TEK 17-01D

ASD OF CONCRETE MASONRY LINTELS BASED ON THE 2012 IBC/2011 MSJC

INTRODUCTION

Lintels and beams are horizontal structural members designed to carry loads above openings. Although lintels may be constructed of grouted and reinforced concrete masonry units, precast or cast-in-place concrete, or structural steel, this TEK addresses reinforced concrete masonry lintels only. Concrete masonry lintels have the advantages of easily maintaining the bond pattern, color, and surface texture of the surrounding masonry and being placed without need for special lifting equipment.

Concrete masonry lintels are sometimes constructed as a portion of a continuous bond beam. This construction provides several benefits: it is considered to be more advantageous in high seismic areas or areas where high winds may be expected to occur; control of wall movement due to shrinkage or temperature differentials is more easily accomplished; and lintel deflection may be substantially reduced.

The content presented in this TEK is based on the requirements of the 2012 IBC (ref. 1a), which in turn references the 2011 edition of the MSJC Code (ref. 2a). For designs based on the 2006 or 2009 IBC (refs. 1b, 1c), which reference the 2005 and 2008 MSJC (refs. 2b, 2c), respectively, the reader is referred to TEK 17-1C (ref. 3).

Significant changes were made to the allowable stress design (ASD) method between the 2009 and 2012 editions of the IBC. These are described in detail in **TEK 14-7C**, Allowable Stress Design of Concrete Masonry Based on the 2012 IBC & 2011 MSJC (ref. 4), along with a detailed presentation of all of the allowable stress design provisions of the 2012 IBC.

DESIGN LOADS

Vertical loads carried by lintels typically include:

1. distributed loads from the dead weight of the lintel, the dead weight of the masonry above, and any floor and roof loads, dead and live loads supported by the masonry; and

2. concentrated loads from floor beams, roof joists, or other beams framing into the wall. Axial load carried by lintels is negligible.

Most of these loads can be separated into the four types illustrated in Figure 1: uniform load acting over the effective span; triangular load with apex at mid-span acting over the effective span; concentrated load; and uniform load acting over a portion of the effective span.

The designer calculates the effects of each individual load and then combines them using superposition to determine the overall effect, typically by assuming the lintel is a simply supported beam.
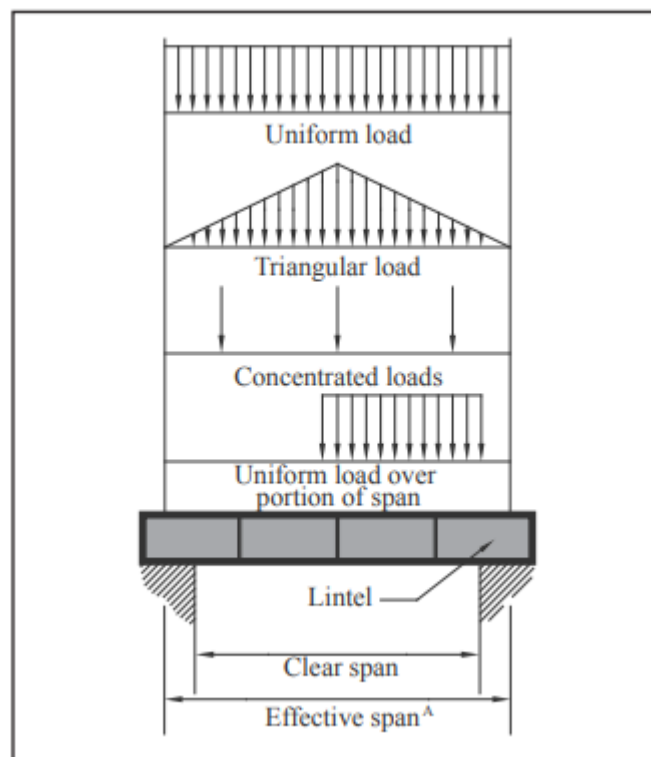

Figure 1—Typical Lintel Load Components

A Effective span length is the center-to-center distance between supports.

Arching Action

For some configurations, the masonry will distribute applied loads in such a manner that they do not act on the lintel. This is called arching action of masonry. Arching action can be assumed when the following conditions are met (see also Figure 2):

- masonry wall laid in running bond,

- sufficient wall height above the lintel to permit formation of a symmetrical triangle with base angles of 45° from the horizontal as shown in Figure 2,

- at least 8 in. (203 mm) of wall height above the apex of the 45° triangle,

- minimum end bearing (4 in. (102 mm) typ.) is maintained,

- control joints are not located adjacent to the lintel, and

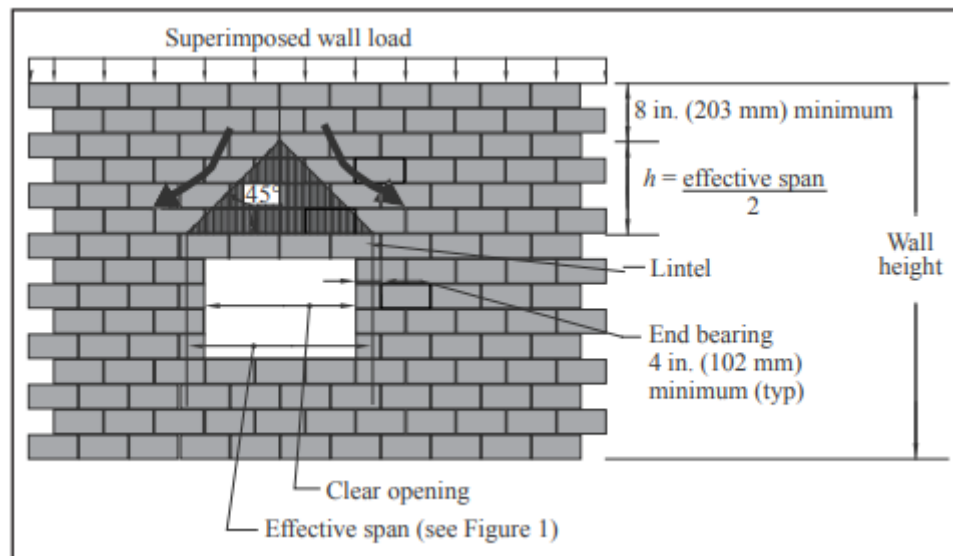- sufficient masonry on each side of the opening to resist lateral thrust from the arching action.

Figure 2—Arching Action

Lintel Loading

The loads supported by a lintel depend on whether or not arching action can occur. When arching is not present, the lintel self-weight, the full weight of the wall section above the lintel and superimposed loads are considered. Self weight is a uniform load based on lintel weight (see Table 1).

When arching occurs, the wall weight supported by the lintel is taken as the wall weight within the triangular area below the apex (see Figure 2 and Table 2). This triangular load has a base equal to the effective span length of the lintel and a height of half the effective span. Any superimposed roof and floor live and dead loads outside this triangle are neglected, since they are assumed to be distributed to the masonry on either side of the lintel. Loads applied within the triangle need to be considered, however.

NCMA

Concentrated loads are assumed to be distributed as illustrated in Figure 3. The load is then resolved onto the lintel as a uniform load, with a magnitude determined by dividing the concentrated load by this length. In most cases, this results in a uniform load acting over a portion of the lintel span.

The MSJC (ref. 2) does not address how to apply uniform loads that are applied within the 45° triangle. There are two schools of thought (see Figure 4):

1. Apply the full uniform load directly to the lintel without further distribution just as though there was no arching for those loads (ref. 7).

2. Distribute the portions of uniform loads that are applied within the 45° triangle to the lintel. These uniform loads within the 45° triangle may be dispersed and distributed at a 45° angle onto the lintel (ref. 6).

Lintels are required to be designed to have adequate stiffness to limit deflections that would adversely affect strength or serviceability. In addition, the deflection of lintels supporting unreinforced masonry is limited to the clear lintel span divided by 600 to limit damage to the supported masonry (ref. 2).

Nominal lintel height, in. (mm)	Nominal wall thickness, in. (mm)				
	6 (152)	8 (203)	10 (254)	12 (305)	16 (406)
	Lightweight CMU				
8 (203)	38 (0.56)	51 (0.75)	65 (0.95)	80 (1.2)	108 (1.6)
16 (406)	76 (1.1)	103 (1.5)	131 (1.9)	160 (2.3)	216 (3.2)
24 (610)	114 (1.7)	154 (2.3)	196 (2.9)	240 (3.5)	324 (4.8)
	Normal weight CMU				
8 (203)	43 (0.63)	58 (0.84)	73 (1.1)	88 (1.3)	118 (1.8)
16 (406)	86 (1.3)	116 (1.7)	145 (2.1)	176 (2.6)	236 (3.5)
24 (610)	128 (1.9)	174 (2.5)	218 (3.2	264 (3.9)	354 (5.2)

Table 1—Lintel Weights per Foot, D(lintel), lb/ft (kN/m) (A)

A Face shell mortar bedding. Unit weights: grout = 140 pcf (2,242 kg/m³); lightweight masonry units = 100 pcf (1602 kg/m³); normal weight units = 135 pcf (2,162 kg/m³).

Grouted cell spacing, in. (mm) o.c.:	Wall weight, lb/ft² (kg/m³) for wall thicknesses, in. (mm), of:									
	Lightweight units					Normal weight units				
	6 (152)	8 (203)	10 (254)	12 (305)	16 (406)	6 (152)	8 (203)	10 (254)	12 (305)	16 (406)
None	23 (112)	29 (142)	34 (166)	37 (181)	44 (215)	30 (147)	39 (191)	45 (220)	49 (239)	58 (283)
48 (1,219)	28 (137)	37 (181)	44 (215)	51 (249)	64 (313)	36 (176)	47 (230)	55 (269)	63 (308)	78 (381)
40 (1,016)	30 (147)	39 (191)	47 (230)	54 (264)	67 (327)	37 (181)	48 (235)	58 (283)	66 (323)	82 (401)
32 (812)	31 (151)	41 (200)	50 (244)	58 (283)	73 (357)	39 (191)	51 (249)	61 (298)	70 (342)	88 (430)
24 (610)	34 (166)	45 (220)	55 (269)	65 (318)	83 (406)	41 (200)	55 (269)	66 (323)	77 (376)	98 (479)
16 (406)	40 (195)	53 (259)	66 (323)	78 (381)	103 (503)	47 (230)	63 (308)	77 (376)	90 (440)	118 (577)
Full grout	57 (279)	77 (376)	98 (479)	120 (587)	163 (796)	64 (313)	86 (420)	109 (533)	132 (645)	177 (865)

Table 2—Wall Weights (A, B)

A Assumes face shell mortar bedding. Unit weights: grout = 140 pcf (2,242 kg/m³); lightweight masonry units = 100 pcf (1,602 kg/m³); normal weight units = 135 pcf (2,162 kg/m³).

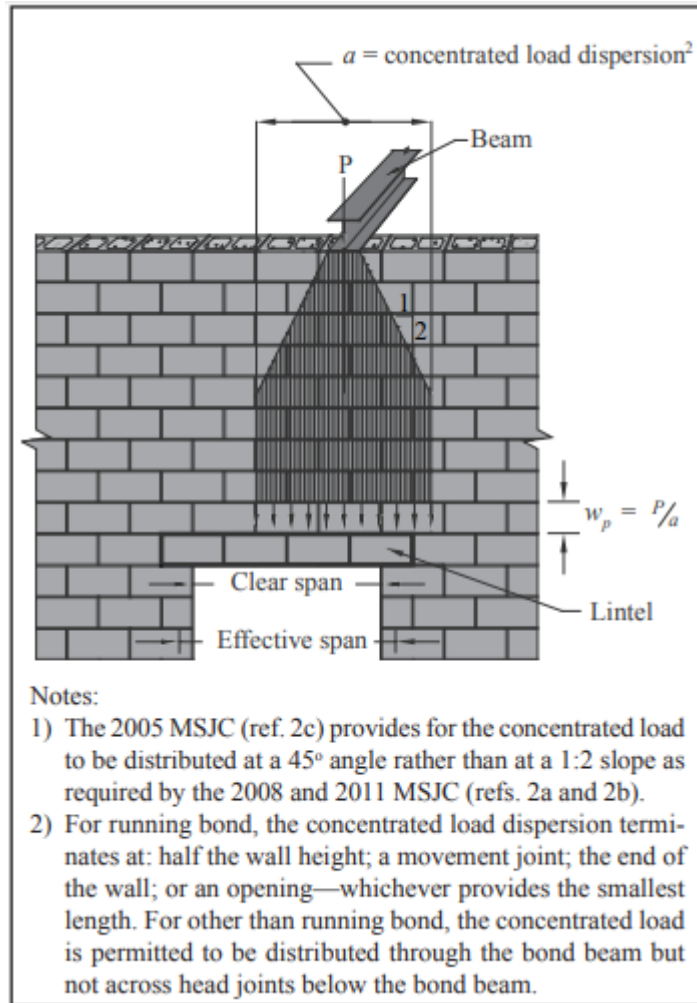B Additional wall weights can be found in **TEK 14-13B** (ref. 5).

Notes:
1) The 2005 MSJC (ref. 2c) provides for the concentrated load to be distributed at a 45° angle rather than at a 1:2 slope as required by the 2008 and 2011 MSJC (refs. 2a and 2b).
2) For running bond, the concentrated load dispersion terminates at: half the wall height; a movement joint; the end of the wall; or an opening—whichever provides the smallest length. For other than running bond, the concentrated load is permitted to be distributed through the bond beam but not across head joints below the bond beam.

Figure 3–Distribution of Concentrated Load for Running Bond Construction

Design philosophy 1: Apply the load directly to the lintel as though there was no arching action (ref. 7).

Design philosophy 2: Distribute the portion of load applied within the 45° triangle to the lintel at a 45° angle onto the lintel (ref. 6).
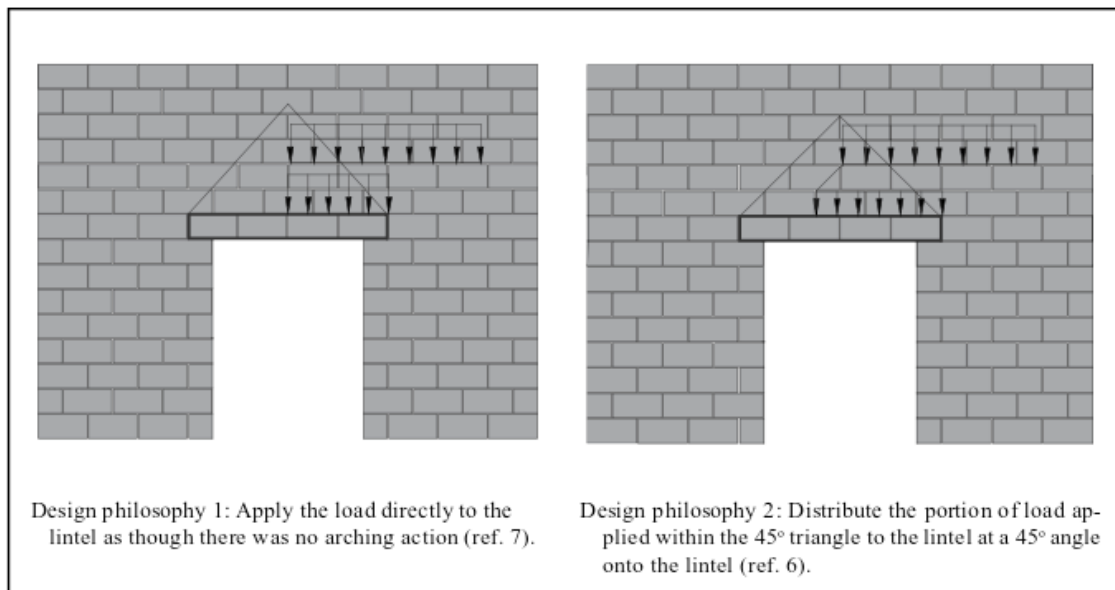
Figure 4–Methods of Applying Uniform Loads that Occur Within the 45° Triangle

DESIGN TABLES

Tables 3 and 4 present allowable shear and moment, respectively, for various concrete masonry lintels, with vari- ous amounts of reinforcement and bottom cover based on a specified compressive strength of masonry, f'_m = 1,500 psi (10.3 MPa) and the allowable stress design provisions of the 2011 MSJC (ref. 2a) and the 2012 IBC (ref.1a). Allowable shear and moment tables for f'_m = 2,000 psi (13.8 MPa) and f'_m = 2,500 psi (17.2 MPa) can be found online. Find the **tables for f'_m = 2,000 psi (13.8 MPa) here**, and the **tables for f'_m = 2,500 psi (17.2 MPa) here**.

Lintel size, in. (mm) (width x height):	Allowable shear[B, C], lb (kN), for bottom cover, in. (mm):			
	1.5 (38)	2.0 (51)	2.5 (64)	3.0 (76)
6 x 8 (152 x 203)	919 (4.09)	796 (3.54)	673 (2.99)	551 (2.45)
6 x 16 (152 x 406)	3,369 (14.99)	3,247 (14.44)	3,124 (13.90)	3,002 (13.35)
6 x 24 (152 x 610)	5,330 (23.71)	5,208 (23.17)	5,085 (22.62)	4,963 (22.08)
8 x 8 (203 x 203)	1,910 (8.50)	1,744 (7.76)	1,578 (7.02)	1,411 (6.28)
8 x 16 (203 x 406)	4,568 (20.32)	4,402 (19.58)	4,235 (18.84)	4,069 (18.10)
8 x 24 (203 x 610)	7,225 (32.14)	7,059 (31.40)	6,893 (30.66)	6,727 (29.92)
10 x 8 (254 x 203)	2,411 (10.72)	2,201 (9.79)	1,992 (8.86)	1,782 (7.93)
10 x 16 (254 x 406)	5,766 (25.65)	5,556 (24.71)	5,346 (23.78)	5,137 (22.85)
10 x 24 (254 x 610)	9,121 (40.57)	8,911 (39.64)	8,701 (38.70)	8,492 (37.77)
12 x 8 (305 x 203)	2,912 (12.95)	2,659 (11.83)	2,405 (10.70)	2,152 (9.57)
12 x 16 (305 x 406)	6,964 (30.98)	6,711 (29.85)	6,458 (28.73)	6,204 (27.60)
12 x 24 (305 x 610)	11,016 (49.00)	10,763 (47.88)	10,510 (46.75)	10,256 (45.62)
16 x 8 (406 x 203)	3,914 (17.41)	3,574 (15.90)	3,233 (14.38)	2,893 (12.87)
16 x 16 (406 x 406)	9,360 (41.64)	9,020 (40.12)	8,680 (38.61)	8,339 (37.09)

Table 3—Allowable Shear Capacities for Concrete Masonry Lintels (A)

[A] Assumes no stirrups, i.e., shear resistance of the steel is neglected. f'_m = 1,500 psi (10.3 MPa).

[B] For M/Vd = 1 and effective shear area = bd, where d is calculated based on a No. 6 (M#19) bar.

[C] Based on 2011 MSJC (ref. 2a) and 2012 IBC (ref. 1a) allowable stress design procedure.

Lintel size, in. (mm)	Reinforcement size	No. of bars	Bottom cover, in. (mm)							
			1.5 (38)		2 (51)		2.5 (64)		3 (76)	
6 x 8 (152 x 203)	No. 4 (M#13)	1	22,533	(2.55)	19,398	(2.19)	16,445	(1.86)	13,683	(1.55)
	No. 5 (M#16)	1	25,258	(2.85)	21,638	(2.44)	18,241	(2.06)	15,076	(1.70)
	No. 6 (M#19)	1	27,235	(3.08)	23,225	(2.62)	19,475	(2.20)	15,997	(1.81)
6 x 16 (152 x 406)	No. 4 (M#13)	1	80,473	(9.09)	77,449	(8.75)	74,429	(8.41)	71,411	(8.07)
	No. 5 (M#16)	1	108,375	(12.24)	101,967	(11.52)	95,705	(10.81)	89,592	(10.12)
	No. 6 (M#19)	1	120,999	(13.67)	113,709	(12.85)	106,591	(12.04)	99,649	(11.26)
6 x 24 (152 x 610)	No. 4 (M#13)	1	129,190	(14.60)	126,130	(14.25)	123,072	(13.91)	120,016	(13.56)
	No. 5 (M#16)	1	196,210	(22.17)	191,521	(21.64)	186,834	(21.11)	182,151	(20.58)
	No. 6 (M#19)	1	259,090	(29.27)	249,360	(28.17)	239,768	(27.09)	230,316	(26.02)
8 x 8 (203 x 203)	No. 4 (M#13)	1	27,627	(3.12)	23,829	(2.69)	20,246	(2.29)	16,888	(1.91)
	No. 5 (M#16)	1	31,288	(3.54)	26,863	(3.04)	22,702	(2.56)	18,816	(2.13)
	No. 6 (M#19)	1	34,046	(3.85)	29,103	(3.29)	24,469	(2.76)	20,159	(2.28)
	No. 4 (M#13)	2[B]	34,383	(3.88)	29,519	(3.34)	24,949	(2.82)	20,687	(2.34)
	No. 5 (M#16)	2[B]	37,992	(4.29)	32,449	(3.67)	27,263	(3.08)	22,448	(2.54)
8 x 16 (203 x 406)	No. 4 (M#13)	1	81,481	(9.21)	78,433	(8.86)	75,387	(8.52)	72,345	(8.17)
	No. 5 (M#16)	1	123,411	(13.94)	118,743	(13.42)	114,080	(12.89)	109,164	(12.33)
	No. 6 (M#19)	1	148,153	(16.74)	139,337	(15.74)	130,723	(14.77)	122,316	(13.82)
	No. 4 (M#13)	2[B]	145,474	(16.44)	136,929	(15.47)	128,576	(14.53)	120,420	(13.61)
	No. 5 (M#16)	2[B]	167,351	(18.91)	157,298	(17.77)	147,484	(16.66)	137,911	(15.58)
8 x 24 (203 x 610)	No. 4 (M#13)	1	130,542	(14.75)	127,463	(14.40)	124,385	(14.05)	121,309	(13.71)
	No. 5 (M#16)	1	198,654	(22.44)	193,927	(21.91)	189,202	(21.38)	184,481	(20.84)
	No. 6 (M#19)	1	277,106	(31.31)	270,459	(30.56)	263,816	(29.81)	257,178	(29.06)
	No. 4 (M#13)	2[B]	254,466	(28.75)	248,406	(28.07)	242,350	(27.38)	236,297	(26.70)
	No. 5 (M#16)	2[B]	357,742	(40.42)	344,327	(38.90)	331,103	(37.41)	318,071	(35.94)
10 x 8 (254 x 203)	No. 4 (M#13)	1	32,155	(3.63)	27,773	(3.14)	23,634	(2.67)	19,748	(2.23)
	No. 5 (M#16)	1	36,683	(4.14)	31,545	(3.56)	26,706	(3.02)	22,180	(2.51)
	No. 6 (M#19)	1	40,181	(4.54)	34,406	(3.89)	28,985	(3.27)	23,933	(2.70)
	No. 4 (M#13)	2	40,489	(4.57)	34,819	(3.93)	29,484	(3.33)	24,498	(2.77)
	No. 5 (M#16)	2	45,131	(5.10)	38,617	(4.36)	32,511	(3.67)	26,831	(3.03)
10 x 16 (254 x 406)	No. 4 (M#13)	1	82,183	(9.29)	79,119	(8.94)	76,057	(8.59)	72,997	(8.25)
	No. 5 (M#16)	1	124,671	(14.09)	119,972	(13.56)	115,278	(13.02)	110,588	(12.49)
	No. 6 (M#19)	1	172,276	(19.46)	162,114	(18.32)	152,181	(17.19)	142,481	(16.10)
	No. 4 (M#13)	2	159,833	(18.06)	153,813	(17.38)	147,800	(16.70)	140,049	(15.82)
	No. 5 (M#16)	2	195,635	(22.10)	183,997	(20.79)	172,627	(19.50)	161,532	(18.25)

Lintel size, in. (mm)	Reinforcement size	No. of bars	Bottom cover, in. (mm)							
			1.5 (38)		2 (51)		2.5 (64)		3 (76)	
10 x 24 (254 x 610)	No. 4 (M#13)	1	131,476	(14.85)	128,384	(14.51)	125,293	(14.16)	122,204	(13.81)
	No. 5 (M#16)	1	200,357	(22.64)	195,605	(22.10)	190,855	(21.56)	186,108	(21.03)
	No. 6 (M#19)	1	279,829	(31.62)	273,140	(30.86)	266,454	(30.11)	259,773	(29.35)
	No. 4 (M#13)	2	256,873	(29.02)	250,776	(28.33)	244,683	(27.65)	238,594	(26.96)
	No. 5 (M#16)	2	389,720	(44.03)	380,383	(42.98)	371,052	(41.92)	361,729	(40.87)
12 x 8 (305 x 203)	No. 4 (M#13)	1	33,873	(3.83)	30,863	(3.49)	26,719	(3.02)	22,356	(2.53)
	No. 5 (M#16)	1	41,611	(4.70)	35,826	(4.05)	30,372	(3.43)	25,264	(2.85)
	No. 6 (M#19)	1	45,809	(5.18)	39,279	(4.44)	33,140	(3.74)	27,411	(3.10)
	No. 4 (M#13)	2	46,082	(5.21)	39,680	(4.48)	33,648	(3.80)	28,004	(3.16)
	No. 5 (M#16)	2	51,714	(5.84)	44,313	(5.01)	37,366	(4.22)	30,894	(3.49)
12 x 16 (305 x 406)	No. 4 (M#13)	1	82,711	(9.35)	79,634	(9.00)	76,560	(8.65)	73,488	(8.30)
	No. 5 (M#16)	1	125,624	(14.19)	120,902	(13.66)	116,184	(13.13)	111,471	(12.59)
	No. 6 (M#19)	1	174,897	(19.76)	168,258	(19.01)	161,627	(18.26)	155,004	(17.51)
	No. 4 (M#13)	2	161,174	(18.21)	155,121	(17.53)	149,074	(16.84)	143,034	(16.16)
	No. 5 (M#16)	2	221,425	(25.02)	208,349	(23.54)	195,570	(22.10)	183,095	(20.69)
12 x 24 (305 x 610)	No. 4 (M#13)	1	132,174	(14.93)	129,072	(14.58)	125,971	(14.23)	122,872	(13.88)
	No. 5 (M#16)	1	201,635	(22.78)	196,865	(22.24)	192,096	(21.70)	187,330	(21.17)
	No. 6 (M#19)	1	281,884	(31.85)	275,164	(31.09)	268,447	(30.33)	261,734	(29.57)
	No. 4 (M#13)	2	258,686	(29.23)	252,563	(28.54)	246,442	(27.84)	240,325	(27.15)
	No. 5 (M#16)	2	392,972	(44.40)	383,584	(43.34)	374,202	(42.28)	364,827	(41.22)
16 x 8 (406 x 203)	No. 4 (M#13)	1	34,307	(3.88)	31,272	(3.53)	28,244	(3.19)	25,225	(2.85)
	No. 5 (M#16)	1	50,450	(5.70)	43,512	(4.92)	36,961	(4.18)	30,816	(3.48)
	No. 6 (M#19)	1	55,949	(6.32)	48,069	(5.43)	40,647	(4.59)	33,706	(3.81)
	No. 4 (M#13)	2	56,145	(6.34)	48,435	(5.47)	41,159	(4.65)	34,338	(3.88)
	No. 5 (M#16)	2	63,635	(7.19)	54,645	(6.17)	46,189	(5.22)	38,292	(4.33)
16 x 16 (406 x 406)	No. 4 (M#13)	1	83,464	(9.43)	80,371	(9.08)	77,279	(8.73)	74,190	(8.38)
	No. 5 (M#16)	1	126,996	(14.35)	122,241	(13.81)	117,491	(13.27)	112,744	(12.74)
	No. 6 (M#19)	1	177,087	(20.01)	170,394	(19.25)	163,708	(18.50)	157,029	(17.74)
	No. 4 (M#13)	2	163,114	(18.43)	157,014	(17.74)	150,920	(17.05)	144,831	(16.36)
	No. 5 (M#16)	2	247,094	(27.92)	237,751	(26.86)	228,419	(25.81)	219,098	(24.75)

Table 4—Allowable Moment, lb-in. (kN-m), Capacities for Concrete Masonry Lintels (width x height) (A, C)

Grade 60 reinforcement. No. 4 f'_m (M#13) = 1,500 psi 2 (10.3 MPa). 159,833

B For 8 in. (204 mm) lintels No. 5 (M#16) with two bars, low lift grouting 195,635 is recommended (22.10) for adjacent 183,997 jambs (20.79) to ensure proper 172,627 grout flow (19.50) and consolidation. 161,532

C Based on 2011 MSJC (ref. 2a) and 2012 IBC (ref. 1a) allowable stress design procedure.

DESIGN EXAMPLE

Check for Arching Action. Determine the height of masonry required for arching action. Assuming the lintel has at least 4 in. (102 mm) bearing on each end, the effective span is:

L = 5.33 + 0.33 = 5.67 ft (1.7 m).

The height of masonry above the lintel necessary for arching to occur in the wall (from Figure 2) is h + 8 in. (203 mm) = $L/2$ + 8 in. = 3.5 ft (1.1 m).
Based on an 8-in. (203-mm) high lintel, there is 18.0 − (3.33 + 4.0 + 0.67) = 10.0 ft (3.0 m) of masonry above the lintel. Therefore, arching is assumed and the superimposed uniform load is neglected.

Design Loads. Because arching occurs, only the lintel and wall dead weights are considered. Lintel weight, from Table 1, for 12 in. (305 mm) normal weight concrete masonry units assuming an 8 in. (203 mm) height is D_{lintel} = 88 lb/ft (1.3 kN/m).
For wall weight, only the triangular portion with a height of 3.5 ft (1.1 m) is considered. From Table 2, wall dead load is:

D_{wall} = 63 lb/ft² (3.5 ft)
= 221 lb/ft (3.2 kN/m) at the apex.

Maximum moment and shear are determined using simply supported beam relationships. The lintel dead weight is considered a uniform load, so the moment and shear are,

$M_{lintel} = D_{lintel}L^2/8$
= (88)(5.7)²/8
= 357 lb-ft (0.48 kN-m)
$V_{lintel} = D_{lintel}L/2$
= (88)(5.7)/2 = 251 lb (1.1 kN)

For triangular wall load, moment and shear are,

$M_{wall} = D_{wall}L^2/12$
$= (221)(5.7)^2/12$
$= 598$ lb-ft (0.81 kN-m)
$V_{wall} = D_{wall}L/4$
$= (221)(5.7)/4 = 315$ lb (1.4 kN)

Because the maximum moments for the two loading conditions occur in the same locations on the lintel (as well as the maximum shears), the moments and shears are superimposed and summed:

$M_{max} = 357 + 598$
$= 955$ lb-ft $= 11,460$ lb-in (1.3 kN-m)
$V_{max} = 251 + 315$
$= 566$ lb (2.5 kN)

Lintel Design. From Tables 3 and 4, a 12 x 8 lintel with one No. 4 (M#13) bar and 3 in. (76 mm) or less bottom cover has adequate strength ($M_{all} = 22,356$ lb-in. (2.53 kN-m) and $V_{all} = 2,152$ lb (9.57 kN)). In this example, shear was conservatively computed at the end of the lintel. However, Building Code Requirements for Masonry Structures (ref. 2) allows maximum shear to be calculated using a distance $d/2$ from the face of the support.

Case 2—No Arching Action

Using the same example, recalculate assuming a 2 ft (0.6 m) height from the bottom of the lintel to the top of the wall. For ease of construction, the entire 2 ft (0.6 m) would be grouted solid, producing a 24 in. (610 mm) deep lintel.

Because the height of masonry above the lintel is less than 3.5 ft (1.1 m), arching cannot be assumed, and the superimposed load must be accounted for.

$D_{lintel} = 264$ lb/ft (3.9 kN/m), from Table 1. Because the lintel is 24 in. (610 mm) deep, there is no additional dead load due to masonry above the lintel.

$W_{total} = 264$ lb/ft + 1,000 lb/ft
$= 1,264$ lb/ft (18.4 kN/m)

$M_{max} = wL^2/8$
$= (1,264)(5.7)^2/8$ x 12 in./ft
$= 61,601$ lb-in (7.0 kN-m)

$V_{max} = wL/2 = (1,264)(5.7)/2$
$= 3,602$ lb (16.0 kN)

From Tables 3 and 4, a 12 x 24 lintel with one No. 4 (M#13) reinforcing bar and 3 in. (76 mm) or less bottom cover is adequate (M_{all} = 122,872 lb-in. (13.88 kN-m) and V_{all} = 10,256 lb (45.62 kN).
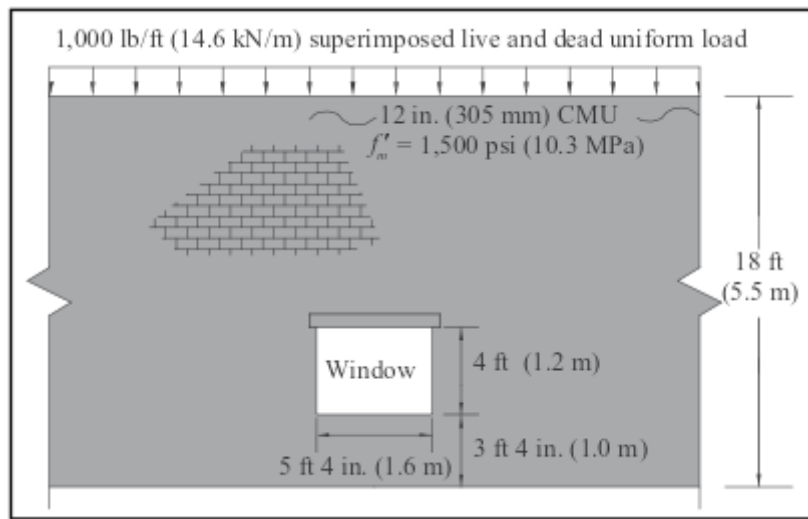

1,000 lb/ft (14.6 kN/m) superimposed live and dead uniform load

12 in. (305 mm) CMU
f'_m = 1,500 psi (10.3 MPa)

18 ft (5.5 m)

Window

4 ft (1.2 m)

3 ft 4 in. (1.0 m)

5 ft 4 in. (1.6 m)

Figure 5—Wall Configuration for Design Example

NOTATIONS

b = width of lintel, in. (mm)

D_{lintel} = lintel dead load, lb/ft (kN/m)

D_{wall} = wall dead load, lb/ft (kN/m)

d = distance from extreme compression fiber to centroid of tension reinforcement, in. (mm)

f'_m = specified compressive strength of masonry, psi (MPa)

h = half of the effective lintel span, L/2, ft (m)

L = effective lintel span, ft (m)

M_{all} = allowable moment, in.-lb (N·m)

M_{lintel} = maximum moment due to lintel dead load, in.-lb (N·m)

M_{max} = maximum moment, in.-lb (N·m)

M_{wall} = maximum moment due to wall dead load moment, in.-lb (N·m)

V_{all} = allowable shear, lb (N)

V_{lintel} = maximum shear due to lintel dead load, lb (N)

V_{max} = maximum shear, lb (N)

V_{wall} = maximum shear due to wall dead load, lb (N)

W_{total} = total uniform live and dead load, lb/ft (kN/m)

w = uniformly distributed load, lb/in. (N/mm)

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