to designers. The lettered dimensions given on Diagrams 6 and 7 are self-explanatory. The general problem is divided into two cases: Case 1, symmetric reinforcement with no tension, Diagram 6; Case 2, symmetric reinforcement with tension, Diagrams 7 and 8. In each case the thickness of insulation is taken as $d_1 = D/10$, making $a = 0.4\ D$. This will usually give good values, even for very large values of D. The reason for adopting this fixed relation is to simplify the formulae which could not otherwise be solved by curves owing to the extra variable d_1.

The curves cover any case of eccentrically applied loading, as for columns, piers or arch sections where N = the resultant thrust normal to the section and v = the eccentricity of this thrust.

Diagram 6 gives everything required for designing a section or for finding the stresses in a given design.

Diagram 7 gives all information for designing a section, while the additional diagram 8 is added to find the stresses in a given design.

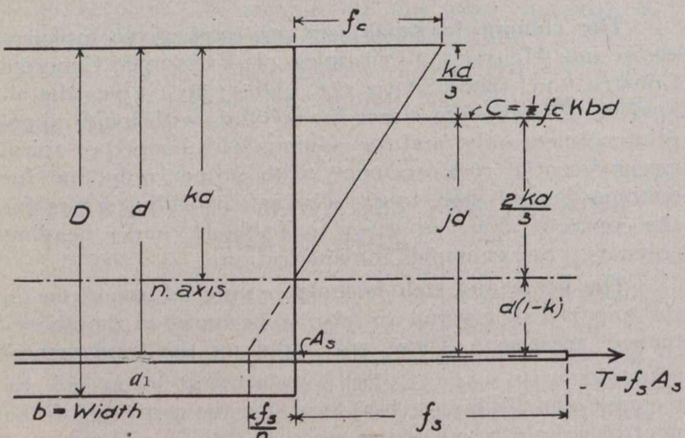
ALLOWABLE UNIT STRESSES AND BEAM FORMULAE.

TABLE II.
PHYSICAL CONSTANTS, CLASS A CONCRETE

Mixture Concrete.	E lbs. per sq. in. (6 months).	ϵ for 1° F.	Ult. comp. lbs. per sq. in. 12" Cubes (6 months)	Working stresses, lbs. per sq. in.					
				Compression.	Columns.	Tension.	Shear.	Bond.	$n = E_s/E_c$
1:1.5:3	3,500,000	0.000,0050	3,400	650	550	0	45	Smooth rod, 60 lb., developed in 65 diam. Deformed bars, 150 lb., developed in 25 diam. for O bars.	15 for average working conditions.
1:2:4	3,000,000	0.000,0055	3,200	600	500	0	40		
1:2.5:5	2,500,000	0.000,0060	3,000	550	450	0	35		
1:3:6	2,000,000	0.000,0065	2,800	500	400	0	30		
Steel	30,000,000	0.000,0067	65,000	15,000	10,000	15,000	10,000		

Weight of plain concrete = 144 lbs. per cu. ft. 1% reinforcement = 132 lbs. per cu. yd. = 4.9 lbs. per cu. ft.

Rectangular Beams in Simple Flexure, Neglecting Tension in the Concrete.



Moment of resistance of the concrete

$= M_c = \frac{1}{2} f_c kjbd^2 = Cjd = R_c bd^2.$

Moment of resistance of the steel

$= M_s = f_s pjbd^2 = Tjd = R_s bd^2.$

The smaller value of M or R governs the strength of the beam.

Steel ratio:

$p = \frac{A_s}{bd}$; $k = \sqrt{2pn + (pn)^2} - pn$; and $j = 1 - \frac{k}{3}$.

Also, $A_s = pbd$; $f_c = \frac{2M}{kjbd^2} = \frac{2R_c}{kj}$; and $f_s = \frac{M}{pjbd^2} = \frac{M}{jd\,A_s} = \frac{R_s}{pj}$,

where M = moment of the external forces.

When $M_c = M_s$, then $R_c = R_s$ and $p = \dfrac{1}{\frac{2f_s}{f_c}\left(\frac{f_s}{nf_c} + 1\right)}$

Insulation $d_1 = \frac{1}{2}\sqrt{D}$ about, and $D = d + d_1$. Min $d_1 = \frac{3}{4}$".

TABLE III.
WORKING VALUES FOR CLASS A CONCRETE.

Mixture Concrete.	$\frac{f_s}{f_c}$	p for $n=15$, $M_s = M_c$	Steel per cu. ft.	j	k	$R_c = \frac{1}{2} f_c kj$	$R_s = f_s pj$	Moments of external loading. Nature of supports.	Uniform load.	Concentr load.
1:1.5:3	23.1	0.0085	4.17 lbs.	0.869	0.393	110.9	110.9	Simple beam, 2 supports	$M = pl^2/8$	$M = Pl/4$
1:2:4	25	0.0075	3.68 lbs.	0.875	0.375	98.4	98.4	One end continuous	$M = pl^2/10$	$M = Pl/5$
1:2.5:5	27.3	0.0065	3.19 lbs.	0.882	0.355	86.0	86.0	Continuous beam	$M = pl^2/12$	$M = Pl/6$
1:3:6	30	0.0056	2.74 lbs.	0.888	0.335	74.5	74.5			