A2003—Method 3

Notation

A = length of clear span in short direction

B = length of clear span in long direction

C = moment coefficients for two-way slabs as given in Tables 1, 2, and 3. Coefficients have identifying indexes, such as $C_{A\ neg}$, $C_{B\ neg}$, $C_{A\ DL}$, $C_{B\ DL}$, $C_{A\ LL}$, $C_{B\ LL}$.

m = ratio of short span to long span for two-way slabs

w = uniform load per sq ft. For negative moments and shears, w is the total dead load plus live load for use in Table 1. For positive moments, w is to be separated into dead and live loads for use in Tables 2 and 3.

w_A, w_B = percentages of load w in A and B directions according to Table 4. These shall be used for computations of shear and for loadings on supports.

(a) *Limitations* — A two-way slab shall be considered as consisting of strips in each direction as follows:

A middle strip one-half panel in width, symmetrical about panel center line and extending through the panel in the direction in which moments are considered.

A column strip one-half panel in width, occupying the two quarter-panel areas outside the middle strip.

Where the ratio of short to long span is less than 0.5, the slab shall be considered as a one-way slab and is to be designed in accordance with Chapter 9 except that negative reinforcement, as required for a ratio of 0.5, shall be provided along the short edge.

At discontinuous edges, a negative moment one-third (1/3) of the postive moment is to be used.

Critical sections for moment calculations are located as follows:

For negative moment along the edges of the panel at the faces of the supports.

For positive moment, along the center lines of the panels.

(b) *Bending moments* — The bending moments for the middle strips shall be computed by the use of Tables 1, 2, and 3 from:

$$M_A = CwA^2 \quad \text{and} \quad M_B = CwB^2$$

The bending moments in the column strips shall be gradually reduced from the full value M_A and M_B from the edge of the middle strip to one-third (1/3) of these values at the edge of the panel.

Where the negative moment on one side of a support is less than 80 percent of that on the other side, the difference shall be distributed in proportion to the relative stiffnesses of the slabs.

(c) *Shear* — The shear stresses in the slab may be computed on the assumption that the load is distributed to the supports in accordance with Table 4.

(d) *Supporting beams* — The loads on the supporting beams for a two-way rectangular panel shall be computed using Table 4 for the percentages of loads in "A" and "B" directions. In no case shall the load on the beam along the short edge be less than that of an area

METHOD 3—TABLE 1—COEFFICIENTS FOR NEGATIVE MOMENTS IN SLABS*

$$\left.\begin{aligned} M_{A\ neg} &= C_{A\ neg} \times w \times A^2 \\ M_{B\ neg} &= C_{B\ neg} \times w \times B^2 \end{aligned}\right\} \text{ where } w = \text{total uniform dead plus live load}$$

Ratio $m = \frac{A}{B}$		Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8	Case 9
1.00	$C_{A\ neg}$		0.045		0.050	0.075	0.071		0.033	0.061
	$C_{B\ neg}$		0.045	0.076	0.050			0.071	0.061	0.033
0.95	$C_{A\ neg}$		0.050		0.055	0.079	0.075		0.038	0.065
	$C_{B\ neg}$		0.041	0.072	0.045			0.067	0.056	0.029
0.90	$C_{A\ neg}$		0.055		0.060	0.080	0.079		0.043	0.068
	$C_{B\ neg}$		0.037	0.070	0.040			0.062	0.052	0.025
0.85	$C_{A\ neg}$		0.060		0.066	0.082	0.083		0.049	0.072
	$C_{B\ neg}$		0.031	0.065	0.034			0.057	0.046	0.021
0.80	$C_{A\ neg}$		0.065		0.071	0.083	0.086		0.055	0.075
	$C_{B\ neg}$		0.027	0.061	0.029			0.051	0.041	0.017
0.75	$C_{A\ neg}$		0.069		0.076	0.085	0.088		0.061	0.078
	$C_{B\ neg}$		0.022	0.056	0.024			0.044	0.036	0.014
0.70	$C_{A\ neg}$		0.074		0.081	0.086	0.091		0.068	0.081
	$C_{B\ neg}$		0.017	0.050	0.019			0.038	0.029	0.011
0.65	$C_{A\ neg}$		0.077		0.085	0.087	0.093		0.074	0.083
	$C_{B\ neg}$		0.014	0.043	0.015			0.031	0.024	0.008
0.60	$C_{A\ neg}$		0.081		0.089	0.088	0.095		0.080	0.085
	$C_{B\ neg}$		0.010	0.035	0.011			0.024	0.018	0.006
0.55	$C_{A\ neg}$		0.084		0.092	0.089	0.096		0.085	0.086
	$C_{B\ neg}$		0.007	0.028	0.008			0.019	0.014	0.005
0.50	$C_{A\ neg}$		0.086		0.094	0.090	0.097		0.089	0.088
	$C_{B\ neg}$		0.006	0.022	0.006			0.014	0.010	0.003

*A cross-hatched edge indicates that the slab continues across or is fixed at the support; an unmarked edge indicates a support at which torsional resistance is negligible.

bounded by the intersection of 45-deg lines from the corners. The equivalent uniformly distributed load per linear foot on this short beam is

$$\frac{wA}{3}$$

METHOD 3—TABLE 2—COEFFICIENTS FOR DEAD LOAD POSITIVE MOMENTS IN SLABS*

$$\left.\begin{aligned} M_{A\ pos\ DL} &= C_{A\ DL} \times w \times A^2 \\ M_{B\ pos\ DL} &= C_{B\ DL} \times w \times B^2 \end{aligned}\right\} \text{ where } w = \text{total uniform dead load}$$

Ratio $m = \frac{A}{B}$		Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8	Case 9
1.00	$C_{A\ DL}$	0.036	0.018	0.018	0.027	0.027	0.033	0.027	0.020	0.023
	$C_{B\ DL}$	0.036	0.018	0.027	0.027	0.018	0.027	0.033	0.023	0.020
0.95	$C_{A\ DL}$	0.040	0.020	0.021	0.030	0.028	0.036	0.031	0.022	0.024
	$C_{B\ DL}$	0.033	0.016	0.025	0.024	0.015	0.024	0.031	0.021	0.017
0.90	$C_{A\ DL}$	0.045	0.022	0.025	0.033	0.029	0.039	0.035	0.025	0.026
	$C_{B\ DL}$	0.029	0.014	0.024	0.022	0.013	0.021	0.028	0.019	0.015
0.85	$C_{A\ DL}$	0.050	0.024	0.029	0.036	0.031	0.042	0.040	0.029	0.028
	$C_{B\ DL}$	0.026	0.012	0.022	0.019	0.011	0.017	0.025	0.017	0.013
0.80	$C_{A\ DL}$	0.056	0.026	0.034	0.039	0.032	0.045	0.045	0.032	0.029
	$C_{B\ DL}$	0.023	0.011	0.020	0.016	0.009	0.015	0.022	0.015	0.010
0.75	$C_{A\ DL}$	0.061	0.028	0.040	0.043	0.033	0.048	0.051	0.036	0.031
	$C_{B\ DL}$	0.019	0.009	0.018	0.013	0.007	0.012	0.020	0.013	0.007
0.70	$C_{A\ DL}$	0.068	0.030	0.046	0.046	0.035	0.051	0.058	0.040	0.033
	$C_{B\ DL}$	0.016	0.007	0.016	0.011	0.005	0.009	0.017	0.011	0.006
0.65	$C_{A\ DL}$	0.074	0.032	0.054	0.050	0.036	0.054	0.065	0.044	0.034
	$C_{B\ DL}$	0.013	0.006	0.014	0.009	0.004	0.007	0.014	0.009	0.005
0.60	$C_{A\ DL}$	0.081	0.034	0.062	0.053	0.037	0.056	0.073	0.048	0.036
	$C_{B\ DL}$	0.010	0.004	0.011	0.007	0.003	0.006	0.012	0.007	0.004
0.55	$C_{A\ DL}$	0.088	0.035	0.071	0.056	0.038	0.058	0.081	0.052	0.037
	$C_{B\ DL}$	0.008	0.003	0.009	0.005	0.002	0.004	0.009	0.005	0.003
0.50	$C_{A\ DL}$	0.095	0.037	0.080	0.059	0.039	0.061	0.089	0.056	0.038
	$C_{B\ DL}$	0.006	0.002	0.007	0.004	0.001	0.003	0.007	0.004	0.002

*A cross-hatched edge indicates that the slab continues across or is fixed at the support; an unmarked edge indicates a support at which torsional resistance is negligible.

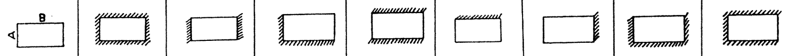
METHOD 3—TABLE 3—COEFFICIENTS FOR LIVE LOAD POSITIVE MOMENTS IN SLABS*

$$\left.\begin{aligned} M_{A\ pos\ LL} &= C_{A\ LL} \times w \times A^2 \\ M_{B\ pos\ LL} &= C_{B\ LL} \times w \times B^2 \end{aligned}\right\} \text{ where } w = \text{total uniform live load}$$

Ratio $m = \frac{A}{B}$		Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8	Case 9
1.00	$C_{A\ LL}$	0.036	0.027	0.027	0.032	0.032	0.035	0.032	0.028	0.030
	$C_{B\ LL}$	0.036	0.027	0.032	0.032	0.027	0.032	0.035	0.030	0.028
0.95	$C_{A\ LL}$	0.040	0.030	0.031	0.035	0.034	0.038	0.036	0.031	0.032
	$C_{B\ LL}$	0.033	0.025	0.029	0.029	0.024	0.029	0.032	0.027	0.025
0.90	$C_{A\ LL}$	0.045	0.034	0.035	0.039	0.037	0.042	0.040	0.035	0.036
	$C_{B\ LL}$	0.029	0.022	0.027	0.026	0.021	0.025	0.029	0.024	0.022
0.85	$C_{A\ LL}$	0.050	0.037	0.040	0.043	0.041	0.046	0.045	0.040	0.039
	$C_{B\ LL}$	0.026	0.019	0.024	0.023	0.019	0.022	0.026	0.022	0.020
0.80	$C_{A\ LL}$	0.056	0.041	0.045	0.048	0.044	0.051	0.051	0.044	0.042
	$C_{B\ LL}$	0.023	0.017	0.022	0.020	0.016	0.019	0.023	0.019	0.017
0.75	$C_{A\ LL}$	0.061	0.045	0.051	0.052	0.047	0.055	0.056	0.049	0.046
	$C_{B\ LL}$	0.019	0.014	0.019	0.016	0.013	0.016	0.020	0.016	0.013
0.70	$C_{A\ LL}$	0.068	0.049	0.057	0.057	0.051	0.060	0.063	0.054	0.050
	$C_{B\ LL}$	0.016	0.012	0.016	0.014	0.011	0.013	0.017	0.014	0.011
0.65	$C_{A\ LL}$	0.074	0.053	0.064	0.062	0.055	0.064	0.070	0.059	0.054
	$C_{B\ LL}$	0.013	0.010	0.014	0.011	0.009	0.010	0.014	0.011	0.009
0.60	$C_{A\ LL}$	0.081	0.058	0.071	0.067	0.059	0.068	0.077	0.065	0.059
	$C_{B\ LL}$	0.010	0.007	0.011	0.009	0.007	0.008	0.011	0.009	0.007
0.55	$C_{A\ LL}$	0.088	0.062	0.080	0.072	0.063	0.073	0.085	0.070	0.063
	$C_{B\ LL}$	0.008	0.006	0.009	0.007	0.005	0.006	0.009	0.007	0.006
0.50	$C_{A\ LL}$	0.095	0.066	0.088	0.077	0.067	0.078	0.092	0.076	0.067
	$C_{B\ LL}$	0.006	0.004	0.007	0.005	0.004	0.005	0.007	0.005	0.004

*A cross-hatched edge indicates that the slab continues across or is fixed at the support; an unmarked edge indicates a support at which torsional resistance is negligible.

METHOD 3—TABLE 4—RATIO OF LOAD w IN A and B DIRECTIONS FOR SHEAR IN SLAB AND LOAD ON SUPPORTS*



Ratio $m = \frac{A}{B}$		Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8	Case 9
1.00	W_A	0.50	0.50	0.17	0.50	0.83	0.71	0.29	0.33	0.67
	W_B	0.50	0.50	0.83	0.50	0.17	0.29	0.71	0.67	0.33
0.95	W_A	0.55	0.55	0.20	0.55	0.86	0.75	0.33	0.38	0.71
	W_B	0.45	0.45	0.80	0.45	0.14	0.25	0.67	0.62	0.29
0.90	W_A	0.60	0.60	0.23	0.60	0.88	0.79	0.38	0.43	0.75
	W_B	0.40	0.40	0.77	0.40	0.12	0.21	0.62	0.57	0.25
0.85	W_A	0.66	0.66	0.28	0.66	0.90	0.83	0.43	0.49	0.79
	W_B	0.34	0.34	0.72	0.34	0.10	0.17	0.57	0.51	0.21
0.80	W_A	0.71	0.71	0.33	0.71	0.92	0.86	0.49	0.55	0.83
	W_B	0.29	0.29	0.67	0.29	0.08	0.14	0.51	0.45	0.17
0.75	W_A	0.76	0.76	0.39	0.76	0.94	0.88	0.56	0.61	0.86
	W_B	0.24	0.24	0.61	0.24	0.06	0.12	0.44	0.39	0.14
0.70	W_A	0.81	0.81	0.45	0.81	0.95	0.91	0.62	0.68	0.89
	W_B	0.19	0.19	0.55	0.19	0.05	0.09	0.38	0.32	0.11
0.65	W_A	0.85	0.85	0.53	0.85	0.96	0.93	0.69	0.74	0.92
	W_B	0.15	0.15	0.47	0.15	0.04	0.07	0.31	0.26	0.08
0.60	W_A	0.89	0.89	0.61	0.89	0.97	0.95	0.76	0.80	0.94
	W_B	0.11	0.11	0.39	0.11	0.03	0.05	0.24	0.20	0.06
0.55	W_A	0.92	0.92	0.69	0.92	0.98	0.96	0.81	0.85	0.95
	W_B	0.08	0.08	0.31	0.08	0.02	0.04	0.19	0.15	0.05
0.50	W_A	0.94	0.94	0.76	0.94	0.99	0.97	0.86	0.89	0.97
	W_B	0.06	0.06	0.24	0.06	0.01	0.03	0.14	0.11	0.03

*A cross-hatched edge indicates that the slab continues across or is fixed at the support; an unmarked edge indicates a support at which torsional resistance is negligible.

METRIC EQUIVALENTS

The following is not part of this standard, but metric equivalents of all the dimensional values in this code and metric conversions of non-homogeneous equations are given below for the convenience of users.

Note that concrete strengths are based on standard 6 x 12-in. (15 x 30-cm) cylinders and steel strengths upon the minimum specified yield strength.

METRIC EQUIVALENTS OF DIMENSIONAL UNITS

Length

English	Metric
1 in.	2.54 cm
0.01 in.	0.25 mm
0.015 in.	0.38 mm
0.04 in.	1.02 mm
¼ in.	6.35 mm
⅜ in.	9.52 mm
½ in.	1.27 cm
¾ in.	1.90 cm
1⅜ in.	3.49 cm
1½ in.	3.81 cm
2 in.	5.08 cm
2½ in.	6.35 cm
3 in.	7.62 cm
3½ in.	8.89 cm
4 in.	10.16 cm
5 in.	12.70 cm
6 in.	15.24 cm
8 in.	20.32 cm
10 in.	25.40 cm
12 in.	30.5 cm
18 in.	45.7 cm
20 in.	50.8 cm
24 in.	61.0 cm
30 in.	76.2 cm
1 ft	0.3048 m
3 ft	0.914 m
10 ft	3.05 m
12 ft	3.66 m
12 ft 6 in.	3.81 m
125 ft	38.1 m

Weight*

1 lb per cu ft	0.016 t per cu m
70 lb per cu ft	1.121 t per cu m
90 lb per cu ft	1.442 t per cu m
145 lb per cu ft	2.323 t per cu m
155 lb per cu ft	2.482 t per cu m

*t = 1000 kg

Stress (pressure)

English	Metric
1 psi	0.07031 kg per sq cm
150 psi	10.5 kg per sq cm
200 psi	14.1 kg per sq cm
350 psi	24.6 kg per sq cm
500 psi	35.2 kg per sq cm
2,500 psi	176 kg per sq cm
3,000 psi	211 kg per sq cm
3,500 psi	246 kg per sq cm
4,000 psi	281 kg per sq cm
5,000 psi	352 kg per sq cm
10,000 psi	703 kg per sq cm
16,000 psi	1,125 kg per sq cm
17,000 psi	1,195 kg per sq cm
18,000 psi	1,266 kg per sq cm
19,000 psi	1,336 kg per sq cm
20,000 psi	1,406 kg per sq cm
24,000 psi	1,687 kg per sq cm
30,000 psi	2,109 kg per sq cm
33,000 psi	2,320 kg per sq cm
40,000 psi	2,812 kg per sq cm
50,000 psi	3,516 kg per sq cm
60,000 psi	4,219 kg per sq cm
75,000 psi	5,273 kg per sq cm
87,000 psi	6,117 kg per sq cm
145,000 psi	10,195 kg per sq cm
29,000,000 psi	2,039,000 kg per sq cm

Temperature

40 F	4 C
50 F	10 C
100 F	38 C
150 F	65 C