SELECTED FORMULAE AND CURVES

1. $\ell_d = K \dfrac{f_y \psi_t \psi_e \lambda}{\sqrt{f'_c}} d_b$ where the constant K is taken as follows:

	≤ No. 20 and deformed wires	> No. 20 deformed bars
Given bar spacing criteria satisfied	$\frac{12}{25} = 0.48$	$\frac{3}{5} = 0.60$
Other cases	$\frac{18}{25} = 0.72$	$\frac{9}{10} = 0.90$

2. $\ell_d = \dfrac{9}{10} \dfrac{f_y}{\sqrt{f'_c}} \dfrac{\psi_t \psi_e \psi_s \lambda}{\left(\dfrac{c_b + K_{tr}}{d_b}\right)} \times d_b$ where $\dfrac{c_b + K_{tr}}{d_b} \ngtr 2.5$

3. $K_{tr} = \dfrac{A_{tr} f_{yt}}{10 s n}$

4. If $0.2 < \alpha_{fm} \leq 2.0$, $h_{min} = \dfrac{\ell_n \left(0.8 + \dfrac{f_y}{1500}\right)}{36 + 5\beta(\alpha_{fm} - 0.2)} \geq 120$ mm

5. If $\alpha_{fm} > 2.0$, $h_{min} = \dfrac{\ell_n \left(0.8 + \dfrac{f_y}{1500}\right)}{36 + 9\beta} \geq 90$ mm

6. $\omega = \dfrac{0.85 f'_c}{f_y}$, $R = \dfrac{M_u}{b d^2}$, $\rho = \omega\left(1 - \sqrt{1 - \dfrac{2.614 R}{f'_c}}\right)$ when $\varepsilon_t \geq 0.005$

7. ***Transverse Distribution of Moments***

Let $\ell_2/\ell_1 = A$ $\quad 0.5 \leq A \leq 2.0$

$\beta_t = B$ $\quad$ If $\beta_t > 2.5$, $B = 2.5$

$\alpha_{f1} \dfrac{\ell_2}{\ell_1} = D$ $\quad$ If $\alpha_{f1} \dfrac{\ell_2}{\ell_1} > 1.0$, $D = 1.0$

Interior negative moment (%age): $75 + 30(1-A)D$

Exterior negative moment (%age): $100 - 10B + 2BD(1 - A)$

Positive moment (%age): $60 + 15(3 - 2A)D$

8. V_c for punching shear = lesser of $\dfrac{1}{6}\left(1 + \dfrac{2}{\beta}\right)\sqrt{f'_c}\, b_o d$, $\dfrac{1}{12}\left(\dfrac{\alpha_s d}{b_o} + 2\right)\sqrt{f'_c}\, b_o d$, and $\dfrac{1}{3}\sqrt{f'_c}\, b_o d$

9. For interior columns: $A_c = 2(b_1 + b_2)d$, $J_c = \dfrac{b_1 d^3}{6} + \dfrac{d b_1^3}{6} + \dfrac{d b_2 b_1^2}{2}$

For edge columns: $A_c = (2b_1 + b_2)d$, $x = b_1^2/(2b_1 + b_2)$

$$J_c = 2\left[\frac{b_1 d^3}{12} + \frac{d b_1^3}{12} + b_1 d\left(\frac{b_1}{2} - x\right)^2\right] + b_2 d x^2$$

For corner columns: $A_c = (b_1 + b_2)d$, $x = b_1^2 d / (2A_c)$

$$J_c = \frac{b_1 d^3}{12} + \frac{d b_1^3}{12} + b_1 d\left(\frac{b_1}{2} - x\right)^2 + b_2 d x^2$$

10. Slabs in EFM: $m = 0.09\left(\dfrac{c_1}{\ell_1} \times \dfrac{c_2}{\ell_2}\right)^{0.015} \alpha^{0.24} \geq 0.083$

$$k = 5.3\left(\frac{c_1}{\ell_1} \times \frac{c_2}{\ell_2}\right)^{0.05} \alpha^{0.9} \geq 4.0$$

$$COF = 0.57\left(\frac{c_1}{\ell_1} \times \frac{c_2}{\ell_2}\right)^{0.02} \alpha^{0.37} \geq 0.5$$

where $\alpha = \dfrac{\text{depth at drop panel}}{\text{depth of slab}}$

Columns in EFM: $k_a = 4.0\left(\dfrac{t_a}{t_b}\right)^{0.08}\left(\dfrac{\ell_c}{\ell_u}\right)^{2.7} \geq 4.0$

for $t_a / t_b = 0.4$ to 2.2 and ℓ_c / ℓ_u up to 1.2

$$COF_a = 0.5\frac{(\ell_c / \ell_u)}{(t_a / t_b)^{0.08}} \geq 0.5$$

11. $A_g(\text{trial}) = \dfrac{P_u + 2M_x + 2M_y}{0.43 f_c' + 0.008 f_y}$, $\dfrac{P_u + 2M_x + 2M_y}{0.50 f_c' + 0.010 f_y}$

12. $a_{n+1} = a_n - \dfrac{F(a_n)}{F'(a_n)}$

13. $P_n = \dfrac{\alpha f_c' b h}{\dfrac{eh}{d^2} + \dfrac{\alpha}{0.85}} + \dfrac{A_{st} f_y}{1 + \dfrac{2e}{d - d'}}$ where $\alpha = 0.408 - 0.00021 f_y$

14. If $e_x / b \geq e_y / h$, $e_{ox} = e_x + \alpha \dfrac{e_y}{h} b$

for $\dfrac{P_u}{f_c' A_g} \leq 0.4$, $\alpha = \left(0.5 + \dfrac{P_u}{f_c' A_g}\right)\dfrac{f_y + 300}{720} \geq 0.6$

for $\dfrac{P_u}{f_c' A_g} > 0.4$, $\alpha = \left(1.3 - \dfrac{P_u}{f_c' A_g}\right)\dfrac{f_y + 300}{720} \geq 0.5$

15. $\left(\dfrac{M_{ux}}{M_{uxo}}\right)^{\alpha} + \left(\dfrac{M_{uy}}{M_{uyo}}\right)^{\alpha} = 1.0$ where $\alpha = \log 0.5 / \log \beta$

16. $E_c = 4700\sqrt{f'_c}$ for normal weight concrete

17. $C_m = 0.6 + 0.4\,\dfrac{M_1}{M_2} \geq 0.4$ for members without transverse loads between supports

18. $T_{cr} = 0.33\sqrt{f'_c}\left(\dfrac{A_{cp}^2}{P_{cp}}\right)$; $T_n = \dfrac{2\,A_0\,A_t\,f_{yv}}{s}\cot\theta$;

19. $A_\ell = \dfrac{A_t}{s}\,\rho_h\left(\dfrac{f_{yv}}{f_{y\ell}}\right)\cot^2\theta$

20. $\sqrt{\left(\dfrac{V_u}{b_w d}\right)^2 + \left(\dfrac{T_u \rho_h}{1.7A_{oh}^2}\right)^2} \leq \phi\left(\dfrac{V_c}{b_w d} + 0.66\sqrt{f'_c}\right)$

21. V_c for one-way shear $\approx$ 1/6 $\sqrt{f'_c}\ b_w\,d$

22. $A_{\ell,\min} = \dfrac{0.42\sqrt{f'_c}A_{cp}}{f_y} - \left(\dfrac{A_t}{s}\right)p_h\dfrac{f_{yt}}{f_y}$ where A_t / s must not be less than $0.175\dfrac{b_w}{f_{yt}}$

23. $(A_v + 2\,A_t)_{\min}$ = larger of $0.062\sqrt{f'_c}\dfrac{b_w s}{f_{yt}}$ and $0.35\dfrac{b_w s}{f_{yt}}$

24. $k = \sqrt{(\rho n)^2 + 2\rho n} - \rho n$ & $k = \dfrac{nf_c}{nf_c + f_s}$

25. $A_{s,min.} = \dfrac{\sqrt{f'_c}}{4f_y}\,b_w d \geq \dfrac{1.4}{f_y}\,b_w d$

26. $\rho_b = 0.85\,\beta_1\dfrac{f'_c}{f_y}\,\dfrac{600}{f_y + 600}$, $\bar{\rho}_b = \rho_b + \rho' \times \dfrac{f'_s}{f_y}$, $\rho_{wb} = \rho_b + \rho_f$

27. $d_{min.} = \sqrt{\dfrac{M_u}{0.205\,f'_c b}}$, $\rho_{max} = 0.85\,\beta_1\dfrac{f'_c}{f_y}\,\dfrac{3}{8}$

28. $R = \dfrac{\ell_x}{\ell_y}$, slab width for interior longer beam = $\left(1 - \dfrac{R^2}{3}\right)\ell_x$

29. $\rho_{sp} = 0.45\left(\dfrac{A_g}{A_c} - 1\right)\dfrac{f'_c}{f_y}$

30. $s_{max.} = \dfrac{\pi\,d_{sp}^2\,f_y}{0.45\,D_c f'_c\left[A_g / A_c - 1\right]}$

31. $k = \dfrac{1 - 32\dfrac{m_{yn}}{q\ell_y^2}}{8\dfrac{\ell_x}{\ell_y} - 1}$

32. $m_{yp} = \dfrac{kq\ell_y^2}{32}\left[8\dfrac{\ell_x}{\ell_y} - 3 + k\right]$

33. $k_2 = \dfrac{k_1(1-\alpha^2) - 2m_{xn} / q\ell_y^2}{\alpha(2-\alpha)}$

34. $A_{s,min.} = \dfrac{\sqrt{f_c'}}{4f_y} b_w d \geq \dfrac{1.4}{f_y} b_w d$

35. $\rho_b = 0.85\, \beta_1 \dfrac{f_c'}{f_y} \dfrac{600}{f_y + 600}$, $\bar{\rho}_b = \rho_b + \rho' \times \dfrac{f_s'}{f_y}$, $\rho_{wb} = \rho_b + \rho_f$

36. $V_c = \left[0.158\sqrt{f_c'} + 17.2\rho_w \dfrac{V_u\, d}{M_u}\right] b_w d \ngtr 0.29\sqrt{f_c'}\; b_w d, \; \dfrac{V_u\, d}{M_u} \ngtr 1.0$

37. $V_n = A_{cv}\left(\dfrac{\alpha_c}{6}\sqrt{f_c'} + \rho_t f_y\right) \leq \dfrac{2}{3} A_{cv}\sqrt{f_c'} \leq \dfrac{5}{6} A_{cw}\sqrt{f_c'}$

where α_c = 2 when $h_w / \ell_w \geq 2.0$ (high-rise wall)
= 3 when $h_w / \ell_w \leq 1.5$ (low-rise wall)
= $6 - h_w / \ell_w \times 2$ when h_w / ℓ_w is between 1.5 and 2.

38. Boundary element is to be provided if $c \geq \dfrac{\ell_w}{600(\delta_u / h_w)}$

39. The minimum ratio of spiral or circular reinforcement in boundary element is:

ρ_s = larger of $0.12 \dfrac{f_c'}{f_{yt}}$ and $0.45\left(\dfrac{A_g}{A_{ch}} - 1\right)\dfrac{f_c'}{f_{yt}}$

40. The minimum ratio of rectangular hoop reinforcement in boundary element is:

$A_{sh} = 0.09\, s\, b_c \dfrac{f_c'}{f_{yt}}$

41. $\ell_{dc} = F_1 F_2 \dfrac{1}{4} \dfrac{f_y}{\sqrt{f_c'}} d_b \geq F_1 F_2 \times 0.04 f_y d_b \geq$ *200 mm*

42. The minimum lap length for splices of deformed bars in compression is as under:

$\ell = 0.07 F f_y d_b \geq 300$ mm for $f_y \leq 420$ MPa
$= (0.13 f_y - 24) F d_b \geq 300$ mm for $f_y > 420$ MPa

where F = 1 when $f_c' > 20$ MPa
= 4/3 when $f_c' \leq 20$ MPa

43. $\ell_{dh} = F_1 F_2 \dfrac{1}{4} \psi_e \lambda \dfrac{f_y}{\sqrt{f_c'}} d_b \geq 8\, d_b \geq 150$ mm

44. $\ell_d \leq K \dfrac{M_n}{V_u} + \ell_a$

45. *a)* If $\alpha_{fm} < 0.20$, the provisions for slabs without interior beams must be applied.

b) For panel with one or more discontinuous edges having edge beam with $\alpha_f < 0.8$, h_{min} is to be increased by at least 10% in that panel. This increase is not required for slabs without interior beams and is not to be applied to the upper limit of 120 and 90 mm.

Two-Way Slab Depth Without Interior Beams
The minimum thickness is greater of the following values and that given by Table:

a) Slabs without drop panels ----------------------------------- 120 mm
b) Slabs with drop panels --------------------------------------- 100 mm

Table. Minimum Slab Depth Without Interior Beams.

f_y (MPa)	Exterior panel + no drop panel + no edge beam	Exterior panel + either drop panel or edge beam (OR) Interior panel + no drop panel	Interior panel + drop panel (OR) Exterior panel + drop panel + edge beam
300	$\ell_n/33$	$\ell_n/36$	$\ell_n/40$
420	$\ell_n/30$	$\ell_n/33$	$\ell_n/36$

46. $C = \sum\left(1-0.63\frac{x}{y}\right)\frac{x^3.y}{3}$ 47. $\beta_t \cong \frac{E_{cb}C}{2E_{cs}\,I_s}$

48. Development Of Flexural Reinforcement

A. Column Strip Top Steel
   i) Half top steel should extend $0.30\,\ell_n$ beyond the face of support. This should be increased to $0.33\,\ell_n$ and 90° hooks are to be provided at ends in exterior supports, if drop panel is present.
   ii) The remainder half steel should extend $0.20\,\ell_n$ past the face of support and must end with 90° hooks in exterior supports.

B. Column Strip Bottom Steel
   All bars must be provided throughout the span, with half having 90° hooks in exterior supports over the columns.

C. Middle Strip Top Steel
   All bars must extend $0.22\,\ell_n$ past the face of support, with 90° hooks in exterior supports.

D. Middle Strip Bottom Steel
   i) Half bottom steel should extend throughout the span.
   ii) The remainder half alternate bars should extend fully to the outer edges but can curtailed at a maximum distance of $0.15\,\ell_n$ from center of the interior supports.

49. $\gamma_f = \frac{1}{1+\frac{2}{3}\sqrt{\frac{b_1}{b_2}}}$, $\gamma_v = 1 - \frac{1}{1+\frac{2}{3}\sqrt{\frac{b_1}{b_2}}}$

50. $\phi = 0.70 + \frac{0.20}{0.005-\varepsilon_y}(\varepsilon_t - \varepsilon_y)$ for spiral reinforcement

$\phi = 0.65 + \frac{0.25}{0.005-\varepsilon_y}(\varepsilon_t - \varepsilon_y)$ for lateral ties

51. $$\frac{1}{\phi P_{ni}} = \frac{1}{\phi P_{nx}} + \frac{1}{\phi P_{ny}} - \frac{1}{\phi P_o}$$

52. $$EI = \frac{E_c I_g / 5 + E_s I_{se}}{1 + \beta_d} \quad \text{or} \quad EI = \frac{0.4 E_c I_g}{1 + \beta_d}$$

53. $$Q = \frac{\sum P_u \, \Delta_o}{V_u \ell_c}$$

54. $$\delta_s = \frac{1}{1 - Q} \geq 1.0 \quad \text{or} \quad \delta_s = \frac{1}{1 - \dfrac{\sum P_u}{0.75 \sum P_c}} \geq 1.0$$

55. $$\delta_{ns} = \frac{1}{1 - \dfrac{P_u}{0.75 P_c}} \geq 1.0$$

56. $$\phi \mathrm{P}_n = \phi \, 0.85 f'_c A_1 \sqrt{A_2 / A_1} \leq \phi \, 0.85 f'_c A_1 \times 2.0$$

57. Area of steel required for dowels within the footing $= \dfrac{P_u - \phi P_n}{\phi f_y}$, where $\phi = 0.65$

58. Area of steel required for dowels within the column $= \dfrac{P_u - \phi 0.85 f'_c A_g}{\phi f_y}$

59. $$h_{min} = 45 \frac{P + M_x + M_y}{\alpha_s \sqrt{A_c f'_c}} + 60 \text{ mm} \geq 250 \text{ mm}$$

60. Reinforcement ratio in central band $= \dfrac{2}{\beta + 1}$

61. $$e_{kx} = \frac{1}{\dfrac{6 e_y}{B e_x} + \dfrac{6}{L}} \quad \text{and} \quad e_{ky} = \frac{1}{\dfrac{6 e_x}{L e_y} + \dfrac{6}{B}}$$

62.

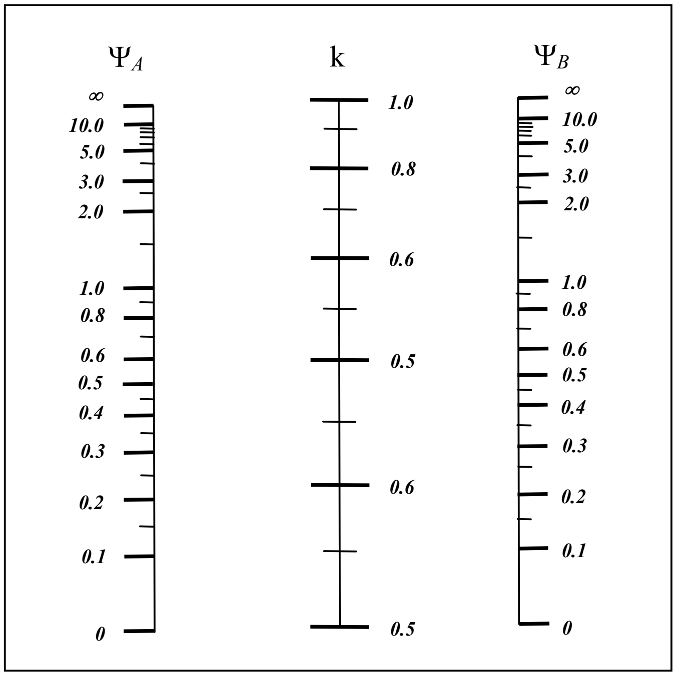


Fig. Effective Length Factor For Braced Columns.

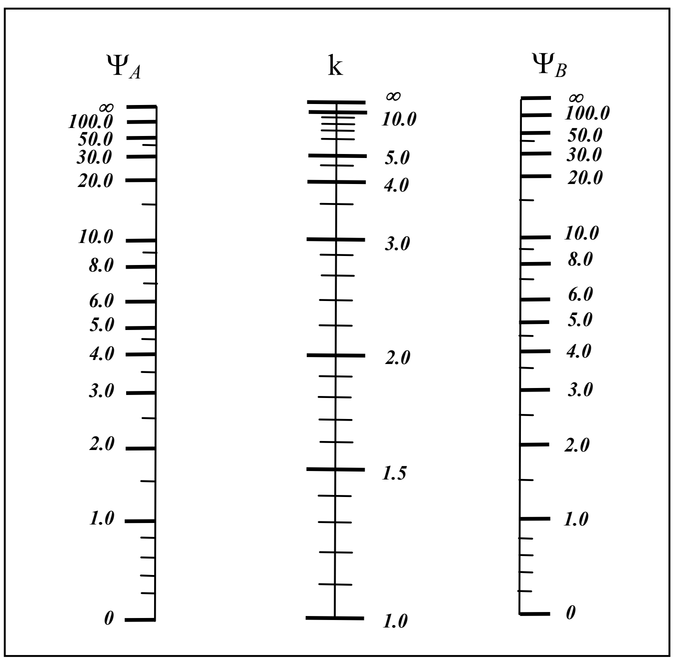


Fig. Effective Length Factor For Unbraced Columns.

63.

Standard US Customary Reinforcing Bars.

US Designation Number	***Nominal Diameter (mm) SI Designation Number***	***Nominal Area (mm^2)***	***Nominal Mass (kgs/m)***
*2	6	32	0.248
3	10	71	0.560
4	13	129	0.994
5	16	199	1.552
6	19	284	2.235
7	22	387	3.042
8	25	510	3.973
9	29	645	5.060
10	32	819	6.404
11	36	1006	7.907
14	43	1452	11.38
18	57	2581	20.24

* This diameter is not a standard bar diameter.

64.

Cross Sectional Area Of US Customary Bars Per Meter Width (mm^2/m)

Bar Spacing (mm)	Bar Number				
	6	10	13	16	19
100	320	710	1300	2000	2850
120	267	592	1083	1667	2375
130	246	546	1000	1538	2192
140	229	507	929	1429	2036
150	213	473	867	1333	1900
160	200	444	813	1250	1781
170	188	418	765	1176	1676
180	178	394	722	1111	1583
190	168	374	684	1053	1500
200	160	355	650	1000	1425
225	142	316	578	889	1267
250	128	284	520	800	1140
275	116	258	473	727	1036
300	107	237	433	667	950
350	91	203	371	571	814
400	80	178	325	500	713
450	71	158	289	444	633

65. $I_e = \left(\frac{M_{cr}}{M_a}\right)^3 I_g + \left[1 - \left(\frac{M_{cr}}{M_a}\right)^3\right] I_{cr} \le I_g$

66. $M_{cr} = \frac{f_r I_g}{y_t}$, $f_r = \frac{5}{8}\sqrt{f'_c}$, $\lambda = \frac{\xi}{1+50\rho'}$

67. $V_c = \left[0.158\sqrt{f'_c} + 17.2\rho_w \frac{V_u d}{M_u}\right] b_w d \not> 0.29\sqrt{f'_c}\ b_w d$, $\frac{V_u d}{M_u} \not> 1.0$

68. $A_f\ (kg/m^3) = \gamma_f\ [1000 - \left(W + \frac{C}{\gamma} + \frac{A_c}{\gamma_c} + 10A\right)$

69. Table: Moment and shear values using ACI coefficients.

1. Positive Moment:	
End spans:	
If discontinuous end is unrestrained	$\frac{1}{11} w_u \ell_n^2$
If discontinuous end is integral with the support	$\frac{1}{14} w_u \ell_n^2$
Interior spans:	$\frac{1}{16} w_u \ell_n^2$
2. Negative moment at exterior face of first interior support:	
Two spans	$\frac{1}{9} w_u \ell_n^2$
More than two spans	$\frac{1}{10} w_u \ell_n^2$
3. Negative moment at other faces of interior supports	$\frac{1}{11} w_u \ell_n^2$
(ℓ_n in no. 3 is the average of clear spans of the two adjacent panels.)	
4. Negative moment at face of all supports for (1) slabs with spans not exceeding 3m and (2) beams and girders where ratio of sum of column stiffness to beam stiffness exceeds 8 at each end of the span.	$\frac{1}{12} w_u \ell_n^2$
5. Negative moment at interior faces of exterior supports for members built Integrally with their supports:	
Where the support is a spandrel beam or girder	$\frac{1}{24} w_u \ell_n^2$
Where the support is a column	$\frac{1}{16} w_u \ell_n^2$
6. Shear in end members at first interior support	$1.15 \frac{w_u \ell_n}{2}$
7. Shear at all other supports	$\frac{w_u \ell_n}{2}$

70. Table: Minimum Depth of Beams and One-Way Slabs

Member	Steel Grade	Simply Supported	One End Continuous	Both Ends Continuous	Cantilever
Solid One-Way Slabs	300	$\ell/25$	$\ell/30$	$\ell/35$	$\ell/12$
	420	$\ell/20$	$\ell/24$	$\ell/28$	$\ell/10$
Beams	300	$\ell/20$	$\ell/23$	$\ell/26$	$\ell/10$
	420	$\ell/16$	$\ell/18.5$	$\ell/21$	$\ell/8$
	515	$\ell/14$	$\ell/16$	$\ell/18$	$\ell/7$

71. Table: BS 8110 Requirements For Durability.

Environment	Exposure Condition	Maximum Free Water/ Cementitious Material Ratio	Minimum Content of Cementitious Material (kg/m^3) for Following Max. Size 0f Aggregate (mm)				Average Cylinder Strength (MPa)
			40	20	14	10	
Mild	Concrete surfaces protected against weather or aggressive conditions.	0.80	150	180	200	220	15
Moderate	Concrete surfaces sheltered from severe rain or freezing whilst wet. Concrete surface continuously under water or in contact with non-aggressive soil	0.65	245	275	295	315	24
Severe	Concrete surfaces exposed to severe rain alternating wetting and drying or occasional freezing.	0.60	270	300	320	340	27
Very severe	Concrete surface exposed to sea water spray, de-icing salts, corrosive fumes or severe freezing conditions.	0.55	295	325	345	365	30 with entrained air
Extreme	Concrete surfaces exposed to abrasive action by sea water carrying solids or flowing water with pH $\leq$ 4.5 or machinery or vehicles.	0.50	320	350	370	390	36

72. Table: ACI Requirements Against Sulphate Attack.

Sulphate Exposure	Water-Soluble Sulphate (SO_4) in Soil (percent by mass)	Sulpahte (SO_4) in Water (ppm)	Type of Cement	Maximum Free Water / Cement Ratio For Normal Weight Aggregate Concrete
Negligible	0.00 – 0.10	0 – 150	No limitation	No limitation
Moderate (sea water)	0.10 – 0.20	150 – 1500	Modified (Type II) Portland-pozzolan, Portland blast furnace	0.50
Severe	0.20 – 2.00	1500 – 10000	Sulphate-resisting Portland (Type V)	0.45
Very severe	over 2.00	over 10,000	Sulphate-resisting Portland plus fly ash or other pozzolan	0.45

73. Table: Relation Between Water / Cement Ratio and Average Compressive Strength of Concrete.

Average Compressive Strength at 28 days (MPa)	Effective Water / Cement Ratio by Mass for Non-Air-Entrained Concrete
45	0.38
40	0.43
35	0.48
30	0.55
25	0.62
20	0.70
15	0.80

74. Table: Approximate Water requirements.

Workability (slump)	Water Content (kg/m^3) of Concrete for Maximum Aggregate Size (mm) for Non-Air-Entrained Concrete				
	10	12.5	20	25	40
30 – 50	205	200	185	180	160
80 – 100	225	215	200	195	175
150 – 180	240	230	210	205	185
Approximate Entrapped Air Content, percent	3	2.5	2	1.5	1
Recommended Average Air Content Percent for:					
Mild Exposure	4.5	4.0	3.5	3.0	2.5
Moderate Exposure	6.0	5.5	5.0	4.5	4.5
Extreme Exposure	7.5	7.0	6.0	6.0	5.5

75. Table: Required Amount of Coarse Aggregate, ACI 211.1 Modified For Less Fineness Modulus.

Maximum Size of Aggregate (mm)	Dry Bulk Volume of Rodded Coarse Aggregate Per Unit Volume of Concrete for Fineness Modulus of Sand of:					
	2.0	2.2	2.4	2.6	2.8	3.0
10	0.54	0.52	0.50	0.48	0.46	0.44
12.5	0.63	0.61	0.59	0.57	0.55	0.53
20	0.70	0.68	0.66	0.64	0.62	0.60
25	0.75	0.73	0.71	0.69	0.67	0.65
40	0.79	0.77	0.75	0.73	0.71	0.69
50	0.82	0.80	0.78	0.76	0.74	0.72
70	0.85	0.84	0.82	0.80	0.78	0.76
150	0.89	0.88	0.87	0.85	0.83	0.81

76. Longitudinal Distribution of Moments

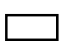
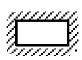
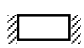
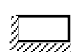
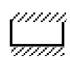
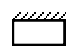
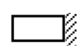
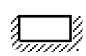
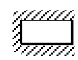
Factored M^- at supports = 0.65 M_o

Factored M^+ at mid-span = 0.35 M_o

	Exterior edge unrestrained, with no beams	Slab with beams between all supports	Slab with edge beams, but without interior beams
	(1)	(2)	(3)
Int. M^-	0.75	0.70	0.70
M^+	0.63	0.57	0.52
Ext. M^-	0	0.16	0.26

77. $$P_u = \frac{P_o}{1 + \left(\frac{P_o}{P_b} - 1 \right) \frac{e}{e_b}}$$

78 - Table. ACI 1963 Coefficients For Dead Load Positive Moments In Slabs Increased by 25%.

Ratio m		Case 1 	Case 2 	Case 3 	Case 4 	Case 5 	Case 6 	Case 7 	Case 8 	Case 9 
1.00	C_x	0.045	0.023	0.023	0.034	0.034	0.041	0.034	0.025	0.029
	C_y	0.045	0.023	0.034	0.034	0.023	0.034	0.038	0.029	0.025
0.95	C_x	0.050	0.025	0.026	0.038	0.035	0.045	0.039	0.028	0.030
	C_y	0.041	0.020	0.031	0.030	0.019	0.030	0.039	0.026	0.021
0.90	C_x	0.056	0.028	0.031	0.041	0.036	0.049	0.044	0.031	0.033
	C_y	0.036	0.018	0.030	0.028	0.016	0.026	0.035	0.024	0.019
0.85	C_x	0.063	0.030	0.036	0.045	0.039	0.053	0.050	0.036	0.035
	C_y	0.033	0.015	0.028	0.024	0.014	0.021	0.031	0.021	0.016
0.80	C_x	0.070	0.033	0.043	0.049	0.040	0.056	0.056	0.040	0.036
	C_y	0.029	0.014	0.025	0.020	0.011	0.019	0.028	0.019	0.013
0.75	C_x	0.076	0.035	0.050	0.054	0.041	0.060	0.064	0.045	0.039
	C_y	0.024	0.011	0.023	0.016	0.009	0.015	0.025	0.016	0.009
0.70	C_x	0.085	0.038	0.058	0.058	0.044	0.064	0.073	0.050	0.041
	C_y	0.020	0.009	0.020	0.014	0.006	0.011	0.021	0.014	0.008
0.65	C_x	0.093	0.040	0.068	0.063	0.045	0.068	0.081	0.055	0.043
	C_y	0.016	0.008	0.018	0.011	0.005	0.009	0.018	0.011	0.006
0.60	C_x	0.101	0.043	0.078	0.066	0.046	0.070	0.091	0.060	0.045
	C_y	0.013	0.005	0.014	0.009	0.004	0.008	0.015	0.009	0.005
0.55	C_x	0.110	0.044	0.089	0.070	0.048	0.073	0.101	0.065	0.046
	C_y	0.010	0.004	0.011	0.006	0.003	0.005	0.011	0.006	0.004
0.5	C_x	0.119	0.046	0.100	0.074	0.049	0.076	0.111	0.070	0.048
	C_y	0.008	0.003	0.009	0.005	0.001	0.004	0.009	0.005	0.003

79.

Table. ACI 1963 Coefficients For Live Load Positive Moments In Slabs Increased by 25%.

		Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8	Case 9
1.00	C_x	0.045	0.034	0.034	0.040	0.040	0.044	0.040	0.035	0.038
	C_y	0.045	0.034	0.040	0.040	0.034	0.040	0.044	0.038	0.035
0.95	C_x	0.050	0.038	0.039	0.044	0.043	0.048	0.045	0.039	0.040
	C_y	0.041	0.031	0.036	0.036	0.030	0.036	0.040	0.034	0.031
0.90	C_x	0.056	0.043	0.044	0.049	0.046	0.053	0.050	0.044	0.045
	C_y	0.036	0.028	0.034	0.033	0.026	0.031	0.036	0.030	0.028
0.85	C_x	0.063	0.046	0.050	0.054	0.051	0.058	0.056	0.050	0.049
	C_y	0.033	0.024	0.030	0.029	0.024	0.028	0.033	0.028	0.025
0.80	C_x	0.070	0.051	0.056	0.060	0.055	0.064	0.064	0.055	0.053
	C_y	0.029	0.021	0.028	0.025	0.020	0.024	0.029	0.024	0.021
0.75	C_x	0.076	0.056	0.064	0.065	0.059	0.069	0.070	0.061	0.058
	C_y	0.024	0.018	0.024	0.020	0.016	0.020	0.025	0.020	0.016

80.

Table. ACI 1963 Coefficients For Live Load Positive Moments In Slabs Increased by 25%.

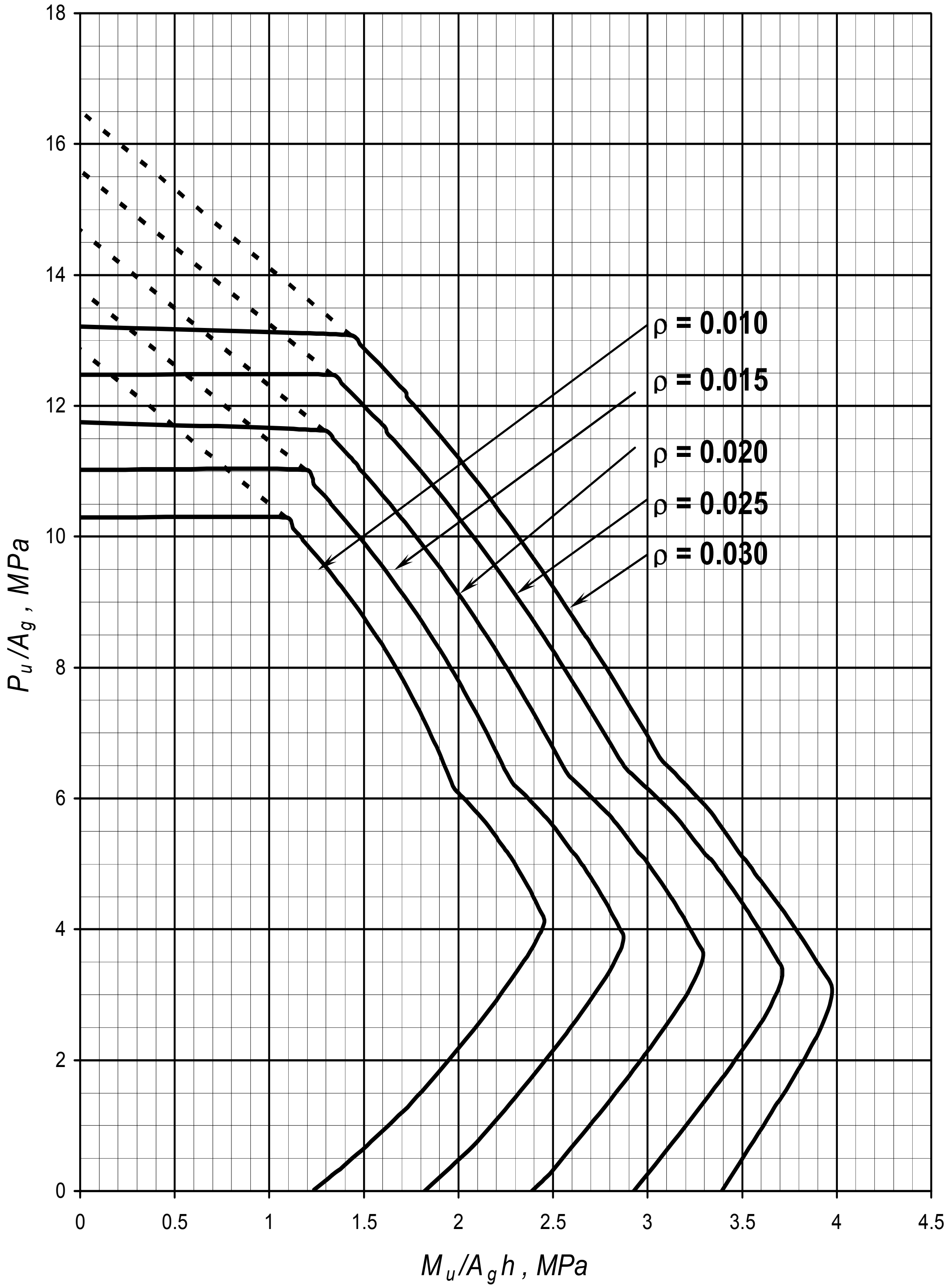
		Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8	Case 9
0.70	C_x	0.085	0.061	0.071	0.071	0.064	0.075	0.079	0.068	0.063
	C_y	0.020	0.015	0.020	0.018	0.014	0.016	0.021	0.018	0.014
0.65	C_x	0.093	0.066	0.080	0.078	0.069	0.080	0.088	0.074	0.068
	C_y	0.016	0.013	0.018	0.014	0.011	0.013	0.018	0.014	0.011
0.60	C_x	0.101	0.073	0.089	0.084	0.074	0.085	0.096	0.081	0.074
	C_y	0.013	0.009	0.014	0.011	0.009	0.010	0.014	0.011	0.009
0.55	C_x	0.110	0.078	0.100	0.090	0.079	0.091	0.106	0.088	0.079
	C_y	0.010	0.008	0.011	0.009	0.006	0.008	0.011	0.009	0.008
0.5	C_x	0.119	0.083	0.110	0.096	0.084	0.098	0.115	0.095	0.084
	C_y	0.008	0.005	0.009	0.006	0.005	0.006	0.009	0.063	0.005

81.

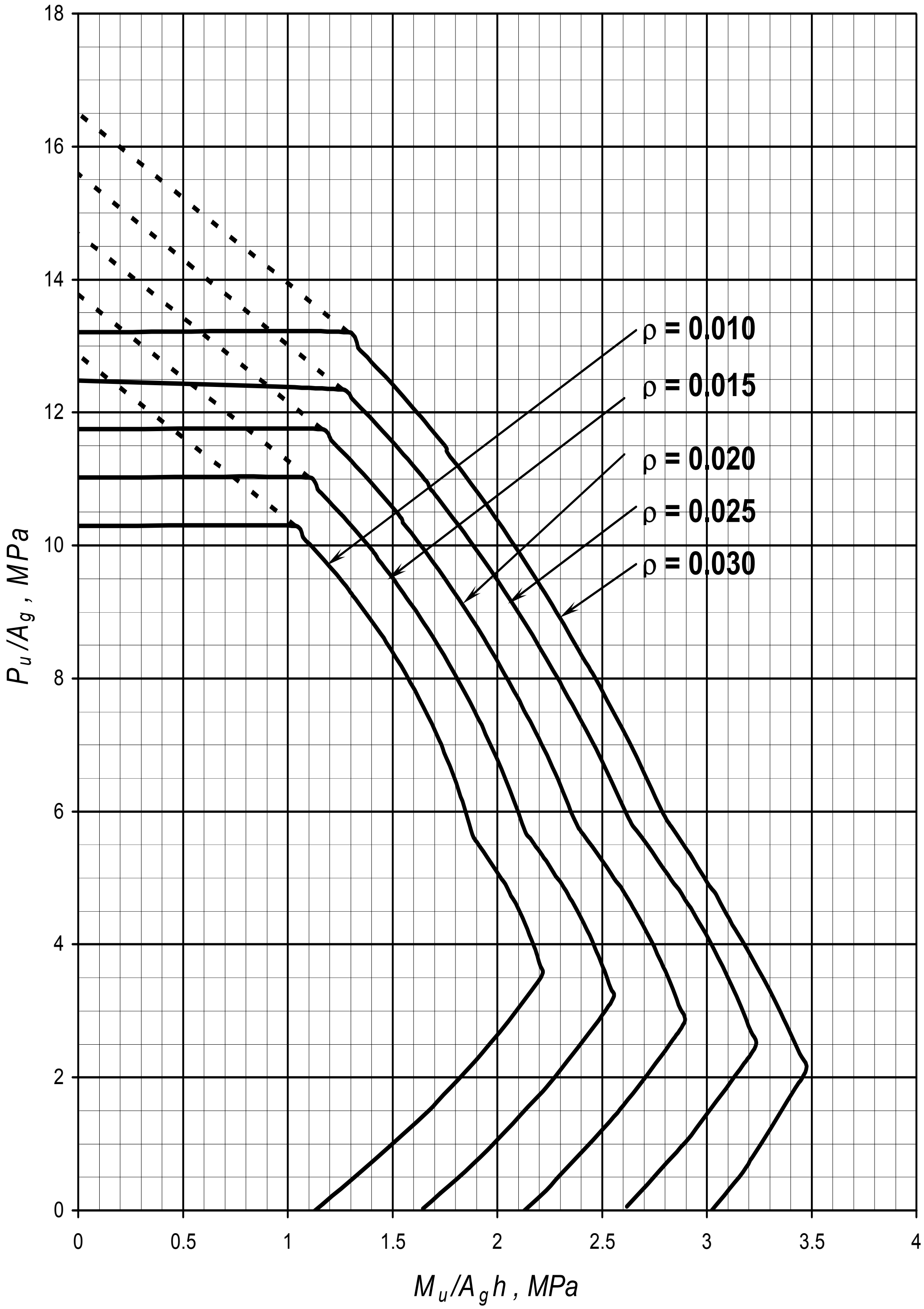
Table. ACI 1963 Coefficients For Negative Moments In Slabs Decreased by 10%.

		Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8	Case 9
1.00	C_x	—	0.041	—	0.045	0.068	0.064	—	0.030	0.055
	C_y	—	0.041	0.068	0.045	—	—	0.064	0.055	0.030
0.95	C_x	—	0.045	—	0.050	0.071	0.068	—	0.034	0.059
	C_y	—	0.037	0.065	0.041	—	—	0.060	0.050	0.026
0.90	C_x	—	0.050	—	0.054	0.072	0.071	—	0.039	0.061
	C_y	—	0.033	0.063	0.036	—	—	0.056	0.047	0.023
0.85	C_x	—	0.054	—	0.059	0.074	0.075	—	0.044	0.065
	C_y	—	0.028	0.059	0.031	—	—	0.051	0.041	0.019
0.80	C_x	—	0.059	—	0.064	0.075	0.077	—	0.050	0.068
	C_y	—	0.024	0.055	0.026	—	—	0.046	0.037	0.015
0.75	C_x	—	0.062	—	0.068	0.077	0.079	—	0.055	0.070
	C_y	—	0.020	0.050	0.022	—	—	0.040	0.032	0.013
0.70	C_x	—	0.067	—	0.073	0.077	0.082	—	0.061	0.073
	C_y	—	0.015	0.045	0.017	—	—	0.034	0.026	0.010
0.65	C_x	—	0.069	—	0.077	0.078	0.084	—	0.067	0.075
	C_y	—	0.013	0.039	0.014	—	—	0.028	0.022	0.007
0.60	C_x	—	0.073	—	0.080	0.079	0.086	—	0.072	0.077
	C_y	—	0.009	0.032	0.010	—	—	0.022	0.016	0.005
0.55	C_x	—	0.076	—	0.083	0.080	0.086	—	0.077	0.077
	C_y	—	0.006	0.025	0.007	—	—	0.017	0.013	0.005
0.5	C_x	—	0.077	—	0.085	0.081	0.087	—	0.080	0.079
	C_y	—	0.005	0.020	0.005	—	—	0.013	0.009	0.003

82. $f_c' = 20\ MPa : f_y = 300\ MPa\ ;\ \gamma = 0.9$



83. $f_c{}' = 20\ MPa : f_y = 300\ MPa\ ;\ \gamma = 0.75$



84. $f_c' = 20\ MPa : f_y = 300\ MPa\ ;\ \gamma = 0.6$