

One-Way Slab Design

ACI 318-08

Span & Load Data

Span 15 ft

	Service	LF	Factored	
LL	100	1.6	160	psf
Imposed D	10	1.2	12	psf
Imposed Tl	110		172	psf

$$w_u = 172 + 15 h$$

Estimate h 6 in

$$w_u = 262 \text{ plf/ftw}$$

$$V_u = 1.00 w_u * L / 2 = 1965 \text{ lb/ftw}$$

$$M_u = w_u * L^2 / 8 = 7.37 \text{ ft-k/ftw}$$

Materials

f'_c 4000 psi

f_y 60000 psi

β_1 0.85

Thickness determination

Cover 0.75 in

est. d_b 1 in

Table 9.5a $h \geq L / 20 = 9 \text{ in}$

Shear

$h \geq 2.46 \text{ in}$

$w_u = 208.96 \text{ psf}$

$V_u = 1567.2 \text{ lb}$

$\phi V_n = 1566.7 \text{ lb}$

$V_u / \phi V_n = 1.000$ <---- goal seek to find or press "Find h" button

Find "h"

Flexure

$\phi = 0.9$

Use approximation equations to select a b and h

	Smallest	Defl control	Largest	
$h \geq$	4.08	4.79	7.38	in
w_u	233.17	243.88	282.65	psf
M_u	6.558	6.859	7.950	ft-k/ft
Required bd^2	96.0	150.5	450.4	in ³
use b	12	12	12	in
computed d	2.83	3.54	6.13	in
cov + bar	1.25	1.25	1.25	in
est. h	4.08	4.79	7.38	in
h/est. h	1.000	1.000	1.000	<---- goal seek to find or press "Find h" button
Actual h	5.00	5.00	8.00	in
estimated d	3.75	3.75	6.75	in
Quad:a	39705.88	39705.88	39705.88	Note, these are quadratic coefficients
Quad:b	-202500	-202500	-364500	to be used in the quadratic
Quad:c	78694.55	82307.85	95394.64	equation
Strength Req'd A_s	0.42	0.45	0.27	in ² /ftw

Suggested minimum h 9.00 in

Select Steel

Use h = 6 in
 est d 4.75 in
Spacing Limits
 Flexural Steel 18 in
 T&S Steel 18 in
 w_u 262 plf/ftw
 M_u 7.369 ft-k/ftw

Min A_s requirement
 ACI 318-05 10.5.1 **0.180** in²/ftw

Flexural A_s requirement
 Quad:a 39705.88
 Quad:b -256500
 Quad:c 88425
 Strength Req'd A_s **0.365** in²/ftw

Controlling Flexural Steel Requirement **0.365** in²/ftw

Bar	A_b (in ²)	d_b (in)	max s (in)	Use s (in)	Act. A_s (in ² /ftw)	Act d (in)	ϕM_n (ft-k/ftw)	$M_u/\phi M_n$	c (in)	Stl Strain
#3	0.11	0.375	3.61	3.50	0.377	5.06	8.12	0.907	0.652	0.02028
#4	0.20	0.500	6.57	6.50	0.369	5.00	7.86	0.938	0.639	0.02048
#5	0.31	0.625	10.18	10.00	0.372	4.94	7.81	0.944	0.644	0.02002
#6	0.44	0.750	14.45	14.00	0.377	4.88	7.80	0.944	0.652	0.01941
#7	0.60	0.875	19.70	18.00	0.400	4.81	8.13	0.906	0.692	0.01786
#8	0.79	1.000	25.94	18.00	0.527	4.75	10.34	0.713	0.911	0.01264
#9	1.00	1.128	32.84	18.00	0.667	4.69	12.59	0.585	1.153	0.00919
#10	1.27	1.270	41.71	18.00	0.847	4.62	15.21	0.484	1.465	0.00645
#11	1.56	1.410	51.23	18.00	1.040	4.55	17.69	0.417	1.799	0.00458
#14	2.25	1.693	73.89	18.00	1.500	4.40	22.28	0.331	2.595	0.00209
#18	4.00	2.257	131.36	18.00	2.667	4.12	25.93	0.284	4.614	-0.00032

0.369

Note: Check development lengths

Temperature & Shrinkage Reinforcement

ρ_o 0.0018
 Req'd A_s 0.1296 in²/ftw

Bar	A_b (in ²)	max s (in)	Use s (in)	Act. A_s (in ² /ftw)
#3	0.11	3.61	3.50	0.377
#4	0.20	6.57	6.50	0.369
#5	0.31	10.18	10.00	0.372
#6	0.44	14.45	14.00	0.377
#7	0.60	19.70	18.00	0.400
#8	0.79	25.94	18.00	0.527
#9	1.00	32.84	18.00	0.667
#10	1.27	41.71	18.00	0.847
#11	1.56	51.23	18.00	1.040
#14	2.25	73.89	18.00	1.500
#18	4.00	131.36	18.00	2.667

0.369