CMAA
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CONCRETE MASONRY LINTELS

This data sheet has been prepared by the Concrete Masonry Association of Australia for use by qualified and experienced structural engineers. The information is based on limit state design and is applicable specifically to concrete masonry with properties as set out in Clause 1 and loads set out in Clause 2.

How to Navigate this Data Sheet

Any words in colour (eg, **Figure 2**) can be clicked to take you to it.

To return to where you were, click the *Previous View Button* in your Acrobat Reader

1 MASONRY PROPERTIES

The design tables are based on masonry components with the following properties:

Masonry units having a characteristic unconfined compressive strength (f'_{uc}), for units with face-shell bed, of 15 MPa or 12 MPa when tested in accordance with AS/NZS 4456.4.

Mortar is of type M3 (or type M4 if required for durability) ie, either a C1:L1:S6 mix or a C1:S5 mix plus methyl cellulose water thickener or equivalent.

Grout shall have a characteristic cylinder compressive strength (f'_c) of 20.0 MPa. Note the maximum value of grout strength (f'_{cg}) used for design is 1.3 times f'_{uc} ie, 1.3 x 15.0 = 19.5 MPa.

Where possible pre-mixed grout should be used and, when ordering, specified that it is for grouting blockwork with a minimum cement content of 300 kg/m³. If the grout is to be site-mixed, it should be mixed in a tilting drum paddle mixer and must flow freely without separation of the aggregate. The aggregate should be rounded gravel where available and preferably 5 mm to 10 mm in size. The following proportions should be used:

Cement	1 part
Hydrated lime	up to 1⁄10 part
Mortar sand	3 parts
Aggregate	2 parts

Reinforcement is to be N-grade with a yield strength (f_{sy}) of 500 MPa.

2 DESIGN BASIS

The loads, load combinations and load factors shall be in accordance with AS/NZS 1170.0.

The serviceability design of lintels is based on a maximum span/deflection ratio of 360 or 10 mm deflection, whichever is the lesser. The long-term elastic modulus (E) has been taken as $1000f'_m$.

The design properties and strength-reduction factors are in accordance with AS 3700 *Masonry structures*.

3 LINTEL CAPACITY

Capacity Tables are based on the practical consideration that the loading will usually be from trusses or similar roof or floor supports, at uniform centres, bearing on and tied down to the lintel. Hence, the Tables are for point loads at 900 mm centres acting in both downward and upward directions. They take into consideration both shear and bending and allowance has been made for the self-weight of the lintel.

Where the depth of masonry, (including the lintel and the height of masonry in running bond above the lintel) is at least equal to the span of the lintel and there is sufficient length of wall adjacent to the opening to act as a buttress, then the lintel will act as an arch and loads on the masonry may be ignored.

The Tables are given for both simply-supported and continuous lintels as detailed in **Figure 1**. However, these Tables do not apply where the bottom reinforcement continues straight through from the adjacent wall.

Capacity Tables are given for the full range of thicknesses and depths shown in **Figure 2**. The Tables cover bar sizes N12, N16 and N20 for one and two bars, where two can fit, ie 190- and 290-mm wide lintels.

The Tables also cover different strength grades of blocks, namely, 12 MPa and 15 MPa blocks.

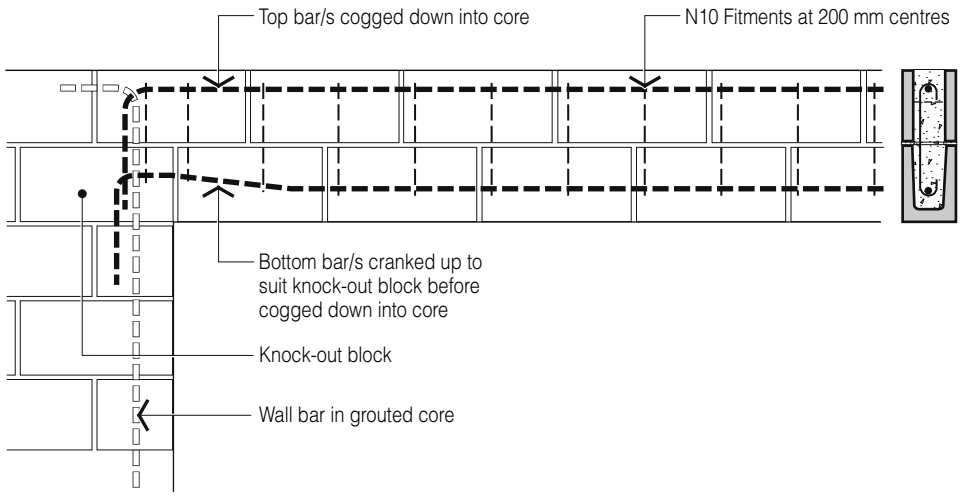


Figure 1 *Reinforcement Anchorage Details for Simply-Supported and Continuous Lintels*

4 DESIGN TABLES

Eight sets of Design Tables are provided to cover the following:

Table 1 12 MPa block, single bars, simply-supported lintel.

Table 2 12 MPa block, single bars, continuous lintel.

Table 3 12 MPa block, double bars, simply-supported lintel.

Table 4 12 MPa block, double bars, continuous lintel.

Table 5 15 MPa block, single bars, simply-supported lintel.

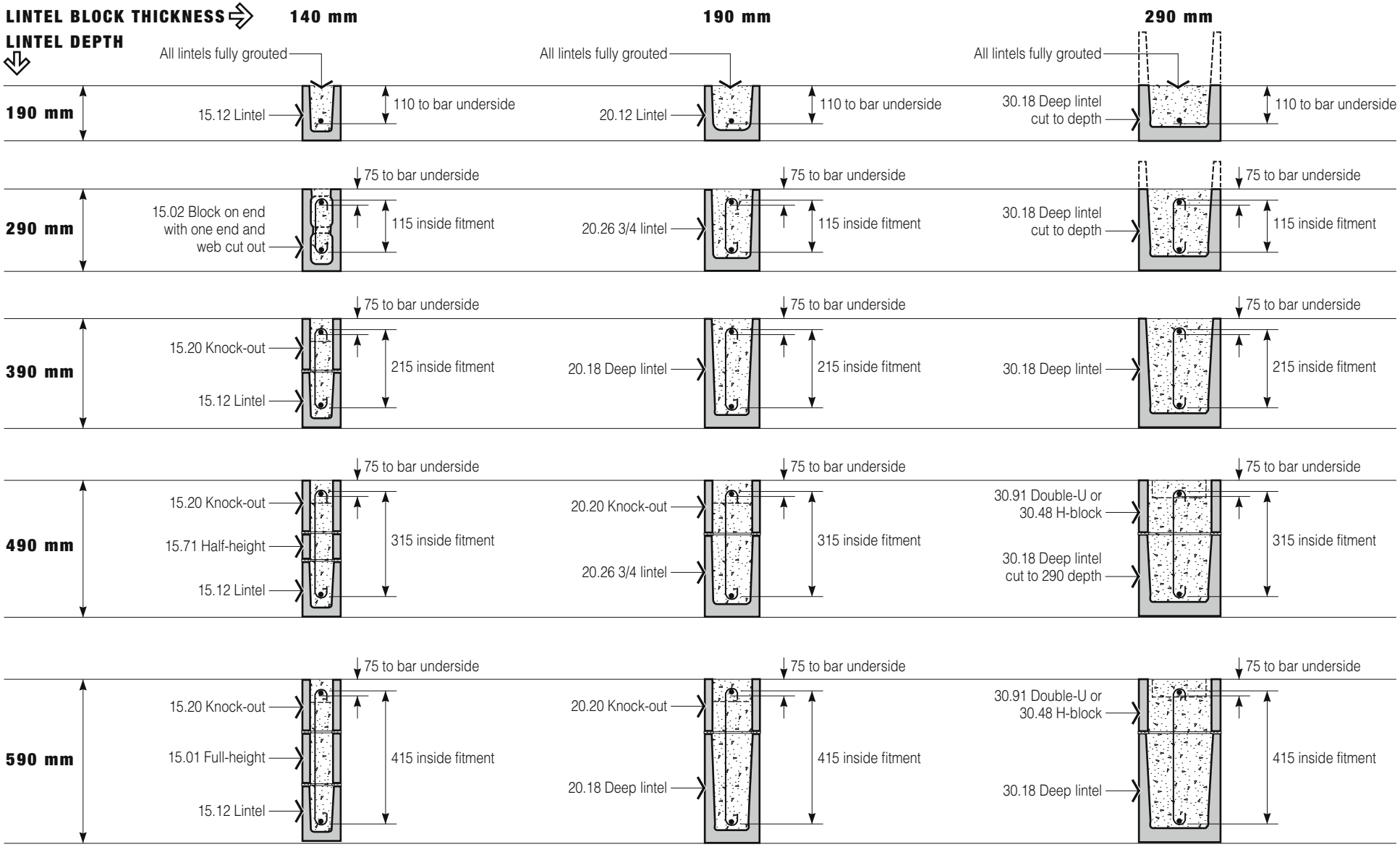
Table 6 15 MPa block, single bars, continuous lintel.

Table 7 15 MPa block, double bars, simply-supported lintel.

Table 8 15 MPa block, double bars, continuous lintel.

5 WORKED EXAMPLE

A **Worked Example** is included to demonstrate the steps required when performing a manual calculation. It also serves the purpose of confirming the basis of the Tables.



NOTE: Design Tables are given for N12, N16 and N20 bars for all thicknesses. For 190 and 290 thick blocks, Tables are for one and two bars top and bottom (except 190-deep lintels). All ligatures are N10 at 200 mm centres.

Figure 2 *Construction Details of Lintels covered by the Design Tables*

TABLE 1 12 MPa Blocks, Single Bars, Simply-Supported Lintel

[Go to Table Index]

Block thickness (mm)	Lintel depth (mm)	Bar details	Load capacity (kN/m) in downward direction — Opening size (m)									Load capacity (kN/m) in upward direction — Opening size (m)								
			0.9	1.2	1.8	2.4	3.0	3.6	4.2	4.8	5.4	0.9	1.2	1.8	2.4	3.0	3.6	4.2	4.8	5.4
140	190	1-N12 only	6	5	3	2	1	1	0	0	0	6	5	3	2	2	1	1	1	1
		1-N16 only	7	6	3	2	1	0	0	0	0	7	5	3	2	2	1	1	1	1
		1-N20 only	8	6	3	2	1	0	0	0	0	7	5	3	2	2	1	1	1	1
	290	1-N12 T&B	25	16	8	5	3	2	1	1	0	30	21	12	8	6	4	3	3	2
		1-N16 T&B	27	18	9	5	3	2	1	1	0	43	30	17	11	8	6	4	3	2
		1-N20 T&B	25	16	8	5	3	2	1	1	0	44	30	17	11	8	6	4	3	2
	390	1-N12 T&B	43	28	14	8	5	3	2	1	1	45	31	18	12	8	6	5	4	4
		1-N16 T&B	71	46	24	14	9	6	5	3	2	70	53	30	19	14	10	8	6	4
		1-N20 T&B	68	45	23	14	9	6	4	3	2	72	62	35	23	16	12	9	6	4
	490	1-N12 T&B	61	40	20	12	8	5	3	2	2	61	42	24	16	11	8	7	6	5
		1-N16 T&B	103	68	35	21	14	10	7	5	4	91	71	40	26	18	14	11	9	7
		1-N20 T&B	128	86	45	27	18	13	9	7	5	93	80	58	37	26	20	15	11	8
	590	1-N12 T&B	79	51	26	16	10	7	5	3	2	76	52	30	19	14	11	8	7	6
		1-N16 T&B	136	89	46	28	18	13	9	7	5	111	90	51	33	23	17	14	11	9
		1-N20 T&B	196	128	67	41	27	19	14	11	8	113	97	74	48	34	25	20	16	13
190	190	1-N12 only	7	6	4	2	1	1	0	0	0	7	6	4	3	2	2	1	1	1
		1-N16 only	9	7	4	2	1	1	0	0	0	8	7	4	3	2	2	1	1	1
		1-N20 only	10	8	4	2	1	1	0	0	0	10	7	4	3	2	2	2	1	1
	290	1-N12 T&B	26	17	8	5	3	2	1	0	0	31	22	12	8	6	5	4	3	3
		1-N16 T&B	37	24	12	7	4	3	2	1	1	53	36	21	13	10	7	6	4	3
		1-N20 T&B	34	22	11	6	4	2	2	1	0	55	41	23	15	11	8	6	4	3
	390	1-N12 T&B	44	28	14	8	5	3	2	1	0	47	32	18	12	9	7	6	5	4
		1-N16 T&B	74	48	25	15	9	6	4	3	2	75	55	31	20	15	11	9	7	6
		1-N20 T&B	85	60	31	19	12	8	6	4	3	77	66	45	29	21	15	12	8	6
	490	1-N12 T&B	61	40	20	12	7	5	3	2	1	62	43	25	16	12	9	7	6	5
		1-N16 T&B	107	70	36	21	14	9	7	5	3	97	74	42	27	19	15	12	10	8
		1-N20 T&B	137	101	53	32	21	15	11	8	6	99	85	61	40	28	21	16	13	11
	590	1-N12 T&B	79	51	26	15	9	6	4	2	1	77	53	31	20	15	11	9	8	6
		1-N16 T&B	139	91	47	28	18	13	9	6	5	119	93	53	34	24	18	15	12	10
		1-N20 T&B	205	134	70	43	28	20	14	11	8	121	104	78	50	35	27	21	17	14
290	190	1-N12 only	10	8	4	2	1	0	0	0	0	10	9	5	4	3	2	2	2	2
		1-N16 only	12	10	6	3	2	1	0	0	0	11	10	6	4	3	3	2	2	2
		1-N20 only	13	11	6	3	2	1	0	0	0	13	11	6	4	3	3	2	2	2
	290	1-N12 T&B	27	17	8	4	2	1	0	0	0	33	23	13	9	7	5	4	4	3
		1-N16 T&B	45	29	14	8	5	3	2	1	0	56	39	22	15	11	8	7	6	4
		1-N20 T&B	52	34	17	10	6	4	2	1	1	62	53	32	21	15	11	9	6	4
	390	1-N12 T&B	44	28	14	7	4	2	1	0	0	48	34	20	13	10	8	6	5	5
		1-N16 T&B	77	50	25	15	9	6	4	2	1	84	58	33	22	16	12	10	8	7
		1-N20 T&B	94	73	37	22	14	10	7	5	3	87	75	49	32	23	17	14	11	9
	490	1-N12 T&B	61	39	19	11	6	3	2	1	0	64	44	26	17	13	10	8	7	6
		1-N16 T&B	109	71	36	21	13	9	6	4	2	110	77	44	29	21	16	13	11	9
		1-N20 T&B	153	106	55	33	21	14	10	7	5	112	97	65	42	30	23	18	15	12
	590	1-N12 T&B	79	50	25	14	8	5	2	1	0	79	55	32	21	16	12	10	9	8
		1-N16 T&B	141	92	47	27	17	11	8	5	3	136	96	55	36	26	20	16	13	11
		1-N20 T&B	212	138	72	43	28	19	13	10	7	138	119	82	53	38	29	23	18	15

TABLE 2 12 MPa Blocks, Single Bars, Continuous Lintel

[Go to Table Index]

Block thickness (mm)	Lintel depth (mm)	Bar details	Load capacity (kN/m) in downward direction — Opening size (m)									Load capacity (kN/m) in upward direction — Opening size (m)								
			0.9	1.2	1.8	2.4	3.0	3.6	4.2	4.8	5.4	0.9	1.2	1.8	2.4	3.0	3.6	4.2	4.8	5.4
140	190	1-N12 only	6	5	4	2	1	1	0	0	0	6	5	3	2	2	1	1	1	1
		1-N16 only	7	6	4	2	1	1	0	0	0	7	6	4	2	2	1	1	1	1
		1-N20 only	8	7	4	2	1	1	0	0	0	8	6	4	3	2	2	1	1	1
	290	1-N12 T&B	32	21	11	6	4	3	2	1	1	37	26	15	10	7	5	4	3	3
		1-N16 T&B	34	22	11	7	4	3	2	1	1	49	37	21	14	10	7	6	5	4
		1-N20 T&B	32	21	11	6	4	3	2	1	1	51	38	21	14	10	7	6	5	4
	390	1-N12 T&B	54	35	18	11	7	5	3	2	2	56	39	22	14	10	8	6	5	4
		1-N16 T&B	80	58	30	18	12	8	6	4	3	70	60	37	24	17	13	10	8	7
		1-N20 T&B	80	56	29	18	12	8	6	4	3	72	62	44	28	20	15	12	9	8
	490	1-N12 T&B	77	50	26	15	10	7	5	3	2	75	52	29	19	14	10	8	7	6
		1-N16 T&B	129	85	44	27	18	13	9	7	5	91	78	50	32	23	17	13	11	9
		1-N20 T&B	128	100	57	35	23	16	12	9	7	93	80	62	46	33	24	19	15	12
	590	1-N12 T&B	99	64	33	20	13	9	6	4	3	94	65	37	24	17	13	10	8	7
		1-N16 T&B	170	112	58	36	24	17	12	9	7	111	96	63	41	29	21	17	14	11
		1-N20 T&B	199	148	85	52	35	25	18	14	11	113	97	76	59	42	31	24	19	16
190	190	1-N12 only	7	6	4	3	2	1	1	0	0	7	6	5	3	2	2	2	1	1
		1-N16 only	9	7	5	3	2	1	1	0	0	8	7	5	3	3	2	2	1	1
		1-N20 only	10	9	5	3	2	1	1	0	0	10	9	5	3	3	2	2	2	1
	290	1-N12 T&B	33	21	11	6	4	2	1	1	0	39	27	15	10	7	6	5	4	3
		1-N16 T&B	47	30	16	9	6	4	3	2	1	53	45	25	17	12	9	7	6	5
		1-N20 T&B	43	28	14	8	5	3	2	1	1	55	47	29	19	13	10	8	6	5
	390	1-N12 T&B	55	36	18	11	7	4	3	2	1	58	40	23	15	11	8	7	6	5
		1-N16 T&B	85	61	32	19	12	8	6	4	3	75	64	39	25	18	13	11	9	7
		1-N20 T&B	85	68	40	24	16	11	8	6	4	77	66	52	36	25	19	15	12	10
	490	1-N12 T&B	77	50	26	15	10	6	4	3	2	77	53	30	20	14	11	9	7	6
		1-N16 T&B	134	88	46	27	18	12	9	6	5	97	84	52	34	24	18	14	12	10
		1-N20 T&B	137	106	66	40	27	19	14	10	8	99	85	67	49	35	26	20	16	14
	590	1-N12 T&B	99	65	33	19	12	8	6	4	2	96	66	38	25	18	14	11	9	8
		1-N16 T&B	175	114	59	36	24	16	12	9	6	119	103	65	42	30	22	18	14	12
		1-N20 T&B	212	158	88	54	36	25	19	14	11	121	104	82	62	44	33	26	21	17
290	190	1-N12 only	10	8	6	3	2	1	0	0	0	10	9	6	4	3	3	2	2	2
		1-N16 only	12	10	7	5	3	2	1	0	0	11	10	7	5	4	3	3	2	2
		1-N20 only	13	11	8	4	3	1	1	0	0	13	11	8	5	4	3	3	2	2
	290	1-N12 T&B	34	22	10	6	3	2	1	0	0	41	28	16	11	8	6	5	4	4
		1-N16 T&B	52	37	19	11	7	4	3	2	1	60	48	27	18	13	10	8	7	6
		1-N20 T&B	52	43	22	13	8	5	3	2	1	62	53	40	26	18	14	11	9	8
	390	1-N12 T&B	56	36	18	10	6	3	2	1	0	60	42	24	16	12	9	7	6	5
		1-N16 T&B	95	63	32	19	12	8	5	4	2	85	72	41	27	19	15	12	10	8
		1-N20 T&B	94	76	48	28	19	13	9	6	5	87	75	59	39	28	21	16	13	11
	490	1-N12 T&B	78	50	25	14	8	5	3	2	1	79	55	32	21	15	12	10	8	7
		1-N16 T&B	138	89	46	27	17	12	8	5	4	110	95	54	35	25	19	15	13	11
		1-N20 T&B	153	119	69	42	27	19	13	10	7	112	97	76	52	37	28	22	18	15
	590	1-N12 T&B	99	64	32	18	11	7	4	2	1	98	68	39	26	19	15	12	10	9
		1-N16 T&B	178	116	60	35	23	15	11	7	5	136	117	68	44	32	24	19	16	13
		1-N20 T&B	238	174	91	55	36	25	18	13	10	138	119	93	66	46	35	27	22	19

TABLE 3 12 MPa Blocks, Double Bars, Simply-Supported Lintel

[Go to Table Index]

Block thickness (mm)	Lintel depth (mm)	Bar details	Load capacity (kN/m) in downward direction — Opening size (m)									Load capacity (kN/m) in upward direction — Opening size (m)								
			0.9	1.2	1.8	2.4	3.0	3.6	4.2	4.8	5.4	0.9	1.2	1.8	2.4	3.0	3.6	4.2	4.8	5.4
190	190	2-N12 only	9	8	4	2	1	1	0	0	0	9	6	4	3	2	2	1	1	1
		2-N16 only	12	9	4	2	1	1	0	0	0	10	7	4	3	2	2	1	1	1
		2-N20 only	12	8	4	2	1	1	0	0	0	10	7	4	3	2	2	2	1	1
	290	2-N12 T&B	40	26	13	8	5	3	2	1	1	53	39	22	14	10	8	6	4	3
		2-N16 T&B	37	24	12	7	4	3	2	1	1	56	40	23	15	11	8	6	4	3
		2-N20 T&B	34	22	11	6	4	2	2	1	0	59	41	23	15	11	8	6	4	3
	390	2-N12 T&B	83	54	28	17	11	7	5	4	3	75	59	34	22	16	12	9	8	6
		2-N16 T&B	89	63	33	20	13	9	6	5	3	78	67	47	31	22	16	13	8	6
		2-N20 T&B	91	60	31	19	12	8	6	4	3	82	70	48	31	22	16	13	8	6
	490	2-N12 T&B	119	77	40	24	16	11	8	5	4	97	80	45	29	21	16	12	10	9
		2-N16 T&B	143	111	63	39	26	18	13	10	7	100	86	67	48	34	25	20	16	11
		2-N20 T&B	144	112	61	37	25	17	13	9	7	104	89	70	52	37	27	21	16	11
	590	2-N12 T&B	154	101	52	31	21	14	10	7	5	119	101	57	37	26	20	16	13	11
		2-N16 T&B	221	163	89	54	36	26	19	14	11	122	105	82	62	44	33	25	20	17
		2-N20 T&B	222	165	101	62	41	29	22	16	13	126	108	85	70	56	41	32	26	18
290	190	2-N12 only	12	10	7	4	2	1	0	0	0	11	10	6	4	3	3	2	2	2
		2-N16 only	15	12	6	3	2	1	0	0	0	14	10	6	4	3	3	2	2	2
		2-N20 only	18	13	6	3	2	1	0	0	0	15	11	6	4	3	3	2	2	2
	290	2-N12 T&B	51	33	17	9	6	4	2	1	1	60	42	24	16	11	9	7	6	4
		2-N16 T&B	55	37	19	11	7	4	3	2	1	63	54	35	23	16	12	9	6	4
		2-N20 T&B	53	34	17	10	6	4	2	1	1	66	57	36	23	17	13	9	6	4
	390	2-N12 T&B	87	56	29	17	10	7	4	3	2	85	63	36	23	17	13	10	9	7
		2-N16 T&B	99	80	48	29	19	13	9	7	5	88	76	59	39	27	21	16	13	9
		2-N20 T&B	101	81	48	29	19	13	9	6	5	92	79	62	47	33	25	20	13	9
	490	2-N12 T&B	122	79	40	24	15	10	7	4	3	110	84	48	31	22	17	14	11	10
		2-N16 T&B	159	124	71	43	28	19	14	10	7	113	97	76	52	37	28	22	18	15
		2-N20 T&B	160	125	86	57	38	26	19	14	11	117	101	79	65	53	40	31	24	16
	590	2-N12 T&B	157	102	52	31	20	13	9	6	4	135	105	59	39	28	21	17	14	12
		2-N16 T&B	248	178	93	56	37	26	18	14	10	139	119	93	66	47	35	28	22	19
		2-N20 T&B	248	184	120	83	55	39	28	21	16	142	122	96	79	67	50	39	32	26

TABLE 4 12 MPa Blocks, Double Bars, Continuous Lintel

[Go to Table Index]

Block thickness (mm)	Lintel depth (mm)	Bar details	Load capacity (kN/m) in downward direction — Opening size (m)									Load capacity (kN/m) in upward direction — Opening size (m)								
			0.9	1.2	1.8	2.4	3.0	3.6	4.2	4.8	5.4	0.9	1.2	1.8	2.4	3.0	3.6	4.2	4.8	5.4
190	190	2-N12 only	9	8	6	3	2	1	1	0	0	9	7	5	3	2	2	2	1	1
		2-N16 only	12	10	5	3	2	1	1	0	0	10	8	5	3	3	2	2	1	1
		2-N20 only	12	10	5	3	2	1	1	0	0	11	9	5	3	3	2	2	2	1
	290	2-N12 T&B	49	33	17	10	6	4	3	2	1	53	45	27	18	13	9	7	6	5
		2-N16 T&B	47	30	16	9	6	4	3	2	1	56	48	28	18	13	10	8	6	5
		2-N20 T&B	43	28	14	8	5	3	2	1	1	59	51	29	19	13	10	8	6	5
	390	2-N12 T&B	88	68	35	21	14	10	7	5	4	75	64	42	27	19	14	11	9	8
		2-N16 T&B	89	72	42	25	17	12	8	6	5	78	67	52	38	27	20	16	13	10
		2-N20 T&B	91	73	40	24	16	11	8	6	4	82	70	55	38	27	20	16	13	11
	490	2-N12 T&B	142	97	51	31	20	14	10	7	6	97	83	56	36	26	19	15	12	10
		2-N16 T&B	143	111	76	49	33	23	17	13	10	100	86	67	55	42	31	24	20	16
		2-N20 T&B	144	112	77	47	31	22	16	12	9	104	89	70	57	46	34	26	21	17
	590	2-N12 T&B	194	127	66	40	26	18	13	10	7	119	103	71	46	32	24	19	15	13
		2-N16 T&B	221	163	107	69	46	33	24	18	14	122	105	82	68	54	40	31	25	21
		2-N20 T&B	222	165	108	78	52	37	28	21	16	126	108	85	70	59	51	40	32	26
290	190	2-N12 only	12	10	7	5	3	2	1	0	0	11	10	7	5	4	3	2	2	2
		2-N16 only	15	12	8	5	3	2	1	0	0	14	12	7	5	4	3	3	2	2
		2-N20 only	18	15	8	4	3	1	1	0	0	16	13	8	5	4	3	3	2	2
	290	2-N12 T&B	55	42	21	12	8	5	3	2	1	60	51	29	19	14	11	8	7	6
		2-N16 T&B	55	46	24	14	9	6	4	3	2	63	54	42	28	20	15	12	10	8
		2-N20 T&B	57	43	22	13	8	5	3	2	1	66	57	44	29	20	15	12	10	8
	390	2-N12 T&B	98	71	36	22	14	9	6	4	3	85	73	44	29	21	16	12	10	9
		2-N16 T&B	99	80	57	37	24	17	12	9	7	88	76	59	48	34	25	20	16	13
		2-N20 T&B	101	81	58	37	24	17	12	9	7	92	79	62	51	41	31	24	19	16
	490	2-N12 T&B	153	100	51	31	20	13	9	7	5	110	95	59	38	27	21	16	14	11
		2-N16 T&B	159	124	85	54	36	25	18	13	10	113	97	76	63	46	34	27	22	18
		2-N20 T&B	160	125	86	65	48	34	25	19	14	117	101	79	65	55	48	38	31	25
	590	2-N12 T&B	198	129	67	40	26	18	12	9	6	135	117	74	48	34	26	21	17	14
		2-N16 T&B	248	183	117	71	47	33	24	18	14	139	119	93	77	58	43	34	27	23
		2-N20 T&B	248	184	120	89	70	50	37	28	22	142	122	96	79	67	59	48	39	32

TABLE 5 15 MPa Blocks, Single Bars, Simply-Supported Lintel

[Go to Table Index]

Block thickness (mm)	Lintel depth (mm)	Bar details	Load capacity (kN/m) in downward direction — Opening size (m)									Load capacity (kN/m) in upward direction — Opening size (m)								
			0.9	1.2	1.8	2.4	3.0	3.6	4.2	4.8	5.4	0.9	1.2	1.8	2.4	3.0	3.6	4.2	4.8	5.4
140	190	1-N12 only	6	5	4	2	1	1	0	0	0	6	5	3	2	2	1	1	1	1
		1-N16 only	7	6	4	2	1	1	0	0	0	7	6	3	2	2	1	1	1	1
		1-N20 only	8	7	3	2	1	1	0	0	0	8	6	3	2	2	1	1	1	1
	290	1-N12 T&B	27	17	9	5	3	2	1	1	0	30	21	12	8	6	4	4	3	2
		1-N16 T&B	31	20	10	6	4	2	2	1	1	48	33	19	12	9	7	5	3	2
		1-N20 T&B	29	19	9	5	3	2	1	1	1	49	34	19	12	9	7	5	3	2
	390	1-N12 T&B	45	29	15	9	5	4	2	2	1	46	32	18	12	8	6	5	4	4
		1-N16 T&B	74	48	25	15	10	7	5	3	2	70	54	30	20	14	10	8	7	5
		1-N20 T&B	78	51	26	16	10	7	5	4	3	72	62	39	25	18	13	10	7	5
	490	1-N12 T&B	63	41	21	12	8	5	3	2	2	61	42	24	16	11	9	7	6	5
		1-N16 T&B	108	70	36	22	14	10	7	5	4	91	72	41	26	19	14	11	9	7
		1-N20 T&B	128	99	51	31	21	15	11	8	6	93	80	59	38	27	20	16	13	9
	590	1-N12 T&B	81	52	27	16	10	7	5	3	2	76	53	30	20	14	11	8	7	6
		1-N16 T&B	141	92	48	29	19	13	9	7	5	111	91	51	33	23	18	14	11	9
		1-N20 T&B	199	133	70	42	28	20	15	11	8	113	97	75	49	34	25	20	16	13
190	190	1-N12 only	7	6	4	3	1	1	0	0	0	7	6	4	3	2	2	2	1	1
		1-N16 only	9	7	5	3	2	1	0	0	0	8	7	4	3	2	2	2	1	1
		1-N20 only	10	9	5	3	1	1	0	0	0	10	8	5	3	2	2	2	1	1
	290	1-N12 T&B	27	17	9	5	3	2	1	0	0	32	22	13	8	6	5	4	3	3
		1-N16 T&B	43	28	14	8	5	3	2	1	1	53	37	21	14	10	7	6	4	3
		1-N20 T&B	40	25	13	7	5	3	2	1	1	55	46	26	17	12	9	6	4	3
	390	1-N12 T&B	45	29	15	8	5	3	2	1	1	47	32	19	12	9	7	6	5	4
		1-N16 T&B	77	50	26	15	10	7	5	3	2	75	56	32	21	15	11	9	7	6
		1-N20 T&B	85	68	36	21	14	10	7	5	4	77	66	46	30	21	16	12	9	6
	490	1-N12 T&B	63	41	20	12	7	5	3	2	1	62	43	25	16	12	9	7	6	5
		1-N16 T&B	111	72	37	22	14	10	7	5	3	97	75	42	28	20	15	12	10	8
		1-N20 T&B	137	105	54	33	22	15	11	8	6	99	85	62	40	28	21	17	14	11
	590	1-N12 T&B	81	52	26	15	10	6	4	2	1	78	54	31	20	15	11	9	8	7
		1-N16 T&B	144	93	48	29	19	13	9	6	5	119	94	53	34	24	18	15	12	10
		1-N20 T&B	212	138	72	44	29	20	15	11	8	121	104	79	51	36	27	21	17	14
290	190	1-N12 only	10	8	5	2	1	0	0	0	0	10	9	5	4	3	2	2	2	2
		1-N16 only	12	10	7	4	2	1	1	0	0	11	10	7	5	4	3	2	2	2
		1-N20 only	13	11	7	4	2	1	1	0	0	13	11	7	5	4	3	2	2	2
	290	1-N12 T&B	28	17	8	4	2	1	0	0	0	33	23	13	9	7	5	4	4	3
		1-N16 T&B	47	30	15	8	5	3	2	1	0	57	39	22	15	11	8	7	6	5
		1-N20 T&B	52	39	20	11	7	5	3	2	1	62	53	33	21	15	12	9	6	5
	390	1-N12 T&B	45	29	14	7	4	2	1	0	0	48	34	20	13	10	8	6	5	5
		1-N16 T&B	80	51	26	15	9	6	4	2	1	85	58	33	22	16	12	10	8	7
		1-N20 T&B	94	75	39	23	15	10	7	5	3	87	75	49	32	23	17	14	11	9
	490	1-N12 T&B	63	40	20	11	6	3	2	1	0	64	44	26	17	13	10	8	7	6
		1-N16 T&B	113	73	37	21	13	9	6	4	2	110	78	44	29	21	16	13	11	9
		1-N20 T&B	153	109	56	33	22	15	10	7	5	112	97	66	43	30	23	18	15	13
	590	1-N12 T&B	81	52	25	14	8	5	2	1	0	79	55	32	21	16	12	10	9	8
		1-N16 T&B	146	94	48	28	18	12	8	5	3	136	97	55	36	26	20	16	13	11
		1-N20 T&B	219	142	73	44	29	19	14	10	7	138	119	82	53	38	29	23	19	16

TABLE 6 15 MPa Blocks, Single Bars, Continuous Lintel

[Go to Table Index]

Block thickness (mm)	Lintel depth (mm)	Bar details	Load capacity (kN/m) in downward direction — Opening size (m)									Load capacity (kN/m) in upward direction — Opening size (m)								
			0.9	1.2	1.8	2.4	3.0	3.6	4.2	4.8	5.4	0.9	1.2	1.8	2.4	3.0	3.6	4.2	4.8	5.4
140	190	1-N12 only	6	5	4	3	2	1	1	0	0	6	5	4	3	2	2	1	1	1
		1-N16 only	7	6	4	3	2	1	1	0	0	7	6	4	3	2	2	1	1	1
		1-N20 only	8	7	4	2	1	1	1	0	0	8	7	4	3	2	2	1	1	1
	290	1-N12 T&B	34	22	11	6	4	3	2	1	1	38	26	15	10	7	5	4	3	3
		1-N16 T&B	40	26	13	8	5	3	2	2	1	49	41	23	15	11	8	6	5	4
		1-N20 T&B	37	24	12	7	5	3	2	1	1	51	42	24	15	11	8	6	5	4
	390	1-N12 T&B	56	36	19	11	7	5	3	2	2	57	39	22	14	10	8	6	5	4
		1-N16 T&B	80	61	31	19	13	9	6	5	3	70	60	37	24	17	13	10	8	7
		1-N20 T&B	80	64	33	20	13	9	7	5	4	72	62	48	32	22	17	13	10	9
	490	1-N12 T&B	79	51	26	16	10	7	5	3	2	76	52	30	19	14	10	8	7	6
		1-N16 T&B	129	88	46	28	18	13	9	7	5	91	78	51	33	23	17	13	11	9
		1-N20 T&B	128	100	65	40	26	19	14	10	8	93	80	62	47	33	25	19	15	13
	590	1-N12 T&B	102	66	34	20	13	9	6	4	3	95	65	37	24	17	13	10	8	7
		1-N16 T&B	177	115	60	36	24	17	12	9	7	111	96	64	41	29	22	17	14	11
		1-N20 T&B	199	148	88	54	36	25	19	14	11	113	97	76	60	42	31	24	20	16
190	190	1-N12 only	7	6	4	3	2	1	1	0	0	7	6	5	4	3	2	2	2	1
		1-N16 only	9	7	5	4	2	1	1	0	0	8	7	5	4	3	2	2	2	1
		1-N20 only	10	9	6	3	2	1	1	0	0	10	9	6	4	3	2	2	2	1
	290	1-N12 T&B	34	22	11	6	4	2	1	1	0	39	27	15	10	7	6	5	4	3
		1-N16 T&B	47	35	18	10	7	4	3	2	1	53	45	26	17	12	9	7	6	5
		1-N20 T&B	47	32	16	10	6	4	3	2	1	55	47	32	21	15	11	9	7	6
	390	1-N12 T&B	57	37	19	11	7	4	3	2	1	58	40	23	15	11	8	7	6	5
		1-N16 T&B	85	63	33	19	13	9	6	4	3	75	64	39	25	18	14	11	9	7
		1-N20 T&B	85	68	45	27	18	13	9	7	5	77	66	52	37	26	19	15	12	10
	490	1-N12 T&B	80	51	26	15	10	6	4	3	2	77	53	30	20	14	11	9	7	6
		1-N16 T&B	138	90	47	28	18	13	9	7	5	97	84	52	34	24	18	14	12	10
		1-N20 T&B	137	106	69	42	28	19	14	11	8	99	85	67	50	35	26	20	17	14
	590	1-N12 T&B	102	66	34	20	13	8	6	4	3	97	67	38	25	18	14	11	9	8
		1-N16 T&B	180	117	61	37	24	17	12	9	7	119	103	66	43	30	23	18	14	12
		1-N20 T&B	212	158	91	55	37	26	19	14	11	121	104	82	63	44	33	26	21	17
290	190	1-N12 only	10	8	6	3	2	1	0	0	0	10	9	6	4	3	3	2	2	2
		1-N16 only	12	10	7	5	3	2	1	1	0	11	10	8	6	4	3	3	2	2
		1-N20 only	13	11	8	5	3	2	1	1	0	13	11	9	6	4	3	3	2	2
	290	1-N12 T&B	35	22	11	6	3	2	1	0	0	41	28	16	11	8	6	5	4	4
		1-N16 T&B	52	38	19	11	7	4	3	2	1	60	49	28	18	13	10	8	7	6
		1-N20 T&B	52	43	25	15	9	6	4	3	2	62	53	40	26	19	14	11	9	8
	390	1-N12 T&B	57	37	18	10	6	4	2	1	0	60	42	24	16	12	9	7	6	5
		1-N16 T&B	95	65	33	19	12	8	5	4	2	85	73	41	27	19	15	12	10	8
		1-N20 T&B	94	76	49	29	19	13	9	7	5	87	75	59	40	28	21	17	14	11
	490	1-N12 T&B	80	51	25	14	9	5	3	2	1	79	55	32	21	15	12	10	8	7
		1-N16 T&B	142	92	47	28	18	12	8	6	4	110	95	55	36	26	19	15	13	11
		1-N20 T&B	153	119	71	43	28	19	14	10	7	112	97	76	53	37	28	22	18	15
	590	1-N12 T&B	102	65	33	19	11	7	4	2	1	99	68	39	26	19	15	12	10	9
		1-N16 T&B	183	119	61	36	23	16	11	8	5	136	117	68	44	32	24	19	16	13
		1-N20 T&B	238	177	93	56	37	25	18	13	10	138	119	93	66	47	35	28	22	19

TABLE 7 15 MPa Blocks, Double Bars, Simply-Supported Lintel

[Go to Table Index]

Block thickness (mm)	Lintel depth (mm)	Bar details	Load capacity (kN/m) in downward direction — Opening size (m)									Load capacity (kN/m) in upward direction — Opening size (m)								
			0.9	1.2	1.8	2.4	3.0	3.6	4.2	4.8	5.4	0.9	1.2	1.8	2.4	3.0	3.6	4.2	4.8	5.4
190	190	2-N12 only	9	8	5	3	2	1	0	0	0	9	7	4	3	2	2	2	1	1
		2-N16 only	12	10	5	3	2	1	0	0	0	10	8	4	3	2	2	2	1	1
		2-N20 only	12	10	5	3	1	1	0	0	0	11	8	5	3	2	2	2	1	1
	290	2-N12 T&B	46	30	15	9	6	4	2	2	1	53	39	22	15	10	8	6	4	3
		2-N16 T&B	43	28	14	8	5	3	2	1	1	56	45	25	17	12	9	6	4	3
		2-N20 T&B	40	25	13	7	5	3	2	1	1	59	46	26	17	12	9	6	4	3
	390	2-N12 T&B	86	56	29	17	11	8	5	4	3	75	60	34	22	16	12	9	8	6
		2-N16 T&B	89	72	38	23	15	10	7	5	4	78	67	52	34	24	18	14	9	6
		2-N20 T&B	91	69	36	21	14	10	7	5	4	82	70	53	34	24	18	14	9	6
	490	2-N12 T&B	123	80	41	25	16	11	8	6	4	97	81	46	30	21	16	13	10	9
		2-N16 T&B	143	111	69	42	28	20	14	11	8	100	86	67	49	35	26	20	16	12
		2-N20 T&B	144	112	70	42	28	20	14	11	8	104	89	70	57	41	31	24	17	12
	590	2-N12 T&B	159	104	54	32	21	14	10	7	5	119	102	57	37	26	20	16	13	11
		2-N16 T&B	221	163	92	56	37	26	19	14	11	122	105	82	63	44	33	26	21	17
		2-N20 T&B	222	165	108	70	47	33	25	19	15	126	108	85	70	59	46	36	29	20
290	190	2-N12 only	12	10	7	4	2	1	1	0	0	11	10	7	4	3	3	2	2	2
		2-N16 only	15	12	7	4	2	1	1	0	0	14	11	7	5	4	3	2	2	2
		2-N20 only	18	15	7	4	2	1	1	0	0	16	12	7	5	4	3	2	2	2
	290	2-N12 T&B	53	34	17	10	6	4	2	1	1	60	42	24	16	11	9	7	6	5
		2-N16 T&B	55	42	21	12	8	5	3	2	1	63	54	39	25	18	14	10	6	5
		2-N20 T&B	57	39	20	11	7	5	3	2	1	66	57	40	26	18	14	10	6	5
	390	2-N12 T&B	90	58	29	17	11	7	5	3	2	85	63	36	24	17	13	10	9	7
		2-N16 T&B	99	80	50	30	20	13	9	7	5	88	76	59	39	28	21	17	13	10
		2-N20 T&B	101	81	55	33	21	15	10	8	6	92	79	62	51	37	28	22	14	10
	490	2-N12 T&B	126	81	41	24	15	10	7	5	3	110	84	48	31	23	17	14	11	10
		2-N16 T&B	159	124	73	44	29	20	14	10	8	113	97	76	53	38	28	22	18	15
		2-N20 T&B	160	125	86	64	42	30	22	16	12	117	101	79	65	54	40	31	25	18
	590	2-N12 T&B	162	105	53	32	20	13	9	6	4	135	105	60	39	28	21	17	14	12
		2-N16 T&B	248	183	95	58	38	26	19	14	10	139	119	93	67	47	35	28	23	19
		2-N20 T&B	248	184	120	85	57	40	29	22	17	142	122	96	79	67	51	40	32	27

TABLE 8 15 MPa Blocks, Double Bars, Continuous Lintel

[Go to Table Index]

Block thickness (mm)	Lintel depth (mm)	Bar details	Load capacity (kN/m) in downward direction — Opening size (m)									Load capacity (kN/m) in upward direction — Opening size (m)								
			0.9	1.2	1.8	2.4	3.0	3.6	4.2	4.8	5.4	0.9	1.2	1.8	2.4	3.0	3.6	4.2	4.8	5.4
190	190	2-N12 only	9	8	6	4	2	1	1	0	0	9	7	5	4	3	2	2	2	1
		2-N16 only	12	10	6	4	2	1	1	0	0	10	9	5	4	3	2	2	2	1
		2-N20 only	12	10	6	3	2	1	1	0	0	11	9	6	4	3	2	2	2	1
	290	2-N12 T&B	49	37	19	11	7	5	3	2	2	53	45	28	18	13	10	8	6	5
		2-N16 T&B	50	35	18	10	7	4	3	2	1	56	48	32	20	15	11	9	7	6
		2-N20 T&B	50	32	16	10	6	4	3	2	1	59	51	32	21	15	11	9	7	6
	390	2-N12 T&B	88	71	36	22	14	10	7	5	4	75	64	42	27	19	15	11	9	8
		2-N16 T&B	89	72	47	29	19	13	10	7	5	78	67	52	42	30	22	17	14	12
		2-N20 T&B	91	73	45	27	18	13	9	7	5	82	70	55	43	30	22	17	14	12
	490	2-N12 T&B	142	100	52	31	21	14	10	8	6	97	83	57	37	26	20	15	12	10
		2-N16 T&B	143	111	76	53	35	25	18	14	11	100	86	67	55	43	32	25	20	17
		2-N20 T&B	144	112	77	54	36	25	19	14	11	104	89	70	57	49	38	29	23	19
	590	2-N12 T&B	200	130	68	41	27	19	14	10	8	119	103	71	46	33	24	19	16	13
		2-N16 T&B	221	163	107	71	47	34	25	19	15	122	105	82	68	55	41	32	25	21
		2-N20 T&B	222	165	108	80	60	42	32	24	19	126	108	85	70	59	52	44	35	29
290	190	2-N12 only	12	10	7	6	3	2	1	1	0	11	10	8	5	4	3	3	2	2
		2-N16 only	15	12	9	5	3	2	1	1	0	14	12	8	6	4	3	3	2	2
		2-N20 only	18	15	9	5	3	2	1	1	0	16	14	9	6	4	3	3	2	2
	290	2-N12 T&B	55	43	22	13	8	5	3	2	1	60	51	30	20	14	11	9	7	6
		2-N16 T&B	55	46	27	16	10	7	5	3	2	63	54	42	31	22	17	13	11	9
		2-N20 T&B	57	47	25	15	9	6	4	3	2	66	57	45	32	23	17	13	11	9
	390	2-N12 T&B	98	73	37	22	14	9	6	4	3	85	73	45	29	21	16	13	10	9
		2-N16 T&B	99	80	57	38	25	17	13	9	7	88	76	59	49	34	26	20	16	14
		2-N20 T&B	101	81	58	42	28	19	14	10	8	92	79	62	51	43	34	27	21	18
	490	2-N12 T&B	158	103	53	31	20	14	9	7	5	110	95	59	39	28	21	17	14	12
		2-N16 T&B	159	124	85	56	37	26	19	14	10	113	97	76	63	46	35	27	22	18
		2-N20 T&B	160	125	86	65	52	38	28	21	16	117	101	79	65	55	48	39	31	26
	590	2-N12 T&B	204	132	68	41	26	18	12	9	6	135	117	74	48	34	26	21	17	14
		2-N16 T&B	248	183	119	73	48	34	25	18	14	139	119	93	77	58	44	34	28	23
		2-N20 T&B	248	184	120	89	70	51	38	29	22	142	122	96	79	67	59	49	40	33

WORKED EXAMPLE

BRIEF

Calculate the permissible net upwards and downwards distributed loads that may be exerted on a 3.0 m continuous lintel as described below:

Note: All clause and table references to AS 3700–2011

Concrete blocks:
- Width 190 mm,
- Depth 390 mm,
- Strength grade 15 MPa

Main reinforcement:
- 1 N16 bar in the top and
- 1 N16 bar in the bottom

Ligatures:
- N10 C @ 200 centres
- (External depth 235 mm)

Hangers:
- R4 V
- (Internal depth 75 mm)

MASONRY PROPERTIES

Masonry unit characteristic unconfined compressive strength

f'_{uc} = 15.0 MPa

Units are hollow

Block type factor

k_m = 1.6 *Table 3.1*

Equivalent blockwork strength

$f'_{mb} = k_m(f'_{uc})^{0.5}$ *Cl 3.3.2(a)(i)*

$= 1.6 \times 15.0^{0.5}$

$= 6.20$ MPa

or f'_{mb} = 6.2 MPa *Table 3.1*

Mortar joint height

h_j = 10 mm

Masonry unit height

h_b = 190 mm

Ratio of block to joint thickness

$h_b/h_j = 190/10$

$= 19.0$

Block height factor

k_h = 1.3 *Table 3.2*

Characteristic masonry strength

$f'_m = k_h f'_{mb}$ *Cl 3.3.2(a)(i)*

$= 1.3 \times 6.20$

$= 8.06$ MPa

CONCRETE GROUT PROPERTIES

Concrete grout specification

Concrete grout shall comply with AS 3700 and have:
- a minimum of portland GB or GP cement content of 300 kg/m^3;
- a maximum aggregate size of 10 mm;
- sufficient slump to completely fill the cores; and
- a minimum compressive cylinder strength of 20 MPa.

Specified characteristic grout cylinder strength

f'_c = 20 MPa

> 12 MPa OK

AS 3700 Clause 11.7.3

Design characteristic grout strength

$f'_{cg} = \min [(1.3 \times f'_{uc}), 20.0]$ *AS 3700 Clause 3.5*

$= \min [(1.3 \times 15), 20.0]$

$= \min [19.5, 20.0]$

$= 19.5$ MPa

MAIN REINFORCEMENT PROPERTIES

Main reinforcement yield strength

f_{sy} = 500 MPa

Main reinforcement shear strength (dowel action)

f_{vs} = 17.5 MPa *Clause 8.8*

Number of main tensile reinforcing bars

N_t = 1

Diameter of main tensile reinforcing bars

$D_{dia.t}$ = 16 mm

$A_{st} = N_t(3.1416\ D^2_{dia.t}/4)$ (approx)

$= 1 \times 3.1416 \times 16^2/4$

$= 200$ mm^2

Cont…

FITMENT PROPERTIES

Fitment yield strength

$f_{sy.f}$ = 500 MPa

Number of legs of ligature

N_f = 1

Diameter of 'C' ligature fitment reinforcement

$D_{dia.C}$ = 10 mm

Fitment area

$A_{sv} = N_f (3.1416 D^2_{dia.C}/4)$

$= 1 \times 3.1416 \times 10^2/4$

$= 78.5 \text{ mm}^2$

Fitment spacing

s = 200 mm

DIMENSIONS

Width of lintel

B = 190 mm

Depth of lintel

D = 390 mm

Density of reinforced concrete masonry

γ_{mas} = 2,200 kg/m^3

Depth of W or V hanger of top steel (From top of block to underside of supported reinforcement)

d_1 = 75 mm

Inside dimension of 'C' ligature fitment (From top of supporting reinforcement to underside of supported reinforcement)

$d_2 = 235 - 10 - 10$

$= 215$ mm

DEFLECTION PARAMETERS

Limiting deflection

Δ_a = min (10, L/360)

Elastic modulus

$E = 1{,}000\ f'_m$

$= 1{,}000 \times 8.06$

$= 8{,}060$ MPa

Deflection coefficients for continuous lintel

$K_{def} = 1 / 864$

$= 0.00116$

Deflection coefficients for simply supported lintel

$K_{def} = 5/384$

$= 0.01302$

Moment of inertia (based on gross section)

$I = BD^3/12$

$= 190 \times 390^3/12$

$= 0.9392 \times 10^9 \text{ mm}^4$

Cont…

NET UPWARDS LOAD

Effective depth for upwards load

$d = D - d_1 + D_{dia.t}/2$
$= 390 - 75 + 16/2$
$= 323$ mm

Design area of main tensile reinformcement

$A_{sd} = \min[0.29(1.3f'_m)bd/f_{sy},\ A_{st}]$ *Cl 8.6*
$= \min[(0.29 \times 1.3 \times 8.06 \times 190 \times 323/500),\ 200]$
$= \min[373,\ 200]$
$= 200$ mm^2

Shear capacity

$\phi V = \phi(f'_{vm} b_w d + f_{vs} A_{st} + f_{sy.f} A_{sv} d/s)$ *Cl 8.8*

$= 0.75[(0.35 \times 190 \times 323) + (17.5 \times 200) + (500 \times 78.5 \times 323/200)]/1000$
$= 0.75(21.5 + 3.5 + 63.4)$
$= 66.3$ kN

Bending Moment Capacity

$\phi M = \phi f_{sy} A_{sd} d[1 - 0.6 f_{sy} A_{sd} d/(1.3 f'_m b d)]$ *Cl 8.6*
$= 0.75 \times 500 \times 200 \times 323\ [1 - (0.6 \times 500 \times 200)/(1.3 \times 8.06 \times 190 \times 323)]/1{,}000{,}000$
$= 22.0$ kN.m

Clear Span

$L_c = 3.000$ m

Edge distance to the vertical anchorage reinforcement

$L_{au} = 0.100$ m

Span for calculation of shear

$L_{vu} = L_c$
$= 3.000$ m

For shear due to uplift, the critical section of the beam is at the face of the support.

Span for calculation of bending moment

$L_{mu} = L_c + 2L_{au}$
$= 3.000 + (2 \times 0.100)$
$= 3.200$ m

For bending due to uplift, the beam will span between the closest vertical reinforcing bars that are fully anchored into the lintel/bond beam and the concrete slab below the wall.

Span for calculation of deflection

$L_{\Delta u} = L_c + 2L_{au}$
$= 3.000 + (2 \times 0.100)$
$= 3.200$ m

For deflection due to uplift, the beam will span between the closest vertical reinforcing bars that are fully anchored into the lintel/bond beam and the concrete slab below the wall.

Spacing of trusses exerting load on the lintel

$S_u = 0.9$ m

Factor to account for increased shear due to point loads close to a support

$k_{vu} = (L_{vu} + S_u)/L_{vu}$
$= (3.000 + 0.9)/3.000$
$= 1.30$

This factor allows for the fact that a point load from a roof truss, supporting load over a distance of S_u, may be positioned immediately adjacent to the critical section. Thus increasing the shear force over the value applicable to the uniformly distributed case.

Cont…

Factor to account for increased moment due to point loads close to a support

$k_{mu} = (L_{mu} + S_u)/L_{mu}$
$= (3.200 + 0.9)/3.200$
$= 1.28$

This factor allows for the fact that a point load from a roof truss, supporting load over a distance of S_u, may be positioned at the centre of the span, thus increasing the bending moment over the value applicable to the uniformly distributed case.

Factor to account for increased deflection due to point loads close to a support

$k_{\Delta u} = (L_{\Delta u} + S_u)/L_{\Delta u}$
$= (3.200 + 0.9)/3.200$
$= 1.28$

This factor allows for the fact that a point load from a roof truss, supporting load over a distance of S_u, may be positioned at the centre of the span, thus increasing the deflection over the value applicable to the uniformly distributed case.

Limiting deflection

$\Delta_a = \min(10, \quad L_c/360)$
$= \min(10, \quad 3000/360)$
$= 8.33$

Load capacity (limited by shear)

$W_{vu} = 2\phi V/(L_{vu} k_{vu})$
$= 2 \times 66.2/(3.000 \times 1.30)$
$= 34.0$ kN/m

Load capacity (limited by bending moment)

$W_{mu} = 10\phi M/(L^2_{mu} k_{mu})$
$= 10 \times 22.0/(3.200^2 \times 1.28)$
$= 16.7$ kN/m

Load capacity (limited by deflection)

$W_{\Delta u} = \Delta_a E I/(K_{def} L^4_{\Delta} k_{\Delta u})$
$= 8.33 \times 8{,}060 \times 0.9392 \times 10^9/$
$(0.00116 \times 3{,}200^4 \times 1.28)$
$= 405$ kN/m

The allowable deflection has been based on the clear span, rather than the span between the vertical anchorage reinforcement.

Load capacity (limited by shear, bending moment or deflection)

$W_{lu} = \min(W_{vu}, \quad W_{mu}, \quad W_{\Delta u})$
$= \min(34.0, \quad 16.7, \quad 405)$
$= 16.7$ kN/m

Factor on dead loads contributing to resistance

$\gamma_R = 0.9$ *AS 1170 .0:2002*

Factored self-weight contributing to failure

$W_{su} = \gamma_R\ 0.0981\ \gamma_{mas}\ B\ D$
$= 0.9 \times 0.00981 \times 2{,}200 \times 190 \times 390/1{,}000{,}000$
$= 1.4$ kN/m

Externally applied load capacity (adding self weight)

$W_u = W_{lu} + W_{su}$
$= 16.7 + 1.4$
$= 18.1$ kN/m

Using Tables

Select Table:

15 MPa blocks, single bars, continuous lintel

Use Table 6

Read Table:

190-mm wide block, 390-mm deep lintel,
1 N16 bar T&B, opening size 3.000 m

Externally applied upward load capacity

$W_u = 18$ kN/m

Note: Net Upwards load
In some cases due to rounding up or down, load capacity (kN/m) values in a upward direction shown in Table 1 to Table 8 may be understated (ie conservative) by approximately 0.6%. This anomaly has resulted from AS1170.0:2002 increasing the permanent load factor γ_R contributinhg to resistance from 0.8 to 0.9. For most practical purposes this difference could be ignored.

Cont…

NET DOWNWARDS LOAD

Effective depth for downwards load

$d = d_1 + d_2 - 1.5\, D_{dia.t}$
$= 75 + 215 - (1.5 \times 16)$
$= 266$ mm

Design area of main tensile reinforcement

$A_{sd} = \min[0.29\,(1.3\, f'_m)\, b\, d/f_{sy},\ A_{st}]$ *Cl 8.6*
$= \min[(0.29 \times 1.3 \times 8.06 \times 190 \times 266 / 500),\ 200]$
$= \min[\,307,\ 200]$
$= 200$ mm^2

Shear capacity

$\phi V = \phi\,(f'_{vm}\, b_w\, d + f_{vs}\, A_{st} + f_{sy.f}\, A_{sv}\, d/s)$ *Cl 8.8*
$= 0.75\,[(0.35 \times 190 \times 266) + (17.5 \times 200) +$
$(500 \times 78.5 \times 266 / 200)]/1000$
$= 0.75\,(17.7 + 3.5 + 52.2)$
$= 55.1$ kN

Bending Moment Capacity

$\phi M = \phi f_{sy}\, A_{sd}\, d[1 - 0.6 f_{sy}\, A_{sd}/(1.3\, f'_m\, b\, d)]$ *Cl 8.6*

$= 0.75 \times 500 \times 200 \times 266$
$[1 - (0.6 \times 500 \times 200)/(1.3 \times 8.06 \times 190 \times 266)]/10^6$
$= 17.7$ kN.m

Clear Span

$L_c = 3.000$ m

Edge distance to the centre of bearing

$L_{ad} = 0.030$ m

Span for calculation of shear

$L_{vd} = L_c - 2\, d$
$= 3.000 - (2 \times 0.266)$
$= 2.468$ m

For shear downwards, the critical section of the beam is at a distance, d, from each face of the support.

Span for calculation of bending moment

$L_{md} = L_c + 2\, L_{ad}$
$= 3.000 + (2 \times 0.030)$
$= 3.060$ m

For bending due to downwards load, the beam will span between the positions in the supporting masonry that has sufficient bearing strength to support the load.

Span for calculation of deflection

$L_{\Delta d} = L_c + 2\, L_{ad}$
$= 3.000 + (2 \times 0.030)$
$= 3.060$ m

For deflection due to downwards load, the beam will span between the positions in the supporting masonry that has sufficient bearing strength to support the load.

Spacing of floor bearers or other supports exerting load on the lintel

$S_d = 0.9$ m

Factor to account for increased shear due to point loads close to a support

$k_{vd} = (L_{vd} + S_d)/L_{vd}$
$= (2.468 + 0.9)/2.468$
$= 1.36$

This factor allows for the fact that a point load from a floor bearer or other support, supporting load over a distance of S_d, may be positioned immediately adjacent to the critical section, thus increasing the shear force on the over the value applicable to the uniformly distributed case.

Cont…

Factor to account for increased moment due to point loads close to a support

$k_{md} = (L_{md} + S_d)/L_{md}$
$= (3.060 + 0.9)/3.060$
$= 1.29$

This factor allows for the fact that a point load from a floor bearer or other support, supporting load over a distance of S_d, may be positioned at the centre of the span, thus increasing the bending moment over the value applicable to the uniformly distributed case.

Factor to account for increased deflection due to point loads close to a support

$k_{\Delta d} = (L_{\Delta d} + S_d)/L_{\Delta d}$
$= (3.060 + 0.9)/3.060$
$= 1.29$

This factor allows for the fact that a point load from a floor bearer or other support, supporting load over a distance of S_d, may be positioned at the centre of the span, thus increasing the deflection over the value applicable to the uniformly distributed case.

Limiting deflection

$\Delta_a = \min(10, \quad L_c/360)$
$= \min(10, \quad 3000/360)$
$= 8.33$

Load capacity (limited by shear)

$W_{vd} = 2\phi V/(L_{vd}\, k_{vd})$
$= 2 \times 55.1/(2.468 \times 1.36)$
$= 32.7$ kN/m

Load capacity (limited by bending moment)

$W_{md} = 10\phi M/(L^2_{md}\, k_{md})$
$= 10 \times 17.7/(3.060^2 \times 1.29)$
$= 14.6$ kN/m

Load capacity (limited by deflection)

$$W_{\Delta d} = \frac{\Delta_a E I}{(K_{def}\, L^4_{\Delta d}\, k_{\Delta d})}$$
$$= \frac{8.33 \times 8{,}060 \times 0.9392 \times 10^9}{(0.00116 \times 3{,}060^4 \times 1.29)}$$
$= 480$ kN/m

The allowable deflection has been based on the clear span, rather than the span between the centres of bearing.

Load capacity (limited by shear, bending moment or deflection)

$W_{ld} = \min(W_{vd}, \; W_{md}, \; W_{\Delta d})$
$= \min(32.7, \; 14.6, \; 480.)$
$= 14.6$ kN/m

Factor on dead loads contributing to failure

$\gamma_F = 1.35$ *AS 1170.0:2002*

Factored self weight contributing to failure

$W_{sd} = \gamma_F\, 0.0981\, \gamma_{mas}\, B\, D$
$= 1.35 \times 0.00981 \times 2{,}200$
$\times 190 \times 390/1{,}000{,}000$
$= 2.1$ kN/m

Externally applied load capacity (subtracting self weight)

$W_d = W_{ld} - W_{sd}$
$= 14.6 - 2.1$
$= 12.5$ kN/m

Using Tables

Select Table:
15 MPa blocks, single bars, continuous lintel

Use Table 6

Read Table:
190 mm wide block,
390 mm deep lintel,
1 N16 bar T&B
opening size 3.000 m

Externally applied downward load capacity
$W_u = 13$ kN/m

Note: Net downwards load
In some cases due to rounding up or down, load capacity (kN/m) values in a downward direction shown in Table 1 to Table 8 may be overstated (ie non conservative) by approximately 1.6%. This anomaly has resulted from AS1170.0:2002 increasing the permanent load factor γ_F contributing to failure from 1.2 to 1.35. For most practical purposes this difference could be ignored.