DIAGRAM FOR REINFORCED CONCRETE.

LIST OF SYMBOLS

A	Area.
A	Total cross-sectional area of a pillar.
A_I	Area of concrete.
A_L	Cross-sectional area of longitudinal steel rods in a pillar.
A_H	Cross-sectional area of a hooped reinforcing rod in a pillar.
A_E	Equivalent area.
A_C	Area of compressive reinforcement in beams.
A_T	Area of tensile reinforcement in beams.
A_S	Area of shear reinforcement.
A_t	Total area.
a	Buckling factor of a column.
B_b	Ratio I/l for beams, i.e. a measure of stiffness.
B_c	Ratio I/l for column.
b	Breadth.
b	Breadth of rectangular beam.
b_r	Breadth of the rib in a T-beam.
b_s	Effective breadth of the slab in a T-beam.
C	Total compressive force or stress.

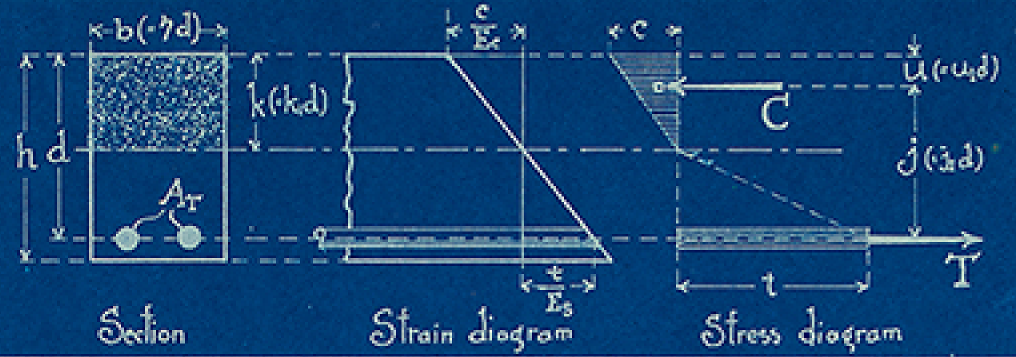
C_c	Total compression on concrete.
C_s	Total compression on steel.
e	Compressive stress intensity.
c	Compressive stress intensity on concrete.
c_p	Compressive stress in column not hooped.
c'	Minimum compressive stress in concrete for combined bending and direct load.
c_s	Compressive stress intensity on steel.
c_r	Ratio c_s/c.
c_s'	Minimum compressive stress in steel for combined bending and direct load.
c^1	compressive stress intencity in long column.
d	Depth.
d	Effective depth of a beam from top of a beam to axis of tensile reinforcement.
d_s	Total depth of a slab in a T-beam.
d_c	Depth or distance of the centre of compressive reinforcement from the compressed edge.
d'	Distance of the centre of reinforcement from any edge.
d	Any diameter.
d	Outside diameter.
d_i	Insid diameter.

d_k	Diameter of the core of a pillar with hooped reinforcement.
d_l	Diameter of a longitudinal reinforcing rod of a pillar.
d_h	Diameter of a herical reinforcing rod of a pillar.
d_b	Diameter of stirrup bar.
E	Elastic modulus of any materials.
E_c	Elastic modulus of concrete in compression.
E_s	Elastic modulus of steel.
e	Eccentricity of any load.
e_c	Unit elongation of concrete.
e_s	Unit elongation of steel.
F	Total friction between any two surfaces.
f	Friction or adhesion between surfaces in unit of force per unit of area.
f	Intensity of stress (general)
f	Fiber stress intensity.
f_c	Compressive stress intensity.
f_t	Tensile stress intensity.
f_{bs}	Bearing stress intensity.
f_u	Intensity of ultimate stress.
g	Gravity.

H	Horizontal component of force.
h	Intensity of horizontal shearing stress.
h	Any height.
h	Total height of beam.
I	Inertia moment.
I_x	Inertia moment on axis XX.
I_Y	Inertia moment on axis YY.
I_S	Inertia moment for steel.
I_C	Inertia moment for concrete.
I_E	Inertia moment for equivalent section.
I_N	Inertia moment on neutral axis.
I_G	Inertia moment on gravity axis.
i	Radius of gyration.
j	Arm of any couple, i.e. distance between two parallel force of equal magnitude, but acting in opposite directions.
j	Arm of the couple formed by the compressive and tensile forces in beam.
j_1	Ratio j/d.
K	A constant.

TABLE I

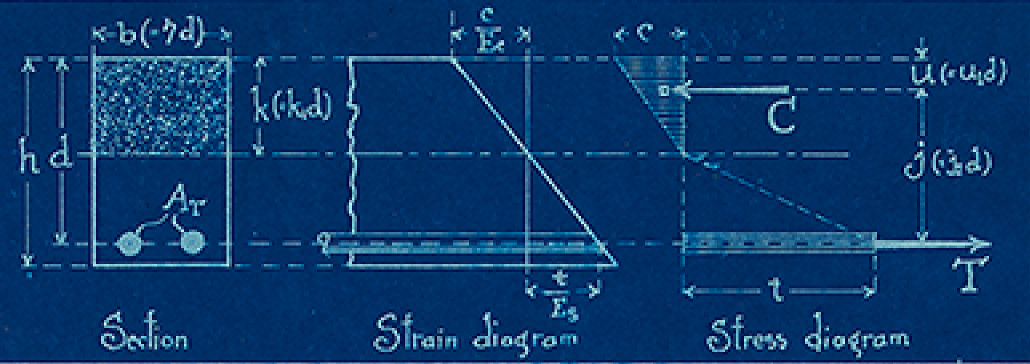
FORMULÆ FOR RECTANGULAR BEAM.



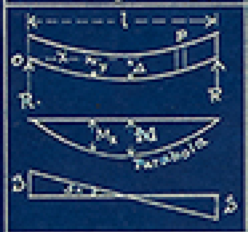
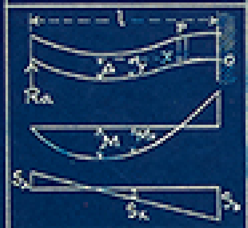
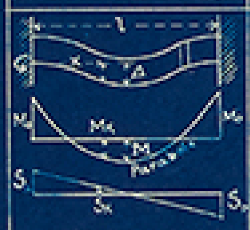
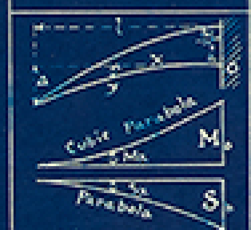
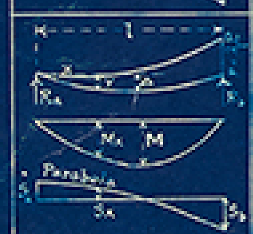
r	$\frac{A_r}{bd}$	$\frac{m}{2t_1(t_1+m)}$			1
t_1	$\frac{t}{c}$	$\frac{m}{2}\left(\sqrt{1+\frac{2}{mr}}-1\right)$			1′
k	k_1d	$\frac{m}{t_1+m}\cdot d$			2
		$mr\left(\sqrt{1+\frac{2}{mr}}-1\right)\cdot d$			2′
u	u_1d	$\frac{k_1}{3}\cdot d$	$\frac{m}{3(t_1+m)}\cdot d$		3
			$\frac{mr}{3}\left(\sqrt{1+\frac{2}{mr}}-1\right)\cdot d$		3′
j	j_1d	$(1-u_1)\cdot d$	$\left(1-\frac{k_1}{3}\right)\cdot d$	$\frac{3t_1+2m}{3(t_1+m)}\cdot d$	4
				$\left\{1-\frac{mr}{3}\left(\sqrt{1+\frac{2}{mr}}-1\right)\right\}\cdot d$	4′
A_r	rbd	$\frac{1}{j_1\cdot t}\cdot\frac{M}{d}$	$\frac{1}{\left(1-\frac{k_1}{3}\right)\cdot t}\cdot\frac{M}{d}$	$\frac{3(t_1+m)}{(3t_1+2m)\cdot t}\cdot\frac{M}{d}$	5
				$\frac{1}{\left\{1-\frac{mr}{3}(\sqrt{1+2/mr}-1)\right\}\cdot t}\cdot\frac{M}{d}$	5′
		$\frac{1}{t_1j_1\cdot c}\cdot\frac{M}{d}$	$\frac{1}{t_1\left(1-\frac{k_1}{3}\right)\cdot c}\cdot\frac{M}{d}$	$\frac{3(t_1+m)}{t_1(3t_1+2m)\cdot c}\cdot\frac{M}{d}$	6
				$\frac{1}{t_1\left\{1-\frac{mr}{3}(\sqrt{1+2/mr}-1)\right\}\cdot c}\cdot\frac{M}{d}$	6′
d	$\sqrt{\frac{M}{N_1b}}$	$\sqrt{\frac{1}{rj_1\cdot t}\cdot\frac{M}{b}}$	$\sqrt{\frac{1}{r\left(1-\frac{k_1}{3}\right)\cdot t}\cdot\frac{M}{b}}$	$\sqrt{\frac{6t_1(t_1+m)^2}{m(3t_1+2m)\cdot t}\cdot\frac{M}{b}}$	7
				————	
		$\sqrt{\frac{2}{k_1j_1\cdot c}\cdot\frac{M}{b}}$	$\sqrt{\frac{2}{k_1\left(1-\frac{k_1}{3}\right)\cdot c}\cdot\frac{M}{b}}$	$\sqrt{\frac{6(t_1+m)^2}{m(3t_1+2m)\cdot c}\cdot\frac{M}{b}}$	8
				————	
b	$\frac{M}{N_1d^2}$	$\frac{1}{rj_1\cdot t}\cdot\frac{M}{d^2}$	$\frac{1}{r\left(1-\frac{k_1}{3}\right)\cdot t}\cdot\frac{M}{d^2}$	$\frac{6t_1(t_1+m)^2}{m(3t_1+2m)\cdot t}\cdot\frac{M}{d^2}$	9
				————	
		$\frac{2}{k_1j_1\cdot c}\cdot\frac{M}{d^2}$	$\frac{2}{k_1\left(1-\frac{k_1}{3}\right)\cdot c}\cdot\frac{M}{d^2}$	$\frac{6(t_1+m)^2}{m(3t_1+2m)\cdot c}\cdot\frac{M}{d^2}$	10
				————	
$\left(\frac{b}{d}=\eta\right)$ d $(b=\eta d)$	$\sqrt[3]{\frac{M}{N_1\eta}}$	$\sqrt[3]{\frac{1}{rj_1\cdot t}\cdot\frac{M}{\eta}}$	$\sqrt[3]{\frac{1}{r\left(1-\frac{k_1}{3}\right)\cdot t}\cdot\frac{M}{\eta}}$	$\sqrt[3]{\frac{6t_1(t_1+m)^2}{m(3t_1+2m)\cdot t}\cdot\frac{M}{\eta}}$	11
				————	
		$\sqrt[3]{\frac{2}{k_1j_1\cdot c}\cdot\frac{M}{\eta}}$	$\sqrt[3]{\frac{2}{k_1\left(1-\frac{k_1}{3}\right)\cdot c}\cdot\frac{M}{\eta}}$	$\sqrt[3]{\frac{6(t_1+m)^2}{m(3t_1+2m)\cdot c}\cdot\frac{M}{\eta}}$	12
				————	
t	t_1c	$\frac{1}{rj_1}\cdot\frac{M}{bd^2}$	$\frac{1}{r(1-k_1/3)}\cdot\frac{M}{bd^2}$	$\frac{3}{mr^2(2-\sqrt{1+2/mr})}\cdot\frac{M}{bd^2}$	13
c	$\frac{t}{t_1}$	$\frac{2}{k_1j_1}\cdot\frac{M}{bd^2}$	$\frac{2}{k_1(1-k_1/3)}\cdot\frac{M}{bd^2}$	$\frac{3(\sqrt{1+2/mr}-1)}{2r^2(2-\sqrt{1+2/mr})}\cdot\frac{M}{bd^2}$	14
T & C	$\frac{M}{j}$	$\frac{1}{j_1}\cdot\frac{M}{d}$	$\frac{1}{(1-k_1/3)}\cdot\frac{M}{d}$	$\frac{3(t_1+m)}{3t_1+2m}\cdot\frac{M}{d}$	15
				$\frac{1}{1-\frac{mr}{3}(\sqrt{1+2/mr}-1)}\cdot\frac{M}{d}$	15′
M	Tj	$rj_1\cdot t\cdot bd^2$	$r\left(1-\frac{k_1}{3}\right)\cdot t\cdot bd^2$	$\frac{3t_1+2m}{6t_1(t_1+m)^2}m\cdot t\cdot bd^2$	16
				————	
	Cj	$\frac{1}{2}k_1j_1\cdot c\cdot bd^2$	$\left\{\frac{k_1}{2}\left(1-\frac{k_1}{3}\right)\right\}\cdot c\cdot bd^2$	$\frac{3t_1+2m}{6(t_1+m)^2}m\cdot c\cdot bd^2$	17
				————	
		a	b		

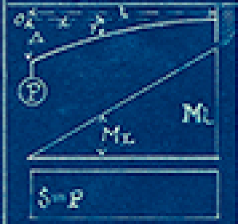
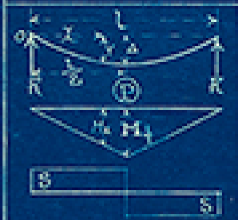
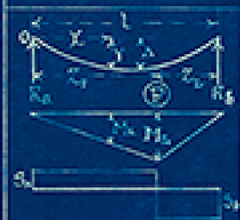
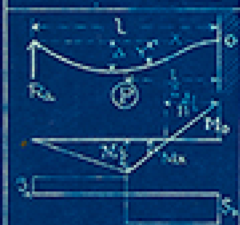
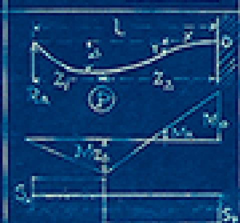
TABLE I

FORMULÆ FOR RECTANGULAR BEAM.

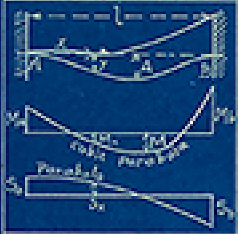
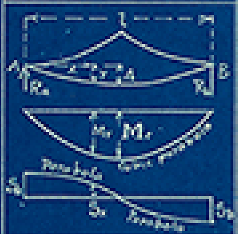
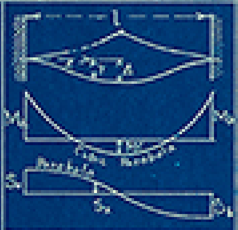
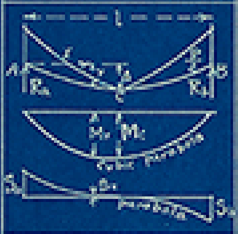
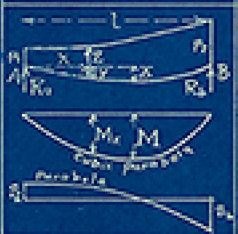


r	$\frac{A_r}{bd}$	$\frac{m}{2t_1(t_1+m)}$			1
t_1	$\frac{t}{c}$	$\frac{m}{2}\left(\sqrt{1+\frac{2}{mr}}-1\right)$			1′
k	k_1d	$\frac{m}{t_1+m}\cdot d$			2
		$mr\left(\sqrt{1+\frac{2}{mr}}-1\right)\cdot d$			2′
u	u_1d	$\frac{k_1}{3}\cdot d$	$\frac{m}{3(t_1+m)}\cdot d$		3
			$\frac{mr}{3}\left(\sqrt{1+\frac{2}{mr}}-1\right)\cdot d$		3′
j	j_1d	$(1-u_1)\cdot d$	$\left(1-\frac{k_1}{3}\right)\cdot d$	$\frac{3t_1+2m}{3(t_1+m)}\cdot d$	4
				$\left\{1-\frac{mr}{3}\left(\sqrt{1+\frac{2}{mr}}-1\right)\right\}\cdot d$	4′
A_r	rbd	$\frac{1}{j_1\cdot t}\cdot\frac{M}{d}$	$\frac{1}{(1-\frac{k_1}{3})\cdot t}\cdot\frac{M}{d}$	$\frac{3(t_1+m)}{(3t_1+2m)\cdot t}\cdot\frac{M}{d}$	5
				$\frac{1}{\{1-\frac{mr}{3}(\sqrt{1+2/mr}-1)\}\cdot t}\cdot\frac{M}{d}$	5′
		$\frac{1}{t_1j_1\cdot c}\cdot\frac{M}{d}$	$\frac{1}{t_1(1-\frac{k_1}{3})\cdot c}\cdot\frac{M}{d}$	$\frac{3(t_1+m)}{t_1(3t_1+2m)\cdot c}\cdot\frac{M}{d}$	6
				$\frac{1}{t_1\{1-\frac{mr}{3}(\sqrt{1+2/mr}-1)\}\cdot c}\cdot\frac{M}{d}$	6′
d	$\sqrt{\frac{M}{N_1b}}$	$\sqrt{\frac{1}{rj_1\cdot t}\cdot\frac{M}{b}}$	$\sqrt{\frac{1}{r(1-\frac{k_1}{3})\cdot t}\cdot\frac{M}{b}}$	$\sqrt{\frac{6t_1(t_1+m)^2}{m(3t_1+2m)\cdot t}\cdot\frac{M}{b}}$	7
		$\sqrt{\frac{2}{k_1j_1\cdot c}\cdot\frac{M}{b}}$	$\sqrt{\frac{2}{k_1(1-\frac{k_1}{3})\cdot c}\cdot\frac{M}{b}}$	$\sqrt{\frac{6(t_1+m)^2}{m(3t_1+2m)\cdot c}\cdot\frac{M}{b}}$	8
b	$\frac{M}{N_1d^2}$	$\frac{1}{rj_1\cdot t}\cdot\frac{M}{d^2}$	$\frac{1}{r(1-\frac{k_1}{3})\cdot t}\cdot\frac{M}{d^2}$	$\frac{6t_1(t_1+m)^2}{m(3t_1+2m)\cdot t}\cdot\frac{M}{d^2}$	9
		$\frac{2}{k_1j_1\cdot c}\cdot\frac{M}{d^2}$	$\frac{2}{k_1(1-\frac{k_1}{3})\cdot c}\cdot\frac{M}{d^2}$	$\frac{6(t_1+m)^2}{m(3t_1+2m)\cdot c}\cdot\frac{M}{d^2}$	10
$(\frac{b}{d}=\eta)$ d $(b=\eta d)$	$\sqrt[3]{\frac{M}{N_1\eta}}$	$\sqrt[3]{\frac{1}{rj_1\cdot t}\cdot\frac{M}{\eta}}$	$\sqrt[3]{\frac{1}{r(1-\frac{k_1}{3})\cdot t}\cdot\frac{M}{\eta}}$	$\sqrt[3]{\frac{6t_1(t_1+m)^2}{m(3t_1+2m)\cdot t}\cdot\frac{M}{\eta}}$	11
		$\sqrt[3]{\frac{2}{k_1j_1\cdot c}\cdot\frac{M}{\eta}}$	$\sqrt[3]{\frac{2}{k_1(1-\frac{k_1}{3})\cdot c}\cdot\frac{M}{\eta}}$	$\sqrt[3]{\frac{6(t_1+m)^2}{m(3t_1+2m)\cdot c}\cdot\frac{M}{\eta}}$	12
t	t_1c	$\frac{1}{rj_1}\cdot\frac{M}{bd^2}$	$\frac{1}{r(1-k_1/3)}\cdot\frac{M}{bd^2}$	$\frac{3}{mr^2(2-\sqrt{1+2/mr})}\cdot\frac{M}{bd^2}$	13
c	$\frac{t}{t_1}$	$\frac{2}{k_1j_1}\cdot\frac{M}{bd^2}$	$\frac{2}{k_1(1-k_1/3)}\cdot\frac{M}{bd^2}$	$\frac{3(\sqrt{1+2/mr}-1)}{2r^2(2-\sqrt{1+2/mr})}\cdot\frac{M}{bd^2}$	14
T & C	$\frac{M}{j}$	$\frac{1}{j_1}\cdot\frac{M}{d}$	$\frac{1}{(1-k_1/3)}\cdot\frac{M}{d}$	$\frac{3(t_1+m)}{3t_1+2m}\cdot\frac{M}{d}$	15
				$\frac{1}{1-\frac{mr}{3}(\sqrt{1+2/mr}-1)}\cdot\frac{M}{d}$	15′
M	Tj	$rj_1\cdot t\cdot bd^2$	$r(1-\frac{k_1}{3})\cdot t\cdot bd^2$	$\frac{3t_1+2m}{6t_1(t_1+m)^2}m\cdot t\cdot bd^2$	16
	Cj	$\frac{1}{2}k_1j_1\cdot c\cdot bd^2$	$\left\{\frac{k_1}{2}\left(1-\frac{k_1}{3}\right)\right\}\cdot c\cdot bd^2$	$\frac{3t_1+2m}{6(t_1+m)^2}m\cdot c\cdot bd^2$	17
		a	b		

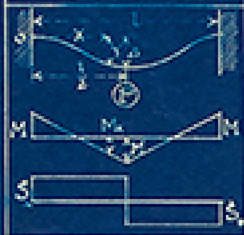
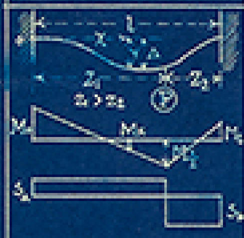
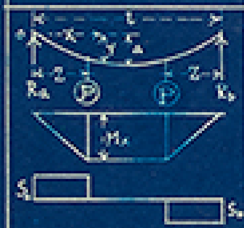
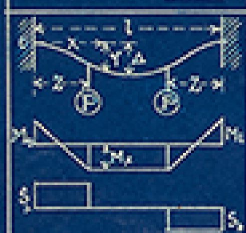
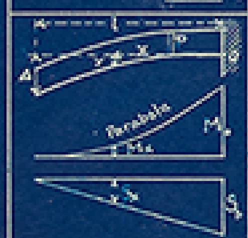
The Beam and Its Load with the B.M. and S.F. Diagrams.	B.M. Equation and Maximum B.M. M_x & M	Equation of Elastic Line, & Max Deflection in Terms of The Loading. Y & Δ	Max Deflection in Terms of Stress on Extreme Fiber of Symmetrical Section. Δ_f	Max Stress on Extreme Fibre in Terms of the Loading Symmetrical Section. f.	Breaking Weight in Terms of the Fibre Stress P	S.F. Equation, Max S.F. and Reactions. S_x, S, R_a & R_b	Relative Strength
	$M_x = \frac{px}{2}(l-x)$ $M_{\frac{l}{2}} = \frac{pl^2}{8}$	$y = \frac{px}{24EI}(l^3 - 2lx^2 + x^3)$ $\Delta = \frac{5Pl^4}{384EI}$	$\Delta_f = \frac{5}{24}\frac{fl^2}{Eh}$	$f = \frac{Pl^2h}{16I}$ $= \frac{Pl^2}{8S_M}$	$P = \frac{16fI}{lh}$ $= \frac{8fS_M}{l}$	$S_x = P(\frac{l}{2} - x)$ $S_a = S_b = \frac{Pl}{2}$ $= R_a = R_b$	1
	$M_x = \frac{P}{4}(2x - \frac{l}{2})(l-x)$ $M_o = -\frac{Pl^2}{8}$ $M_{\frac{5}{8}l} = \frac{9}{16} \cdot \frac{Pl^2}{8}$	$y = \frac{Px^2}{48EI}(l-x)(3l-2x)$ $\Delta = \frac{Pl^4}{185EI}$ for $x = 0{\cdot}5781$	$\Delta_f = \frac{16}{185}\frac{fl^2}{Eh}$	$f = \frac{Pl^2h}{16I}$ $= \frac{Pl^2}{8S_M}$	$P = \frac{16fI}{lh}$ $= \frac{8fS_M}{l}$	$S_x = P(x - \frac{5}{8}l)$ $S_a = \frac{3}{8}Pl = R_a$ $S_b = -\frac{5}{8}Pl = R_b$	1 Distance of pt. of inflection. $x = 0{\cdot}2661$ $\frac{1}{4}l$
	$M_x = \frac{Plx}{2} - \frac{Px^2}{2} - \frac{Pl^2}{12}$ $M_o = -\frac{Pl^2}{12} = M_l$ $M_{\frac{l}{2}} = \frac{Pl^2}{24}$	$y = \frac{Px^2}{24EI}(l^2 + x^2 - 2lx)$ $\Delta = \frac{Pl^4}{384EI}$ at centre	$\Delta_f = \frac{1}{16}\frac{fl^2}{Eh}$	$f = \frac{Pl^2h}{24I}$ $= \frac{Pl^2}{12S_M}$	$P = \frac{24fI}{lh}$ $= \frac{12fS_M}{l}$	$S_x = P(\frac{l}{2} - x)$ $S_a = S_b = \frac{Pl}{2}$ $= R_a = R_b$	$\frac{3}{2}$ Distance of pt of inflection $x = 0{\cdot}2113l$
	$P = \frac{pl}{2}$ $M_x = \frac{-Px^3}{3l^2} = \frac{-px^3}{6l}$ $M_o = \frac{-Pl}{3} = \frac{-pl^2}{6}$	$y = \frac{Pl^3}{12EI}(\frac{x}{l} - \frac{x^5}{5l^5})$ $\Delta = \frac{Pl^3}{15EI}$ at end	$\Delta_f = \frac{2}{5}\frac{fl^2}{Eh}$	$f = \frac{Plh}{6I}$ $= \frac{Pl}{3S_M}$	$P = \frac{6fI}{lh}$ $= \frac{3fS_M}{l}$	$S_x = -\frac{P(l-x)^2}{l^2}$ $= -\frac{p(l-x)^2}{2l}$ $S_b = -P$ $S_a = 0$	$\frac{3}{8}$
	$P = \frac{pl}{2}$ $M_x = \frac{Px}{3}(1 - \frac{x^2}{l^2})$ $= \frac{px}{6}(l - \frac{x^2}{l})$ $M = \frac{52}{405}Pl$ $= \frac{26}{405}pl^2$ at $x = 0{\cdot}577l$	$\Delta = \frac{47}{3600}\frac{Pl^3}{EI}$ for $x = 0{\cdot}519l$	$\Delta_f = \frac{423}{2080}\frac{fl^2}{Eh}$	$f = \frac{26Plh}{405I}$ $= \frac{52Pl}{405S_M}$	$P = \frac{405fI}{26lh}$ $= \frac{405fS_M}{52l}$	$S_x = \frac{1}{3}P - \frac{x^2}{l^2}$ $S_b = -\frac{2}{3}P = R_b$ $S_a = \frac{1}{3}P = R_a$	$\frac{405}{416}$

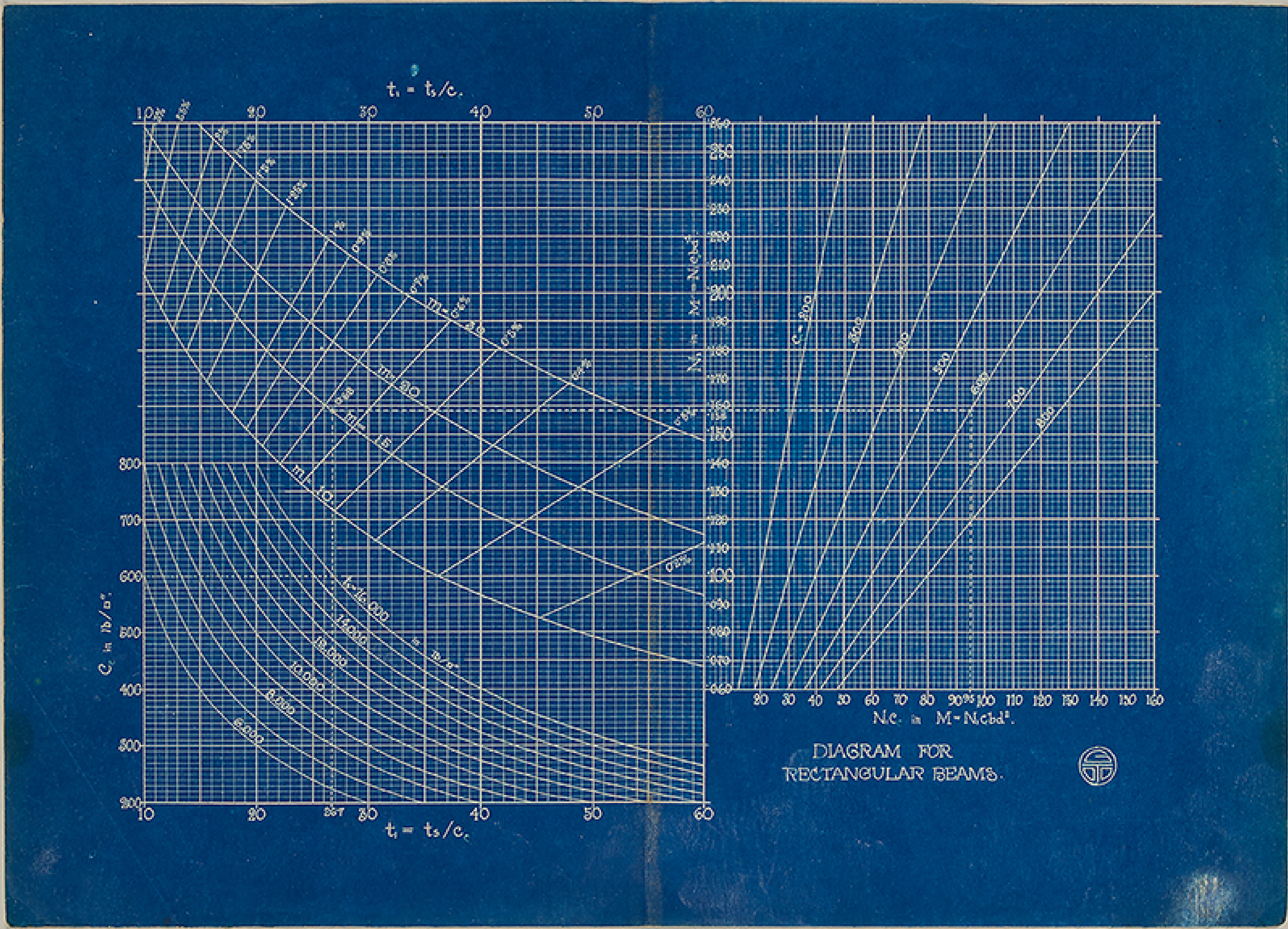
The Beam and Its Load with the B.M. and S.F. Diagrams.	B.M. Equation and Maximum B.M. Mx & M	Equation of Elastic Line, & Max. Deflection in Terms of The Loading. Y & Δ	Max. Deflection in Terms of Stress on Extreme Fiber of Symmetrical Section. Δf	Max. Stress on Extreme Fibre in Terms of the Loading Symmetrical Section. f.	Breaking Load in Terms of the Fiber Stress. P	S.F. Equation, Max. S.F. & Reactions. Sx, S, Ra & Rb	Relative Strength
	$M_x = -Px$ $M_l = -Pl$	$y = \frac{P}{6EI}(2l^3 - 3l^2x + x^3)$ $\Delta = \frac{Pl^3}{3EI}$ at end	$\Delta_f = \frac{2fl^2}{3Eh}$	$f = \frac{Plh}{2I}$ $= \frac{Pl}{S_m}$	$P = \frac{2fI}{lh}$ $= \frac{fS_m}{l}$	$S_b = -P$ $= R_b$ $S_a = 0$	$\frac{1}{8}$
	$M_x = \frac{P}{2}x$ $M_{\frac{l}{2}} = \frac{Pl}{4}$	$y = \frac{Px}{48EI}(3l^2 - 4x^2)$ $\Delta = \frac{Pl^3}{48EI}$ at centre	$\Delta_f = \frac{fl^2}{6Eh}$	$f = \frac{Plh}{8I}$ $= \frac{Pl}{4S_m}$	$P = \frac{8fI}{lh}$ $= \frac{4fS_m}{l}$	$S_a = -S_b = \frac{P}{2}$ $= R_a = R_b$	$\frac{1}{2}$
	$x < z_1$ $M_x = \frac{Pz_2x}{l}$ $x > z_1$ $M_x = \frac{Pz_2x}{l} - P(x - z_1)$ $M_{z_1} = \frac{Pz_1z_2}{l}$	$x < z_1$ $y = \frac{Pz_2x}{6EIl}(2lz_1 - z_1^2 - x^2)$ $x > z_1$ $y = \frac{Pz_1(l-x)}{27EIl}(2lx - x^2 - z_1^2)$ $\Delta = \frac{Pz_2}{27EIl}\sqrt{3\{z_1(2z_2+z_1)\}^3}$ for $x = \frac{1}{3}\sqrt{3\{z_1(2z_2+z_1)\}}$	$\Delta_f = \frac{f}{27Eh}\sqrt{3z_1(2z_2+z_1)^3}$	$f = \frac{Pz_1z_2h}{2Il}$ $= \frac{Pz_1z_2}{S_ml}$	$P = \frac{2flI}{z_1z_2h}$ $= \frac{flS_m}{z_1z_2}$	If $z_1 > z_2$ $S_b = \frac{-Pz_1}{l} = R_b$ $S_a = \frac{Pz_2}{l} = R_a$	$\frac{l^2}{8z_1z_2}$
	$x > \frac{l}{2}$ $M_x = \frac{5}{16}P(l - x)$ $x < \frac{l}{2}$ $M_x = \frac{P}{16}(11x - 3l)$ $M_{\frac{l}{2}} = \frac{5}{32}Pl$ $M_o = -\frac{3}{16}Pl$	$x < \frac{l}{2}$ $y = \frac{Px^2}{96EI}(9l - 11x)$ $x > \frac{l}{2}$ $y = \frac{P}{96EI}(5l^3 - \frac{3}{2}l^2x^2 + 12l\dots x - 2\dots)$ $\Delta = \frac{1}{\sqrt{5}}\frac{Pl^3}{48EI}$ for $x = l(1 - \frac{1}{\sqrt{5}})$	$\Delta_f = \frac{1}{\sqrt{5}}\frac{4fl^2}{15hE}$	$f = \frac{5Plh}{64I}$ $= \frac{5Pl}{64S_m}$	$P = \frac{64fI}{5hl}$ $= \frac{64fS_m}{5l}$	$S_b = -\frac{11}{16}P = R_b$ $S_a = \frac{5}{16}P = R_a$	$\frac{8}{5}$ Distance of Pt. of inflection $x = \frac{3}{11}l$
	$R_a = \frac{P}{2l^3}(3lz_2^2 - z_2^3)$ $x < z_2$ $M_x = R_a(l - x) - P(z_2 - x)$ $x > z_2$ $M_x = R_a(l - x)$ $M_{z_2} = R_a(l - z_2)$ $M_o = R_al - Pz_2$	$x < z_2$ $y = \frac{1}{6EI}(R_ax^3 - 3R_alx^2 + 3Pz_2^2x^2 - Px^3)$ $x > z_2$ $y = \frac{1}{6EI}(R_ax^3 - 3R_alx^2 + 3Pz_2^2x - Pz_2^3)$ $\Delta = \frac{Pz_2^2}{6EI}(l - z_2)\sqrt{\frac{l - z_2}{3l - z_2}}$ for $x = l(1 - \sqrt{\frac{l - z_2}{3l - z_2}})$	$\Delta_f = \frac{2f}{3Eh}\sqrt{(3l - z_2)(l - z_2)}$	$f = \frac{Ph}{4Il^3}(3lz_2^2 - z_2^3)(l - z_2)$ $= \frac{P}{2l^3S_m}(3lz_2^2 - z_2^3)(l - z_2)$	$P = \frac{4fl^3I}{z_2^2(3l - z_2)(l - z_2)h}$ $= \frac{2fl^3S_m}{z_2^2(3l - z_2)(l - z_2)}$	$S_a = \frac{P}{2l^3}(3lz_2^2 - z_2^3)$ $= R_a$ $S_b = R_a - P$ $= R_b$	$\frac{l^4}{4z_2^2(3l - z_2)(l - z_2)}$ When $z_2 > \cdot586\,l$ $M_{z_2} > M_o$ $M_{z_2 = \cdot 586l} = \cdot 17Pl$

後藤が構造学の研究・普及のために作成した資料_DIAGRAM FOR REINFORCED CONCRETE_9_001

The Beam and Its Load with the B.M. and S.F. Diagrams.	B.M. Equation and Maximum B.M. M_x & M	Equation of Elastic Line, & Max. Deflection in Terms of The Loading. y & Δ.	Max. Deflection in Terms of Stress on Extreme Fiber of Symmetrical Section. Δf	Max. Stress on Extreme Fibre in Terms of the Loading Symmetrical Section. f.	Breaking weight in Terms of the Fibre stress P	S.F. Equation, Max. S.F. and Reactions. S_x, S, R_a & R_b	Relative Strength
	$M_x = -\frac{Pl}{30}(10\frac{x^3}{l^3} - 9\frac{x}{l} + 2)$ $M_a = -\frac{1}{15}Pl$ $M_b = -\frac{1}{10}Pl$ $M = \frac{3\sqrt{\frac{3}{10}}-1}{15}Pl = 0{\cdot}0429Pl$ at $x = l\sqrt{\frac{3}{10}} = 0{\cdot}548l$	$y = \frac{Pl^3}{60EI}(2\frac{x^4}{l^4} - 3\frac{x^3}{l^3} + \frac{x^2}{l^2})$ $\Delta = \frac{Pl^3}{384EI}$ for $x = 0{\cdot}525l$	$\Delta f = \frac{10}{192}\frac{fl^2}{Eh}$	$f = \frac{Plh}{20I}$ $= \frac{Pl}{10S_m}$	$P = \frac{20fI}{lh}$ $= \frac{10fS_m}{l}$	$S_x = \frac{1}{3}P - \frac{x^2}{l^2}P$ $S_b = -\frac{2}{3}P = R_b$ $S_a = \frac{1}{3}P = R_a$	$\frac{5}{4}$
	for $x < \frac{l}{2}$ $M_x = Px(\frac{1}{2} - \frac{2}{3}\frac{x^2}{l^2})$ $M_{\frac{l}{2}} = \frac{Pl}{6}$	$y = \frac{Pl^3}{12EI}(\frac{5}{8}\frac{x}{l} - \frac{x^3}{l^3} + \frac{2}{5}\frac{x^5}{l^5})$ $\Delta = \frac{Pl^3}{60EI}$ at Centre	$\Delta f = \frac{1}{5}\frac{fl^2}{Eh}$	$f = \frac{Plh}{12I}$ $= \frac{Pl}{6S_m}$	$P = \frac{12fI}{lh}$ $= \frac{6fS_m}{l}$	for $x < \frac{l}{2}$ $S_x = P(\frac{1}{2} - \frac{2x^2}{l^2})$ for $x > \frac{l}{2}$ $S_x = -P(\frac{1}{2} - \frac{2(l-x)^2}{l^2})$ $S_a = \frac{1}{2}P = R_a$ $S_b = -\frac{1}{2}P = R_b$	$\frac{3}{4}$
	for $x < \frac{l}{2}$ $M_x = -Pl(\frac{5}{48} - \frac{x}{2l} + \frac{2x^3}{3l^3})$ $M_a = M_b = -\frac{5}{48}Pl$ $M_c = \frac{Pl}{16}$	$y = \frac{Pl^3}{6EI}(\frac{5x^2}{16l^2} - \frac{x^3}{2l^3} + \frac{x^5}{5l^5})$ $\Delta = \frac{7Pl^3}{1920EI}$ at centre	$\Delta f = \frac{7}{100}\frac{fl^2}{Eh}$	$f = \frac{5Plh}{96I}$ $= \frac{5Pl}{48S_m}$	$P = \frac{96fI}{5lh}$ $= \frac{48fS_m}{5l}$	for $x < \frac{l}{2}$ $S_x = P(\frac{1}{2} - \frac{2x^2}{l^2})$ $S_a = \frac{1}{2}P = R_a$ $S_b = -\frac{1}{2}P = R_b$	$\frac{6}{5}$
	for $x < \frac{l}{2}$ $M_x = Px(\frac{1}{2} - \frac{x}{l} + \frac{2x^2}{3l^2})$ $M_c = \frac{Pl}{12}$	$y = \frac{Pl^3}{12EI}(\frac{3}{8}\frac{x}{l} - \frac{x^3}{l^3} + \frac{x^4}{l^4} - \frac{2}{5}\frac{x^5}{l^5})$ $\Delta = \frac{3}{320}\frac{Pl^3}{EI}$	$\Delta f = \frac{9}{40}\frac{fl^2}{Eh}$	$f = \frac{Plh}{24I}$ $= \frac{Pl}{12S_m}$	$P = \frac{24fI}{lh}$ $= \frac{12fS_m}{l}$	for $x < \frac{l}{2}$ $S_x = \frac{2(\frac{l}{2}-x)^2}{l^2}P$ for $x > \frac{l}{2}$ $S_x = \frac{2(x-\frac{l}{2})^2}{l^2}P$ $S_a = \frac{1}{2}P = R_a$ $S_b = -\frac{1}{2}P = R_b$	$\frac{3}{2}$
	$M_x = \frac{x(l-x)}{6l}\{P_1(2l-x) + P_2(l+x)\}$ $M = \frac{l^2}{6}\frac{r-P_1}{(P_2-P_1)^2}\{(2P_1+P_2)(P_2-P_1) - (r^2+P_1r-2P_1^2)\}$ at $x = l\frac{r-P_1}{P_2-P_1}$ where $r = \sqrt{\frac{P_1^2+P_1P_2+P_2^2}{3}}$					$S_x = R_a - \frac{P_1+z}{2}x$ $S_a = \frac{l}{6}(2P_1+P_2)$ $= R_a$ $S_b = -\frac{l}{6}(2P_2+P_1)$ $= R_b$ where $z = P_1 + \frac{x(P_2-P_1)}{l}$	

後藤が構造学の研究・普及のために作成した資料_DIAGRAM FOR REINFORCED CONCRETE_10_001

The Beam and Its Load with the B.M. and S.F. Diagrams.	B.M. Equation and Maximum B.M. M_x & M	Equation of Elastic Line, & Max. Deflection in Terms of The Loading. y & Δ	Max. Deflection in Terms of Stress on Extreme Fibre of Symmetrical Section. Δ_f	Max. Stress on Extreme Fibre in Terms of the Loading Symmetrical Section. f	Breaking Weight in Terms of the Fibre Stress P	S.F. Equation, Max. S.F. and Reactions S_x, S, R_a & R_b	Relative Strength
	$x < \frac{l}{2}$ $M_x = \frac{P}{4}(2x - \frac{l}{2})$ $x > \frac{l}{2}$ $M_x = \frac{P}{4}(\frac{3}{2}l - 2x)$ $-M_o = M_{\frac{l}{2}} = \frac{Pl}{8}$	$x < \frac{l}{2}$ $y = \frac{Px^2}{24EI}(\frac{3}{2}l - 2x)$ $x > \frac{l}{2}$ $y = \frac{P}{24EI}(2x^3 + 1.5l^2x - \frac{l^3}{8} - \frac{9}{2}lx^2)$ $\Delta = \frac{Pl^3}{192EI}$	$\Delta_f = \frac{fl^2}{12Eh}$	$f = \frac{Phl}{16I}$ $= \frac{Pl}{8S_m}$	$P = \frac{16fI}{hl}$ $= \frac{8fS_m}{l}$	$S_a = -S_b = \frac{P}{2}$ $= R_a = R_b$	1 Distance of Pt. of inflection. $x = \frac{l}{4}$
	$R_a = P\frac{z_2^2(3z_1 + z_2)}{l^3}$ $M_o = -P\frac{z_1z_2^2}{l^2}$ $x < z_1$ $M_x = R_1x + M_o$ $x > z_1$ $M_x = R_1x - P(x - z_1) + M_o$	$x < z_1$ $y = \frac{Px^2z_2^2}{6EIl^3}(3z_1l - (3z_1 + z_2)x)$ $x > z_1$ $y = \frac{Px^2z_1^2}{6EIl}(\frac{l^2(x - z_1)^3}{x^2z_1^2} - 3z_1l - (3z_1 + z_2)x)$ $\Delta = \frac{2Pz_1^3z_2^2}{3EI(3z_1 + z_2)^2}$ for $x = \frac{2lz_1}{3z_1 + z_2}$	$\Delta_f = \frac{9fz_1^2z_2^2}{E(3z_1 + z_2)^2hl}$	$f = \frac{Pz_1z_2^2h}{2Il^2}$ $= \frac{Pz_1z_2^2}{l^2S_m}$	$P = \frac{2fIl^2}{z_1z_2^2h}$ $= \frac{fl^2S_m}{z_1z_2^2}$	$S_a = P\frac{z_2^2(3z_1 + z_2)}{l^3}$ $= R_a$ $S_b = -P\frac{z_1^2(3z_2 + z_1)}{l^3}$ $= R_b$	$\frac{l^2}{8z_1z_2^2}$ Distance of pt. of inf. $x_o = \frac{z_1}{3z_1 + z_2}l$ $x_1 = \frac{2l^2 - 2z_1l}{l^2 - 2l(3z_1 + z_2)}$
	$x < z$ $M_x = Px$ $x > z$ $M = Pz$	$x < z$ $y = \frac{Px}{6EI}(3lz - 3z^2 - x^2)$ $x > z$ $y = \frac{Pz}{6EI}(3lx - 3x^2 - z^2)$ $\Delta = \frac{Pz}{6EI}(\frac{3}{4}l^2 - z^2)$ at centre	$\Delta_f = \frac{f}{3Eh}(\frac{3}{4}l^2 - z^2)$	$f = \frac{Phz}{2I}$ $= \frac{Pz}{S_m}$	$P = \frac{2fI}{hz}$ $= \frac{fS_m}{z}$	$S_a = -S_b = P$ $= R_a = R_b$ at middle portion $S = 0$	$\frac{l}{8z}$
	$x < z$ $M_x = Px + \frac{Pz^2}{l} - Pz$ $x > z$ $M = \frac{Pz^2}{l}$ $M_o = M_l = -Pz(1 - \frac{z}{l})$	$x < z$ $y = \frac{Px^2}{6EIl}(3lz - 3z^2 - xl)$ $x > z$ $y = \frac{Pz^2}{6EIl}(3lx - 3x^2 - zl)$ $\Delta = \frac{Pz^2}{12EI}(\frac{3}{2}l - 2z)$ at centre	$\Delta_f = \frac{fl}{6Eh}(\frac{3}{2}l - 2z)$	$f = \frac{Phz^2}{2Il}$ $= \frac{Pz^2}{S_ml}$	$P = \frac{2fIl}{hz^2}$ $= \frac{flS_m}{z^2}$	$S_a = -S_b = P$ in middle portion $S = 0$	$\frac{l^2}{8z^2}$ Distance of point of inflection $x = z - \frac{z^2}{2l}$
	$M_x = -\frac{px^2}{2}$ $M_o = -\frac{pl^2}{2}$	$y = \frac{p}{24EI}(x^4 - 4l^3x + 3l^4)$ $\Delta = \frac{pl^4}{8EI}$	$\Delta_f = \frac{fl^2}{2Eh}$	$f = \frac{pl^2h}{4I}$ $= \frac{pl}{2S_m}$	$P = \frac{4fI}{lh}$ $= \frac{2fS_m}{l}$	$S_x = -p(l - x)$ $S_b = -pl$ $S_a = 0$	$\frac{1}{4}$



t₁ = ts/c.
N.c. in M = N.cbd².
C. in lb/□".
DIAGRAM FOR
RECTANGULAR BEAMS.

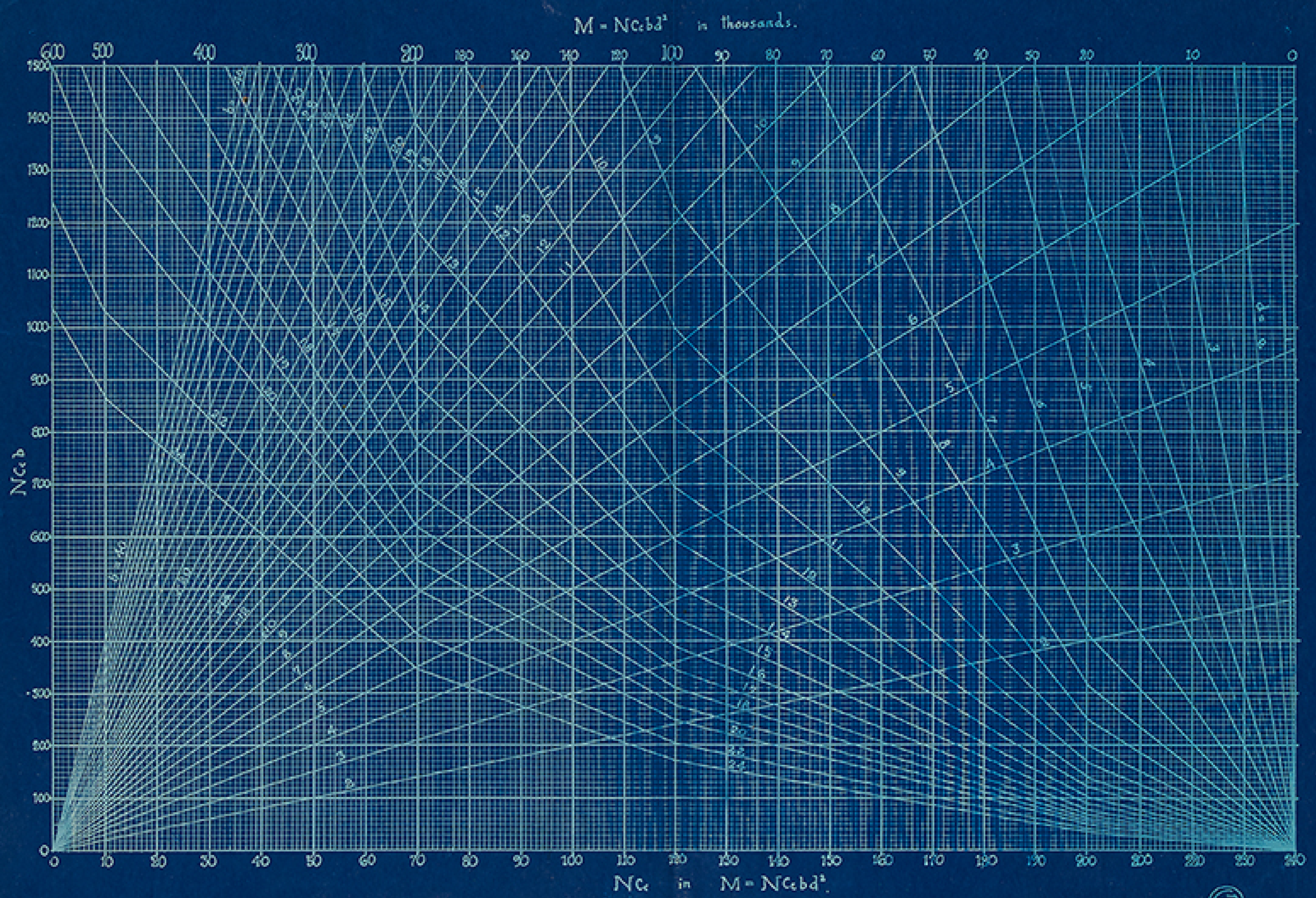


DIAGRAM FOR RESISTING MOMENT OF BEAMS.

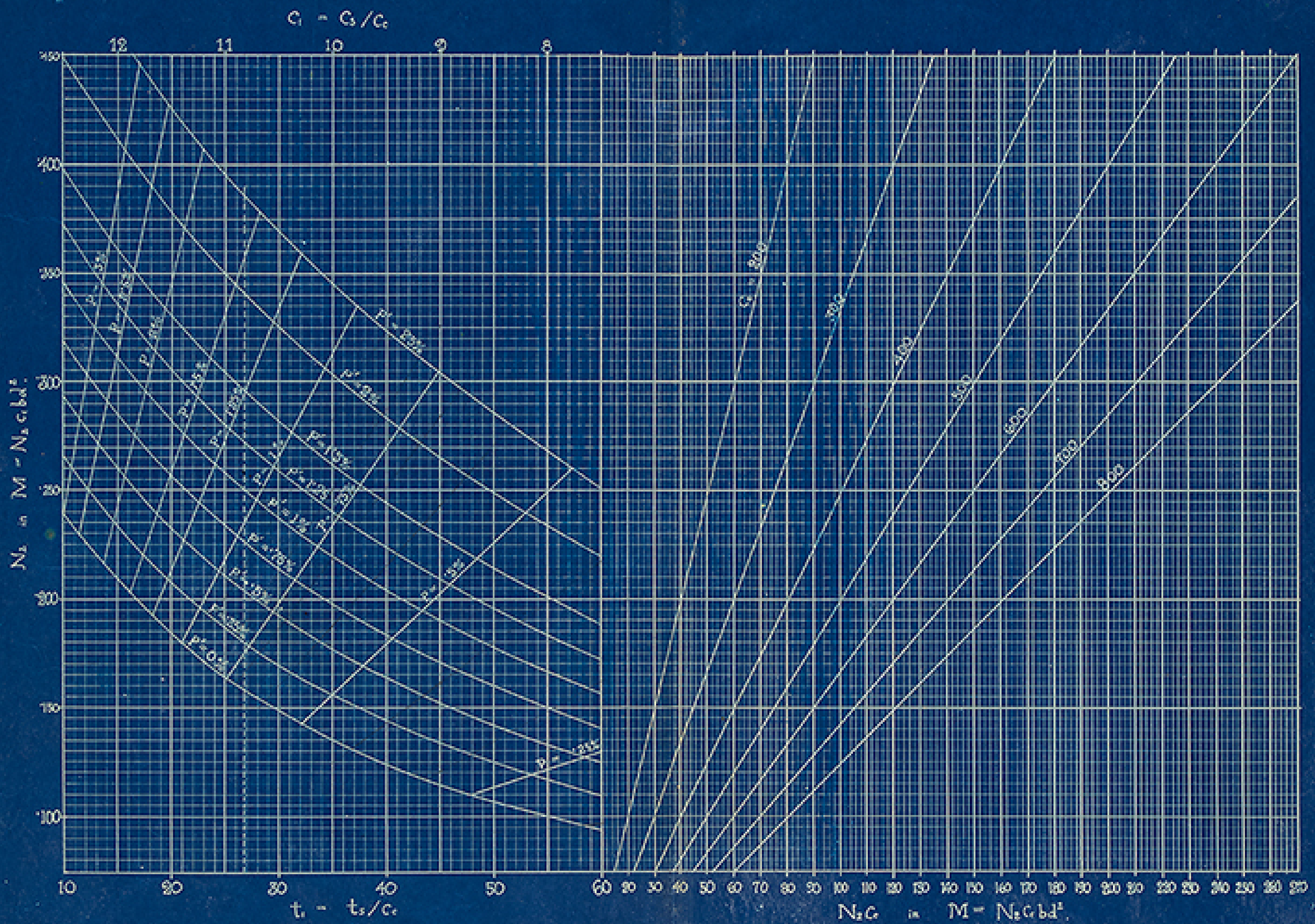
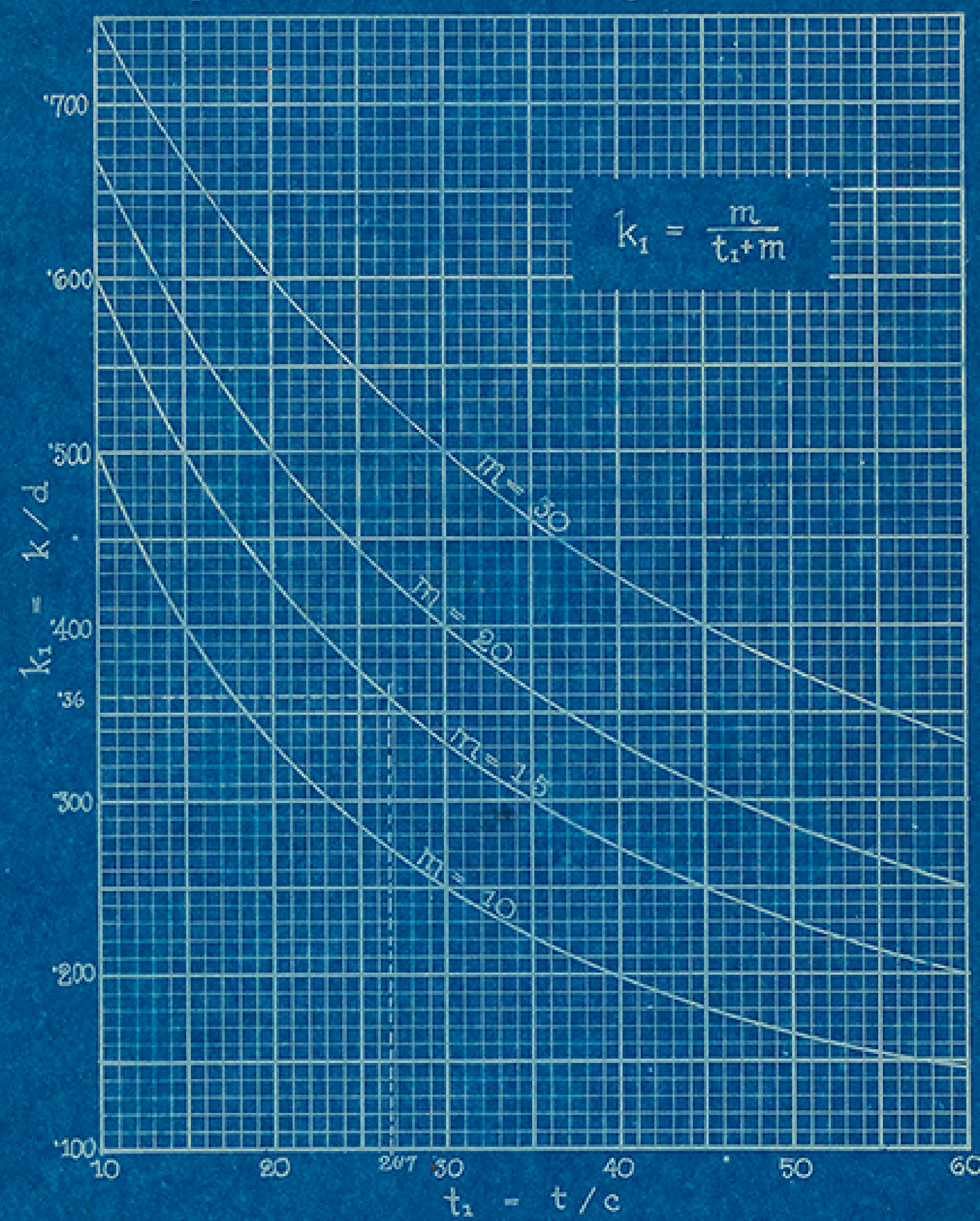
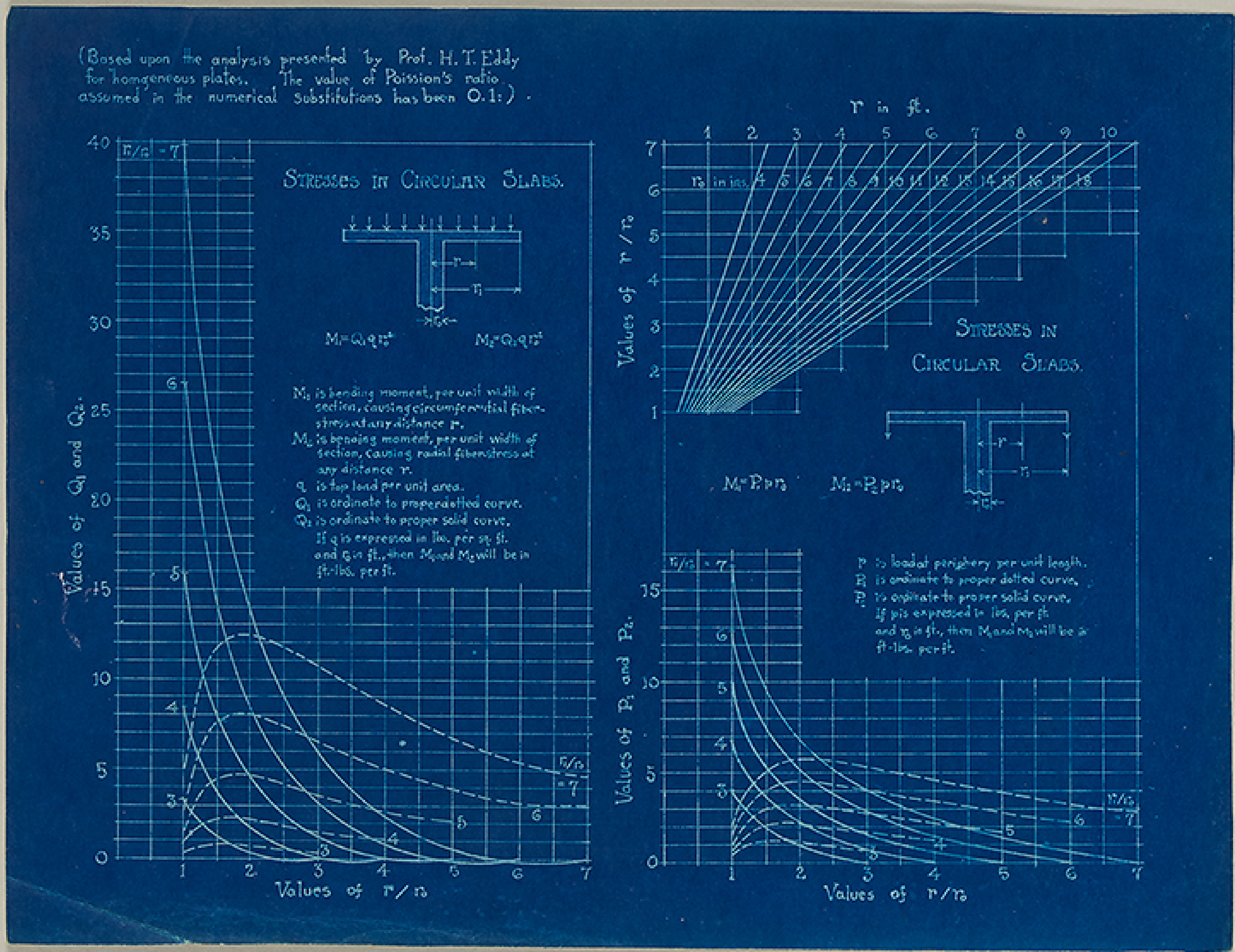


DIAGRAM FOR DOUBLE REINFORCED RECTANGULAR BEAMS. $\frac{d_c}{d} = \frac{1}{10}$.

DEPTH OF NEUTRAL AXIS
FOR VARIOUS RATIO OF STRESSES.





後藤が構造学の研究・普及のために作成した資料_DIAGRAM FOR REINFORCED CONCRETE_16_001

LIST OF SYMBOLS

A	Area.
A	Total cross-sectional area of a pillar.
A_1	Area of concrete.
A_L	Cross-sectional area of longitudinal steel rods in a pillar.
A_H	Cross-sectional area of a hooped reinforcing rod in a pillar.
A_E	Equivalent area.
A_c	Area of compressive reinforcement in beams.
A_T	Area of tensile reinforcement in beams.
A_s	Area of shear reinforcement.
A_t	Total area.
a	Buckling factor of a column.
B_b	Ratio I/l for beams, i.e. a measure of stiffness.
B_c	Ratio I/l for column.
b	Breadth.
b	Breadth of rectangular beam.
b_r	Breadth of the rib in a T-beam.
b_s	Effective breadth of the slab in a T-beam.
C	Total compressive force or stress.

C_c	Total compression on concrete.
C_s	Total compression on steel.
c	Compressive stress intensity.
c	Compressive stress intensity on concrete.
c_p	Compressive stress in column not hooped.
c'	Minimum compressive stress in concrete for combined bending and direct load.
c_s	Compressive stress intensity on steel.
c_r	Ratio c_s/c.
c_s'	Minimum compressive stress in steel for combined bending and direct load.
c^1	Compressive stress intencity in long column.
d	Depth.
d	Effective depth of a beam from top of a beam to axis of tensile reinforcement.
d_s	Total depth of a slab in a T-beam.
d_c	Depth or distance of the centre of compressive reinforcement from the compressed edge.
d'	Distance of the centre of reinforcement from any edge.
d	Any diameter.
d	Outside diameter.
d_i	Insid diameter.

d_k	Diameter of the core of a pillar with hooped reinforcement.
d_l	Diameter of a longitudinal reinforcing rod of a pillar.
d_h	Diameter of a herical reinforcing rod of a pillar.
d_b	Diameter of stirrup bar.
E	Elastic modulus of any materials.
E_c	Elastic modulus of concrete in compression.
E_S	Elastic modulus of steel.
e	Eccentricity of any load.
e_c	Unit elongation of concrete.
e_S	Unit elongation of steel.
F	Total friction between any two surfaces.
f	Friction or adhesion between surfaces in unit of force per unit of area.
f	Intensity of stress (general)
f	Fiber stress intensity.
f_c	Compressive stress intensity.
f_t	Tensile stress intensity.
f_{bg}	Bearing stress intensity.
f_u	Intensity of ultimate stress.
g	Gravity.

H	Horizontal component of force.
h	Intensity of horizontal shearing stress.
h	Any height.
h	Total height of beam.
I	Inertia moment.
I_x	Inertia moment on axis XX.
I_y	Inertia moment on axis YY.
I_S	Inertia moment for steel.
I_c	Inertia moment for concrete.
I_E	Inertia moment for equivalent section.
I_N	Inertia moment on neutral axis.
I_G	Inertia moment on gravity axis.
i	Radius of gyration.
j	Arm of any couple, i.e. distance between two parallel force of equal magnitude, but acting in opposite directions.
j	Arm of the couple formed by the compressive and tensile forces in beam.
j_1	Ratio j/d.
K	A constant.

k	Distance of the neutral axis from the compressed edge of a beam.
k_1	Ratio k/d.
k'	In beams with combined bending and direct stress, distance of neutral axis from more compressed edge of the beam.
l	Length.
l	Effective length or span of a beam or arch.
l_L	Longer span of a rectangular slab.
l_S	Shorter span of a rectangular slab.
M	Bending moment.
M	Any moment.
M_{max}	Maximum bending moment of the external forces or loads on a beam.
M_x	Bending moment at a distance x from left abutment.
M_F	Fixing moment of built in beam.
M_C	Bending moment at centre of beam.
M_E	Bending moment at end of beam.
M_S	Statical moment or first moment of area.
M_L	Bending moment of longer beam.
M_S	Bending moment of shorter beam.
$\mathfrak{M}$	Maximum bending moment on beam supported at both ends and not continuous.
m	Modular ratio, E_S/E_C.

N_1, N_2, N_3, N_4	Constants in stress formulas.
n	Any number.
n	Number of reinforcing bars.
n_1	Number of bars to be bent.
O	Perimeter of any regular or irregular figure.
P	Total pressure on a given area.
p	Intensity of pressure per unit of length or area in any direction.
p	Percentage of steel, i.e. $p = 100r$
R	Reaction of a beam on its support.
R	Resistance moment of the internal stresses in a beam at a given cross-section.
R_L	Left reaction.
R_R	Right reaction.
r	Radius.
r_I	Inner radius.
r	Ratio.

r	Ratio of area of steel to area of concrete in singly reinforced beams.
r_t	Ratio of area of steel in tension to area of concrete in doubly reinforced beams.
r_c	Ratio of area of steel in compression to area of concrete.
S	Total shearing force.
s	Shearing stress intensity.
s	Shearing stress intensity on concrete.
S_r	Safety factor.
T	Total tensile force.
T	Total tensile stress on a given cross-section.
T_c	Total tension on concrete, when necessary to discriminate.
T	Total tension on steel.
T_d	Total diagonal tension.
t	Tensile stress intensity.
t	Tensile stress intensity on steel.
t_c	Tensile stress intensity on concrete.
t_r	Ratio of stress, t/c
t_d	Intensity of diagonal tension.
u	Ultimate stress in a material.
u	The distance of the centre of compression from compressed edge of a beam.

V	Volume.
V	Volume of hooped core of column.
V_H	Volume of hooped reinforcement in a column.
V_L	Volume of longitudinal reinforcement in a column.
V	Vertical component of force.
v	Intensity of vertical component of force.
W	Weight or load.
W_f	Working factor, i.e. $1/S_r$
w	Weight per unit of length.
w	Weight per unit of area.
w	Weight per unit of volume.
x	Any unknown quantity.
x	Independent variable in any function.
x	Horizontal coordinate of a point.
x_1	Distance from the support to the point where no sheare reinforcement are required.
x_2	Distance from the support to the point wher the horizontal rein-forcement may be bent.
y	A second unknown quantity.
y	Dependent variable corresponding with x.

y	Vertical co-ordinate of a point.
Z	Section modulas.
z	A third unknown quantity.
z	Distance between any two stirrups.
α	Dinominator in formula $M = \frac{pl^2}{\alpha}$.
Δ	Deflection.
θ	Any angle.
ξ	Ratio of depth d_s/d in T-beam.
ν	Ratio of depth d_c/d. in doubly reinforced beam.
η	Ratio of breadth to depth in rectangular beam.

A Area

A Total area.

A Total cross-sectional area of a pillar.

A_e Equivalent area (等値面積)

A_o Cross-sectional area of a hooped reinforcing rod in a pillar (柱ノ有効断面積)

a Area of reinforcement. (鉄筋断面積)

a Total area of reinforcement. in beams. $a_t + a_c$

a_c Area of compressive reinforcement in beams. (応圧鉄筋断面積)

a_t Area of tensile reinforcement in beams (応張鉄筋断面積)

a_t Area of reinforcement in minor compression side in case of combined stress.

a_s Area of shear reinforcement. (応剪鉄筋断面積)

B 柱ノ太サ（曲ル方向ニ直角ニトリタル寸法）

B Effective breadth of the slab in a T-beam.

b Breadth of a rectangular beam.

b Breadth of the rib in a T-beam.

C
C_1 Constants in stress formula.
C_2
⋮

D_0 Diameter of the core of a pillar with hooped reinforcement
巻筋又ハ緊筋 中心内ノ直径

D 柱ノ直径又ハ柱ノ曲ル方向ニトリタル断面ノ寸法

D Total depth of a beam.

D Outside diameter.

d Effective depth of a beam ~~or distance of the center of tensile reinforcements from the top of a beam.~~ from top of beam to axis of tensile reinforcement.

*d ~~Diameter.~~

E Elastic modulas.

${}_cE$ Elastic modulas of concrete.

${}_sE$ Elastic modulas of steel.

e	Eccentricity of any load.
ε	Modular ratio, $\frac{{}_sE}{{}_cE}$.
F	Force (力)
f	Stress intensity (應力度)
f_a	Bond stress intensity (応滑力度)
f_b	Bending stress

Member		Stress lb		Length ft.	Least Rad. of Gyration r ins	Unit Loading lb per □in	Area Required A' □ins	Make up Members: Shape	Make up Members: Section ins.	Area Used A □ins	Weight lb per ft	Weight lb for total Length	Min. Number of Rivet
F-8	+	5,200	5,400	3'5	·488	9,950	·548	2Ls	2×2×·175	2-·670	2-2·28	16	2
I-11	+	5,400	″	″	″	″	″	″	″	″	″	″	″
8-9	-	2,300	3,900	3'816	/	15,500	·252	1L	2½×2×·175	·750	2·57	10	″
10-11	-	3,900	″	″	/	″	″	″	″	″	″	″	″
2-3	-	3,000	3,000	4'3615	/	″	·194	1L	2×2×·175	·670	2·28	″	″
16-17	-	2,100	″	″	/	″	″	″	″	″	″	″	″
5-6	-	5,400	5,400	″	/	″	·349	2Ls	″	2-·670	2-2·28.	20	″
13-14	-	4,400	″	″	/	″	″	″	″	″	″	″	″
5-N	-	14,800	22,000	6'	/	″	1·47	″	3×2×·250	2-1·181	2-4·04	49	5
14-N	-	10,200	″	″	/	″	″	″	″	″	″	″	″
7-N	-	22,000	″	″	/	″	″	″	″	″	″	″	3
12-N	-	16,700	″	″	/	″	″	″	″	″	″	″	″
O-1	-	36,700	36,700	″	/	″	·237	″	3×2½×·250	2-1·312	2-4·46	54	8
O-18	-	30,300	″	″	/	″	″	″	″	″	″	″	″
O-3	-	32,500	″	″	/	″	″	″	″	″	″	″	7
O-16	-	27,700	″	″	/	″	″	″	″	″	″	″	″
O-N	-	18,100	18,100	12'	/	″	1·17	″	2½×2×·175	2-·757	2-2·51	62	4

芝桜町細木一之入 東京図

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二丁五反

$t_1 = 30$

[illegible] $k_1 = \frac{1}{3}$

[illegible] $r = \cdot 0056$

$$d = \sqrt{\frac{6t_1(t_1+m)^2}{m(3t_1+2m)\cdot t}\cdot\frac{M}{b}} = \sqrt{\frac{6\times 30\,(45)^2}{15(90+30)\cdot 15{,}000}\cdot\frac{M}{b}}$$

$$= \sqrt{\frac{6\times 30\times 2025}{15\times 120\times 15{,}000}\cdot\frac{M}{b}} = \sqrt{\frac{2025}{150{,}000}\cdot\frac{M}{b}} = \sqrt{\cdot 0135\cdot\frac{M}{b}}$$

$$= \cdot 1162\sqrt{\frac{M}{b}} = \cdot 1162\sqrt{\frac{WL}{8b}}$$

$$d = \sqrt{\frac{6(t_1+m)^2}{m(3t_1+2m)\cdot c}\cdot\frac{M}{b}} = \sqrt{\frac{6\times 2025}{15\times 120\times 150}\cdot\frac{M}{b}}$$

$$= \sqrt{\frac{27}{2000}\cdot\frac{M}{b}} = \sqrt{\cdot 0135\cdot\frac{M}{b}}$$

$$= \sqrt{\frac{1}{741}\cdot\frac{M}{b}} = \frac{1}{8\cdot 6}\sqrt{\frac{M}{b}}$$

M′ ハ 1呎ニツキ　$M = M'\times 12$

$$d = \sqrt{\cdot 162}\sqrt{\frac{M}{b}} = \cdot 4025\sqrt{\frac{M}{b}} \doteqdot \boxed{\cdot 4\sqrt{\frac{M}{b}}}$$

$$\sqrt{\frac{1}{6\cdot 18}}\sqrt{\frac{M}{b}} = \frac{1}{2\cdot 485}\sqrt{\frac{M}{b}}$$

$d = \cdot 4\sqrt{\frac{M}{b}}$ $M = \frac{Wl}{8}$

$W = 48000$ $\frac{W}{8} = 6,000$

$\frac{\cdot 4}{1\cdot 73} = \cdot 231$

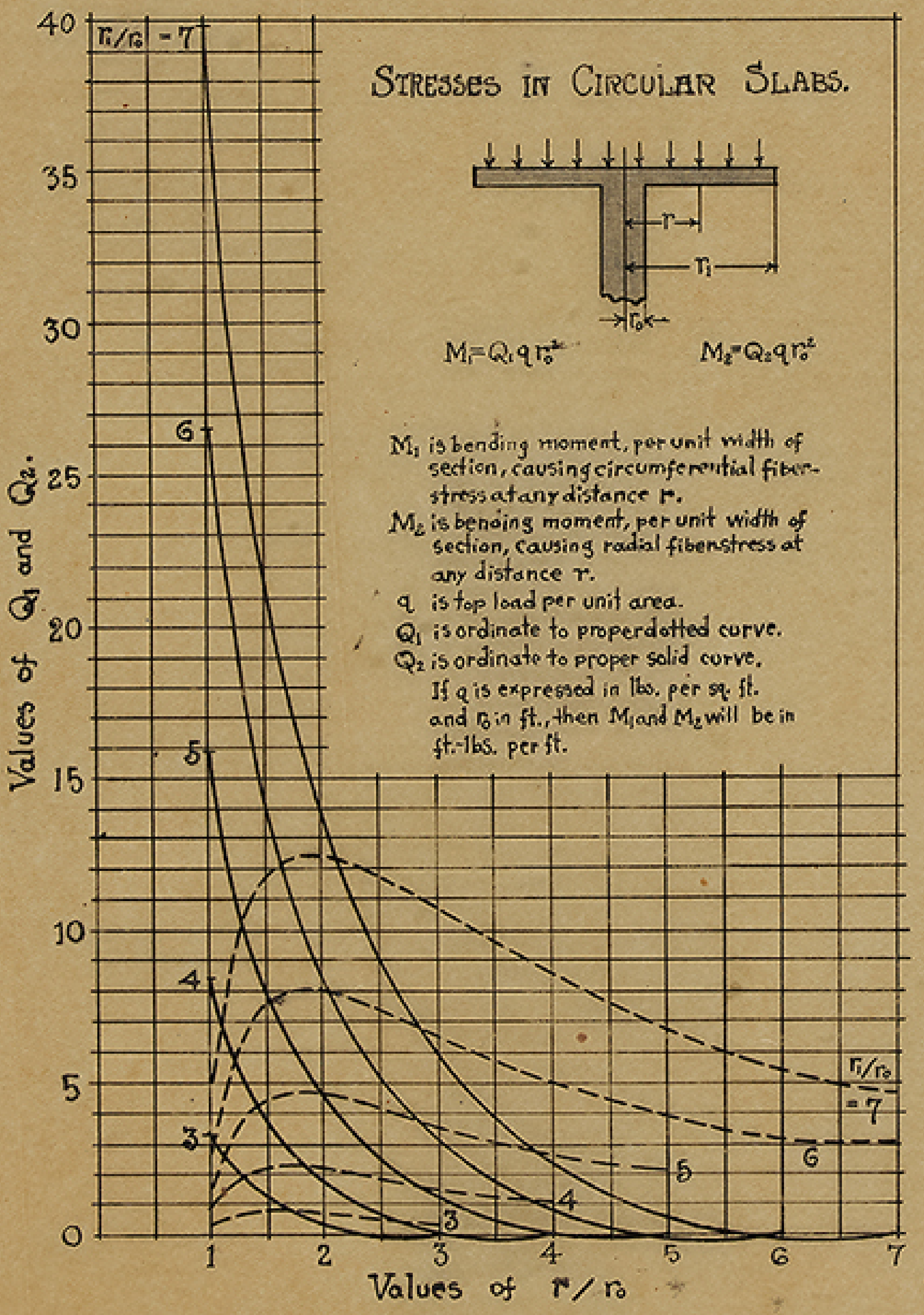
$b = 3''$ $\sqrt{3} = 1\cdot 73$

l	$\frac{Wl}{8}$
2	12,000
3	18,000
4	24,000
5	30,000
6	36,000
7	42,000
8	48,000
9	54,000
10	60,000
12	72,000
14	84000
16	96,000
18	~~120,000~~ 108,000
20	~~132,000~~ 120,000
22	~~144,000~~ 132,000
24	~~156,000~~ 144,000
26	~~168,000~~ 156,000
28	168000
30	180,000

M	√M	$\frac{\sqrt{M}}{1\cdot 73}\times\cdot 4$
10,000	100.	23·1
20,000	141	
30,000	173	
40,000	200	
50,000	224	
60,000	245	
70,000	265	
80,000	283	
90,000	300	
100,000	316	
120,000	346	
140,000	374	
160,000	400	
180,000	424	

l	M	√M	b=3" $\frac{\cdot 4}{1\cdot 73}=\cdot 231$	b=4" $\frac{\cdot 4}{2}=\cdot 2$	b=5 $\frac{\cdot 4}{2\cdot 24}=\cdot 179$	b=6 $\frac{\cdot 4}{2\cdot 45}=\cdot 163$	b=7	b=8 $\frac{\cdot 4}{2\cdot 83}=\cdot 141$	b=9 $\frac{\cdot 4}{3}=\cdot 133$
2	1,000	31·6	7·3	6·2	5·65	5·16	4·77	4·47	4·22
3	2,000	44·7	10·3	8·9	7·99	7·3	6·75	6·3	5·95
4	3,000	54·8	12·7	10·9	9·8	8·9	8·26	7·75	7·3
5	4,000	63·2	14·6	12·6	11·3	10·3	9·53	8·95	8·4
6	5,000	70·7			12·6	11·5	10·7	10	9·4
7	6,000	77·5			13·8	12·7	11·7	11	10·4
8	7,000	83·7			14·9	13·7	12·6	11·8	11·2
9	8,000	89·4				14·6	13·5	12·7	11·9
10	9,000	94·9				15·5	14·3	13·4	12·8 13·3
12	10,000	100·				16·3	15·1	14·1	26·6
14	20,000	141				35·6	30·2	28·3	
16	30,000	173							
18	40,	200							
20	50,	224							
22	60,	245							
24	70,	265							
26	80,	283							
28	90,	300							
30	100,	316							
	120	346							

(Based upon the analysis presented by Prof. H. T. Eddy for homogeneous plates. The value of Poission's ratio assumed in the numerical substitutions has been 0.1:).



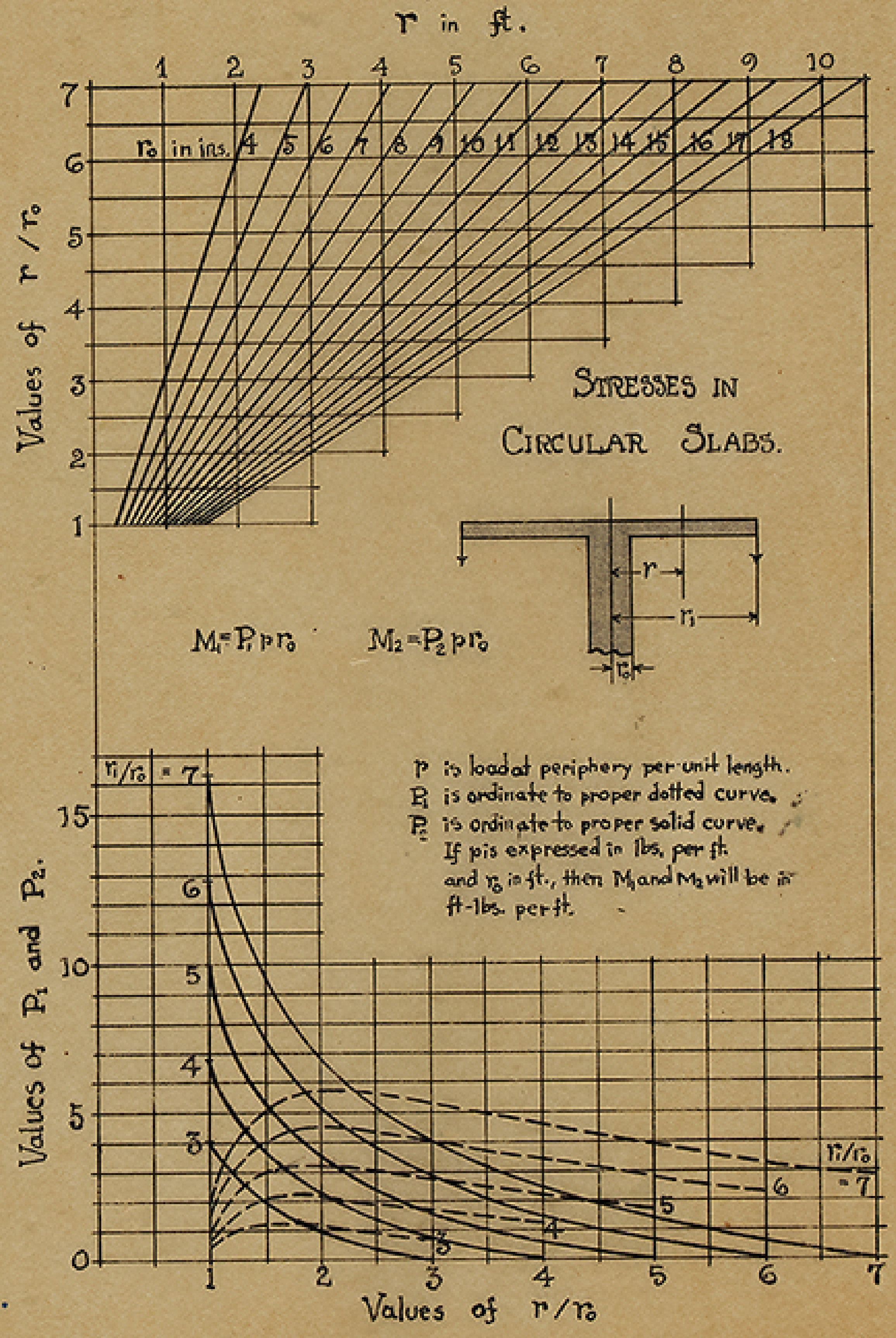
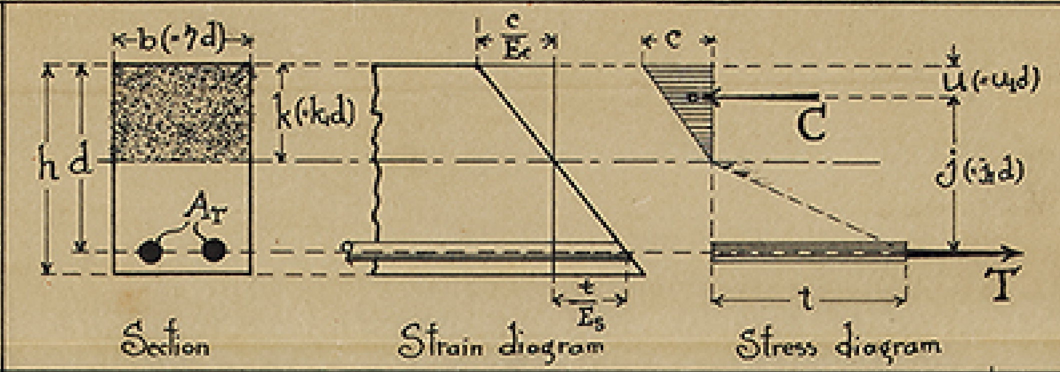


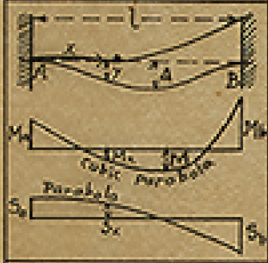
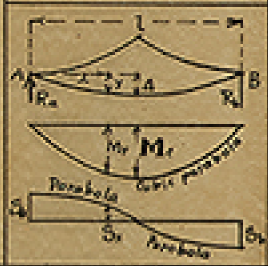
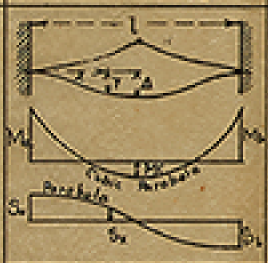
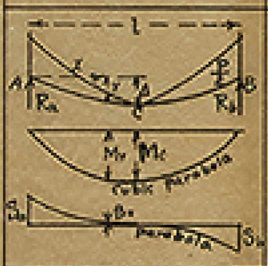
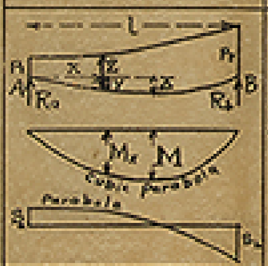
TABLE I

FORMULÆ FOR RECTANGULAR BEAM.

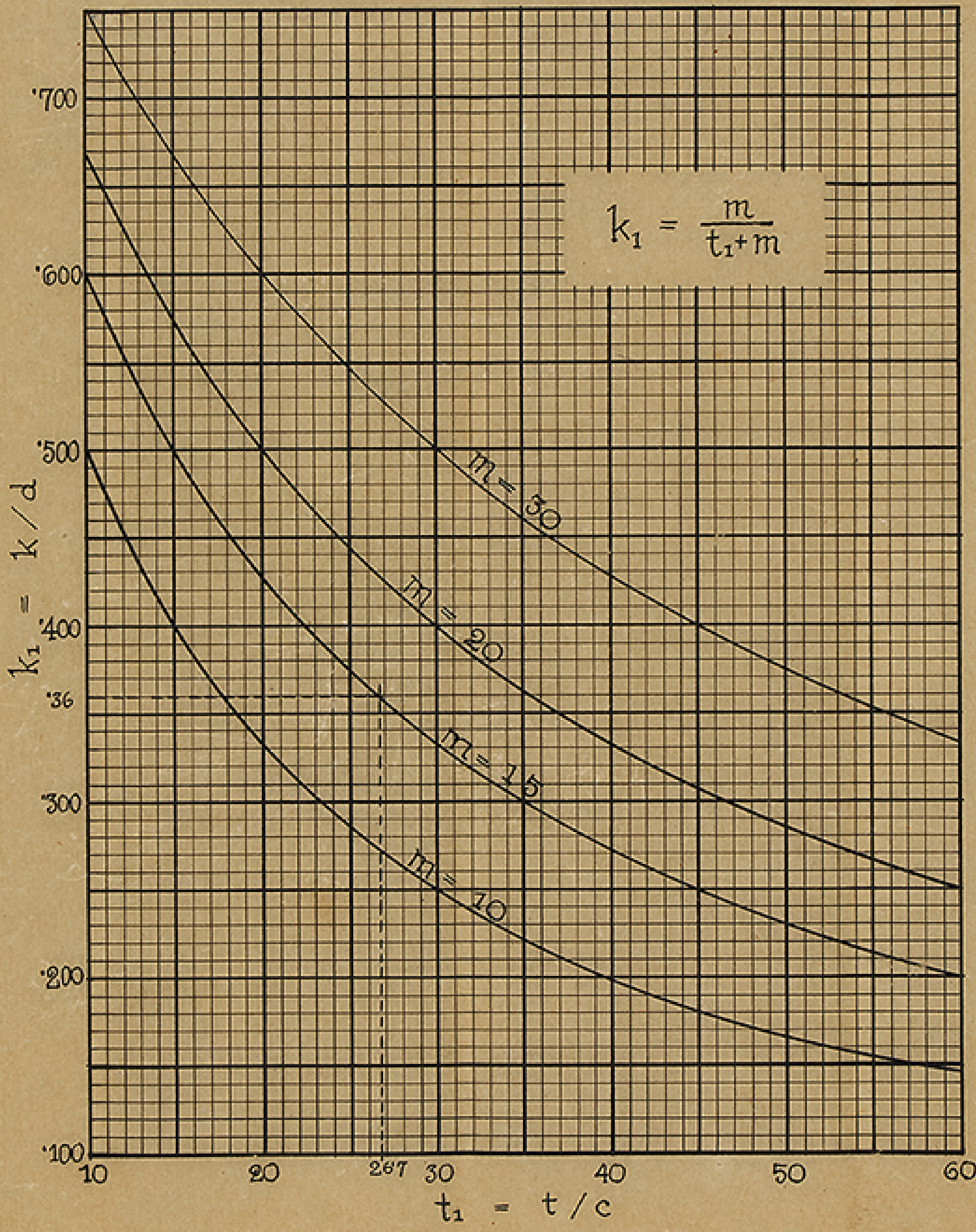


r	$\frac{A_T}{bd}$	$\frac{m}{2t_1(t_1+m)}$			1
t_1	$\frac{t}{c}$	$\frac{m}{2}\left(\sqrt{1+\frac{2}{mr}}-1\right)$			1′
k	k_1d	$\frac{m}{t_1+m}\cdot d$			2
		$mr\left(\sqrt{1+\frac{2}{mr}}-1\right)\cdot d$			2′
u	u_1d	$\frac{k_1}{3}\cdot d$	$\frac{m}{3(t_1+m)}\cdot d$		3
			$\frac{mr}{3}\left(\sqrt{1+\frac{2}{mr}}-1\right)\cdot d$		3′
j	j_1d	$(1-u_1)\cdot d$	$\left(1-\frac{k_1}{3}\right)\cdot d$	$\frac{3t_1+2m}{3(t_1+m)}\cdot d$	4
				$\left\{1-\frac{mr}{3}\left(\sqrt{1+\frac{2}{mr}}-1\right)\right\}\cdot d$	4′
A_T	rbd	$\frac{1}{j_1\cdot t}\cdot\frac{M}{d}$	$\frac{1}{\left(1-\frac{k_1}{3}\right)\cdot t}\cdot\frac{M}{d}$	$\frac{3(t_1+m)}{(3t_1+2m)\cdot t}\cdot\frac{M}{d}$	5
				$\frac{1}{\left\{1-\frac{mr}{3}(\sqrt{1+2/mr}-1)\right\}\cdot t}\cdot\frac{M}{d}$	5′
		$\frac{1}{t_1j_1\cdot c}\cdot\frac{M}{d}$	$\frac{1}{t_1\left(1-\frac{k_1}{3}\right)\cdot c}\cdot\frac{M}{d}$	$\frac{3(t_1+m)}{t_1(3t_1+2m)\cdot c}\cdot\frac{M}{d}$	6
				$\frac{1}{t_1\left\{1-\frac{mr}{3}(\sqrt{1+2/mr}-1)\right\}\cdot c}\cdot\frac{M}{d}$	6′
d	$\sqrt{\frac{M}{N_1b}}$	$\sqrt{\frac{1}{rj_1\cdot t}\cdot\frac{M}{b}}$	$\sqrt{\frac{1}{r\left(1-\frac{k_1}{3}\right)\cdot t}\cdot\frac{M}{b}}$	$\sqrt{\frac{6t_1(t_1+m)^2}{m(3t_1+2m)\cdot t}\cdot\frac{M}{b}}$	7
				______	
		$\sqrt{\frac{2}{k_1j_1\cdot c}\cdot\frac{M}{b}}$	$\sqrt{\frac{2}{k_1\left(1-\frac{k_1}{3}\right)\cdot c}\cdot\frac{M}{b}}$	$\sqrt{\frac{6(t_1+m)^2}{m(3t_1+2m)\cdot c}\cdot\frac{M}{b}}$	8
				______	
b	$\frac{M}{N_1d^2}$	$\frac{1}{rj_1\cdot t}\cdot\frac{M}{d^2}$	$\frac{1}{r\left(1-\frac{k_1}{3}\right)\cdot t}\cdot\frac{M}{d^2}$	$\frac{6t_1(t_1+m)^2}{m(3t_1+2m)\cdot t}\cdot\frac{M}{d^2}$	9
				______	
		$\frac{2}{k_1j_1\cdot c}\cdot\frac{M}{d^2}$	$\frac{2}{k_1\left(1-\frac{k_1}{3}\right)\cdot c}\cdot\frac{M}{d^2}$	$\frac{6(t_1+m)^2}{m(3t_1+2m)\cdot c}\cdot\frac{M}{d^2}$	10
				______	
$\left(\frac{b}{d}=\eta\right)$ d $(b=\eta d)$	$\sqrt[3]{\frac{M}{N_1\eta}}$	$\sqrt[3]{\frac{1}{rj_1\cdot t}\cdot\frac{M}{\eta}}$	$\sqrt[3]{\frac{1}{r\left(1-\frac{k_1}{3}\right)\cdot t}\cdot\frac{M}{\eta}}$	$\sqrt[3]{\frac{6t_1(t_1+m)^2}{m(3t_1+2m)\cdot t}\cdot\frac{M}{\eta}}$	11
				______	
		$\sqrt[3]{\frac{2}{k_1j_1\cdot c}\cdot\frac{M}{\eta}}$	$\sqrt[3]{\frac{2}{k_1\left(1-\frac{k_1}{3}\right)\cdot c}\cdot\frac{M}{\eta}}$	$\sqrt[3]{\frac{6(t_1+m)^2}{m(3t_1+2m)\cdot c}\cdot\frac{M}{\eta}}$	12
				______	
t	t_1c	$\frac{1}{rj_1}\cdot\frac{M}{bd^2}$	$\frac{1}{r(1-k_1/3)}\cdot\frac{M}{bd^3}$	$\frac{3}{mr^2(2-\sqrt{1+2/mr})}\cdot\frac{M}{bd^2}$	13
c	$\frac{t}{t_1}$	$\frac{2}{k_1j_1}\cdot\frac{M}{bd^2}$	$\frac{2}{k_1(1-k_1/3)}\cdot\frac{M}{bd^2}$	$\frac{3(\sqrt{1+2/mr}-1)}{2r^2(2-\sqrt{1+2/mr})}\cdot\frac{M}{bd^2}$	14
T & C	$\frac{M}{j}$	$\frac{1}{j_1}\cdot\frac{M}{d}$	$\frac{1}{(1-k_1/3)}\cdot\frac{M}{d}$	$\frac{3(t_1+m)}{3t_1+2m}\cdot\frac{M}{d}$	15
				$\frac{1}{1-\frac{mr}{3}(\sqrt{1+2/mr}-1)}\cdot\frac{M}{d}$	15′
M	Tj	$rj_1\cdot t\cdot bd^2$	$r\left(1-\frac{k_1}{3}\right)\cdot t\cdot bd^2$	$\frac{3t_1+2m}{6t_1(t_1+m)^2}\,m\cdot t\cdot bd^2$	16
				______	
	Cj	$\frac{1}{2}k_1j_1\cdot c\cdot bd^2$	$\left\{\frac{k_1}{2}\left(1-\frac{k_1}{3}\right)\right\}\cdot c\cdot bd^2$	$\frac{3t_1+2m}{6(t_1+m)^2}\,m\cdot c\cdot bd^2$	17
				______	
		a	b		

後藤が構造学の研究・普及のために作成した資料_DIAGRAM FOR REINFORCED CONCRETE_27_001

The Beam and Its Load with the B.M. and S.F. Diagrams.	B.M. Equation and Maximum B.M. M_x & M	Equation of Elastic Line, & Max. Deflection in Terms of The Loading. y & Δ.	Max. Deflection in Terms of Stress on Extreme Fiber of Symmetrical Section. Δf	Max. Stress on Extreme Fibre in Terms of the Loading Symmetrical Section. f.	Breaking weight in Terms of the Fibre stress P	S.F. Equation, Max. S.F. and Reactions. S_x, S, R_a & R_b	Relative Strength
	$M_x = \frac{Pl}{30}(10\frac{x^3}{l^3} - 9\frac{x}{l} + 2)$ $M_a = -\frac{1}{15}Pl$ $M_b = -\frac{1}{10}Pl$ $M = \frac{3\sqrt{\frac{3}{10}}+1}{15}Pl = 0.0429Pl$ at $x = l\sqrt{\frac{3}{10}} = 0.548l$	$y = \frac{Pl^3}{60EI}(2\frac{x^2}{l^2} - 3\frac{x^3}{l^3} + \frac{x^5}{l^5})$ $\Delta = \frac{Pl^3}{384EI}$ for $x = 0.525l$	$\Delta f = \frac{10}{192}\frac{fl^2}{Eh}$	$f = \frac{Plh}{20I}$ $= \frac{Pl}{10S_m}$	$P = \frac{20fI}{lh}$ $= \frac{10fS_m}{l}$	$S_x = \frac{1}{3}P - \frac{x^2}{l^2}P$ $S_b = -\frac{2}{3}P = R_b$ $S_a = \frac{1}{3}P = R_a$	$\frac{5}{4}$
	for $x < \frac{l}{2}$ $M_x = Px(\frac{1}{2} - \frac{2}{3}\frac{x^2}{l^2})$ $M_{\frac{l}{2}} = \frac{Pl}{6}$	$y = \frac{Pl^3}{12EI}(\frac{5}{8}\frac{x}{l} - \frac{x^3}{l^3} + \frac{2}{5}\frac{x^5}{l^5})$ $\Delta = \frac{Pl^3}{60EI}$ at Centre	$\Delta f = \frac{1}{5}\frac{fl^2}{Eh}$	$f = \frac{Plh}{12I}$ $= \frac{Pl}{6S_m}$	$P = \frac{12fI}{lh}$ $= \frac{6fS_m}{l}$	for $x < \frac{l}{2}$ $S_x = P(\frac{1}{2} - \frac{2x^2}{l^2})$ for $x > \frac{l}{2}$ $S_x = -P(\frac{1}{2} - \frac{2(l-x)^2}{l^2})$ $S_a = \frac{1}{2}P = R_a$ $S_b = -\frac{1}{2}P = R_b$	$\frac{3}{4}$
	for $x < \frac{l}{2}$ $M_x = -Pl(\frac{5}{48} - \frac{x}{2l} + \frac{2x^3}{3l^3})$ $M_a = M_b = -\frac{5}{48}Pl$ $M_c = \frac{Pl}{16}$	$y = \frac{Pl^3}{6EI}(\frac{5x^2}{16l^2} - \frac{x^3}{2l^3} + \frac{x^5}{5l^5})$ $\Delta = \frac{7Pl^3}{1920EI}$ at centre	$\Delta f = \frac{7}{100}\frac{fl^2}{Eh}$	$f = \frac{5Plh}{96I}$ $= \frac{5Pl}{48S_m}$	$P = \frac{96fI}{5lh}$ $= \frac{48fS_m}{5l}$	for $x < \frac{l}{2}$ $S_x = P(\frac{1}{2} - \frac{2x^2}{l^2})$ $S_a = \frac{1}{2}P = R_a$ $S_b = \frac{1}{2}P = R_b$	$\frac{6}{5}$
	for $x < \frac{l}{2}$ $M_x = Px(\frac{1}{2} - \frac{x}{l} + \frac{2x^2}{3l^2})$ $M_c = \frac{Pl}{12}$	$y = \frac{P^3}{12EI}(\frac{3}{8}\frac{x}{l} - \frac{x^3}{l^3} + \frac{x^4}{l^4} - \frac{2}{5}\frac{x^5}{l^5})$ $\Delta = \frac{3}{320}\frac{Pl^3}{EI}$	$\Delta f = \frac{9}{40}\frac{fl^2}{Eh}$	$f = \frac{Plh}{24I}$ $= \frac{Pl}{12S_m}$	$P = \frac{24fI}{lh}$ $= \frac{12fS_m}{l}$	for $x < \frac{l}{2}$ $S_x = \frac{2(\frac{l}{2} - x)^2}{l^2}P$ for $x > \frac{l}{2}$ $S_x = \frac{2(x - \frac{l}{2})^2}{l^2}P$ $S_a = \frac{1}{2}P = R_a$ $S_b = -\frac{1}{2}P = R_b$	$\frac{3}{2}$
	$M_x = \frac{x(l-x)}{6l}\{P_1(2l-x) + P_2(l+x)\}$ $M = \frac{l^2}{6}\frac{r-P_1}{(P_2-P_1)^2}\{(2P_1+P_2)(P_2-P_1)-(r^2+P_1r-2P_1^2)\}$ at $x = l\frac{r-P_1}{P_2-P_1}$ where $r = \sqrt{\frac{P_1^2+P_1P_2+P_2^2}{3}}$					$S_x = R_a - \frac{P_1+Z}{2}x$ $S_a = \frac{1}{6}(2P_1+P_2) = R_a$ $S_b = -\frac{1}{6}(2P_2+P_1) = R_b$ where $Z = P_1 + \frac{x(P_2-P_1)}{l}$	

DEPTH OF NEUTRAL AXIS FOR VARIOUS RATIO OF STRESSES.



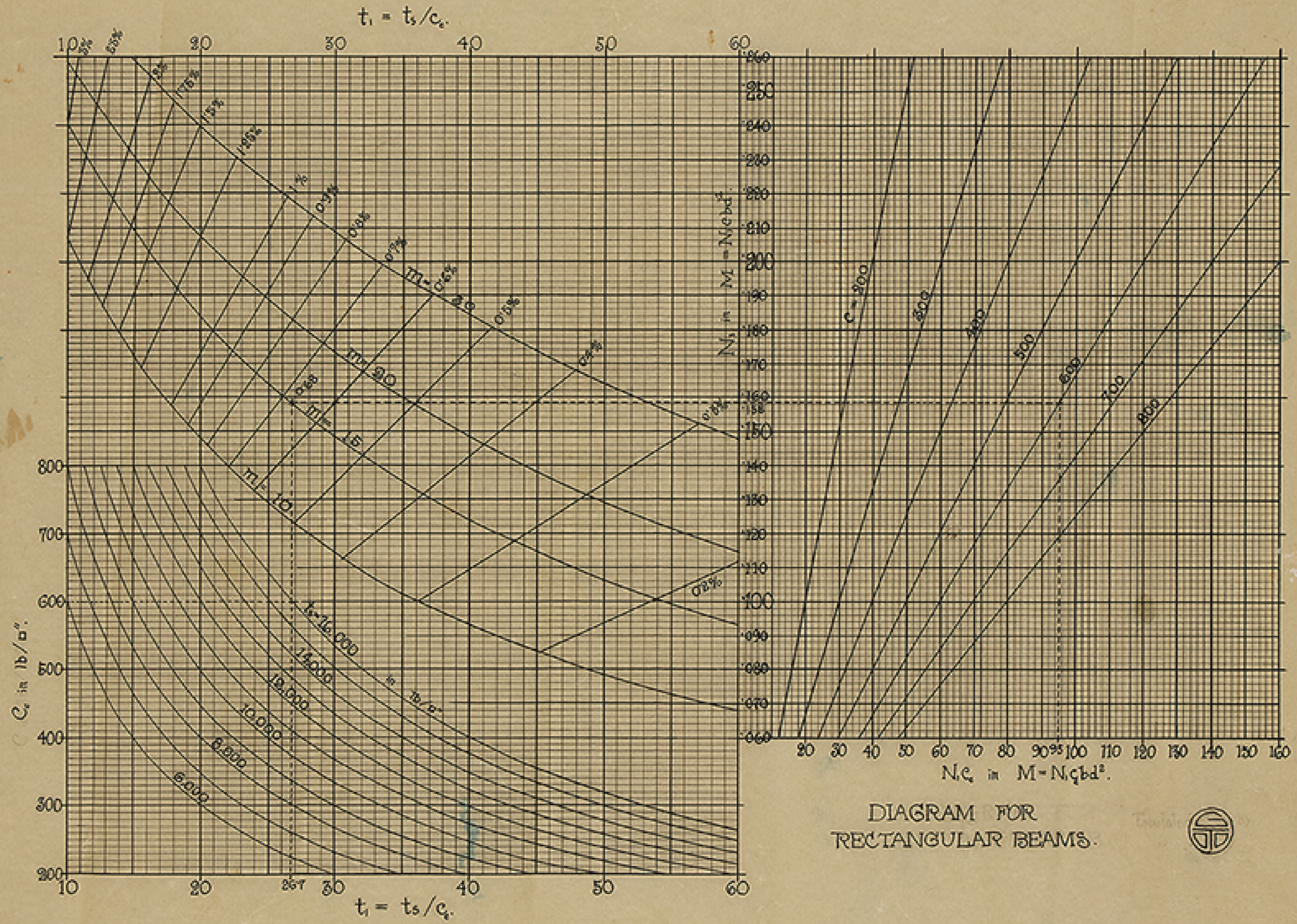


DIAGRAM FOR
RECTANGULAR BEAMS.

後藤が構造学の研究・普及のために作成した資料_DIAGRAM FOR REINFORCED CONCRETE_30_001