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PRECAST CONCRETE LINTELS

FOR CONCRETE MASONRY CONSTRUCTION

Lintel Dimensions

To determine lintel dimensions see Figure 1. The following load tables are based on a minimum of 8” bearing. Minimum concrete cover over the reinforcing steel is 1 1/2”. Lintel width should equal the width of the supported masonry wythe.

Lintels are marked on the top to be sure reinforcing steel is correctly placed.

Lintels are designed in accordance with IBC 2009, ASCE 7-10, ACI 318-08, NCMA TEK 17-2A and NCMA Lintel Design Manual 2004.

See load tables for materials properties and design parameters. Lintels are lightweight concrete: unit weight 100 pcf, compressive strength 3,000 psi or normal weight concrete: unit weight 126 pcf, compressive strength 3,000 psi. Load tables are the same for each unit weight.

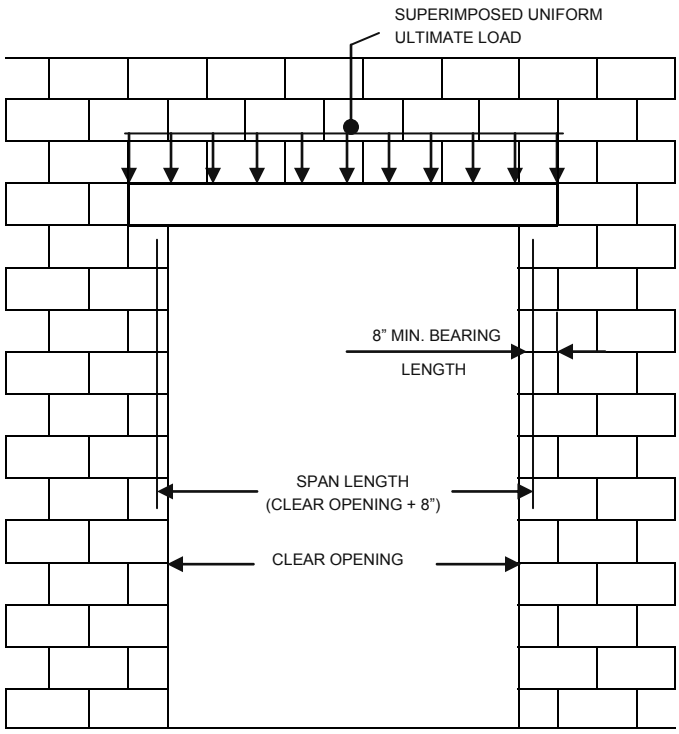
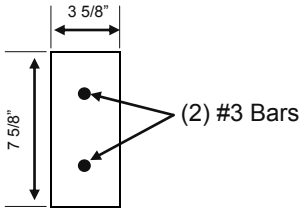


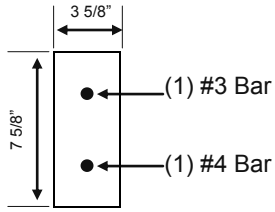
Figure 1—Precast Lintel Design Parameters

4” x 8” LINTEL SECTION

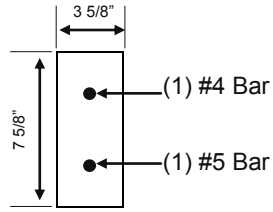
4” x 8” (32” - 80”)



4” x 8” (88” - 104”)

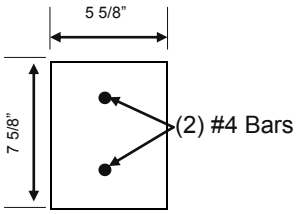


4” x 8” (112” - 144”)

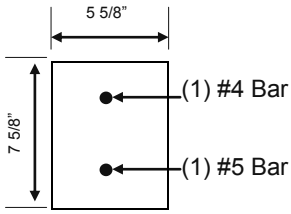


6” x 8” LINTEL SECTION

6” x 8” (32” - 120”)

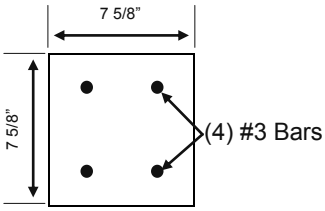


6” x 8” (128” - 144”)

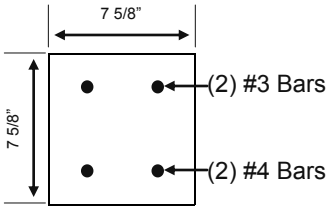


8” x 8” LINTEL SECTION

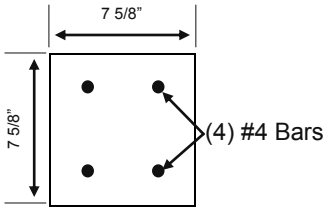
8” x 8” (32” - 88”)



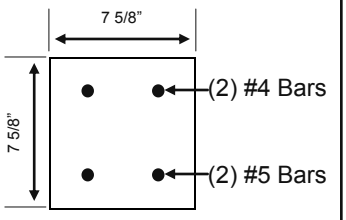
8” x 8” (96”)



8” x 8” (104” - 120”)



8” x 8” (128” - 144”)



4” x 8” CONCRETE LINTEL LOAD TABLE

Lintel Reinforcing	Nominal Lintel Length (in)	Clear Opening, L (in)	Lintel Ultimate Load Capacity; wu (plf)
(1) #3 Bar Top and Bottom	32	16	2948
	40	24	1766
	48	32	1256
	56	40	972
	64	48	791
	72	56	665
	80	64	587
(1) #4 Bar in Bottom, (1) #3 Bar in Top	88	72	500
	96	80	379
	104	88	294
(1) #5 Bar in Bottom, (1) #4 Bar in Top	112	96	275
	128	112	175
	144	128	117
	= Governed by Shear Capacity		
	= Governed by Deflection of L/600		

4” x 8” Lintel
Lintel Width = 3 5/8”
Lintel Height = 7 5/8”

Material Properties:
f’c = 3,000 psi
fy = 60,000 psi
Lintel Lightweight = 19 plf
Lintel Normal Weight = 24 plf

6” x 8” CONCRETE LINTEL LOAD TABLE

Lintel Reinforcing	Nominal Lintel Length (in)	Clear Opening, L (in)	Lintel Ultimate Load Capacity; wu (plf)
(1) #4 Bar Top and Bottom	32	16	4480
	40	24	2693
	48	32	1919
	56	40	1486
	64	48	1210
	72	56	1018
	80	64	878
	88	72	718
	96	80	548
	112	96	340
	120	104	274
(1) #5 Bar in Bottom, (1) #4 Bar in Top	128	112	236
	144	128	160
	= Governed by Shear Capacity		
	= Governed by Deflection of L/600		

6” x 8” Lintel
Lintel Width = 5 5/ 8”
Lintel Height = 7 5/8”

Material Properties:
f’c = 3,000 psi
fy = 60,000 psi
Lintel Lightweight = 30 plf
Lintel Normal Weight = 38 plf

8” x 8” CONCRETE LINTEL LOAD TABLE

Lintel Reinforcing	Nominal Lintel Length (in)	Clear Opening, L (in)	Lintel Ultimate Load Capacity; wu (plf)
(2) #3 Bars Top and Bottom	32	16	6202
	40	24	3714
	48	32	2641
	56	40	2044
	64	48	1663
	72	56	1399
	80	64	1175
	88	72	922
(2) #4 Bars in Bottom, (2) #3 Bars in Top	96	80	780
(2) #4 Bars Top and Bottom	104	88	659
	112	96	519
	120	104	415
(2) #5 Bars in Bottom, (2) #4 Bars in Top	128	112	363
	132	116	327
	140	124	267
	144	128	242
	= Governed by Shear Capacity		
	= Governed by Deflection of L/600		

8” x 8” Lintel
Lintel Width = 7 5/8”
Lintel Height = 7 5/8”

Material Properties:
f’c = 3,000 psi
fy = 60,000 psi
Lintel Lightweight = 40 plf
Lintel Normal Weight = 51 plf

DEFLECTIONS

1) Limit deflections to L/600.
2) Deflections were calculated in accordance with the notes on ACI 318-08 Section 10.
3) Service load moments were used in deflection calculations. To be conservative the ultimate uniform load was divided by 1.2 to arrive at a uniform superimposed service load for deflection calculations.
4) The modulus of rupture was calculated using the following ACI equation for Eq 9-10:

$$Fr = 7.5\sqrt{f'c}$$

DETERMINATION OF ULTIMATE MOMENT CAPACITY (Mu) AND SUPERIMPOSED LOAD (wu):

1) The moment capacity of each section was calculated using the below equations for ultimate moments.
2) Actual masonry dimensions were used in the calculations; 4" = 3 5/8", 6" = 5 5/8", and 8" = 7 5/8".
3) Lintel lengths and clear opening dimensions given indicate a bearing length of 8" on each end. The span length, L, used in the calculations = lintel length – 8".
4) The distance 'd' used in the calculation of moment capacity was the lintel height – 1.5" cover – 1/2 bar diameter.
5) The equivalent uniform load was then calculated from the calculated ultimate moment by the following equation:

$$wu = 8\,(phiMn)/12/(L/12)^2 - 1.4Wlintel$$

6) The ultimate uniform loads in the tables are based on controlling criteria: moment capacity, shear capacity or allowable deflection.

REFERENCE CODES

2009 International Building Code
ASCE 7-10
ACI 318-08
NCMA TEK 17-2A
NCMA Lintel Design Manual 2004

MATERIAL PROPERTIES

Lightweight Concrete; f'c = 3,000 psi
Unit Weight of Lightweight Concrete = 100 pcf
$Ec = Wc^{1.5}\ 33\sqrt{f'c} = (100\ pcf)^{1.5}\ (33)\sqrt{3{,}000}/1{,}000 = 1807\ ksi$
Reinforcing Steel; fy = 60,000 psi
Es = 29,000 ksi
Cover on Reinforcing Steel for Calculations = 1.5"

ULTIMATE LOAD EQUATIONS

Gravity Loads:

U = 1.4D (IBC Eq. 16-1, ASCE Eq. 2.3.2.1)
U = 1.2D + 1.6L + 0.5S (IBC Eq. 16-2, ASCE Eq. 2.3.2.2)
U = 1.2D + 1.6S + 1.0L (IBC Eq. 16-3, ASCE Eq. 2.3.2.3)

D = Dead Load Applied to Top of Lintel + Lintel Weight
L = Live Load Applied to Top of Lintel
S = Snow Load Applied to Top of Lintel

FLEXURAL DESIGN EQUATIONS

As min = $(3\sqrt{f'c}/fy)(bwd)$ (ACI Eq. 10-3)
By Statics
T = Asfy
C = 0.85f'cba
C = T
a = Asfy/0.85f'cb
phiMn = phi$[(C \text{ or } T)(d - a/2)]$
For Flexure, phi = 0.90

SHEAR DESIGN EQUATIONS

phiVc = $2\lambda\sqrt{f'c}$ bwd (ACI Eq. 11-3)
λ = 0.85 for Lightweight Concrete
phi = 0.75 for Shear
Per ACI 11.4.6.1 (d) No Shear Steel required if H < 10"
Vu Max occurs at the Distance of 'd' from the Face of Support
Vu = wu [(L/2-d)/12]