3)**
WB225-EA10/10	EA10/10	3100	0.49 / 0.35	64
WB225-AA13/10	AA13/10	3170	0.59 / 0.35	74
WB225-DA10/10	DA10/10	3250	0.70 / 0.35	82
WB225-EA13/10	EA13/10	3340	0.83 / 0.35	89
WB225-EA10d/10	EA10d/10	3440	0.98 / 0.35	101
WB225-B13	B13	3590	1.18 / 0.35	120
WB225-DA10d/10	DA10d/10	3740	1.40 / 0.35	137
WB225-EA13d/10	EA13d/10	3920	1.65 / 0.35	151
WB225-DA13d/10	DA13d/10	4420	2.36 / 0.35	212

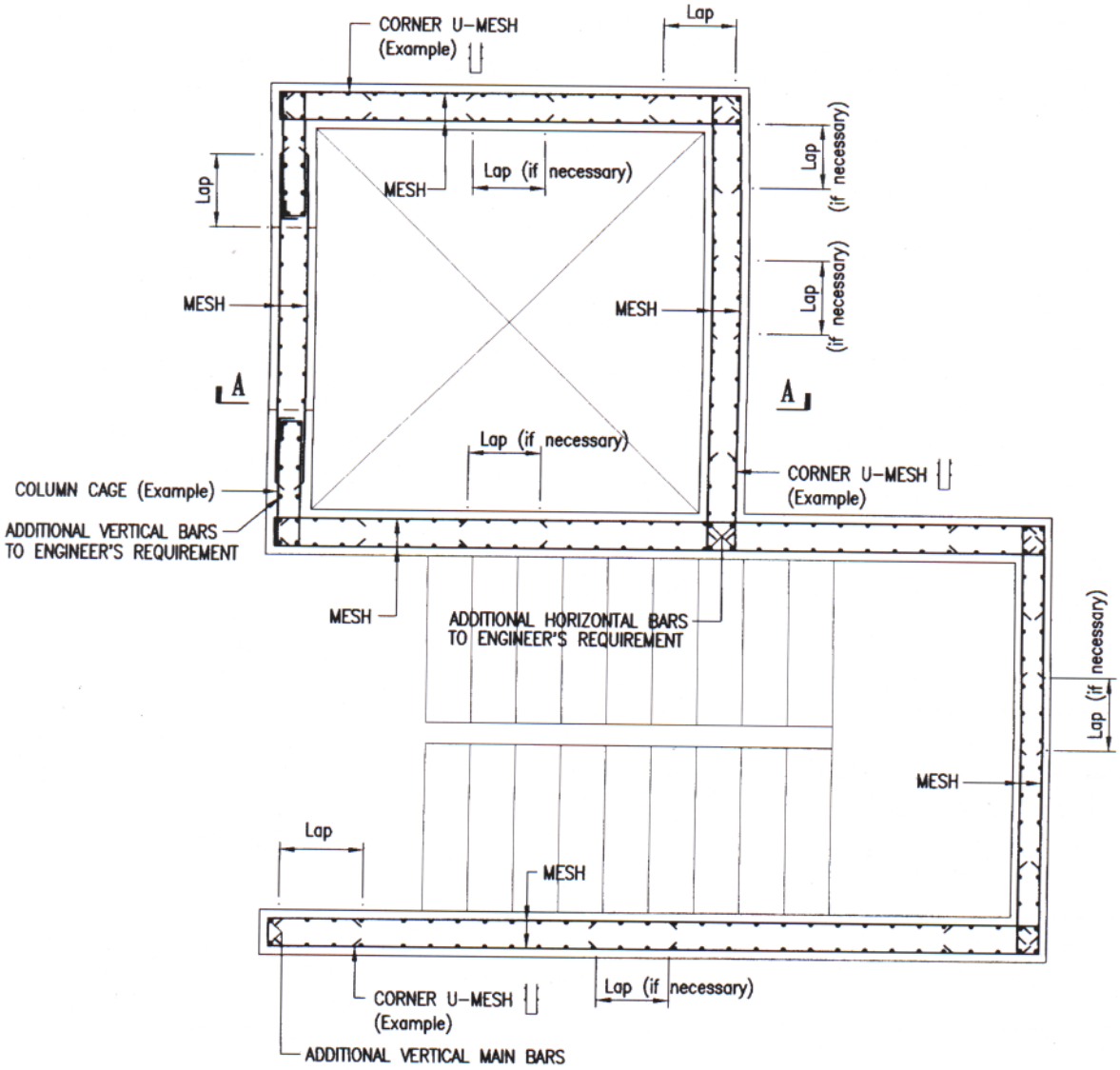
Building Wall Design Table: **WB6**		Thickness: 250 mm		
		Concrete Grade : **35** N/mm^2		
Wall Ref No.	**WWF Size**	**Ult Vert Load Capacity (KNm)**	**% of Vertical Reinf** / **% of Horizontal Reinf**	**Steel/Concrete (kg/m^3)**
WB250-EA10/10	EA10/10	3410	0.44 / 0.31	58
WB250-AA13/10	AA13/10	3480	0.53 / 0.31	66
WB250-DA10/10	DA10/10	3550	0.63 / 0.31	74
WB250-EA13/10	EA13/10	3640	0.74 / 0.31	80
WB250-EA10d/10	EA10d/10	3750	0.88 / 0.31	90
WB250-B13	B13	3890	1.06 / 0.31	108
WB250-DA10d/10	DA10d/10	4040	1.26 / 0.31	123
WB250-EA13d/10	EA13d/10	4220	1.49 / 0.31	136
WB250-DA13d/10	DA13d/10	4720	2.12 / 0.31	191

Building Wall Design Table: **WB7**		Thickness: 275 mm		
		Concrete Grade : 35 N/mm^2		
Wall Ref No.	**WWF Size**	**Ult Vert Load Capacity (KNm)**	**% of Vertical Reinf** / **% of Horizontal Reinf**	**Steel/Concrete (kg/m^3)**
WB275-EA10/10	EA10/10	3710	0.40 / 0.29	52
WB275-AA13/10	AA13/10	3780	0.48 / 0.29	60
WB275-DA10/10	DA10/10	3860	0.57 / 0.29	67
WB275-EA13/10	EA13/10	3950	0.68 / 0.29	73
WB275-EA10d/10	EA10d/10	4060	0.80 / 0.29	82
WB275-B13	B13	4200	0.97 / 0.29	98
WB275-DA10d/10	DA10d/10	4350	1.14 / 0.29	112
WB275-EA13d/10	EA13d/10	4530	1.35 / 0.29	123
WB275-DA13d/10	DA13d/10	5030	1.93 / 0.29	174

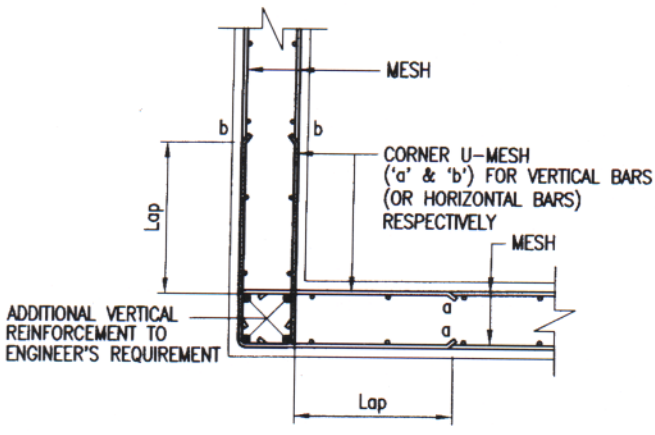
Building Wall Design Table: **WB8**		Thickness: 300 mm		
		Concrete Grade : 35 N/mm^2		
Wall Ref No.	**WWF Size**	**Ult Vert Load Capacity (KNm)**	**% of Vertical Reinf** / **% of Horizontal Reinf**	**Steel/Concrete (kg/m^3)**
WB300-AA13/10	AA13/10	4090	0.44 / 0.26	55
WB300-DA10/10	DA10/10	4170	0.52 / 0.26	62
WB300-EA13/10	EA13/10	4260	0.62 / 0.26	67
WB300-EA10d/10	EA10d/10	4360	0.73 / 0.26	75
WB300-B13	B13	4510	0.88 / 0.26	90
WB300-DA10d/10	DA10d/10	4660	1.05 / 0.26	103
WB300-EA13d/10	EA13d/10	4840	1.24 / 0.26	113
WB300-DA13d/10	DA13d/10	5340	1.77 / 0.26	159

4.3 Illustration On Use Of Mesh

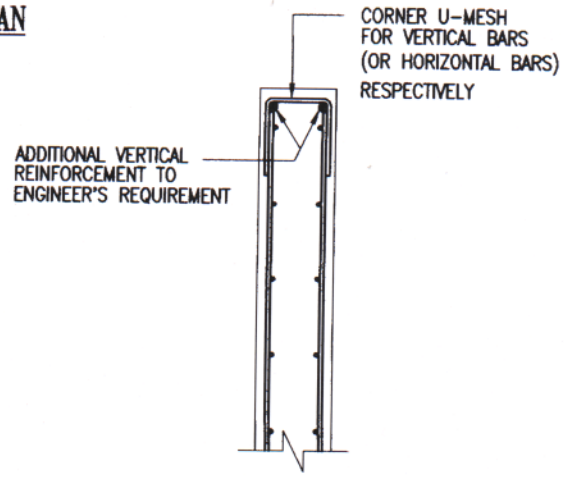
EXAMPLES FOR R.C. WALL



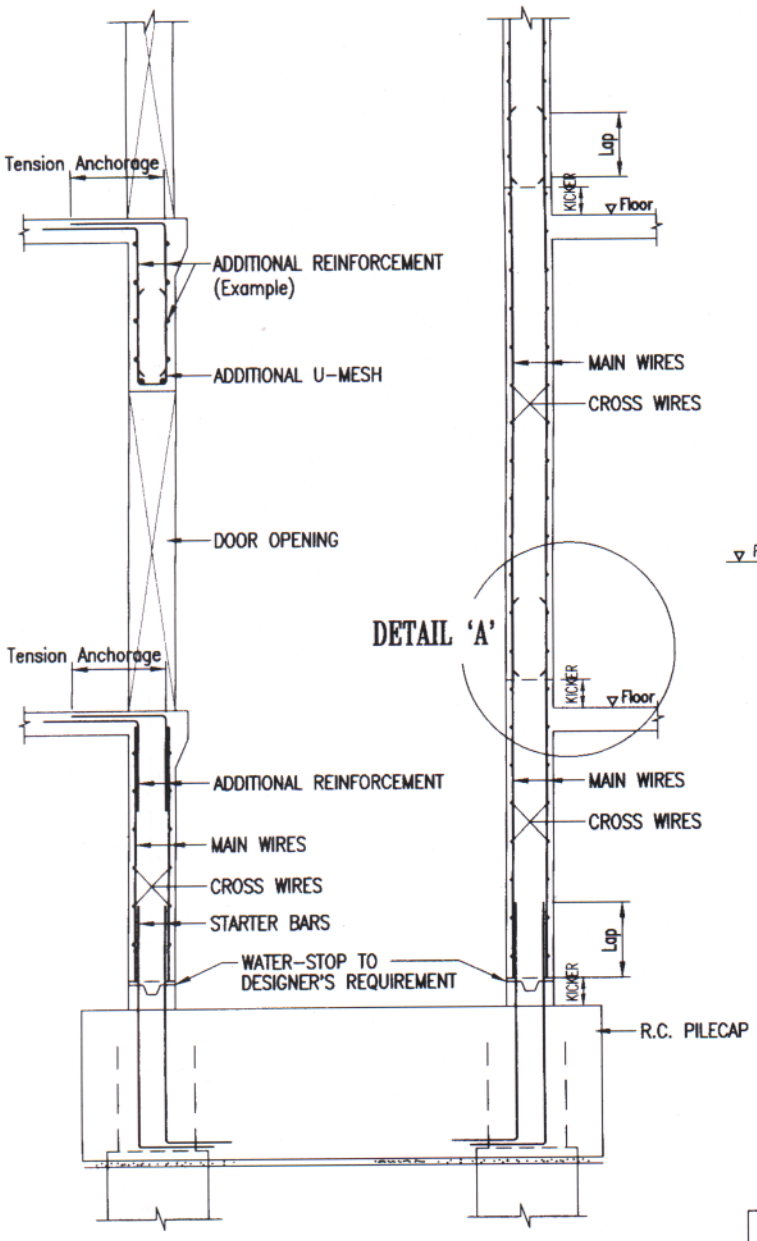
PLAN



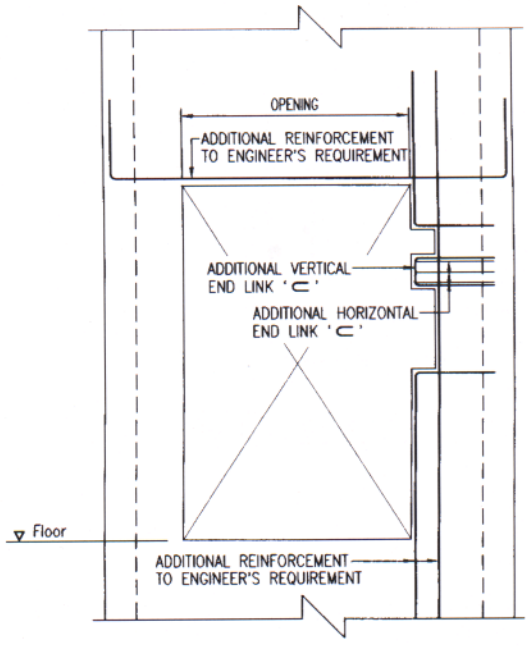
PLAN
Typical Wall Corner Reinforcement Detail
(On Horizontal & Vertical)



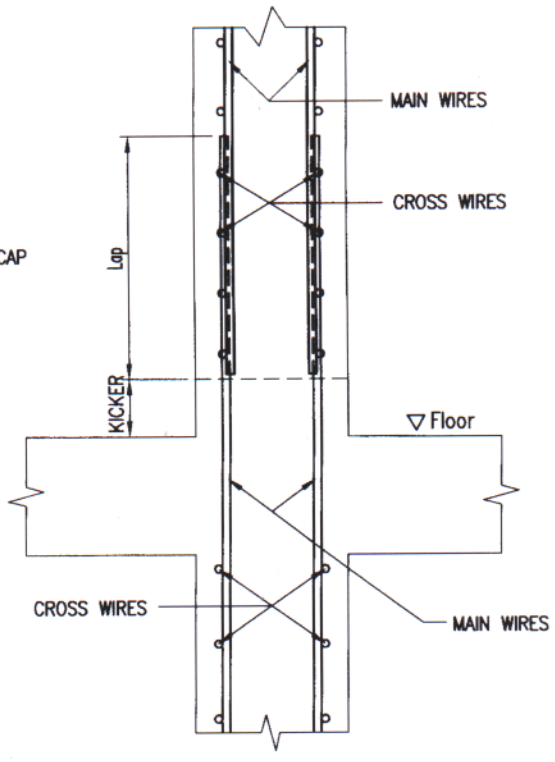
PLAN
Typical Wall End Reinforcement Detail
(On Horizontal & Vertical)



SECTION A - A



TYPICAL DETAIL OF WALL OPENING



DETAIL 'A'