

APPENDIX E

318/318R-385

APPENDIX E — STEEL REINFORCEMENT INFORMATION

As an aid to users of the ACI Building Code, information on sizes, areas, and weights of various steel reinforcement is presented.

ASTM STANDARD REINFORCING BARS

Bar size, no.	Nominal diameter, in.	Nominal area, in. ²	Nominal weight, lb/ft
3	0.375	0.11	0.376
4	0.500	0.20	0.668
5	0.625	0.31	1.043
6	0.750	0.44	1.502
7	0.875	0.60	2.044
8	1.000	0.79	2.670
9	1.128	1.00	3.400
10	1.270	1.27	4.303
11	1.410	1.56	5.313
14	1.693	2.25	7.650
18	2.257	4.00	13.600

ASTM STANDARD PRESTRESSING TENDONS

Type*	Nominal diameter, in.	Nominal area, in. ²	Nominal weight, lb/ft
Seven-wire strand (Grade 250)	1/4 (0.250)	0.036	0.122
	5/16 (0.313)	0.058	0.197
	3/8 (0.375)	0.080	0.272
	7/16 (0.438)	0.108	0.367
	1/2 (0.500) (0.600)	0.144 0.216	0.490 0.737
Seven-wire strand (Grade 270)	3/8 (0.375)	0.085	0.290
	7/16 (0.438)	0.115	0.390
	1/2 (0.500)	0.153	0.520
	(0.600)	0.217	0.740
Prestressing wire	0.192	0.029	0.098
	0.196	0.030	0.100
	0.250	0.049	0.170
	0.276	0.060	0.200
Prestressing bars (plain)	3/4	0.44	1.50
	7/8	0.60	2.04
	1	0.78	2.67
	1-1/8	0.99	3.38
	1-1/4	1.23	4.17
Prestressing bars (deformed)	1-3/8	1.48	5.05
	5/8	0.28	0.98
	3/4	0.42	1.49
	1	0.85	3.01
	1-1/4	1.25	4.39
	1-3/8	1.58	5.56

* Availability of some tendon sizes should be investigated in advance.

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ASTM STANDARD WIRE REINFORCEMENT

W & D size		Nominal diameter, in.	Nominal area, in. ²	Nominal weight, lb/ft	Area, in. ² /ft of width for various spacings						
					Center-to-center spacing, in.						
Plain	Deformed				2	3	4	6	8	10	12
W31	D31	0.628	0.310	1.054	1.86	1.24	0.93	0.62	0.465	0.372	0.31
W30	D30	0.618	0.300	1.020	1.80	1.20	0.90	0.60	0.45	0.366	0.30
W28	D28	0.597	0.280	0.952	1.68	1.12	0.84	0.56	0.42	0.336	0.28
W26	D26	0.575	0.260	0.934	1.56	1.04	0.78	0.52	0.39	0.312	0.26
W24	D24	0.553	0.240	0.816	1.44	0.96	0.72	0.48	0.36	0.288	0.24
W22	D22	0.529	0.220	0.748	1.32	0.88	0.66	0.44	0.33	0.264	0.22
W20	D20	0.504	0.200	0.680	1.20	0.80	0.60	0.40	0.30	0.24	0.20
W18	D18	0.478	0.180	0.612	1.08	0.72	0.54	0.36	0.27	0.216	0.18
W16	D16	0.451	0.160	0.544	0.96	0.64	0.48	0.32	0.24	0.192	0.16
W14	D14	0.422	0.140	0.476	0.84	0.56	0.42	0.28	0.21	0.168	0.14
W12	D12	0.390	0.120	0.408	0.72	0.48	0.36	0.24	0.18	0.144	0.12
W11	D11	0.374	0.110	0.374	0.66	0.44	0.33	0.22	0.165	0.132	0.11
W10.5		0.366	0.105	0.357	0.63	0.42	0.315	0.21	0.157	0.126	0.105
W10	D10	0.356	0.100	0.340	0.60	0.40	0.30	0.20	0.15	0.12	0.10
W9.5		0.348	0.095	0.323	0.57	0.38	0.285	0.19	0.142	0.114	0.095
W9	D9	0.338	0.090	0.306	0.54	0.36	0.27	0.18	0.135	0.108	0.09
W8.5		0.329	0.085	0.289	0.51	0.34	0.255	0.17	0.127	0.102	0.085
W8	D8	0.319	0.080	0.272	0.48	0.32	0.24	0.16	0.12	0.096	0.08
W7.5		0.309	0.075	0.255	0.45	0.30	0.225	0.15	0.112	0.09	0.075
W7	D7	0.298	0.070	0.238	0.42	0.28	0.21	0.14	0.105	0.084	0.07
W6.5		0.288	0.065	0.221	0.39	0.26	0.195	0.13	0.097	0.078	0.065
W6	D6	0.276	0.060	0.204	0.36	0.24	0.18	0.12	0.09	0.072	0.06
W5.5		0.264	0.055	0.187	0.33	0.22	0.165	0.11	0.082	0.066	0.055
W5	D5	0.252	0.050	0.170	0.30	0.20	0.15	0.10	0.075	0.06	0.05
W4.5		0.240	0.045	0.153	0.27	0.18	0.135	0.09	0.067	0.054	0.045
W4	D4	0.225	0.040	0.136	0.24	0.16	0.12	0.08	0.06	0.048	0.04
W3.5		0.211	0.035	0.119	0.21	0.14	0.105	0.07	0.052	0.042	0.035
W3		0.195	0.030	0.102	0.18	0.12	0.09	0.06	0.045	0.036	0.03
W2.9		0.192	0.029	0.098	0.174	0.116	0.087	0.058	0.043	0.035	0.029
W2.5		0.178	0.025	0.085	0.15	0.10	0.075	0.05	0.037	0.03	0.025
W2		0.159	0.020	0.068	0.12	0.08	0.06	0.04	0.03	0.024	0.02
W1.4		0.135	0.014	0.049	0.084	0.056	0.042	0.028	0.021	0.017	0.014

STEEL REINFORCEMENT INFORMATION

Table 3.7.1

Total Areas for Various Numbers of Reinforcing Bars

Bar Size	Nominal Diameter (in.)	Weight (lb/ft)	Number of Bars									
			1	2	3	4	5	6	7	8	9	10
#3	0.375	0.376	0.11	0.22	0.33	0.44	0.55	0.66	0.77	0.88	0.99	1.10
#4	0.500	0.668	0.20	0.40	0.60	0.80	1.00	1.20	1.40	1.60	1.80	2.00
#5	0.625	1.043	0.31	0.62	0.93	1.24	1.55	1.86	2.17	2.48	2.79	3.10
#6	0.750	1.502	0.44	0.88	1.32	1.76	2.20	2.64	3.08	3.52	3.96	4.40
#7	0.875	2.044	0.60	1.20	1.80	2.40	3.00	3.60	4.20	4.80	5.40	6.00
#8	1.000	2.670	0.79	1.58	2.37	3.16	3.95	4.74	5.53	6.32	7.11	7.90
#9	1.128	3.400	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00
#10	1.270	4.303	1.27	2.54	3.81	5.08	6.35	7.62	8.89	10.16	11.43	12.70
#11	1.410	5.313	1.56	3.12	4.68	6.24	7.80	9.36	10.92	12.48	14.04	15.60
#14 ^a	1.693	7.65	2.25	4.50	6.75	9.00	11.25	13.50	15.75	18.00	20.25	22.50
#18 ^a	2.257	13.60	4.00	8.00	12.00	16.00	20.00	24.00	28.00	32.00	36.00	40.00

^a #14 and #18 bars are used primarily as column reinforcement and are rarely used in beams.

Table 3-7 Areas of Bars per Foot Width of Slab— A_s (in.²/ft)

Bar size	Bar spacing (in.)												
	6	7	8	9	10	11	12	13	14	15	16	17	18
#3	0.22	0.19	0.17	0.15	0.13	0.12	0.11	0.10	0.09	0.09	0.08	0.08	0.07
#4	0.40	0.34	0.30	0.27	0.24	0.22	0.20	0.18	0.17	0.16	0.15	0.14	0.13
#5	0.62	0.53	0.46	0.41	0.37	0.34	0.31	0.29	0.27	0.25	0.23	0.22	0.21
#6	0.88	0.75	0.66	0.59	0.53	0.48	0.44	0.41	0.38	0.35	0.33	0.31	0.29
#7	1.20	1.03	0.90	0.80	0.72	0.65	0.60	0.55	0.51	0.48	0.45	0.42	0.40
#8	1.58	1.35	1.18	1.05	0.95	0.86	0.79	0.73	0.68	0.63	0.59	0.56	0.53
#9	2.00	1.71	1.50	1.33	1.20	1.09	1.00	0.92	0.86	0.80	0.75	0.71	0.67
#10	2.54	2.18	1.91	1.69	1.52	1.39	1.27	1.17	1.09	1.02	0.95	0.90	0.85
#11	3.12	2.67	2.34	2.08	1.87	1.70	1.56	1.44	1.34	1.25	1.17	1.10	1.04

Table 3-4 Maximum Bar Spacing in One-Way Slabs for Crack Control (in.)*

Bar Size	Exterior Exposure ($z = 129$ kips/in.)				Interior Exposure ($z = 156$ kips/in.)			
	Cover (in.)				Cover (in.)			
	$\frac{3}{4}$	1	$1\frac{1}{2}$	2	$\frac{3}{4}$	1	$1\frac{1}{2}$	2
#4	--	14.7	7.5	4.5	--	--	13.3	8.0
#5	--	13.4	7.0	4.3	--	--	12.4	7.6
#6	--	12.2	6.5	4.1	--	--	11.6	7.2
#7	16.3	11.1	6.1	3.9	--	--	10.8	6.8
#8	14.7	10.2	5.8	3.7	--	--	10.2	6.5
#9	13.3	9.4	5.4	3.5	--	16.6	9.6	6.2
#10	12.0	8.6	5.0	3.3	--	15.2	8.9	5.9
#11	10.9	7.9	4.7	3.1	--	14.0	8.4	5.6

*Valid for $f_s = 0.6f_y = 36$ ksi, and single layer of reinforcement. Spacing should not exceed 3 times slab thickness nor 18 in. (ACI 7.6.5). No value indicates spacing greater than 18 in.

Table 3-3 Maximum Number of Bars in a Single Layer

Bar Size	Maximum size coarse aggregate—3/4 in.										
	Beam width, b_w (in.)										
	10	12	14	16	18	20	22	24	26	28	30
#5	3	5	6	7	8	10	11	12	13	15	16
#6	3	4	6	7	8	9	10	11	12	14	15
#7	3	4	5	6	7	8	9	10	11	12	13
#8	3	4	5	6	7	8	9	10	11	12	13
#9	2	3	4	5	6	7	8	8	9	10	11
#10	2	3	4	4	5	6	7	8	8	9	10
#11	2	3	3	4	5	5	6	7	8	8	9

Bar Size	Maximum size coarse aggregate—1 in.										
	Beam width, b_w (in.)										
	10	12	14	16	18	20	22	24	26	28	30
#5	3	4	5	6	7	8	9	10	11	12	13
#6	3	4	5	6	7	8	9	10	10	11	12
#7	2	3	4	5	6	7	8	9	10	10	11
#8	2	3	4	5	6	7	7	8	9	10	11
#9	2	3	4	5	5	6	7	8	9	9	10
#10	2	3	4	4	5	6	7	7	8	9	10
#11	2	3	3	4	5	5	6	7	8	8	9

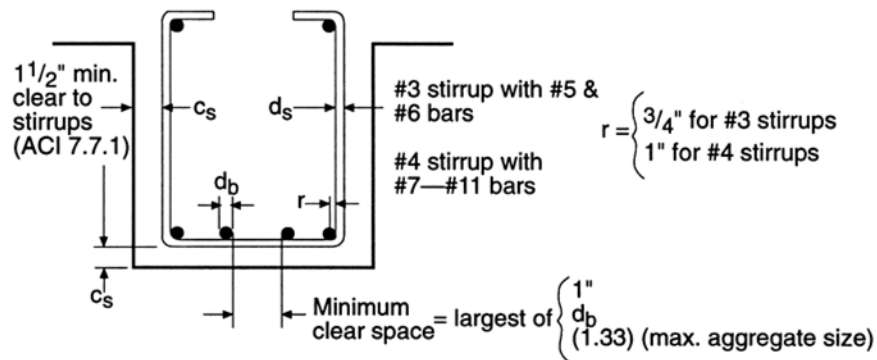


Figure 3-2 Cover and Spacing Requirements for Tables 3-2 and 3-3

Table 3-2 Minimum Number of Bars in a Single Layer (ACI 10.6)*

Bar Size	INTERIOR EXPOSURE ($z = 175$ kips/in.)										
	Beam width, b_w (in.)										
	10	12	14	16	18	20	22	24	26	28	30
#5	1	2	2	2	2	2	3	3	3	3	3
#6	1	2	2	2	2	2	3	3	3	3	3
#7	2	2	2	2	2	3	3	3	3	3	4
#8	2	2	2	2	2	3	3	3	3	4	4
#9	2	2	2	2	3	3	3	3	3	4	4
#10	2	2	2	2	3	3	3	3	4	4	4
#11	2	2	2	3	3	3	3	4	4	4	4