CAMBRIA STEEL

A handbook of information relating to

STRUCTURAL STEEL

Manufactured by the

CAMBRIA STEEL CO.

containing useful tables, rules, data and formulæ
for the use of

ENGINEERS, ARCHITECTS,

BUILDERS AND MECHANICS.

Prepared and Compiled by

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GENERAL OFFICE, PHILADELPHIA.

WORKS, JOHNSTOWN, PA.

1904

PRICE, $1.00

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PHILADELPHIA, PA.

PREFACE TO SEVENTH EDITION.

The present edition of our hand book contains most of the matter of the three prior editions, corrected or revised, as needed, to bring it up to date.

New sections and sizes of material which we have prepared to furnish since the publication of the sixth edition, together with the information relating to the properties of these sections, have been incorporated in the drawings and tables.

Among the new sections which have been added are a number of T-Bars, making our list of these shapes more complete than formerly, two sections of ship channels, two sections of angles, and a fuller line of squares, rounds, flats, blooms and slabs. A list of forgings for car work and other small forgings also has been added.

Bolts of $\frac{3}{4}$-inch diameter have been adopted for all beam separators, the table of rivet sizes and dimensions and the list of clevises have been revised, the tables of weights and areas of square and round bars and circumferences of round bars and the table of weights of flat rolled steel bars have been corrected.

PREFACE TO SIXTH EDITION.

The sixth edition of our hand book, contains all of the data of the fourth and fifth editions, which, however, have been corrected where necessary and revised to conform to our present practice.

The present edition also contains a considerable amount of new matter relating to new sections of angles and T-Bars, and additional sizes of billets, blooms, ingots, edged and sheared plates.

The weights of angles, Z-Bars and T-Bars now given are those adopted as standards by the Association of American Steel Manufacturers.

Other new matter, which has been introduced, consists of tables of safe loads and dimensions for plate and angle columns and for Z-Bar columns with cover plates. Tables have been added showing the section moduli and moments of inertia for all of the built-up columns for which the safe loads are tabulated, which values will be of special assistance in cases where it is necessary to consider the effect of eccentric loads in figuring the strength of the columns.

Tables of safe loads for angles, T-Bars and Z-Bars acting as beams with uniformly distributed loads, have been inserted, and in the case of angles with unequal legs the safe loads are given for both positions, that is, with the long leg vertical and with the short leg vertical.

The matter relating to fire-proof construction has been revised, and some changes have been made in the information relating to wood.

Special attention is called to the list of sheared plates which we can now furnish in widths up to 126 inches.

CONTENTS.

(*For complete detail of Contents, see Index.*)

GENERAL INFORMATION.

Our product is almost exclusively steel, made by the Bessemer or Open Hearth process, as required, and of all qualities from the softest rivet stock to high carbon special spring material.

Our Beams and Channels are made to conform to the American Standards, adopted January, 1896, in which the flanges have a uniform slope of one to six, and the dimensions, proportions and weights are determined by a regular schedule, as shown on the diagrams on pages 22 and 23. The standard proportions of beams and channels are further shown on page 24.

The principal structural angles now made, are limited in number to conform to the American Standards, adopted December, 1895, and include twelve base, or a total of eighty-four, sizes for equal leg angles, and nine base, or a total of eighty-six, sizes of unequal leg angles, all varying in thickness by one-sixteenth inch, as shown on pages 12 and 14 and tables herein. It is believed that these standard angles include a sufficient range of sizes to meet all usual structural requirements, but, at the same time, we will continue the manufacture of angles of special sizes and proportions for those who require them, as shown on pages 13 and 15.

The weights of angles, Z-Bars and T-Bars now given, are those adopted as American Standards in July, 1902.

The method of increasing the sectional area of shapes from the minimum or base sizes to intermediate and maximum sizes, is shown on page 21. For beams and channels the increase from the minimum adds equally to the web thickness and flange width, the weight of the increase being equal to that of a plate of the same depth as the section, and of a thickness equal to the increase of the dimensions stated.

The method of increasing the thickness of angles and Z-Bars from the minimum has the effect of adding to the length of the legs, as shown on page 21, so that for intermediate and maximum sizes the legs will be somewhat longer than the minimum or nominal dimensions, except in the cases for which we have finishing grooves. The plates of drawings of sections, pages 2 to 21 inclusive, show the minimum or base sizes of the various shapes. Sections shown on the plates or lists for which more than one weight is stated can be rolled of different thicknesses to produce the stated weights. Others for which only one weight is given cannot be varied. Each section shown herein is numbered, both in the plates and tables, for convenience in reference and ordering.

I-Beams and Channels should be ordered of weights shown in the tables.

Orders for angles and plates should specify either the thickness or the weight, but not both.

All weights are stated in pounds per lineal foot of section, except in the table of rails on page 186 in which the weights are given in pounds per yard, as customary. Weights of rolled sections are calculated on the basis of 489.6 pounds per cubic foot of steel, and 3.4 times the sectional area in square inches equals the weight in pounds per lineal foot. In calculating the weights, areas, and properties of I-Beams, Channels, and structural angles for the lists and tables herewith, the fillets and smaller rounded corners were not considered.

Structural material, unless otherwise ordered, will be cut to length with variation not to exceed $\frac{3}{8}$ inch more or less than that specified. For cutting to exact lengths or with less variation than $\frac{3}{8}$ inch an extra price will be charged.

All sections shown herein are steel.

OFFICES FOR SALE OF CAMBRIA STEEL CO.'S PRODUCTS

GENERAL OFFICES, PHILADELPHIA: Arcade Building, Corner Fifteenth and Market Streets. (Connected by bridge with P. R. R. Terminal Station.)

NEW YORK.........Empire Building, 71 Broadway.

CHICAGO...........Western Union Building, Corner of Clark and Jackson Streets.

CINCINNATI.......Union Trust Building, Corner of Fourth and Walnut Streets.

BOSTON............Paddock Building, 101 Tremont Street.

ST. LOUIS..........Chemical Building, Corner of Eighth and Olive Streets.

TOLEDO............Nasby Building, Corner of Huron and Madison Streets.

CLEVELAND........Citizens Building, 190 Euclid Avenue.

PITTSBURG..........Park Building, Corner of Fifth Avenue and Smithfield Street.

BALTIMORE........310–312 North Street.

NEW ORLEANS......Hennen Building, Corner of Common and Carondelet Streets.

ATLANTA...........Austell Building, 10 N. Forsyth Street.

SAN FRANCISCO.....17–23 Beale Street.

TACOMA...........1501 Pacific Avenue.

WORKS AT

JOHNSTOWN, PA.

STRUCTURAL STEEL WORK.

Finished Steel Work for Buildings, including Beams, Girders, Columns, Roof Trusses, etc., fitted complete and ready for erection.

STEEL CARS.

Gondola, Hopper-Gondola, Hopper, Flat, etc.

STEEL RAILS.

Steel T-Rails, 8 lbs. to 100 lbs. per yard.
Angle and Plain Splice Bars.
Standard and Special Track Bolts and Nuts.
For detailed information, see T-Rail Catalogue.

STEEL AXLES.

Passenger Car, Freight Car, Tender Truck,
Engine Truck, Driving, Street Car,
Mine Car, etc.

CRANK PINS, PISTON RODS.

Crank Pins and Piston Rods made to any requirement.

MACHINE BOLTS, NUTS, RIVETS, AND PIPE OR TANK BANDS WITH ROLLED THREADS.

FORGINGS.

Axles, Crank Pins, Piston Rods and Forgings will be furnished of carbon steel or nickel steel as required and are annealed, or treated by our Coffin toughening process (patented) as specified.

Particular attention is called to our Coffin Process of treatment for toughening Axles, Crank Pins, Piston Rods and other forgings.

Crank Pins and Piston Rods are oil-tempered and other small Forgings will be, if desired.

See special catalogues for description and specifications of our various classes of steel forgings, and for small car forgings see list on page 28 herein.

SECTIONS

OF

STRUCTURAL STEEL SHAPES

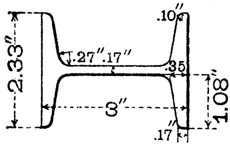
MANUFACTURED BY

CAMBRIA STEEL CO.

STANDARD BEAMS.

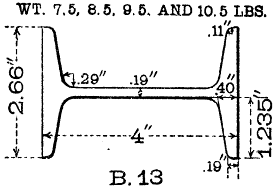
B. 5

WT. 5.5, 6.5 AND 7.5 LBS.



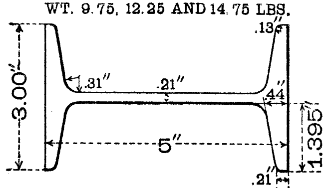
B. 9

WT. 7.5, 8.5, 9.5, AND 10.5 LBS.



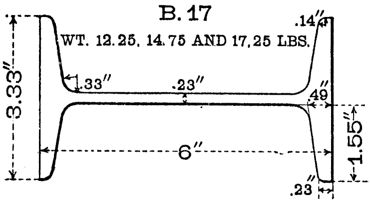
B. 13

WT. 9.75, 12.25 AND 14.75 LBS.



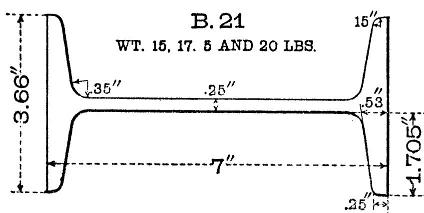
B. 17

WT. 12.25, 14.75 AND 17.25 LBS.



B. 21

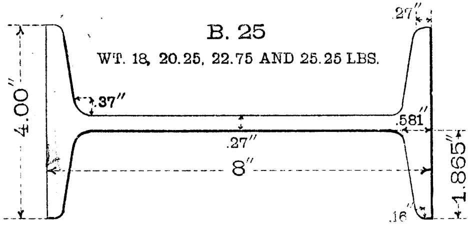
WT. 15, 17. 5 AND 20 LBS.



STANDARD BEAMS.

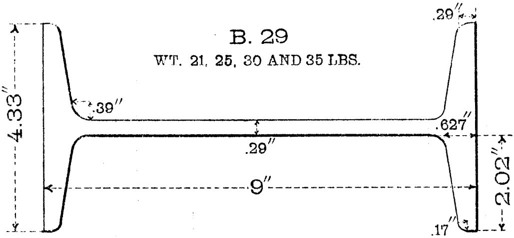
B. 25

WT. 18, 20.25, 22.75 AND 25.25 LBS.



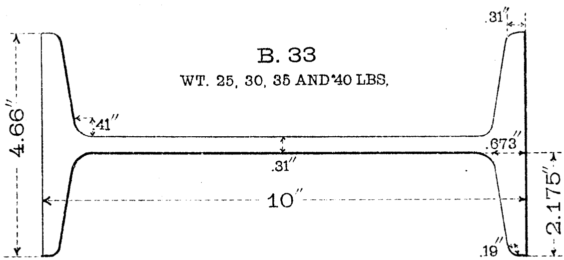
B. 29

WT. 21, 25, 30 AND 35 LBS.



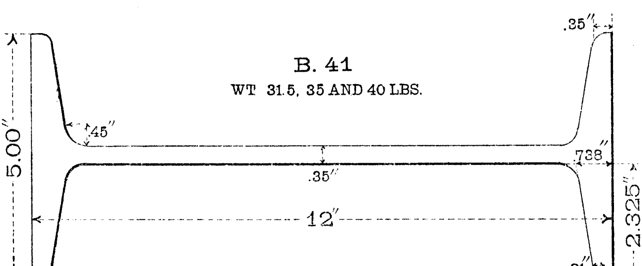
B. 33

WT. 25, 30, 35 AND 40 LBS.



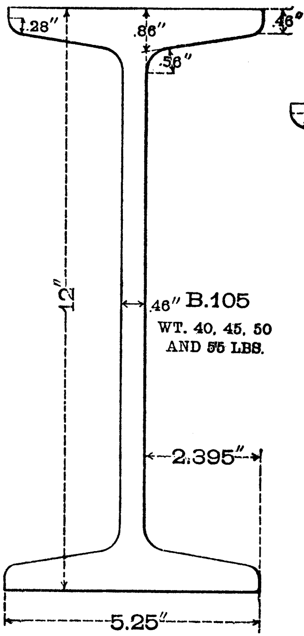
B. 41

WT 31.5, 35 AND 40 LBS.

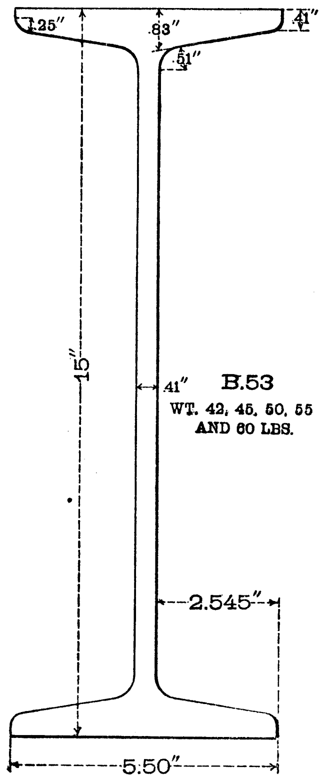


BEAMS.

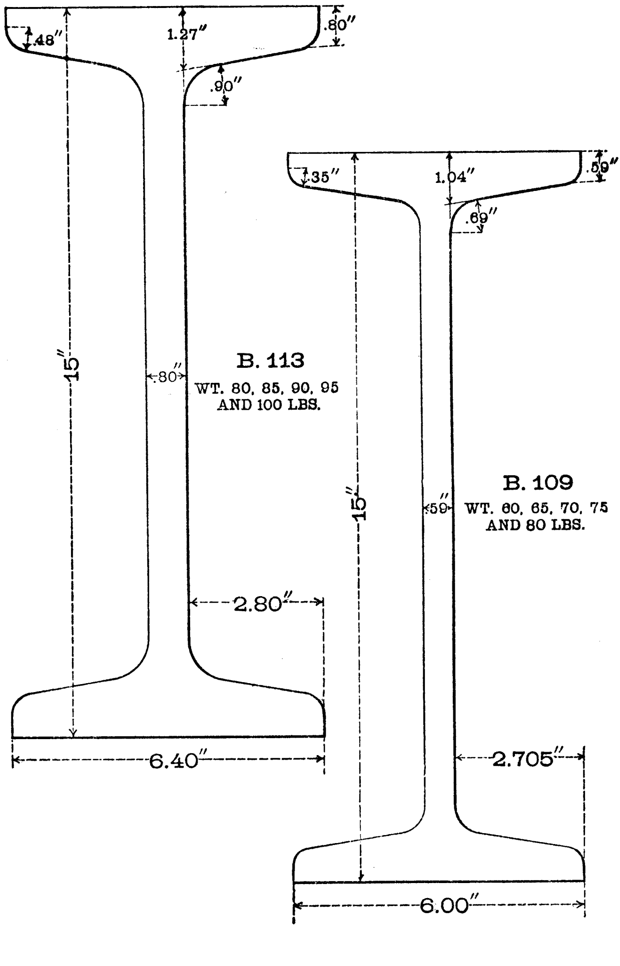
SPECIAL 12" BEAM.



STANDARD 15" BEAM.



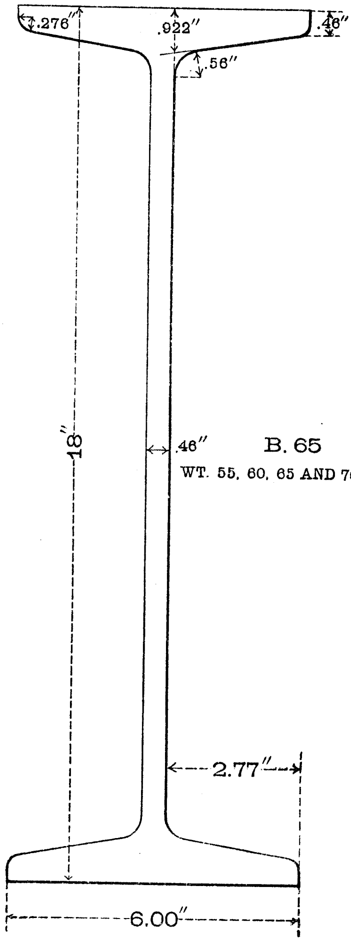
SPECIAL BEAMS.



B. 113
WT. 80, 85, 90, 95 AND 100 LBS.

B. 109
WT. 60, 65, 70, 75 AND 80 LBS.

STANDARD BEAMS.

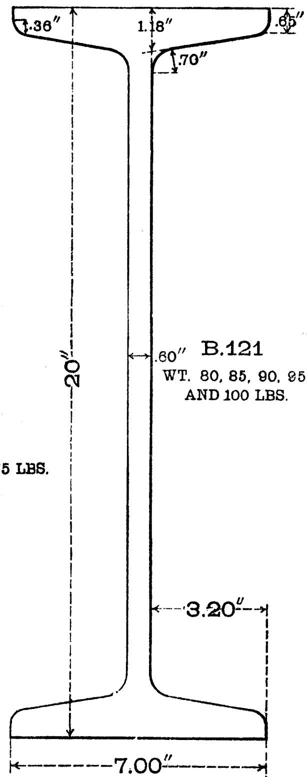


B. 65

WT. 55, 60, 65 AND 70 LBS.

BEAMS.

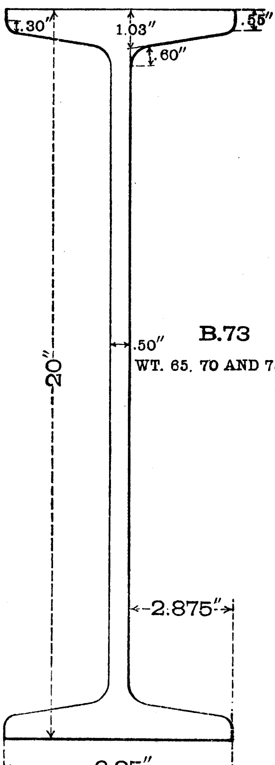
SPECIAL 20" BEAM.



B.121

WT. 80, 85, 90, 95 AND 100 LBS.

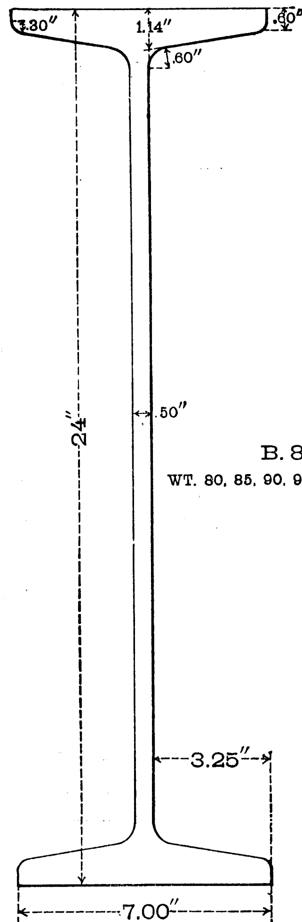
STANDARD 20" BEAM.



B.73

WT. 65, 70 AND 75 LBS.

STANDARD BEAMS.



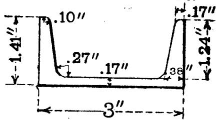
B. 89

WT. 80, 85, 90, 95 AND 100 LBS.

STANDARD CHANNELS.

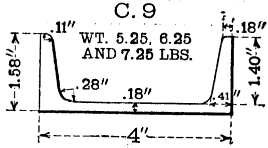
C. 5

WT. 4, 5 AND 6 LBS.



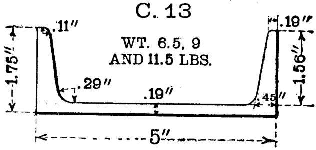
C. 9

WT. 5.25, 6.25 AND 7.25 LBS.



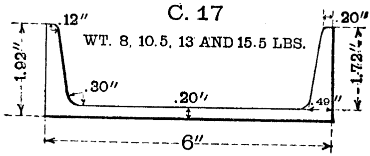
C. 13

WT. 6.5, 9 AND 11.5 LBS.



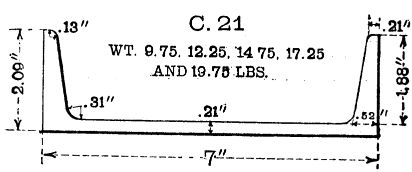
C. 17

WT. 8, 10.5, 13 AND 15.5 LBS.



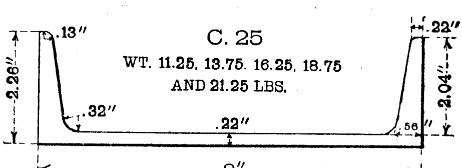
C. 21

WT. 9.75, 12.25, 14 75, 17.25 AND 19.75 LBS.



C. 25

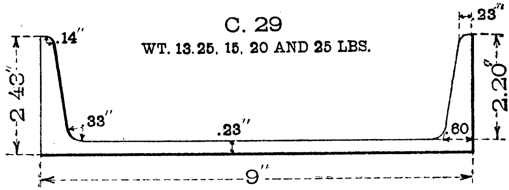
WT. 11.25, 13.75, 16.25, 18.75 AND 21.25 LBS.



STANDARD CHANNELS.

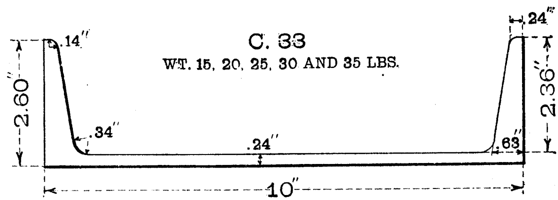
C. 29

WT. 13.25, 15, 20 AND 25 LBS.



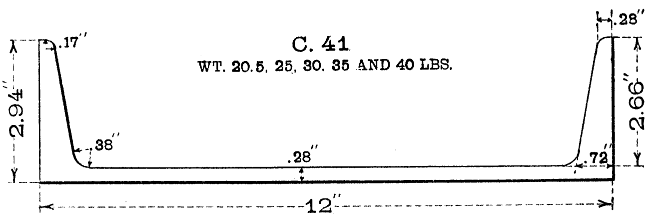
C. 33

WT. 15, 20, 25, 30 AND 35 LBS.



C. 41

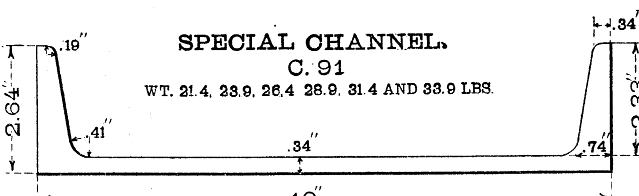
WT. 20.5, 25, 30, 35 AND 40 LBS.



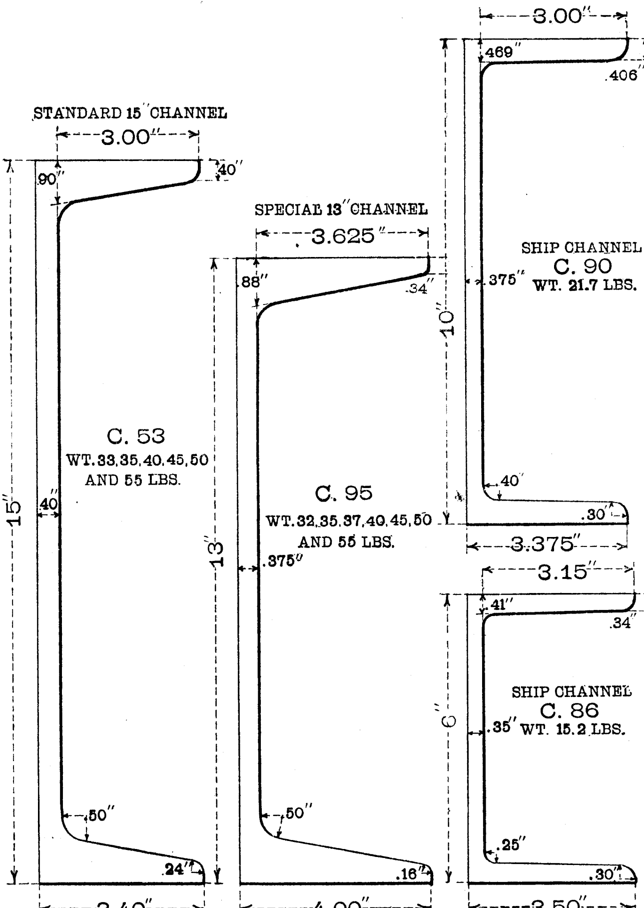
SPECIAL CHANNEL.

C. 91

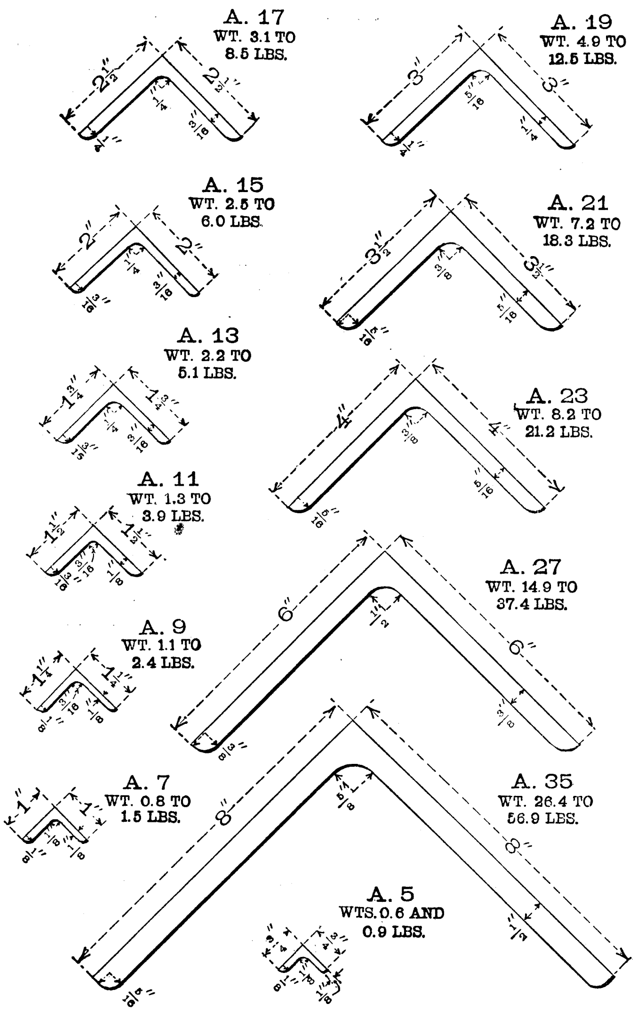
WT. 21.4, 23.9, 26.4 28.9, 31.4 AND 33.9 LBS.



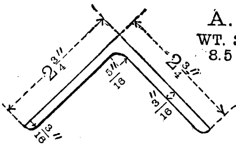
CHANNELS


STANDARD 15" CHANNEL
3.00"
.40"
.90"
C. 53
WT. 33, 35, 40, 45, 50
AND 55 LBS.
.40"
15"
.50"
.24"
3.40"
SPECIAL 13" CHANNEL
3.625"
.88"
.34"
C. 95
WT. 32, 35, 37, 40, 45, 50
AND 55 LBS.
.375"
13"
.50"
.16"
4.00"
3.00"
.469"
.406"
SHIP CHANNEL
C. 90
WT. 21.7 LBS.
.375"
10"
.40"
.30"
3.375"
3.15"
.41"
.34"
SHIP CHANNEL
C. 86
WT. 15.2 LBS.
.35"
6"
.25"
.30"
3.50"

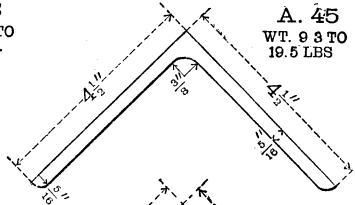
STANDARD ANGLES WITH EQUAL LEGS.



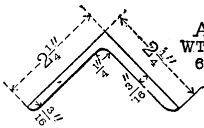
SPECIAL ANGLES



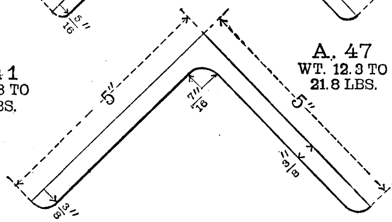
A. 43
WT. 3.4 TO 8.5 LBS.



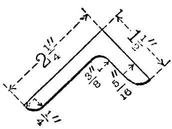
A. 45
WT. 9 3 TO 19.5 LBS



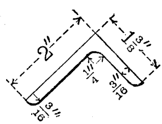
A. 41
WT. 2.8 TO 6.1 LBS.



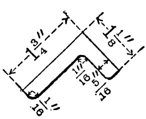
A. 47
WT. 12.3 TO 21.8 LBS.



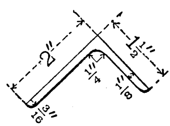
A. 84
WT. 3.7 LBS.



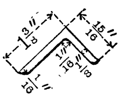
A. 121
WT. 2.1 TO 4.4 LBS.



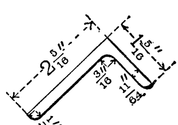
A. 165
WT. 2.8 LBS.



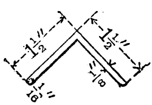
A. 123
WT. 1.5 TO 4.6 LBS.



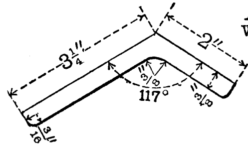
A. 170
WT. 1.0 LB.



A. 155
WT. 2.1 LBS

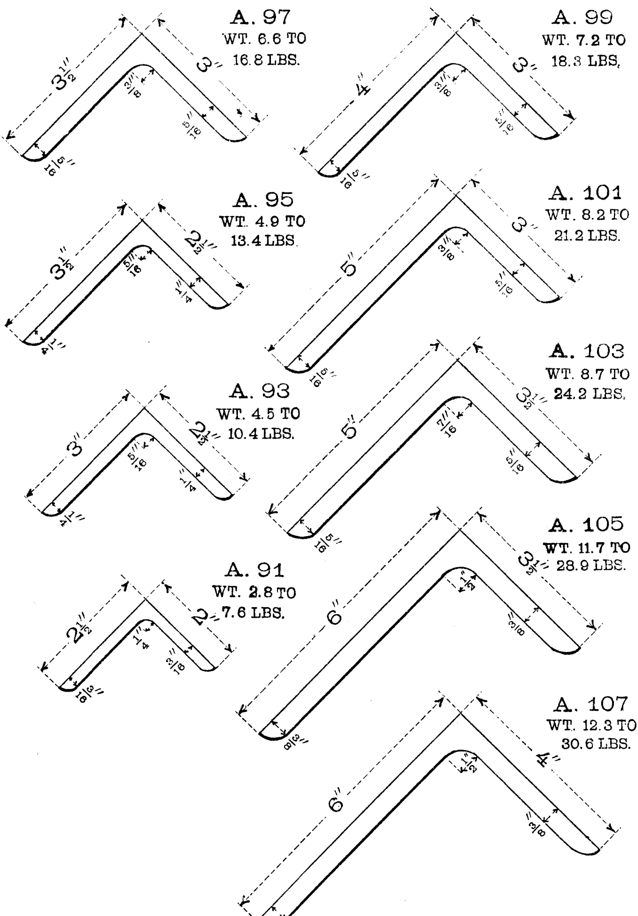


A. 61
WT. 1.3 TO 1.8 LBS.



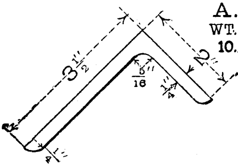
A. 253
WT. 6.4 TO 8.4 LBS.

STANDARD ANGLES WITH UNEQUAL LEGS.

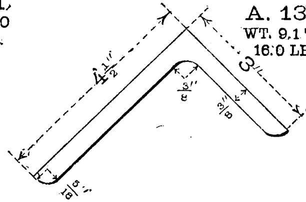


SPECIAL ANGLES WITH UNEQUAL LEGS.

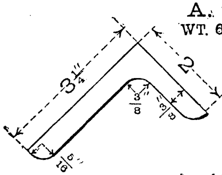
A. 151
WT. 4.5 TO 10.4 LBS.



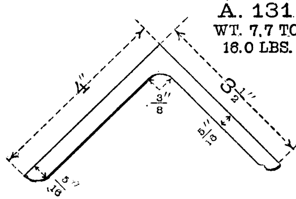
A. 133
WT. 9.1 TO 16.0 LBS.



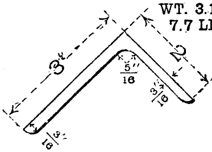
A. 149
WT. 6.2 LBS.



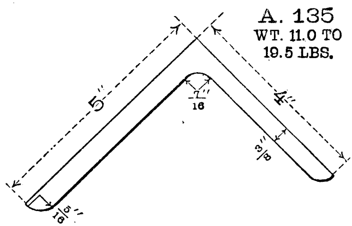
A. 131
WT. 7.7 TO 16.0 LBS.



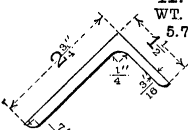
A. 129
WT. 3.1 TO 7.7 LBS.



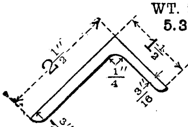
A. 135
WT. 11.0 TO 19.5 LBS.



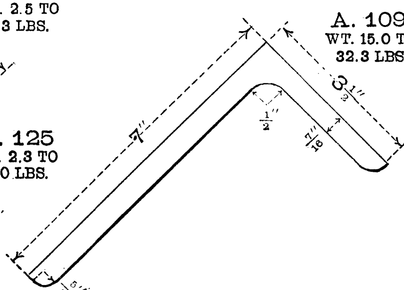
A. 128
WT. 2.6 TO 5.7 LBS.



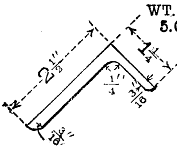
A. 127
WT. 2.5 TO 5.3 LBS.



A. 109
WT. 15.0 TO 32.3 LBS.



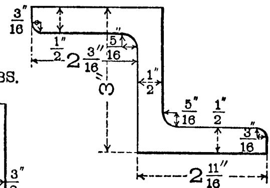
A. 125
WT. 2.3 TO 5.0 LBS.



STANDARD Z-BARS.

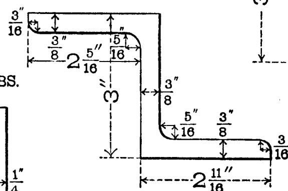
Z. 13

WT. 12.5 TO 14.2 LBS.



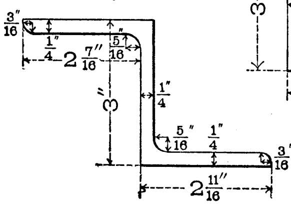
Z. 9

WT. 9.7 TO 11.4 LBS.



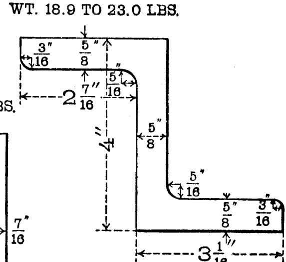
Z. 5

WT. 6.7 TO 8.4 LBS.



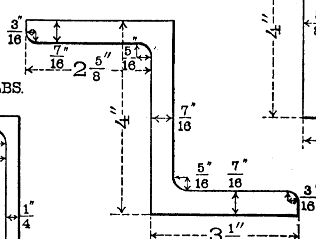
Z. 29

WT. 18.9 TO 23.0 LBS.



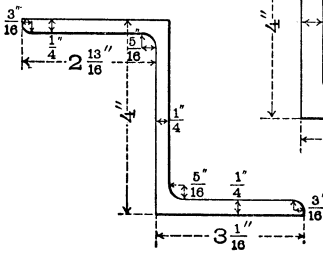
Z. 25

WT. 13.8 TO 17.9 LBS.



Z. 21

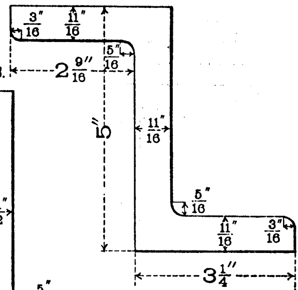
WT. 8.2 TO 12.4 LBS.



STANDARD Z-BARS.

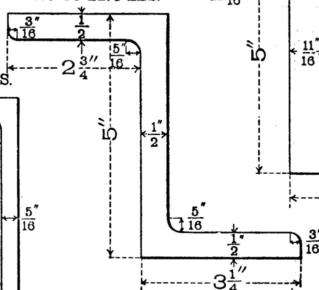
Z. 45

WT. 23.7 TO 28.3 LBS.



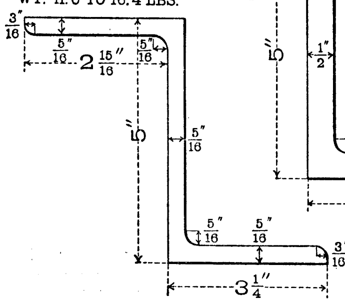
Z. 41

WT. 17.9 TO 22.6 LBS.



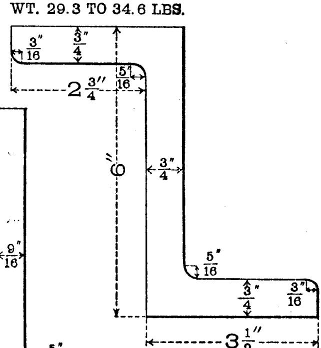
Z. 37

WT. 11.6 TO 16.4 LBS.



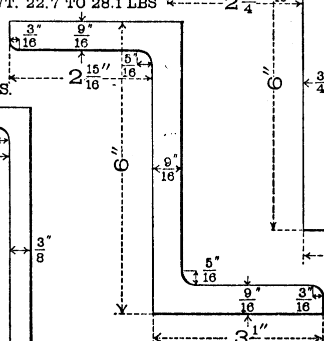
Z. 61

WT. 29.3 TO 34.6 LBS.



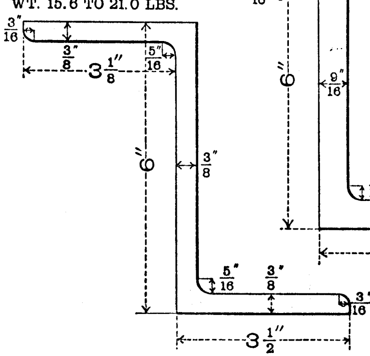
Z. 57

WT. 22.7 TO 28.1 LBS



Z. 53

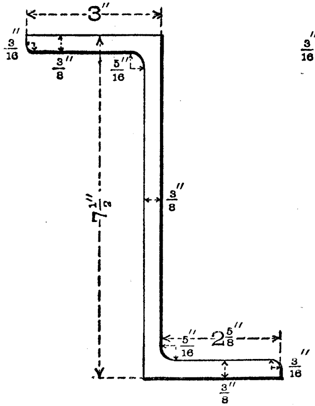
WT. 15.6 TO 21.0 LBS.



SPECIAL Z-BARS.

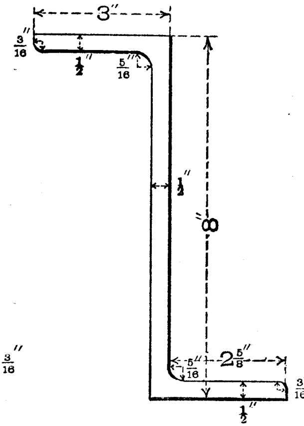
Z. 67

WT. 16.3 LBS.



Z. 73

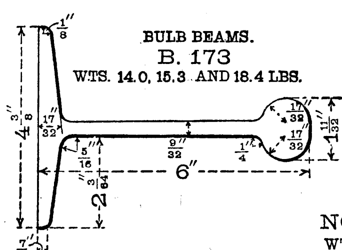
WT. 22.1 LBS.



BULB BEAMS.

B. 173

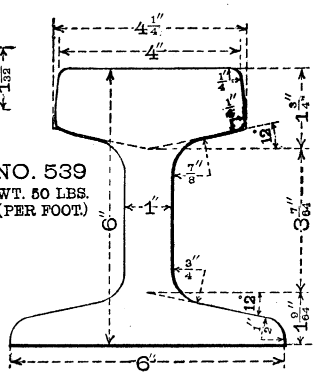
WTS. 14.0, 15.3 AND 18.4 LBS.



CRANE RAIL.

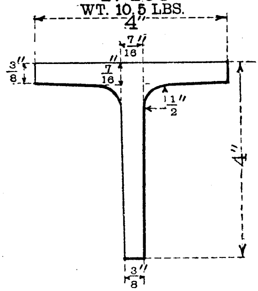
NO. 539

WT. 50 LBS. (PER FOOT.)

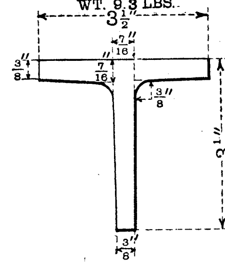


TEES WITH EQUAL LEGS.

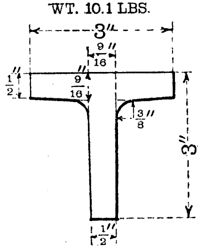
T. 108
WT. 10.5 LBS.



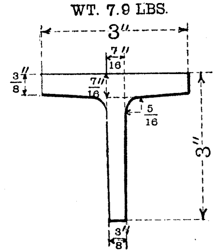
T. 97
WT. 9.3 LBS.



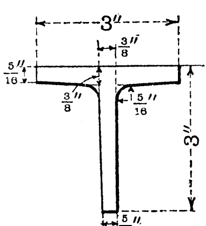
T. 73
WT. 10.1 LBS.



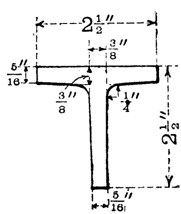
T. 69
WT. 7.9 LBS.



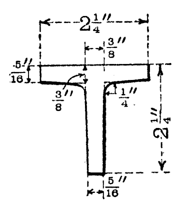
T. 67
WT. 6.8 LBS.



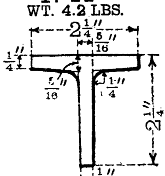
T. 49
WT. 5.6 LBS.



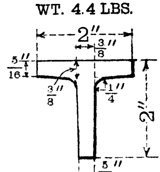
T. 42
WT. 5.0 LBS.



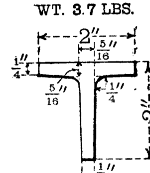
T. 41
WT. 4.2 LBS.



T. 39
WT. 4.4 LBS.

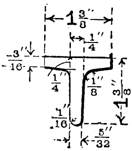


T. 37
WT. 3.7 LBS.

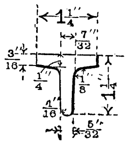


TEES WITH EQUAL LEGS.

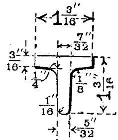
T. 189
WT. 1.9 LBS.



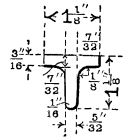
T. 187
WT. 1.7 LBS.



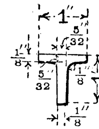
T. 183
WT. 1.6 LBS.



T. 181
WT. 1.4 LBS.

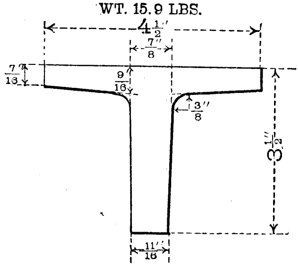


T. 5
WT. 1.0 LB.

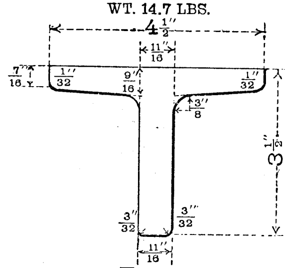


TEES WITH UNEQUAL LEGS.

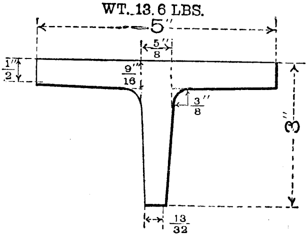
T. 140
WT. 15.9 LBS.



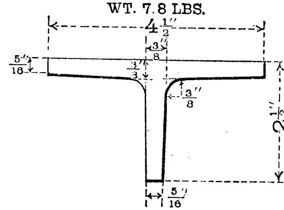
T. 138
WT. 14.7 LBS.



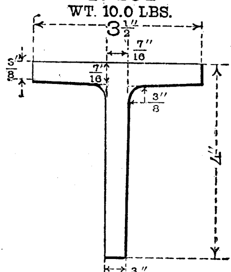
T. 169
WT. 13.6 LBS.



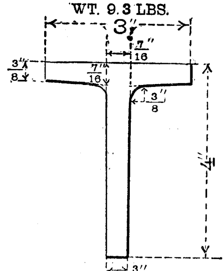
T. 120
WT. 7.8 LBS.



T. 101
WT. 10.0 LBS.

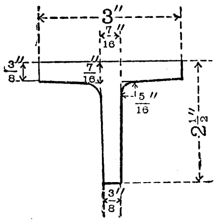


T. 84
WT. 9.3 LBS.

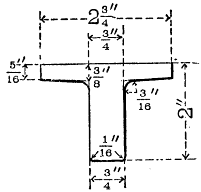


TEES WITH UNEQUAL LEGS.

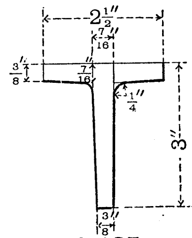
T. 65
WT. 7.2 LBS.



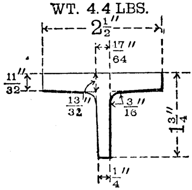
T. 62
WT. 7.4 LBS.



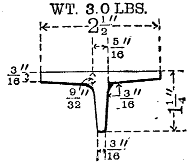
T. 56
WT. 7.0 LBS.



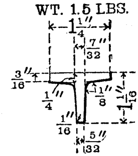
T. 27
WT. 4.4 LBS.



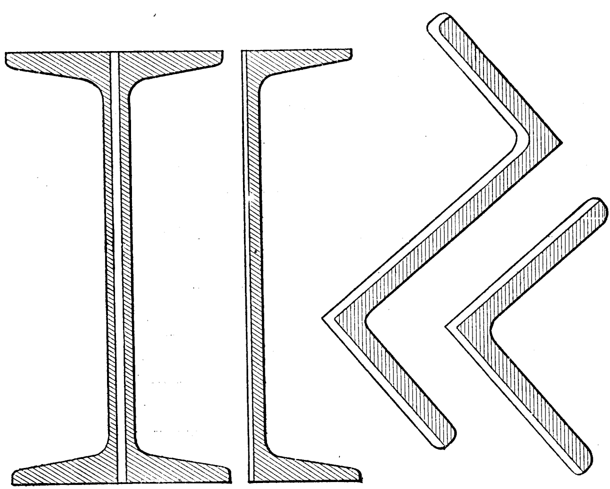
T. 22
WT. 3.0 LBS.



T. 185
WT. 1.5 LBS.



METHOD OF INCREASING SECTIONAL AREAS.



STANDARD BEAMS.

The following Formulas and Diagram relate to the Properties of I-Beams:

$$\text{Weight per foot} = \text{Area} \times 3.4.$$

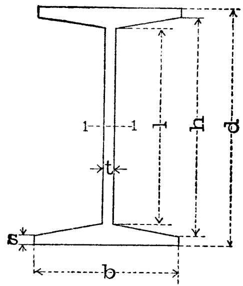
$$\text{Area} = td + 2s\,(b-t) + \frac{(b-t)^2}{12}.$$

$$\text{Section Modulus} = s = \frac{2I}{d}.$$

$$\text{Slope of Flange} = g = \frac{h-l}{b-t} = \tfrac{1}{6} \text{ for Standard Beams.}$$

I = Moment of Inertia, Neutral Axis (1–1) parallel to flange.

$$I = \tfrac{1}{12}\left[bd^3 - \frac{1}{4g}(h^4 - l^4)\right] \text{ or } \frac{bd^3}{12} - \tfrac{1}{8}(h^4 - l^4) \text{ for Standard Beams.}$$



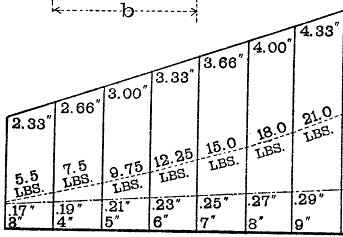
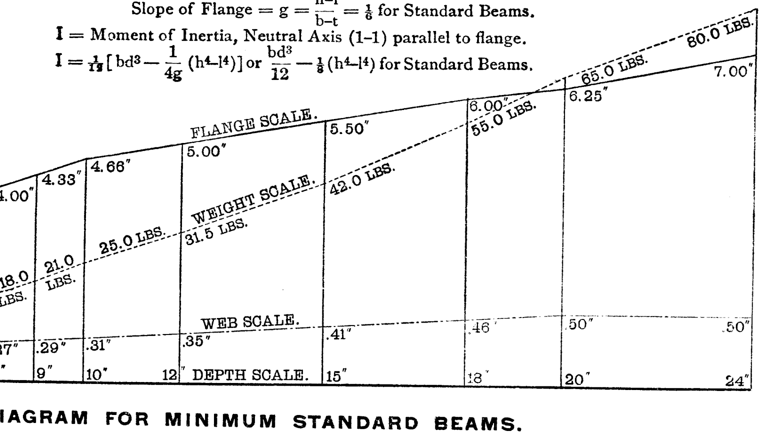
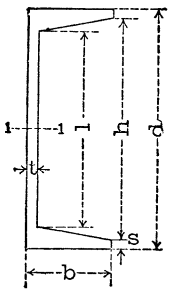



DIAGRAM FOR MINIMUM STANDARD BEAMS.

STANDARD CHANNELS.



The following Formulas and Diagram relate to the Properties of Channels:

$$\text{Weight per foot} = \text{Area} \times 3.4.$$

$$\text{Area} = td + 2s\,(b-t) + \frac{(b-t)^2}{6}.$$

$$\text{Section Modulus} = s = \frac{2I}{d}.$$

$$\text{Slope of Flange} = g = \frac{h-l}{2(b-t)}, \text{ or } \tfrac{1}{6} \text{ for Standard Channels.}$$

I = Moment of Inertia, Neutral Axis (1–1) parallel to flange.

$$I = \tfrac{1}{12}\left[bd^3 - \frac{1}{8g}(h^4 - l^4)\right] \text{ or } \frac{bd^3}{12} - \frac{h^4 - l^4}{16} \text{ for Standard Channels.}$$

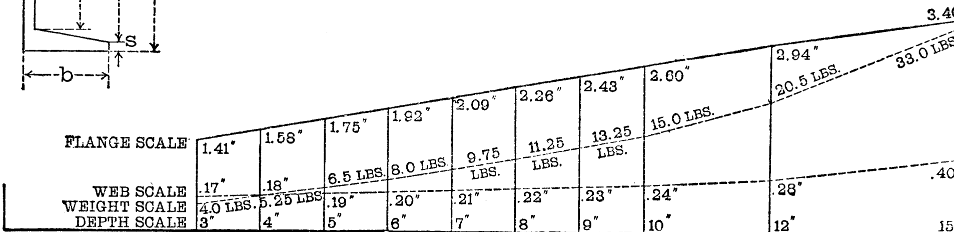
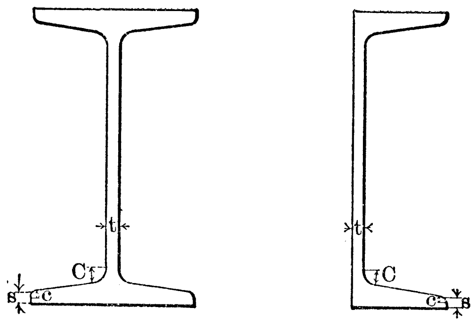


DIAGRAM FOR MINIMUM STANDARD CHANNELS.

STANDARD BEAMS AND CHANNELS.



The following data are common to all I-Beams and Channels, with the exceptions stated:

$$c = \tfrac{6}{10} \text{ Minimum Web.}$$

$$C = \text{Minimum Web} + \tfrac{1}{10} \text{ inch.}$$

s = Minimum Thickness of Web = t Minimum for all Channels and Beams, except 20″ I and 24″ I.

For 20″ Standard I s = .55″ t Minimum = .50″.

For 24″ Standard I s = .60″ t Minimum = .50″.

For 20″ Special I s = .65″ t Minimum = .60″.

The Slope of Flange of all Beams and Channels is $16\frac{2}{3}\%$ $= 9^\circ - 27' - 44'' = 2''$ per foot.

TABLES OF SQUARES, ROUNDS AND FLATS.

STEEL SQUARES.

All sizes from $\frac{3}{16}''$ to $2\frac{1}{2}''$ increasing by $\frac{1}{32}''$
All sizes from $\frac{1}{2}''$ to $1\frac{5}{8}''$ increasing by $\frac{1}{16}''$
All sizes from $\frac{3}{4}''$ to $3\frac{3}{8}''$ increasing by $\frac{1}{16}''$
All sizes from $3\frac{1}{2}''$ to $5\frac{1}{2}''$ increasing by $\frac{1}{8}''$

STEEL HAND ROUNDS.

All sizes from $\frac{3}{4}''$ to $3\frac{1}{8}''$ increasing by $\frac{1}{16}''$
All sizes from $3\frac{1}{8}''$ to $7''$ increasing by $\frac{1}{8}''$

STEEL GUIDE ROUNDS.

All sizes from $\frac{3}{16}''$ to $1''$ increasing by $\frac{1}{64}''$
All sizes from $1''$ to $1\frac{1}{2}''$ increasing by $\frac{1}{32}''$
All sizes from $1\frac{1}{2}''$ to $1\frac{3}{4}''$ increasing by $\frac{1}{16}''$
All sizes from $1\frac{3}{4}''$ to $2''$ increasing by $\frac{1}{8}''$
All sizes from $4\frac{1}{32}''$ to $5\frac{1}{32}''$ increasing by $\frac{1}{8}''$
All sizes from $6\frac{25}{32}''$ to $7\frac{9}{32}''$ increasing by $\frac{1}{8}''$

REGULAR FLATS.

WIDTH.		THICKNESS.	
Inches.	Increasing by	Inches.	Increasing by
$\frac{33}{64}$ to 1	$\frac{1}{64}''$	$\frac{1}{8}$ to 1	$\frac{1}{64}''$
$\frac{25}{64}$ " $\frac{1}{2}$	"	$\frac{1}{8}$ " $\frac{1}{2}$	"
$\frac{1}{4}$ " $\frac{3}{8}$	"	$\frac{3}{16}$ " $\frac{3}{8}$	"
$\frac{13}{16}$ " 3		$\frac{1}{4}$ " $\frac{5}{8}$	
2		$\frac{1}{4}$ " $1\frac{1}{4}$	$\frac{1}{16}''$
$2\frac{1}{2}$		$\frac{1}{4}$ " $1\frac{1}{16}$	"
3		$\frac{1}{4}$ " 2	"
$3\frac{1}{2}$		$\frac{1}{4}$ " $1\frac{3}{4}$	"
4		$\frac{1}{4}$ " 2	"
$4\frac{1}{2}$		$\frac{3}{8}$ " $1\frac{3}{4}$	"
5		$\frac{5}{16}$ " 2	"
6		$\frac{3}{8}$ " $2\frac{1}{4}$	"
7		$\frac{7}{16}$ " $2\frac{1}{8}$	"
8		$\frac{1}{2}$ " $2\frac{1}{2}$	"
9		$1\frac{1}{2}$ " $2\frac{1}{2}$	"
10		$1\frac{1}{2}$ " $2\frac{1}{2}$	"
12		$1\frac{1}{2}$ " $2\frac{1}{2}$	"

THIN FLATS OR LIGHT BANDS.

$\frac{1}{2}$ to 6	$\frac{1}{16}$	No. 10 to No. 16 gau.	gauges.

EDGED PLATES.

Width In Inches.	THICKNESS IN INCHES.													
	$\frac{3}{16}$	$\frac{1}{4}$	$\frac{5}{16}$	$\frac{3}{8}$	$\frac{7}{16}$	$\frac{1}{2}$	$\frac{9}{16}$	$\frac{5}{8}$	$\frac{11}{16}$	$\frac{3}{4}$	$\frac{13}{16}$	$\frac{7}{8}$	$\frac{15}{16}$	1
	LENGTH IN FEET.													
4	50	50	50	50	50	50	40	40	30	30	30	28	28	28
5	30	42	42	42	42	40	30	30	30	30	30	30	30	30
6	30	42	42	42	42	40	35	30	30	30	30	30	30	30
7	25	42	42	42	42	40	35	30	30	30	30	30	30	30
8	25	42	42	42	42	42	38	36	32	30	29	28	26	25
9	25	42	42	42	42	42	38	34	32	30	29	28	26	25
10	25	42	42	42	42	42	38	33	32	30	29	28	26	25
11	25	42	42	42	42	42	38	33	31	29	28	27	25	24
12	25	42	42	42	42	42	37	32	30	28	27	26	24	23
13		42	42	42	42	42	37	32	30	27	25	24	22	20
14		42	42	42	42	40	35	30	28	26	25	23	22	20
14½		42	42	42	42	36	33	30	28	25				

Intermediate widths varying by ¼″ can be furnished.

STEEL INGOTS.

DIMENSIONS.		WEIGHT.	GRADE.
Butt.	Top.		
Inches.	Inches.	Pounds.	
22 x 19½	20 x 16	6000 to 7000	Open Hearth or Bess.
25 x 20	23 x 17	7700 " 8700	" " " "
27 x 22	23 x 18	8800 " 9800	" " " "
29 x 25	27½ x 22	12000 " 13000	Open Hearth.
39 x 25	37½ x 22	17000 " 18000	" "
52 x 25½	50½ x 22½	23000 " 24000	" "
29½ x 29½	28 x 28	21000 " 22000	" "
29 x 29	26½ x 26½	15000 " 16000	" "
37 x 31	33 x 27	23000 " 24000	" "
SPECIAL.			
15″ to 36″ square or round. Maximum Length 15 feet.		7000 " 40000	" "

STEEL BILLETS, BLOOMS AND SLABS.

WIDTH.	THICKNESS.	WIDTH.	THICKNESS.	WIDTH.	THICKNESS.
Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
3	3	18	2 to 18	34	3 to 20
$3\frac{1}{2}$	$3\frac{1}{2}$	19	2 " 19	35	3 " 20
4	4	20	2 " 20	36	3 " 20
5	$3\frac{1}{2}$ to 5	21	2 " 21	37	3 " 20
6	2 " 6	22	2 " 22	38	3 " 20
7	2 " 7	23	2 " 23	39	3 " 20
8	2 " 8	24	2 " 20	40	3 " 20
9	2 " 9	25	2 " 20	41	3 " 15
10	2 " 10	26	2 " 20	42	3 " 15
11	2 " 11	27	2 " 20	43	3 " 15
12	2 " 12	28	2 " 20	44	3 " 15
13	2 " 13	29	2 " 20	45	3 " 15
14	2 " 14	30	3 " 20	46	3 " 15
15	2 " 15	31	3 " 20	47	3 " 15
16	2 " 16	32	3 " 20	48	3 " 15
17	2 " 17	33	3 " 20	49	3 " 15
				50	3 " 15

Sections larger than 4″ x 4″ can be furnished in thicknesses varying by $\frac{1}{2}$″.

Billets, Blooms and Slabs, of sections given in the above table, can be furnished within the limits of length given in the following table, provided the weight does not exceed the maximum given for the different sizes.

SECTION.	WIDTH.	SECTIONAL AREA.	LENGTHS. Minimum.		LENGTHS. Maximum.	MAXIMUM WEIGHTS.
	Inches.	Sq. Ins.	Feet.	Ins.	Feet.	Pounds.
Billets and slabs	3 to 7	9 to 16	1	6	10	300 to 600
" " "	4 " 17	16 " 36	3	0	30	1600 " 3600
Blooms and slabs	6 " 34	36 and over	"	"	"	3600 " 20000
" " "	35 " 37	105 " "	"	"	"	11000 " 20000
" " "	38 " 50	114 " "	"	"	27	11000 " 20000

STEEL BILLETS, SQUARE CORNERS.

1″ x 1″ to $3\frac{1}{4}$″ x $3\frac{1}{4}$″ increasing by $\frac{1}{16}$″.

FORGINGS FOR CAR WORK AND OTHER SMALL FORGINGS.

Air Cylinder Push Rod.
Air Reservoir Release Rod.
Arch Bars.
Bottom Follower Guide.
Bottom Side Bearing.
Bracket for Brake Shaft.
Brake Beam Hanger.
Brake Beam Hanger Carrier.
Brake Connection Rod Carrier.
Brake Levers.
Brake Mast.
Brake Mast Yoke.
Brake Pins.
Brake Rods with Clevises.
Brake Step Bracket.
Chain Hook.
Chain Link.
Column Bolt Nut Lock.
Coupler Yokes.
Coupling Links.
Coupling Pins.
Cylinder Levers Connecting Rod.
Cylinder Lever Fulcrum.
Door Chain U-Bolt.
Door Hinge.
Door Hinge Pins.
Door Operating Lever.
Door Safety Chain Eye-Bolt.
Door Safety Chain, Hook and Links.
Door Safety Chain Support.
Door Shaft Pawl.
Door Tumbling Link.
Draft Cylinder Support.
Draw Bar Carrier.
Draw Bar Liner.
Draw Bar Yoke.
Door Clevises.
Door Tumbling Lever.
End Sill Pipe Clamp.
Eye-Bolts.
Floating Lever.
Floating Lever Carrier.
Floating Lever Connecting Rod.
Floating Lever Fulcrum.
Grab Irons.
Hand Brake Lever Carrier.
Hand Brake Lever Fulcrum.
Hand Brake Lever Guide.
Hand Brake Rod.
Hand Brake Rod Guide.
Hand Brake Rod Stop.
Hand Brake Rod with Threaded Connection for Malleable Stop.
Hook Bolts.
Inside Body Step.
King Bolt.
King Pin Support.
Lever Guides.
Live Truck Lever Guide.
Main Follower Sprocket Wheel Shaft.
Operating Shaft.
Operating Shaft Cam.
Operating Shaft Cam Stops.
Operating Ratchet Pawl.
Operating Ratchet Pawl Guard.
Pipe Clamp.
Pipe Clamp and Support.
Pushrod Carrier.
Ratchet Wrench Dog.
Roping Staple.
Sheave and Link Pin.
Side Stake Pockets.
Sill Step.
Suspension Spring.
Suspension Spring Hanger.
Tie Bars with Upset Ends or Plain.
Top Body Tie Angle.
Top Side Bearing.
Truck Bolster Tie Bar.
Truck Door Stop, Chain Clamp Hooks.
Truck Levers.
Truck Side Bearing.
U-Bolt Clamp for Angle Valve.
Uncoupling Lever.

SHEARED PLATES.

Width in Inches.	THICKNESS IN INCHES.																
	$\frac{3}{16}$	$\frac{1}{4}$	$\frac{5}{16}$	$\frac{3}{8}$	$\frac{7}{16}$	$\frac{1}{2}$	$\frac{9}{16}$	$\frac{5}{8}$	$\frac{11}{16}$	$\frac{3}{4}$	$\frac{13}{16}$	$\frac{7}{8}$	$\frac{15}{16}$	1	$1\frac{1}{8}$	$1\frac{1}{4}$	$1\frac{1}{2}$
	LENGTH IN INCHES.																
15	240	320	400	500	500	550	500	475	475	475	425	400	375	360	300	280	280
16	240	320	400	500	500	550	500	475	475	475	425	400	375	360	300	280	280
17	240	320	400	500	500	550	500	475	475	475	425	400	375	360	300	280	280
18	240	360	400	500	500	500	500	550	550	550	500	500	450	400	400	400	350
19	240	360	400	500	500	500	500	550	550	550	500	500	450	400	400	400	350
20	240	360	400	500	500	500	500	550	550	550	500	500	450	400	400	400	350
21	216	360	400	500	525	525	525	550	550	550	500	500	450	400	400	400	350
22	216	360	400	500	525	525	525	550	550	550	500	500	450	400	400	400	350
23	204	360	400	500	525	525	525	550	550	550	500	500	450	400	400	400	350
24	204	360	400	500	525	550	550	550	550	550	500	475	425	400	350	350	325
25	204	360	400	500	525	550	550	550	550	550	500	475	425	400	350	350	325
26	180	360	400	500	525	550	550	550	550	550	500	475	425	400	350	350	325
27	168	340	400	500	500	550	550	500	500	500	450	450	400	380	330	300	300
28	168	340	400	500	500	550	550	500	500	500	450	450	400	380	330	300	300
29	156	340	400	500	500	550	550	500	500	500	450	450	400	380	330	300	300
30 to 35		320	400	500	500	550	500	475	475	475	425	400	375	360	300	280	280
36 " 41		360	400	500	500	500	500	550	550	550	500	500	450	400	400	400	350
42 " 47		360	400	500	525	525	525	550	550	550	500	500	450	400	400	400	350
48 " 53		360	400	500	525	550	550	550	550	550	500	475	425	400	350	350	325
54 " 59		340	400	500	500	550	550	500	500	500	450	450	400	380	330	300	300
60 " 65		320	400	500	500	550	500	475	475	475	425	400	375	360	300	280	280
66 " 71		300	350	430	450	475	425	425	425	410	375	340	330	320	280	260	260
72 " 77		260	300	400	425	450	400	400	400	390	350	320	320	300	260	240	240
78 " 83		240	275	380	400	420	375	375	375	370	325	300	300	300	240	220	220
84 " 89		200	250	350	375	385	350	350	350	350	300	280	275	275	230	210	210
90 " 95		180	230	330	340	350	350	325	325	325	275	260	260	260	220	200	200
96 " 101		120	175	240	250	275	275	275	275	275	240	240	220	220	200	180	180
102 " 107			150	200	230	230	250	250	250	250	230	230	210	210	190	170	170
108 " 113				180	180	200	220	225	225	225	220	220	200	200	180	160	160
114 " 119						180	200	210	210	210	200	200	180	180	170	150	150
120 " 125						120	150	150	180	180	175	175	160	160	160	144	144

WEIGHTS AND DIMENSIONS OF
STANDARD I-BEAMS.

Section Number.	Depth of Beam. Inches.	Weight per Foot. Pounds.	Area of Section. Sq. In.	Thickness of Web. Inch.	Width of Flange. Inches.	Page Number of Section.
B 5	3	5.5	1.63	.17	2.33	2
"	"	6.5	1.91	.26	2.42	"
"	"	7.5	2.21	.36	2.52	"
B 9	4	7.5	2.21	.19	2.66	2
"	"	8.5	2.50	.26	2.73	"
"	"	9.5	2.79	.34	2.81	"
"	"	10.5	3.09	.41	2.88	"
B 13	5	9.75	2.87	.21	3.00	2
"	"	12.25	3.60	.36	3.15	"
"	"	14.75	4.34	.50	3.29	"
B 17	6	12.25	3.61	.23	3.33	2
"	"	14.75	4.34	.35	3.45	"
"	"	17.25	5.07	.47	3.57	"
B 21	7	15.0	4.42	.25	3.66	2
"	"	17.5	5.15	.35	3.76	"
"	"	20.0	5.88	.46	3.87	"
B 25	8	18.0	5.33	.27	4.00	3
"	"	20.25	5.96	.35	4.08	"
"	"	22.75	6.69	.44	4.17	"
"	"	25.25	7.43	.53	4.26	"
B 29	9	21.0	6.31	.29	4.33	3
"	"	25 0	7.35	.41	4.45	"
"	"	30.0	8.82	.57	4.61	"
"	"	35.0	10.29	.73	4.77	"
B 33	10	25.0	7.37	.31	4.66	3
"	"	30.0	8.82	.45	4.80	"
"	"	35.0	10.29	.60	4.95	"
"	"	40.0	11.76	.75	5.10	"
B 41	12	31.5	9.26	.35	5.00	3
"	"	35.0	10.29	.44	5.09	"
"	"	40.0	11.76	.56	5.21	"
B 53	15	42.0	12.48	.41	5.50	4
"	"	45.0	13.24	.46	5.55	"
"	"	50.0	14.71	.56	5.65	"
"	"	55.0	16.18	.66	5.75	"
"	"	60.0	17.65	.75	5.84	"

WEIGHTS AND DIMENSIONS OF STANDARD I-BEAMS.

Section Number.	Depth of Beam. Inches.	Weight per Foot. Pounds.	Area of Section. Sq. In.	Thickness of Web. Inch.	Width of Flange. Inches.	Page Number of Section.
B 65	18	55.0	15.93	.46	6.00	6
"	"	60.0	17.65	.56	6.10	"
"	"	65.0	19.12	.64	6.18	"
"	"	70.0	20.59	.72	6.26	"
B 73	20	65.0	19.08	.50	6.25	7
"	"	70.0	20.59	.58	6.33	"
"	"	75.0	22.06	.65	6.40	"
B 89	24	80.0	23.32	.50	7.00	8
"	"	85.0	25.00	.57	7.07	"
"	"	90.0	26.47	.63	7.13	"
"	"	95.0	27.94	.69	7.19	"
"	"	100.0	29.41	.75	7.25	"

WEIGHTS AND DIMENSIONS OF SPECIAL I-BEAMS.

Section Number.	Depth of Beam. Inches.	Weight per Foot. Pounds.	Area of Section. Sq. Inches.	Thickness of Web. Inch.	Width of Flange. Inches.	Page Number of Section.
B 105	12	40.0	11.84	.46	5.25	4
"	"	45.0	13.24	.58	5.37	"
"	"	50.0	14.71	.70	5.49	"
"	"	55.0	16.18	.82	5.61	"
B 109	15	60.0	17.67	.59	6.00	5
"	"	65.0	19.12	.69	6.10	"
"	"	70.0	20.59	.78	6.19	"
"	"	75.0	22.06	.88	6.29	"
"	"	80.0	23.53	.98	6.39	"
B 113	15	80.0	23.57	.80	6.40	5
"	"	85.0	25.00	.90	6.50	"
"	"	90.0	26.47	.99	6.59	"
"	"	95.0	27.94	1.09	6.69	"
"	"	100.0	29.41	1.19	6.79	"
B 121	20	80.0	23.73	.60	7.00	7
"	"	85.0	25.00	.66	7.06	"
"	"	90.0	26.47	.74	7.14	"
"	"	95.0	27.94	.81	7.21	"
"	"	100.0	29.41	.88	7.28	"

WEIGHTS AND DIMENSIONS OF STANDARD CHANNELS.

Section Number.	Depth of Channel.	Weight per Foot.	Area of Section.	Thickness of Web.	Width of Flange.	Page Number of Section.
	Inches.	Pounds.	Sq. In.	Inch.	Inches.	
C 5	3	4.0	1.19	.17	1.41	9
"	"	5.0	1.47	.26	1.50	"
"	"	6.0	1.76	.36	1.60	"
C 9	4	5.25	1.55	.18	1.58	9
"	"	6.25	1.84	.25	1.65	"
"	"	7.25	2.13	.33	1.73	"
C 13	5	6.50	1.95	.19	1.75	9
"	"	9.00	2.65	.33	1.89	"
"	"	11.50	3.38	.48	2.04	"
C 17	6	8.00	2.38	.20	1.92	9
"	"	10.50	3.09	.32	2.04	"
"	"	13.00	3.82	.44	2.16	"
"	"	15.50	4.56	.56	2.28	"
C 21	7	9.75	2.85	.21	2.09	9
"	"	12.25	3.60	.32	2.20	"
"	"	14.75	4.34	.42	2.30	"
"	"	17.25	5.07	.53	2.41	"
"	"	19.75	5.81	.63	2.51	"
C 25	8	11.25	3.35	.22	2.26	9
"	"	13.75	4.04	.31	2.35	"
"	"	16.25	4.78	.40	2.44	"
"	"	18.75	5.51	.49	2.53	"
"	"	21.25	6.25	.58	2.62	"
C 29	9	13.25	3.89	.23	2.43	10
"	"	15.00	4.41	.29	2.49	"
"	"	20.00	5.88	.45	2.65	"
"	"	25.00	7.35	.61	2.81	"
C 33	10	15.0	4.46	.24	2.60	10
"	"	20.0	5.88	.38	2.74	"
"	"	25.0	7.35	.53	2.89	"
"	"	30.0	8.82	.68	3.04	"
"	"	35.0	10.29	.82	3.18	"
C 41	12	20.5	6.03	.28	2.94	10
"	"	25.0	7.35	.39	3.05	"
"	"	30.0	8.82	.51	3.17	"
"	"	35.0	10.29	.64	3.30	"
"	"	40.0	11.76	.76	3.42	"

WEIGHTS AND DIMENSIONS OF STANDARD CHANNELS.

Section Number.	Depth of Channel.	Weight per Foot.	Area of Section.	Thickness of Web.	Width of Flange.	Page Number of Section.
	Inches.	Pounds.	Sq. Ins.	Inch.	Inches.	
C 53	15	33	9.90	.40	3.40	11
"	"	35	10.29	.43	3.43	"
"	"	40	11.76	.52	3.52	"
"	"	45	13.24	.62	3.62	"
"	"	50	14.71	.72	3.72	"
"	"	55	16.18	.82	3.82	"

WEIGHTS AND DIMENSIONS OF SPECIAL CHANNELS.

Section Number.	Depth of Channel.	Weight per Foot.	Area of Section.	Thickness of Web.	Width of Flange.	Increase in Web and Flange for each pound increase of Weight.	Page Number of Section.
	Inches.	Pounds.	Sq. Ins.	Inch.	Inches.	Inch.	
C 86	6	15.2	4.46	.35	3.50	.049	11
C 90	10	21.7	6.38	.38	3.38	.029	11
C 91	12	21.4	6.30	.31	2.64	.024	10
"	"	23.9	7.03	.37	2.70	"	"
"	"	26.4	7.77	.44	2.76	"	"
"	"	28.9	8.50	.50	2.82	"	"
"	"	31.4	9.24	.56	2.89	"	"
"	"	33.9	9.97	.62	2.95	"	"
C 95	13	32	9.30	.38	4.00	.023	11
"	"	35	10.29	.45	4.08	"	"
"	"	37	10.88	.50	4.12	"	"
"	"	40	11.76	.56	4.19	"	"
"	"	45	13.24	.68	4.30	"	"
"	"	50	14.71	.79	4.42	"	"
"	"	55	16.18	.90	4.53	"	"

WEIGHTS AND DIMENSIONS OF STANDARD ANGLES.

EQUAL LEGS.

Section Number.	Dimensions. Inches.	Thickness. Inch.	Weight per Foot. Pounds.	Area of Section. Sq. Ins.
A 5	$\frac{3}{4}$ x $\frac{3}{4}$	$\frac{1}{8}$	.6	.18
"	$\frac{3}{4}$ x $\frac{3}{4}$	$\frac{3}{16}$	.9	.25
A 7	1 x 1	$\frac{1}{8}$	.8	.24
"	1 x 1	$\frac{3}{16}$	1.2	.34
"	1 x 1	$\frac{1}{4}$	1.5	.44
A 9	$1\frac{1}{4}$ x $1\frac{1}{4}$	$\frac{1}{8}$	1.1	.30
"	$1\frac{1}{4}$ x $1\frac{1}{4}$	$\frac{3}{16}$	1.5	.44
"	$1\frac{1}{4}$ x $1\frac{1}{4}$	$\frac{1}{4}$	2.0	.57
"	$1\frac{1}{4}$ x $1\frac{1}{4}$	$\frac{5}{16}$	2.4	.69
A 11	$1\frac{1}{2}$ x $1\frac{1}{2}$	$\frac{1}{8}$	1.3	.36
"	$1\frac{1}{2}$ x $1\frac{1}{2}$	$\frac{3}{16}$	1.8	.53
"	$1\frac{1}{2}$ x $1\frac{1}{2}$	$\frac{1}{4}$	2.4	.69
"	$1\frac{1}{2}$ x $1\frac{1}{2}$	$\frac{5}{16}$	2.9	.84
"	$1\frac{1}{2}$ x $1\frac{1}{2}$	$\frac{3}{8}$	3.4	.99
"	$1\frac{1}{2}$ x $1\frac{1}{2}$	$\frac{7}{16}$	3.9	1.13
A 13	$1\frac{3}{4}$ x $1\frac{3}{4}$	$\frac{3}{16}$	2.2	.63
"	$1\frac{3}{4}$ x $1\frac{3}{4}$	$\frac{1}{4}$	2.8	.82
"	$1\frac{3}{4}$ x $1\frac{3}{4}$	$\frac{5}{16}$	3.4	1.00
"	$1\frac{3}{4}$ x $1\frac{3}{4}$	$\frac{3}{8}$	4.0	1.18
"	$1\frac{3}{4}$ x $1\frac{3}{4}$	$\frac{7}{16}$	4.6	1.34
"	$1\frac{3}{4}$ x $1\frac{3}{4}$	$\frac{1}{2}$	5.1	1.50
A 15	2 x 2	$\frac{3}{16}$	2.5	.72
"	2 x 2	$\frac{1}{4}$	3.2	.94
"	2 x 2	$\frac{5}{16}$	4.0	1.16
"	2 x 2	$\frac{3}{8}$	4.7	1.36
"	2 x 2	$\frac{7}{16}$	5.3	1.56
"	2 x 2	$\frac{1}{2}$	6.0	1.75
A 17	$2\frac{1}{2}$ x $2\frac{1}{2}$	$\frac{3}{16}$	3.1	.91
"	$2\frac{1}{2}$ x $2\frac{1}{2}$	$\frac{1}{4}$	4.1	1.19
"	$2\frac{1}{2}$ x $2\frac{1}{2}$	$\frac{5}{16}$	5.0	1.47
A 17	$2\frac{1}{2}$ x $2\frac{1}{2}$	$\frac{3}{8}$	5.9	1.74
"	$2\frac{1}{2}$ x $2\frac{1}{2}$	$\frac{7}{16}$	6.8	2.00
"	$2\frac{1}{2}$ x $2\frac{1}{2}$	$\frac{1}{2}$	7.7	2.25
"	$2\frac{1}{2}$ x $2\frac{1}{2}$	$\frac{9}{16}$	8.5	2.50
A 19	3 x 3	$\frac{1}{4}$	4.9	1.44
"	3 x 3	$\frac{5}{16}$	6.1	1.78
"	3 x 3	$\frac{3}{8}$	7.2	2.11
"	3 x 3	$\frac{7}{16}$	8.3	2.44
"	3 x 3	$\frac{1}{2}$	9.4	2.75
"	3 x 3	$\frac{9}{16}$	10.4	3.06
"	3 x 3	$\frac{5}{8}$	11.5	3.36
"	3 x 3	$\frac{11}{16}$	12.5	3.66
A 21	$3\frac{1}{2}$ x $3\frac{1}{2}$	$\frac{5}{16}$	7.2	2.09
"	$3\frac{1}{2}$ x $3\frac{1}{2}$	$\frac{3}{8}$	8.5	2.49
"	$3\frac{1}{2}$ x $3\frac{1}{2}$	$\frac{7}{16}$	9.8	2.88
"	$3\frac{1}{2}$ x $3\frac{1}{2}$	$\frac{1}{2}$	11.1	3.25
"	$3\frac{1}{2}$ x $3\frac{1}{2}$	$\frac{9}{16}$	12.4	3.63
"	$3\frac{1}{2}$ x $3\frac{1}{2}$	$\frac{5}{8}$	13.6	3.99
"	$3\frac{1}{2}$ x $3\frac{1}{2}$	$\frac{11}{16}$	14.8	4.34
"	$3\frac{1}{2}$ x $3\frac{1}{2}$	$\frac{3}{4}$	16.0	4.69
"	$3\frac{1}{2}$ x $3\frac{1}{2}$	$\frac{13}{16}$	17.1	5.03
"	$3\frac{1}{2}$ x $3\frac{1}{2}$	$\frac{7}{8}$	18.3	5.36
A 23	4 x 4	$\frac{5}{16}$	8.2	2.41
"	4 x 4	$\frac{3}{8}$	9.8	2.86
"	4 x 4	$\frac{7}{16}$	11.3	3.31
"	4 x 4	$\frac{1}{2}$	12.8	3.75
"	4 x 4	$\frac{9}{16}$	14.3	4.19
"	4 x 4	$\frac{5}{8}$	15.7	4.62
"	4 x 4	$\frac{11}{16}$	17.1	5.03
"	4 x 4	$\frac{3}{4}$	18.5	5.44
"	4 x 4	$\frac{13}{16}$	19.9	5.84
"	4 x 4	$\frac{7}{8}$	21.2	6.24

Standard Angles vary only by $\frac{1}{16}$ inch. Sections shown on page 12.

WEIGHTS AND DIMENSIONS OF STANDARD ANGLES.

EQUAL LEGS.—CONTINUED.

Section Number.	Dimensions.	Thickness.	Weight per Foot.	Area of Section.	Section Number.	Dimensions.	Thickness.	Weight per Foot.	Area of Section.
	Inches.	Inch.	Pounds.	Sq. Ins.		Inches.	Inch.	Pounds.	Sq. Ins.
A 27	6 x 6	$\frac{3}{8}$	14.9	4.36	A 35	8 x 8	$\frac{1}{2}$	26.4	7.75
"	6 x 6	$\frac{7}{16}$	17.2	5.06	"	8 x 8	$\frac{9}{16}$	29.6	8.69
"	6 x 6	$\frac{1}{2}$	19.6	5.75	"	8 x 8	$\frac{5}{8}$	32.7	9.61
"	6 x 6	$\frac{9}{16}$	21.9	6.44	"	8 x 8	$\frac{11}{16}$	35.8	10.53
"	6 x 6	$\frac{5}{8}$	24.2	7.11	"	8 x 8	$\frac{3}{4}$	38.9	11.44
"	6 x 6	$\frac{11}{16}$	26.5	7.78	"	8 x 8	$\frac{13}{16}$	42.0	12.34
"	6 x 6	$\frac{3}{4}$	28.7	8.44	"	8 x 8	$\frac{7}{8}$	45.0	13.24
"	6 x 6	$\frac{13}{16}$	31.0	9.09	"	8 x 8	$\frac{15}{16}$	48.1	14.13
"	6 x 6	$\frac{7}{8}$	33.1	9.74	"	8 x 8	1	51.0	15.00
"	6 x 6	$\frac{15}{16}$	35.3	10.38	"	8 x 8	$1\frac{1}{16}$	54.0	15.88
"	6 x 6	1	37.4	11.00	"	8 x 8	$1\frac{1}{8}$	56.9	16.74

Standard Angles vary only by $\frac{1}{16}$ inch. Sections shown on page 12.

WEIGHTS AND DIMENSIONS OF STANDARD ANGLES.

UNEQUAL LEGS.

Section Number.	Dimensions.	Thickness.	Weight per Foot.	Area of Section.	Section Number.	Dimensions.	Thickness.	Weight per Foot.	Area of Section.
	Inches.	Inch.	Pounds.	Sq. Ins.		Inches.	Inch.	Pounds.	Sq. Ins.
A 91	$2\frac{1}{2}$ x 2	$\frac{3}{16}$	2.8	.81	A 93	3 x $2\frac{1}{2}$	$\frac{9}{16}$	9.5	2.78
"	$2\frac{1}{2}$ x 2	$\frac{1}{4}$	3.7	1.07	"	3 x $2\frac{1}{2}$	$\frac{5}{8}$	10.4	3.05
"	$2\frac{1}{2}$ x 2	$\frac{5}{16}$	4.5	1.31					
"	$2\frac{1}{2}$ x 2	$\frac{3}{8}$	5.3	1.55	A 95	$3\frac{1}{2}$ x $2\frac{1}{2}$	$\frac{1}{4}$	4.9	1.44
"	$2\frac{1}{2}$ x 2	$\frac{7}{16}$	6.1	1.78	"	$3\frac{1}{2}$ x $2\frac{1}{2}$	$\frac{5}{16}$	6.1	1.78
"	$2\frac{1}{2}$ x 2	$\frac{1}{2}$	6.8	2.00	"	$3\frac{1}{2}$ x $2\frac{1}{2}$	$\frac{3}{8}$	7.2	2.11
"	$2\frac{1}{2}$ x 2	$\frac{9}{16}$	7.6	2.22	"	$3\frac{1}{2}$ x $2\frac{1}{2}$	$\frac{7}{16}$	8.3	2.44
					"	$3\frac{1}{2}$ x $2\frac{1}{2}$	$\frac{1}{2}$	9.4	2.75
A 93	3 x $2\frac{1}{2}$	$\frac{1}{4}$	4.5	1.32	"	$3\frac{1}{2}$ x $2\frac{1}{2}$	$\frac{9}{16}$	10.4	3.06
"	3 x $2\frac{1}{2}$	$\frac{5}{16}$	5.6	1.63	"	$3\frac{1}{2}$ x $2\frac{1}{2}$	$\frac{5}{8}$	11.5	3.36
"	3 x $2\frac{1}{2}$	$\frac{3}{8}$	6.6	1.93	"	$3\frac{1}{2}$ x $2\frac{1}{2}$	$\frac{11}{16}$	12.5	3.66
"	3 x $2\frac{1}{2}$	$\frac{7}{16}$	7.6	2.22	"	$3\frac{1}{2}$ x $2\frac{1}{2}$	$\frac{3}{4}$	13.4	3.94
"	3 x $2\frac{1}{2}$	$\frac{1}{2}$	8.5	2.50					

Standard Angles vary only by $\frac{1}{16}$ inch. Sections shown on page 14.

WEIGHTS AND DIMENSIONS OF STANDARD ANGLES.

UNEQUAL LEGS.—Continued.

Section Number.	Dimensions.	Thickness.	Weight per Foot.	Area of Section.	Section Number.	Dimensions.	Thickness.	Weight per Foot.	Area of Section.
	Inches.	Inch.	Pounds.	Sq. Ins.		Inches.	Inch.	Pounds.	Sq. Ins.
A 97	$3\frac{1}{2}$ x 3	$\frac{5}{16}$	6.6	1.94	A103	5 x $3\frac{1}{2}$	$\frac{5}{16}$	8.7	2.56
"	$3\frac{1}{2}$ x 3	$\frac{3}{8}$	7.9	2.30	"	5 x $3\frac{1}{2}$	$\frac{3}{8}$	10.4	3.05
"	$3\frac{1}{2}$ x 3	$\frac{7}{16}$	9.1	2.66	"	5 x $3\frac{1}{2}$	$\frac{7}{16}$	12.0	3.53
"	$3\frac{1}{2}$ x 3	$\frac{1}{2}$	10.2	3.00	"	5 x $3\frac{1}{2}$	$\frac{1}{2}$	13.6	4.00
"	$3\frac{1}{2}$ x 3	$\frac{9}{16}$	11.4	3.34	"	5 x $3\frac{1}{2}$	$\frac{9}{16}$	15.2	4.47
"	$3\frac{1}{2}$ x 3	$\frac{5}{8}$	12.5	3.68	"	5 x $3\frac{1}{2}$	$\frac{5}{8}$	16.8	4.93
"	$3\frac{1}{2}$ x 3	$\frac{11}{16}$	13.6	4.00	"	5 x $3\frac{1}{2}$	$\frac{11}{16}$	18.3	5.38
"	$3\frac{1}{2}$ x 3	$\frac{3}{4}$	14.7	4.32	"	5 x $3\frac{1}{2}$	$\frac{3}{4}$	19.8	5.82
"	$3\frac{1}{2}$ x 3	$\frac{13}{16}$	15.8	4.63	"	5 x $3\frac{1}{2}$	$\frac{13}{16}$	21.3	6.25
"	$3\frac{1}{2}$ x 3	$\frac{7}{8}$	16.8	4.93	"	5 x $3\frac{1}{2}$	$\frac{7}{8}$	22.7	6.68
					"	5 x $3\frac{1}{2}$	$\frac{15}{16}$	24.2	7.09
A 99	4 x 3	$\frac{5}{16}$	7.2	2.09	A105	6 x $3\frac{1}{2}$	$\frac{3}{8}$	11.7	3.43
"	4 x 3	$\frac{3}{8}$	8.5	2.49	"	6 x $3\frac{1}{2}$	$\frac{7}{16}$	13.5	3.97
"	4 x 3	$\frac{7}{16}$	9.8	2.88	"	6 x $3\frac{1}{2}$	$\frac{1}{2}$	15.3	4.50
"	4 x 3	$\frac{1}{2}$	11.1	3.25	"	6 x $3\frac{1}{2}$	$\frac{9}{16}$	17.1	5.03
"	4 x 3	$\frac{9}{16}$	12.4	3.63	"	6 x $3\frac{1}{2}$	$\frac{5}{8}$	18.9	5.55
"	4 x 3	$\frac{5}{8}$	13.6	3.99	"	6 x $3\frac{1}{2}$	$\frac{11}{16}$	20.6	6.06
"	4 x 3	$\frac{11}{16}$	14.8	4.34	"	6 x $3\frac{1}{2}$	$\frac{3}{4}$	22.4	6.57
"	4 x 3	$\frac{3}{4}$	16.0	4.69	"	6 x $3\frac{1}{2}$	$\frac{13}{16}$	24.0	7.06
"	4 x 3	$\frac{13}{16}$	17.1	5.03	"	6 x $3\frac{1}{2}$	$\frac{7}{8}$	25.7	7.55
"	4 x 3	$\frac{7}{8}$	18.3	5.36	"	6 x $3\frac{1}{2}$	$\frac{15}{16}$	27.3	8.03
					"	6 x $3\frac{1}{2}$	1	28.9	8.50
A101	5 x 3	$\frac{5}{16}$	8.2	2.41	A107	6 x 4	$\frac{3}{8}$	12.3	3.61
"	5 x 3	$\frac{3}{8}$	9.8	2.86	"	6 x 4	$\frac{7}{16}$	14.3	4.19
"	5 x 3	$\frac{7}{16}$	11.3	3.31	"	6 x 4	$\frac{1}{2}$	16.2	4.75
"	5 x 3	$\frac{1}{2}$	12.8	3.75	"	6 x 4	$\frac{9}{16}$	18.1	5.31
"	5 x 3	$\frac{9}{16}$	14.3	4.19	"	6 x 4	$\frac{5}{8}$	20.0	5.86
"	5 x 3	$\frac{5}{8}$	15.7	4.61	"	6 x 4	$\frac{11}{16}$	21.8	6.41
"	5 x 3	$\frac{11}{16}$	17.1	5.03	"	6 x 4	$\frac{3}{4}$	23.6	6.94
"	5 x 3	$\frac{3}{4}$	18.5	5.44	"	6 x 4	$\frac{13}{16}$	25.4	7.47
"	5 x 3	$\frac{13}{16}$	19.9	5.84	"	6 x 4	$\frac{7}{8}$	27.2	7.99
"	5 x 3	$\frac{7}{8}$	21.2	6.24	"	6 x 4	$\frac{15}{16}$	28.9	8.50
					"	6 x 4	1	30.6	9.00

Standard Angles vary only by $\frac{1}{16}$ inch. Sections shown on page 14.

WEIGHTS AND DIMENSIONS OF SPECIAL ANGLES.

EQUAL LEGS.

Section Number.	Dimensions. Inches.	Thickness. Inch.	Weight per Foot. Pounds.	Area of Section. Sq. Ins.	Section Number.	Dimensions. Inches.	Thickness. Inch.	Weight per Foot. Pounds.	Area of Section. Sq. Ins.
A 41	$2\frac{1}{4} \times 2\frac{1}{4}$	$\frac{3}{16}$	2.8	.81	A 45	$4\frac{1}{2} \times 4\frac{1}{2}$	$\frac{5}{16}$	9.3	2.72
"	$2\frac{1}{4} \times 2\frac{1}{4}$	$\frac{1}{4}$	3.7	1.07	"	$4\frac{1}{2} \times 4\frac{1}{2}$	$\frac{3}{8}$	11.0	3.24
"	$2\frac{1}{4} \times 2\frac{1}{4}$	$\frac{5}{16}$	4.5	1.31	"	$4\frac{1}{2} \times 4\frac{1}{2}$	$\frac{7}{16}$	12.8	3.75
"	$2\frac{1}{4} \times 2\frac{1}{4}$	$\frac{3}{8}$	5.3	1.55	"	$4\frac{1}{2} \times 4\frac{1}{2}$	$\frac{1}{2}$	14.5	4.25
"	$2\frac{1}{4} \times 2\frac{1}{4}$	$\frac{7}{16}$	6.1	1.78	"	$4\frac{1}{2} \times 4\frac{1}{2}$	$\frac{9}{16}$	16.2	4.75
					"	$4\frac{1}{2} \times 4\frac{1}{2}$	$\frac{5}{8}$	17.8	5.24
					"	$4\frac{1}{2} \times 4\frac{1}{2}$	$\frac{11}{16}$	19.5	5.72
A 43	$2\frac{3}{4} \times 2\frac{3}{4}$	$\frac{3}{16}$	3.4	1.00	A 47	5×5	$\frac{3}{8}$	12.3	3.61
"	$2\frac{3}{4} \times 2\frac{3}{4}$	$\frac{1}{4}$	4.5	1.32	"	5×5	$\frac{7}{16}$	14.3	4.19
"	$2\frac{3}{4} \times 2\frac{3}{4}$	$\frac{5}{16}$	5.6	1.63	"	5×5	$\frac{1}{2}$	16.2	4.75
"	$2\frac{3}{4} \times 2\frac{3}{4}$	$\frac{3}{8}$	6.6	1.93	"	5×5	$\frac{9}{16}$	18.1	5.31
"	$2\frac{3}{4} \times 2\frac{3}{4}$	$\frac{7}{16}$	7.6	2.22	"	5×5	$\frac{5}{8}$	20.0	5.86
"	$2\frac{3}{4} \times 2\frac{3}{4}$	$\frac{1}{2}$	8.5	2.50	"	5×5	$\frac{11}{16}$	21.8	6.41

Sections shown on page 13.

WEIGHTS AND DIMENSIONS OF SPECIAL ANGLES.

UNEQUAL LEGS.

Section Number.	Dimensions. Inches.	Thickness. Inch.	Weight per Foot. Pounds.	Area of Section. Sq. Ins.
A170	$1\frac{3}{8}$ x $\frac{15}{16}$	$\frac{1}{8}$	1.0	.28
A167	$1\frac{1}{2}$ x $\frac{3}{4}$	$\frac{1}{8}$	1.0	.27
A165	$1\frac{3}{4}$ x $1\frac{1}{8}$	$\frac{5}{16}$	2.8	.81
A163	$1\frac{3}{4}$ x $1\frac{1}{4}$	$\frac{3}{16}$	1.8	.53
A121	2 x $1\frac{3}{8}$	$\frac{3}{16}$	2.1	.60
"	2 x $1\frac{3}{8}$	$\frac{1}{4}$	2.7	.79
"	2 x $1\frac{3}{8}$	$\frac{5}{16}$	3.3	.96
"	2 x $1\frac{3}{8}$	$\frac{3}{8}$	3.9	1.13
"	2 x $1\frac{3}{8}$	$\frac{7}{16}$	4.4	1.29
A123	2 x $1\frac{1}{2}$	$\frac{1}{8}$	1.5	.43
"	2 x $1\frac{1}{2}$	$\frac{3}{16}$	2.2	.63
"	2 x $1\frac{1}{2}$	$\frac{1}{4}$	2.8	.82
"	2 x $1\frac{1}{2}$	$\frac{5}{16}$	3.4	1.00
"	2 x $1\frac{1}{2}$	$\frac{3}{8}$	4.0	1.18
"	2 x $1\frac{1}{2}$	$\frac{7}{16}$	4.6	1.34
A 84	$2\frac{1}{4}$ x $1\frac{1}{2}$	$\frac{5}{16}$	3.7	1.07
A125	$2\frac{1}{2}$ x $1\frac{1}{4}$	$\frac{3}{16}$	2.3	.67
"	$2\frac{1}{2}$ x $1\frac{1}{4}$	$\frac{1}{4}$	3.0	.88
"	$2\frac{1}{2}$ x $1\frac{1}{4}$	$\frac{5}{16}$	3.7	1.08
"	$2\frac{1}{2}$ x $1\frac{1}{4}$	$\frac{3}{8}$	4.4	1.27
"	$2\frac{1}{2}$ x $1\frac{1}{4}$	$\frac{7}{16}$	5.0	1.45
A127	$2\frac{1}{2}$ x $1\frac{1}{2}$	$\frac{3}{16}$	2.5	.72
"	$2\frac{1}{2}$ x $1\frac{1}{2}$	$\frac{1}{4}$	3.2	.94
"	$2\frac{1}{2}$ x $1\frac{1}{2}$	$\frac{5}{16}$	4.0	1.16
"	$2\frac{1}{2}$ x $1\frac{1}{2}$	$\frac{3}{8}$	4.7	1.36
"	$2\frac{1}{2}$ x $1\frac{1}{2}$	$\frac{7}{16}$	5.3	1.56
A128	$2\frac{3}{4}$ x $1\frac{1}{2}$	$\frac{3}{16}$	2.6	.77
"	$2\frac{3}{4}$ x $1\frac{1}{2}$	$\frac{1}{4}$	3.4	1.00
"	$2\frac{3}{4}$ x $1\frac{1}{2}$	$\frac{5}{16}$	4.2	1.24
"	$2\frac{3}{4}$ x $1\frac{1}{2}$	$\frac{3}{8}$	5.0	1.46
"	$2\frac{3}{4}$ x $1\frac{1}{2}$	$\frac{7}{16}$	5.7	1.67

Section Number.	Dimensions. Inches.	Thickness. Inch.	Weight per Foot. Pounds.	Area of Section. Sq. Ins.
A129	3 x 2	$\frac{3}{16}$	3.1	.91
"	3 x 2	$\frac{1}{4}$	4.1	1.19
"	3 x 2	$\frac{5}{16}$	5.0	1.47
"	3 x 2	$\frac{3}{8}$	5.9	1.74
"	3 x 2	$\frac{7}{16}$	6.8	2.00
"	3 x 2	$\frac{1}{2}$	7.7	2.25
A149	$3\frac{1}{4}$ x 2	$\frac{3}{8}$	6.2	1.83
A151	$3\frac{1}{2}$ x 2	$\frac{1}{4}$	4.5	1.32
"	$3\frac{1}{2}$ x 2	$\frac{5}{16}$	5.6	1.63
"	$3\frac{1}{2}$ x 2	$\frac{3}{8}$	6.6	1.93
"	$3\frac{1}{2}$ x 2	$\frac{7}{16}$	7.6	2.22
"	$3\frac{1}{2}$ x 2	$\frac{1}{2}$	8.5	2.50
"	$3\frac{1}{2}$ x 2	$\frac{9}{16}$	9.5	2.78
"	$3\frac{1}{2}$ x 2	$\frac{5}{8}$	10.4	3.05
A131	4 x $3\frac{1}{2}$	$\frac{5}{16}$	7.7	2.25
"	4 x $3\frac{1}{2}$	$\frac{3}{8}$	9.1	2.68
"	4 x $3\frac{1}{2}$	$\frac{7}{16}$	10.6	3.09
"	4 x $3\frac{1}{2}$	$\frac{1}{2}$	11.9	3.50
"	4 x $3\frac{1}{2}$	$\frac{9}{16}$	13.3	3.91
"	4 x $3\frac{1}{2}$	$\frac{5}{8}$	14.7	4.30
"	4 x $3\frac{1}{2}$	$\frac{11}{16}$	16.0	4.69
A133	$4\frac{1}{2}$ x 3	$\frac{3}{8}$	9.1	2.68
"	$4\frac{1}{2}$ x 3	$\frac{7}{16}$	10.6	3.09
"	$4\frac{1}{2}$ x 3	$\frac{1}{2}$	11.9	3.50
"	$4\frac{1}{2}$ x 3	$\frac{9}{16}$	13.3	3.91
"	$4\frac{1}{2}$ x 3	$\frac{5}{8}$	14.7	4.30
"	$4\frac{1}{2}$ x 3	$\frac{11}{16}$	16.0	4.69
A135	5 x 4	$\frac{3}{8}$	11.0	3.24
"	5 x 4	$\frac{7}{16}$	12.8	3.75
"	5 x 4	$\frac{1}{2}$	14.5	4.25
"	5 x 4	$\frac{9}{16}$	16.2	4.75
"	5 x 4	$\frac{5}{8}$	17.8	5.24
"	5 x 4	$\frac{11}{16}$	19.5	5.72

Sections shown on pages 13 and 15.

WEIGHTS AND DIMENSIONS OF SPECIAL ANGLES.

UNEQUAL LEGS.—Continued.

Section Number.	Dimensions. Inches.	Thickness. Inch.	Weight per Foot. Pounds.	Area of Section. Sq. Ins.	Section Number.	Dimensions. Inches.	Thickness. Inch.	Weight per Foot. Pounds.	Area of Section. Sq. Ins.
A109	7 x $3\frac{1}{2}$	$\frac{7}{16}$	15.0	4.41	A109	7 x $3\frac{1}{2}$	$\frac{3}{4}$	24.9	7.32
"	7 x $3\frac{1}{2}$	$\frac{1}{2}$	17.0	5.00	"	7 x $3\frac{1}{2}$	$\frac{13}{16}$	26.8	7.88
"	7 x $3\frac{1}{2}$	$\frac{9}{16}$	19.1	5.59	"	7 x $3\frac{1}{2}$	$\frac{7}{8}$	28.7	8.43
"	7 x $3\frac{1}{2}$	$\frac{5}{8}$	21.0	6.18	"	7 x $3\frac{1}{2}$	$\frac{15}{16}$	30.5	8.97
"	7 x $3\frac{1}{2}$	$\frac{11}{16}$	23.0	6.75	"	7 x $3\frac{1}{2}$	1	32.3	9.50

Sections shown on page 15.

WEIGHTS AND DIMENSIONS OF ODD ANGLES.

Section Number.	Dimensions. Inches.	Thickness. Inch.	Weight per Foot. Pounds.	Area of Section. Sq. Ins.	Section Number.	Dimensions. Inches.	Thickness. Inch.	Weight per Foot. Pounds.	Area of Section. Sq. Ins.
A 61	$1\frac{1}{2}$ x $1\frac{1}{2}$	$\frac{1}{8}$	1.3	.36	A253	$3\frac{1}{4}$ x 2	$\frac{3}{8}$	6.4	1.88
"	$1\frac{1}{2}$ x $1\frac{1}{2}$	$\frac{3}{16}$	1.8	.53	"	$3\frac{1}{4}$ x 2	$\frac{7}{16}$	7.4	2.18
					"	$3\frac{1}{4}$ x 2	$\frac{1}{2}$	8.4	2.47
A155	$2\frac{5}{16}$ x $1\frac{5}{16}$	$\frac{11}{64}$	2.1	.60					

Sections shown on page 13.

WEIGHTS AND DIMENSIONS OF BULB BEAMS.

Section Number	Depth of Beam. Inches.	Weight per Foot. Pounds.	Area of Section. Sq. Ins.	Thickness of Web. Inch.	Width of Flange. Inches.	Diameter of Head. Inches.	Page Number of Section.
B 173	6	14.0	4.11	$\frac{9}{32}$	$4\frac{3}{8}$		18
"	6	15.3	4.48	$\frac{11}{32}$	$4\frac{7}{16}$		"
"	6	18.4	5.42	$\frac{1}{2}$	$4\frac{19}{32}$		"

WEIGHTS AND DIMENSIONS OF
REGULAR T-BARS.
EQUAL LEGS.

Section Number.	Width of Flange.	Depth of Bar.	Thickness of Flange.	Thickness of Stem.	Weight per Foot.	Area of Section.	Page Number of Section.
	Inches.	Inches.	Inch.	Inch.	Pounds.	Sq. Ins.	
T 5	1	1	$\frac{1}{8}$ to $\frac{5}{32}$	$\frac{1}{8}$ to $\frac{5}{32}$	1.0	.27	20
T 181	$1\frac{1}{8}$	$1\frac{1}{8}$	$\frac{3}{16}$ “ $\frac{7}{32}$	$\frac{5}{32}$ “ $\frac{7}{32}$	1.4	.41	“
T 183	$1\frac{3}{16}$	$1\frac{3}{16}$	$\frac{3}{16}$ “ $\frac{1}{4}$	$\frac{5}{32}$ “ $\frac{7}{32}$	1.6	.45	“
T 187	$1\frac{1}{4}$	$1\frac{1}{4}$	$\frac{3}{16}$ “ $\frac{1}{4}$	$\frac{5}{32}$ “ $\frac{7}{32}$	1.7	.48	“
T 189	$1\frac{3}{8}$	$1\frac{3}{8}$	$\frac{3}{16}$ “ $\frac{1}{4}$	$\frac{5}{32}$ “ $\frac{1}{4}$	1.9	.55	“
T 37	2	2	$\frac{1}{4}$ “ $\frac{5}{16}$	$\frac{1}{4}$ “ $\frac{5}{16}$	3.7	1.07	19
T 39	2	2	$\frac{5}{16}$ “ $\frac{3}{8}$	$\frac{5}{16}$ “ $\frac{3}{8}$	4.4	1.28	“
T 41	$2\frac{1}{4}$	$2\frac{1}{4}$	$\frac{1}{4}$ “ $\frac{5}{16}$	$\frac{1}{4}$ “ $\frac{5}{16}$	4.2	1.21	“
T 42	$2\frac{1}{4}$	$2\frac{1}{4}$	$\frac{5}{16}$ “ $\frac{3}{8}$	$\frac{5}{16}$ “ $\frac{3}{8}$	5.0	1.46	“
T 49	$2\frac{1}{2}$	$2\frac{1}{2}$	$\frac{5}{16}$ “ $\frac{3}{8}$	$\frac{5}{16}$ “ $\frac{3}{8}$	5.6	1.63	“
T 67	3	3	$\frac{5}{16}$ “ $\frac{3}{8}$	$\frac{5}{16}$ “ $\frac{3}{8}$	6.8	1.99	“
T 69	3	3	$\frac{3}{8}$ “ $\frac{7}{16}$	$\frac{3}{8}$ “ $\frac{7}{16}$	7.9	2.31	“
T 73	3	3	$\frac{1}{2}$ “ $\frac{9}{16}$	$\frac{1}{2}$ “ $\frac{9}{16}$	10.1	2.96	“
T 97	$3\frac{1}{2}$	$3\frac{1}{2}$	$\frac{3}{8}$ “ $\frac{7}{16}$	$\frac{3}{8}$ “ $\frac{7}{16}$	9.3	2.74	“
T 108	4	4	$\frac{3}{8}$ “ $\frac{7}{16}$	$\frac{3}{8}$ “ $\frac{7}{16}$	10.5	3.09	“

WEIGHTS AND DIMENSIONS OF
REGULAR T-BARS.
UNEQUAL LEGS.

Section Number.	Width of Flange.	Depth of Bar.	Thickness of Flange.	Thickness of Stem.	Weight per Foot.	Area of Section.	Page Number of Section.
	Inches.	Inches.	Inch.	Inch.	Pounds.	Sq. Ins.	
T 185	$1\frac{1}{4}$	$1\frac{1}{16}$	$\frac{3}{16}$ to $\frac{1}{4}$	$\frac{5}{32}$ to $\frac{7}{32}$	1.5	.44	21
T 22	$2\frac{1}{2}$	$1\frac{1}{4}$	$\frac{3}{16}$ “ $\frac{9}{32}$	$\frac{3}{16}$ “ $\frac{5}{16}$	3.0	.86	“
T 27	$2\frac{1}{2}$	$1\frac{3}{4}$	$\frac{11}{32}$ “ $\frac{13}{32}$	$\frac{1}{4}$ “ $\frac{17}{64}$	4.4	1.29	“
T 56	$2\frac{1}{2}$	3	$\frac{3}{8}$ “ $\frac{7}{16}$	$\frac{3}{8}$ “ $\frac{7}{16}$	7.0	2.07	“
T 62	$2\frac{3}{4}$	2	$\frac{5}{16}$ “ $\frac{3}{8}$	$\frac{3}{4}$	7.4	2.19	“
T 65	3	$2\frac{1}{2}$	$\frac{3}{8}$ “ $\frac{7}{16}$	$\frac{3}{8}$ to $\frac{7}{16}$	7.2	2.11	“
T 84	3	4	$\frac{3}{8}$ “ $\frac{7}{16}$	$\frac{3}{8}$ “ $\frac{7}{16}$	9.3	2.74	20
T 101	$3\frac{1}{2}$	4	$\frac{3}{8}$ “ $\frac{7}{16}$	$\frac{3}{8}$ “ $\frac{7}{16}$	10.0	2.94	“
T 120	$4\frac{1}{2}$	$2\frac{1}{2}$	$\frac{5}{16}$ “ $\frac{3}{8}$	$\frac{5}{16}$ “ $\frac{3}{8}$	7.8	2.29	“
T 138	$4\frac{1}{2}$	$3\frac{1}{2}$	$\frac{7}{16}$ “ $\frac{9}{16}$	$\frac{11}{16}$	14.7	4.32	“
T 140	$4\frac{1}{2}$	$3\frac{1}{2}$	$\frac{7}{16}$ “ $\frac{9}{16}$	$\frac{11}{16}$ to $\frac{7}{8}$	15.9	4.65	“
T 169	5	3	$\frac{1}{2}$ “ $\frac{9}{16}$	$\frac{13}{32}$ “ $\frac{5}{8}$	13.6	3.99	“

WEIGHTS AND DIMENSIONS OF

Z-BARS.

Section Number.	Depth of Bar.	Length of Legs.	Thickness of Web and Legs.	Weight per Foot.	Area of Section.	Page Number of Section.
	Inches.	Inches.	Inch.	Pounds.	Sq. Ins.	
Z 5	3	$2\frac{11}{16}$	$\frac{1}{4}$	6.7	1.97	16
"	$3\frac{1}{16}$	$2\frac{3}{4}$	$\frac{5}{16}$	8.4	2.48	"
Z 9	3	$2\frac{11}{16}$	$\frac{3}{8}$	9.7	2.86	16
"	$3\frac{1}{16}$	$2\frac{3}{4}$	$\frac{7}{16}$	11.4	3.36	"
Z 13	3	$2\frac{11}{16}$	$\frac{1}{2}$	12.5	3.69	16
"	$3\frac{1}{16}$	$2\frac{3}{4}$	$\frac{9}{16}$	14.2	4.18	"
Z 21	4	$3\frac{1}{16}$	$\frac{1}{4}$	8.2	2.41	16
"	$4\frac{1}{16}$	$3\frac{1}{8}$	$\frac{5}{16}$	10.3	3.03	"
"	$4\frac{1}{8}$	$3\frac{3}{16}$	$\frac{3}{8}$	12.4	3.66	"
Z 25	4	$3\frac{1}{16}$	$\frac{7}{16}$	13.8	4.05	16
"	$4\frac{1}{16}$	$3\frac{1}{8}$	$\frac{1}{2}$	15.8	4.66	"
"	$4\frac{1}{8}$	$3\frac{3}{16}$	$\frac{9}{16}$	17.9	5.27	"
Z 29	4	$3\frac{1}{16}$	$\frac{5}{8}$	18.9	5.55	16
"	$4\frac{1}{16}$	$3\frac{1}{8}$	$\frac{11}{16}$	20.9	6.14	"
"	$4\frac{1}{8}$	$3\frac{3}{16}$	$\frac{3}{4}$	23.0	6.75	"
Z 37	5	$3\frac{1}{4}$	$\frac{5}{16}$	11.6	3.40	17
"	$5\frac{1}{16}$	$3\frac{5}{16}$	$\frac{3}{8}$	13.9	4.10	"
"	$5\frac{1}{8}$	$3\frac{3}{8}$	$\frac{7}{16}$	16.4	4.81	"
Z 41	5	$3\frac{1}{4}$	$\frac{1}{2}$	17.9	5.25	17
"	$5\frac{1}{16}$	$3\frac{5}{16}$	$\frac{9}{16}$	20.2	5.94	"
"	$5\frac{1}{8}$	$3\frac{3}{8}$	$\frac{5}{8}$	22.6	6.64	"
Z 45	5	$3\frac{1}{4}$	$\frac{11}{16}$	23.7	6.96	17
"	$5\frac{1}{16}$	$3\frac{5}{16}$	$\frac{3}{4}$	26.0	7.64	"
"	$5\frac{1}{8}$	$3\frac{3}{8}$	$\frac{13}{16}$	28.3	8.33	"
Z 53	6	$3\frac{1}{2}$	$\frac{3}{8}$	15.6	4.59	17
"	$6\frac{1}{16}$	$3\frac{9}{16}$	$\frac{7}{16}$	18.3	5.39	"
"	$6\frac{1}{8}$	$3\frac{5}{8}$	$\frac{1}{2}$	21.0	6.19	"
Z 57	6	$3\frac{1}{2}$	$\frac{9}{16}$	22.7	6.68	17
"	$6\frac{1}{16}$	$3\frac{9}{16}$	$\frac{5}{8}$	25.4	7.46	"
"	$6\frac{1}{8}$	$3\frac{5}{8}$	$\frac{11}{16}$	28.1	8.25	"
Z 61	6	$3\frac{1}{2}$	$\frac{3}{4}$	29.3	8.63	17
"	$6\frac{1}{16}$	$3\frac{9}{16}$	$\frac{13}{16}$	31.9	9.39	"
"	$6\frac{1}{8}$	$3\frac{5}{8}$	$\frac{7}{8}$	34.6	10.17	"
Z 67	$7\frac{1}{2}$	3	$\frac{3}{8}$	16.3	4.78	18
Z 73	8	3	$\frac{1}{2}$	22.1	6.5	"

STANDARD CONNECTION ANGLES FOR I-BEAMS AND CHANNELS.

Standard connection angles for all sizes of beams and channels are shown on page 45. These are of sufficient strength for all usual connections of the various sizes shown, figured on the basis of 10 000 pounds per square inch, as the allowable unit stress for single shear of rivets or bolts, and 20 000 pounds per square inch as the allowable unit stress for double shear and bearing value of the parts connected by the rivets.

When beams of very short spans are loaded to their full capacity, the end shear or reaction which has to be transmitted through the connections becomes so great that stronger connections than the standard should be used.

The following tables give the limits of length below which the standard connections do not apply and for which special designs should be made. For all lengths greater than those given in the tables the standard connections are sufficiently strong.

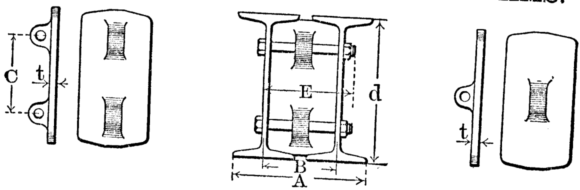
MINIMUM SPANS OF STANDARD CHANNELS FOR WHICH STANDARD CONNECTION ANGLES MAY BE SAFELY USED WITH CHANNELS UNIFORMLY LOADED TO THEIR FULL CAPACITY, IN ACCORDANCE WITH TABLES OF SAFE LOADS, FOR FIBER STRESS OF 16 000 LBS. PER SQUARE INCH.

Section Number.	Depth of Channel.	Weight per Foot.	Minimum Safe Span.	Section Number.	Depth of Channel.	Weight per Foot.	Minimum Safe Span.	Section Number.	Depth of Channel.	Weight per Foot.	Minimum Safe Span.
	Inches.	Pounds.	Feet.		Inches.	Pounds.	Feet.		Inches.	Pounds.	Feet.
C 5	3	4.0	1.1	C 21	7	12.25	2.6	C 33	10	25.0	5.5
“	“	5.0	0.8	“	“	14.75	2.3	“	“	30.0	6.2
“	“	6.0	0.8	“	“	17.25	2.6	“	“	35.0	7.0
				“	“	19.75	2.9				
C 9	4	5.25	1.9								
“	“	6.25	1.5	C 25	8	11.25	4.4	C 41	12	20.5	5.4
“	“	7.25	1.4	“	“	13.75	3.4	“	“	25.0	4.8
				“	“	16.25	3.0	“	“	30.0	5.4
C 13	5	6.5	2.8	“	“	18.75	3.3	“	“	35.0	6.0
“	“	9.0	2.1	“	“	21.25	3.6	“	“	40.0	6.6
“	“	11.5	2.5								
				C 29	9	13.25	5.4				
C 17	6	8.0	3.9	“	“	15.00	4.6	C 53	15	33.0	7.4
“	“	10.5	3.0	“	“	20.00	4.1	“	“	35.0	7.1
“	“	13.0	3.5	“	“	25.00	4.7	“	“	40.0	7.0
“	“	15.5	3.9					“	“	45.0	7.5
				C 33	10	15.0	6.6	“	“	50.0	8.1
C 21	7	9.75	3.4	“	“	20.0	4.9	“	“	55.0	8.7

MINIMUM SPANS OF I-BEAMS FOR WHICH STANDARD CONNECTION ANGLES MAY BE SAFELY USED WITH I-BEAMS UNIFORMLY LOADED TO THEIR FULL CAPACITY, IN ACCORDANCE WITH TABLES OF SAFE LOADS, FOR FIBER STRESS OF 16 000 LBS. PER SQUARE INCH.

Section Number.	Depth of Beam.	Weight per Foot.	Minimum Safe Span.	Section Number.	Depth of Beam.	Weight per Foot.	Minimum Safe Span.	Section Number.	Depth of Beam.	Weight per Foot.	Minimum Safe Span.
	Inches.	Pounds.	Feet.		Inches.	Pounds.	Feet.		Inches.	Pounds.	Feet.
B 5	3	5.5	1.7	B29	9	30.0	6.8	B113	15	80.0	15.9
“	“	6.5	1.2	“	“	35.0	7.5	“	“	85.0	16.4
“	“	7.5	1.2					“	“	90.0	17.0
				B33	10	25.0	9.3	“	“	95.0	17.5
B 9	4	7.5	2.8	“	“	30.0	8.1	“	“	100.0	18.1
“	“	8.5	2.2	“	“	35.0	8.8				
“	“	9.5	2.0	“	“	40.0	9.6	B65	18	55.0	13.7
“	“	10.5	2.2					“	“	60.0	11.9
				B41	12	31.5	7.3	“	“	65.0	11.8
B13	5	9.75	4.1	“	“	35.0	7.7	“	“	70.0	12.4
“	“	12.25	3.3	“	“	40.0	8.2				
“	“	14.75	3.7					B73	20	65.0	13.9
				B105	12	40.0	9.0	“	“	70.0	12.5
B17	6	12.25	5.6	“	“	45.0	9.6	“	“	75.0	12.8
“	“	14.75	4.8	“	“	50.0	10.2				
“	“	17.25	5.3	“	“	55.0	10.8	B121	20	80.0	14.8
								“	“	85.0	15.2
B21	7	15.00	4.9	B53	15	42.0	10.2	“	“	90.0	15.7
“	“	17.50	3.8	“	“	45.0	9.4	“	“	95.0	16.2
“	“	20.00	3.6	“	“	50.0	9.7	“	“	100.0	16.7
				“	“	55.0	10.3				
B25	8	18.00	6.2	“	“	60.0	10.8	B89	24	80.0	17.7
“	“	20.25	5.1					“	“	85.0	16.1
“	“	22.75	4.8	B109	15	60.0	12.3	“	“	90.0	16.1
“	“	25.25	5.1	“	“	65.0	12.8	“	“	95.0	16.6
				“	“	70.0	13.4	“	“	100.0	17.1
B29	9	21.0	7.7	“	“	75.0	13.9				
“	“	25.0	6.2	“	“	80.0	14.5				

CAST IRON SEPARATORS FOR I-BEAMS.

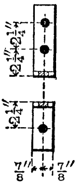


Section Number.	Beams. Depth. d	Weight per Foot.	Out to Out of Flanges of Beams. A	Center to Center of Beams. B	Separators. Thickness. t	Weight.	Increase of Weight for each inch additional spread of Beams.	Bolts, Square Heads and Hex. Nuts. Diameter.	Center to Center of Bolts. C	Length. E	Weight of Bolts and Nuts.	Increase of Weight of Bolts for each in. additional spread of Beams.
	Ins.	Pounds.	Inches.	Inches.	In.	Pounds.	Pounds.	In.	Ins.	Ins.	Pounds.	Pound.
SEPARATORS WITH ONE BOLT.												
B 5	3	5.5	$5\frac{5}{16}$	3	$\frac{3}{8}$	1.1	.29	$\frac{3}{4}$		4	.95	.123
B 9	4	7.5	$5\frac{7}{8}$	$3\frac{1}{4}$	"	1.6	.38	"		$4\frac{1}{2}$	1.01	"
B 13	5	9.75	$6\frac{1}{2}$	$3\frac{1}{2}$	"	2.0	.49	"		$4\frac{3}{4}$	1.04	"
B 17	6	12.25	$7\frac{5}{16}$	4	$\frac{1}{2}$	3.3	.78	"		$5\frac{1}{4}$	1.11	"
B 21	7	15.0	$7\frac{7}{8}$	$4\frac{1}{4}$	"	3.9	.92	"		$5\frac{1}{2}$	1.14	"
B 25	8	18.0	$8\frac{1}{2}$	$4\frac{1}{2}$	"	4.7	1.06	"		$5\frac{3}{4}$	1.17	"
B 29	9	21.0	$9\frac{5}{16}$	5	"	5.9	1.20	"		$6\frac{1}{4}$	1.23	"
B 33	10	25.0	$9\frac{7}{8}$	$5\frac{1}{4}$	"	6.8	1.33	"		$6\frac{1}{2}$	1.26	"
B 41	12	31.5	$10\frac{3}{4}$	$5\frac{3}{4}$	"	8.8	1.61	"		7	1.32	"
B 105	12	40.0	$11\frac{1}{4}$	6	"	8.9	1.58	"		$7\frac{1}{2}$	1.38	"
SEPARATORS WITH TWO BOLTS.												
B 41	12	31.5	$10\frac{3}{4}$	$5\frac{3}{4}$	$\frac{1}{2}$	9.5	1.61	$\frac{3}{4}$	$6\frac{1}{2}$	7	2.64	.246
B 105	12	40.0	$11\frac{1}{4}$	6	"	9.5	1.58	"	"	$7\frac{1}{2}$	2.76	"
B 53	15	42.0	$11\frac{3}{4}$	$6\frac{1}{4}$	"	12.5	2.02	"	7	$7\frac{3}{4}$	2.82	"
B 109	15	60.0	$12\frac{3}{4}$	$6\frac{3}{4}$	"	13.0	1.97	"	"	$8\frac{1}{4}$	2.95	"
B 113	15	80.0	$13\frac{3}{8}$	$7\frac{1}{4}$	"	13.2	1.91	"	"	9	3.13	"
B 65	18	55.0	$12\frac{3}{4}$	$6\frac{3}{4}$	$\frac{5}{8}$	19.8	2.41	"	9	$8\frac{1}{4}$	2.95	"
B 73	20	65.0	$13\frac{1}{4}$	7	"	22.9	3.37	"	10	$8\frac{1}{2}$	3.01	"
B 121	20	80.0	$14\frac{3}{4}$	$7\frac{3}{4}$	"	24.6	3.34	"	"	$9\frac{1}{4}$	3.19	"
B 89	24	80.0	$14\frac{3}{4}$	$7\frac{3}{4}$	"	30.3	4.07	"	12	$9\frac{1}{4}$	3.19	"

Lengths and weights of separator bolts in above table are for girders composed of two beams of minimum section as shown. Lengths of bolts for intermediate and maximum sizes of beams may be obtained by adding twice the increase of web thickness to the lengths given.

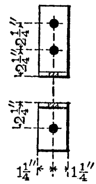
STANDARD CONNECTION ANGLES FOR I-BEAMS AND CHANNELS.

FOR 3" AND 4" BEAMS AND CHANNELS



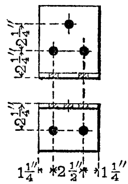
6" x 4" x 3/8" ANGLE - 1 3/4" LONG

FOR 5" AND 6" BEAMS AND CHANNELS



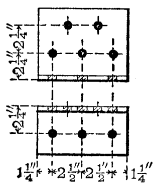
6" x 4" x 3/8" ANGLE - 2 1/2" LONG

FOR 7", 8", 9" AND 10" BEAMS AND CHANNELS



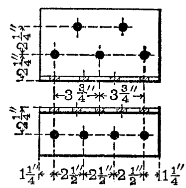
6" x 4" x 3/8" ANGLE - 5" LONG

FOR 12" BEAMS AND CHANNELS



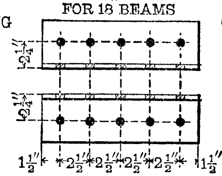
6" x 4" x 3/8" ANGLE - 7 1/2" LONG

FOR 15" BEAMS AND CHANNELS



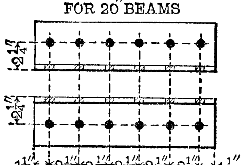
6" x 4" x 3/8" ANGLE - 10" LONG

FOR 18" BEAMS



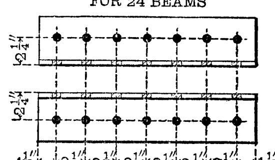
4" x 4" x 3/8" ANGLE - 13" LONG

FOR 20" BEAMS



4" x 4" x 3/8" ANGLE - 15" LONG

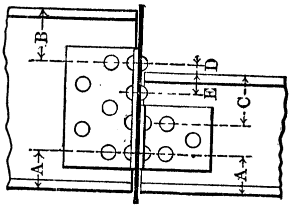
FOR 24" BEAMS



4" x 4" x 3/8" ANGLE - 18" LONG

ALL RIVETS OR BOLTS TO BE 3/4" DIAMETER   ALL OPEN HOLES TO BE 13/16" DIAMETER

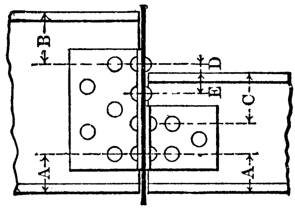
LOCATION OF CONNECTION ANGLES FOR BEAMS OF THE SAME OR DIFFERENT SIZES FRAMING OPPOSITE, BOTTOMS OR TOPS FLUSH.



DEPTH OF BEAMS. Inches. Main Beam.	Opposite Beam.	A Inches.	B Inches.	C Inches.	D Inches.	E Inches.
3	3	1½	1½	1½	..	..
4	3	1½	2½	1½	..	..
"	4	2	2	2	..	..
5	4	2	3	2	..	..
"	5	2½	2½	2½	..	..
6	4	2	4	2	..	..
"	5	"	"	3	..	..
"	6	3	3	3	..	..
7	4	2½	2	1½	1	1½
"	5	"	"	2½	0	0
"	6	"	"	3½	..	1
"	7	2¼	2¼	2¼	..	..
8	4	2½	3	1½	1	1½
"	5	"	"	2½	0	0
"	6	"	"	3½	..	1
"	7	"	"	2	..	2
"	8	2¾	2¾	2¾	..	..
9	5	2½	4	2½	0	0
"	6	"	"	3½	..	1
"	7	"	"	2	..	..
"	8	"	"	3	..	..
"	9	3¼	3¼	3¼	..	..
10	6	2½	5	3½	..	1
"	7	"	"	2	..	2
"	8	"	"	3	..	3
"	9	"	"	4	..	4
"	10	3¾	3¾	3¾	..	..

For cases where **D** is zero or **E** is 1″ or zero cut beam back ½″ or cope flanges back ½″ to clear rivet head.

LOCATION OF CONNECTION ANGLES FOR BEAMS OF THE SAME OR DIFFERENT SIZES FRAMING OPPOSITE, BOTTOMS OR TOPS FLUSH.



DEPTH OF BEAMS. Inches. Main Beam.	Opposite Beam.	A Inches.	B Inches.	C Inches.	D Inches.	E Inches.
12	8	3¼	3¾	2¼	¼	2¼
"	9	"	"	3¼	. .	¾
"	10	"	"	4¼	. .	1¾
"	12	3½	3½	3½	. .	. .
15	8	3¼	4¼	2¼	¼	2¼
"	9	"	"	3¼	1¾	¾
"	10	"	"	4¼	¾	1¾
"	12	"	"	3¾	. .	1¼
"	15	3¾	3¾	3¾	. .	. .
18	8	3¼	4¾	2¼	¼	2¼
"	9	"	"	3¼	1¾	¾
"	10	"	"	4¼	¾	1¾
"	12	"	"	3¾	1¼	1¼
"	15	"	"	4¼	. .	1¾
"	18	4	4	4	. .	. .
20	8	3¼	4¼	2¼	¼	2¼
"	9	"	"	3¼	1¾	¾
"	10	"	"	4¼	¾	1¾
"	12	"	"	3¾	1¼	1¼
"	15	"	"	4¼	¾	1¾
"	18	"	"	4¾	. .	2¼
"	20	3¾	3¾	3¾	. .	. .
24	8	3¼	5¾	2¼	¼	2¼
"	9	"	"	3¼	1¾	¾
"	10	"	"	4¼	¾	1¾
"	12	"	"	3¾	1¼	1¼
"	15	"	"	4¼	¾	1¾
"	18	"	"	4¾	¼	2¼
"	20	"	"	4¼	. .	1¾
"	24	4½	4½	4½	. .	. .

For cases where **D** is ¼″ or ¾″ or **E** is ¾″ or 1¼″ cut beam back ½″ or cope flanges back ½″ to clear rivet head.

BEARING PLATES FOR SHAPES USED AS BEAMS.

Shapes used as beams resting on masonry walls or piers will generally require bearing plates of steel or their equivalents, set in or upon the masonry to properly distribute the load thereon with due regard to the allowable safe pressures for the class of stonework or brickwork in question.

A table of bearing plates is presented on page 49, which gives the bearing values in pounds for plates of various sizes based on the safe unit pressure allowable on different classes of masonry. As the strength of masonry varies largely according to the qualities of the material used, the workmanship and age, it is impossible to present absolute figures for safe unit pressures for all classes of work, but the values given below are believed to fairly represent these for the usual kinds of ordinary architectural masonry. The strength of ordinary masonry generally depends upon the crushing value of the mortar or cement used and does not bear any fixed relation to the ultimate strength of the brick or stone entering into the construction.

The table of bearing plates gives the bearing values of various sizes of plates when used with different classes of masonry, but the thickness of the plate should be computed for each case.

For a plate of given length and breadth the thickness depends upon the allowable load and unit stress, and the width of the flange of the beam or channel resting upon it.

The thickness may be determined by the following formula:

$$t = .866\,(l - b)\sqrt{\frac{R}{pb'l}}$$

t = thickness of plate in inches.
l = length of plate in a direction perpendicular to the axis of the beam or channel in inches.
b = width of flange of beam or channel in inches.
R = reaction at point of support in pounds.
For uniformly distributed loads R = one-half of the load given in Tables of Safe Loads, pages 78 to 94 inclusive.
p = allowable stress in pounds per square inch on extreme fibre of plate.
b′ = width of plate in the direction of the axis of the beam or channel; *i. e.*, bearing on wall in inches.

If p = 16 000 lbs. for steel we have

$$t = .00685\,(l - b)\sqrt{\frac{R}{b'l}}$$

Examples.

What is the proper size of steel bearing plate to be used in a wall of good brick laid in lime mortar to support the end of a 10-inch standard I-Beam, weighing 25 pounds per foot, of 16-foot span, subjected to its safe load uniformly distributed?

On page 81 in the Table of Safe Loads Uniformly Distributed for Cambria I-Beams, the total load is found to be 16 280 pounds, and half of this, or 8 140 pounds, will be the reaction at each end.

On referring to the Table of Bearing Plates, on page 49, the proper size for this load on the class of masonry in question is found to be 6″ x 10″. The width of flange of a 10-inch 25 lb. standard beam is 4.66 inches.

Substituting these values in the formula for thickness gives

$$t = .00685\,(10 - 4.66)\sqrt{\frac{8140}{6 \times 10}} = .426$$

The nearest commercial size above this is $\frac{7}{16}$ inch, which is the thickness required.

If a shorter plate would suit the location better it may be seen from the table that a plate 8″ x 8″ will give the necessary bearing value and the thickness of this would be

$$t = .00685\,(8 - 4.66)\sqrt{\frac{8140}{8 \times 8}} = .258$$

and the nearest commercial size above this is $\frac{5}{16}$″, which is the thickness required.

BEARING PLATES FOR I-BEAMS AND CHANNELS.

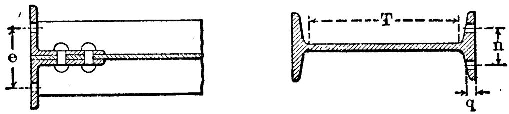
To be used on walls of different kinds of masonry.

Bearing on Wall. Inches.	Size of Plate. Inches.	Safe Bearing Value of Plate in Pounds. Ordinary Stone Masonry.	Good Stone Masonry.	Brick in Lime Mortar.	Brick in Cement Mortar.	Bearing on Wall. Inches.	Size of Plate. Inches.	Safe Bearing Value of Plate in Pounds. Ordinary Stone Masonry.	Good Stone Masonry.	Brick in Lime Mortar.	Brick in Cement Mortar.
4	4x 4	2880	4800	2400	3200	14	14x14	35280	58800	29400	39200
4	4x 6	4320	7200	3600	4800	14	14x16	40320	67200	33600	44800
4	4x 8	5760	9600	4800	6400	14	14x18	45360	75600	37800	50400
						14	14x20	50400	84000	42000	56000
6	6x 6	6480	10800	5400	7200						
6	6x 8	8640	14400	7200	9600	16	16x16	46080	76800	38400	51200
6	6x10	10800	18000	9000	12000	16	16x18	51840	86400	43200	57600
						16	16x20	57600	96000	48000	64000
8	8x 8	11520	19200	9600	12800	16	16x22	63360	105600	52800	70400
8	8x10	14400	24000	12000	16000						
8	8x12	17280	28800	14400	19200	18	18x18	58320	97200	48600	64800
						18	18x20	64800	108000	54000	72000
10	10x10	18000	30000	15000	20000	18	18x22	71280	118800	59400	79200
10	10x12	21600	36000	18000	24000	18	18x24	77760	129600	64800	86400
10	10x14	25200	42000	21000	28000						
						20	20x20	72000	120000	60000	80000
12	12x12	25920	43200	21600	28800	20	20x22	79200	132000	66000	88000
12	12x14	30240	50400	25200	33600	20	20x24	86400	144000	72000	96000
12	12x16	34560	57600	28800	38400	20	20x26	93600	156000	78000	104000
12	12x18	38880	64800	32400	43200						

Bearing values are based on the following allowed pressures :

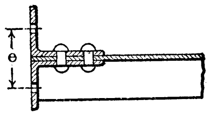
Masonry.	Allowable Pressure. Pounds per Square Inch.	Tons per Square Foot.
Ordinary Stone	180	12.96
Good Stone	300	21.60
Brick in Lime Mortar.....................	150	10.80
Brick in Cement Mortar	200	14.40

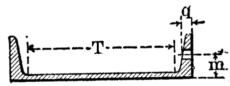
STANDARD SPACING OF RIVET AND BOLT HOLES THROUGH FLANGES AND CONNECTION ANGLES OF I-BEAMS, AND TANGENT DISTANCES BETWEEN FILLETS MEASURED ALONG THE WEB.



Depth of Beam.	Weight.	n	e	q	T
Inches.	Lbs. per Ft.	Inches.	Inches.	In.	Inches.
3	5.5	$1\frac{7}{16}$	$4\frac{21}{32}$	$\frac{1}{4}$	$1\frac{13}{16}$
"	6.5	"	$4\frac{3}{4}$	"	"
"	7.5	"	$4\frac{7}{8}$	"	"
4	7.5	$1\frac{1}{2}$	$4\frac{11}{16}$	$\frac{9}{32}$	$2\frac{11}{16}$
"	8.5	"	$4\frac{3}{4}$	"	"
"	9.5	"	$4\frac{27}{32}$	$\frac{5}{16}$	"
"	10.5	"	$4\frac{29}{32}$	"	"
5	9.75	$1\frac{3}{4}$	$4\frac{23}{32}$	$\frac{5}{16}$	$3\frac{5}{8}$
"	12.25	"	$4\frac{7}{8}$	"	"
"	14.75	"	5	$\frac{11}{32}$	"
6	12.25	2	$4\frac{23}{32}$	$\frac{11}{32}$	$4\frac{7}{16}$
"	14.75	"	$4\frac{27}{32}$	"	"
"	17.25	"	$4\frac{31}{32}$	$\frac{3}{8}$	"
7	15.00	$2\frac{1}{4}$	$4\frac{3}{4}$	$\frac{3}{8}$	$5\frac{3}{8}$
"	17.50	"	$4\frac{27}{32}$	"	"
"	20.00	"	$4\frac{31}{32}$	"	"
8	18.00	$2\frac{1}{4}$	$4\frac{25}{32}$	$\frac{13}{32}$	$6\frac{3}{16}$
"	20.25	"	$4\frac{27}{32}$	$\frac{7}{16}$	"
"	22.75	"	$4\frac{15}{16}$	"	"
"	25.25	"	$5\frac{1}{32}$	"	"
9	21.0	$2\frac{1}{2}$	$4\frac{25}{32}$	$\frac{7}{16}$	$7\frac{1}{16}$
"	25.0	"	$4\frac{29}{32}$	"	"
"	30.0	"	$5\frac{1}{16}$	$\frac{15}{32}$	"
"	35.0	"	$5\frac{7}{32}$	"	"
10	25.0	$2\frac{5}{8}$	$4\frac{13}{16}$	$\frac{15}{32}$	$7\frac{15}{16}$
"	30.0	"	$4\frac{15}{16}$	$\frac{1}{2}$	"
"	35.0	"	$5\frac{3}{32}$	"	"
"	40.0	"	$5\frac{1}{4}$	$\frac{17}{32}$	"
12	31.5	$2\frac{3}{4}$	$4\frac{27}{32}$	$\frac{17}{32}$	$9\frac{3}{4}$
"	35.0	"	$4\frac{15}{16}$	"	"
"	40.0	"	$5\frac{1}{16}$	$\frac{9}{16}$	"
12	40.0	3	$4\frac{31}{32}$	$\frac{21}{32}$	$9\frac{5}{16}$
"	45.0	"	$5\frac{3}{32}$	"	"
"	50.0	"	$5\frac{3}{16}$	"	"
12	55.0	3	$5\frac{5}{16}$	$\frac{11}{16}$	$9\frac{5}{16}$
15	42.0	3	$4\frac{29}{32}$	$\frac{5}{8}$	$12\frac{1}{2}$
"	45.0	"	$4\frac{31}{32}$	"	"
"	50.0	"	$5\frac{1}{16}$	"	"
"	55.0	"	$5\frac{5}{32}$	"	"
"	60.0	"	$5\frac{1}{4}$	$\frac{21}{32}$	"
15	60.0	$3\frac{1}{4}$	$5\frac{3}{32}$	$\frac{13}{16}$	$11\frac{3}{4}$
"	65.0	"	$5\frac{3}{16}$	"	"
"	70.0	"	$5\frac{9}{32}$	$\frac{27}{32}$	"
"	75.0	"	$5\frac{3}{8}$	"	"
"	80.0	"	$5\frac{15}{32}$	"	"
15	80.0	$3\frac{3}{4}$	$5\frac{5}{16}$	$1\frac{1}{32}$	$10\frac{15}{16}$
"	85.0	"	$5\frac{13}{32}$	"	"
"	90.0	"	$5\frac{1}{2}$	"	"
"	95.0	"	$5\frac{19}{32}$	"	"
"	100.0	"	$5\frac{11}{16}$	$1\frac{1}{16}$	"
18	55.0	$3\frac{1}{4}$	$4\frac{31}{32}$	$\frac{11}{16}$	$15\frac{3}{16}$
"	60.0	"	$5\frac{1}{16}$	"	"
"	65.0	"	$5\frac{1}{8}$	$\frac{23}{32}$	"
"	70.0	"	$5\frac{7}{32}$	"	"
20	65.0	$3\frac{1}{2}$	5	$\frac{25}{32}$	$16\frac{15}{16}$
"	70.0	"	$5\frac{3}{32}$	"	"
"	75.0	"	$5\frac{5}{32}$	"	"
20	80.0	4	$5\frac{3}{32}$	$\frac{29}{32}$	$16\frac{7}{16}$
"	85.0	"	$5\frac{5}{32}$	"	"
"	90.0	"	$5\frac{1}{4}$	"	"
"	95.0	"	$5\frac{5}{16}$	"	"
"	100.0	"	$5\frac{3}{8}$	$\frac{15}{16}$	"
24	80.0	4	5	$\frac{27}{32}$	$20\frac{11}{16}$
"	85.0	"	$5\frac{1}{16}$	"	"
"	90.0	"	$5\frac{1}{8}$	$\frac{7}{8}$	"
"	95.0	"	$5\frac{3}{16}$	"	"
"	100.0	"	$5\frac{1}{4}$	"	"

STANDARD SPACING OF RIVET AND BOLT HOLES IN FLANGES AND CONNECTION ANGLES OF CHANNELS, AND TANGENT DISTANCES BETWEEN FILLETS MEASURED ALONG THE WEB.



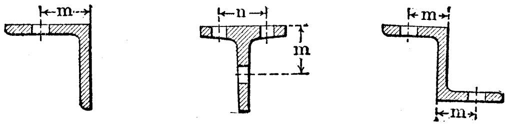


Depth of Channel	Weight.	m	e	q	T
Inches.	Lbs. per Ft.	Inches.	Inches.	In.	Inches.
3	4.0	15/16	4 21/32	1/4	1 13/16
"	5.0	"	4 3/4	"	"
"	6.0	"	4 7/8	9/32	"
4	5.25	1	4 11/16	9/32	2 11/16
"	6.25	"	4 3/4	"	"
"	7.25	"	4 27/32	5/16	"
5	6.5	1	4 11/16	5/16	3 5/8
"	9.0	1 1/4	4 27/32	9/32	"
"	11.5	"	4 31/32	5/16	"
6	8.0	1 1/16	4 11/16	11/32	4 1/2
"	10.5	1 3/16	4 13/16	"	"
"	13.0	1 5/16	4 15/16	"	"
"	15.5	1 7/16	5 1/16	"	"
7	9.75	1 3/16	4 23/32	11/32	5 7/16
"	12.25	1 5/16	4 13/16	3/8	"
"	14.75	1 7/16	4 29/32	"	"
"	17.25	1 1/2	5 1/32	"	"
"	19.75	1 5/8	5 1/8	"	"
8	11.25	1 1/4	4 23/32	3/8	6 5/16
"	13.75	1 5/16	4 13/16	13/32	"
"	16.25	1 3/8	4 29/32	3/8	"
"	18.75	1 1/2	5	13/32	"
8	21.25	1 9/16	5 3/32	13/32	6 5/16
9	13.25	1 3/8	4 3/4	13/32	7 1/4
"	15.00	1 7/16	4 25/32	"	"
"	20.00	1 9/16	4 15/16	3/8	"
"	25.00	1 3/4	5 1/8	13/32	"
10	15.0	1 1/2	4 3/4	7/16	8 3/16
"	20.0	1 5/8	4 27/32	"	"
"	25.0	1 3/4	5 1/32	3/8	"
"	30.0	1 15/16	5 3/16	13/32	"
"	35.0	2 1/16	5 5/16	7/16	"
12	20.5	1 3/4	4 25/32	15/32	9 15/16
"	25.0	1 7/8	4 7/8	1/2	"
"	30.0	2	5	15/32	"
"	35.0	2 1/8	5 1/8	1/2	"
"	40.0	2 1/4	5 1/4	17/32	"
15	33.0	1 7/8	4 29/32	21/32	12 3/8
"	35.0	1 15/16	4 15/16	"	"
"	40.0	2	5 1/32	11/16	"
"	45.0	2 1/8	5 1/8	5/8	"
"	50.0	2 1/4	5 7/32	21/32	"
"	55.0	2 5/16	5 5/16	"	"

MAXIMUM SIZE OF RIVETS IN BEAMS AND CHANNELS.

I-Beams.						Channels.		
Depth of Beam.	Weight.	Diameter of Rivets.	Depth of Beam.	Weight.	Diameter of Rivets.	Depth of Channel.	Weight.	Diameter of Rivets.
Inches.	Lbs. per Ft.	Inch.	Inches.	Lbs. per Ft.	Inch.	Inches.	Lbs. per Ft.	Inch.
3	5.50	3/8	15	42.0	3/4	3	4.00	3/8
4	7 50	1/2	15	60.0	"	4	5.25	1/2
5	9.75	"	15	80.0	7/8	5	6.50	"
6	12.25	5/8	18	55.0	"	6	8.00	5/8
7	15.00	"	20	65.0	1	7	9.75	"
8	18.00	3/4	20	80.0	"	8	11.25	3/4
9	21.00	"	24	80.0	"	9	13.25	"
10	25.00	"				10	15.00	"
12	31.50	"				12	20.50	"
12	40.00	"				15	33.00	"

STANDARD SPACING OF RIVET AND BOLT HOLES IN ANGLES, T-BARS AND Z-BARS, WITH MAXIMUM SIZE OF RIVETS TO BE USED.



ANGLES.

Length of Leg.	m	Diameter of Rivet.	Length of Leg.	m	Diameter of Rivet.	Length of Leg.	m	Diameter of Rivet.
Inches.	Inch.	Inch.	Inches.	Inch.	Inch.	Inches.	Inches.	Inch.
3/4	7/16	1/4	2	1 1/8	5/8	3 1/2	Variable, depending on diameter of rivet, thickness of metal and length of leg.	1
1	9/16	3/8	2 1/4	1 1/4	3/4	4		"
1 1/4	11/16	1/2	2 5/16	"	"	4 1/2		"
1 5/16	3/4	"	2 1/2	1 1/2	"	5		"
1 3/8	"	"	2 3/4	"	"	6		"
1 1/2	13/16	"	3	1 3/4	7/8	7		"
1 3/4	15/16	5/8				8		"

T-BARS.

Width of Flange.	n	Max. Diam. of Rivets in Flange.	Depth of Bar.	m	Max. Diam. of Rivets in Stem.
Inches.	Inches.	Inch.	Inches.	Inches.	Inch.
1	5/8	1/4	1	9/16	3/8
1 1/8	"	"	1 1/16	"	"
1 3/16	"	"	1 1/8	"	1/2
1 1/4	"	"	1 3/16	5/8	"
1 3/8	"	"	1 1/4	11/16	"
2	1	1/2	1 3/8	3/4	"
2 1/4	1 1/8	"	1 3/4	1	5/8
2 1/2	1 1/4	"	2	1 1/8	"
2 3/4	1 3/8	"	2 1/4	1 1/4	3/4
3	1 1/2	"	2 1/2	1 3/8	"
3 1/2	1 3/4	5/8	3	1 3/4	7/8
4	2	"	3 1/2	2	1
4 1/2	2 1/4	3/4	4	2 1/4	"
5	2 3/8	"			

Z-BARS.

Depth of Bar.	Weight.	m	Max. Diam. of Rivets.
Inches.	Lbs. per Foot.	Inches.	Inch.
3 to 3 1/16	6.7 to 14.2	1 5/8	3/4
4 " 4 1/8	8.2 " 23.0	1 3/4	7/8
5 " 5 1/8	11.6 " 28.3	1 7/8	"
6 " 6 1/8	15.6 " 34.6	2	1

FIREPROOF CONSTRUCTION.

Buildings of fireproof construction consist essentially of a steel frame or skeleton to support the floors, and in the case of high buildings, the outside walls also are carried by the steel framing. All parts of the steel work are enclosed and protected by some fire-resisting material which should be of such quality and arrangement as not to disintegrate or fall away when heated to high temperatures and at the same time exposed to a stream of cold water. The fireproofing for the floors, in addition to its ability to afford a fireproof protection to the steel beams, must be capable of supporting the load and distributing it to the floor beams, which in turn transmit it to the columns and thence to the foundations.

One of the earlier forms of floors consists of brick arches built between and supported by the bottom flanges and lower portions of the web of iron or steel I-Beams, but this style has considerable dead weight and, as ordinarily constructed, does not provide fireproof protection for the bottom flanges of the beams. Another of the earlier forms of floor is composed of sheets of corrugated iron arched between the beams, on which a concrete filling is placed, and this also, as ordinarily constructed, does not provide protection for the bottom flanges of the beams, besides, it is quite heavy.

A later style of floor is the hollow tile system, which is composed of flat or segmental arches constructed of moulded blocks of hard burned clay, specially shaped, and of various depths to suit different loads and the sizes of the I-beams supporting them. In the hollow tile system, the blocks may also be of porous terra-cotta which is lighter than hard clay.

Various other systems of fireproofing are now in use, the most usual forms of which consist of cement, concrete or other material used alone or deposited or arranged about a strengthening or supporting framework of steel shapes, bars, rods, wire, wire-cloth, etc.

Column or girder fireproofing may be accomplished by the use of hard clay or porous terra-cotta blocks shaped to fit and enclose the steel work, or the steel may be wrapped with wire, wire-cloth, metal lath, etc., and a concrete or plastered coating applied to it.

Fireproof partitions may be constructed of hollow tiles composed of hard clay or porous terra-cotta to which the plaster finish may be directly applied, or they may be composed of suitable metal studding on which is secured the wire-cloth or metal lath that serves to support the concrete or other fireproofing, the surface then being plastered in the usual manner.

The dead weights of fireproof floors vary between wide limits dependent upon the system employed, the load to be carried and the distance between the supporting beams.

TESTS OF FLOOR ARCHES.

Reports of tests of various forms of floor arches may be found in the *American Architect*, March, 1891, and in the *Engineering Record* for September and October, 1897.

A paper on this subject, entitled "Tests of Fire-proof Flooring Material," was published in the *Transactions of the American Society of Civil Engineers*, with discussions, in Vols. xxxiv and xxxv, dated 1895 and 1896.

A summary of the principal data and results of the tests which were the subject of the latter paper is given in the following table:

BREAKING LOAD OF HOLLOW TILE ARCHES.

Depth of Arch.	Rise.	Span.	Length.	Total Load.	Load per Sq. Foot.	Total Horizontal Thrust.	Horizontal Thrust per Ft. of Arch.	BLOCKS. Style.	BLOCKS. Material.	Character of Load.	Manner of Laying Joints.
Ins.	Ins.	Ins.	Ins.	Lbs.	Lbs.	Lbs.					
6.	3.5	60	48.	13750	688	29474	7369	E	Hard	Dis.	Port.
7.5	5.	46	11.5	9000	2452	10367	10818	"	"	"	N. M.
7.5	5.	60	35.2	11250		33750	11505	"	"	Cen.	Port.
7.5	5.	60	36.5	13000		39000	12822	"	Porous	"	"
8.	7.	60	38.25	14500		31071	9747	"	"	"	"
8.	7.	60	38.25	15750		33750	10588	"	Hard	"	"
12.	10.	60	41.	16400		24600	7200	"	"	"	"
12.	8.75	60	10.	3100		5314	6377	"	"	"	N. M.
12.	9.	60	10.	5000		8333	10000	"	"	"	"
12.	9.	60	10.	15100	3630	12583	15100	"	"	Dis.	"
12.	9.5	60	10.	2500		3947	4736	"	"	Cen.	......
8.	5.5	46	11.5	2500	681	2614	2727	S	"	Dis.	N. M.
8.	5.	45	11.5	1300	362	1463	1526	"	"	"	"
8.	6.	60	36.	10000		25000	8333	"	"	Cen.	Port.
8.	5.	60	36.	5700	380	8550	2850	"	"	Dis.	"
8.	5.	60	12.	3500	700	5250	5250	"	"	"	N. M.
8.	5.5	60	12.	10000	2000	13636	13636	"	"	"	"
8.	5.5	60	12.	2500		6818	6818	"	"	Cen.	"
8.	5.5	60	24.	9950	995	13568	6784	"	"	Dis.	"
8.	5.5	60	24.	2500		6818	3209	"	"	Cen.	"
10.	7.5	60	36.	13500	900	13500	4500	"	"	Dis.	Port.
10.	8.	60	37.	14500	940	13594	4408	"	"	"	......

NOTE.—In the above table the following abbreviations are used: "E," End Construction; "S," Side Construction; "Hard," Hard Clay; "Porous," Porous Terra-Cotta; "Dis.," Distributed Load; "Cen.," Concentrated Load at Centre; "Port.," Portland Cement, and "N. M.," No Mortar.

The Loads per Sq. Foot in the above table were obtained in all cases by dividing the Total Load by the superficial area of the arch in square feet. The Horizontal Thrust for Distributed and Central Loads was obtained by formulæ similar to those given therefor on one of the preceding pages, and for Central Loads this is double that for a Distributed Load of the same weight.

THRUST OF ARCHES.

The horizontal thrust of segmental floor arches, on the assumption of uniform loading, may be found by the following formula:

$$T = \frac{3WL^2}{2R}$$

in which

T = pressure or thrust in pounds per lineal foot of arch.
W = load on arch in pounds per square foot, uniformly distributed.
L = span of arch in feet.
R = rise of segmental arch in inches.

For a concentrated load at the centre, of weight P, the thrust

$$T = \frac{3PL}{R}$$

For arches with flat tops and bottoms, such as are used in floors, the voussoir joints on each side of the central key are usually laid out on parallel lines, and in these cases the thrust may be determined approximately by using for R, in the above formula, the effective depth of the arch, which is somewhat less than the nominal depth, as indicated on page 57.

For segmental arches the rise R is the vertical distance from the highest part of the intrados to the plane of the springing line. If the radius of the intrados for segmental arches is r, the rise may be obtained from the following formula:

$$R = r - \sqrt{r^2 - \frac{L^2}{4}}$$

$$\text{conversely, } r = \frac{R}{2} + \frac{L^2}{8R}$$

TIE RODS.

Although in the completed structure the horizontal thrusts of adjoining arches may counterbalance each other, the tie rods should be so proportioned and spaced as to withstand the entire thrust of the arches, thus tying the structure together and facilitating the construction.

SPACING OF TIE RODS FOR TILE ARCHES.

The table on the next page was computed from the following formula, which was obtained from that giving the thrust of arches on page 55.

$$B = \frac{A \times R \times 10\,000}{W L^2}$$

in which

B = spacing of tie rods in feet.
A = net area of rod in square inches.
R = rise of arch in inches.
W = load in pounds per square foot of the arch.
L = span of arch in feet.

The above formula gives the spacing of tie rods corresponding to a tensile stress in the rods of 15 000 pounds per square inch, without considering the flexure of the beams.

In spacing tie rods, the lateral strength of beams, for flexure due to the thrust of the arches, should be taken into consideration, explanations for which are given on pages 60 to 63 inclusive.

Spacings for other loads than that of the table may be found by proportion, thus:

Required spacing =

$$\frac{100 + \text{weight of arch in pounds per square foot}}{\text{New load in lbs. per sq. ft.} + \text{weight of arch in lbs. per sq. ft.}} \times \text{spacing from table.}$$

Weights of tile arches per square foot are given on page 59.

As noted under the heading "Lateral Strength of Beams," on pages 64 and 65, care should be taken that the spacing of tie rods is not greater than twenty times the least flange width, otherwise the safe loads should be reduced to compensate for the strains produced by flexure of the upper flange considered as a column in compression.

SPACING OF TIE RODS FOR TILE ARCHES IN FEET.

For a uniform load of 100 lbs. per square foot in addition to the weight of the arch.

Span of Arch.	Diameter of Tie Rods.	Nominal Depth of Arch. Inches.					
		6	7	8	9	10	12
		Effective Depth or Rise of Arch. Inches.					
Feet.	Inch.	3.6	4.6	5.6	6.6	7.6	9.6
3	$\frac{5}{8}$	6.4	8.0	9.5	10.9	12.3	15.0
"	$\frac{3}{4}$	9.5	12.0	14.2	16.3	18.3	22.4
"	$\frac{7}{8}$	13.2	16.6	19.8	22.6	25.5	31.1
4	$\frac{5}{8}$	3.6	4.5	5.4	6.1	6.9	8.4
"	$\frac{3}{4}$	5.4	6.7	8.0	9.2	10.3	12.6
"	$\frac{7}{8}$	7.4	9.4	11.1	12.7	14.3	17.5
5	$\frac{5}{8}$	2.3	2.9	3.4	3.9	4.4	5.4
"	$\frac{3}{4}$	3.4	4.3	5.1	5.9	6.6	8.0
"	$\frac{7}{8}$	4.8	6.0	7.1	8.1	9.2	11.2
6	$\frac{5}{8}$	..	2.0	2.4	2.7	3.1	3.7
"	$\frac{3}{4}$	..	3.0	3.6	4.1	4.6	5.6
"	$\frac{7}{8}$	..	4.2	4.9	5.7	6.4	7.8
7	$\frac{5}{8}$	..	..	..	2.0	2.3	2.8
"	$\frac{3}{4}$	..	..	..	3.0	3.4	4.1
"	$\frac{7}{8}$	..	..	..	4.2	4.7	5.7
8	$\frac{5}{8}$	..	..	..	..	1.7	2.1
"	$\frac{3}{4}$	..	..	..	..	2.6	3.1
"	$\frac{7}{8}$	..	..	..	..	3.6	4.4

BEAM TABLES.

Tables of safe loads for beams and channels and spacings of I-Beams for floors are given with explanatory notes on pages 72 to 105 inclusive.

BEAMS AS GIRDERS.

In some cases two or more beams may be bolted together side by side to form a girder, in which case cast iron separators with bolts should be used to hold the various members together. Separators should be placed at each end of the girder, at points of concentrated loading, and for uniform loading should be located at distances apart not greater than twenty times the width of the smallest beam flange, in order to laterally support the upper flanges which are in compression and prevent their failure by buckling. The separators should fit closely between the beam flanges so as to unite the beams forming the girder and thereby cause them to act together in resisting the load. A table of separators is given on page 44.

CONNECTION ANGLES.

When beams are coped or fitted together at right angles, connection angles are generally used, standards for which, covering usual cases, are shown on pages 45, 46 and 47. Explanations and tables of limiting spans for which these standards may be used are given on pages 42 and 43. Beams may be fitted together thus with flush tops or bottoms or in intermediate positions, as required in cases where the girder or trimmer beam is the larger. In cases where the girder or trimmer beam is the smaller, special stirrups or other connections are required.

LIVE LOADS FOR FLOORS.

The following loads per square foot, exclusive of weight of floor materials, show the range assumed in usual practice:

Dwellings.................. 70 lbs. per sq. ft.
Offices..................... 70 to 100 lbs. per sq. ft.
Buildings for public assembly..120 to 150 lbs. per sq. ft.
Stores, warehouses, etc........150 to 250 lbs. and upwards per sq. ft.

On page 303 are given in detail the safe loads for which floors should be designed in accordance with the building laws of various cities.

WEIGHTS OF HOLLOW TILE FLOOR ARCHES AND FIREPROOF MATERIALS.

END CONSTRUCTION, FLAT ARCH.

Width of Span Between Beams.	Depth of Arch.	Weight per Square Foot.
5 feet to 6 feet.	8 inches.	27 pounds.
6 " 7 "	9 "	29 "
7 " 8 "	10 "	33 "
8 " 9 "	12 "	38 "

HOLLOW BRICK FOR FLAT ARCHES.

(SIDE CONSTRUCTION).

Width of Span Between Beams.	Depth of Arch.	Weight per Square Foot.
3 feet 6 inches to 4 feet 0 inches.	6 inches.	27 pounds.
4 " 0 " 4 " 6 "	7 "	29 "
4 " 6 " 5 " 0 "	8 "	32 "
5 " 6 " 6 " 0 "	9 "	36 "
6 " 0 " 6 " 6 "	10 "	39 "
6 " 6 " 7 " 0 "	12 "	44 "

PARTITIONS.

	Thickness.	Weight per Square Foot.
Hollow Brick (Clay) Partitions	2 inches.	11 pounds.
" " " "	3 "	14 "
" " " "	4 "	15 "
" " " "	5 "	19 "
" " " "	6 "	20 "
" " " "	8 "	27 "
Porous Terra-Cotta Partitions	3 "	16 "
" " " "	4 "	19 "
" " " "	5 "	22 "
" " " "	6 "	23 "
" " " "	8 "	33 "

FURRING, ROOFING AND CEILING.

	Thickness.	Weight per Square Foot.
Porous Terra-Cotta Furring	2 inches.	8 pounds.
" " " Roofing	2 "	12 "
" " " "	3 "	15 "
" " " "	4 "	19 "
" " " Ceiling	2 "	11 "
" " " "	3 "	15 "
" " " "	4 "	19 "

6-inch Segmental Arches, 27 pounds per square foot.
8- " " " 33 " " " "
2-inch Porous Terra-Cotta Partition, 8 pounds per square foot.

LATERAL STRENGTH OF BEAMS TO RESIST FLEXURE DUE TO THRUST OF ARCHES, ETC.

In special cases where the thrust of a floor arch is exerted against a beam, channel, angle or other shape without other lateral support than the tie rods, or braces, this will produce lateral flexure and stresses in addition to those caused by the vertical loading. Throughout the body of the floor the thrusts of the adjoining arches, when completed, will usually counterbalance each other, but in the outer beams around shafts or elsewhere, if unsupported sideways, the stresses due to the lateral forces should be considered.

The total allowable stress per square inch for the extreme fibres of beams has been placed at 16 000 pounds per square inch, and in order that this may not be exceeded owing to lateral stresses, the stress due to vertical loading should be correspondingly reduced so that the resultant intensity shall not exceed the allowable limit. This may be calculated by considering the beam as continuous and laterally supported at intervals by the tie rods, the spans being equal to the spacing of the rods.

In this case the fibre stress due to the lateral forces is:

$$p' = \frac{w x_1 B^2}{I'} \qquad (1)$$

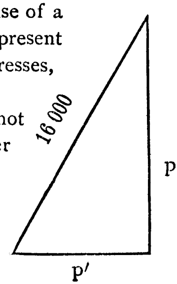
in which

p' = fibre stress in pounds per square inch due to lateral forces.
w = lateral load or thrust in pounds per lineal foot of section used as a beam.
x_1 = distance of the extreme fibre from the neutral axis in inches.
B = distance between tie rods or lateral supports in feet.
I' = moment of inertia about the vertical axis of the section or that one at right angles to the line of application of the lateral forces.

For I-Beams with the web placed vertically, as usual, x_1 becomes equal to $\frac{b}{2}$, where b is the width of the flange in inches. In this case the above formula for intensity of unit stress due to lateral load becomes:

$$p' = \frac{wbB^2}{2I'} \qquad (2)$$

The resultant fibre stress from the horizontal or lateral and the vertical loads may be represented by the hypothenuse of a right angle triangle, the two sides of which represent the intensities of the horizontal and vertical stresses, thus:



In order that the total resultant stress shall not exceed the allowable limit of 16 000 pounds per square inch, the stress due to vertical loading should therefore be reduced to equal the following:

$$p = \sqrt{16\,000^2 - p'^2} \qquad (3)$$

Having thus obtained the reduced vertical stress p, the safe vertical load of the tables corresponding to this stress should accordingly be reduced by multiplying it by the ratio $\frac{p}{16\,000}$ and similarly for other stresses and corresponding loads, thus making proper allowance for the additional stresses produced by the lateral forces.

If the reduction of the safe loads on this account is a considerable proportion of the original amount due to vertical loading only, it would be more economical to provide lateral braces or tie rods at shorter intervals, thus avoiding the use of an excessive amount of material in the beam.

As the stresses due to vertical forces for usual cases of loading are a maximum at the centre of the span it will ordinarily be sufficient to space the tie rods or braces at shorter intervals near the centre in order to allow for the combined stresses due to vertical loading and horizontal thrusts.

The above method of calculation is not exact when considering the lateral thrust of arches, or loads from similar materials which do not exert a uniform pressure throughout their surfaces of contact with the sustaining beam on account of the friction and bond of their component parts, but this analysis of the stresses may serve as a guide in designing.

The above formulæ should be used in connection with the tables and formula given on pages 64 and 65 relating to the lateral strength of beams, due to compression of the upper flange figured as a column between points of lateral support.

EXAMPLE.

What is the proper size of I-Beam without other lateral support than the usual tie rods, corresponding to a total fibre stress of 16 000 pounds per square inch under the following conditions? The beam is 18 feet between end supports and carries a tile arch on one side having a nominal depth of 9 inches, effective depth of 6.6 inches, a span of 5 feet, designed to carry a superimposed load of 100 pounds per square foot in addition to the weight of the arch and other floor materials. The hollow tile arch weighs 36 pounds per square foot and the other materials, including plastering, weigh 14 pounds, making a total load, exclusive of the weight of the beam, equal to 150 pounds per square foot.

For tie rods of ¾″ diameter the spacing between them would be 5.9 feet, as shown by the table of Spacing of Tie Rods on page 57, in which the safe stresses in the rods only are considered.

Substituting the proper values in the formula for lateral thrust of arches, given on page 55, this will be

$$T = \frac{3 \times 150 \times 5^2}{2 \times 6.6} = 852 \text{ lbs. per lineal foot.}$$

Substituting this value for w in formula (2) page 60, we have

$$p' = \frac{852 \times 4.66 \times 5.9^2}{2 \times 6.89} = 10\,029 \text{ lbs. per sq. in.}$$

Therefore $p = \sqrt{16\,000^2 - 10\,029^2} = 12\,466$ lbs. per sq. in.

Hence the safe load as determined by the consideration of vertical loads only, should be reduced to $\frac{12\,466}{16\,000}$, or approximately ¾ of the amount given by the Tables of Safe Loads in case the spacing of the tie rods is not changed.

Assume a 10″ beam 25 lbs. per foot, the moment of inertia of which is 6.89, as given in the Tables of Properties of I-Beams, page 158.

The safe vertical load for a 10″ beam, weighing 25 lbs. per foot, 18 feet long between supports, for fibre stress of 16 000 lbs. per square inch, is 14 470 lbs. uniformly distributed, including the weight of the beam as given in the Tables of Safe Loads, on page 81, or 14 020 exclusive of the weight of the beam, and ¾ of this is 10 515 lbs., which is the vertical load it can safely carry in order that the total stress due to it and the lateral thrust shall not exceed 16 000 lbs. per square inch.

The actual vertical load on the beam under consideration is as follows:

$$\frac{5}{2} \times 18 \times 150 = 6\,750 \text{ lbs.},$$

which is less than the allowable amount, 10 515 lbs., as figured above, so that a smaller beam may suffice.

Therefore, assume a 9-inch beam, weighing 21 lbs. per foot, the moment of inertia of which about an axis coincident with centre line of web is found in the Table of Properties, on page 158, to be 5.16.

In this case

$$p' = \frac{852 \times 4.33 \times 5.9^2}{2 \times 5.16} = 12\,444 \text{ lbs. per sq. in.}$$

Substituting this in the formula for p we have

$$p = \sqrt{16\,000^2 - 12\,444^2} = 10\,106 \text{ lbs. per sq. in.}$$

Therefore the safe vertical load will be $\frac{10\,106}{16\,000}$, or approximately ⅝ of the tabular safe load.

The safe vertical load for a 9″ 21 lb. beam, 18 feet long, for a fibre stress of 16 000 lbs. per square inch is 11 180 lbs., as given in the Tables of Safe Loads, on page 81, and ⅝ of this is 6 987 lbs., which is slightly greater than the actual amount, 6 750 lbs., as calculated above, so that the 9″ 21 lb. beam will suffice.

If the spacing of the tie rods at the centre be reduced from 5.9 feet to 4 feet, it may be found, in a manner similar to that used in the above calculations, that the safe vertical load for an 8″ I-Beam, weighing 18.0 lbs. per foot, is reduced to ⅞ of its tabular value of 8 430 lbs., or 7 376 lbs., and as this amount is greater than the actual load as above, namely, 6 750 lbs., the 8″ beam would answer the purpose, under the changed conditions as to spacing of tie rods. As this beam might deflect beyond the limit for plastered ceilings, it should be examined in accordance with the rule or formula given for obtaining safe deflections in the explanation of the Tables of Safe Loads, and elsewhere herein.

Calculating this by the rule given on page 74, the safe load for the allowable limit of deflection is

$$W = \frac{9\,480 \times 16^2}{18^2} = 7\,491 \text{ lbs.},$$

which is greater than the actual amount, 6 750 lbs., so that the 8″ beam is sufficient and proper if the spacing of central tie rods be changed to 4 feet, as assumed in the last case.

LATERAL STRENGTH OF BEAMS,
WITHOUT LATERAL SUPPORT.

The Tables of Safe Loads for Cambria I-Beams and Channels and Tables of Spacing of Cambria I-Beams, on pages 78 to 105, are calculated on the assumption that proper provision is made for preventing lateral deflection by means of tie rods or other braces. In order to prevent undue strains in the compression flange, considered as a column, the beams should be supported laterally at distances not exceeding twenty times the flange width, this ratio being determined by the following formula, which gives the safe load for solid columns of soft steel:

$$p = \frac{18000}{1 + \frac{l^2}{3000b^2}}$$

in which

p = allowable stress in pounds per square inch.
l = length between lateral supports in inches.
b = width of flange in inches.

Substituting 16 000 for p in the above formula, which is the allowable unit stress of the safe load tables, it is found that the ratio $\frac{l}{b} = 19.37$, from which it may be seen that the compression flange should be supported laterally at distances not exceeding twenty times the flange width as stated above.

Beams which are not thus supported laterally should not be loaded to their full transverse capacity. The allowable fibre stresses and proportions of their full loads which they can safely carry when laterally supported at various distances is given in the following table:

REDUCTION IN VALUES OF ALLOWABLE FIBRE STRESS AND SAFE LOADS FOR SHAPES USED AS BEAMS DUE TO LATERAL FLEXURE.

Ratio of Span or Distance between Lateral Supports to Flange Width. $\frac{l}{b}$	Allowable Unit Stress for Direct Flexure in Extreme Fibre. p	Proportion of Tabular Safe Load to be Used.	Ratio of Span or Distance between Lateral Supports to Flange Width. $\frac{l}{b}$	Allowable Unit Stress for Direct Flexure in Extreme Fibre. p	Proportion of Tabular Safe Load to be Used.
19.37	16000	1.0	65	7474	.47
20	15882	.97	70	6835	.43
25	14897	.93	75	6261	.39
30	13846	.87	80	5745	.36
35	12781	.80	85	5281	.33
40	11739	.73	90	4865	.30
45	10746	.67	95	4595	.29
50	9818	.61	100	4154	.26
55	8963	.56	105	3850	.24
60	8182	.51	110	3576	.22

The above table should be used in connection with the Tables of Safe Loads Uniformly Distributed for Cambria I-Beams and Channels, on pages 78 to 94 inclusive, and limits the values found therein under the conditions given above.

EXAMPLE.

Required the safe load for a 15-inch standard I-Beam weighing 42 pounds per foot for a span of 30 feet without lateral supports:

From the data the ratio $\frac{l}{b} = \frac{30 \times 12}{5.5} = 65.$

From the above table the proportion of the safe load which the beam can safely support under these conditions is .47. From the Table of Safe Loads for I-Beams, page 83, the safe load for this beam when properly supported laterally is 20 940 pounds, which multiplied by .47 gives 9 842 pounds as the safe load uniformly distributed under the conditions given, including the weight of the beam, or 8 582 pounds superimposed load.

LIMITING SPANS AND MAXIMUM LOADS OF I-BEAMS AND CHANNELS DUE TO CRIPPLING OF THE WEB.

I-Beams and Channels, when used as beams for very short spans in which the ratio of length of span to depth of beam is small, should be examined for safe strength of the web considered as a column, subjected to crippling due to the shearing strains.

The Tables of Safe Loads of Beams and Channels are computed with regard to the safe unit stresses due to flexure, and, with one or two exceptions, as indicated by dotted lines and accompanying footnotes, the lengths of spans tabulated are such that the limitation due to web crippling does not appear. The shearing stresses acting in the web of a beam may be considered to consist of two stresses of equal intensity acting at right angles to each other, and at angles of 45 degrees with the neutral axis. The intensity of each of these stresses is equal to the intensity of the vertical shear, which is a maximum at the points of support for uniform loading, and uniform throughout from the point of loading to the supports for a superimposed concentrated load at the centre.

The vertical shears for different systems of loading may be obtained by the use of moments in the usual way, and these are given for various cases on pages 138 to 141 inclusive.

The shearing stresses which act at angles of 45 degrees with the neutral axis are equivalent to compressive and tensile forces, and the former will tend to buckle the web, which should therefore be figured as composed of a series of columns of a length equal to its diagonal depth.

If c is the vertical depth of the web in the clear between the fillets which connect it with the flanges, the square of the length of the column to be considered will be $2c^2$.

Substituting this value for l^2 in the formula for long columns

$$p = \frac{12000}{1 + \frac{l^2}{3000\,t^2}}$$

we have

$$p = \frac{12000}{1 + \frac{c^2}{1500\,t^2}}$$

in which

p = intensity of vertical shear, in pounds per square inch = $\frac{\text{Total shear in pounds}}{\text{dt.}}$

c = depth of web in clear between fillets, in inches.

t = thickness of web, in inches.

d = depth of beam, in inches.

This formula is also applicable for computing the safe shearing stress in the webs of plate girders, in which case the length l is the vertical distance between centres of upper and lower rows of rivet holes connecting the webs and flanges.

The webs of plate girders should be reinforced by stiffening angles at points of support and concentrated loading, and in cases where the intensity of shear exceeds that given by the above formula the web should be provided with stiffeners.

The following tables have been prepared based upon the above formula for safe unit shearing stress in the webs of beams and channels.

MAXIMUM SAFE LOADS FOR I-BEAMS OF ANY LENGTH AND CORRESPONDING MINIMUM SAFE SPANS BASED UPON CRIPPLING OF THE WEB.

For loads in pounds uniformly distributed including weight of beam.

Section Number.	Depth of Beam. Inches.	Weight per Foot. Pounds.	Maximum Safe Load. Pounds.	Minimum Span. Feet.
B 5	3	5.5	10644	1.7
		6.5	16983	1.1
		7.5	23884	.9
B 9	4	7.5	15045	2.1
		8.5	21809	1.6
		9.5	29349	1.2
		10.5	35847	1.1
B 13	5	9.75	19773	2.6
		12.25	37984	1.5
		14.75	54380	1.2
B 17	6	12.25	24826	3.1
		14.75	42634	2.0
		17.25	59857	1.6
B 21	7	15	30192	3.7
		17.5	47720	2.5
		20	66478	1.9
B 25	8	18.	35925	4.2
		20.25	52072	3.1
		22.75	69914	2.4
		25.25	87403	2.1
B 29	9	21	41992	4.8
		25	69224	3.1
		30	104631	2.3
		35	139074	1.9
B 33	10	25	48406	5.4
		30	83739	3.4
		35	120792	2.6
		40	156930	2.2
B 41	12	31.5	62193	6.2
		35	89412	4.5
		40	125695	3.5
B105	12	40	97469	4.9
		45	133560	3.8
		50	168991	3.2
		55	203806	2.8
B 53	15	42	85591	7.3
		45	104200	6.2
		50	142044	4.8
		55	179929	4.0
		60	213732	3.6
B109	15	60	157484	5.5
		65	195147	4.6
		70	228658	4.1
		75	265452	3.7
		80	301820	3.4
B113	15	80	240024	4.6
		85	275411	4.2
		90	308939	3.9
		95	344691	3.6
		100	380169	3.4
B 65	18	55	107758	8.8
		60	152031	6.6
		65	188299	5.5
		70	224737	4.9
B 73	20	65	127592	9.6
		70	178434	7.3
		75	201484	6.7
B121	20	80	179940	8.7
		85	210096	7.7
		90	250558	6.6
		95	285966	6.0
		100	321253	5.5
B 89	24	80	126012	14.7
		85	163791	11.8
		90	197821	10.1
		95	232873	8.8
		100	268596	7.9

MAXIMUM SAFE LOADS FOR STANDARD CHANNELS OF ANY LENGTH AND CORRESPONDING MINIMUM SAFE SPANS BASED UPON CRIPPLING OF THE WEB.

For loads in pounds uniformly distributed including weight of Channel.

Section Number.	Depth of Channel.	Weight per Foot.	Maximum Safe Load.	Minimum Span.
	Inches.	Pounds.	Pounds.	Feet.
C5	3	4	10692	1.1
		5	17016	0.8
		6	23909	.6
C9	4	5.25	14032	1.4
		6.25	20868	1.1
		7.25	28424	.9
C13	5	6.5	19231	1.6
		9	34382	1.1
		11.5	52036	.9
C17	6	8	20024	2.3
		10.5	38027	1.4
		13	55414	1.1
		15.5	72401	1.0
C21	7	9.75	22865	2.8
		12.25	42273	1.7
		14.75	59506	1.4
		17.25	78006	1.2
		19.75	94532	1.1
C25	8	11.25	25494	3.4
		13.75	43638	2.2
		16.25	61676	1.7
C25	8	18.75	79348	1.5
		21.25	96698	1.3
C29	9	13.25	28044	4.0
		15	41483	2.9
		20	77711	1.8
		25	115740	1.4
C33	10	15	30461	4.7
		20	65360	2.6
		25	102947	1.9
		30	139563	1.6
		35	173036	1.4
C41	12	20.5	41173	5.5
		25	73588	3.5
		30	109976	2.6
		35	148961	2.1
		40	184279	1.9
C53	15	33	82528	5.4
		35	93615	4.9
		40	114450	4.3
		45	165466	3.2
		50	203148	2.8
		55	245311	2.5

COEFFICIENTS FOR DEFLECTION IN INCHES FOR CAMBRIA SHAPES, USED AS BEAMS SUBJECTED TO SAFE LOADS UNIFORMLY DISTRIBUTED.

Distance between Supports in Feet. L	Coefficient for Fibre Stress of 16 000 lbs. per Square Inch. H	Coefficient for Fibre Stress of 12 500 lbs. per Square Inch. H′	Distance between Supports in Feet. L	Coefficient for Fibre Stress of 16 000 lbs. per Square Inch. H	Coefficient for Fibre Stress of 12 500 lbs. per Square Inch. H′
4	.265	.207	23	8.756	6.841
5	.414	.323	24	9.534	7.448
6	.596	.466	25	10.345	8.082
7	.811	.634	26	11.189	8.741
8	1.059	.828	27	12.066	9.427
9	1.341	1.047	28	12.977	10.138
10	1.655	1.293	29	13.920	10.875
11	2.003	1.565	30	14.897	11.638
12	2.383	1.862	31	15.906	12.427
13	2.797	2.185	32	16.949	13.241
14	3.244	2.534	33	18.025	14.082
15	3.724	2.909	34	19.134	14.948
16	4.237	3.310	35	20.276	15.841
17	4.783	3.737	36	21.451	16.759
18	5.363	4.190	37	22.659	17.703
19	5.975	4.668	38	23.901	18.672
20	6.621	5.172	39	25.175	19.668
21	7.299	5.703	40	26.483	20.690
22	8.011	6.259			

The above coefficients are for use in obtaining the deflection of steel shapes subjected to transverse strain, under their uniformly distributed safe loads for extreme fibre stresses of 16 000 pounds and 12 500 pounds per square inch; the modulus of elasticity being 29 000 000.

To find the deflection of any shape that is symmetrical about its neutral axis under the above conditions of loading when used as a beam, such as I-Beams, Channels, etc., divide the coefficient in the table corresponding to the given span and fibre stress, by the depth of the beam in inches. The result will be the deflection in inches.

To find the deflection of any shape that is unsymmetrical about its neutral axis when used as a beam, under the above conditions of loading, such as T-Bars, Angles, etc., divide the coefficient in the table corresponding to the given span and fibre stress by twice the distance of the most remote fibre from the neutral axis, expressed in inches.

If, in construction, the beam is placed in position in the usual manner upon its end supports without special scaffolding or falsework between them, it will deflect somewhat by reason of its own weight, and upon the addition of external loading a further deflection will occur.

The deflections obtained as above described are the total deflections due to the weight of the beam itself and the superimposed safe load uniformly distributed.

Thus to find from the preceding table the deflection in inches for Cambria shapes used as beams under their safe loads uniformly distributed including the weight of the beam:

Let D = deflection in inches.
L = length between supports in feet.
H = coefficient for deflection from table for fibre stress of 16 000 pounds per square inch.
H′ = coefficient for deflection from table for fibre stress of 12 500 pounds per square inch.
d = depth of beam in inches for symmetrical sections.
x_1 = distances in inches from neutral axis to most remote fibre for unsymmetrical sections.

FOR SYMMETRICAL SECTIONS.

For fibre stress of 16 000 pounds per square inch $D = \frac{H}{d}$

For fibre stress of 12 500 pounds per square inch $D = \frac{H'}{d}$

FOR UNSYMMETRICAL SECTIONS.

For fibre stress of 16 000 pounds per square inch $D = \frac{H}{2x_1}$

For fibre stress of 12 500 pounds per square inch $D = \frac{H'}{2x_1}$

EXAMPLES.

Case I.—To find the deflection of a 9″ I-Beam weighing 30 pounds per foot, for a span of 15 feet and a maximum fibre stress of 16 000 pounds per square inch, under its safe load uniformly distributed.

From the above table the deflection coefficient for this case is found to be 3.724, which divided by 9, the depth of the beam in inches, gives .414, which is the required deflection in inches.

The safe load for this beam under the conditions named is 16 100 pounds including the weight of the beam itself as stated in the Tables of Safe Loads for Cambria I-Beams on page 81.

Case II.—To find the deflection of a 6″ × 4″ × ½″ angle, supported at the ends on its short leg as a horizontal base, for a span of 9 feet and a maximum fibre stress of 16 000 pounds per square inch under its safe load uniformly distributed including its own weight.

From the table of "Properties of Angles" on page 175 the distance x′ from the neutral axis to the back of the shorter leg is found to be 1.99 inches, which subtracted from the length of long leg, 6 inches, gives 4.01 as the distance x_1 from the neutral axis to the most remote fibre. From the above table the deflection coefficient for this case is found to be 1.341, which divided by 8.02, twice x_1, gives .167, which is the required deflection in inches.

NOTE.—For deflections of Beams, Channels and Z-Bars due to any central or uniform load see coefficients of deflection N and N′ in the Tables of Properties relating to these sections and the accompanying explanations.

For deflections of any symmetrical beams due to various systems of loading, see general formulæ and diagrams on pages 136 to 141 inclusive.

TABLES OF SAFE LOADS FOR CAMBRIA SECTIONS USED AS BEAMS, AND SPACING FOR CAMBRIA I-BEAMS.

Pages 78 to 135 inclusive.

Tables of Safe Loads and Spacings.

The Tables of Safe Loads for Cambria I-Beams, Channels, Angles, T-Bars and Z-Bars, give the safe loads in pounds uniformly distributed for all usual spans based upon extreme fibre stresses of 16 000 pounds per square inch.

These loads include the weight of the steel shape itself, which should be deducted in order to obtain the external load that it will safely carry. In case the shape is used to support a floor, the weight of the steel together with that of the other portions of the floor construction, must be deducted in order to obtain the net live load which can be safely sustained. Weights of hollow tile floor arches and fireproofing material are given on page 59, to which should be added the weight of plastering, filling on top of arches and the weight of the material forming the surface of the floor, in order to obtain the dead load of materials in figuring fireproof floors, in addition to the weight of the steel.

A table of superimposed loads per square foot, exclusive of the weights of materials, in accordance with the usual practice for different classes of buildings, is given on p. 58.

The Tables of Safe Loads for Cambria sections used as beams and the Tables for Spacing of Cambria I-Beams are calculated on the assumption that proper provision has been made for preventing lateral deflection by means of tie-rods or other braces spaced at suitable distances apart; which for beams and channels should not exceed twenty times the flange width. In cases where intermediate lateral support is not provided, the safe loads shown in the tables must be reduced, and for beams and channels the amount of this reduction can be determined by reference to the explanations and tables therefor on pages 64 and 65.

The thrust of floor arches, which is considerable, particularly in the case of long spans or distances between tie-rods, should be taken into account where it tends to produce lateral flexure of the floor beams.

Explanations of this and a formula for reducing the unit stresses from vertical loading, on account of the additional stresses caused by horizontal forces, are given on pages 60 to 63 inclusive.

In some instances the allowable deflection will govern the design rather than the transverse strength, as in the case of beams carrying plastered ceilings, in which the deflection should be limited to $\frac{1}{30}$ inch per foot of span, or $\frac{1}{360}$ of the distance between supports in order to avoid cracking the plaster.

This limit of deflection is indicated in the tables by full horizontal lines, the figures below which correspond to loads or spacings for the given spans that will produce greater deflections than the allowable limit for plastered ceilings.

The deflection limits of the Tables of Safe Loads have been calculated for the total loads, including the weight of the section used as a beam. The superimposed live load will not produce all of this deflection, and therefore the deflection limit of the tables includes an element of safety for the reason that the beams will be deflected, after being put in place, by their own weight and that of the floor materials before the plastering is applied.

In cases where the deflection limits the use of the beam for the safe loads corresponding to the fibre stresses of the tables, the beam may be used with a less load such as to produce only the allowable deflection. The lesser load corresponding to the limit of deflection may be obtained for any span from the Table of Safe Loads as follows:

$$W = \frac{W_s \times L^2}{L_1^2}$$

in which

W = safe load in pounds for the limit of deflection for plastered ceilings = $\frac{1}{360}$ of the span.

W_s = safe load of tables next above the line giving the limit of deflection.

L = length of span in feet corresponding to W_s from the table.

L_1 = length of span for the case under consideration.

This may also be expressed by the following —

RULE.

Multiply the safe load next above the heavy line of the tables by the square of the corresponding span in feet and divide the product by the square of the required span. The result will be the required load corresponding to the limit of allowable deflection for plastered ceilings.

A Table of Deflections for Cambria shapes used as beams, subjected to their safe loads uniformly distributed, and accompanying explanations with examples, are given on pages 70 and 71.

TABLES OF SAFE LOADS FOR I-BEAMS AND CHANNELS.

Tables of Safe Loads for all sizes and weights of Cambria I-Beams and channels for the usual spans, expressed in feet, are given on pages 78 to 94 inclusive.

TABLES FOR SPACING OF CAMBRIA I-BEAMS.

Tables for Spacing of Cambria I-Beams for a total load of 100 pounds per square foot including the weight of the beam, corresponding to spans from 4 to 36 feet, are given on pages 95 to 105 inclusive.

For any given size of beam the spacing or distances from centers to centers for different intensities of loading varies inversely as the load, so that the spacing for any intensity of loading may be found from the tabular spacing by proportion as stated in the notes at the foot of the tables.

TABLES OF SAFE LOADS FOR ANGLES, T-BARS AND Z-BARS.

Tables of uniformly distributed safe loads for the usual sizes of angles, all sections of T-Bars and all sections of standard Z-Bars are given on pages 108 to 135. In these tables the safe loads for equal leg angles are given on the assumption that one of the legs of the angle is horizontal and the other leg vertical. In the case of angles with unequal legs the safe loads are given for both positions, that is, with the long leg vertical and with the short leg vertical.

The safe loads for T-Bars are given on the assumption that the flange is horizontal and the stem vertical, and for Z-Bars with the web vertical.

EXAMPLES OF APPLICATION OF TABLES OF SAFE LOADS AND TABLES OF SPACING.

EXAMPLE I.

What is the proper size of beam with a clear span of 24 feet to carry a superimposed load of 30 000 pounds uniformly distributed, the deflection to be such as not to crack a plastered ceiling?

From the Tables of Safe Loads for Cambria I-Beams, page 83, it is found that a 15-inch standard beam of this length, weighing 60 pounds per foot, will carry a gross load of 31 910 pounds, and the weight of the beam itself is $60 \times 24 = 1440$ pounds. Thus the net load may be 30 470 pounds, so that this is the proper size for the conditions named, as its deflection is within the allowable limit, which is shown to be at a span of 30 feet as indicated by the horizontal line on the table.

Similarly it may be found from page 84, that a 15-inch special beam, of 60 pounds per foot, will more than suffice, but as this section is not regularly kept in stock the standard 15-inch 60-pound beam should be ordered if prompt delivery is wanted.

It may also be found from page 86, that an 18-inch 55-pound beam will amply suffice, and as this is both stiffer and lighter than the 15-inch 60-pound beams, it could be used with economy if otherwise suitable for the location.

EXAMPLE II.

What is the safe load for an 8-inch standard I-Beam weighing 18.0

pounds per foot for a span of 20 feet, the deflection to be such as not to crack a plastered ceiling?

From the Tables of Safe Loads, page 80, it is found that the safe load for the beam in question is 7 580 pounds, but this value is below the line which indicates the span corresponding to the allowable limit of deflection.

Substituting the proper values in the formula for obtaining the reduced load corresponding to the allowable deflection, as given on page 74, we have

$$W = \frac{W_s \times L^2}{L_1^2} = \frac{9\,480 \times 16^2}{20^2} = 6\,067 \text{ pounds,}$$

which is the safe load required.

Example III.

Required the best arrangement of beams for the floor system of a building 40 feet wide x 88 feet deep to safely support a live load of 100 pounds per square foot, using 10-inch tile arches resting on 12-inch I-Beams.

The weight of the floor materials will be about 50 pounds per square foot, allowing 39 pounds for the arch and 11 pounds for the other materials, or a total load of 150 pounds per square foot to be carried by the beams.

From the Table of Spacing for I-Beams for a uniform load of 100 pounds per square foot, page 99, it is seen that 12″ standard I-Beams weighing 31½ pounds per foot and spaced 9.6 feet apart from center to center can be used with a span of 20 feet, and for a load of 150 pounds per square foot the spacing will be

$$\frac{9.6 \times 100}{150} = 6.4 \text{ feet.}$$

This will require one row of interior columns lengthwise of building.

To support the beams at the center of the building will require a line of girder beams resting on the columns. Assume the columns 22 feet apart, thus dividing the building into 8 bays, four on each side of the center.

The load on each girder will be

$$\frac{40}{2} \times 22 \times 150 = 66\,000 \text{ pounds.}$$

From the Table of Safe Loads, page 83, it is found that this will require two 15-inch standard I-Beams, each weighing 60 pounds per foot.

On account of the advisability of spacing the floor beams equally, the arrangement outlined above would reduce their distances to $\frac{22}{4} = 5.5$ feet center to center, so that 10-inch I-Beams, weighing 40 pounds per foot, might be used for the body of the floor, as may be determined by referring to the Table of Spacings of Cambria I-Beams, page 98, and calculating as before, with the result that the allowable spacing for these conditions is found to be 5.7 feet. The 10-inch 40-pound beam under these condilions, will, however, deflect almost to the allowable limit for plastered ceilings, besides, they are heavier than the 12-inch 31.5-pound beams first considered, so that the latter will be the stiffer and more economical.

Although the load on the girder is not uniformly distributed, but concentrated at three points between the supports, the bending moment in this case will be the same as if the load were figured to be distributed uniformly, and for similar cases with different spacings the moments would be very nearly identical.

TABLES OF MAXIMUM BENDING MOMENTS.

The Tables of Maximum Bending Moments for beams and channels given on pages 106 and 107 are useful in determining the proper section required to support one or more irregularly located concentrated loads or various arrangements of loads to which the tables of safe loads uniformly distributed will not apply.

The method used consists in computing the maximum bending moment in foot pounds resulting from the specified loading, the proper section corresponding to a fibre stress of 16 000 or 12 500 lbs. per square inch, being taken directly from the tables without further computation.

SAFE LOADS IN POUNDS UNIFORMLY DISTRIBUTED FOR CAMBRIA I-BEAMS.

Safe loads below are figured for fibre stress of 16 000 pounds per square inch and include weight of beam.

STANDARD I-BEAMS.

Distance between supports in feet.	3 Inch No. B 5.			4 Inch No. B 9.			
	5.5 lbs.	6.5 lbs.	7.5 lbs.	7.5 lbs.	8.5 lbs.	9.5 lbs.	10.5 lbs.
4	4410	4780	5180	7950	8470	9000	9520
5	3530	3830	4140	6360	6780	7200	7610
6	2940	3190	3450	5300	5650	6000	6350
7	2520	2730	2960	4540	4840	5140	5440
8	2210	2390	2590	3980	4240	4500	4760
9	1960	2130	2300	3530	3770	4000	4230
10	1770	1910	2070	3180	3390	3600	3810
11	1600	1740	1880	2890	3080	3270	3460
12	1470	1590	1730	2650	2820	3000	3170
13	1360	1470	1590	2450	2610	2770	2930
14	1260	1370	1480	2270	2420	2570	2720
15	1180	1280	1380	2120	2260	2400	2540
16	1100	1200	1290	1990	2120	2250	2380
17	1040	1130	1220	1870	1990	2120	2240
18	980	1060	1150	1770	1880	2000	2120
19	930	1010	1090	1670	1780	1890	2000
20	880	960	1040	1590	1690	1800	1900
21	840	910	990	1510	1610	1710	1810

For safe loads below the heavy lines, the deflections will be greater than the allowable limit for plastered ceilings = $\frac{1}{360}$ span.

SAFE LOADS IN POUNDS UNIFORMLY DISTRIBUTED FOR CAMBRIA I-BEAMS.

Safe loads below are figured for fibre stress of 16 000 pounds per square inch and include weight of beam.

STANDARD I-BEAMS.

Distance between supports in feet.	5 Inch No. B 13.			6 Inch No. B 17.		
	9.75 lbs.	12.25 lbs.	14.75 lbs.	12.25 lbs.	14.75 lbs.	17.25 lbs.
4	12900	14520	16160	19370	21320	23280
5	10320	11620	12930	15490	17050	18620
6	8600	9680	10770	12910	14210	15520
7	7370	8300	9230	11070	12180	13300
8	6450	7260	8080	9680	10660	11640
9	5730	6460	7180	8610	9470	10350
10	5160	5810	6460	7750	8530	9310
11	4690	5280	5880	7040	7750	8460
12	4300	4840	5390	6460	7110	7760
13	3970	4470	4970	5960	6560	7160
14	3680	4150	4620	5530	6090	6650
15	3440	3870	4310	5160	5680	6210
16	3220	3630	4040	4840	5330	5820
17	3030	3420	3800	4560	5020	5480
18	2870	3230	3590	4300	4740	5170
19	2720	3060	3400	4080	4490	4900
20	2580	2900	3230	3870	4260	4660
21	2460	2770	3080	3690	4060	4430
22	2340	2640	2940	3520	3880	4230
23	2240	2530	2810	3370	3710	4050
24	2150	2420	2690	3230	3550	3880
25	2060	2320	2590	3100	3410	3720
26	1980	2230	2490	2980	3280	3580
27	1910	2150	2390	2870	3160	3450
28	....	....	....	2770	3050	3330
29	....	....	....	2670	2940	3210

For safe loads below the heavy lines, the deflections will be greater than the allowable limit for plastered ceilings = $\frac{1}{360}$ span.

SAFE LOADS IN POUNDS UNIFORMLY DISTRIBUTED FOR CAMBRIA I-BEAMS.

Safe loads below are figured for fibre stress of 16 000 pounds per square inch and include weight of beam.

STANDARD I-BEAMS.

Distance between supports in feet.	7 Inch No. B 21.			8 Inch No. B 25.			
	15 lbs.	17.5 lbs.	20 lbs.	18.00 lbs.	20.25 lbs.	22.75 lbs.	25.25 lbs.
4	27600	29850	32140	37920	40130	42740	45360
5	22080	23880	25710	30330	32100	34190	36290
6	18400	19900	21430	25280	26750	28500	30240
7	15770	17060	18370	21670	22930	24420	25920
8	13800	14930	16070	18960	20060	21370	22680
9	12270	13270	14280	16850	17830	19000	20160
10	11040	11940	12860	15170	16050	17100	18140
11	10040	10860	11690	13790	14590	15540	16490
12	9200	9950	10710	12640	13380	14250	15120
13	8490	9190	9890	11670	12350	13150	13960
14	7890	8530	9180	10830	11470	12210	12960
15	7360	7960	8570	10110	10700	11400	12100
16	6900	7460	8030	9480	10030	10690	11340
17	6490	7020	7560	8920	9440	10060	10670
18	6130	6630	7140	8430	8920	9500	10080
19	5810	6280	6770	7980	8450	9000	9550
20	5520	5970	6430	7580	8030	8550	9070
21	5260	5690	6120	7220	7640	8140	8640
22	5020	5430	5840	6890	7300	7770	8250
23	4800	5190	5590	6590	6980	7430	7890
24	4600	4980	5360	6320	6690	7120	7560
25	4420	4780	5140	6070	6420	6840	7260
26	4250	4590	4940	5830	6170	6580	6980
27	4090	4420	4760	5620	5940	6330	6720
28	3940	4260	4590	5420	5730	6110	6480
29	3810	4120	4430	5230	5530	5900	6260

For safe loads below the heavy lines, the deflections will be greater than the allowable limit for plastered ceilings = $\frac{1}{360}$ span.

The safe load above dotted line is greater than the safe load for web crippling, as explained and shown on pages 66 to 68 inclusive.

SAFE LOADS IN POUNDS UNIFORMLY DISTRIBUTED FOR CAMBRIA I-BEAMS.

Safe loads below are figured for fibre stress of 16 000 pounds per square inch and include weight of beam.

STANDARD I-BEAMS.

Distance between supports in feet.	9 Inch No. B 29.				10 Inch No. B 33.			
	21 lbs.	25 lbs.	30 lbs.	35 lbs.	25 lbs.	30 lbs.	35 lbs.	40 lbs.
8	25160	27240	30180	33120	....	....	....	....
9	22370	24210	26830	29440	....	....	....	....
10	20130	21790	24150	26500	26050	28620	31240	33850
11	18300	19810	21950	24090	23680	26020	28400	30780
12	16770	18160	20120	22080	21710	23850	26030	28210
13	15480	16760	18570	20380	20040	22020	24030	26040
14	14380	15570	17250	18930	18610	20450	22310	24180
15	13420	14530	16100	17670	17360	19080	20830	22570
16	12580	13620	15090	16560	16280	17890	19520	21160
17	11840	12820	14200	15590	15320	16840	18380	19910
18	11180	12110	13410	14720	14470	15900	17350	18810
19	10590	11470	12710	13950	13710	15070	16440	17820
20	10064	10900	12070	13250	13020	14310	15620	16930
21	9590	10380	11500	12620	12400	13630	14880	16120
22	9150	9910	10980	12050	11840	13010	14200	15390
23	8750	9480	10500	11520	11320	12450	13580	14720
24	8390	9080	10060	11040	10850	11930	13020	14110
25	8050	8720	9660	10600	10420	11450	12500	13540
26	7740	8380	9290	10190	10020	11010	12020	13020
27	7460	8070	8940	9810	9650	10600	11570	12540
28	7190	7780	8620	9460	9300	10220	11160	12090
29	6940	7510	8330	9140	8980	9870	10770	11670
30	6710	7260	8050	8830	8680	9540	10410	11280
31	6490	7030	7790	8550	8400	9230	10080	10920
32	....	....	....	....	8140	8950	9760	10580
33	....	....	....	....	7890	8670	9470	10260

For safe loads below the heavy lines, the deflections will be greater than the allowable limit for plastered ceilings $= \frac{1}{360}$ span.

SAFE LOADS IN POUNDS UNIFORMLY DISTRIBUTED FOR CAMBRIA I-BEAMS.

Safe loads below are figured for fibre stress of 16 000 pounds per square inch and include weight of beam.

Distance between supports in feet.	STANDARD I-BEAMS. 12 Inch No. B 41.			SPECIAL I-BEAMS. 12 Inch No. B 105.			
	31.5 lbs.	35 lbs.	40 lbs.	40 lbs.	45 lbs.	50 lbs.	55 lbs.
10	38370	40580	43720	47810	50790	53930	57070
11	34880	36890	39740	43470	46180	49030	51880
12	31970	33820	36430	39840	42330	44940	47560
13	29510	31220	33630	36780	39070	41480	43900
14	27400	28990	31230	34150	36280	38520	40760
15	25580	27050	29140	31880	33860	35950	38040
16	23980	25360	27320	29880	31750	33710	35670
17	22570	23870	25720	28130	29880	31720	33570
18	21310	22540	24290	26560	28220	29960	31700
19	20190	21360	23010	25160	26730	28380	30040
20	19180	20290	21860	23910	25400	26960	28530
21	18270	19320	20820	22770	24190	25680	27170
22	17440	18450	19870	21730	23090	24510	25940
23	16680	17640	19010	20790	22080	23450	24810
24	15990	16910	18220	19920	21160	22470	23780
25	15350	16230	17490	19130	20320	21570	22830
26	14760	15610	16810	18390	19540	20740	21950
27	14210	15030	16190	17710	18810	19970	21140
28	13700	14490	15610	17080	18140	19260	20380
29	13230	13990	15070	16490	17510	18600	19680
30	12790	13530	14570	15940	16930	17980	19020
31	12380	13090	14100	15420	16380	17400	18410
32	11990	12680	13660	14940	15870	16850	17830
33	11630	12300	13250	14490	15390	16340	17290
34	11280	11940	12860	14060	14940	15860	16780
35	10960	11590	12490	13660	14510	15410	16300
36	10660	11270	12140	13280	14110	14980	15850

For safe loads below the heavy lines, the deflections will be greater than the allowable limit for plastered ceilings $= \frac{1}{360}$ span.

SAFE LOADS IN POUNDS UNIFORMLY DISTRIBUTED FOR CAMBRIA I-BEAMS.

Safe loads below are figured for fibre stress of 16 000 pounds per square inch and include weight of beam.

STANDARD I-BEAM.

Distance between supports in feet.	15 Inch No. B 53.				
	42 lbs.	45 lbs.	50 lbs.	55 lbs.	60 lbs.
10	62830	64830	68750	72670	76600
11	57120	58940	62500	66070	69630
12	52360	54030	57290	60560	63830
13	48330	49870	52890	55900	58920
14	44880	46310	49110	51910	54710
15	41880	43220	45840	48450	51060
16	39270	40520	42970	45420	47870
17	36960	38140	40440	42750	45060
18	34900	36020	38200	40370	42550
19	33070	34120	36190	38250	40310
20	31410	32420	34380	36340	38300
21	29920	30870	32740	34610	36470
22	28560	29470	31250	33030	34820
23	27320	28190	29890	31600	33300
24	26180	27010	28650	30280	31910
25	25130	25930	27500	29070	30640
26	24160	24940	26440	27950	29460
27	23270	24010	25460	26920	28370
28	22440	23150	24550	25960	27360
29	21660	22360	23710	25060	26410
30	20940	21610	22920	24220	25530
31	20270	20910	22180	23440	24710
32	19630	20260	21490	22710	23940
33	19040	19650	20830	22020	23210
34	18480	19070	20220	21370	22530
35	17950	18520	19640	20760	21880
36	17450	18010	19100	20190	21280

For safe loads below the heavy lines, the deflections will be greater than the allowable limit for plastered ceilings $= \frac{1}{360}$ span.

SAFE LOADS IN POUNDS UNIFORMLY DISTRIBUTED FOR CAMBRIA I-BEAMS.

Safe loads below are figured for fibre stress of 16 000 pounds per square inch and include weight of beam.

SPECIAL I-BEAM.

15 Inch No. B 109.

Distance between supports in feet.	60 lbs.	65 lbs.	70 lbs.	75 lbs.	80 lbs.
10	86610	90470	94390	98310	102230
11	78740	82240	85810	89370	92940
12	72180	75390	78660	81920	85190
13	66630	69590	72610	75620	78640
14	61870	64620	67420	70220	73020
15	57740	60310	62920	65540	68150
16	54130	56540	58990	61440	63890
17	50950	53220	55520	57830	60140
18	48120	50260	52440	54620	56790
19	45590	47610	49680	51740	53810
20	43310	45230	47190	49150	51120
21	41240	43080	44950	46810	48680
22	39370	41120	42900	44690	46470
23	37660	39330	41040	42740	44450
24	36090	37690	39330	40960	42600
25	34650	36190	37750	39320	40890
26	33310	34790	36300	37810	39320
27	32080	33510	34960	36410	37860
28	30930	32310	33710	35110	36510
29	29870	31200	32550	33900	35250
30	28870	30160	31460	32770	34080
31	27940	29180	30450	31710	32980
32	27070	28270	29500	30720	31950
33	26250	27410	28600	29790	30980
34	25470	26610	27760	28910	30070
35	24750	25850	26970	28090	29210
36	24060	25130	26220	27310	28400

For safe loads below the heavy lines, the deflections will be greater than the allowable limit for plastered ceilings = $\frac{1}{360}$ span.

SAFE LOADS IN POUNDS UNIFORMLY DISTRIBUTED FOR CAMBRIA I-BEAMS.

Safe loads below are figured for fibre stress of 16 000 pounds per square inch and include weight of beam.

Distance between supports in feet.	SPECIAL I-BEAM. 15 Inch No. B 113.				
	80 lbs.	85 lbs.	90 lbs.	95 lbs.	100 lbs.
10	112230	116030	119960	123880	127800
11	102030	105490	109050	112620	116180
12	93520	96700	99960	103230	106500
13	86330	89260	92270	95290	98310
14	80160	82880	85680	88480	91280
15	74820	77360	79970	82580	85200
16	70140	72520	74970	77420	79870
17	66020	68260	70560	72870	75180
18	62350	64460	66640	68820	71000
19	59070	61070	63130	65200	67260
20	56110	58020	59980	61940	63900
21	53440	55250	57120	58990	60860
22	51010	52740	54530	56310	58090
23	48800	50450	52150	53860	55560
24	46760	48350	49980	51620	53250
25	44890	46410	47980	49550	51120
26	43170	44630	46140	47650	49150
27	41570	42980	44430	45880	47330
28	40080	41440	42840	44240	45640
29	38700	40010	41360	42720	44070
30	37410	38680	39990	41290	42600
31	36200	37430	38700	39960	41230
32	35070	36260	37490	38710	39940
33	34010	35160	36350	37540	38730
34	33010	34130	35280	36430	37590
35	32070	33150	34270	35390	36510
36	31170	32230	33320	34410	35500

For safe loads below the heavy lines, the deflections will be greater than the allowable limit for plastered ceilings $= \frac{1}{360}$ span.

SAFE LOADS IN POUNDS UNIFORMLY DISTRIBUTED FOR CAMBRIA I-BEAMS.

Safe loads below are figured for fibre stress of 16 000 pounds per square inch and include weight of beam.

STANDARD I-BEAMS.

Distance between supports in feet.	18 Inch No. B 65.				20 Inch No. B 73.		
	55 lbs.	60 lbs.	65 lbs.	70 lbs.	65 lbs.	70 lbs.	75 lbs.
10	94290	99770	104470	109180	124750	130110	135340
11	85720	90700	94980	99250	113410	118280	123040
12	78570	83140	87060	90980	103960	108430	112780
13	72530	76740	80360	83980	95960	100090	104110
14	67350	71260	74620	77990	89110	92940	96670
15	62860	66510	69650	72790	83170	86740	90230
16	58930	62360	65300	68240	77970	81320	84590
17	55460	58650	61460	64220	73380	76540	79610
18	52380	55430	58040	60660	69310	72280	75190
19	49630	52510	54990	57460	65660	68480	71230
20	47140	49880	52240	54590	62370	65060	67670
21	44900	47510	49750	51990	59400	61960	64450
22	42860	45350	47490	49630	56700	59140	61520
23	40990	43380	45420	47470	54240	56570	58840
24	39290	41570	43530	45490	51980	54210	56390
25	37720	39910	41790	43670	49900	52040	54140
26	36260	38370	40180	41990	47980	50040	52050
27	34920	36950	38690	40440	46200	48190	50130
28	33670	35630	37310	38990	44550	46470	48340
29	32510	34400	36030	37650	43020	44870	46670
30	31430	33260	34820	36390	41580	43370	45110
31	30420	32180	33700	35220	40240	41970	43660
32	29460	31200	32650	34120	38980	40660	42290
33	28570	30230	31660	33080	37800	39430	41010
34	27730	29340	30730	32110	36690	38270	39810
35	26940	28510	29850	31190	35640	37170	38670
36	26190	27710	29020	30330	34650	36140	37590

SAFE LOADS IN POUNDS UNIFORMLY DISTRIBUTED FOR CAMBRIA I-BEAMS.

Safe loads below are figured for fibre stress of 16 000 pounds per square inch and include weight of beam.

SPECIAL I-BEAM.

20 Inch No. B 121.

Distance between supports in feet.	80 lbs.	85 lbs.	90 lbs.	95 lbs.	100 lbs.
10	156410	160910	166140	171370	176600
11	142190	146280	151040	155790	160540
12	130340	134090	138450	142810	147160
13	120310	123780	127800	131820	135840
14	111720	114940	118670	122410	126140
15	104270	107270	110760	114250	117730
16	97750	100570	103840	107100	110370
17	92000	94650	97730	100800	103880
18	86890	89390	92300	95200	98110
19	82320	84690	87440	90190	92950
20	78200	80460	83070	85680	88300
21	74480	76620	79110	81600	84090
22	71090	73140	75520	77890	80270
23	68000	69960	72230	74510	76780
24	65170	67050	69220	71400	73580
25	62560	64360	66460	68550	70640
26	60160	61890	63900	65910	67920
27	57930	59600	61530	63470	65410
28	55860	57470	59340	61200	63070
29	53930	55490	57290	59090	60900
30	52140	53640	55380	57120	58870
31	50450	51910	53590	55280	56970
32	48880	50280	51920	53550	55190
33	47400	48760	50350	51930	53510
34	46000	47330	48860	50400	51940
35	44690	45970	47470	48960	50460
36	43450	44700	46150	47600	49050

SAFE LOADS IN POUNDS UNIFORMLY DISTRIBUTED FOR CAMBRIA I-BEAMS.

Safe loads below are figured for fibre stress of 16 000 pounds per square inch and include weight of beam.

Distance between supports in feet.	STANDARD I-BEAM. 24 Inch No. B 89.				
	80 lbs.	85 lbs.	90 lbs.	95 lbs.	100 lbs.
10	185530	192700	198970	205240	211520
11	168660	175180	180880	186590	192290
12	154610	160580	165810	171040	176270
13	142720	148230	153050	157880	162710
14	132520	137640	142120	146600	151080
15	123690	128460	132650	136830	141010
16	115960	120430	124360	128280	132200
17	109140	113350	117040	120730	124420
18	103070	107050	110540	114020	117510
19	97650	101420	104720	108020	111330
20	92770	96350	99480	102620	105760
21	88350	91760	94750	97740	100720
22	84330	87590	90440	93290	96140
23	80670	83780	86510	89240	91960
24	77300	80290	82900	85520	88130
25	74210	77080	79590	82100	84610
26	71360	74110	76530	78940	81350
27	68720	71370	73690	76020	78340
28	66260	68820	71060	73300	75540
29	63980	66450	68610	70770	72940
30	61840	64230	66320	68410	70510
31	59850	62160	64180	66210	68230
32	57980	60220	62180	64140	66100
33	56220	58390	60290	62200	64100
34	54570	56680	58520	60370	62210
35	53010	55060	56850	58640	60430
36	51540	53530	55270	57010	58760

Safe loads above dotted line are greater than safe loads for web crippling, as explained and shown on pages 66 to 68 inclusive.

SAFE LOADS IN POUNDS UNIFORMLY DISTRIBUTED FOR CAMBRIA CHANNELS.

Safe loads below are figured for fibre stress of 16 000 pounds per square inch and include weight of channel.

STANDARD CHANNELS.

Distance between supports in feet.	3 Inch No. C 5.			4 Inch No. C 9.			5 Inch No. C 13.		
	4 lbs.	5 lbs.	6 lbs.	5.25 lbs.	6.25 lbs.	7.25 lbs.	6.5 lbs.	9 lbs.	11.5 lbs.
4	2910	3290	3680	5060	5570	6090	7910	9460	11100
5	2330	2630	2940	4050	4450	4870	6330	7570	8880
6	1940	2190	2450	3370	3710	4060	5270	6310	7400
7	1660	1880	2100	2890	3180	3480	4520	5410	6340
8	1450	1640	1840	2530	2780	3050	3960	4730	5550
9	1290	1460	1630	2250	2470	2510	3520	4210	4930
10	1160	1310	1470	2020	2230	2440	3160	3790	4440
11	1060	1190	1340	1840	2020	2210	2880	3440	4040
12	970	1100	1230	1690	1860	2030	2640	3150	3700
13	890	1010	1130	1560	1710	1870	2430	2910	3410
14	830	940	1050	1440	1590	1740	2260	2700	3170
15	780	880	980	1350	1480	1620	2110	2520	2960
16	730	820	920	1260	1390	1520	1980	2370	2770
17	680	770	870	1190	1310	1430	1860	2230	2610
18	650	730	820	1120	1240	1350	1760	2100	2470
19	610	690	770	1060	1170	1280	1670	1990	2340
20	580	660	740	1010	1110	1220	1580	1890	2220
21	550	630	700	960	1060	1160	1510	1800	2110
22	530	600	670	920	1010	1110	1440	1720	2020
23	510	570	640	880	970	1060	1380	1650	1930
24	480	550	610	840	930	1020	1320	1580	1850
25	470	530	590	810	890	970	1270	1510	1780

For safe loads below the heavy lines, the deflections will be greater than the allowable limit for plastered ceilings $= \frac{1}{360}$ span.

SAFE LOADS IN POUNDS UNIFORMLY DISTRIBUTED FOR CAMBRIA CHANNELS.

Safe loads below are figured for fibre stress of 16 000 pounds per square inch and include weight of channel.

STANDARD CHANNELS.

Distance between supports in feet.	6 Inch No. C 17.				7 Inch No. C 21.				
	8 lbs.	10.5 lbs.	13 lbs.	15.5 lbs.	9.75 lbs.	12.25 lbs.	14.75 lbs.	17.25 lbs.	19.75 lbs.
4	11550	13440	15400	17360	16070	18410	20700	22990	25280
5	9240	10750	12320	13890	12850	14730	16560	18390	20220
6	7700	8960	10270	11570	10710	12280	13800	15330	16850
7	6600	7680	8800	9920	9180	10520	11830	13140	14440
8	5780	6720	7700	8680	8030	9210	10350	11490	12640
9	5130	5970	6840	7720	7140	8180	9200	10220	11230
10	4620	5380	6160	6940	6430	7370	8280	9200	10110
11	4200	4890	5600	6310	5840	6700	7530	8360	9190
12	3850	4480	5130	5790	5360	6140	6900	7660	8430
13	3550	4130	4740	5340	4940	5670	6370	7070	7780
14	3300	3840	4400	4960	4590	5260	5910	6570	7220
15	3080	3580	4110	4630	4280	4910	5520	6130	6740
16	2890	3360	3850	4340	4020	4600	5180	5750	6320
17	2720	3160	3620	4080	3780	4330	4870	5410	5950
18	2570	2990	3420	3860	3570	4090	4600	5110	5620
19	2430	2830	3240	3650	3380	3880	4360	4840	5320
20	2310	2690	3080	3470	3210	3680	4140	4600	5060
21	2200	2560	2930	3310	3060	3510	3940	4380	4810
22	2100	2440	2800	3160	2920	3350	3760	4180	4600
23	2010	2340	2680	3020	2790	3200	3600	4000	4400
24	1930	2240	2570	2890	2680	3070	3450	3830	4210
25	1850	2150	2460	2780	2570	2950	3310	3680	4040

For safe loads below the heavy lines, the deflections will be greater than the allowable limit for plastered ceilings $= \frac{1}{360}$ span.

SAFE LOADS IN POUNDS UNIFORMLY DISTRIBUTED FOR CAMBRIA CHANNELS.

Safe loads below are figured for fibre stress of 16 000 pounds per square inch and include weight of channel.

STANDARD CHANNELS.

Distance between supports in feet.	8 Inch No. C 25.					9 Inch No. C 29.			
	11.25 lbs.	13.75 lbs.	16.25 lbs.	18.75 lbs.	21.25 lbs.	13.25 lbs.	15 lbs.	20 lbs.	25 lbs.
4	21530	24000	26610	29230	31840	28040	30130	36020	41900
5	17230	19200	21290	23380	25470	22430	24110	28810	33520
6	14360	16000	17740	19480	21230	18690	20090	24010	27930
7	12310	13710	15210	16700	18200	16020	17220	20580	23940
8	10770	12000	13310	14610	15920	14020	15070	18010	20950
9	9570	10670	11830	12990	14150	12460	13390	16010	18620
10	8610	9600	10650	11690	12740	11220	12050	14410	16760
11	7830	8730	9680	10630	11580	10200	10960	13100	15240
12	7180	8000	8870	9740	10610	9350	10040	12010	13970
13	6630	7380	8190	8990	9800	8630	9270	11080	12890
14	6150	6860	7600	8350	9100	8010	8610	10290	11970
15	5740	6400	7100	7790	8490	7480	8040	9600	11170
16	5380	6000	6650	7310	7960	7010	7530	9000	10470
17	5070	5650	6260	6880	7490	6600	7090	8470	9860
18	4790	5330	5910	6490	7080	6230	6700	8000	9310
19	4530	5050	5600	6150	6700	5900	6340	7580	8820
20	4310	4800	5320	5850	6370	5610	6030	7200	8380
21	4100	4570	5070	5570	6070	5340	5740	6860	7980
22	3920	4360	4840	5310	5790	5100	5480	6550	7620
23	3750	4170	4630	5080	5540	4880	5240	6260	7290
24	3590	4000	4440	4870	5310	4670	5020	6000	6980
25	3450	3840	4260	4680	5090	4490	4820	5760	6700

For safe loads below the heavy lines, the deflections will be greater than the allowable limit for plastered ceilings $= \frac{1}{360}$ span.

SAFE LOADS IN POUNDS UNIFORMLY DISTRIBUTED FOR CAMBRIA CHANNELS.

Safe loads below are figured for fibre stress of 16 000 pounds per square inch and include weight of channel.

Distance between supports in feet.	STANDARD CHANNEL.				
	10 Inch No. C 33.				
	15 lbs.	20 lbs.	25 lbs.	30 lbs.	35 lbs.
10	14270	16790	19410	22020	24640
11	12970	15270	17640	20020	22400
12	11890	14000	16170	18350	20530
13	10980	12920	14930	16940	18950
14	10190	12000	13860	15730	17600
15	9510	11200	12940	14680	16430
16	8920	10500	12130	13760	15400
17	8390	9880	11420	12950	14490
18	7930	9330	10780	12240	13690
19	7510	8840	10220	11590	12970
20	7130	8400	9700	11010	12320
21	6790	8000	9240	10490	11730
22	6490	7630	8820	10010	11200
23	6200	7300	8440	9580	10710
24	5940	7000	8090	9180	10270
25	5710	6720	7760	8810	9860
26	5490	6460	7460	8470	9480
27	5280	6220	7190	8160	9130
28	5100	6000	6930	7870	8800
29	4920	5790	6690	7590	8500
30	4760	5600	6470	7340	8210

For safe loads below the heavy lines, the deflections will be greater than the allowable limit for plastered ceilings $= \frac{1}{360}$ span.

SAFE LOADS IN POUNDS UNIFORMLY DISTRIBUTED FOR CAMBRIA CHANNELS.

Safe loads below are figured for fibre stress of 16 000 pounds per square inch and include weight of channel.

STANDARD CHANNEL.

Distance between supports in feet.	12 Inch No. C 41.				
	20.5 lbs.	25 lbs.	30 lbs.	35 lbs.	40 lbs.
10	22780	25600	28740	31870	35010
11	20700	23270	26120	28980	31830
12	18980	21330	23950	26560	29180
13	17520	19690	22110	24520	26930
14	16270	18290	20530	22770	25010
15	15180	17070	19160	21250	23340
16	14230	16000	17960	19920	21880
17	13400	15060	16900	18750	20600
18	12650	14220	15970	17710	19450
19	11990	13470	15120	16780	18430
20	11390	12800	14370	15940	17510
21	10850	12190	13680	15180	16670
22	10350	11640	13060	14490	15910
23	9900	11130	12490	13860	15220
24	9490	10670	11970	13280	14590
25	9110	10240	11490	12750	14000
26	8760	9850	11050	12260	13470
27	8440	9480	10640	11810	12970
28	8130	9140	10260	11380	12500
29	7850	8830	9910	10990	12070
30	7590	8530	9580	10620	11670

For safe loads below the heavy lines, the deflections will be greater than the allowable limit for plastered ceilings $= \frac{1}{360}$ span.

SAFE LOADS IN POUNDS UNIFORMLY DISTRIBUTED FOR CAMBRIA CHANNELS.

Safe loads below are figured for fibre stress of 16 000 pounds per square inch and include weight of channel.

STANDARD CHANNEL.

15 Inch No. C 53.

Distance between supports in feet.	33 lbs.	35 lbs.	40 lbs.	45 lbs.	50 lbs.	55 lbs.
10	44450	45500	49420	53350	57270	61190
11	40410	41370	44930	48500	52060	55630
12	37040	37920	41190	44460	47720	50990
13	34190	35000	38020	41040	44050	47070
14	31750	32500	35300	38100	40910	43710
15	29630	30340	32950	35560	38180	40790
16	27780	28440	30890	33340	35790	38240
17	26150	26770	29070	31380	33690	35990
18	24700	25280	27460	29640	31820	33990
19	23400	23950	26010	28080	30140	32210
20	22230	22750	24710	26670	28630	30590
21	21170	21670	23540	25400	27270	29140
22	20210	20680	22470	24250	26030	27810
23	19330	19780	21490	23190	24900	26600
24	18520	18960	20590	22230	23860	25500
25	17780	18200	19770	21340	22910	24480
26	17100	17500	19010	20520	22030	23530
27	16460	16850	18310	19760	21210	22660
28	15880	16250	17650	19050	20450	21850
29	15330	15690	17040	18400	19750	21100
30	14820	15170	16470	17780	19090	20400

SPACING OF CAMBRIA I-BEAMS FOR UNIFORM LOAD OF 100 LBS. PER SQUARE FOOT.

Proper distance in feet, center to center of Beams.
Maximum fibre stress 16 000 pounds per square inch.

Distance beween supports in feet.	STANDARD I-BEAMS.						
	3 Inch No. B 5.			4 Inch No. B 9.			
	5.5 lbs.	6.5 lbs.	7.5 lbs.	7.5 lbs.	8.5 lbs.	9.5 lbs.	10.5 lbs.
4	11.0	12.0	12.9	19.9	21.2	22.5	23.8
5	7.1	7.7	8.3	12.7	13.6	14.4	15.2
6	4.9	5.3	5.8	8.8	9.4	10.0	10.6
7	3.6	3.9	4.2	6.5	6.9	7.3	7.8
8	2.8	3.0	3.2	5.0	5.3	5.6	5.9
9	2.2	2.4	2.6	3.9	4.2	4.4	4.7
10	1.8	1.9	2.1	3.2	3.4	3.6	3.8
11	1.5	1.6	1.7	2.6	2.8	3.0	3.1
12	1.2	1.3	1.4	2.2	2.4	2.5	2.6
13	1.0	1.1	1.2	1.9	2.0	2.1	2.3
14	....	1.0	1.1	1.6	1.7	1.8	1.9
15	....	....	....	1.4	1.5	1.6	1.7
16	....	....	....	1.2	1.3	1.4	1.5
17	....	....	....	1.1	1.2	1.2	1.3
18	....	....	....	1.0	1.0	1.1	1.2
19	....	....	....	....	....	1.0	1.1
20	....	....	....	....	....	....	1.0

For spacings below the heavy lines the deflections will be greater than the allowable limit for plastered ceilings = $\frac{1}{360}$ span.

Spacings for other intensities of loading may be obtained from those in tables as follows:

$$\text{Required spacing} = \frac{\text{Intensity of loading from table}}{\text{New intensity of loading}} \times \text{Computed spacing from table.}$$

SPACING OF CAMBRIA I-BEAMS FOR UNIFORM LOAD OF 100 LBS. PER SQUARE FOOT.

Proper distance in feet, center to center of Beams.
Maximum fibre stress 16 000 pounds per square inch.

Distance between supports in feet.	STANDARD I-BEAMS.					
	5 Inch No. B 13.			6 Inch No. B 17.		
	9.75 lbs.	12.25 lbs.	14.75 lbs.	12.25 lbs.	14.75 lbs.	17.25 lbs.
4	32.2	36.3	40.4	48.4	53.3	58.2
5	20.6	23.2	25.9	31.0	34.1	37.2
6	14.3	16.1	18.0	21.5	23.7	25.9
7	10.5	11.9	13.2	15.8	17.4	19.0
8	8.1	9.1	10.1	12.1	13.3	14.5
9	6.4	7.2	8.0	9.6	10.5	11.5
10	5.2	5.8	6.5	7.7	8.5	9.3
11	4.3	4.8	5.3	6.4	7.0	7.7
12	3.6	4.0	4.5	5.4	5.9	6.5
13	3.1	3.4	3.8	4.6	5.0	5.5
14	2.6	3.0	3.3	4.0	4.4	4.8
15	2.3	2.6	2.9	3.4	3.8	4.1
16	2.0	2.3	2.5	3.0	3.3	3.6
17	1.8	2.0	2.2	2.7	3.0	3.2
18	1.6	1.8	2.0	2.4	2.6	2.9
19	1.4	1.6	1.8	2.1	2.4	2.6
20	1.3	1.5	1.6	1.9	2.1	2.3
21	1.2	1.3	1.5	1.8	1.9	2.1
22	1.1	1.2	1.3	1.6	1.8	1.9
23	1.0	1.1	1.2	1.5	1.6	1.8
24	....	1.0	1.1	1.3	1.5	1.6
25	....	....	1.0	1.2	1.4	1.5
26	....	....	1.0	1.1	1.3	1.4
27	....	....	....	1.1	1.2	1.3
28	....	....	....	1.0	1.1	1.2
29	....	....	....	....	1.0	1.1

For spacings below the heavy lines the deflections will be greater than the allowable limit for plastered ceilings = $\frac{1}{360}$ span.

Spacings for other intensities of loading may be obtained from those in tables as follows:

$$\text{Required spacing} = \frac{\text{Intensity of loading from table}}{\text{New intensity of loading}} \times \text{Computed spacing from table.}$$

SPACING OF CAMBRIA I-BEAMS FOR UNIFORM LOAD OF 100 LBS. PER SQUARE FOOT.

Proper distance in feet, center to center of Beams.
Maximum fibre stress 16 000 pounds per square inch.

Distance between supports in feet.	STANDARD I-BEAMS.						
	7 Inch No. B 21.			8 Inch No. B 25.			
	15 lbs.	17.5 lbs.	20 lbs.	18.00 lbs.	20.25 lbs.	22.75 lbs.	25.25 lbs.
4	69.0	74.6	80.3	94.8	100.3	106.9	113.4
5	44.2	47.8	51.4	60.7	64.2	68.4	72.6
6	30.7	33.2	35.7	42.1	44.6	47.5	50.4
7	22.5	24.4	26.2	31.0	32.8	34.9	37.0
8	17.3	18.7	20.1	23.7	25.1	26.7	28.3
9	13.6	14.7	15.9	18.7	19.8	21.1	22.4
10	11.0	11.9	12.9	15.2	16.1	17.1	18.1
11	9.1	9.9	10.6	12.5	13.3	14.1	15.0
12	7.7	8.3	8.9	10.5	11.1	11.9	12.6
13	6.5	7.1	7.6	9.0	9.5	10.1	10.7
14	5.6	6.1	6.6	7.7	8.2	8.7	9.3
15	4.9	5.3	5.7	6.7	7.1	7.6	8.1
16	4.3	4.7	5.0	5.9	6.3	6.7	7.1
17	3.8	4.1	4.4	5.2	5.6	5.9	6.3
18	3.4	3.7	4.0	4.7	5.0	5.3	5.6
19	3.1	3.3	3.6	4.2	4.4	4.7	5.0
20	2.8	3.0	3.2	3.8	4.0	4.3	4.5
21	2.5	2.7	2.9	3.4	3.6	3.9	4.1
22	2.3	2.5	2.7	3.1	3.3	3.5	3.7
23	2.1	2.3	2.4	2.9	3.0	3.2	3.4
24	1.9	2.1	2.2	2.6	2.8	3.0	3.1
25	1.8	1.9	2.1	2.4	2.6	2.7	2.9
26	1.6	1.8	1.9	2.2	2.4	2.5	2.7
27	1.5	1.6	1.8	2.1	2.2	2.3	2.5
28	1.4	1.5	1.6	1.9	2.0	2.2	2.3
29	1.3	1.4	1.5	1.8	1.9	2.0	2.2

For spacing above the dotted line the safe load for bending is greater than the safe load for web crippling, as explained and shown on pages 66 to 68 inclusive.

For spacings below the heavy lines the deflections will be greater than the allowable limit for plastered ceilings $= \frac{1}{360}$ span.

Spacings for other intensities of loading may be obtained from those in tables as follows:

$$\text{Required spacing} = \frac{\text{Intensity of loading from table}}{\text{New intensity of loading}} \times \text{Computed spacing from table.}$$

SPACING OF CAMBRIA I-BEAMS FOR UNIFORM LOAD OF 100 LBS. PER SQUARE FOOT.

Proper distance in feet, center to center of Beams.
Maximum fibre stress 16 000 pounds per square inch.

Distance between supports in feet.	STANDARD I-BEAMS.							
	9 Inch No. B 29.				10 Inch No. B 33.			
	21 lbs.	25 lbs.	30 lbs.	35 lbs.	25 lbs.	30 lbs.	35 lbs.	40 lbs.
8	31.5	34.1	37.7	41.4	....	....	....	....
9	24.9	26.9	29.8	32.7	....	....	....	....
10	20.1	21.8	24.1	26.5	26.0	28.6	31.2	33.9
11	16.6	18.0	20.0	21.9	21.5	23.7	25.8	28.0
12	14.0	15.1	16.8	18.4	18.1	19.9	21.7	23.5
13	11.9	12.9	14.3	15.7	15.4	16.9	18.5	20.0
14	10.3	11.1	12.3	13.5	13.3	14.6	15.9	17.3
15	8.9	9.7	10.7	11.8	11.6	12.7	13.9	15.0
16	7.9	8.5	9.4	10.4	10.2	11.2	12.2	13.2
17	7.0	7.5	8.4	9.2	9.0	9.9	10.8	11.7
18	6.2	6.7	7.5	8.2	8.0	8.8	9.6	10.4
19	5.6	6.0	6.7	7.3	7.2	7.9	8.7	9.4
20	5.0	5.4	6.0	6.6	6.5	7.2	7.8	8.5
21	4.6	4.9	5.5	6.0	5.9	6.5	7.1	7.7
22	4.2	4.5	5.0	5.5	5.4	5.9	6.5	7.0
23	3.8	4.1	4.6	5.0	4.9	5.4	5.9	6.4
24	3.5	3.8	4.2	4.6	4.5	5.0	5.4	5.9
25	3.2	3.5	3.9	4.2	4.2	4.6	5.0	5.4
26	3.0	3.2	3.6	3.9	3.9	4.2	4.6	5.0
27	2.8	3.0	3.3	3.6	3.6	3.9	4.3	4.6
28	2.6	2.8	3.1	3.4	3.3	3.7	4.0	4.3
29	2.4	2.6	2.9	3.2	3.1	3.4	3.7	4.0
30	2.2	2.4	2.7	2.9	2.9	3.2	3.5	3.8
31	2.1	2.3	2.5	2.8	2.7	3.0	3.3	3.5
32	....	....	....	....	2.5	2.8	3.1	3.3
33	....	....	....	....	2.4	2.6	2.9	3.1

For spacings below the heavy lines the deflections will be greater than the allowable limit for plastered ceilings $= \frac{1}{360}$ span.

Spacings for other intensities of loading may be obtained from those in tables as follows:

$$\text{Required spacing} = \frac{\text{Intensity of loading from table}}{\text{New intensity of loading}} \times \text{Computed spacing from table.}$$

SPACING OF CAMBRIA I-BEAMS FOR UNIFORM LOAD OF 100 LBS. PER SQUARE FOOT.

Proper distance in feet, center to center of Beams.
Maximum fibre stress 16 000 pounds per square inch.

Distance between supports in feet.	STANDARD I-BEAM. 12 Inch No. B 41.			SPECIAL I-BEAM. 12 Inch No. B 105.			
	31.5 lbs.	35 lbs.	40 lbs.	40 lbs.	45 lbs.	50 lbs.	55 lbs.
10	38.4	40.6	43.7	47.8	50.8	53.9	57.1
11	31.7	33.5	36.1	39.5	42.0	44.6	47.2
12	26.6	28.2	30.4	33.2	35.3	37.5	39.6
13	22.7	24.0	25.9	28.3	30.1	31.9	33.8
14	19.6	20.7	22.3	24.4	25.9	27.5	29.1
15	17.1	18.0	19.4	21.3	22.6	24.0	25.4
16	15.0	15.9	17.1	18.7	19.8	21.1	22.3
17	13.3	14.0	15.1	16.5	17.6	18.7	19.7
18	11.8	12.5	13.5	14.8	15.7	16.6	17.6
19	10.6	11.2	12.1	13.2	14.1	14.9	15.8
20	9.6	10.1	10.9	12.0	12.7	13.5	14.3
21	8.7	9.2	9.9	10.8	11.5	12.2	12.9
22	7.9	8.4	9.0	9.9	10.5	11.1	11.8
23	7.3	7.7	8.3	9.0	9.6	10.2	10.8
24	6.7	7.0	7.6	8.3	8.8	9.4	9.9
25	6.1	6.5	7.0	7.7	8.1	8.6	9.1
26	5.7	6.0	6.5	7.1	7.5	8.0	8.4
27	5.3	5.6	6.0	6.6	7.0	7.4	7.8
28	4.9	5.2	5.6	6.1	6.5	6.9	7.3
29	4.6	4.8	5.2	5.7	6.0	6.4	6.8
30	4.3	4.5	4.9	5.3	5.6	6.0	6.3
31	4.0	4.2	4.5	5.0	5.3	5.6	5.9
32	3.7	4.0	4.3	4.7	5.0	5.3	5.6
33	3.5	3.7	4.0	4.4	4.7	5.0	5.2
34	3.3	3.5	3.8	4.1	4.4	4.7	4.9
35	3.1	3.3	3.6	3.9	4.1	4.4	4.7
36	3.0	3.1	3.4	3.7	3.9	4.2	4.4

For spacings below the heavy lines the deflections will be greater than the allowable limit for plastered ceilings $= \frac{1}{360}$ span.

Spacings for other intensities of loading may be obtained from those in tables as follows:

$$\text{Required spacing} = \frac{\text{Intensity of loading from table}}{\text{New intensity of loading}} \times \text{Computed spacing from table.}$$

SPACING OF CAMBRIA I-BEAMS FOR UNIFORM LOAD OF 100 LBS. PER SQUARE FOOT.

Proper distance in feet, center to center of Beams.
Maximum fibre stress 16 000 pounds per square inch.

Distance between supports in feet.	STANDARD I-BEAM. 15 Inch No. B 53.				
	42 lbs.	45 lbs.	50 lbs.	55 lbs.	60 lbs.
10	62.8	64.8	68.8	72.7	76.6
11	51.9	53.6	56.8	60.1	63.3
12	43.6	45.0	47.7	50.5	53.2
13	37.2	38.4	40.7	43.0	45.3
14	32.0	33.1	35.1	37.1	39.1
15	27.9	28.8	30.6	32.3	34.0
16	24.5	25.3	26.9	28.4	29.9
17	21.7	22.4	23.8	25.1	26.5
18	19.4	20.0	21.2	22.4	23.6
19	17.4	18.0	19.0	20.1	21.2
20	15.7	16.2	17.2	18.2	19.1
21	14.2	14.7	15.6	16.5	17.4
22	13.0	13.4	14.2	15.0	15.8
23	11.9	12.3	13.0	13.7	14.5
24	10.9	11.3	11.9	12.6	13.3
25	10.1	10.4	11.0	11.6	12.3
26	9.3	9.6	10.2	10.8	11.3
27	8.6	8.9	9.4	10.0	10.5
28	8.0	8.3	8.8	9.3	9.8
29	7.5	7.7	8.2	8.6	9.1
30	7.0	7.2	7.6	8.1	8.5
31	6.5	6.7	7.2	7.6	8.0
32	6.1	6.3	6.7	7.1	7.5
33	5.8	6.0	6.3	6.7	7.0
34	5.4	5.6	5.9	6.3	6.6
35	5.1	5.3	5.6	5.9	6.3
36	4.8	5.0	5.3	5.6	5.9

For spacings below the heavy lines the deflections will be greater than the allowable limit for plastered ceilings = $\frac{1}{360}$ span.

Spacings for other intensities of loading may be obtained from those in tables as follows:

$$\text{Required spacing} = \frac{\text{Intensity of loading from table}}{\text{New intensity of loading}} \times \text{Computed spacing from table.}$$

SPACING OF CAMBRIA I-BEAMS FOR UNIFORM LOAD OF 100 LBS. PER SQUARE FOOT.

Proper distance in feet, center to center of Beams.
Maximum fibre stress 16000 pounds per square inch.

Distance between supports in feet.	SPECIAL I-BEAM. 15 Inch No. B 109.				
	60 lbs.	65 lbs.	70 lbs.	75 lbs.	80 lbs.
10	86.6	90.5	94.4	98.3	102.2
11	71.6	74.8	78.0	81.2	84.5
12	60.1	62.8	65.5	68.3	71.0
13	51.3	53.5	55.9	58.2	60.5
14	44.2	46.2	48.2	50.2	52.2
15	38.5	40.2	41.9	43.7	45.4
16	33.8	35.3	36.9	38.4	39.9
17	30.0	31.3	32.7	34.0	35.4
18	26.7	27.9	29.1	30.3	31.6
19	24.0	25.1	26.1	27.2	28.3
20	21.7	22.6	23.6	24.6	25.6
21	19.6	20.5	21.4	22.3	23.2
22	17.9	18.7	19.5	20.3	21.1
23	16.4	17.1	17.8	18.6	19.3
24	15.0	15.7	16.4	17.1	17.7
25	13.9	14.5	15.1	15.7	16.4
26	12.8	13.4	14.0	14.5	15.1
27	11.9	12.4	12.9	13.5	14.0
28	11.0	11.5	12.0	12.5	13.0
29	10.3	10.8	11.2	11.7	12.2
30	9.6	10.1	10.5	10.9	11.4
31	9.0	9.4	9.8	10.2	10.6
32	8.5	8.8	9.2	9.6	10.0
33	8.0	8.3	8.7	9.0	9.4
34	7.5	7.8	8.2	8.5	8.8
35	7.1	7.4	7.7	8.0	8.3
36	6.7	7.0	7.3	7.6	7.9

For spacings below the heavy lines the deflections will be greater than the allowable limit for plastered ceilings = $\frac{1}{360}$ span.

Spacings for other intensities of loading may be obtained from those in tables as follows:

$$\text{Required spacing} = \frac{\text{Intensity of loading from table}}{\text{New intensity of loading}} \times \text{Computed spacing from table.}$$

SPACING OF CAMBRIA I-BEAMS FOR UNIFORM LOAD OF 100 LBS. PER SQUARE FOOT.

Proper distance in feet, center to center of Beams.
Maximum fibre stress 16 000 pounds per square inch.

Distance between supports in feet.	SPECIAL I-BEAM. 15 Inch No. B 113.				
	80 lbs.	85 lbs.	90 lbs.	95 lbs.	100 lbs.
10	112.2	116.0	120.0	123.9	127.8
11	92.8	95.9	99.1	102.4	105.6
12	77.9	80.6	83.3	86.0	88.7
13	66.4	68.7	71.0	73.3	75.6
14	57.3	59.2	61.2	63.2	65.2
15	49.9	51.6	53.3	55.1	56.8
16	43.8	45.3	46.9	48.4	49.9
17	38.8	40.2	41.5	42.9	44.2
18	34.6	35.8	37.0	38.2	39.4
19	31.1	32.1	33.2	34.3	35.4
20	28.1	29.0	30.0	31.0	31.9
21	25.4	26.3	27.2	28.1	29.0
22	23.2	24.0	24.8	25.6	26.4
23	21.2	21.9	22.7	23.4	24.2
24	19.5	20.1	20.8	21.5	22.2
25	18.0	18.6	19.2	19.8	20.4
26	16.6	17.2	17.7	18.3	18.9
27	15.4	15.9	16.5	17.0	17.5
28	14.3	14.8	15.3	15.8	16.3
29	13.3	13.8	14.3	14.7	15.2
30	12.5	12.9	13.3	13.8	14.2
31	11.7	12.1	12.5	12.9	13.3
32	11.0	11.3	11.7	12.1	12.5
33	10.3	10.7	11.0	11.4	11.7
34	9.7	10.0	10.4	10.7	11.1
35	9.2	9.5	9.8	10.1	10.4
36	8.7	9.0	9.3	9.6	9.9

For spacings below the heavy lines the deflections will be greater than the allowable limit for plastered ceilings = $\frac{1}{360}$ span.

Spacings for other intensities of loading may be obtained from those in tables as follows:

$$\text{Required spacing} = \frac{\text{Intensity of loading from table}}{\text{New intensity of loading}} \times \text{Computed spacing from table.}$$

SPACING OF CAMBRIA I-BEAMS FOR UNIFORM LOAD OF 100 LBS. PER SQUARE FOOT.

Proper distance in feet, center to center of Beams.
Maximum fibre stress 16 000 pounds per square inch.

Distance between supports in feet.	STANDARD I-BEAMS.						
	18 Inch No. B 65.				20 Inch No. B 73.		
	55 lbs.	60 lbs.	65 lbs.	70 lbs.	65 lbs.	70 lbs.	75 lbs.
10	94.3	99.8	104.5	109.2	124.7	130.1	135.3
11	77.9	82.5	86.3	90.2	103.1	107.5	111.9
12	65.5	69.3	72.6	75.8	86.6	90.4	94.0
13	55.8	59.0	61.8	64.6	73.8	77.0	80.1
14	48.1	50.9	53.3	55.7	63.6	66.4	69.1
15	41.9	44.3	46.4	48.5	55.4	57.8	60.2
16	36.8	39.0	40.8	42.6	48.7	50.8	52.9
17	32.6	34.5	36.2	37.8	43.2	45.0	46.8
18	29.1	30.8	32.2	33.7	38.5	40.2	41.8
19	26.1	27.6	28.9	30.2	34.6	36.0	37.5
20	23.6	24.9	26.1	27.3	31.2	32.5	33.8
21	21.4	22.6	23.7	24.8	28.3	29.5	30.7
22	19.5	20.6	21.6	22.6	25.8	26.9	28.0
23	17.8	18.9	19.7	20.6	23.6	24.6	25.6
24	16.4	17.3	18.1	19.0	21.7	22.6	23.5
25	15.1	16.0	16.7	17.5	20.0	20.8	21.7
26	13.9	14.8	15.5	16.2	18.5	19.2	20.0
27	12.9	13.7	14.3	15.0	17.1	17.8	18.6
28	12.0	12.7	13.3	13.9	15.9	16.6	17.3
29	11.2	11.9	12.4	13.0	14.8	15.5	16.1
30	10.5	11.1	11.6	12.1	13.9	14.5	15.0
31	9.8	10.4	10.9	11.4	13.0	13.5	14.1
32	9.2	9.7	10.2	10.7	12.2	12.7	13.2
33	8.7	9.2	9.6	10.0	11.5	11.9	12.4
34	8.2	8.6	9.0	9.4	10.8	11.3	11.7
35	7.7	8.1	8.5	8.9	10.2	10.6	11.0
36	7.3	7.7	8.1	8.4	9.6	10.0	10.4

Spacings for other intensities of loading may be obtained from those in tables as follows:

$$\text{Required spacing} = \frac{\text{Intensity of loading from table}}{\text{New intensity of loading}} \times \text{Computed spacing from table.}$$

SPACING OF CAMBRIA I-BEAMS FOR UNIFORM LOAD OF 100 LBS. PER SQUARE FOOT.

Proper distance in feet, center to center of Beams.
Maximum fibre stress 16 000 pounds per square inch.

Distance between supports in feet.	SPECIAL I-BEAM. 20 Inch No. B 121.				
	80 lbs.	85 lbs.	90 lbs.	95 lbs.	100 lbs.
10	156.4	160.9	166.1	171.4	176.6
11	129.3	133.0	137.3	141.6	145.9
12	108.6	111.7	115.4	119.0	122.6
13	92.5	95.2	98.3	101.4	104.5
14	79.8	82.1	84.8	87.4	90.1
15	69.5	71.5	73.8	76.2	78.5
16	61.1	62.9	64.9	66.9	69.0
17	54.1	55.7	57.5	59.3	61.1
18	48.3	49.7	51.3	52.9	54.5
19	43.3	44.6	46.0	47.5	48.9
20	39.1	40.2	41.5	42.8	44.1
21	35.5	36.5	37.7	38.9	40.0
22	32.3	33.2	34.3	35.4	36.5
23	29.6	30.4	31.4	32.4	33.4
24	27.2	27.9	28.8	29.8	30.7
25	25.0	25.7	26.6	27.4	28.3
26	23.1	23.8	24.6	25.4	26.1
27	21.5	22.1	22.8	23.5	24.2
28	19.9	20.5	21.2	21.9	22.5
29	18.6	19.1	19.8	20.4	21.0
30	17.4	17.9	18.5	19.0	19.6
31	16.3	16.7	17.3	17.8	18.4
32	15.3	15.7	16.2	16.7	17.2
33	14.4	14.8	15.3	15.7	16.2
34	13.5	13.9	14.4	14.8	15.3
35	12.8	13.1	13.6	14.0	14.4
36	12.1	12.4	12.8	13.2	13.6

Spacings for other intensities of loading may be obtained from those in tables as follows:

$$\text{Required spacing} = \frac{\text{Intensity of loading from table}}{\text{New intensity of loading}} \times \text{Computed spacing from table.}$$

SPACING OF CAMBRIA I-BEAMS FOR UNIFORM LOAD OF 100 LBS. PER SQUARE FOOT.

Proper distance in feet, center to center of Beams.
Maximum fibre stress 16 000 pounds per square inch.

Distance between supports in feet.	STANDARD I-BEAM. 24 Inch No. B 89.				
	80 lbs.	85 lbs.	90 lbs.	95 lbs.	100 lbs.
10	185.5	192.7	199.0	205.2	211.5
11	153.3	159.3	164.4	169.6	174.8
12	128.8	133.8	138.2	142.5	146.9
13	109.8	114.0	117.7	121.4	125.2
14	94.7	98.3	101.5	104.7	107.9
15	82.5	85.6	88.4	91.2	94.0
16	72.5	75.3	77.7	80.2	82.6
17	64.2	66.7	68.8	71.0	73.2
18	57.3	59.5	61.4	63.3	65.3
19	51.4	53.4	55.1	56.9	58.6
20	46.4	48.2	49.7	51.3	52.9
21	42.1	43.7	45.1	46.5	48.0
22	38.3	39.8	41.1	42.4	43.7
23	35.1	36.4	37.6	38.8	40.0
24	32.2	33.5	34.5	35.6	36.7
25	29.7	30.8	31.8	32.8	33.8
26	27.4	28.5	29.4	30.4	31.3
27	25.5	26.4	27.3	28.2	29.0
28	23.7	24.6	25.4	26.2	27.0
29	22.1	22.9	23.7	24.4	25.2
30	20.6	21.4	22.1	22.8	23.5
31	19.3	20.1	20.7	21.4	22.0
32	18.1	18.8	19.4	20.0	20.7
33	17.0	17.7	18.3	18.8	19.4
34	16.0	16.7	17.2	17.8	18.3
35	15.1	15.7	16.2	16.8	17.3
36	14.3	14.9	15.4	15.8	16.3

For spacings above the dotted lines the safe loads for bending are greater than the safe loads for web crippling, as explained and shown on pages 66 to 68 inclusive.

Spacings for other intensities of loading may be obtained from those in tables as follows:

$$\text{Required spacing} = \frac{\text{Intensity of loading from table}}{\text{New intensity of loading}} \times \text{Computed spacing from table.}$$

MAXIMUM BENDING MOMENTS IN FOOT POUNDS FOR CAMBRIA I-BEAMS.

Section Number.	Depth of Beam.	Weight per Foot.	Maximum Bending Moment. Foot Pounds. Fibre Stress 16 000 lbs. per Sq. In.	Maximum Bending Moment. Foot Pounds. Fibre Stress 12 500 lbs. per Sq. In.
	Inches.	Pounds.		
B 5	3	5.5	2270	1770
"	"	6.5	2400	1880
"	"	7.5	2530	1980
B 9	4	7.5	4000	3130
"	"	8.5	4270	3330
"	"	9.5	4530	3540
"	"	10.5	4800	3750
B 13	5	9.75	6400	5000
"	"	12.25	7200	5630
"	"	14.75	8130	6350
B 17	6	12.25	9730	7600
"	"	14.75	10670	8330
"	"	17.25	11600	9060
B 21	7	15	13870	10830
"	"	17.5	14930	11670
"	"	20	16130	12600
B 25	8	18	18930	14790
"	"	20.25	20000	15630
"	"	22.75	21330	16670
"	"	25.25	22670	17710
B 29	9	21	25200	19690
"	"	25	27200	21250
"	"	30	30130	23540
"	"	35	33070	25830
B 33	10	25	32530	25420
"	"	30	35730	27920
"	"	35	39070	30520
"	"	40	42270	33020
B 41	12	31.5	48000	37500
"	"	35	50670	39580
"	"	40	54670	42710
B105	12	40	59730	46670
"	"	45	63470	49580
B105	12	50	67470	52710
"	"	55	71330	55730
B 53	15	42	78530	61350
"	"	45	81070	63330
"	"	50	86000	67190
"	"	55	90800	70940
"	"	60	95730	74790
B109	15	60	108270	84580
"	"	65	113070	88330
"	"	70	118000	92190
"	"	75	122930	96040
"	"	80	127730	99790
B113	15	80	140270	109580
"	"	85	145070	113330
"	"	90	150000	117190
"	"	95	154800	120940
"	"	100	159730	124790
B 65	18	55	117870	92080
"	"	60	124670	97400
"	"	65	130530	101980
"	"	70	136530	106670
B 73	20	65	156000	121880
"	"	70	162670	127080
"	"	75	169200	132190
B121	20	80	195470	152710
"	"	85	201200	157190
"	"	90	207730	162290
"	"	95	214270	167400
"	"	100	220800	172500
B 89	24	80	231870	181150
"	"	85	240930	188230
"	"	90	248670	194270
"	"	95	256530	200420
"	"	100	264400	206560

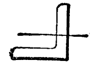
MAXIMUM BENDING MOMENTS IN FOOT POUNDS FOR CAMBRIA CHANNELS.

Section Number.	Depth of Channel.	Weight per Foot.	Maximum Bending Moment. Foot Pounds.	
			Fibre Stress 16 000 lbs. per Sq. In.	Fibre Stress 12 500 lbs. per Sq. In.
	Inches.	Pounds.		
C 5	3	4	1470	1150
“	“	5	1600	1250
“	“	6	1870	1460
C 9	4	5.25	2530	1980
“	“	6.25	2800	2190
“	“	7.25	3070	2400
C13	5	6.5	4000	3130
“	“	9	4670	3650
“	“	11.5	5600	4380
C17	6	8	5730	4480
“	“	10.5	6670	5210
“	“	13	7730	6040
“	“	15.5	8670	6770
C21	7	9.75	8000	6250
“	“	12.25	9200	7190
“	“	14.75	10400	8130
“	“	17.25	11470	8960
“	“	19.75	12670	9900
C25	8	11.25	10800	8440
“	“	13.75	12000	9380
“	“	16.25	13330	10420
C25	8	18.75	14670	11460
“	“	21.25	15870	12400
C29	9	13.25	14000	10940
“	“	15	15070	11770
“	“	20	18000	14060
“	“	25	20930	16350
C33	10	15	17870	13960
“	“	20	20930	16350
“	“	25	24270	18960
“	“	30	27470	21460
“	“	35	30800	24060
C41	12	20.5	28530	22290
“	“	25	32000	25000
“	“	30	35870	28020
“	“	35	39870	31150
“	“	40	43730	34170
C53	15	33	55600	43440
“	“	35	56930	44480
“	“	40	61730	48230
“	“	45	66670	52080
“	“	50	71600	55940
“	“	55	76530	59790

SAFE LOADS IN POUNDS UNIFORMLY DISTRIBUTED FOR CAMBRIA ANGLES.

EQUAL LEGS.

NEUTRAL AXIS PARALLEL TO EITHER LEG.



Safe loads below are figured for fibre stress of 16000 pounds per square inch and include weight of angle.

Section No. A 11.

$1\frac{1}{2}'' \times 1\frac{1}{2}''$

Distance between supports in feet.	$\frac{1}{8}''$ 1.3 lbs. per ft.	$\frac{3}{16}''$ 1.8 lbs. per ft.	$\frac{1}{4}''$ 2.4 lbs. per ft.	$\frac{5}{16}''$ 2.9 lbs. per ft.	$\frac{3}{8}''$ 3.4 lbs. per ft.	$\frac{7}{16}''$ 3.9 lbs. per ft.
2	390	560	720	860	1010	1140
3	260	370	480	580	670	760
4	190	280	360	430	500	570
5	150	220	290	350	400	460
6	130	190	240	290	340	380
7	110	160	200	250	290	330
8	100	140	180	220	250	290
9	90	120	160	190	220	250

Section No. A 13.

$1\frac{3}{4}'' \times 1\frac{3}{4}''$

Distance between supports in feet.	$\frac{3}{16}''$ 2.2 lbs. per ft.	$\frac{1}{4}''$ 2.8 lbs. per ft.	$\frac{5}{16}''$ 3.4 lbs. per ft.	$\frac{3}{8}''$ 4.0 lbs. per ft.	$\frac{7}{16}''$ 4.6 lbs. per ft.	$\frac{1}{2}''$ 5.1 lbs. per ft.
2	770	990	1200	1400	1600	1780
3	510	660	800	940	1060	1190
4	380	500	600	700	800	890
5	310	400	480	560	640	710
6	260	330	400	470	530	590
7	220	280	340	400	460	510
8	190	250	300	350	400	450
9	170	220	270	310	350	400
10	150	200	240	280	320	360

Section No. A 15.

$2'' \times 2''$

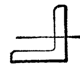
Distance between supports in feet.	$\frac{3}{16}''$ 2.5 lbs. per ft.	$\frac{1}{4}''$ 3.2 lbs. per ft.	$\frac{5}{16}''$ 4.0 lbs. per ft.	$\frac{3}{8}''$ 4.7 lbs. per ft.	$\frac{7}{16}''$ 5.3 lbs. per ft.	$\frac{1}{2}''$ 6.0 lbs. per ft.
2	1020	1320	1600	1870	2130	2380
3	680	880	1070	1250	1420	1590
4	510	660	800	940	1070	1190
5	410	530	640	750	850	950
6	340	440	530	620	710	790
7	290	380	460	540	610	680
8	250	330	400	470	530	600
9	230	290	360	420	470	530
10	200	260	320	370	430	480

For safe loads below heavy lines the deflections will be greater than the allowable limit for plastered ceilings = $\frac{1}{360}$ span.

SAFE LOADS IN POUNDS UNIFORMLY DISTRIBUTED FOR CAMBRIA ANGLES.

EQUAL LEGS.

NEUTRAL AXIS PARALLEL TO EITHER LEG.



Safe loads below are figured for fibre stress of 16 000 pounds per square inch and include weight of angle.

Distance between supports in feet.	Section No. A 41. $2\frac{1}{4}'' \times 2\frac{1}{4}''$				
	$\frac{3}{16}''$	$\frac{1}{4}''$	$\frac{5}{16}''$	$\frac{3}{8}''$	$\frac{7}{16}''$
	2.8 lbs. per ft.	3.7 lbs. per ft.	4.5 lbs. per ft.	5.3 lbs. per ft.	6.1 lbs. per ft.
2	1300	1690	2060	2410	2750
3	870	1120	1370	1610	1830
4	650	840	1030	1210	1380
5	520	670	820	960	1100
6	430	560	690	800	920
7	370	480	590	690	790
8	320	420	510	600	690
9	290	380	460	540	610
10	260	340	410	480	550
11	240	310	370	440	500
12	220	280	340	400	460

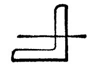
Distance between supports in feet.	Section No. A 17. $2\frac{1}{2}'' \times 2\frac{1}{2}''$						
	$\frac{3}{16}''$	$\frac{1}{4}''$	$\frac{5}{16}''$	$\frac{3}{8}''$	$\frac{7}{16}''$	$\frac{1}{2}''$	$\frac{9}{16}''$
	3.1 lbs. per ft.	4.1 lbs. per ft.	5.0 lbs. per ft.	5.9 lbs. per ft.	6.8 lbs. per ft.	7.7 lbs. per ft.	8.5 lbs. per ft.
2	1610	2100	2570	3020	3450	3860	4260
3	1080	1400	1710	2010	2300	2580	2840
4	810	1050	1290	1510	1720	1930	2130
5	650	840	1030	1210	1380	1550	1710
6	540	700	860	1010	1150	1290	1420
7	460	600	730	860	990	1100	1220
8	400	530	640	760	860	970	1070
9	360	470	570	670	770	860	950
10	320	420	510	600	690	770	850
11	290	380	470	550	630	700	780
12	270	350	430	500	580	640	710

For safe loads below heavy lines the deflections will be greater than the allowable limit for plastered ceilings = $\frac{1}{360}$ span.

SAFE LOADS IN POUNDS UNIFORMLY DISTRIBUTED FOR CAMBRIA ANGLES.

EQUAL LEGS.

NEUTRAL AXIS PARALLEL TO EITHER LEG.



Safe loads below are figured for fibre stress of 16 000 pounds per square inch and include weight of angle.

Distance between supports in feet.	Section No. A 43. $2\frac{3}{4}'' \times 2\frac{3}{4}''$					
	$\frac{3}{16}''$ 3.4 lbs. per ft.	$\frac{1}{4}''$ 4.5 lbs. per ft.	$\frac{5}{16}''$ 5.6 lbs. per ft.	$\frac{3}{8}''$ 6.6 lbs. per ft.	$\frac{7}{16}''$ 7.6 lbs. per ft.	$\frac{1}{2}''$ 8.5 lbs. per ft.
2	1970	2570	3140	3700	4230	4740
3	1310	1710	2090	2460	2820	3160
4	980	1280	1570	1850	2110	2370
5	790	1030	1260	1480	1690	1900
6	660	860	1050	1230	1410	1580
7	560	730	900	1060	1210	1360
8	490	640	790	920	1060	1190
9	440	570	700	820	940	1050
10	390	510	630	740	850	950
11	360	470	570	670	770	860
12	330	430	520	620	710	790

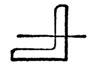
Distance between supports in feet.	Section No. A 19. $3'' \times 3''$							
	$\frac{1}{4}''$ 4.9 lbs. per ft.	$\frac{5}{16}''$ 6.1 lbs. per ft.	$\frac{3}{8}''$ 7.2 lbs. per ft.	$\frac{7}{16}''$ 8.3 lbs. per ft.	$\frac{1}{2}''$ 9.4 lbs. per ft.	$\frac{9}{16}''$ 10.4 lbs. per ft.	$\frac{5}{8}''$ 11.5 lbs. per ft.	$\frac{11}{16}''$ 12.5 lbs. per ft.
2	3080	3770	4440	5090	5720	6320	6910	7480
3	2050	2510	2960	3390	3810	4210	4610	4990
4	1540	1890	2220	2540	2860	3160	3450	3740
5	1230	1510	1780	2040	2290	2530	2760	2990
6	1030	1260	1480	1700	1910	2110	2300	2490
7	880	1080	1270	1450	1630	1810	1970	2140
8	770	940	1110	1270	1430	1580	1730	1870
9	680	840	990	1130	1270	1410	1540	1660
10	620	750	890	1020	1140	1260	1380	1500
11	560	690	810	930	1040	1150	1260	1360
12	510	630	740	850	950	1050	1150	1250

For safe loads below heavy lines the deflections will be greater than the allowable limit for plastered ceilings = $\frac{1}{360}$ span.

SAFE LOADS IN POUNDS UNIFORMLY DISTRIBUTED FOR CAMBRIA ANGLES.

EQUAL LEGS.

NEUTRAL AXIS PARALLEL TO EITHER LEG.



Safe loads below are figured for fibre stress of 16 000 pounds per square inch and include weight of angle.

Section No. A 21.

Distance between supports in feet.	3½″ x 3½″									
	5/16″	3/8″	7/16″	1/2″	9/16″	5/8″	11/16″	3/4″	13/16″	7/8″
	7.2 lbs. per ft.	**8.5** lbs. per ft.	**9.8** lbs. per ft.	**11.1** lbs. per ft.	**12.4** lbs. per ft.	**13.6** lbs. per ft.	**14.8** lbs. per ft.	**16.0** lbs. per ft.	**17.1** lbs. per ft.	**18.3** lbs. per ft.
2	5200	6140	7050	7940	8800	9630	10440	11230	12010	12760
3	3470	4100	4700	5290	5860	6420	6960	7490	8000	8510
4	2600	3070	3530	3970	4400	4810	5220	5620	6000	6380
5	2080	2460	2820	3180	3520	3850	4180	4490	4800	5110
6	1730	2050	2350	2650	2930	3210	3480	3740	4000	4250
7	1490	1760	2020	2270	2510	2750	2980	3210	3430	3650
8	1300	1540	1760	1980	2200	2410	2610	2810	3000	3190
9	1160	1370	1570	1760	1950	2140	2320	2500	2670	2840
10	1040	1230	1410	1590	1760	1930	2090	2250	2400	2550
11	950	1120	1280	1440	1600	1750	1900	2040	2180	2320
12	870	1020	1180	1320	1470	1600	1740	1870	2000	2130
13	800	950	1090	1220	1350	1480	1610	1730	1850	1960
14	740	880	1010	1130	1260	1380	1490	1610	1720	1820
15	690	820	940	1060	1170	1280	1390	1500	1600	1700
16	650	770	880	990	1100	1200	1310	1400	1500	1600

Section No. A 23.

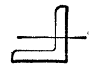
Distance between supports in feet.	4″ x 4″									
	5/16″	3/8″	7/16″	1/2″	9/16″	5/8″	11/16″	3/4″	13/16″	7/8″
	8.2 lbs. per ft.	**9.8** lbs. per ft.	**11.3** lbs. per ft.	**12.8** lbs. per ft.	**14.3** lbs. per ft.	**15.7** lbs. per ft.	**17.1** lbs. per ft.	**18.5** lbs. per ft.	**19.9** lbs. per ft.	**21.2** lbs. per ft.
2	6870	8120	9340	10530	11690	12810	13910	14980	16030	17060
3	4580	5420	6230	7020	7790	8540	9270	9990	10690	11370
4	3430	4060	4670	5270	5840	6410	6960	7490	8020	8530
5	2750	3250	3740	4210	4670	5130	5560	5990	6410	6820
6	2290	2710	3120	3510	3900	4270	4640	4990	5340	5690
7	1960	2320	2670	3010	3340	3660	3970	4280	4580	4870
8	1720	2030	2340	2630	2920	3200	3480	3740	4010	4260
9	1530	1810	2080	2340	2600	2850	3090	3330	3560	3790
10	1370	1620	1870	2110	2340	2560	2780	3000	3210	3410
11	1250	1480	1700	1910	2130	2330	2530	2720	2910	3100
12	1140	1350	1560	1760	1950	2140	2320	2500	2670	2840
13	1060	1250	1440	1620	1800	1970	2140	2300	2470	2620
14	980	1160	1340	1500	1670	1830	1990	2140	2290	2440
15	920	1080	1250	1400	1560	1710	1860	2000	2140	2270
16	860	1020	1170	1320	1460	1600	1740	1870	2000	2130

For safe loads below heavy lines the deflections will be greater than the allowable limit for plastered ceilings = $\frac{1}{360}$ span.

SAFE LOADS IN POUNDS UNIFORMLY DISTRIBUTED FOR CAMBRIA ANGLES.

EQUAL LEGS.

NEUTRAL AXIS PARALLEL TO EITHER LEG.



Safe loads below are figured for fibre stress of 16 000 pounds per square inch and include weight of angle.

Section No. A 45. $4\frac{1}{2}'' \times 4\frac{1}{2}''$

Distance between supports in feet.	$\frac{5}{16}''$ 9.3 lbs. per ft.	$\frac{3}{8}''$ 11.0 lbs. per ft.	$\frac{7}{16}''$ 12.8 lbs. per ft.	$\frac{1}{2}''$ 14.5 lbs. per ft.	$\frac{9}{16}''$ 16.2 lbs. per ft.	$\frac{5}{8}''$ 17.8 lbs. per ft.	$\frac{11}{16}''$ 19.5 lbs. per ft.
2	8760	10380	11960	13490	14990	16460	17890
3	5840	6920	7970	9000	10000	10970	11930
4	4380	5190	5980	6750	7500	8230	8950
5	3510	4150	4780	5400	6000	6580	7160
6	2920	3460	3990	4500	5000	5490	5960
7	2500	2970	3420	3860	4280	4700	5110
8	2190	2600	2990	3370	3750	4120	4470
9	1950	2310	2660	3000	3330	3660	3980
10	1750	2080	2390	2700	3000	3290	3580
11	1590	1890	2170	2450	2730	2990	3250
12	1460	1730	1990	2250	2500	2740	2980
13	1350	1600	1840	2080	2310	2530	2750
14	1250	1480	1710	1930	2140	2350	2560
15	1170	1380	1590	1800	2000	2190	2390
16	1100	1300	1490	1690	1870	2060	2240
17	1030	1220	1410	1590	1760	1940	2110
18	970	1150	1330	1500	1670	1830	1990

Section No. A 47. $5'' \times 5''$

Distance between supports in feet.	$\frac{3}{8}''$ 12.3 lbs. per ft.	$\frac{7}{16}''$ 14.3 lbs. per ft.	$\frac{1}{2}''$ 16.2 lbs. per ft.	$\frac{9}{16}''$ 18.1 lbs. per ft.	$\frac{5}{8}''$ 20.0 lbs. per ft.	$\frac{11}{16}''$ 21.8 lbs. per ft.
2	12910	14900	16830	18720	20570	22380
3	8610	9930	11220	12480	13710	14920
4	6460	7450	8410	9360	10280	11190
5	5170	5960	6730	7490	8230	8950
6	4310	4960	5610	6240	6860	7460
7	3690	4260	4810	5350	5880	6390
8	3230	3720	4210	4680	5140	5600
9	2870	3310	3740	4160	4570	4970
10	2580	2980	3370	3740	4110	4480
11	2350	2710	3060	3400	3740	4070
12	2150	2480	2800	3120	3430	3730
13	1990	2290	2590	2880	3160	3440
14	1850	2130	2400	2670	2940	3200
15	1720	1990	2240	2500	2740	2980
16	1610	1860	2100	2340	2570	2800
17	1520	1750	1980	2200	2420	2630
18	1440	1660	1870	2080	2290	2490

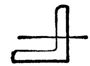
For safe loads below heavy lines the deflections will be greater than the allowable limit for plastered ceilings $= \frac{1}{360}$ span.

SAFE LOADS IN POUNDS UNIFORMLY DISTRIBUTED FOR CAMBRIA ANGLES.

EQUAL LEGS.

[NEUTRAL AXIS PARALLEL TO EITHER LEG.

Safe loads below are figured for fibre stress of 16 000 pounds per square inch and include weight of angle.



Section No. A 27.

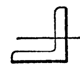
Distance between supports in feet.	6″ x 6″										
	$\frac{3}{8}$″	$\frac{7}{16}$″	$\frac{1}{2}$″	$\frac{9}{16}$″	$\frac{5}{8}$″	$\frac{11}{16}$″	$\frac{3}{4}$″	$\frac{13}{16}$″	$\frac{7}{8}$″	$\frac{15}{16}$″	1″
	14.9 lbs. per ft.	**17.2** lbs. per ft.	**19.6** lbs. per ft.	**21.9** lbs. per ft.	**24.2** lbs. per ft.	**26.5** lbs. per ft.	**28.7** lbs. per ft.	**31.0** lbs. per ft.	**33.1** lbs. per ft.	**35.3** lbs. per ft.	**37.4** lbs. per ft.
2	18820	21720	24610	27420	30170	32880	35540	38150	40720	43240	45720
3	12550	14480	16400	18280	20120	21920	23690	25430	27150	28830	30480
4	9410	10860	12300	13710	15090	16440	17770	19080	20360	21620	22860
5	7530	8690	9840	10970	12070	13150	14220	15260	16290	17300	18290
6	6270	7240	8200	9140	10060	10960	11850	12720	13570	14410	15240
7	5380	6210	7030	7830	8620	9390	10150	10900	11630	12360	13060
8	4700	5430	6150	6850	7540	8220	8890	9540	10180	10810	11430
9	4180	4830	5470	6090	6710	7310	7900	8480	9050	9610	10160
10	3760	4340	4920	5480	6030	6580	7110	7630	8140	8650	9140
11	3420	3950	4470	4990	5490	5980	6460	6940	7400	7860	8310
12	3140	3620	4100	4570	5030	5480	5920	6360	6790	7210	7620
13	2900	3340	3790	4220	4640	5060	5470	5870	6260	6650	7030
14	2690	3100	3520	3920	4310	4700	5080	5450	5820	6180	6530
15	2510	2900	3280	3660	4020	4380	4740	5090	5430	5770	6100
16	2350	2720	3080	3430	3770	4110	4440	4770	5090	5410	5720
17	2210	2560	2900	3230	3550	3870	4180	4490	4790	5090	5380
18	2090	2410	2730	3050	3350	3650	3950	4240	4520	4810	5080
19	1980	2290	2590	2890	3180	3460	3740	4020	4290	4550	4810
20	1880	2170	2460	2740	3020	3290	3550	3820	4070	4320	4570
21	1790	2070	2340	2610	2870	3130	3390	3630	3880	4120	4350
22	1710	1970	2240	2490	2740	2990	3230	3470	3700	3930	4160

For safe loads below heavy lines the deflections will be greater than the allowable limit for plastered ceilings = $\frac{1}{360}$ span.

SAFE LOADS IN POUNDS UNIFORMLY DISTRIBUTED FOR CAMBRIA ANGLES.

EQUAL LEGS.

NEUTRAL AXIS PARALLEL TO EITHER LEG.



Safe loads below are figured for fibre stress of 16 000 pounds per square inch and include weight of angle.

Section No. A 35.

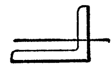
Distance between supports in feet.	8″ x 8″										
	$\frac{1}{2}''$	$\frac{9}{16}''$	$\frac{5}{8}''$	$\frac{11}{16}''$	$\frac{3}{4}''$	$\frac{13}{16}''$	$\frac{7}{8}''$	$\frac{15}{16}''$	1″	$1\frac{1}{16}''$	$1\frac{1}{8}''$
	26.4 lbs. per ft.	29.6 lbs. per ft.	32.7 lbs. per ft.	35.8 lbs. per ft.	38.9 lbs. per ft.	42.0 lbs. per ft.	45.0 lbs. per ft.	48.1 lbs. per ft.	51.0 lbs. per ft.	54.0 lbs. per ft.	56.9 lbs. per ft.
4	22310	24910	27470	30000	32490	34950	37370	39760	42120	44450	46750
5	17850	19920	21980	24000	25990	27960	29900	31810	33700	35560	37400
6	14880	16600	18310	20000	21660	23300	24920	26510	28080	29630	31160
7	12750	14230	15700	17140	18570	19970	21360	22720	24070	25400	26710
8	11160	12450	13740	15000	16250	17480	18690	19880	21060	22220	23370
9	9920	11070	12210	13330	14440	15530	16610	17670	18720	19760	20780
10	8930	9960	10990	12000	13000	13980	14950	15910	16850	17780	18700
11	8110	9060	9990	10910	11820	12710	13590	14460	15320	16160	17000
12	7440	8300	9160	10000	10830	11650	12460	13250	14040	14820	15580
13	6870	7660	8450	9230	10000	10750	11500	12240	12960	13680	14380
14	6380	7120	7850	8570	9280	9990	10680	11360	12030	12700	13360
15	5950	6640	7330	8000	8660	9320	9970	10600	11230	11850	12470
16	5580	6230	6870	7500	8120	8740	9340	9940	10530	11110	11690
17	5250	5860	6460	7060	7650	8220	8790	9360	9910	10460	11000
18	4960	5530	6100	6670	7220	7770	8310	8840	9360	9880	10390
19	4700	5240	5780	6320	6840	7360	7870	8370	8870	9360	9840
20	4460	4980	5490	6000	6500	6990	7470	7950	8420	8890	9350
21	4250	4740	5230	5710	6190	6660	7120	7570	8020	8470	8900
22	4060	4530	4990	5450	5910	6350	6800	7230	7660	8080	8500
23	3880	4330	4780	5220	5650	6080	6500	6920	7330	7730	8130
24	3720	4150	4580	5000	5420	5830	6230	6630	7020	7410	7790
25	3570	3980	4400	4800	5200	5590	5980	6360	6740	7110	7480
26	3430	3830	4230	4620	5000	5380	5750	6120	6480	6840	7190
27	3310	3690	4070	4440	4810	5180	5540	5890	6240	6590	6930
28	3190	3560	3920	4290	4640	4990	5340	5680	6020	6350	6680
29	3080	3440	3790	4140	4480	4820	5160	5480	5810	6130	6450
30	2980	3320	3660	4000	4330	4660	4980	5300	5620	5930	6230

For safe loads below heavy lines the deflections will be greater than the allowable limit for plastered ceilings $= \frac{1}{360}$ span.

SAFE LOADS IN POUNDS UNIFORMLY DISTRIBUTED FOR CAMBRIA ANGLES.

UNEQUAL LEGS.

NEUTRAL AXIS PARALLEL TO LONG LEG.



Safe loads below are figured for fibre stress of 16 000 pounds per square inch and include weight of angle.

Distance between supports in feet.	Section No. A 121. 2″ x 1⅜″					Section No. A 123. 2″ x 1½″					
	3/16″	1/4″	5/16″	3/8″	7/16″	1/8″	3/16″	1/4″	5/16″	3/8″	7/16″
	2.1 lbs. per ft.	2.7 lbs. per ft.	3.3 lbs. per ft.	3.9 lbs. per ft.	4.4 lbs. per ft.	1.5 lbs. per ft.	2.2 lbs. per ft.	2.8 lbs. per ft.	3.4 lbs. per ft.	4.0 lbs. per ft.	4.6 lbs. per ft.
2	510	620	760	880	1000	400	580	740	900	1050	1190
3	340	420	500	590	670	270	380	500	600	700	800
4	260	310	380	440	500	200	290	370	450	520	600
5	200	250	300	350	400	160	230	300	360	420	480
6	170	210	250	290	330	130	190	250	300	350	400
7	150	180	220	250	290	110	160	210	260	300	340
8	130	160	190	220	250	100	140	190	230	260	300

Distance between supports in feet.	Section No. A 125. 2½″ x 1¼″					Section No. A 127. 2½″ x 1½″				
	3/16″	1/4″	5/16″	3/8″	7/16″	3/16″	1/4″	5/16″	3/8″	7/16″
	2.3 lbs. per ft.	3.0 lbs. per ft.	3.7 lbs. per ft.	4.4 lbs. per ft.	5.0 lbs. per ft.	2.5 lbs. per ft.	3.2 lbs. per ft.	4.0 lbs. per ft.	4.7 lbs. per ft.	5.3 lbs. per ft.
2	440	530	640	750	860	590	760	930	1080	1230
3	290	350	430	500	570	390	510	620	720	820
4	220	260	320	380	430	300	380	460	540	620
5	170	210	260	300	340	240	300	370	430	490
6	150	180	210	250	290	200	250	310	360	410
7	120	150	180	210	250	170	220	260	310	350
8	110	130	160	190	210	150	190	230	270	310

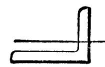
Distance between supports in feet.	No. A 149. 3¼″ x 2″	Section No. A 91. 2½″ x 2″						
	3/8″	3/16″	1/4″	5/16″	3/8″	7/16″	1/2″	9/16″
	6.2 lbs. per ft.	2.8 lbs. per ft.	3.7 lbs. per ft.	4.5 lbs. per ft.	5.3 lbs. per ft.	6.1 lbs. per ft.	6.8 lbs. per ft.	7.6 lbs. per ft.
2	2000	1050	1360	1650	1930	2200	2460	2720
3	1330	700	900	1100	1290	1470	1640	1810
4	1000	520	680	830	970	1100	1230	1360
5	800	420	540	660	770	880	990	1090
6	670	350	450	550	640	730	820	910
7	570	300	390	470	550	630	700	780
8	500	260	340	410	480	550	620	680

For safe loads below heavy lines the deflections will be greater than the allowable limit for plastered ceilings = $\frac{1}{360}$ span.

SAFE LOADS IN POUNDS UNIFORMLY DISTRIBUTED FOR CAMBRIA ANGLES.

UNEQUAL LEGS.

NEUTRAL AXIS PARALLEL TO LONG LEG.



Safe loads below are figured for fibre stress of 16 000 pounds per square inch and include weight of angle.

Distance between supports in feet.	Section No. A 128. $2\frac{3}{4}''$ x $1\frac{1}{2}''$					Section No. A 129. $3''$ x $2''$					
	$\frac{3}{16}''$	$\frac{1}{4}''$	$\frac{5}{16}''$	$\frac{3}{8}''$	$\frac{7}{16}''$	$\frac{3}{16}''$	$\frac{1}{4}''$	$\frac{5}{16}''$	$\frac{3}{8}''$	$\frac{7}{16}''$	$\frac{1}{2}''$
	2.6 lbs. per ft.	**3.4** lbs. per ft.	**4.2** lbs. per ft.	**5.0** lbs. per ft.	**5.7** lbs. per ft.	**3.1** lbs. per ft.	**4.1** lbs. per ft.	**5.0** lbs. per ft.	**5.9** lbs. per ft.	**6.8** lbs. per ft.	**7.7** lbs. per ft.
2	600	770	940	1100	1250	1070	1390	1690	1980	2260	2530
3	400	520	620	730	830	710	920	1120	1320	1510	1690
4	300	390	470	550	630	530	690	840	990	1130	1260
5	240	310	370	440	500	430	550	670	790	900	1010
6	200	260	310	370	420	360	460	560	660	750	840
7	170	220	270	310	360	310	400	480	570	650	720
8	150	190	230	270	310	270	350	420	500	560	630
9	130	170	210	240	280	240	310	370	440	500	560
10	120	150	190	220	250	210	280	340	400	450	510
11	110	140	170	200	230	190	250	310	360	410	460
12	100	130	160	180	210	180	230	280	330	380	420

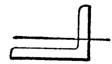
Distance between supports in feet.	Section No. A 93. $3''$ x $2\frac{1}{2}''$						
	$\frac{1}{4}''$	$\frac{5}{16}''$	$\frac{3}{8}''$	$\frac{7}{16}''$	$\frac{1}{2}''$	$\frac{9}{16}''$	$\frac{5}{8}''$
	4.5 lbs. per ft.	**5.6** lbs. per ft.	**6.6** lbs. per ft.	**7.6** lbs. per ft.	**8.5** lbs. per ft.	**9.5** lbs. per ft.	**10.4** lbs. per ft.
2	2160	2640	3100	3540	3970	4380	4780
3	1440	1760	2060	2360	2650	2920	3190
4	1080	1320	1550	1770	1980	2190	2390
5	860	1050	1240	1420	1590	1750	1910
6	720	880	1030	1180	1320	1460	1590
7	620	750	880	1010	1130	1250	1370
8	540	660	770	890	990	1100	1200
9	480	590	690	790	880	970	1060
10	430	530	620	710	790	880	960
11	390	480	560	640	720	800	870
12	360	440	520	590	660	730	800

For safe loads below heavy lines the deflections will be greater than the allowable limit for plastered ceilings $= \frac{1}{360}$ span.

SAFE LOADS IN POUNDS UNIFORMLY DISTRIBUTED FOR CAMBRIA ANGLES.

UNEQUAL LEGS.

NEUTRAL AXIS PARALLEL TO LONG LEG.



Safe loads below are figured for fibre stress of 16 000 pounds per square inch and include weight of angle.

Distance between supports in feet.	Section No. A 151.						
	$3\frac{1}{2}'' \times 2''$						
	$\frac{1}{4}''$	$\frac{5}{16}''$	$\frac{3}{8}''$	$\frac{7}{16}''$	$\frac{1}{2}''$	$\frac{9}{16}''$	$\frac{5}{8}''$
	4.5 lbs. per ft.	5.6 lbs. per ft.	6.6 lbs. per ft.	7.6 lbs. per ft.	8.5 lbs. per ft.	9.5 lbs. per ft.	10.4 lbs. per ft.
2	1410	1720	2020	2300	2580	2860	3130
3	940	1150	1340	1540	1720	1900	2080
4	710	860	1010	1150	1290	1430	1560
5	560	690	810	920	1030	1140	1250
6	470	570	670	770	860	950	1040
7	400	490	580	660	740	820	890
8	350	430	500	580	650	710	780
9	310	380	450	510	570	630	690
10	280	340	400	460	520	570	630
11	260	310	370	420	470	520	570
12	240	290	340	380	430	480	520

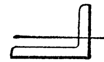
Distance between supports in feet.	Section No. A 95.								
	$3\frac{1}{2}'' \times 2\frac{1}{2}''$								
	$\frac{1}{4}''$	$\frac{5}{16}''$	$\frac{3}{8}''$	$\frac{7}{16}''$	$\frac{1}{2}''$	$\frac{9}{16}''$	$\frac{5}{8}''$	$\frac{11}{16}''$	$\frac{3}{4}''$
	4.9 lbs. per ft.	6.1 lbs. per ft.	7.2 lbs. per ft.	8.3 lbs. per ft.	9.4 lbs. per ft.	10.4 lbs. per ft.	11.5 lbs. per ft.	12.5 lbs. per ft.	13.4 lbs. per ft.
2	2200	2690	3160	3610	4050	4480	4890	5300	5700
3	1460	1790	2110	2410	2700	2990	3260	3530	3800
4	1100	1340	1580	1810	2030	2240	2450	2650	2850
5	880	1080	1260	1450	1620	1790	1960	2120	2280
6	730	900	1050	1200	1350	1490	1630	1770	1900
7	630	770	900	1030	1160	1280	1400	1510	1630
8	550	670	790	900	1010	1120	1220	1320	1420
9	490	600	700	800	900	1000	1090	1180	1270
10	440	540	630	720	810	900	980	1060	1140
11	400	490	570	660	740	810	890	960	1040
12	370	450	530	600	680	750	820	880	950

For safe loads below heavy lines the deflections will be greater than the allowable limit for plastered ceilings = $\frac{1}{360}$ span.

SAFE LOADS IN POUNDS UNIFORMLY DISTRIBUTED FOR CAMBRIA ANGLES.

UNEQUAL LEGS.

NEUTRAL AXIS PARALLEL TO LONG LEG.



Safe loads below are figured for fibre stress of 16 000 pounds per square inch and include weight of angle.

Section No. A 97.

Distance between supports in feet.	$3\frac{1}{2}'' \times 3''$									
	$\frac{5}{16}''$	$\frac{3}{8}''$	$\frac{7}{16}''$	$\frac{1}{2}''$	$\frac{9}{16}''$	$\frac{5}{8}''$	$\frac{11}{16}''$	$\frac{3}{4}''$	$\frac{13}{16}''$	$\frac{7}{8}''$
	6.6 lbs. per ft.	7.9 lbs. per ft.	9.1 lbs. per ft.	10.2 lbs. per ft.	11.4 lbs. per ft.	12.5 lbs. per ft.	13.6 lbs. per ft.	14.7 lbs. per ft.	15.8 lbs. per ft.	16.8 lbs. per ft.
2	3850	4540	5200	5840	6460	7070	7660	8230	8790	9350
3	2570	3030	3470	3900	4310	4710	5110	5490	5860	6230
4	1930	2270	2600	2920	3230	3530	3830	4120	4400	4670
5	1540	1820	2080	2340	2590	2830	3060	3290	3520	3740
6	1280	1510	1730	1950	2150	2360	2550	2740	2930	3120
7	1100	1300	1490	1670	1850	2020	2190	2350	2510	2670
8	960	1130	1300	1460	1620	1770	1910	2060	2200	2340
9	860	1010	1160	1300	1440	1570	1700	1830	1950	2080
10	770	910	1040	1170	1290	1410	1530	1650	1760	1870
11	700	830	950	1060	1180	1290	1390	1500	1600	1700
12	640	760	870	970	1080	1180	1280	1370	1470	1560
13	590	700	800	900	990	1090	1180	1270	1350	1440
14	550	650	740	830	920	1010	1090	1180	1260	1340

Section No. A 99.

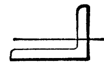
Distance between supports in feet.	$4'' \times 3''$									
	$\frac{5}{16}''$	$\frac{3}{8}''$	$\frac{7}{16}''$	$\frac{1}{2}''$	$\frac{9}{16}''$	$\frac{5}{8}''$	$\frac{11}{16}''$	$\frac{3}{4}''$	$\frac{13}{16}''$	$\frac{7}{8}''$
	7.2 lbs. per ft.	8.5 lbs. per ft.	9.8 lbs. per ft.	11.1 lbs. per ft.	12.4 lbs. per ft.	13.6 lbs. per ft.	14.8 lbs. per ft.	16.0 lbs. per ft.	17.1 lbs. per ft.	18.3 lbs. per ft.
2	3920	4620	5290	5950	6580	7200	7810	8400	8980	9550
3	2610	3080	3530	3960	4390	4800	5200	5600	5980	6360
4	1960	2310	2650	2970	3290	3600	3900	4200	4490	4770
5	1570	1850	2120	2380	2630	2880	3120	3360	3590	3820
6	1310	1540	1760	1980	2190	2400	2600	2800	2990	3180
7	1120	1320	1510	1700	1880	2060	2230	2400	2560	2730
8	980	1150	1320	1490	1650	1800	1950	2100	2240	2390
9	870	1030	1180	1320	1460	1600	1730	1870	1990	2120
10	780	920	1060	1190	1320	1440	1560	1680	1800	1910
11	710	840	960	1080	1200	1310	1420	1530	1630	1740
12	650	770	880	990	1100	1200	1300	1400	1500	1590
13	600	710	810	910	1010	1110	1200	1290	1380	1470
14	560	660	760	850	940	1030	1120	1200	1280	1360

For safe loads below heavy lines the deflections will be greater than the allowable limit for plastered ceilings $= \frac{1}{360}$ span.

SAFE LOADS IN POUNDS UNIFORMLY DISTRIBUTED FOR CAMBRIA ANGLES.

UNEQUAL LEGS.

NEUTRAL AXIS PARALLEL TO LONG LEG.



Safe loads below are figured for fibre stress of 16 000 pounds per square inch and include weight of angle.

Section No. A 131.

4″ x 3½″

Distance between supports in feet.	5/16″ 7.7 lbs. per ft.	3/8″ 9.1 lbs. per ft.	7/16″ 10.6 lbs. per ft.	1/2″ 11.9 lbs. per ft.	9/16″ 13.3 lbs. per ft.	5/8″ 14.7 lbs. per ft.	11/16″ 16.0 lbs. per ft.
2	5300	6260	7190	8090	8970	9760	10650
3	3530	4170	4790	5390	5980	6510	7100
4	2650	3130	3590	4040	4480	4880	5320
5	2120	2500	2870	3240	3590	3900	4260
6	1770	2090	2400	2700	2990	3250	3550
7	1510	1790	2050	2310	2560	2790	3040
8	1320	1560	1800	2020	2240	2440	2660
9	1180	1390	1600	1800	1990	2170	2370
10	1060	1250	1440	1620	1790	1950	2130
11	960	1140	1310	1470	1630	1770	1940
12	880	1040	1200	1350	1490	1630	1770
13	820	960	1110	1240	1380	1500	1640
14	760	890	1030	1160	1280	1390	1520

Section No. A 133.

4½″ x 3″

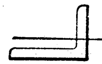
Distance between supports in feet.	3/8″ 9.1 lbs. per ft.	7/16″ 10.6 lbs. per ft.	1/2″ 11.9 lbs. per ft.	9/16″ 13.3 lbs. per ft.	5/8″ 14.7 lbs. per ft.	11/16″ 16.0 lbs. per ft.
2	4680	5370	6040	6680	7320	7930
3	3120	3580	4020	4460	4880	5290
4	2340	2680	3020	3340	3660	3970
5	1870	2150	2410	2670	2930	3170
6	1560	1790	2010	2230	2440	2640
7	1340	1530	1720	1910	2090	2270
8	1170	1340	1510	1670	1830	1980
9	1040	1190	1340	1490	1630	1760
10	940	1070	1210	1340	1460	1590
11	850	980	1100	1220	1330	1440
12	780	890	1010	1110	1220	1320
13	720	830	930	1030	1130	1220
14	670	770	860	950	1050	1130

For safe loads below heavy lines the deflections will be greater than the allowable limit for plastered ceilings = $\frac{1}{360}$ span.

SAFE LOADS IN POUNDS UNIFORMLY DISTRIBUTED FOR CAMBRIA ANGLES.

UNEQUAL LEGS.

NEUTRAL AXIS PARALLEL TO LONG LEG.



Safe loads below are figured for fibre stress of 16 000 pounds per square inch and include weight of angle.

Section No. A 101.

Distance between supports in feet.	5″ x 3″									
	$\frac{5}{16}''$	$\frac{3}{8}''$	$\frac{7}{16}''$	$\frac{1}{2}''$	$\frac{9}{16}''$	$\frac{5}{8}''$	$\frac{11}{16}''$	$\frac{3}{4}''$	$\frac{13}{16}''$	$\frac{7}{8}''$
	8.2 lbs. per ft.	9.8 lbs. per ft.	11.3 lbs. per ft.	12.8 lbs. per ft.	14.3 lbs. per ft.	15.7 lbs. per ft.	17.1 lbs. per ft.	18.5 lbs. per ft.	19.9 lbs. per ft.	21.2 lbs. per ft.
2	4020	4740	5430	6110	6770	7410	8040	8660	9270	9870
3	2680	3160	3620	4070	4510	4940	5360	5770	6180	6580
4	2010	2370	2720	3060	3380	3710	4020	4330	4630	4940
5	1610	1900	2170	2440	2710	2960	3220	3460	3710	3950
6	1340	1580	1810	2040	2260	2470	2680	2890	3090	3290
7	1150	1350	1550	1750	1930	2120	2300	2470	2650	2820
8	1000	1180	1360	1530	1690	1850	2010	2160	2320	2470
9	890	1050	1210	1360	1500	1650	1790	1920	2060	2190
10	800	950	1090	1220	1350	1480	1610	1730	1850	1970
11	730	860	990	1110	1230	1350	1460	1570	1690	1790
12	670	790	910	1020	1130	1240	1340	1440	1540	1650
13	620	730	840	940	1040	1140	1240	1330	1430	1520
14	570	680	780	870	970	1060	1150	1240	1320	1410

Section No. A 103.

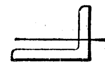
Distance between supports in feet.	5″ x $3\frac{1}{2}''$										
	$\frac{5}{16}''$	$\frac{3}{8}''$	$\frac{7}{16}''$	$\frac{1}{2}''$	$\frac{9}{16}''$	$\frac{5}{8}''$	$\frac{11}{16}''$	$\frac{3}{4}''$	$\frac{13}{16}''$	$\frac{7}{8}''$	$\frac{15}{16}''$
	8.7 lbs. per ft.	10.4 lbs. per ft.	12.0 lbs. per ft.	13.6 lbs. per ft.	15.2 lbs. per ft.	16.8 lbs. per ft.	18.3 lbs. per ft.	19.8 lbs. per ft.	21.3 lbs. per ft.	22.7 lbs. per ft.	24.2 lbs. per ft.
2	5450	6430	7400	8320	9230	10110	10980	11820	12650	13460	14270
3	3630	4290	4930	5550	6150	6740	7320	7880	8430	8970	9510
4	2720	2220	3700	4160	4610	5060	5490	5910	6330	6730	7130
5	2180	2570	2960	3330	3690	4050	4390	4730	5060	5380	5710
6	1820	2140	2470	2770	3080	3370	3660	3940	4220	4490	4760
7	1560	1840	2110	2380	2640	2890	3140	3380	3610	3850	4080
8	1360	1610	1850	2080	2310	2530	2740	2960	3160	3370	3570
9	1210	1430	1640	1850	2050	2250	2440	2630	2810	2990	3170
10	1090	1290	1480	1660	1850	2020	2200	2360	2530	2690	2850
11	990	1170	1340	1510	1680	1840	2000	2150	2300	2450	2590
12	910	1070	1230	1390	1540	1690	1830	1970	2110	2240	2380
13	840	990	1140	1280	1420	1560	1690	1820	1950	2070	2190
14	780	920	1060	1190	1320	1440	1570	1690	1810	1920	2040

For safe loads below heavy lines the deflections will be greater than the allowable limit for plastered ceilings $= \frac{1}{360}$ span.

SAFE LOADS IN POUNDS UNIFORMLY DISTRIBUTED FOR CAMBRIA ANGLES.

UNEQUAL LEGS.

NEUTRAL AXIS PARALLEL TO LONG LEG.



Safe loads below are figured for fibre stress of 16 000 pounds per square inch and include weight of angle.

Section No. A 135. 5″ x 4″

Distance between supports in feet.	$\frac{3}{8}''$ 11.0 lbs. per ft.	$\frac{7}{16}''$ 12.8 lbs. per ft.	$\frac{1}{2}''$ 14.5 lbs. per ft.	$\frac{9}{16}''$ 16.2 lbs. per ft.	$\frac{5}{8}''$ 17.8 lbs. per ft.	$\frac{11}{16}''$ 19.5 lbs. per ft.
2	8370	9630	10860	12050	13220	14360
3	5580	6420	7240	8030	8810	9570
4	4180	4810	5430	6030	6610	7180
5	3350	3850	4340	4820	5290	5740
6	2790	3210	3620	4020	4410	4790
7	2390	2750	3100	3440	3780	4100
8	2090	2410	2710	3010	3300	3590
9	1860	2140	2410	2680	2940	3190
10	1670	1930	2170	2410	2640	2870
11	1520	1750	1970	2190	2400	2610
12	1390	1600	1810	2010	2200	2390
13	1290	1480	1670	1850	2030	2210
14	1200	1380	1550	1720	1890	2050
15	1120	1280	1450	1610	1760	1910
16	1050	1200	1360	1510	1650	1790

Section No. A 105. 6″ x $3\frac{1}{2}''$

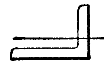
Distance between supports in feet.	$\frac{3}{8}''$ 11.7 lbs. per ft.	$\frac{7}{16}''$ 13.5 lbs. per ft.	$\frac{1}{2}''$ 15.3 lbs. per ft.	$\frac{9}{16}''$ 17.1 lbs. per ft.	$\frac{5}{8}''$ 18.9 lbs. per ft.	$\frac{11}{16}''$ 20.6 lbs. per ft.	$\frac{3}{4}''$ 22.4 lbs. per ft.	$\frac{13}{16}''$ 24.0 lbs. per ft.	$\frac{7}{8}''$ 25.7 lbs. per ft.	$\frac{15}{16}''$ 27.3 lbs. per ft.	1″ 28.9 lbs. per ft.
2	6570	7550	8500	9430	10340	11230	12100	12960	13800	14640	15470
3	4380	5030	5670	6290	6890	7480	8070	8640	9200	9760	10310
4	3280	3770	4250	4720	5170	5610	6050	6480	6900	7320	7730
5	2630	3020	3400	3770	4140	4490	4840	5180	5520	5850	6190
6	2190	2520	2830	3140	3450	3740	4030	4320	4600	4880	5160
7	1880	2160	2430	2690	2950	3210	3460	3700	3940	4180	4420
8	1640	1890	2120	2360	2580	2810	3020	3240	3450	3660	3870
9	1460	1680	1890	2100	2300	2490	2690	2880	3070	3250	3440
10	1310	1510	1700	1890	2070	2250	2420	2590	2760	2930	3090
11	1190	1370	1550	1710	1880	2040	2200	2360	2510	2660	2810
12	1090	1260	1420	1570	1720	1870	2020	2160	2300	2440	2580
13	1010	1160	1310	1450	1590	1730	1860	1990	2120	2250	2380
14	940	1080	1210	1350	1480	1600	1730	1850	1970	2090	2210

For safe loads below heavy lines the deflections will be greater than the allowable limit for plastered ceilings = $\frac{1}{360}$ span.

SAFE LOADS IN POUNDS UNIFORMLY DISTRIBUTED FOR CAMBRIA ANGLES.

UNEQUAL LEGS.

NEUTRAL AXIS PARALLEL TO LONG LEG.



Safe loads below are figured for fibre stress of 16 000 pounds per square inch and include weight of angle.

Section No. A 107.

$6'' \times 4''$

Distance between supports in feet.	$\frac{3}{8}''$	$\frac{7}{16}''$	$\frac{1}{2}''$	$\frac{9}{16}''$	$\frac{5}{8}''$	$\frac{11}{16}''$	$\frac{3}{4}''$	$\frac{13}{16}''$	$\frac{7}{8}''$	$\frac{15}{16}''$	$1''$
	12.3 lbs. per ft.	**14.3** lbs. per ft.	**16.2** lbs. per ft.	**18.1** lbs. per ft.	**20.0** lbs. per ft.	**21.8** lbs. per ft.	**23.6** lbs. per ft.	**25.4** lbs. per ft.	**27.2** lbs. per ft.	**28.9** lbs. per ft.	**30.6** lbs. per ft.
2	8550	9840	11100	12320	13520	14690	15840	16970	18070	19160	20230
3	5700	6560	7400	8220	9020	9800	10560	11310	12050	12770	13490
4	4280	4920	5550	6160	6760	7350	7920	8480	9040	9580	10120
5	3420	3940	4440	4930	5410	5880	6340	6790	7230	7660	8090
6	2850	3280	3700	4110	4510	4900	5280	5660	6020	6390	6740
7	2440	2810	3170	3520	3860	4200	4530	4850	5760	5470	5780
8	2140	2460	2770	3080	3380	3670	3960	4240	4520	4790	5060
9	1900	2190	2470	2740	3010	3270	3520	3770	4020	4260	4500
10	1710	1970	2220	2460	2700	2940	3170	3390	3610	3830	4050
11	1550	1790	2020	2240	2460	2670	2880	3080	3290	3480	3680
12	1430	1640	1850	2050	2250	2450	2640	2830	3010	3190	3370
13	1320	1510	1710	1900	2080	2260	2440	2610	2780	2950	3110
14	1220	1410	1590	1760	1930	2100	2260	2420	2580	2740	2890
15	1140	1310	1480	1640	1800	1960	2110	2260	2410	2550	2700
16	1070	1230	1390	1540	1690	1840	1980	2120	2260	2400	2530

Section No. A 109.

$7'' \times 3\frac{1}{2}''$

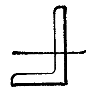
Distance between supports in feet.	$\frac{7}{16}''$	$\frac{1}{2}''$	$\frac{9}{16}''$	$\frac{5}{8}''$	$\frac{11}{16}''$	$\frac{3}{4}''$	$\frac{13}{16}''$	$\frac{7}{8}''$	$\frac{15}{16}''$	$1''$
	15.0 lbs. per ft.	**17.0** lbs. per ft.	**19.1** lbs. per ft.	**21.0** lbs. per ft.	**23.0** lbs. per ft.	**24.9** lbs. per ft.	**26.8** lbs. per ft.	**28.7** lbs. per ft.	**30.5** lbs. per ft.	**32.3** lbs. per ft.
2	7670	8640	9590	10520	11430	12320	13210	14090	14950	15810
3	5110	5760	6390	7010	7620	8220	8810	9390	9960	10540
4	2830	4320	4790	5260	5710	6160	6600	7040	7470	7900
5	3070	3460	3840	4210	4570	4930	5280	5630	5980	6320
6	2560	2880	3200	3510	3810	4110	4400	4700	4980	5270
7	2190	2470	2740	3010	3270	3520	3770	4020	4270	4520
8	1920	2160	2400	2630	2860	3080	3300	3520	3740	3950
9	1700	1920	2130	2340	2540	2740	2940	3130	3320	3510
10	1530	1730	1920	2100	2290	2460	2640	2820	2990	3160
11	1390	1570	1740	1910	2080	2240	2400	2560	2720	2870
12	1280	1440	1600	1750	1900	2050	2200	2350	2490	2630
13	1180	1330	1480	1620	1760	1900	2030	2170	2300	2430
14	1100	1230	1370	1500	1630	1760	1890	2010	2140	2260
15	1020	1150	1280	1400	1520	1640	1760	1880	1990	2110
16	960	1080	1200	1320	1430	1540	1650	1760	1870	1980

For safe loads below the heavy lines, the deflections will be greater than the allowable limit for plastered ceilings = $\frac{1}{360}$ span.

SAFE LOADS IN POUNDS UNIFORMLY DISTRIBUTED FOR CAMBRIA ANGLES.

UNEQUAL LEGS.

NEUTRAL AXIS PARALLEL TO SHORT LEG.



Safe loads below are figured for fibre stress of 16 000 pounds per square inch and include weight of angle.

Distance between supports in feet.	No. A 149.	Section No. A 91.						
	$3\frac{1}{4}'' \times 2''$	$2\frac{1}{2}'' \times 2''$						
	$\frac{3}{8}''$	$\frac{3}{16}''$	$\frac{1}{4}''$	$\frac{5}{16}''$	$\frac{3}{8}''$	$\frac{7}{16}''$	$\frac{1}{2}''$	$\frac{9}{16}''$
	6.2 lbs. per ft.	2.8 lbs. per ft.	3.7 lbs. per ft.	4.5 lbs. per ft.	5.3 lbs. per ft.	6.1 lbs. per ft.	6.8 lbs. per ft.	7.6 lbs. per ft.
2	4870	1560	2030	2490	2920	3330	3730	4110
3	3240	1040	1360	1660	1940	2220	2480	2740
4	2430	780	1020	1240	1460	1660	1860	2050
5	1950	620	810	990	1170	1330	1490	1640
6	1620	520	680	830	970	1110	1240	1370
7	1390	450	580	710	830	950	1070	1170
8	1220	390	510	620	730	830	930	1030
9	1080	350	450	550	650	740	830	910
10	970	310	410	500	580	670	750	820
11	880	280	370	450	530	610	680	750
12	810	260	340	410	490	560	620	690

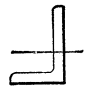
Distance between supports in feet.	Section No. A 128.					Section No. A 129.					
	$2\frac{3}{4}'' \times 1\frac{1}{2}''$					$3'' \times 2''$					
	$\frac{3}{16}''$	$\frac{1}{4}''$	$\frac{5}{16}''$	$\frac{3}{8}''$	$\frac{7}{16}''$	$\frac{3}{16}''$	$\frac{1}{4}''$	$\frac{5}{16}''$	$\frac{3}{8}''$	$\frac{7}{16}''$	$\frac{1}{2}''$
	2.6 lbs. per ft.	3.4 lbs. per ft.	4.2 lbs. per ft.	5.0 lbs. per ft.	5.7 lbs. per ft.	3.1 lbs. per ft.	4.1 lbs. per ft.	5.0 lbs. per ft.	5.9 lbs. per ft.	6.8 lbs. per ft.	7.7 lbs. per ft.
2	1790	2330	2850	3340	3810	2210	2890	3540	4170	4770	5350
3	1190	1550	1900	2230	2540	1470	1930	2360	2780	3180	3570
4	890	1160	1420	1670	1910	1110	1440	1770	2080	2380	2670
5	710	930	1140	1340	1530	880	1160	1420	1670	1910	2140
6	600	780	950	1110	1270	740	960	1180	1390	1590	1780
7	510	670	810	950	1090	630	830	1010	1190	1360	1530
8	450	580	710	840	950	550	720	890	1040	1190	1340
9	400	520	630	740	850	490	640	790	930	1060	1190
10	360	470	570	670	760	440	580	710	830	950	1070
11	320	420	520	610	690	400	530	640	760	870	970
12	300	390	470	560	640	370	480	590	690	800	890

For safe loads below heavy lines the deflections will be greater than the allowable limit for plastered ceilings $= \frac{1}{360}$ span.

SAFE LOADS IN POUNDS UNIFORMLY DISTRIBUTED FOR CAMBRIA ANGLES.

UNEQUAL LEGS.

NEUTRAL AXIS PARALLEL TO SHORT LEG.



Safe loads below are figured for fibre stress of 16 000 pounds per square inch and include weight of angle.

Distance between supports in feet.	Section No. A 121. 2″ x $1\frac{3}{8}$″					Section No. A 123. 2″ x $1\frac{1}{2}$″					
	$\frac{3}{16}$″	$\frac{1}{4}$″	$\frac{5}{16}$″	$\frac{3}{8}$″	$\frac{7}{16}$″	$\frac{1}{8}$″	$\frac{3}{16}$″	$\frac{1}{4}$″	$\frac{5}{16}$″	$\frac{3}{8}$″	$\frac{7}{16}$″
	2.1 lbs. per ft.	**2.7** lbs. per ft.	**3.3** lbs. per ft.	**3.9** lbs. per ft.	**4.4** lbs. per ft.	**1.5** lbs. per ft.	**2.2** lbs. per ft.	**2.8** lbs. per ft.	**3.4** lbs. per ft.	**4.0** lbs. per ft.	**4.6** lbs. per ft.
2	960	1240	1510	1760	2000	670	970	1260	1530	1790	2030
3	640	830	1010	1170	1330	440	650	840	1020	1190	1350
4	480	620	750	880	1000	330	490	630	770	890	1020
5	380	500	600	700	800	270	390	500	610	720	810
6	320	410	500	590	670	220	320	420	510	600	680
7	270	350	430	500	570	190	280	360	440	510	580
8	240	310	380	440	500	170	240	320	380	450	510
9	210	280	340	390	450	150	220	280	340	400	450
10	190	250	300	350	400	130	190	250	310	360	410
11	170	230	270	320	360	120	180	230	280	330	370
12	160	210	250	290	330	110	160	210	260	300	340

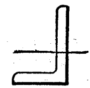
Distance between supports in feet.	Section No. A 125. $2\frac{1}{2}$″ x $1\frac{1}{4}$″					Section No. A 127. $2\frac{1}{2}$″ x $1\frac{1}{2}$″				
	$\frac{3}{16}$″	$\frac{1}{4}$″	$\frac{5}{16}$″	$\frac{3}{8}$″	$\frac{7}{16}$″	$\frac{3}{16}$″	$\frac{1}{4}$″	$\frac{5}{16}$″	$\frac{3}{8}$″	$\frac{7}{16}$″
	2.3 lbs. per ft.	**3.0** lbs. per ft.	**3.7** lbs. per ft.	**4.4** lbs. per ft.	**5.0** lbs. per ft.	**2.5** lbs. per ft.	**3.2** lbs. per ft.	**4.0** lbs. per ft.	**4.7** lbs. per ft.	**5.3** lbs. per ft.
2	1440	1880	2290	2680	3050	1490	1940	2370	2770	3160
3	960	1250	1530	1790	2040	990	1290	1580	1850	2110
4	720	940	1140	1340	1530	750	970	1180	1390	1580
5	580	750	920	1070	1220	600	780	950	1110	1270
6	480	630	760	890	1020	500	650	790	920	1050
7	410	540	650	770	870	430	550	680	790	900
8	360	470	570	670	760	370	490	590	690	790
9	320	420	510	600	680	330	430	530	620	700
10	290	380	460	540	610	300	390	470	550	630
11	260	340	420	490	560	270	350	430	500	580
12	240	310	380	450	510	250	320	390	460	530

For safe loads below heavy lines the deflections will be greater than the allowable limit for plastered ceilings = $\frac{1}{360}$ span.

SAFE LOADS IN POUNDS UNIFORMLY DISTRIBUTED FOR CAMBRIA ANGLES.

UNEQUAL LEGS.

NEUTRAL AXIS PARALLEL TO SHORT LEG.



Safe loads below are figured for fibre stress of 16 000 pounds per square inch and include weight of angle.

Section No. A 151.

$3\frac{1}{2}'' \times 2''$

Distance between supports in feet.	$\frac{1}{4}''$ 4.5 lbs. per ft.	$\frac{5}{16}''$ 5.6 lbs. per ft.	$\frac{3}{8}''$ 6.6 lbs. per ft.	$\frac{7}{16}''$ 7.6 lbs. per ft.	$\frac{1}{2}''$ 8.5 lbs. per ft.	$\frac{9}{16}''$ 9.5 lbs. per ft.	$\frac{5}{8}''$ 10.4 lbs. per ft.
2	3880	4760	5610	6440	7230	8000	8750
3	2580	3170	3740	4290	4820	5340	5830
4	1940	2380	2810	3220	3620	4000	4370
5	1550	1900	2250	2570	2890	3200	3500
6	1290	1590	1870	2150	2410	2670	2920
7	1110	1360	1600	1840	2070	2290	2500
8	970	1190	1400	1610	1810	2000	2190
9	860	1060	1250	1430	1610	1780	1940
10	780	950	1120	1290	1450	1600	1750
11	710	870	1020	1170	1310	1460	1590
12	650	790	940	1070	1210	1330	1460
13	600	730	860	990	1110	1230	1350
14	550	680	800	920	1030	1140	1250

Section No. A 93.

$3'' \times 2\frac{1}{2}''$

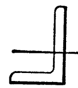
Distance between supports in feet.	$\frac{1}{4}''$ 4.5 lbs. per ft.	$\frac{5}{16}''$ 5.6 lbs. per ft.	$\frac{3}{8}''$ 6.6 lbs. per ft.	$\frac{7}{16}''$ 7.6 lbs. per ft.	$\frac{1}{2}''$ 8.5 lbs. per ft.	$\frac{9}{16}''$ 9.5 lbs. per ft.	$\frac{5}{8}''$ 10.4 lbs. per ft.
2	2990	3670	4320	4950	5560	6140	6710
3	2000	2450	2880	3300	3700	4090	4470
4	1500	1840	2160	2470	2780	3070	3350
5	1200	1470	1730	1980	2220	2460	2680
6	1000	1220	1440	1650	1850	2050	2240
7	860	1050	1230	1410	1590	1760	1920
8	750	920	1080	1240	1390	1540	1680
9	670	820	960	1100	1230	1360	1490
10	600	730	860	990	1110	1230	1340
11	540	670	790	900	1010	1120	1220
12	500	610	720	820	930	1020	1120
13	460	560	660	760	850	940	1030
14	430	520	620	710	790	880	960

For safe loads below heavy lines the deflections will be greater than the allowable limit for plastered ceilings $= \frac{1}{360}$ span.

SAFE LOADS IN POUNDS UNIFORMLY DISTRIBUTED FOR CAMBRIA ANGLES.

UNEQUAL LEGS.

NEUTRAL AXIS PARALLEL TO SHORT LEG.



Safe loads below are figured for fibre stress of 16 000 pounds per square inch and include weight of angle.

Section No. A 95. $3\frac{1}{2}'' \times 2\frac{1}{2}''$

Distance between supports in feet.	$\frac{1}{4}''$ 4.9 lbs. per ft.	$\frac{5}{16}''$ 6.1 lbs. per ft.	$\frac{3}{8}''$ 7.2 lbs. per ft.	$\frac{7}{16}''$ 8.3 lbs. per ft.	$\frac{1}{2}''$ 9.4 lbs. per ft.	$\frac{9}{16}''$ 10.4 lbs. per ft.	$\frac{5}{8}''$ 11.5 lbs. per ft.	$\frac{11}{16}''$ 12.5 lbs. per ft.	$\frac{3}{4}''$ 13.4 lbs. per ft.
2	4020	4940	5830	6690	7530	8330	9120	9880	10620
3	2680	3300	3890	4460	5020	5560	6080	6580	7080
4	2010	2470	2920	3350	3760	4170	4560	4940	5310
5	1610	1980	2330	2680	3010	3330	3650	3950	4250
6	1340	1650	1940	2230	2510	2780	3040	3290	3540
7	1150	1410	1670	1910	2150	2380	2600	2820	3030
8	1010	1240	1460	1670	1880	2080	2280	2470	2650
9	890	1100	1300	1490	1670	1850	2030	2190	2360
10	800	990	1170	1340	1510	1670	1820	1980	2120
11	730	900	1060	1220	1370	1520	1660	1800	1930
12	670	820	970	1120	1250	1390	1520	1650	1770
13	620	760	900	1030	1160	1280	1400	1520	1630
14	570	710	830	960	1080	1190	1300	1410	1520
15	540	660	780	890	1000	1110	1220	1320	1420
16	500	620	730	840	940	1040	1140	1230	1330

Section No. A 97. $3\frac{1}{2}'' \times 3''$

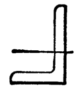
Distance between supports in feet.	$\frac{5}{16}''$ 6.6 lbs. per ft.	$\frac{3}{8}''$ 7.9 lbs. per ft.	$\frac{7}{16}''$ 9.1 lbs. per ft.	$\frac{1}{2}''$ 10.2 lbs. per ft.	$\frac{9}{16}''$ 11.4 lbs. per ft.	$\frac{5}{8}''$ 12.5 lbs. per ft.	$\frac{11}{16}''$ 13.6 lbs. per ft.	$\frac{3}{4}''$ 14.7 lbs. per ft.	$\frac{13}{16}''$ 15.8 lbs. per ft.	$\frac{7}{8}''$ 16.8 lbs. per ft.
2	5090	6010	6890	7750	8590	9400	10190	10960	11710	12440
3	3390	4000	4600	5170	5730	6270	6790	7300	7800	8290
4	2540	3000	3450	3880	4290	4700	5090	5480	5850	6220
5	2040	2400	2760	3100	3440	3760	4080	4380	4680	4980
6	1700	2000	2300	2580	2860	3130	3400	3650	3900	4150
7	1450	1720	1970	2220	2450	2690	2910	3130	3340	3550
8	1270	1500	1720	1940	2150	2350	2550	2740	2930	3110
9	1130	1330	1530	1720	1910	2090	2260	2430	2600	2760
10	1020	1200	1380	1550	1720	1880	2040	2190	2340	2490
11	930	1090	1250	1410	1560	1710	1850	1990	2130	2260
12	850	1000	1150	1290	1430	1570	1700	1830	1950	2070
13	780	920	1060	1190	1320	1450	1570	1690	1800	1910
14	730	860	980	1110	1230	1340	1460	1570	1670	1780
15	680	800	920	1030	1150	1250	1360	1460	1560	1660
16	640	750	860	970	1070	1180	1270	1370	1460	1550

For safe loads below heavy lines the deflections will be greater than the allowable limit for plastered ceilings = $\frac{1}{360}$ span.

SAFE LOADS IN POUNDS UNIFORMLY DISTRIBUTED FOR CAMBRIA ANGLES.

UNEQUAL LEGS.

NEUTRAL AXIS PARALLEL TO SHORT LEG.



Safe loads below are figured for fibre stress of 16 000 pounds per square inch and include weight of angle.

Section No. A 99.

4″ x 3″

Distance between supports in feet.	5/16″ 7.2 lbs. per ft.	3/8″ 8.5 lbs. per ft.	7/16″ 9.8 lbs. per ft.	1/2″ 11.1 lbs. per ft.	9/16″ 12.4 lbs. per ft.	5/8″ 13.6 lbs. per ft.	11/16″ 14.8 lbs. per ft.	3/4″ 16.0 lbs. per ft.	13/16″ 17.1 lbs. per ft.	7/8″ 18.3 lbs. per ft.
2	6580	7780	8940	10070	11170	12240	13280	14300	15290	16260
3	4390	5180	5960	6710	7450	8160	8860	9530	10190	10840
4	3290	3890	4470	5040	5590	6120	6640	7150	7650	8130
5	2630	3110	3580	4030	4470	4900	5310	5720	6120	6500
6	2190	2590	2980	3360	3720	4080	4430	4770	5100	5420
7	1880	2220	2550	2880	3190	3500	3800	4090	4370	4650
8	1640	1940	2240	2520	2790	3060	3320	3580	3820	4060
9	1460	1730	1990	2240	2480	2720	2950	3180	3400	3610
10	1320	1560	1790	2010	2230	2450	2660	2860	3060	3250
11	1200	1410	1630	1830	2030	2230	2420	2600	2780	2960
12	1100	1300	1490	1680	1860	2040	2210	2380	2550	2710
13	1010	1200	1380	1550	1720	1880	2040	2200	2350	2500
14	940	1110	1280	1440	1600	1750	1900	2040	2180	2320
15	880	1040	1190	1340	1490	1630	1770	1910	2040	2170
16	820	970	1120	1260	1400	1530	1660	1790	1910	2030

Section No. A 131.

4″ x 3½″

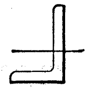
Distance between supports in feet.	5/16″ 7.7 lbs. per ft.	3/8″ 9.1 lbs. per ft.	7/16″ 10.6 lbs. per ft.	1/2″ 11.9 lbs. per ft.	9/16″ 13.3 lbs. per ft.	5/8″ 14.7 lbs. per ft.	11/16″ 16.0 lbs. per ft.
2	6740	7970	9160	10320	11450	12550	13630
3	4490	5310	6110	6880	7640	8370	9080
4	3370	3980	4580	5160	5730	6280	6810
5	2690	3190	3660	4130	4580	5020	5450
6	2250	2660	3050	3440	3820	4180	4540
7	1920	2280	2620	2950	3270	3590	3890
8	1680	1990	2290	2580	2860	3140	3410
9	1500	1770	2040	2290	2550	2790	3030
10	1350	1590	1830	2060	2290	2510	2730
11	1220	1450	1670	1880	2080	2280	2480
12	1120	1330	1530	1720	1910	2090	2270
13	1040	1230	1410	1590	1760	1930	2100
14	960	1140	1310	1470	1640	1790	1950
15	900	1060	1220	1380	1530	1670	1820
16	840	1000	1150	1290	1430	1570	1700

For safe loads below heavy lines the deflections will be greater than the allowable limit for plastered ceilings = $\frac{1}{360}$ span.

SAFE LOADS IN POUNDS UNIFORMLY DISTRIBUTED FOR CAMBRIA ANGLES.

UNEQUAL LEGS.

NEUTRAL AXIS PARALLEL TO SHORT LEG.



Safe loads below are figured for fibre stress of 16 000 pounds per square inch and include weight of angle.

Section No. A 133. $4\frac{1}{2}'' \times 3''$

Distance between supports in feet.	$\frac{3}{8}''$ 9.1 lbs. per ft.	$\frac{7}{16}''$ 10.6 lbs. per ft.	$\frac{1}{2}''$ 11.9 lbs. per ft.	$\frac{9}{16}''$ 13.3 lbs. per ft.	$\frac{5}{8}''$ 14.7 lbs. per ft.	$\frac{11}{16}''$ 16.0 lbs. per ft.
2	9750	11230	12660	14060	15420	16750
3	6500	7480	8440	9370	10280	11170
4	4880	5610	6330	7030	7710	8380
5	3900	4490	5060	5620	6170	6700
6	3250	3740	4220	4690	5140	5580
7	2790	3210	3620	4020	4410	4790
8	2440	2810	3170	3510	3860	4190
9	2170	2490	2810	3120	3430	3720
10	1950	2250	2530	2810	3080	3350
11	1770	2040	2300	2560	2800	3050
12	1630	1870	2110	2340	2570	2790
13	1500	1730	1950	2160	2370	2580
14	1390	1600	1810	2010	2200	2390
15	1300	1500	1690	1870	2060	2230
16	1220	1400	1580	1760	1930	2090
17	1150	1320	1490	1650	1810	1970
18	1080	1250	1410	1560	1710	1860

Section No. A 101. $5'' \times 3''$

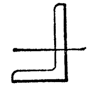
Distance between supports in feet.	$\frac{5}{16}''$ 8.2 lbs. per ft.	$\frac{3}{8}''$ 9.8 lbs. per ft.	$\frac{7}{16}''$ 11.3 lbs. per ft.	$\frac{1}{2}''$ 12.8 lbs. per ft.	$\frac{9}{16}''$ 14.3 lbs. per ft.	$\frac{5}{8}''$ 15.7 lbs. per ft.	$\frac{11}{16}''$ 17.1 lbs. per ft.	$\frac{3}{4}''$ 18.5 lbs. per ft.	$\frac{13}{16}''$ 19.9 lbs. per ft.	$\frac{7}{8}''$ 21.2 lbs. per ft.
2	10060	11920	13740	15510	17240	18930	20580	22190	23770	25310
3	6710	7950	9160	10340	11490	12620	13720	14790	15850	16870
4	5030	5960	6870	7760	8620	9470	10290	11100	11880	12660
5	4020	4770	5500	6210	6900	7570	8230	8880	9510	10120
6	3350	3970	4580	5170	5750	6310	6860	7400	7920	8440
7	2870	3410	3930	4430	4930	5410	5880	6340	6790	7230
8	2520	2980	3440	3880	4310	4730	5140	5550	5940	6330
9	2240	2650	3050	3450	3830	4210	4570	4930	5280	5620
10	2010	2380	2750	3100	3450	3790	4120	4440	4750	5060
11	1830	2170	2500	2820	3130	3440	3740	4030	4320	4600
12	1680	1990	2290	2590	2870	3160	3430	3700	3960	4220
13	1550	1830	2110	2390	2650	2910	3170	3410	3660	3890
14	1440	1700	1960	2220	2460	2700	2940	3170	3400	3620
15	1340	1590	1830	2070	2300	2520	2740	2960	3170	3370
16	1260	1490	1720	1940	2160	2370	2570	2770	2970	3160
17	1180	1400	1620	1830	2030	2230	2420	2610	2800	2980
18	1120	1330	1530	1720	1920	2100	2290	2470	2640	2810

For safe loads below heavy lines the deflections will be greater than the allowable limit for plastered ceilings = $\frac{1}{360}$ span.

SAFE LOADS IN POUNDS UNIFORMLY DISTRIBUTED FOR CAMBRIA ANGLES.

UNEQUAL LEGS.

NEUTRAL AXIS PARALLEL TO SHORT LEG.



Safe loads below are figured for fibre stress of 16 000 pounds per square inch and include weight of angle.

Section No. A 103. $5'' \times 3\frac{1}{2}''$

Distance between supports in feet.	$\frac{5}{16}''$ 8.7 lbs. per ft.	$\frac{3}{8}''$ 10.4 lbs. per ft.	$\frac{7}{16}''$ 12.0 lbs. per ft.	$\frac{1}{2}''$ 13.6 lbs. per ft.	$\frac{9}{16}''$ 15.2 lbs. per ft.	$\frac{5}{8}''$ 16.8 lbs. per ft.	$\frac{11}{16}''$ 18.3 lbs. per ft.	$\frac{3}{4}''$ 19.8 lbs. per ft.	$\frac{13}{16}''$ 21.3 lbs. per ft.	$\frac{7}{8}''$ 22.7 lbs. per ft.	$\frac{15}{16}''$ 24.2 lbs. per ft.
2	10320	12240	14100	15930	17710	19450	21150	22810	24440	26030	27590
3	6880	8160	9400	10620	11810	12970	14100	15210	16290	17350	18400
4	5160	6120	7050	7960	8850	9720	10570	11410	12220	13020	13800
5	4130	4890	5640	6370	7080	7780	8460	9120	9780	10410	11040
6	3440	4080	4700	5310	5900	6480	7050	7600	8150	8680	9200
7	2950	3500	4030	4550	5060	5560	6040	6520	6980	7440	7880
8	2580	3060	3530	3980	4430	4860	5290	5700	6110	6510	6900
9	2290	2720	3130	3540	3940	4320	4700	5070	5430	5780	6130
10	2060	2450	2820	3190	3540	3890	4230	4560	4890	5210	5520
11	1880	2220	2560	2900	3220	3540	3850	4150	4440	4730	5020
12	1720	2040	2350	2650	2950	3240	3520	3800	4070	4340	4600
13	1590	1880	2170	2450	2720	2990	3250	3510	3760	4000	4240
14	1470	1750	2010	2280	2530	2780	3020	3260	3490	3720	3940
15	1380	1630	1880	2120	2360	2590	2820	3040	3260	3470	3680
16	1290	1530	1760	1990	2210	2430	2640	2850	3050	3250	3450
17	1210	1440	1660	1870	2080	2290	2490	2680	2880	3060	3250
18	1150	1360	1570	1770	1970	2160	2350	2530	2720	2890	3070

Section No. A 135. $5'' \times 4''$

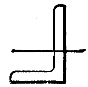
Distance between supports in feet.	$\frac{3}{8}''$ 11.0 lbs. per ft.	$\frac{7}{16}''$ 12.8 lbs. per ft.	$\frac{1}{2}''$ 14.5 lbs. per ft.	$\frac{9}{16}''$ 16.2 lbs. per ft.	$\frac{5}{8}''$ 17.8 lbs. per ft.	$\frac{11}{16}''$ 19.5 lbs. per ft.
2	12500	14410	16280	18100	19880	21620
3	8330	9610	10850	12070	13250	14420
4	6250	7200	8140	9050	9940	10810
5	5000	5760	6510	7240	7950	8650
6	4170	4800	5430	6030	6630	7210
7	3570	4120	4650	5170	5680	6180
8	3120	3600	4070	4520	4970	5410
9	2780	3200	3620	4020	4420	4810
10	2500	2880	3260	3620	3980	4320
11	2270	2620	2960	3290	3610	3930
12	2080	2400	2710	3020	3310	3600
13	1920	2220	2500	2780	3060	3330
14	1790	2060	2330	2590	2840	3090
15	1670	1920	2170	2410	2650	2880
16	1560	1800	2030	2260	2490	2700
17	1470	1700	1910	2130	2340	2540
18	1390	1600	1810	2010	2210	2400

For safe loads below heavy lines the deflections will be greater than the allowable limit for plastered ceilings = $\frac{1}{360}$ span.

SAFE LOADS IN POUNDS UNIFORMLY DISTRIBUTED FOR CAMBRIA ANGLES.

UNEQUAL LEGS.

NEUTRAL AXIS PARALLEL TO SHORT LEG.



Safe loads below are figured for fibre stress of 16 000 pounds per square inch and include weight of angle.

Section No. A 105.

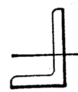
Distance between supports in feet.	6″ x $3\frac{1}{2}$″										
	$\frac{3}{8}$″	$\frac{7}{16}$″	$\frac{1}{2}$″	$\frac{9}{16}$″	$\frac{5}{8}$″	$\frac{11}{16}$″	$\frac{3}{4}$″	$\frac{13}{16}$″	$\frac{7}{8}$″	$\frac{15}{16}$″	1″
	11.7 lbs. per ft.	13.5 lbs. per ft.	15.3 lbs. per ft.	17.1 lbs. per ft.	18.9 lbs. per ft.	20.6 lbs. per ft.	22.4 lbs. per ft.	24.0 lbs. per ft.	25.7 lbs. per ft.	27.3 lbs. per ft.	28.9 lbs. per ft.
2	17300	19980	22600	25160	27670	30130	32550	34910	37230	39510	41630
3	11540	13320	15060	16770	18450	20090	21700	23270	24820	26340	27750
4	8650	9990	11300	12580	13840	15070	16270	17460	18620	19760	20810
5	6920	7990	9040	10060	11070	12050	13020	13960	14890	15800	16650
6	5770	6660	7530	8390	9220	10040	10850	11640	12410	13170	13880
7	4940	5710	6460	7190	7910	8610	9300	9970	10640	11290	11890
8	4330	4990	5650	6290	6920	7530	8140	8730	9310	9880	10410
9	3850	4440	5020	5590	6150	6700	7230	7760	8270	8780	9250
10	3460	4000	4520	5030	5530	6030	6510	6980	7450	7900	8330
11	3150	3630	4110	4570	5030	5480	5920	6350	6770	7180	7570
12	2880	3330	3770	4190	4610	5020	5420	5820	6210	6590	6940
13	2660	3070	3480	3870	4260	4640	5010	5370	5730	6080	6400
14	2470	2850	3230	3590	3950	4300	4650	4990	5320	5640	5950
15	2310	2660	3010	3350	3690	4020	4340	4650	4960	5270	5550
16	2160	2500	2820	3150	3460	3770	4070	4360	4650	4940	5200
17	2040	2350	2660	2960	3260	3550	3830	4110	4380	4650	4900
18	1920	2220	2510	2800	3070	3350	3620	3880	4140	4390	4630
19	1820	2100	2380	2650	2910	3170	3430	3680	3920	4160	4380
20	1730	2000	2260	2520	2770	3010	3250	3490	3720	3950	4160
21	1650	1900	2150	2400	2640	2870	3100	3320	3550	3760	3960
22	1570	1810	2050	2290	2520	2740	2960	3170	3380	3590	3780

For safe loads below heavy lines the deflections will be greater than the allowable limit for plastered ceilings = $\frac{1}{360}$ span.

SAFE LOADS IN POUNDS UNIFORMLY DISTRIBUTED FOR CAMBRIA ANGLES.

UNEQUAL LEGS.

NEUTRAL AXIS PARALLEL TO SHORT LEG.



Safe loads below are figured for fibre stress of 16 000 pounds per square inch and include weight of angle.

Section No. A 107.

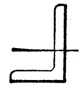
Distance between supports in feet.	6″ x 4″										
	$\frac{3}{8}''$	$\frac{7}{16}''$	$\frac{1}{2}''$	$\frac{9}{16}''$	$\frac{5}{8}''$	$\frac{11}{16}''$	$\frac{3}{4}''$	$\frac{13}{16}''$	$\frac{7}{8}''$	$\frac{15}{16}''$	$1''$
	12.3 lbs. per ft.	14.3 lbs. per ft.	16.2 lbs. per ft.	18.1 lbs. per ft.	20.0 lbs. per ft.	21.8 lbs. per ft.	23.6 lbs. per ft.	25.4 lbs. per ft.	27.2 lbs. per ft.	28.9 lbs. per ft.	30.6 lbs. per ft.
2	17700	20430	23120	25750	28320	30850	33330	35760	38140	40480	42780
3	11800	13620	15410	17160	18880	20570	22220	23840	25430	26990	28520
4	8850	10230	11560	12870	14160	15420	16660	17880	19070	20240	21390
5	7080	8170	9250	10300	11330	12340	13330	14300	15260	16190	17110
6	5900	6810	7710	8580	9440	10280	11110	11920	12710	13490	14260
7	5060	5840	6600	7360	8090	8810	9520	10220	10900	11570	12220
8	4420	5110	5780	6440	7080	7710	8330	8940	9540	10120	10700
9	3930	4540	5140	5720	6290	6860	7410	7950	8480	9000	9510
10	3540	4090	4620	5150	5660	6170	6670	7150	7630	8100	8560
11	3220	3720	4200	4680	5150	5610	6060	6500	6930	7360	7780
12	2950	3410	3850	4290	4720	5140	5550	5960	6360	6750	7130
13	2720	3140	3560	3960	4360	4750	5130	5500	5870	6230	6580
14	2530	2920	3300	3680	4050	4410	4760	5110	5450	5780	6110
15	2360	2720	3080	3430	3780	4110	4440	4770	5090	5400	5700
16	2210	2550	2890	3220	3540	3860	4170	4470	4770	5060	5350
17	2080	2400	2720	3030	3330	3630	3920	4210	4490	4760	5030
18	1970	2270	2570	2860	3150	3430	3700	3970	4240	4500	4750
19	1860	2150	2430	2710	2980	3250	3510	3760	4020	4260	4500
20	1770	2040	2310	2570	2830	3080	3330	3580	3810	4050	4280
21	1690	1950	2200	2450	2700	2940	3170	3400	3630	3860	4070
22	1610	1860	2100	2340	2570	2800	3030	3250	3470	3680	3890

For safe loads below heavy lines the deflections will be greater than the allowable limit for plastered ceilings = $\frac{1}{360}$ span.

SAFE LOADS IN POUNDS UNIFORMLY DISTRIBUTED FOR CAMBRIA ANGLES.

UNEQUAL LEGS.

NEUTRAL AXIS PARALLEL TO SHORT LEG.



Safe loads below are figured for fibre stress of 16 000 pounds per square inch and include weight of angle.

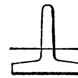
Distance between supports in feet.	Section No. A 109.									
	7″ x $3\frac{1}{2}$″									
	$\frac{7}{16}$″	$\frac{1}{2}$″	$\frac{9}{16}$″	$\frac{5}{8}$″	$\frac{11}{16}$″	$\frac{3}{4}$″	$\frac{13}{16}$″	$\frac{7}{8}$″	$\frac{15}{16}$″	1″
	15.0 lbs. per ft.	**17.0** lbs. per ft.	**19.1** lbs. per ft.	**21.0** lbs. per ft.	**23.0** lbs. per ft.	**24.9** lbs. per ft.	**26.8** lbs. per ft.	**28.7** lbs. per ft.	**30.5** lbs. per ft.	**32.3** lbs. per ft.
4	13360	15140	16900	18570	20260	21910	23530	25110	26670	28210
5	10690	12120	13520	14850	16210	17530	18830	20090	21340	22560
6	8910	10100	11270	12380	13510	14600	15690	16740	17780	18800
7	7640	8650	9660	10610	11580	12520	13450	14350	15240	16120
8	6680	7570	8450	9280	10130	10950	11770	12560	13340	14100
9	5940	6730	7510	8250	9010	9740	10460	11160	11850	12540
10	5340	6060	6760	7430	8100	8760	9410	10050	10670	11280
11	4860	5510	6150	6750	7370	7970	8560	9130	9700	10260
12	4450	5050	5630	6190	6750	7300	7840	8370	8890	9400
13	4110	4660	5200	5710	6230	6740	7240	7730	8210	8680
14	3820	4330	4830	5310	5790	6260	6720	7180	7620	8060
15	3560	4040	4510	4950	5400	5840	6280	6700	7110	7520
16	3340	3790	4230	4640	5070	5480	5880	6280	6670	7050
17	3140	3560	3980	4370	4770	5150	5540	5910	6280	6640
18	2970	3370	3760	4130	4500	4870	5230	5580	5930	6270
19	2810	3190	3560	3910	4270	4610	4950	5290	5620	5940
20	2670	3030	3380	3710	4050	4380	4710	5020	5330	5640
21	2550	2880	3220	3540	3860	4170	4480	4780	5080	5370
22	2430	2750	3070	3380	3680	3980	4280	4570	4850	5130
23	2320	2630	2940	3230	3520	3810	4090	4370	4640	4910
24	2230	2520	2820	3090	3380	3650	3920	4190	4450	4700

For safe loads below heavy lines the deflections will be greater than the allowable limit for plastered ceilings = $\frac{1}{360}$ span.

SAFE LOADS IN POUNDS UNIFORMLY DISTRIBUTED FOR CAMBRIA T-BARS.

EQUAL LEGS.

Safe loads below are figured for fibre stress of 16000 pounds per square inch and include weight of T-Bar.



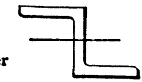
Section Number.	Width of Flange.	Depth of Bar.	Weight per Foot.	Distance Between Supports in Feet.										
	Inches.	Inches.	Lbs.	2	3	4	5	6	7	8	9	10	11	12
T 5	1	1	1.0	180	120	90	70	60	50	40	..	..	..	..
T181	$1\frac{1}{8}$	$1\frac{1}{8}$	1.4	280	190	140	110	90	80	70	60	..	..	..
T183	$1\frac{3}{16}$	$1\frac{3}{16}$	1.6	320	210	160	130	110	90	80	70	..	..	..
T187	$1\frac{1}{4}$	$1\frac{1}{4}$	1.7	350	230	180	140	120	100	90	80	..	..	..
T189	$1\frac{3}{8}$	$1\frac{3}{8}$	1.9	450	300	220	180	150	130	110	100	..	..	..
T 37	2	2	3.7	1390	920	690	550	460	400	350	310	280	250	..
T 39	2	2	4.4	1670	1110	830	670	560	480	420	370	330	300	..
T 41	$2\frac{1}{4}$	$2\frac{1}{4}$	4.2	1720	1150	860	690	570	490	430	380	340	310	290
T 42	$2\frac{1}{4}$	$2\frac{1}{4}$	5.0	2150	1430	1070	860	720	610	540	480	430	390	360
T 49	$2\frac{1}{2}$	$2\frac{1}{2}$	5.6	2630	1750	1310	1050	880	750	660	580	530	480	440
T 67	3	3	6.8	3930	2620	1970	1570	1310	1120	980	870	790	720	660
T 69	3	3	7.9	4590	3060	2300	1840	1530	1310	1150	1020	920	840	770
T 73	3	3	10.1	5850	3900	2930	2340	1950	1670	1460	1300	1170	1060	980
T 97	$3\frac{1}{2}$	$3\frac{1}{2}$	9.3	6570	4380	3290	2630	2190	1880	1640	1460	1310	1200	1100
T108	4	4	10.5	8430	5620	4210	3370	2810	2410	2110	1870	1690	1530	1400

UNEQUAL LEGS.

Section Number.	Width of Flange.	Depth of Bar.	Weight per Foot.	2	3	4	5	6	7	8	9	10	11	12
T185	$1\frac{1}{4}$	$1\frac{1}{16}$	1.5	250	170	130	100	80	70	60	..	..	..	..
T 22	$2\frac{1}{2}$	$1\frac{1}{4}$	3.0	470	310	230	190	160	130	120	100	..	..	..
T 27	$2\frac{1}{2}$	$1\frac{3}{4}$	4.4	850	570	420	340	280	240	210	190	170	150	140
T 56	$2\frac{1}{2}$	3	7.0	4470	2980	2230	1790	1490	1280	1120	990	890	810	740
T 62	$2\frac{3}{4}$	2	7.4	3510	2340	1760	1400	1170	1000	880	780	700	640	590
T 65	3	$2\frac{1}{2}$	7.2	3200	2130	1600	1280	1070	910	800	710	640	580	530
T120	$4\frac{1}{2}$	$2\frac{1}{2}$	7.8	2880	1920	1440	1150	960	820	720	640	580	520	480
T138	$4\frac{1}{2}$	$3\frac{1}{2}$	14.7	10800	7200	5400	4320	3600	3090	2700	2400	2160	1960	1800
T140	$4\frac{1}{2}$	$3\frac{1}{2}$	15.9	11340	7560	5670	4540	3780	3240	2840	2520	2270	2060	1890
T169	5	3	13.6	5670	3780	2840	2270	1890	1620	1420	1260	1130	1030	950
T 84	3	4	9.3	8050	5360	4020	3220	2680	2300	2010	1790	1610	1460	1340
T101	$3\frac{1}{2}$	4	10.0	8240	5490	4120	3290	2750	2350	2060	1830	1650	1500	1370

For safe loads to the right of heavy lines the deflections will be greater than the allowable limit for plastered ceilings $= \frac{1}{360}$ span.

SAFE LOADS IN POUNDS UNIFORMLY DISTRIBUTED FOR CAMBRIA Z-BARS.



Safe loads below are figured for fibre stress of 16 000 pounds per square inch and include weight of Z-bar.

STANDARD 3″ Z-BARS.

Distance between supports in feet.	Sec. No. Z 5.		Sec. No. Z 9.		Sec. No. Z 13.	
	$\frac{1}{4}''$	$\frac{5}{16}''$	$\frac{3}{8}''$	$\frac{7}{16}''$	$\frac{1}{2}''$	$\frac{9}{16}''$
	6.7 lbs. per ft.	8.4 lbs. per ft.	9.7 lbs. per ft.	11.4 lbs. per ft.	12.5 lbs. per ft.	14.2 lbs. per ft.
2	10200	12700	13700	15900	16300	18300
3	6800	8470	9130	10600	10870	12200
4	5100	6350	6850	7950	8150	9150
5	4080	5080	5480	6360	6520	7320
6	3400	4230	4570	5300	5430	6100
7	2910	3630	3910	4540	4660	5230
8	2550	3180	3430	3980	4080	4580
9	2270	2820	3040	3530	3620	4070
10	2040	2540	2740	3180	3260	3660
11	1850	2310	2490	2890	2960	3330
12	1700	2120	2280	2650	2720	3050

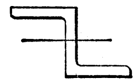
STANDARD 4″ Z-BARS.

Distance between supports in feet.	Sec. No. Z 21.			Sec. No. Z 25.			Sec. No. Z 29.		
	$\frac{1}{4}''$	$\frac{5}{16}''$	$\frac{3}{8}''$	$\frac{7}{16}''$	$\frac{1}{2}''$	$\frac{9}{16}''$	$\frac{5}{8}''$	$\frac{11}{16}''$	$\frac{3}{4}''$
	8.2 lbs. per ft.	10.3 lbs. per ft.	12.4 lbs. per ft.	13.8 lbs. per ft.	15.8 lbs. per ft.	17.9 lbs. per ft.	18.9 lbs. per ft.	20.9 lbs. per ft.	23.0 lbs. per ft.
2	16750	20850	24900	25750	29350	32950	32300	35500	38700
3	11170	13900	16600	17170	19570	21970	21530	23670	25800
4	8380	10430	12450	12880	14680	16480	16150	17750	19350
5	6700	8340	9960	10300	11740	13180	12920	14200	15480
6	5580	6950	8300	8580	9780	10980	10770	11830	12900
7	4790	5960	7110	7360	8390	9410	9230	10140	11060
8	4190	5210	6230	6440	7340	8240	8080	8880	9680
9	3720	4630	5530	5720	6520	7320	7180	7890	8600
10	3350	4170	4980	5150	5870	6590	6460	7100	7740
11	3050	3790	4530	4680	5340	5990	5870	6450	7040
12	2790	3480	4150	4290	4890	5490	5380	5920	6450
13	2580	3210	3830	3960	4520	5070	4970	5460	5950
14	2390	2980	3560	3680	4190	4710	4610	5070	5530

For safe loads below heavy lines the deflections will be greater than the allowable limit for plastered ceilings = $\frac{1}{360}$ span.

For complete and exact dimensions of Z-bars see page 41.

SAFE LOADS IN POUNDS UNIFORMLY DISTRIBUTED FOR CAMBRIA Z-BARS.



Safe loads below are figured for fibre stress of 16 000 pounds per square inch and include weight of Z-bar.

STANDARD 5″ Z-BARS.

Distance between supports in feet.	Sec. No. Z 37.			Sec. No. Z 41.			Sec. No. Z 45.		
	5/16″	3/8″	7/16″	1/2″	9/16″	5/8″	11/16″	3/4″	13/16″
	11.6 lbs. per ft.	13.9 lbs. per ft.	16.4 lbs. per ft.	17.9 lbs. per ft.	20.2 lbs. per ft.	22.6 lbs. per ft.	23.7 lbs. per ft.	26.0 lbs. per ft.	28.3 lbs. per ft.
2	28500	34100	39700	40950	46000	51050	50500	55100	59750
3	19000	22730	26470	27300	30670	34030	33670	36730	39830
4	14250	17050	19850	20480	23000	25530	25250	27550	29880
5	11400	13640	15880	16380	18400	20420	20200	22040	23900
6	9500	11370	13230	13650	15330	17020	16830	18370	19920
7	8140	9740	11340	11700	13140	14590	14430	15740	17070
8	7130	8530	9930	10240	11500	12760	12630	13780	14940
9	6330	7580	8820	9100	10220	11340	11220	12240	13280
10	5700	6820	7940	8190	9200	10210	10100	11020	11950
11	5180	6200	7220	7450	8360	9280	9180	10020	10860
12	4750	5680	6620	6830	7670	8510	8420	9180	9960
13	4380	5250	6110	6300	7080	7850	7770	8480	9190
14	4070	4870	5670	5850	6570	7290	7210	7870	8540
15	3800	4550	5290	5460	6130	6810	6730	7350	7970
16	3560	4260	4960	5120	5750	6380	6310	6890	7470

STANDARD 6″ Z-BARS.

Distance between supports in feet.	Sec. No. Z 53.			Sec. No. Z 57.			Sec. No. Z 61.		
	3/8″	7/16″	1/2″	9/16″	5/8″	11/16″	3/4″	13/16″	7/8″
	15.6 lbs. per ft.	18.3 lbs. per ft.	21.0 lbs. per ft.	22.7 lbs. per ft.	25.4 lbs. per ft.	28.1 lbs. per ft.	29.3 lbs. per ft.	31.9 lbs. per ft.	34.6 lbs. per ft.
2	45000	52450	59850	61600	68400	75200	74900	81150	87450
3	30000	34970	39900	41070	45600	50130	49930	54100	58300
4	22500	26230	29930	30800	34200	37600	37450	40580	43730
5	18000	20980	23940	24640	27360	30080	29960	32460	34980
6	15000	17480	19950	20530	22800	25070	24970	27050	29150
7	12860	14990	17100	17600	19540	21490	21400	23190	24990
8	11250	13110	14960	15400	17100	18800	18730	20290	21860
9	10000	11660	13300	13690	15200	16710	16640	18030	19430
10	9000	10490	11970	12320	13680	15040	14980	16230	17490
11	8180	9540	10880	11200	12440	13670	13620	14750	15900
12	7500	8740	9980	10270	11400	12530	12480	13530	14580
13	6920	8070	9210	9480	10520	11570	11520	12480	13450
14	6430	7490	8550	8800	9770	10740	10700	11590	12490
15	6000	6990	7980	8210	9120	10030	9990	10820	11660
16	5630	6560	7480	7700	8550	9400	9360	10140	10930
17	5290	6170	7040	7250	8050	8850	8810	9550	10290
18	5000	5830	6650	6840	7600	8360	8320	9020	9720

For safe loads below heavy lines the deflections will be greater than the allowable limit for plastered ceilings = $\frac{1}{360}$ span.

For complete and exact dimensions of Z-bars see page 41.

GENERAL FORMULÆ FOR FLEXURE OF BEAMS.

NOTATION.

A = Area of Section in square inches.
d = Depth of Cross Section in inches.
l = Length of Span in inches.
L = Length of Span in feet.
p = Stress in extreme fibre of section in pounds per square inch.
X_1 = Distance of Center of Gravity of Section from extreme fibre in inches.
W = Total Load, in pounds, Uniformly Distributed, including the Weight of Beam.
W_1 = Total Superimposed or Live Load, in pounds, Uniformly Distributed.
W_2 = Total Weight of Beam, in pounds, Uniformly Distributed.
W_s = Total Safe Load, in pounds, Uniformly Distributed.
P = Load, in pounds, concentrated at any point.
F = Coefficient of Strength of the Tables of Properties = Safe Load, in pounds, for a fibre stress of 16 000 pounds per square inch for a span of one foot.
F′ = Coefficient of Strength of the Tables of Properties = Safe Load, in pounds, for a fibre stress of 12 500 pounds per square inch for a span of one foot.
D = Total Deflection of Beam, in inches, due to weight W.
D_{W_1} and D_p = Deflections of Beams, in inches, due to the weights W_1 and P respectively.
N = Coefficient of Deflection of the Tables of Properties = Deflection, in inches, due to a total load of 1 000 pounds uniformly distributed for a span of one foot.
N′ = Coefficient of Deflection of the Tables of Properties = Deflection, in inches, due to a superimposed load of 1 000 pounds, concentrated at the middle of a Beam with a span of one foot.
H = Coefficient of Deflection, in inches, for fibre stress of 16 000 pounds per square inch, for any section used as a Beam subjected to its safe load Uniformly Distributed. (See table, page 70.)
H′ = Coefficient of Deflection, in inches, for fibre stress of 12 500 pounds per square inch for any section used as a Beam subjected to its safe load Uniformly Distributed. (See table, page 70.)
M = Total Bending Moment, in inch pounds, due to the Weight of Beam and Superimposed Load.
I = Moment of Inertia, in inches^4, Axis through Center of Gravity.
I_1 = Moment of Inertia, in inches^4 Axis parallel to above but not through Center of Gravity.
v = Distance, in inches, between these Axes.
S = Section Modulus in inches^3.
r = Radius of Gyration in inches.
E = Modulus of Elasticity, in pounds, per square inch (Steel = 29 000 000).

GENERAL FORMULÆ.

$$S = \frac{I}{X_1} \qquad I_1 = I + Av^2 \qquad r = \sqrt{\frac{I}{A}}$$

$$M = \frac{pI}{X_1} = pS \quad \therefore \quad p = \frac{MX_1}{I} = \frac{M}{S}. \quad \text{Or for Symmetrical Section } M = \frac{2pI}{d}$$

For Beam supported at both ends and Uniformly Loaded :

$$M = \frac{Wl}{8} = \frac{(W_1 + W_2)\,l}{8} \quad \therefore \quad W = (W_1 + W_2) = \frac{8\,M}{l} = \frac{8pI}{lX_1} = \frac{8pS}{l}$$

SAFE LOADS.

$$F = \frac{8pS}{l} \text{ where } p = 16\,000 \text{ pounds and } l = 12'' \text{ therefore } F = \frac{2}{3}\,16\,000\,S$$

$$F' = \frac{8pS}{l} \text{ where } p = 12\,500 \text{ pounds and } l = 12'' \text{ therefore } F' = \frac{2}{3}\,12\,500\,S$$

To obtain the Safe Load for any span in feet, for fibre stress of 16 000 pounds per square inch :

$$\text{Safe Load} = W_s = \frac{2}{3}\,\frac{16\,000\,S}{L} = \frac{F}{L}$$

To obtain the Safe Load for any span in feet, for fibre stress of 12 500 pounds per square inch :

$$\text{Safe Load} = W_s = \frac{2}{3}\,\frac{12\,500\,S}{L} = \frac{F'}{L}$$

GENERAL FORMULÆ FOR FLEXURE OF BEAMS. Continued.

DEFLECTIONS.

(1) Beam supported at both ends and Uniformly Loaded:

$$\text{Deflection for Total Load} = D = \frac{5}{384}\frac{Wl^3}{EI} = \frac{5}{384}\frac{(W_1 + W_2)\,l^3}{EI}$$

$$\text{Deflection for Superimposed Load} = Dw_1 = \frac{5}{384}\frac{W_1 l^3}{EI}$$

(2) Beam supported at both ends with load concentrated at the middle:

$$\text{Deflection for Total Load} = D = \frac{Pl^3}{48EI} + \frac{5}{384}\frac{W_2 l^3}{EI}$$

$$\text{Deflection for Superimposed Load} = D_p = \frac{Pl^3}{48EI}$$

(3) Beam fixed at one end, unsupported at the other, and Uniformly Loaded:

$$\text{Deflection for Total Load} = D = \frac{Wl^3}{8EI} = \frac{(W_1 + W_2)\,l^3}{8EI}$$

$$\text{Deflection for Superimposed Load} = Dw_1 = \frac{W_1 l^3}{8EI}$$

(4) Beam fixed at one end, and unsupported at the other, with load concentrated at the unsupported end:

$$\text{Deflection for Total Load} = D = \frac{Pl^3}{3EI} + \frac{W_2 l^3}{8EI}$$

$$\text{Deflection for Superimposed Load} = D_p = \frac{Pl^3}{3EI}$$

$N = \frac{5}{384}\frac{Wl^3}{EI} = \frac{5}{384}\frac{(W_1 + W_2)\,l^3}{EI}$, where $W = (W_1 + W_2) = 1\,000$ pounds and $l = 12''$

$N' = \frac{Pl^3}{48EI}$, where $P = 1\,000$ pounds and $l = 12''$

Total Deflection, in inches, due to a Beam Uniformly Loaded for any span in feet $= D = \frac{NWL^3}{1\,000} = \frac{N\,(W_1 + W_2)\,L^3}{1\,000}$

Total Deflection, in inches, due to a Superimposed Load P and the Weight of Beam W_2 for any span in feet $= D = \frac{N'PL^3}{1\,000} + \frac{NW_2L^3}{1\,000}$

$$H = \frac{12}{725}L^2 \qquad H' = \frac{3}{232}L^2$$

FOR SYMMETRICAL SECTIONS.

Total Deflection, in inches, for a fibre stress of 16 000 lbs. per square inch $= D = \frac{H}{d}$

Total Deflection, in inches, for a fibre stress of 12 500 lbs. per square inch $= D = \frac{H'}{d}$

FOR UNSYMMETRICAL SECTIONS.

Total Deflection, in inches, for a fibre stress of 16 000 pounds per square inch $= D = \frac{H}{2X_1}$

Total Deflection, in inches, for a fibre stress of 12 500 pounds per square inch $= D = \frac{H'}{2X_1}$

BENDING MOMENTS AND DEFLECTIONS FOR BEAMS OF UNIFORM SECTION.

W = Total Load, in lbs., uniformly distributed, including the weight of beam.
W_1 = Total Superimposed or Live Load, in lbs., uniformly distributed.
W_2 = Total Weight of Beam or Dead Load, in lbs., uniformly distributed.
P, P_1, P_2, P_3 = Loads, in lbs., concentrated at any points.

M = Total Bending Moment, in inch-lbs.
M_{w1}, M_p = Bending Moments, in inch-lbs., due to Weights W_1 and P respectively.
I = Moment of Intertia, in inches^4.
l = Length of Span, in inches.
E = Modulus of Elasticity, in lbs. per square inch = 29 000 000 for steel.
W_s = Total Safe Load, in lbs., uniformly distributed, including weight of beam = Total Safe Load of Tables.

The ordinates in diagrams give the bending moments for corresponding points on beam. For superimposed load only, make W_2 in formulæ equal to zero.

(1) Beam Supported at both ends and Uniformly Loaded.

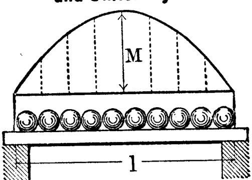


Diagram for Total Load:—
Draw parabola having $M = \frac{Wl}{8}$

Safe Superimposed Load, in lbs., uniformly distributed, $W'_s = W_s - W_2$.

Maximum Bending Moment at middle of beam $= M = \frac{Wl}{8} = \frac{(W_1 + W_2)\,l}{8}$.

Maximum Shear at points of support $= \frac{W}{2} = \frac{W_1 + W_2}{2}$.

Maximum Deflection $= \frac{5}{384}\,\frac{Wl^3}{EI} = \frac{5}{384}\,\frac{(W_1 + W_2)\,l^3}{EI}$.

(2) Beam Supported at both ends with Load Concentrated at the Middle.

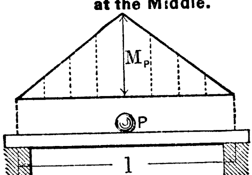


Diagram for Superimposed Load:—
Draw triangle having $M_p = \frac{Pl}{4}$
Diagram for Dead Load similar to Case (1)

Safe Superimposed Load, in lbs., concentrated, $P_s = \frac{W_s - W_2}{2}$.

Maximum Bending Moment at middle of beam $= M = \frac{Pl}{4} + \frac{W_2\,l}{8}$.

Maximum Shear at points of support $= \frac{P + W_2}{2}$.

Max. Deflection $= \frac{Pl^3}{48EI} + \frac{5}{384}\,\frac{W_2\,l^3}{EI}$.

(3) Beam fixed at one end, Unsupported at the other and Uniformly Loaded.

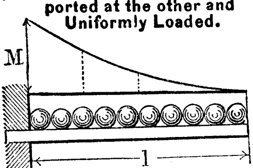


Diagram for Total Load:—
Draw Parabola having $M = \frac{Wl}{2}$

Safe Superimposed Load, in lbs., uniformly distributed, $W'_s = \frac{W_s}{4} - W_2$.

Maximum Bending Moment at point of support $= \frac{Wl}{2} = \frac{(W_1 + W_2)\,l}{2}$.

Maximum Shear at point of support $= W = W_1 + W_2$.

Max. Deflection $= \frac{Wl^3}{8EI} = \frac{(W_1 + W_2)\,l^3}{8EI}$.

BENDING MOMENTS AND DEFLECTIONS FOR BEAMS OF UNIFORM SECTION.

W = Total Load, in lbs., uniformly distributed, including the weight of beam.

W_1 = Total Superimposed or Live Load, in lbs., uniformly distributed.

W_2 = Total Weight of Beam or Dead Load, in lbs., uniformly distributed.

P, P_1, P_2, P_3 = Loads, in lbs., concentrated at any points.

M = Total Bending Moment, in inch-lbs.

M_{w1}, M_p = Bending Moments, in inch-lbs., due to Weights W_1 and P respectively.

I = Moment of Inertia, in inches⁴.

l = Length of Span, in inches.

E = Modulus of Elasticity, in lbs. per square inch = 29 000 000 for steel.

W_s = Total Safe Load, in lbs., uniformly distributed, including weight of beam = Total Safe Load of Tables.

The ordinates in diagrams give the bending moments for corresponding points on beam. For superimposed load only, make W_2 in formulæ equal to zero.

(4) Beam fixed at one end, and Unsupported at the other, with Load Concentrated at the free end.

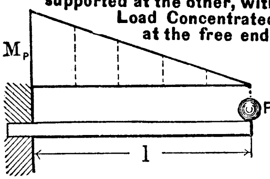


Diagram for Superimposed Load :—
Draw triangle having $M_p = Pl$.
Diagram for Dead Load similar to Case (3)

Safe Superimposed Load, in lbs., concentrated, $P_s = \frac{W_s - 4W_2}{8}$.

Maximum Bending Moment at point of support $= Pl + \frac{W_2 l}{2}$.

Maximum Shear at point of support $= P + W_2$.

Maximum Deflection $= \frac{Pl^3}{3EI} + \frac{W_2 l^3}{8EI}$.

(5) Beam Supported at both ends with Load Concentrated at any point.

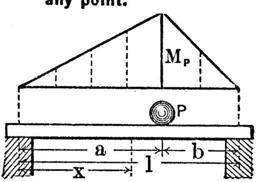


Diagram for Superimposed Load :—

Draw triangle having $M_p = \frac{Pab}{l}$.

Diagram for Dead Load similar to Case (1)

Safe Superimposed Load, in lbs., concentrated, $P_s = \frac{W_s l^2 - 4a\,W_2\,(l - a)}{8ab}$.

Maximum Bending Moment under load $= \frac{a\,(2\,Pb + W_2 l - W_2 a)}{2l}$.

Max. Shear at Sup. near a $= \frac{Pb}{l} + \frac{W_2}{2}$.

Max. Shear at Sup. near b $= \frac{Pa}{l} + \frac{W_2}{2}$.

Deflection at distance x from left support $= \frac{1}{3lEI}\left[\frac{2al - a^2}{3}\right]^{\frac{3}{2}}$
$\left[Pb + \frac{W_2}{8}\left(2l - \sqrt{\frac{2al - a^2}{3}} - \frac{3l^3}{2al - a^2}\right)\right]$

$x = \sqrt{\frac{2al - a^2}{3}}$ = Distance, from left support, of point of maximum deflection for superimposed load.

(6) Beam Supported at both ends with two Symmetrical Loads.

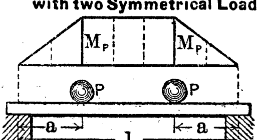


Diagram for Superimposed Load :—
Draw trapezoid having $M_p = Pa$.
Diagram for Dead Load similar to Case (1)

Safe Superimposed Load, in lbs., concentrated, each, $P_s = \frac{W_s l - W_2 l}{8a}$.

Maximum Bending Moment at center of beam $= Pa + \frac{W_2 l}{8}$.

Maximum Shear at points of support $= \frac{2P + W_2}{2}$.

Maximum Deflection $= \frac{Pa}{24EI}\left(3l^2 - 4a^2\right) + \frac{5}{384}\,\frac{W_2\,l^3}{EI}$.

BENDING MOMENTS AND DEFLECTIONS FOR BEAMS OF UNIFORM SECTION.

W = Total Load, in lbs., uniformly distributed, including the weight of beam.

W_1 = Total Superimposed or Live Load, in lbs., uniformly distributed.

W_2 = Total Weight of Beam or Dead Load, in lbs., uniformly distributed.

P, P_1, P_2, P_3 = Loads, in lbs., concentrated at any points.

M = Total Bending Moment, in inch-lbs.

M_{w1}, M_p = Bending Moments, in inch-lbs., due to Weights W_1 and P respectively.

I = Moment of Inertia, in inches^4.

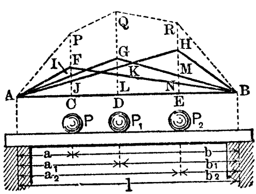
l = Length of Span, in inches.

E = Modulus of Elasticity, in lbs., per square inch = 29 000 000 for steel.

W_s = Total Safe Load, in lbs., uniformly distributed, including the weight of beam = Total Safe Load of Tables.

The ordinates in diagrams give the bending moments for corresponding points on beam. For superimposed load only, make W_2 in formulæ equal to zero.

(7) Beam Supported at both ends with Loads Concentrated at various Points.



The total bending moment at any point produced by all the weights is equal to the sum of the moments at that point produced by each of the weights separately.

Diagram for Dead Load similar to Case (1)

The Maximum Bending Moment occurs at the point where the vertical shear equals zero and will be at one of the loads P, P_1, or P_2 depending upon their amounts and spacing if W_2 is neglected.

Let R = Reaction at Left Support.

Bending Moment at P =

$$M_p = Ra - \frac{W_2\ a^2}{2l}.$$

Bending Moment at P_1 =

$$M_{p1} = Ra_1 - \left[\frac{W_2\ a_1{}^2}{2l} + P\ (a_1 - a)\right].$$

Bending Moment at P_2 = M_{p2} = Ra_2 —

$$\left[\frac{W_2\ a_2{}^2}{2l} + P_1\ (a_2 - a_1) + P\ (a_2 - a)\right].$$

Shear or Reaction at Left Support =

$$\frac{P_2\ b_2 + P_1\ b_1 + Pb}{l} + \frac{W_2}{2}.$$

Shear or Reaction at Right Support =

$$\frac{P_2\ a_2 + P_1\ a_1 + Pa}{l} + \frac{W_2}{2}.$$

Diagram for Superimposed Load:—Draw as in Case (5) the Ordinates FC, GD and HE representing the bending moments due to loads P, P_1 and P_2 respectively. Produce FC to P, making PC = FC + IC + JC; GD to Q, making QD = GD + KD + LD; and HE to R, making RE = HE + ME + NE. Join the points A, P, Q, R and B, then the ordinates between A B and polygon A P Q R B will represent the bending moments for corresponding points on beam.

BENDING MOMENTS AND DEFLECTIONS FOR BEAMS OF UNIFORM SECTION.

W = Total Load, in lbs., uniformly distributed, including the weight of beam.

W_1 = Total Superimposed or Live Load, in lbs., uniformly distributed.

W_2 = Total Weight of Beam or Dead Load, in lbs., uniformly distributed.

P, P_1, P_2, P_3 = Loads, in lbs., concentrated at any points.

M = Total Bending Moment, in inch-lbs.

M_{w1}, M_p = Bending Moments, in inch-lbs., due to Weights W_1 and P respectively.

I = Moment of Inertia, in inches^4.

l = Length of Span, in inches.

E = Modulus of Elasticity, in lbs., per square inch = 29 000 000 for steel.

W_s = Total Safe Load, in lbs., uniformly distributed, including the weight of beam = Total Safe Load of Tables.

The ordinates in diagrams give the bending moments for corresponding points on beam. For superimposed load only, make W_2 in formulæ equal to zero.

(8) Beam Fixed at both ends and Uniformly Loaded.

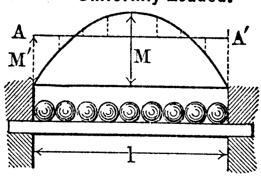


Diagram for Total Load:—Draw parabola having $M = \frac{Wl}{8}$. Also A A′ parallel to base and at a distance $M' = \frac{Wl}{12}$. The Vertical distances between the parabola and line A A′ are the moments for corresponding points on beam.

Safe Superimposed Load, in lbs., uniformly distributed, $W'_s = \frac{3}{2} W_s - W_2$.

Distance of points of contra-flexure from supports = .2113l.

Maximum Bending Moment at points of support $= \frac{Wl}{12} = \frac{(W_1 + W_2)\,l}{12}$.

Bending Moment at middle of beam $= \frac{Wl}{24} = \frac{(W_1 + W_2)\,l}{24}$.

Maximum Shear at points of support $= \frac{W_1 + W_2}{2}$.

Maximum Deflection $= \frac{Wl^3}{384EI} = \frac{(W_1 + W_2)\,l^3}{384EI}$

(9) Beam Fixed at both ends with Load Concentrated at the Middle.

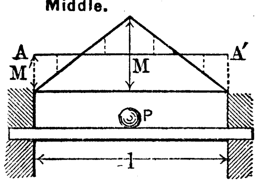


Diagram for Superimposed Load:—Draw triangle having $M = \frac{Pl}{4}$. Also A A′ parallel to base and at a distance $M' = \frac{Pl}{8}$. The Vertical distances between the triangle and line A A′ are the moments for corresponding points on beam.

Diagram for Dead Load similar to Case (8)

Safe Superimposed Load, in lbs., concentrated, $P_s = W_s - \frac{2}{3} W_2$.

Distance of points of contra-flexure from supports = $\frac{1}{4}$l.

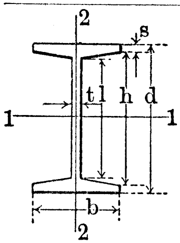
Maximum Bending Moment at points of support $= \frac{Pl}{8} + \frac{W_2 l}{12}$.

Bending Moment at middle of beam $= \frac{Pl}{8} + \frac{W_2 l}{24}$.

Maximum Shear at points of support $= \frac{P + W_2}{2}$.

Maximum Deflection $= \frac{Pl^3}{192EI} + \frac{W_2 l^3}{384EI}$.

VALUES OF MOMENTS OF INERTIA FOR STANDARD AND CAMBRIA SECTIONS.



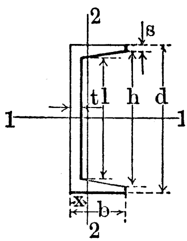
$$A = td + 2s\,(b-t) + \frac{(b-t)^2}{12}.$$

$$I,\ \text{Axis } 1\text{—}1 = \frac{bd^3}{12} - \frac{h^4-l^4}{8}.$$

$$I',\ \text{Axis } 2\text{—}2 = \frac{b^3s}{6} + \frac{lt^3}{12} + \frac{b^4-t^4}{288}.$$

Slope of flange $= g = \dfrac{h-l}{b-t} = \dfrac{1}{6}$ for standard sections.

$h = d - 2s.$ $\qquad l = h - g(b-t).$



$$A = td + 2s\,(b-t) + \frac{(b-t)^2}{6}.$$

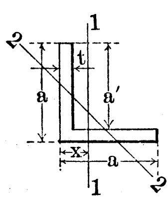
$$x = \left[b^2s + \frac{ht^2}{2} + \frac{(b-t)^2\,(b+2t)}{18}\right] \div A.$$

$$I,\ \text{Axis } 1-1 = \frac{bd^3}{12} - \frac{h^4-l^4}{16}.$$

$$I',\ \text{Axis } 2-2 = \frac{1}{3}\left[2sb^3 + lt^3 + \frac{b^4-t^4}{12}\right] - Ax^2.$$

Slope of flange $= g = \dfrac{h-l}{2(b-t)} = \dfrac{1}{6}$ for standard sections.

$h = d - 2s.$ $\qquad l = h - 2g(b-t).$

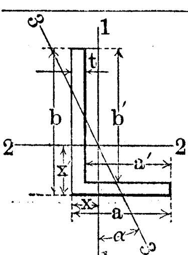


$$A = t\,(2a-t).$$

$$x = \frac{a^2+at-t^2}{2(2a-t)}.$$

$$I,\ \text{Axis } 1-1 = \frac{t(a-x)^3+ax^3-(a-t)\,(x-t)^3}{3}.$$

$$I'',\ \text{Axis } 2-2 = \frac{2x^4-2(x-t)^4+t\left[a-\left(2x-\frac{t}{2}\right)\right]^3}{3}$$



$$A = t(a+b-t).$$

$$x = \frac{t(2a'+b)+a'^2}{2(a'+b)}. \qquad x' = \frac{t(2b'+a)+b'^2}{2(b'+a)}.$$

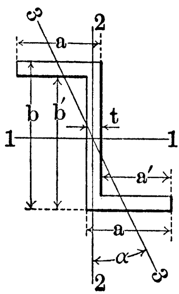
$$\text{Tan.}\,2\alpha = -\frac{[(2x-t)b(b-2x')+(2x'-t)(a-t)(a+t-2x)]\,t}{2(I'-I)}.$$

$$I,\ \text{Axis } 1-1 = \frac{t(a-x)^3+bx^3-(b-t)(x-t)^3}{3}.$$

$$I',\ \text{Axis } 2-2 = \frac{t(b-x')^3+ax'^3-(a-t)(x'-t)^3}{3}.$$

$$I'',\ \text{Axis } 3-3 = \frac{I\cos^2\alpha - I'\sin^2\alpha}{\cos 2\alpha}.$$

VALUES OF MOMENTS OF INERTIA FOR STANDARD AND CAMBRIA SECTIONS.



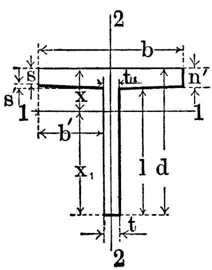
$$A = [b + 2(a - t)]\, t.$$

$$\text{Tan. } 2\alpha = -\frac{(bt - t^2)(a^2 - at)}{I - I'}.$$

$$I, \text{ Axis } 1-1 = \frac{ab^3 - a'(b - 2t)^3}{12}.$$

$$I', \text{ Axis } 2-2 = \frac{b(a + a')^3 - 2a'^3b' - 6a'a^2b'}{12}.$$

$$I'' \text{ Minimum, Axis } 3-3 = \frac{I' \cos^2\alpha - I \sin^2\alpha}{\cos 2\alpha}.$$

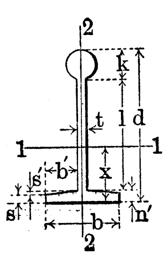


$$A = \frac{l(t + t_1)}{2} + n' t_1 + b'(s + n').$$

$$x = \frac{3s^2(b-t_1)+2b's'(s'+3s)+3t_1d^2-l(t_1-t)(3d-l)}{6A}.$$

$$I, \text{ Axis } 1-1 = \frac{l^3(3t+t_1)+4bn'^3-2b's'^3}{12} - A(x-n')^2$$

$$I', \text{ Axis } 2-2 = \frac{sb^3+s't_1^3+lt^3}{12} + \frac{s'b'[2b'^2+(2b'+3t_1)^2]}{36} + \frac{l(t_1-t)[(t_1-t)^2+2(t_1+2t)^2]}{144}.$$



e = Area of head.

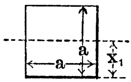
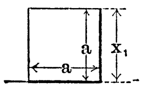
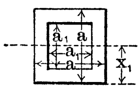
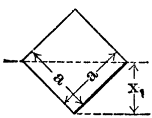
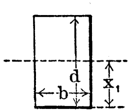
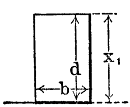
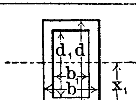
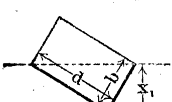
$$A = e + t(d - k) + (b - t)\left(s + \frac{s'}{2}\right).$$

$$x = \frac{e(2d-k) + t(d-k)^2 + (b-t)\left(s^2 + ss' + \frac{s'^2}{3}\right)}{2A}.$$

$$I, \text{ Axis } 1-1 = e\left[\frac{k^2}{16} + \left(d - \frac{2s + k}{2}\right)^2\right] + \frac{t(l + s')^3}{3} + \frac{b's'^3 + 2bs^3}{6} - A(x-s)^2.$$

$$I', \text{ Axis } 2-2 = \frac{ek^2}{16} + \frac{t^3(l+s')+sb^3}{12} + \frac{s'b'[2b'^2+(2b'+3t)^2]}{36}$$

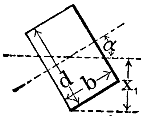
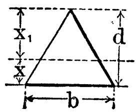
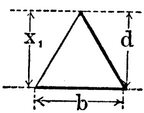
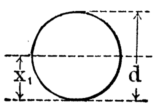
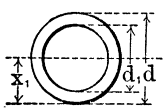
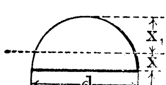
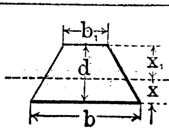
PROPERTIES OF VARIOUS SECTIONS.

Sections.	Area of Section. A	Distance from Neutral Axis to Extremities of Section. x and x_1
	a^2	$x_1 = \frac{a}{2}$
	a^2	$x_1 = a$
	$a^2 - a_1^2$	$x_1 = \frac{a}{2}$
	a^2	$x_1 = \frac{a}{\sqrt{2}} = .707a$
	bd	$x_1 = \frac{d}{2}$
	bd	$x_1 = d$
	$bd - b_1d_1$	$x_1 = \frac{d}{2}$
	bd	$x_1 = \frac{bd}{\sqrt{b^2 + d^2}}$

PROPERTIES OF VARIOUS SECTIONS.

Moment of Inertia. I	Section Modulus. $S = \frac{I}{x_1}$.	Radius of Gyration. $r = \sqrt{\frac{I}{A}}$.
$\frac{a^4}{12}$	$\frac{a^3}{6}$	$\frac{a}{\sqrt{12}} = .289a$
$\frac{a^4}{3}$	$\frac{a^3}{3}$	$\frac{a}{\sqrt{3}} = .577a$
$\frac{a^4 - a_1^4}{12}$	$\frac{a^4 - a_1^4}{6a}$	$\sqrt{\frac{a^2 + a_1^2}{12}}$
$\frac{a^4}{12}$	$\frac{a^3}{6\sqrt{2}} = .118a^3$	$\frac{a}{\sqrt{12}} = .289a$
$\frac{bd^3}{12}$	$\frac{bd^2}{6}$	$\frac{d}{\sqrt{12}} = .289d$
$\frac{bd^3}{3}$	$\frac{bd^2}{3}$	$\frac{d}{\sqrt{3}} = .577d$
$\frac{bd^3 - b_1d_1^3}{12}$	$\frac{bd^3 - b_1d_1^3}{6d}$	$\sqrt{\frac{bd^3 - b_1d_1^3}{12(bd - b_1d_1)}}$
$\frac{b^3d^3}{6(b^2 + d^2)}$	$\frac{b^2d^2}{6\sqrt{b^2 + d^2}}$	$\frac{bd}{\sqrt{6(b^2 + d^2)}}$

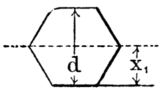
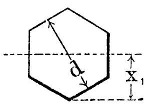
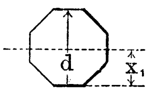
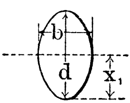
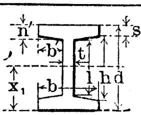
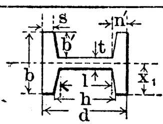
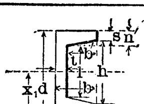
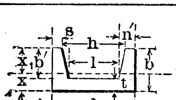
PROPERTIES OF VARIOUS SECTIONS.

Sections.	Area of Section. A	Distance from Neutral Axis to Extremities of Section. x and x_1
	bd	$x_1 = \dfrac{d \cos \alpha + b \sin \alpha}{2}$
	$\dfrac{bd}{2}$	$x = \dfrac{d}{3}$ $x_1 = \dfrac{2d}{3}$
	$\dfrac{bd}{2}$	$x_1 = d$
	$\dfrac{\pi d^2}{4} = .785d^2$	$x_1 = \dfrac{d}{2}$
	$\dfrac{\pi(d^2 - d_1^2)}{4} = .785(d^2 - d_1^2)$	$x_1 = \dfrac{d}{2}$
	$\dfrac{\pi d^2}{8} = .393d^2$	$x = \dfrac{2d}{3\pi} = .212d$ $x_1 = \dfrac{(3\pi - 4)\,d}{6\pi} = .288d$
	$\dfrac{b + b_1}{2} \cdot d$	$x = \dfrac{b + 2b_1}{b + b_1} \cdot \dfrac{d}{3}$ $x_1 = \dfrac{b_1 + 2b}{b + b_1} \cdot \dfrac{d}{3}$

PROPERTIES OF VARIOUS SECTIONS.

Moment of Inertia. I	Section Modulus. $S = \frac{I}{x_1}$	Radius of Gyration. $r = \sqrt{\frac{I}{A}}$
$\frac{bd}{12}(d^2\cos^2\alpha + b^2\sin^2\alpha)$	$\frac{db}{6}\left(\frac{d^2\cos^2\alpha + b^2\sin^2\alpha}{d\cos\alpha + b\sin\alpha}\right)$	$\sqrt{\frac{d^2\cos^2\alpha + b^2\sin^2\alpha}{12}}$
$\frac{bd^3}{36}$	$\frac{bd^2}{24}$	$\frac{d}{\sqrt{18}} = .236d$
$\frac{bd^3}{12}$	$\frac{bd^2}{12}$	$\frac{d}{\sqrt{6}} = .408d$
$\frac{\pi d^4}{64} = .049d^4$	$\frac{\pi d^3}{32} = .098d^3$	$\frac{d}{4}$
$\frac{\pi(d^4 - d_1^4)}{64} = .049(d^4 - d_1^4)$	$\frac{\pi}{32}\frac{(d^4 - d_1^4)}{d} = .098\frac{(d^4 - d_1^4)}{d}$	$\frac{\sqrt{d^2 + d_1^2}}{4}$
$\frac{9\pi^2 - 64}{1152\pi} \cdot d^4 = .007d^4$	$\frac{9\pi^2 - 64}{192(3\pi - 4)} \cdot d^3 = .024d^3$	$\frac{\sqrt{9\pi^2 - 64}}{12\pi} \cdot d = .132d$
$\frac{b^2 + 4bb_1 + b_1^2}{36(b + b_1)} \cdot d^3$	$\frac{b^2 + 4bb_1 + b_1^2}{12(b_1 + 2b)} \cdot d^2$	$\frac{d}{6(b+b_1)}\sqrt{2(b^2+4bb_1+b_1^2)}$

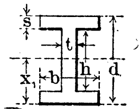
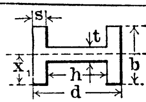
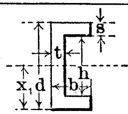
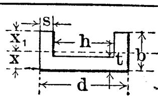
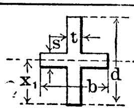
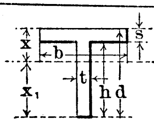
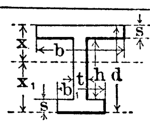
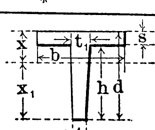
PROPERTIES OF VARIOUS SECTIONS.

Sections.	Area of Section. A	Distance from Neutral Axis to Extremities of Section. x and x_1
	$\frac{3}{2} d^2 \tan. 30^\circ = .866d^2$	$x_1 = \frac{d}{2}$
	$\frac{3}{2} d^2 \tan. 30^\circ = .866d^2$	$x_1 = \frac{d}{2 \cos 30^\circ} = .577d$
	$2d^2 \tan. 22\frac{1}{2}^\circ = .828d^2$	$x_1 = \frac{d}{2}$
	$\frac{\pi bd}{4} = .785\ bd$	$x_1 = \frac{d}{2}$
	$td + 2b'(s + n')$	$x_1 = \frac{d}{2}$
	$td + 2b'(s + n')$	$x_1 = \frac{b}{2}$
	$td + b'(s + n')$	$x_1 = \frac{d}{2}$
	$td + b'(s + n')$	$x = \left[b^2 s + \frac{ht^2}{2} + \frac{g}{3}(b-t)^2 (b + 2t)\right] \div A$ $x_1 = b - x$

PROPERTIES OF VARIOUS SECTIONS.

Moment of Inertia. I	Section Modulus. $S = \frac{I}{x_1}$	Radius of Gyration. $r = \sqrt{\frac{I}{A}}$
$\frac{A}{12}\left[\frac{d^2 (1 + 2\cos^2 30^\circ)}{4\cos^2 30^\circ}\right] = .06d^4$	$\frac{A}{6}\left[\frac{d(1+2\cos^2 30^\circ)}{4\cos^2 30^\circ}\right] = .12d^3$	$\frac{d}{4\cos 30^\circ}\sqrt{\frac{1+2\cos^2 30^\circ}{3}} = .264d$
$\frac{A}{12}\left[\frac{d^2 (1 + 2\cos^2 30^\circ)}{4\cos^2 30^\circ}\right] = .06d^4$	$\frac{A}{6}\left[\frac{d(1+2\cos^2 30^\circ)}{4\cos 30^\circ}\right] = .104d^3$	$\frac{d}{4\cos 30^\circ}\sqrt{\frac{1+2\cos^2 30^\circ}{3}} = .264d$
$\frac{A}{12}\left[\frac{d^2 (1 + 2\cos^2 22\frac{1}{2}^\circ)}{4\cos^2 22\frac{1}{2}^\circ}\right] = .055d^4$	$\frac{A}{6}\left[\frac{d(1+2\cos^2 22\frac{1}{2}^\circ)}{4\cos 22\frac{1}{2}^\circ}\right] = .109d^3$	$\frac{d}{4\cos 22\frac{1}{2}^\circ}\sqrt{\frac{1+2\cos^2 22\frac{1}{2}^\circ}{3}} = .257d$
$\frac{\pi bd^3}{64} = .049bd^3$	$\frac{\pi bd^2}{32} = .098bd^2$	$\frac{d}{4}$
$\frac{1}{12}\left[bd^3 - \frac{1}{4g}(h^4 - l^4)\right]$	$\frac{2I}{d}$	$r = \sqrt{\frac{I}{A}}$
$\frac{1}{12}\left[b^3(d-h) + lt^3 + \frac{g}{4}(b^4 - t^4)\right]$	$\frac{2I}{b}$	$r = \sqrt{\frac{I}{A}}$
$\frac{1}{12}\left[bd^3 - \frac{1}{8g}(h^4 - l^4)\right]$	$\frac{2I}{d}$	$r = \sqrt{\frac{I}{A}}$
$\frac{1}{3}\left[2sb^3 + lt^3 + \frac{g}{2}(b^4 - t^4)\right] - Ax^2$	$\frac{I}{b-x}$	$r = \sqrt{\frac{I}{A}}$

PROPERTIES OF VARIOUS SECTIONS.

Sections.	Area of Section. A	Distance from Neutral Axis to Extremities of Section. x and x_1
	$bd - h(b - t)$	$x_1 = \frac{d}{2}$
	$bd - h(b - t)$	$x_1 = \frac{b}{2}$
	$bd - h(b - t)$	$x_1 = \frac{d}{2}$
	$bd - h(b - t)$	$x = \frac{2b^2s + ht^2}{2A}$ $x_1 = b - x$
	$td + s(b - t)$	$x_1 = \frac{d}{2}$
	$bs + ht$	$x = \frac{d^2t + s^2(b - t)}{2A}$ $x_1 = d - x$
	$bs + ht + b_1s$	$x = \frac{td^2 + s^2(b - t) + s(b_1 - t)(2d - s)}{2A}$ $x_1 = d - x$
	$bs + \frac{h(t + t_1)}{2}$	$x = \frac{3bs^2 + 3th(d + s) + h(t_1 - t)(h + 3s)}{6A}$ $x_1 = d - x$

PROPERTIES OF VARIOUS SECTIONS.

Moment of Inertia. I	Section Modulus. $S = \frac{I}{x_1}$	Radius of Gyration. $r = \sqrt{\frac{I}{A}}$
$\frac{bd^3 - h^3(b-t)}{12}$	$\frac{bd^3 - h^3(b-t)}{6d}$	$\sqrt{\frac{bd^3 - h^3(b-t)}{12[bd - h(b-t)]}}$
$\frac{2sb^3 + ht^3}{12}$	$\frac{2sb^3 + ht^3}{6b}$	$\sqrt{\frac{2sb^3 + ht^3}{12[bd - h(b-t)]}}$
$\frac{bd^3 - h^3(b-t)}{12}$	$\frac{bd^3 - h^3(b-t)}{6d}$	$\sqrt{\frac{bd^3 - h^3(b-t)}{12[bd - h(b-t)]}}$
$\frac{2sb^3 + ht^3}{3} - Ax^2$	$\frac{I}{b - x}$	$\sqrt{\frac{I}{A}}$
$\frac{td^3 + s^3(b-t)}{12}$	$\frac{td^3 + s^3(b-t)}{6d}$	$\sqrt{\frac{td^3 + s^3(b-t)}{12[td + s(b-t)]}}$
$\frac{tx_1^3 + bx^3 - (b-t)(x-s)^3}{3}$	$\frac{I}{d - x}$	$\sqrt{\frac{tx_1^3 + bx^3 - (b-t)(x-s)^3}{3(bs + ht)}}$
$\frac{bx^3 + b_1x_1^3 - (b-t)(x-s)^3}{3} - \frac{(b_1 - t)(x_1 - s)^3}{3}$	$\frac{I}{d - x}$	$\left[\frac{bx^3 + b_1x_1^3 - (b-t)(x-s)^3}{3(bs + ht + b_1s)} - \frac{(b_1 - t)(x_1 - s)^3}{3(bs + ht + b_1s)}\right]^{\frac{1}{2}}$
$\frac{4bs^3 + h^3(3t + t_1)}{12} - A(x-s)^2$	$\frac{I}{d - x}$	$\sqrt{\frac{I}{A}}$

EXPLANATIONS OF THE TABLES OF PROPERTIES OF STANDARD AND SPECIAL I-BEAMS, STANDARD AND SPECIAL CHANNELS, STANDARD AND SPECIAL ANGLES WITH EQUAL AND UNEQUAL LEGS, Z-BARS AND T-BARS.

PROPERTIES OF I-BEAMS.

PAGES 158 TO 161 INCLUSIVE.

The figures or values in the various columns give the section numbers, dimensions, weights, areas and properties of the sections as noted in the different headings.

The columns which require special explanation are as follows:

SECTION MODULUS—Column 8.

This is obtained from the moment of inertia in column 7 by dividing it by the distance from the neutral axis to the most remote fibre, which in this case is one-half the depth of the beam.

COEFFICIENTS OF STRENGTH—Columns 13 and 14.

The coefficients of strength F and F′ have been computed for fibre stresses of 16 000 and 12 500 pounds per square inch respectively, as stated in the headings of the columns, and are the safe loads in pounds uniformly distributed, including its own weight, for a beam one foot long. Thus the safe load for any span may be obtained by dividing the proper coefficient by the length of the span in feet.

The coefficients of strength were obtained from the following formulæ:

$$F = \tfrac{8}{3} \times 16\,000 \times S$$

$$F' = \tfrac{8}{3} \times 12\,500 \times S$$

in which S is the section modulus.

Coefficients of Deflection—Columns 15 and 16.

The coefficients of Deflection N and N′ for uniform and center loads, respectively, were obtained from the following formulæ:

$$N = \frac{Wl^3}{76.8EI} \qquad N' = \frac{Pl^3}{48EI}$$

in which

P and W = 1 000 pounds.

l = 12 inches.

E = 29 000 000.

I = moment of inertia about axis 1-1.

These coefficients are, therefore, the deflections in inches of a beam one foot long with a load of 1 000 pounds, hence, the deflection of a beam for any load and span may be obtained by multiplying the proper coefficient by the cube of the span in feet, and by the number of 1 000-pound units in the given load.

PROPERTIES OF STANDARD AND SPECIAL CHANNELS.

Pages 162 to 165 inclusive.

The various columns in the Tables of Properties of Standard Channels are similar to those in the Tables of Properties of I-Beams, as explained above, with the addition of column 11, which gives the Section Modulus about an axis through the center of gravity parallel to the web, and column 13, which gives the distance of the center of gravity from the outside of the web. In this case the Section Modulus $S' = \frac{I'}{b - x}$ the notation being as given at the heads of the columns.

PROPERTIES OF T-BARS.

A Table of Properties of Cambria T-Bars is given on pages 180 and 181.

PROPERTIES OF ANGLES.

The values in the Tables of Properties of Standard and Special Angles, with Equal Legs, pages 166 to 171, are these stated in the headings, and those in the Tables of Properties of Standard and Special Angles, with Unequal Legs, on pages 172 to 179, are similar, but with the addition of values for I'', S'' and r'' about the inclined axis 3-3, the position of which, in order to give the minimum values, was determined by the formula on page 142 for the value of the tangent of 2α. After determining the position of the inclined axis, the properties corresponding thereto were obtained by the formula on page 142.

PROPERTIES OF Z-BARS.

The Tables of Properties of Z-Bars, on pages 182 and 183, are similar to those for Beams and Channels with the addition of values in column 13 for determining the position of the inclined axis 3-3 to give the minimum values of the radius of gyration, as shown in column 14, these values being obtained in a manner similar to that used in calculating like quantities for the Tables of Properties of Angles with Unequal Legs, as explained above.

MOMENTS OF INERTIA OF RECTANGLES.

A Table of Moments of Inertia of Rectangles, about a transverse axis through the center of gravity, is added on pages 184 and 185 for convenience in calculating the Moments of Inertia, Section Moduli, and Radii of Gyration for compound shapes in which plates are used.

GENERAL FORMULÆ FOR PROPERTIES AND FLEXURE.

Formulæ for obtaining the Properties of Standard Sections are given on pages 142 and 143, and for various usual sections on pages 144 to 151 inclusive.

General formulæ for Flexure of Beams, Bending Moments, and Deflections for various cases of loading are given on pages 136 to 141 inclusive.

EXAMPLES OF APPLICATION OF THE TABLES OF PROPERTIES.

EXAMPLE I.

What is the proper size of I-Beam to carry a load of 35 000 pounds concentrated at the center of a span of 25 feet, the fibre stress not to exceed 16 000 pounds per square inch?

In the Tables of Properties of Standard I-Beams, the column headed F gives the coefficient of strength for a uniform load corresponding to a fibre stress of 16 000 pounds per square inch.

The coefficient of strength for a concentrated load at the center is twice that for the same load uniformly distributed, hence the coefficient necessary to meet the conditions is $35\,000 \times 25 \times 2 = 1\,750\,000$. From the Table of Properties of Standard I-Beams, page 161, column 13, the coefficient F for a 24-inch 80-pound beam is found to be 1 855 310. The weight of the beam itself is $80 \times 25 = 2000$ pounds, which corresponds to a coefficient of $2000 \times 25 = 50\,000$, which deducted from 1 855 310 gives a net coefficient of 1 800 310. A 24-inch beam weighing 80 pounds per foot is, therefore, the proper size.

EXAMPLE II.

What is the deflection of the beam in the preceding example under the given load?

In the Table of Properties of Standard I-Beams, pages 158 to 161 inclusive, the coefficient of deflection for beams with centre loads is given in column 16. To obtain the required deflection it is only necessary to multiply the coefficient by the cube of the span and the number of 1 000 pound units contained in the load.

Thus for the given example the deflection in inches =

$$.0000006 \times 25^3 \times \frac{35\,000}{1\,000} = .328 \text{ inch.}$$

EXAMPLE III.

What is the safe load uniformly distributed that can be placed on an 8-inch standard channel weighing 11.25 pounds per foot, with a clear span of 15 feet for a maximum fibre stress of 12 500 pounds per square inch, the web to be placed vertically?

From the Table of Properties of Standard Channels, page 163, column 16, the coefficient of strength F′ for the given channel under the conditions named, is found to be 67 300. Hence, the total load may be $67\,300 \div 15 = 4487$ pounds, and, as the channel itself weighs 169 pounds, the net superimposed load which it can safely carry under the given conditions is 4318 pounds.

EXAMPLE IV.

What is the fibre stress in a 5″ x 3″ angle weighing 8.2 pounds per foot if loaded at the center with a weight of 1500 pounds, used as a beam with a span of 6 feet, the 5-inch leg to be placed vertically?

The bending moment at the center will be

$$\frac{W_1\,l}{4} + \frac{W_2\,l}{8} = \frac{1\,500 \times 72}{4} + \frac{8.2 \times 6 \times 72}{8} = 27\,443 \text{ inch pounds.}$$

Referring to the Table of Properties of Standard Angles, Unequal Legs, on page 175, the Section Modulus for this angle, corresponding to the axis 2—2, is found to be 1.89.

The maximum fibre stress is obtained by dividing the bending moment by the section modulus, thus: $\frac{27\,443}{1.89} = 14\,520$, which is the maximum fibre stress in pounds per square inch at the point most remote from the neutral axis, which in this case is the extremity of the longer leg of the angle.

The second term in the above expression for the bending moment is that due to the weight of the angle itself and is inconsiderable, so that in practice it might be neglected for short spans, but should be taken into consideration for the longer ones.

PROPERTIES OF COMPOUND SHAPES.

The moments of inertia, section moduli, and radii of gyration of compound sections used as beams or columns, composed of plates and angles, channels, beams, Z-bars, T-bars, or any combination of these, may be obtained with the aid of the Tables of Properties as follows:

The first step is to find the center of gravity of the proposed section, which in the case of symmetrical sections is at the center of the figure.

For unsymmetrical sections the position of the center of gravity may be determined by multiplying the areas of the component parts by the distances of their centers of gravity from any convenient line, taken as an axis, and dividing the sum of these products by the sum of the areas, which will give the distance of the center of gravity of the compound section from the assumed axis.

The position of the center of gravity for all sizes of angles, channels, and T-bars is given in the Tables of Properties for these shapes, and is given for various geometrical sections on pages 144 to 151 inclusive, in connection with their other properties.

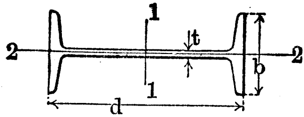
After determining the position of the center of gravity of a compound section, as explained above, the moment of inertia about an axis through its center of gravity may be found by taking the sum of the moments of inertia of each component part about an axis through its own center of gravity, parallel to the axis of the compound section, and adding thereto the sum of products obtained by multiplying the area of each component part by the square of the distance of its center of gravity from the axis of the compound section.

Having thus obtained the moment of inertia of the compound section, the section modulus may be obtained by dividing this moment of inertia by the distance from the neutral axis to the most remote extremity of the section.

The square of the radius of gyration for the compound section may be obtained by dividing the moment of inertia by the total area.

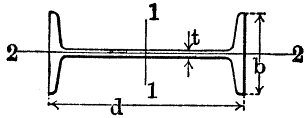
The moment of inertia of a compound section about any axis other than that through its center of gravity may be found in a manner similar to that above described.

PROPERTIES OF STANDARD I-BEAMS.



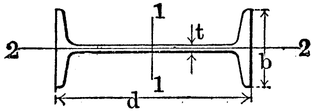
1	2	3	4	5	6	7	8	9	10	11
Section Number.	Depth of Beam.	Weight per Foot.	Area of Section.	Thick-ness of Web.	Width of Flange.	Moment of Inertia Axis 1-1.	Section Modulus Axis 1-1.	Radius of Gyra-tion Axis 1-1.	Moment of Inertia Axis 2-2.	Radius of Gyra-tion Axis 2-2.
	d		A	t	b	I	S	r	I′	r′
	Inches.	Pounds.	Sq. Ins.	Inch.	Inches.	Inches.[4]	Inches.[3]	Inches.	Inches.[4]	Inch.
B 5	3	5.50	1.63	.17	2.33	2.5	1.7	1.23	.46	.53
“	“	6.50	1.91	.26	2.42	2.7	1.8	1.19	.53	.52
“	“	7.50	2.21	.36	2.52	2.9	1.9	1.15	.60	.52
B 9	4	7.50	2.21	.19	2.66	6.0	3.0	1.64	.77	.59
“	“	8.50	2.50	.26	2.73	6.4	3.2	1.59	.85	.58
“	“	9.50	2.79	.34	2.81	6.7	3.4	1.54	.93	.58
“	“	10.50	3.09	.41	2.88	7.1	3.6	1.52	1.01	.57
B13	5	9.75	2.87	.21	3.00	12.1	4.8	2.05	1.23	.65
“	“	12.25	3.60	.36	3.15	13.6	5.4	1.94	1.45	.63
“	“	14.75	4.34	.50	3.29	15.1	6.1	1.87	1.70	.63
B17	6	12.25	3.61	.23	3.33	21.8	7.3	2.46	1.85	.72
“	“	14.75	4.34	.35	3.45	24.0	8.0	2.35	2.09	.69
“	“	17.25	5.07	.47	3.57	26.2	8.7	2.27	2.36	.68
B21	7	15.00	4.42	.25	3.66	36.2	10.4	2.86	2.67	.78
“	“	17.50	5.15	.35	3.76	39.2	11.2	2.76	2.94	.76
“	“	20.00	5.88	.46	3.87	42.2	12.1	2.68	3.24	.74
B25	8	18.00	5.33	.27	4.00	56.9	14.2	3.27	3.78	.84
“	“	20.25	5.96	.35	4.08	60.2	15.0	3.18	4.04	.82
“	“	22.75	6.69	.44	4.17	64.1	16.0	3.10	4.36	.81
“	“	25.25	7.43	.53	4.26	68.0	17.0	3.03	4.71	.80
B29	9	21.00	6.31	.29	4.33	84.9	18.9	3.67	5.16	.90
“	“	25.00	7.35	.41	4.45	91.9	20.4	3.54	5.65	.88
“	“	30.00	8.82	.57	4.61	101.9	22.6	3.40	6.42	.85
“	“	35.00	10.29	.73	4.77	111.8	24.8	3.30	7.31	.84
B33	10	25.00	7.37	.31	4.66	122.1	24.4	4.07	6.89	.97
“	“	30.00	8.82	.45	4.80	134.2	26.8	3.90	7.65	.93
“	“	35.00	10.29	.60	4.95	146.4	29.3	3.77	8.52	.91
“	“	40.00	11.76	.75	5.10	158.7	31.7	3.67	9.50	.90
B41	12	31.50	9.26	.35	5.00	215.8	36.0	4.83	9.50	1.01
“	“	35.00	10.29	.44	5.09	228.3	38.0	4.71	10.07	.99
“	“	40.00	11.76	.56	5.21	245.9	41.0	4.57	10.95	.96
B53	15	42.00	12.48	.41	5.50	441.8	58.9	5.95	14.62	1.08
“	“	45.00	13.24	.46	5.55	455.8	60.8	5.87	15.09	1.07
“	“	50.00	14.71	.56	5.65	483.4	64.5	5.73	16.04	1.04
“	“	55.00	16.18	.66	5.75	511.0	68.1	5.62	17.06	1.03
“	“	60.00	17.65	.75	5.84	538.6	71.8	5.52	18.17	1.01

PROPERTIES OF STANDARD I-BEAMS.



12	13	14	15	16	1
Increase of Thickness of Web for each Pound Increase in Weight.	Coefficient of Strength.		Coefficient of Deflection.		Section Number.
	For Fibre Stress of 16 000 Pounds per Square Inch for Buildings.	For Fibre Stress of 12 500 Pounds per Square Inch for Bridges.	Uniform Load.	Center Load.	
f	F	F′	N	N′	
.098	17650	13790	.00031253	.00050006	B 5
	19140	14950	.00028827	.00046124	"
	20710	16180	.00026644	.00042630	"
.074	31810	24850	.00013009	.00020815	B 9
	33890	26480	.00012209	.00019535	"
	35980	28110	.00011500	.00018400	"
	38070	29750	.00010868	.00017389	"
.059	51590	40300	.00006417	.00010267	B13
	58100	45390	.00005698	.00009117	"
	64630	50490	.00005122	.00008195	"
.049	77460	60520	.00003561	.00005698	B17
	85270	66610	.00003235	.00005177	"
	93110	72740	.00002963	.00004741	"
.042	110410	86260	.00002142	.00003427	B21
	119400	93290	.00001980	.00003168	"
	128560	100430	.00001839	.00002943	"
.037	151660	118490	.00001364	.00002183	B25
	160510	125400	.00001289	.00002062	"
	170970	133570	.00001210	.00001936	"
	181430	141740	.00001140	.00001825	"
.033	201300	157260	.00000914	.00001462	B29
	217930	170260	.00000844	.00001350	"
	241460	188640	.00000762	.00001219	"
	264990	207020	.00000694	.00001110	"
.029	260470	203500	.00000635	.00001017	B33
	286250	223630	.00000578	.00000925	"
	312390	244050	.00000530	.00000848	"
	338530	264480	.00000489	.00000782	"
.025	383670	299740	.00000360	.00000575	B41
	405800	317030	.00000340	.00000544	"
	437170	341540	.00000316	.00000505	"
.020	628270	490840	.00000176	.00000281	B53
	648310	506490	.00000170	.00000272	"
	687530	537130	.00000161	.00000257	"
	726740	567770	.00000152	.00000243	"
	765960	598410	.00000144	.00000231	"

PROPERTIES OF STANDARD I-BEAMS.

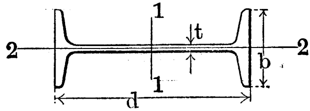


1	2	3	4	5	6	7	8	9	10	11
Section Number.	Depth of Beam.	Weight per Foot.	Area of Section.	Thickness of Web.	Width of Flange.	Moment of Inertia Axis 1-1.	Section Modulus Axis 1-1.	Radius of Gyration Axis 1-1.	Moment of Inertia Axis 2-2.	Radius of Gyration Axis 2-2.
	d		A	t	b	I	S	r	I′	r′
	Inches.	Pounds.	Sq. Ins.	Inch.	Inches.	Inches.⁴	Inches.³	Inches.	Inches.⁴	Inch.
B 65	18	55.0	15.93	.46	6.00	795.6	88.4	7.07	21.19	1.15
"	"	60.0	17.65	.56	6.10	841.8	93.5	6.91	22.38	1.13
"	"	65.0	19.12	.64	6.18	881.5	97.9	6.79	23.47	1.11
"	"	70.0	20.59	.72	6.26	921.2	102.4	6.69	24.62	1.09
B 73	20	65.0	19.08	.50	6.25	1169.5	117.0	7.83	27.86	1.21
"	"	70.0	20.59	.58	6.33	1219.8	122.0	7.70	29.04	1.19
"	"	75.0	22.06	.65	6.40	1268.8	126.9	7.58	30.25	1.17
B 89	24	80.0	23.32	.50	7.00	2087.2	173.9	9.46	42.86	1.36
"	"	85.0	25.00	.57	7.07	2167.8	180.7	9.31	44.35	1.33
"	"	90.0	26.47	.63	7.13	2238.4	186.5	9.20	45.70	1.31
"	"	95.0	27.94	.69	7.19	2309.0	192.4	9.09	47.10	1.30
"	"	100.0	29.41	.75	7.25	2379.6	198.3	8.99	48.55	1.28

PROPERTIES OF SPECIAL I-BEAMS.

B105	12	40.0	11.84	.46	5.25	268.9	44.8	4.77	13.81	1.08
"	"	45.0	13.24	.58	5.37	285.7	47.6	4.65	14.89	1.06
"	"	50.0	14.71	.70	5.49	303.4	50.6	4.54	16.12	1.05
"	"	55.0	16.18	.82	5.61	321.0	53.5	4.45	17.46	1.04
B109	15	60.0	17.67	.59	6.00	609.0	81.2	5.87	25.96	1.21
"	"	65.0	19.12	.69	6.10	636.1	84.8	5.77	27.42	1.20
"	"	70.0	20.59	.78	6.19	663.7	88.5	5.68	29.00	1.19
"	"	75.0	22.06	.88	6.29	691.2	92.2	5.60	30.68	1.18
"	"	80.0	23.53	.98	6.39	718.8	95.8	5.53	32.46	1.17
B113	15	80.0	23.57	.80	6.40	789.1	105.2	5.79	41.31	1.32
"	"	85.0	25.00	.90	6.50	815.9	108.8	5.71	43.46	1.32
"	"	90.0	26.47	.99	6.59	843.4	112.5	5.64	45.79	1.32
"	"	95.0	27.94	1.09	6.69	871.0	116.1	5.58	48.25	1.31
"	"	100.0	29.41	1.19	6.79	898.6	119.8	5.53	50.84	1.31
B121	20	80.0	23.73	.60	7.00	1466.3	146.6	7.86	45.81	1.39
"	"	85.0	25.00	.66	7.06	1508.5	150.9	7.77	47.25	1.37
"	"	90.0	26.47	.74	7.14	1557.5	155.8	7.67	48.98	1.36
"	"	95.0	27.94	.81	7.21	1606.6	160.7	7.58	50.78	1.35
"	"	100.0	29.41	.88	7.28	1655.6	165.6	7.50	52.65	1.34

PROPERTIES OF STANDARD I-BEAMS.

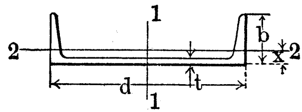


12	13	14	15	16	1
	Coefficient of Strength.		Coefficient of Deflection.		
Increase of Thickness of Web for each Pound Increase in Weight.	For Fibre Stress of 16 000 Pounds per Square Inch for Buildings.	For Fibre Stress of 12 500 Pounds per Square Inch for Bridges.	Uniform Load.	Center Load.	Section Number.
f	F	F′	N	N′	
.016	942880	736620	.00000098	.00000156	B 65
	997680	779440	.00000092	.00000148	"
	1044740	816200	.00000088	.00000141	"
	1091800	852970	.00000084	.00000135	"
.015	1247490	974600	.00000066	.00000106	B 73
	1301110	1016490	.00000064	.00000102	"
	1353400	1057340	.00000061	.00000098	"
.0123	1855310	1449460	.00000037	.00000060	B 89
	1926950	1505430	.00000036	.00000057	"
	1989700	1554450	.00000035	.00000056	"
	2052440	1603470	.00000034	.00000054	"
	2115190	1652490	.00000033	.00000052	"

PROPERTIES OF SPECIAL I-BEAMS.

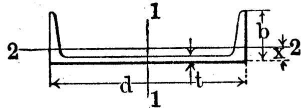
.025	478130	373540	.00000288	.00000462	B105
	507930	396820	.00000272	.00000485	"
	539300	421320	.00000256	.00000409	"
	570670	445830	.00000242	.00000387	"
.020	866130	676670	.00000127	.00000204	B109
	904660	706770	.00000122	.00000195	"
	943870	737400	.00000117	.00000187	"
	983090	768040	.00000112	.00000180	"
	1022300	798670	.00000108	.00000173	"
.020	1122290	876790	.00000098	.00000157	B113
	1160340	906520	.00000095	.00000152	"
	1199550	937150	.00000092	.00000147	"
	1238770	967790	.00000089	.00000143	"
	1277980	998420	.00000086	.00000138	"
.015	1564060	1221920	.00000053	.00000085	B121
	1609100	1257110	.00000051	.00000082	"
	1661390	1297960	.00000050	.00000080	"
	1713670	1338810	.00000048	.00000077	"
	1765960	1379660	.00000047	.00000075	"

PROPERTIES OF STANDARD CHANNELS.



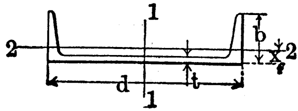
1	2	3	4	5	6	7	8	9	10	11	12
Section Number.	Depth of Channel.	Weight per Foot.	Area of Section.	Thickness of Web.	Width of Flange.	Moment of Inertia Axis 1-1.	Section Modulus Axis 1-1.	Radius of Gyration Axis 1-1	Moment of Inertia Axis 2-2.	Section Modulus Axis 2-2.	Radius of Gyration Axis 2-2.
	d		A	t	b	I	S	r	I′	S′	r′
	Inches.	Pounds.	Sq. Ins.	Inch.	Inches.	Inches.^{4}	Ins.^{3}	Inches.	Inches.^{4}	Ins.^{3}	Inch.
C 5	3	4.00	1.19	.17	1.41	1.6	1.1	1.17	.20	.21	.41
"	"	5.00	1.47	.26	1.50	1.8	1.2	1.12	.25	.24	.41
"	"	6.00	1.76	.36	1.60	2.1	1.4	1.08	.31	.27	.42
C 9	4	5.25	1.55	.18	1.58	3.8	1.9	1.56	.32	.29	.45
"	"	6.25	1.84	.25	1.65	4.2	2.1	1.51	.38	.32	.45
"	"	7.25	2.13	.33	1.73	4.6	2.3	1.46	.44	.35	.46
C13	5	6.50	1.95	.19	1.75	7.4	3.0	1.95	.48	.38	.50
"	"	9.00	2.65	.33	1.89	8.9	3.5	1.83	.64	.45	.49
"	"	11.50	3.38	.48	2.04	10.4	4.2	1.75	.82	.54	.49
C17	6	8.00	2.38	.20	1.92	13.0	4.3	2.34	.70	.50	.54
"	"	10.50	3.09	.32	2.04	15.1	5.0	2.21	.88	.57	.53
"	"	13.00	3.82	.44	2.16	17.3	5.8	2.13	1.07	.65	.53
"	"	15.50	4.56	.56	2.28	19.5	6.5	2.07	1.28	.74	.53
C21	7	9.75	2.85	.21	2.09	21.1	6.0	2.72	.98	.63	.59
"	"	12.25	3.60	.32	2.20	24.2	6.9	2.59	1.19	.71	.57
"	"	14.75	4.34	.42	2.30	27.2	7.8	2.50	1.40	.79	.57
"	"	17.25	5.07	.53	2.41	30.2	8.6	2.44	1.62	.87	.56
"	"	19.75	5.81	.63	2.51	33.2	9.5	2.39	1.85	.96	.56
C25	8	11.25	3.35	.22	2.26	32.3	8.1	3.10	1.33	.79	.63
"	"	13.75	4.04	.31	2.35	36.0	9.0	2.98	1.55	.87	.62
"	"	16.25	4.78	.40	2.44	39.9	10.0	2.89	1.78	.95	.61
"	"	18.75	5.51	.49	2.53	43.8	11.0	2.82	2.01	1.02	.60
"	"	21.25	6.25	.58	2.62	47.8	11.9	2.76	2.25	1.11	.60
C29	9	13.25	3.89	.23	2.43	47.3	10.5	3.49	1.77	.97	.67
"	"	15.00	4.41	.29	2.49	50.9	11.3	3.40	1.95	1.03	.66
"	"	20.00	5.88	.45	2.65	60.8	13.5	3.21	2.45	1.19	.65
"	"	25.00	7.35	.61	2.81	70.7	15.7	3.10	2.98	1.36	.64
C33	10	15.00	4.46	.24	2.60	66.9	13.4	3.87	2.30	1.17	.72
"	"	20.00	5.88	.38	2.74	78.7	15.7	3.66	2.85	1.34	.70
"	"	25.00	7.35	.63	2.89	91.0	18.2	3.52	3.40	1.50	.68
"	"	30.00	8.82	.68	3.04	103.2	20.6	3.42	3.99	1.67	.67
"	"	35.00	10.29	.82	3.18	115.5	23.1	3.35	4.66	1.87	.67
C41	12	20.50	6.03	.28	2.94	128.1	21.4	4.61	3.91	1.75	.81
"	"	25.00	7.35	.39	3.05	144.0	24.0	4.43	4.53	1.91	.78
"	"	30.00	8.82	.51	3.17	161.6	26.9	4.28	5.21	2.09	.77
"	"	35.00	10.29	.64	3.30	179.3	29.9	4.17	5.90	2.27	.76
"	"	40.00	11.76	.76	3.42	196.9	32.8	4.09	6.63	2.46	.75
C53	15	33.00	9.90	.40	3.40	312.6	41.7	5.62	8.23	3.16	.91
"	"	35.00	10.29	.43	3.43	319.9	42.7	5.57	8.48	3.22	.91
"	"	40.00	11.76	.52	3.52	347.5	46.3	5.44	9.39	3.43	.89
"	"	45.00	13.24	.62	3.62	375.1	50.0	5.32	10.29	3.63	.88
"	"	50.00	14.71	.72	3.72	402.7	53.7	5.23	11.22	3.85	.87
"	"	55.00	16.18	.82	3.82	430.2	57.4	5.16	12.19	4.07	.87

PROPERTIES OF STANDARD CHANNELS.



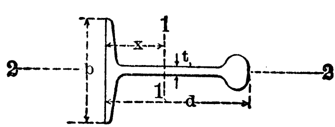
13	14	15	16	17	18	1
Distance of Center of Gravity from Outside of Web.	Increase of Thickness of Web for each Pound Increase in Weight.	Coef. of Strength. Fibre Stress 16 000 Pounds per Sq. Inch for Buildings.	Coef. of Strength. Fibre Stress 12 500 Pounds per Sq. Inch. for Bridges.	Coef. of Deflection. Uniform Load.	Coef. of Deflection. Center Load.	Section Number.
x	f	F	F′	N	N′	
Inch.	Inches.					
.44	.098	11630	9090	.0004743	.0007589	C 5
.44		13140	10270	.0004199	.0006718	"
.46		14710	11490	.0003751	.0006001	"
.46	.074	20230	15800	.0002046	.0003273	C 9
.46		22270	17400	.0001858	.0002973	"
.46		24360	19030	.0001698	.0002717	"
.49	.059	31640	24720	.0001046	.0001674	C13
.48		37860	29570	.0000875	.0001399	"
.51		44390	34680	.0000746	.0001193	"
.52	.049	46210	36100	.0000597	.0000855	C17
.50		53750	42000	.0000513	.0000821	"
.52		61600	48120	.0000448	.0000717	"
.55		69440	54250	.0000397	.0000636	"
.55	.042	64270	50210	.0000368	.0000588	C21
.53		73650	57540	.0000321	.0000714	"
.53		82740	64690	.0000286	.0000457	"
.55		91950	71840	.0000257	.0000411	"
.58		101100	78990	.0000234	.0000374	"
.58	.037	86140	67300	.0000240	.0000384	C25
.56		95990	75000	.0000216	.0000345	"
.56		106450	83170	.0000194	.0000311	"
.57		116910	91340	.0000177	.0000283	"
.59		127370	99510	.0000162	.0000260	"
.61	.033	112170	87630	.0000164	.0000262	C29
.59		120540	94170	.0000153	.0000244	"
.58		144070	112550	.0000128	.0000204	"
.62		167590	130930	.0000110	.0000176	"
.64	.029	142680	111470	.0000116	.0000186	C33
.61		167940	131210	.0000099	.0000158	"
.62		194090	151630	.0000085	.0000136	"
.65		220230	172060	.0000075	.0000120	"
.69		246380	192480	.0000067	.0000107	"
.70	.025	227750	177930	.0000061	.0000097	C41
.68		256000	200000	.0000054	.0000086	"
.68		287370	224510	.0000048	.0000077	"
.69		318750	249020	.0000043	.0000069	"
.72		350120	273530	.0000039	.0000063	"
.79	.020	444520	347280	.0000025	.0000040	C53
.79		455030	355500	.0000024	.0000039	"
.78		494250	386130	.0000022	.0000036	"
.79		533470	416770	.0000021	.0000033	"
.80		572680	447410	.0000019	.0000031	"
.82		611900	478050	.0000018	.0000029	"

PROPERTIES OF SPECIAL CHANNELS.



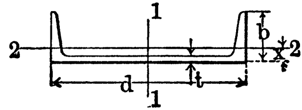
1	2	3	4	5	6	7	8	9	10	11	12	13
Section Number.	Depth of Chan'l.	W'ght per Foot.	Area of Section.	Thickness of Web.	Width of Flange.	Thickness of Flange.	Slope of Flange.	Moment of Inertia. Axis 1-1.	Section Modulus Axis 1-1.	Radius of Gyration Axis 1-1.	Moment of Inertia Axis 2-2.	Section Modulus Axis 2-2.
	d		A	t	b	s	g	I	S	r	I′	S′
	Ins.	Lbs.	Sq. Ins.	Inch.	Inches.	Inch.		Inches.^{4}	Ins.^{3}	Inches.	Inches.^{4}	Ins.^{3}
C86	6	15.2	4.46	.35	3.50	.34	.02	25.0	8.3	2.37	5.19	2.14
C90	10	21.7	6.38	.38	3.38	.41	“	91.3	18.3	3.78	6.22	2.48
C91	12	21.4	6.30	.31	2.64	.34	.17	128.2	21.4	4.51	3.23	1.61
“	“	23.9	7.03	.37	2.70	“	“	137.0	22.8	4.41	3.52	1.69
“	“	26.4	7.77	.44	2.76	“	“	145.9	24.3	4.33	3.80	1.78
“	“	28.9	8.50	.50	2.82	“	“	154.7	25.8	4.27	4.09	1.86
“	“	31.4	9.24	.56	2.89	“	“	163.5	27.3	4.21	4.38	1.95
“	“	33.9	9.97	.62	2.95	“	“	172.3	28.7	4.16	4.69	2.04
C95	13	32.0	9.30	.38	4.00	.34	.15	237.5	36.5	5.05	11.54	3.86
“	“	35.0	10.29	.45	4.08	“	“	251.5	38.7	4.94	12.54	4.06
“	“	37.0	10.88	.50	4.12	“	“	259.8	40.0	4.89	13.10	4.17
“	“	40.0	11.76	.56	4.19	“	“	272.2	41.9	4.81	13.94	4.33
“	“	45.0	13.24	.68	4.30	“	“	292.9	45.1	4.70	15.32	4.59
“	“	50.0	14.71	.79	4.42	“	“	313.7	48.3	4.62	16.71	4.86
“	“	55.0	16.18	.90	4.53	“	“	334.4	51.4	4.55	18.14	5.14

PROPERTIES OF BULB BEAMS.



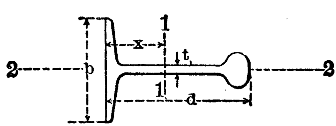
1	2	3	4	5	6	7	8	9
Section Number.	Depth of Beam.	Weight per Foot.	Area of Section.	Thickness of Web.	Width of Flange.	Moment of Inertia Axis 1-1.	Section Modulus Axis 1-1.	Radius of Gyration Axis 1-1.
	d		A	t	b	I	S	r
	Inches.	Pounds.	Sq. Ins.	Inch.	Inches.	Inches.^{4}	Inches.^{3}	Inches.
B173	6	14.0	4.11	$\frac{9}{32}$	$4\frac{3}{8}$	21.52	6.12	2.29
“	“	15.3	4.48	$\frac{11}{32}$	$4\frac{7}{16}$	22.73	6.55	2.25
“	“	18.4	5.42	$\frac{1}{2}$	$4\frac{19}{32}$	25.72	7.59	2.18

PROPERTIES OF SPECIAL CHANNELS.



14	15	16	17	18	19	20	1
Radius of Gyration Axis 2-2.	Distance of Center of Gravity from Outside of Web.	Increase of Thickness of Web for each Lb. Increase in Weight.	Coef. of Strength. Fibre Stress 16 000 Pounds per Sq. Inch for Buildings.	Coef. of Strength. Fibre Stress 12 500 Pounds per Sq. Inch for Bridges.	Coef. of Deflection. Uniform Load.	Coef. of Deflection. Center Load.	Section Number.
r′	x	f	F	F′	N	N′	
Inch.	Inch.	Inch.					
1.08	1.08	.049	88920	69470	.0000310	.0000496	C86
.99	.87	.029	194750	152150	.0000085	.0000136	C90
.72	.63	.024	227950	178080	.0000061	.0000097	C91
.71	.62	"	243630	190340	.0000057	.0000091	"
.70	.62	"	259320	202590	.0000053	.0000085	"
.69	.63	"	275000	214850	.0000050	.0000080	"
.69	.64	"	290690	227100	.0000048	.0000076	"
.69	.65	"	306380	239360	.0000045	.0000072	"
1.11	1.01	.023	389710	304460	.0000033	.0000052	C95
1.10	.99	"	412750	322460	.0000031	.0000049	"
1.10	.98	"	426340	333080	.0000030	.0000048	"
1.09	.97	"	446740	349010	.0000029	.0000046	"
1.08	.97	"	480720	375560	.0000027	.0000042	"
1.07	.98	"	514710	402120	.0000025	.0000040	"
1.06	1.00	"	548700	428670	.0000023	.0000037	"

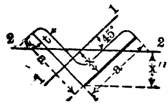
PROPERTIES OF BULB BEAMS.



10	11	12	13	14	15	1
Distance of Center of Gravity from Outside of Flange.	Increase of Thickness of Web for each Lb. Increase in Weight.	Coef. of Strength. Fibre Stress 16 000 Pounds per Sq. Inch for Buildings.	Coef. of Strength. Fibre Stress 12 500 Pounds per Sq. Inch for Bridges.	Coef. of Deflection. Uniform Load.	Coef. of Deflection. Center Load.	Section Number.
x	f	F	F′	N	N′	
Inches.						
2.49	.049	65320	51030	.0000361	.0000577	B173
2.53	"	69860	54580	.0000341	.0000546	"
2.61	"	80930	63230	.0000302	.0000483	"

PROPERTIES OF STANDARD ANGLES.

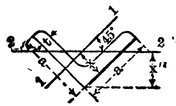
EQUAL LEGS.



1	2	3	4	5	6	7	8
Section Number.	Dimensions.	Thickness.	Weight per Foot.	Area of Section.	Distance of Center of Gravity from Back of Leg.	Moment of Inertia Axis 1-1.	Section Modulus Axis 1-1.
	a x a	t		A	x	I	S
	Inches.	Inch.	Pounds.	Sq. Ins.	Inch.	$Inches.^4$	$Inches.^3$
A 5	3/4 x 3/4	1/8	.6	.18	.23	.009	.017
"	"	3/16	.9	.25	.25	.012	.024
A 7	1 x 1	1/8	.8	.24	.30	.022	.031
"	"	3/16	1.2	.34	.32	.030	.044
"	"	1/4	1.5	.44	.34	.037	.056
A 9	1 1/4 x 1 1/4	1/8	1.1	.30	.36	.044	.049
"	"	3/16	1.5	.44	.38	.061	.071
"	"	1/4	2.0	.57	.40	.077	.091
"	"	5/16	2.4	.69	.42	.090	.109
A11	1 1/2 x 1 1/2	1/8	1.3	.36	.42	.08	.072
"	"	3/16	1.8	.53	.44	.11	.104
"	"	1/4	2.4	.69	.47	.14	.134
"	"	5/16	2.9	.84	.49	.16	.162
"	"	3/8	3.4	.99	.51	.19	.188
"	"	7/16	3.9	1.13	.53	.21	.214
A13	1 3/4 x 1 3/4	3/16	2.2	.63	.51	.18	.14
"	"	1/4	2.8	.82	.53	.23	.19
"	"	5/16	3.4	1.00	.55	.27	.23
"	"	3/8	4.0	1.18	.57	.31	.26
"	"	7/16	4.6	1.34	.59	.35	.30
"	"	1/2	5.1	1.50	.61	.38	.33
A15	2 x 2	3/16	2.5	.72	.57	.27	.19
"	"	1/4	3.2	.94	.59	.35	.25
"	"	5/16	4.0	1.16	.61	.42	.30
"	"	3/8	4.7	1.36	.64	.48	.35
"	"	7/16	5.3	1.56	.66	.54	.40
"	"	1/2	6.0	1.75	.68	.59	.45
A17	2 1/2 x 2 1/2	3/16	3.1	.91	.69	.55	.30
"	"	1/4	4.1	1.19	.72	.70	.39
"	"	5/16	5.0	1.47	.74	.85	.48
"	"	3/8	5.9	1.74	.76	.98	.57
"	"	7/16	6.8	2.00	.78	1.11	.65
"	"	1/2	7.7	2.25	.81	1.23	.72
"	"	9/16	8.5	2.50	.83	1.34	.80
A19	3 x 3	1/4	4.9	1.44	.84	1.24	.58
"	"	5/16	6.1	1.78	.87	1.51	.71
"	"	3/8	7.2	2.11	.89	1.76	.83
"	"	7/16	8.3	2.44	.91	1.99	.95
"	"	1/2	9.4	2.75	.93	2.22	1.07
"	"	9/16	10.4	3.06	.95	2.43	1.19
"	"	5/8	11.5	3.36	.98	2.62	1.30
"	"	11/16	12.5	3.66	1.00	2.81	1.40

PROPERTIES OF STANDARD ANGLES.

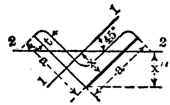
EQUAL LEGS.



9	10	11	12	13	1
Radius of Gyration Axis 1-1.	Distance of Center of Gravity from External Apex.	Least Moment of Inertia Axis 2-2.	Section Modulus Axis 2-2.	Least Radius of Gyration Axis 2-2.	Section Number.
r	x″	I″	S″	r″	
Inch.	Inch.	Inches.⁴	Inches.³	Inch.	
.22	.33	.004	.011	.14	A 5
.22	.36	.005	.014	.14	"
.30	.42	.009	.021	.19	A 7
.30	.45	.013	.028	.19	"
.29	.48	.016	.034	.19	"
.38	.51	.018	.035	.24	A 9
.38	.54	.025	.047	.24	"
.37	.57	.033	.057	.24	"
.36	.60	.040	.066	.24	"
.47	.60	.031	.053	.30	A11
.46	.63	.045	.072	.29	"
.45	.66	.058	.088	.29	"
.44	.69	.070	.101	.29	"
.44	.72	.082	.114	.29	"
.43	.75	.094	.126	.29	"
.54	.72	.073	.10	.34	A13
.53	.75	.094	.13	.34	"
.52	.78	.113	.15	.34	"
.51	.81	.133	.16	.34	"
.51	.84	.152	.18	.34	"
.50	.87	.171	.20	.34	"
.62	.80	.11	.14	.39	A15
.61	.84	.14	.17	.39	"
.60	.87	.17	.20	.39	"
.59	.90	.20	.22	.39	"
.59	.93	.23	.25	.38	"
.58	.96	.26	.27	.38	"
.78	.98	.22	.22	.49	A17
.77	1.01	.29	.28	.49	"
.76	1.05	.35	.33	.49	"
.75	1.08	.41	.38	.48	"
.75	1.11	.46	.42	.48	"
.74	1.14	.52	.46	.48	"
.73	1.17	.58	.49	.48	"
.93	1.19	.50	.42	.59	A19
.92	1.22	.61	.50	.59	"
.91	1.26	.72	.57	.58	"
.91	1.29	.82	.64	.58	"
.90	1.32	.92	.70	.58	"
.89	1.35	1.02	.76	.58	"
.88	1.38	1.12	.81	.58	"
.88	1.41	1.22	.86	.58	"

PROPERTIES OF STANDARD ANGLES.

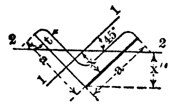
EQUAL LEGS.



1	2	3	4	5	6	7	8
Section Number.	Dimensions.	Thickness	Weight per Foot.	Area of Section.	Distance of Center of Gravity from Back of Leg.	Moment of Inertia Axis 1-1.	Section Modulus Axis 1-1.
	a x a	t		A	x	I	S
	Inches.	Inch.	Pounds.	Sq. Ins.	Inches.	Inches.^{4}	Inches.^{3}
A21	$3\frac{1}{2}$ x $3\frac{1}{2}$	$\frac{5}{16}$	7.2	2.09	.99	2.45	.98
"	"	$\frac{3}{8}$	8.5	2.49	1.01	2.87	1.15
"	"	$\frac{7}{16}$	9.8	2.88	1.04	3.26	1.32
"	"	$\frac{1}{2}$	11.1	3.25	1.06	3.64	1.49
"	"	$\frac{9}{16}$	12.4	3.63	1.08	3.99	1.65
"	"	$\frac{5}{8}$	13.6	3.99	1.10	4.33	1.81
"	"	$\frac{11}{16}$	14.8	4.34	1.12	4.65	1.96
"	"	$\frac{3}{4}$	16.0	4.69	1.15	4.96	2.11
"	"	$\frac{13}{16}$	17.1	5.03	1.17	5.25	2.25
"	"	$\frac{7}{8}$	18.3	5.36	1.19	5.53	2.39
A23	4 x 4	$\frac{5}{16}$	8.2	2.41	1.12	3.71	1.29
"	"	$\frac{3}{8}$	9.8	2.86	1.14	4.36	1.52
"	"	$\frac{7}{16}$	11.3	3.31	1.16	4.97	1.75
"	"	$\frac{1}{2}$	12.8	3.75	1.18	5.56	1.97
"	"	$\frac{9}{16}$	14.3	4.19	1.21	6.12	2.19
"	"	$\frac{5}{8}$	15.7	4.62	1.23	6.66	2.40
"	"	$\frac{11}{16}$	17.1	5.03	1.25	7.17	2.61
"	"	$\frac{3}{4}$	18.5	5.44	1.27	7.66	2.81
"	"	$\frac{13}{16}$	19.9	5.84	1.29	8.14	3.01
"	"	$\frac{7}{8}$	21.2	6.24	1.31	8.59	3.20
A27	6 x 6	$\frac{3}{8}$	14.9	4.36	1.64	15.39	3.53
"	"	$\frac{7}{16}$	17.2	5.06	1.66	17.68	4.07
"	"	$\frac{1}{2}$	19.6	5.75	1.68	19.91	4.61
"	"	$\frac{9}{16}$	21.9	6.44	1.71	22.07	5.14
"	"	$\frac{5}{8}$	24.2	7.11	1.73	24.16	5.66
"	"	$\frac{11}{16}$	26.5	7.78	1.75	26.19	6.17
"	"	$\frac{3}{4}$	28.7	8.44	1.78	28.15	6.66
"	"	$\frac{13}{16}$	31.0	9.09	1.80	30.06	7.15
"	"	$\frac{7}{8}$	33.1	9.74	1.82	31.92	7.63
"	"	$\frac{15}{16}$	35.3	10.38	1.84	33.72	8.11
"	"	1	37.4	11.00	1.86	35.46	8.57
A35	8 x 8	$\frac{1}{2}$	26.4	7.75	2.19	48.65	8.37
"	"	$\frac{9}{16}$	29.6	8.69	2.21	54.09	9.34
"	"	$\frac{5}{8}$	32.7	9.61	2.23	59.43	10.30
"	"	$\frac{11}{16}$	35.8	10.53	2.25	64.64	11.25
"	"	$\frac{3}{4}$	38.9	11.44	2.28	69.74	12.18
"	"	$\frac{13}{16}$	42.0	12.34	2.30	74.72	13.11
"	"	$\frac{7}{8}$	45.0	13.24	2.32	79.58	14.02
"	"	$\frac{15}{16}$	48.1	14.13	2.34	84.34	14.91
"	"	1	51.0	15.00	2.37	88.98	15.80
"	"	$1\frac{1}{16}$	54.0	15.88	2.39	93.53	16.67
"	"	$1\frac{1}{8}$	56.9	16.74	2.41	97.97	17.53

PROPERTIES OF STANDARD ANGLES.

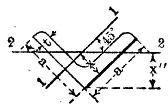
EQUAL LEGS.



9	10	11	12	13	1
Radius of Gyration Axis 1-1.	Distance of Center of Gravity from External Apex.	Least Moment of Inertia Axis 2-2.	Section Modulus Axis 2-2.	Least Radius of Gyration Axis 2-2.	Section Number.
r	x''	I''	S''	r''	
Inches.	Inches.	Inches.[4]	Inches.[3]	Inch.	
1.08	1.40	.99	.71	.69	A21
1.07	1.43	1.16	.81	.68	“
1.07	1.46	1.33	.91	.68	“
1.06	1.50	1.50	1.00	.68	“
1.05	1.53	1.66	1.09	.68	“
1.04	1.56	1.82	1.17	.68	“
1.04	1.59	1.97	1.24	.67	“
1.03	1.62	2.13	1.31	.67	“
1.02	1.65	2.28	1.38	67	“
1.02	1.68	2.43	1.45	.67	“
1.24	1.58	1.50	.95	.79	A23
1.23	1.61	1.77	1.10	.79	“
1.23	1.64	2.02	1.23	.78	“
1.22	1.67	2.28	1.36	.78	“
1.21	1.71	2.52	1.48	.78	“
1.20	1.74	2.76	1.59	.77	“
1.19	1.77	3.00	1.70	.77	“
1.19	1.80	3.23	1.80	.77	“
1.18	1.83	3.46	1.89	.77	“
1.17	1.86	3.69	1.99	.77	“
1.88	2.32	6.19	2.67	1.19	A27
1.87	2.34	7.13	3.04	1.19	“
1.86	2.38	8.04	3.37	1.18	“
1.85	2.41	8.94	3.70	1.18	“
1.84	2.45	9.81	4.01	1.17	“
1.83	2.48	10.67	4.31	1.17	“
1.83	2.51	11.52	4.59	1.17	“
1.82	2.54	12.35	4.86	1.17	“
1.81	2.57	13.17	5.12	1.16	“
1.80	2.60	13.98	5.37	1.16	“
1.80	2.64	14.78	5.61	1.16	“
2.51	3.09	19.56	6.33	1.59	A35
2.50	3.12	21.79	6.98	1.58	“
2.49	3.16	23.97	7.60	1.58	“
2.48	3.19	26.13	8.20	1.58	“
2.47	3.22	28.24	8.77	1.57	“
2.46	3.25	30.33	9.33	1.57	“
2.45	3.28	32.38	9.86	1.56	“
2.44	3.32	34.40	10.38	1.56	“
2.44	3.35	36.40	10.88	1.56	“
2.43	3.38	38.38	11.36	1.56	“
2.42	3.41	40.33	11.83	1.55	“

PROPERTIES OF SPECIAL ANGLES.

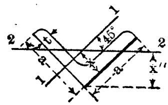
EQUAL LEGS.



1	2	3	4	5	6	7	8
Section Number.	Dimensions.	Thickness.	Weight per Foot.	Area of Section.	Distance of Center of Gravity from Back of Leg.	Moment of Inertia Axis 1-1.	Section Modulus Axis 1-1.
	a x a	t		A	x	I	S
	Inches.	Inch.	Pounds.	Sq. Ins.	Inch.	Inches.^{4}	Inches.^{3}
A61	$1\frac{1}{2}$ x $1\frac{1}{2}$	$\frac{1}{8}$	1.3	.36	.42	.08	.072
"	"	$\frac{3}{16}$	1.8	.53	.44	.11	.104
A41	$2\frac{1}{4}$ x $2\frac{1}{4}$	$\frac{3}{16}$	2.8	.81	.63	.39	.24
"	"	$\frac{1}{4}$	3.7	1.07	.65	.50	.32
"	"	$\frac{5}{16}$	4.5	1.31	.68	.61	.39
"	"	$\frac{3}{8}$	5.3	1.55	.70	.70	.45
"	"	$\frac{7}{16}$	6.1	1.78	.72	.79	.52
A43	$2\frac{3}{4}$ x $2\frac{3}{4}$	$\frac{3}{16}$	3.4	1.00	.76	.73	.37
"	"	$\frac{1}{4}$	4.5	1.32	.78	.95	.48
"	"	$\frac{5}{16}$	5.6	1.63	.80	1.15	.59
"	"	$\frac{3}{8}$	6.6	1.93	.82	1.33	.69
"	"	$\frac{7}{16}$	7.6	2.22	.85	1.51	.79
"	"	$\frac{1}{2}$	8.5	2.50	.87	1.67	.89
A45	$4\frac{1}{2}$ x $4\frac{1}{2}$	$\frac{5}{16}$	9.3	2.72	1.24	5.36	1.64
"	"	$\frac{3}{8}$	11.0	3.24	1.26	6.30	1.95
"	"	$\frac{7}{16}$	12.8	3.75	1.29	7.20	2.24
"	"	$\frac{1}{2}$	14.5	4.25	1.31	8.07	2.58
"	"	$\frac{9}{16}$	16.2	4.75	1.33	8.91	2.81
"	"	$\frac{5}{8}$	17.8	5.24	1.35	9.71	3.09
"	"	$\frac{11}{16}$	19.5	5.72	1.38	10.48	3.35
A47	5 x 5	$\frac{3}{8}$	12.3	3.61	1.39	8.74	2.42
"	"	$\frac{7}{16}$	14.3	4.19	1.41	10.02	2.79
"	"	$\frac{1}{2}$	16.2	4.75	1.43	11.25	3.16
"	"	$\frac{9}{16}$	18.1	5.31	1.46	12.44	3.51
"	"	$\frac{5}{8}$	20.0	5.86	1.48	13.58	3.86
"	"	$\frac{11}{16}$	21.8	6.41	1.50	14.68	4.20

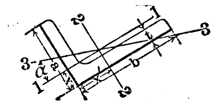
PROPERTIES OF SPECIAL ANGLES.

EQUAL LEGS.



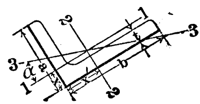
9	10	11	12	13	1
Radius of Gyration Axis 1-1.	Distance of Center of Gravity from External Apex.	Least Moment of Inertia Axis 2-2.	Section Modulus Axis 2-2.	Least Radius of Gyration Axis 2-2.	Section Number.
r	x''	I''	S''	r''	
Inch.	Inches.	Inches.[4]	Inches.[3]	Inch.	
.47	.60	.031	.053	.30	A61
.46	.63	.045	.072	.29	"
.70	.89	.16	.18	.44	A41
.69	.92	.21	.22	.44	"
.68	.96	.25	.26	.44	"
.67	.99	.29	.30	.43	"
.67	1.02	.33	.33	.43	"
.86	1.07	.30	.28	.54	A43
.85	1.10	.38	.35	.54	"
.84	1.13	.47	.41	.54	"
.83	1.17	.55	.47	.53	"
.83	1.20	.63	.52	.53	"
.82	1.23	.70	.57	.53	"
1.40	1.75	2.16	1.23	.89	A45
1.40	1.79	2.54	1.42	.89	"
1.39	1.82	2.92	1.61	.88	"
1.38	1.85	3.29	1.78	.88	"
1.37	1.88	3.64	1.94	.88	"
1.36	1.91	3.99	2.03	.87	"
1.35	1.95	4.34	2.23	.87	"
1.56	1.96	3.53	1.79	.99	A47
1.55	2.00	4.05	2.03	.98	"
1.54	2.03	4.56	2.25	.98	"
1.53	2.06	5.06	2.46	.98	"
1.52	2.09	5.55	2.66	.97	"
1.51	2.12	6.03	2.84	.97	"

PROPERTIES OF STANDARD ANGLES.
UNEQUAL LEGS.



1	2	3	4	5	6	7	8
Section Number.	Dimensions.	Thickness.	Weight per Foot.	Area of Section.	Distance of Center of Gravity from Back of Longer Leg.	Moment of Inertia Axis 1-1.	Section Modulus Axis 1-1.
	b x a	t		A	x	I	S
	Inches.	Inch.	Pounds.	Sq. Ins.	Inch.	Inches.^{4}	Inches.^{3}
A91	$2\frac{1}{2}$ x 2	$\frac{3}{16}$	2.8	.81	.51	.29	.20
"	"	$\frac{1}{4}$	3.7	1.07	.54	.37	.25
"	"	$\frac{5}{16}$	4.5	1.31	.56	.45	.31
"	"	$\frac{3}{8}$	5.3	1.55	.58	.51	.36
"	"	$\frac{7}{16}$	6.1	1.78	.60	.58	.41
"	"	$\frac{1}{2}$	6.8	2.00	.63	.64	.46
"	"	$\frac{9}{16}$	7.6	2.22	.65	.69	.51
A93	3 x $2\frac{1}{2}$	$\frac{1}{4}$	4.5	1.32	.66	.74	.40
"	"	$\frac{5}{16}$	5.6	1.63	.68	.90	.49
"	"	$\frac{3}{8}$	6.6	1.93	.71	1.04	.58
"	"	$\frac{7}{16}$	7.6	2.22	.73	1.18	.66
"	"	$\frac{1}{2}$	8.5	2.50	.75	1.30	.74
"	"	$\frac{9}{16}$	9.5	2.78	.77	1.42	.82
"	"	$\frac{5}{8}$	10.4	3.05	.79	1.53	.90
A95	$3\frac{1}{2}$ x $2\frac{1}{2}$	$\frac{1}{4}$	4.9	1.44	.61	.78	.41
"	"	$\frac{5}{16}$	6.1	1.78	.64	.94	.50
"	"	$\frac{3}{8}$	7.2	2.11	.66	1.09	.59
"	"	$\frac{7}{16}$	8.3	2.44	.68	1.23	.68
"	"	$\frac{1}{2}$	9.4	2.75	.70	1.36	.76
"	"	$\frac{9}{16}$	10.4	3.06	.73	1.49	.84
"	"	$\frac{5}{8}$	11.5	3.36	.75	1.61	.92
"	"	$\frac{11}{16}$	12.5	3.66	.77	1.72	.99
"	"	$\frac{3}{4}$	13.4	3.94	.79	1.83	1.07
A97	$3\frac{1}{2}$ x 3	$\frac{5}{16}$	6.6	1.94	.81	1.58	.72
"	"	$\frac{3}{8}$	7.9	2.30	.83	1.85	.85
"	"	$\frac{7}{16}$	9.1	2.66	.85	2.09	.98
"	"	$\frac{1}{2}$	10.2	3.00	.88	2.33	1.10
"	"	$\frac{9}{16}$	11.4	3.34	.90	2.55	1.21
"	"	$\frac{5}{8}$	12.5	3.68	.92	2.76	1.33
"	"	$\frac{11}{16}$	13.6	4.00	.94	2.96	1.44
"	"	$\frac{3}{4}$	14.7	4.32	.96	3.15	1.54
"	"	$\frac{13}{16}$	15.8	4.63	.98	3.33	1.65
"	"	$\frac{7}{8}$	16.8	4.93	1.00	3.50	1.75
A99	4 x 3	$\frac{5}{16}$	7.2	2.09	.76	1.65	.73
"	"	$\frac{3}{8}$	8.5	2.49	.78	1.92	.87
"	"	$\frac{7}{16}$	9.8	2.88	.80	2.18	.99
"	"	$\frac{1}{2}$	11.1	3.25	.83	2.42	1.12
"	"	$\frac{9}{16}$	12.4	3.63	.85	2.66	1.23
"	"	$\frac{5}{8}$	13.6	3.99	.87	2.87	1.35
"	"	$\frac{11}{16}$	14.8	4.34	.89	3.08	1.46
"	"	$\frac{3}{4}$	16.0	4.69	.92	3.28	1.57
"	"	$\frac{13}{16}$	17.1	5.03	.94	3.47	1.68
"	"	$\frac{7}{8}$	18.3	5.36	.96	3.66	1.79

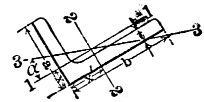
PROPERTIES OF STANDARD ANGLES.
UNEQUAL LEGS.



9	10	11	12	13	14	15	1
Radius of Gyration Axis 1-1.	Distance of Center of Gravity from Back of Shorter Leg.	Moment of Inertia Axis 2-2.	Section Modulus Axis 2-2.	Radius of Gyration Axis 2-2.	Tangent of Angle	Least Radius of Gyration Axis 3-3.	Section Number.
r	x′	I′	S′	r′	α	r″	
Inch.	Inch.	Inches.⁴	Inches.³	Inches.		Inch.	
.60	.76	.51	.29	.79	.632	.43	A91
.59	.79	.65	.38	.78	.626	.42	"
.58	.81	.79	.47	.78	.620	.42	"
.58	.83	.91	.55	.77	.614	.42	"
.57	.85	1.03	.62	.76	.607	.42	"
.56	.88	1.14	.70	.75	.600	.42	"
.56	.90	1.24	.77	.75	.592	.42	"
.75	.91	1.17	.56	.95	.684	.53	A93
.74	.93	1.42	.69	.94	.680	.53	"
.74	.96	1.66	.81	.93	.676	.52	"
.73	.98	1.88	.93	.92	.672	.52	"
.72	1.00	2.08	1.04	.91	.666	.52	"
.72	1.02	2.28	1.15	.91	.661	.52	"
.71	1.04	2.46	1.26	.90	.655	.52	"
.74	1.11	1.80	.75	1.12	.506	.54	A95
.73	1.14	2.19	.93	1.11	.501	.54	"
.72	1.16	2.56	1.09	1.10	.496	.54	"
.71	1.18	2.91	1.26	1.09	.491	.54	"
.70	1.20	3.24	1.41	1.09	.486	.53	"
.70	1.23	3.55	1.56	1.08	.480	.53	"
.69	1.25	3.85	1.71	1.07	.472	.53	"
.69	1.27	4.13	1.85	1.06	.468	.53	"
.68	1.29	4.40	1.99	1.06	.461	.54	"
.90	1.06	2.33	.95	1.10	.724	.63	A97
.90	1.08	2.72	1.13	1.09	.721	.62	"
.89	1.10	3.10	1.29	1.08	.718	.62	"
.88	1.13	3.45	1.45	1.07	.714	.62	"
.87	1.15	3.79	1.61	1.07	.711	.62	"
.87	1.17	4.11	1.76	1.06	.707	.62	"
.86	1.19	4.41	1.91	1.05	.703	.62	"
.85	1.21	4.70	2.05	1.04	.698	.62	"
.85	1.23	4.98	2.20	1.04	.694	.62	"
.84	1.25	5.24	2.33	1.03	.689	.63	"
.89	1.26	3.38	1.23	1.27	.554	.65	A99
.88	1.28	3.96	1.46	1.26	.551	.64	"
.87	1.30	4.52	1.68	1.25	.547	.64	"
.86	1.33	5.05	1.89	1.25	.543	.64	"
.86	1.35	5.55	2.09	1.24	.538	.64	"
.85	1.37	6.03	2.30	1.23	.534	.64	"
.84	1.39	6.49	2.49	1.22	.529	.64	"
.84	1.42	6.93	2.68	1.22	.524	.64	"
.83	1.44	7.35	2.87	1.21	.518	.64	"
.83	1.46	7.75	3.05	1.20	.512	.64	"

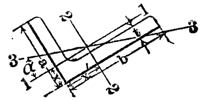
PROPERTIES OF STANDARD ANGLES.

UNEQUAL LEGS.



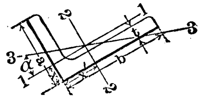
1	2	3	4	5	6	7	8
Section Number.	Dimensions.	Thickness.	Weight per Foot.	Area of Section.	Distance of Center of Gravity from Back of Longer Leg.	Moment of Inertia Axis 1-1.	Section Modulus Axis 1-1.
	b x a	t		A	x	I	S
	Inches.	Inch.	Pounds.	Sq. Ins.	Inch.	Inches.^{4}	Inches.^{3}
A101	5 x 3	$\frac{5}{16}$	8.2	2.41	.68	1.75	.75
"	"	$\frac{3}{8}$	9.8	2.86	.70	2.04	.89
"	"	$\frac{7}{16}$	11.3	3.31	.73	2.32	1.02
"	"	$\frac{1}{2}$	12.8	3.75	.75	2.58	1.15
"	"	$\frac{9}{16}$	14.3	4.19	.77	2.83	1.27
"	"	$\frac{5}{8}$	15.7	4.61	.80	3.06	1.39
"	"	$\frac{11}{16}$	17.1	5.03	.82	3.29	1.51
"	"	$\frac{3}{4}$	18.5	5.44	.84	3.51	1.62
"	"	$\frac{13}{16}$	19.9	5.84	.86	3.71	1.74
"	"	$\frac{7}{8}$	21.2	6.24	.88	3.91	1.85
A103	5 x 3½	$\frac{5}{16}$	8.7	2.56	.84	2.72	1.02
"	"	$\frac{3}{8}$	10.4	3.05	.86	3.18	1.21
"	"	$\frac{7}{16}$	12.0	3.53	.88	3.63	1.39
"	"	$\frac{1}{2}$	13.6	4.00	.91	4.05	1.56
"	"	$\frac{9}{16}$	15.2	4.47	.93	4.45	1.73
"	"	$\frac{5}{8}$	16.8	4.93	.95	4.83	1.90
"	"	$\frac{11}{16}$	18.3	5.38	.97	5.20	2.06
"	"	$\frac{3}{4}$	19.8	5.82	1.00	5.55	2.22
"	"	$\frac{13}{16}$	21.3	6.25	1.02	5.89	2.37
"	"	$\frac{7}{8}$	22.7	6.68	1.04	6.21	2.52
"	"	$\frac{15}{16}$	24.2	7.09	1.06	6.52	2.67
A105	6 x 3½	$\frac{3}{8}$	11.7	3.43	.79	3.34	1.23
"	"	$\frac{7}{16}$	13.5	3.97	.81	3.81	1.41
"	"	$\frac{1}{2}$	15.3	4.50	.83	4.25	1.59
"	"	$\frac{9}{16}$	17.1	5.03	.86	4.67	1.77
"	"	$\frac{5}{8}$	18.9	5.55	.88	5.08	1.94
"	"	$\frac{11}{16}$	20.6	6.06	.90	5.47	2.11
"	"	$\frac{3}{4}$	22.4	6.57	.93	5.84	2.27
"	"	$\frac{13}{16}$	24.0	7.06	.95	6.20	2.43
"	"	$\frac{7}{8}$	25.7	7.55	.97	6.55	2.59
"	"	$\frac{15}{16}$	27.3	8.03	.99	6.88	2.74
"	"	1	28.9	8.50	1.01	7.21	2.90
A107	6 x 4	$\frac{3}{8}$	12.3	3.61	.94	4.90	1.60
"	"	$\frac{7}{16}$	14.3	4.19	.96	5.60	1.85
"	"	$\frac{1}{2}$	16.2	4.75	.99	6.27	2.08
"	"	$\frac{9}{16}$	18.1	5.31	1.01	6.91	2.31
"	"	$\frac{5}{8}$	20.0	5.86	1.03	7.52	2.54
"	"	$\frac{11}{16}$	21.8	6.41	1.06	8.11	2.76
"	"	$\frac{3}{4}$	23.6	6.94	1.08	8.68	2.97
"	"	$\frac{13}{16}$	25.4	7.47	1.10	9.23	3.18
"	"	$\frac{7}{8}$	27.2	7.99	1.12	9.75	3.39
"	"	$\frac{15}{16}$	28.9	8.50	1.14	10.26	3.59
"	"	1	30.6	9.00	1.17	10.75	3.79

PROPERTIES OF STANDARD ANGLES.
UNEQUAL LEGS.



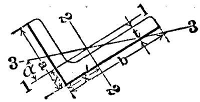
9	10	11	12	13	14	15	1
Radius of Gyration Axis 1-1.	Distance of Center of Gravity from Back of Shorter Leg.	Moment of Inertia Axis 2-2.	Section Modulus Axis 2-2.	Radius of Gyration Axis 2-2.	Tangent of Angle	Least Radius of Gyration Axis 3-3.	Section Number.
r	x′	I′	S′	r′	α	r″	
Inch.	Inches.	Inches.⁴	Inches.³	Inch.		Inch.	
.85	1.68	6.26	1.89	1.61	.368	.66	A101
.84	1.70	7.37	2.24	1.61	.364	.65	“
.84	1.73	8.43	2.58	1.60	.361	.65	“
.83	1.75	9.45	2.91	1.59	.357	.65	“
.82	1.77	10.43	3.23	1.58	.353	.65	“
.82	1.80	11.37	3.55	1.57	.349	.64	“
.81	1.82	12.28	3.86	1.56	.345	.64	“
.80	1.84	13.15	4.16	1.55	.340	.64	“
.80	1.86	13.98	4.46	1.55	.336	.64	“
.79	1.88	14.78	4.75	1.54	.331	.64	“
1.03	1.59	6.60	1.94	1.61	.489	.77	A103
1.02	1.61	7.78	2.29	1.60	.485	.76	“
1.01	1.63	8.90	2.64	1.59	.482	.76	“
1.01	1.66	9.99	2.99	1.58	.479	.75	“
1.00	1.68	11.03	3.32	1.57	.476	.75	“
.99	1.70	12.03	3.65	1.56	.472	.75	“
.98	1.72	12.99	3.97	1.56	.468	.75	“
.98	1.75	13.92	4.28	1.55	.464	.75	“
.97	1.77	14.81	4.58	1.54	.460	.75	“
.96	1.79	15.67	4.88	1.53	.455	.75	“
.96	1.81	16.49	5.17	1.53	.451	.75	“
.99	2.04	12.86	3.24	1.94	.350	.77	A105
.98	2.06	14.76	3.75	1.93	.347	.76	“
.97	2.08	16.59	4.24	1.92	.344	.76	“
.96	2.11	18.37	4.72	1.91	.341	.75	“
.96	2.13	20.08	5.19	1.90	.338	.75	“
.95	2.15	21.74	5.65	1.89	.334	.75	“
.94	2.18	23.34	6.10	1.89	.331	.75	“
.94	2.20	24.89	6.55	1.88	.327	.75	“
.93	2.22	26.39	6.98	1.87	.323	.75	“
.93	2.24	27.84	7.41	1.86	.320	.75	“
.92	2.26	29.15	7.80	1.85	.317	.75	“
1.17	1.94	13.47	3.32	1.93	.446	.88	A107
1.16	1.96	15.46	3.83	1.92	.443	.87	“
1.15	1.99	17.40	4.33	1.91	.440	.87	“
1.14	2.01	19.26	4.83	1.90	.438	.87	“
1.13	2.03	21.07	5.31	1.90	.434	.86	“
1.13	2.06	22.82	5.78	1.89	.431	.86	“
1.12	2.08	24.51	6.25	1.88	.428	.86	“
1.11	2.10	26.15	6.70	1.87	.425	.86	“
1.11	2.12	27.73	7.15	1.86	.421	.86	“
1.10	2.14	29.26	7.59	1.86	.418	.86	“
1.09	2.17	30.75	8.02	1.85	.414	86	“

PROPERTIES OF SPECIAL ANGLES.
UNEQUAL LEGS.



1	2	3	4	5	6	7	8
Section Number.	Dimensions.	Thickness.	Weight per Foot.	Area of Section.	Distance of Center of Gravity from Back of Longer Leg.	Moment of Inertia Axis 1-1.	Section Modulus Axis 1-1.
	b x a	t		A	x	I	S
	Inches.	Inch.	Pounds.	Sq. Ins.	Inch.	$Inches.^4$	$Inches.^3$
A170	1 3/8 x 15/16	1/8	1.0	.28	.24	.020	.003
A167	1 1/2 x 3/4	1/8	1.0	.27	.17	.011	.018
A165	1 3/4 x 1 1/8	5/16	2.8	.81	.33	.073	.093
A163	1 3/4 x 1 1/4	3/16	1.8	.53	.33	.07	.07
A121	2 x 1 3/8	3/16	2.1	.60	.35	.10	.10
"	"	1/4	2.7	.79	.37	.12	.12
"	"	5/16	3.3	.96	.39	.14	.14
"	"	3/8	3.9	1.13	.42	.16	.17
"	"	7/16	4.4	1.29	.44	.18	.19
A123	2 x 1 1/2	1/8	1.5	.43	.37	.08	.07
"	"	3/16	2.2	.63	.39	.12	.11
"	"	1/4	2.8	.82	.41	.15	.14
"	"	5/16	3.4	1.00	.44	.18	.17
"	"	3/8	4.0	1.18	.46	.21	.20
"	"	7/16	4.6	1.34	.48	.23	.22
A 84	2 1/4 x 1 1/2	5/16	3.7	1.07	.42	.19	.17
A155	2 5/16 x 1 5/16	11/64	2.1	.60	.30	.08	.08
A125	2 1/2 x 1 1/4	3/16	2.3	.67	.28	.07	.08
"	"	1/4	3.0	.88	.30	.09	.10
"	"	5/16	3.7	1.08	.33	.11	.12
"	"	3/8	4.4	1.27	.35	.13	.14
"	"	7/16	5.0	1.45	.37	.14	.16
A127	2 1/2 x 1 1/2	3/16	2.5	.72	.35	.13	.11
"	"	1/4	3.2	.94	.38	.16	.14
"	"	5/16	4.0	1.16	.40	.19	.17
"	"	3/8	4.7	1.36	.42	.22	.20
"	"	7/16	5.3	1.56	.44	.24	.23
A128	2 3/4 x 1 1/2	3/16	2.6	.77	.34	.13	.11
"	"	1/4	3.4	1.00	.36	.17	.14
"	"	5/16	4.2	1.24	.38	.20	.18
"	"	3/8	5.0	1.46	.41	.22	.21
"	"	7/16	5.7	1.67	.43	.25	.23
A129	3 x 2	3/16	3.1	.91	.47	.31	.20
"	"	1/4	4.1	1.19	.49	.39	.26
"	"	5/16	5.0	1.47	.51	.47	.32
"	"	3/8	5.9	1.74	54	.54	.37
"	"	7/16	6.8	2.00	.56	.61	.42
"	"	1/2	7.7	2.25	.58	.67	.47
A149	3 1/4 x 2	3/8	6.2	1.83	.52	.55	.37

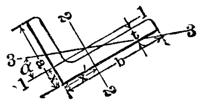
PROPERTIES OF SPECIAL ANGLES.
UNEQUAL LEGS.



9	10	11	12	13	14	15	1
Radius of Gyration.	Distance of Center of Gravity from Back of Shorter Leg.	Moment of Inertia Axis 2-2.	Section Modulus Axis 2-2.	Radius of Gyration Axis 2-2.	Tangent of Angle.	Least Radius of Gyration Axis 3-3.	Section Number.
r	x′	I′	S′	r′	α	r″	
Inch.	Inch.	Inches.⁴	Inches.³	Inch.		Inch.	
.27	.46	.052	.057	.44	.458	.20	A170
.20	.55	.061	.064	.48	.261	.16	A167
.30	.65	.140	.127	.42	.104	.30	A165
.36	.58	.16	.14	.55	.496	.27	A163
.41	.66	.24	.18	.63	.475	.31	A121
.39	.68	.31	.23	.63	.455	.30	"
.38	.71	.37	.28	.62	.445	.29	"
.38	.73	.42	.33	.61	.434	.29	"
.37	.75	.47	.38	.60	.421	.30	"
.45	.62	.17	.13	.64	.558	.33	A123
.44	.64	.25	.18	.63	.551	.32	"
.43	.66	.32	.24	.62	.543	.32	"
.42	.69	.38	.29	.62	.534	.32	"
.42	.71	.43	.34	.61	.524	.32	"
.41	.73	.48	.38	.60	.512	.32	"
.42	.79	.53	.36	.70	.424	.32	A 84
.36	.80	.33	.22	.74	.330	.29	A155
.33	.91	.43	.27	.80	.264	.27	A125
.33	.93	.55	.35	.79	.256	.27	"
.32	.95	.66	.43	.79	.247	.26	"
.32	.97	.77	.50	.78	.238	.26	"
.31	1.00	.86	.57	.77	.228	.27	"
.42	.85	.46	.28	.80	.364	.33	A127
.41	.88	.59	.36	.79	.357	.32	"
.41	.90	.71	.44	.79	.349	.32	"
.40	.92	.82	.52	.78	.340	.32	"
.40	.94	.92	.59	.77	.331	.32	"
.41	.96	.60	.33	.89	.309	.33	A128
.41	.98	.77	.44	.88	.302	.32	"
.40	1.01	.93	.53	.87	.295	.32	"
.39	1.03	1.08	.63	.86	.287	.32	"
.39	1.05	1.21	.72	.85	.279	.32	"
.58	.97	.84	.41	.97	.446	.44	A129
.57	.99	1.09	.54	.96	.440	.43	"
.57	1.02	1.32	.66	.95	.434	.43	"
.56	1.04	1.53	.78	.94	.428	.43	"
.55	1.06	1.73	.89	.93	.421	.43	"
.55	1.08	1.92	1.00	.92	.414	.43	"
.55	1.15	1.92	.91	1.02	.369	.43	A149

PROPERTIES OF SPECIAL ANGLES.

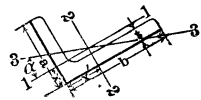
UNEQUAL LEGS.



1	2	3	4	5	6	7	8
Section Number.	Dimensions.	Thickness.	Weight per Foot.	Area of Section.	Distance of Center of Gravity from Back of Longer Leg.	Moment of Inertia Axis 1-1.	Section Modulus Axis 1-1.
	b x a	t		A	x	I	S
	Inches.	Inch.	Pounds.	Sq. Ins.	Inch.	Inches.^{4}	Inches.^{3}
A151	$3\frac{1}{2}$ x 2	$\frac{1}{4}$	4.5	1.32	.46	.41	.26
"	"	$\frac{5}{16}$	5.6	1.63	.48	.49	.32
"	"	$\frac{3}{8}$	6.6	1.93	.50	.57	.38
"	"	$\frac{7}{16}$	7.6	2.22	.53	.64	.43
"	"	$\frac{1}{2}$	8.5	2.50	.55	.70	.48
"	"	$\frac{9}{16}$	9.5	2.78	.57	.76	.54
"	"	$\frac{5}{8}$	10.4	3.05	.59	.82	.59
A131	4 x $3\frac{1}{2}$	$\frac{5}{16}$	7.7	2.25	.93	2.55	.99
"	"	$\frac{3}{8}$	9.1	2.68	.96	2.99	1.17
"	"	$\frac{7}{16}$	10.6	3.09	.98	3.40	1.35
"	"	$\frac{1}{2}$	11.9	3.50	1.00	3.79	1.52
"	"	$\frac{9}{16}$	13.3	3.91	1.02	4.17	1.68
"	"	$\frac{5}{8}$	14.7	4.30	1.04	4.49	1.83
"	"	$\frac{11}{16}$	16.0	4.69	1.07	4.86	2.00
A133	$4\frac{1}{2}$ x 3	$\frac{3}{8}$	9.1	2.68	.74	1.98	.88
"	"	$\frac{7}{16}$	10.6	3.09	.76	2.25	1.01
"	"	$\frac{1}{2}$	11.9	3.50	.79	2.51	1.13
"	"	$\frac{9}{16}$	13.3	3.91	.81	2.75	1.25
"	"	$\frac{5}{8}$	14.7	4.30	.83	2.98	1.37
"	"	$\frac{11}{16}$	16.0	4.69	.85	3.19	1.49
A135	5 x 4	$\frac{3}{8}$	11.0	3.24	1.03	4.66	1.57
"	"	$\frac{7}{16}$	12.8	3.75	1.05	5.32	1.81
"	"	$\frac{1}{2}$	14.5	4.25	1.07	5.96	2.04
"	"	$\frac{9}{16}$	16.2	4.75	1.10	6.56	2.26
"	"	$\frac{5}{8}$	17.8	5.24	1.12	7.14	2.48
"	"	$\frac{11}{16}$	19.5	5.72	1.14	7.70	2.69
A109	7 x $3\frac{1}{2}$	$\frac{7}{16}$	15.0	4.41	.75	3.95	1.44
"	"	$\frac{1}{2}$	17.0	5.00	.78	4.41	1.62
"	"	$\frac{9}{16}$	19.1	5.59	.80	4.86	1.80
"	"	$\frac{5}{8}$	21.0	6.18	.82	5.28	1.97
"	"	$\frac{11}{16}$	23.0	6.75	.85	5.69	2.14
"	"	$\frac{3}{4}$	24.9	7.32	.87	6.08	2.31
"	"	$\frac{13}{16}$	26.8	7.88	.89	6.46	2.48
"	"	$\frac{7}{8}$	28.7	8.43	.91	6.83	2.64
"	"	$\frac{15}{16}$	30.5	8.97	.94	7.18	2.80
"	"	1	32.3	9.50	.96	7.53	2.96

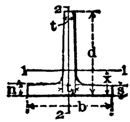
PROPERTIES OF SPECIAL ANGLES.

UNEQUAL LEGS.



9	10	11	12	13	14	15	1
Radius of Gyration Axis 1-1.	Distance of Center of Gravity from Back of Shorter Leg.	Moment of Inertia Axis 2-2.	Section Modulus Axis 2-2.	Radius of Gyration Axis 2-2.	Tangent of Angle α	Radius of Gyration Axis 3-3.	Section Number.
r	x′	I′	S′	r′		r″	
Inch.	Inches.	Inches.[4]	Inches.[3]	Inches.		Inch.	
.56	1.21	1.67	.73	1.13	.335	.44	A151
.55	1.23	2.02	.89	1.12	.329	.43	"
.54	1.25	2.36	1.05	1.11	.324	.43	"
.54	1.28	2.68	1.21	1.10	.318	.43	"
.53	1.30	2.98	1.36	1.09	.312	.43	"
.52	1.32	3.27	1.50	1.08	.305	.43	"
.52	1.34	3.54	1.64	1.08	.298	.43	"
1.07	1.18	3.56	1.26	1.26	.757	.73	A131
1.06	1.21	4.18	1.49	1.25	.755	.73	"
1.05	1.23	4.76	1.72	1.24	.753	.72	"
1.04	1.25	5.32	1.94	1.23	.750	.72	"
1.03	1.27	5.86	2.15	1.23	.747	.72	"
1.02	1.29	6.37	2.35	1.22	.742	.72	"
1.02	1.32	6.86	2.56	1.21	.742	.72	"
.86	1.49	5.50	1.83	1.44	.440	.65	A133
.85	1.51	6.29	2.10	1.43	.437	.65	"
.85	1.54	7.04	2.37	1.42	.431	.65	"
.84	1.56	7.75	2.64	1.41	.428	.64	"
.83	1.58	8.44	2.89	1.40	.424	.64	"
.83	1.60	9.10	3.14	1.39	.419	.64	"
1.20	1.53	8.14	2.34	1.59	.631	.85	A135
1.19	1.55	9.32	2.70	1.58	.629	.85	"
1.18	1.57	10.46	3.05	1.57	.626	.85	"
1.18	1.60	11.55	3.39	1.56	.623	.85	"
1.17	1.62	12.61	3.73	1.55	.620	.84	"
1.16	1.64	13.62	4.05	1.54	.617	.84	"
.95	2.50	22.56	5.01	2.26	.267	.76	A109
.94	2.53	25.41	5.68	2.25	.264	.75	"
.93	2.55	28.18	6.34	2.25	.262	.75	"
.93	2.57	30.86	6.96	2.24	.259	.75	"
.92	2.60	33.47	7.60	2.23	.257	.74	"
.91	2.62	35.99	8.22	2.22	.253	.74	"
.91	2.64	38.45	8.83	2.21	.250	.74	"
.90	2.66	40.82	9.42	2.20	.247	.74	"
.89	2.69	43.13	10.00	2.19	.244	.74	"
.89	2.71	45.37	10.58	2.19	.241	.74	"

PROPERTIES OF T-BARS.



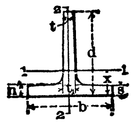
EQUAL LEGS.

1	2	3	4	5	6	7	8	9
	Dimensions.							
Section Number.	Width of Flange.	Depth of Bar.	Thickness of Flange.	Thickness of Stem.	Weight per Foot.	Area of Section.	Distance of Center of Gravity from Outside of Flange.	Moment of Inertia Axis 1-1.
	b	d	s to n′	t to t′		A	x	I
	Inches.	Inches.	Inch.	Inch.	Pounds.	Sq. Ins.	Inch.	Inches.^{4}
T 5	1	1	1/8 to 5/32	1/8 to 5/32	1.0	.27	.29	.02
T181	1 1/8	1 1/8	3/16 " 7/32	5/32 " 7/32	1.4	.41	.33	.04
T183	1 3/16	1 3/16	3/16 " 1/4	5/32 " 7/32	1.6	.45	.34	.05
T187	1 1/4	1 1/4	3/16 " 1/4	5/32 " 1/4	1.7	.48	.36	.06
T189	1 3/8	1 3/8	3/16 " 1/4	5/32 " 1/4	1.9	.55	.39	.08
T 37	2	2	1/4 " 5/16	1/4 " 5/16	3.7	1.07	.59	.37
T 39	2	2	5/16 " 3/8	5/16 " 3/8	4.4	1.28	.61	.43
T 41	2 1/4	2 1/4	1/4 " 5/16	1/4 " 5/16	4.2	1.21	.68	.51
T 42	2 1/4	2 1/4	5/16 " 3/8	5/16 " 3/8	5.0	1.46	.67	.64
T 49	2 1/2	2 1/2	5/16 " 3/8	5/16 " 3/8	5.6	1.63	.73	.87
T 67	3	3	5/16 " 3/8	5/16 " 3/8	6.8	1.99	.86	1.58
T 69	3	3	3/8 " 7/16	3/8 " 7/16	7.9	2.31	.88	1.82
T 73	3	3	1/2 " 9/16	1/2 " 9/16	10.1	2.96	.93	2.27
T 97	3 1/2	3 1/2	3/8 " 7/16	3/8 " 7/16	9.3	2.74	.99	3.10
T108	4	4	3/8 " 7/16	3/8 " 7/16	10.5	3.09	1.12	4.54

UNEQUAL LEGS.

T185	1 1/4	1 1/16	3/16 to 1/4	5/32 to 7/32	1.5	.44	.29	.04
T 22	2 1/2	1 1/4	3/16 " 9/32	3/16 " 5/16	3.0	.86	.30	.08
T 27	2 1/2	1 3/4	11/32 " 13/32	1/4 " 17/64	4.4	1.29	.43	.21
T 56	2 1/2	3	3/8 " 7/16	3/8 " 7/16	7.0	2.07	.95	1.72
T 62	2 3/4	2	5/16 " 3/8	3/4	7.4	2.19	.74	.83
T 65	3	2 1/2	3/8 " 7/16	3/8 to 7/16	7.2	2.11	.71	1.08
T 84	3	4	3/8 " 7/16	3/8 " 7/16	9.3	2.74	1.27	4.12
T101	3 1/2	4	3/8 " 7/16	3/8 " 7/16	10.0	2.94	1.20	4.33
T120	4 1/2	2 1/2	5/16 " 3/8	5/16 " 3/8	7.8	2.29	.57	1.04
T138	4 1/2	3 1/2	7/16 " 9/16	11/16	14.7	4.31	1.09	4.89
T140	4 1/2	3 1/2	7/16 " 9/16	11/16 to 7/8	15.9	4.65	1.11	5.08
T169	5	3	1/2 " 9/16	13/32 " 5/8	13.6	3.99	.72	2.42

PROPERTIES OF T-BARS.



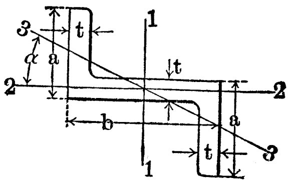
EQUAL LEGS.

10	11	12	13	14	15	16	1
					Coef. of Strength.		
Section Modulus Axis 1-1.	Radius of Gyration Axis 1-1.	Moment of Inertia Axis 2-2.	Section Modulus Axis 2-2.	Radius of Gyration Axis 2-2.	For Fibre Stress of 16 000 Lbs. per Square Inch.	For Fibre Stress of 12 500 Lbs. per Square Inch.	Section Number.
S	r	I′	S′	r′	F	F′	
Inches.³	Inch.	Inches.⁴	Inches.³	Inch.			
.03	.30	.01	.02	.21	350	270	T 5
.05	.32	.02	.04	.25	560	440	T181
.06	.33	.03	.05	.26	630	490	T183
.07	.35	.03	.05	.27	700	550	T187
.08	.39	.05	.07	.29	890	690	T189
.26	.59	.18	.18	.42	2770	2160	T 37
.31	.59	.23	.23	.42	3330	2600	T 39
.32	.65	.24	.21	.45	3440	2690	T 41
.40	.66	.32	.29	.47	4300	3360	T 42
.49	.74	.44	.35	.52	5250	4100	T 49
.74	.90	.75	.50	.62	7860	6140	T 67
.86	.90	.92	.61	.64	9180	7180	T 69
1.10	.88	1.20	.80	.64	11710	9150	T 73
1.23	1.08	1.42	.81	.73	13140	10260	T 97
1.58	1.21	2.11	1.06	.83	16850	13170	T108

UNEQUAL LEGS.

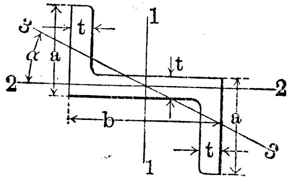
.05	.29	.03	.01	.28	500	390	T185
.09	.31	.28	.22	.58	930	730	T 22
.16	.40	.47	.38	.60	1700	1320	T 27
.84	.91	.53	.42	.50	8930	6980	T 56
.66	.62	.64	.46	.54	7020	5490	T 62
.60	.64	.90	.60	.66	6400	5000	T 65
1.51	1.24	.90	.60	.58	16090	12570	T 84
1.54	1.23	1.42	.81	.70	16470	12860	T101
.54	.68	2.51	1.12	1.05	5760	4500	T120
2.03	1.06	3.68	1.64	.92	21610	16880	T138
2.13	1.05	3.73	1.66	.90	22690	17720	T140
1.06	.78	5.42	2.17	1.17	11340	8860	T169

PROPERTIES OF Z-BARS.



1	2	3	4	5	6	7	8	9	10	11	12
Section Number.	Depth of Bar.	Length of Legs.	Thickness of Web and Legs.	W'ght per Foot.	Area of Section.	Moment of Inertia Axis 1-1.	Section Modulus Axis 1-1.	Radius of Gyration Axis 1-1.	Moment of Inertia Axis 2-2.	Section Modulus Axis 2-2.	Radius of Gyration Axis 2-2.
	b	a	t		A	I	S	r	I′	S′	r′
	Inches.	Inches.	Inch.	Lbs.	Sq. Ins.	Inches.^{4}	Inches.^{3}	Ins.	Inches.^{4}	Ins.^{3}	Inch.
Z 5	3	2 11/16	1/4	6.7	1.97	2.87	1.92	1.21	2.81	1.10	1.19
"	3 1/16	2 3/4	5/16	8.4	2.48	3.64	2.38	1.21	3.64	1.40	1.21
Z 9	3	2 11/16	3/8	9.7	2.86	3.85	2.57	1.16	3.92	1.57	1.17
"	3 1/16	2 3/4	7/16	11.4	3.36	4.57	2.98	1.17	4.75	1.88	1.19
Z13	3	2 11/16	1/2	12.5	3.69	4.59	3.06	1.12	4.85	1.99	1.15
"	3 1/16	2 3/4	9/16	14.2	4.18	5.26	3.43	1.12	5.68	2.30	1.17
Z21	4	3 1/16	1/4	8.2	2.41	6.28	3.14	1.62	4.23	1.44	1.33
"	4 1/16	3 1/8	5/16	10.3	3.03	7.94	3.91	1.62	5.46	1.84	1.34
"	4 1/8	3 3/16	3/8	12.4	3.66	9.63	4.67	1.62	6.77	2.26	1.36
Z25	4	3 1/16	7/16	13.8	4.05	9.66	4.83	1.54	6.73	2.37	1.29
"	4 1/16	8 1/8	1/2	15.8	4.66	11.18	5.50	1.55	7.96	2.77	1.31
"	4 1/8	3 3/16	9/16	17.9	5.27	12.74	6.18	1.55	9.26	3.19	1.32
Z29	4	3 1/16	5/8	18.9	5.55	12.11	6.05	1.48	8.73	3.18	1.25
"	4 1/16	3 1/8	11/16	20.9	6.14	13.52	6.65	1.48	9.95	3.58	1.27
"	4 1/8	3 3/16	3/4	23.0	6.75	14.97	7.26	1.49	11.24	4.00	1.29
Z37	5	3 1/4	5/16	11.6	3.40	13.36	5.34	1.98	6.18	2.00	1.35
"	5 1/16	3 5/16	3/8	13.9	4.10	16.18	6.39	1.99	7.65	2.45	1.37
"	5 1/8	3 3/8	7/16	16.4	4.81	19.07	7.44	1.99	9.20	2.92	1.38
Z41	5	3 1/4	1/2	17.9	5.25	19.19	7.68	1.91	9.05	3.02	1.31
"	5 1/16	3 5/16	9/16	20.2	5.94	21.83	8.62	1.92	10.51	3.47	1.33
"	5 1/8	3 3/8	5/8	22.6	6.64	24.53	9.57	1.92	12.06	3.94	1.35
Z45	5	3 1/4	11/16	23.7	6.96	23.68	9.47	1.84	11.37	3.91	1.28
"	5 1/16	3 5/16	3/4	26.0	7.64	26.16	10.34	1.85	12.83	4.37	1.30
"	5 1/8	3 3/8	13/16	28.3	8.33	28.70	11.20	1.86	14.37	4.84	1.31
Z53	6	3 1/2	3/8	15.6	4.59	25.32	8.44	2.35	9.11	2.75	1.41
"	6 1/16	3 9/16	7/16	18.3	5.39	29.80	9.83	2.35	10.94	3.27	1.43
"	6 1/8	3 5/8	1/2	21.0	6.19	34.36	11.22	2.36	12.87	3.81	1.44
Z57	6	3 1/2	9/16	22.7	6.68	34.64	11.55	2.28	12.59	3.91	1.37
"	6 1/16	3 9/16	5/8	25.4	7.46	38.87	12.82	2.28	14.41	4.44	1.39
"	6 1/8	3 5/8	11/16	28.1	8.25	43.18	14.10	2.29	16.34	4.98	1.41
Z61	6	3 1/2	3/4	29.3	8.63	42.12	14.04	2.21	15.44	4.94	1.34
"	6 1/16	3 9/16	13/16	31.9	9.39	46.13	15.22	2.22	17.27	5.47	1.36
"	6 1/8	3 5/8	7/8	34.6	10.17	50.22	16.40	2.22	19.18	6.02	1.37
Z67	7 1/2	3	3/8	16.3	4.78	38.19	10.18	2.83	5.59	1.99	1.08
Z73	8	3	1/2	22.1	6.50	56.54	14.14	2.95	7.01	2.55	1.04

PROPERTIES OF Z-BARS.



13	14	15	16	17	18	1
		Coef. of Strength.		Coef. of Deflection.		
Tangent of Angle α	Least Radius of Gyration Axis 3-3. r″ Inch.	For Fibre Stress of 16 000 Pounds per Square Inch. F	For Fibre Stress of 12 500 Pounds per Square Inch. F′	Uniform Load. N	Center Load. N′	Section Number.
.986	.55	20400	16000	.000270	.000432	Z 5
1.000	.55	25400	19800	.000213	.000341	"
.990	.54	27400	21400	.000201	.000322	Z 9
.975	.55	31800	24800	.000170	.000272	"
.965	.53	32600	25500	.000169	.000271	Z13
.951	.54	36600	28600	.000148	.000236	"
.778	.67	33500	26200	.000124	.000198	Z21
.788	.68	41700	32600	.000098	.000156	"
.798	.69	49800	38900	.000081	.000129	"
.794	.66	51500	40200	.000080	.000129	Z25
.804	.67	58700	45900	.000069	.000111	"
.814	.68	65900	51500	.000061	.000098	"
.808	.65	64600	50500	.000064	.000103	Z29
.818	.67	71000	55500	.000057	.000092	"
.828	.68	77400	60500	.000052	.000083	"
.611	.75	57000	44500	.000058	.000093	Z37
.619	.76	68200	53300	.000048	.000077	"
.628	.76	79400	62000	.000041	.000065	"
.616	.74	81900	64000	.000040	.000065	Z41
.623	.75	92000	71900	.000036	.000057	"
.631	.76	102100	79800	.000032	.000051	"
.619	.73	101000	78900	.000033	.000052	Z45
.626	.74	110200	86100	.000030	.000048	"
.633	.76	119500	93300	.000027	.000043	"
.519	.83	90000	70300	.000031	.000049	Z53
.526	.83	104900	81900	.000026	.000042	"
.532	.84	119700	93500	.000023	.000036	"
.520	.81	123200	96200	.000022	.000036	Z57
.526	.82	136800	106800	.000020	.000032	"
.532	.84	150400	117500	.000018	.000029	"
.519	.81	149800	117000	.000018	.000030	Z61
.525	.82	162300	126800	.000017	.000027	"
.530	.83	174900	136700	.000015	.000025	"
.29	.72	108600	84800	.000020	.000033	Z67
.26	.71	150800	117800	.000014	.000022	Z73

MOMENTS OF INERTIA OF RECTANGLES.

Depth in Inches.	Width of Rectangle in Inches. 1/4	5/16	3/8	7/16	1/2	9/16	5/8
2	.17	.21	.25	.29	.33	.38	.42
3	.56	.70	.84	.98	1.13	1.27	1.41
4	1.33	1.67	2.00	2.33	2.67	3.00	3.33
5	2.60	3.26	3.91	4.56	5.21	5.86	6.51
6	4.50	5.63	6.75	7.88	9.00	10.13	11.25
7	7.15	8.93	10.72	12.51	14.29	16.08	17.86
8	10.67	13.33	16.00	18.67	21.33	24.00	26.67
9	15.19	18.98	22.78	26.58	30.38	34.17	37.97
10	20.83	26.04	31.25	36.46	41.67	46.87	52.08
11	27.73	34.66	41.59	48.53	55.46	62.39	69.32
12	36.00	45.00	54.00	63.00	72.00	81.00	90.00
13	45.77	57.21	68.66	80.10	91.54	102.98	114.43
14	57.17	71.46	85.75	100.04	114.33	128.63	142 92
15	70.31	87.89	105.47	123.05	140.63	158.20	175.78
16	85.33	106.67	128.00	149.33	170.67	192.00	213.33
17	102.35	127.94	153.53	179.12	204.71	230.30	255.89
18	121.50	151.88	182.25	212.63	243.00	273.38	303.75
19	142.90	178.62	214.34	250.07	285.79	321.52	357.24
20	166.67	208.33	250.00	291.67	333.33	375.00	416.67
21	192.94	241.17	289.41	337.64	385.88	434.11	482.34
22	221.83	277.29	332.75	388.21	443.67	499.13	554.58
23	253.48	316.85	380.22	443.59	506.96	570.33	633.70
24	288.00	360.00	432.00	504.00	576.00	648.00	720.00
25	325.52	406.90	488.28	569.66	651.04	732.42	813.80
26	366.17	457.71	549.25	640.79	732.33	823.88	915.42
27	410.06	512.58	615.09	717.61	820.13	922.64	1025.16
28	457.33	571.67	686.00	800.33	914.67	1029.00	1143.33
29	508.10	635.13	762.16	889.18	1016.21	1143.23	1270.26
30	562.50	703.13	843.75	984.38	1125.00	1265.63	1406.25
32	682.67	853.33	1024.00	1194.67	1365.33	1536.00	1706.67
34	818.83	1023.54	1228.25	1432.96	1637.67	1842.38	2047.08
36	972.00	1215.00	1458.00	1701.00	1944.00	2187.00	2430.00
38	1143.17	1428.96	1714.75	2000.54	2286.33	2572.13	2857.92
40	1333.33	1666.67	2000 00	2333.33	2666.67	3000.00	3333.33
42	1543.50	1929.38	2315.25	2701.13	3087.00	3472.88	3858.75
44	1774.67	2218.33	2662.00	3105.67	3549.33	3993.00	4436.67
46	2027.83	2534.79	3041.75	3548.71	4055.67	4562.63	5069.58
48	2304.00	2880.00	3456.00	4032.00	4608.00	5184.00	5760.00
50	2604.17	3255.21	3906.25	4557.29	5208.33	5859.38	6510.42
52	2929.33	3661.67	4394.00	5126.33	5858.67	6591.00	7323.33
54	3280.50	4100.63	4920.75	5740.88	6561.00	7381.13	8201.25
56	3658.67	4573.33	5488.00	6402.67	7317.33	8232.00	9146.67
58	4064.83	5081.04	6097.25	7113.46	8129.67	9145.87	10162.08
60	4500.00	5625.00	6750.00	7875.00	9000.00	10125.00	11250.00

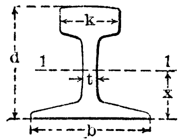
MOMENTS OF INERTIA OF RECTANGLES.

Neutral Axis

Width of Rectangle in Inches.

$\frac{11}{16}$	$\frac{3}{4}$	$\frac{13}{16}$	$\frac{7}{8}$	$\frac{15}{16}$	1	Depth in Inches.
.46	.50	.54	.58	.63	.67	2
1.55	1.69	1.83	1.97	2.11	2.25	3
3.67	4.00	4.33	4.67	5.00	5.33	4
7.16	7.81	8.46	9.11	9.77	10.42	5
12.38	13.50	14.63	15.75	16.88	18.00	6
19.65	21.44	23.22	25.01	26.80	28.58	7
29.33	32.00	34.67	37.33	40.00	42.67	8
41.77	45.56	49.36	53.16	56.95	60.75	9
57.29	62.50	67.71	72.92	78.13	83.33	10
76.26	83.19	90.12	97.05	103.98	110.92	11
99.00	108.00	117.00	126.00	135.00	144.00	12
125.87	137.31	148.75	160.20	171.64	183.08	13
157.21	171.50	185.79	200.08	214.38	228.67	14
193.36	210.94	228.52	246.09	263.67	281.25	15
234.67	256.00	277.33	298.67	320.00	341.33	16
281.47	307.06	332.65	358.24	383.83	409.42	17
334.13	364.50	394.88	425.25	455.63	486.00	18
392.96	428.69	464.41	500.14	535.86	571.58	19
458.33	500.00	541.67	583.33	625.00	666.67	20
530.58	578.81	627.05	675.28	723.52	771.75	21
610.04	665.50	720.96	776.42	831.87	887.33	22
697.07	760.44	823.81	887.18	950.55	1013.92	23
792.00	864.00	936.00	1008.00	1080.00	1152.00	24
895.18	976.56	1057.94	1139.32	1220.70	1302.08	25
1006.96	1098.50	1190.04	1281.58	1373.13	1464.67	26
1127.67	1230.19	1332.70	1435.22	1537.73	1640.25	27
1257.67	1372.00	1486.33	1600.67	1715.00	1829.33	28
1397.29	1524.31	1651.34	1778.36	1905.39	2032.42	29
1546.88	1687.50	1828.13	1968.75	2109.38	2250.00	30
1877.33	2048.00	2218.67	2389.33	2560.00	2730.67	32
2251.79	2456.50	2661.21	2865.92	3070.63	3275.33	34
2673.00	2916.00	3159.00	3402.00	3645.00	3888.00	36
3143.71	3429.50	3715.29	4001.08	4286.88	4572.67	38
3666.67	4000.00	4333.33	4666.67	5000.00	5333.33	40
4244.63	4630.50	5016.38	5402.25	5788.13	6174.00	42
4880.33	5324.00	5767.67	6211.33	6655.00	7098.67	44
5576.54	6083.50	6590.46	7097.42	7604.38	8111.33	46
6336.00	6912.00	7488.00	8064.00	8640.00	9216.00	48
7161.46	7812.50	8463.54	9114.58	9765.63	10416.67	50
8055.67	8788.00	9520.33	10252.67	10985.00	11717.33	52
9021.38	9841.50	10661.63	11481.75	12301.88	13122.00	54
10061.33	10976.00	11890.67	12805.33	13720.00	14634.67	56
11178.29	12194.50	13210.71	14226.92	15243.12	16259.33	58
12375.00	13500.00	14625.00	15750.00	16875.00	18000.00	60

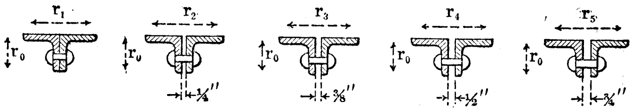
PROPERTIES AND PRINCIPAL DIMENSIONS OF STANDARD T-RAILS.



Section Number.	Weight per Yard.	Area.	b	d	k	t	x	Axis 1-1. Moment of Inertia.	Section Modulus.
	Pounds.	Sq. Ins.	Inches.	Inches.	Inches.	Inch.	Inches.	I	S
522	8	0.78	1 1/2	1 1/2	13/16	5/32	0.75	0.23	0.31
523	12	1.18	1 7/8	1 7/8	1 1/16	3/16	0.92	0.55	0.58
524	16	1.57	2 1/4	2 1/4	1 3/16	7/32	1.10	1.13	0.99
525	20	2.0	2 3/8	2 3/8	1 3/8	1/4	1.2	1.5	1.2
526	25	2.5	2 3/4	2 3/4	1 1/2	19/64	1.4	2.4	1.7
544	30	2.9	3	3	1 5/8	21/64	1.4	3.6	2.3
546	35	3.4	3 1/4	3 1/4	1 3/4	23/64	1.6	4.9	2.9
545	40	3.9	3 1/2	3 1/2	1 7/8	25/64	1.7	6.6	3.6
549	45	4.4	3 11/16	3 11/16	2	27/64	1.8	8.1	4.2
542	50	4.9	3 7/8	3 7/8	2 1/8	7/16	1.9	10.1	5.1
537	55	5.4	4 1/16	4 1/16	2 1/4	15/32	2.0	12.2	5.9
533	60	5.9	4 1/4	4 1/4	2 3/8	31/64	2.1	14.7	6.7
534	65	6.4	4 7/16	4 7/16	2 13/32	1/2	2.1	17.0	7.4
532	70	6.9	4 5/8	4 5/8	2 7/16	33/64	2.2	20.0	8.4
529	75	7.4	4 13/16	4 13/16	2 15/32	17/32	2.3	23.0	9.1
530	80	7.8	5	5	2 1/2	35/64	2.4	26.7	10.1
531	85	8.3	5 3/16	5 3/16	2 9/16	9/16	2.5	30.5	11.2
535	90	8.8	5 3/8	5 3/8	2 5/8	9/16	2.6	35.2	12.6
550	95	9.3	5 9/16	5 9/16	2 11/16	9/16	2.7	38.8	13.3
536	100	9.8	5 3/4	5 3/4	2 3/4	9/16	2.8	44.4	15.0
539	150	14.7	6	6	4 1/4	1	3.0	69.3	22.9

Sections No. 529 to 537 and 542 to 549 inclusive, are Am. Soc. C. E. Standard.
For detail dimensions of Section No. 539 see page 18.

RADII OF GYRATION FOR TWO ANGLES PLACED BACK TO BACK. ANGLES WITH EQUAL LEGS.

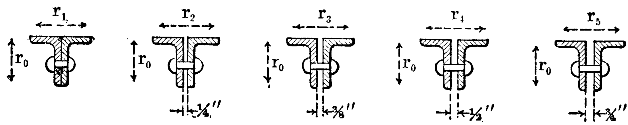


Radii of gyration correspond to directions indicated by arrowheads.

Section Number.	Dimensions. Inches.	Thickness. Inch.	Area of Two Angles. Sq. Ins.	Radii of Gyration. r_0	r_1	r_2	r_3	r_4	r_5
A11	$1\frac{1}{2} \times 1\frac{1}{2}$	$\frac{3}{16}$	1.06	0.46	0.64	0.73	0.78	0.83	0.94
"	"	$\frac{3}{8}$	1.98	0.44	0.67	0.77	0.82	0.88	0.99
A13	$1\frac{3}{4} \times 1\frac{3}{4}$	$\frac{3}{16}$	1.26	0.54	0.74	0.83	0.88	0.93	1.03
"	"	$\frac{7}{16}$	2.68	0.51	0.78	0.88	0.93	0.98	1.09
A15	2×2	$\frac{3}{16}$	1.44	0.62	0.84	0.93	0.98	1.03	1.13
"	"	$\frac{5}{16}$	2.32	0.60	0.86	0.95	1.00	1.05	1.16
"	"	$\frac{7}{16}$	3.12	0.59	0.88	0.98	1.03	1.08	1.19
*A41	$2\frac{1}{4} \times 2\frac{1}{4}$	$\frac{3}{16}$	1.62	0.70	0.94	1.03	1.08	1.12	1.22
"	"	$\frac{3}{8}$	3.10	0.67	0.97	1.06	1.11	1.16	1.27
A17	$2\frac{1}{2} \times 2\frac{1}{2}$	$\frac{1}{4}$	2.38	0.77	1.05	1.14	1.19	1.24	1.34
"	"	$\frac{3}{8}$	3.48	0.75	1.07	1.16	1.21	1.26	1.36
"	"	$\frac{1}{2}$	4.50	0.74	1.09	1.19	1.24	1.29	1.39
*A43	$2\frac{3}{4} \times 2\frac{3}{4}$	$\frac{3}{16}$	2.00	0.86	1.14	1.23	1.28	1.32	1.42
"	"	$\frac{5}{16}$	3.26	0.84	1.16	1.25	1.30	1.35	1.45
"	"	$\frac{7}{16}$	4.44	0.83	1.18	1.28	1.32	1.37	1.47
A19	3×3	$\frac{1}{4}$	2.88	0.93	1.26	1.34	1.39	1.43	1.53
"	"	$\frac{7}{16}$	4.88	0.91	1.28	1.37	1.42	1.47	1.57
"	"	$\frac{5}{8}$	6.72	0.88	1.32	1.41	1.46	1.51	1.61
A21	$3\frac{1}{2} \times 3\frac{1}{2}$	$\frac{3}{8}$	4.98	1.07	1.48	1.56	1.61	1.66	1.75
"	"	$\frac{5}{8}$	7.98	1.04	1.52	1.61	1.66	1.71	1.81
"	"	$\frac{13}{16}$	10.06	1.02	1.55	1.65	1.70	1.75	1.85
A23	4×4	$\frac{5}{16}$	4.82	1.24	1.67	1.76	1.80	1.85	1.94
"	"	$\frac{9}{16}$	8.33	1.21	1.71	1.80	1.85	1.89	1.99
"	"	$\frac{13}{16}$	11.68	1.18	1.75	1.85	1.89	1.94	2.04
*A45	$4\frac{1}{2} \times 4\frac{1}{2}$	$\frac{5}{16}$	5.44	1.40	1.87	1.96	2.00	2.05	2.14
"	"	$\frac{1}{2}$	8.50	1.38	1.90	1.99	2.04	2.08	2.18
"	"	$\frac{5}{8}$	10.48	1.36	1.92	2.01	2.06	2.10	2.20
*A47	5×5	$\frac{3}{8}$	7.22	1.56	2.09	2.17	2.22	2.26	2.35
"	"	$\frac{1}{2}$	9.50	1.54	2.10	2.19	2.24	2.28	2.38
"	"	$\frac{5}{8}$	11.72	1.52	2.12	2.21	2.26	2.30	2.40
A27	6×6	$\frac{7}{16}$	10.12	1.87	2.50	2.58	2.63	2.67	2.76
"	"	$\frac{5}{8}$	14.22	1.84	2.53	2.62	2.66	2.71	2.80
"	"	$\frac{7}{8}$	19.48	1.81	2.57	2.66	2.70	2.75	2.85
A35	8×8	$\frac{1}{2}$	15.50	2.51	3.32	3.41	3.45	3.49	3.58
"	"	$\frac{5}{8}$	19.22	2.49	3.34	3.43	3.47	3.51	3.60
"	"	$\frac{3}{4}$	22.88	2.47	3.36	3.44	3.49	3.53	3.62
"	"	$\frac{7}{8}$	26.47	2.45	3.38	3.46	3.51	3.55	3.64
"	"	1	30.00	2.44	3.40	3.48	3.53	3.57	3.67
"	"	$1\frac{1}{8}$	33.47	2.42	3.42	3.51	3.55	3.60	3.69

Angles marked * are special sections.

RADII OF GYRATION FOR TWO ANGLES PLACED BACK TO BACK.
ANGLES WITH UNEQUAL LEGS.



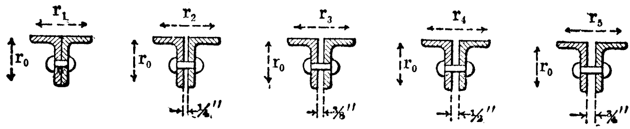
Radii of gyration correspond to directions indicated by arrowheads.

Section Number.	Dimensions. Inches.	Thickness. Inch.	Area of Two Angles. Sq. Ins.	Radii of Gyration. r_0	r_1	r_2	r_3	r_4	r_5
*A121	2 x 1⅜	3/16	1.20	0.63	0.54	0.62	0.67	0.72	0.83
"	"	⅜	2.26	0.61	0.56	0.66	0.71	0.76	0.88
*A123	2 x 1½	3/16	1.26	0.63	0.59	0.68	0.73	0.78	0.88
"	"	⅜	2.36	0.61	0.62	0.72	0.77	0.82	0.93
*A125	2½ x 1¼	3/16	1.34	0.80	0.44	0.52	0.58	0.63	0.74
"	"	⅜	2.54	0.78	0.47	0.57	0.62	0.68	0.79
*A127	2½ x 1½	3/16	1.44	0.80	0.55	0.64	0.69	0.74	0.84
"	"	⅜	2.72	0.78	0.58	0.68	0.73	0.78	0.89
*A161	2½ x 1¾	3/16	1.54	0.80	0.67	0.75	0.80	0.85	0.95
"	"	¼	2.00	0.79	0.68	0.77	0.81	0.86	0.97
A91	2½ x 2	3/16	1.62	0.79	0.79	0.88	0.92	0.97	1.07
"	"	⅜	3.10	0.77	0.82	0.91	0.96	1.01	1.12
"	"	½	4.00	0.75	0.84	0.94	0.99	1.04	1.15
*A128	2¾ x 1½	3/16	1.54	0.89	0.53	0.62	0.67	0.72	0.82
"	"	5/16	2.48	0.87	0.55	0.65	0.70	0.75	0.86
"	"	7/16	3.34	0.85	0.58	0.68	0.73	0.78	0.89
*A129	3 x 2	3/16	1.82	0.97	0.75	0.83	0.88	0.93	1.03
"	"	5/16	2.94	0.95	0.76	0.85	0.90	0.95	1.05
"	"	7/16	4.00	0.93	0.79	0.88	0.93	0.98	1.09
A93	3 x 2½	¼	2.64	0.95	1.00	1.09	1.13	1.18	1.28
"	"	⅜	3.86	0.93	1.02	1.11	1.16	1.21	1.31
"	"	9/16	5.56	0.91	1.05	1.15	1.20	1.25	1.35
*A151	3½ x 2	¼	2.63	1.13	.72	.81	.85	.90	1.00
"	"	7/16	4.43	1.10	.75	.84	.89	.94	1.05
"	"	⅝	6.10	1.08	.79	.89	.94	.99	1.10
A95	3½ x 2½	¼	2.88	1.12	0.96	1.04	1.09	1.13	1.23
"	"	½	5.50	1.09	1.00	1.09	1.14	1.19	1.29
"	"	11/16	7.32	1.06	1.03	1.13	1.18	1.23	1.33
A97	3½ x 3	5/16	3.88	1.10	1.21	1.30	1.35	1.39	1.49
"	"	9/16	6.68	1.07	1.25	1.34	1.39	1.44	1.54
"	"	13/16	9.26	1.04	1.30	1.40	1.45	1.50	1.60

Angles marked * are special sections.

RADII OF GYRATION FOR TWO ANGLES PLACED BACK TO BACK.

ANGLES WITH UNEQUAL LEGS.

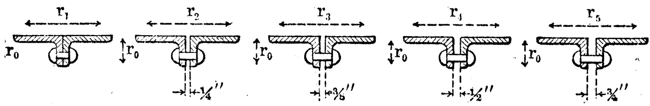


Radii of gyration correspond to directions indicated by arrowheads.

Section Number.	Dimensions. Inches.	Thickness. Inch.	Area of Two Angles. Sq. Ins.	Radii of Gyration. r_0	r_1	r_2	r_3	r_4	r_5
A99	4 x 3	5/16	4.18	1.27	1.17	1.25	1.30	1.34	1.44
"	"	9/16	7.26	1.24	1.21	1.30	1.34	1.39	1.49
"	"	13/16	10.06	1.21	1.25	1.35	1.40	1.45	1.55
*A131	4 x 3½	5/16	4.50	1.26	1.42	1.50	1.55	1.59	1.69
"	"	½	7.00	1.23	1.44	1.53	1.58	1.63	1.72
"	"	⅝	8.60	1.22	1.46	1.55	1.60	1.65	1.75
*A133	4½ x 3	⅜	5.36	1.44	1.14	1.22	1.27	1.31	1.41
"	"	½	7.00	1.42	1.15	1.24	1.29	1.34	1.44
"	"	⅝	8.60	1.40	1.18	1.27	1.31	1.36	1.46
A101	5 x 3	5/16	4.82	1.61	1.09	1.17	1.22	1.26	1.36
"	"	9/16	8.38	1.58	1.13	1.22	1.26	1.31	1.41
"	"	13/16	11.68	1.55	1.17	1.27	1.32	1.37	1.47
A103	5 x 3½	⅜	6.10	1.60	1.34	1.42	1.46	1.51	1.60
"	"	⅝	9.86	1.56	1.37	1.46	1.51	1.56	1.66
"	"	⅞	13.36	1.53	1.42	1.51	1.56	1.61	1.71
*A135	5 x 4	⅜	6.48	1.59	1.58	1.66	1.71	1.75	1.85
"	"	½	8.50	1.57	1.60	1.68	1.73	1.78	1.87
"	"	⅝	10.48	1.55	1.62	1.71	1.75	1.80	1.90
A105	6 x 3½	⅜	6.86	1.94	1.26	1.34	1.39	1.43	1.53
"	"	⅝	11.10	1.90	1.30	1.39	1.43	1.48	1.58
"	"	⅞	15.10	1.87	1.34	1.44	1.49	1.53	1.64
A107	6 x 4	⅜	7.22	1.93	1.50	1.58	1.62	1.67	1.76
"	"	⅝	11.72	1.90	1.53	1.62	1.67	1.71	1.81
"	"	⅞	15.98	1.86	1.58	1.67	1.71	1.76	1.86
*A109	7 x 3½	7/16	8.82	2.26	1.16	1.29	1.33	1.38	1.47
"	"	½	10.00	2.25	1.22	1.30	1.35	1.39	1.48
"	"	⅝	12.36	2.24	1.24	1.32	1.37	1.42	1.51
"	"	13/16	15.76	2.21	1.27	1.36	1.41	1.46	1.56
"	"	1	19.00	2.19	1.31	1.40	1.45	1.50	1.60

Angles marked * are special sections.

RADII OF GYRATION FOR TWO ANGLES PLACED BACK TO BACK.
ANGLES WITH UNEQUAL LEGS.



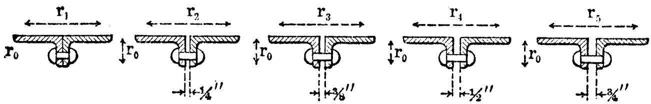
Radii of gyration correspond to directions indicated by arrowheads.

Section Number.	Dimensions. Inches.	Thickness. Inch.	Area of Two Angles. Sq. Ins.	Radii of Gyration. r_0	r_1	r_2	r_3	r_4	r_5
*A121	2 x 1 3/8	3/16	1.20	0.41	0.92	1.01	1.06	1.11	1.22
"	"	3/8	2.26	0.38	0.95	1.05	1.10	1.15	1.26
*A123	2 x 1 1/2	3/16	1.26	0.44	0.90	0.99	1.05	1.09	1.20
"	"	3/8	2.36	0.42	0.93	1.09	1.14	1.19	1.29
*A125	2 1/2 x 1 1/4	3/16	1.34	0.33	1.21	1.31	1.36	1.41	1.51
"	"	3/8	2.54	0.32	1.25	1.35	1.40	1.45	1.56
*A127	2 1/2 x 1 1/2	3/16	1.44	0.42	1.17	1.26	1.31	1.36	1.47
"	"	3/8	2.72	0.40	1.20	1.30	1.35	1.40	1.51
*A161	2 1/2 x 1 3/4	3/16	1.54	0.51	1.13	1.23	1.27	1.32	1.43
"	"	1/4	2.00	0.50	1.14	1.24	1.29	1.34	1.44
A91	2 1/2 x 2	3/16	1.62	0.60	1.10	1.19	1.24	1.29	1.39
"	"	3/8	3.10	0.58	1.13	1.23	1.28	1.33	1.43
"	"	1/2	4.00	0.56	1.15	1.25	1.30	1.35	1.46
*A128	2 3/4 x 1 1/2	3/16	1.54	0.41	1.31	1.40	1.45	1.50	1.60
"	"	5/16	2.48	0.40	1.33	1.43	1.48	1.53	1.63
"	"	7/16	3.34	0.39	1.36	1.45	1.51	1.56	1.66
*A129	3 x 2	3/16	1.82	0.58	1.37	1.46	1.51	1.56	1.66
"	"	5/16	2.94	0.57	1.39	1.48	1.53	1.58	1.68
"	"	7/16	4.00	0.55	1.41	1.51	1.56	1.61	1.71
A93	3 x 2 1/2	1/4	2.64	0.75	1.31	1.40	1.45	1.50	1.60
"	"	3/8	3.86	0.74	1.33	1.42	1.47	1.52	1.63
"	"	9/16	5.56	0.72	1.37	1.46	1.51	1.56	1.66
*A151	3 1/2 x 2	1/4	2.63	0.56	1.65	1.75	1.79	1.84	1.94
"	"	7/16	4.43	0.54	1.69	1.78	1.83	1.88	1.99
"	"	5/8	6.10	0.52	1.72	1.82	1.87	1.92	2.03
A95	3 1/2 x 2 1/2	1/4	2.88	0.74	1.58	1.67	1.72	1.76	1.86
"	"	1/2	5.50	0.70	1.62	1.72	1.77	1.81	1.92
"	"	11/16	7.32	0.69	1.66	1.75	1.80	1.86	1.96
A97	3 1/2 x 3	5/16	3.88	0.90	1.52	1.61	1.66	1.71	1.80
"	"	9/16	6.68	0.87	1.57	1.66	1.71	1.76	1.86
"	"	13/16	9.26	0.85	1.61	1.71	1.76	1.81	1.91

Angles marked * are special sections.

RADII OF GYRATION FOR TWO ANGLES PLACED BACK TO BACK.

ANGLES WITH UNEQUAL LEGS.



Radii of gyration correspond to directions indicated by arrowheads.

Section Number.	Dimensions. Inches.	Thickness. Inch.	Area of Two Angles. Sq. Ins.	Radii of Gyration. r_0	r_1	r_2	r_3	r_4	r_5
A99	4 x 3	5/16	4.18	0.89	1.79	1.88	1.93	1.97	2.07
"	"	9/16	7.26	0.86	1.83	1.93	1.97	2.02	2.12
"	"	13/16	10.06	0.83	1.88	1.97	2.02	2.08	2.18
*A131	4 x 3½	5/16	4.50	1.07	1.73	1.81	1.86	1.91	2.00
"	"	1/2	7.00	1.04	1.76	1.85	1.89	1.94	2.04
"	"	5/8	8.60	1.02	1.78	1.87	1.92	1.97	2.07
*A133	4½ x 3	3/8	5.36	0.86	2.07	2.16	2.21	2.26	2.35
"	"	1/2	7.00	0.85	2.09	2.18	2.23	2.28	2.38
"	"	5/8	8.60	0.83	2.11	2.21	2.26	2.31	2.41
A101	5 x 3	5/16	4.82	0.85	2.33	2.42	2.47	2.52	2.61
"	"	9/16	8.38	0.82	2.37	2.47	2.52	2.57	2.67
"	"	13/16	11.68	0.80	2.42	2.52	2.57	2.62	2.72
A103	5 x 3½	3/8	6.10	1.02	2.27	2.36	2.41	2.45	2.55
"	"	5/8	9.86	0.99	2.31	2.40	2.45	2.50	2.60
"	"	7/8	13.36	0.96	2.36	2.45	2.50	2.55	2.65
*A135	5 x 4	3/8	6.48	1.20	2.20	2.29	2.34	2.38	2.48
"	"	1/2	8.50	1.18	2.22	2.31	2.36	2.41	2.50
"	"	5/8	10.48	1.17	2.24	2.33	2.38	2.43	2.53
A105	6 x 3½	3/8	6.86	0.99	2.81	2.90	2.95	3.00	3.09
"	"	5/8	11.10	0.96	2.86	2.95	3.00	3.05	3.15
"	"	7/8	15.10	0.93	2.90	3.00	3.05	3.10	3.20
A107	6 x 4	3/8	7.22	1.17	2.74	2.83	2.87	2.92	3.02
"	"	5/8	11.72	1.13	2.78	2.87	2.92	2.97	3.06
"	"	7/8	15.98	1.11	2.82	2.92	2.97	3.02	3.12
*A109	7 x 3½	7/16	8.82	0.95	3.37	3.47	3.52	3.56	3.66
"	"	1/2	10.00	0.94	3.39	3.48	3.53	3.58	3.67
"	"	5/8	12.36	0.93	3.40	3.50	3.55	3.60	3.70
"	"	13/16	15.76	0.91	3.45	3.54	3.59	3.64	3.74
"	"	1	19.00	0.89	3.48	3.58	3.63	3.68	3.78

Angles marked * are special sections.

STRENGTH OF STEEL COLUMNS OR STRUTS.

For various values of $\frac{L}{r}$ in which L = length in feet and r = radius of gyration in inches.

P = ultimate strength in lbs. per square inch.

FOR SOFT STEEL.

Square bearing

$$P = \frac{45\,000}{1 + \frac{(12\,L)^2}{36\,000\,r^2}}$$

Pin and square bearing

$$P = \frac{45\,000}{1 + \frac{(12\,L)^2}{24\,000\,r^2}}$$

Pin bearing

$$P = \frac{45\,000}{1 + \frac{(12\,L)^2}{18\,000\,r^2}}$$

To obtain safe unit stress:

For quiescent loads, as in buildings, divide by **4**.
For moving loads, as in bridges, divide by **5**.

$\frac{L}{r}$	Ultimate Strength in lbs. per Square Inch.			$\frac{L}{r}$	Ultimate Strength in lbs. per Square Inch.		
	Square.	Pin and Square.	Pin.		Square.	Pin and Square.	Pin.
3.0	43437	42694	41978	7.6	36554	33419	30779
3.2	43230	42395	41593	7.8	36193	32966	30268
3.4	43011	42081	41190				
3.6	42782	41754	40773	8.0	35828	32514	29762
3.8	42543	41412	40340	8.2	35462	32064	29260
				8.4	35095	31615	28763
4.0	42294	41058	39893	8.6	34727	31169	28272
4.2	42035	40693	39435	8.8	34358	30724	27787
4.4	41765	40317	38966				
4.6	41488	39930	38485	9.0	33988	30282	27306
4.8	41203	39534	37998	9.2	33611	29844	26832
				9.4	33249	29408	26364
5.0	40910	39130	37500	9.6	32880	28977	25903
5.2	40608	38807	36997	9.8	32511	28549	25448
5.4	40299	38300	36488				
5.6	39984	37874	35975	10.0	32143	28125	25000
5.8	39663	37443	35457	10.2	31776	27706	24559
				10.4	31411	27290	24125
6.0	39335	37006	34938	10.6	31054	26879	23698
6.2	39003	36566	34416	10.8	30684	26474	23279
6.4	38665	36122	33894				
6.6	38323	35675	33371	11.0	30324	26072	22866
6.8	37976	35219	32849	11.2	29965	25675	22460
				11.4	29608	25285	22063
7.0	37616	34776	32328	11.6	29247	24899	21671
7.2	37272	34324	31809	11.8	28903	24517	21288
7.4	36914	33872	31292				

STRENGTH OF STEEL COLUMNS OR STRUTS.

For various values of $\frac{L}{r}$ in which L = length in feet and r = radius of gyration in inches.

P = ultimate strength in lbs. per square inch.

FOR SOFT STEEL.

Square bearing

$$P = \frac{45\,000}{1 + \frac{(12\,L)^2}{36\,000\,r^2}}$$

Pin and square bearing

$$P = \frac{45\,000}{1 + \frac{(12\,L)^2}{24\,000\,r^2}}$$

Pin bearing

$$P = \frac{45\,000}{1 + \frac{(12\,L)^2}{18\,000\,r^2}}$$

To obtain safe unit stress:

For quiescent loads, as in buildings, divide by 4.
For moving loads, as in bridges, divide by 5.

$\frac{L}{r}$	Ultimate Strength in lbs. per Square Inch.			$\frac{L}{r}$	Ultimate Strength in lbs. per Square Inch.		
	Square.	Pin and Square.	Pin.		Square.	Pin and Square.	Pin.
12.0	28553	24142	20911	16.6	21406	16960	14043
12.2	28207	23771	20542	16.8	21137	16708	13812
12.4	27863	23406	20179				
12.6	27522	23046	19823	17.0	20872	16459	13584
12.8	27185	22693	19474	17.2	20611	16216	13366
				17.4	20353	15977	13150
13.0	26850	22343	19133	17.6	20098	15742	12938
13.2	26524	22005	18797	17.8	19847	15512	12731
13.4	26189	21662	18469				
13.6	25864	21329	18148	18.0	19599	15286	12528
13.8	25543	21002	17833	18.2	19351	15063	12329
				18.4	19114	14845	12135
14.0	25224	20680	17523	18.6	18878	14630	11944
14.2	24909	20363	17221	18.8	18644	14420	11757
14.4	24598	20052	16925				
14.6	24290	19746	16634	19.0	18418	14218	11579
14.8	23985	19445	16350	19.2	18185	14010	11394
				19.4	17961	13811	11219
15.0	23684	19148	16071	19.6	17740	13616	11048
15.2	23387	18858	15799	19.8	17519	13422	10877
15.4	23093	18572	15532				
15.6	22803	18288	15270	20.0	17308	13235	10715
15.8	22516	18015	15105	20.2	17096	13050	10553
				20.4	16888	12868	10434
16.0	22234	17744	14764	20.6	16682	12690	10249
16.2	21954	17478	14518	20.8	16480	12515	10087
16.4	21678	17216	14279				

STRENGTH OF STEEL COLUMNS OR STRUTS.

For various values of $\frac{L}{r}$ in which L = length in feet and r = radius of gyration in inches.

P = ultimate strength in lbs. per square inch.

FOR MEDIUM STEEL.

Square bearing

$$P = \frac{50\,000}{1 + \frac{(12\,L)^2}{36\,000\,r^2}}$$

Pin and square bearing

$$P = \frac{50\,000}{1 + \frac{(12\,L)^2}{24\,000\,r^2}}$$

Pin bearing

$$P = \frac{50\,000}{1 + \frac{(12\,L)^2}{18\,000\,r^2}}$$

To obtain safe unit stress:

For quiescent loads, as in buildings, divide by 4.
For moving loads, as in bridges, divide by 5.

$\frac{L}{r}$	Ultimate Strength in lbs. per Square Inch. Square.	Pin and Square.	Pin.
3.0	48263	47438	46642
3.2	48033	47106	46214
3.4	47790	46757	45767
3.6	47536	46393	45303
3.8	47270	46013	44822
4.0	46993	45620	44325
4.2	46705	45214	43817
4.4	46406	44797	43295
4.6	46098	44367	42761
4.8	45781	43927	42220
5.0	45455	43478	41667
5.2	45120	43119	41108
5.4	44777	42555	40542
5.6	44427	42082	39972
5.8	44070	41603	39397
6.0	43706	41118	38820
6.2	43337	40629	38240
6.4	42961	40136	37660
6.6	42581	39640	37079
6.8	42196	39132	36499
7.0	41796	38640	35920
7.2	41413	38138	35343
7.4	41016	37635	34769
7.6	40616	37132	34199
7.8	40214	36629	33631
8.0	39809	36127	33069
8.2	39402	35627	32511
8.4	38994	35128	31959
8.6	38585	34632	31413
8.8	38175	34138	30874
9.0	37764	33647	30340
9.2	37345	33160	29813
9.4	36943	32676	29293
9.6	36533	32197	28781
9.8	36123	31721	28275
10.0	35714	31250	27778
10.2	35307	30784	27288
10.4	34901	30322	26806
10.6	34504	29866	26331
10.8	34093	29415	25865
11.0	33693	28969	25407
11.2	33294	28528	24956
11.4	32898	28094	24514
11.6	32497	27665	24079
11.8	32114	27241	23653

STRENGTH OF STEEL COLUMNS OR STRUTS.

For various values of $\frac{L}{r}$ in which L = length in feet and r = radius of gyration in inches.

P = ultimate strength in lbs. per square inch.

FOR MEDIUM STEEL.

Square bearing

$$P = \frac{50\,000}{1 + \frac{(12\,L)^2}{36\,000\,r^2}}$$

Pin and Square bearing

$$P = \frac{50\,000}{1 + \frac{(12\,L)^2}{24\,000\,r^2}}$$

Pin bearing

$$P = \frac{50\,000}{1 + \frac{(12\,L)^2}{18\,000\,r^2}}$$

To obtain safe unit stress:

For quiescent loads, as in buildings, divide by 4.
For moving loads, as in bridges, divide by 5.

$\frac{L}{r}$	Ultimate Strength in lbs. per Square Inch.			$\frac{L}{r}$	Ultimate Strength in lbs. per Square Inch.		
	Square.	Pin and Square.	Pin.		Square.	Pin and Square.	Pin.
12.0	31726	26824	23234	16.6	23784	18844	15603
12.2	31341	26412	22824	16.8	23486	18564	15347
12.4	30959	26007	22421				
12.6	30580	25607	22026	17.0	23191	18288	15093
12.8	30205	25214	21638	17.2	22901	18018	14851
				17.4	22614	17752	14611
13.0	29833	24826	21259	17.6	22331	17491	14376
13.2	29471	24450	20886	17.8	22052	17235	14145
13.4	29099	24069	20521				
13.6	28738	23699	20164	18.0	21777	16984	13920
13.8	28381	23336	19814	18.2	21501	16737	13699
				18.4	21238	16494	13483
14.0	28027	22978	19470	18.6	20975	16256	13271
14.2	27677	22626	19134	18.8	20715	16022	13063
14.4	27331	22280	18805				
14.6	26989	21940	18482	19.0	20464	15798	12865
14.8	26650	21605	18167	19.2	20206	15567	12661
				19.4	19957	15346	12466
15.0	26316	21276	17857	19.6	19711	15129	12275
15.2	25985	20953	17554	19.8	19466	14913	12086
15.4	25659	20636	17258				
15.6	25337	20320	16967	20.0	19231	14706	11905
15.8	25018	20017	16683	20.2	18996	14500	11725
				20.4	18764	14298	11549
16.0	24704	19716	16404	20.6	18536	14100	11377
16.2	24393	19420	16131	20.8	18311	13905	11208
16.4	24087	19129	15865				

EXAMPLE OF THE USE OF THE TABLES OF RADII OF GYRATION FOR TWO ANGLES PLACED BACK TO BACK AND THE TABLES OF STRENGTH OF STEEL COLUMNS OR STRUTS.

PAGES 187 TO 195 INCLUSIVE.

What is the size of truss member required to safely sustain 50 000 pounds in compression, the safety factor being **4**, the unsupported length 8 feet, the gusset plates at each end being 3/8″ thick?

Assume for trial two **4″** x 3″ x 5/16″ angles with the long legs together. Referring to page 189, the least Radius of Gyration, comparing values in columns r_0 and r_8, is found to be 1.27. The ratio of the length of the column in feet to the Least Radius of Gyration in inches, $\frac{L}{r}$ is, therefore,

$$\frac{8}{1.27}=6.3.$$

Referring to the table of Strength of Steel Columns or Struts for medium steel, page 194, the ultimate strength of a column in which $\frac{L}{r}=6.3$ is found by interpolation between the values for 6.2 and 6.4 to be 43 149 pounds per square inch, which, divided by the safety factor 4, gives 10 787 pounds as the safe unit stress per square inch. Multiplying the safe unit stress per square inch. 10 787 pounds, by 4.18, the area of the two angles in square inches, gives 45 090 pounds as the total safe load. This is slightly less than the specified load of 50 000 pounds, and, therefore, it will be necessary to increase the assumed section. Assume the angles to be **4″** x 3″ x 3/8″, for which the Least Radius of Gyration is found by interpolation to be 1.26, and, by the same process used above, $\frac{L}{r}$ is found to be **6.35**, which corresponds to an ultimate strength of **43** 055 pounds per square inch, or a safe unit stress of **10 764** pounds per square inch, which, if multiplied by the area of the two angles, **4.96** square inches, gives a safe total load of **53** 389 pounds, which is ample to meet the conditions stated.

EXPLANATION OF TABLES RELATING TO DIMENSIONS AND SAFE LOADS OF STEEL COLUMNS OF VARIOUS SECTIONS.

PAGES 198 TO 279 INCLUSIVE.

Tables of Dimensions for Plate and Angle Columns are given on pages 198 and 199, the Moments of Inertia and Section Moduli about two rectangular axes are given on pages 200 to 202, and the Safe Loads for various lengths, calculated for the Radius of Gyration about each of the two rectangular axes, are given on pages 224 to 243 inclusive.

Tables of Dimensions for Z-bar Columns with Cover Plates are given on page 204, the Moments of Inertia and Section Moduli about two rectangular axes are given on page 205, and the Safe Loads for various lengths, based upon the Least Radius of Gyration, are given on pages 246 and 247.

Tables of Dimensions for Latticed Channel Columns are given on page 206, the Moments of Inertia and Section Moduli about two rectangular axes are given on page 207, the Safe Loads for various lengths, based upon the Least Radius of Gyration, are given on pages 248 to 251, and data relating to the proper sizes of lattice bars and stay-plates to be used with these columns are given on pages 250 and 251.

On pages 208 and 209 are given the Principal Dimensions of Plate and Channel Columns with comparatively narrow plates, called, for convenience of reference, Series A, and on pages 210 and 211 for Series B, which differs from Series A, in having wider plates. Moments of Inertia and Section Moduli about two rectangular axes are given for Series A and B on pages 212 to 218 inclusive, and the Safe Loads for different lengths, based upon the Least Radius of Gyration, are given on pages 252 to 279 inclusive.

Safe Loads for I-beams used as Columns or Struts are given on pages 220 to 223, and the dimensions of these sections can be obtained from the tables on pages 158 to 161 inclusive.

The Plate and Channel Columns given in Series A are particularly useful in buildings or locations in which it is desired to keep the extreme dimensions of the cross section as small as possible for this style of column, although in this series the Radius of Gyration about the central axis parallel to the channel webs is somewhat smaller than the Radius of Gyration about the axis perpendicular to the channel webs. This makes the narrower columns of Series A somewhat less economical of material than the wider columns of Series B, which, however, is small in amount for columns of ordinary story length of 10 feet to 14 feet, such as are used in skeleton buildings.

In Series B of Plate and Channel Columns with wider plates, the Radii of Gyration about the two axes are practically equal for the intermediate thicknesses and these columns are slightly more economical of material than those of Series A, although they require somewhat more space on account of their wider sections.

The Safe Loads for columns of various kinds, as given on pages 220 to 279 inclusive, are expressed in thousands of pounds, and have been figured by the use of Gordon's formula, as stated at the heads of the various tables, using the safety factor 4, which relates to static or quiescent loads such as occur in ordinary buildings.

On page 219 is given a table showing the Distances Back to Back for Spacing two Channels of the same size in order to produce equal Moments of Inertia about the two rectangular axes. This table will be found to be useful in designing compression members of trusses, etc.

The Safe Loads of the tables are assumed to be centrally applied, and for convenience in computing the proper sizes required to support eccentric loads, the tables of Moments of Inertia and Section Moduli for the different sections of columns are given.

The Safe Loads in the various tables are figured for extreme ratios from 30 to 150 for $\frac{l}{r}$, in which l is the length of the column and r the Least Radius of Gyration, both expressed in inches.

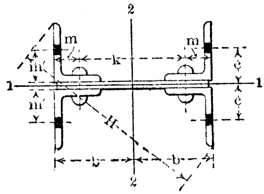
The weights of columns stated in the tables are per lineal foot of shaft, and do not include any allowances for bases, brackets or other connections, as these depend upon the particular details and requirements of each case.

Loads for other safety factors can be figured from the tables by inverse proportion, thus:

New safety factor : 4 : : load from tables : new loads.

Drawings of typical details of steel columns are given on pages 300 and 301.

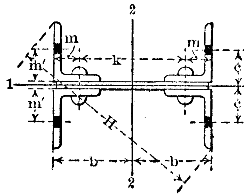
DIMENSIONS FOR PLATE AND ANGLE COLUMNS.



Size of Angles.	Size of Plates.	Weight of Column.	Area of Column Section.	b	c	m	m′	k	H
Inches.	Inches.	Lbs. per Ft.	Sq. Ins.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
3 x 2½ x ¼	6 x ¼	24.9	6.79	3⅛	1⅞	1½	1¾	3½	8 13/16
" " ⅝	" ⅝	56.1	15.94	"	2 1/16	"	"	"	9⅛
3 x 2½ x ¼	8 x ¼	26.6	7.29	4⅛	1⅞	1½	1¾	5½	10⅜
" " ⅝	" ⅝	60.4	17.19	"	2 1/16	"	"	"	10 9/16
3 x 2½ x ¼	10 x ¼	28.3	7.79	5⅛	1⅞	1½	1¾	7½	12
" " ⅝	" ⅝	64.6	18.44	"	2 1/16	"	"	"	12 3/16
3 x 2½ x ¼	12 x ¼	30.0	8.29	6⅛	1⅞	1½	1¾	9½	13¾
" " ⅝	" ⅝	68.9	19.69	"	2 1/16	"	"	"	13 15/16
3½ x 2½ x ¼	7 x ¼	27.4	7.50	3⅝	2⅜	1½	2¼	4½	10¼
" " ¾	" ¾	73.3	21.00	"	2⅝	"	"	"	10⅝
3½ x 2½ x ¼	8 x ¼	28.3	7.75	4⅛	2⅜	1½	2¼	5½	11
" " ¾	" ¾	75.9	21.75	"	2⅝	"	"	"	11 5/16
3½ x 2½ x ¼	10 x ¼	30.0	8.25	5⅛	2⅜	1½	2¼	7½	12 9/16
" " ¾	" ¾	81.0	23.25	"	2⅝	"	"	"	12⅞
3½ x 2½ x ¼	12 x ¼	31.7	8.75	6⅛	2⅜	1½	2¼	9½	14¼
" " ¾	" ¾	86.1	24.75	"	2⅝	"	"	"	14½
4 x 3 x 5/16	8 x 5/16	39.3	10.86	4⅛	2 7/16	1¾	2¼	4¾	11 11/16
" " ⅞	" ⅞	98.6	28.44	"	2 11/16	"	"	"	12⅛
4 x 3 x 5/16	10 x 5/16	41.4	11.49	5⅛	2 7/16	1¾	2¼	6¾	13 3/16
" " ⅞	" ⅞	104.6	30.19	"	2 11/16	"	"	"	13 9/16
4 x 3 x 5/16	12 x 5/16	43.5	12.11	6⅛	2 7/16	1¾	2¼	8¾	14 13/16
" " ⅞	" ⅞	110.5	31.94	"	2 11/16	"	"	"	15⅛
4 x 3 x 5/16	14 x 5/16	45.6	12.74	7⅛	2 7/16	1¾	2¼	10¾	16½
" " ⅞	" ⅞	116.5	33.69	"	2 11/16	"	"	"	16 13/16

Dimensions m′ and c may be varied to suit requirements.

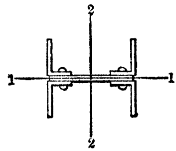
DIMENSIONS FOR PLATE AND ANGLE COLUMNS.



Size of Angles.	Size of Plates.	Weight of Column.	Area of Column Section.	b	c	m	m′	k	H
Inches.	Inches.	Lbs. per Ft.	Sq. Ins.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
5 x 3½ x 5/16	10 x 5/16	47.4	13.36	5⅛	2 7/16	2¼	2¼	5¾	14 9/16
“ “ 15/16	“ 15/16	130.6	37.74	“	2¾	“	“	“	15
5 x 3½ x 5/16	12 x 5/16	49.5	13.98	6⅛	2 7/16	2¼	2¼	7¾	16
“ “ 15/16	“ 15/16	137.0	39.61	“	2¾	“	“	“	16 7/16
5 x 3½ x 5/16	14 x 5/16	51.6	14.61	7⅛	2 7/16	2¼	2¼	9¾	17 9/16
“ “ 15/16	“ 15/16	143.4	41.49	“	2¾	“	“	“	17 15/16
5 x 3½ x 5/16	16 x 5/16	53.7	15.23	8⅛	2 7/16	2¼	2¼	11¾	19¼
“ “ 15/16	“ 15/16	149.8	43.36	“	2¾	“	“	“	19 9/16
6 x 3½ x ⅜	12 x ⅜	64.2	18.23	6⅛	2 7/16	2¼	2¼	7¾	17 7/16
“ “ 1	“ 1	158.3	46.00	“	2¾	“	“	“	17⅞
6 x 3½ x ⅜	14 x ⅜	66.7	18.98	7⅛	2 7/16	2¼	2¼	9¾	18⅞
“ “ 1	“ 1	165.1	48.00	“	2¾	“	“	“	19 5/16
6 x 3½ x ⅜	16 x ⅜	69.3	19.73	8⅛	2 7/16	2¼	2¼	11¾	20 7/16
“ “ 1	“ 1	171.9	50.00	“	2¾	“	“	“	20 13/16
6 x 3½ x ⅜	18 x ⅜	71.8	20.48	9⅛	2 7/16	2¼	2¼	13¾	22 1/16
“ “ 1	“ 1	178.7	52.00	“	2¾	“	“	“	22 7/16
7 x 3½ x 7/16	14 x 7/16	82.6	23.74	7⅛	2½	2¼	2¼	9¾	20 5/16
“ “ 1	“ 1	178.7	52.00	“	2¾	“	“	“	20 11/16
7 x 3½ x 7/16	16 x 7/16	85.6	24.61	8⅛	2½	2¼	2¼	11¾	21¾
“ “ 1	“ 1	185.5	54.00	“	2¾	“	“	“	22⅛
7 x 3½ x 7/16	18 x 7/16	88.6	25.49	9⅛	2½	2¼	2¼	13¾	23¼
“ “ 1	“ 1	192.3	56.00	“	2¾	“	“	“	23⅝
7 x 3½ x 7/16	20 x 7/16	91.6	26.40	10⅛	2½	2¼	2¼	15¾	24⅞
“ “ 1	“ 1	199.1	58.00	“	2¾	“	“	“	25 3/16

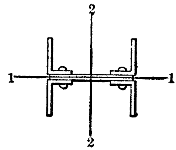
Dimensions m′ and c may be varied to suit requirements.

MOMENTS OF INERTIA AND SECTION MODULI FOR PLATE AND ANGLE COLUMNS.



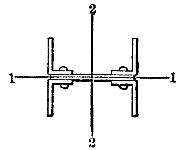
Size of Angles.	Size of Plate.	Axis 1-1. Moment of Inertia.	Axis 1-1. Section Modulus.	Axis 2-2. Moment of Inertia.	Axis 2-2. Section Modulus.	Size of Plate.	Axis 1-1. Moment of Inertia.	Axis 1-1. Section Modulus.	Axis 2-2. Moment of Inertia.	Axis 2-2. Section Modulus.
Inches.	Inches.	Ins.^{4}	Ins.^{3}	Ins.^{4}	Ins.^{3}	Inches.	Ins.^{4}	Ins.^{3}	Ins.^{4}	Ins.^{3}
3 x 2½ x ¼	6 x ¼	10.3	3.3	39.4	12.6	8 x ¼	10.3	3.3	76.7	18.6
" 5/16	" 5/16	13.4	4.3	47.9	15.3	" 5/16	13.4	4.3	93.7	22.7
" ⅜	" ⅜	16.7	5.2	55.9	17.9	" ⅜	16.7	5.3	110.1	26.7
" 7/16	" 7/16	20.2	6.3	63.5	20.3	" 7/16	20.3	6.3	125.6	30.5
" ½	" ½	24.0	7.4	70.6	22.6	" ½	24.0	7.4	140.5	34.1
" 9/16	" 9/16	28.1	8.6	77.3	24.8	" 9/16	28.1	8.6	154.6	37.5
" ⅝	" ⅝	32.4	9.8	83.7	26.8	" ⅝	32.4	9.8	168.1	40.8
3 x 2½ x ¼	10 x ¼	10.3	3.3	128.4	25.1	12 x ¼	10.3	3.3	195.7	32.0
" 5/16	" 5/16	13.4	4.3	157.5	30.7	" 5/16	13.4	4.3	240.5	39.3
" ⅜	" ⅜	16.7	5.3	185.6	36.2	" ⅜	16.7	5.3	284.0	46.4
" 7/16	" 7/16	20.3	6.3	212.5	41.5	" 7/16	20.3	6.3	325.8	53.2
" ½	" ½	24.1	7.4	238.3	46.5	" ½	24.1	7.4	366.1	59.8
" 9/16	" 9/16	28.1	8.6	263.1	51.3	" 9/16	28.2	8.6	405.1	66.1
" ⅝	" ⅝	32.5	9.8	286.9	56.0	" ⅝	32.5	9.8	442.7	72.3
3½ x 2½ x ¼	7 x ¼	16.0	4.4	62.4	17.2	8 x ¼	16.0	4 4	84.7	20.5
" 5/16	" 5/16	20.7	5.7	76.2	21.0	" 5/16	20.7	5.7	103.6	25.1
" ⅜	" ⅜	25.6	6.9	89.3	24.6	" ⅜	25.6	6.9	121.7	29.5
" 7/16	" 7/16	30.8	8.3	101.7	28.1	" 7/16	30.8	8.3	138.9	33.7
" ½	" ½	36.3	9.7	113.6	31.3	" ½	36.3	9.7	155.5	37.7
" 9/16	" 9/16	42.1	11.1	124.8	34.4	" 9/16	42.1	11.1	171.2	41.5
" ⅝	" ⅝	48.3	12.7	135.5	37.4	" ⅝	48.3	12.7	186.3	45.2
" 11/16	" 11/16	54.8	14.3	145.6	40.2	" 11/16	54.8	14.3	200.6	48.6
" ¾	" ¾	61.6	15.9	155.2	42.8	" ¾	61.6	15.9	214.3	52.0
3½ x 2½ x ¼	10 x ¼	16.0	4.4	140.9	27.5	12 x ¼	16.0	4.4	213.7	34.9
" 5/16	" 5/16	20.7	5.7	173.0	33.8	" 5/16	20.7	5.7	262.9	42.9
" ⅜	" ⅜	25.6	6.9	203.9	39.8	" ⅜	25.6	7.0	310.5	50.7
" 7/16	" 7/16	30.8	8.3	233.5	45.6	" 7/16	30.8	8.3	356.2	58.2
" ½	" ½	36.3	9.7	262.1	51.1	" ½	36.4	9.7	400.7	65.4
" 9/16	" 9/16	42.2	11.2	289.4	56.5	" 9/16	42.2	11.2	443.4	72.4
" ⅝	" ⅝	48.3	12.7	315.9	61.7	" ⅝	48.4	12.7	484.9	79.2
" 11/16	" 11/16	54.9	14.3	341.2	66.6	" 11/16	54.9	14.3	524.8	85.7
" ¾	" ¾	61.7	15.9	365.6	71.3	" ¾	61.8	15.9	563.3	92.0

MOMENTS OF INERTIA AND SECTION MODULI FOR PLATE AND ANGLE COLUMNS.



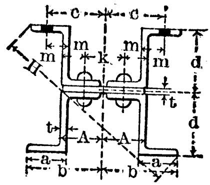
Size of Angles.	Size of Plate.	Axis 1-1. Moment of Inertia.	Axis 1-1. Section Modulus.	Axis 2-2. Moment of Inertia.	Axis 2-2. Section Modulus.	Size of Plate.	Axis 1-1. Moment of Inertia.	Axis 1-1. Section Modulus.	Axis 2-2. Moment of Inertia.	Axis 2-2. Section Modulus.
Inches.	Inches.	Ins.^{4}	Ins.^{3}	Ins.^{4}	Ins.^{3}	Inches.	Ins.^{4}	Ins.^{3}	Ins.^{4}	Ins.^{3}
4 x 3 x 5/16	8 x 5/16	30.3	7.3	114.6	27.8	10 x 5/16	30.3	7.3	192.0	37.5
" 3/8	" 3/8	37.4	8.9	134.8	32.7	" 3/8	37.4	8.9	226.4	44.2
" 7/16	" 7/16	44.8	10.6	154.0	37.3	" 7/16	44.8	10.6	259.5	50.6
" 1/2	" 1/2	52.6	12.4	172.4	41.8	" 1/2	52.6	12.4	291.5	56.9
" 9/16	" 9/16	60.8	14.2	190.0	46.1	" 9/16	60.9	14.2	322.2	62.9
" 5/8	" 5/8	69.5	16.1	206.9	50.2	" 5/8	69.5	16.1	352.0	68.7
" 11/16	" 11/16	78.6	18.1	223.0	54.1	" 11/16	78.6	18.1	380.5	74.2
" 3/4	" 3/4	88.1	20.1	238.3	57.8	" 3/4	88.2	20.2	408.0	79.6
" 13/16	" 13/16	98.1	22.3	253.0	61.3	" 13/16	98.2	22.3	434.4	84.7
" 7/8	" 7/8	108.5	24.4	267.0	64.7	" 7/8	108.6	24.5	459.8	89.7
4 x 3 x 5/16	12 x 5/16	30.3	7.3	292.3	47.7	14 x 5/16	30.3	7.3	416.8	58.5
" 3/8	" 3/8	37.4	8.9	345.5	56.4	" 3/8	37.4	8.9	493.4	69.3
" 7/16	" 7/16	44.8	10.6	396.7	64.8	" 7/16	44.8	10.6	567.4	79.6
" 1/2	" 1/2	52.6	12.4	446.6	72.9	" 1/2	52.7	12.4	639.7	89.8
" 9/16	" 9/16	60.9	14.2	494.7	80.8	" 9/16	60.9	14.2	709.6	99.6
" 5/8	" 5/8	69.6	16.1	541.5	88.4	" 5/8	69.6	16.1	777.8	109.2
" 11/16	" 11/16	78.7	18.1	586.5	95.8	" 11/16	78.7	18.1	843.7	118.4
" 3/4	" 3/4	88.2	20.2	630.1	102.9	" 3/4	88.3	20.2	907.7	127.4
" 13/16	" 13/16	98.2	22.3	672.2	109.8	" 13/16	98.3	22.3	969.8	136.1
" 7/8	" 7/8	108.7	24.5	713.1	116.4	" 7/8	108.8	24.5	1030.1	144.6
5 x 3½ x 5/16	10 x 5/16	57.6	11.2	225.0	43.9	12 x 5/16	57.6	11.2	341.9	55.8
" 3/8	" 3/8	70.6	13.6	265.7	51.8	" 3/8	70.6	13.6	404.6	66.1
" 7/16	" 7/16	84.1	16.1	304.8	59.5	" 7/16	84.1	16.1	465.2	75.9
" 1/2	" 1/2	98.2	18.7	342.6	66.9	" 1/2	98.2	18.7	524.0	85.5
" 9/16	" 9/16	112.9	21.4	379.1	74.0	" 9/16	112.9	21.4	581.0	94.9
" 5/8	" 5/8	128.2	24.1	414.4	80.9	" 5/8	128.2	24.1	636.4	103.9
" 11/16	" 11/16	144.1	27.0	448.2	87.5	" 11/16	144.1	27.0	689.8	112.6
" 3/4	" 3/4	160.6	29.9	481.1	93.9	" 3/4	160.7	29.9	741.8	121.1
" 13/16	" 13/16	177.8	32.9	512.6	100.0	" 13/16	177.9	32.9	792.1	129.3
" 7/8	" 7/8	195.7	36.0	543.1	106.0	" 7/8	195.8	36.0	841.0	137.3
" 15/16	" 15/16	214.2	39.2	572.5	111.7	" 15/16	214.3	39.2	888.2	145.0
5 x 3½ x 5/16	14 x 5/16	57.6	11.2	486.8	68.3	16 x 5/16	57.6	11.2	660.8	81.3
" 3/8	" 3/8	70.6	13.6	576.9	81.0	" 3/8	70.6	13.6	784.0	96.5
" 7/16	" 7/16	84.1	16.1	664.2	93.2	" 7/16	84.1	16.1	903.8	111.2
" 1/2	" 1/2	98.2	18.7	749.3	105.2	" 1/2	98.3	18.7	1020.6	125.6
" 9/16	" 9/16	112.9	21.4	832.1	116.8	" 9/16	113.0	21.4	1134.7	139.7
" 5/8	" 5/8	128.3	24.1	912.7	128.1	" 5/8	128.3	24.2	1245.9	153.3
" 11/16	" 11/16	144.2	27.0	990.8	139.1	" 11/16	144.2	27.0	1354.0	166.6
" 3/4	" 3/4	160.8	29.9	1067.1	149.8	" 3/4	160.8	29.9	1459.8	179.7
" 13/16	" 13/16	178.0	32.9	1141.0	160.1	" 13/16	178.1	32.9	1562.6	192.3
" 7/8	" 7/8	195.9	36.0	1213.2	170.3	" 7/8	196.0	36.0	1663.3	204.7
" 15/16	" 15/16	214.4	39.2	1283.1	180.1	" 15/16	214.6	39.2	1761.0	216.7

MOMENTS OF INERTIA AND SECTION MODULI FOR PLATE AND ANGLE COLUMNS.



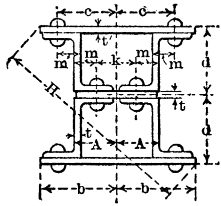
Size of Angles.	Size of Plate.	Axis 1-1. Moment of Inertia.	Axis 1-1. Section Modulus.	Axis 2-2. Moment of Inertia.	Axis 2-2. Section Modulus.	Size of Plate.	Axis 1-1. Moment of Inertia.	Axis 1-1. Section Modulus.	Axis 2-2. Moment of Inertia.	Axis 2-2. Section Modulus.
Inches.	Inches.	Ins.^{4}	Ins.^{3}	Ins.^{4}	Ins.^{3}	Inches.	Ins.^{4}	Ins.^{3}	Ins.^{4}	Ins.^{3}
6 x 3½ x 3/8	12 x 3/8	119.2	19.3	457.5	74.7	14 x 3/8	119.2	19.3	649.1	91.1
" 7/16	" 7/16	141.5	22.8	526.2	85.9	" 7/16	141.5	22.8	747.7	104.9
" 1/2	" 1/2	164.5	26.3	593.0	96.8	" 1/2	164.5	26.3	843.9	118.4
" 9/16	" 9/16	188.3	30.0	657.9	107.4	" 9/16	188.3	30.0	937.6	131.6
" 5/8	" 5/8	212.9	33.7	720.9	117.7	" 5/8	212.9	33.7	1028.8	144.4
" 11/16	" 11/16	238.3	37.6	781.8	127.6	" 11/16	238.3	37.6	1117.3	156.8
" 3/4	" 3/4	264.5	41.5	841.2	137.3	" 3/4	264.6	41.5	1203.9	169.0
" 13/16	" 13/16	291.5	45.5	898.5	146.7	" 13/16	291.6	45.5	1287.9	180.8
" 7/8	" 7/8	319.5	49.6	954.4	155.8	" 7/8	319.6	49.6	1370.0	192.3
" 15/16	" 15/16	348.2	53.8	1008.4	164.6	" 15/16	348.4	53.9	1449.5	203.4
" 1	" 1	377.5	58.1	1060.8	173.2	" 1	377.7	58.1	1526.9	214.3
6 x 3½ x 3/8	16 x 3/8	119.2	19.3	878.6	108.1	18 x 3/8	119.3	19.3	1147.4	125.7
" 7/16	" 7/16	141.5	22.8	1013.2	124.7	" 7/16	141.5	22.8	1324.4	145.1
" 1/2	" 1/2	164.5	26.3	1144.7	140.9	" 1/2	164.6	26.3	1497.5	164.1
" 9/16	" 9/16	188.4	30.0	1273.2	156.7	" 9/16	188.4	30.0	1667.1	182.7
" 5/8	" 5/8	213.0	33.7	1398.6	172.1	" 5/8	213.0	33.7	1832.8	200.9
" 11/16	" 11/16	238.4	37.6	1520.6	187.2	" 11/16	238.4	37.6	1994.3	218.6
" 3/4	" 3/4	264.6	41.5	1640.2	201.9	" 3/4	264.7	41.5	2152.9	235 9
" 13/16	" 13/16	291.7	45.5	1756.4	216.2	" 13/16	291.8	45.5	2307.4	252.9
" 7/8	" 7/8	319.7	49.7	1870.4	230.2	" 7/8	319.8	49.7	2459.2	269 5
" 15/16	" 15/16	348.5	53.9	1981.1	243.8	" 15/16	348.6	53.9	2606.8	285.7
" 1	" 1	377.8	58.1	2089.1	257.1	" 1	378.0	58.2	2751.3	301.5
7 x 3½ x 7/16	14 x 7/16	220.8	30.6	831.2	116.7	16 x 7/16	220.8	30.6	1122.6	138.2
" 1/2	" 1/2	255.8	35.3	938.4	131.7	" 1/2	255.8	35.3	1268.8	156.2
" 9/16	" 9/16	292.7	40.2	1043.0	146.4	" 9/16	292.7	40.2	1411.6	173.7
" 5/8	" 5/8	328.5	44.9	1144.6	160.7	" 5/8	328.5	44.9	1550.9	190.9
" 11/16	" 11/16	367.3	50.0	1243.9	174.6	" 11/16	367.4	50.0	1687.2	207.7
" 3/4	" 3/4	406.6	55.1	1340.7	188.2	" 3/4	406.7	55.1	1820.5	224.0
" 13/16	" 13/16	447.2	60.4	1434.8	201.4	" 13/16	447.3	60.4	1950.3	240.0
" 7/8	" 7/8	488.3	65.7	1526.7	214.3	" 7/8	488.4	65.7	2077.4	255.7
" 15/16	" 15/16	530.8	71.1	1615.9	226.8	" 15/16	530.9	71.1	2201.1	270.9
" 1	" 1	574.3	76.6	1702.8	239.0	" 1	574.5	76.6	2322.0	285.8
7 x 3½ x 7/16	18 x 7/16	220.8	30.6	1463.2	160.4	20 x 7/16	220.8	30.6	1854.8	183.2
" 1/2	" 1/2	255.9	35.3	1655.1	181.4	" 1/2	255.9	35.3	2099.4	207.4
" 9/16	" 9/16	292.8	40.2	1843.0	202.0	" 9/16	292.8	40.2	2339.4	231.1
" 5/8	" 5/8	328.6	44.9	2026.6	222.1	" 5/8	328.6	44.9	2574.2	254.2
" 11/16	" 11/16	367.4	50.0	2206.4	241.8	" 11/16	367.5	50.0	2804.4	277.0
" 3/4	" 3/4	406.7	55.2	2382.7	261.1	" 3/4	406.8	55.2	3030.5	299.3
" 13/16	" 13/16	447.4	60.4	2554.7	280.0	" 13/16	447.5	60.4	3251.4	321.1
" 7/8	" 7/8	488.5	65.7	2723.5	298.5	" 7/8	488.6	65.7	3468.5	342.6
" 15/16	" 15/16	531.0	71.1	2888.1	316.5	" 15/16	531.2	71.1	3680.5	363.5
" 1	" 1	574.7	76.6	3049.1	334.2	" 1	574.8	76.6	3888.3	384.0

DIMENSIONS FOR Z-BAR COLUMNS.



Section of Column.	t	a	b	d	H	c	k	m	A
	Inch.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
4-3″ Z-Bars and 1 Web-plate 5¾″ wide.	$\frac{1}{4}$	$2\frac{11}{16}$	$5\frac{7}{16}$	$3\frac{1}{8}$	$12\frac{9}{16}$	$4\frac{3}{8}$	$2\frac{3}{4}$	$1\frac{5}{8}$	3
	$\frac{5}{16}$	$2\frac{3}{4}$	$5\frac{7}{16}$	$3\frac{7}{32}$	$12\frac{5}{8}$	$4\frac{5}{16}$	“	“	“
	$\frac{3}{8}$	$2\frac{11}{16}$	$5\frac{5}{16}$	$3\frac{3}{16}$	$12\frac{3}{8}$	$4\frac{1}{4}$	“	“	“
	$\frac{7}{16}$	$2\frac{3}{4}$	$5\frac{5}{16}$	$3\frac{9}{32}$	$12\frac{1}{2}$	$4\frac{3}{16}$	“	“	“
	$\frac{1}{2}$	$2\frac{11}{16}$	$5\frac{3}{16}$	$3\frac{1}{4}$	$12\frac{1}{4}$	$4\frac{1}{8}$	“	“	“
	$\frac{9}{16}$	$2\frac{3}{4}$	$5\frac{3}{16}$	$3\frac{11}{32}$	$12\frac{5}{16}$	$4\frac{1}{16}$	“	“	“
4-4″ Z-Bars and 1 Web-plate 6¾″ wide.	$\frac{1}{4}$	$3\frac{1}{16}$	$6\frac{5}{16}$	$4\frac{1}{8}$	$15\frac{1}{16}$	5	$3\frac{1}{2}$	$1\frac{3}{4}$	$3\frac{1}{2}$
	$\frac{5}{16}$	$3\frac{1}{8}$	$6\frac{5}{16}$	$4\frac{7}{32}$	$15\frac{3}{16}$	$4\frac{15}{16}$	“	“	“
	$\frac{3}{8}$	$3\frac{3}{16}$	$6\frac{5}{16}$	$4\frac{5}{16}$	$15\frac{5}{16}$	$4\frac{7}{8}$	“	“	“
	$\frac{7}{16}$	$3\frac{1}{16}$	$6\frac{1}{8}$	$4\frac{7}{32}$	$14\frac{7}{8}$	$4\frac{13}{16}$	“	“	“
	$\frac{1}{2}$	$3\frac{1}{8}$	$6\frac{1}{8}$	$4\frac{5}{16}$	15	$4\frac{3}{4}$	“	“	“
	$\frac{9}{16}$	$3\frac{3}{16}$	$6\frac{1}{8}$	$4\frac{13}{32}$	$15\frac{1}{8}$	$4\frac{11}{16}$	“	“	“
	$\frac{5}{8}$	$3\frac{1}{16}$	$5\frac{15}{16}$	$4\frac{5}{16}$	$14\frac{11}{16}$	$4\frac{5}{8}$	“	“	“
	$\frac{11}{16}$	$3\frac{1}{8}$	$5\frac{15}{16}$	$4\frac{13}{32}$	$14\frac{13}{16}$	$4\frac{9}{16}$	“	“	“
	$\frac{3}{4}$	$3\frac{3}{16}$	$5\frac{15}{16}$	$4\frac{1}{2}$	$14\frac{7}{8}$	$4\frac{1}{2}$	“	“	“
4-5″ Z-Bars and 1 Web-plate 7″ wide.	$\frac{5}{16}$	$3\frac{1}{4}$	$6\frac{9}{16}$	$5\frac{5}{32}$	$16\frac{11}{16}$	$5\frac{3}{16}$	$3\frac{1}{2}$	$1\frac{7}{8}$	$3\frac{5}{8}$
	$\frac{3}{8}$	$3\frac{5}{16}$	$6\frac{9}{16}$	$5\frac{1}{4}$	$16\frac{13}{16}$	$5\frac{1}{8}$	“	“	“
	$\frac{7}{16}$	$3\frac{3}{8}$	$6\frac{9}{16}$	$5\frac{11}{32}$	$16\frac{15}{16}$	$5\frac{1}{16}$	“	“	“
	$\frac{1}{2}$	$3\frac{1}{4}$	$6\frac{3}{8}$	$5\frac{1}{4}$	$16\frac{1}{2}$	5	“	“	“
	$\frac{9}{16}$	$3\frac{5}{16}$	$6\frac{3}{8}$	$5\frac{11}{32}$	$16\frac{5}{8}$	$4\frac{15}{16}$	“	“	“
	$\frac{5}{8}$	$3\frac{3}{8}$	$6\frac{3}{8}$	$5\frac{7}{16}$	$16\frac{3}{4}$	$4\frac{7}{8}$	“	“	“
	$\frac{11}{16}$	$3\frac{1}{4}$	$6\frac{3}{16}$	$5\frac{11}{32}$	$16\frac{5}{16}$	$4\frac{13}{16}$	“	“	“
	$\frac{3}{4}$	$3\frac{5}{16}$	$6\frac{3}{16}$	$5\frac{7}{16}$	$16\frac{1}{2}$	$4\frac{3}{4}$	“	“	“
	$\frac{13}{16}$	$3\frac{3}{8}$	$6\frac{3}{16}$	$5\frac{17}{32}$	$16\frac{5}{8}$	$4\frac{11}{16}$	“	“	“
4-6″ Z-Bars and 1 Web-plate 7¾″ wide.	$\frac{3}{8}$	$3\frac{1}{2}$	$7\frac{1}{8}$	$6\frac{3}{16}$	$18\frac{7}{8}$	$5\frac{5}{8}$	4	2	4
	$\frac{7}{16}$	$3\frac{9}{16}$	$7\frac{1}{8}$	$6\frac{9}{32}$	19	$5\frac{9}{16}$	“	“	“
	$\frac{1}{2}$	$3\frac{5}{8}$	$7\frac{1}{8}$	$6\frac{3}{8}$	$19\frac{1}{8}$	$5\frac{1}{2}$	“	“	“
	$\frac{9}{16}$	$3\frac{1}{2}$	$6\frac{15}{16}$	$6\frac{9}{32}$	$18\frac{3}{4}$	$5\frac{7}{16}$	“	“	“
	$\frac{5}{8}$	$3\frac{9}{16}$	$6\frac{15}{16}$	$6\frac{3}{8}$	$18\frac{13}{16}$	$5\frac{3}{8}$	“	“	“
	$\frac{11}{16}$	$3\frac{5}{8}$	$6\frac{15}{16}$	$6\frac{15}{32}$	19	$5\frac{5}{16}$	“	“	“
	$\frac{3}{4}$	$3\frac{1}{2}$	$6\frac{3}{4}$	$6\frac{3}{8}$	$18\frac{9}{16}$	$5\frac{1}{4}$	“	“	“
	$\frac{13}{16}$	$3\frac{9}{16}$	$6\frac{3}{4}$	$6\frac{15}{32}$	$18\frac{11}{16}$	$5\frac{3}{16}$	“	“	“
	$\frac{7}{8}$	$3\frac{5}{8}$	$6\frac{3}{4}$	$6\frac{9}{16}$	$18\frac{7}{8}$	$5\frac{1}{8}$	“	“	“

DIMENSIONS FOR Z-BAR COLUMNS WITH COVER PLATES



Section of Column.	Thickness of Web-plate and Z-Bars. t	Cover Plates. Width.	Cover Plates. Thick-ness. t′	b	d	H	c	k	m	A
	Inch.	Inches.	Inch.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
4-6″ Z-Bars and 1 Web-plate 7¾″ wide.	11/16	14	3/8	7	6 27/32	19 9/16	5 5/16	4	2	4
	"	"	7/16	"	6 29/32	19 11/16	"	"	"	"
	"	"	1/2	"	6 31/32	19 3/4	"	"	"	"
	"	"	9/16	"	7 1/32	19 13/16	"	"	"	"
	"	"	5/8	"	7 3/32	19 15/16	"	"	"	"
	"	"	11/16	"	7 5/32	20	"	"	"	"
	"	"	3/4	"	7 7/32	20 1/8	"	"	"	"
	"	"	13/16	"	7 9/32	20 3/16	"	"	"	"
	"	"	7/8	"	7 11/32	20 5/16	"	"	"	"
	3/4	14	3/8	7	6 3/4	19 7/16	5 1/4	4	2	4
	"	"	7/16	"	6 13/16	19 9/16	"	"	"	"
	"	"	1/2	"	6 7/8	19 5/8	"	"	"	"
	"	"	9/16	"	6 15/16	19 11/16	"	"	"	"
	"	"	5/8	"	7	19 13/16	"	"	"	"
	"	"	11/16	"	7 1/16	19 7/8	"	"	"	"
	"	"	3/4	"	7 1/8	20	"	"	"	"
	"	"	13/16	"	7 3/16	20 1/16	"	"	"	"
	"	"	7/8	"	7 1/4	20 1/8	"	"	"	"
	13/16	14	3/8	7	6 27/32	19 9/16	5 3/16	4	2	4
	"	"	7/16	"	6 29/32	19 11/16	"	"	"	"
	"	"	1/2	"	6 31/32	19 3/4	"	"	"	"
	"	"	9/16	"	7 1/32	19 13/16	"	"	"	"
	"	"	5/8	"	7 3/32	19 15/16	"	"	"	"
	"	"	11/16	"	7 5/32	20	"	"	"	"
	"	"	3/4	"	7 7/32	20 1/8	"	"	"	"
	"	"	13/16	"	7 9/32	20 3/16	"	"	"	"
	"	"	7/8	"	7 11/32	20 5/16	"	"	"	"
	7/8	14	3/8	7	6 15/16	19 11/16	5 1/8	4	2	4
	"	"	7/16	"	7	19 13/16	"	"	"	"
	"	"	1/2	"	7 1/16	19 7/8	"	"	"	"
	"	"	9/16	"	7 1/8	20	"	"	"	"
	"	"	5/8	"	7 3/16	20 1/16	"	"	"	"
	"	"	11/16	"	7 1/4	20 1/8	"	"	"	"
	"	"	3/4	"	7 5/16	20 1/4	"	"	"	"
	"	"	13/16	"	7 3/8	20 5/16	"	"	"	"
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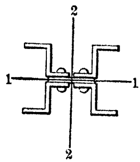
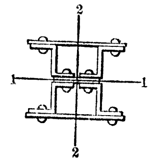
PROPERTIES OF Z-BAR COLUMNS.





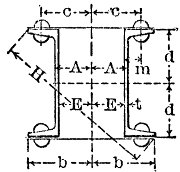
Z-Bar Columns.

Section of Column.	Thickness of Web-plate and Z-Bars.	Axis 1-1.		Axis 2-2.	
		Moment of Inertia.	Section Modulus.	Moment of Inertia.	Section Modulus.
	In.	Ins.^{4}	Ins.^{3}	Ins.^{4}	Ins.^{3}
4-3" Z-Bars and 1 Web-plate 5¾" wide.	¼	32.3	10.3	80.3	14.8
	5/16	42.8	13.3	99.8	18.3
	⅜	48.0	15.1	112.1	21.1
	7/16	59.5	18.1	130.0	24.5
	½	63.6	19.6	138.9	26.8
	9/16	76.1	22.8	155.3	29.9
4-4" Z-Bars and 1 Web-plate 6¾" wide.	¼	68.6	16.6	133.0	21.1
	5/16	89.7	21.3	165.2	26.2
	⅜	112.6	26.1	197.2	31.2
	7/16	118.4	28.1	212.4	34.7
	½	141.7	32.9	241.4	39.4
	9/16	166.9	37.9	270.0	44.1
	⅝	167.2	38.8	276.4	46.5
	11/16	192.9	43.8	302.3	50.9
	¾	220.5	49.0	327.9	55.2
4-5" Z-Bars and 1 Web-plate 7" wide.	5/16	149.4	29.0	197.2	30.1
	⅜	186.0	35.4	235.2	35.8
	7/16	225.2	42.4	272.7	41.5
	½	235.6	44.9	289.7	45.4
	9/16	275.4	51.5	323.8	50.8
	⅝	317.8	58.4	357.6	56.1
	11/16	320.1	59.9	364.9	59.0
	¾	363.0	66.8	395.6	63.9
	13/16	408.7	73.9	425.8	68.8
4-6" Z-Bars and 1 Web-plate 7¾" wide.	⅜	288.0	46.5	318.1	44.6
	7/16	346.8	55.2	368.8	51.8
	½	409.1	64.2	418.9	58.8
	9/16	426.3	67.9	441.7	63.7
	⅝	489.3	76.8	487.7	70.3
	11/16	555.8	85.9	533.2	76.9
	¾	561.7	88.1	544.2	80.6
	13/16	628.9	97.7	585.9	86.8
	⅞	699.7	107.7	627.1	92.9

Z-Bar Columns with Cover Plates.

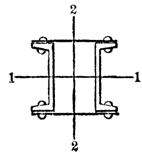
Section of Column.	Thickness of Cover Plates.	Axis 1-1.		Axis 2-2.	
		Moment of Inertia.	Section Modulus.	Moment of Inertia.	Section Modulus.
	In.	Ins.^{4}	Ins.^{3}	Ins.^{4}	Ins.^{3}
4 Z-Bars 6⅛" x 3⅝" x 11/16" and 1 Web-plate 7¾" x 11/16"	⅜	1021.1	149.2	704.7	100.7
	7/16	1103.9	159.8	733.3	104.8
	½	1188.1	170.5	761.8	108.8
	9/16	1273.8	181.2	790.4	112.9
	⅝	1361.1	191.9	819.0	117.0
	11/16	1450.0	202.6	847.6	121.1
	¾	1540.4	213.4	876.2	125.2
	13/16	1632.4	224.2	904.8	129.3
	⅞	1725.9	235.0	933.3	133.3
4 Z-Bars 6" x 3½" x ¾" and 1 Web-plate 7¾" x ¾"	⅜	1014.0	150.2	715.7	102.2
	7/16	1094.5	160.7	744.3	106.3
	½	1176.5	171.1	772.9	110.4
	9/16	1259.9	181.6	801.5	114.5
	⅝	1344.9	192.1	830.1	118.6
	11/16	1431.5	202.7	858.6	122.7
	¾	1519.5	213.3	887.2	126.7
	13/16	1609.1	223.9	915.8	130.8
	⅞	1700.3	234.5	944.4	134.9
4 Z-Bars 6 1/16" x 3 9/16" x 13/16" and 1 Web-plate 7¾" x 13/16"	⅜	1094.2	159.9	757.4	108.2
	7/16	1176.9	170.4	786.0	112.3
	½	1261.2	181.0	814.6	116.4
	9/16	1346.9	191.6	843.2	120.5
	⅝	1434.2	202.2	871.7	124.5
	11/16	1523.0	212.8	900.3	128.6
	¾	1613.4	223.5	928.9	132.7
	13/16	1705.4	234.2	957.5	136.8
	⅞	1799.0	245.0	986.1	140.9
4 Z-Bars 6⅛" x 3⅝" x ⅞" and 1 Web-plate 7¾" x ⅞"	⅜	1178.3	169.8	798.6	114.1
	7/16	1263.3	180.5	827.1	118.2
	½	1349.8	191.1	855.7	122.2
	9/16	1437.8	201.8	884.3	126.3
	⅝	1527.5	212.5	912.9	130.4
	11/16	1618.7	223.3	941.5	134.5
	¾	1711.4	234.0	970.1	138.6
	13/16	1805.8	244.9	998.6	142.7
	⅞	1901.8	255.7	1027.2	146.7

DIMENSIONS FOR LATTICED CHANNEL COLUMNS.



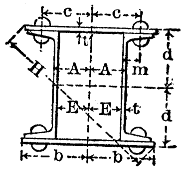
Depth of Channel and Section Number.	Weight per Foot.	t	b	d	H	c	E	A	m
	Pounds.	Inch.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
6″ C17	8.00	.20	3 3/4	3	9 9/16	2 7/8	1 13/16	2	1 1/16
	10.50	.32	"	"	"	"	1 11/16	"	1 3/16
	13.00	.44	"	"	"	"	1 9/16	"	1 5/16
	15.50	.56	"	"	"	"	1 7/16	"	1 7/16
7″ C21	9.75	.21	4 1/4	3 1/2	11	3 3/8	2 3/16	2 3/8	1 3/16
	12.25	.32	"	"	"	"	2 1/16	"	1 5/16
	14.75	.42	"	"	"	"	1 15/16	"	1 7/16
	17.25	.53	"	"	"	"	1 7/8	"	1 1/2
	19.75	.63	"	"	"	"	1 3/4	"	1 5/8
8″ C25	11.25	.23	4 13/16	4	12 1/2	3 3/4	2 1/2	2 3/4	1 1/4
	13.75	.31	"	"	"	"	2 7/16	"	1 5/16
	16.25	.40	"	"	"	"	2 3/8	"	1 3/8
	18.75	.49	"	"	"	"	2 1/4	"	1 1/2
	21.25	.58	"	"	"	"	2 3/16	"	1 9/16
9″ C29	13.25	.23	5 3/16	4 1/2	13 3/4	4 1/8	2 3/4	3	1 3/8
	15.00	.29	"	"	"	"	2 11/16	"	1 7/16
	20.00	.45	"	"	"	"	2 9/16	"	1 9/16
	25.00	.61	"	"	"	"	2 3/8	"	1 3/4
10″ C33	15.00	.24	5 3/4	5	15 1/4	4 5/8	3 1/8	3 3/8	1 1/2
	20.00	.38	"	"	"	"	3	"	1 5/8
	25.00	.53	"	"	"	"	2 7/8	"	1 3/4
	30.00	.68	"	"	"	"	2 11/16	"	1 15/16
	35.00	.82	"	"	"	"	2 9/16	"	2 1/16
12″ C41	20.50	.28	6 13/16	6	18 1/8	5 5/8	3 7/8	4 1/8	1 3/4
	25.00	.39	"	"	"	"	3 3/4	"	1 7/8
	30.00	.51	"	"	"	"	3 5/8	"	2
	35.00	.64	"	"	"	"	3 1/2	"	2 1/8
	40.00	.76	"	"	"	"	3 3/8	"	2 1/4
15″ C53	33.00	.40	8 1/8	7 1/2	22 1/8	6 5/8	4 3/4	5 1/8	1 7/8
	35.00	.43	"	"	"	"	4 11/16	"	1 15/16
	40.00	.52	"	"	"	"	4 5/8	"	2
	45.00	.62	"	"	"	"	4 1/2	"	2 1/8
	50.00	.72	"	"	"	"	4 7/16	"	2 1/4
	55.00	.82	"	"	"	"	4 5/16	"	2 5/16

PROPERTIES OF LATTICED CHANNEL COLUMNS.



Depth of Channel and Section Number.	Weight per Foot.	Axis 1-1.		Axis 2-2.	
		Moment of Inertia.	Section Modulus.	Moment of Inertia.	Section Modulus.
	Pounds.	Inches.^{4}	Inches.^{3}	Inches.^{4}	Inches.^{3}
6″ C17	8.00	26.0	8.7	27.0	7.3
	10.50	30.2	10.1	31.1	8.4
	13.00	34.6	11.5	35.2	9.5
	15.50	39.0	13.0	38.7	10.4
7″ C21	9.75	42.2	12.1	44.0	10.3
	12.25	48.4	13.8	50.5	11.9
	14.75	54.4	15.5	56.4	13.3
	17.25	60.4	17.3	61.4	14.4
	19.75	66.4	19.0	66.5	15.6
8″ C25	11.25	64.6	16.2	67.5	14.0
	13.75	72.0	18.0	75.8	15.8
	16.25	79.8	20.0	84.5	17.6
	18.75	87.7	21.9	92.3	19.3
	21.25	95.6	23.9	99.7	20.8
9″ C29	13.25	94.6	21.0	92.4	17.8
	15.00	101.8	22.6	100.0	19.2
	20.00	121.6	27.0	120.1	23.1
	25.00	141.4	31.4	139.1	26.8
10″ C33	15.00	133.8	26.8	106.2	18.5
	20.00	157.4	31.5	158.5	27.6
	25.00	182.0	36.4	183.3	32.0
	30.00	206.4	41.3	205.4	35.8
	35.00	231.0	46.2	226.0	39.4
12″ C41	20.50	256.2	42.7	256.9	37.9
	25.00	288.0	48.0	295.6	43.6
	30.00	323.2	53.9	335.8	49.5
	35.00	358.6	59.8	370.5	54.6
	40.00	393.8	65.6	405.7	59.8
15″ C53	33.00	625.2	83.4	618.7	76.1
	35.00	639.8	85.3	636.1	78.3
	40.00	695.0	92.7	700.8	86.3
	45.00	750.2	100.0	763.0	93.9
	50.00	805.4	107.4	819.5	100.9
	55.00	860.4	114.7	874.3	107.6

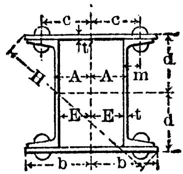
DIMENSIONS FOR PLATE AND CHANNEL COLUMNS.



SERIES A.

Depth of Channel and Section No.	Weight per Foot.	Size of Plates. Width.	Size of Plates. Thickness. t′	t	b	d	H	c	E	A	m
	Pounds.	Inches.	Inch.	Inch.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inch.
6″ C17	8.0	8	1/4	.20	4	3 1/4	10 5/16	2 7/8	1 13/16	2	1 1/16
	"	"	5/8	"	"	3 5/8	10 13/16	"	"	"	"
	10.5	"	1/4	.32	"	3 1/4	10 5/16	"	1 11/16	"	1 3/16
	"	"	5/8	"	"	3 5/8	10 13/16	"	"	"	"
	13.0	"	1/4	.44	"	3 1/4	10 5/16	"	1 9/16	"	1 5/16
	"	"	5/8	"	"	3 5/8	10 13/16	"	"	"	"
	15.5	"	1/4	.56	"	3 1/4	10 5/16	"	1 7/16	"	1 7/16
	"	"	5/8	"	"	3 5/8	10 13/16	"	"	"	"
7″ C21	9.75	9	1/4	.21	4 1/2	3 3/4	11 3/4	3 1/4	2 1/16	2 1/4	1 3/16
	"	"	5/8	"	"	4 1/8	12 3/16	"	"	"	"
	12.25	"	1/4	.32	"	3 3/4	11 3/4	"	1 15/16	"	1 5/16
	"	"	5/8	"	"	4 1/8	12 3/16	"	"	"	"
	14.75	"	1/4	.42	"	3 3/4	11 3/4	"	1 13/16	"	1 7/16
	"	"	5/8	"	"	4 1/8	12 3/16	"	"	"	"
	17.25	"	1/4	.53	"	3 3/4	11 3/4	"	1 3/4	"	1 1/2
	"	"	5/8	"	"	4 1/8	12 3/16	"	"	"	"
	19.75	"	1/4	.63	"	3 3/4	11 3/4	"	1 5/8	"	1 5/8
	"	"	5/8	"	"	4 1/8	12 3/16	"	"	"	"
8″ C25	11.25	10	1/4	.22	5	4 1/4	13 1/8	3 5/8	2 3/8	2 5/8	1 1/4
	"	"	5/8	"	"	4 5/8	13 5/8	"	"	"	"
	13.75	"	1/4	.31	"	4 1/4	13 1/8	"	2 5/16	"	1 5/16
	"	"	5/8	"	"	4 5/8	13 5/8	"	"	"	"
	16.25	"	1/4	.40	"	4 1/4	13 1/8	"	2 1/4	"	1 3/8
	"	"	5/8	"	"	4 5/8	13 5/8	"	"	"	"
	18.75	"	1/4	.49	"	4 1/4	13 1/8	"	2 1/8	"	1 1/2
	"	"	5/8	"	"	4 5/8	13 5/8	"	"	"	"
	21.25	"	1/4	.58	"	4 1/4	13 1/2	"	2 1/16	"	1 9/16
	"	"	5/8	"	"	4 5/8	13 5/8	"	"	"	"
9″ C29	13.25	11	1/4	.23	5 1/2	4 3/4	14 1/2	4 1/8	2 3/4	3	1 3/8
	"	"	5/8	"	"	5 1/8	15 1/16	"	"	"	"
	15.00	"	1/4	.29	"	4 3/4	14 1/2	"	2 11/16	"	1 7/16
	"	"	5/8	"	"	5 1/8	15 1/16	"	"	"	"
	20.00	"	1/4	.45	"	4 3/4	14 1/2	"	2 9/16	"	1 9/16
	"	"	5/8	"	"	5 1/8	15 1/16	"	"	"	"
	25.00	"	1/4	.61	"	4 3/4	14 1/2	"	2 3/8	"	1 3/4
	"	"	5/8	"	"	5 1/8	15 1/16	"	"	"	"

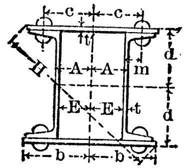
DIMENSIONS FOR PLATE AND CHANNEL COLUMNS.



SERIES A.

Depth of Channel and Section No.	Weight per Foot.	Size of Plates.		t	b	d	H	c	E	A	m
		Width.	Thickness. t′								
	Pounds.	Inches.	Inch.	Inch.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
10″ C33	15.0	12	1/4	.24	6	5 1/4	15 15/16	4 1/2	3	3 1/4	1 1/2
	"	"	5/8	"	"	5 5/8	16 7/16	"	"	"	"
	20.0	"	1/4	.38	"	5 1/4	15 15/16	"	2 7/8	"	1 5/8
	"	"	5/8	"	"	5 5/8	16 7/16	"	"	"	"
	25.0	"	1/4	.53	"	5 1/4	15 15/16	"	2 3/4	"	1 3/4
	"	"	5/8	"	"	5 5/8	16 7/16	"	"	"	"
	30.0	"	1/4	.68	"	5 1/4	15 15/16	"	2 9/16	"	1 15/16
	"	"	5/8	"	"	5 5/8	16 7/16	"	"	"	"
	35.0	"	1/4	.82	"	5 1/4	15 15/16	"	2 7/16	"	2 1/16
	"	"	5/8	"	"	5 5/8	16 7/16	"	"	"	"
12″ C41	20.5	14	1/4	.28	7	6 1/4	18 3/4	5 5/8	3 7/8	4 1/8	1 3/4
	"	"	5/8	"	"	6 5/8	19 5/16	"	"	"	"
	25.0	"	1/4	.39	"	6 1/4	18 3/4	"	3 3/4	"	1 7/8
	"	"	5/8	"	"	6 5/8	19 5/16	"	"	"	"
	30.0	"	1/4	.51	"	6 1/4	18 3/4	"	3 5/8	"	2
	"	"	5/8	"	"	6 5/8	19 5/16	"	"	"	"
	35.0	"	1/4	.64	"	6 1/4	18 3/4	"	3 1/2	"	2 1/8
	"	"	5/8	"	"	6 5/8	19 5/16	"	"	"	"
	40.0	"	1/4	.76	"	6 1/4	18 3/4	"	3 3/8	"	2 1/4
	"	"	5/8	"	"	6 5/8	19 5/16	"	"	"	"
15″ C53	33.0	17	3/8	.40	8 1/2	7 7/8	23 3/16	6 3/4	4 7/8	5 1/4	1 7/8
	"	"	3/4	"	"	8 1/4	23 11/16	"	"	"	"
	35.0	"	3/8	.43	"	7 7/8	23 3/16	"	4 13/16	"	1 15/16
	"	"	3/4	"	"	8 1/4	23 11/16	"	"	"	"
	40.0	"	3/8	.52	"	7 7/8	23 3/16	"	4 3/4	"	2
	"	"	3/4	"	"	8 1/4	23 11/16	"	"	"	"
	45.0	"	3/8	.62	"	7 7/8	23 3/16	"	4 5/8	"	2 1/8
	"	"	3/4	"	"	8 1/4	23 11/16	"	"	"	"
	50.0	"	3/8	.72	"	7 7/8	23 3/16	"	4 9/16	"	2 1/4
	"	"	3/4	"	"	8 1/4	23 11/16	"	"	"	"
	55.0	"	3/8	.82	"	7 7/8	23 3/16	"	4 7/16	"	2 5/16
	"	"	3/4	"	"	8 1/4	23 11/16	"	"	"	"

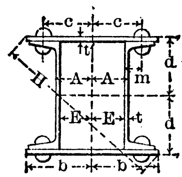
DIMENSIONS FOR PLATE AND CHANNEL COLUMNS.



SERIES B.

Depth of Channel and Section No.	Weight per Foot.	Size of Plates. Width.	Size of Plates. Thickness. t′	t	b	d	H	c	E	A	m
	Pounds.	Inches.	Inch.	Inch.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inch.
6″ C17	8	9	1/4	.20	4 1/2	3 1/4	11 1/8	3 3/8	2 5/16	2 1/2	1 1/16
	"	"	5/8	"	"	3 5/8	11 9/16	"	"	"	"
	10.5	"	1/4	.32	"	3 1/4	11 1/8	"	2 3/16	"	1 3/16
	"	"	5/8	"	"	3 5/8	11 9/16	"	"	"	"
	13.0	"	1/4	.44	"	3 1/4	11 1/8	"	2 1/16	"	1 5/16
	"	"	5/8	"	"	3 5/8	11 9/16	"	"	"	"
	15.5	"	1/4	.56	"	3 1/4	11 1/8	"	1 15/16	"	1 7/16
	"	"	5/8	"	"	3 5/8	11 9/16	"	"	"	"
7″ C21	9.75	11	1/4	.21	5 1/2	3 3/4	13 5/16	4 1/4	3 1/16	3 1/4	1 3/16
	"	"	5/8	"	"	4 1/8	13 3/4	"	"	"	"
	12.25	"	1/4	.32	"	3 3/4	13 5/16	"	2 15/16	"	1 5/16
	"	"	5/8	"	"	4 1/8	13 3/4	"	"	"	"
	14.75	"	1/4	.42	"	3 3/4	13 5/16	"	2 13/16	"	1 7/16
	"	"	5/8	"	"	4 1/8	13 3/4	"	"	"	"
	17.25	"	1/4	.53	"	3 3/4	13 5/16	"	2 3/4	"	1 1/2
	"	"	5/8	"	"	4 1/8	13 3/4	"	"	"	"
	19.75	"	1/4	.63	"	3 3/4	13 5/16	"	2 5/8	"	1 5/8
	"	"	5/8	"	"	4 1/8	13 3/4	"	"	"	"
8″ C25	11.25	12	1/4	.22	6	4 1/4	14 11/16	4 5/8	3 7/16	3 5/8	1 1/4
	"	"	5/8	"	"	4 5/8	15 1/2	"	"	"	"
	13.75	"	1/4	.31	"	4 1/4	14 11/16	"	3 5/16	"	1 5/16
	"	"	5/8	"	"	4 5/8	15 1/2	"	"	"	"
	16.25	"	1/4	.40	"	4 1/4	14 11/16	"	3 1/4	"	1 3/8
	"	"	5/8	"	"	4 5/8	15 1/2	"	"	"	"
	18.75	"	1/4	.49	"	4 1/4	14 11/16	"	3 1/8	"	1 1/2
	"	"	5/8	"	"	4 5/8	15 1/2	"	"	"	"
	21.25	"	1/4	.58	"	4 1/4	14 11/16	"	3 1/16	"	1 9/16
	"	"	5/8	"	"	4 5/8	15 1/2	"	"	"	"
9″ C29	13.25	13	1/4	.23	6 1/2	4 3/4	16 1/8	5 1/8	3 3/4	4	1 3/8
	"	"	5/8	"	"	5 1/8	16 9/16	"	"	"	"
	15.00	"	1/4	.29	"	4 3/4	16 1/8	"	3 11/16	"	1 7/16
	"	"	5/8	"	"	5 1/8	16 9/16	"	"	"	"
	20.00	"	1/4	.45	"	4 3/4	16 1/8	"	3 9/16	"	1 9/16
	"	"	5/8	"	"	5 1/8	16 9/16	"	"	"	"
	25.00	"	1/4	.61	"	4 3/4	16 1/8	"	3 3/8	"	1 3/4
	"	"	5/8	"	"	5 1/8	16 9/16	"	"	"	"

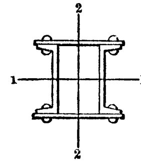
DIMENSIONS FOR PLATE AND CHANNEL COLUMNS.



SERIES B.

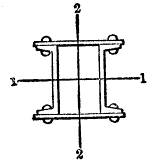
Depth of Channel and Section No.	Weight per Foot.	Size of Plates.		t	b	d	H	c	E	A	m
		Width.	Thickness. t′								
	Pounds.	Inches.	Inch.	Inch.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
10″ C33	15.0	15	¼	.24	7½	5¼	18 5/16	6	4½	4¾	1½
	"	"	⅝	"	"	5⅝	18¾	"	"	"	"
	20.0	"	¼	.38	"	5¼	18 5/16	"	4⅜	"	1⅝
	"	"	⅝	"	"	5⅝	18¾	"	"	"	"
	25.0	"	¼	.53	"	5¼	18 5/16	"	4¼	"	1¾
	"	"	⅝	"	"	5⅝	18¾	"	"	"	"
	30.0	"	¼	.68	"	5¼	18 5/16	"	4 1/16	"	1 15/16
	"	"	⅝	"	"	5⅝	18¾	"	"	"	"
	35.0	"	¼	.82	"	5¼	18 5/16	"	3 15/16	"	2 1/16
	"	"	⅝	"	"	5⅝	18¾	"	"	"	"
12″ C41	20.5	16	¼	.28	8	6¼	20 5/16	6⅝	4⅞	5⅛	1¾
	"	"	⅝	"	"	6⅝	20¾	"	"	"	"
	25.0	"	¼	.39	"	6¼	20 5/16	"	4¾	"	1⅞
	"	"	⅝	"	"	6⅝	20¾	"	"	"	"
	30.0	"	¼	.51	"	6¼	20 5/16	"	4⅝	"	2
	"	"	⅝	"	"	6⅝	20¾	"	"	"	"
	35.0	"	¼	.64	"	6¼	20 5/16	"	4½	"	2⅛
	"	"	⅝	"	"	6⅝	20¾	"	"	"	"
	40.0	"	¼	.76	"	6¼	20 5/16	"	4⅜	"	2¼
	"	"	⅝	"	"	6⅝	20¾	"	"	"	"
15″ C53	33.0	20	⅜	.40	10	7⅞	25 7/16	8¼	6⅜	6¾	1⅞
	"	"	¾	"	"	8¼	25 15/16	"	"	"	"
	35.0	"	⅜	.43	"	7⅞	25 7/16	"	6 5/16	"	1 15/16
	"	"	¾	"	"	8¼	25 15/16	"	"	"	"
	40.0	"	⅜	.52	"	7⅞	22 7/16	"	6¼	"	2
	"	"	¾	"	"	8¼	25 15/16	"	"	"	"
	45.0	"	⅜	.62	"	7⅞	25 7/16	"	6⅛	"	2⅛
	"	"	¾	"	"	8¼	25 15/16	"	"	"	"
	50.0	"	⅜	.72	"	7⅞	25 7/16	"	6 1/16	"	2¼
	"	"	¾	"	"	8¼	25 15/16	"	"	"	"
	55.0	"	⅜	.82	"	7⅞	25 7/16	"	5 15/16	"	2 5/16
	"	"	¾	"	"	8¼	25 15/16	"	"	"	"

MOMENTS OF INERTIA AND SECTION MODULI FOR PLATE AND CHANNEL COLUMNS.



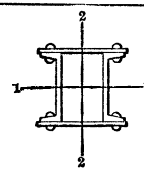
Depth of Channel and Section Number.	Weight per Foot.	SERIES A.						SERIES B.					
		Width of Plate.	Thickness of Plate.	Axis 1-1.		Axis 2-2.		Width of Plate.	Thickness of Plate.	Axis 1-1.		Axis 2-2.	
				Moment of Inertia.	Section Modulus.	Moment of Inertia.	Section Modulus.			Moment of Inertia.	Section Modulus.	Moment of Inertia.	Section Modulus.
	Lbs.	Ins.	In.	$Ins.^4$	$Ins.^3$	$Ins.^4$	$Ins.^3$	Ins.	In.	$Ins.^4$	$Ins.^3$	$Ins.^4$	$Ins.^3$
	8.00	8	$\frac{1}{4}$	65.1	20.0	48.4	12.1	9	$\frac{1}{4}$	70.0	21.5	69.6	15.5
	"	"	$\frac{5}{16}$	75.9	22.9	53.7	13.4	"	$\frac{5}{16}$	82.1	24.8	77.2	17.2
	"	"	$\frac{3}{8}$	87.0	25.8	59.0	14.8	"	$\frac{3}{8}$	94.7	28.1	84.8	18.9
6″ C 17	"	"	$\frac{7}{16}$	98.6	28.7	64.4	16.1	"	$\frac{7}{16}$	107.8	31.4	92.4	20.5
	"	"	$\frac{1}{2}$	110.7	31.6	69.7	17.4	"	$\frac{1}{2}$	121.3	34.6	100.0	22.2
	"	"	$\frac{9}{16}$	123.1	34.6	75.0	18.8	"	$\frac{9}{16}$	135.3	38.0	107.6	23.9
	"	"	$\frac{5}{8}$	136.1	37.5	80.4	20.1	"	$\frac{5}{8}$	149.8	41.3	115.2	25.6
	10.50	8	$\frac{1}{4}$	69.3	21.3	52.5	13.1	9	$\frac{1}{4}$	74.2	22.8	76.5	17.0
	"	"	$\frac{5}{16}$	80.1	24.2	57.8	14.5	"	$\frac{5}{16}$	86.3	26.1	84.1	18.7
	"	"	$\frac{3}{8}$	91.2	27.0	63.1	15.8	"	$\frac{3}{8}$	98.9	29.3	91.7	20.4
6″ C 17	"	"	$\frac{7}{16}$	102.8	29.9	68.5	17.1	"	$\frac{7}{16}$	112.0	32.6	99.3	22.1
	"	"	$\frac{1}{2}$	114.9	32.8	73.8	18.5	"	$\frac{1}{2}$	125.5	35.8	106.9	23.8
	"	"	$\frac{9}{16}$	127.3	35.7	79.1	19.8	"	$\frac{9}{16}$	139.5	39.2	114.5	25.4
	"	"	$\frac{5}{8}$	140.3	38.7	84.5	21.1	"	$\frac{5}{8}$	154.0	42.5	122.1	27.1
	13.00	8	$\frac{1}{4}$	73.7	22.7	56.5	14.1	9	$\frac{1}{4}$	78.6	24.2	83.4	18.5
	"	"	$\frac{5}{16}$	84.5	25.5	61.9	15.5	"	$\frac{5}{16}$	90.7	27.4	91.0	20.2
	"	"	$\frac{3}{8}$	95.6	28.3	67.2	16.8	"	$\frac{3}{8}$	103.3	30.6	98.6	21.9
6″ C 17	"	"	$\frac{7}{16}$	107.2	31.2	72.5	18.1	"	$\frac{7}{16}$	116.4	33.9	106.2	23.6
	"	"	$\frac{1}{2}$	119.3	34.1	77.9	19.5	"	$\frac{1}{2}$	129.9	37.1	113.7	25.3
	"	"	$\frac{9}{16}$	131.7	37.0	83.2	20.8	"	$\frac{9}{16}$	143.9	40.4	121.3	27.0
	"	"	$\frac{5}{8}$	144.7	39.9	88.5	22.1	"	$\frac{5}{8}$	158.4	43.7	128.9	28.7
	15.50	8	$\frac{1}{4}$	78.1	24.0	60.0	15.0	9	$\frac{1}{4}$	83.0	25.5	89.5	19.9
	"	"	$\frac{5}{16}$	88.9	26.8	65.4	16.3	"	$\frac{5}{16}$	95.1	28.7	97.1	21.6
	"	"	$\frac{3}{8}$	100.0	29.6	70.7	17.7	"	$\frac{3}{8}$	107.7	31.9	104.7	23.3
6″ C 17	"	"	$\frac{7}{16}$	111.6	32.5	76.0	19.0	"	$\frac{7}{16}$	120.8	35.1	112.3	25.0
	"	"	$\frac{1}{2}$	123.7	35.3	81.4	20.3	"	$\frac{1}{2}$	134.3	38.4	119.9	26.6
	"	"	$\frac{9}{16}$	136.1	38.2	86.7	21.7	"	$\frac{9}{16}$	148.3	41.6	127.4	28.3
	"	"	$\frac{5}{8}$	149.1	41.1	92.0	23.0	"	$\frac{5}{8}$	162.8	44.9	135.0	30.0

MOMENTS OF INERTIA AND SECTION MODULI FOR PLATE AND CHANNEL COLUMNS.



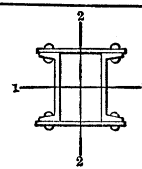
Depth of Channel and Section Number.	Weight per Foot.	SERIES A.						SERIES B.					
		Width of Plate.	Thickness Plate.	Axis 1-1.		Axis 2-2.		Width of Plate.	Thickness Plate.	Axis 1-1.		Axis 2-2.	
				Moment of Inertia.	Section Modulus.	Moment of Inertia.	Section Modulus.			Moment of Inertia.	Section Modulus.	Moment of Inertia.	Section Modulus.
	Lbs.	Ins.	In.	Ins.⁴	Ins.³	Ins.⁴	Ins.³	Ins.	In.	Ins.⁴	Ins.³	Ins.⁴	Ins.³
	9.75	9	1/4	101.4	27.0	70.6	15.7	11	1/4	114.5	30.5	130.9	23.8
	“	“	5/16	117.4	30.8	78.1	17.4	“	5/16	134.2	35.2	144.7	26.3
	“	“	3/8	134.1	34.6	85.8	19.1	“	3/8	154.5	39.9	158.6	28.8
	“	“	7/16	151.3	38.4	93.4	20.8	“	7/16	175.5	44.6	172.5	31.4
7″ C 21	“	“	1/2	169.0	42.2	101.0	22.4	“	1/2	197.1	49.3	186.3	33.9
	“	“	9/16	187.2	46.1	108.5	24.1	“	9/16	219.5	54.0	200.2	36.4
	“	“	5/8	206.2	50.0	116.1	25.8	“	5/8	242.5	58.8	214.1	38.9
	“	“	11/16	225.6	53.9	123.8	27.5	“	11/16	266.3	63.6	227.9	41.4
	“	“	3/4	245.5	57.8	131.3	29.2	“	3/4	290.7	68.4	241.8	44.0
	12.25	9	1/4	107.6	28.7	76.3	17.0	11	1/4	120.7	32.2	144.0	26.2
	“	“	5/16	123.6	32.4	83.9	18.6	“	5/16	140.4	36.8	157.9	28.7
	“	“	3/8	140.3	36.2	91.5	20.3	“	3/8	160.7	41.5	171.8	31.2
	“	“	7/16	157.5	40.0	99.1	22.0	“	7/16	181.7	46.1	185.6	33.8
7″ C 21	“	“	1/2	175.2	43.8	106.7	23.7	“	1/2	203.3	50.8	199.5	36.3
	“	“	9/16	193.4	47.6	114.3	25.4	“	9/16	225.7	55.6	213.4	38.8
	“	“	5/8	212.4	51.5	121.9	27.1	“	5/8	248.7	60.3	227.2	41.3
	“	“	11/16	231.8	55.4	129.5	28.8	“	11/16	272.5	65.1	241.1	43.8
	“	“	3/4	251.7	59.2	137.1	30.5	“	3/4	296.9	69.9	255.0	46.4
	14.75	9	1/4	113.6	30.3	81.5	18.1	11	1/4	126.7	33.8	156.3	28.4
	“	“	5/16	129.6	34.0	89.1	19.8	“	5/16	146.4	38.4	170.1	30.9
	“	“	3/8	146.3	37.7	96.7	21.5	“	3/8	166.7	43.0	184.0	33.5
	“	“	7/16	163.5	41.5	104.3	23.2	“	7/16	187.7	47.7	197.8	36.0
7″ C 21	“	“	1/2	181.2	45.3	111.9	24.9	“	1/2	209.3	52.3	211.7	38.5
	“	“	9/16	199.4	49.1	119.5	26.5	“	9/16	231.7	57.0	225.6	41.0
	“	“	5/8	218.4	53.0	127.1	28.2	“	5/8	254.7	61.8	239.4	43.5
	“	“	11/16	237.8	56.8	134.7	29.9	“	11/16	278.5	66.5	253.3	46.1
	“	“	3/4	257.7	60.6	142.3	31.6	“	3/4	302.9	71.3	267.2	48.6
	17.25	9	1/4	119.6	31.9	85.9	19.1	11	1/4	132.7	35.4	167.1	30.4
	“	“	5/16	135.6	35.6	93.4	20.8	“	5/16	152.4	40.0	181.0	32.9
	“	“	3/8	152.3	39.3	101.1	22.5	“	3/8	172.7	44.6	194.9	35.4
	“	“	7/16	169.5	43.1	108.7	24.2	“	7/16	193.7	49.2	208.7	38.0
7″ C 21	“	“	1/2	187.2	46.8	116.2	25.8	“	1/2	215.3	53.8	222.6	40.5
	“	“	9/16	205.4	50.6	123.8	27.5	“	9/16	237.7	58.5	236.5	43.0
	“	“	5/8	224.4	54.4	131.4	29.2	“	5/8	260.7	63.2	250.3	45.5
	“	“	11/16	243.8	58.2	139.1	30.9	“	11/16	284.5	67.9	264.2	48.0
	“	“	3/4	263.7	62.1	146.6	32.6	“	3/4	308.9	72.7	278.1	50.6
	19.75	9	1/4	125.6	33.5	90.3	20.1	11	1/4	138.7	37.0	178.2	32.4
	“	“	5/16	141.6	37.1	97.9	21.8	“	5/16	158.4	41.5	192.0	34.9
	“	“	3/8	158.3	40.8	105.5	23.4	“	3/8	178.7	46.1	205.9	37.4
	“	“	7/16	175.5	44.6	113.1	25.1	“	7/16	199.7	50.7	219.7	40.0
7″ C 21	“	“	1/2	193.2	48.3	120.7	26.8	“	1/2	221.3	55.3	233.6	42.5
	“	“	9/16	211.4	52.0	128.3	28.5	“	9/16	243.7	60.0	247.5	45.0
	“	“	5/8	230.4	55.9	135.9	30.2	“	5/8	266.7	64.7	261.3	47.5
	“	“	11/16	249.8	59.7	143.5	31.9	“	11/16	290.5	69.4	275.2	50.0
	“	“	3/4	269.7	63.5	151.1	33.6	“	3/4	314.9	74.1	289.1	52.6

MOMENTS OF INERTIA AND SECTION MODULI FOR PLATE AND CHANNEL COLUMNS.



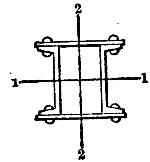
Depth of Channel and Section Number.	Weight per Foot.	SERIES A. Width of Plate.	Thickness Plate.	Axis 1-1. Moment of Inertia.	Axis 1-1. Section Modulus.	Axis 2-2. Moment of Inertia.	Axis 2-2. Section Modulus.	SERIES B. Width of Plate.	Thickness Plate.	Axis 1-1. Moment of Inertia.	Axis 1-1. Section Modulus.	Axis 2-2. Moment of Inertia.	Axis 2-2. Section Modulus.
	Lbs.	Ins.	In.	Ins.^{4}	Ins.^{3}	Ins.^{4}	Ins.^{3}	Ins.	In.	Ins.^{4}	Ins.^{3}	Ins.^{4}	Ins.^{3}
	11.25	10	$\frac{1}{4}$	149.7	35 2	104.0	20.8	12	$\frac{1}{4}$	166.7	39.2	181.1	30.2
	“	“	$\frac{5}{16}$	172.6	40.0	114.4	22.9	“	$\frac{5}{16}$	194.2	45.0	199.1	33.2
	“	“	$\frac{3}{8}$	196.2	44.9	124.9	25.0	“	$\frac{3}{8}$	222.5	50.9	217.1	36.2
	“	“	$\frac{7}{16}$	220.5	49.7	135.3	27.1	“	$\frac{7}{16}$	251.7	56.7	235.1	39.2
8″ C 25	“	“	$\frac{1}{2}$	245.4	54.5	145.7	29.1	“	$\frac{1}{2}$	281.6	62.6	253.1	42.2
	“	“	$\frac{9}{16}$	271.1	59.4	156.1	31.2	“	$\frac{9}{16}$	312.4	68.5	271.1	45.2
	“	“	$\frac{5}{8}$	297.5	64.3	166.5	33.3	“	$\frac{5}{8}$	344.1	74.4	289.1	48.2
	“	“	$\frac{11}{16}$	324.6	69.2	176.9	35.4	“	$\frac{11}{16}$	376 6	80.3	307.1	51.2
	“	“	$\frac{3}{4}$	352.4	74.2	187.4	37.5	“	$\frac{3}{4}$	410.0	86.3	325.1	54.2
	13.75	10	$\frac{1}{4}$	157.1	37.0	111.6	22.3	12	$\frac{1}{4}$	174.1	41.0	196.4	32.7
	“	“	$\frac{5}{16}$	180.0	41.7	122.0	24.4	“	$\frac{5}{16}$	201.6	46.8	214.4	35.7
	“	“	$\frac{3}{8}$	203.6	46.5	132.4	26.5	“	$\frac{3}{8}$	229.9	52.6	232.4	38.7
	“	“	$\frac{7}{16}$	227.9	51.4	142.8	28.6	“	$\frac{7}{16}$	259.1	58.4	250.4	41.7
8″ C 25	“	“	$\frac{1}{2}$	252.8	56.2	153.2	30.6	“	$\frac{1}{2}$	289.0	64.2	268.4	44.7
	“	“	$\frac{9}{16}$	278.5	61.0	163.6	32.7	“	$\frac{9}{16}$	319.8	70.1	286.4	47.7
	“	“	$\frac{5}{8}$	304.9	65.9	174.1	34.8	“	$\frac{5}{8}$	351.5	76.0	304.4	50.7
	“	“	$\frac{11}{16}$	332.0	70.8	184.5	36.9	“	$\frac{11}{16}$	384.0	81.9	322.4	53.7
	“	“	$\frac{3}{4}$	359.8	75.8	194.9	39.0	“	$\frac{3}{4}$	417.4	87.9	340.4	56.7
	16 25	10	$\frac{1}{4}$	164.9	38.8	119.4	23.9	12	$\frac{1}{4}$	181.9	42.8	212.5	35.4
	“	“	$\frac{5}{16}$	187.8	43.6	129.8	26.0	“	$\frac{5}{16}$	209.4	48.6	230.5	38.4
	“	“	$\frac{3}{8}$	211.4	48.3	140.2	28.0	“	$\frac{3}{8}$	237.7	54.3	248.5	41.4
	“	“	$\frac{7}{16}$	235.7	53.1	150.6	30.1	“	$\frac{7}{16}$	266.9	60.1	266.5	44.4
8″ C 25	“	“	$\frac{1}{2}$	260.6	57.9	161.0	32.2	“	$\frac{1}{2}$	296.8	66.0	284.5	47.4
	“	“	$\frac{9}{16}$	286.3	62.8	171.5	34.3	“	$\frac{9}{16}$	327.6	71.8	302.5	50.4
	“	“	$\frac{5}{8}$	312.7	67.6	181.9	36.4	“	$\frac{5}{8}$	359.3	77.7	320.5	53.4
	“	“	$\frac{11}{16}$	339.8	72.5	192.3	38.5	“	$\frac{11}{16}$	391.8	83.6	338.5	56.4
	“	“	$\frac{3}{4}$	367.6	77.4	202.7	40.5	“	$\frac{3}{4}$	425.2	89.5	356.5	59.4
	18.75	10	$\frac{1}{4}$	172.7	40.6	126.3	25.3	12	$\frac{1}{4}$	189.7	44.6	227.3	37.9
	“	“	$\frac{5}{16}$	195.6	45.4	136.7	27.4	“	$\frac{5}{16}$	217.2	50.4	245.3	40.9
	“	“	$\frac{3}{8}$	219.2	50.1	147.2	29.4	“	$\frac{3}{8}$	245.5	56.1	263.3	43.9
	“	“	$\frac{7}{16}$	243.5	54 9	157.6	31.5	“	$\frac{7}{16}$	274.7	61.9	281.3	46.9
8″ C 25	“	“	$\frac{1}{2}$	268.4	59.7	168.0	33.6	“	$\frac{1}{2}$	304.6	67.7	299.3	49.9
	“	“	$\frac{9}{16}$	294.1	64.5	178.4	35.7	“	$\frac{9}{16}$	335.4	73.5	317.3	52.9
	“	“	$\frac{5}{8}$	320.5	69.3	188.8	37.8	“	$\frac{5}{8}$	367.1	79.4	335.3	55.9
	“	“	$\frac{11}{16}$	347.6	74.2	199.2	39.9	“	$\frac{11}{16}$	399.6	85.2	353.3	58.9
	“	“	$\frac{3}{4}$	375.4	79.0	209.7	41.9	“	$\frac{3}{4}$	433.0	91.2	371.3	61.9
	21.25	10	$\frac{1}{4}$	180.7	42.5	133.0	26.6	12	$\frac{1}{4}$	197.7	46.5	241 7	40.3
	“	“	$\frac{5}{16}$	203.6	47.2	143.4	28.7	“	$\frac{5}{16}$	225.2	52.2	259.7	43.3
	“	“	$\frac{3}{8}$	227.2	51.9	153.8	30.8	“	$\frac{3}{8}$	253.5	58.0	277.7	46.3
	“	“	$\frac{7}{16}$	251.5	56.7	164.2	32.8	“	$\frac{7}{16}$	282.7	63.7	295.7	49.3
8″ C 25	“	“	$\frac{1}{2}$	276.4	61.4	174.6	34.9	“	$\frac{1}{2}$	312.6	69.5	313.7	52.3
	“	“	$\frac{9}{16}$	302.1	66.2	185.0	37.0	“	$\frac{9}{16}$	343.4	75.3	331.7	55.3
	“	“	$\frac{5}{8}$	328.5	71.0	195.5	39.1	“	$\frac{5}{8}$	375.1	81.1	349.7	58.3
	“	“	$\frac{11}{16}$	355.6	75.9	205.9	41.2	“	$\frac{11}{16}$	407.6	87.0	367.7	61.3
	“	“	$\frac{3}{4}$	383.4	80.7	216.3	43.3	“	$\frac{3}{4}$	441.0	92.8	385.7	64.3

MOMENTS OF INERTIA AND SECTION MODULI FOR PLATE AND CHANNEL COLUMNS.



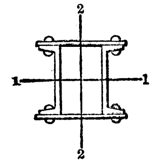
Depth of Channel and Section Number.	Weight per Foot.	SERIES A. Width of Plate.	Thickness of Plate.	Axis 1-1. Moment of Inertia.	Axis 1-1. Section Modulus.	Axis 2-2. Moment of Inertia.	Axis 2-2. Section Modulus.	SERIES B. Width of Plate.	Thickness of Plate.	Axis 1-1. Moment of Inertia.	Axis 1-1. Section Modulus.	Axis 2-2. Moment of Inertia.	Axis 2-2. Section Modulus.
	Lbs.	Ins.	In.	Ins.⁴	Ins.³	Ins.⁴	Ins.³	Ins.	In.	Ins.⁴	Ins.³	Ins.⁴	Ins.³
	13.25	11	1/4	212.3	44.7	147.9	26.9	13	1/4	233.7	49.2	244.3	37.6
	"	"	5/16	243.8	50.7	161.8	29.4	"	5/16	270.8	56.3	267.2	41.1
	"	"	3/8	276.0	56.6	175.6	31.9	"	3/8	308.9	63.4	290.1	44.6
9″	"	"	7/16	309.0	62.6	189.4	34.4	"	7/16	348.1	70.5	313.0	48.2
C 29	"	"	1/2	343.0	68.6	203.3	37.0	"	1/2	388.2	77.6	335.9	51.7
	"	"	9/16	377.9	74.7	217.3	39.5	"	9/16	429.3	84.8	358.8	55.2
	"	"	5/8	413.5	80.7	231.1	42.0	"	5/8	471.5	92.0	381.6	58.7
	"	"	11/16	449.9	86.7	244.9	44.5	"	11/16	514.7	99.2	404.5	62.2
	"	"	3/4	487.5	92.9	258.8	47.1	"	3/4	558.9	106.5	427.4	65.8
	15.00	11	1/4	219.5	46.2	155.4	28.3	13	1/4	240.9	50.7	258.5	39.8
	"	"	5/16	251.0	52.2	169.3	30.8	"	5/16	278.0	57.8	281.4	43.3
	"	"	3/8	283.2	58.1	183.1	33.3	"	3/8	316.1	64.9	304.3	46.8
9″	"	"	7/16	316.2	64.0	197.0	35.8	"	7/16	355.3	72.0	327.2	50.3
C 29	"	"	1/2	350.2	70.0	210.9	38.3	"	1/2	395.4	79.1	350.1	53.9
	"	"	9/16	385.1	76.1	224.8	40.9	"	9/16	436.5	86.2	373.0	57.4
	"	"	5/8	420.7	82.1	238.6	43.4	"	5/8	478.7	93.4	395.8	60.9
	"	"	11/16	457.1	88.1	252.4	45.9	"	11/16	521.9	100.6	418.7	64.4
	"	"	3/4	494.7	94.2	266.3	48.4	"	3/4	566.1	107.8	441.6	67.9
	20.00	11	1/4	239.3	50.4	175.6	31.9	13	1/4	260.7	54.9	297.0	45.7
	"	"	5/16	270.8	56.3	189.5	34.5	"	5/16	297.8	61.9	319.9	49.2
	"	"	3/8	303.0	62.2	203.3	37.0	"	3/8	335.9	68.9	342.8	52.7
9″	"	"	7/16	336.0	68.0	217.1	39.5	"	7/16	375.1	76.0	365.7	56 3
C 29	"	"	1/2	370.0	74.0	231.0	42.0	"	1/2	415.2	83.0	388.6	59.8
	"	"	9/16	404.9	80.0	244.9	44.5	"	9/16	456.3	90.1	411.5	63.3
	"	"	5/8	440.5	86.0	258.8	47.1	"	5/8	498.5	97.3	434.3	66.8
	"	"	11/16	476.9	91.9	272.6	49.6	"	11/16	541.7	104.4	457.2	70.3
	"	"	3/4	514.5	98.0	286.5	52.1	"	3/4	585.9	111.6	480.1	73.9
	25.00	11	1/4	259.1	54.5	194.6	35.4	13	1/4	280.5	59.1	333.9	51.4
	"	"	5/16	290.6	60.4	208.5	37.9	"	5/16	317.6	66.0	356.8	54.9
	"	"	3/8	322.8	66.2	222.3	40.4	"	3/8	355.7	73.0	379.7	58.4
9″	"	"	7/16	355.8	72.1	236.1	42.9	"	7/16	394.9	80.0	402.5	61.9
C 29	"	"	1/2	389.8	78.0	250.1	45.5	"	1/2	435.0	87.0	425.4	65.5
	"	"	9/16	424.7	83.9	264.0	48.0	"	9/16	476.1	94.1	448.3	69.0
	"	"	5/8	460.3	89.8	277.8	50.5	"	5/8	518.3	101.1	471.2	72.5
	"	"	11/16	496.7	95.8	291.6	53.0	"	11/16	561.5	108.2	494.1	76.0
	"	"	3/4	534.3	101.8	305.5	55.6	"	3/4	605.7	115.4	517.0	79.5

MOMENTS OF INERTIA AND SECTION MODULI FOR PLATE AND CHANNEL COLUMNS.



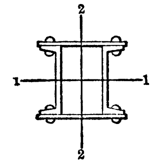
Depth of Channel and Section Number.	Weight per Foot.	SERIES A. Width of Plate.	Thickness Plate.	Axis 1-1. Moment of Inertia.	Axis 1-1. Section Modulus.	Axis 2-2. Moment of Inertia.	Axis 2-2. Section Modulus.	SERIES B. Width of Plate.	Thickness Plate.	Axis 1-1. Moment of Inertia.	Axis 1-1. Section Modulus.	Axis 2-2. Moment of Inertia.	Axis 2-2. Section Modulus.
	Lbs.	Ins.	In.	$Ins.^4$	$Ins.^3$	$Ins.^4$	$Ins.^3$	Ins.	In.	$Ins.^4$	$Ins.^3$	$Ins.^4$	$Ins.^3$
	15.0	12	1/4	291.4	55.5	195.4	32.6	15	1/4	330.8	63.0	381.8	50.9
	"	"	5/16	333.3	62.7	213.4	35.6	"	5/16	383.3	72.1	417.0	55.6
	"	"	3/8	376.1	70.0	231.4	38.6	"	3/8	436.7	81.2	452.1	60.3
	"	"	7/16	419.9	77.2	249.4	41.6	"	7/16	491.6	90.4	487.3	65.0
10″ C 33	"	"	1/2	464.8	84.5	267.4	44.6	"	1/2	547.6	99.6	522.4	69.7
	"	"	9/16	510.7	91.8	285.4	47.6	"	9/16	605.1	108.8	557.6	74.3
	"	"	5/8	557.6	99.1	303.4	50.6	"	5/8	663.6	118.0	592.7	79.0
	"	"	11/16	605.6	106.5	321.4	53.6	"	11/16	723.7	127.3	627.9	83.7
	"	"	3/4	654.7	113.9	339.4	56.6	"	3/4	784.9	136.5	663.1	88.4
	20.0	12	1/4	315.0	60.0	220.1	36.7	15	1/4	354.4	67.5	438.0	58.4
	"	"	5/16	356.9	67.2	238.1	39.7	"	5/16	406.9	76.6	473.1	63.1
	"	"	3/8	399.7	74.4	256.1	42.7	"	3/8	460.3	85.6	508.3	67.8
	"	"	7/16	443.5	81.6	274.1	45.7	"	7/16	515.2	94.8	543.4	72.5
10″ C 33	"	"	1/2	488.4	88.8	292.1	48.7	"	1/2	571.2	103.9	578.6	77.2
	"	"	9/16	534.3	96.1	310.1	51.7	"	9/16	628.7	113.0	613.8	81.8
	"	"	5/8	581.2	103.3	328.1	54.7	"	5/8	687.2	122.2	648.9	86.5
	"	"	11/16	629.2	110.6	346.1	57.7	"	11/16	747.3	131.4	684.1	91.2
	"	"	3/4	678.3	118.0	364.1	60.7	"	3/4	808.5	140.6	719.2	95.9
	25.0	12	1/4	339.6	64.7	242.8	40.5	15	1/4	379.0	72.2	491.8	65.6
	"	"	5/16	381.5	71.8	260.8	43.5	"	5/16	431.5	81.2	526.9	70.3
	"	"	3/8	424.3	78.9	278.8	46.5	"	3/8	484.9	90.2	562.1	75.0
	"	"	7/16	468.1	86.1	296.8	49.5	"	7/16	539.8	99.3	597.3	79.6
10″ C 33	"	"	1/2	513.0	93.3	314.8	52.5	"	1/2	595.8	108.3	632.4	84.3
	"	"	9/16	558.9	100.5	332.8	55.5	"	9/16	653.3	117.4	667.6	89.0
	"	"	5/8	605.8	107.7	350.8	58.5	"	5/8	711.8	126.5	702.7	93.7
	"	"	11/16	653.8	115.0	368.8	61.5	"	11/16	771.9	135.7	737.9	98.4
	"	"	3/4	702.9	122.2	386.8	64.5	"	3/4	833.1	144.9	773.0	103.1
	30.0	12	1/4	364.0	69.3	262.9	43.8	15	1/4	403.4	76.8	541.6	72.2
	"	"	5/16	405.9	76.4	280.9	46.8	"	5/16	455.9	85.8	576.8	76.9
	"	"	3/8	448.7	83.5	298.9	49.8	"	3/8	509.3	94.8	611.9	81.6
	"	"	7/16	492.5	90.6	316.9	52.8	"	7/16	564.2	103.8	647.1	86.3
10″ C 33	"	"	1/2	537.4	97.7	334.9	55.8	"	1/2	620.2	112.8	682.2	91.0
	"	"	9/16	583.3	104.9	352.9	58.8	"	9/16	677.7	121.8	717.4	95.7
	"	"	5/8	630.2	112.0	370.9	61.8	"	5/8	736.2	130.9	752.5	100.3
	"	"	11/16	678.2	119.3	388.9	64.8	"	11/16	796.3	140.0	787.7	105.0
	"	"	3/4	727.3	126.5	406.9	67.8	"	3/4	857.5	149.1	822.9	109.7
	35.0	12	1/4	388.6	74.0	281.7	46.9	15	1/4	428.0	81.5	589.2	78.6
	"	"	5/16	430.5	81.0	299.7	49.9	"	5/16	480.5	90.4	624.4	83.3
	"	"	3/8	473.3	88.1	317.7	52.9	"	3/8	533.9	99.3	659.5	87.9
	"	"	7/16	517.1	95.1	335.7	55.9	"	7/16	588.8	108.3	694.7	92.6
10″ C 33	"	"	1/2	562.0	102.2	353.7	58.9	"	1/2	644.8	117.2	729.8	97.3
	"	"	9/16	607.9	109.3	371.7	61.9	"	9/16	702.3	126.3	765.0	102.0
	"	"	5/8	654.8	116.4	389.7	64.9	"	5/8	760.8	135.3	800.2	106.7
	"	"	11/16	702.8	123.6	407.7	67.9	"	11/16	820.9	144.3	835.3	111.4
	"	"	3/4	751.9	130.8	425.7	70.9	"	3/4	882.1	153.4	870.5	116.1

MOMENTS OF INERTIA AND SECTION MODULI FOR PLATE AND CHANNEL COLUMNS.



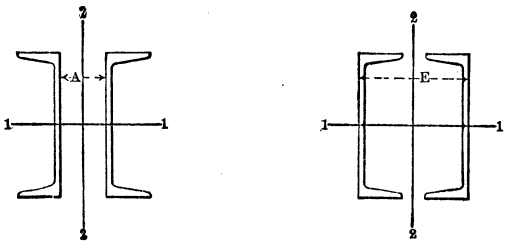
Depth of Channel and Section Number.	Weight per Foot.	SERIES A. Width of Plate.	SERIES A. Thickness Plate.	SERIES A. Axis 1-1. Moment of Inertia.	SERIES A. Axis 1-1. Section Modulus.	SERIES A. Axis 2-2. Moment of Inertia.	SERIES A. Axis 2-2. Section Modulus.	SERIES B. Width of Plate.	SERIES B. Thickness Plate.	SERIES B. Axis 1-1. Moment of Inertia.	SERIES B. Axis 1-1. Section Modulus.	SERIES B. Axis 2-2. Moment of Inertia.	SERIES B. Axis 2-2. Section Modulus.
	Lbs.	Ins.	In.	$Ins.^4$	$Ins.^3$	$Ins.^4$	$Ins.^3$	Ins.	In.	$Ins.^4$	$Ins.^3$	$Ins.^4$	$Ins.^3$
	20.5	14	1/4	518.9	83.0	371.3	53.0	16	1/4	556.4	89.0	549.3	68.7
	"	"	5/16	587.9	93.1	399.9	57.1	"	5/16	635.3	100.6	592.0	74.0
	"	"	3/8	658.3	103.3	428.4	61.2	"	3/8	715.8	112.3	634.6	79.3
	"	"	7/16	730.1	113.4	457.0	65.3	"	7/16	797.8	123.9	677.3	84.7
12″ C 41	"	"	1/2	803.4	123.6	485.6	69.4	"	1/2	881.5	135.6	720.0	90.0
	"	"	9/16	878.0	133.8	514.2	73.5	"	9/16	966.9	147.3	762.6	95.3
	"	"	5/8	954.1	144.0	542.8	77.5	"	5/8	1053.8	159.1	805.3	100.7
	"	"	11/16	1031.6	154.3	571.4	81.6	"	11/16	1142.4	170.8	848.0	106.0
	"	"	3/4	1110.6	164.5	599.9	85.7	"	3/4	1232.7	182.6	890.6	111.3
	25.0	14	1/4	550.7	88.1	409.9	58.6	16	1/4	588.2	94.1	610.8	76.4
	"	"	5/16	619.7	98.2	438.5	62.7	"	5/16	667.1	105.7	653.4	81.7
	"	"	3/8	690.1	108.3	467.1	66.7	"	3/8	747.6	117.3	696.1	87.0
	"	"	7/16	761.9	118.4	495.7	70.8	"	7/16	829.6	128.9	738.8	92.4
12″ C 41	"	"	1/2	835.2	128.5	524.3	74.9	"	1/2	913.3	140.5	781.4	97.7
	"	"	9/16	909.8	138.6	552.9	79.0	"	9/16	998.7	152.2	824.1	103.0
	"	"	5/8	985.9	148.8	581.4	83.1	"	5/8	1085.6	163.9	866.8	108.4
	"	"	11/16	1063.4	159.0	610.0	87.2	"	11/16	1174.2	175.6	909.4	113.7
	"	"	3/4	1142.4	169.3	638.6	91.2	"	3/4	1264.5	187.3	952.1	119.0
	30.0	14	1/4	585.9	93.7	450.2	64.3	16	1/4	623.4	99.7	675.7	84.5
	"	"	5/16	654.9	103.7	478.8	68.4	"	5/16	702.3	111.3	718.3	89.8
	"	"	3/8	725.3	113.8	507.3	72.5	"	3/8	782.8	122.8	761.0	95.1
	"	"	7/16	797.1	123.8	535.9	76.6	"	7/16	864.8	134.3	803.7	100.5
12″ C 41	"	"	1/2	870.4	133.9	564.5	80.6	"	1/2	948.5	145.9	846.3	105.8
	"	"	9/16	945.0	144.0	593.1	84.7	"	9/16	1033.9	157.5	889.0	111.1
	"	"	5/8	1021.1	154.1	621.7	88.8	"	5/8	1120.8	169.2	931.6	116.5
	"	"	11/16	1098.6	164.3	650.3	92.9	"	11/16	1209.4	180.9	974.3	121.8
	"	"	3/4	1177.6	174.5	678.8	97.0	"	3/4	1299.7	192.6	1017.0	127.1
	35.0	14	1/4	621.3	99.4	484.9	69.3	16	1/4	658.8	105.4	733.6	91.7
	"	"	5/16	690.3	109.4	513.4	73.4	"	5/16	737.7	116.9	776.3	97.0
	"	"	3/8	760.7	119.3	542.0	77.4	"	3/8	818.2	128.3	818.9	102.4
	"	"	7/16	832.5	129.3	570.6	81.5	"	7/16	900.2	139.8	861.6	107.7
12″ C 41	"	"	1/2	905.8	139.4	599.2	85.6	"	1/2	983.9	151.4	904.3	113.0
	"	"	9/16	980.4	149.4	627.8	89.7	"	9/16	1069.3	162.9	946.9	118.4
	"	"	5/8	1056.5	159.5	656.4	93.8	"	5/8	1156.2	174.5	989.6	123.7
	"	"	11/16	1134.0	169.6	684.9	97.9	"	11/16	1244.8	186.1	1032.3	129.0
	"	"	3/4	1213.0	179.7	713.5	101.9	"	3/4	1335.1	197.8	1074.9	134.4
	40.0	14	1/4	656.5	105.0	520.1	74.3	16	1/4	694.0	111.0	792.1	99.0
	"	"	5/16	725.5	114.9	548.7	78.4	"	5/16	772.9	122.4	834.8	104.3
	"	"	3/8	795.9	124.9	577.2	82.5	"	3/8	853.4	133.9	877.4	109.7
	"	"	7/16	867.7	134.8	605.8	86.6	"	7/16	935.4	145.3	920.1	115.0
12″ C 41	"	"	1/2	941.0	144.8	634.4	90.6	"	1/2	1019.1	156.8	962.8	120.3
	"	"	9/16	1015.6	154.8	663.0	94.7	"	9/16	1104.5	168.3	1005.4	125.7
	"	"	5/8	1091.7	164.8	691.6	98.8	"	5/8	1191.4	179.8	1048.1	131.0
	"	"	11/16	1169.2	174.8	720.2	102.9	"	11/16	1280.0	191.4	1090.8	136.3
	"	"	3/4	1248.2	184.9	748.7	107.0	"	3/4	1370.3	203.0	1133.4	141.7

MOMENTS OF INERTIA AND SECTION MODULI FOR PLATE AND CHANNEL COLUMNS.



Depth of Channel and Section Number.	Weight per Foot.	Series A. Width of Plate.	Series A. Thickness of Plate.	Series A. Axis 1-1. Moment of Inertia.	Series A. Axis 1-1. Section Modulus.	Series A. Axis 2-2. Moment of Inertia.	Series A. Axis 2-2. Section Modulus.	Series B. Width of Plate.	Series B. Thickness of Plate.	Series B. Axis 1-1. Moment of Inertia.	Series B. Axis 1-1. Section Modulus.	Series B. Axis 2-2. Moment of Inertia.	Series B. Axis 2-2. Section Modulus.
	Lbs.	Ins.	In.	Ins.^{4}	Ins.^{3}	Ins.^{4}	Ins.^{3}	Ins.	In.	Ins.^{4}	Ins.^{3}	Ins.^{4}	Ins.^{3}
	33.0	17	3/8	1378.9	175.1	953.4	112.2	20	3/8	1511.8	192.0	1525.9	152.6
	"	"	7/16	1512.0	190.5	1004.7	118.2	"	7/16	1668.1	210.2	1609.2	160.9
15″ C 53	"	"	1/2	1646.6	205.8	1055.7	124.2	"	1/2	1826.9	228.4	1692.5	169.3
	"	"	9/16	1783.4	221.2	1106.8	130.2	"	9/16	1988.1	246.6	1775.9	177.6
	"	"	5/8	1922.9	236.7	1158.1	136.2	"	5/8	2151.9	264.9	1859.2	185.9
	"	"	11/16	2064.6	252.2	1209.4	142.3	"	11/16	2318.2	283.1	1942.5	194.3
	"	"	3/4	2207.8	267.6	1260.4	148.3	"	3/4	2487.1	301.5	2025.9	202.6
	35.0	17	3/8	1393.5	177.0	971.7	114.3	20	3/8	1526.4	193.8	1557.3	155.7
	"	"	7/16	1526.6	192.3	1023.0	120.4	"	7/16	1682.7	212.0	1640.7	164.1
15″ C 53	"	"	1/2	1661.2	207.7	1074.1	126.4	"	1/2	1841.5	230.2	1724.0	172.4
	"	"	9/16	1798.0	223.0	1125.1	132.4	"	9/16	2002.7	248.4	1807.3	180.7
	"	"	5/8	1937.5	238.5	1176.4	138.4	"	5/8	2166.5	266.6	1890.7	189.1
	"	"	11/16	2079.2	254.0	1227.7	144.4	"	11/16	2332.8	284.9	1974.0	197.4
	"	"	3/4	2222.4	269.4	1278.8	150.4	"	3/4	2501.7	303.2	2057.3	205.7
	40.0	17	3/8	1448.7	184.0	1039.9	122.3	20	3/8	1581.6	200.8	1674.6	167.5
	"	"	7/16	1581.8	199.3	1091.2	128.4	"	7/16	1737.9	219.0	1757.9	175.8
15″ C 53	"	"	1/2	1716.4	214.6	1142.3	134.4	"	1/2	1896.7	237.1	1841.2	184.1
	"	"	9/16	1853.2	229.9	1193.3	140.4	"	9/16	2057.9	255.3	1924.6	192.5
	"	"	5/8	1992.7	245.3	1244.6	146.4	"	5/8	2221.7	273.4	2007.9	200.8
	"	"	11/16	2134.4	260.7	1295.9	152.5	"	11/16	2388.0	291.7	2091.2	209.1
	"	"	3/4	2277.6	276.1	1347.0	158.5	"	3/4	2556.9	309.9	2174.6	217.5
	45.0	17	3/8	1503.9	191.0	1105.4	130.1	20	3/8	1636.8	207.9	1788.6	178.9
	"	"	7/16	1637.0	206.2	1156.8	136.1	"	7/16	1793.1	225.9	1871.9	187.2
15″ C 53	"	"	1/2	1771.6	221.5	1207.9	142.1	"	1/2	1951.9	244.0	1955.3	195.5
	"	"	9/16	1908.4	236.7	1258.9	148.1	"	9/16	2113.1	262.1	2038.6	203.9
	"	"	5/8	2047.9	252.0	1310.2	154.2	"	5/8	2276.9	280.2	2121.9	212.2
	"	"	11/16	2189.6	267.4	1361.5	160.2	"	11/16	2443.2	298.4	2205.3	220.5
	"	"	3/4	2332.8	282.8	1412.6	166.2	"	3/4	2612.1	316.6	2288.6	228.9
	50.0	17	3/8	1559.1	198.0	1165.3	137.1	20	3/8	1692.0	214.9	1894.9	189.5
	"	"	7/16	1692.2	213.2	1216.6	143.1	"	7/16	1848.3	232.9	1978.2	197.8
15″ C 53	"	"	1/2	1826.8	228.4	1267.7	149.1	"	1/2	2007.1	250.9	2061.5	206.2
	"	"	9/16	1963.6	243.5	1318.7	155.1	"	9/16	2168.3	268.9	2144.9	214.5
	"	"	5/8	2103.1	258.8	1370.0	161.2	"	5/8	2332.1	287.0	2228.2	222.8
	"	"	11/16	2244.8	274.2	1421.3	167.2	"	11/16	2498.4	305.2	2311.5	231.2
	"	"	3/4	2388.0	289.5	1472.4	173.2	"	3/4	2667.3	323.3	2394.9	239.5
	55.0	17	3/8	1614.1	205.0	1223.4	143.9	20	3/8	1747.0	221.9	1998.8	199.9
	"	"	7/16	1747.2	220.1	1274.7	150.0	"	7/16	1903.3	239.8	2082.1	208.2
15″ C 53	"	"	1/2	1881.8	235.2	1325.7	156.0	"	1/2	2062.1	257.8	2165.5	216.6
	"	"	9/16	2018.6	250.4	1376.8	162.0	"	9/16	2223.3	275.8	2248.8	224.9
	"	"	5/8	2158.1	265.6	1428.1	168.0	"	5/8	2387.1	293.8	2332.1	233.2
	"	"	11/16	2299.8	280.9	1479.4	174.0	"	11/16	2553.4	311.9	2415.5	241.6
	"	"	3/4	2443.0	296.1	1530.4	180.1	"	3/4	2722.3	330.0	2498.8	249.9

SPACING OF CHANNELS FOR EQUAL MOMENTS OF INERTIA ABOUT THE TWO RECTANGULAR AXES 1-1 AND 2-2.



Section Number.	Depth of Channel.	Weight per ft. of one Channel.	Area of Section of one Channel.	A	E
	Inches.	Pounds.	Sq. Ins.	Inches.	Inches.
C 5	3	4.00	1.19	1.29	3.05
"	"	5.00	1.47	1.17	2.93
"	"	6.00	1.76	1.10	2.94
C 9	4	5.25	1.55	2.08	3.92
"	"	6.25	1.84	1.96	3.80
"	"	7.25	2.13	1.88	3.72
C 13	5	6.50	1.95	2.79	4.75
"	"	9.50	2.65	2.57	4.49
"	"	11.50	3.38	2.35	4.39
C 17	6	8.00	2.38	3.51	5.59
"	"	10.50	3.09	3.29	5.29
"	"	13.00	3.82	3.08	5.16
"	"	15.50	4.56	2.90	5.10
C 21	7	9.75	2.85	4.21	6.41
"	"	12.25	3.60	4.00	6.12
"	"	14.75	4.34	3.82	5.94
"	"	17.25	5.07	3.65	5.85
"	"	19.75	5.81	3.49	5.81
C 25	8	11.25	3.35	4.92	7.24
"	"	13.75	4.04	4.72	6.96
"	"	16.25	4.78	4.53	6.77

Section Number.	Depth of Channel.	Weight per ft. of one Channel.	Area of Section of one Channel.	A	E
	Inches.	Pounds.	Sq. Ins.	Inches.	Inches.
C 25	8	18.75	5.51	4.37	6.65
"	"	21.25	6.25	4.22	6.58
C 29	9	13.25	3.89	5.62	8.06
"	"	15.00	4.41	5.48	7.84
"	"	20.00	5.88	5.14	7.46
"	"	25.00	7.35	4.83	7.31
C 33	10	15.00	4.46	6.33	8.89
"	"	20.00	5.88	5.96	8.40
"	"	25.00	7.35	5.66	8.14
"	"	30.00	8.82	5.41	8.01
"	"	35.00	10.29	5.18	7.94
C 41	12	20.50	6.03	7.68	10.48
"	"	25.00	7.35	7.35	10.07
"	"	30.00	8.82	7.06	9.78
"	"	35.00	10.29	6.83	9.59
"	"	40.00	11.76	6.60	9.48
C 53	15	33.00	9.90	9.51	12.67
"	"	35.00	10.29	9.42	12.58
"	"	40.00	11.76	9.16	12.28
"	"	45.00	13.24	8.92	12.08
"	"	50.00	14.71	8.72	11.92
"	"	55.00	16.18	8.53	11.81

SAFE LOADS IN THOUSANDS OF POUNDS FOR I-BEAMS USED AS COLUMNS WITH SQUARE ENDS.

Based on Gordon's Formula $P = \frac{50\,000}{1 + \frac{(12\,L)^2}{36\,000\,r^2}}$. **Safety factor** 4.

Depth of Beam and Section Number.	Weight per Foot.	Area of Section.	Least Radius of Gyration.	Length in Feet.						
	Pounds.	Sq. Ins.	Inch.	2	3	4	5	6	7	8
3″ B5	5.5	1.63	.53	19	18	17	15	13	12	11
	6.5	1.91	.52	23	21	19	17	16	14	12
	7.5	2.21	.52	26	24	22	20	18	16	14
4″ B9	7.5	2.21	.59	26	25	23	21	20	18	16
	8.5	2.50	.58	30	28	26	24	22	20	18
	9.5	2.79	.58	33	31	29	27	24	22	20
	10.5	3.09	.57	37	35	32	29	27	24	22
5″ B13	9.75	2.87	.65	35	33	31	29	27	24	22
	12.25	3.60	.63	43	41	39	36	33	30	27
	14.75	4.34	.63	52	50	47	43	40	36	33
6″ B17	12.25	3.61	.72	44	42	40	38	35	33	30
	14.75	4.34	.69	52	51	48	45	42	39	35
	17.25	5.07	.68	61	59	56	52	48	44	41
7″ B21	15.0	4.42	.78	54	52	50	47	45	42	39
	17.5	5.15	.76	63	61	58	55	52	48	45
	20.0	5.88	.74	71	69	66	62	58	54	50
8″ B25	18.00	5.33	.84	65	63	61	58	55	52	49
	20.25	5.96	.82	73	71	68	65	61	58	54
	22.75	6.69	.81	82	79	76	72	69	65	60
	25.25	7.43	.80	91	88	84	80	76	71	66
9″ B29	21.0	6.31	.90	77	76	73	70	67	63	60
	25.0	7.35	.88	90	88	85	81	78	73	69
	30.0	8.82	.85	108	105	101	97	92	87	81
	35.0	10.29	.84	126	122	118	112	107	101	95
10″ B33	25.0	7.37	.97	91	89	86	83	80	76	73
	30.0	8.82	.93	108	106	103	99	94	90	85
	35.0	10.29	.91	126	123	119	115	110	104	98
	40.0	11.76	.90	144	141	136	131	125	118	112
12″ B41	31.5	9.26	1.01	114	112	109	105	102	97	93
	35.0	10.29	.99	127	124	121	117	112	107	102
	40.0	11.76	.96	144	142	137	133	127	121	115

SAFE LOADS IN THOUSANDS OF POUNDS FOR I-BEAMS USED AS COLUMNS WITH SQUARE ENDS.

Based on Gordon's Formula $P = \frac{50\,000}{1+\frac{(12\,L)^2}{36\,000\,r^2}}$. **Safety factor** 4.

Length in Feet.									Weight per Foot.	Depth of Beam and Section Number.
9	10	11	12	13	14	15	16	17	Pounds.	
9	...	...	...	...	...	...	...	...	5.5	3″ B5
11	...	...	...	...	...	...	...	...	6.5	
13	...	...	...	...	...	...	...	...	7.5	
14	13	...	...	...	...	...	...	...	7.5	4″ B9
16	14	...	...	...	...	...	...	...	8.5	
18	16	...	...	...	...	...	...	...	9.5	
19	17	...	...	...	...	...	...	...	10.5	
20	18	17	...	...	...	...	...	...	9.75	5″ B13
25	22	20	...	...	...	...	...	...	12.25	
30	27	24	...	...	...	...	...	...	14.75	
28	25	23	21	...	...	...	...	...	12.25	6″ B17
32	29	27	25	...	...	...	...	...	14.75	
37	34	31	28	...	...	...	...	...	17 25	
36	33	31	28	26	...	...	...	...	15.0	7″ B21
41	38	35	32	30	...	...	...	...	17.5	
46	43	39	36	33	...	...	...	...	20.0	
46	43	40	37	34	31	...	...	...	18.00	8″ B25
50	47	43	40	37	34	...	...	...	20.25	
56	52	48	45	41	38	...	...	...	22.75	
61	57	53	49	45	42	...	...	...	25.25	
56	53	49	46	43	40	37	...	...	21.0	9″ B29
65	60	57	53	49	46	43	...	...	25.0	
76	71	66	61	57	53	49	...	...	30.0	
88	82	76	71	66	61	56	...	...	35.0	
68	65	61	57	54	50	47	44	...	25 0	10″ B33
80	75	71	66	62	58	54	50	...	30.0	
92	87	81	76	71	66	62	57	...	35.0	
105	98	92	86	80	74	69	65	...	40.0	
88	83	78	74	69	65	61	58	54	31.5	12″ B41
97	91	86	81	76	72	67	63	59	35.0	
109	103	96	90	85	79	74	69	65	40.0	

SAFE LOADS IN THOUSANDS OF POUNDS FOR I-BEAMS USED AS COLUMNS WITH SQUARE ENDS.

Based on Gordon's Formula $P = \dfrac{50\,000}{1+\dfrac{(12\,L)^2}{36\,000\,r^2}}$. **Safety factor 4.**

Depth of Beam and Section Number.	Weight per Foot.	Area of Section.	Least Radius of Gyration.	Length in Feet.							
	Pounds.	Sq. Ins.	Inches.	2	3	4	5	6	7	8	9
12″ B105	40.0	11.84	1.08	146	144	140	136	132	127	121	116
	45.0	13.24	1.06	163	160	156	152	146	141	135	128
	50.0	14.71	1.05	181	178	174	168	163	156	149	142
	55.0	16.18	1.04	199	196	191	185	178	171	163	155
15″ B 53	42.0	12.48	1.08	154	151	148	144	139	133	128	122
	45.0	13.24	1.07	163	160	157	152	147	142	135	129
	50.0	14.71	1.04	181	178	174	168	162	156	149	141
	55.0	16.18	1.03	199	196	191	185	178	171	163	155
	60.0	17.65	1.01	217	213	207	201	194	185	177	167
15″ B109	60.0	17.67	1.21	218	215	212	207	201	195	188	181
	65.0	19.12	1.20	236	233	229	223	217	211	203	195
	70.0	20.59	1.19	254	251	246	240	234	226	218	209
	75.0	22.06	1.18	273	269	264	258	250	242	233	224
	80.0	23.53	1.17	291	286	281	274	266	257	248	238
15″ B113	80.0	23.57	1.32	292	289	284	279	273	265	256	249
	85.0	25.00	1.32	309	306	302	295	289	281	272	264
	90.0	26.47	1.32	328	324	319	313	306	297	288	279
	95.0	27.94	1.31	346	342	336	330	322	314	304	293
	100.0	29.41	1.31	364	360	354	348	339	330	320	309
18″ B 65	55.0	15.93	1.15	197	194	190	185	180	173	166	160
	60.0	17.65	1.13	218	214	210	205	198	191	184	176
	65.0	19.12	1.11	236	232	227	221	214	206	198	189
	70.0	20.59	1.09	254	250	244	237	230	221	212	202
20″ B 73	65.0	19.08	1.21	236	233	229	223	217	210	203	196
	70.0	20.59	1.19	254	251	246	240	234	226	218	209
	75.0	22.06	1.17	273	268	264	257	250	241	233	223
20″ B121	80.0	23.73	1.39	294	291	287	282	276	270	261	254
	85.0	25.00	1.37	309	307	302	297	290	283	275	266
	90.0	26.47	1.36	328	325	320	314	307	300	290	282
	95.0	27.94	1.35	346	343	337	331	324	315	307	296
	100.0	29.41	1.34	364	361	355	349	340	332	321	312
24″ B 89	80.0	23.32	1.36	289	286	282	276	271	264	256	248
	85.0	25.00	1.33	309	306	302	295	289	281	273	264
	90.0	26.47	1.31	328	324	319	313	305	297	288	278
	95.0	27.94	1.30	346	342	336	330	322	313	303	293
	100.0	29.41	1.28	364	360	354	347	338	328	317	307

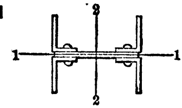
SAFE LOADS IN THOUSANDS OF POUNDS FOR I-BEAMS USED AS COLUMNS WITH SQUARE ENDS.

Based on Gordon's Formula $P = \dfrac{50\,000}{1+\dfrac{(12\,L)^2}{36\,000\,r^2}}$. **Safety factor 4.**

Length in Feet.										Weight per Foot.	Depth of Beam and Section Number.
10	11	12	13	14	15	16	17	18	19	Pounds.	
110	105	99	94	88	83	79	75	70	. . .	40.0	
122	116	110	103	98	92	87	82	77	. . .	45.0	12″
135	128	121	114	108	101	96	90	85	. . .	50.0	**B105**
148	140	132	124	117	111	104	98	92	. . .	55.0	
116	110	105	99	93	88	83	79	74	. . .	42.0	
123	116	110	104	98	93	87	82	78	. . .	45.0	15″
134	127	120	113	106	101	94	89	84	. . .	50.0	**B 53**
147	139	131	124	116	109	103	97	91	. . .	55.0	
158	150	141	132	124	117	110	104	97	. . .	60.0	
173	166	159	152	144	137	130	124	117	111	60.0	
187	179	171	163	154	147	140	132	126	120	65.0	15″
201	192	183	174	165	157	150	142	135	127	70.0	**B109**
214	205	195	186	176	168	158	151	142	135	75.0	
228	217	206	197	187	178	168	160	151	143	80.0	
239	231	221	213	203	194	186	177	169	161	80.0	
254	245	235	226	216	206	197	188	180	171	85.0	15″
269	259	249	239	228	218	209	199	190	181	90.0	**B113**
284	272	261	251	240	228	219	208	199	190	95.0	
299	287	275	264	252	240	230	219	210	200	100.0	
153	145	139	132	125	119	112	106	100	95	55.0	
168	160	152	144	137	129	122	116	110	104	60.0	18″
181	172	163	154	146	138	131	123	117	110	65.0	**B 65**
192	183	173	164	155	146	138	130	123	116	70.0	
187	179	171	164	155	148	141	134	126	120	65.0	20″
201	192	183	174	165	157	150	142	135	127	70.0	**B 73**
214	204	194	185	175	167	158	150	142	135	75.0	
246	237	229	219	211	202	194	186	177	169	80.0	
258	249	239	230	221	212	202	194	185	176	85.0	20″
271	262	253	241	232	223	213	204	195	185	90.0	**B121**
286	277	265	255	244	234	223	214	205	195	95.0	
300	290	278	267	257	245	235	223	214	203	100.0	
239	231	223	213	205	196	187	179	172	163	80.0	
255	245	236	226	217	207	198	189	181	172	85.0	24″
269	258	247	238	227	216	207	197	189	180	90.0	**B 89**
282	271	261	249	239	228	218	207	198	188	95.0	
296	284	272	260	249	238	226	215	205	196	100.0	

SAFE LOADS IN THOUSANDS OF POUNDS FOR PLATE AND ANGLE COLUMNS. SQUARE ENDS.

CALCULATED FOR LEAST RADIUS OF GYRATION AXIS 1-1.



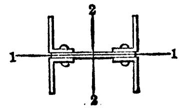
Based on Gordon's Formula $P = \dfrac{50\,000}{1+\dfrac{(12\,L)^2}{36\,000\,r^2}}$.

Safety Factor 4.

Size of Angles.	Size of Plates.	Weight of Column.	Area of Column Section.	Least Radius of Gyration Axis 1-1.	Radius of Gyration Axis 2-2.	Length in Feet.		
Inches.	Inches.	Lbs. per Ft.	Sq. Ins.	Inches.	Inches.	2	4	6
3 x 2½ x ¼	6 x ¼	23.1	6.79	1.24	2.41	84	81	77
“ “ $\frac{5}{16}$	“ $\frac{5}{16}$	28.8	8.40	1.27	2.39	103	100	96
“ “ ⅜	“ ⅜	34.1	9.98	1.30	2.37	123	120	114
“ “ $\frac{7}{16}$	“ $\frac{7}{16}$	39.3	11.53	1.33	2.35	142	139	133
“ “ ½	“ ½	44.2	13.00	1.36	2.33	161	157	151
“ “ $\frac{9}{16}$	“ $\frac{9}{16}$	49.5	14.49	1.39	2.31	180	175	169
“ “ ⅝	“ ⅝	54.4	15.94	1.43	2.29	198	193	186
3½ x 2½ x ¼	7 x ¼	25.6	7.50	1.46	2.88	93	91	88
“ “ $\frac{5}{16}$	“ $\frac{5}{16}$	31.8	9.30	1.49	2.86	115	113	109
“ “ ⅜	“ ⅜	37.7	11.07	1.52	2.84	137	135	130
“ “ $\frac{7}{16}$	“ $\frac{7}{16}$	43.6	12.83	1.55	2.82	159	156	151
“ “ ½	“ ½	49.5	14.50	1.58	2.80	180	177	171
“ “ $\frac{9}{16}$	“ $\frac{9}{16}$	55.0	16.17	1.61	2.78	201	197	192
“ “ ⅝	“ ⅝	60.9	17.82	1.65	2.76	221	218	212
“ “ $\frac{11}{16}$	“ $\frac{11}{16}$	66.4	19.46	1.68	2.74	241	237	231
“ “ ¾	“ ¾	71.5	21.00	1.71	2.72	261	257	250
4 x 3 x $\frac{5}{16}$	8 x $\frac{5}{16}$	37.3	10.86	1.67	3.25	...	133	129
“ “ ⅜	“ ⅜	44.2	12.98	1.70	3.23	...	158	154
“ “ $\frac{7}{16}$	“ $\frac{7}{16}$	51.1	15.02	1.73	3.21	...	183	179
“ “ ½	“ ½	58.0	17.00	1.76	3.18	...	208	203
“ “ $\frac{9}{16}$	“ $\frac{9}{16}$	64.9	19.02	1.79	3.16	...	233	227
“ “ ⅝	“ ⅝	71.4	20.98	1.82	3.14	...	257	251
“ “ $\frac{11}{16}$	“ $\frac{11}{16}$	77.9	22.86	1.85	3.12	...	281	274
“ “ ¾	“ ¾	84.4	24.75	1.89	3.10	...	304	297
“ “ $\frac{13}{16}$	“ $\frac{13}{16}$	90.5	26.61	1.92	3.08	...	327	320
“ “ ⅞	“ ⅞	97.0	28.44	1.95	3.06	...	350	343
5 x 3½ x $\frac{5}{16}$	10 x $\frac{5}{16}$	45.4	13.36	2.08	4.10	...	165	162
“ “ ⅜	“ ⅜	54.4	15.94	2.10	4.08	...	196	193
“ “ $\frac{7}{16}$	“ $\frac{7}{16}$	62.9	18.49	2.13	4.06	...	228	224
“ “ ½	“ ½	71.4	21.00	2.16	4.04	...	259	255
“ “ $\frac{9}{16}$	“ $\frac{9}{16}$	79.9	23.53	2.19	4.02	...	290	285
“ “ ⅝	“ ⅝	88.5	25.98	2.22	4.00	...	320	315
“ “ $\frac{11}{16}$	“ $\frac{11}{16}$	96.6	28.40	2.25	3.98	...	350	345
“ “ ¾	“ ¾	104.7	30.79	2.29	3.96	...	380	374
“ “ $\frac{13}{16}$	“ $\frac{13}{16}$	112.8	33.11	2.32	3.93	...	409	403
“ “ ⅞	“ ⅞	120.6	35.48	2.35	3.91	...	438	432
“ “ $\frac{15}{16}$	“ $\frac{15}{16}$	128.7	37.74	2.38	3.89	...	466	460
6 x 3½ x ⅜	12 x ⅜	62.1	18.23	2.56	5.01	...	225	222
“ “ $\frac{7}{16}$	“ $\frac{7}{16}$	71.9	21.15	2.59	4.99	...	261	258
“ “ ½	“ ½	81.6	24.00	2.62	4.97	...	297	294
“ “ $\frac{9}{16}$	“ $\frac{9}{16}$	91.4	26.86	2.65	4.95	...	333	329
“ “ ⅝	“ ⅝	101.1	29.69	2.68	4.93	...	368	364
“ “ $\frac{11}{16}$	“ $\frac{11}{16}$	110.5	32.48	2.71	4.91	...	402	398
“ “ ¾	“ ¾	120.2	35.29	2.74	4.88	...	437	432
“ “ $\frac{13}{16}$	“ $\frac{13}{16}$	129.2	37.98	2.77	4.86	...	471	466
“ “ ⅞	“ ⅞	138.5	40.69	2.80	4.84	...	505	499
“ “ $\frac{15}{16}$	“ $\frac{15}{16}$	147.5	43.36	2.83	4.82	...	538	532
“ “ 1	“ 1	156.4	46.00	2.86	4.80	...	571	565

SAFE LOADS IN THOUSANDS OF POUNDS FOR PLATE AND ANGLE COLUMNS. SQUARE ENDS.

CALCULATED FOR LEAST RADIUS OF GYRATION AXIS 1-1.



Based on Gordon's Formula $P = \dfrac{50\,000}{1 + \dfrac{(12\,L)^2}{36\,000\,r^2}}$.

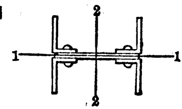
Safety Factor 4.

Length in Feet.

8	10	12	14	16	18	20	22	24	26	28	30	32	34
72	67	61	56	51	...	...	...	...	...	...	...	...	...
90	84	77	70	64	...	...	...	...	...	...	...	...	...
108	100	93	85	77	...	...	...	...	...	...	...	...	...
125	117	108	99	91	...	...	...	...	...	...	...	...	...
143	134	124	114	105	...	...	...	...	...	...	...	...	...
160	150	140	129	119	...	...	...	...	...	...	...	...	...
177	166	155	144	132	...	...	...	...	...	...	...	...	...
84	79	74	69	63	58	54	...	...	...	...	...	...	...
104	99	92	86	80	73	68	...	...	...	...	...	...	...
125	118	111	103	96	89	82	...	...	...	...	...	...	...
145	137	129	121	112	104	96	...	...	...	...	...	...	...
164	156	147	138	129	119	111	...	...	...	...	...	...	...
184	175	166	155	145	135	125	...	...	...	...	...	...	...
204	194	184	173	162	151	140	...	...	...	...	...	...	...
223	213	202	190	178	166	155	...	...	...	...	...	...	...
241	231	219	207	195	182	170	...	...	...	...	...	...	...
124	119	113	106	99	93	86	80	74	...	...	...	...	...
149	142	135	127	119	112	104	97	90	...	...	...	...	...
172	165	157	148	139	131	122	114	106	...	...	...	...	...
196	188	179	170	160	150	140	131	122	...	...	...	...	...
220	211	201	191	180	169	158	148	138	...	...	...	...	...
243	234	223	212	200	188	177	165	155	...	...	...	...	...
266	256	245	233	220	208	195	183	171	...	...	...	...	...
289	278	266	254	240	227	213	200	188	...	...	...	...	...
311	300	288	274	260	246	232	218	205	...	...	...	...	...
333	322	309	295	280	265	250	236	222	...	...	...	...	...
158	153	147	141	135	128	122	115	109	103	97	...	...	...
188	183	176	169	162	154	146	139	131	124	117	...	...	...
219	212	205	197	189	180	171	162	153	145	137	...	...	...
249	242	234	225	215	206	196	186	176	166	157	...	...	...
279	271	262	252	242	231	220	209	198	188	178	...	...	...
308	300	290	280	269	257	245	233	221	210	198	...	...	...
337	329	318	307	295	282	270	257	244	231	219	...	...	...
366	357	346	334	321	308	294	280	267	253	240	...	...	...
395	385	374	361	348	333	319	304	290	275	261	...	...	...
423	413	401	388	374	359	343	328	313	297	283	...	...	...
451	441	428	414	400	384	368	352	336	320	304	...	...	...
219	214	209	203	197	190	183	176	168	161	154	147	140	133
254	249	243	236	229	221	213	205	196	188	180	172	164	156
289	283	277	269	261	252	243	234	225	215	206	197	188	179
324	318	310	302	293	283	273	263	253	242	232	222	212	202
358	352	344	335	325	314	303	292	281	269	258	247	236	226
392	385	376	367	356	345	333	321	309	297	284	272	261	249
426	418	409	399	388	376	363	350	337	324	311	298	285	273
459	451	442	431	419	406	393	379	365	351	337	323	310	296
493	484	474	462	450	437	423	408	393	378	363	349	334	320
525	516	506	494	481	467	452	437	421	405	390	374	359	344
558	548	537	525	511	497	481	465	449	432	416	400	384	368

SAFE LOADS IN THOUSANDS OF POUNDS FOR PLATE AND ANGLE COLUMNS. SQUARE ENDS.

CALCULATED FOR LEAST RADIUS OF GYRATION AXIS 1-1.



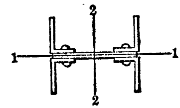
Based on Gordon's Formula $P = \dfrac{50\,000}{1+\dfrac{(12\,L)^2}{36\,000\,r^2}}$

Safety Factor 4.

Size of Angles.	Size of Plates.	Weight of Column.	Area of Column Section.	Least Radius of Gyration Axis 1-1.	Radius of Gyration Axis 2-2.	Length in Feet.		
Inches.	Inches.	Lbs. per Ft.	Sq. Ins.	Inches.	Inches.	2	4	6
3 x 2½ x ¼	8 x ¼	24.8	7.29	1.19	3.25	90	87	82
" " 5/16	" 5/16	30.9	9.02	1.22	3.23	111	108	102
" " 3/8	" 3/8	36.6	10.73	1.25	3.21	132	128	122
" " 7/16	" 7/16	42.3	12.40	1.28	3.19	153	149	142
" " ½	" ½	47.6	14.00	1.31	3.17	173	169	161
" " 9/16	" 9/16	53.3	15.61	1.34	3.15	193	188	181
" " 5/8	" 5/8	58.6	17.19	1.37	3.13	213	208	200
3½ x 2½ x ¼	8 x ¼	26.4	7.75	1.44	3.31	96	94	91
" " 5/16	" 5/16	32.9	9.61	1.47	3.28	119	117	113
" " 3/8	" 3/8	39.0	11.44	1.50	3.26	142	139	134
" " 7/16	" 7/16	45.1	13.27	1.53	3.24	164	161	156
" " ½	" ½	51.2	15.00	1.56	3.22	186	183	177
" " 9/16	" 9/16	56.9	16.73	1.59	3.20	208	204	198
" " 5/8	" 5/8	63.0	18.44	1.62	3.18	229	225	218
" " 11/16	" 11/16	68.7	20.15	1.65	3.16	250	246	239
" " ¾	" ¾	74.0	21.75	1.68	3.14	270	266	259
4 x 3 x 5/16	10 x 5/16	39.4	11.49	1.62	4.09	...	140	136
" " 3/8	" 3/8	46.8	13.73	1.65	4.07	...	167	163
" " 7/16	" 7/16	54.1	15.90	1.68	4.04	...	194	189
" " ½	" ½	61.4	18.00	1.71	4.02	...	220	214
" " 9/16	" 9/16	68.7	20.15	1.74	4.00	...	246	240
" " 5/8	" 5/8	75.7	22.23	1.77	3.98	...	272	265
" " 11/16	" 11/16	82.6	24.24	1.80	3.96	...	297	290
" " ¾	" ¾	89.5	26.25	1.83	3.94	...	322	315
" " 13/16	" 13/16	96.0	28.24	1.86	3.92	...	347	339
" " 7/8	" 7/8	103.0	30.19	1.90	3.90	...	371	363
5 x 3½ x 5/16	12 x 5/16	47.6	13.98	2.03	4.95	...	172	169
" " 3/8	" 3/8	56.9	16.69	2.06	4.92	...	206	202
" " 7/16	" 7/16	65.9	19.36	2.08	4.90	...	238	234
" " ½	" ½	74.8	22.00	2.11	4.88	...	271	266
" " 9/16	" 9/16	83.8	24.65	2.14	4.86	...	303	298
" " 5/8	" 5/8	92.7	27.23	2.17	4.84	...	335	330
" " 11/16	" 11/16	101.3	29.77	2.20	4.82	...	367	361
" " ¾	" ¾	109.8	32.29	2.23	4.80	...	398	392
" " 13/16	" 13/16	118.4	34.73	2.26	4.78	...	429	422
" " 7/8	" 7/8	126.5	37.23	2.29	4.76	...	459	452
" " 15/16	" 15/16	135.1	39.61	2.33	4.74	...	489	482
6 x 3½ x 3/8	14 x 3/8	64.7	18.98	2.51	5.85	...	234	231
" " 7/16	" 7/16	74.8	22.03	2.54	5.83	...	272	269
" " ½	" ½	85.0	25.00	2.57	5.81	...	309	306
" " 9/16	" 9/16	95.2	27.99	2.59	5.79	...	347	343
" " 5/8	" 5/8	105.3	30.94	2.62	5.77	...	383	379
" " 11/16	" 11/16	115.1	33.86	2.65	5.74	...	419	415
" " ¾	" ¾	125.3	36.79	2.68	5.72	...	455	450
" " 13/16	" 13/16	134.7	39.61	2.71	5.70	...	491	486
" " 7/8	" 7/8	144.5	42.44	2.74	5.68	...	526	521
" " 15/16	" 15/16	153.8	45.24	2.77	5.66	...	561	555
" " 1	" 1	163.2	48.00	2.81	5.64	...	595	589

SAFE LOADS IN THOUSANDS OF POUNDS FOR PLATE AND ANGLE COLUMNS. SQUARE ENDS.

CALCULATED FOR LEAST RADIUS OF GYRATION AXIS 1-1.



Based on Gordon's Formula $P = \dfrac{50\,000}{1 + \dfrac{(12\,L)^2}{36\,000\,r^2}}$.

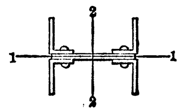
Safety Factor 4.

Length in Feet.

8	10	12	14	16	18	20	22	24	26	28	30	32	34
77	71	65	58	53	...	...	...	...	...	...	...	...	...
96	89	81	74	67	...	...	...	...	...	...	...	...	...
115	106	98	89	81	...	...	...	...	...	...	...	...	...
134	124	114	105	95	...	...	...	...	...	...	...	...	...
152	142	131	120	110	...	...	...	...	...	...	...	...	...
171	160	148	136	124	...	...	...	...	...	...	...	...	...
189	177	165	152	139	...	...	...	...	...	...	...	...	...
86	81	76	70	65	60	55	...	...	...	...	...	...	...
107	101	95	88	81	75	69	...	...	...	...	...	...	...
128	121	114	106	98	91	83	...	...	...	...	...	...	...
149	141	133	124	115	106	98	...	...	...	...	...	...	...
170	161	151	142	132	122	113	...	...	...	...	...	...	...
190	180	170	159	149	138	128	...	...	...	...	...	...	...
210	200	189	177	166	154	143	...	...	...	...	...	...	...
230	219	208	195	183	170	158	...	...	...	...	...	...	...
249	238	226	213	200	187	174	...	...	...	...	...	...	...
131	125	118	111	103	96	89	83	77	...	...	...	...	...
156	149	141	133	124	116	108	100	93	...	...	...	...	...
182	174	165	155	145	136	127	118	109	...	...	...	...	...
207	198	188	177	167	156	145	135	126	...	...	...	...	...
232	222	211	200	188	176	164	153	143	...	...	...	...	...
256	246	234	222	209	196	184	171	160	...	...	...	...	...
281	270	257	244	230	216	203	190	177	...	...	...	...	...
305	293	280	266	251	237	222	208	195	...	...	...	...	...
329	317	303	288	273	257	242	227	212	...	...	...	...	...
352	340	325	310	294	277	261	245	230	...	...	...	...	...
165	159	153	147	140	133	126	119	112	105	99	...	...	...
197	191	184	176	168	160	151	143	135	127	120	...	...	...
229	222	214	205	196	186	177	167	158	149	141	...	...	...
260	252	244	234	224	213	202	192	181	171	162	...	...	...
291	283	273	263	251	240	228	216	205	194	183	...	...	...
322	313	303	291	279	267	254	241	228	216	204	...	...	...
353	343	332	320	307	293	279	266	252	239	226	...	...	...
383	373	361	348	334	320	305	290	276	261	247	...	...	...
413	403	390	376	362	346	331	315	299	284	269	...	...	...
443	432	419	405	389	373	357	340	323	307	291	...	...	...
473	461	447	432	416	399	382	365	347	330	313	...	...	...
228	223	217	211	204	196	189	181	173	166	158	151	143	136
264	259	252	245	237	229	220	211	202	194	185	176	168	160
301	295	287	279	270	261	251	241	231	221	212	202	193	184
337	330	322	313	304	293	283	272	261	250	239	228	217	207
373	366	357	347	337	325	314	302	290	278	266	254	242	231
408	400	391	381	369	357	345	332	319	306	293	280	268	255
444	435	425	414	402	389	376	362	348	334	320	306	293	280
478	470	459	447	435	421	407	392	377	362	347	333	318	304
513	504	493	480	467	453	438	422	406	390	375	359	344	329
547	538	526	513	499	484	468	452	435	419	402	385	369	353
581	571	559	546	531	515	499	482	464	447	429	412	395	378

SAFE LOADS IN THOUSANDS OF POUNDS FOR PLATE AND ANGLE COLUMNS. SQUARE ENDS.

CALCULATED FOR LEAST RADIUS OF GYRATION AXIS 1-1.



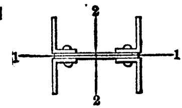
Based on Gordon's Formula $P=\dfrac{50\,000}{1+\dfrac{(12\,L)^2}{36\,000\,r^2}}$.

Safety factor 4.

Size of Angles.	Size of Plates.	Weight of Column.	Area of Column Section.	Least Radius of Gyration Axis 1-1.	Radius of Gyration Axis 2-2.	Length in Feet.		
Inches.	Inches.	Lbs. per Ft.	Sq. Ins.	Inches.	Inches.	2	4	6
3 x 2½ x ¼	10 x ¼	26.5	7.79	1.16	4.07	96	92	87
" " 5/16	" 5/16	33.0	9.65	1.18	4.05	119	115	109
" " 3/8	" 3/8	39.2	11.48	1.21	4.03	141	137	130
" " 7/16	" 7/16	45.3	13.28	1.24	4.01	164	159	151
" " ½	" ½	51.0	15.00	1.27	3.99	186	180	172
" " 9/16	" 9/16	57.1	16.74	1.30	3.96	207	202	193
" " 5/8	" 5/8	62.9	18.44	1.33	3.94	228	222	213
3½ x 2½ x ¼	10 x ¼	28.1	8.25	1.39	4.13	102	100	96
" " 5/16	" 5/16	35.0	10.24	1.42	4.11	127	124	119
" " 3/8	" 3/8	41.6	12.19	1.45	4.09	151	148	143
" " 7/16	" 7/16	48.1	14.15	1.48	4.07	175	171	165
" " ½	" ½	54.6	16.00	1.51	4.05	199	195	188
" " 9/16	" 9/16	60.7	17.86	1.54	4.03	222	217	210
" " 5/8	" 5/8	67.3	19.69	1.57	4.01	245	240	232
" " 11/16	" 11/16	73.4	21.53	1.60	3.99	267	262	254
" " ¾	" ¾	79.1	23.25	1.63	3.97	289	284	276
4 x 3 x 5/16	12 x 5/16	41.6	12.11	1.58	4.91	. . .	148	143
" " 3/8	" 3/8	49.3	14.48	1.61	4.89	. . .	176	171
" " 7/16	" 7/16	57.1	16.77	1.64	4.87	. . .	204	198
" " ½	" ½	64.8	19.00	1.66	4.85	. . .	232	226
" " 9/16	" 9/16	72.6	21.27	1.69	4.83	. . .	260	253
" " 5/8	" 5/8	79.9	23.48	1.72	4.81	. . .	287	279
" " 11/16	" 11/16	87.3	25.61	1.75	4.79	. . .	314	306
" " ¾	" ¾	94.6	27.75	1.78	4.77	. . .	340	332
" " 13/16	" 13/16	101.6	29.86	1.81	4.74	. . .	366	358
" " 7/8	" 7/8	108.9	31.94	1.84	4.72	. . .	392	383
5 x 3½ x 5/16	14 x 5/16	49.7	14.61	1.98	5.77	. . .	180	176
" " 3/8	" 3/8	59.5	17.44	2.01	5.75	. . .	215	211
" " 7/16	" 7/16	68.8	20.24	2.04	5.73	. . .	249	245
" " ½	" ½	78.2	23.00	2.07	5.71	. . .	283	278
" " 9/16	" 9/16	87.6	25.78	2.09	5.69	. . .	317	312
" " 5/8	" 5/8	96.9	28.48	2.12	5.67	. . .	351	345
" " 11/16	" 11/16	105.9	31.15	2.15	5.64	. . .	384	377
" " ¾	" ¾	114.9	33.79	2.18	5.62	. . .	416	410
" " 13/16	" 13/16	123.9	36.36	2.21	5.60	. . .	449	442
" " 7/8	" 7/8	132.5	38.98	2.24	5.58	. . .	481	473
" " 15/16	" 15/16	141.4	41.49	2.27	5.56	. . .	512	505
6 x 3½ x 3/8	16 x 3/8	67.2	19.73	2.46	6.68	. . .	244	240
" " 7/16	" 7/16	77.8	22.90	2.49	6.66	. . .	283	279
" " ½	" ½	88.4	26.00	2.52	6.64	. . .	322	318
" " 9/16	" 9/16	99.0	29.11	2.54	6.61	. . .	360	356
" " 5/8	" 5/8	109.6	32.19	2.57	6.59	. . .	399	394
" " 11/16	" 11/16	119.8	35.23	2.60	6.57	. . .	436	431
" " ¾	" ¾	130.4	38.29	2.63	6.55	. . .	474	468
" " 13/16	" 13/16	140.2	41.23	2.66	6.53	. . .	511	505
" " 7/8	" 7/8	150.4	44.19	2.69	6.51	. . .	548	542
" " 15/16	" 15/16	160.2	47.11	2.72	6.48	. . .	584	578
" " 1	" 1	170.0	50.00	2.75	6.46	. . .	620	613

SAFE LOADS IN THOUSANDS OF POUNDS FOR PLATE AND ANGLE COLUMNS. SQUARE ENDS.

CALCULATED FOR LEAST RADIUS OF GYRATION AXIS 1-1.



Based on Gordon's Formula $P = \dfrac{50\,000}{1+\dfrac{(12\,L)^2}{36\,000\,r^2}}$.

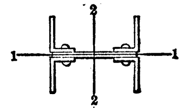
Safety factor 4.

Length in Feet.

8	10	12	14	16	18	20	22	24	26	28	30	32	34
81	75	68	61	55	...	...	..	..	..	..	..	..	..
102	93	85	77	69	...	...	..	..	..	..	..	..	..
122	112	103	93	84	...	...	..	..	..	..	..	..	..
142	131	120	109	99	...	...	..	..	..	..	..	..	..
162	150	138	126	114	...	...	..	..	..	..	..	..	..
182	169	156	143	130	...	...	..	..	..	..	..	..	..
201	188	174	159	146	...	...	..	..	..	..	..	..	..
91	86	80	73	68	62	57	..	..	..	..	..	..	..
114	107	100	92	85	78	71	..	..	..	..	..	..	..
136	128	120	111	102	94	86	..	..	..	..	..	..	..
158	149	140	130	120	111	102	..	..	..	..	..	..	..
180	170	160	149	138	127	117	..	..	..	..	..	..	..
201	191	179	168	156	144	133	..	..	..	..	..	..	..
223	212	199	187	174	161	149	..	..	..	..	..	..	..
244	232	219	205	192	178	165	..	..	..	..	..	..	..
265	253	239	224	210	195	181	..	..	..	..	..	..	..
137	131	123	115	107	100	92	85	79	..	..	..	..	..
164	156	148	139	129	120	112	103	95	..	..	..	..	..
191	182	172	162	151	141	131	121	112	..	..	..	..	..
217	208	197	185	173	162	151	140	130	..	..	..	..	..
244	233	221	208	196	183	170	158	147	..	..	..	..	..
270	258	245	232	218	204	190	177	165	..	..	..	..	..
296	283	270	255	240	225	210	196	183	..	..	..	..	..
321	308	294	278	262	246	231	216	201	..	..	..	..	..
346	333	318	301	285	268	251	235	220	..	..	..	..	..
371	357	341	324	307	289	272	254	238	..	..	..	..	..
171	166	159	152	145	137	130	122	115	108	102	..	..	..
205	198	191	183	174	165	156	147	139	131	123	..	..	..
238	231	222	213	203	193	183	173	163	153	144	..	..	..
271	263	253	243	232	221	209	198	187	176	166	..	..	..
304	295	284	273	261	248	236	223	211	199	188	..	..	..
336	327	315	303	290	276	262	249	235	222	210	..	..	..
369	358	346	333	319	304	289	274	260	246	232	..	..	..
400	389	376	362	347	332	316	300	284	269	254	..	..	..
432	420	407	392	376	359	343	326	309	293	277	..	..	..
463	451	437	421	404	387	369	351	334	317	300	..	..	..
494	481	467	450	433	415	396	377	359	340	323	..	..	..
236	231	225	218	211	203	195	187	178	170	162	154	147	140
274	268	261	254	245	236	227	218	208	199	190	181	172	164
312	306	298	289	280	270	259	249	238	228	217	207	197	188
350	343	334	325	314	303	292	280	268	257	245	234	223	212
387	379	370	360	348	336	324	311	298	286	273	261	249	237
424	416	406	395	382	370	356	342	329	315	301	287	274	262
461	452	441	429	416	403	388	374	359	344	329	314	300	287
497	488	477	464	450	436	420	405	389	373	357	342	326	312
533	523	512	498	484	468	452	436	419	402	385	369	353	337
569	559	546	532	517	501	484	467	449	431	414	396	379	362
605	594	581	566	550	534	516	498	479	460	442	423	405	388

SAFE LOADS IN THOUSANDS OF POUNDS FOR PLATE AND ANGLE COLUMNS. SQUARE ENDS.

CALCULATED FOR LEAST RADIUS OF GYRATION AXIS 1-1.



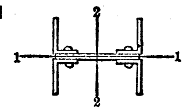
Based on Gordon's Formula $P = \dfrac{50\,000}{1 + \dfrac{(12\,L)^2}{36\,000\,r^2}}$.

Safety factor 4.

Size of Angles.	Size of Plates.	Weight of Column.	Area of Column Section.	Least Radius of Gyration Axis 1-1.	Radius of Gyration Axis 2-2.	Length in Feet.		
Inches.	Inches.	Lbs. per Ft.	Sq. Ins.	Inches.	Inches.	2	4	6
3 x 2½ x ¼	12 x ¼	28.2	8.29	1.12	4.87	102	98	92
“ “ 5/16	“ 5/16	35.2	10.27	1 15	4.85	126	122	115
“ “ ⅜	“ ⅜	41.7	12.23	1.17	4 83	151	146	138
“ “ 7/16	“ 7/16	48.3	14.15	1.20	4.81	174	169	160
“ “ ½	“ ½	54.4	16.00	1.23	4.78	198	192	183
“ “ 9/16	“ 9/16	61 0	17.86	1.26	4.76	221	215	205
“ “ ⅝	“ ⅝	67.1	19.69	1.28	4.74	244	237	226
3½ x 2½ x ¼	12 x ¼	29.8	8.75	1.35	4.94	108	106	101
“ “ 5/16	“ 5/16	37.2	10.86	1.38	4 92	135	131	126
“ “ ⅜	“ ⅜	44.1	12.94	1.41	4.90	160	157	151
“ “ 7/16	“ 7/16	51.1	15.02	1.43	4.88	186	182	175
“ “ ½	“ ½	58.0	17.00	1.46	4 85	211	206	199
“ “ 9/16	“ 9/16	64.6	18.98	1.49	4.83	236	231	223
“ “ ⅝	“ ⅝	71.5	20.94	1.52	4.81	260	255	246
“ “ 11/16	“ 11/16	78.1	22.90	1.55	4.79	284	278	270
“ “ ¾	“ ¾	84.2	24.75	1.58	4 77	307	302	292
4 x 3 x 5/16	14 x 5/16	43.7	12.74	1.54	5.72	. . .	155	150
“ “ ⅜	“ ⅜	51.9	15.23	1.57	5.70	. . .	185	179
“ “ 7/16	“ 7/16	60.0	17.65	1.60	5.68	. . .	215	208
“ “ ½	“ ½	68.2	20.00	1.62	5.66	. . .	244	237
“ “ 9/16	“ 9/16	76.4	22.40	1.65	5.63	. . .	273	265
“ “ ⅝	“ ⅝	84.1	24.73	1.68	5 61	. . .	302	294
“ “ 11/16	“ 11/16	91.9	26.99	1.71	5.59	. . .	330	322
“ “ ¾	“ ¾	99.7	29.25	1.74	5.57	. . .	358	349
“ “ 13/16	“ 13/16	107.1	31.49	1.77	5.55	. . .	386	376
“ “ ⅞	“ ⅞	114.9	33.69	1.80	5.53	. . .	413	403
5 x 3½ x 5/16	16 x 5/16	51.8	15.23	1.94	6.59	. . .	187	183
“ “ ⅜	“ ⅜	62.0	18.19	1.97	6.57	. . .	224	219
“ “ 7/16	“ 7/16	71.8	21.11	2.00	6.54	. . .	260	255
“ “ ½	“ ½	81.6	24.00	2 02	6.52	. . .	295	290
“ “ 9/16	“ 9/16	91.4	26.90	2.05	6 50	. . .	331	325
“ “ ⅝	“ ⅝	101.2	29.73	2.08	6.48	. . .	366	359
“ “ 11/16	“ 11/16	110.6	32.52	2.11	6.46	. . .	400	393
“ “ ¾	“ ¾	120.0	35.29	2.14	6.44	. . .	435	427
“ “ 13/16	“ 13/16	129.4	37.98	2.17	6.41	. . .	468	461
“ “ ⅞	“ ⅞	138.4	40.73	2.19	6.39	. . .	502	494
“ “ 15/16	“ 15/16	147.8	43.36	2.22	6.37	. . .	535	527
6 x 3½ x ⅜	18 x ⅜	69.8	20.48	2.42	7.49	. . .	253	249
“ “ 7/16	“ 7/16	80.8	23.78	2.44	7.47	. . .	294	290
“ “ ½	“ ½	91.8	27.00	2.47	7.45	. . .	334	330
“ “ 9/16	“ 9/16	102.8	30.24	2.50	7.42	. . .	374	369
“ “ ⅝	“ ⅝	113 9	33.44	2.52	7.40	. . .	414	409
“ “ 11/16	“ 11/16	124.5	36.61	2.55	7.38	. . .	453	448
“ “ ¾	“ ¾	135.5	39.79	2.58	7.36	. . .	492	486
“ “ 13/16	“ 13/16	145.7	42.86	2.61	7.34	. . .	531	525
“ “ ⅞	“ ⅞	156.4	45.94	2.64	7.32	. . .	569	563
“ “ 15/16	“ 15/16	166.6	48.99	2.67	7.29	. . .	607	600
“ “ 1	“ 1	176.8	52.00	2.70	7.27	. . .	644	637

SAFE LOADS IN THOUSANDS OF POUNDS FOR PLATE AND ANGLE COLUMNS. SQUARE ENDS.

CALCULATED FOR LEAST RADIUS OF GYRATION AXIS 1-1.



Based on Gordon's Formula $P = \dfrac{50\,000}{1 + \dfrac{(12\,L)^2}{36\,000\,r^2}}$.

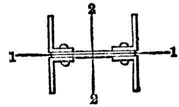
Safety Factor 4.

Length in Feet.

8	10	12	14	16	18	20	22	24	26	28	30	32	34
86	78	71	63	57	..	..	..	..	..	..	..	..	..
107	98	89	80	72	..	..	..	..	..	..	..	..	..
128	118	107	97	87	..	..	..	..	..	..	..	..	..
150	138	126	114	103	..	..	..	..	..	..	..	..	..
171	158	145	131	119	..	..	..	..	..	..	..	..	..
192	178	164	149	135	..	..	..	..	..	..	..	..	..
213	198	182	167	152	..	..	..	..	..	..	..	..	..
96	90	83	77	70	64	58	..	..	..	..	..	..	..
120	112	104	96	88	81	74	..	..	..	..	..	..	..
143	135	125	116	107	98	89	..	..	..	..	..	..	..
167	157	146	136	125	115	105	..	..	..	..	..	..	..
190	179	167	156	144	132	122	..	..	..	..	..	..	..
213	201	188	175	162	150	138	..	..	..	..	..	..	..
236	223	210	195	181	168	155	..	..	..	..	..	..	..
258	245	230	215	200	186	171	..	..	..	..	..	..	..
281	267	251	235	219	204	188	..	..	..	..	..	..	..
144	136	128	120	111	103	95	88	81	..	..	..	..	..
172	163	154	144	134	124	115	106	98	..	..	..	..	..
200	190	180	168	157	146	135	125	116	..	..	..	..	..
228	217	205	193	180	168	156	144	133	..	..	..	..	..
255	244	231	217	203	189	176	163	151	..	..	..	..	..
283	270	256	241	226	211	197	183	170	..	..	..	..	..
310	297	282	266	250	234	218	203	188	..	..	..	..	..
337	323	307	290	273	256	239	223	207	..	..	..	..	..
364	349	332	315	296	278	260	243	226	..	..	..	..	..
390	375	357	339	320	301	282	263	246	..	..	..	..	..
178	172	165	158	150	142	134	126	118	111	104	..	..	..
213	206	198	189	180	170	161	152	143	134	126	..	..	..
248	240	231	220	210	199	188	178	167	157	148	..	..	..
282	273	263	252	240	228	216	204	192	181	170	..	..	..
316	307	295	283	270	257	243	230	217	204	192	..	..	..
350	340	327	314	300	286	271	256	242	228	215	..	..	..
384	372	359	345	330	314	298	283	267	252	238	..	..	..
417	405	391	376	360	343	326	309	293	277	261	..	..	..
450	437	423	407	390	372	354	336	318	301	284	..	..	..
483	470	454	437	419	401	382	363	344	326	308	..	..	..
515	501	485	468	449	430	410	390	370	350	332	..	..	..
245	239	233	225	217	209	201	192	183	175	166	158	150	143
285	278	271	262	253	244	234	224	214	204	194	185	176	167
324	317	308	299	289	278	267	256	245	234	223	212	202	192
363	355	346	336	325	313	301	288	276	264	251	240	228	217
402	393	383	372	360	347	334	321	307	293	280	267	254	242
440	431	420	408	395	382	367	353	338	323	309	295	281	268
478	469	457	445	431	416	401	385	369	353	338	323	308	293
516	506	494	480	466	450	434	417	400	383	367	350	334	319
554	543	530	516	501	484	467	449	431	414	396	378	362	345
591	580	567	552	535	518	500	481	463	444	425	407	389	371
628	616	602	587	570	552	533	513	494	474	454	435	416	397

SAFE LOADS IN THOUSANDS OF POUNDS FOR PLATE AND ANGLE COLUMNS. SQUARE ENDS.

CALCULATED FOR LEAST RADIUS OF GYRATION AXIS 1-1.



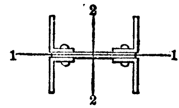
Based on Gordon's Formula $P = \dfrac{50\,000}{1 + \dfrac{(12\,L)^2}{36\,000\,r^2}}$.

Safety factor 4.

Size of Angles. Inches.	Size of Plates. Inches.	Weight of Column. Lbs. per Ft.	Area of Column Section. Sq. Ins.	Least Radius of Gyration Axis 1-1. Inches.	Radius of Gyration Axis 2-2. Inches.	Length in Feet. 6	8	10
7 x 3½ x 7/16	14 x 7/16	80.8	23.78	3.05	5.92	292	289	285
“ “ 1/2	“ 1/2	91.8	27.00	3.08	5.90	332	329	324
“ “ 9/16	“ 9/16	103.2	30.24	3.11	5.87	372	368	363
“ “ 5/8	“ 5/8	113.7	33.48	3.13	5.85	412	407	402
“ “ 11/16	“ 11/16	124.7	36.61	3.17	5.83	451	446	440
“ “ 3/4	“ 3/4	135.3	39.79	3.20	5.81	490	485	478
“ “ 13/16	“ 13/16	145.9	42.90	3.23	5.79	528	523	516
“ “ 7/8	“ 7/8	156.5	45.98	3.26	5.76	567	561	553
“ “ 15/16	“ 15/16	166.6	49.03	3.29	5.74	604	598	591
“ “ 1	“ 1	176.8	52.00	3.32	5.72	642	635	627
7 x 3½ x 7/16	16 x 7/16	83.8	24.65	3.00	6.75	303	299	294
“ “ 1/2	“ 1/2	95.2	28.00	3.02	6.73	345	340	335
“ “ 9/16	“ 9/16	107.0	31.36	3.06	6.71	386	382	376
“ “ 5/8	“ 5/8	118.0	34.73	3.08	6.69	427	422	416
“ “ 11/16	“ 11/16	129.4	37.98	3.11	6.67	468	463	456
“ “ 3/4	“ 3/4	140.4	41.29	3.14	6.64	508	503	496
“ “ 13/16	“ 13/16	151.4	44.52	3.17	6.62	548	542	535
“ “ 7/8	“ 7/8	162.4	47.73	3.20	6.60	588	582	574
“ “ 15/16	“ 15/16	173.0	50.90	3.23	6.58	627	621	612
“ “ 1	“ 1	183.6	54.00	3.26	6.56	666	659	651
7 x 3½ x 7/16	18 x 7/16	86.8	25.53	2.94	7.58	313	309	305
“ “ 1/2	“ 1/2	98.6	29.00	2.97	7.55	357	352	347
“ “ 9/16	“ 9/16	110.8	32.49	3.00	7.53	400	395	389
“ “ 5/8	“ 5/8	122.3	35.98	3.02	7.51	442	437	430
“ “ 11/16	“ 11/16	134.1	39.36	3.06	7.49	485	479	472
“ “ 3/4	“ 3/4	145.5	42.79	3.08	7.47	526	520	513
“ “ 13/16	“ 13/16	156.9	46.15	3.11	7.44	568	562	554
“ “ 7/8	“ 7/8	168.4	49.48	3.14	7.42	609	602	594
“ “ 15/16	“ 15/16	179.4	52.78	3.17	7.40	650	643	634
“ “ 1	“ 1	190.4	56.00	3.20	7.38	690	683	674
7 x 3½ x 7/16	20 x 7/16	89.8	26.40	2.89	8.39	324	320	314
“ “ 1/2	“ 1/2	102.0	30.00	2.92	8.37	369	364	358
“ “ 9/16	“ 9/16	114.7	33.61	2.95	8.34	413	408	402
“ “ 5/8	“ 5/8	126.5	37.23	2.97	8.32	457	452	445
“ “ 11/16	“ 11/16	138.7	40.73	3.00	8.30	501	495	488
“ “ 3/4	“ 3/4	150.6	44.29	3.03	8.28	545	538	530
“ “ 13/16	“ 13/16	162.5	47.77	3.06	8.25	588	581	572
“ “ 7/8	“ 7/8	174.3	51.23	3.09	8.23	630	623	614
“ “ 15/16	“ 15/16	185.8	54.65	3.12	8.21	673	665	656
“ “ 1	“ 1	197.2	58.00	3.15	8.19	715	707	697

SAFE LOADS IN THOUSANDS OF POUNDS FOR PLATE AND ANGLE COLUMNS. SQUARE ENDS.

CALCULATED FOR LEAST RADIUS OF GYRATION AXIS 1-1.



Based on Gordon's Formula $P = \dfrac{50\,000}{1+\dfrac{(12\,L)^2}{36\,000\,r^2}}$.

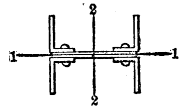
Safety factor 4.

Length in Feet.

12	14	16	18	20	22	24	26	28	30	32	34	36	38	40
279	274	267	260	253	246	238	230	222	214	206	198	191	183	176
318	312	305	297	289	280	271	263	254	245	236	227	218	210	201
357	350	342	333	324	315	305	295	286	276	266	256	246	237	228
395	387	379	369	359	349	339	328	317	306	295	284	274	263	253
433	424	415	405	395	384	372	360	349	337	325	313	302	290	279
470	462	452	441	430	418	406	393	380	368	355	342	330	318	306
508	498	488	477	465	452	439	425	412	398	385	371	358	345	332
545	535	524	512	499	486	472	458	443	429	415	400	386	372	358
581	571	559	547	534	520	505	490	475	460	444	429	414	399	385
618	607	595	582	568	553	538	522	506	490	474	458	442	427	412
289	283	276	269	261	253	245	236	228	220	211	203	195	187	180
329	322	315	307	298	289	280	270	261	251	242	232	223	214	206
369	362	353	344	335	325	314	304	293	283	272	262	252	242	233
409	400	391	381	371	360	349	337	326	314	303	291	280	269	259
448	439	429	419	407	396	383	371	359	346	334	321	309	297	286
487	478	467	456	444	431	418	405	391	378	364	351	338	325	313
526	516	505	493	480	466	452	438	424	409	395	381	367	353	340
564	554	542	529	516	501	487	472	456	441	426	411	396	381	367
603	591	579	566	551	536	521	505	489	473	457	441	425	409	394
640	629	616	602	587	571	555	538	521	504	487	471	454	437	421
299	292	285	277	269	260	252	243	234	255	216	208	199	191	. .
340	333	325	316	307	297	287	277	267	257	248	238	228	219	. .
382	374	365	355	345	334	323	312	301	290	279	268	258	247	. .
423	414	404	393	382	371	359	347	335	322	310	298	287	275	. .
463	454	443	432	420	407	395	382	368	355	342	329	316	304	. .
504	494	483	470	457	444	430	416	402	388	374	360	346	333	. .
544	533	521	508	495	481	466	451	436	420	405	390	376	361	. .
584	573	560	546	532	517	501	485	469	453	437	421	405	390	. .
624	612	598	584	569	553	536	520	503	486	469	452	435	419	. .
663	650	636	622	606	589	572	554	536	518	500	483	465	448	. .
308	301	294	285	277	268	258	249	240	230	221	212	204	195	. .
351	343	335	326	316	306	295	285	274	264	253	243	233	224	. .
394	385	376	366	355	344	332	321	309	297	286	274	263	253	. .
436	427	417	405	394	381	369	356	343	330	318	305	293	281	. .
479	468	457	445	432	419	406	392	378	364	350	337	323	310	. .
521	510	498	485	471	457	442	427	412	397	383	368	354	340	. .
562	551	538	524	510	495	479	463	447	431	415	400	384	369	. .
603	591	578	563	548	532	515	499	482	465	448	431	415	399	. .
644	632	618	602	586	569	552	534	516	498	480	463	445	428	. .
685	672	657	641	624	607	588	570	551	532	513	494	476	458	. .

SAFE LOADS IN THOUSANDS OF POUNDS FOR PLATE AND ANGLE COLUMNS. SQUARE ENDS.

CALCULATED FOR RADIUS OF GYRATION AXIS 2-2.



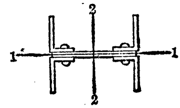
Based on Gordon's Formula $P = \dfrac{50\,000}{1 + \dfrac{(12\,L)^2}{36\,000\,r^2}}$.

Safety factor 4.

Size of Angles.	Size of Plates.	Weight of Column.	Area of Column Section.	Least Radius of Gyration Axis 1-1.	Radius of Gyration Axis 2-2.	Length in Feet.		
Inches.	Inches.	Lbs. per Ft.	Sq. Ins.	Inches.	Inches.	4	6	8
3 x 2½ x ¼	6 x ¼	23.1	6.79	1.24	2.41	83	82	81
“ “ 5/16	“ 5/16	28.8	8.40	1.27	2.39	103	102	100
“ “ 3/8	“ 3/8	34.1	9.98	1.30	2.37	123	121	119
“ “ 7/16	“ 7/16	39.3	11.53	1.33	2.35	142	140	137
“ “ ½	“ ½	44.2	13.00	1.36	2.33	161	158	155
“ “ 9/16	“ 9/16	49.5	14.49	1.39	2.31	179	176	173
“ “ 5/8	“ 5/8	54.4	15.94	1.43	2.29	197	194	190
3½ x 2½ x ¼	7 x ¼	25.6	7.50	1.46	2.88	93	92	91
“ “ 5/16	“ 5/16	31.8	9.30	1.49	2.86	115	114	113
“ “ 3/8	“ 3/8	37.7	11.07	1.52	2.84	137	136	134
“ “ 7/16	“ 7/16	43.6	12.83	1.55	2.82	159	157	155
“ “ ½	“ ½	49.5	14.50	1.58	2.80	180	178	176
“ “ 9/16	“ 9/16	55.0	16.17	1.61	2.78	200	198	196
“ “ 5/8	“ 5/8	60.9	17.82	1.65	2.76	221	219	216
“ “ 11/16	“ 11/16	66.4	19.46	1.68	2.74	241	238	235
“ “ ¾	“ ¾	71.5	21.00	1.71	2.72	260	257	254
4 x 3 x 5/16	8 x 5/16	37.3	10.86	1.67	3.25	. . .	134	133
“ “ 3/8	“ 3/8	44.2	12.98	1.70	3.23	. . .	160	158
“ “ 7/16	“ 7/16	51.1	15.02	1.73	3.21	. . .	185	183
“ “ ½	“ ½	58.0	17.00	1.76	3.18	. . .	210	207
“ “ 9/16	“ 9/16	64.9	19.02	1.79	3.16	. . .	234	231
“ “ 5/8	“ 5/8	71.4	20.98	1.82	3.14	. . .	258	255
“ “ 11/16	“ 11/16	77.9	22.86	1.85	3.12	. . .	282	278
“ “ ¾	“ ¾	84.4	24.75	1.89	3.10	. . .	305	301
“ “ 13/16	“ 13/16	90.5	26.61	1.92	3.08	. . .	328	324
“ “ 7/8	“ 7/8	97.0	28.44	1.95	3.06	. . .	350	346
5 x 3½ x 5/16	10 x 5/16	45.4	13.36	2.08	4.10	. . .	166	165
“ “ 3/8	“ 3/8	54.4	15.94	2.10	4.08	. . .	198	196
“ “ 7/16	“ 7/16	62.9	18.49	2.13	4.06	. . .	229	228
“ “ ½	“ ½	71.4	21.00	2.16	4.04	. . .	260	258
“ “ 9/16	“ 9/16	79.9	23.53	2.19	4.02	. . .	291	289
“ “ 5/8	“ 5/8	88.5	25.98	2.22	4.00	. . .	321	319
“ “ 11/16	“ 11/16	96.6	28.40	2.25	3.98	. . .	351	349
“ “ ¾	“ ¾	104.7	30.79	2.29	3.96	. . .	381	378
“ “ 13/16	“ 13/16	112.8	33.11	2.32	3.93	. . .	410	407
“ “ 7/8	“ 7/8	120.6	35.48	2.35	3.91	. . .	439	436
“ “ 15/16	“ 15/16	128.7	37.74	2.38	3.89	. . .	467	464
6 x 3½ x 3/8	12 x 3/8	62.1	18.23	2.56	5.01	. . .	. . .	225
“ “ 7/16	“ 7/16	71.9	21.15	2.59	4.99	. . .	. . .	261
“ “ ½	“ ½	81.6	24.00	2.62	4.97	. . .	. . .	297
“ “ 9/16	“ 9/16	91.4	26.86	2.65	4.95	. . .	. . .	332
“ “ 5/8	“ 5/8	101.1	29.69	2.68	4.93	. . .	. . .	367
“ “ 11/16	“ 11/16	110.5	32.48	2.71	4.91	. . .	. . .	402
“ “ ¾	“ ¾	120.2	35.29	2.74	4.88	. . .	. . .	436
“ “ 13/16	“ 13/16	129.2	37.98	2.77	4.86	. . .	. . .	470
“ “ 7/8	“ 7/8	138.5	40.69	2.80	4.84	. . .	. . .	503
“ “ 15/16	“ 15/16	147.5	43.36	2.83	4.82	. . .	. . .	536
“ “ 1	“ 1	156.4	46.00	2.86	4.80	. . .	. . .	569

SAFE LOADS IN THOUSANDS OF POUNDS FOR PLATE AND ANGLE COLUMNS. SQUARE ENDS.

CALCULATED FOR RADIUS OF GYRATION AXIS 2-2.



Based on Gordon's Formula $P=\dfrac{50\,000}{1+\dfrac{(12\,L)^2}{36\,000\,r^2}}$.

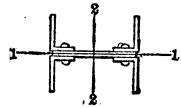
Safety factor 4.

Length in Feet.

10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40
79	77	74	72	69	66	63	60	58	55	52	..	..	..	..	..
98	95	92	89	85	82	78	75	71	68	64	..	..	..	..	..
116	113	109	105	101	97	92	88	84	80	76	..	..	..	..	..
134	130	126	121	116	111	106	101	96	92	87	..	..	..	..	..
151	147	142	137	131	126	120	114	108	103	98	..	..	..	..	..
169	163	158	152	146	139	133	127	120	114	108	..	..	..	..	..
185	180	173	167	160	153	146	138	132	125	118	..	..	..	..	..
89	88	86	83	81	79	76	73	71	68	65	63	60	58	..	..
111	109	106	103	100	97	94	91	87	84	81	77	74	71	..	..
132	129	126	123	119	115	112	108	104	100	96	92	88	84	..	..
152	149	146	142	137	133	129	124	119	115	110	106	101	97	..	..
172	169	165	160	156	151	145	140	135	129	124	119	114	109	..	..
192	188	183	178	173	167	162	156	150	144	138	132	126	121	..	..
212	207	202	196	190	184	178	171	164	158	151	145	139	132	..	..
230	225	220	214	207	200	193	186	178	171	164	157	150	144	..	..
249	244	237	231	223	216	208	200	192	184	177	169	161	154	..	..
131	129	126	124	121	118	115	111	108	105	101	98	94	91	88	85
156	153	150	147	144	140	136	132	128	124	120	116	112	108	104	100
180	177	174	170	166	162	158	153	148	143	139	134	129	124	120	115
204	201	197	193	188	184	178	173	168	162	157	151	146	141	135	130
228	224	220	215	210	205	199	193	187	181	175	168	162	156	150	145
252	247	243	237	231	225	219	212	206	199	192	185	178	172	165	159
274	270	264	259	252	245	238	231	224	216	209	201	194	187	179	173
297	292	286	280	273	265	258	250	242	233	225	217	209	201	193	186
319	314	307	300	293	285	276	268	259	250	241	232	224	215	207	199
341	335	328	321	312	304	295	285	276	266	257	248	238	229	220	211
163	161	160	157	155	153	150	147	144	141	138	134	131	128	124	121
195	193	190	188	185	182	179	175	171	168	164	160	156	152	148	144
226	223	221	218	214	211	207	203	199	194	190	185	181	176	171	166
256	254	250	247	243	239	235	230	225	220	215	210	205	199	194	189
287	284	280	276	272	267	262	257	251	246	240	234	228	222	216	210
316	313	309	305	300	295	289	283	277	271	265	258	251	245	238	232
346	342	338	333	328	322	316	309	303	296	289	282	274	267	260	252
375	371	366	361	355	349	342	335	328	320	312	305	297	289	281	273
403	399	394	388	382	375	368	360	352	344	336	327	319	310	301	293
432	427	421	415	408	401	393	385	377	368	359	350	340	331	322	313
460	454	449	442	435	427	418	410	400	391	381	371	362	352	342	332
224	222	221	218	216	214	211	208	205	202	199	196	192	189	185	181
260	258	256	253	251	248	245	242	238	234	231	227	223	218	214	210
295	293	291	288	285	282	278	274	270	266	262	257	253	248	243	238
330	328	325	322	319	315	311	307	302	298	293	288	282	277	272	266
365	363	360	356	352	348	344	339	334	329	323	318	312	306	300	294
399	397	393	389	385	381	376	371	365	359	353	347	341	334	327	321
433	430	427	422	418	413	408	402	396	389	383	376	369	362	355	347
467	463	460	455	450	445	439	433	426	419	412	405	397	389	382	374
500	496	492	487	482	476	470	463	456	449	441	433	425	417	408	400
533	529	524	519	513	507	500	493	486	478	469	461	452	443	434	425
565	561	556	551	544	538	530	523	515	506	497	488	479	469	460	450

SAFE LOADS IN THOUSANDS OF POUNDS FOR PLATE AND ANGLE COLUMNS. SQUARE ENDS.

CALCULATED FOR RADIUS OF GYRATION AXIS 2-2.



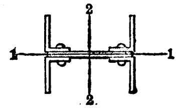
Based on Gordon's Formula $P = \dfrac{50\,000}{1 + \dfrac{(12\,L)^2}{36\,000\,r^2}}$.

Safety factor 4.

Size of Angles.	Size of Plates.	Weight of Column.	Area of Column Section.	Least Radius of Gyration Axis 1-1.	Radius of Gyration Axis 2-2.	Length in Feet.		
Inches.	Inches.	Lbs. per Ft.	Sq. Ins.	Inches.	Inches.	4	6	8
3 x 2½ x ¼	8 x ¼	24.8	7.29	1.19	3.25	90	89	88
" " 5/16	" 5/16	30.9	9.02	1.22	3.23	112	111	110
" " ⅜	" ⅜	36.6	10.73	1.25	3.21	133	132	130
" " 7/16	" 7/16	42.3	12.40	1.28	3.19	154	152	151
" " ½	" ½	47.6	14.00	1.31	3.17	174	173	171
" " 9/16	" 9/16	53.3	15.61	1.34	3.15	194	192	190
" " ⅝	" ⅝	58.6	17.19	1.37	3.13	213	212	209
3½ x 2½ x ¼	8 x ¼	26.4	7.75	1.44	3.31	...	96	95
" " 5/16	" 5/16	32.9	9.61	1.47	3.28	...	119	117
" " ⅜	" ⅜	39.0	11.44	1.50	3.26	...	141	140
" " 7/16	" 7/16	45.1	13.27	1.53	3.24	...	163	161
" " ½	" ½	51.2	15.00	1.56	3.22	...	185	183
" " 9/16	" 9/16	56.9	16.73	1.59	3.20	...	206	204
" " ⅝	" ⅝	63.0	18.44	1.62	3.18	...	227	225
" " 11/16	" 11/16	68.7	20.15	1.65	3.16	...	248	245
" " ¾	" ¾	74.0	21.75	1.68	3.14	...	268	265
4 x 3 x 5/16	10 x 5/16	39.4	11.49	1.62	4.09	...	142	141
" " ⅜	" ⅜	46.8	13.73	1.65	4.07	...	170	169
" " 7/16	" 7/16	54.1	15.90	1.68	4.04	...	197	195
" " ½	" ½	61.4	18.00	1.71	4.02	...	223	222
" " 9/16	" 9/16	68.7	20.15	1.74	4.00	...	249	247
" " ⅝	" ⅝	75.7	22.23	1.77	3.98	...	275	273
" " 11/16	" 11/16	82.6	24.24	1.80	3.96	...	300	298
" " ¾	" ¾	89.5	26.25	1.83	3.94	...	325	323
" " 13/16	" 13/16	96.0	28.24	1.86	3.92	...	350	347
" " ⅞	" ⅞	103.0	30.19	1.90	3.90	...	374	371
5 x 3½ x 5/16	12 x 5/16	47.6	13.98	2.03	4.95	...	...	173
" " ⅜	" ⅜	56.9	16.69	2.06	4.92	...	...	206
" " 7/16	" 7/16	65.9	19.36	2.08	4.90	...	...	239
" " ½	" ½	74.8	22.00	2.11	4.88	...	...	272
" " 9/16	" 9/16	83.8	24.65	2.14	4.86	...	...	304
" " ⅝	" ⅝	92.7	27.23	2.17	4.84	...	...	336
" " 11/16	" 11/16	101.3	29.77	2.20	4.82	...	...	368
" " ¾	" ¾	109.8	32.29	2.23	4.80	...	...	399
" " 13/16	" 13/16	118.4	34.73	2.26	4.78	...	...	429
" " ⅞	" ⅞	126.5	37.23	2.29	4.76	...	...	460
" " 15/16	" 15/16	135.1	39.61	2.33	4.74	...	...	490
6 x 3½ x ⅜	14 x ⅜	64.7	18.98	2.51	5.85	...	...	..
" " 7/16	" 7/16	74.8	22.03	2.54	5.83	...	...	..
" " ½	" ½	85.0	25.00	2.57	5.81	...	...	..
" " 9/16	" 9/16	95.2	27.99	2.59	5.79	...	...	..
" " ⅝	" ⅝	105.3	30.94	2.62	5.77	...	...	..
" " 11/16	" 11/16	115.1	33.86	2.65	5.74	...	...	..
" " ¾	" ¾	125.3	36.79	2.68	5.72	...	...	..
" " 13/16	" 13/16	134.7	39.61	2.71	5.70	...	...	..
" " ⅞	" ⅞	144.5	42.44	2.74	5.68	...	...	..
" " 15/16	" 15/16	153.8	45.24	2.77	5.66	...	...	..
" " 1	" 1	163.2	48.00	2.81	5.64	...	...	..

SAFE LOADS IN THOUSANDS OF POUNDS FOR PLATE AND ANGLE COLUMNS. SQUARE ENDS.

CALCULATED FOR RADIUS OF GYRATION AXIS 2-2.



Based on Gordon's Formula $P = \dfrac{50\,000}{1 + \dfrac{(12\,L)^2}{36\,000\,r^2}}$.

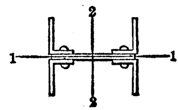
Safety factor 4.

Length in Feet.

10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40
87	86	84	83	81	79	77	74	72	70	68	65	63	61	59	56
108	106	104	102	100	97	95	92	89	86	83	81	78	75	72	70
129	127	124	122	119	116	112	109	106	102	99	96	92	89	86	82
149	146	143	140	137	133	130	126	122	118	114	110	106	102	99	95
168	166	162	159	155	151	147	142	138	133	129	124	120	115	111	107
188	184	181	177	173	168	163	158	153	148	143	138	133	128	123	119
206	203	199	195	190	185	179	174	168	163	157	151	146	140	135	130
93	92	90	89	87	85	82	80	78	75	73	70	68	66	63	61
116	114	112	110	108	105	102	99	96	93	90	87	84	81	78	75
138	136	133	130	127	124	121	118	114	110	107	103	100	96	93	89
159	157	154	151	147	144	140	136	132	127	123	119	115	111	107	103
181	178	174	171	167	162	158	153	149	144	139	134	130	125	120	116
201	198	194	190	186	181	176	171	165	160	155	149	144	139	134	129
222	218	214	209	204	199	193	188	182	176	170	164	158	152	147	141
242	238	233	228	222	217	211	204	198	191	185	178	172	165	159	153
261	257	252	246	240	234	227	220	213	206	199	192	185	178	171	165
140	139	137	135	133	131	129	126	124	121	118	115	112	110	107	104
167	165	163	161	159	156	153	150	147	144	141	137	134	130	127	123
194	192	189	187	184	181	177	174	170	166	162	159	155	151	147	143
220	217	215	212	208	205	201	197	193	189	184	180	175	170	166	161
245	243	240	236	233	229	224	220	215	210	205	200	195	190	185	180
271	268	264	261	256	252	247	242	237	232	226	220	215	209	203	198
295	292	289	284	280	275	270	264	258	253	246	240	234	228	222	215
320	316	312	308	303	298	292	286	280	273	266	260	253	246	239	232
344	340	336	331	326	320	314	307	300	293	286	279	271	264	257	249
368	364	359	354	348	342	335	328	320	313	305	297	289	282	274	266
172	171	169	168	166	164	162	160	157	155	152	150	147	144	141	139
205	204	202	200	198	196	193	191	188	185	182	178	175	172	168	165
238	236	234	232	230	227	224	221	218	214	210	207	203	199	195	191
270	269	266	264	261	258	254	251	247	243	239	235	230	226	221	217
303	300	298	295	292	288	284	280	276	272	267	262	257	252	247	242
334	332	329	326	322	318	314	309	305	300	295	289	284	278	273	267
365	363	359	356	352	348	343	338	333	327	322	316	310	304	298	291
396	393	390	386	382	377	372	366	361	355	349	342	336	329	322	315
427	423	420	415	411	406	400	394	388	382	375	368	361	354	346	339
457	453	449	445	440	434	428	422	415	408	401	394	386	378	370	362
486	483	478	474	468	462	456	449	442	434	427	419	410	402	394	385
234	233	231	230	228	226	224	222	219	217	214	211	209	206	203	199
272	270	269	267	265	263	260	257	255	252	249	245	242	239	235	231
309	307	305	303	301	298	296	293	289	286	282	279	275	271	267	263
346	344	342	340	337	334	331	327	324	320	316	312	307	303	298	294
382	380	378	375	372	369	365	362	358	353	349	344	340	335	330	324
418	416	413	411	407	404	400	396	391	387	382	377	371	366	360	355
454	451	449	445	442	438	434	429	424	419	414	408	403	397	391	384
489	487	483	480	476	472	467	462	457	452	446	440	433	427	420	414
524	521	518	514	510	505	500	495	490	484	477	471	464	457	450	443
559	556	552	548	544	539	533	528	521	515	508	501	494	487	479	471
593	589	586	581	577	571	566	559	553	546	539	532	524	516	508	500

SAFE LOADS IN THOUSANDS OF POUNDS FOR PLATE AND ANGLE COLUMNS. SQUARE ENDS.

CALCULATED FOR RADIUS OF GYRATION AXIS 2-2.



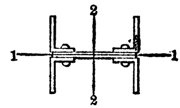
Based on Gordon's Formula $P = \dfrac{50\,000}{1 + \dfrac{(12\,L)^2}{36\,000\,r^2}}$.

Safety factor 4.

Size of Angles.	Size of Plates.	Weight of Column.	Area of Column Section.	Least Radius of Gyration Axis 1-1.	Radius of Gyration Axis 2-2.	Length in Feet.		
Inches.	Inches.	Lbs. per Ft.	Sq. Ins.	Inches.	Inches.	6	8	10
3 x 2½ x ¼	10 x ¼	26.5	7.79	1.16	4.07	96	95	95
" " 5/16	" 5/16	33.0	9.65	1.18	4.05	119	118	117
" " 3/8	" 3/8	39.2	11.48	1.21	4.03	142	141	140
" " 7/16	" 7/16	45.3	13.28	1.24	4.01	164	163	161
" " ½	" ½	51.0	15.00	1.27	3.99	186	185	183
" " 9/16	" 9/16	57.1	16.74	1.30	3.96	207	206	204
" " 5/8	" 5/8	62.9	18.44	1.33	3.94	228	227	225
3½ x 2½ x ¼	10 x ¼	28.1	8.25	1.39	4.13	102	102	101
" " 5/16	" 5/16	35.0	10.24	1.42	4.11	127	126	125
" " 3/8	" 3/8	41.6	12.19	1.45	4.09	151	150	149
" " 7/16	" 7/16	48.1	14.15	1.48	4.07	175	174	172
" " ½	" ½	54.6	16.00	1.51	4.05	198	197	195
" " 9/16	" 9/16	60.7	17.86	1.54	4.03	221	220	218
" " 5/8	" 5/8	67.3	19.69	1.57	4.01	244	242	240
" " 11/16	" 11/16	73.4	21.53	1.60	3.99	266	264	262
" " ¾	" ¾	79.1	23.25	1.63	3.97	288	286	283
4 x 3 x 5/16	12 x 5/16	41.6	12.11	1.58	4.91	...	150	149
" " 3/8	" 3/8	49.3	14.48	1.61	4.89	...	179	178
" " 7/16	" 7/16	57.1	16.77	1.64	4.87	...	207	206
" " ½	" ½	64.8	19.00	1.66	4.85	...	235	234
" " 9/16	" 9/16	72.6	21.27	1.69	4.83	...	262	261
" " 5/8	" 5/8	79.9	23.48	1.72	4.81	...	290	288
" " 11/16	" 11/16	87.3	25.61	1.75	4.79	...	317	315
" " ¾	" ¾	94.6	27.75	1.78	4.77	...	343	341
" " 13/16	" 13/16	101.6	29.86	1.81	4.74	...	369	367
" " 7/8	" 7/8	108.9	31.94	1.84	4.72	...	395	392
5 x 3½ x 5/16	14 x 5/16	49.7	14.61	1.98	5.77	...	...	180
" " 3/8	" 3/8	59.5	17.44	2.01	5.75	...	...	215
" " 7/16	" 7/16	68.8	20.24	2.04	5.73	...	...	250
" " ½	" ½	78.2	23.00	2.07	5.71	...	...	284
" " 9/16	" 9/16	87.6	25.78	2.09	5.69	...	...	318
" " 5/8	" 5/8	96.9	28.48	2.12	5.67	...	...	351
" " 11/16	" 11/16	105.9	31.15	2.15	5.64	...	...	384
" " ¾	" ¾	114.9	33.79	2.18	5.62	...	...	417
" " 13/16	" 13/16	123.9	36.36	2.21	5.60	...	...	449
" " 7/8	" 7/8	132.5	38.98	2.24	5.58	...	...	481
" " 15/16	" 15/16	141.4	41.49	2.27	5.56	...	...	512
6 x 3½ x 3/8	16 x 3/8	67.2	19.73	2.46	6.68	...	...	..
" " 7/16	" 7/16	77.8	22.90	2.49	6.66	...	...	..
" " ½	" ½	88.4	26.00	2.52	6.64	...	...	..
" " 9/16	" 9/16	99.0	29.11	2.54	6.61	...	...	..
" " 5/8	" 5/8	109.6	32.19	2.57	6.59	...	...	..
" " 11/16	" 11/16	119.8	35.23	2.60	6.57	...	...	..
" " ¾	" ¾	130.4	38.29	2.63	6.55	...	...	..
" " 13/16	" 13/16	140.2	41.23	2.66	6.53	...	...	..
" " 7/8	" 7/8	150.4	44.19	2.69	6.51	...	...	..
" " 15/16	" 15/16	160.2	47.11	2.72	6.48	...	...	..
" " 1	" 1	170.0	50.00	2.75	6.46	...	...	..

SAFE LOADS IN THOUSANDS OF POUNDS FOR PLATE AND ANGLE COLUMNS. SQUARE ENDS.

CALCULATED FOR RADIUS OF GYRATION AXIS 2-2.



Based on Gordon's Formula $P=\dfrac{50\,000}{1+\dfrac{(12\,L)^2}{36\,000\,r^2}}$.

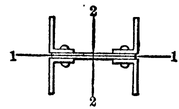
Safety factor 4.

Length in Feet.

12	14	16	18	20	22	24	26	28	30	32	34	36	38	40
94	92	91	90	88	87	85	83	81	80	78	76	74	72	70
116	115	113	111	109	107	105	103	101	98	96	94	91	89	86
138	136	135	132	130	128	125	123	120	117	114	111	108	105	103
160	158	156	153	150	148	145	142	138	135	132	128	125	122	118
181	179	176	173	170	167	164	160	157	153	149	145	141	138	134
202	199	196	193	190	186	183	179	174	170	166	162	157	153	149
222	219	216	213	209	205	201	196	192	187	182	178	173	168	163
100	99	97	96	94	93	91	89	87	85	83	81	79	77	75
124	122	121	119	117	115	113	110	108	106	103	101	98	95	93
147	146	144	141	139	137	134	131	128	125	122	119	116	113	110
170	168	166	164	161	158	155	152	148	145	141	138	134	131	127
193	191	188	185	182	179	175	172	168	164	160	156	152	148	144
216	213	210	207	203	199	195	191	187	183	178	174	169	165	160
238	235	231	228	224	220	215	211	206	201	196	191	186	181	176
259	256	252	248	244	239	235	230	224	219	214	208	203	197	191
280	277	273	268	264	259	253	248	242	236	231	225	219	213	207
148	147	145	144	142	140	138	136	134	132	129	127	125	122	120
176	175	173	171	169	167	165	162	160	157	154	151	148	145	142
204	202	200	198	196	193	191	188	185	182	178	175	172	168	165
232	230	228	225	222	219	216	213	210	206	202	198	195	191	187
259	257	254	251	248	245	242	238	234	230	226	221	217	213	208
286	283	281	277	274	270	266	262	258	254	249	244	239	234	229
312	310	306	303	299	295	291	286	282	277	272	266	261	256	250
338	335	332	328	324	320	315	310	305	299	294	288	282	277	271
364	361	357	353	348	344	339	333	328	322	316	310	303	297	291
389	386	382	377	373	367	362	356	350	344	337	331	324	317	310
180	178	177	176	174	173	171	169	167	165	163	160	158	156	153
214	213	211	210	208	206	204	202	199	197	194	191	188	186	183
249	247	245	243	241	239	236	234	231	228	225	222	218	215	212
283	281	279	277	274	271	269	265	262	259	255	252	248	244	240
316	314	312	309	307	304	300	297	293	290	286	281	277	273	269
349	347	345	342	339	335	332	328	324	320	315	311	306	301	296
382	380	377	374	370	367	363	358	354	349	345	340	334	329	324
414	412	409	405	402	398	393	389	384	379	373	368	362	357	351
446	443	440	436	432	428	423	418	413	408	402	396	390	384	378
478	475	471	467	463	458	453	448	442	436	430	424	417	411	404
509	506	502	498	493	488	483	477	471	465	458	451	444	437	430
243	242	241	239	238	236	234	232	230	228	225	223	221	218	215
282	281	279	278	276	274	272	269	267	264	262	259	256	253	250
321	319	318	316	314	311	309	306	303	300	297	294	291	287	284
359	357	356	353	351	348	346	343	340	336	333	329	325	321	317
397	395	393	391	388	385	382	379	375	372	368	364	359	355	351
435	433	430	428	425	421	418	414	411	406	402	398	393	388	384
472	470	467	464	461	457	454	450	446	441	436	432	427	421	416
509	506	503	500	497	493	489	485	480	475	470	465	459	454	448
545	542	539	536	532	528	524	519	514	509	504	498	492	486	480
581	578	575	571	567	563	558	553	548	542	537	531	524	518	511
617	613	610	606	602	597	592	587	581	575	569	563	556	549	542

SAFE LOADS IN THOUSANDS OF POUNDS FOR PLATE AND ANGLE COLUMNS. SQUARE ENDS.

CALCULATED FOR RADIUS OF GYRATION AXIS 2-2.



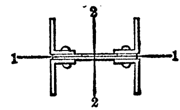
Based on Gordon's Formula $P=\dfrac{50\,000}{1+\dfrac{(12\,L)^2}{36\,000\,r^2}}$.

Safety factor 4.

Size of Angles. Inches.	Size of Plates. Inches.	Weight of Column. Lbs. per Ft.	Area of Column Section. Sq. Ins.	Least Radius of Gyration Axis 1-1. Inches.	Radius of Gyration Axis 2-2. Inches.	Length in Feet. 6	8	10
3 x 2½ x ¼	12 x ¼	28.2	8.29	1.12	4.87	103	102	101
" " 5/16	" 5/16	35.2	10.27	1.15	4.85	127	126	126
" " 3/8	" 3/8	41.7	12.23	1.17	4.83	151	151	150
" " 7/16	" 7/16	48.3	14.15	1.20	4.81	175	174	173
" " ½	" ½	54.4	16.00	1.23	4.78	199	198	197
" " 9/16	" 9/16	61.0	17.86	1.26	4.76	222	221	219
" " 5/8	" 5/8	67.1	19.69	1.28	4.74	245	243	242
3½ x 2½ x ¼	12 x ¼	29.8	8.75	1.35	4.94	...	108	108
" " 5/16	" 5/16	37.2	10.86	1.38	4.92	...	134	134
" " 3/8	" 3/8	44.1	12.94	1.41	4.90	...	160	159
" " 7/16	" 7/16	51.1	15.02	1.43	4.88	...	185	184
" " ½	" ½	58.0	17.00	1.46	4.85	...	210	209
" " 9/16	" 9/16	64.6	18.98	1.49	4.83	...	235	233
" " 5/8	" 5/8	71.5	20.94	1.52	4.81	...	259	257
" " 11/16	" 11/16	78.1	22.90	1.55	4.79	...	283	281
" " ¾	" ¾	84.2	24.75	1.58	4.77	...	306	304
4 x 3 x 5/16	14 x 5/16	43.7	12.74	1.54	5.72	...	158	157
" " 3/8	" 3/8	51.9	15.23	1.57	5.70	...	188	188
" " 7/16	" 7/16	60.0	17.65	1.60	5.68	...	218	217
" " ½	" ½	68.2	20.00	1.62	5.66	...	248	247
" " 9/16	" 9/16	76.4	22.40	1.65	5.63	...	277	276
" " 5/8	" 5/8	84.1	24.73	1.68	5.61	...	306	305
" " 11/16	" 11/16	91.9	26.99	1.71	5.59	...	335	333
" " ¾	" ¾	99.7	29.25	1.74	5.57	...	363	361
" " 13/16	" 13/16	107.1	31.49	1.77	5.55	...	390	389
" " 7/8	" 7/8	114.9	33.69	1.80	5.53	...	418	416
5 x 3½ x 5/16	16 x 5/16	51.8	15.23	1.94	6.59	...	...	189
" " 3/8	" 3/8	62.0	18.19	1.97	6.57	...	...	225
" " 7/16	" 7/16	71.8	21.11	2.00	6.54	...	...	261
" " ½	" ½	81.6	24.00	2.02	6.52	...	...	297
" " 9/16	" 9/16	91.4	26.90	2.05	6.50	...	...	333
" " 5/8	" 5/8	101.2	29.73	2.08	6.48	...	...	368
" " 11/16	" 11/16	110.6	32.52	2.11	6.46	...	...	402
" " ¾	" ¾	120.0	35.29	2.14	6.44	...	...	436
" " 13/16	" 13/16	129.4	37.98	2.17	6.41	...	...	470
" " 7/8	" 7/8	138.4	40.73	2.19	6.39	...	...	504
" " 15/16	" 15/16	147.8	43.36	2.22	6.37	...	...	537
6 x 3½ x 3/8	18 x 3/8	69.8	20.48	2.42	7.49	...	...	..
" " 7/16	" 7/16	80.8	23.78	2.44	7.47	...	...	..
" " ½	" ½	91.8	27.00	2.47	7.45	...	...	..
" " 9/16	" 9/16	102.8	30.24	2.50	7.42	...	...	..
" " 5/8	" 5/8	113.9	33.44	2.52	7.40	...	...	..
" " 11/16	" 11/16	124 5	36.61	2.55	7.38	...	...	..
" " ¾	" ¾	135.5	39.79	2.58	7.36	...	...	..
" " 13/16	" 13/16	145.7	42.86	2.61	7.34	...	...	..
" " 7/8	" 7/8	156.4	45.94	2.64	7.32	...	...	..
" " 15/16	" 15/16	166.6	48.99	2.67	7.29	...	...	..
" " 1	" 1	176.8	52.00	2.70	7.27	...	...	..

SAFE LOADS IN THOUSANDS OF POUNDS FOR PLATE AND ANGLE COLUMNS. SQUARE ENDS.

CALCULATED FOR RADIUS OF GYRATION AXIS 2-2.



Based on Gordon's Formula $P = \dfrac{50\,000}{1 + \dfrac{(12\,L)^2}{36\,000\,r^2}}$.

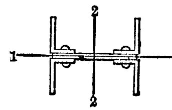
Safety factor 4.

Length in Feet.

12	14	16	18	20	22	24	26	28	30	32	34	36	38	40
101	100	99	98	97	95	94	93	91	90	88	86	85	83	81
125	124	123	121	120	118	116	115	113	111	109	107	105	103	101
149	147	146	144	143	141	139	137	134	132	130	127	125	122	120
172	171	169	167	165	163	160	158	155	153	150	147	144	141	138
195	193	191	189	187	184	182	179	176	173	170	166	163	160	156
218	216	214	211	209	206	203	199	196	193	189	185	182	178	174
240	238	235	233	230	227	223	220	216	212	208	204	200	196	192
107	106	105	104	103	101	100	98	97	95	94	92	90	88	87
133	131	130	129	127	126	124	122	120	118	116	114	112	110	107
158	157	155	153	152	150	148	145	143	141	138	136	133	130	128
183	181	180	178	175	173	171	168	165	163	160	157	154	151	148
207	206	204	201	199	196	194	191	188	184	181	178	174	171	167
232	230	227	225	222	219	216	213	209	206	202	198	194	190	186
255	253	251	248	245	242	238	234	231	227	222	218	214	210	205
279	276	274	270	267	264	260	256	251	247	242	238	233	228	223
302	299	296	293	289	285	281	277	272	267	262	257	252	247	241
156	156	154	153	152	150	149	147	145	143	142	140	137	135	133
187	185	184	183	181	179	177	175	173	171	169	166	164	161	159
216	215	213	212	210	208	205	203	201	198	195	193	190	187	184
246	244	242	240	238	236	233	231	228	225	222	218	215	212	208
275	273	271	269	266	263	261	258	254	251	248	244	240	236	233
303	301	299	296	294	291	288	284	281	277	273	269	265	261	257
331	329	327	324	321	318	314	311	307	303	298	294	289	285	280
359	357	354	351	348	344	340	336	332	328	323	318	313	308	303
386	384	381	378	374	370	366	362	357	352	347	342	337	331	326
413	411	407	404	400	396	392	387	382	377	371	366	360	354	348
188	187	186	185	184	182	181	179	178	176	174	172	170	168	166
224	223	222	221	219	218	216	214	212	210	208	205	203	201	198
260	259	258	256	254	252	250	248	246	243	241	238	235	233	230
296	295	293	291	289	287	285	282	279	277	274	271	267	264	261
331	330	328	326	324	321	318	316	313	309	306	303	299	295	292
366	364	362	360	357	355	352	349	345	342	338	334	330	326	322
400	399	396	394	391	388	385	381	378	374	370	365	361	357	352
435	432	430	427	424	421	417	414	410	405	401	396	392	387	382
468	466	463	460	457	453	450	445	441	437	432	427	422	416	411
502	499	496	493	489	486	481	477	472	467	462	457	451	446	440
534	532	529	525	521	517	513	508	503	498	492	487	481	475	468
253	252	251	250	248	247	245	244	242	240	238	236	234	232	229
294	293	291	290	288	287	285	283	281	279	276	274	272	269	266
334	333	331	330	328	326	324	322	319	317	314	312	309	306	303
374	373	371	369	367	365	363	360	358	355	352	349	346	342	339
414	412	410	408	406	404	401	398	395	392	389	385	382	378	374
453	451	449	447	445	442	439	436	433	429	426	422	418	414	410
492	490	488	485	483	480	477	473	470	466	462	458	453	449	444
530	528	526	523	520	517	514	510	506	502	498	493	489	484	479
568	566	563	561	558	554	551	547	542	538	533	529	524	518	513
606	603	601	598	595	591	587	583	578	574	569	563	558	552	547
643	641	638	634	631	627	623	618	614	609	603	598	592	586	580

SAFE LOADS IN THOUSANDS OF POUNDS FOR PLATE AND ANGLE COLUMNS. SQUARE ENDS.

CALCULATED FOR RADIUS OF GYRATION AXIS 2-2.



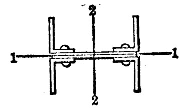
Based on Gordon's Formula $P=\dfrac{50\,000}{1+\dfrac{(12\,L)^2}{36\,000\,r^2}}$.

Safety Factor 4.

Size of Angles.	Size of Plates.	Weight of Column.	Area of Column Section.	Least Radius of Gyration Axis 1-1.	Radius of Gyration Axis 2-2.	Length in Feet.	
Inches.	Inches.	Lbs. per Ft.	Sq. Ins.	Inches.	Inches.	10	12
7 x 3½ x 7/16	14 x 7/16	80.8	23.78	3.05	5.92	293	292
" " 1/2	" 1/2	91.8	27.00	3.08	5.90	334	332
" " 9/16	" 9/16	103.2	30.24	3.11	5.87	374	372
" " 5/8	" 5/8	113.7	33.48	3.13	5.85	413	411
" " 11/16	" 11/16	124.7	36.61	3.17	5.83	452	450
" " 3/4	" 3/4	135.3	39.79	3.20	5.81	491	489
" " 13/16	" 13/16	145.9	42.90	3.23	5.79	529	527
" " 7/8	" 7/8	156.5	45.98	3.26	5.76	567	564
" " 15/16	" 15/16	166.6	49.03	3.29	5.74	605	602
" " 1	" 1	176.8	52.00	3.32	5.72	642	639
7 x 3½ x 7/16	16 x 7/16	83.8	24.65	3.00	6.75	. . .	304
" " 1/2	" 1/2	95.2	28.00	3.02	6.73	. . .	346
" " 9/16	" 9/16	107.0	31.36	3.06	6.71	. . .	387
" " 5/8	" 5/8	118.0	34.73	3.08	6.69	. . .	428
" " 11/16	" 11/16	129.4	37.98	3.11	6.67	. . .	469
" " 3/4	" 3/4	140.4	41.29	3.14	6.64	. . .	509
" " 13/16	" 13/16	151.4	44.52	3.17	6.62	. . .	549
" " 7/8	" 7/8	162.4	47.73	3.20	6.60	. . .	588
" " 15/16	" 15/16	173.0	50.90	3.23	6.58	. . .	627
" " 1	" 1	183.6	54.00	3.26	6.56	. . .	666
7 x 3½ x 7/16	18 x 7/16	86.8	25.53	2.94	7.58	. . .	315
" " 1/2	" 1/2	98.6	29.00	2.97	7.55	. . .	359
" " 9/16	" 9/16	110.8	32.49	3.00	7.53	. . .	402
" " 5/8	" 5/8	122.3	35.98	3.02	7.51	. . .	445
" " 11/16	" 11/16	134.1	39.36	3.06	7.49	. . .	487
" " 3/4	" 3/4	145.5	42.79	3.08	7.47	. . .	529
" " 13/16	" 13/16	156.9	46.15	3.11	7.44	. . .	570
" " 7/8	" 7/8	168.4	49.48	3.14	7.42	. . .	612
" " 15/16	" 15/16	179.4	52.78	3.17	7.40	. . .	652
" " 1	" 1	190.4	56.00	3.20	7.38	. . .	693
7 x 3½ x 7/16	20 x 7/16	89.8	26.40	2.89	8.39	. . .	. . .
" " 1/2	" 1/2	102.0	30.00	2.92	8.37	. . .	. . .
" " 9/16	" 9/16	114.7	33.61	2.95	8.34	. . .	. . .
" " 5/8	" 5/8	126.5	37.23	2.97	8.32	. . .	. . .
" " 11/16	" 11/16	138.7	40.73	3.00	8.30	. . .	. . .
" " 3/4	" 3/4	150.6	44.29	3.03	8.28	. . .	. . .
" " 13/16	" 13/16	162.5	47.77	3.06	8.25	. . .	. . .
" " 7/8	" 7/8	174.3	51.23	3.09	8.23	. . .	. . .
" " 15/16	" 15/16	185.8	54.65	3.12	8.21	. . .	. . .
" " 1	" 1	197.2	58.00	3.15	8.19	. . .	. . .

SAFE LOADS IN THOUSANDS OF POUNDS FOR PLATE AND ANGLE COLUMNS. SQUARE ENDS.

CALCULATED FOR RADIUS OF GYRATION AXIS 2-2.



Based on Gordon's Formula $P = \dfrac{50\,000}{1 + \dfrac{(12\,L)^2}{36\,000\,r^2}}$.

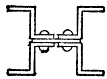
Safety Factor 4.

Length in Feet.

14	16	18	20	22	24	26	28	30	32	34	36	38	40
290	288	286	284	281	278	275	272	269	266	262	258	255	251
330	328	325	323	320	317	313	310	306	302	298	294	289	285
370	367	364	361	358	354	351	347	342	338	333	329	324	319
409	406	403	399	396	392	387	383	378	373	368	363	358	352
447	444	441	437	433	429	424	419	414	408	403	397	391	385
486	482	478	474	470	465	460	455	449	443	437	431	424	418
523	520	516	511	506	501	496	490	484	477	471	464	457	450
561	557	553	548	543	537	531	525	518	511	504	497	489	482
598	594	589	584	578	572	566	559	552	545	537	529	521	513
635	630	625	620	614	607	600	593	586	578	570	561	553	544
302	301	299	297	295	293	290	288	285	282	279	276	273	270
344	342	340	338	336	333	330	327	324	321	318	314	310	307
385	383	381	379	376	373	370	366	363	359	355	352	347	343
426	424	421	419	416	412	409	405	401	397	393	389	384	379
467	464	461	458	455	451	448	443	439	435	430	425	420	415
507	504	501	498	494	490	486	481	477	472	467	461	456	450
546	543	540	536	532	528	524	519	514	509	503	497	491	485
586	582	579	575	571	566	561	556	551	545	539	533	526	520
624	621	617	613	609	604	598	593	587	581	574	568	561	554
663	659	655	651	646	641	635	629	623	616	609	602	595	588
314	313	312	310	308	306	304	302	300	297	295	292	290	287
358	356	354	353	351	348	346	344	341	338	335	332	329	326
401	399	397	395	393	390	388	385	382	379	376	372	369	365
443	441	439	437	434	432	429	426	422	419	415	411	408	403
485	483	481	478	476	473	469	466	462	459	455	450	446	442
527	525	522	519	516	513	510	506	502	498	493	489	484	479
568	566	563	560	557	553	550	546	541	537	532	527	522	517
609	607	604	601	597	593	589	585	580	575	570	565	559	554
650	647	644	641	637	633	628	624	619	613	608	602	596	590
690	687	684	680	676	672	667	662	657	651	645	639	633	626
326	325	324	322	321	319	317	315	313	311	309	307	305	302
371	370	368	367	365	363	361	359	357	354	352	349	346	344
415	414	412	411	409	407	404	402	399	397	394	391	388	385
460	458	456	454	452	450	447	445	442	439	436	432	429	426
503	502	500	498	495	493	490	487	484	481	477	473	470	466
547	545	543	541	538	535	532	529	526	522	518	514	510	506
590	588	585	583	580	577	574	570	567	563	559	554	550	545
633	630	628	625	622	619	615	612	608	603	599	594	590	585
675	672	670	667	664	660	656	652	648	644	639	634	629	623
717	714	711	708	705	701	697	693	688	683	678	673	667	662

SAFE LOADS IN THOUSANDS OF POUNDS FOR Z-BAR COLUMNS.
SQUARE ENDS.

Based on Gordon's Formula $P = \dfrac{50\,000}{1 + \dfrac{(12\,L)^2}{36\,000\,r^2}}$. **Safety factor 4.**

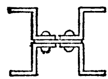


Section of Column.	Thickness of Web-plate and Z-Bars.	Area of Column Section.	Weight of Column per Foot.	Least Radius of Gyration.	Length in Feet.					
	Inch.	Sq. Ins.	Pounds.	Inches.	4	6	8	10	12	14
4-3" Z-Bars and 1 Web-plate 5¾" wide.	¼	9.31	31.7	1.86	114	112	108	104	100	95
	5/16	11.72	39.7	1.91	144	141	137	132	126	121
	⅜	13.59	46.1	1.88	167	163	158	153	146	139
	7/16	15.97	54.2	1.93	196	192	187	180	173	165
	½	17.62	59.8	1.90	216	212	206	198	190	181
	9/16	19.97	67.8	1.95	245	240	234	226	216	207
4-4" Z-Bars and 1 Web-plate 6¾" wide.	¼	11.31	38.5	2.46	140	138	135	132	129	125
	5/16	14.22	48.4	2.51	176	174	171	167	163	158
	⅜	17.16	58.2	2.56	212	210	207	202	197	191
	7/16	19.14	65.2	2.49	237	234	230	225	219	213
	½	22.00	74.7	2.54	272	269	265	259	253	245
	9/16	24.89	84.5	2.59	308	305	300	293	287	279
	⅝	26.41	89.9	2.52	327	323	317	310	302	293
	11/16	29.22	99.4	2.57	362	358	352	344	336	327
	¾	32.06	109.2	2.62	397	392	386	379	369	360
4-5" Z-Bars and 1 Web-plate 7" wide.	5/16	15.78	52.8	3.08	. . .	194	192	189	186	182
	⅜	19.03	64.5	3.13	. . .	234	232	229	225	220
	7/16	22.31	76.0	3.18	. . .	275	272	269	264	259
	½	24.50	83.5	3.10	. . .	302	298	294	289	283
	9/16	27.70	94.2	3.15	. . .	341	338	333	327	321
	⅝	30.94	105.3	3.21	. . .	381	377	372	367	359
	11/16	32.66	111.2	3.13	. . .	402	398	392	386	378
	¾	35.81	121.9	3.18	. . .	441	437	431	423	415
	13/16	39.00	132.5	3.24	. . .	481	476	469	462	454
4-6" Z-Bars and 1 Web-plate 7¾" wide.	⅜	21.28	72.3	3.68	. . .	263	261	258	255	251
	7/16	24.94	84.7	3.73	. . .	309	306	303	299	295
	½	28.62	97.2	3.78	. . .	354	352	348	344	339
	9/16	31.08	105.6	3.70	. . .	385	381	377	373	367
	⅝	34.69	118.1	3.75	. . .	429	426	421	417	411
	11/16	38.33	130.5	3.73	. . .	474	471	466	460	453
	¾	40.31	137.0	3.67	. . .	499	494	490	483	476
	13/16	43.87	149.0	3.65	. . .	543	538	533	525	519
	⅞	47.47	161.5	3.63	. . .	587	582	575	569	559

For detail dimensions see page 203.

SAFE LOADS IN THOUSANDS OF POUNDS FOR Z-BAR COLUMNS. SQUARE ENDS.

Based on Gordon's Formula $P = \dfrac{50\,000}{1 + \dfrac{(12\,L)^2}{36\,000\,r^2}}$. **Safety factor** 4.

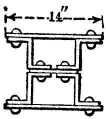


Length in Feet.											Thickness of Web-plate and Z-Bars.
16	18	20	22	24	26	28	30	32	34	36	Inch.
90	85	79	...	...	...	...	...	...	...	...	1/4
114	108	102	...	...	...	...	...	...	...	...	5/16
132	124	117	...	...	...	...	...	...	...	...	3/8
157	148	139	...	...	...	...	...	...	...	...	7/16
172	162	153	...	...	...	...	...	...	...	...	1/2
197	186	175	...	...	...	...	...	...	...	...	9/16
121	117	112	107	102	98	...	...	...	...	...	1/4
153	147	142	136	130	124	...	...	...	...	...	5/16
186	179	173	166	158	151	...	...	...	...	...	3/8
206	198	190	183	175	167	...	...	...	...	...	7/16
237	229	220	211	203	194	...	...	...	...	...	1/2
270	260	251	241	231	222	...	...	...	...	...	9/16
285	275	264	253	243	232	...	...	...	...	...	5/8
317	305	294	282	271	259	...	...	...	...	...	11/16
349	337	326	313	299	288	...	...	...	...	...	3/4
178	174	169	164	159	154	148	143	138	133	...	5/16
215	210	204	199	192	186	181	174	168	161	...	3/8
254	247	241	234	228	220	213	206	198	191	...	7/16
276	270	262	255	248	239	231	223	215	206	...	1/2
314	306	299	289	281	271	263	254	245	236	...	9/16
352	344	335	325	316	306	297	287	276	267	...	5/8
370	360	351	341	330	320	310	298	288	277	...	11/16
407	396	386	376	365	353	342	331	318	307	...	3/4
445	433	423	411	400	388	376	362	350	338	...	13/16
248	243	238	233	228	221	216	210	204	199	192	3/8
290	285	279	274	268	261	254	248	241	234	227	7/16
334	328	322	315	309	300	293	286	278	270	263	1/2
362	354	348	341	332	325	316	308	300	290	282	9/16
404	397	390	381	373	364	354	345	336	326	317	5/8
446	439	429	421	412	401	391	381	370	360	348	11/16
468	460	451	440	431	419	409	397	387	374	364	3/4
509	500	489	479	467	456	443	432	419	407	394	13/16
551	539	529	516	505	491	480	465	453	438	426	7/8

For detail dimensions see page 203.

SAFE LOADS IN THOUSANDS OF POUNDS FOR Z-BAR COLUMNS WITH COVER PLATES.

Based on Gordon's Formula $P = \dfrac{50\,000}{1 + \dfrac{(12\,L)^2}{36\,000\,r^2}}$. **Safety Factor 4.**

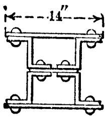


SQUARE ENDS.

Section of Column.	Thickness of Cover Plates.	Area of Column Section.	Weight of Column.	Least Radius of Gyration.	Length in Feet.						
	Inch.	Sq. Ins.	Lbs. per Ft.	Inches.	10	12	14	16	18	20	22
4 Z-Bars 6⅛" x 3⅝" x 11/16" and 1 Web-plate 7¾" x 11/16"	3/8	48.83	166.2	3.80	594	587	579	570	560	549	538
	7/16	50.58	172.2	3.81	615	608	600	591	580	569	558
	1/2	52.33	178.1	3.82	637	629	621	611	601	589	577
	9/16	54.08	184.1	3.82	658	650	642	632	621	609	597
	5/8	55.83	190.0	3.83	679	671	662	652	641	629	616
	11/16	57.58	196.0	3.84	701	693	683	673	661	649	636
	3/4	59.33	201.9	3.84	722	714	704	694	682	669	656
	13/16	61.08	207.9	3.85	743	735	725	714	702	689	675
	7/8	62.83	213.8	3.85	765	756	746	735	722	709	695
4 Z-Bars 6" x 3½" x ¾" and 1 Web-plaie 7¾" x ¾"	3/8	50.81	172.7	3.75	618	610	602	592	582	570	558
	7/16	52.56	178.6	3.76	639	631	623	613	602	590	578
	1/2	54.31	184.6	3.77	660	653	643	633	622	610	598
	9/16	56.06	190.5	3.78	682	674	664	654	643	630	617
	5/8	57.81	196.5	3.79	703	695	685	675	663	650	637
	11/16	59.56	202.4	3.80	724	716	706	695	683	670	656
	3/4	61.31	208.4	3.80	746	737	727	716	703	690	676
	13/16	63.06	214.3	3.81	767	758	748	736	724	710	696
	7/8	64.81	220.3	3.82	789	779	769	757	744	730	715
4 Z-Bars 6 1/16" x 3 9/16" x 13/16" and 1 Web-plate 7¾" x 13/16"	3/8	54.37	184.7	3.73	661	653	643	633	622	610	597
	7/16	56.12	190.7	3.74	682	674	664	654	642	630	616
	1/2	57.87	196.6	3.75	703	695	685	674	662	650	636
	9/16	59.62	202.6	3.76	725	716	706	695	683	670	656
	5/8	61.37	208.5	3.77	746	737	727	716	703	690	675
	11/16	63.12	214.5	3.78	768	758	748	736	723	709	695
	3/4	64.87	220.4	3.78	789	780	769	757	744	729	714
	13/16	66.62	226.4	3.79	810	801	790	777	764	749	734
	7/8	68.37	232.3	3.80	832	822	811	798	784	769	754
4 Z-Bars 6⅛" x 3⅝" x ⅞" and 1 Web-plate 7¾" x ⅞"	3/8	57.97	197.2	3.71	704	696	686	674	662	649	635
	7/16	59.72	203.1	3.72	726	717	706	695	683	669	655
	1/2	61.47	209.1	3.73	747	738	727	716	703	689	675
	9/16	63.22	215.0	3.74	768	759	748	736	723	709	694
	5/8	64.97	221.0	3.75	790	780	769	757	744	729	714
	11/16	66.72	226.9	3.76	811	801	790	778	764	749	733
	3/4	68.47	232.9	3.76	832	822	811	798	784	769	753
	13/16	70.22	238.8	3.77	854	844	832	819	804	789	773
	7/8	71.97	244.8	3.78	875	865	853	839	825	809	792

SAFE LOADS IN THOUSANDS OF POUNDS FOR Z-BAR COLUMNS WITH COVER PLATES.

Based on Gordon's Formula $P = \dfrac{50\,000}{1 + \dfrac{(12\,L)^2}{36\,000\,r^2}}$. **Safety factor 4.**

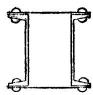


SQUARE ENDS.

Length in Feet. 24	26	28	30	32	34	36	38	40	42	44	46	Thickness of Cover Plates. Inch.
526	514	501	489	475	462	449	436	423	410	397	385	3/8
546	533	520	506	493	479	466	452	439	425	412	399	7/16
565	552	538	524	510	496	482	468	454	441	427	414	1/2
584	570	557	542	528	514	499	485	470	456	442	428	9/16
603	589	575	560	546	531	516	501	486	471	457	443	5/8
622	608	593	578	563	548	532	517	502	487	472	457	11/16
642	627	612	596	581	565	549	533	517	502	487	471	3/4
661	646	630	614	598	582	566	549	533	517	501	486	13/16
680	664	648	632	616	599	582	565	549	532	516	500	7/8
546	533	520	506	492	478	464	450	437	423	410	397	3/8
565	552	538	524	510	495	481	467	453	439	425	411	7/16
584	571	556	542	527	512	498	483	468	454	440	426	1/2
604	589	575	560	545	530	514	499	484	469	455	440	9/16
623	608	593	578	562	547	531	515	500	485	469	455	5/8
642	627	612	596	580	564	548	532	516	500	484	469	11/16
661	646	630	614	597	581	564	548	531	515	499	484	3/4
680	665	648	632	615	598	581	564	547	531	514	498	13/16
700	683	667	650	632	615	598	580	563	546	529	512	7/8
583	569	555	540	525	510	495	480	466	451	437	423	3/8
602	588	573	558	543	527	512	497	482	467	452	437	7/16
622	607	592	576	560	545	529	513	497	482	467	452	1/2
641	626	610	594	578	562	545	529	513	497	482	466	9/16
660	644	628	612	595	579	562	545	529	513	496	481	5/8
679	663	647	630	613	596	579	562	545	528	511	495	11/16
699	682	665	648	631	613	595	578	560	543	526	510	3/4
718	701	684	666	648	630	612	594	576	559	541	524	13/16
737	720	702	684	666	647	629	610	592	574	556	539	7/8
621	606	590	574	559	543	526	511	495	479	464	449	3/8
640	625	609	592	576	560	543	527	511	495	479	463	7/16
659	643	627	610	594	577	560	543	526	510	494	478	1/2
678	662	646	628	611	594	577	559	542	525	509	492	9/16
698	681	664	646	629	611	593	576	558	541	524	507	5/8
717	700	682	664	646	628	610	592	574	556	538	521	11/16
736	719	701	682	664	645	627	608	590	571	553	536	3/4
755	738	719	700	681	662	643	624	605	587	568	550	13/16
775	756	738	718	699	679	660	640	621	602	583	565	7/8

SAFE LOADS IN THOUSANDS OF POUNDS FOR LATTICED CHANNEL COLUMNS. SQUARE ENDS.

Based on Gordon's Formula $P = \dfrac{50\,000}{1 + \dfrac{(12\,L)^2}{36\,000\,r^2}}$. **Safety factor** 4.

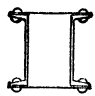


Depth of Channel.	Weight of each Channel.	Area of Column Section.	Least Radius of Gyration.	Length in Feet.					
Inches.	Lbs. per Foot.	Sq. Ins.	Inches.	4	6	8	10	12	14
6	8.0	4.76	2.34	59	58	57	55	54	52
"	10.5	6.18	2.21	76	75	73	71	69	67
"	13.0	7.64	2.13	94	93	90	88	85	81
"	15.5	9.12	2.06	112	110	107	104	100	96
7	9.75	5.70	2.72	71	70	69	68	66	65
"	12.25	7.20	2.59	89	88	87	85	83	81
"	14.75	8.68	2.50	107	106	104	102	99	96
"	17.25	10.14	2.44	125	124	121	119	116	112
"	19.75	11.62	2.39	144	142	139	136	132	128
8	11.25	6.70	3.11	83	83	82	80	79	77
"	13.75	8.08	2.99	100	99	98	97	95	93
"	16.25	9.56	2.89	119	117	116	114	112	109
"	18.75	11.02	2.82	137	135	134	131	128	125
"	21.25	12.50	2.77	155	153	151	149	145	142
9	13.25	7.78	3.45	...	96	95	94	93	91
"	15.00	8.82	3.37	...	109	108	107	105	103
"	20.00	11.76	3.20	...	145	143	142	139	137
"	25.00	14.70	3.08	...	181	179	177	173	170
10	15.0	8.92	3.84	...	110	110	109	107	106
"	20.0	11.76	3.66	...	146	144	143	141	139
"	25.0	14.70	3.52	...	182	180	178	176	173
"	30.0	17.64	3.41	...	218	216	213	210	207
"	35.0	20.58	3.31	...	254	251	248	245	240
12	20.5	12.06	4.61	...	...	149	148	147	146
"	25.0	14.70	4.43	...	...	181	180	179	177
"	30.0	17.64	4.28	...	...	217	216	214	211
"	35.0	20.58	4.17	...	...	254	251	249	246
"	40.0	23.52	4.09	...	...	289	287	284	281
15	33.0	19.80	5.59	...	...	246	244	243	241
"	35.0	20.58	5.56	...	...	255	254	252	251
"	40.0	23.52	5.44	...	...	291	290	288	286
"	45.0	26.48	5.32	...	...	328	326	324	322
"	50.0	29.42	5.23	...	...	364	363	360	357
"	55.0	32.36	5.16	...	...	400	399	396	393

For detail dimensions see page 206.

SAFE LOADS IN THOUSANDS OF POUNDS FOR LATTICED CHANNEL COLUMNS. SQUARE ENDS.

Based on Gordon's Formula $P=\dfrac{50\,000}{1+\dfrac{(12\ L)^2}{36000\,r^2}}$. **Safety factor** 4.

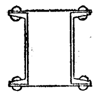


Length in Feet.								Weight of each Channel.	Depth of Channels.
16	18	20	22	24	26	28	30	Lbs. per Foot.	Inches.
50	48	46	44	42	. . .	. . .	. . .	8.0	6
64	61	58	55	52	. . .	. . .	. . .	10.5	"
78	74	71	67	63	. . .	. . .	. . .	13.0	"
92	88	83	78	74	. . .	. . .	. . .	15.5	"
63	61	58	56	54	52	. . .	. . .	9.75	7
78	76	73	70	67	64	. . .	. . .	12.25	"
93	90	86	83	79	76	. . .	. . .	14.75	"
108	104	100	96	92	87	. . .	. . .	17.25	"
123	119	113	108	104	98	. . .	. . .	19.75	"
76	74	72	70	68	65	63	61	11.25	8
90	88	86	83	80	78	75	72	13.75	"
107	104	100	97	94	90	87	83	16.25	"
122	118	115	111	107	103	99	95	18.75	"
138	134	129	124	120	115	111	106	21.25	"
90	88	86	84	82	80	77	75	13.25	9
101	99	97	94	92	90	87	84	15.00	"
134	131	127	124	120	116	113	109	20.00	"
166	162	157	153	149	143	139	134	25.00	"
104	102	101	99	97	95	93	90	15.0	10
136	134	131	128	125	122	119	116	20.0	"
170	166	163	159	155	151	146	143	25.0	"
203	198	194	189	185	179	174	168	30.0	"
236	230	225	219	213	207	201	194	35.0	"
144	142	140	138	136	134	131	129	20.5	12
175	172	170	167	165	161	159	155	25.0	"
209	206	203	200	196	192	187	184	30.0	"
243	240	236	231	227	223	218	213	35.0	"
277	273	268	263	258	253	248	243	40.0	"
240	238	235	233	230	228	225	222	33.0	15
249	247	245	242	240	236	234	230	35.0	"
284	282	279	276	273	269	266	262	40.0	"
319	316	313	310	306	302	298	294	45.0	"
354	352	348	344	339	334	329	325	50.0	"
390	386	381	377	372	368	362	357	55.0	"

For detail dimensions see page 206.

SAFE LOADS IN THOUSANDS OF POUNDS FOR LATTICED CHANNEL COLUMNS. SQUARE ENDS.

Based on Gordon's Formula $P = \dfrac{50\,000}{1 + \dfrac{(12\,L)^2}{36\,000\,r^2}}$. **Safety factor 4.**



Depth of Channels.	Weight of each Channel.	Area of Column Section.	Least Radius of Gyration.	Length in Feet.				
Inches.	Lbs. per Foot.	Sq. Ins.	Inches.	32	34	36	38	40
9	13.25	7.78	3.45	73	71	....	....	....
"	15.00	8.82	3.37	81	79	....	....	....
"	20.00	11.76	3.20	106	101	....	....	....
"	25.00	14.70	3.08	129	124	....	....	....
10	15.0	8.92	3.84	87	85	83	....	....
"	20.0	11.76	3.66	113	109	106	....	....
"	25.0	14.70	3.52	138	134	130	....	....
"	30.0	17.64	3.41	163	158	153	....	....
"	35.0	20.58	3.31	188	183	176	....	....
12	20.5	12.06	4.61	127	124	121	119	116
"	25.0	14.70	4.43	152	149	146	142	139
"	30.0	17.64	4.28	180	176	172	167	164
"	35.0	20.58	4.17	208	203	199	193	188
"	40.0	23.52	4.09	236	231	224	218	212
15	33.0	19.80	5.59	219	215	213	209	206
"	35.0	20.58	5.56	228	224	220	217	213
"	40.0	23.52	5 44	258	254	250	246	241
"	45.0	26.48	5.32	289	284	279	275	270
"	50.0	29.42	5.23	320	315	309	303	299
"	55.0	32.36	5.16	351	344	338	332	325

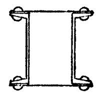
For detail dimensions see page 206.

SIZE OF LATTICE BARS TO BE USED WITH LATTICED CHANNEL COLUMNS.

Depth of Channels.	Dimensions of Lattice Bars.		Weight of Lattice Bars per Foot.	Center of Hole to End of Bar. (a)	Distance Center to Center of Rivets. (d)	
	w	Thickness.			Maximum.	Minimum.
Inches.	Inches.	Inch.	Pounds.	Inch.		
6	$1\frac{1}{2}$	$\frac{1}{4}$	1.28	$1\frac{1}{8}$	0'—$11\frac{1}{2}$"	$6\frac{5}{8}$"
7	$1\frac{3}{4}$	$\frac{1}{4}$	1.49	$1\frac{1}{8}$	1'— $1\frac{1}{2}$"	$7\frac{5}{8}$"
8	2	$\frac{5}{16}$	2.12	$1\frac{1}{4}$	1'— 3"	$8\frac{11}{16}$"
9	2	$\frac{5}{16}$	2.12	$1\frac{1}{4}$	1'— $4\frac{1}{2}$"	$9\frac{1}{2}$"
10	2	$\frac{3}{8}$	2.55	$1\frac{1}{4}$	1'— $6\frac{1}{2}$"	$10\frac{11}{16}$"
12	$2\frac{1}{4}$	$\frac{3}{8}$	2.87	$1\frac{3}{8}$	1'—$10\frac{1}{2}$"	13"
15	$2\frac{1}{2}$	$\frac{3}{8}$	3.19	$1\frac{1}{2}$	2'— $2\frac{1}{2}$"	$15\frac{5}{16}$"

SAFE LOADS IN THOUSANDS OF POUNDS FOR LATTICED CHANNEL COLUMNS. SQUARE ENDS.

Based on Gordon's Formula $P=\dfrac{50\,000}{1+\dfrac{(12\,L)^2}{36\,000\,r^2}}$. **Safety factor** 4.

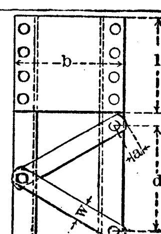


Length in Feet.							Weight of each Channel.	Depth of Channels.
42	44	46	48	50	52	54	Lbs. per Foot.	Inches.
....	....	....	....	....	....	....	13.25	9
....	....	....	....	....	....	....	15.00	"
....	....	....	....	....	....	....	20.00	"
....	....	....	....	....	....	....	25.00	"
....	....	....	....	....	....	....	15.0	10
....	....	....	....	....	....	....	20.0	"
....	....	....	....	....	....	....	25.0	"
....	....	....	....	....	....	....	30.0	"
....	....	....	....	....	....	....	35.0	"
113	111	108	....	....	....	....	20.5	12
135	132	128	....	....	....	....	25.0	"
159	155	151	....	....	....	....	30.0	"
183	178	173	....	....	....	....	35.0	"
206	200	196	....	....	....	....	40.0	"
202	199	195	192	188	184	181	33.0	15
210	206	203	199	194	191	187	35.0	"
238	233	228	224	220	215	211	40.0	"
265	260	255	250	245	239	234	45.0	"
293	287	281	275	269	264	258	50.0	"
319	314	307	301	294	287	281	55.0	"

For detail dimensions see page 206.

SIZE OF STAY PLATES TO BE USED WITH LATTICED CHANNEL COLUMNS.

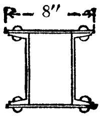
Minimum Size of Stay Plates at Ends of Columns.			Weight of Minimum Stay Plates.	Diameter of Rivets.
b	Thickness.	l		
Inches.	Inch.	Inches.	Pounds.	Inch.
$8\frac{1}{4}$	$\frac{1}{4}$	$7\frac{1}{2}$	4.38	$\frac{5}{8}$
$9\frac{1}{4}$	$\frac{1}{4}$	10	6.55	$\frac{5}{8}$
$10\frac{1}{2}$	$\frac{5}{16}$	9	8.37	$\frac{3}{4}$
$11\frac{1}{4}$	$\frac{5}{16}$	12	11.95	$\frac{3}{4}$
$12\frac{1}{4}$	$\frac{3}{8}$	12	15.62	$\frac{3}{4}$
$14\frac{1}{4}$	$\frac{3}{8}$	15	22.73	$\frac{3}{4}$
$16\frac{1}{4}$	$\frac{3}{8}$	15	25.90	$\frac{3}{4}$



SAFE LOADS IN THOUSANDS OF POUNDS FOR 6″ CHANNEL AND PLATE COLUMNS.

SQUARE ENDS.

Based on Gordon's Formula $P = \dfrac{50\,000}{1 + \dfrac{(12\,L)^2}{36\,000\,r^2}}$. **Safety factor 4.**



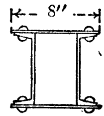
SERIES A.

Weight of each Channel.	Thickness of Plates.	Weight of Column.	Area of Column Section.	Least Radius of Gyration.	Length in Feet.			
Lbs. per Foot.	Inch.	Lbs. per Ft.	Sq. Ins.	Inches.	4	6	8	10
8	1/4	29.6	8.76	2.35	108	107	105	102
"	5/16	33.0	9.76	2.35	121	119	117	114
"	3/8	36.4	10.76	2.34	133	131	129	125
"	7/16	39.8	11.76	2.34	145	143	141	137
"	1/2	43.2	12.76	2.34	158	155	152	149
"	9/16	46.6	13.76	2.34	170	167	164	160
"	5/8	50.0	14.76	2.33	182	180	176	172
10.5	1/4	34.6	10.18	2.27	126	124	121	118
"	5/16	38.0	11.18	2.27	138	136	133	130
"	3/8	41.4	12.18	2.28	150	148	145	141
"	7/16	44.8	13.18	2.28	163	160	157	153
"	1/2	48.2	14.18	2.28	175	173	169	165
"	9/16	51.6	15.18	2.28	187	185	181	176
"	5/8	55.0	16.18	2.28	200	197	193	188
13	1/4	39.6	11.64	2.20	144	141	138	135
"	5/16	43.0	12.64	2.21	156	154	150	146
"	3/8	46.4	13.64	2.22	168	166	162	158
"	7/16	49.8	14.64	2.23	181	178	174	169
"	1/2	53.2	15.64	2.23	193	190	186	181
"	9/16	56.6	16.64	2.24	205	202	198	192
"	5/8	60.0	17.64	2.24	218	214	210	204
15.5	1/4	44.6	13.12	2.14	162	159	155	151
"	5/16	48.0	14.12	2.15	174	171	167	162
"	3/8	51.4	15.12	2.16	186	183	179	174
"	7/16	54.8	16.12	2.17	199	195	191	186
"	1/2	58.2	17.12	2.18	211	207	203	197
"	9/16	61.6	18.12	2.19	224	220	215	209
"	5/8	65.0	19.12	2.19	236	232	227	220

For detail dimensions see page 208.

SAFE LOADS IN THOUSANDS OF POUNDS FOR 6″ CHANNEL AND PLATE COLUMNS. SQUARE ENDS.

Based on Gordon's Formula $P = \dfrac{50\,000}{1+\dfrac{(12\,L)^2}{36\,000\,r^2}}$. **Safety factor 4.**



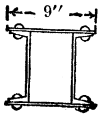
SERIES A.

Length in Feet.							Thickness of Plates.	Weight of each Channel.
12	14	16	18	20	22	24	Inch.	Lbs. per Foot.
99	96	92	89	85	81	77	1/4	8
111	107	103	99	95	90	86	5/16	"
122	118	114	109	104	99	94	3/8	"
133	128	124	119	114	109	103	7/16	"
144	139	135	129	124	118	112	1/2	"
156	150	145	139	133	127	121	9/16	"
166	161	155	149	142	136	130	5/8	"
114	110	106	102	97	92	88	1/4	10.5
126	121	117	112	107	102	96	5/16	"
137	133	127	122	116	111	106	3/8	"
148	143	138	132	126	120	114	7/16	"
159	154	148	142	135	130	123	1/2	"
171	165	159	152	144	139	132	9/16	"
182	176	169	162	154	148	140	5/8	"
130	125	120	115	109	104	99	1/4	13
141	136	131	125	119	113	107	5/16	"
153	147	141	135	129	122	116	3/8	"
164	158	152	145	138	131	125	7/16	"
175	169	162	155	148	140	133	1/2	"
186	179	173	166	158	150	143	9/16	"
197	190	183	176	167	159	151	5/8	"
146	140	134	128	122	115	109	1/4	15.5
157	151	145	138	131	125	118	5/16	"
170	162	155	148	140	133	127	3/8	"
180	172	165	158	150	143	135	7/16	"
191	184	176	168	160	152	144	1/2	"
202	195	187	178	170	162	153	9/16	"
213	205	197	188	180	171	161	5/8	"

For detail dimensions see page 208.

SAFE LOADS IN THOUSANDS OF POUNDS FOR 7″ CHANNEL AND PLATE COLUMNS. SQUARE ENDS.

Based on Gordon's Formula $P = \dfrac{50\,000}{1+\dfrac{(12\,L)^2}{36\,000\,r^2}}$. **Safety factor 4.**



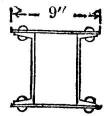
SERIES A.

Weight of each Channel.	Thickness of Plates.	Weight of Column.	Area of Column Section.	Least Radius of Gyration.	Length in Feet.			
Lbs. per Foot.	Inch.	Lbs. per Ft.	Sq. Ins.	Inches.	4	6	8	10
9.75	1/4	34.8	10.20	2.63	126	125	123	121
"	5/16	38.6	11.32	2.63	140	139	137	134
"	3/8	42.5	12.45	2.62	154	152	150	147
"	7/16	46.3	13.58	2.62	168	166	163	160
"	1/2	50.1	14.70	2.62	182	180	177	174
"	9/16	53.9	15.82	2.62	196	194	190	187
"	5/8	57.8	16.95	2.62	210	207	204	200
12.25	1/4	39.8	11.70	2.55	145	143	141	138
"	5/16	43.6	12.82	2.56	159	157	154	151
"	3/8	47.5	13.95	2.56	173	171	168	164
"	7/16	51.3	15.08	2.56	187	185	182	178
"	1/2	55.1	16.20	2.57	200	198	195	191
"	9/16	58.9	17.32	2.57	214	212	208	204
"	5/8	62.8	18.45	2.57	228	226	222	217
14.75	1/4	44.8	13.18	2.49	163	161	158	155
"	5/16	48.6	14.30	2.50	177	175	172	168
"	3/8	52.5	15.43	2.50	191	189	185	181
"	7/16	56.3	16.56	2.51	205	202	199	195
"	1/2	60.1	17.68	2.52	219	216	212	208
"	9/16	63.9	18.80	2.52	233	230	226	221
"	5/8	67.8	19.93	2.53	247	244	239	234
17.25	1/4	49.8	14.64	2.42	181	178	175	171
"	5/16	53.6	15.76	2.43	195	192	189	185
"	3/8	57.5	16.89	2.45	209	206	202	198
"	7/16	61.3	18.02	2.46	223	220	216	211
"	1/2	65.1	19.14	2.46	237	234	229	224
"	9/16	68.9	20.26	2.47	251	248	243	238
"	5/8	72.8	21.39	2.48	265	261	257	251
19.75	1/4	54.8	16.12	2.37	199	197	193	188
"	5/16	58.6	17.24	2.38	213	210	206	201
"	3/8	62.5	18.37	2.40	227	224	220	214
"	7/16	66.3	19.50	2.41	241	238	234	228
"	1/2	70.1	20.62	2.42	255	251	247	242
"	9/16	73.9	21.74	2.43	269	265	260	255
"	5/8	77.8	22.87	2.44	283	279	274	268

For detail dimensions see page 208.

SAFE LOADS IN THOUSANDS OF POUNDS FOR 7″ CHANNEL AND PLATE COLUMNS. SQUARE ENDS.

Based on Gordon's Formula $P=\dfrac{50\,000}{1+\dfrac{(12\,L)^2}{36\,000\,r^2}}$. **Safety factor** 4.



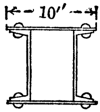
SERIES A.

Length in Feet.								Thickness of Plates.	Weight of each Channel.
12	14	16	18	20	22	24	26	Inch.	Lbs. per Ft.
118	115	111	108	104	99	96	92	1/4	9.75
130	127	123	119	115	110	106	102	5/16	“
143	140	135	131	126	121	116	112	3/8	“
156	153	148	143	138	132	127	122	7/16	“
169	165	160	154	149	143	137	132	1/2	“
182	178	172	166	161	154	148	142	9/16	“
195	190	184	178	172	165	158	152	5/8	“
134	130	126	122	118	113	108	103	1/4	12.25
147	143	139	134	129	124	118	113	5/16	“
160	156	151	146	140	135	129	123	3/8	“
173	168	163	158	152	145	139	133	7/16	“
186	181	176	169	163	156	150	144	1/2	“
199	194	188	181	174	167	161	154	9/16	“
212	207	200	193	185	178	171	164	5/8	“
151	146	142	136	131	126	120	115	1/4	14.75
164	159	154	148	142	136	131	125	5/16	“
177	171	166	160	154	147	141	135	3/8	“
190	184	178	171	165	158	151	144	7/16	“
202	196	191	184	177	170	162	155	1/2	“
215	209	203	196	188	180	173	165	9/16	“
229	222	215	207	199	191	183	175	5/8	“
166	161	156	150	143	137	131	126	1/4	17.25
180	174	168	162	155	148	142	135	5/16	“
193	187	181	174	166	159	153	146	3/8	“
206	199	193	186	178	171	163	155	7/16	“
218	212	205	197	190	182	173	165	1/2	“
231	224	217	209	201	192	184	176	9/16	“
245	238	229	220	212	203	194	186	5/8	“
183	177	170	164	157	150	143	136	1/4	19.75
196	189	183	175	168	161	153	146	5/16	“
209	202	195	187	180	172	164	157	3/8	“
222	215	208	199	191	183	174	166	7/16	“
234	227	220	211	202	194	185	177	1/2	“
248	240	231	223	214	204	195	186	9/16	“
261	253	243	235	225	216	207	196	5/8	“

For detail dimensions see page 208.

SAFE LOADS IN THOUSANDS OF POUNDS FOR 8'' CHANNEL AND PLATE COLUMNS. SQUARE ENDS.

Based on Gordon's Formula $P = \dfrac{50\,000}{1 + \dfrac{(12\,L)^2}{36\,000\,r^2}}$. **Safety factor** 4.



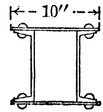
SERIES A.

Weight of each Channel.	Thickness of Plates.	Weight of Column.	Area of Column Section.	Least Radius of Gyration.	Length in Feet.				
Lbs. per Foot.	Inch.	Lbs. per Ft.	Sq. Ins.	Inches.	4	6	8	10	12
11.25	1/4	39.5	11.70	2.98	145	144	142	140	137
"	5/16	43.7	12.95	2.97	161	159	157	155	152
"	3/8	48.0	14.20	2.97	176	175	172	170	167
"	7/16	52.3	15.45	2.96	192	190	188	185	181
"	1/2	56.5	16.70	2.95	207	205	203	200	196
"	9/16	60.8	17.95	2.95	223	221	219	214	210
"	5/8	65.0	19.20	2.95	238	236	233	229	225
13.75	1/4	44.5	13.08	2.92	162	161	159	156	153
"	5/16	48.7	14.33	2.92	178	176	174	171	168
"	3/8	53.0	15.58	2.92	193	191	189	186	182
"	7/16	57.3	16.83	2.91	209	207	204	201	197
"	1/2	61.5	18.08	2.91	224	222	220	216	212
"	9/16	65.8	19.33	2.91	240	237	235	231	226
"	5/8	70.0	20.58	2.91	255	253	250	246	241
16.25	1/4	49.5	14.56	2.86	181	179	176	173	170
"	5/16	53.7	15.81	2.87	196	194	192	188	185
"	3/8	58.0	17.06	2.87	212	210	207	203	199
"	7/16	62.3	18.31	2.87	227	225	222	218	214
"	1/2	66.5	19.56	2.87	243	240	237	233	228
"	9/16	70.8	20.81	2.87	258	256	252	248	243
"	5/8	75.0	22.06	2.87	274	271	267	263	258
18.75	1/4	54.5	16.02	2.81	199	197	194	190	186
"	5/16	58.7	17.27	2.81	214	212	209	205	201
"	3/8	63.0	18.52	2.82	230	227	224	221	216
"	7/16	67.3	19.77	2.82	245	243	240	236	230
"	1/2	71.5	21.02	2.83	261	258	255	250	245
"	9/16	75.8	22.27	2.83	276	274	270	265	260
"	5/8	80.0	23.52	2.83	292	289	285	280	275
21.25	1/4	59.5	17.50	2.76	217	215	212	208	204
"	5/16	63.7	18.75	2.77	233	230	227	223	218
"	3/8	68.0	20.00	2.77	248	245	242	238	233
"	7/16	72.3	21.25	2.78	264	261	257	253	247
"	1/2	76.5	22.50	2.79	279	276	272	267	262
"	9/16	80.8	23.75	2.79	295	291	287	282	276
"	5/8	85.0	25.00	2.80	310	307	302	297	291

For detail dimensions see page 208.

SAFE LOADS IN THOUSANDS OF POUNDS FOR 8″ CHANNEL AND PLATE COLUMNS. SQUARE ENDS.

Based on Gordon's Formula $P = \dfrac{50\,000}{1+\dfrac{(12\,L)^2}{36\,000\,r^2}}$. **Safety factor** 4.



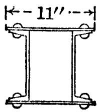
SERIES A.

Length in Feet.									Thickness of Plates.	Weight of each Channel.
14	16	18	20	22	24	26	28	30	Inch.	Lbs. per Ft.
134	131	128	124	120	116	112	108	104	1/4	11.25
149	145	141	137	133	128	124	120	115	5/16	"
163	159	154	150	146	141	136	131	126	3/8	"
177	173	168	163	158	153	147	142	137	7/16	"
192	187	182	176	170	165	159	153	147	1/2	"
206	201	195	189	183	178	171	165	158	9/16	"
221	215	209	203	196	190	183	177	169	5/8	"
150	146	142	138	133	129	124	119	115	1/4	13.75
164	160	155	151	146	141	136	131	126	5/16	"
178	174	169	164	159	153	148	142	137	3/8	"
193	188	182	177	171	166	160	153	148	7/16	"
207	202	196	190	184	178	172	164	159	1/2	"
221	216	209	203	196	190	183	176	170	9/16	"
236	229	223	216	209	203	195	187	181	5/8	"
166	162	157	152	147	142	137	131	126	1/4	16.25
180	176	171	165	160	154	148	143	137	5/16	"
195	189	184	178	172	166	160	154	148	3/8	"
209	203	198	191	185	178	172	165	159	7/16	"
223	217	211	204	198	191	184	177	170	1/2	"
237	231	224	217	210	203	195	188	181	9/16	"
252	245	238	231	223	215	207	199	191	5/8	"
182	177	172	167	161	155	149	143	137	1/4	18.75
196	191	185	180	174	167	160	154	148	5/16	"
210	205	199	193	186	180	173	166	160	3/8	"
225	219	212	206	199	192	185	178	171	7/16	"
240	233	226	219	211	204	196	189	181	1/2	"
254	246	239	232	224	216	208	200	192	9/16	"
268	260	253	245	236	228	220	211	203	5/8	"
198	193	187	181	174	168	162	155	148	1/4	21.25
212	207	200	194	187	180	173	166	159	5/16	"
226	220	214	207	200	192	185	178	170	3/8	"
241	234	227	220	213	205	196	189	181	7/16	"
256	249	241	233	225	217	209	201	192	1/2	"
270	263	254	246	238	229	221	212	202	9/16	"
284	277	268	260	250	241	232	223	214	5/8	"

For detail dimensions see page 208.

SAFE LOADS IN THOUSANDS OF POUNDS FOR 9″ CHANNEL AND PLATE COLUMNS. SQUARE ENDS.

Based on Gordon's Formula $P = \dfrac{50\,000}{1+\dfrac{(12\,L)^2}{36\,000\,r^2}}$. **Safety factor** 4.



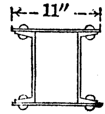
SERIES A.

Weight of each Channel.	Thickness of Plates.	Weight of Column.	Area of Column Section.	Least Radius of Gyration.	Length in Feet.					
Lbs. per Ft.	Inch.	Lbs. per Ft.	Sq. Ins.	Inches.	6	8	10	12	14	16
13.25	1/4	45.2	13.28	3.34	164	162	160	158	155	152
"	5/16	49.9	14.66	3.32	181	179	177	174	171	168
"	3/8	54.6	16.03	3.31	198	196	193	191	187	183
"	7/16	59.2	17.40	3.30	215	213	210	207	203	199
"	1/2	63.9	18.78	3.29	232	229	227	223	219	214
"	9/16	68.5	20.16	3.28	249	246	243	239	235	230
"	5/8	73.3	21.53	3.28	266	263	260	255	251	246
15	1/4	48.7	14.32	3.29	177	175	173	170	167	163
"	5/16	53.4	15.70	3.28	194	192	189	186	183	179
"	3/8	58.1	17.07	3.28	211	209	206	202	199	195
"	7/16	62.7	18.44	3.27	228	225	222	219	215	210
"	1/2	67.4	19.82	3.26	245	242	239	235	231	226
"	9/16	72.0	21.20	3.26	262	259	255	251	247	242
"	5/8	76.8	22.57	3.25	279	275	272	267	263	257
20	1/4	58.7	17.26	3.19	213	210	208	204	200	196
"	5/16	63.4	18.64	3.19	230	227	224	220	216	212
"	3/8	68.1	20.01	3.19	247	244	241	236	232	227
"	7/16	72.7	21.38	3.19	263	261	257	253	248	243
"	1/2	77.4	22.76	3.19	280	278	274	269	264	259
"	9/16	82.0	24.14	3.19	297	294	291	285	280	274
"	5/8	86.8	25.51	3.18	314	311	307	301	296	290
25	1/4	68.7	20.20	3.10	249	246	243	238	234	228
"	5/16	73.4	21.58	3.11	266	263	259	254	250	244
"	3/8	78.1	22.95	3.11	283	279	276	270	265	260
"	7/16	82.7	24.32	3.12	300	296	292	287	281	275
"	1/2	87.4	25.70	3.12	317	313	309	304	297	291
"	9/16	92.0	27.08	3.12	334	330	325	320	313	307
"	5/8	96.8	28.45	3.12	351	346	342	336	329	322

For detail dimensions see page 208.

SAFE LOADS IN THOUSANDS OF POUNDS FOR 9″ CHANNEL AND PLATE COLUMNS. SQUARE ENDS.

Based on Gordon's Formula $P = \dfrac{50\,000}{1 + \dfrac{(12\,L)^2}{36\,000\,r^2}}$. **Safety factor** 4.



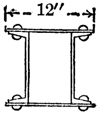
SERIES A.

Length in Feet.									Thickness of Plates.	Weight of each Channel.
18	**20**	**22**	**24**	**26**	**28**	**30**	**32**	**34**	Inch.	Lbs. per Ft.
149	145	141	137	134	129	125	121	117	$\frac{1}{4}$	**13.25**
164	160	156	152	147	143	138	134	129	$\frac{5}{16}$	"
179	175	171	165	160	155	150	146	141	$\frac{3}{8}$	"
194	189	184	179	174	169	163	158	153	$\frac{7}{16}$	"
209	204	199	194	188	182	176	171	165	$\frac{1}{2}$	"
225	219	214	208	202	195	189	182	176	$\frac{9}{16}$	"
240	234	228	222	215	209	202	194	188	$\frac{5}{8}$	"
160	156	152	148	143	139	134	130	126	$\frac{1}{4}$	**15**
175	171	166	162	157	152	147	142	137	$\frac{5}{16}$	"
190	186	181	176	171	166	160	154	149	$\frac{3}{8}$	"
206	201	195	190	184	178	172	167	161	$\frac{7}{16}$	"
221	216	210	203	197	191	185	179	173	$\frac{1}{2}$	"
236	231	225	217	211	204	198	191	185	$\frac{9}{16}$	"
252	245	238	231	225	218	211	204	196	$\frac{5}{8}$	"
192	186	181	176	170	165	159	154	148	$\frac{1}{4}$	**20**
207	201	196	190	184	178	172	166	160	$\frac{5}{16}$	"
222	216	210	204	197	191	185	179	172	$\frac{3}{8}$	"
237	231	224	218	211	204	197	191	183	$\frac{7}{16}$	"
253	246	239	232	224	217	210	203	195	$\frac{1}{2}$	"
268	260	253	246	238	230	223	216	207	$\frac{9}{16}$	"
282	275	268	260	251	243	236	226	219	$\frac{5}{8}$	"
223	216	210	204	197	191	183	177	170	$\frac{1}{4}$	**25**
238	232	224	218	210	204	197	189	183	$\frac{5}{16}$	"
253	246	239	232	224	217	210	201	194	$\frac{3}{8}$	"
268	261	253	246	238	230	222	213	206	$\frac{7}{16}$	"
283	276	267	260	252	243	235	226	218	$\frac{1}{2}$	"
298	291	282	274	265	256	247	238	229	$\frac{9}{16}$	"
313	306	296	287	279	269	260	250	241	$\frac{5}{8}$	"

For detail dimensions see page 208.

SAFE LOADS IN THOUSANDS OF POUNDS FOR 10″ CHANNEL AND PLATE COLUMNS. SQUARE ENDS.

Based on Gordon's Formula $P = \dfrac{50\,000}{1+\dfrac{(12\,L)^2}{36\,000\,r^2}}$. **Safety factor** 4.



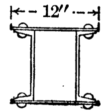
SERIES A.

Weight of each Channel.	Thickness of Plates.	Weight of Column.	Area of Column Section.	Least Radius of Gyration.	Length in Feet.					
Lbs. per Ft.	Inch.	Lbs. per Ft.	Sq. Ins.	Inches.	6	8	10	12	14	16
15	1/4	50.4	14.92	3.62	184	183	181	179	176	173
“	5/16	55.5	16.42	3.61	203	201	199	197	193	191
“	3/8	60.6	17.92	3.59	221	220	217	215	211	207
“	7/16	65.7	19.42	3.58	240	238	235	232	229	225
“	1/2	70.8	20.92	3.58	259	257	254	250	247	242
“	9/16	75.9	22.42	3.57	277	275	272	268	264	259
“	5/8	81.0	23.92	3.56	296	293	290	286	282	277
20	1/4	60.4	17.76	3.52	219	217	215	212	209	205
“	5/16	65.5	19.26	3.52	238	236	233	230	226	223
“	3/8	70.6	20.76	3.51	257	254	252	248	244	239
“	7/16	75.7	22.26	3.51	275	272	270	266	262	257
“	1/2	80.8	23.76	3.51	294	291	288	284	279	274
“	9/16	85.9	25.26	3.50	312	309	305	302	297	291
“	5/8	91.0	26.76	3.50	331	328	324	320	314	308
25	1/4	70.4	20.70	3.42	255	253	250	247	242	238
“	5/16	75.5	22.20	3.43	274	272	268	265	260	255
“	3/8	80.6	23.70	3.43	293	290	287	282	278	272
“	7/16	85.7	25.20	3.43	311	308	305	300	295	289
“	1/2	90.8	26.70	3.43	330	327	323	318	313	307
“	9/16	95.9	28.20	3.44	348	345	341	336	330	324
“	5/8	101.0	29.70	3.44	367	364	359	355	348	341
30	1/4	80.4	23.64	3.33	292	289	285	281	276	271
“	5/16	85.5	25.14	3.34	310	307	303	299	294	288
“	3/8	90.6	26.64	3.35	329	325	321	317	311	305
“	7/16	95.7	28.14	3.36	347	344	340	334	329	322
“	1/2	100.8	29.64	3.36	366	362	358	352	346	339
“	9/16	105.9	31.14	3.37	384	380	376	370	364	358
“	5/8	111.0	32.64	3.37	403	399	394	388	381	375
35	1/4	90.4	26.58	3.26	328	324	320	315	309	303
“	5/16	95.5	28.08	3.27	347	343	338	333	327	320
“	3/8	100.6	29.58	3.28	365	361	357	351	344	337
“	7/16	105.7	31.08	3.29	384	380	375	369	362	354
“	1/2	110.8	32.58	3.29	402	398	393	387	379	372
“	9/16	115.9	34.08	3.30	421	416	411	405	398	390
“	5/8	121.0	35.58	3.31	439	435	429	423	415	407

For detail dimensions see page 209.

SAFE LOADS IN THOUSANDS OF POUNDS FOR 10″ CHANNEL AND PLATE COLUMNS. SQUARE ENDS.

Based on Gordon's Formula $P = \dfrac{50\,000}{1+\dfrac{(12\,L)^2}{36\,000\,r^2}}$. **Safety factor 4.**



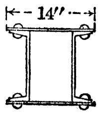
SERIES A.

Length in Feet.										Thickness of Plates.	Weight of each Channel.
18	20	22	24	26	28	30	32	34	36	Inch.	Lbs. per Ft.
170	166	162	159	154	151	146	142	138	134	1/4	15
187	183	179	175	170	165	161	156	152	147	5/16	"
204	199	195	190	186	180	175	170	165	160	3/8	"
221	216	211	206	200	195	189	184	178	172	7/16	"
238	232	228	222	216	210	204	199	192	186	1/2	"
255	249	243	238	231	225	219	212	206	199	9/16	"
271	266	259	253	246	239	233	226	218	212	5/8	"
201	196	192	187	182	177	172	167	161	157	1/4	20
218	213	208	203	197	192	187	181	175	170	5/16	"
235	230	224	219	213	207	201	195	189	182	3/8	"
252	246	240	235	228	222	216	209	202	195	7/16	"
269	263	256	251	244	236	230	223	216	209	1/2	"
286	279	272	265	259	251	244	237	229	222	9/16	"
303	296	289	281	274	266	258	251	243	235	5/8	"
233	228	222	216	210	204	198	191	186	180	1/4	25
250	245	238	232	225	219	213	206	199	193	5/16	"
267	261	255	248	241	233	227	220	213	206	3/8	"
284	278	271	263	256	248	242	234	226	219	7/16	"
301	294	287	279	271	263	256	248	240	232	1/2	"
318	311	303	295	286	279	271	262	253	245	9/16	"
335	327	319	310	302	294	285	276	267	258	5/8	"
265	258	252	245	238	230	223	216	209	201	1/4	30
281	275	268	260	253	245	237	230	222	214	5/16	"
298	291	284	276	268	260	252	243	237	228	3/8	"
315	307	301	293	284	276	267	258	250	241	7/16	"
332	324	317	308	299	290	281	272	263	254	1/2	"
350	342	333	324	315	305	296	286	276	267	9/16	"
367	358	349	339	330	320	310	300	290	280	5/8	"
296	289	282	273	265	256	248	240	232	224	1/4	35
313	306	298	289	279	271	262	254	245	237	5/16	"
330	322	313	305	296	287	278	267	258	249	3/8	"
347	338	329	320	311	301	292	282	273	263	7/16	"
363	354	345	336	326	316	306	296	286	276	1/2	"
380	371	361	351	341	330	320	310	299	289	9/16	"
398	389	379	367	356	345	334	323	312	301	5/8	"

For detail dimensions see page 209.

SAFE LOADS IN THOUSANDS OF POUNDS FOR 12″ CHANNEL AND PLATE COLUMNS.
SQUARE ENDS.

Based on Gordon's Formula $P = \dfrac{50\,000}{1 + \dfrac{(12\,L)^2}{36\,000\,r^2}}$. **Safety factor** 4.



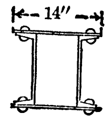
SERIES A.

Weight of each Channel.	Thickness of Plates.	Weight of Column.	Area of Column Section.	Least Radius of Gyration.	Length in Feet.							
Lbs. per Ft.	Inch.	Lbs. per Ft.	Sq. Ins.	Inches.	8	10	12	14	16	18	20	22
20.5	1/4	64.8	19.06	4.41	235	233	232	229	227	223	220	217
"	5/16	70.8	20.81	4.38	257	255	253	250	247	244	240	236
"	3/8	76.7	22.56	4.36	278	276	273	271	267	264	260	256
"	7/16	82.7	24.31	4.34	300	298	295	292	288	285	280	275
"	1/2	88.6	26.06	4.32	321	319	316	313	309	304	300	295
"	9/16	94.6	27.81	4.30	343	340	337	333	330	325	319	315
"	5/8	100.5	29.56	4.28	364	362	358	354	350	345	339	335
25	1/4	73.8	21.70	4.35	268	266	263	261	257	254	250	246
"	5/16	79.8	23.45	4.32	289	287	284	282	278	274	270	266
"	3/8	85.7	25.20	4.31	311	308	305	303	299	294	290	285
"	7/16	91.7	26.95	4.29	332	330	327	323	319	315	310	305
"	1/2	97.6	28.70	4.27	354	351	348	344	340	335	330	324
"	9/16	103.6	30.45	4.26	375	373	369	365	360	356	350	343
"	5/8	109.5	32.20	4.25	397	393	390	386	381	376	370	363
30	1/4	83.8	24.64	4.27	304	302	299	295	292	288	283	278
"	5/16	89.8	26.39	4.26	325	323	320	316	312	308	303	298
"	3/8	95.7	28.14	4.25	347	344	341	337	333	329	323	317
"	7/16	101.7	29.89	4.23	368	365	362	358	353	348	343	337
"	1/2	107.6	31.64	4.22	390	387	383	379	374	368	363	357
"	9/16	113.6	33.39	4.21	411	408	404	400	395	389	382	377
"	5/8	119.5	35.14	4.21	433	429	425	421	415	409	402	396
35	1/4	93.8	27.58	4.19	340	337	334	330	326	321	316	310
"	5/16	99.8	29.33	4.18	361	358	355	351	347	341	336	330
"	3/8	105.7	31.08	4.18	383	380	376	372	367	362	356	349
"	7/16	111.7	32.83	4.17	405	401	397	392	388	382	376	369
"	1/2	117.6	34.58	4.16	426	422	418	413	409	402	396	389
"	9/16	123.6	36.33	4.16	448	444	439	434	429	423	416	408
"	5/8	129.5	38.08	4.15	469	465	461	455	449	443	436	428
40	1/4	103.8	30.52	4.13	376	373	369	365	360	354	349	343
"	5/16	109.8	32.27	4.12	398	394	390	386	380	374	368	363
"	3/8	115.7	34.02	4.12	419	416	411	406	401	395	388	382
"	7/16	121.7	35.77	4.12	441	437	433	427	421	415	408	402
"	1/2	127.6	37.52	4.11	462	458	454	448	442	435	428	420
"	9/16	133.6	39.27	4.11	484	480	475	469	463	456	448	440
"	5/8	139.5	41.02	4.11	505	501	496	490	483	476	468	459

For detail dimensions see page 209.

SAFE LOADS IN THOUSANDS OF POUNDS FOR 12'' CHANNEL AND PLATE COLUMNS. SQUARE ENDS.

Based on Gordon's Formula $P = \dfrac{50\,000}{1+\dfrac{(12\,L)^2}{36\,000\,r^2}}$. **Safety factor 4.**



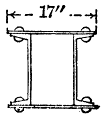
SERIES A.

Length in Feet.											Thickness of Plates.	Weight of each Channel.
24	26	28	30	32	34	36	38	40	42	44	Inch.	Lbs. per Ft.
213	209	206	201	196	193	188	184	179	175	170	1/4	20.5
232	228	223	220	214	209	205	200	195	190	186	5/16	"
252	246	242	237	232	227	221	216	211	206	200	3/8	"
271	266	260	255	249	244	238	232	227	223	216	7/16	"
289	285	279	274	267	261	255	249	242	237	230	1/2	"
309	304	297	291	285	278	271	265	258	251	245	9/16	"
328	322	316	309	302	296	288	281	274	267	259	5/8	"
242	237	233	228	223	218	213	208	203	197	193	1/4	25
260	256	251	246	240	235	230	224	218	213	207	5/16	"
280	275	269	263	258	252	246	241	234	229	222	3/8	"
299	293	288	282	275	270	263	256	250	243	237	7/16	"
319	312	306	300	293	286	280	272	265	259	252	1/2	"
338	331	324	318	311	303	295	289	281	273	267	9/16	"
358	350	343	335	329	320	312	306	297	289	281	5/8	"
274	268	262	257	251	245	240	234	228	223	216	1/4	30
293	287	281	276	269	263	256	250	244	237	232	5/16	"
313	306	300	293	287	280	273	267	260	253	246	3/8	"
331	325	318	311	304	297	290	282	275	268	261	7/16	"
350	343	337	329	321	313	307	299	291	282	276	1/2	"
369	362	354	347	339	331	322	315	307	298	290	9/16	"
389	381	372	365	357	348	339	332	323	314	305	5/8	"
305	299	292	286	280	273	266	259	253	246	239	1/4	35
324	318	311	304	296	290	283	275	268	262	254	5/16	"
344	337	329	322	314	308	300	292	284	277	270	3/8	"
362	356	348	340	332	323	317	308	300	291	283	7/16	"
381	375	366	358	349	341	332	325	316	307	298	1/2	"
400	394	385	376	367	358	349	341	332	323	313	3/16	"
420	411	404	394	385	375	365	356	348	338	328	5/8	"
336	329	322	314	308	301	293	285	277	269	262	1/4	40
356	348	340	333	324	316	310	301	293	285	277	5/16	"
375	367	359	351	342	333	326	318	309	300	292	3/8	"
394	386	377	369	360	351	343	334	325	316	307	7/16	"
413	405	396	387	377	368	358	350	341	331	322	1/2	"
433	424	412	405	395	385	375	367	357	347	337	9/16	"
452	442	433	423	412	402	391	383	373	362	352	5/8	"

For detail dimensions see page 209.

SAFE LOADS IN THOUSANDS OF POUNDS FOR 15″ CHANNEL AND PLATE COLUMNS. SQUARE ENDS.

Based on Gordon's Formula $P = \dfrac{50\,000}{1 + \dfrac{(12\,L)^2}{36\,000\,r^2}}$. **Safety factor 4.**



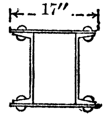
SERIES A.

Weight of each Channel.	Thickness of Plates.	Weight of Column.	Area of Column Section.	Least Radius of Gyration.	Length in Feet.								
Lbs. per Ft.	Inch.	Lbs. per Ft.	Sq. Ins.	Inches.	12	14	16	18	20	22	24	26	28
33	3/8	109.4	32.55	5.41	399	396	393	390	386	381	378	373	367
“	7/16	116.6	34.68	5.38	425	422	418	415	411	406	401	397	391
“	1/2	123.8	36.80	5.36	451	448	444	440	436	431	426	420	415
“	9/16	131.0	38.92	5.33	476	474	470	465	460	456	450	444	437
“	5/8	138.2	41.05	5.31	502	500	495	490	485	481	475	468	461
“	11/16	145.4	43.18	5.29	529	523	521	516	510	504	499	492	485
“	3/4	152.7	45.30	5.24	555	550	545	541	535	529	522	515	509
35	3/8	113.4	33.33	5.40	409	406	402	399	395	390	387	381	376
“	7/16	120.6	35.46	5.37	435	432	428	424	420	415	410	406	400
“	1/2	127.8	37.58	5.35	461	457	453	449	445	440	435	429	424
“	9/16	135.0	39.70	5.32	486	483	479	474	469	465	459	453	446
“	5/8	142.2	41.83	5.30	512	509	505	500	494	488	484	477	470
“	11/16	149.4	43.96	5.28	538	534	530	525	520	513	508	501	494
“	3/4	156.7	46.08	5.27	564	560	556	551	545	538	531	525	518
40	3/8	123.4	36.27	5.35	445	441	438	433	430	425	419	414	409
“	7/16	130.6	38.40	5.33	470	467	463	459	454	450	444	438	432
“	1/2	137.8	40.52	5.31	496	493	489	484	479	475	469	462	455
“	9/16	145.0	42.64	5.29	522	519	514	509	504	498	493	486	479
“	5/8	152.2	44.77	5.27	548	544	540	535	529	523	516	511	503
“	11/16	159.4	46.90	5.26	574	570	566	560	554	548	540	535	527
“	3/4	166.7	49.02	5.24	600	595	590	586	579	572	565	557	551
45	3/8	133.4	39.23	5.31	480	477	473	469	464	459	454	447	441
“	7/16	140.6	41.36	5.29	506	503	499	494	489	483	478	472	465
“	1/2	147.8	43.48	5.27	532	528	525	519	514	508	501	496	489
“	9/16	155.0	45.60	5.25	558	554	550	545	539	532	525	518	512
“	5/8	162.2	47.73	5.24	584	580	575	570	564	557	550	542	536
“	11/16	169.4	49.86	5.23	610	606	600	596	589	582	575	567	558
“	3/4	176.7	51.98	2.21	636	631	626	619	614	607	599	591	582
50	3/8	143.4	42.17	5.26	516	512	509	504	498	492	486	481	474
“	7/16	150.6	44.30	5.24	542	538	533	529	524	517	511	503	498
“	1/2	157.8	46.42	5.23	568	564	559	555	549	542	535	528	520
“	9/16	165.0	48.54	5.21	594	590	584	578	574	567	559	552	543
“	5/8	172.2	50.67	5.20	620	615	610	604	599	592	584	576	567
“	11/16	179.4	52.80	5.19	646	641	636	629	622	616	608	600	591
“	3/4	186.7	54.92	5.18	672	667	661	654	647	641	633	624	615
55	3/8	153.4	45.11	5.21	552	548	543	538	533	527	520	513	505
“	7/16	160.6	47.24	5.19	578	574	569	563	557	552	544	537	529
“	1/2	167.8	49.36	5.18	604	600	594	588	582	576	569	561	553
“	9/16	175.0	51.48	5.17	630	625	620	613	607	599	593	585	576
“	5/8	182.2	53.61	5.16	656	651	645	639	632	624	616	609	600
“	11/16	189.4	55.74	5.15	682	677	671	664	657	649	640	633	624
“	3/4	196.7	57.86	5.14	708	703	696	689	682	673	665	655	648

For detail dimensions see page 209.

SAFE LOADS IN THOUSANDS OF POUNDS FOR 15″ CHANNEL AND PLATE COLUMNS. SQUARE ENDS.

Based on Gordon's Formula $P = \dfrac{50\,000}{1+\dfrac{(12\,L)^2}{36\,000\,r^2}}$. **Safety factor 4.**



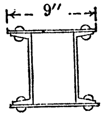
SERIES A.

Length in Feet.												Thickness of Plates.	Weight of each Channel.
30	32	34	36	38	40	42	44	46	48	50	52	Inch.	Lbs. per Ft.
363	357	351	345	340	334	327	322	316	309	304	297	3/8	33
385	381	374	368	361	356	349	342	335	329	322	315	7/16	“
409	402	397	390	383	376	370	362	355	347	342	334	1/2	“
432	425	418	411	405	397	389	381	375	367	359	351	9/16	“
456	449	441	433	425	419	411	402	394	388	379	371	5/8	“
478	472	464	456	447	438	432	423	414	405	397	390	11/16	“
501	493	484	476	467	460	451	442	432	423	416	407	3/4	“
370	366	360	353	348	342	335	330	323	316	310	304	3/8	35
394	387	383	376	369	364	357	349	342	337	329	322	7/16	“
417	411	404	398	391	383	376	370	362	355	349	341	1/2	“
441	434	426	419	413	405	397	389	383	375	367	359	9/16	“
463	457	449	441	433	427	418	410	401	393	386	378	5/8	“
486	478	472	464	455	446	437	431	422	413	404	397	11/16	“
510	501	493	486	477	468	459	452	442	433	423	414	3/4	“
403	396	390	384	377	370	363	357	350	342	337	329	3/8	40
427	420	412	405	399	392	384	376	370	363	355	347	7/16	“
450	443	435	427	420	413	405	397	389	383	374	366	1/2	“
472	466	458	450	441	433	427	418	409	400	392	385	9/16	“
495	487	479	472	464	455	446	439	430	420	411	402	5/8	“
519	510	502	495	486	476	467	457	450	440	431	421	11/16	“
542	533	524	515	505	498	488	478	468	458	450	440	3/4	“
436	429	421	414	406	400	392	384	376	370	362	354	3/8	45
458	452	444	436	428	420	414	405	397	388	380	374	7/16	“
481	473	465	459	450	441	433	426	417	408	399	390	1/2	“
504	496	488	479	472	463	454	445	435	428	419	409	9/16	“
528	519	510	501	492	485	475	465	456	446	438	429	5/8	“
552	542	533	523	514	506	496	486	476	465	455	448	11/16	“
573	566	556	546	536	525	515	507	496	485	475	464	3/4	“
466	459	451	445	437	428	420	411	405	396	387	379	3/8	50
490	482	474	465	456	450	441	432	423	414	407	398	7/16	“
513	505	496	487	478	471	462	453	443	433	424	417	1/2	“
535	528	519	510	500	490	481	473	463	453	443	433	9/16	“
558	549	542	532	522	512	502	491	484	473	463	452	5/8	“
582	572	562	554	544	533	523	512	501	493	482	471	11/16	“
605	595	585	574	566	555	544	533	521	510	499	490	3/4	“
497	491	482	474	465	456	447	440	431	421	412	403	3/8	55
520	512	503	496	487	477	468	458	448	441	431	422	7/16	“
544	535	525	516	509	499	489	479	469	458	448	441	1/2	“
567	558	548	538	528	520	510	499	489	478	468	457	9/16	“
591	581	571	560	550	539	531	520	509	498	487	476	5/8	“
614	604	593	582	572	560	549	541	529	518	506	495	11/16	“
638	627	616	605	593	582	570	558	549	537	525	514	3/4	“

For detail dimensions see page 209.

SAFE LOADS IN THOUSANDS OF POUNDS FOR 6″ CHANNEL AND PLATE COLUMNS. SQUARE ENDS.

Based on Gordon's Formula $P = \dfrac{50\,000}{1+\dfrac{(12\,L)^2}{36\,000\,r^2}}$. **Safety factor 4.**



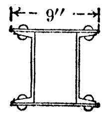
SERIES B.

Weight of each Channel.	Thickness of Plates.	Weight of Column.	Area of Column Section.	Least Radius of Gyration.	Length in Feet.				
Lbs. per Ft.	Inch.	Lbs. per Ft.	Sq. Ins.	Inches.	4	6	8	10	12
8	1/4	31.3	9.26	2.74	115	114	112	110	107
"	5/16	35.1	10.39	2.73	129	127	126	123	121
"	3/8	39.0	11.51	2.71	142	141	139	136	134
"	7/16	42.8	12.64	2.70	156	155	153	150	147
"	1/2	46.6	13.76	2.70	170	169	166	163	160
"	9/16	50.4	14.89	2.69	184	183	180	176	172
"	5/8	54.3	16.01	2.68	198	196	193	190	185
10.5	1/4	36.3	10.68	2.68	132	131	129	126	123
"	5/16	40.1	11.81	2.67	146	145	142	140	137
"	3/8	44.0	12.93	2.66	160	158	156	153	150
"	7/16	47.8	14.06	2.66	174	172	170	166	163
"	1/2	51.6	15.18	2.65	188	186	183	179	176
"	9/16	55.4	16.31	2.65	202	200	197	193	189
"	5/8	59.3	17.43	2.65	216	213	210	206	202
13	1/4	41.3	12.14	2.54	150	148	146	143	139
"	5/16	45.1	13.27	2.62	164	162	160	157	153
"	3/8	49.0	14.39	2.62	178	176	173	170	164
"	7/16	52.8	15.52	2.62	192	190	187	183	179
"	1/2	56.6	16.64	2.61	206	204	200	197	192
"	9/16	60.4	17.77	2.61	220	218	214	210	205
"	5/8	64.3	18.89	2.61	234	231	227	223	218
15.5	1/4	46.3	13.62	2.47	169	166	164	160	155
"	5/16	50.1	14.75	2.54	183	180	178	174	169
"	3/8	54.0	15.87	2.57	196	194	191	187	182
"	7/16	57.8	17.00	2.57	210	208	205	200	195
"	1/2	61.6	18.12	2.57	224	222	218	214	208
"	9/16	65.4	19.25	2.57	238	236	232	227	221
"	5/8	69.3	20.37	2.57	252	249	245	240	234

For detail dimensions see page 210.

SAFE LOADS IN THOUSANDS OF POUNDS FOR 6″ CHANNEL AND PLATE COLUMNS. SQUARE ENDS.

Based on Gordon's Formula $P = \dfrac{50\,000}{1 + \dfrac{(12\,L)^2}{36\,000\,r^2}}$. **Safety factor 4.**



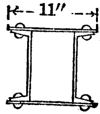
SERIES B.

Length in Feet.								Thickness of Plates.	Weight of each Channel.
14	**16**	**18**	**20**	**22**	**24**	**26**	**28**	Inch.	Lbs. per Ft.
105	102	99	95	92	88	85	82	$\frac{1}{4}$	**8**
118	114	111	107	103	99	95	91	$\frac{5}{16}$	"
130	126	123	118	114	109	105	101	$\frac{3}{8}$	"
143	139	134	130	125	120	115	110	$\frac{7}{16}$	"
155	151	146	141	136	131	126	120	$\frac{1}{2}$	"
168	163	158	153	147	141	135	130	$\frac{9}{16}$	"
181	175	170	163	158	151	145	140	$\frac{5}{8}$	"
120	116	113	108	105	100	96	92	$\frac{1}{4}$	**10.5**
133	129	125	121	116	111	107	102	$\frac{5}{16}$	"
145	141	136	132	127	122	117	112	$\frac{3}{8}$	"
158	154	148	143	138	133	127	122	$\frac{7}{16}$	"
171	166	160	155	149	143	137	131	$\frac{1}{2}$	"
183	178	172	166	160	153	147	141	$\frac{9}{16}$	"
196	190	184	178	171	164	157	151	$\frac{5}{8}$	"
135	131	126	121	116	112	107	102	$\frac{1}{4}$	**13**
149	144	139	135	129	124	119	114	$\frac{5}{16}$	"
162	157	151	146	134	134	129	123	$\frac{3}{8}$	"
174	169	163	158	151	145	139	133	$\frac{7}{16}$	"
186	181	175	168	162	155	149	143	$\frac{1}{2}$	"
199	193	187	180	173	166	159	152	$\frac{9}{16}$	"
211	206	198	191	184	176	169	162	$\frac{5}{8}$	"
151	146	140	135	129	124	118	113	$\frac{1}{4}$	**15.5**
164	159	153	148	142	136	130	124	$\frac{5}{16}$	"
178	172	166	160	153	147	141	134	$\frac{3}{8}$	"
190	184	178	171	164	158	151	144	$\frac{7}{16}$	"
203	196	189	182	175	168	161	154	$\frac{1}{2}$	"
215	209	201	194	186	179	171	163	$\frac{9}{16}$	"
228	221	213	205	196	189	181	173	$\frac{5}{8}$	"

For detail dimensions see page 210.

SAFE LOADS IN THOUSANDS OF POUNDS FOR 7″ CHANNEL AND PLATE COLUMNS. SQUARE ENDS.

Based on Gordon's Formula $P = \dfrac{50\,000}{1 + \dfrac{(12\,L)^2}{36\,000\,r^2}}$. **Safety factor** 4.



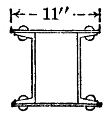
SERIES B.

Weight of each Channel.	Thick-ness of Plates.	Weight of Column.	Area of Column Section.	Least Radius of Gyration.	Length in Feet.					
Lbs. per Ft.	Inch.	Lbs. per Ft.	Sq. Ins.	Inches.	6	8	10	12	14	16
9.75	¼	38.2	11.20	3.20	138	137	135	132	130	127
"	5/16	42.9	12.58	3.27	155	154	151	149	146	143
"	⅜	47.6	13.95	3.33	172	170	168	166	163	160
"	7/16	52.2	15.32	3.35	189	187	185	182	179	175
"	½	56.9	16.70	3.34	206	204	202	198	195	191
"	9/16	61.5	18.08	3.33	223	221	218	215	211	207
"	⅝	66.3	19.45	3.32	240	238	235	231	227	223
12.25	¼	43.2	12.70	3.08	156	155	153	150	147	143
"	5/16	47.9	14.08	3.16	173	172	169	166	163	159
"	⅜	52.6	15.45	3.22	190	188	186	183	180	176
"	7/16	57.2	16.82	3.29	208	206	203	200	196	192
"	½	61.9	18.20	3.31	225	222	220	216	213	208
"	9/16	66.5	19.58	3.30	242	239	236	233	229	224
"	⅝	71.3	20.95	3.29	259	256	253	249	244	239
14.75	¼	48.2	14.18	2.99	174	172	170	167	163	159
"	5/16	52.9	15.56	3.07	191	189	186	183	179	176
"	⅜	57.6	16.93	3.14	209	206	203	200	196	192
"	7/16	62.2	18.30	3.20	225	223	220	216	212	208
"	½	66.9	19.68	3.26	243	240	237	233	229	224
"	9/16	71.5	21.06	3.27	260	257	253	250	245	240
"	⅝	76.3	22.43	3.27	277	274	270	266	261	256
17.25	¼	53.2	15.64	2.91	192	190	187	183	179	174
"	5/16	57.9	17.02	2.99	209	207	204	200	195	191
"	⅜	62.6	18.39	3.06	226	224	220	217	212	207
"	7/16	67.2	19.76	3.13	243	240	237	234	228	224
"	½	71.9	21.14	3.19	260	258	254	250	245	240
"	9/16	76.5	22.52	3.24	277	275	271	267	262	257
"	⅝	81.3	23.89	3.24	294	291	288	283	278	272
19.75	¼	58.2	17.12	2.85	210	207	204	200	195	190
"	5/16	62.9	18.50	2.93	228	225	221	217	212	206
"	⅜	67.6	19.87	3.00	244	241	238	233	228	223
"	7/16	72.2	21.24	3.07	261	259	254	250	245	240
"	½	76.9	22.62	3.13	279	275	272	267	262	256
"	9/16	81.5	24.00	3.19	296	293	289	284	278	273
"	⅝	86.3	25.37	3.21	313	309	305	301	294	288

For detail dimensions see page 210.

SAFE LOADS IN THOUSANDS OF POUNDS FOR 7″ CHANNEL AND PLATE COLUMNS. SQUARE ENDS.

Based on Gordon's Formula $P = \dfrac{50\,000}{1 + \dfrac{(12\,L)^2}{36\,000\,r^2}}$. **Safety factor 4.**



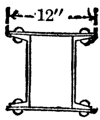
SERIES B.

Length in Feet.									Thickness of Plates.	Weight of each Channel.
18	20	22	24	26	28	30	32	34	Inch.	Lbs. per Ft.
124	121	118	114	111	107	103	100	97	1/4	9.75
140	137	133	130	125	121	117	114	110	5/16	"
156	152	148	144	140	136	132	127	123	3/8	"
171	167	163	159	154	149	145	140	136	7/16	"
187	182	178	173	168	163	158	153	147	1/2	"
202	198	192	187	182	176	171	165	160	9/16	"
218	213	207	201	196	190	184	178	172	5/8	"
140	136	132	128	124	119	115	111	107	1/4	12.25
156	152	147	143	139	134	129	125	120	5/16	"
172	167	163	158	153	148	143	139	133	3/8	"
188	183	178	173	168	163	158	153	148	7/16	"
204	199	194	188	182	176	171	165	160	1/2	"
218	213	207	202	196	190	184	178	172	9/16	"
234	228	222	216	210	203	197	190	184	5/8	"
155	150	145	141	136	131	127	122	117	1/4	14.75
171	166	161	156	151	146	141	136	130	5/16	"
187	182	177	172	166	161	155	149	144	3/8	"
203	198	192	187	181	175	169	163	158	7/16	"
219	214	209	202	196	190	184	178	172	1/2	"
235	229	223	217	210	203	197	190	184	9/16	"
250	244	238	231	223	216	209	203	196	5/8	"
169	164	159	154	148	143	137	132	128	1/4	17.25
186	180	175	169	163	157	152	146	140	5/16	"
202	197	190	185	178	172	166	160	154	3/8	"
218	212	206	200	194	188	180	174	167	7/16	"
235	228	222	216	208	202	195	189	181	1/2	"
250	244	238	231	224	217	209	202	195	9/16	"
265	259	252	245	238	230	222	215	207	5/8	"
185	179	173	167	161	155	149	143	137	1/4	19.75
201	195	189	182	176	169	163	157	150	5/16	"
217	211	205	198	191	185	177	170	164	3/8	"
233	227	220	214	206	199	192	185	178	7/16	"
249	243	236	229	222	215	207	200	192	1/2	"
267	259	252	245	236	229	222	214	206	9/16	"
282	275	266	259	251	243	236	227	219	5/8	"

For detail dimensions see page 210.

SAFE LOADS IN THOUSANDS OF POUNDS FOR 8″ CHANNEL AND PLATE COLUMNS. SQUARE ENDS.

Based on Gordon's Formula $P = \dfrac{50\,000}{1 + \dfrac{(12\,L)^2}{36\,000\,r^2}}$. **Safety factor** 4.



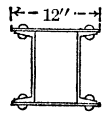
SERIES B.

Weight of each Channel.	Thickness of Plates.	Weight of Column.	Area of Column Section.	Least Radius of Gyration.	Length in Feet.						
Lbs. per Ft.	Inch.	Lbs. per Ft.	Sq. Ins.	Inches.	6	8	10	12	14	16	18
11.25	1/4	42.9	12.70	3.62	157	156	154	152	150	147	144
"	5/16	48.0	14.20	3.70	176	174	172	171	168	165	162
"	3/8	53.1	15.70	3.72	194	193	191	189	186	183	180
"	7/16	58.2	17.20	3.70	213	211	209	207	203	200	196
"	1/2	63.3	18.70	3.68	231	229	227	224	221	218	213
"	9/16	68.4	20.20	3.66	250	248	245	242	239	234	230
"	5/8	73.5	21.70	3.65	268	266	264	260	256	252	247
13.75	1/4	47.9	14.08	3.52	174	172	171	168	165	163	159
"	5/16	53.0	15.58	3.60	193	191	189	187	184	181	177
"	3/8	58.1	17.08	3.67	211	209	207	205	202	198	195
"	7/16	63.2	18.58	3.67	230	228	226	223	220	216	212
"	1/2	68.3	20.08	3.66	248	246	244	241	237	233	229
"	9/16	73.4	21.58	3.64	267	265	262	258	255	250	246
"	5/8	78.5	23.08	3.63	285	283	280	276	272	268	262
16.25	1/4	52.9	15.56	3.42	192	190	188	185	182	179	175
"	5/16	58.0	17.06	3.50	211	209	206	204	200	197	193
"	3/8	63.1	18.56	3.58	229	228	225	222	219	215	211
"	7/16	68.2	20.06	3.64	248	246	244	240	237	233	229
"	1/2	73.3	21.56	3.63	266	264	261	258	254	250	245
"	9/16	78.4	23.06	3.62	285	283	279	276	272	268	262
"	5/8	83.5	24.56	3.61	303	301	298	294	289	285	279
18.75	1/4	57.9	17.02	3.34	210	208	205	202	199	195	191
"	5/16	63.0	18.52	3.42	229	227	224	221	217	213	208
"	3/8	68.1	20.02	3.50	247	245	242	239	235	231	227
"	7/16	73.2	21.52	3.57	266	264	261	257	254	249	245
"	1/2	78.3	23.02	3.61	284	282	279	276	271	267	262
"	9/16	83.4	24.52	3.60	303	301	297	294	289	284	279
"	5/8	88.5	26.02	3.59	322	319	315	312	307	301	296
21.25	1/4	62.9	18.50	3.27	228	226	223	219	215	211	206
"	5/16	68.0	20.00	3.36	247	244	241	238	234	229	224
"	3/8	73.1	21.50	3.43	266	263	260	256	252	247	243
"	7/16	78.2	23.00	3.51	284	282	279	275	270	265	260
"	1/2	83.3	24.50	3.57	303	300	297	293	289	283	278
"	9/16	88.4	26.00	3.57	321	319	315	311	306	301	295
"	5/8	93.5	27.50	3.57	340	337	333	329	324	318	313

For detail dimensions see page 210.

SAFE LOADS IN THOUSANDS OF POUNDS FOR 8″ CHANNEL AND PLATE COLUMNS. SQUARE ENDS.

Based on Gordon's Formula $P=\dfrac{50\,000}{1+\dfrac{(12\,L)^2}{36\,000\,r^2}}$. **Safety factor 4.**



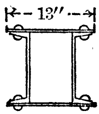
SERIES B.

Length in Feet.										Thickness of Plates.	Weight of each Channel.
20	22	24	26	28	30	32	34	36	38	Inch.	Lbs. per Ft.
142	138	135	131	128	124	121	117	114	110	1/4	11.25
159	156	152	148	144	141	137	133	129	125	5/16	"
176	172	168	164	160	155	151	147	143	139	3/8	"
193	189	184	180	175	170	166	161	156	151	7/16	"
209	204	200	194	190	184	179	175	169	164	1/2	"
225	221	215	210	204	199	194	188	182	176	9/16	"
242	237	231	226	219	214	207	202	195	189	5/8	"
156	152	149	144	140	137	132	128	124	120	1/4	13.75
173	170	165	161	157	153	148	144	139	134	5/16	"
191	187	183	178	173	168	164	159	154	149	3/8	"
208	203	199	193	187	183	178	173	168	162	7/16	"
224	219	214	209	203	198	193	186	181	175	1/2	"
241	236	230	224	218	213	206	200	194	188	9/16	"
257	251	246	239	233	226	220	213	207	200	5/8	"
171	167	163	158	153	149	144	140	135	130	1/4	16.25
189	184	179	175	170	165	160	155	150	145	5/16	"
206	202	197	191	187	181	176	170	165	160	3/8	"
224	219	214	209	203	198	191	186	180	175	7/16	"
240	235	230	223	218	211	206	199	194	187	1/2	"
257	251	245	239	233	226	220	213	207	200	9/16	"
274	267	261	254	247	241	233	227	219	213	5/8	"
186	181	176	171	166	161	155	150	145	140	1/4	18.75
204	199	194	188	182	177	171	166	161	155	5/16	"
221	216	210	205	199	193	188	182	176	170	3/8	"
239	233	228	222	216	210	203	198	191	186	7/16	"
257	250	245	238	231	226	219	213	206	200	1/2	"
272	267	260	254	247	240	233	226	219	212	9/16	"
289	283	276	269	262	254	247	239	232	224	5/8	"
201	196	191	184	178	173	167	161	156	150	1/4	21.25
219	214	208	202	196	190	184	178	172	165	5/16	"
237	231	225	218	212	206	200	193	187	180	3/8	"
254	248	243	236	229	223	216	209	202	196	7/16	"
272	265	260	252	246	239	231	225	218	211	1/2	"
289	282	276	268	261	253	245	239	231	224	9/16	"
305	298	291	283	276	268	260	253	244	237	5/8	"

For detail dimensions see page 210.

SAFE LOADS IN THOUSANDS OF POUNDS FOR 9″ CHANNEL AND PLATE COLUMNS. SQUARE ENDS.

Based on Gordon's Formula $P=\frac{50\,000}{1+\frac{(12\,L)^2}{36\,000\,r^2}}$. **Safety factor** 4.



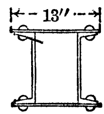
SERIES B.

Weight of each Channel.	Thickness of Plates.	Weight of Column.	Area of Column Section.	Least Radius of Gyration.	Length in Feet.							
Lbs. per Ft.	Inch.	Lbs. per Ft.	Sq. Ins.	Inches.	6	8	10	12	14	16	18	20
13.25	1/4	48.6	14.28	4.05	177	176	174	172	170	168	166	163
"	5/16	54.1	15.90	4.10	197	196	194	192	190	187	184	181
"	3/8	59.7	17.53	4.07	217	216	214	212	209	207	203	200
"	7/16	65.2	19.16	4.04	237	236	234	231	228	225	222	218
"	1/2	70.7	20.78	4.02	257	256	253	251	248	244	240	236
"	9/16	76.2	22.40	4.00	277	276	273	270	267	263	259	255
"	5/8	81.7	24.03	3.99	297	296	293	290	286	282	278	273
15.0	1/4	52.1	15.32	3.97	190	188	187	185	183	180	177	174
"	5/16	57.6	16.94	4.05	210	208	207	204	202	199	197	193
"	3/8	63.2	18.57	4.05	230	228	226	224	221	218	215	212
"	7/16	68.7	20.20	4.03	250	249	246	244	241	237	234	230
"	1/2	74.2	21.82	4.01	270	268	266	263	260	256	252	248
"	9/16	79.7	23.44	3.99	290	288	286	283	279	275	271	266
"	5/8	85.2	25.07	3.97	310	308	306	302	299	295	290	285
20.0	1/4	62.1	18.26	3.78	226	224	222	219	216	213	209	205
"	5/16	67.6	19.88	3.87	246	244	242	239	236	233	228	224
"	3/8	73.2	21.51	3.95	266	264	262	260	256	252	248	244
"	7/16	78.7	23.14	3.98	286	285	282	279	276	272	268	263
"	1/2	84.2	24.76	3.96	306	305	302	299	295	291	286	280
"	9/16	89.7	26.39	3.95	327	325	322	318	314	309	304	299
"	5/8	95.2	28.01	3.94	347	345	342	338	333	328	323	317
25.0	1/4	72.1	21.20	3.64	262	260	257	254	251	246	242	236
"	5/16	77.6	22.82	3.73	282	280	277	274	270	266	261	255
"	3/8	83.2	24.45	3.81	303	300	298	294	290	285	281	276
"	7/16	88.7	26.08	3.89	323	320	317	314	310	305	301	295
"	1/2	94.2	27.70	3.92	343	341	337	333	329	324	319	314
"	9/16	99.7	29.32	3.91	363	361	357	353	348	343	338	332
"	5/8	105.2	30.95	3.90	383	380	377	373	368	362	357	350

For detail dimensions see page 210.

SAFE LOADS IN THOUSANDS OF POUNDS FOR 9'' CHANNEL AND PLATE COLUMNS. SQUARE ENDS.

Based on Gordon's Formula $P = \dfrac{50\,000}{1 + \dfrac{(12\,L)^2}{36\,000\,r^2}}$. **Safety factor 4.**



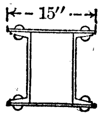
SERIES B.

Length in Feet.											Thickness of Plates.	Weight of each Channel.
22	24	26	28	30	32	34	36	38	40	42	Inch.	Lbs. per Ft.
160	157	153	150	146	143	139	136	132	128	125	1/4	**13.25**
178	174	172	168	164	160	156	152	148	144	140	5/16	“
196	192	188	184	180	175	171	167	163	158	154	3/8	“
214	210	206	201	196	192	187	182	177	172	167	7/16	“
232	227	222	217	212	207	202	196	191	186	181	1/2	“
250	245	240	234	229	223	217	211	206	200	194	9/16	“
268	263	257	251	245	239	233	227	221	215	208	5/8	“
171	167	164	159	156	152	148	144	140	136	132	1/4	**15.0**
190	186	182	178	174	169	165	161	156	152	148	5/16	“
208	204	199	195	190	186	181	176	172	167	162	3/8	“
225	221	216	212	207	202	197	192	187	181	176	7/16	“
243	238	233	228	223	217	212	206	200	195	189	1/2	“
261	256	251	245	239	233	227	221	215	209	203	9/16	“
280	274	268	261	255	248	242	235	229	223	216	5/8	“
201	197	192	187	183	177	172	168	162	158	153	1/4	**20.0**
220	215	211	206	200	195	190	185	180	174	168	5/16	“
239	234	229	224	218	213	207	202	196	191	186	3/8	“
258	253	247	242	236	230	224	218	213	205	200	7/16	“
275	269	264	258	251	245	239	232	226	220	214	1/2	“
293	287	281	274	268	261	255	248	241	234	228	9/16	“
311	305	298	291	284	277	270	263	256	247	240	5/8	“
232	226	221	214	209	202	197	190	185	179	173	1/4	**25.0**
250	245	238	233	227	220	214	207	201	196	189	5/16	“
269	264	258	252	245	238	232	226	218	212	206	3/8	“
288	283	276	270	264	257	250	242	236	229	222	7/16	“
308	301	295	288	280	273	266	259	252	245	238	1/2	“
326	319	312	304	296	289	281	274	266	260	251	9/16	“
344	335	328	320	313	309	297	289	281	273	264	5/8	“

For detail dimensions see page 210.

SAFE LOADS IN THOUSANDS OF POUNDS FOR 10″ CHANNEL AND PLATE COLUMNS. SQUARE ENDS.

Based on Gordon's Formula $P = \dfrac{50\,000}{1 + \dfrac{(12\,L)^2}{36\,000\,r^2}}$. **Safety factor 4.**



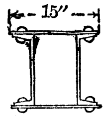
SERIES B.

Weight of each Channel.	Thickness of Plates.	Weight of Column.	Area of Column Section.	Least Radius of Gyration.	Length in Feet.								
Lbs. per Ft.	Inch.	Lbs. per Ft.	Sq. Ins.	Inches.	8	10	12	14	16	18	20	22	24
15	1/4	55.5	16.42	4.49	203	201	199	198	195	193	190	187	185
"	5/16	61.9	18.30	4.58	226	224	223	220	218	216	212	209	206
"	3/8	68.3	20.17	4.65	249	247	245	243	241	238	235	232	228
"	7/16	74.6	22.05	4.70	272	271	268	266	263	261	257	253	250
"	1/2	81.0	23.92	4.67	296	294	291	289	286	282	278	275	271
"	9/16	87.4	25.80	4.65	319	316	314	311	308	304	300	296	291
"	5/8	93.8	27.67	4.63	342	339	337	334	330	326	322	317	312
20	1/4	65.5	19.26	4.29	237	236	233	231	228	225	221	218	214
"	5/16	71.9	21.14	4.39	261	259	257	254	251	248	244	240	236
"	3/8	78.3	23.01	4.47	284	282	279	277	273	270	266	262	258
"	7/16	84.6	24.89	4.55	307	305	303	300	297	292	289	285	280
"	1/2	91.0	26.76	4.62	331	328	326	323	319	315	311	306	302
"	9/16	97.4	28.64	4.63	354	351	349	346	341	337	333	328	323
"	5/8	103.8	30.51	4.61	377	374	371	368	364	359	355	349	344
25	1/4	75.5	22.20	4.13	274	271	268	265	262	258	254	249	245
"	5/16	81.9	24.08	4.23	297	294	292	288	285	280	277	272	266
"	3/8	88.3	25.95	4.32	320	318	315	312	308	303	299	294	288
"	7/16	94.6	27.83	4.40	343	341	338	334	331	326	322	316	310
"	1/2	101.0	29.70	4.48	367	364	361	357	353	349	343	339	332
"	9/16	107.4	31.58	4.55	390	387	384	380	376	371	366	361	355
"	5/8	113.8	33.45	4.58	413	410	407	403	399	394	388	383	377
30	1/4	85.5	25.14	4.01	309	307	303	300	295	291	286	280	275
"	5/16	91.9	27.02	4.11	333	330	327	323	318	313	308	302	298
"	3/8	98.3	28.89	4.20	356	353	349	346	341	336	331	326	320
"	7/16	104.6	30.77	4.28	379	377	373	369	365	359	353	348	342
"	1/2	111.0	32.64	4.36	403	400	396	392	387	382	376	371	364
"	9/16	117.4	34.52	4.43	426	423	419	415	410	404	399	392	386
"	5/8	123.8	36.39	4.50	449	446	442	438	432	428	422	415	409
35	1/4	95.5	28.08	3.90	345	342	338	334	329	324	318	312	304
"	5/16	101.9	29.96	4.00	369	365	361	357	352	346	340	334	327
"	3/8	108.3	31.83	4.10	392	389	385	380	375	369	363	356	349
"	7/16	114.6	33.71	4.18	415	412	408	404	398	392	386	379	373
"	1/2	121.0	35.58	4.26	438	436	431	426	420	415	409	401	395
"	9/16	127.4	37.46	4.33	462	459	454	450	444	437	432	424	418
"	5/8	133.8	39.33	4.40	485	481	478	472	467	461	455	447	439

For detail dimensions see page 211.

SAFE LOADS IN THOUSANDS OF POUNDS FOR 10″ CHANNEL AND PLATE COLUMNS. SQUARE ENDS.

Based on Gordon's Formula $P = \dfrac{50\,000}{1 + \dfrac{(12\,L)^2}{36\,000\,r^2}}$. **Safety factor 4.**



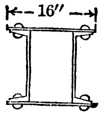
SERIES B.

Length in Feet.												Thickness of Plates.	Weight of each Channel.
26	28	30	32	34	36	38	40	42	44	46	48	Inch.	Lbs. per Ft.
181	178	174	171	167	163	159	156	152	148	145	141	$\frac{1}{4}$	15
202	199	195	191	188	183	179	176	171	167	163	159	$\frac{5}{16}$	"
224	220	216	212	208	204	199	195	190	185	181	177	$\frac{3}{8}$	"
246	241	237	233	228	223	218	214	209	204	199	195	$\frac{7}{16}$	"
266	261	257	251	246	242	237	231	226	221	215	210	$\frac{1}{2}$	"
287	282	276	271	266	261	254	249	244	237	232	226	$\frac{9}{16}$	"
307	302	296	291	285	278	273	267	260	254	248	241	$\frac{5}{8}$	"
210	206	201	197	193	188	183	179	174	169	165	160	$\frac{1}{4}$	20
232	227	223	218	214	208	203	198	193	189	183	179	$\frac{5}{16}$	"
254	248	244	238	234	228	223	218	213	208	202	197	$\frac{3}{8}$	"
275	270	265	260	254	249	243	238	232	226	221	216	$\frac{7}{16}$	"
297	291	286	281	274	269	264	257	251	246	239	233	$\frac{1}{2}$	"
318	313	306	301	295	288	282	276	269	263	257	250	$\frac{9}{16}$	"
339	332	326	320	313	307	301	293	286	280	272	266	$\frac{5}{8}$	"
239	234	229	224	219	213	207	202	196	190	186	180	$\frac{1}{4}$	25
262	256	250	245	240	234	227	221	216	210	204	199	$\frac{5}{16}$	"
284	277	272	266	260	254	248	241	236	229	223	217	$\frac{3}{8}$	"
305	299	294	287	281	274	268	261	256	248	241	236	$\frac{7}{16}$	"
327	322	315	309	302	296	288	282	274	268	261	255	$\frac{1}{2}$	"
349	342	336	330	322	316	308	301	295	287	280	274	$\frac{9}{16}$	"
370	364	356	350	343	335	328	321	312	305	299	290	$\frac{5}{8}$	"
269	263	257	250	244	237	231	224	218	212	205	199	$\frac{1}{4}$	30
291	285	278	272	265	258	252	245	239	232	225	218	$\frac{5}{16}$	"
313	306	300	293	286	279	273	265	258	251	243	238	$\frac{3}{8}$	"
335	329	322	314	308	300	292	286	278	270	264	256	$\frac{7}{16}$	"
357	351	342	336	328	320	313	305	298	290	282	275	$\frac{1}{2}$	"
379	372	364	357	349	342	333	326	317	310	301	294	$\frac{9}{16}$	"
401	394	386	378	370	362	355	345	338	329	321	312	$\frac{5}{8}$	"
298	291	284	277	269	262	255	248	239	232	225	219	$\frac{1}{4}$	35
320	313	306	298	291	283	275	267	260	252	245	238	$\frac{5}{16}$	"
343	336	328	320	312	304	296	287	281	273	265	257	$\frac{3}{8}$	"
365	357	349	340	334	325	317	309	301	292	284	276	$\frac{7}{16}$	"
387	379	372	363	354	345	338	329	320	312	303	294	$\frac{1}{2}$	"
409	401	393	384	375	367	358	350	340	331	323	314	$\frac{9}{16}$	"
432	422	415	405	397	387	379	369	361	351	341	333	$\frac{5}{8}$	"

For detail dimensions see page 211.

SAFE LOADS IN THOUSANDS OF POUNDS FOR 12″ CHANNEL AND PLATE COLUMNS. SQUARE ENDS.

Based on Gordon's Formula $P = \dfrac{50\,000}{1 + \dfrac{(12\,L)^2}{36\,000\,r^2}}$. **Safety factor** 4.



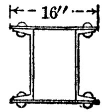
SERIES B.

Weight of each Channel.	Thickness of Plates.	Weight of Column.	Area of Column Section.	Least Radius of Gyration.	Length in Feet.								
Lbs. per Ft.	Inch.	Lbs. per Ft.	Sq. Ins.	Inches.	8	10	12	14	16	18	20	22	24
20.5	1/4	68.2	20.06	5.23	248	247	246	244	241	240	237	234	231
"	5/16	75.0	22.06	5.18	273	272	270	268	266	263	260	258	254
"	3/8	81.8	24.06	5.14	298	296	295	292	290	287	283	280	276
"	7/16	88.6	26.06	5.10	322	321	318	317	314	311	307	303	299
"	1/2	95.4	28.06	5.07	347	345	343	340	337	333	331	327	322
"	9/16	102.2	30.06	5.04	372	370	367	364	361	357	354	349	344
"	5/8	109.0	32.06	5.01	397	394	392	389	385	381	377	372	367
25	1/4	77.2	22.70	5.09	281	279	277	275	273	270	267	264	261
"	5/16	84.0	24.70	5.14	306	304	302	300	297	294	291	287	284
"	3/8	90.8	26.70	5.11	330	328	326	324	321	318	315	311	307
"	7/16	97.6	28.70	5.07	355	353	351	348	345	341	338	334	330
"	1/2	104.4	30.70	5.05	380	378	375	372	369	365	361	356	351
"	9/16	111.2	32.70	5.02	405	402	400	396	393	389	384	379	374
"	5/8	118.0	34.70	5.00	429	427	424	421	417	412	408	403	397
30	1/4	87.2	25.64	4.93	317	315	313	311	308	304	300	296	292
"	5/16	94.0	27.64	5.04	342	340	338	335	332	328	326	321	316
"	3/8	100.8	29.64	5.07	367	365	362	359	356	352	349	345	340
"	7/16	107.6	31.64	5.04	391	389	387	383	380	376	373	367	362
"	1/2	114.4	33.64	5.02	416	414	411	408	404	400	395	390	385
"	9/16	121.2	35.64	4.99	441	438	435	432	428	424	419	413	408
"	5/8	128.0	37.64	4.98	466	463	460	456	452	447	442	437	431
35	1/4	97.2	28.58	4.80	353	351	349	346	342	338	334	329	325
"	5/16	104.0	30.58	4.91	378	376	374	370	366	362	358	354	349
"	3/8	110.8	32.58	5.01	403	401	398	395	391	387	383	378	373
"	7/16	117.6	34.58	4.99	428	425	422	419	415	411	406	401	396
"	1/2	124.4	36.58	4.97	453	450	447	443	439	435	430	424	419
"	9/16	131.2	38.58	4.95	477	475	471	468	463	458	453	448	442
"	5/8	138.0	40.58	4.94	502	499	496	492	487	482	477	469	463
40	1/4	107.2	31.52	4.69	389	387	384	380	377	373	367	362	357
"	5/16	114.0	33.52	4.80	414	412	409	405	402	396	391	386	381
"	3/8	120.8	35.52	4.90	439	437	434	430	425	421	416	411	405
"	7/16	127.6	37.52	4.95	464	462	458	455	451	446	441	435	429
"	1/2	134.4	39.52	4.94	489	486	483	479	474	470	464	457	451
"	9/16	141.2	41.52	4.92	514	511	507	503	497	492	486	480	473
"	5/8	148.0	43.52	4.91	538	535	532	526	521	516	510	503	496

For detail dimensions see page 211.

SAFE LOADS IN THOUSANDS OF POUNDS FOR 12″ CHANNEL AND PLATE COLUMNS. SQUARE ENDS.

Based on Gordon's Formula $P = \dfrac{50\,000}{1 + \dfrac{(12\,L)^2}{36\,000\,r^2}}$. **Safety factor 4.**



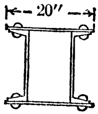
SERIES B.

Length in Feet.												Thickness of Plates.	Weight of each Channel.
26	28	30	32	34	36	38	40	42	44	46	48	Inch.	Lbs. per Ft.
228	225	222	218	215	211	207	204	200	196	191	187	1/4	20.5
251	247	243	239	235	231	227	223	218	214	209	205	5/16	"
272	269	265	261	256	251	247	242	237	232	228	223	3/8	"
295	291	286	281	276	271	266	262	257	251	246	241	7/16	"
318	313	308	303	297	292	286	281	275	269	263	258	1/2	"
339	334	328	324	319	313	307	301	295	288	282	276	9/16	"
362	356	350	344	338	332	326	319	313	306	299	293	5/8	"
257	253	249	245	241	236	232	227	222	219	214	210	1/4	25
280	276	272	268	263	258	253	248	243	238	234	229	5/16	"
302	298	293	288	283	279	274	268	263	258	252	247	3/8	"
325	320	315	310	304	299	293	287	281	275	269	264	7/16	"
348	342	337	331	325	319	313	307	301	295	288	282	1/2	"
369	363	357	351	345	339	332	325	319	312	305	299	9/16	"
391	385	379	373	366	359	352	345	338	331	324	317	5/8	"
288	284	279	274	269	264	259	254	249	243	238	233	1/4	30
312	307	302	298	293	287	282	276	271	265	260	254	5/16	"
336	330	325	320	314	308	302	296	290	284	278	272	3/8	"
357	351	346	341	335	329	323	316	310	304	297	291	7/16	"
379	374	368	361	355	348	342	335	328	321	314	307	1/2	"
402	396	389	383	376	369	362	355	347	340	333	326	9/16	"
425	418	411	404	397	390	382	375	367	359	351	344	5/8	"
320	315	310	303	297	292	286	280	273	267	261	255	1/4	35
344	338	333	327	321	315	309	303	295	289	282	276	5/16	"
368	362	356	350	344	337	331	324	318	311	304	298	3/8	"
390	384	378	371	365	358	351	344	337	330	323	316	7/16	"
413	406	400	393	386	379	371	364	355	347	340	332	1/2	"
434	427	420	413	405	398	390	382	374	366	358	350	9/16	"
456	449	442	434	426	418	410	402	394	385	377	369	5/8	"
351	344	339	333	326	318	312	306	298	291	285	278	1/4	40
375	369	363	355	349	342	335	328	320	313	306	299	5/16	"
399	393	386	380	373	366	357	350	343	335	328	321	3/8	"
422	415	408	401	394	387	379	372	364	356	348	341	7/16	"
444	437	430	423	415	407	399	391	383	375	367	359	1/2	"
466	459	452	444	436	428	420	411	403	394	386	375	9/16	"
489	481	473	465	457	448	440	431	420	411	402	393	5/8	"

For detail dimensions see page 211.

SAFE LOADS IN THOUSANDS OF POUNDS FOR 15″ CHANNEL AND PLATE COLUMNS. SQUARE ENDS.

Based on Gordon's Formula $P = \dfrac{50\,000}{1+\dfrac{(12\ L)^2}{36\,000 r^2}}$. **Safety factor 4.**



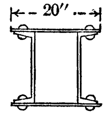
SERIES B.

Weight of each Channel.	Thickness of Plates.	Weight of Column.	Area of Column Section.	Least Radius of Gyration.	Length in Feet.								
Lbs. per Ft.	Inch.	Lbs. per Ft.	Sq. Ins.	Inches.	12	14	16	18	20	22	24	26	28
33	3/8	117.0	34.80	6.59	429	427	425	423	420	417	414	410	406
"	7/16	125.5	37.30	6.57	460	458	456	453	450	447	442	438	434
"	1/2	134.0	39.80	6.52	491	489	485	482	479	476	472	468	463
"	9/16	142.5	42.30	6.48	521	519	516	513	509	505	501	497	492
"	5/8	151.0	44.80	6.44	552	549	546	543	539	535	531	526	521
"	11/16	159.5	47.30	6.41	583	580	577	573	569	565	561	554	549
"	3/4	168.0	49.80	6.38	614	611	607	604	599	595	589	583	578
35	3/8	121.0	35.58	6.55	439	437	435	432	428	425	422	418	414
"	7/16	129.5	38.08	6.56	470	468	465	463	459	455	451	447	443
"	1/2	138.0	40.58	6.52	501	498	495	492	488	485	481	477	472
"	9/16	146.5	43.08	6.48	531	528	525	522	519	515	511	506	501
"	5/8	155.0	45.58	6.44	562	559	556	552	549	545	540	535	531
"	11/16	163.5	48.08	6.41	592	590	586	583	579	574	570	563	558
"	3/4	172.0	50.58	6.38	623	620	617	613	609	604	598	592	587
40	3/8	131.0	38.52	6.41	475	472	470	467	464	460	457	451	447
"	7/16	139.5	41.02	6.51	506	503	500	497	494	490	486	482	477
"	1/2	148.0	43.52	6.50	537	534	531	527	524	520	516	511	507
"	9/16	156.5	46.02	6.47	567	564	561	558	554	550	545	541	536
"	5/8	165.0	48.52	6.43	598	595	592	588	584	580	575	570	563
"	11/16	173.5	51.02	6.40	629	626	622	618	614	610	603	598	592
"	3/4	182.0	53.52	6.37	659	656	653	649	644	638	633	627	621
45	3/8	141.0	41.48	6.28	511	509	506	502	498	494	490	486	480
"	7/16	149.5	43.98	6.39	542	539	536	533	529	525	520	515	510
"	1/2	158.0	46.48	6.48	573	570	567	563	559	555	551	546	541
"	9/16	166.5	48.98	6.45	604	601	597	594	590	585	580	575	570
"	5/8	175.0	51.48	6.42	634	631	628	624	620	615	610	603	597
"	11/16	183.5	53.98	6.39	665	662	658	654	650	645	638	632	626
"	3/4	192.0	56.48	6.37	696	693	689	685	680	673	667	661	655
50	3/8	151.0	44.42	6.17	547	544	541	537	533	528	523	519	514
"	7/16	159.5	46.92	6.28	578	575	572	567	563	559	555	550	543
"	1/2	168.0	49.42	6.37	609	606	603	599	595	589	584	579	573
"	9/16	176.5	51.92	6.43	640	636	633	629	625	620	615	610	602
"	5/8	185.0	54.42	6.40	671	667	664	660	655	650	643	637	631
"	11/16	193.5	56.92	6.37	701	698	694	690	685	678	673	667	660
"	3/4	202.0	59.42	6.35	732	729	725	720	715	708	702	696	689
55	3/8	161.0	47.36	6.07	583	580	576	571	567	563	556	551	546
"	7/16	169.5	49.86	6.18	614	610	607	603	599	593	588	582	577
"	1/2	178.0	52.36	6.28	645	642	639	633	629	624	619	613	605
"	9/16	186.5	54.86	6.37	676	673	669	665	660	654	648	643	636
"	5/8	195.0	57.36	6.38	707	703	700	695	690	685	678	672	665
"	11/16	203.5	59.86	6.35	738	734	730	726	721	713	707	701	694
"	3/4	212.0	62.36	6.33	768	764	760	756	751	743	737	730	724

For detail dimensions see page 211.

SAFE LOADS IN THOUSANDS OF POUNDS FOR 15″ CHANNEL AND PLATE COLUMNS. SQUARE ENDS.

Based on Gordon's Formula $P=\dfrac{50\,000}{1+\dfrac{(12\,L)^2}{36\,000\,r^2}}$. **Safety factor** 4.



SERIES B.

Length in Feet.												Thick-ness of Plates.	Weight of each Channel.
30	32	34	36	38	40	42	44	46	48	50	52	Inch.	Lbs. per Ft.
401	397	393	388	383	379	374	369	364	359	353	348	3/8	**33**
430	425	421	416	411	406	401	395	390	384	379	373	7/16	"
459	454	449	444	439	433	427	422	414	408	402	396	1/2	"
487	482	477	470	464	458	452	446	440	434	427	421	9/16	"
515	509	503	498	492	485	479	473	466	457	450	444	5/8	"
543	538	532	525	519	512	504	497	490	483	476	468	11/16	"
572	566	560	553	544	537	530	523	516	508	501	491	3/4	"
410	406	401	397	392	387	382	377	372	367	361	356	3/8	**35**
439	434	430	425	420	414	409	404	398	392	387	381	7/16	"
468	463	458	452	447	442	436	430	422	416	410	404	1/2	"
496	491	486	478	473	467	461	454	448	442	435	429	9/16	"
523	518	512	506	500	494	487	481	474	465	458	451	5/8	"
552	546	540	534	528	521	512	505	498	491	483	476	11/16	"
581	575	568	562	553	546	538	531	524	516	509	498	3/4	"
442	438	433	428	423	417	410	404	399	393	387	381	3/8	**40**
473	468	463	457	452	446	439	433	427	421	414	408	7/16	"
502	496	491	485	480	471	465	459	453	446	440	433	1/2	"
530	525	517	511	505	499	492	485	479	472	465	458	9/16	"
557	551	545	539	532	526	519	512	502	495	488	480	5/8	"
586	580	573	567	560	553	543	536	528	521	513	505	11/16	"
615	608	601	592	585	577	570	562	554	546	538	527	3/4	"
475	470	464	459	451	445	440	433	427	421	413	407	3/8	**45**
505	500	494	488	483	474	468	462	455	449	442	435	7/16	"
536	530	524	516	510	504	497	490	483	477	470	463	1/2	"
563	557	550	544	537	531	524	517	509	502	492	485	9/16	"
591	585	578	572	565	558	550	540	533	525	518	510	5/8	"
620	613	607	600	592	582	575	567	559	551	543	535	11/16	"
649	642	635	625	617	609	601	593	585	576	568	556	3/4	"
507	501	495	489	481	475	469	462	453	447	440	433	3/8	**50**
537	531	525	519	510	504	497	493	483	476	467	460	7/16	"
568	562	555	547	540	533	526	519	512	504	497	487	1/2	"
596	590	583	577	570	563	555	548	538	530	522	514	9/16	"
625	618	612	604	597	590	579	571	563	555	547	539	5/8	"
654	647	640	630	622	614	606	598	589	581	572	561	11/16	"
682	675	665	657	649	641	632	623	615	603	594	585	3/4	"
540	532	526	520	511	504	497	490	481	474	466	457	3/8	**55**
569	562	556	549	542	533	526	519	511	501	494	486	7/16	"
599	593	586	579	570	562	555	547	540	532	521	513	1/2	"
630	623	616	607	599	592	584	576	568	560	552	540	9/16	"
659	652	645	637	627	619	611	602	594	585	577	565	5/8	"
687	680	670	662	654	646	637	628	620	608	599	590	11/16	"
716	706	698	690	681	673	664	652	643	633	624	614	3/4	"

For detail dimensions see page 211.

SAFE LOADS IN THOUSANDS OF POUNDS FOR HOLLOW ROUND CAST IRON COLUMNS. SQUARE ENDS.

Based on Gordon's Formula $P=\dfrac{10\,000}{1+\dfrac{l^2}{800\,d^2}}$.

P=safe load in pounds per square inch.
l=length of column in inches.
d=outside diameter of column in inches.
Ultimate compressive strength=80 000 pounds per square inch. Safety factor 8.
Safe loads for other safety factors than that of the tables may be obtained as follows:—New safe load=Safe load from table $\times \dfrac{8}{\text{New factor}}$.

Outside Diameter in Inches.	Thickness in Inches.	Length of Column in Feet.										Area of Metal in Sq. Ins.	Weight per Foot in Pounds.
		6	8	10	12	14	16	18	20	22	24		
6	3/4	105	94	82	72	62	54	47	41	36	32	12.4	38.7
	7/8	119	107	94	82	71	62	54	47	41	36	14.1	44.0
7	3/4	130	119	108	96	86	76	67	60	53	47	14.7	46.0
	7/8	149	136	123	110	98	87	77	68	61	54	16.8	52.6
8	3/4	155	145	133	122	110	99	89	80	72	65	17.1	53.4
	7/8	178	166	153	139	126	114	104	92	83	75	19.6	61.2
	1	200	186	172	158	142	128	115	103	93	84	22.0	68.7
9	7/8	207	196	183	169	159	142	130	118	108	98	22.3	69.8
	1	233	220	206	190	179	160	146	133	121	110	25.1	78.5
	1 1/8	258	244	228	211	198	177	162	147	134	122	27.8	87.0
10	7/8	235	225	212	199	185	172	158	146	134	123	25.1	78.4
	1	265	254	240	224	209	194	178	164	151	139	28.3	88.4
	1 1/8	294	281	266	249	232	215	198	182	168	154	31.4	98.0
	1 1/4	323	308	291	273	254	235	217	200	184	169	34.4	107.4
11	1	298	287	273	259	243	227	212	197	183	169	31.4	98.2
	1 1/8	330	317	304	287	270	253	235	219	203	188	34.9	109.1
	1 1/4	363	350	333	315	296	277	258	240	223	206	38.3	119.7
	1 3/8	395	380	361	342	322	301	280	261	242	224	41.6	129.9
12	1 1/8	368	356	342	326	309	291	274	256	239	223	38.4	120.1
	1 1/4	404	391	375	358	339	320	300	281	263	245	42.2	131.9
	1 3/8	439	425	408	389	369	348	327	306	287	267	45.9	143.4
	1 1/2	473	458	440	419	397	375	352	330	308	288	49.5	154.6
13	1 1/8	404	393	379	364	347	330	312	294	277	260	42.0	131.2
	1 1/4	444	432	417	400	382	363	343	323	304	286	46.1	144.2
	1 3/8	484	470	454	435	415	395	373	352	331	311	50.2	156.9
	1 1/2	522	507	490	470	448	426	403	380	358	336	54.2	169.4
14	1 1/4	485	473	459	442	424	405	386	366	347	327	50.1	156.5
	1 3/8	528	515	499	482	462	441	420	399	378	357	54.5	170.4
	1 1/2	570	556	540	520	499	477	454	431	408	385	58.9	184.1
	1 5/8	612	597	579	558	535	511	487	462	437	413	63.2	197.4
15	1 3/8	573	560	545	528	509	489	467	446	424	406	58.9	183.9
	1 1/2	618	605	589	570	550	528	505	482	459	439	63.6	203.4
	1 5/8	664	650	632	612	590	567	542	517	492	471	68.3	213.4
	1 3/4	708	694	675	653	630	605	577	552	525	502	72.8	227.6
16	1 1/2	666	654	638	620	600	579	557	533	510	486	68.3	213.5
	1 5/8	716	702	686	666	645	622	598	573	548	522	73.4	229.3
	1 3/4	764	750	732	711	689	664	638	611	584	558	78.3	244.8
	1 7/8	909	892	871	846	819	790	759	727	695	663	93.2	291.3

SAFE LOADS IN THOUSANDS OF POUNDS FOR HOLLOW ROUND CAST IRON COLUMNS. SQUARE ENDS.

Based on Gordon's Formula $P = \dfrac{10\,000}{1 + \dfrac{l^2}{800\,d^2}}$.

P=safe load in pounds per square inch.
l=length of column in inches.
d=outside diameter of column in inches.
Ultimate compressive strength=80 000 pounds per square inch. Safety factor 8.
Safe loads for other safety factors than that of the tables may be obtained as follows :—New safe load=Safe load from table $\times \dfrac{8}{\text{New factor}}$.

Outside Diameter in Inches.	Thickness in Inches.	Length of Column in Feet.										Area of Metal in Sq. Ins.	Weight per Foot in Pounds.
		14	16	18	20	22	24	26	28	30	32		
18	1 5/8	754	732	708	684	659	633	608	596	557	533	83.6	261.2
	1 3/4	806	782	757	732	704	677	650	637	596	569	89.3	279.2
	1 7/8	857	832	805	777	749	720	691	677	633	605	95.0	296.8
	2	907	880	852	823	792	762	731	717	670	641	100.5	314.2
20	1 3/4	922	900	876	850	824	797	769	742	714	687	100.3	313.6
	1 7/8	981	957	932	905	877	848	819	789	760	731	106.8	333.6
	2	1039	1014	987	958	929	898	867	836	805	774	113.1	353.4
	2 1/8	1097	1070	1041	1011	980	948	915	882	849	817	119.3	372.9
22	1 7/8	1105	1082	1058	1032	1005	976	947	918	888	859	118.5	370.5
	2	1171	1147	1122	1094	1065	1035	1004	974	941	910	125.7	392.7
	2 1/8	1239	1213	1186	1157	1126	1094	1062	1029	996	962	132.9	415.3
	2 1/4	1301	1275	1246	1215	1183	1150	1116	1081	1046	1011	139.6	436.3
24	2	1303	1280	1241	1229	1201	1171	1141	1110	1079	1047	138.2	432.0
	2 1/8	1376	1352	1311	1298	1268	1238	1206	1173	1140	1106	146.0	456.4
	2 1/4	1449	1423	1380	1367	1335	1303	1269	1235	1200	1165	153.7	480.4
	2 3/8	1520	1494	1448	1434	1402	1367	1332	1296	1259	1222	161.4	504.2
26	2 1/8	1515	1492	1467	1440	1412	1382	1351	1319	1286	1252	159.4	498.1
	2 1/4	1596	1572	1546	1517	1487	1456	1423	1389	1354	1319	167.9	524.6
	2 3/8	1675	1650	1623	1593	1562	1528	1494	1458	1422	1385	176.3	550.9
	2 1/2	1754	1728	1699	1668	1635	1600	1564	1527	1489	1450	184.6	576.8
28	2 1/4	1742	1719	1694	1667	1638	1608	1576	1542	1508	1474	182.0	568.8
	2 3/8	1829	1806	1780	1751	1721	1689	1655	1620	1584	1548	191.2	597.5
	2 1/2	1917	1892	1864	1834	1802	1769	1734	1697	1660	1622	200.3	625.9
	2 5/8	2002	1967	1948	1917	1883	1848	1811	1773	1734	1694	209.3	653.9
30	2 3/8	1982	1961	1936	1909	1879	1848	1816	1782	1747	1711	206.1	644.1
	2 1/2	2078	2055	2028	2000	1969	1937	1903	1867	1830	1793	216.0	675.0
	2 5/8	2172	2148	2119	2090	2058	2024	1989	1952	1913	1874	225.8	705.5
	2 3/4	2265	2240	2210	2180	2147	2111	2074	2035	1995	1954	235.4	735.7
32	2 1/2	2239	2217	2192	2165	2135	2104	2071	2036	2000	1963	231.7	724.0
	2 5/8	2341	2318	2292	2264	2233	2200	2165	2129	2092	2053	242.2	757.0
	2 3/4	2442	2418	2391	2361	2329	2295	2259	2221	2182	2141	252.7	789.7
	2 7/8	2542	2517	2489	2458	2424	2389	2351	2312	2271	2229	263.1	822.1
34	2 5/8	2511	2488	2463	2436	2406	2374	2341	2306	2272	2232	258.7	808.6
	2 3/4	2620	2596	2570	2542	2511	2478	2441	2406	2370	2329	270.0	843.7
	2 7/8	2728	2703	2676	2646	2614	2580	2544	2505	2468	2425	281.1	878.5
	3	2835	2810	2781	2750	2717	2681	2643	2604	2565	2520	292.2	913.0
36	2 3/4	2796	2774	2749	2721	2692	2660	2626	2591	2553	2515	287.3	897.7
	2 7/8	2913	2889	2863	2834	2803	2770	2735	2698	2659	2619	299.2	935.0
	3	3028	3003	2976	2946	2904	2880	2849	2805	2765	2723	311.0	971.9

STRENGTH OF HOLLOW ROUND AND HOLLOW RECTANGULAR CAST IRON COLUMNS.

For various values of $\frac{L}{d}$ in which:—

L = length of column in feet.
d = least outside diameter in inches.
P = ultimate strength in pounds per square inch.

BASED ON GORDON'S FORMULÆ FOR COLUMNS WITH SQUARE ENDS.

HOLLOW ROUND.

$$P = \frac{80000}{1 + \frac{(12L)^2}{800\,d^2}}$$

HOLLOW RECTANGULAR.

$$P = \frac{80000}{1 + \frac{(12L)^2}{1067\,d^2}}$$

$\frac{L}{d}$	Ultimate Strength in lbs. per sq. in. Hollow Round.	Ultimate Strength in lbs. per sq. in. Hollow Rectangular.	$\frac{L}{d}$	Ultimate Strength in lbs. per sq. in. Hollow Round.	Ultimate Strength in lbs. per sq. in. Hollow Rectangular.
1.0	67800	70487	2.5	37647	43396
1.1	65692	68770	2.6	36088	41834
1.2	63532	66983	2.7	34599	40326
1.3	61340	65142	2.8	33178	38871
1.4	59137	63265	2.9	31817	37471
1.5	56940	61366	3.0	30534	36123
1.6	54766	59458	3.1	29306	34829
1.7	52625	57553	3.2	28137	33586
1.8	50531	55660	3.3	27025	32393
1.9	48491	53792	3.4	25967	31249
2.0	46512	51954	3.5	24961	30152
2.1	44598	50151	3.6	24004	29101
2.2	42753	48391	3.7	23093	28094
2.3	40979	46676	3.8	22227	27130
2.4	39277	45011	3.9	21403	26206

Safe loads for any given hollow round or hollow rectangular columns, corresponding to any suitable factor of safety can be found from the above table as follows:—

Find from the table the ultimate strength in pounds per square inch corresponding to the given value of $\frac{L}{d}$. Multiply this by the area of the column in square inches and divide the product by the safety factor which will give as a quotient the required safe load in pounds.

EXAMPLE:—Required the safe load for a hollow round cast iron column 16 feet long, 10 inches external diameter with metal 1 inch thick with safety factor of eight. The ratio of $\frac{L}{d}$ in this case is $\frac{16}{10} = 1.6$ and the corresponding ultimate strength from the tables is 54 766 pounds per square inch.

From the table of areas of circles it is found that the net area of the column is 28.3 square inches. The safe load is, therefore, $\frac{54\,766 \times 28.3}{8} = 193\,735$ pounds or approximately 97 net tons, which is the required result.

EXPLANATIONS OF TABLES OF SAFE LOADS FOR BEAM BOX-GIRDERS AND PLATE GIRDERS, PAGES 284 TO 298 INCLUSIVE.

For cases in which the loads to be carried exceed the capacities of single rolled beams or ordinary beam girders composed of two or more beams with the usual bolts and separators, it is necessary to use built-up sections.

BEAM BOX-GIRDERS.—A useful and economical section of this kind can be composed of two rolled beams with plates riveted to the top and bottom flanges, making a beam box-girder, for which tables of safe uniformly distributed loads are given on pages 284 to 293 inclusive.

The safe loads given in the tables include the weights of the beam box-girders, and are figured from the moment of inertia or the section modulus after making the necessary deductions for rivet holes, the fibre stress used in the calculations being 15 000 pounds per square inch of net section.

Beam box-girders are particularly useful for supporting wide walls and in other locations up to the limits of their capacity, but they should not be placed where exposed to moisture, as the section is such that access cannot be had to their interior for inspection and painting.

PLATE GIRDERS.—In cases where the widths of beam box-girders would prohibit their use, and for loads greater than their capacities, plate girders composed of plates and angles may be used.

Tables of safe loads uniformly distributed for plate girders from 24″ to 48″ deep are given on pages 294 to 298 inclusive.

The loads given in the tables include the weights of the girders and are calculated from the moment of inertia or the section modulus after making a proper deduction for rivet holes, the fibre stress used in the calculation being 15 000 pounds per square inch of net section.

Although the tables do not show the stiffener angles for plate girders, care should be taken that these are provided in all cases where necessary to prevent buckling of the web due to the shearing action therein. The stiffeners should be made of angles riveted to the web, fitted tightly between the top and bottom flange angles, and they should be provided, at the end of the girders, of such size and number as to be capable of carrying the total reaction at each end to the supports. Stiffeners should also be provided at intervals along the girder, spaced at suitable distances apart, as determined by the formula and explanations on pages 66 and 67.

Care should also be taken in arranging the rivet spacing for connecting the flange angles to the web, so that sufficient rivets are provided to properly transmit the stresses which act between these two portions of the construction. This will require the rivets to be spaced more closely at the ends than at the center, and the exact spacing at any point along the girder may be obtained by dividing the product of the distance between the center lines of the rivet holes in the two flanges and the resistance of one rivet by the total vertical shear at the given point, thus:

$$p = \frac{r\,h}{S} \text{ in which}$$

S = the total vertical shear, in pounds, at the point under consideration.
r = the resistance of one rivet, *i. e.*, the bearing value or shearing value, whichever is the smaller, expressed in pounds.
h = the depth of the girder between the upper and lower center lines of rivets, expressed in inches.
p = pitch of rivets in the flange angles, expressed in inches.

The formula above will give the theoretical rivet spacing at any point in the flanges due to the total shear, but in practice the pitch for various portions of the length should be stated for the least possible number of spacing panels containing an even number of spaces, the pitch in each of which should preferably be expressed in even inches or even inches and halves or quartets of an inch, and the usual limits of pitch will vary from 2½″ to 6″.

The rivet spacing should also conform to the rules given on page 314, and in cases where loads are applied directly to the flanges, sufficient rivets must be provided to carry these in addition to the rivets necessary for securing the web and flanges together as explained above.

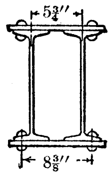
It should also be noted that the safe loads given in the tables are based on the assumption that the girder is supported laterally, otherwise a proper reduction in the allowable safe load must be made, as explained in connection with beams on pages 64 and 65.

The weights of beam box-girders and plate girders in the tables are expressed in pounds per lineal foot, including the rivets necessary to secure the web and flanges together, but the weights do not include any allowance for brackets, stiffeners, connections or other details, as these will vary, subject to the conditions of each case.

SAFE LOADS IN THOUSANDS OF POUNDS UNIFORMLY DISTRIBUTED FOR BEAM BOX GIRDERS.

Safe loads below are figured for fibre stress of 15 000 pounds per square inch, with $\frac{13}{16}''$ rivet holes in both flanges deducted, and include weight of girder.

2-Plates 12″ Wide.



2-10″ I-Beams 25 lbs. per foot.

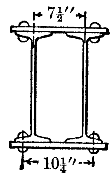
Distance Center to Center of Bearings in Feet.	Thickness of Plates in Inches. For Thicknesses Greater than ¾″ Use Two Plates.								
	½	9/16	⅝	11/16	¾	13/16	⅞	15/16	1
10	90	96	102	109	115	121	127	134	140
11	82	87	93	99	104	110	116	121	127
12	75	80	85	90	96	101	106	111	117
13	69	74	79	84	88	93	98	103	108
14	64	69	73	78	82	86	91	95	100
15	60	64	68	72	77	81	85	89	93
16	56	60	64	68	72	76	80	83	87
17	53	57	60	64	68	71	75	79	82
18	50	53	57	60	64	67	71	74	78
19	47	51	54	57	60	64	67	70	74
20	45	48	51	54	57	60	64	67	70
21	43	46	49	52	55	58	61	64	67
22	41	44	47	49	52	55	58	61	64
23	39	42	45	47	50	53	55	58	61
24	38	40	43	45	48	50	53	56	58
25	36	38	41	43	46	48	51	53	56
26	35	37	39	42	44	47	49	51	54
27	33	36	38	40	43	45	47	49	52
28	32	34	37	39	41	43	45	48	50
29	31	33	35	37	40	42	44	46	48
30	30	32	34	36	38	40	42	45	47
31	29	31	33	35	37	39	41	43	45
32	28	30	32	34	36	38	40	42	44
33	27	29	31	33	35	37	39	40	42
34	26	28	30	32	34	36	37	39	41
Weight per Foot in Pounds.	94.6	99.8	104.8	110.0	115.0	120.1	125.2	130.3	135.4
Section Modulus.	90.1	96.3	102.4	108.6	114.8	121.0	127.2	133.5	139.8
Coefficient of Deflection.	0.00000145			0.00000118			0.00000098		

For safe loads below the heavy lines, the deflections will be greater than the allowable limit for plastered ceilings $= \frac{1}{360}$ span.

SAFE LOADS IN THOUSANDS OF POUNDS UNIFORMLY DISTRIBUTED FOR BEAM BOX GIRDERS.

Safe loads below are figured for fibre stress of 15 000 pounds per square inch, with $\frac{13}{16}''$ rivet holes in both flanges deducted, and include weight of girder.

2-Plates 14″ Wide.



2-12″ I-Beams 31.5 lbs. per foot.

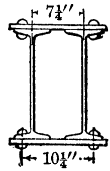
Distance Center to Center of Bearings in Feet.	Thickness of Plates in Inches. For Thicknesses Greater than ¾″ Use Two Plates.								
	$\frac{1}{2}$	$\frac{9}{16}$	$\frac{5}{8}$	$\frac{11}{16}$	$\frac{3}{4}$	$\frac{13}{16}$	$\frac{7}{8}$	$\frac{15}{16}$	1
10	132	141	150	159	167	176	185	194	203
11	120	128	136	144	152	160	168	177	185
12	110	117	125	132	140	147	154	162	169
13	102	108	115	122	129	136	143	149	156
14	94	101	107	113	120	126	132	139	145
15	88	94	100	106	112	118	123	129	135
16	83	88	94	99	105	110	116	121	127
17	78	83	88	93	98	104	109	114	120
18	73	78	83	88	93	98	103	108	113
19	70	74	79	83	88	93	98	102	107
20	66	70	75	79	84	88	93	97	102
21	63	67	71	76	80	84	88	92	97
22	60	64	68	72	76	80	84	88	92
23	57	61	65	69	73	77	81	84	88
24	55	59	62	66	70	73	77	81	85
25	53	56	60	63	67	71	74	78	81
26	51	54	58	61	64	68	71	75	78
27	49	52	55	59	62	65	69	72	75
28	47	50	53	57	60	63	66	69	73
29	46	49	52	55	58	61	64	67	70
30	44	47	50	53	56	59	62	65	68
31	43	45	48	51	54	57	60	63	66
32	41	44	47	50	52	55	58	61	64
33	40	43	45	48	51	53	56	59	62
34	39	41	44	47	49	52	54	57	60
Weight per Foot in Pounds.	114.4	120.4	126.3	132.3	138.3	144.2	150.1	156.1	162.0
Section Modulus.	132.1	140.9	149.7	158.5	167.4	176.3	185.3	194.2	203.2
Coefficient of Deflection.	0.000000842			0.000000688			0.000000577		

For safe loads below the heavy lines, the deflections will be greater than the allowable limit for plastered ceilings = $\frac{1}{360}$ span.

SAFE LOADS IN THOUSANDS OF POUNDS UNIFORMLY DISTRIBUTED FOR BEAM BOX GIRDERS.

Safe loads below are figured for fibre stress of 15 000 pounds per square inch, with $\frac{13}{16}''$ rivet holes in both flanges deducted, and include weight of girder.

2–Plates 14″ Wide.



2–12″ I-Beams 40 lbs. per foot.

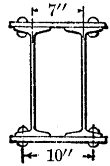
Distance Center to Center of Bearings in Feet.	Thickness of Plates in Inches. For Thicknesses Greater than ¾″ Use Two Plates.								
	$\frac{1}{2}$	$\frac{9}{16}$	$\frac{5}{8}$	$\frac{11}{16}$	$\frac{3}{4}$	$\frac{13}{16}$	$\frac{7}{8}$	$\frac{15}{16}$	1
10	147	155	164	173	181	190	199	208	217
11	133	141	149	157	165	173	181	189	197
12	122	129	137	144	151	158	166	173	181
13	113	119	126	133	140	146	153	160	167
14	105	111	117	123	130	136	142	148	155
15	98	104	109	115	121	127	133	139	144
16	92	97	102	108	113	119	124	130	135
17	86	91	96	102	107	112	117	122	127
18	81	86	91	96	101	106	111	115	120
19	77	82	86	91	95	100	105	109	114
20	73	78	82	86	91	95	99	104	108
21	70	74	78	82	86	91	95	99	103
22	67	71	75	78	82	86	90	94	99
23	64	68	71	75	79	83	87	90	94
24	61	65	68	72	76	79	83	87	90
25	59	62	66	69	73	76	80	83	87
26	56	60	63	66	70	73	77	80	83
27	54	58	61	64	67	70	74	77	80
28	52	55	59	62	65	68	71	74	77
29	51	54	57	60	63	66	69	72	75
30	49	52	55	58	60	63	66	69	72
31	47	50	53	56	59	61	64	67	70
32	46	49	51	54	57	59	62	65	68
33	44	47	50	52	55	58	60	63	66
34	43	46	48	51	53	56	59	61	64
Weight per Foot in Pounds.	131.4	137.4	143.3	149.3	155.3	161.2	167.1	173.1	179.0
Section Modulus.	146.6	155.3	163.9	172.7	181.4	190.2	199.0	207.8	216.7
Coefficient of Deflection.	0.000000763				0.000000635			0.000000539	

For safe loads below the heavy lines, the deflections will be greater than the allowable limit for plastered ceilings = $\frac{1}{360}$ span.

SAFE LOADS IN THOUSANDS OF POUNDS UNIFORMLY DISTRIBUTED FOR BEAM BOX GIRDERS.

Safe loads below are figured for fibre stress of 15 000 pounds per square inch, with $\frac{13}{16}$″ rivet holes in both flanges deducted, and include weight of girder.

2-Plates 14″ Wide.



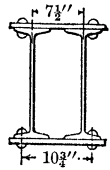
2-15″ I-Beams 42 lbs. per foot.

Distance Center to Center of Bearings in Feet.	Thickness of Plates in Inches. For Thicknesses Greater than ¾″ Use Two Plates.										
	$\frac{5}{8}$	$\frac{11}{16}$	$\frac{3}{4}$	$\frac{13}{16}$	$\frac{7}{8}$	$\frac{15}{16}$	1	$1\frac{1}{16}$	$1\frac{1}{8}$	$1\frac{3}{16}$	$1\frac{1}{4}$
10	212	223	234	245	256	267	278	289	300	312	323
11	193	203	213	223	233	243	253	263	273	283	293
12	177	186	195	204	213	223	232	241	250	260	269
13	163	172	180	188	197	205	214	223	231	240	248
14	151	159	167	175	183	191	199	207	215	223	231
15	141	149	156	163	171	178	185	193	200	208	215
16	133	139	146	153	160	167	174	181	188	195	202
17	125	131	138	144	151	157	164	170	177	183	190
18	118	124	130	136	142	148	155	161	167	173	179
19	112	117	123	129	135	141	146	152	158	164	170
20	106	112	117	122	128	134	139	145	150	156	161
21	101	106	111	117	122	127	132	138	143	148	154
22	96	101	106	111	116	121	126	131	137	142	147
23	92	97	102	107	111	116	121	126	131	135	140
24	88	93	98	102	107	111	116	121	125	130	135
25	85	89	94	98	102	107	111	116	120	125	129
26	82	86	90	94	98	103	107	111	116	120	124
27	79	83	87	91	95	99	103	107	111	115	120
28	76	80	84	88	91	95	99	103	107	111	115
29	73	77	81	84	88	92	96	100	104	107	111
30	71	74	78	82	85	89	93	96	100	104	108
31	68	72	75	79	83	86	90	93	97	101	104
32	66	70	73	77	80	83	87	90	94	97	101
33	64	68	71	74	78	81	84	88	91	94	98
34	62	66	69	72	75	79	82	85	88	92	95
Weight per Ft. in Pounds.	147.3	153.3	159.3	165.2	171.1	177.1	183.0	189.0	194.9	200.9	206.8
Section Modulus.	212.1	223.0	234.0	245.0	256.0	267.1	278.2	289.3	300.5	311.6	322.8
Coefficient of Deflection.	0.000000426			0.000000362			0.000000314			0.000000281	

SAFE LOADS IN THOUSANDS OF POUNDS UNIFORMLY DISTRIBUTED FOR BEAM BOX GIRDERS.

Safe loads below are figured for fiber stress of 15 000 pounds per square inch, with $\frac{13}{16}''$ rivet holes in both flanges deducted, and include weight of girder.

2-Plates 15″ Wide.



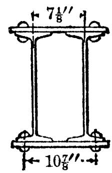
2-15″ I-Beams 60 lbs. per foot.

Distance Center to Center of Bearings in Feet.	Thickness of Plates in Inches. For Thicknesses Greater than ¾″ Use Two Plates.										
	$\frac{5}{8}$	$\frac{11}{16}$	$\frac{3}{4}$	$\frac{13}{16}$	$\frac{7}{8}$	$\frac{15}{16}$	1	$1\frac{1}{16}$	$1\frac{1}{8}$	$1\frac{3}{16}$	$1\frac{1}{4}$
10	259	271	282	294	306	318	329	341	353	365	377
11	236	246	257	267	278	289	299	310	321	332	342
12	216	226	235	245	255	265	274	284	294	304	314
13	199	208	217	226	235	244	253	262	272	281	290
14	185	193	202	210	218	227	235	244	252	261	269
15	173	181	188	196	204	212	220	227	235	243	251
16	162	169	177	184	191	198	206	213	221	228	235
17	152	159	166	173	180	187	194	201	208	215	222
18	144	150	157	163	170	176	183	190	196	203	209
19	136	143	149	155	161	167	173	180	186	192	198
20	130	135	141	147	153	159	165	171	176	182	188
21	123	129	134	140	146	151	157	162	168	174	179
22	118	123	128	134	139	144	150	155	160	166	171
23	113	118	123	128	133	138	143	148	153	159	164
24	108	113	118	123	127	132	137	142	147	152	157
25	104	108	113	118	122	127	132	136	141	146	151
26	100	104	109	113	118	122	127	131	136	140	145
27	96	100	105	109	113	118	122	126	131	135	140
28	93	97	101	105	109	113	118	122	126	130	135
29	89	93	97	101	105	109	114	118	122	126	130
30	86	90	94	98	102	106	110	114	118	122	126
31	84	87	91	95	99	102	106	110	114	118	122
32	81	85	88	92	96	99	103	107	110	114	118
33	79	82	86	89	93	96	100	103	107	111	114
34	76	80	83	87	90	93	97	100	104	107	111
Weight per Ft. in Pounds.	187.6	194.0	200.4	206.7	213.1	219.5	225.8	232.2	238.6	245.0	251.4
Section Modulus.	259.2	270.8	282.4	294.1	305.8	317.5	329.3	341.1	353.0	364.9	376.8
Coefficient of Deflection.	0.000000350			0.000000303			0.000000266			0.000000240	

SAFE LOADS IN THOUSANDS OF POUNDS UNIFORMLY DISTRIBUTED FOR BEAM BOX GIRDERS.

Safe loads below are figured for fiber stress of 15 000 pounds per square inch, with $\frac{13}{16}''$ rivet holes in both flanges deducted, and include weight of girder.

2–Plates 15″ Wide.



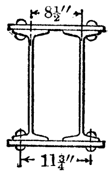
2–15″ I-Beams 80 lbs. per foot.

Distance Center to Center of Bearings in Feet.	Thickness of Plates in Inches. For Thicknesses Greater than ¾″ Use Two Plates.										
	$\frac{5}{8}$	$\frac{11}{16}$	$\frac{3}{4}$	$\frac{13}{16}$	$\frac{7}{8}$	$\frac{15}{16}$	1	$1\frac{1}{16}$	$1\frac{1}{8}$	$1\frac{3}{16}$	$1\frac{1}{4}$
10	300	311	322	334	345	357	368	380	391	403	414
11	272	283	293	303	314	324	335	345	356	366	377
12	250	259	269	278	288	297	307	316	326	336	345
13	231	239	248	257	265	274	283	292	301	310	319
14	214	222	230	238	247	255	263	271	279	288	296
15	200	207	215	222	230	238	245	253	261	269	276
16	187	194	201	209	216	223	230	237	244	252	259
17	176	183	190	196	203	210	217	223	230	237	244
18	167	173	179	185	192	198	204	211	217	224	230
19	158	164	170	176	182	188	194	200	206	212	218
20	150	156	161	167	173	178	184	190	196	201	207
21	143	148	154	159	164	170	175	181	186	192	197
22	136	141	147	152	157	162	167	173	178	183	188
23	130	135	140	145	150	155	160	165	170	173	180
24	125	130	134	139	144	149	153	158	163	168	173
25	120	124	129	133	138	143	147	152	156	161	166
26	115	120	124	128	133	137	142	146	150	155	159
27	111	115	119	124	128	132	136	141	145	149	153
28	107	111	115	119	123	127	131	136	140	144	148
29	103	107	111	115	119	123	127	131	135	139	143
30	100	104	107	111	115	119	123	127	130	134	138
31	97	100	104	108	111	115	119	122	126	130	134
32	94	97	101	104	108	111	115	119	122	126	130
33	91	94	98	101	105	108	112	115	119	122	126
34	88	91	95	98	102	105	108	112	115	118	122
Weight per Ft. in Pounds.	227.6	234.0	240.4	246.7	253.1	259.5	265.8	272.2	278.6	285.0	291.4
Section Modulus.	299.7	311.0	322.4	333.7	345.1	356.6	368.1	379.6	391.2	402.8	414.4
Coefficient of Deflection.	0.000000305			0.000000269			0.000000239			0.000000218	

SAFE LOADS IN THOUSANDS OF POUNDS UNIFORMLY DISTRIBUTED FOR BEAM BOX GIRDERS.

Safe loads below are figured for fiber stress of 15 000 pounds per square inch, with $\frac{13}{16}''$ rivet holes in both flanges deducted, and include weight of girder.

2-Plates 16″ Wide.



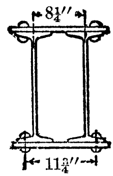
2-18″ I-Beams 55 lbs. per foot.

Distance Center to Center of Bearings in Feet.	Thickness of Plates in Inches. For Thicknesses Greater than ¾″ Use Two Plates.										
	$\frac{3}{4}$	$\frac{13}{16}$	$\frac{7}{8}$	$\frac{15}{16}$	1	$1\frac{1}{16}$	$1\frac{1}{8}$	$1\frac{3}{16}$	$1\frac{1}{4}$	$1\frac{5}{16}$	$1\frac{3}{8}$
15	227	237	247	258	268	278	289	299	309	320	330
16	213	222	232	242	251	261	271	280	290	300	310
17	200	209	218	227	237	246	255	264	273	282	291
18	189	198	206	215	223	232	241	249	258	267	275
19	179	187	195	203	212	220	228	236	244	253	261
20	170	178	186	193	201	209	217	224	232	240	248
21	162	169	177	184	191	199	206	214	221	228	236
22	155	162	169	176	183	190	197	204	211	218	225
23	148	155	161	168	175	182	188	195	202	209	215
24	142	148	155	161	168	174	180	187	193	200	206
25	136	142	148	155	161	167	173	179	186	192	198
26	131	137	143	149	155	161	167	173	179	185	191
27	126	132	137	143	149	155	160	166	172	178	183
28	122	127	133	138	144	149	155	160	166	171	177
29	117	123	128	133	139	144	149	155	160	165	171
30	113	119	124	129	134	139	144	150	155	160	165
31	110	115	120	125	130	135	140	145	150	155	160
32	106	111	116	121	126	130	135	140	145	150	155
33	103	108	112	117	122	127	131	136	141	145	150
34	100	105	109	114	118	123	127	132	137	141	146
35	97	102	106	110	115	119	124	128	133	137	142
36	95	99	103	107	112	116	120	125	129	133	138
37	92	96	100	104	109	113	117	121	125	130	134
38	90	94	98	102	106	110	114	118	122	126	130
39	87	91	95	99	103	107	111	115	119	123	127
Weight per Ft. in Pounds.	195.5	202.2	209.0	215.8	222.6	229.4	236.2	243.1	249.8	256.7	263.4
Section Modulus.	340.5	355.8	371.2	386.6	402.1	417.5	433.0	448.6	464.2	479.8	495.4
Coefficient of Deflection.	0.000000223			0.000000193			0.000000170			0.000000154	

SAFE LOADS IN THOUSANDS OF POUNDS UNIFORMLY DISTRIBUTED FOR BEAM BOX GIRDERS.

Safe loads below are figured for fiber stress of 15 000 pounds per square inch, with $\frac{13}{16}''$ rivet holes in both flanges deducted, and include weight of girder.

2-Plates 16″ Wide.



2-20″ I-Beams 65 lbs. per foot.

Thickness of Plates in Inches.

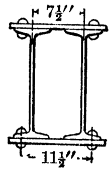
For Thicknesses Greater than ¾″ Use Two Plates.

Distance Center to Center of Bearings in Feet.	$\frac{3}{4}$	$\frac{13}{16}$	$\frac{7}{8}$	$\frac{15}{16}$	1	$1\frac{1}{16}$	$1\frac{1}{8}$	$1\frac{3}{16}$	$1\frac{1}{4}$	$1\frac{5}{16}$	$1\frac{3}{8}$
15	275	286	297	308	320	331	343	354	365	377	388
16	257	268	279	289	300	310	321	332	343	350	364
17	242	252	262	272	282	292	302	312	322	333	343
18	229	238	248	257	266	276	285	295	305	314	324
19	217	226	235	244	252	261	270	280	288	298	307
20	206	214	223	231	240	248	257	266	274	283	291
21	196	204	212	220	228	237	245	253	261	269	277
22	187	195	203	210	218	226	234	241	249	257	265
23	179	186	194	201	209	216	223	231	238	246	253
24	172	179	186	193	200	207	214	221	228	236	243
25	165	171	178	185	192	199	206	212	219	226	233
26	158	165	171	178	184	191	198	204	211	217	224
27	153	159	165	171	178	184	190	197	203	209	216
28	147	153	159	165	171	177	184	190	196	202	208
29	142	148	154	160	165	171	177	183	189	195	201
30	137	143	149	154	160	166	171	177	183	188	194
31	133	138	144	149	155	160	166	171	177	182	188
32	129	134	139	145	150	155	161	166	171	177	182
33	125	130	135	140	145	151	156	161	166	171	177
34	121	126	131	136	141	146	151	156	161	166	171
35	118	122	127	132	137	142	147	152	157	162	166
36	114	119	124	129	133	138	143	148	152	157	162
37	111	116	120	125	130	134	139	144	148	153	157
38	108	113	117	122	126	131	135	140	144	149	153
39	106	110	114	119	123	127	132	136	141	145	149
Weight per Ft. in Pounds.	215.5	222.2	229.0	235.8	242.6	249.4	256.2	263.1	269.8	276.7	283.4
Section Modulus.	411.8	428.7	445.7	462.7	479.7	496.7	513.8	531.2	548.1	565.3	582.5
Coefficient of Deflection.	0.000000168			0.000000147			0.000000131			0.000000119	

SAFE LOADS IN THOUSANDS OF POUNDS UNIFORMLY DISTRIBUTED FOR BEAM BOX GIRDERS.

Safe loads below are figured for fiber stress of 15 000 pounds per square inch, with $\frac{13}{16}''$ rivet holes in both flanges deducted, and include weight of girder.

2-Plates 16″ Wide.



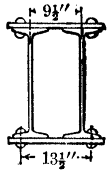
2-20″ I-Beams 80 lbs. per foot.

Distance Center to Center of Bearings in Feet.	Thickness of Plates in Inches. For Thicknesses Greater than ¾″ Use Two Plates.										
	$\frac{3}{4}$	$\frac{13}{16}$	$\frac{7}{8}$	$\frac{15}{16}$	1	$1\frac{1}{16}$	$1\frac{1}{8}$	$1\frac{3}{16}$	$1\frac{1}{4}$	$1\frac{5}{16}$	$1\frac{3}{8}$
15	309	320	331	343	354	365	376	387	399	410	421
16	290	300	311	321	332	342	353	363	374	384	395
17	273	283	292	302	312	322	332	342	352	362	372
18	258	267	276	285	295	304	313	323	332	342	351
19	244	253	262	270	279	288	297	306	315	324	332
20	232	240	249	257	265	274	282	291	299	307	316
21	221	229	237	245	253	261	269	277	285	293	301
22	211	218	226	234	241	249	256	264	272	279	287
23	202	209	216	223	231	238	245	253	260	267	275
24	193	200	207	214	221	228	235	243	249	256	263
25	186	192	199	206	212	219	226	232	239	246	253
26	178	185	191	198	204	211	217	224	230	236	243
27	172	178	184	190	196	203	209	215	221	228	234
28	166	172	178	184	189	195	201	208	214	220	226
29	160	166	171	177	183	189	195	200	206	212	218
30	155	160	166	171	177	182	188	194	199	205	211
31	150	155	160	166	171	177	182	187	193	198	204
32	145	150	155	161	166	171	176	182	187	192	197
33	141	146	151	156	161	166	171	176	181	186	191
34	136	141	146	151	156	161	166	171	176	181	186
35	133	137	142	147	152	156	161	166	171	176	180
36	129	133	138	143	147	152	157	161	166	171	175
37	125	130	134	139	143	148	152	157	162	166	171
38	122	126	131	135	140	144	148	153	157	162	166
39	119	123	127	132	136	140	145	149	153	158	162
Weight per Ft. in Pounds.	245.5	252.2	259.0	265.8	272.6	279.4	286.2	293.1	299.8	306.7	313.4
Section Modulus.	463.8	480.4	497.1	513.8	530.6	547.3	564.1	581.2	597.8	614.7	631.7
Coefficient of Deflection.	0.000000149			0.000000133			0.000000119			0.000000110	

SAFE LOADS IN THOUSANDS OF POUNDS UNIFORMLY DISTRIBUTED FOR BEAM BOX GIRDERS.

Safe loads below are figured for fiber stress of 15 000 pounds per square inch, with $\frac{13}{16}''$ rivet holes in both flanges deducted, and include weight of girder.

2-Plates 18″ Wide.



2-24″ I-Beams 80 lbs. per foot.

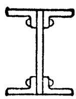
Thickness of Plates in Inches.
For Thicknesses Greater than ¾″ Use Two Plates.

Distance Center to Center of Bearings in Feet.	$\frac{3}{4}$	$\frac{13}{16}$	$\frac{7}{8}$	$\frac{15}{16}$	1	$1\frac{1}{16}$	$1\frac{1}{8}$	$1\frac{3}{16}$	$1\frac{1}{4}$	$1\frac{5}{16}$	$1\frac{3}{8}$
15	396	411	427	442	458	473	489	505	520	536	551
16	371	386	400	415	429	444	458	473	488	502	517
17	349	363	377	390	404	418	431	445	459	473	487
18	330	343	356	369	381	394	407	421	433	446	460
19	312	325	337	349	361	374	386	398	411	423	435
20	297	308	320	332	343	355	367	379	390	402	414
21	283	294	305	316	327	338	349	361	372	383	394
22	270	280	291	302	312	323	333	344	355	365	376
23	258	268	278	288	299	309	319	329	339	349	360
24	247	257	267	276	286	296	306	315	325	335	345
25	237	247	256	265	275	284	293	303	312	321	331
26	228	237	246	255	264	273	282	291	300	309	318
27	220	228	237	246	254	263	272	280	289	298	306
28	212	220	229	237	245	254	262	270	279	287	295
29	205	213	221	229	237	245	253	261	269	277	285
30	198	206	213	221	229	237	244	252	260	268	276
31	192	199	206	214	222	229	237	244	252	259	267
32	186	193	200	207	215	222	229	237	244	251	258
33	180	187	194	201	208	215	222	229	236	244	251
34	175	181	188	195	202	209	216	223	229	236	243
35	170	176	183	190	196	203	210	216	223	230	236
36	165	171	178	184	191	197	204	210	217	223	230
37	160	167	173	179	186	192	198	205	211	217	224
38	156	162	168	175	181	187	193	199	205	211	218
39	152	158	164	170	176	182	188	194	200	206	212
Weight per Ft. in Pounds.	255.7	263.3	271.0	278.6	286.2	293.9	301.5	309.2	316.8	324.5	332.1
Section Modulus.	593.7	616.9	640.1	663.4	686.7	710.0	733.3	757.1	780.2	803.6	827.1
Coefficient of Deflection.	0.0000000983			0.0000000870			0.0000000778			0.0000000713	

SAFE UNIFORMLY DISTRIBUTED LOADS FOR PLATE GIRDERS IN THOUSANDS OF POUNDS.

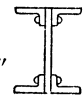
The safe loads below include the weight of the girder and are calculated for a fiber stress of 15 000 pounds per square inch on the net section. The net section is obtained by deducting holes figured at ⅞ of an inch in diameter (for ¾″ rivets) from both flanges.

Web Plate 24″ × ⅜″



Flange Angles 5″ × 3½″

Web Plate 27″ × ⅜″



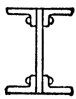
Flange Angles 5″ × 3½″

Distance Center to Center of Bearings in Feet.	Web Plate 24″ × ⅜″, Flange Angles 5″ × 3½″ — Thickness of Flange Angles in Inches.				Web Plate 27″ × ⅜″, Flange Angles 5″ × 3½″ — Thickness of Flange Angles in Inches.			
	⅜	½	⅝	¾	⅜	½	⅝	¾
25	59	74	87		69	85	101	
26	57	71	84		67	82	97	
27	55	68	81	92	64	79	93	
28	53	66	78	89	62	76	90	103
29	51	63	75	86	60	74	87	99
30	50	61	73	83	58	71	84	96
31	48	59	70	80	56	69	81	93
32	46	57	68	78	54	67	79	90
33	45	56	66	75	53	65	76	87
34	44	54	64	73	51	63	74	85
35	42	53	62	71	50	61	72	82
36	41	51	60	69	48	59	70	80
37	40	50	59	67	47	58	68	78
38	39	48	57	66	46	56	66	76
39	38	47	56	64	44	55	65	74
40	37	46	54	62	43	53	63	72
41	36	45	53	61	42	52	61	70
42	35	44	52	59	41	51	60	69
43	35	43	51	58	40	50	59	67
44	34	42	49	57	39	49	57	65
45	33	41	48	55	39	47	56	64
46	32	40	47	54	38	46	55	63
47	32	39	46	53	37	45	54	61
48	31	38	45	52	36	44	53	60
49	30	38	44	51	35	44	51	59
50	30	37	44	50	35	43	50	58
51	29	36	43	49	34	42	49	57
52	29	35	42	48	33	41	48	55
53	28	35	41	47	33	40	48	54
54	28	34	40	46	32	40	47	53
Weight per Foot in Pounds.	74.1	86.9	99.7	111.7	78	90.8	103.6	115.6

SAFE UNIFORMLY DISTRIBUTED LOADS FOR PLATE GIRDERS IN THOUSANDS OF POUNDS.

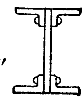
The safe loads below include the weight of the girder and are calculated for a fiber stress of 15 000 pounds per square inch on the net section. The net section is obtained by deducting holes figured at ⅞ of an inch in diameter (for ¾″ rivets) from both flanges.

Web Plate 30″ × ⅜″



Flange Angles 6″ × 3½″

Web Plate 33″ × ⅜″



Flange Angles 6″ × 3½″

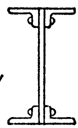
Distance Center to Center of Bearings in Feet.	Web 30″ × ⅜″, Flange Angles 6″ × 3½″: Thickness of Flange Angles in Inches.				Web 33″ × ⅜″, Flange Angles 6″ × 3½″: Thickness of Flange Angles in Inches.			
	⅜	½	⅝	¾	⅜	½	⅝	¾
30	74	91	108		83	103	122	
31	71	88	105		81	100	118	
32	69	86	101	116	78	97	114	131
33	67	83	98	113	76	94	111	127
34	65	81	95	109	74	91	107	123
35	63	78	93	106	72	88	104	119
36	61	76	90	103	70	86	101	116
37	60	74	88	101	68	84	99	113
38	58	72	85	98	66	81	96	110
39	57	70	83	95	64	79	94	107
40	55	69	81	93	63	77	91	104
41	54	67	79	91	61	75	89	102
42	53	65	77	89	60	74	87	99
43	51	64	75	86	58	72	85	97
44	50	62	74	85	57	70	83	95
45	49	61	72	83	56	69	81	93
46	48	60	71	81	54	67	79	91
47	47	58	69	79	53	66	78	89
48	46	57	68	77	52	64	76	87
49	45	56	66	76	51	63	75	85
50	44	55	65	74	50	62	73	84
51	43	54	64	73	49	61	72	82
52	43	53	62	72	48	59	70	80
53	42	52	61	70	47	58	69	79
54	41	51	60	69	46	57	68	77
55	40	50	59	68	46	56	66	76
56	39	49	58	66	45	55	65	75
57	39	48	57	65	44	54	64	73
58	38	47	56	64	43	53	63	72
59	37	46	55	63	42	52	62	71
Weight per Foot in Pounds.	87.0	101.4	115.8	129.8	90.8	105.2	119.6	133.6

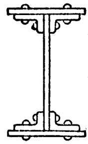
SAFE UNIFORMLY DISTRIBUTED LOADS FOR PLATE GIRDERS IN THOUSANDS OF POUNDS.

The safe loads below include the weight of the girder and are calculated for a fiber stress of 15 000 pounds per square inch on the net section. The net section is obtained by deducting holes figured at ⅞ of an inch in diameter (for ¾″ rivets) from both flanges.

Web Plate 36″ × ⅜″

Flange Angles 6″ × 6″





Web Plate 36″ × ⅜″

Flange Angles 6″ × 6″ × ¾″

Flange Plates 14″

Distance Center to Center of Bearings in Feet.	Thickness of Flange Angles in Inches.				Thickness of Flange Plate in Inches.				
	⅜	½	⅝	¾	½	⅝	¾	⅞	1
30	108	134	159	183	238	255			
31	104	130	154	177	230	247	264		
32	101	125	149	171	223	239	256		
33	98	122	144	166	216	232	248	264	
34	95	118	140	161	210	225	241	256	
35	92	115	136	157	204	219	234	249	264
36	90	112	132	152	198	213	227	242	257
37	87	109	129	148	193	207	221	235	250
38	85	106	125	144	188	201	215	229	243
39	83	103	122	141	183	196	210	223	237
40	81	100	119	137	178	191	205	218	231
41	79	98	116	134	174	187	200	213	225
42	77	96	113	131	170	182	195	207	220
43	75	93	111	128	166	178	190	203	215
44	74	91	108	125	162	174	186	198	210
45	72	89	106	122	158	170	182	194	205
46	70	87	104	119	155	166	178	189	201
47	69	85	101	117	152	163	174	185	197
48	67	84	99	114	149	160	171	182	193
49	66	82	97	112	146	156	167	178	189
50	65	80	95	110	143	153	164	174	185
51	63	79	93	108	140	150	160	171	181
52	62	77	92	106	137	147	157	168	178
53	61	76	90	104	135	144	154	164	174
54	60	74	88	102	132	142	152	161	171
55	59	73	87	100	130	139	149	158	168
56	58	72	85	98	127	137	146	156	165
57	57	70	84	96	125	134	144	153	162
58	56	69	82	95	123	132	141	150	159
59	55	68	81	93	121	130	139	148	157
Weight per Foot in Pounds.	107.5	126.3	144.7	162.7	214.1	226	237.9	249.8	261.7

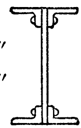
NOTE.—When Flange plates are thicker than ¾″, use two plates.

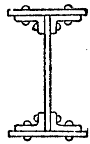
SAFE UNIFORMLY DISTRIBUTED LOADS FOR PLATE GIRDERS IN THOUSANDS OF POUNDS.

The safe loads below include the weight of the girder and are calculated for a fiber stress of 15 000 pounds per square inch on the net section. The net section is obtained by deducting holes figured at one inch in diameter (for 7/8″ rivets) from both flanges.

Web Plate 42″ × 3/8″

Flange Angles 6″ × 6″





Web Plate 42″ × 3/8″

Flange Angles 6″ × 6″ × 3/4″

Flange Plates 14″

Distance Center to Center of Bearings in Feet.	Thickness of Flange Angles in Inches.			Thickness of Flange Plate in Inches.					
	1/2	5/8	3/4	1/2	5/8	3/4	7/8	1	1¼
35	139	164	189	240	257	275	292	309	
36	135	160	184	234	250	267	284	301	
37	131	155	179	227	244	260	276	293	
38	128	151	174	221	237	253	269	285	
39	125	148	169	216	231	247	260	278	309
40	122	144	165	210	225	240	256	271	301
41	119	140	161	205	220	235	249	264	294
42	116	137	157	200	215	229	243	258	287
43	113	134	154	195	210	224	238	252	280
44	111	131	150	191	205	219	232	246	274
45	108	128	147	187	200	214	227	241	268
46	106	125	144	183	196	209	222	235	262
47	103	122	141	179	192	205	217	230	256
48	101	120	138	175	188	200	213	226	251
49	99	117	135	172	184	196	209	221	246
50	97	115	132	168	180	192	204	217	241
51	95	113	130	165	177	189	200	212	236
52	94	111	127	162	173	185	197	208	232
53	92	109	125	159	170	181	193	204	227
54	90	107	122	156	167	178	189	201	223
55	88	105	120	153	164	175	186	197	219
56	87	103	118	150	161	172	183	193	215
57	85	101	116	147	158	169	179	190	211
58	84	99	114	145	155	166	176	187	208
59	82	98	112	142	153	163	173	184	204
60	81	96	110	140	150	160	170	180	201
61	80	94	108	138	148	158	168	178	197
62	78	93	107	136	145	155	165	175	194
63	77	91	105	133	143	153	162	172	191
64	76	90	103	131	141	150	160	169	188
Weight per Foot in Pounds.	134.9	153.3	171.3	224.7	236.6	248.5	260.4	272.3	296.1

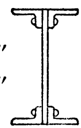
NOTE.—When Flange plates are thicker than 3/4″, use two plates.

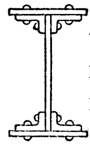
SAFE UNIFORMLY DISTRIBUTED LOADS FOR PLATE GIRDERS IN THOUSANDS OF POUNDS.

The safe loads below include the weight of the girder and are calculated for a fiber stress of 15 000 pounds per square inch on the net section. The net section is obtained by deducting holes figured at one inch in diameter (for ⅞″ rivets) from both flanges.

Web Plate 48″ × ⅜″

Flange Angles 6″ × 6″





Web Plate 48″ × ⅜″

Flange Angles 6″ × 6″ × ¾″

Flange Plates 14″

Distance Center to Center of Bearings in Feet.	Thickness of Flange Angles in Inches.			Thickness of Flange Plate in Inches.					
	½	⅝	¾	½	⅝	¾	⅞	1	1¼
35	166	195	224	283	303	322	342	362	
36	161	190	218	275	294	313	333	352	
37	157	185	212	267	286	305	324	342	
38	153	180	206	260	279	297	315	333	
39	149	175	201	254	272	289	307	325	361
40	145	171	196	247	265	282	299	317	352
41	141	167	191	241	258	275	292	309	343
42	138	163	187	236	252	269	285	302	335
43	135	159	182	230	246	263	279	295	327
44	132	155	178	225	241	256	272	288	320
45	129	152	174	220	235	251	266	282	312
46	126	149	170	215	230	245	260	275	306
47	123	145	167	211	225	240	255	270	299
48	121	142	163	206	221	235	249	264	293
49	118	140	160	202	216	230	244	259	287
50	116	137	157	198	212	226	240	253	281
51	114	134	154	194	208	221	235	248	276
52	112	131	151	190	204	217	230	244	270
53	109	129	148	187	2 0	213	226	239	265
54	107	127	145	183	196	209	222	235	260
55	105	124	142	180	193	205	218	230	256
56	104	122	140	177	189	201	214	226	251
57	102	120	137	174	186	198	210	222	247
58	100	118	135	171	183	195	206	218	242
59	98	116	133	168	179	191	203	215	238
60	97	114	131	165	176	188	200	211	234
61	95	112	128	162	174	185	196	208	231
62	94	110	126	160	171	182	193	204	227
63	92	109	124	157	168	179	190	201	223
64	91	107	122	155	165	176	187	198	220
Weight per Foot in Pounds.	142.5	160.9	178.9	232.3	244.2	256.2	268	279.9	303.7

GRILLAGE BEAMS FOR FOUNDATIONS.

In designing foundations for walls or columns carrying heavy loads resting upon the soil, it is necessary to distribute the weight over a suitable area, and this is readily accomplished, in a small depth, by using a grillage composed of steel beams imbedded in concrete, thus obviating the necessity of large masses of masonry and deep excavations. For heavy loads on soil of small bearing power three tiers of beams may be necessary, while for lighter loads and soil of greater bearing power two tiers of beams will ordinarily suffice.

The grillage beams which are to be surrounded by concrete should be spaced not less than 3″ apart in the clear between the flanges, so that the concrete may be thoroughly rammed between them, and gas-pipe, or standard cast-iron separators should be used to maintain the beams in proper position.

Knowing the total weight to be carried and the allowable intensity of loading per square foot of the supporting soil, the area of the footing required can be readily found, which, taken into consideration with any other conditions limiting the form or proportions of the footing, will determine the external dimensions of the foundation. The beams may be considered as subjected to a uniform load extending over a portion of their upper surfaces, the center of which is at the center of length of the beams, and as being uniformly supported from below throughout their length.

Under these circumstances, the maximum bending moment will occur at the center of the beam and, using the notation given for the upper tier in the sketch below, this bending moment for one beam will be as follows :

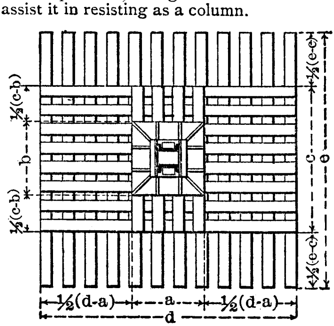
$$\text{Bending moment in inch pounds} = \frac{W}{8}(c - b)$$

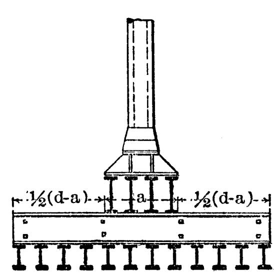
in which c and b are expressed in inches and W is the total weight in pounds on one beam, obtained by dividing the total load by the number of beams composing the tier in question.

This formula for the bending moment is the same as that for a beam of the length (c — b) supported at the ends and uniformly loaded with the total weight W, so that the proper sizes of beams, bending considered, may be obtained directly from the tables of safe loads uniformly distributed for Cambria I-beams, on pages 78 to 88 inclusive, or for cases in which the lengths are shorter than those given in these tables, the sizes may be calculated from the coefficients of strength or the section moduli given in the tables of properties of I-beams, pages 158 to 161 inclusive, taking care, however, to use as the length, the distance (c — b), for the upper tier, and the corresponding figures for the other tiers.

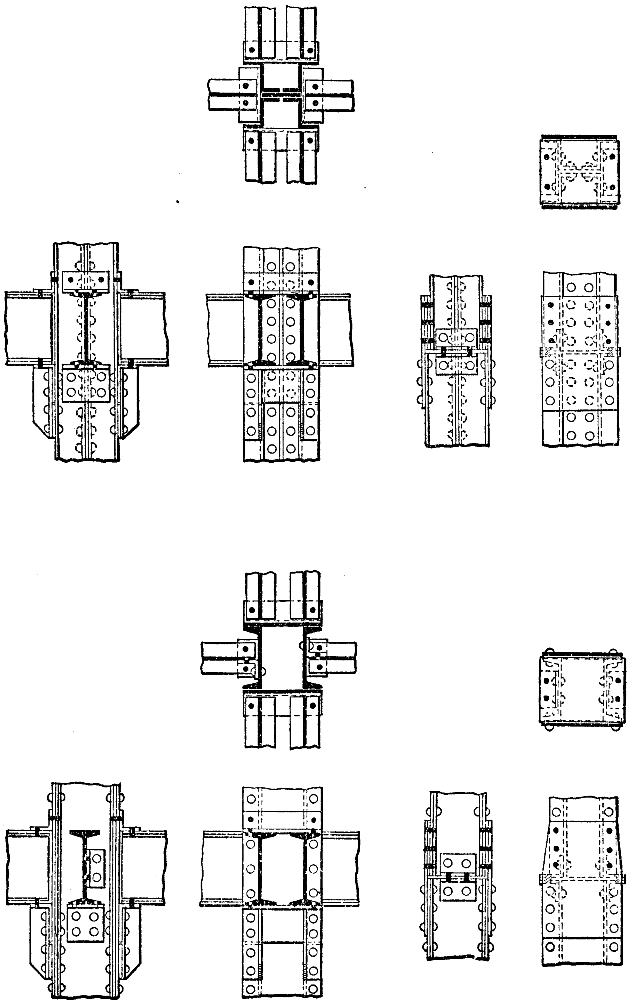
After determining the size of beam required based upon bending, as stated above, an examination should also be made of the capacity of the beam web to resist buckling. This may be done by considering the web as a column of height equal to the clear distance between the fillets and calculating the safe load therefor by the use of the tables of strength for steel columns or struts, on pages 192 to 195, using the proper safety factor.

If the beam web is found insufficient as a column when calculated in this manner, a beam with a web of greater thickness should be tried until one is found that will meet this requirement and the conditions for bending; or it might be more economical, in some cases, to use the beam with the thinner web and provide it with sufficient separators, fitting between the beam flanges, or stiffeners secured to the web to assist it in resisting as a column.

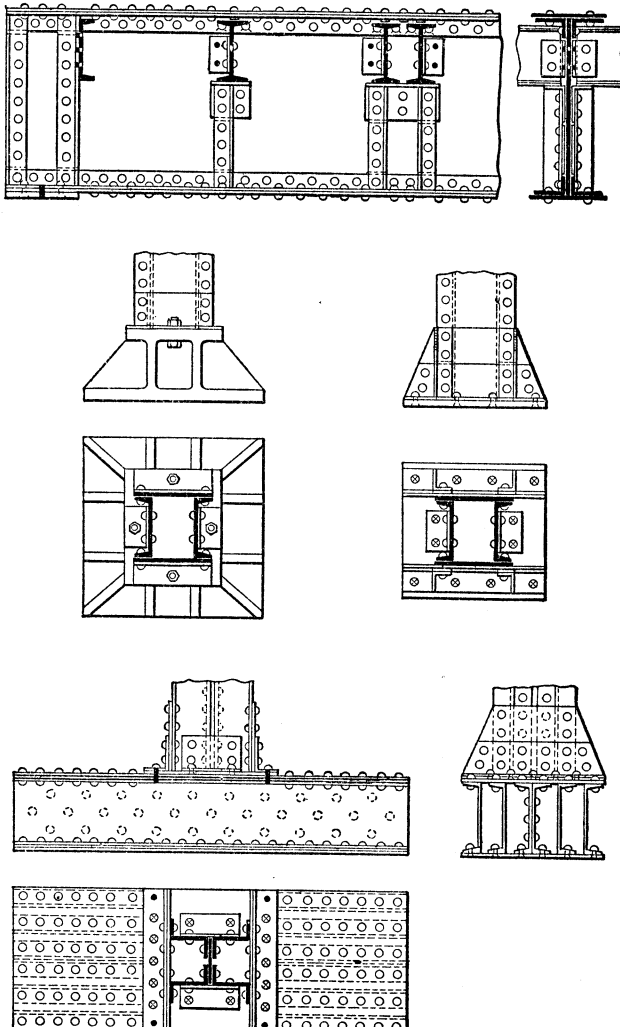




TYPICAL DETAILS FOR STEEL COLUMNS.



TYPICAL DETAILS OF COLUMN BASES AND PLATE GIRDERS.



ALLOWABLE UNIT STRESSES AND LOADS IN ACCORDANCE WITH THE BUILDING LAWS OF VARIOUS CITIES.

Allowable Unit Stresses for Steel and Iron.	New York. 1902.	Chicago. 1902.	Philadelphia. 1902.	Boston. 1902.
	Pounds per Square Inch.			
COMPRESSION: Rolled Steel	16 000	. . .	14 500‡	. . .
Rolled Steel	"	. . .	16 250‖	. . .
Cast "	16 000	. . .	. . .	8 000
Wrought Iron	12 000	. . .	12 500	. . .
Cast " (in Short Blocks)	16 000	. . .	17 500	. . .
Steel Pins and Rivets (Bearing)	20 000	20 000	. . .	18 000
Wrought Iron Pins and Rivets (Bearing)	15 000	15 000	. . .	15 000
TENSION: Rolled Steel	16 000	15 000	14 500‡	15 000
Rolled Steel	"	"	16 250‖	. . .
Cast "	16 000	. . .	. . .	. . .
Wrought Iron	12 000	12 000	12 500	12 000
Cast "	3 000	. . .	. . .	. . .
EXTREME FIBER STRESS—BENDING				
Rolled Steel Beams	16 000	16 000	. . .	16 000
" " Pins, Rivets and Bolts	20 000	22 500	. . .	22 500
Riveted " Beams (Net Flange Section)	14 000	15 000	. . .	. . .
Rolled Wrought Iron Beams	12 000	12 000	. . .	12 000
" " " Pins, Rivets & Bolts	15 000	18 000	. . .	18 000
Riveted " " Beams (Net Flange Section)	12 000	10 000	. . .	. . .
Cast Iron—Compression Side	16 000	. . .	. . .	8 000
" " Tension "	3 000	2 500	3 750	2 500
Compression in Flanges of Built Beams, Steel	. . . .	. . .	. . .	12 000
Compression in Flanges of Built Beams, Wrought Iron	. . . .	. . .	. . .	10 000
SHEAR: Steel Web Plates	9 000	. . .	8 750‡	10 000
Steel Web Plates	"	. . .	10 000‖	"
" Shop Rivets and Pins	10 000	10 000	8 750‡	"
" " " " "	"	"	10 000‖	"
" Field " " "	8 000	"	8 750‡	"
" " " " "	"	"	10 000‖	"
" " Bolts	7 000	. . .	8 750‡	"
" " "	"	. . .	10 000‖	"
Wrought Iron Web Plates	6 000	. . .	7 500	9 000
" " Shop Rivets and Pins	7 500	7 500	"	"
" " Field "	6 000	"	"	"
" " " Bolts	5 500	. . .	"	"
Cast Iron	3 000	. . .	. . .	. . .
COLUMNS: Mild Steel	$15\,200-58\frac{L}{R}$	15 000*	$\frac{14\,500}{1+\frac{L^2}{13\,500R^2}}$	12 000*
Medium Steel	"	"	$\frac{16\,250}{1+\frac{L^2}{11\,000R^2}}$	"
Wrought Iron	$14\,000-80\frac{L}{R}$	12 000*	$\frac{12\,500}{1+\frac{L^2}{15\,000D^2}}$	10 000*
Cast Iron	$11\,300-30\frac{L}{R}$	10 000†	$\frac{17\,500}{1+\frac{L^2}{400D^2}}$	See Section 19 of Boston Building Laws

* Reduced by approved modern formulæ. ‡ Mild. ‖ Medium.
† Reduced by Gordon's formula. Reduced for eccentric loads.

ALLOWABLE UNIT STRESSES AND LOADS IN ACCORDANCE WITH THE BUILDING LAWS OF VARIOUS CITIES.

Live Loads for Floors in Different Classes of Buildings, Exclusive of the Weight of the Materials of Construction.	New York, 1902.	Chicago, 1902.	Philadelphia, 1902.	Boston, 1902.
	Pounds per Square Foot.			
Dwellings, Apartment Houses, Hotels, Tenement Houses or Lodging Houses	60	40	70	50
Office Buildings—First Floor	150	100	100	100
" " above First Floor	75	100	100	100
Schools or Places of Instruction	75	...	...	80
Stables or Carriage Houses	75	40* / 100†	...	...
Buildings for Public Assembly	90	100	120	150
" " Ordinary Stores, Light Manufacturing and Light Storage	120	100	120	...
Stores for Heavy Materials, Warehouses and Factories	150	...	150	250
Roofs—Pitch less than 20°	50	25	30	25‡
" " more " 20°	30	25	30	25‡
Sidewalks	300	...	...	...
Public Buildings, except Schools	...	...	...	150
Allowable Unit Stresses for Masonry and Building Materials.				
COMPRESSION.	Pounds per Square Inch.			
Concrete (Portland) Cement, 1; Sand, 2; Stone, 4	230	55	208	...
Concrete (Portland) Cement, 1; Sand, 2; Stone, 5	208	"	"	...
Concrete (Rosendale or equal) Cement, 1; Sand, 2; Stone, 4	125	"	"	...
Concrete (Rosendale or equal) Cement, 1; Sand, 2; Stone, 5	111	"	"	...
Rubble Stonework, Portland Cement Mortar	140	...	139	...
" " Rosendale " "	111	...	"	...
" " Lime and " "	97	...	111	...
" " Lime Mortar	70	...	69½	...
Brickwork in Portland Cement Mortar; Cement, 1; Sand, 3	250	...	208	...
Brickwork in Rosendale, or equal, Cement Mortar; Cement, 1; Sand, 3	208	...	"	...
Brickwork in Lime and Cement Mortar; Cement, 1; Lime, 1; Sand, 6	160	...	167	...
Brickwork in Lime Mortar; Lime, 1; Sand, 4	111	...	111	...
Dimension Stones in Cement Mortar	...	70	...	...
" " " " , Dressed Beds	...	97	...	...
Granites (according to Test)	1000 to 2400	...	...	...
Greenwich Stone	1200	...	...	...
Gneiss (New York City)	1300	...	...	...
Limestone (according to Test)	700 to 2300	...	...	...
Marble (" " ")	600 to 1200	...	...	...
Sandstone (" " ")	400 to 1600	...	...	...
Bluestone (North River)	2000	...	...	...
Brick (Haverstraw, Flatwise)	300	...	...	...
Slate	1000	...	...	...

* Stables less than 500 Square Feet in Area.
† " over 500 " " " "
‡ Make proper allowance for Wind at 30 lbs. per Square Foot Horizontal.

ALLOWABLE UNIT STRESSES AND LOADS IN ACCORDANCE WITH THE BUILDING LAWS OF VARIOUS CITIES.

Allowable Unit Stresses for Masonry.	New York. 1902.	Chicago. 1902.	Philadelphia. 1902.	Boston. 1902.
EXTREME FIBRE STRESS—BENDING	Pounds per Square Inch.			
Granite	180	...	....	...
Greenwich Stone	150	...	....	...
Gneiss (New York City)	150	...	....	...
Limestone	150	...	....	...
Slate	400	...	....	...
Marble	120	...	....	...
Sandstone	100	...	....	...
Bluestone—North River	300	...	....	...
Concrete (Portland) Cement, 1; Sand, 2; Stone, 4	30	...	....	...
Concrete (Portland) Cement, 1; Sand, 2; Stone, 5	20	...	....	...
Concrete (Rosendale or equal) Cement, 1; Sand, 2; Stone, 4.	16	...	....	...
Concrete (Rosendale or equal) Cement, 1; Sand, 2; Stone, 5	10	...	....	...
Brick (Common)	50	...	....	...
Brickwork (in Cement)	30	...	....	...
Allowable Unit Stresses for Timber.				
COMPRESSION:				
Oak, with Grain	900	...	....	...
" across "	800	...	....	250
Yellow Pine, with Grain	1000	...	750	...
" " across "	600	...	91⅔	250
White " with "	800	...	....	...
" " across "	400	...	....	150
Spruce, with Grain	800	...	500	...
" across "	400	...	50	150
Locust, with "	1200	...	....	...
" across "	1000	...	....	...
Hemlock, with "	500	...	350	...
" across "	500	...	41⅔	...
Chestnut, with "	500	...	....	...
" across "	1000	...	....	...
TENSION:				
Yellow Pine	1200	...	1800	...
White "	800	...	....	...
Spruce	800	...	1250	...
Oak	1000	...	....	...
Hemlock	600	...	1000	...

ALLOWABLE UNIT STRESSES AND LOADS IN ACCORDANCE WITH THE BUILDING LAWS OF VARIOUS CITIES.

Allowable Unit Stresses for Timber.	New York. 1902.	Chicago 1902.	Philadelphia. 1902.	Boston. 1902.
EXTREME FIBER STRESS—BENDING:	Pounds Per Square Inch.			
Yellow Pine	1200	1250	1600	1250
White "	800	750	. . . .	750
Spruce	800	750	1100	750
Oak	1000	1000	. . . .	1000
Locust	1200	. . .	. . . .	. . .
Hemlock	600	. . .	900	. . .
Chestnut	800	. . .	. . . .	. . .
Wooden Columns or Posts with Flat Ends.				
Yellow Pine (Long Leaf)	$1000-18\frac{L}{D}$	. . .	$\frac{U}{6} \times \frac{L^*}{600D}$	. . .
White Pine, Norway Pine and Spruce	$800-15\frac{L}{D}$	. . .	"	. . .
Oak	$900-17\frac{L}{D}$	. . .	"	. . .
Chestnut and Hemlock	$\frac{5}{8}\left(800-15\frac{L}{D}\right)$	. . .	"	. . .
Locust	$1\frac{1}{2}$(")	. . .	"	. . .
SHEAR: Yellow Pine, with Fiber	70	100	$66\frac{2}{3}$	100
Yellow Pine, across fiber	500	250	750	
White " with "	40	80	. . . .	80
" " across "	250	150	. . . .	
Spruce, with Fiber	50	80	50	80
" across "	320	150	500	
Oak, with "	100	150	. . . .	150
" across "	600	250	. . . .	. . .
Locust with "	100	. . .	. . . .	. . .
" across "	720	. . .	. . . .	. . .
Hemlock, with "	40	. . .	$41\frac{2}{3}$	. . .
" across "	275	. . .	$416\frac{2}{3}$	. . .
Chestnut, " "	150	. . .	. . . .	. . .

* $\frac{U}{6}$ = Allowable Compression in Lbs. per Sq. Inch and $\frac{L}{D}$ = Ratio of Length to Diameter in Inches.

Allowable Unit Stresses for Timber Columns in Accordance with the Building Laws of Boston and Chicago.

For Posts with Flat Ends.

The Stresses given in the following table, in which L = Length of Post, D = Least Diameter of Post, and S = Stress per Square Inch.

White Pine and Spruce.		Long-Leaf Yellow Pine		White Oak.
$\frac{L}{D}$	S	$\frac{L}{D}$	S	S
0 to 10	625	0 to 15	1000	750
10 " 35	500	15 " 30	875	650
35 " 45	375	30 " 40	750	560
45 " 50	250	40 " 45	625	470
		45 " 50	500	375

For information not given in these tables, see Complete Building Laws of the Various Cities.

EXPLANATION OF TABLES OF RIVETS AND PINS.

Rivets.

In the design of riveted joints the total stress transmitted is assumed to be taken up by the rivets, no allowance being made for the friction between the plates riveted together, and the manner of failure of the joint will be by shearing of the rivet or crushing of the plate. This assumes that the rules given on page 314 are followed and failure by tearing off the plate caused by the rivets being too near the edge is thus prevented.

In the table of "Shearing Value of Rivets and Bearing Value of Riveted Plates," pages 308 and 309, these values are given for all customary sizes and thicknesses corresponding to various usual allowable unit stresses.

For any given size of rivet or thickness of plate to be used, an inspection of the table will show at once if the bearing value of the plate or the shearing value of the rivet is to govern the design and the amount of stress that can be transmitted by each rivet.

Pins.

In designing pin-connected joints the points which govern the design are the bending moments produced in the pin by the bars or plates connected, and the bearing value of the plates themselves. The bearing value in the case of eye-bars of proper proportions is sufficiently ample and need not be computed. Shear in pins need not ordinarily be considered, as the bending and bearing stresses usually determine the size.

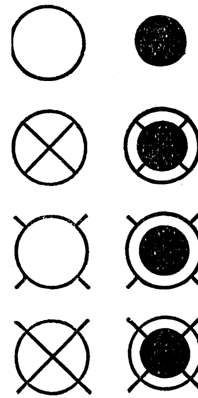
In the table of "Maximum Bending Moments on Pins," pages 310 and 311, is given the allowable bending moments on pins of various diameters for the usual allowable fibre stresses.

In the table of "Bearing Values of Pin Plates for One-Inch Thickness of Plate," on page 315, is given the allowable bearing values of plates against pins of various usual diameters, corresponding to the customary unit stresses of this character.

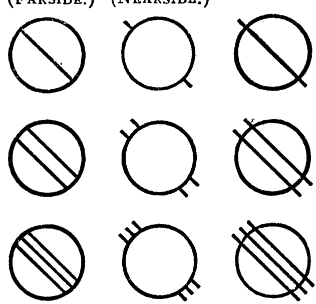
If the bearing value exceeds the allowable limit in any given case pin-plates must be added, thus increasing the bearing value until it is reduced to a safe limit as shown by the tables.

CONVENTIONAL SIGNS FOR RIVETING.

	Shop.	Field.
Two Full Heads.		
Countersunk Inside (Farside) and Chipped.		
Countersunk Outside (Nearside) and Chipped.		
Countersunk both Sides and Chipped.		



	Inside. (Farside.)	Outside. (Nearside.)	Both Sides.
Flattened to ⅛″ high or Countersunk and not Chipped.			
Flattened to ¼″ high.			
Flattened to ⅜″ high.			



This system, designed by F. C. Osborn, C.E., has for foundation the diagonal cross to represent a countersink, the blackened circle for a field rivet and the diagonal stroke to indicate a flattened head. The position of the cross, with respect to the circle (inside, outside or both sides), indicates the location of the countersink and, similarly, the number and position of the diagonal strokes indicate the height and position of the flattened heads.

Any combination of field, countersunk and flattened head rivets liable to occur may be readily indicated by the proper combination of above signs.

SHEARING VALUE OF RIVETS AND BEARING VALUE OF RIVETED PLATES.

ALL DIMENSIONS IN INCHES.

Shearing Value = Area of Rivet × Allowable Shearing Stress per Square Inch.

Diameter of Rivet.	Area in Square Inches.	Single Shear at 6 000 lbs.	Double Shear at 12 000 lbs.	Bearing Value for Different			
				1/4	5/16	3/8	7/16
3/8	.1105	663	1325	1125	1406	1688	
1/2	.1964	1178	2356	1500	1875	2250	2625
5/8	.3068	1841	3682	1875	2344	2813	3281
3/4	.4418	2651	5301	2250	2813	3375	3938
7/8	.6013	3608	7216	2625	3281	3938	4594
1	.7854	4712	9425	3000	3750	4500	5250

Diameter of Rivet.	Area in Square Inches.	Single Shear at 6 750 lbs.	Double Shear at 13 500 lbs.	Bearing Value for Different			
				1/4	5/16	3/8	7/16
3/8	.1105	746	1491	1266	1582	1898	
1/2	.1964	1325	2651	1688	2109	2531	2953
5/8	.3068	2071	4142	2109	2637	3164	3691
3/4	.4418	2982	5964	2531	3164	3797	4430
7/8	.6013	4059	8118	2953	3691	4430	5168
1	.7854	5301	10603	3375	4219	5063	5906

Diameter of Rivet.	Area in Square Inches.	Single Shear at 7 500 lbs.	Double Shear at 15 000 lbs.	Bearing Value for Different			
				1/4	5/16	3/8	7/16
3/8	.1105	828	1657	1406	1758	2109	
1/2	.1964	1473	2945	1875	2344	2813	3281
5/8	.3068	2301	4602	2344	2930	3516	4102
3/4	.4418	3313	6627	2813	3516	4219	4922
7/8	.6013	4510	9020	3281	4102	4922	5742
1	.7854	5891	11781	3750	4688	5625	6563

Diameter of Rivet.	Area in Square Inches.	Single Shear at 10 000 lbs.	Double Shear at 20 000 lbs.	Bearing Value for Different			
				1/4	5/16	3/8	7/16
3/8	.1105	1105	2209	1875	2344	2813	
1/2	.1964	1964	3927	2500	3125	3750	4375
5/8	.3068	3068	6136	3125	3906	4688	5469
3/4	.4418	4418	8836	3750	4688	5625	6563
7/8	.6013	6013	12026	4375	5469	6563	7656
1	.7854	7854	15708	5000	6250	7500	8750

In the above tables the bearing values between the lower and upper zigzag black lines are greater than single and less than double shear for the corresponding dimensions, so that in case of single shear, the single shearing value governs, and in case of double shear, the bearing value governs the design.

SHEARING VALUE OF RIVETS AND BEARING VALUE OF RIVETED PLATES.

ALL DIMENSIONS IN INCHES.

Bearing Value = Diameter of Rivet × Thickness of Plate × Allowable Bearing Stress per Square Inch.

Thicknesses of Plate in Inches at 12 000 Pounds per Square Inch.

$\frac{1}{2}$	$\frac{9}{16}$	$\frac{5}{8}$	$\frac{11}{16}$	$\frac{3}{4}$	$\frac{13}{16}$	$\frac{7}{8}$	$\frac{15}{16}$	1
3000								
3750	4219	4688						
4500	5063	5625	6188	6750				
5250	5906	6563	7219	7875	8531	9188	9844	
6000	6750	7500	8250	9000	9750	10500	11250	12000

Thicknesses of Plate in Inches at 13 500 Pounds per Square Inch.

$\frac{1}{2}$	$\frac{9}{16}$	$\frac{5}{8}$	$\frac{11}{16}$	$\frac{3}{4}$	$\frac{13}{16}$	$\frac{7}{8}$	$\frac{15}{16}$	1
3375								
4219	4746	5273						
5063	5695	6328	6961	7594				
5906	6645	7383	8121	8859	9598	10336	11074	
6750	7594	8438	9281	10125	10969	11813	12656	13500

Thicknesses of Plate in Inches at 15 000 Pounds per Square Inch.

$\frac{1}{2}$	$\frac{9}{16}$	$\frac{5}{8}$	$\frac{11}{16}$	$\frac{3}{4}$	$\frac{13}{16}$	$\frac{7}{8}$	$\frac{15}{16}$	1
3750								
4688	5273	5859						
5625	6328	7031	7734	8438				
6563	7383	8203	9023	9844	10664	11484	12305	
7500	8438	9375	10313	11250	12188	13125	14063	15000

Thicknesses of Plate in Inches at 20 000 Pounds per Square Inch.

$\frac{1}{2}$	$\frac{9}{16}$	$\frac{5}{8}$	$\frac{11}{16}$	$\frac{3}{4}$	$\frac{13}{16}$	$\frac{7}{8}$	$\frac{15}{16}$	1
5000								
6250	7031	7813						
7500	8438	9375	10313	11250				
8750	9844	10938	12031	13125	14219	15313	16406	
10000	11250	12500	13750	15000	16250	17500	18750	20000

The bearing values above and to the right of the upper zigzag black lines are greater than double shear for the corresponding dimensions, so that in these cases the shearing values govern the design.

The bearing values below and to the left of the lower zigzag black lines are less than single shear, so that in these cases the bearing values govern the design.

MAXIMUM BENDING MOMENTS ON PINS WITH EXTREME FIBRE STRESSES

VARYING FROM 15 000 TO 25 000 POUNDS PER SQUARE INCH.

Diameter of Pin in Inches.	Area of Pin in Square Inches.	Moments in Inch-Pounds for Fibre Stresses of				
		15 000 Lbs. per Square Inch.	18 000 Lbs. per Square Inch.	20 000 Lbs. per Square Inch.	22 500 Lbs. per Square Inch.	25 000 Lbs. per Square Inch.
1	.785	1470	1770	1960	2210	2450
1 1/8	.994	2100	2520	2800	3150	3490
1 1/4	1.227	2900	3450	3830	4310	4790
1 3/8	1.485	3830	4590	5100	5740	6380
1 1/2	1.767	4970	5960	6630	7460	8280
1 5/8	2.074	6320	7580	8430	9480	10530
1 3/4	2.405	7890	9470	10520	11840	13150
1 7/8	2.761	9710	11650	12940	14560	16180
2	3.142	11780	14140	15710	17670	19630
2 1/8	3.547	14130	16960	18840	21200	23550
2 1/4	3.976	16770	20130	22370	25160	27960
2 3/8	4.430	19730	23670	26300	29590	32880
2 1/2	4.909	23010	27610	30680	34510	38350
2 5/8	5.412	26640	31960	35520	39960	44400
2 3/4	5.940	30630	36750	40830	45940	51040
2 7/8	6.492	34990	41990	46660	52490	58320
3	7.069	39730	47680	52970	59600	66220
3 1/8	7.670	44940	53930	59920	67410	74900
3 1/4	8.296	50550	60660	67400	75830	84250
3 3/8	8.946	56610	67940	75480	84920	94350
3 1/2	9.621	63140	75770	84180	94710	105230
3 5/8	10.321	70150	84180	93530	105220	116910
3 3/4	11.045	77660	93190	103540	116490	129430
3 7/8	11.793	85690	102820	114250	128530	142810
4	12.566	94250	113100	125660	141370	157080
4 1/8	13.364	103360	124040	137820	155040	172270
4 1/4	14.186	113050	135660	150730	169570	188410
4 3/8	15.033	123320	147980	164420	184980	205530
4 1/2	15.904	134190	161030	178920	201290	223650
4 5/8	16.800	145690	174830	194250	218510	242810
4 3/4	17.721	157820	189390	210430	236740	263040
4 7/8	18.665	170580	204740	227490	255920	284360
5	19.635	184080	220890	245440	276120	306800
5 1/8	20.629	198230	237880	264310	297350	330390
5 1/4	21.648	213090	255710	284120	319640	355160
5 3/8	22.691	228680	274420	304910	343020	381130
5 1/2	23.758	245010	294010	326680	367510	408350
5 5/8	24.850	262100	314510	349460	393140	436830
5 3/4	25.967	279960	335950	373280	419940	466600
5 7/8	27.109	298620	358340	398160	447930	497700

MAXIMUM BENDING MOMENTS ON PINS WITH EXTREME FIBRE STRESSES

VARYING FROM 15 000 TO 25 000 POUNDS PER SQUARE INCH.

Diameter of Pin in Inches.	Area of Pin in Square Inches.	Moments in Inch-Pounds for Fibre Stresses of				
		15 000 Lbs. per Square Inch.	18 000 Lbs. per Square Inch.	20 000 Lbs. per Square Inch.	22 500 Lbs. per Square Inch.	25 000 Lbs. per Square Inch.
6	28.274	318090	381700	424120	477130	530140
6⅛	29.465	338380	406060	451180	507580	563970
6¼	30.680	359530	431430	479370	539290	599210
6⅜	31.919	381530	457840	508710	572300	635890
6½	33.183	404420	485400	539230	606630	674030
6⅝	34.472	428200	513840	570940	642300	713670
6¾	35.785	452900	543480	603870	679350	754830
6⅞	37.122	478530	574240	638040	717800	797550
7	38.485	505110	606130	673480	757660	841850
7⅛	39.871	532650	639190	710210	798980	887760
7¼	41.282	561180	673420	748250	841780	935310
7⅜	42.718	590710	708860	787620	886070	984520
7½	44.179	621260	745510	828350	931890	1035440
7⅝	45.664	652850	783410	870460	979270	1088080
7¾	47.173	685480	822580	913980	1028220	1142470
7⅞	48.707	719190	863030	958920	1078780	1198650
8	50.265	753980	904780	1005310	1130970	1256640
8⅛	51.849	789880	947860	1053170	1184820	1316470
8¼	53.456	826900	992280	1102530	1240350	1378170
8⅜	55.088	865060	1038070	1153410	1297590	1441760
8½	56.745	904370	1085250	1205830	1356560	1507290
8⅝	58.426	944860	1133830	1259820	1417290	1574770
8¾	60.132	986540	1183850	1315390	1479810	1644240
8⅞	61.862	1029430	1235310	1372570	1544140	1715710
9	63.617	1073540	1288250	1431390	1610310	1789240
9⅛	65.397	1118900	1342680	1491860	1678340	1864830
9¼	67.201	1165510	1398610	1554010	1748270	1942520
9⅜	69.029	1213400	1456080	1617870	1820100	2022340
9½	70.882	1262590	1515110	1683450	1893880	2104310
9⅝	72.760	1313090	1575700	1750780	1969630	2188480
9¾	74.662	1364910	1637900	1819880	2047370	2274850
9⅞	76.590	1418090	1701700	1890780	2127130	2363480
10	78.540	1472620	1767150	1963500	2208930	2454370
10¼	82.516	1585850	1903020	2114470	2378780	2643090
10½	86.590	1704740	2045690	2272990	2557120	2841240
10¾	90.763	1829430	2195320	2439250	2744150	3049060
11	95.033	1960060	2352070	2613410	2940090	3266770
11¼	99.402	2096760	2516110	2795680	3145140	3494600
11½	103.869	2239670	2687610	2986230	3359510	3732790
12	113.098	2544690	3053630	3392920	3817040	4241150

AREAS OF RIVET HOLES.

SQUARE INCHES.

Thickness Plates in Inches.	SIZE OF HOLE. Inches.													
	1/4	5/16	3/8	7/16	1/2	9/16	5/8	11/16	3/4	13/16	7/8	15/16	1	1 1/16
1/4	.06	.08	.09	.11	.13	.14	.16	.17	.19	.20	.22	.23	.25	.27
5/16	.08	.10	.12	.14	.16	.18	.20	.21	.23	.25	.27	.29	.31	.33
3/8	.09	.12	.14	.16	.19	.21	.23	.26	.28	.30	.33	.35	.38	.40
7/16	.11	.14	.16	.19	.22	.25	.27	.30	.33	.36	.38	.41	.44	.46
1/2	.13	.16	.19	.22	.25	.28	.31	.34	.38	.41	.44	.47	.50	.53
9/16	.14	.18	.21	.25	.28	.32	.35	.39	.42	.46	.49	.53	.56	.60
5/8	.16	.20	.23	.27	.31	.35	.39	.43	.47	.51	.55	.59	.63	.66
11/16	.17	.21	.26	.30	.34	.39	.43	.47	.52	.56	.60	.64	.69	.73
3/4	.19	.23	.28	.33	.38	.42	.47	.52	.56	.61	.66	.70	.75	.80
13/16	.20	.25	.30	.36	.41	.46	.51	.56	.61	.66	.71	.76	.81	.86
7/8	.22	.27	.33	.38	.44	.49	.55	.60	.66	.71	.77	.82	.88	.93
15/16	.23	.29	.35	.41	.47	.53	.59	.64	.70	.76	.82	.88	.94	1.00
1	.25	.31	.38	.44	.50	.56	.63	.69	.75	.81	.88	.94	1.00	1.06
1 1/16	.27	.33	.40	.46	.53	.60	.66	.73	.80	.86	.93	1.00	1.06	1.13
1 1/8	.28	.35	.42	.49	.56	.63	.70	.77	.84	.91	.98	1.05	1.13	1.20
1 3/16	.30	.37	.45	.52	.59	.67	.74	.82	.89	.96	1.04	1.11	1.19	1.26
1 1/4	.31	.39	.47	.55	.63	.70	.78	.86	.94	1.02	1.09	1.17	1.25	1.33
1 5/16	.33	.41	.49	.57	.66	.74	.82	.90	.98	1.07	1.15	1.23	1.31	1.39
1 3/8	.34	.43	.52	.60	.69	.77	.86	.95	1.03	1.12	1.20	1.29	1.38	1.46
1 7/16	.36	.45	.54	.63	.72	.81	.90	.99	1.08	1.17	1.26	1.35	1.44	1.53
1 1/2	.38	.47	.56	.66	.75	.84	.94	1.03	1.13	1.22	1.31	1.41	1.50	1.59
1 9/16	.39	.49	.59	.68	.78	.88	.98	1.07	1.17	1.27	1.37	1.46	1.56	1.66
1 5/8	.41	.51	.61	.71	.81	.91	1.02	1.12	1.22	1.32	1.42	1.52	1.63	1.73
1 11/16	.42	.53	.63	.74	.84	.95	1.05	1.16	1.27	1.37	1.47	1.58	1.69	1.79
1 3/4	.44	.55	.66	.77	.88	.98	1.09	1.20	1.31	1.42	1.53	1.64	1.75	1.86
1 13/16	.45	.57	.68	.79	.91	1.02	1.13	1.25	1.36	1.47	1.59	1.70	1.81	1.93
1 7/8	.47	.59	.70	.82	.94	1.05	1.17	1.29	1.41	1.52	1.64	1.76	1.88	1.99
1 15/16	.48	.61	.73	.85	.97	1.09	1.21	1.33	1.45	1.57	1.70	1.82	1.94	2.06
2	.50	.63	.75	.88	1.00	1.13	1.25	1.38	1.50	1.63	1.75	1.88	2.00	2.13

MAXIMUM SIZE OF RIVETS IN BEAMS, CHANNELS AND ANGLES.

I-BEAMS.						CHANNELS.			ANGLES.			
Depth of Beam. Ins.	Weight per Foot. Pounds.	Size of Rivet. Inch.	Depth of Beam Ins.	Weight per Foot. Pounds.	Size of Rivet. Inch.	Depth of Channel Inches.	Weight per Foot. Pounds.	Size of Rivet. Inch.	Len'th of Leg. Inches	Size of Rivet. Inch.	Len'th of Leg. Inches	Size of Rivet. Inch.
3	5.5	3/8	15	42.0	3/4	3	4.0	3/8	3/4	1/4	2 1/2	3/4
4	7.5	1/2	15	60.0	3/4	4	5.25	1/2	1	3/8	2 3/4	3/4
5	9.75	1/2	15	80.0	7/8	5	6.50	1/2	1 1/4	1/2	3	7/8
6	12.25	5/8	18	55.0	7/8	6	8.0	5/8	1 5/16	1/2	3 1/2	1
7	15.0	5/8	20	65.0	1	7	9.75	5/8	1 3/8	1/2	4	1
8	18.00	3/4	20	80.0	1	8	11.25	3/4	1 1/2	1/2	4 1/2	1
9	21.0	3/4	24	80.0	1	9	13.25	3/4	1 3/4	5/8	5	1
10	25.0	3/4				10	15.0	3/4	2	5/8	6	1
12	31.5	3/4				12	20.50	3/4	2 1/4	3/4	7	1
12	40.0	3/4				15	33.0	3/4	2 5/16	3/4		

AREAS OF RIVET HOLES.

SQUARE INCHES.

SIZE OF HOLE. Inches. $1\frac{1}{8}$	$1\frac{3}{16}$	$1\frac{1}{4}$	$1\frac{5}{16}$	$1\frac{3}{8}$	$1\frac{7}{16}$	$1\frac{1}{2}$	$1\frac{9}{16}$	$1\frac{5}{8}$	$1\frac{11}{16}$	$1\frac{3}{4}$	$1\frac{13}{16}$	$1\frac{7}{8}$	$1\frac{15}{16}$	2	Thickness Plates in Inches.
.28	.30	.31	.33	.34	.36	.38	.39	.41	.42	.44	.45	.47	.48	.50	$\frac{1}{4}$
.35	.37	.39	.41	.43	.45	.47	.49	.51	.53	.55	.57	.59	.61	.63	$\frac{5}{16}$
.42	.45	.47	.49	.52	.54	.56	.59	.61	.63	.66	.68	.70	.73	.75	$\frac{3}{8}$
.49	.52	.55	.57	.60	.63	.66	.68	.71	.74	.77	.79	.82	.85	.88	$\frac{7}{16}$
.56	.59	.63	.66	.69	.72	.75	.78	.81	.84	.88	.91	.94	.97	1.00	$\frac{1}{2}$
.63	.67	.70	.74	.77	.81	.84	.88	.91	.95	.98	1.02	1.05	1.09	1.13	$\frac{9}{16}$
.70	.74	.78	.82	.86	.90	.94	.98	1.02	1.05	1.09	1.13	1.17	1.21	1.25	$\frac{5}{8}$
.77	.82	.86	.90	.95	.99	1.03	1.07	1.12	1.16	1.20	1.25	1.29	1.33	1.38	$\frac{11}{16}$
.84	.89	.94	.98	1.03	1.08	1.13	1.17	1.22	1.27	1.31	1.36	1.41	1.45	1.50	$\frac{3}{4}$
.91	.96	1.02	1.07	1.12	1.17	1.22	1.27	1.32	1.37	1.42	1.47	1.52	1.57	1.63	$\frac{13}{16}$
.98	1.04	1.09	1.15	1.20	1.26	1.31	1.37	1.42	1.48	1.53	1.59	1.64	1.70	1.75	$\frac{7}{8}$
1.05	1.11	1.17	1.23	1.29	1.35	1.41	1.46	1.52	1.58	1.64	1.70	1.76	1.82	1.88	$\frac{15}{16}$
1.13	1.19	1.25	1.31	1.38	1.44	1.50	1.56	1.63	1.69	1.75	1.81	1.88	1.94	2.00	1
1.20	1.26	1.33	1.39	1.46	1.53	1.59	1.66	1.73	1.79	1.86	1.93	1.99	2.06	2.13	$1\frac{1}{16}$
1.27	1.34	1.41	1.48	1.55	1.62	1.69	1.76	1.83	1.90	1.97	2.04	2.11	2.18	2.25	$1\frac{1}{8}$
1.34	1.41	1.48	1.56	1.63	1.71	1.78	1.86	1.93	2.00	2.08	2.15	2.23	2.30	2.38	$1\frac{3}{16}$
1.41	1.48	1.56	1.64	1.72	1.80	1.88	1.95	2.03	2.11	2.19	2.27	2.34	2.42	2.50	$1\frac{1}{4}$
1.48	1.56	1.64	1.72	1.80	1.89	1.97	2.05	2.13	2.21	2.30	2.38	2.46	2.54	2.63	$1\frac{5}{16}$
1.55	1.63	1.72	1.80	1.89	1.98	2.06	2.15	2.23	2.32	2.41	2.49	2.58	2.66	2.75	$1\frac{3}{8}$
1.62	1.71	1.80	1.89	1.98	2.07	2.16	2.25	2.34	2.43	2.52	2.61	2.70	2.79	2.88	$1\frac{7}{16}$
1.69	1.78	1.88	1.97	2.06	2.16	2.25	2.34	2.44	2.53	2.63	2.72	2.81	2.91	3.00	$1\frac{1}{2}$
1.76	1.86	1.95	2.05	2.15	2.25	2.34	2.44	2.54	2.64	2.73	2.83	2.93	3.03	3.13	$1\frac{9}{16}$
1.83	1.93	2.03	2.13	2.23	2.34	2.44	2.54	2.64	2.74	2.84	2.95	3.05	3.15	3.25	$1\frac{5}{8}$
1.90	2.00	2.11	2.21	2.32	2.43	2.53	2.64	2.74	2.85	2.95	3.06	3.16	3.27	3.38	$1\frac{11}{16}$
1.97	2.08	2.19	2.30	2.41	2.52	2.63	2.73	2.84	2.95	3.06	3.17	3.28	3.39	3.50	$1\frac{3}{4}$
2.04	2.15	2.27	2.38	2.49	2.61	2.72	2.83	2.95	3.06	3.17	3.29	3.40	3.51	3.63	$1\frac{13}{16}$
2.11	2.23	2.34	2.46	2.58	2.70	2.81	2.93	3.05	3.16	3.28	3.40	3.52	3.63	3.75	$1\frac{7}{8}$
2.18	2.30	2.42	2.54	2.66	2.79	2.91	3.03	3.15	3.27	3.39	3.51	3.63	3.75	3.88	$1\frac{15}{16}$
2.25	2.38	2.50	2.63	2.75	2.88	3.00	3.13	3.25	3.38	3.50	3.63	3.75	3.88	4.00	2

RIVET SPACING.

ALL DIMENSIONS IN INCHES.

Size of Rivet.	Minimum Pitch.	Maximum Pitch at Ends of Compression Members.	Minimum Pitch in Flanges of Chords and Gird's.	Distance from Edge of Piece to Center of Rivet Hole. Minimum.	Usual.
$\frac{1}{4}$	$\frac{3}{4}$	...	...	..	..
$\frac{3}{8}$	$1\frac{1}{8}$	...	...	..	..
$\frac{1}{2}$	$1\frac{1}{2}$	...	...	..	..
$\frac{5}{8}$	$1\frac{7}{8}$	$2\frac{1}{2}$	4	$\frac{15}{16}$	$1\frac{1}{4}$
$\frac{3}{4}$	$2\frac{1}{4}$	3	4	$1\frac{1}{8}$	$1\frac{1}{2}$
$\frac{7}{8}$	$2\frac{5}{8}$	$3\frac{1}{2}$	4	$1\frac{5}{16}$	$1\frac{3}{4}$
1	3	4	4	$1\frac{1}{2}$	2

For General Rules for Rivet Spacing see next page.

GENERAL RULES FOR RIVET SPACING FOR BRIDGE AND STRUCTURAL WORK.

The pitch or distance from center to center of rivets should not be less than 3 diameters of the rivet. In bridge work the pitch should not exceed 6 inches or 16 times the thickness of the thinnest outside plates except in special cases hereafter noted. In the flanges of beams and girders where plates more than 12 inches wide are used, an extra line of rivets with a pitch not greater than 9 inches should be driven along each edge to draw the plates together.

At the ends of compression members the pitch should not exceed 4 diameters of the rivet for a length equal to twice the width or diameter of the member.

In the flanges of girders and chords carrying floors, the pitch should not exceed 4 inches.

For plates in compression the pitch in the direction of the line of stress should not exceed 16 times the thickness of the plate, and the pitch in a direction at right angles to the line of stress should not exceed 32 times the thickness, except for cover plates of top chords and end posts in which the pitch should not exceed 40 times their thickness.

The distance between the edge of any piece and the center of the rivet hole should not be less than $1\frac{1}{4}$ inches for $\frac{3}{4}$ inch and $\frac{7}{8}$ inch rivets except in bars less than $2\frac{1}{2}$ inches wide; when practicable it should, for all sizes, be at least 2 diameters of the rivet and should not exceed 8 times the thickness of the plate.

Minimum spacing is generally used in pin plates, at ends of columns, girders, etc., etc.

In figuring clearance of rivets for special cases, allow $\frac{3}{8}$ inch in addition to diameter of head.

BEARING VALUES OF PIN PLATES.

FOR ONE INCH THICKNESS OF PLATE.

Bearing value = Diameter of Pin × 1″ × Stress per Square Inch.

Diameter of Pin.	Area of Pin.	Bearing Value at 12 000 Pounds per Square Inch.	Bearing Value at 13 500 Pounds per Square Inch.	Bearing Value at 15 000 Pounds per Square Inch.	Diameter of Pin.	Area of Pin.	Bearing Value at 12 000 Pounds per Square Inch.	Bearing Value at 13 500 Pounds per Square Inch.	Bearing Value at 15 000 Pounds per Square Inch.
Inches.	Sq. Ins.	Pounds.	Pounds.	Pounds.	Inches.	Sq. Ins.	Pounds.	Pounds.	Pounds.
1	.785	12000	13500	15000	4½	15.90	54000	60750	67500
1⅛	.994	13500	15190	16880	4⅝	16.80	55500	62440	69380
1¼	1.227	15000	16880	18750	4¾	17.72	57000	64130	71250
1⅜	1.485	16500	18560	20630	4⅞	18.67	58500	65810	73130
1½	1.767	18000	20250	22500	5	19.64	60000	67500	75000
1⅝	2.074	19500	21940	24380	5⅛	20.63	61500	69190	76880
1¾	2.405	21000	23630	26250	5¼	21.65	63000	70880	78750
1⅞	2.761	22500	25310	28130	5⅜	22.69	64500	72560	80630
2	3.142	24000	27000	30000	5½	23.76	66000	74250	82500
2⅛	3.547	25500	28690	31880	5⅝	24.85	67500	75940	84380
2¼	3.976	27000	30380	33750	5¾	25.97	69000	77630	86250
2⅜	4.430	28500	32060	35630	5⅞	27.11	70500	79310	88130
2½	4.909	30000	33750	37500	6	28.27	72000	81000	90000
2⅝	5.412	31500	35440	39380	6⅛	29.46	73500	82690	91880
2¾	5.940	33000	37130	41250	6¼	30.68	75000	84380	93750
2⅞	6.492	34500	38810	43130	6⅜	31.92	76500	86060	95630
3	7.069	36000	40500	45000	6½	33.18	78000	87750	97500
3⅛	7.670	37500	42190	46880	6⅝	34.47	79500	89440	99380
3¼	8.296	39000	43880	48750	6¾	35.79	81000	91130	101250
3⅜	8.946	40500	45560	50630	6⅞	37.12	82500	92810	103130
3½	9.621	42000	47250	52500	7	38.48	84000	94500	105000
3⅝	10.32	43500	48940	54380	7½	44.18	90000	101250	112500
3¾	11.05	45000	50630	56250	8	50.27	96000	108000	120000
3⅞	11.79	46500	52310	58130	8½	56.75	102000	114750	127500
4	12.57	48000	54000	60000	9	63.62	108000	121500	135000
4⅛	13.36	49500	55690	61880	10	78.54	120000	135000	150000
4¼	14.19	51000	57380	63750	11	95.03	132000	148500	165000
4⅜	15.03	52500	59060	65630	12	113.10	144000	162000	180000

EXAMPLE.—The stress in the end post of a bridge is 250 000 pounds and the diameter of the pin is 5⅝″. Required the total thickness of steel pin plates for a bearing value of 15 000 pounds per square inch.

From the table the bearing value of a 5⅝″ pin in a 1″ plate for 15 000 pounds unit stress is 84 380 pounds. Therefore the total thickness of metal required is $\frac{250\,000}{84\,380} = 2.96''$.

The nearest commercial size would therefore be 1½″ on each side, including web and necessary reinforcing plates.

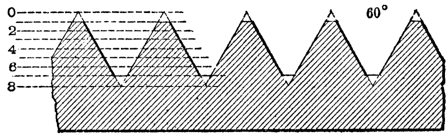
DIMENSIONS OF BOLTS AND NUTS.

Franklin Institute Standard.

Bolts and Threads.						Rough Nuts and Heads.				
Diameter of Bolt.	Threads per Inch.	Diameter at Root of Thread.	Width of Flat.	Area of Bolt Body.	Area of Bolt at Root of Thread.	Short Diameter of Square and Hexagon.	Long Diameter of Square.	Long Diameter of Hexagon.	Thickness of Nuts.	Thickness of Heads.
Ins.	No.	Ins.	Ins.	Sq. Ins.	Sq. Ins.	Ins.	Ins.	Ins.	Ins.	Ins.
1/4	20	.185	.0062	.049	.027	1/2	.707	.577	1/4	1/4
5/16	18	.240	.0070	.077	.045	19/32	.840	.686	5/16	19/64
3/8	16	.294	.0078	.110	.068	11/16	.972	.794	3/8	11/32
7/16	14	.344	.0089	.150	.093	25/32	1.105	.902	7/16	25/64
1/2	13	.400	.0096	.196	.126	7/8	1.238	1.010	1/2	7/16
9/16	12	.454	.0104	.249	.162	31/32	1.370	1.119	9/16	31/64
5/8	11	.507	.0113	.307	.202	1 1/16	1.503	1.227	5/8	17/32
3/4	10	.620	.0125	.442	.302	1 1/4	1.768	1.443	3/4	5/8
7/8	9	.731	.0140	.601	.420	1 7/16	2.033	1.660	7/8	23/32
1	8	.837	.0156	.785	.550	1 5/8	2.298	1.876	1	13/16
1 1/8	7	.940	.0180	.994	.694	1 13/16	2.563	2.093	1 1/8	29/32
1 1/4	7	1.065	.0180	1.227	.893	2	2.829	2.309	1 1/4	1
1 3/8	6	1.160	.0210	1.485	1.057	2 3/16	3.094	2.526	1 3/8	1 3/32
1 1/2	6	1.284	.0210	1.767	1.295	2 3/8	3.359	2.742	1 1/2	1 3/16
1 5/8	5 1/2	1.389	.0227	2.074	1.515	2 9/16	3.624	2.959	1 5/8	1 9/32
1 3/4	5	1.490	.0250	2.405	1.744	2 3/4	3.889	3.175	1 3/4	1 3/8
1 7/8	5	1.615	.0250	2.761	2.048	2 15/16	4.154	3.392	1 7/8	1 15/32
2	4 1/2	1.712	.0280	3.142	2.302	3 1/8	4.420	3.608	2	1 9/16
2 1/4	4 1/2	1.962	.0280	3.976	3.023	3 1/2	4.950	4.042	2 1/4	1 3/4
2 1/2	4	2.175	.0310	4.909	3.715	3 7/8	5.480	4.475	2 1/2	1 15/16
2 3/4	4	2.425	.0310	5.940	4.619	4 1/4	6.011	4.908	2 3/4	2 1/8
3	3 1/2	2.629	.0357	7.069	5.428	4 5/8	6.541	5.341	3	2 5/16
3 1/4	3 1/2	2.879	.0357	8.296	6.510	5	7.071	5.774	3 1/4	2 1/2
3 1/2	3 1/4	3.100	.0384	9.621	7.548	5 3/8	7.602	6.207	3 1/2	2 11/16
3 3/4	3	3.317	.0410	11.045	8.641	5 3/4	8.132	6.640	3 3/4	2 7/8
4	3	3.567	.0410	12.566	9.993	6 1/8	8.662	7.073	4	3 1/16
4 1/4	2 7/8	3.798	.0435	14.186	11.329	6 1/2	9.193	7.506	4 1/4	3 1/4
4 1/2	2 3/4	4.028	.0460	15.904	12.743	6 7/8	9.723	7.939	4 1/2	3 7/16
4 3/4	2 5/8	4.255	.0480	17.721	14.220	7 1/4	10.253	8.372	4 3/4	3 5/8
5	2 1/2	4.480	.0500	19.635	15.763	7 5/8	10.784	8.805	5	3 13/16
5 1/4	2 1/2	4.730	.0500	21.648	17.572	8	11.314	9.238	5 1/4	4
5 1/2	2 3/8	4.953	.0526	23.758	19.267	8 3/8	11.844	9.671	5 1/2	4 3/16
5 3/4	2 3/8	5.203	.0526	25.967	21.262	8 3/4	12.375	10.104	5 3/4	4 3/8
6	2 1/4	5.423	.0555	28.274	23.098	9 1/8	12.905	10.537	6	4 9/16

RULES FOR PROPORTIONS OF BOLTS AND NUTS.

FRANKLIN INSTITUTE STANDARD.



The dimensions of nuts and bolts are determined by the following rules, which apply to both square and hexagon.

Short diameter of rough nut $= 1\frac{1}{2} \times$ diameter of bolt $+ \frac{1}{8}$ in.

Short diameter of finished nut $= 1\frac{1}{2} \times$ diameter of bolt $+ \frac{1}{16}$ in.

Thickness of rough nut $=$ diameter of bolt.

Thickness of finished nut $=$ diameter of bolt $- \frac{1}{16}$ in.

Short diameter of rough head $= 1\frac{1}{2} \times$ diameter of bolt $+ \frac{1}{8}$ in.

Short diameter of finished head $= 1\frac{1}{2} \times$ diameter of bolt $+ \frac{1}{16}$ in.

Thickness of rough head $= \frac{1}{2}$ of short diameter of head.

Thickness of finished head $=$ diameter of bolt $- \frac{1}{16}$ in.

In 1864, a committee of the Franklin Institute recommended the above system of screw threads and bolts which was devised by Mr. William Sellers, of Philadelphia. This system as far as it relates to screw threads is generally used in the United States, but the proportions of bolt heads and nuts are not adhered to because the sizes of bar required to make the nuts are special and extra work is necessary to make the bolt heads. Sizes of nuts and bolt heads in accordance with the *Manufacturers' Standard* are given on pages 323, 324 and 325.

WEIGHTS OF 100 MACHINE BOLTS WITH SQUARE HEADS AND HEXAGON NUTS.

FRANKLIN INSTITUTE STANDARD SIZES.

Basis — 1 cubic foot Iron = 480 pounds.

Length under Head to Point. Inches.	Diameter of Bolts in Inches. $\frac{1}{4}$	$\frac{5}{16}$	$\frac{3}{8}$	$\frac{7}{16}$	$\frac{1}{2}$	$\frac{9}{16}$	$\frac{5}{8}$
1½	4.9	8.2	12.2	17.5	24.0	31.8	41.1
1¾	5.3	8.7	13.0	18.5	25.3	33.5	43.2
2	5.6	9.2	13.8	19.6	26.7	35.2	45.3
2¼	6.0	9.8	14.5	20.6	28.1	37.0	47.5
2½	6.3	10.3	15.3	21.6	29.4	38.7	49.6
2¾	6.6	10.8	16.1	22.7	30.8	40.4	51.7
3	7.0	11.4	16.8	23.7	32.1	42.1	53.9
3¼	7.3	11.9	17.6	24.8	33.5	43.9	56.0
3½	7.7	12.4	18.4	25.8	34.9	45.6	58.1
3¾	8.0	13.0	19.1	26.9	36.2	47.3	60.3
4	8.3	13.5	19.9	27.9	37.6	49.0	62.4
4½	9.0	14.6	21.4	30.0	40.3	52.5	66.6
5	9.7	15.6	23.0	32.1	43.0	55.9	70.9
5½	10.4	16.7	24.5	34.2	45.8	59.4	75.2
6	11.1	17.8	26.0	36.2	48.5	62.8	79.4
6½	11.7	18.8	27.6	38.3	51.2	66.3	83.7
7	12.4	19.9	29.1	40.4	53.9	69.7	87.9
7½	13.1	21.0	30.6	42.5	56.7	73.2	92.2
8	13.8	22.0	32.2	44.6	59.4	76.6	96 5
8½	14.5	23.1	33.7	46.7	62.1	80.1	100.7
9	15.1	24.2	35.3	48.8	64.8	83.5	105.0
9½	15.8	25.2	36.8	50.8	67.6	87.0	109.2
10	16.5	26.3	38.3	52.9	70.3	90.4	113.5
10½	17.2	27.4	39.9	55.0	73.0	93.9	117.8
11	17.9	28.4	41.4	57.1	75.7	97.3	122.0
11½	18.5	29.5	42.9	59.2	78.5	100.8	126.3
12	...	30.5	44.5	61.3	81.2	104.2	130.5
12½	...	31.6	46.0	63.3	83.9	107.7	134.8
13	...	32.7	47.5	65.4	86.6	111.1	139.1
13½	...	33.7	49.1	67.5	89.4	114.6	143.3
14	...	...	50.6	69.6	92.1	118.0	147.6
14½	...	...	52.1	71.7	94.8	121.5	151.8
15	...	...	53.7	73.8	97.5	124.9	156.1
15½	...	...	55.2	75.9	100.3	128.4	160.4
16	...	...	...	77.9	103.0	131.8	164.6
16½	...	...	...	80.0	105.7	135.3	168.9
17	...	...	...	82.1	108.4	138.7	173.1
17½	...	...	...	84.2	111.2	142.2	177.4
18	...	...	...	...	113.9	145.6	181.7
18½	...	...	...	...	116.6	149.1	185.9
19	...	...	...	...	119.3	152.5	190.2
19½	...	...	...	...	122.1	156.0	194.4
20	...	...	...	...	124.8	159.4	198.7
One inch in length of 100 Bolts.	1.36	2.13	3.07	4.18	5.45	6.90	8.52
To obtain Weights with Square Nuts per 100: Add.	.23	.41	.66	.99	1.42	1.96	2.62
Weight of one Hexagon Nut.	.0116	.020	.031	.046	.065	.088	.117
Weight of one Hexagon Head.	.0150	.025	.039	.057	.081	.109	.144
Weight of one Square Nut.	.0139	.024	.038	.056	.079	.108	.143
Weight of one Square Head.	.0173	.029	.045	.066	.093	.126	.167

All weights are approximate.

WEIGHTS OF 100 MACHINE BOLTS WITH SQUARE HEADS AND HEXAGON NUTS.

FRANKLIN INSTITUTE STANDARD SIZES.

Basis — 1 cubic foot Iron = 480 pounds.

Length under Head to Point. Inches.	Diameter of Bolts in Inches. $\frac{3}{4}$	$\frac{7}{8}$	1	$1\frac{1}{8}$	$1\frac{1}{4}$	$1\frac{3}{8}$	$1\frac{1}{2}$
$1\frac{1}{2}$	64.5	95.2	134	182	240	309	390
$1\frac{3}{4}$	67.6	99.4	140	189	248	319	402
2	70.6	103.5	145	196	257	329	414
$2\frac{1}{4}$	73.7	107.7	150	203	265	340	426
$2\frac{1}{2}$	76.8	111.9	156	210	274	350	439
$2\frac{3}{4}$	79.8	116.1	161	216	282	360	451
3	82.9	120.2	167	223	291	371	463
$3\frac{1}{4}$	86.0	124.4	172	230	300	381	475
$3\frac{1}{2}$	89.1	128.6	178	237	308	391	488
$3\frac{3}{4}$	92.1	132.8	183	244	317	402	500
4	95.2	136.9	189	251	325	412	512
$4\frac{1}{2}$	101.3	145.3	199	265	342	432	537
5	107.4	153.6	210	279	359	453	561
$5\frac{1}{2}$	113.6	162.0	221	292	376	474	586
6	119.7	170.3	232	306	393	494	610
$6\frac{1}{2}$	125.9	178.7	243	320	410	515	635
7	132.0	187.0	254	334	427	536	659
$7\frac{1}{2}$	138.1	195.4	265	348	444	556	684
8	144.3	203.7	276	361	461	577	709
$8\frac{1}{2}$	150.4	212.1	287	375	478	597	733
9	156.5	220.4	298	389	495	618	758
$9\frac{1}{2}$	162.7	228.8	308	402	513	639	782
10	168.8	237.1	319	417	530	659	807
$10\frac{1}{2}$	174.9	245.5	330	430	547	680	831
11	181.1	253.8	341	444	564	701	856
$11\frac{1}{2}$	187.2	262.2	352	458	581	721	880
12	193.3	270.5	363	472	598	742	905
$12\frac{1}{2}$	199.5	278.9	374	486	615	762	929
13	205.6	287.2	385	499	632	783	954
$13\frac{1}{2}$	211.7	295.6	396	513	649	804	978
14	217.9	303.9	407	527	666	824	1003
$14\frac{1}{2}$	224.0	312.3	417	541	683	845	1027
15	230.1	320.6	428	555	700	866	1052
$15\frac{1}{2}$	236.3	329.0	439	568	717	886	1077
16	242.4	337.3	450	582	734	907	1101
$16\frac{1}{2}$	248.5	345.7	461	596	751	927	1126
17	254.7	354.0	472	610	768	948	1150
$17\frac{1}{2}$	260.8	362.4	483	624	785	969	1175
18	266.9	370.7	494	637	802	989	1199
$18\frac{1}{2}$	273.1	379.1	505	651	819	1010	1224
19	279.2	387.4	516	665	836	1031	1248
$19\frac{1}{2}$	285.3	395.8	526	679	853	1051	1273
20	291.5	404.1	537	693	870	1072	1297
One inch in length of 100 Bolts.	12.27	16.70	21.82	27.61	34.09	41.25	49.09
To obtain Weights with Square Nuts per 100: Add .	4.35	6.72	9.81	13.73	18.57	24.42	31.42
Weight of one Hexagon Nut .	.190	.289	.417	.579	.777	1.016	1.299
Weight of one Hexagon Head.	.235	.357	.516	.616	.962	1.259	1.611
Weight of one Square Nut . .	.234	.356	.515	.716	.963	1.260	1.614
Weight of one Square Head . .	.271	.412	.596	.827	1.111	1.453	1.860

All weights are approximate.

WEIGHTS OF 100 MACHINE BOLTS WITH SQUARE HEADS AND NUTS.

WROUGHT IRON.

MANUFACTURERS' STANDARD SIZES.

Basis — Hoopes & Townsend's List.

Length under Head to Point.	Diameter of Bolt in Inches.							
Inches.	$\frac{1}{4}$	$\frac{5}{16}$	$\frac{3}{8}$	$\frac{7}{16}$	$\frac{1}{2}$	$\frac{9}{16}$	$\frac{5}{8}$	$\frac{3}{4}$
$1\frac{1}{2}$	3.9	6.2	9.7	14.7	20.4	26.0	37.0	58.0
2	4.6	7.2	11.3	16.5	22.4	29.0	39.9	63.2
$2\frac{1}{2}$	5.4	8.2	12.9	18.5	25.0	32.2	44.1	69.0
3	6.2	9.3	14.5	20.5	27.8	35.4	48.3	75.2
$3\frac{1}{2}$	6.9	10.4	16.1	22.6	30.6	38.7	52.5	81.4
4	7.6	11.5	17.7	24.7	33.4	42.0	56.7	87.6
$4\frac{1}{2}$	8.3	12.6	19.2	26.8	36.2	45.3	60.9	93.8
5	9.0	13.7	20.7	28.9	39.0	48.6	65.1	100.0
$5\frac{1}{2}$	9.7	14.8	22.2	31.0	41.8	51.9	69.2	106.1
6	10.4	15.9	23.7	33.1	44.6	55.2	73.4	112.2
$6\frac{1}{2}$	11.1	17.0	25.2	35.2	47.4	58.5	77.6	118.3
7	11.8	18.1	26.7	37.3	50.2	61.8	81.8	124.4
$7\frac{1}{2}$	12.5	19.2	28.2	39.4	53.1	65.1	86.0	130.5
8	13.2	20.3	29.7	41.5	56.0	68.5	90.0	136.6
9	14.6	22.5	33.1	45.7	61.5	75.2	98.0	148.8
10	...	...	36.5	49.9	67.0	81.9	106.3	161.0
11	...	...	40.0	54.1	72.5	88.7	114.6	173.2
12	...	...	43.5	58.3	78.0	95.5	122.9	184.4
13	...	...	47.0	61.5	83.5	102.3	131.2	196.6
14	...	...	...	...	89.0	109.1	139.5	208.8
15	...	...	...	...	94.5	116.0	148.0	221.0
16	...	...	...	...	100.0	123.0	156.5	233.2
17	...	...	...	...	105.5	130.0	165.0	245.4
18	...	...	...	...	111.0	137.0	173.5	257.6
19	...	...	...	...	116.5	144.0	182.0	269.8
20	...	...	...	...	122.0	151.0	190.5	282.0
21	...	...	...	...	127.5	158.0	198.0	294.0
22	...	...	...	...	...	...	206.0	306.0
23	...	...	...	...	...	...	215.0	318.0
24	...	...	...	...	...	...	224.0	330.0
25	...	...	...	...	...	...	233.0	342.0

WEIGHTS OF 100 MACHINE BOLTS WITH SQUARE HEADS AND NUTS.

WROUGHT IRON.

MANUFACTURERS' STANDARD SIZES.

Basis — Hoopes & Townsend's List.

Length under Head to Point.	Diameter of Bolt in Inches.							
Inches.	$\frac{7}{8}$	1	$1\frac{1}{8}$	$1\frac{1}{4}$	$1\frac{3}{8}$	$1\frac{1}{2}$	$1\frac{3}{4}$	2
	. .	. . .	. . .	. . .	. . .	. . .	. . .	. . .
2	98	145	. . .	. . .	. . .	. . .	. . .	. . .
$2\frac{1}{2}$	106	153	. . .	. . .	. . .	. . .	. . .	. . .
3	114	163	240	309	350	480	. . .	. . .
$3\frac{1}{2}$	122	174	253	325	370	500	. . .	. . .
4	130	185	267	342	390	520	800	. . .
$4\frac{1}{2}$	138	196	281	359	410	545	833	. . .
5	147	207	295	376	430	570	866	1370
$5\frac{1}{2}$	155	218	309	394	450	595	900	1414
6	163	229	323	412	470	620	934	1458
$6\frac{1}{2}$	172	240	337	430	490	645	968	1502
7	180	251	351	448	510	670	1002	1546
$7\frac{1}{2}$	187	262	365	466	530	695	1036	1590
8	195	273	379	484	550	725	1070	1634
9	212	295	407	518	590	775	1138	1722
10	229	317	435	552	630	825	1206	1810
11	246	339	463	586	670	875	1274	1898
12	263	361	491	620	710	925	1342	1986
13	280	383	519	655	751	975	1410	2074
14	297	405	547	690	793	1025	1478	2162
15	314	427	575	725	835	1075	1548	2250
16	331	449	603	760	877	1125	1616	2338
17	348	471	631	795	919	1175	1684	2426
18	365	493	659	830	961	1225	1752	2514
19	382	515	687	865	1003	1275	1820	2602
20	399	537	715	900	1045	1325	1888	2690
21	416	559	743	935	1087	1375	1956	2778
22	437	581	771	970	1129	1425	2024	2866
23	454	603	799	1005	1171	1475	2092	2954
24	470	625	827	1040	1213	1525	2160	3042
25	487	647	855	1075	1255	1575	2228	3130

Bolts from $1\frac{1}{8}$ inch to 2 inches, inclusive, are fitted with nuts made to U. S. Standard.

WEIGHTS OF 100 ROUND-HEADED RIVETS OR ROUND-HEADED BOLTS WITHOUT NUTS.

WROUGHT IRON.

Basis — 1 cubic foot Iron = 480 pounds.

Length under Head to Point. Inches.	Diameter of Rivet in Inches. $\frac{3}{8}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{7}{8}$	1	$1\frac{1}{8}$
1	4.7	9.3	16.0	25.2	37.2	52.6	71.3
$1\frac{1}{4}$	5.5	10.7	18.1	28.3	41.3	58.0	78.2
$1\frac{1}{2}$	6.2	12.1	20.2	31.3	45.5	63.5	85.1
$1\frac{3}{4}$	7.0	13.4	22.4	34.4	49.7	68.9	92.0
2	7.8	14.8	24.5	37.5	53.9	74.4	98.9
$2\frac{1}{4}$	8.5	16.2	26.6	40.5	58.0	79.8	105.8
$2\frac{1}{2}$	9.3	17.5	28.8	43.6	62.2	85.3	112.7
$2\frac{3}{4}$	10.1	18.9	30.9	46.7	66.4	90.7	119.6
3	10.8	20.3	33.0	49.8	70.6	96.2	126.5
$3\frac{1}{4}$	11.6	21.6	35.1	52.8	74.7	101.6	133.4
$3\frac{1}{2}$	12.4	23.0	37.3	55.9	78.9	107.1	140.3
$3\frac{3}{4}$	13.1	24.3	39.4	59.0	83.1	112.6	147.2
4	13.9	25.7	41.5	62.0	87.3	118.0	154.1
$4\frac{1}{4}$	14.7	27.1	43.7	65.1	91.4	123.5	161.0
$4\frac{1}{2}$	15.4	28.4	45.8	68.2	95.6	128.9	167.9
$4\frac{3}{4}$	16.2	29.8	47.9	71.2	99.8	134.4	174.8
5	17.0	31.2	50.1	74.3	104.0	139.8	181.7
$5\frac{1}{4}$	17.7	32.5	52.2	77.4	108.2	145.3	188.6
$5\frac{1}{2}$	18.5	33.9	54.3	80.4	112.3	150.7	195.6
$5\frac{3}{4}$	19.3	35.3	56.4	83.5	116.5	156.2	202.5
6	20.0	36.6	58.6	86.6	120.7	161.6	209.4
$6\frac{1}{4}$	20.8	38.0	60.7	89.6	124.8	167.1	216.3
$6\frac{1}{2}$	21.6	39.3	62.8	92.7	129.0	172.5	223.2
$6\frac{3}{4}$	22.3	40.7	65.0	95.8	133.2	178.0	230.1
7	23.1	42.1	67.1	98.8	137.4	183.5	237.0
$7\frac{1}{4}$	23.9	43.4	69.2	101.9	141.6	188.9	243.9
$7\frac{1}{2}$	24.6	44.8	71.4	105.0	145.7	194.4	250.8
$7\frac{3}{4}$	25.4	46.2	73.5	108.0	149.9	199.8	257.7
8	26.2	47.5	75.6	111.1	154.1	205.3	264.6
$8\frac{1}{2}$	27.7	50.2	79.9	117.2	162.4	216.2	278.4
9	29.2	53.0	84.1	123.4	170.8	227.1	292.2
$9\frac{1}{2}$	30.8	55.7	88.4	129.5	179.1	238.0	306.0
10	32.3	58.4	92.7	135.6	187.5	248.8	319.8
$10\frac{1}{2}$	33.8	61.2	96.9	141.8	195.8	259.8	333.6
11	35.4	63.9	101.2	147.9	204.2	270.7	347.4
$11\frac{1}{2}$	36.9	66.6	105.4	154.1	212.5	281.6	361.2
12	38.4	69.3	109.7	160.2	220.9	292.5	375.0
One inch in length of 100 Rivets	3.07	5.45	8.52	12.27	16.70	21.82	27.61
Weight of 100 Rivet Heads . .	1.78	4.82	9.95	16.12	24.29	34.77	47.67

WEIGHTS AND DIMENSIONS OF BOLT HEADS.

MANUFACTURERS' STANDARD SIZES.

BASIS—HOOPES & TOWNSEND'S LIST.

Diameter of Bolt.	Square.				Hexagon.			
	Short Diameter.	Long Diameter.	Thickness.	Weight per 100.	Short Diameter.	Long Diameter.	Thickness.	Weight per 100.
Inches.	Inches.	Inches.	Inch.	Pounds.	Inches.	Inches.	Inches.	Pounds.
$\frac{1}{4}$	$\frac{7}{16}$	.619	$\frac{3}{16}$	1.0	$\frac{7}{16}$	.505	$\frac{3}{16}$	.9
$\frac{5}{16}$	$\frac{1}{2}$	.707	$\frac{1}{4}$	1.7	$\frac{1}{2}$	.578	$\frac{1}{4}$	1.5
$\frac{3}{8}$	$\frac{19}{32}$	.840	$\frac{9}{32}$	2.8	$\frac{19}{32}$	.686	$\frac{9}{32}$	2.4
$\frac{7}{16}$	$\frac{11}{16}$	.972	$\frac{3}{8}$	4.9	$\frac{11}{16}$	.794	$\frac{3}{8}$	4.3
$\frac{1}{2}$	$\frac{3}{4}$	1.061	$\frac{7}{16}$	6.8	$\frac{3}{4}$	.866	$\frac{7}{16}$	5.9
$\frac{9}{16}$	$\frac{27}{32}$	1.193	$\frac{1}{2}$	9.9	$\frac{27}{32}$	.974	$\frac{1}{2}$	8.6
$\frac{5}{8}$	$\frac{15}{16}$	1.326	$\frac{17}{32}$	13.0	$\frac{15}{16}$	1.083	$\frac{17}{32}$	11.2
$\frac{3}{4}$	$1\frac{1}{8}$	1.591	$\frac{5}{8}$	22.0	$1\frac{1}{8}$	1.299	$\frac{5}{8}$	19.0
$\frac{7}{8}$	$1\frac{5}{16}$	1.856	$\frac{3}{4}$	34.8	$1\frac{5}{16}$	1.516	$\frac{3}{4}$	33.1
1	$1\frac{1}{2}$	2.122	$\frac{7}{8}$	54.7	$1\frac{1}{2}$	1.733	$\frac{7}{8}$	47.4
$1\frac{1}{8}$	$1\frac{5}{8}$	2.298	1	73.3	$1\frac{5}{8}$	1.877	1	63.5
$1\frac{1}{4}$	$1\frac{3}{4}$	2.475	$1\frac{1}{8}$	95.7	$1\frac{3}{4}$	2.021	$1\frac{1}{8}$	82.9
$1\frac{3}{8}$	$2\frac{1}{8}$	3.006	$1\frac{1}{4}$	156.8	2	2.309	$1\frac{3}{8}$	132.3
$1\frac{1}{2}$	$2\frac{3}{8}$	3.359	$1\frac{3}{8}$	215.4	$2\frac{3}{8}$	2.743	$1\frac{1}{2}$	203.5
$1\frac{5}{8}$	$2\frac{1}{2}$	3.536	$1\frac{1}{2}$	260.3	$2\frac{1}{2}$	2.888	$1\frac{5}{8}$	244.4
$1\frac{3}{4}$	$2\frac{3}{4}$	3.889	$1\frac{5}{8}$	341.3	$2\frac{3}{4}$	3.176	$1\frac{3}{4}$	318.4
$1\frac{7}{8}$	3	4.243	$1\frac{3}{4}$	437.4	3	3.464	$1\frac{7}{8}$	408.2
2	$3\frac{1}{8}$	4.420	$1\frac{7}{8}$	508.5	$3\frac{1}{8}$	3.610	2	469.9

WEIGHTS AND DIMENSIONS OF HEXAGON NUTS.

MANUFACTURERS' STANDARD SIZES.

BASIS—HOOPES & TOWNSEND'S LIST.

Diameter of Bolt.	Short Diameter.	Long Diameter.	Thickness.	Diameter of Rough Hole.	Plain.		Cupped.	
					Weight per 100.	Number in 100 Pounds.	Weight per 100.	Number in 100 Pounds.
Inches.	Inches.	Inches.	Inches.	Inch.	Pounds.		Pounds.	
$\frac{1}{4}$	$\frac{1}{2}$	.578	$\frac{1}{4}$	$\frac{7}{32}$	1.3	7800	1.2	8500
$\frac{5}{16}$	$\frac{5}{8}$	.722	$\frac{5}{16}$	$\frac{9}{32}$	2.3	4440	2.1	4790
$\frac{3}{8}$	$\frac{3}{4}$	.866	$\frac{3}{8}$	$\frac{11}{32}$	4.3	2330	4.0	2510
$\frac{7}{16}$	$\frac{7}{8}$	1.011	$\frac{7}{16}$	$\frac{13}{32}$	7.0	1430	6.3	1580
$\frac{1}{2}$	$\frac{7}{8}$	1.011	$\frac{1}{2}$	$\frac{7}{16}$	7.5	1330	6.9	1440
$\frac{1}{2}$	1	1.155	$\frac{1}{2}$	$\frac{7}{16}$	9.9	1010	9.2	1090
$\frac{1}{2}$	1	1.155	$\frac{9}{16}$	$\frac{7}{16}$	10.8	930	10.2	980
$\frac{9}{16}$	$1\frac{1}{8}$	1.299	$\frac{9}{16}$	$\frac{1}{2}$	13.7	730	12.5	800
$\frac{5}{8}$	$1\frac{1}{8}$	1.299	$\frac{5}{8}$	$\frac{9}{16}$	15.9	630	15.2	660
$\frac{5}{8}$	$1\frac{1}{8}$	1.299	$\frac{3}{4}$	$\frac{9}{16}$	17.9	560	17.0	588
$\frac{5}{8}$	$1\frac{1}{4}$	1.444	$\frac{5}{8}$	$\frac{9}{16}$	19.5	514	18.5	541
$\frac{5}{8}$	$1\frac{1}{4}$	1.444	$\frac{3}{4}$	$\frac{9}{16}$	23.0	435	21.7	460
$\frac{3}{4}$	$1\frac{1}{4}$	1.444	$\frac{3}{4}$	$\frac{21}{32}$	22.2	450	20.6	485
$\frac{3}{4}$	$1\frac{3}{8}$	1.588	$\frac{3}{4}$	$\frac{21}{32}$	26.6	376	25.4	394
$\frac{3}{4}$	$1\frac{3}{8}$	1.588	$\frac{7}{8}$	$\frac{21}{32}$	30.3	330	28.8	347
$\frac{3}{4}$	$1\frac{1}{2}$	1.733	$\frac{3}{4}$	$\frac{21}{32}$	34.5	290	32.3	310
$\frac{3}{4}$	$1\frac{1}{2}$	1.733	$\frac{7}{8}$	$\frac{21}{32}$	40.0	250	37.6	266
$\frac{7}{8}$	$1\frac{1}{2}$	1.733	$\frac{7}{8}$	$\frac{25}{32}$	37.7	265	35.3	283
$\frac{7}{8}$	$1\frac{1}{2}$	1.733	1	$\frac{25}{32}$	45.9	218	43.5	230
$\frac{7}{8}$	$1\frac{5}{8}$	1.877	$\frac{7}{8}$	$\frac{25}{32}$	45.3	221	42.6	235
$\frac{7}{8}$	$1\frac{5}{8}$	1.877	1	$\frac{25}{32}$	50.8	197	47.6	210
1	$1\frac{3}{4}$	2.021	1	$\frac{7}{8}$	57.5	174	53.8	186
1	$1\frac{3}{4}$	2.021	$1\frac{1}{8}$	$\frac{7}{8}$	63.7	157	59.5	168
$1\frac{1}{8}$	2	2.309	$1\frac{1}{4}$	$\frac{15}{16}$	100.0	100	90.9	110
$1\frac{1}{4}$	$2\frac{1}{4}$	2.599	$1\frac{3}{8}$	$1\frac{1}{16}$	138.9	72	126.6	79
$1\frac{3}{8}$	$2\frac{1}{2}$	2.888	$1\frac{1}{2}$	$1\frac{3}{16}$	185.2	54	169.5	59
$1\frac{1}{2}$	$2\frac{3}{4}$	3.176	$1\frac{5}{8}$	$1\frac{5}{16}$	243.9	41	222.2	45
$1\frac{5}{8}$	3	3.464	$1\frac{3}{4}$	$1\frac{7}{16}$	333.3	30	303.0	33
$1\frac{3}{4}$	$3\frac{1}{4}$	3.754	$1\frac{7}{8}$	$1\frac{9}{16}$	408.2	$24\frac{1}{2}$	370.4	27
$1\frac{7}{8}$	$3\frac{1}{2}$	4.043	2	$1\frac{11}{16}$	493.8	$20\frac{1}{4}$	459.8	$21\frac{3}{4}$
2	$3\frac{1}{2}$	4.043	2	$1\frac{13}{16}$	487.8	$20\frac{1}{2}$	454.5	22
2	$3\frac{1}{2}$	4.043	$2\frac{1}{8}$	$1\frac{13}{16}$	512.8	$19\frac{1}{2}$	487.8	$20\frac{1}{2}$

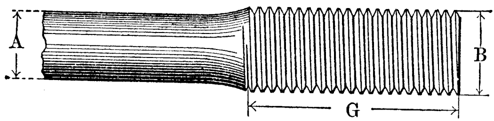
WEIGHTS AND DIMENSIONS OF SQUARE NUTS.

MANUFACTURERS' STANDARD SIZES.

BASIS—HOOPES & TOWNSEND'S LIST.

Diameter of Bolt.	Short Diameter.	Long Diameter.	Thickness.	Diameter of Rough Hole.	Plain.		Cupped.	
					Weight per 100.	Number in 100 Pounds.	Weight per 100.	Number in 100 Pounds.
Inches.	Inches.	Inches.	Inches.	Inch.	Pounds.		Pounds.	
$\frac{1}{4}$	$\frac{1}{2}$	.707	$\frac{1}{4}$	$\frac{7}{32}$	1.5	6750	1.4	7200
$\frac{5}{16}$	$\frac{5}{8}$	.884	$\frac{5}{16}$	$\frac{9}{32}$	2.8	3540	2.5	4000
$\frac{3}{8}$	$\frac{3}{4}$	1.061	$\frac{3}{8}$	$\frac{11}{32}$	4.8	2100	4.2	2380
$\frac{7}{16}$	$\frac{7}{8}$	1.237	$\frac{7}{16}$	$\frac{13}{32}$	7.5	1330	6.8	1460
$\frac{1}{2}$	$\frac{7}{8}$	1.237	$\frac{1}{2}$	$\frac{7}{16}$	8.9	1120	8.1	1230
$\frac{1}{2}$	1	1.414	$\frac{1}{2}$	$\frac{7}{16}$	11.9	840	10.8	930
$\frac{9}{16}$	$1\frac{1}{8}$	1.591	$\frac{9}{16}$	$\frac{1}{2}$	15.4	650	14.3	700
$\frac{5}{8}$	$1\frac{1}{8}$	1.591	$\frac{5}{8}$	$\frac{9}{16}$	17.3	575	16.1	620
$\frac{5}{8}$	$1\frac{1}{4}$	1.768	$\frac{5}{8}$	$\frac{9}{16}$	23.0	435	21.1	475
$\frac{3}{4}$	$1\frac{1}{4}$	1.768	$\frac{3}{4}$	$\frac{21}{32}$	27.8	360	25.0	400
$\frac{3}{4}$	$1\frac{3}{8}$	1.945	$\frac{3}{4}$	$\frac{21}{32}$	31.7	315	29.0	345
$\frac{3}{4}$	$1\frac{1}{2}$	2.122	$\frac{3}{4}$	$\frac{21}{32}$	41.0	244	37.0	270
$\frac{7}{8}$	$1\frac{1}{2}$	2.122	$\frac{7}{8}$	$\frac{25}{32}$	46.5	215	41.7	240
$\frac{7}{8}$	$1\frac{5}{8}$	2.298	$\frac{7}{8}$	$\frac{25}{32}$	55.6	180	48.8	205
$\frac{7}{8}$	$1\frac{3}{4}$	2.475	$\frac{7}{8}$	$\frac{25}{32}$	61.3	163	54.6	183
1	$1\frac{3}{4}$	2.475	1	$\frac{7}{8}$	70.9	141	64.1	156
1	2	2.828	1	$\frac{7}{8}$	95.2	105	87.0	115
$1\frac{1}{8}$	2	2.828	$1\frac{1}{8}$	$\frac{15}{16}$	102.0	98	94.3	106
$1\frac{1}{8}$	$2\frac{1}{4}$	3.182	$1\frac{1}{8}$	$\frac{15}{16}$	135.1	74	123.5	81
$1\frac{1}{4}$	$2\frac{1}{4}$	3.182	$1\frac{1}{4}$	$1\frac{1}{16}$	156.3	64	142.9	70
$1\frac{1}{4}$	$2\frac{1}{2}$	3.536	$1\frac{1}{4}$	$1\frac{1}{16}$	192.3	52	175.4	57
$1\frac{3}{8}$	$2\frac{3}{4}$	3.889	$1\frac{3}{8}$	$1\frac{3}{16}$	250.0	40	227.3	44
$1\frac{1}{2}$	3	4.243	$1\frac{1}{2}$	$1\frac{5}{16}$	317.5	$31\frac{1}{2}$	285.7	35
$1\frac{5}{8}$	$3\frac{1}{4}$	4.597	$1\frac{5}{8}$	$1\frac{7}{16}$	454.5	22	400.0	25
$1\frac{3}{4}$	$3\frac{1}{2}$	4.950	$1\frac{3}{4}$	$1\frac{9}{16}$	555.6	18	500.0	20
$1\frac{7}{8}$	$3\frac{3}{4}$	5.303	$1\frac{7}{8}$	$1\frac{11}{16}$	666.7	15	625.0	16
2	4	5.657	2	$1\frac{13}{16}$	816.3	$12\frac{1}{4}$	784.3	$12\frac{3}{4}$

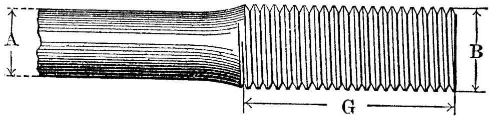
UPSET SCREW ENDS FOR ROUND BARS.



Diameter of Bar. A	Area of Body of Bar.	Diameter of Screw. B	Length of Upset. G	Area at Root of Thread.	Number of Threads per Inch.	Weight per Foot of Bar.	Add for Upset.	Excess of Area at Root of Thread Over that of Body of Bar.
Inch.	Sq. Ins.	Inches.	Inches.	Sq. Ins.		Pounds.	Inches.	Per Cent.
$\frac{1}{2}$	.196	$\frac{3}{4}$	$4\frac{1}{4}$	.302	10	.668	$6\frac{1}{2}$	54
$\frac{9}{16}$	.249	$\frac{3}{4}$	$4\frac{1}{4}$	.302	10	.845	$4\frac{1}{4}$	21
$\frac{5}{8}$	.307	$\frac{7}{8}$	$4\frac{1}{2}$	.420	9	1.043	$5\frac{1}{2}$	37
$\frac{11}{16}$	.371	1	$4\frac{1}{2}$	.550	8	1.262	$6\frac{1}{4}$	48
$\frac{3}{4}$	.442	1	$4\frac{1}{2}$	.550	8	1.502	$4\frac{1}{2}$	25
$\frac{13}{16}$	.519	$1\frac{1}{8}$	$4\frac{3}{4}$	.694	7	1.763	$5\frac{1}{2}$	34
$\frac{7}{8}$	.601	$1\frac{1}{4}$	$4\frac{3}{4}$	.893	7	2.044	$6\frac{1}{4}$	49
$\frac{15}{16}$	.690	$1\frac{1}{4}$	$4\frac{3}{4}$	.893	7	2.347	$4\frac{1}{2}$	29
1	.785	$1\frac{3}{8}$	5	1.057	6	2.670	$5\frac{1}{4}$	35
$1\frac{1}{16}$	.887	$1\frac{3}{8}$	5	1.057	6	3.014	$4\frac{1}{4}$	19
$1\frac{1}{8}$	.994	$1\frac{1}{2}$	5	1.295	6	3.379	$4\frac{3}{4}$	30
$1\frac{3}{16}$	1.108	$1\frac{1}{2}$	5	1.295	6	3.766	$3\frac{3}{4}$	17
$1\frac{1}{4}$	1.227	$1\frac{5}{8}$	$5\frac{1}{4}$	1.515	$5\frac{1}{2}$	4.173	$4\frac{1}{2}$	23
$1\frac{5}{16}$	1.353	$1\frac{3}{4}$	$5\frac{1}{4}$	1.744	5	4.600	5	29
$1\frac{3}{8}$	1.485	$1\frac{3}{4}$	$5\frac{1}{4}$	1.744	5	5.049	4	18
$1\frac{7}{16}$	1.623	$1\frac{7}{8}$	$5\frac{1}{2}$	2.048	5	5.518	$4\frac{3}{4}$	26
$1\frac{1}{2}$	1.767	2	$5\frac{1}{2}$	2.302	$4\frac{1}{2}$	6.008	$5\frac{1}{4}$	30
$1\frac{9}{16}$	1.918	2	$5\frac{1}{2}$	2.302	$4\frac{1}{2}$	6.520	$4\frac{1}{2}$	20
$1\frac{5}{8}$	2.074	$2\frac{1}{8}$	$5\frac{3}{4}$	2.650	$4\frac{1}{2}$	7.051	5	28
$1\frac{11}{16}$	2.237	$2\frac{1}{8}$	$5\frac{3}{4}$	2.650	$4\frac{1}{2}$	7.604	$4\frac{1}{4}$	18
$1\frac{3}{4}$	2.405	$2\frac{1}{4}$	$5\frac{3}{4}$	3.023	$4\frac{1}{2}$	8.178	$4\frac{3}{4}$	26
$1\frac{13}{16}$	2.580	$2\frac{1}{4}$	$5\frac{3}{4}$	3.023	$4\frac{1}{2}$	8.773	4	17
$1\frac{7}{8}$	2.761	$2\frac{3}{8}$	6	3.419	$4\frac{1}{2}$	9.388	$4\frac{1}{2}$	24
$1\frac{15}{16}$	2.948	$2\frac{1}{2}$	6	3.715	4	10.020	5	26

Lengths of Upset Ends above are best adapted for use with Turnbuckles of standard length, six inches between heads, as shown on page 332, and with Clevises shown on page 334. Lengths of Upset Ends for use with ordinary Right and Left Nuts, shown on page 333, may be one inch shorter than above.

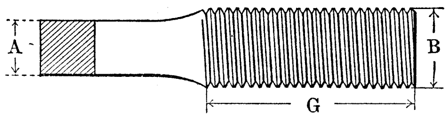
UPSET SCREW ENDS FOR ROUND BARS.



Diameter of Bar. A	Area of Body of Bar.	Diameter of Screw. B	Length of Upset. G	Area at Root of Thread.	Number of Threads per Inch.	Weight per Foot of Bar.	Add for Upset.	Excess of Area at Root of Thread Over that of Body of Bar.
Inches.	Sq. Ins.	Inches.	Inches.	Sq. Ins.		Pounds.	Inches.	Per Cent.
2	3.142	$2\frac{1}{2}$	6	3.715	4	10.68	$4\frac{1}{4}$	18
$2\frac{1}{16}$	3.341	$2\frac{5}{8}$	$6\frac{1}{4}$	4.155	4	11.36	$4\frac{3}{4}$	24
$2\frac{1}{8}$	3.547	$2\frac{5}{8}$	$6\frac{1}{4}$	4.155	4	12.06	4	17
$2\frac{3}{16}$	3.758	$2\frac{3}{4}$	$6\frac{1}{4}$	4.619	4	12.78	$4\frac{1}{2}$	23
$2\frac{1}{4}$	3.976	$2\frac{7}{8}$	$6\frac{1}{2}$	5.108	4	13.52	$5\frac{1}{4}$	28
$2\frac{5}{16}$	4.200	$2\frac{7}{8}$	$6\frac{1}{2}$	5.108	4	14.28	$4\frac{1}{2}$	22
$2\frac{3}{8}$	4.430	3	$6\frac{1}{2}$	5.428	$3\frac{1}{2}$	15.07	$4\frac{3}{4}$	23
$2\frac{7}{16}$	4.666	$3\frac{1}{8}$	$6\frac{3}{4}$	5.957	$3\frac{1}{2}$	15.86	$5\frac{1}{2}$	28
$2\frac{1}{2}$	4.909	$3\frac{1}{8}$	$6\frac{3}{4}$	5.957	$3\frac{1}{2}$	16.69	$4\frac{3}{4}$	21
$2\frac{9}{16}$	5.157	$3\frac{1}{4}$	$6\frac{3}{4}$	6.510	$3\frac{1}{2}$	17.53	$5\frac{1}{4}$	26
$2\frac{5}{8}$	5.412	$3\frac{1}{4}$	$6\frac{3}{4}$	6.510	$3\frac{1}{2}$	18.40	$4\frac{1}{2}$	20
$2\frac{11}{16}$	5.673	$3\frac{3}{8}$	7	7.087	$3\frac{1}{2}$	19.29	5	25
$2\frac{3}{4}$	5.940	$3\frac{3}{8}$	7	7.087	$3\frac{1}{2}$	20.20	$4\frac{1}{2}$	19
$2\frac{13}{16}$	6.213	$3\frac{1}{2}$	7	7.548	$3\frac{1}{4}$	21.12	$4\frac{3}{4}$	22
$2\frac{7}{8}$	6.492	$3\frac{5}{8}$	$7\frac{1}{4}$	8.171	$3\frac{1}{4}$	22.07	$5\frac{1}{4}$	26
$2\frac{15}{16}$	6.777	$3\frac{5}{8}$	$7\frac{1}{4}$	8.171	$3\frac{1}{4}$	23.04	$4\frac{3}{4}$	21
3	7.069	$3\frac{3}{4}$	$7\frac{1}{4}$	8.641	3	24.03	5	22
$3\frac{1}{8}$	7.670	$3\frac{7}{8}$	$7\frac{1}{2}$	9.305	3	26.08	$5\frac{1}{4}$	21
$3\frac{1}{4}$	8.296	4	$7\frac{1}{2}$	9.993	3	28.20	$4\frac{3}{4}$	20
$3\frac{3}{8}$	8.946	$4\frac{1}{8}$	$7\frac{3}{4}$	10.706	3	30.42	$4\frac{3}{4}$	20
$3\frac{1}{2}$	9.621	$4\frac{1}{4}$	8	11.329	$2\frac{7}{8}$	32.71	$4\frac{1}{2}$	18
$3\frac{5}{8}$	10.321	$4\frac{1}{2}$	8	12.743	$2\frac{3}{4}$	35.09	$5\frac{1}{4}$	23
$3\frac{3}{4}$	11.045	$4\frac{5}{8}$	$8\frac{1}{4}$	13.544	$2\frac{3}{4}$	37.56	$5\frac{1}{4}$	23
$3\frac{7}{8}$	11.793	$4\frac{3}{4}$	$8\frac{1}{2}$	14.220	$2\frac{5}{8}$	40.10	5	21
4	12.566	5	$8\frac{1}{2}$	15.763	$2\frac{1}{2}$	42.73	$5\frac{1}{4}$	25

Lengths of Upset Ends above are best adapted for use with Turnbuckles of standard length, six inches between heads, as shown on page 332, and with Clevises shown on page 334. Lengths of Upset Ends for use with ordinary Right and Left Nuts, shown on page 333, may be one inch shorter than above.

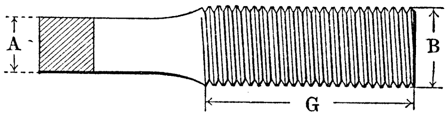
UPSET SCREW ENDS FOR SQUARE BARS.



Side of Square Bar.	Area of Body of Bar.	Diameter of Screw.	Length of Upset.	Area at Root of Thread.	Number of Threads per Inch.	Weight per Foot of Bar.	Add for Upset.	Excess of Area at Root of Thread Over that of Body of Bar.
A		B	G					
Inch.	Sq. Ins.	Inches.	Inches.	Sq. Ins.		Pounds.	Inches.	Per Cent.
$\frac{1}{2}$	.250	$\frac{3}{4}$	$4\frac{1}{4}$	.302	10	.850	4	21
$\frac{9}{16}$	.316	$\frac{7}{8}$	$4\frac{1}{2}$	.420	9	1.076	5	33
$\frac{5}{8}$	.391	1	$4\frac{1}{2}$	.550	8	1.328	$5\frac{3}{4}$	41
$\frac{11}{16}$	.473	1	$4\frac{1}{2}$	.550	8	1.607	$3\frac{3}{4}$	17
$\frac{3}{4}$	.563	$1\frac{1}{8}$	$4\frac{3}{4}$	.694	7	1.913	$4\frac{1}{2}$	23
$\frac{13}{16}$	.660	$1\frac{1}{4}$	$4\frac{3}{4}$	.893	7	2.245	5	35
$\frac{7}{8}$	.766	$1\frac{3}{8}$	5	1.057	6	2.603	$5\frac{3}{4}$	38
$\frac{15}{16}$	.879	$1\frac{3}{8}$	5	1.057	6	2.989	$4\frac{1}{4}$	20
1	1.000	$1\frac{1}{2}$	5	1.295	6	3.400	$4\frac{3}{4}$	29
$1\frac{1}{16}$	1.129	$1\frac{5}{8}$	$5\frac{1}{4}$	1.515	$5\frac{1}{2}$	3.838	$5\frac{1}{2}$	34
$1\frac{1}{8}$	1.266	$1\frac{5}{8}$	$5\frac{1}{4}$	1.515	$5\frac{1}{2}$	4.303	$4\frac{1}{4}$	20
$1\frac{3}{16}$	1.410	$1\frac{3}{4}$	$5\frac{1}{4}$	1.744	5	4.795	$4\frac{3}{4}$	24
$1\frac{1}{4}$	1.563	$1\frac{7}{8}$	$5\frac{1}{2}$	2.048	5	5.312	$5\frac{1}{4}$	31
$1\frac{5}{16}$	1.723	$1\frac{7}{8}$	$5\frac{1}{2}$	2.048	5	5.851	$4\frac{1}{4}$	19
$1\frac{3}{8}$	1.891	2	$5\frac{1}{2}$	2.302	$4\frac{1}{2}$	6.428	$4\frac{1}{2}$	22
$1\frac{7}{16}$	2.066	$2\frac{1}{8}$	$5\frac{3}{4}$	2.650	$4\frac{1}{2}$	7.026	$5\frac{1}{4}$	28
$1\frac{1}{2}$	2.250	$2\frac{1}{8}$	$5\frac{3}{4}$	2.650	$4\frac{1}{2}$	7.650	$4\frac{1}{4}$	18
$1\frac{9}{16}$	2.441	$2\frac{1}{4}$	$5\frac{3}{4}$	3.023	$4\frac{1}{2}$	8.300	$4\frac{1}{2}$	24
$1\frac{5}{8}$	2.641	$2\frac{3}{8}$	6	3.419	$4\frac{1}{2}$	8.978	5	30
$1\frac{11}{16}$	2.848	$2\frac{3}{8}$	6	3.419	$4\frac{1}{2}$	9.682	$4\frac{1}{4}$	20
$1\frac{3}{4}$	3.063	$2\frac{1}{2}$	6	3.715	4	10.410	$4\frac{1}{2}$	21
$1\frac{13}{16}$	3.285	$2\frac{5}{8}$	$6\frac{1}{4}$	4.155	4	11.170	5	26
$1\frac{7}{8}$	3.516	$2\frac{5}{8}$	$6\frac{1}{4}$	4.155	4	11.950	$4\frac{1}{4}$	18
$1\frac{15}{16}$	3.754	$2\frac{3}{4}$	$6\frac{1}{4}$	4.619	4	12.760	$4\frac{1}{2}$	23

Lengths of Upset Ends above are best adapted for use with Turnbuckles of standard length, six inches between heads, as shown on page 332, and with Clevises shown on page 334. Lengths of Upset Ends for use with ordinary Right and Left Nuts, shown on page 333, may be one inch shorter than above.

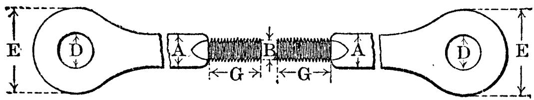
UPSET SCREW ENDS FOR SQUARE BARS.



Side of Square Bar. A Inches.	Area of Body of Bar. Sq. Ins.	Diameter of Screw. B Inches.	Length of Upset. G Inches.	Area at Root of Thread. Sq. Ins.	Number of Threads per Inch.	Weight per Foot of Bar. Pounds.	Add for Upset. Inches.	Excess of Area at Root of Thread Over that of Body of Bar. Per Cent.
2	4.000	2 7/8	6 1/2	5.108	4	13.60	5	28
2 1/16	4.254	2 7/8	6 1/2	5.108	4	14.46	4 1/4	20
2 1/8	4.516	3	6 1/2	5.428	3 1/2	15.35	4 1/2	20
2 3/16	4.785	3 1/8	6 3/4	5.957	3 1/2	16.27	5	24
2 1/4	5.063	3 1/8	6 3/4	5.957	3 1/2	17.22	4 1/4	18
2 5/16	5.348	3 1/4	6 3/4	6.510	3 1/2	18.19	4 3/4	22
2 3/8	5.641	3 3/8	7	7.087	3 1/2	19.18	5 1/4	26
2 7/16	5.941	3 3/8	7	7.087	3 1/2	20.20	4 1/2	19
2 1/2	6.250	3 1/2	7	7.548	3 1/4	21.25	4 3/4	21
2 9/16	6.566	3 5/8	7 1/4	8.171	3 1/4	22.33	5 1/4	24
2 5/8	6.891	3 5/8	7 1/4	8.171	3 1/4	23.43	4 1/2	19
2 11/16	7.223	3 3/4	7 1/4	8.641	3	24.56	4 3/4	20
2 3/4	7.563	3 7/8	7 1/2	9.305	3	25.71	5 1/4	23
2 13/16	7.910	3 7/8	7 1/2	9.305	3	26.90	4 1/2	18
2 7/8	8.266	4	7 1/2	9.993	3	28.10	4 3/4	21
2 15/16	8.629	4 1/8	7 1/2	10.706	3	29.34	5	24
3	9.000	4 1/8	7 3/4	10.706	3	30.60	4 1/2	19
3 1/8	9.766	4 3/8	8	12.087	2 7/8	33.20	5 1/4	24
3 1/4	10.563	4 1/2	8	12.743	2 3/4	35.92	5	21
3 3/8	11.391	4 5/8	8 1/4	13.544	2 3/4	38.73	5	19
3 1/2	12.250	4 7/8	8 1/2	15.068	2 5/8	41.65	5 1/2	23
3 5/8	13.141	5	8 1/2	15.763	2 1/2	44.68	5 1/4	20
3 3/4	14.063	5 1/8	8 3/4	16.658	2 1/2	47.82	5	18
3 7/8	15.016	5 1/4	8 3/4	17.572	2 1/2	51.05	4 3/4	17
4	16.000	5 1/2	9	19.267	2 3/8	54.40	5 1/4	20

Lengths of Upset Ends above are best adapted for use with Turnbuckles of standard length, six inches between heads, as shown on page 332, and with Clevises shown on page 334. Lengths of Upset Ends for use with ordinary Right and Left Nuts, shown on page 333, may be one inch shorter than above.

UPSET SCREW ENDS FOR FLAT BARS.



Width of Bar. A Inches.	Thickness of Bar. T Inch.	Diameter of Upset. B Inches.	Area of Bar. Sq. Inches.	Area at Root of Thread. Sq. Inches.	Length of Upset. G Inches.	Add for Upset. Inches.
2	1	2	2.00	2.30	5½	6
3	⅞	2¼	2.63	3.023	6½	11½
3	1	2½	3.0	3.719	6½	11¼
3	1⅛	2⅝	3.38	4.159	7	11¼
3	1¼	2¾	3.75	4.62	7	11
3	1⅜	2⅞	4.13	4.92	7	10
3	1½	3	4.50	5.43	7	10
4	¾	2½	3.00	3.719	6½	12¾
4	⅞	2⅝	3.50	4.159	7	12
4	1	2¾	4.00	4.62	7	11
4	1⅛	3	4.50	5.43	7	11
4	1¼	3¼	5.00	6.51	7¼	11
4	1⅜	3¼	5.50	6.51	7¼	11
4	1½	3½	6.00	7.54	7½	10
4	1⅝	3½	6.50	7.54	7½	10
4	1¾	3¾	7.00	8.64	7½	9½
5	¾	2¾	3.75	4.62	7	11
5	⅞	3	4.38	5.43	7	11
5	1	3¼	5.00	6.51	7¼	10½
5	1⅛	3¼	5.63	6.51	7¼	10½
5	1¼	3½	6.25	7.55	7½	9½
5	1⅜	3¾	6.88	8.64	7½	9½
5	1½	3¾	7.50	8.64	7½	9¾
5	1⅝	..	8.13	9.99	..	..
5	1¾	..	8.75	9.99	..	..
6	1⅛	3¾	6.75	8.64	7½	10
6	1¼	3¾	7.50	8.64	7½	9
6	1⅜	..	8.25	9.99	..	..
6	1½	..	9.00	9.99	..	..

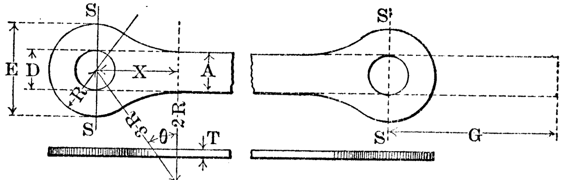
For dimensions of heads corresponding to different-sized pins, see table of Eye Bars on page 331.

Shortest length of bar permissible on account of method of manufacture is 6′ 0″ center to end.

The above length is used only for bars having heads 12½″ diameter or less.

When possible lengths of 7′ 0″ are preferred.

STEEL EYE BARS.



A_E = Area of Excess to form one Head = Plane Area of Head — AX.

$$A_E = \frac{(180 + 2\theta)}{360} \pi R^2 + \left(4 R^2 - \frac{A^2}{4}\right) \text{Tan. } \theta - .0698 R^2 \theta.$$

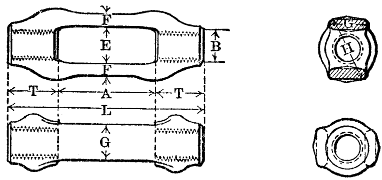
$$\cos \theta = \frac{2R + \frac{A}{2}}{3R}. \quad G = \frac{5A_E}{4A}. \qquad \text{Log. } \frac{\pi}{360} = 7.940848 - 10. \quad \text{“ } .0698 = 8.843855 - 10.$$

Width of Body of Bar.	Minimum Thickness.	Diameter of Head.	Diameter of Largest Pin Hole.	Sectional Area of the Head on Line S—S in Excess of that in Body of Bar.	Additional Length of Bar Beyond Center of Eye Required to Form One Head.
A	T	E	D		G
Inches.	Inch.	Inches.	Inches.		Inches.
2	..	$4\frac{1}{2}$	$1\frac{7}{8}$	33 %	$7\frac{1}{2}$
2	..	$5\frac{1}{2}$	$2\frac{7}{8}$	"	$12\frac{1}{2}$
$2\frac{1}{2}$	..	$5\frac{1}{2}$	$2\frac{1}{8}$	"	$9\frac{1}{2}$
$2\frac{1}{2}$	..	$6\frac{1}{2}$	$3\frac{1}{8}$	"	$13\frac{1}{2}$
3	$\frac{3}{4}$	$6\frac{1}{2}$	$2\frac{1}{2}$	"	$10\frac{1}{2}$
3	$\frac{3}{4}$	8	4	"	$17\frac{1}{2}$
3	$\frac{3}{4}$	9	5	"	$22\frac{1}{2}$
4	$\frac{3}{4}$	$9\frac{1}{2}$	$4\frac{1}{8}$	"	$17\frac{1}{2}$
4	$\frac{3}{4}$	$10\frac{1}{2}$	$5\frac{1}{8}$	"	21
4	$\frac{3}{4}$	$11\frac{1}{2}$	$6\frac{1}{8}$	"	$27\frac{1}{2}$
5	$\frac{3}{4}$	$11\frac{1}{2}$	$4\frac{5}{8}$	37 %	20
5	$\frac{3}{4}$	$12\frac{1}{2}$	$5\frac{5}{8}$	"	24
5	1	13	$6\frac{1}{8}$	"	$27\frac{1}{2}$
5	1	14	$7\frac{1}{8}$	"	32
6	$\frac{7}{8}$	$13\frac{1}{2}$	$5\frac{1}{4}$	"	$21\frac{1}{2}$
6	$\frac{7}{8}$	$14\frac{1}{2}$	$6\frac{1}{4}$	"	27
6	1	$15\frac{1}{2}$	$7\frac{1}{4}$	"	$31\frac{1}{2}$
7	$\frac{15}{16}$	$15\frac{1}{2}$	$5\frac{5}{8}$	40 %	26
7	$\frac{15}{16}$	17	$7\frac{1}{8}$	"	32
8	1	17	$5\frac{3}{4}$	"	$25\frac{1}{2}$
8	1	18	$6\frac{3}{4}$	"	$30\frac{1}{2}$
8	1	19	8	"	35
9	$1\frac{1}{8}$	$19\frac{1}{2}$	7	"	$32\frac{1}{2}$
9	$1\frac{1}{8}$	$21\frac{1}{2}$	9	"	$36\frac{1}{2}$
9	$1\frac{1}{4}$	$22\frac{1}{2}$	10	..	..
10	$1\frac{3}{8}$	$24\frac{1}{2}$	$10\frac{5}{8}$	..	..

The size of head given is the size of die. The size of finished head will overrun this about $\frac{1}{4}''$. Eye Bars are Hydraulic Forged without the addition of extraneous metal and without buckles or welds. The heads on Eye Bars are finished of the same thickness "T" as body of bar.

TURNBUCKLES.

PRESSED WROUGHT IRON.



THE CLEVELAND CITY FORGE AND IRON CO.

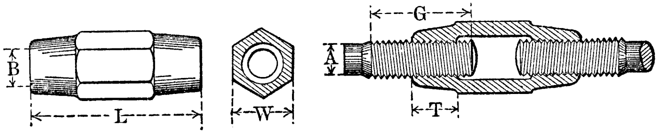
Dimensions of Bar.			L	T	A	E	F	H	G
Diameter of Screw. B	Diameter of Bar.	Side of Square Bar.							
Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
3/8			7 1/8	9/16	6	9/16	3/16	1 1/16	1/2
7/16			7 5/16	21/32	6	5/8	1/4	1 3/8	5/8
1/2			7 1/2	3/4	6	5/8	1/4	1 3/8	5/8
9/16			7 11/16	27/32	6	13/16	5/16	1 9/16	3/4
5/8			7 7/8	15/16	6	13/16	5/16	1 9/16	3/4
3/4	1/2 and 9/16	1/2	8 1/4	1 1/8	6	1 1/16	11/32	2	7/8
7/8	5/8	9/16	8 5/8	1 5/16	6	1 1/4	3/8	2 1/4	1
1	11/16 " 3/4	5/8 and 11/16	9	1 1/2	6	1 5/16	7/16	2 7/16	1 1/4
1 1/8	13/16	3/4	9 3/8	1 11/16	6	1 7/16	1/2	2 9/16	1 1/4
1 1/4	7/8 " 1 5/16	13/16	9 3/4	1 7/8	6	1 9/16	1/2	2 3/4	1 1/2
1 3/8	1 " 1 1/16	7/8 " 15/16	10 1/8	2 1/16	6	1 11/16	1/2	3 1/16	1 5/8
1 1/2	1 1/8 " 1 3/16	1	10 1/2	2 1/4	6	1 3/4	5/8	3 3/16	1 3/4
1 5/8	1 1/4	1 1/16 " 1 1/8	10 7/8	2 7/16	6	2	5/8	3 1/2	1 7/8
1 3/4	1 5/16 " 1 3/8	1 3/16	11 1/4	2 5/8	6	2 1/8	5/8	3 3/4	2
1 7/8	1 7/16	1 1/4 " 1 5/16	11 5/8	2 13/16	6	2 3/16	11/16	3 7/8	2 1/8
2	1 1/2 " 1 9/16	1 3/8	12	3	6	2 3/8	11/16	4 1/4	2 1/4
2 1/8	1 5/8 " 1 11/16	1 7/16 " 1 1/2	12 3/8	3 3/16	6	2 1/2	23/32	4 1/2	2 1/2
2 1/4	1 3/4 " 1 13/16	1 9/16	12 3/4	3 3/8	6	2 11/16	13/16	4 3/4	2 1/2
2 3/8	1 7/8	1 5/8 " 1 11/16	13 1/8	3 9/16	6	2 3/4	13/16	4 7/8	2 3/4
2 1/2	1 15/16 " 2	1 3/4	13 1/2	3 3/4	6	3 1/16	27/32	5 3/8	3
2 5/8	2 1/16 " 2 1/8	1 13/16 " 1 7/8	13 7/8	3 15/16	6	3 1/8	15/16	5 9/16	3
2 3/4	2 3/16	1 15/16	14 1/4	4 1/8	6	3 1/4	15/16	5 3/4	3 1/4
2 7/8	2 1/4 " 2 5/16	2 " 2 1/16	14 5/8	4 5/16	6	3 7/16	1 1/32	6 1/16	3 1/4
3	2 3/8	2 1/8	15	4 1/2	6	3 5/8	1 1/32	6 3/8	3 1/2
3 1/4	2 9/16 " 2 5/8	2 5/16	15 3/4	4 7/8	6	3 3/4	1 1/4	7	4
3 1/2	2 13/16	2 1/2	16 1/2	5 1/4	6	3 7/8	1 5/16	7 1/2	4 1/2
3 3/4	3	2 11/16	17 1/4	5 5/8	6	4 1/8	1 7/16	8 3/8	5
4	3 1/4	2 7/8	18	6	6	4 5/8	1 5/8	9 3/8	5 1/8
4 1/4	3 1/2	3 1/16	21 1/2	6 1/4	9	5	1 5/8	10 1/8	6
4 1/2	3 5/8	3 1/4	22 1/2	6 3/4	9	5 3/8	1 3/4	10 7/8	6 1/2
4 3/4	3 7/8	3 3/8	23 1/2	7 1/4	9	5 1/2	2	11 3/8	6 1/2
5	4 1/8	3 7/16	24	7 1/2	9	5 7/8	2 1/4	12	6 1/2

Standard Lengths, 6, 9, 12, 15, 18, 24, 36, 48 and 72 inches between heads (A) for all sizes.

Lengths of Upset Ends shown on pages 326 to 329 inclusive are those best adapted for use with Turnbuckles of Standard Lengths, as above.

Dimensions E, F, G and H depend upon the specifications of the Bars with which the Turnbuckles are to be used.

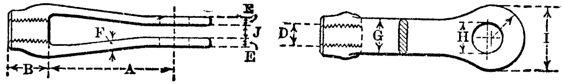
RIGHT AND LEFT NUTS.



Diameter of Screw. B	Length of Upset. G	Diameter of Bar. A	Side of Square Bar. A	Length of Nut. L	Length of Thread. T	Diameter of Hex. W	Weight of One Nut.	Weight of One Nut and Two Screw Ends.
Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Pounds.	Pounds.
				Ordinary Lengths.				
$\frac{7}{8}$	$4\frac{1}{2}$	$\frac{5}{8}$	$\frac{9}{16}$	6	$1\frac{7}{16}$	$1\frac{5}{8}$	$1\frac{3}{4}$	$4\frac{1}{4}$
1	$4\frac{1}{2}$	$\frac{11}{16}$ and $\frac{3}{4}$	$\frac{5}{8}$ and $\frac{11}{16}$	6	$1\frac{7}{16}$	$1\frac{5}{8}$	$1\frac{3}{4}$	$4\frac{1}{4}$
$1\frac{1}{8}$	$4\frac{3}{4}$	$\frac{13}{16}$	$\frac{3}{4}$	$6\frac{1}{2}$	$1\frac{5}{8}$	2	3	$7\frac{1}{2}$
$1\frac{1}{4}$	$4\frac{3}{4}$	$\frac{7}{8}$ " $\frac{15}{16}$	$\frac{13}{16}$	$6\frac{1}{2}$	$1\frac{5}{8}$	2	3	$7\frac{1}{2}$
$1\frac{3}{8}$	5	1 " $1\frac{1}{16}$	$\frac{7}{8}$ " $\frac{15}{16}$	7	$1\frac{7}{8}$	$2\frac{3}{8}$	$4\frac{3}{4}$	$11\frac{3}{4}$
$1\frac{1}{2}$	5	$1\frac{1}{8}$ " $1\frac{3}{16}$	1	7	$1\frac{7}{8}$	$2\frac{3}{8}$	$4\frac{3}{4}$	$11\frac{3}{4}$
$1\frac{5}{8}$	$5\frac{1}{4}$	$1\frac{1}{4}$	$1\frac{1}{16}$ " $1\frac{1}{8}$	$7\frac{1}{2}$	$2\frac{1}{16}$	$2\frac{3}{4}$	$6\frac{3}{4}$	$16\frac{3}{4}$
$1\frac{3}{4}$	$5\frac{1}{4}$	$1\frac{5}{16}$ " $1\frac{3}{8}$	$1\frac{3}{16}$	$7\frac{1}{2}$	$2\frac{1}{16}$	$2\frac{3}{4}$	$6\frac{3}{4}$	$16\frac{3}{4}$
$1\frac{7}{8}$	$5\frac{1}{2}$	$1\frac{7}{16}$	$1\frac{1}{4}$ " $1\frac{5}{16}$	8	$2\frac{5}{16}$	$3\frac{1}{8}$	$9\frac{1}{4}$	$23\frac{1}{4}$
2	$5\frac{1}{2}$	$1\frac{1}{2}$ " $1\frac{9}{16}$	$1\frac{3}{8}$	8	$2\frac{5}{16}$	$3\frac{1}{8}$	$9\frac{1}{4}$	$23\frac{1}{4}$
$2\frac{1}{8}$	$5\frac{3}{4}$	$1\frac{5}{8}$ " $1\frac{11}{16}$	$1\frac{7}{16}$ " $1\frac{1}{2}$	$8\frac{1}{2}$	$2\frac{1}{2}$	$3\frac{1}{2}$	$12\frac{1}{2}$	$31\frac{1}{2}$
$2\frac{1}{4}$	$5\frac{3}{4}$	$1\frac{3}{4}$ " $1\frac{13}{16}$	$1\frac{9}{16}$	$8\frac{1}{2}$	$2\frac{1}{2}$	$3\frac{1}{2}$	$12\frac{1}{2}$	$31\frac{1}{2}$
$2\frac{3}{8}$	6	$1\frac{7}{8}$	$1\frac{5}{8}$ " $1\frac{11}{16}$	9	$2\frac{3}{4}$	$3\frac{7}{8}$	$16\frac{3}{4}$	$41\frac{3}{4}$
$2\frac{1}{2}$	6	$1\frac{15}{16}$ " 2	$1\frac{3}{4}$	9	$2\frac{3}{4}$	$3\frac{7}{8}$	$16\frac{3}{4}$	$41\frac{3}{4}$
$2\frac{5}{8}$	$6\frac{1}{4}$	$2\frac{1}{16}$ " $2\frac{1}{8}$	$1\frac{13}{16}$ " $1\frac{7}{8}$	$9\frac{1}{2}$	$2\frac{15}{16}$	$4\frac{1}{4}$	$21\frac{1}{2}$	$53\frac{1}{4}$
$2\frac{3}{4}$	$6\frac{1}{4}$	$2\frac{3}{16}$	$1\frac{15}{16}$	$9\frac{1}{2}$	$2\frac{15}{16}$	$4\frac{1}{4}$	$21\frac{1}{2}$	$53\frac{1}{4}$
$2\frac{7}{8}$	$6\frac{1}{2}$	$2\frac{1}{4}$ " $2\frac{5}{16}$	2 " $2\frac{1}{16}$	10	$3\frac{3}{16}$	$4\frac{5}{8}$	$26\frac{1}{2}$	$66\frac{1}{4}$
3	$6\frac{1}{2}$	$2\frac{3}{8}$	$2\frac{1}{8}$	10	$3\frac{3}{16}$	$4\frac{5}{8}$	$26\frac{1}{2}$	$66\frac{1}{4}$
$3\frac{1}{4}$	$6\frac{3}{4}$	$2\frac{9}{16}$ " $2\frac{5}{8}$	$2\frac{5}{16}$	$10\frac{1}{2}$	$3\frac{3}{8}$	5	32	81
$3\frac{1}{2}$	7	$2\frac{13}{16}$	$2\frac{1}{2}$	11	$3\frac{5}{8}$	$5\frac{3}{8}$	$38\frac{1}{4}$	$97\frac{3}{4}$
$3\frac{3}{4}$	$7\frac{1}{4}$	3	$2\frac{11}{16}$	$11\frac{1}{2}$	$3\frac{13}{16}$	$5\frac{3}{4}$	45	116
4	$7\frac{1}{2}$	$3\frac{1}{4}$	$2\frac{7}{8}$	12	$4\frac{1}{16}$	$6\frac{1}{8}$	$53\frac{1}{2}$	138
				Extra Lengths.				
$1\frac{1}{4}$	$4\frac{3}{4}$	$\frac{7}{8}$ " $\frac{15}{16}$	$\frac{13}{16}$	12	$2\frac{1}{8}$	2		
$1\frac{1}{8}$	$4\frac{3}{4}$	$\frac{13}{16}$	$\frac{3}{4}$	$8\frac{1}{2}$	$1\frac{5}{8}$	2	4	$9\frac{3}{4}$
$1\frac{1}{4}$	$4\frac{3}{4}$	$\frac{7}{8}$ " $\frac{15}{16}$	$\frac{13}{16}$	$8\frac{1}{2}$	$1\frac{5}{8}$	2	4	$9\frac{3}{4}$
$1\frac{3}{8}$	5	1 " $1\frac{1}{16}$	$\frac{7}{8}$ " $\frac{15}{16}$	9	$1\frac{7}{8}$	$2\frac{3}{8}$	$6\frac{1}{4}$	$15\frac{1}{4}$
$1\frac{1}{2}$	5	$1\frac{1}{8}$ " $1\frac{3}{16}$	1	9	$1\frac{7}{8}$	$2\frac{3}{8}$	$6\frac{1}{4}$	$15\frac{1}{4}$
$1\frac{5}{8}$	$5\frac{1}{4}$	$1\frac{1}{4}$	$1\frac{1}{16}$ " $1\frac{1}{8}$	$9\frac{1}{2}$	$2\frac{1}{16}$	$2\frac{3}{4}$	$8\frac{3}{4}$	$21\frac{1}{2}$
$1\frac{3}{4}$	$5\frac{1}{4}$	$1\frac{5}{16}$ " $1\frac{3}{8}$	$1\frac{3}{16}$	$9\frac{1}{2}$	$2\frac{1}{16}$	$2\frac{3}{4}$	$8\frac{3}{4}$	$21\frac{1}{2}$
$1\frac{7}{8}$	$5\frac{1}{2}$	$1\frac{7}{16}$	$1\frac{1}{4}$ " $1\frac{5}{16}$	10	$2\frac{5}{16}$	$3\frac{1}{8}$	$12\frac{1}{4}$	$29\frac{3}{4}$
2	$5\frac{1}{2}$	$1\frac{1}{2}$ " $1\frac{9}{16}$	$1\frac{3}{8}$	10	$2\frac{5}{16}$	$3\frac{1}{8}$	$12\frac{1}{4}$	$29\frac{3}{4}$

For Details of Upset Ends, see pages 326 to 329 inclusive.
Length of Upset Ends for use with Right and Left Nuts may be made one inch shorter than the dimensions given in column "G" above.

CLEVISES.



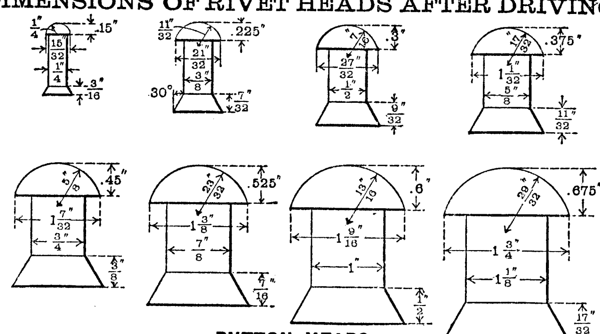
THE CLEVELAND CITY FORGE AND IRON CO.

Diameter of Screw. D	Length of Fork. A	Length of Thread. B	Diameter of Pin in Inches. 1	1¼	1½	1¾	2	2¼	2½	2¾	3	3¼	3½	3¾	4
Ins.	Ins.	Ins.	Diameter I in Inches.												
¾	5½	1⅛	2¾	2¾	2¾	3	..	..	..	..	..	..	..	..	..
⅞	5½	1⅜	2¾	2¾	3	3	..	..	..	..	..	..	..	..	..
1	6	1½	2¾	2¾	3	3¼	3½	..	..	..	..	..	..	..	..
1⅛	6	1¾	..	2¾	3	3¼	3½	3¾	..	..	..	..	..	..	..
1¼	6½	1⅞	..	3	3¼	3½	3½	3¾	..	..	..	..	..	..	..
1⅜	6½	2⅛	..	3¼	3½	3¾	4	4⅜	4⅜	..	..	..	..	..	..
1½	7	2¼	..	..	3¾	4	4⅜	4⅜	4¾	..	..	..	..	..	..
1⅝	7	2½	..	..	3¾	4	4⅜	4¾	5¼	..	..	..	..	..	..
1¾	8	2⅝	..	..	..	4⅜	4¾	5¼	5¼	5¼	..	..	..	..	..
1⅞	8	2⅞	..	..	..	..	5¼	5¼	5¼	5¾	..	..	..	..	..
2	9	3	..	..	..	..	5¼	5¼	5¾	5¾	6¾	..	..	..	..
2⅛	9	3¼	..	..	..	..	..	5¾	5¾	6¾	6¾	6¾	..	..	..
2¼	10	3¼	..	..	..	..	..	5¾	6¾	6¾	6¾	6¾	..	..	..
2⅜	10	3½	..	..	..	..	..	6¾	6¾	6¾	6¾	8	8	..	..
2½	10	3¾	..	..	..	..	..	..	6¾	6¾	8	8	8	..	..
2⅝	10	4	..	..	..	..	..	..	6¾	8	8	8	8	8	8
2¾	12	4¼	..	..	..	..	..	..	8	8	8	8	8	8	8
2⅞	12	4¼	..	..	..	..	..	..	..	8	8	8	8	9	9
3	12	4½	..	..	..	..	..	..	..	..	8	8	9	9	9

Dimensions to be used with Specified Diameters I. I	G	F	E
Ins.	Ins.	Ins.	Ins.
2¾	1½	½	$\frac{17}{32}$
3	1⅝	½	$\frac{17}{32}$
3¼	1¾	$\frac{9}{16}$	$\frac{19}{32}$
3½	1⅞	$\frac{9}{16}$	$\frac{19}{32}$
3¾	2	⅝	$\frac{21}{32}$
4	2⅛	⅝	$\frac{21}{32}$
4⅜	2¼	$\frac{11}{16}$	¾
4¾	2½	$\frac{23}{32}$	$\frac{25}{32}$
5¼	2¾	$\frac{13}{16}$	⅞
5¾	3	$\frac{27}{32}$	$\frac{15}{16}$
6¾	3¼	$\frac{15}{16}$	$1\frac{1}{16}$
8	4	$1\frac{1}{16}$	1¼
9	4½	$1\frac{5}{16}$	1½

Dimension H is usually $\frac{1}{32}''$ larger than diameter of pin and J is made to suit the thickness of the pin plate. The above Clevises are designed for use with medium steel rods of 60 000 to 68 000 pounds tensile strength per square inch, having standard upsets as shown on pages 324 to 327.

DIMENSIONS OF RIVET HEADS AFTER DRIVING.



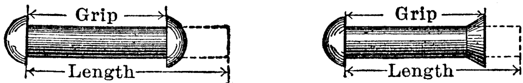
BUTTON HEADS.

Height of Head = $\frac{6}{10}$ × Diameter of Rivet. Radius of Head = ¾ Diameter of Rivet + $\frac{1}{16}''$.

COUNTERSUNK HEADS.

Diameter of Countersunk Head same as Button Head. Angle of Countersink = 30°. In figuring Clearances for Rivet Heads allow for Heights as follows: ⅝″ for ¾″ rivets, ¾″ for ⅞″ rivets. All dimensions in inches.

LENGTH OF RIVETS REQUIRED FOR VARIOUS GRIPS INCLUDING AMOUNT NECESSARY TO FORM ONE HEAD.

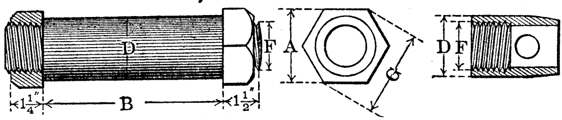


Grip of Rivet in Inches.	Diameter of Rivet in Inches. 1/4″	3/8″	1/2″	5/8″	3/4″	7/8″	1″	1 1/8″
1/2	1	1 1/4	1 1/2	1 3/4	1 7/8	2	2 1/8	2 1/4
5/8	1 1/8	1 3/8	1 5/8	1 7/8	2	2 1/8	2 1/4	2 3/8
3/4	1 1/4	1 1/2	1 3/4	2	2 1/8	2 1/4	2 3/8	2 1/2
7/8	1 3/8	1 5/8	1 7/8	2 1/8	2 1/4	2 3/8	2 1/2	2 5/8
1	1 1/2	1 3/4	2	2 1/4	2 3/8	2 1/2	2 5/8	2 3/4
1 1/8	1 5/8	1 7/8	2 1/8	2 3/8	2 1/2	2 5/8	2 3/4	2 7/8
1 1/4	1 3/4	2	2 1/4	2 1/2	2 5/8	2 3/4	2 7/8	3
1 3/8	1 7/8	2 1/8	2 3/8	2 5/8	2 7/8	3	3	3 1/8
1 1/2	2	2 1/4	2 1/2	2 3/4	3	3 1/8	3 1/8	3 1/4
1 5/8	2 1/8	2 3/8	2 5/8	2 7/8	3 1/8	3 1/4	3 1/4	3 1/2
1 3/4	2 1/4	2 1/2	2 3/4	3	3 1/4	3 3/8	3 1/2	3 5/8
1 7/8	2 3/8	2 5/8	2 7/8	3 1/4	3 3/8	3 1/2	3 5/8	3 3/4
2	2 1/2	2 3/4	3 1/8	3 3/8	3 1/2	3 5/8	3 3/4	3 7/8
2 1/8	2 5/8	2 7/8	3 1/4	3 1/2	3 5/8	3 3/4	3 7/8	4
2 1/4	2 3/4	3	3 3/8	3 5/8	3 3/4	3 7/8	4	4 1/8
2 3/8	2 7/8	3 1/8	3 1/2	3 3/4	3 7/8	4	4 1/8	4 1/4
2 1/2	3	3 1/4	3 5/8	3 7/8	4	4 1/8	4 1/4	4 3/8
2 5/8	3 1/8	3 1/2	3 3/4	4	4 1/8	4 1/4	4 3/8	4 1/2
2 3/4	3 1/4	3 5/8	3 7/8	4 1/8	4 1/4	4 3/8	4 1/2	4 5/8
2 7/8	3 3/8	3 3/4	4	4 1/4	4 3/8	4 1/2	4 5/8	4 3/4
3	3 1/2	3 7/8	4 1/8	4 3/8	4 1/2	4 5/8	4 3/4	4 7/8
3 1/8	3 5/8	4	4 1/4	4 1/2	4 3/4	4 3/4	5	5
3 1/4	3 3/4	4 1/8	4 3/8	4 3/4	4 7/8	5	5 1/8	5 1/4
3 3/8	3 7/8	4 1/4	4 1/2	4 7/8	5	5 1/8	5 1/4	5 3/8
3 1/2	4	4 3/8	4 5/8	5	5 1/8	5 1/4	5 3/8	5 1/2
3 5/8	4 1/8	4 1/2	4 3/4	5 1/8	5 1/4	5 3/8	5 1/2	5 5/8
3 3/4	4 1/4	4 5/8	4 7/8	5 1/4	5 3/8	5 1/2	5 5/8	5 3/4
3 7/8	4 3/8	4 3/4	5	5 3/8	5 1/2	5 5/8	5 3/4	5 7/8
4	4 1/2	4 7/8	5 1/8	5 1/2	5 5/8	5 3/4	5 7/8	6
4 1/8	4 5/8	5	5 1/4	5 5/8	5 3/4	5 7/8	6	6 1/8
4 1/4	4 3/4	5 1/8	5 1/2	5 3/4	5 7/8	6	6 1/8	6 1/4
4 3/8	4 7/8	5 1/4	5 5/8	5 7/8	6	6 1/8	6 1/4	6 3/8
4 1/2	5	5 3/8	5 3/4	6	6 1/8	6 1/4	6 3/8	6 1/2
4 5/8	5 1/8	5 1/2	5 7/8	6 1/8	6 1/4	6 3/8	6 1/2	6 5/8
4 3/4	5 1/4	5 5/8	6	6 1/4	6 1/2	6 5/8	6 3/4	6 3/4
4 7/8	5 3/8	5 3/4	6 1/8	6 1/2	6 5/8	6 3/4	6 7/8	6 7/8
5	5 1/2	5 7/8	6 1/4	6 5/8	6 3/4	6 7/8	7	7
5 1/8	5 5/8	6	6 3/8	6 3/4	6 7/8	7	7 1/8	7 1/8
5 1/4	5 3/4	6 1/8	6 1/2	6 7/8	7	7 1/8	7 1/4	7 1/4
5 3/8	5 7/8	6 1/4	6 5/8	7	7 1/8	7 1/4	7 3/8	7 3/8
5 1/2	6	6 3/8	6 3/4	7 1/8	7 1/4	7 3/8	7 1/2	7 1/2
5 5/8	6 1/8	6 1/2	6 7/8	7 1/4	7 3/8	7 1/2	7 5/8	7 5/8
5 3/4	6 1/4	6 3/4	7	7 3/8	7 5/8	7 5/8	7 3/4	7 3/4
5 7/8	6 3/8	6 7/8	7 1/8	7 1/2	7 3/4	7 3/4	7 7/8	7 7/8
6	6 1/2	7	7 1/4	7 5/8	7 7/8	7 7/8	8	8 1/8

Amount in Inches to be subtracted from above lengths for Countersunk Heads.

	1/8	1/4	1/2	1/2	5/8	3/4	7/8	7/8

BRIDGE PINS, NUTS AND PILOT NUTS.

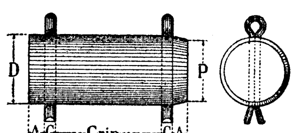


All Threads 8 per inch.

Nominal Diameter of Pin.	Turned Diameter of Pin. D	Diameter of Thread. F	Short Diameter of Nut. A	Long Diameter of Nut. G	Diameter of Holes in Eye Bars.
Inches.	Inches.	Inches.	Inches.	Inches.	
1½	1 7/16	1¼	2	2 5/16	D + 1/100
1¾	1 11/16	1½	2½	2⅞	" + 1/100
2	1 15/16	1½	2½	2⅞	" + 1/100
2¼	2 3/16	1½	3	3½	" + 1/100
2½	2 7/16	2	3	3½	" + 2/100
2¾	2 11/16	2	3½	4 1/16	" + 2/100
3	2 15/16	2	3½	4 1/16	" + 2/100
3¼	3 3/16	2½	4	4 11/16	" + 2/100
3½	3 7/16	2½	4	4 11/16	" + 2/100
3¾	3 11/16	2¾	4½	5 3/16	" + 2/100
4	3 15/16	3	4½	5 3/16	" + 2/100
4¼	4 3/16	3½	5	5 13/16	" + 2/100
4½	4 7/16	3½	5	5 13/16	" + 2/100
4¾	4 11/16	4	5½	6⅜	" + 2/100
5	4 15/16	4	5½	6⅜	" + 3/100
5¼	5 3/16	4	6	6 15/16	" + 3/100
5½	5 7/16	4	6	6 15/16	" + 3/100
5¾	5 11/16	4	6½	7½	" + 3/100
6	5 15/16	4	6½	7½	" + 3/100
6¼	6 3/16	4	7	8⅛	" + 3/100
6½	6 7/16	4	7	8⅛	" + 3/100
6¾	6 11/16	4	7½	8 11/16	" + 3/100
7	6 15/16	4	7½	8 11/16	" + 3/100

Allow 1/16" excess for each eye bar packed on the pin.

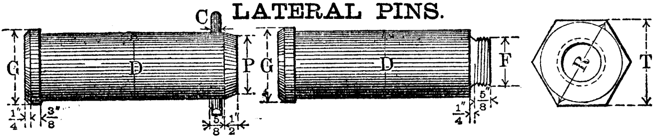
COLD ROLLED STEEL COTTER PINS.



Dimensions of Pin in Inches.

Diameter of Pin.	D	1	1¼	1½	1¾	2	2¼	2½	2¾	3	3¼	3½	3¾	4
Diameter of Reduced Point.	P	⅞	1⅛	1¼	1½	1¾	2	2¼	2½	2¾	3	3¼	3½	3¾
Lengths of Ends.	A	5/16	5/16	9/16	9/16	½	½	½	½	⅞	⅞	⅞	⅞	⅞
Diameter of Cotter.	C	5/16	5/16	5/16	5/16	⅜	⅜	⅜	⅜	½	½	½	½	½
Diameter of Pin Hole.		1 1/16	1 5/16	1 9/16	1 13/16	2 1/16	2 5/16	2 9/16	2 13/16	3 1/16	3 5/16	3 9/16	3 13/16	4 1/16

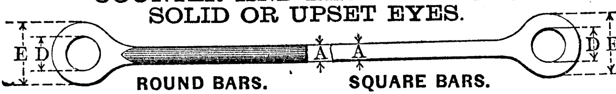
LATERAL PINS.



Rough Diameter of Pin.	Nominal Diameter of Pin.	Finished Diameter of Pin.	Reduced Point.	Short Diameter of Nut.	Long Diameter of Nut.	Diameter of Thread.	Diameter of Cotter Pin.
G	N	D	P	T	R	F	C
Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inch.
1½	1¼	1 3/16	1	1⅝	1⅞	1	5/16
1¾	1½	1 7/16	1¼	2	2 5/16	1¼	"
2	1¾	1 11/16	1½	2½	2⅞	1½	"
2¼	2	1 15/16	1¾	2½	2⅞	1½	"
2½	2¼	2 3/16	2	2½	2⅞	1½	3/8
2¾	2½	2 7/16	2¼	3½	4 1/16	2	"
3	2¾	2 11/16	2½	3½	4 1/16	2	"
3¼	3	2 15/16	2¾	3½	4 1/16	2	"
3½	3¼	3 3/16	3	4½	5 3/16	2½	"
3¾	3½	3 7/16	3¼	4½	5 3/16	2½	"
4	3¾	3 11/16	3½	4½	5 3/16	2½	"

$D = G - \frac{5}{16}''$. $P = N - \frac{1}{4}''$.

COUNTER AND LATERAL RODS.
SOLID OR UPSET EYES.

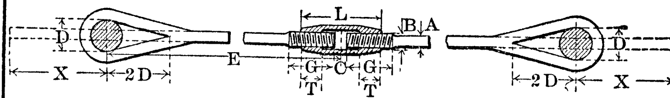


Diameter of Bar.	Diameter of Largest Head.	Diameter of Largest Pin.	Add for One Head.	Side of Square Bar.	Diameter of Largest Head.	Diameter of Largest Pin.	Add for One Head.
A	E	D		A	E	D	
Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
7/8	2¼	1¼	9	1	4¼	2½	16
1	4¼	2½	18	1⅛	4¼	2½	14
1⅛	4¼	2½	16	1¼	5	2¾	18½
1¼	5	2¾	20½	1⅜	5	2¾	16½
1⅜	5	2¾	18½	1½	5½	3	18
1½	5½	3	20	1⅝	5½	3	16½
1⅝	5½	3	18½	1¾	6	3¼	18
1¾	6	3¼	21	1⅞	6	3¼	16½
1⅞	6	3¼	19½	2	6½	3½	18½
2	6½	3½	21½	2⅛	6½	3½	17
2⅛	6½	3½	20	2¼	7½	4	21½
2¼	7½	4	24½	2⅜	7½	4	19¾
2⅜	7½	4	22¾	2½	8	4	22½
2½	8	4	25½	2⅝	8	4	21
2⅝	8	4	24	2¾	8	4	19½
2¾	8	4	22½	1⅛	5¼	3 3/16	23
. . .	. . .	. . .	. .	1¼	5½	3 3/16	23
. . .	. . .	. . .	. .	1⅜	5¾	3 3/16	20
. . .	. . .	. . .	. .	1½	6	3 3/16	20
. . .	. . .	. . .	. .	7/8	3½	2¼	
. . .	. . .	. . .	. .	1 3/16	4½	2½	18

For details of upset screw ends for round and square bars see pages 326 to 329.

COUNTER AND LATERAL RODS.

LOOP WELDED EYES.



Additional length of bar beyond center of pin required to make eye for square or round bars.

Diameter or Side of Bar.	Diameter of Pin in Inches.										
Inches.	¾	1	1¼	1½	1¾	2	2¼	2½	2¾	3	3¼
½	5¾	6¾	7½	8½	9½	10¼	11¼	12¼	13¼	14	15
⅝	6¼	7¼	8	9	10	10¾	11¾	12¾	13½	14½	15½
¾	6¾	7½	8½	9½	10¼	11¼	12¼	13¼	14	15	16
⅞	....	8	9	10	10¾	11¾	12¾	13½	14½	15½	16½
1	....	8½	9½	10¼	11¼	12¼	13¼	14	15	16	16¾
1⅛	....	....	10	10¾	11¾	12¾	13½	14½	15½	16½	17¼
1¼	....	....	10¼	11¼	12¼	13¼	14	15	16	16¾	17¾
1⅜	....	....	....	11¾	12¾	13½	14½	15½	16½	17¼	18¼
1½	....	....	....	12¼	13¼	14	15	16	16¾	17¾	18¾
1⅝	....	....	....	....	13½	14½	15½	16½	17¼	18¼	19¼
1¾	....	....	....	....	14	15	16	16¾	17¾	18¾	19½
1⅞	....	....	....	....	....	15½	16½	17¼	18¼	19¼	20
2	....	....	....	....	....	16	16¾	17¾	18¾	19½	20½
2⅛	....	....	....	....	....	....	17¼	18¼	19¼	20¼	21
2¼	....	....	....	....	....	....	18	18¾	19¾	20¾	21½
2⅜	....	....	....	....	....	....	....	19¼	20¼	21¼	22
2½	....	....	....	....	....	....	....	19¾	20¾	21¾	22¾
2⅝	....	....	....	....	....	....	....	....	21¼	22¼	23¼
2¾	....	....	....	....	....	....	....	....	21¾	22¾	23¾
2⅞	....	....	....	....	....	....	....	....	....	23¼	24¼
3	....	....	....	....	....	....	....	....	....	23¾	24¾
3⅛	....	....	....	....	....	....	....	....	....	....	25¼
3¼	....	....	....	....	....	....	....	....	....	....	25¾

Length in inches beyond center of pin required to form one eye = X.

FORMULÆ: When $\frac{A}{2}$ = or $<$ 1

$$X = 3.7\,[D + A] + 1$$

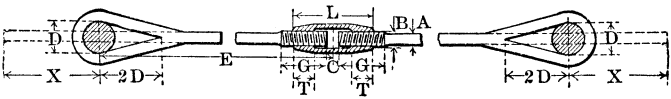
When $\frac{A}{2} > 1$

$$X = 3.7\,[D + A] + \frac{A}{2}$$

A = Side or Diameter of Bar.
D = Diameter of Pin.
Length of bar including amount required to form one eye = E — ½ C + X.

COUNTER AND LATERAL RODS.

LOOP WELDED EYES.



Additional length of bar beyond center of pin required to make eye for square or round bars.

Diameter or Side of Bar.	Diameter of Pin in Inches.										
Inches.	3½	3¾	4	4¼	4½	4¾	5	5¼	5½	5¾	6
½	16	16¾	17¾	18¾	19½	20½	21½	22½	23¼	24¼	25¼
⅝	16½	17¼	18¼	19¼	20	21	22	22¾	23¾	24¾	25¾
¾	16¾	17¾	18¾	19½	20½	21½	22½	23¼	24¼	25¼	26
⅞	17¼	18¼	19¼	20	21	22	22¾	23¾	24¾	25¾	26½
1	17¾	18¾	19½	20½	21½	22½	23¼	24¼	25¼	26	27
1⅛	18¼	19¼	20	21	22	22¾	23¾	24¾	25¾	26½	27½
1¼	18¾	19½	20½	21½	22½	23¼	24¼	25¼	26	27	28
1⅜	19¼	20	21	22	22¾	23¾	24¾	25¾	26½	27½	28½
1½	19½	20½	21½	22½	23¼	24¼	25¼	26	27	28	28¾
1⅝	20	21	22	22¾	23¾	24¾	25¾	26½	27½	28½	29¼
1¾	20½	21½	22½	23¼	24¼	25¼	26	27	28	28¾	29¾
1⅞	21	22	22¾	23¾	24¾	25¾	26½	27½	28½	29¼	30¼
2	21½	22½	23¼	24¼	25¼	26	27	28	28¾	29¾	30¾
2⅛	22	23	23¾	24¾	25¾	26½	27½	28½	29½	30¼	31¼
2¼	22½	23½	24¼	25¼	26¼	27¼	28	29	30	30¾	31¾
2⅜	23	24	25	25¾	26¾	27¾	28½	29½	30½	31¼	32¼
2½	23½	24½	25½	26¼	27¼	28¼	29	30	31	32	32¾
2⅝	24	25	26	26¾	27¾	28¾	29¾	30½	31½	32½	33¼
2¾	24½	25½	26½	27½	28¼	29¼	30¼	31	32	33	33¾
2⅞	25¼	26	27	28	28¾	29¾	30¾	31½	32½	33½	34½
3	25¾	26½	27½	28½	29¼	30¼	31¼	32¼	33	34	35
3⅛	26¼	27	28	29	30	30¾	31¾	32¾	33½	34½	35½
3¼	26¾	27¾	28½	29½	30½	31¼	32¼	33¼	34	35	36
3⅜	27¼	28¼	29	30	31	31¾	32¾	33¾	34¾	35½	36½
3½	27¾	28¾	29½	30½	31½	32½	33¼	34¼	35¼	36	37

For additional length required to form upset end and details of same see tables of Upset Ends, pages 326 to 329 inclusive.
For details of Turnbuckles, see page 332.
For details of Right and Left Nuts, see page 333.

STANDARD STEEL WIRE NAILS AND SPIKES.

Sizes, Lengths, and Approximate Number per Pound.

Sizes.	Length. Ins.	COMMON. Diameter. B. W. G.	Diameter. Inch.	No. per Pound.	Barbed Common.	Clinch.	Fence.	Finishing.	Barbed Finishing.	Fine.	Barrel.	Casing.	Smooth Box.
	3/4	...	...	...	...	..	..	..	..	..	940	..	..
	7/8	...	...	...	...	..	..	..	..	..	804	..	..
2d . . .	1	15	.072	900	860	622	..	1558	1558	1440	620	1140	1000
3d Fine.	1 1/8	...	...	...	...	..	..	..	..	810	590	..	..
3d Com.	1 1/4	14	.083	615	594	412	..	884	884	..	542	675	660
	1 3/8	...	...	...	...	..	..	..	..	..	365	..	..
4d . . .	1 1/2	12 1/2	.102	322	339	267	..	767	767	550	322	567	550
5d . . .	1 3/4	12 1/2	.102	250	230	230	127	491	491	..	..	396	366
6d . . .	2	11 1/2	.115	200	205	156	114	359	359	..	..	260	250
7d . . .	2 1/4	11 1/2	.115	154	135	110	88	317	317	..	..	239	236
8d . . .	2 1/2	10 1/4	.124	106	96	98	74	214	214	..	..	160	157
9d . . .	2 3/4	10 1/4	.124	85	92	86	58	195	195	..	..	148	145
10d . . .	3	9	.148	74	63	66	42	134	134	..	..	108	107
12d . . .	3 1/4	9	.148	57	52	57	36	120	120	..	..	99	98
16d . . .	3 1/2	8	.165	46	38	46	28	91	91	..	..	69	65
20d . . .	4	6	.203	29	30	35	22	61	61	..	..	50	45
30d . . .	4 1/2	5	.220	23	23	..	..	..	..	..	..	45	40
40d . . .	5	4	.238	17	17	..	..	..	..	..	..	35	30
50d . . .	5 1/2	3	.259	13 1/2	13 1/2	..	..	..	..	..	..	..	..
60d . . .	6	2	.284	10 1/2	10 1/2	..	..	..	..	..	..	..	..

Sizes.	Length. Ins.	Barbed Box.	Flooring Brads.	Barbed Oval Head Car Nails. Light.	Barbed Oval Head Car Nails. Heavy.	Slating.	Barbed Roofing.	Shingle.	Tobacco.	Lining.	WIRE SPIKES. Diameter. B. W. G.	Diameter. Inch.	No. per Pound.
	3/4	..	..	..	...	..	648	..	..	1930	...	...	...
	7/8	..	..	..	...	..	413	..	..	1660	...	...	...
2d . . .	1	1000	..	..	...	385	384	..	..	1440	...	...	...
3d Fine.	1 1/8	..	..	..	...	..	339	..	..	..	...	...	...
3d Com.	1 1/4	660	..	..	...	230	231	380	..	..	...	...	...
	1 3/8	..	..	..	...	..	..	..	..	..	...	...	...
4d . . .	1 1/2	550	..	260	164	198	154	256	256	..	...	...	...
5d . . .	1 3/4	366	..	134	103	125	135	226	226	..	...	...	...
6d . . .	2	250	151	119	91	112	90	200	145	..	...	...	...
7d . . .	2 1/4	236	136	85	73	..	..	130	130	..	...	...	...
8d . . .	2 1/2	157	98	75	65	..	..	120	100	..	...	...	...
9d . . .	2 3/4	145	86	58	51	..	..	115	85	..	...	...	...
10d . . .	3	107	66	55	45	..	..	79	65	..	6	.203	37
12d . . .	3 1/4	98	51	43	38	..	..	..	..	..	...	...	...
16d . . .	3 1/2	65	40	39	34	..	..	..	..	..	5	.220	29
20d . . .	4	45	29	31	26	..	..	..	..	..	4	.238	23
30d . . .	4 1/2	40	..	27	23	..	..	..	..	..	3	.259	18
40d . . .	5	30	..	21	17	..	..	..	..	..	2	.284	13
50d . . .	5 1/2	..	..	18	14	..	..	..	..	..	1	.300	10
60d . . .	6	..	..	15	13	..	..	..	..	..	1	.300	9
	6 1/2	..	..	..	...	..	..	..	..	..	...	5/16	7 1/2
	7	..	..	..	...	..	..	..	..	..	...	5/16	6 1/2
	8	..	..	..	...	..	..	..	..	..	...	3/8	4 1/4
	9	..	..	..	...	..	..	..	..	..	...	3/8	3 2/3
	10	..	..	..	...	..	..	..	..	..	...	3/8	3 1/4
	12	..	..	..	...	..	..	..	..	..	...	3/8	2 3/4

MISCELLANEOUS STEEL WIRE NAILS.

Approximate Number per Pound.

Birmingham Wire Gauge.	Diameter in Inches.	Length in Inches.										
		3/16	1/4	3/8	1/2	5/8	3/4	7/8	1	1 1/8	1 1/4	1 1/2
00	.380	...	...	...	...	...	...	...	..	..	33	27
3/8	.375	...	...	...	...	...	...	...	..	..	33	27
0	.340	...	...	...	...	...	...	...	..	..	34	29
5/16	.313	...	...	...	...	...	...	...	57	50	45	38
2	.284	...	...	...	...	...	...	...	65	58	52	44
3	.259	...	...	...	...	...	100	87	76	67	60	50
4	.238	...	...	...	...	...	120	104	90	80	72	60
5	.220	...	...	...	211	169	141	121	106	94	85	71
6	.203	...	...	...	247	197	164	141	123	111	99	82
7	.180	...	...	...	299	239	200	171	149	133	120	100
8	.165	...	...	...	345	275	229	197	172	153	137	115
9	.148	...	...	...	414	331	276	236	207	184	165	138
10	.134	...	...	663	496	397	333	283	248	220	198	165
11	.120	...	...	837	628	502	418	359	314	279	251	209
12	.109	...	...	1096	822	658	548	469	411	365	329	274
13	.095	...	...	1429	1072	857	714	613	536	476	429	357
14	.083	...	2840	1893	1420	1136	947	811	710	631	568	473
15	.072	...	3504	2336	1752	1402	1168	1001	876	778	701	584
16	.065	...	4571	3048	2280	1828	1523	1305	1143	1015	913	761
17	.058	...	6233	4156	3116	2495	2077	1781	1558	1385	1246	1038
18	.049	...	8276	5517	4138	3310	2758	2364	2069	1839	1655	1379
19	.042	...	10668	7112	5334	4267	3556	2933	2667	2370	2133	1778
20	.035	20000	15000	10000	7500	6000	5000	4400	3750	3333	3000	
21	.032	23702	17777	11850	8888	7111	5926	5079	4444			
22	.028	30476	22856	15237	11428	9143	7618					

Birmingham Wire Gauge.	Diameter in Inches.	Length in Inches.														
		1 3/4	2	2 1/4	2 1/2	2 3/4	3	3 1/2	4	4 1/2	5	6	7	8	9	10
00	.380	23	20	18	16	15	14	12	10	9	8	7	6	5	4 1/2	4
3/8	.375	23	20	18	16	15	14	12	10	9	8	7	6	5	4 1/2	4
0	.340	25	21	19	17	16	15	13	11	10	9	8	7	5 1/2	5	4 1/3
5/16	.313	32	28	25	23	21	19	16	14	13	11	10	8	7	6	5 1/2
2	.284	37	32	29	26	24	22	19	16	14	13	11	9	8	7	6 1/2
3	.259	43	38	34	30	28	25	22	19	17	15	13	11	10	8	7 1/2
4	.238	51	45	40	36	33	30	26	23	20	18	15	13	11	10	9
5	.220	60	53	47	42	39	35	30	26	24	21	18	15			
6	.203	71	62	55	50	45	41	35	31	28	25	21	18			
7	.180	85	75	67	60	54	50	43	37	33	30	25				
8	.165	98	86	76	69	62	57	49	43	39	35	29				
9	.148	118	103	92	82	75	69	59	52	46	41					
10	.134	142	124	110	99	90	83	71	62	55	50					
11	.120	179	157	139	125	114	105	90	79	70						
12	.109	235	204	182	164	149	137	117	103							
13	.095	306	268	238	214	195	178	153								
14	.083	406	350	315	284	258	236									
15	.072	500	438	389	350											
16	.065	653	571	508												
17	.058	890	779													
18	.049	1182														

Wire Gauge.	11	12
00	3 3/4	3 1/4
3/8	3 3/4	3 1/4
0	4	3 1/2
5/16	5	4 1/2
2	6	5 1/2

These approximate numbers are an average only, and the figures given may be varied either way, by changes in the dimensions of heads or points. Brads and no-head nails will run more to the pound than table shows, and large or thick-headed nails will run less.

CUT STEEL NAILS AND SPIKES.

Sizes, Lengths, and Approximate Number per Pound.

Sizes.	Length. Inches.	Common.	Clinch.	Finishing.	Casing and Box.	Fencing.	Spikes.
2d	1	740	400	1100			
3d	1¼	460	260	880			
4d	1½	280	180	530	420		
5d	1¾	210	125	350	300	100	
6d	2	160	100	300	210	80	
7d	2¼	120	80	210	180	60	
8d	2½	88	68	168	130	52	
9d	2¾	73	52	130	107	38	
10d	3	60	48	104	88	26	
12d	3¼	46	40	96	70	20	
16d	3½	33	34	86	52	18	17
20d	4	23	24	76	38	16	14
25d	4¼	20	....	....	....	....	
30d	4½	16½	....	....	30	....	11
40d	5	12	....	....	26	....	9
50d	5½	10	....	....	20	....	7½
60d	6	8	....	....	16	....	6
	6½	....	....	....	....	....	5½
	7	....	....	....	....	....	5

Sizes.	Length. Inches.	Flat Grip. Fine.	Edge Grip. Fine.
...	¾	1462	
...	⅞	1300	
2d	1	1100	960
3d	1⅛	800	750
4d	1⅜	650	600

Sizes.	Length. Inches.	Barrel.	Light Barrel.	Slating.	Tobacco.	Brads.	Shingle.
	⅝	750	....	....			
	¾	600	....	....			
	⅞	500	....	....			
2d	1	450	....	340			
	1⅛	310	400	....			
3d	1¼	280	304	280			
	1⅜	210	....	....			
4d	1½	190	224	220			
5d	1¾	....	....	180	130		
6d	2	....	....	....	97	120	
7d	2¼	....	....	....	85	94	
8d	2½	....	....	....	68	74	90
9d	2¾	....	....	....	58	62	72
10d	3	....	....	....	48	50	60
12d	3¼	....	....	....	....	40	
16d	3½	....	....	....	....	27	

SQUARE BOAT SPIKES.

Approximate Number in a Keg of 200 Pounds.

Size. Inch.	Length of Spike—Inches. 3	4	5	6	7	8	9	10	11	12	14	16
$\frac{1}{4}$	3000	2375	2050	1825								
$\frac{5}{16}$	1660	1360	1230	1175	990	880						
$\frac{3}{8}$	1320	1140	940	800	650	600	525	475				
$\frac{7}{16}$	. . .	. . .	. . .	600	590	510	400	360	320	230		
$\frac{1}{2}$	. . .	. . .	. . .	450	375	335	300	275	260	240		
$\frac{5}{8}$	. . .	. . .	. . .	. . .	. .	260	240	220	205	190	175	160

RAILROAD SPIKES.

Size Measured Under Head. Inches.	Average Number per Keg of 200 Pounds.	Quantity of Spikes per Mile of Single Track. Ties 2 feet c. to c. 4 Spikes per Tie. Pounds.	Kegs.	Rail Used. Weight per Yard. Pounds.
$5\frac{1}{2} \times \frac{5}{8}$	300	7040	$35\frac{1}{5}$	75 to 100
$5\frac{1}{2} \times \frac{9}{16}$	375	5870	$29\frac{1}{3}$	45 " 75
$5 \times \frac{9}{16}$	400	5170	26	40 " 56
$5 \times \frac{1}{2}$	450	4660	$23\frac{1}{3}$	35 " 40
$4\frac{1}{2} \times \frac{1}{2}$	530	3960	20	30 " 35
$4 \times \frac{1}{2}$	600	3520	$17\frac{2}{3}$	25 " 35
$4\frac{1}{2} \times \frac{7}{16}$	680	3110	$15\frac{1}{2}$	20 " 30
$4 \times \frac{7}{16}$	720	2910	$14\frac{3}{4}$	20 " 30
$3\frac{1}{2} \times \frac{7}{16}$	900	2350	11	16 " 25
$4 \times \frac{3}{8}$	1000	2090	$10\frac{1}{2}$	16 " 25
$3\frac{1}{2} \times \frac{3}{8}$	1190	1780	9	16 " 20
$3 \times \frac{3}{8}$	1240	1710	$8\frac{1}{2}$	16 " 20
$2\frac{1}{2} \times \frac{3}{8}$	1342	1575	$7\frac{7}{8}$	8 " 16

WROUGHT-IRON WELDED STEAM, GAS AND WATER PIPE.

TABLE OF STANDARD SIZES AND DIMENSIONS BY AMERICAN TUBE AND IRON CO.

Nominal Inside Diameter.	Actual Inside Diameter.	Actual Outside Diameter.	Thickness.	Nominal Weight per Foot.	Circumference. Internal.	Circumference. External.	Length per Square Foot of Surface. Inside.	Length per Square Foot of Surface. Outside.
Inches.	Inches.	Inches.	Inches.	Pounds.	Inches.	Inches.	Feet.	Feet.
1/8	.27	.405	.07	.24	.84	1.27	14.15	9.44
1/4	.36	.54	.08	.42	1.14	1.69	10.50	7.07
3/8	.49	.675	.09	.56	1.55	2.12	7.67	5.65
1/2	.62	.84	.10	.84	1.95	2.65	6.13	4.50
3/4	.82	1.05	.11	1.12	2.58	3.29	4.63	3.63
1	1.04	1.315	.13	1.67	3.29	4.13	3.67	2.90
1 1/4	1.38	1.66	.14	2.24	4.33	5.21	2.76	2.30
1 1/2	1.61	1.9	.14	2.68	5.06	5.96	2.37	2.01
2	2.06	2.375	.15	3.61	6.49	7.46	1.84	1.61
2 1/2	2.46	2.875	.20	5.74	7.75	9.03	1.54	1.32
3	3.06	3.5	.21	7.54	9.63	10.96	1.24	1.09
3 1/2	3.56	4.	.22	9.00	11.14	12.56	1.07	.95
4	4.02	4.5	.23	10.66	12.64	14.13	.94	.84
4 1/2	4.50	5.	.24	12.34	14.15	15.70	.84	.76
5	5.04	5.56	.25	14.50	15.84	17.47	.75	.62
6	6.06	6.625	.28	18.76	19.05	20.81	.63	.57
7	7.02	7.625	.30	23.27	22.06	23.95	.54	.50
8	7.98	8.625	.32	28.18	25.07	27.09	.47	.44
9	9.00	9.625	.34	33.70	28.27	30.43	.42	.39
10	10.01	10.75	.36	40.06	31.47	33.77	.38	.35
11	11.00	11.75	.37	45.00	34.55	36.91	.34	.32
12	12.00	12.75	.37	49.00	37.70	40.05	.32	.30
13	13.25	14.	.37	54.00	41.62	43.98	.29	.27
14	14.25	15.	.37	58.00	44.76	47.12	.27	.25
15	15.40	16.	.28	66.00	48.48	50.26	.25	.24
16	16.40	17.	.30	70.00	51.52	53.41	.23	.23
17	17.30	18.	.34	75.00	54.41	56.55	.22	.21

Nominal Inside Diameter.	Internal Area.	External Area.	Length Containing 1 Cubic Foot.	No. of Threads per Inch.	Contents of One Foot in Length.	Sockets on Pipe. Outside Diameter.	Sockets on Pipe. Length.
Inches.	Sq. Inches.	Sq. Inches.	Feet.		Gallons.	Inches.	Inches.
1/8	.06	.12	2500.	27	.002	.60	.81
1/4	.10	.22	1385.	18	.002	.78	1.00
3/8	.19	.35	751.5	18	.005	.91	1.10
1/2	.30	.55	472.4	14	.010	1.10	1.31
3/4	.53	.86	270.	14	.023	1.34	1.56
1	.86	1.35	166.9	11 1/2	.040	1.66	1.75
1 1/4	1.49	3.16	96.25	11 1/2	.063	2.00	1.94
1 1/2	2.03	2.83	70.65	11 1/2	.091	2.28	2.19
2	3.35	4.43	42.36	11 1/2	.163	2.81	2.31
2 1/2	4.78	6.49	30.11	8	.255	3.28	2.70
3	7.38	9.62	19.49	8	.367	4.02	3.00
3 1/2	9.83	12.56	14.56	8	.500	4.50	3.12
4	12.73	15.90	11.31	8	.652	5.10	3.12
4 1/2	15.93	19.63	9.03	8	.826	5.53	3.12
5	19.99	24.29	7.20	8	1.02	6.25	3.70
6	28.88	34.47	4.98	8	1.46	7.34	3.70
7	38.73	45.66	3.72	8	2.00	8.34	4.31
8	50.03	58.42	2.88	8	2.61	9.44	4.56
9	63.63	73.71	2.26	8	3.30	10.47	5.75
10	78.83	90.79	1.80	8	4.08	11.50	6.25
11	95.03	108.43	1.50	8	4.93	. . .	. . .
12	113.09	127.67	1.27	8	5.87	13.78	6.25
13	137.88	153.94	1.04	8	6.89	. . .	. . .
14	159.48	176.71	.90	8	8.00	. . .	. . .
15	187.04	201.06	.77	8	9.18	. . .	. . .
16	211.24	226.98	.68	8	10.44	. . .	. . .
17	235.61	254.47	.61	8	11.79	. . .	. . .

MANUFACTURERS' STANDARD SPECIFICATIONS.

REVISED TO FEBRUARY 6, 1903.

STRUCTURAL STEEL.

PROCESS OF MANUFACTURE.

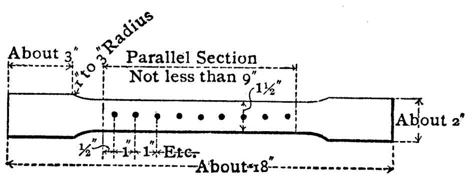
1. Steel may be made by either the Open-hearth or Bessemer process.

TESTING AND INSPECTION.

2. All tests and inspections shall be made at the place of manufacture prior to shipment.

TEST PIECES.

3. The tensile strength, limit of elasticity and ductility, shall be determined from a standard test piece cut from the finished material. The standard shape of the test piece for sheared plates shall be as shown by the following sketch:



Piece to be the same thickness as the plate.

On tests cut from other material the test piece may be either the same as for sheared plates, or it may be planed or turned parallel throughout its entire length, and in all cases where possible, two opposite sides of the test piece shall be the rolled surfaces. The elongation shall be measured on an original length of 8 inches, except as modified in section 12 paragraph *c*. Rivet rounds and small bars shall be tested of full size as rolled.

Two test pieces shall be taken from each melt or blow of finished material, one for tension and one for bending; but in case either test develops flaws, or the tensile test piece breaks outside of the middle third of its gauged length, it may be discarded and another test piece substituted therefor.

ANNEALED TEST PIECES.

4. Material which is to be used without annealing or further treatment shall be tested in the condition in which it comes from the rolls. When material is to be annealed or otherwise treated before use, the specimen representing such material shall be similarly treated before testing.

MARKING.

5. Every finished piece of steel shall be stamped with the blow or melt number, and steel for pins shall have the blow or melt number stamped on the ends. Rivet and lacing steel, and small pieces for pin plates and stiffeners, may be shipped in bundles securely wired together, with the blow or melt number on a metal tag attached.

FINISH.

6. Finished bars shall be free from injurious seams, flaws or cracks, and have a workmanlike finish.

CHEMICAL PROPERTIES.

7*a*.	Steel for Buildings, Train Sheds, Highway Bridges and similar structures.	Maximum Phosphorus .10 per cent.
7*b*.	Steel for Railway Bridges.	Maximum Phosphorus .08 per cent.

PHYSICAL PROPERTIES.

8. Structural Steel shall be of three grades, RIVET, RAILWAY BRIDGE and MEDIUM.

RIVET STEEL.

9. Ultimate strength, 48,000 to 58,000 pounds per square inch.

Elastic limit, not less than one-half the ultimate strength.

Percentage of elongation, $\frac{1,400,000}{\text{Ultimate strength}}$.

Bending test, 180 degrees flat on itself, without fracture on outside of bent portion.

STEEL FOR RAILWAY BRIDGES.

10. Ultimate strength, 55,000 to 65,000 pounds per square inch.

Elastic limit, not less than one-half the ultimate strength.

Percentage of elongation, $\frac{1,400,000}{\text{Ultimate strength}}$.

Bending test, 180 degrees to a diameter equal to thickness of piece tested, without fracture on outside of bent portion.

MEDIUM STEEL.

11. Ultimate strength, 60,000 to 70,000 pounds per square inch.

Elastic limit, not less than one-half the ultimate strength.

Percentage of elongation, $\frac{1,400,000}{\text{Ultimate strength}}$.

Bending test, 180 degrees to a diameter equal to thickness of piece tested, without fracture on outside of bent portion.

MODIFICATIONS IN ELONGATION FOR THIN AND THICK MATERIAL.

12. For material less than $\frac{5}{16}$ inch, and more than $\frac{3}{4}$ inch in thickness, the following modifications shall be made in the requirements for elongation:

a. For each increase of $\frac{1}{8}$ inch in thickness above $\frac{3}{4}$ inch, a deduction of 1 per cent. shall be made from the specified elongation, except that the minimum elongation shall be 20 per cent. for eye-bar material and 18 per cent. for other structural material.

b. For each decrease of $\frac{1}{16}$ inch in thickness below $\frac{5}{16}$ inch, a deduction of $2\frac{1}{2}$ per cent. shall be made from the specified elongation.

c. In rounds of $\frac{5}{8}$ inch or less in diameter, the elongation shall be measured in a length equal to eight times the diameter of section tested.

d. For pins made from any of the before-mentioned grades of steel, the required elongation shall be 5 per cent. less than that specified for each grade, as determined on a test piece, the center of which shall be one inch from the surface of the bar.

VARIATION IN WEIGHT.

13. The variation in cross-section or weight of more than $2\frac{1}{2}$ per cent. from that specified will be sufficient cause for rejection, except in the case of sheared plates which will be covered by the following permissible variations:

a. Plates $12\frac{1}{2}$ pounds per square foot or heavier, up to 100 inches wide, when ordered to weight, shall not average more than $2\frac{1}{2}$ per cent. variation above or $2\frac{1}{2}$ per cent. below the theoretical weight. When 100 inches wide and over, 5 per cent. above or 5 per cent. below the theoretical weight.

b. Plates under $12\frac{1}{2}$ pounds per square foot when ordered to weight, shall not average a greater variation than the following:

Up to 75 inches wide, $2\frac{1}{2}$ per cent. above or $2\frac{1}{2}$ per cent. below the theoretical weight. 75 inches wide up to 100 inches wide, 5 per cent. above or 3 per cent. below the theoretical weight. When 100 inches wide and over, 10 per cent. above or 3 per cent. below the theoretical weight.

c. For all plates ordered to gauge, there will be permitted an average excess of weight over that corresponding to the dimensions on the order equal in amount to that specified in the following table:

TABLE OF ALLOWANCES FOR OVERWEIGHT FOR RECTANGULAR PLATES WHEN ORDERED TO GAUGE.

PLATES WILL BE CONSIDERED UP TO GAUGE IF MEASURING NOT OVER $\frac{1}{100}$ INCH LESS THAN THE ORDERED GAUGE.
THE WEIGHT OF 1 CUBIC INCH OF ROLLED STEEL IS ASSUMED TO BE 0.2833 POUND.

Plates $\frac{1}{4}''$ and Over in Thickness.

Thickness of Plate. Inch.	Width of Plate. Up to 75 Inches. Per Cent.	75 to 100 Inches. Per Cent.	Over 100 to 115 Ins. Per Cent.	Over 115 Inches. Per Cent.
$\frac{1}{4}$	10	14	18	..
$\frac{5}{16}$	8	12	16	..
$\frac{3}{8}$	7	10	13	17
$\frac{7}{16}$	6	8	10	13
$\frac{1}{2}$	5	7	9	12
$\frac{9}{16}$	$4\frac{1}{2}$	$6\frac{1}{2}$	$8\frac{1}{2}$	11
$\frac{5}{8}$	4	6	8	10
Over $\frac{5}{8}$	$3\frac{1}{2}$	5	$6\frac{1}{2}$	9

Plates Under $\frac{1}{4}''$ in Thickness.

Thickness of Plate. Inch.	Width of Plate. Up to 50 Inches. Per Cent.	50 to 70 Inches. Per Cent.	Over 70 Inches. Per Cent.
$\frac{1}{8}$ up to $\frac{5}{32}$	10	15	20
$\frac{5}{32}$ " $\frac{3}{16}$	$8\frac{1}{2}$	$12\frac{1}{2}$	17
$\frac{3}{16}$ " $\frac{1}{4}$	7	10	15

STRUCTURAL CAST IRON.

1. Except when chilled iron is specified, all castings shall be tough gray iron, free from injurious cold-shuts or blow-holes, true to pattern, and of a workmanlike finish. Sample pieces, one inch square, cast from the same heat of metal in sand moulds, shall be capable of sustaining on a clear span of 4 feet 8 inches, a central load of 500 pounds when tested in the rough bar.

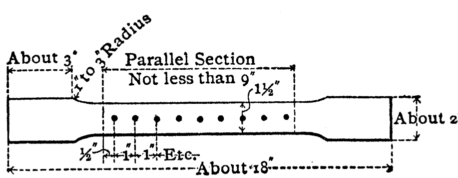
SPECIAL OPEN-HEARTH PLATE AND RIVET STEEL.

TESTING AND INSPECTION.

1. All tests and inspections shall be made at the place of manufacture prior to shipment.

TEST PIECES.

2. The tensile strength, limit of elasticity and ductility, shall be determined from a standard test piece cut from the finished material. The standard shape of the test piece for sheared plates shall be as shown by the following sketch:



Piece to be the same thickness as the plate.

On tests cut from other material the test piece may be either the same as for sheared plates, or it may be planed or turned parallel throughout its entire length, and in all cases where possible, two opposite sides of the test piece shall be the rolled surfaces. The elongation shall be measured on an original length of 8 inches, except as modified in section 12 paragraph *c*. Rivet rounds and small bars shall be tested of full size as rolled.

Four test pieces shall be taken from each melt of finished material, two for tension and two for bending; but in case either test develops flaws, or the tensile test piece breaks outside of the middle third of its gauged length, it may be discarded and another test piece substituted therefor.

ANNEALED TEST PIECES.

3. Material which is to be used without annealing or further treatment shall be tested in the condition in which it comes from the rolls. When material is to be annealed or otherwise treated before use, the specimen representing such material shall be similarly treated before testing.

MARKING.

4. Every finished piece of steel shall be stamped with the melt number. Rivet steel may be shipped in bundles securely wired together, with the melt number on a metal tag attached.

FINISH.

5. All plates shall be free from injurious surface defects and have a workmanlike finish.

CHEMICAL PROPERTIES.

6*a*. Flange or Boiler Steel.	Maximum	Phosphorus	.06	per cent.
	"	Sulphur	.04	"
6*b*. Extra Soft and Fire Box Steel.	"	Phosphorus	.04	"
	"	Sulphur	.04	"

PHYSICAL PROPERTIES.

7. Special Open-hearth Plate and Rivet Steel shall be of three grades, EXTRA SOFT, FIRE BOX and FLANGE or BOILER STEEL.

EXTRA SOFT STEEL.

8. Ultimate strength, 45,000 to 55,000 pounds per square inch.

Elastic limit, not less than one-half the ultimate strength.

Elongation, 28 per cent.

Cold and Quench bends, 180 degrees flat on itself, without fracture on outside of bent portion.

FIRE BOX STEEL.

9. Ultimate strength, 52,000 to 62,000 pounds per square inch.

Elastic limit, not less than one-half the ultimate strength.

Elongation, 26 per cent.

Cold and Quench bends, 180 degrees flat on itself, without fracture on outside of bent portion.

FLANGE OR BOILER STEEL.

10. Ultimate strength, 55,000 to 65,000 pounds per square inch.

Elastic limit, not less than one-half the ultimate strength.

Elongation, 25 per cent.

Cold and Quench bends, 180 degrees flat on itself, without fracture on outside of bent portion.

BOILER RIVET STEEL.

11. Steel for boiler rivets shall be made of the extra soft grade specified in paragraph No. 8.

MODIFICATIONS IN ELONGATION FOR THIN AND THICK MATERIAL.

12. For material less than $\frac{5}{16}$ inch, and more than $\frac{3}{4}$ inch in thickness, the following modifications shall be made in the requirements for elongation:

a. For each increase of $\frac{1}{8}$ inch in thickness above $\frac{3}{4}$ inch, a deduction of 1 per cent. shall be made from the specified elongation.

b. For each decrease of $\frac{1}{16}$ inch in thickness below $\frac{5}{16}$ inch, a deduction of $2\frac{1}{2}$ per cent. shall be made from the specified elongation.

c. In rounds of $\frac{5}{8}$ inch or less in diameter, the elongation shall be measured in a length equal to eight times the diameter of section tested.

VARIATION IN WEIGHT.

13. The variation in cross-section or weight of more than $2\frac{1}{2}$ per cent. from that specified will be sufficient cause for rejection, except in the case of sheared plates which will be covered by the following permissible variations:

a. Plates $12\frac{1}{2}$ pounds per square foot or heavier, up to 100 inches wide, when ordered to weight, shall not average more than $2\frac{1}{2}$ per cent. variation above or $2\frac{1}{2}$ per cent. below the theoretical weight. When 100 inches wide and over, 5 per cent. above or 5 per cent. below the theoretical weight.

b. Plates under $12\frac{1}{2}$ pounds per square foot, when ordered to weight, shall not average a greater variation than the following:

Up to 75 inches wide, $2\frac{1}{2}$ per cent. above or $2\frac{1}{2}$ per cent. below the theoretical weight. 75 inches wide up to 100 inches wide, 5 per cent. above or 3 per cent. below the theoretical weight. When 100 inches wide and over, 10 per cent. above or 3 per cent. below the theoretical weight.

c. For all plates ordered to gauge there will be permitted an average excess of weight over that corresponding to the dimensions on the order equal in amount to that specified in the following table:

TABLE OF ALLOWANCES FOR OVERWEIGHT FOR RECTANGULAR PLATES WHEN ORDERED TO GAUGE.

PLATES WILL BE CONSIDERED UP TO GAUGE IF MEASURING NOT OVER $\frac{1}{100}$ INCH LESS THAN THE ORDERED GAUGE.

THE WEIGHT OF ONE CUBIC INCH OF ROLLED STEEL IS ASSUMED TO BE 0.2833 POUND.

Plates $\frac{1}{4}''$ and Over in Thickness.

Thickness of Plate. Inch.	Width of Plate.			
	Up to 75 Inches. Per Cent.	75 to 100 Inches. Per Cent.	Over 100 to 115 Ins. Per Cent.	Over 115 Inches. Per Cent.
$\frac{1}{4}$	10	14	18	..
$\frac{5}{16}$	8	12	16	..
$\frac{3}{8}$	7	10	13	17
$\frac{7}{16}$	6	8	10	13
$\frac{1}{2}$	5	7	9	12
$\frac{9}{16}$	$4\frac{1}{2}$	$6\frac{1}{2}$	$8\frac{1}{2}$	11
$\frac{5}{8}$	4	6	8	10
Over $\frac{5}{8}$	$3\frac{1}{2}$	5	$6\frac{1}{2}$	9

Plates Under $\frac{1}{4}''$ in Thickness.

Thickness of Plate. Inch.	Width of Plate.		
	Up to 50 Inches. Per Cent.	50 to 70 Inches. Per Cent.	Over 70 Inches. Per Cent.
$\frac{1}{8}$ up to $\frac{5}{32}$	10	15	20
$\frac{5}{32}$ " $\frac{3}{16}$	$8\frac{1}{2}$	$12\frac{1}{2}$	17
$\frac{3}{16}$ " $\frac{1}{4}$	7	10	15

WOODEN BEAMS AND COLUMNS.

The results of a series of studies of wooden beams and columns of various kinds of American timber are contained in the Proceedings of the Fifth Annual Convention of the Association of Railway Superintendents of Bridges and Buildings, October, 1895, at which the Committee on Strength of Bridge and Trestle Timbers presented a report, portions of which have been used in preparing certain of the tables on the following pages, but as noted thereon the arrangement and values in many cases have been modified by later information from various sources.

The publications of the Forestry Division of the United States Department of Agriculture, Bulletins Nos. 8 and 12, and Circular No. 15, contain reports of tests of American woods, and deductions drawn therefrom. Extracts and tables from these reports are given on the following pages.

The tables of safe loads for wooden beams and tables of strength of wooden columns given on the following pages have been specially calculated for this book, using the information regarding the properties of the various species contained in the reports above referred to, as modified in some cases by later data.

EXPLANATION OF THE TABLES OF SAFE LOADS IN POUNDS, UNIFORMLY DISTRIBUTED FOR RECTANGULAR WOODEN BEAMS ONE INCH THICK, PAGES 362 TO 367 INCLUSIVE.

General.

For convenience in use, three of these tables have been prepared, from which the safe loads of the various species can be obtained, either directly or by proportion as stated in the footnotes.

The values given in the tables are the safe loads in pounds uniformly distributed, including the weight of the beam itself, for rectangular beams one inch thick for spans from four to forty feet and for depths from four to twenty-four inches. The safe load for a beam of any thickness may be found by multiplying the values given in the tables by the thickness of the beam in inches.

The last column of each of the three Tables of Safe Loads for Rectangular Wooden Beams gives a coefficient of deflection, by means of which the deflection for any beam may be obtained, corresponding to the given span and safe load, by dividing the coefficient by the depth of the beam in inches, which will give approximately the deflection in inches under the given conditions.

In each table the deflection coefficient is given for only one species of wood, as shown, but the deflections for other species may be obtained from these by proportion as explained hereafter.

For the reason that wood has no well-defined limit or modulus of elasticity the deflections obtained by the use of the coefficients are only approximate and will vary, according to the moisture content of the wood and the character of the loading. The deflections thus obtained are, therefore, useful only as a general indication of the amount of bending to be expected under the given conditions and are not exact as in the case of materials like steel, which has a well-defined limit and modulus of elasticity.*

The safe loads for other species of woods than those stated in the headings of the tables may be obtained from those given, by direct proportion, dependent upon the ratio of their allowable unit stress as compared with that for which the table is figured, as stated in the footnotes at the bottom of the tables.

*NOTE.—"A series of tests, undertaken at the College of Forestry at Cornell University, seems to demonstrate that, at least in coniferous wood, a definite elastic limit for any particular piece can be easily shown, and, that it coincides with the theoretically calculated elastic limit upon the bases of compression tests and their application, according to Neely's formula."

EXPLANATION OF THE TABLE OF SAFE LOADS FOR RECTANGULAR BEAMS OF WHITE PINE, CEDAR, SPRUCE OR EASTERN FIR.

The values for the various species of woods, which are included in this table are calculated for an allowable fibre stress, for flexure, of 700 pounds per square inch.

The deflection coefficients are given for white pine, and are based upon a modulus of elasticity of 1 000 000 pounds per square inch.

The lower dotted line crossing the table indicates the limits of spans for which the deflection will exceed $\frac{1}{360}$ of the span for the kind of wood for which the deflection coefficient is given. For spans below the line the safe loads given in the tables will produce a deflection greater than $\frac{1}{360}$ of the span, while those above the line will produce less than this, which is the usual limit of deflection in order to prevent cracking of plastered ceilings. Similarly, the upper dotted line indicates the limit of deflection for the kind of wood for which the deflection coefficient is given, corresponding to a modulus of elasticity of

500 000 pounds per square inch, which should be considered in cases where the deflection should be more closely limited.

The coefficients of deflection for Cedar corresponding to moduli of 700 000 and 350 000 may be obtained by multiplying those of the table by $\frac{10}{7}$ and $\frac{20}{7}$ respectively, and for Spruce and Eastern Fir corresponding to moduli of 1 200 000 and 600 000 by multiplying those of the table by $\frac{5}{6}$ and $\frac{5}{3}$ respectively.

The full zig-zag line in the table gives the limits of the safe loads corresponding to the allowable shearing stress along the neutral axis of the beam. The safe loads above the line, which are based upon the extreme fibre strains, will produce shearing stresses along the axis or with the grain in excess of that allowable, which, in the case of White Pine and the other woods of this table, is 100 pounds per square inch.

The position of this line, which indicates the limit of safe loads for shearing along the neutral axis, was determined by the aid of the following formula:

$$W = \frac{4bds}{3}$$

in which

W = safe load in pounds uniformly distributed.
d = depth of beam in inches.
b = breadth of beam in inches.
s = allowable shear in the direction of the grain in pounds per square inch.

Explanation of the Table of Safe Loads for Rectangular Beams of Short-leaf Yellow Pine.

The table is calculated for an allowable fibre stress, for flexure, of 1 000 pounds per square inch.

The deflection coefficients are figured for a modulus of elasticity of 1 200 000 pounds per square inch, but may be used for other moduli, after obtaining the corresponding coefficients by proportion as heretofore explained.

The lower dotted line across the table indicates the limits of spans for which the safe load will produce deflections greater than $\frac{1}{360}$ of the length of the beam. Values above the line will give less deflection than this, and those below will give greater, based on a modulus of 1 200 000 pounds per square inch. Similarly, the upper dotted line indicates the limit of deflection corresponding to a modulus of elasticity of 600 000 pounds per square inch.

The full zig-zag line across the table indicates the limiting spans and loads based on the allowable intensity of shearing stress along the neutral axis of the beam. The values above the full zig-zag line correspond to shearing stresses greater than the allowable stress in the direction of the grain for Short-leaf Yellow Pine, while those below the line correspond to shearing stresses less than that allowable, which, in this case, is assumed to be 100 pounds per square inch.

Explanation of Tables of Safe Loads for Rectangular Beams of White Oak and Long-leaf Yellow Pine.

This table is computed for an allowable fibre stress of 1 200 pounds per square inch, for flexure, and the deflection coefficients are calculated for a modulus of elasticity of 1 500 000 pounds per square inch.

The limit for a deflection of $\frac{1}{360}$ of the span is indicated by the lower dotted zig-zag line on the tables, the values below which correspond to deflections greater than, and those above to deflections less than, the limiting deflections. The upper dotted zig-zag line similarly indicates the limits of deflection for a modulus of elasticity of 750 000 pounds per square inch.

The lower full zig-zag line indicates the limit of allowable shearing stress along the axis corresponding to the allowable intensity, for Yellow Pine, of 150 pounds per square inch.

Similarly, the upper full zig-zag line indicates the limits for shearing along the axis for White Oak based on an allowable intensity of 200 pounds per square inch.

BEARING AT POINTS OF SUPPORT.

Care should be taken in designing to provide sufficient bearing at the points of support so that the allowable intensity of compression across the grain, as given in the tables on pages 359 and 361, is not exceeded.

This may be obtained, where necessary, by the use of corbels or bearing plates of harder wood arranged so as to give a large bearing area against the softer beam.

The following statements are made in Bulletin No. 12, U. S. Department of Agriculture, Division of Forestry:

RECOMMENDED PRACTICE.

"Since the strength of timber varies very greatly with the moisture contents (see Bulletin 8 of the Forestry Division), the economical designing of such structures will necessitate their being separated into groups according to the maximum moisture contents in use.

MOISTURE CLASSIFICATION.

"Class A (moisture contents, 18 per cent.)—Structures freely exposed to the weather, such as railway trestles, uncovered bridges, etc.

"Class B (moisture contents, 15 per cent.)—Structures under roof but without side shelter, freely exposed to outside air, but protected from rain, such as roof trusses of open shops and sheds, covered bridges over streams, etc.

"Class C (moisture contents, 12 per cent.)—Structures in buildings unheated, but more or less protected from outside air, such as roof trusses of barns, enclosed shops and sheds, etc.

"Class D (moisture contents, 10 per cent.)—Structures in buildings at all times protected from the outside air, heated in the winter, such as roof trusses in houses, halls, churches, etc.

"For long-leaf pine add to all the values given in the tables, except those for moduli of elasticity, tension and shearing, for Class B, 15 per cent.; for Class C, 40 per cent.; and for Class D, 55 per cent. For the other species add to these values, for Class B, 8 per cent.; for Class C, 18 per cent., and for Class D, 25 per cent."

Based upon the above classification of structures, the two following tables have been figured to facilitate calculations of allowable loads for wooden beams and columns.

PROPORTION OF THE VALUES GIVEN IN THE "TABLES OF SAFE LOADS FOR WOODEN BEAMS," PAGES 362 TO 367 INCLUSIVE, TO BE USED IN ORDER TO OBTAIN THE SAFE LOADS FOR THE VARIOUS CLASSES OF STRUCTURES REFERRED TO ABOVE.

Classes.	Yellow Pine.	All Others.
Class A	1.00	1.00
Class B	1.15	1.08
Class C	1.40	1.18
Class D	1.55	1.25

SAFETY FACTORS TO BE APPLIED TO THE VALUES GIVEN IN THE TABLE OF "STRENGTH OF SOLID WOODEN COLUMNS," PAGES 368 AND 369, IN ORDER TO OBTAIN THE SAFE LOADS FOR THE VARIOUS CLASSES OF STRUCTURES REFERRED TO ABOVE.

Classes.	Yellow Pine.	All Others.
Class A	0.20	0.20
Class B	0.23	0.22
Class C	0.28	0.24
Class D	0.31	0.25

SPECIFIC GRAVITY AND WEIGHT PER FOOT FOR VARIOUS KINDS OF TIMBER.

Name of Wood.	Specific Gravity.	Weight per Cubic Foot.	Weight per Foot, Board Measure.
White Oak	0.80	49.94	4.16
White Pine	0.38	23.72	1.98
Southern Long-leaf or Georgia Yellow Pine	0.61	38.08	3.17
Douglas Fir	0.51	31.84	2.65
Short-leaf Yellow Pine	0.51	31.84	2.65
Red Pine (Norway Pine)	0.50	31.21	2.60
Spruce and Eastern Fir	0.40	24.97	2.08
Hemlock	0.40	24.97	2.08
Cypress	0.46	28.72	2.39
Cedar	0.37	23.10	1.93
Chestnut	0.66	41.20	3.43
California Redwood	0.39	24.16	2.01
California Spruce	0.40	24.97	2.08

The specific gravities and weights given above are the averages of a large number of determinations by various authorities, for woods containing less than 15 per cent. of moisture or such as are commercially known as dry timber. The weights of green or unseasoned woods will be from 20 to 40 per cent. greater than those given in the above table.

SAFE UNIT STRESSES FOR TIMBER.

Recommended in Bulletin No. 12, U. S. Department of Agriculture.

Division of Forestry.

Safe Unit Stresses at 18% Moisture.

Species.	Modulus of Strength at Rupture per Square Inch.	Modulus of Elasticity per Square Inch.	Elastic Resilience per Cubic Inch.	Crushing Strength Endwise per Square Inch.	Crushing Strength Across the Grain per Square Inch.	Tensile Strength per Square Inch.	Shearing Strength per Square Inch.
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Long-leaf Pine (Pinus palustris) D	1550	720000	1.30	1000	215	12000	125
Short-leaf Pine (Pinus echinata) D	1300	600000	1.30	840	215	9000	100
White Pine (Pinus strobus)	880	435000	1.00	700	147	7000	75
Norway Pine (Pinus resinosa)	1090	566000	....	760	143	....	....
Colorado Pine (Pinus ponderosa)	980	444000	....	630	180	....	....
Douglas Fir (Pseudotsuga douglasii)	1320	690000	....	880	167	....	....
Redwood (Sequoia sempervirens)	*1440	†226000	....	650	115	....	....
Red Cedar (Juniperus virginiana)	1000	335000	....	700	250	....	....
Bald Cypress (Taxodium distichum) D	1000	450000	1.10	675	120	6000	60
White Oak (Quercus alba) D	1200	550000	1.25	800	400	10000	200
Factor of Safety	5	2	1	5	3	1	4

The values marked "D" were obtained from experiments made by the Forestry Division. The other values were obtained from various sources, chiefly the 10th Census Report, but so modified as to give results comparable with Forestry Division values. To arrive at true average values of strength multiply safe loads by factor of safety given in each column. The values for resilience and tensile strength are the ultimate values. The former is practically never used in designing. The latter is a factor impossible to develop in practice, since the piece will always fail in some other way, usually by shearing.

The crushing strength across the grain in above is based upon a crushing of 3 per cent. of the cross sectional height of the piece.

* This value is certainly too large.
† " " " " small.—Ed.

AVERAGE ULTIMATE BREAKING UNIT

Kind of Timber.	Tension.	
	With Grain.	Across Grain.
White Oak	12000	2000
White Pine	7000	500
Southern Long-leaf or Georgia Yellow Pine	12000	600
Douglas Fir	8000	......
Short-leaf Yellow Pine	9000	500
Red Pine (Norway Pine)	8000	500
Spruce and Eastern Fir	8000	500
Hemlock	6000	......
Cypress	6000	.....
Cedar	7000	......
Chestnut	8500	......
California Redwood	7000	......
California Spruce	......	......

AVERAGE SAFE ALLOWABLE WORKING UNIT

Kind of Timber.	Tension.	
	With Grain.	Across Grain.
Factor of Safety.	Ten.	Ten.
White Oak	1200	200
White Pine	700	50
Southern Long-leaf or Georgia Yellow Pine	1200	60
Douglas Fir	800	......
Short-leaf Yellow Pine	900	50
Red Pine (Norway Pine)	800	50
Spruce and Eastern Fir	800	50
Hemlock	600	......
Cypress	600	.....
Cedar	700	......
Chestnut	850	......
California Redwood	700	...
California Spruce	......	......

The above tables are based on those recommended by the committee on intendents of Bridges and Buildings at their Fifth Annual Convention in October, from various sources.

STRESSES, IN POUNDS PER SQUARE INCH.

Compression.			Transverse.		Shearing.	
With Grain.						
End Bearing.	Columns Under 15 Diams.	Across Grain.	Extreme Fibre Stress.	Modulus of Elasticity.	With Grain.	Across Grain.
7000	5000	2000	7000	1500000	800	4000
5500	3500	700	4000	1000000	400	2000
7000	5000	1400	7000	1500000	600	5000
5700	4500	800	5000	1400000	500	. . . .
6000	4500	1000	6000	1200000	400	4000
5000	4000	800	5000	1130000	. . . .	. . . .
6000	4000	700	4000	1200000	400	3000
. . . . . .	4000	600	3500	900000	350	2500
5000	4000	700	5000	900000	. . . .	. . . .
5500	3500	700	4000	700000	400	1500
. . . . . .	4000	900	5000	1000000	600	2000
. . . . . .	4000	600	4500	700000	400	. . . .
. . . . . .	4000	. . . . .	5000	1200000	. . . .	. . . .

STRESSES, IN POUNDS PER SQUARE INCH.

Compression.			Transverse.		Shearing.	
With Grain.						
End Bearing.	Columns Under 15 Diams.	Across Grain.	Extreme Fibre Stress.	Modulus of Elasticity.	With Grain.	Across Grain.
Five.	Five.	Four.	Six.	Two.	Four.	Four.
1400	1000	500	1200	750000	200	1000
1100	700	200	700	500000	100	500
1400	1000	350	1200	750000	150	1250
1100	900	200	800	750000	130	. . . .
1200	900	250	1000	600000	100	1000
1000	800	200	800	565000	. . . .	. . . .
1200	800	200	700	600000	100	750
. . . . . .	800	150	600	450000	100	600
1000	800	200	800	450000	. . . .	. . . .
1100	700	200	700	350000	100	400
. . . . . .	800	250	800	500000	150	500
. . . . . .	800	150	750	350000	100	. . . .
. . . . . .	800	. . . . .	800	600000	. . . .	. . . .

"Strength of Bridge and Trestle Timbers" of the Association of Railway Super-
1895, but the arrangement and values in many cases are now modified by later data

SAFE LOAD IN POUNDS FOR RECTANGULAR OF WHITE PINE, CEDAR

Allowable fibre stress 700 pounds per square inch. Safety factor 6.

Safe loads for other safety factors may be obtained as follows:

Span in Feet.	Depth of Beam in Inches. 4	5	6	7	8	9	10	11	12	13	14	Deflection Coefficient for White Pine. V
4	311	486	700	953	1244	1575	1944	2352	2800	3286	38[illegible]	.34
5	249	389	560	762	996	1260	1556	1882	2240	2629	3049	.53
6	207	324	467	635	830	1050	1296	1569	1867	2191	2541	.76
7	178	278	400	544	711	900	1111	1344	1600	1878	2178	1.03
8	156	243	350	476	622	788	972	1176	1400	1643	1906	1.34
9	138	216	311	423	553	700	864	1046	1244	1460	1694	1.70
10	124	194	280	381	498	630	778	941	1120	1314	1524	2.10
11	113	177	255	346	453	573	707	856	1018	1195	1386	2.54
12	103	162	233	318	415	525	648	784	933	1095	1270	3.02
13	96	150	215	293	383	485	598	724	862	1011	1173	3.55
14	89	139	200	272	356	450	556	672	800	939	1089	4.12
15	83	130	187	254	332	420	519	627	747	876	1016	4.73
16	78	122	175	238	311	394	486	588	700	821	953	5.38
17	73	114	165	224	293	371	458	554	659	773	897	6.07
18	69	108	156	212	277	350	432	523	622	730	847	6.80
19	65	102	147	201	262	332	409	495	589	692	802	7.58
20		97	140	191	249	315	389	471	560	657	762	8.40
21		93	133	182	237	300	370	448	533	626	726	9.26
22		88	127	173	226	286	354	428	509	597	693	10.16
23		85	122	166	216	274	338	409	487	572	663	11.11
24			117	159	207	263	324	392	467	548	635	12.10
25			112	152	199	252	311	376	448	526	610	13.13
26			108	147	191	242	299	362	431	506	586	14.20
27			104	141	184	233	288	349	415	487	565	15.31
28			100	136	178	225	278	336	400	469	544	16.46
29			97	131	172	217	268	325	386	453	526	17.66
30			93	127	166	210	259	314	373	438	508	18.90
31			90	123	161	203	251	304	361	424	492	20.18
32			88	119	156	197	243	294	350	411	476	21.50
33			85	115	151	191	236	285	339	398	462	22.87
34				112	146	185	229	277	329	387	448	24.28
35				109	142	180	222	269	320	376	436	25.73

UNIFORMLY DISTRIBUTED BEAMS ONE INCH THICK AND SPRUCE OR EASTERN FIR.

Modulus of rupture 4 200 pounds per square inch.

New safe load = Safe load from table $\times \frac{6}{\text{New factor}}$.

Span in Feet.	Depth of Beam in Inches.										Deflection Coefficient for White Pine.
	15	16	17	18	19	20	21	22	23	24	V
9	1944	2212	2498	2800	3120	3457	3811	4183	4571	4978	1.70
10	1750	1991	2248	2520	2808	3111	3430	3764	4114	4480	2.10
11	1601	1810	2044	2291	2552	2828	3118	3422	3740	4073	2.54
12	1458	1659	1873	2100	2340	2593	2858	3137	3428	3733	3.02
13	1346	1531	1729	1938	2160	2393	2638	2896	3165	3446	3.55
14	1250	1422	1606	1800	2056	2222	2450	2689	2939	3200	4.12
15	1167	1328	1499	1680	1872	2074	2287	2510	2743	2987	4.73
16	1094	1244	1405	1575	1755	1944	2144	2353	2571	2800	5.38
17	1029	1171	1322	1482	1652	1830	2018	2214	2420	2635	6.07
18	972	1106	1249	1400	1560	1728	1906	2091	2286	2489	6.80
19	921	1048	1183	1326	1478	1637	1805	1981	2165	2358	7.58
20	875	996	1124	1260	1404	1556	1715	1882	2057	2240	8.40
21	833	948	1070	1200	1337	1481	1633	1793	1959	2133	9.26
22	795	905	1022	1145	1276	1414	1559	1711	1870	2036	10.16
23	761	866	977	1096	1221	1353	1491	1637	1789	1948	11.11
24	729	830	937	1050	1170	1296	1429	1569	1714	1867	12.10
25	700	796	899	1008	1123	1244	1372	1506	1645	1792	13.13
26	673	766	865	969	1080	1197	1319	1448	1582	1723	14.20
27	648	737	833	933	1040	1152	1270	1394	1524	1659	15.31
28	625	711	803	900	1003	1111	1225	1344	1469	1600	16.46
29	603	687	775	869	968	1073	1183	1298	1419	1545	17.66
30	583	664	749	840	936	1037	1143	1255	1371	1493	18.90
31	565	642	725	813	906	1004	1106	1214	1327	1445	20.18
32	547	622	703	787	877	972	1072	1176	1286	1400	21.50
33	534	603	681	764	850	943	1039	1141	1247	1358	22.87
34	515	586	661	741	826	915	1009	1107	1210	1318	24.28
35	500	569	642	720	802	889	980	1076	1176	1280	25.73
36	486	553	624	700	780	864	953	1046	1143	1244	27.22
37	473	538	608	681	759	841	927	1017	1112	1211	28.75
38	460	524	592	663	739	819	903	991	1083	1179	30.32
39	449	511	576	646	720	798	880	965	1055	1149	31.94
40	438	498	562	630	702	778	858	941	1029	1120	33.60

SAFE LOADS IN POUNDS
FOR RECTANGULAR
OF SHORT-LEAF

Allowable fibre stress 1000 pounds per square inch. Safety factor 6.

Safe loads for other safety factors may be obtained as follows:

Span in Feet.	Depth of Beam in Inches. 4	5	6	7	8	9	10	11	12	13	14	Deflection Coefficient. V
4	444	694	1000	1361	1778	2250	2778	3361	4000	4694	5444	.40
5	356	556	800	1089	1422	1800	2222	2689	3200	3756	4356	.63
6	296	463	667	907	1185	1500	1852	2241	2667	3130	3630	.90
7	254	397	571	778	1016	1286	1587	1921	2286	2683	3111	1.23
8	222	347	500	681	889	1125	1389	1681	2000	2347	2722	1.60
9	198	309	444	605	790	1000	1235	1494	1778	2086	2420	2.03
10	178	278	400	544	711	900	1111	1344	1600	1878	2178	2.50
11	162	253	364	495	646	818	1010	1222	1455	1707	1980	3.03
12	148	231	333	454	593	750	926	1120	1333	1565	1815	3.60
13	137	214	308	419	547	692	855	1034	1231	1444	1675	4.23
14	127	198	286	389	508	643	794	960	1143	1341	1556	4.90
15	119	185	267	363	474	600	741	896	1067	1252	1452	5.63
16	111	174	250	340	444	563	694	840	1000	1174	1361	6.40
17	105	163	235	320	418	529	654	791	941	1105	1281	7.23
18	99	154	222	302	395	500	617	747	889	1043	1210	8.10
19	94	146	211	287	374	474	585	708	842	988	1146	9.03
20	89	139	200	272	356	450	556	672	800	939	1089	10.00
21	85	132	190	259	339	429	529	640	762	894	1037	11.03
22	81	126	182	247	323	409	505	611	727	854	990	12.10
23	77	121	174	237	309	391	483	585	696	816	947	13.23
24		116	162	227	296	375	463	560	667	782	907	14.40
25		111	160	218	284	360	444	538	640	751	871	15.63
26		107	154	209	274	346	427	517	615	722	838	16.90
27		103	148	202	263	333	412	498	593	695	807	18.23
28		99	143	194	254	321	397	480	571	671	778	19.60
29			138	188	245	310	383	464	552	648	751	21.03
30			133	181	237	300	370	448	533	626	726	22.50
31			129	176	229	290	358	434	516	606	703	24.03
32			125	170	222	281	347	420	500	587	681	25.60
33			121	165	215	273	337	407	485	569	660	27.23
34			118	160	209	265	327	395	471	552	641	28.90
35			114	156	203	257	317	384	457	537	602	30.63

Safe loads for any fibre stress may be readily obtained from this table by proportion.

UNIFORMLY DISTRIBUTED, BEAMS ONE INCH THICK, YELLOW PINE.

Modulus of rupture 6 000 pounds per square inch.

New safe load = Safe load from table $\times \frac{6}{\text{New factor}}$.

Span in Feet.	Depth of Beam in Inches. 15	16	17	18	19	20	21	22	23	24	Deflection Coefficient. V
9	2778	3160	3568	4000	4457	4938	5444	5975	6531	7111	2.03
10	2500	2844	3211	3600	4011	4444	4900	5378	5878	6400	2.50
11	2273	2586	2919	3273	3646	4040	4455	4889	5343	5818	3.03
12	2083	2370	2676	3000	3343	3704	4083	4481	4898	5333	3.60
13	1923	2188	2470	2769	3085	3419	3769	4137	4521	4923	4.23
14	1786	2032	2294	2571	2865	3175	3500	3841	4198	4571	4.90
15	1667	1896	2141	2400	2674	2963	3267	3585	3919	4267	5.63
16	1563	1778	2007	2250	2507	2778	3062	3361	3674	4000	6.40
17	1471	1673	1889	2118	2359	2614	2882	3163	3458	3765	7.23
18	1389	1580	1789	2000	2228	2469	2722	2988	3265	3556	8.10
19	1316	1497	1690	1895	2111	2339	2579	2830	3094	3368	9.03
20	1250	1422	1606	1800	2006	2222	2450	2689	2939	3200	10.00
21	1190	1354	1529	1714	1910	2116	2333	2561	2799	3048	11.03
22	1136	1293	1460	1636	1823	2020	2227	2444	2672	2909	12.10
23	1087	1237	1396	1565	1744	1932	2130	2338	2556	2783	13.23
24	1042	1185	1338	1500	1671	1852	2042	2241	2449	2667	14.40
25	1000	1138	1284	1440	1604	1778	1960	2131	2351	2560	15.63
26	962	1094	1235	1385	1543	1709	1885	2068	2261	2462	16.90
27	926	1053	1189	1333	1486	1646	1815	1992	2177	2370	18.23
28	893	1016	1147	1286	1433	1587	1750	1921	2099	2286	19.60
29	862	981	1107	1241	1383	1533	1690	1854	2027	2207	21.03
30	833	948	1070	1200	1337	1481	1633	1793	1959	2133	22.50
31	806	918	1036	1161	1294	1434	1581	1735	1896	2065	24.03
32	781	889	1003	1125	1253	1389	1531	1681	1837	2000	25.60
33	758	862	973	1091	1215	1347	1485	1630	1781	1939	27.23
34	735	837	944	1059	1180	1307	1441	1582	1728	1882	28.90
35	714	813	917	1029	1146	1270	1400	1537	1677	1829	30.63
36	694	780	894	1000	1114	1235	1361	1494	1633	1778	32.40
37	676	769	868	973	1084	1201	1324	1453	1589	1730	34.23
38	658	749	845	947	1056	1169	1289	1415	1547	1684	36.10
39	641	729	823	923	1028	1140	1256	1379	1507	1641	38.03
40	625	711	803	900	1003	1111	1225	1344	1469	1600	40.00

Safe loads for beams of California Redwood, ¾ of above.

SAFE LOADS IN POUNDS FOR RECTANGULAR OF WHITE OAK AND

Allowable fibre stress 1 200 pounds per square inch. Safety factor 6.

Safe loads for other safety factors may be obtained as follows :

Span in Feet.	Depth of Beam in Inches.											Deflection Coefficient. V
	4	5	6	7	8	9	10	11	12	13	14	
4	533	833	1200	1633	2133	2700	3333	4033	4800	5633	6533	.38
5	427	667	960	1307	1707	2160	2667	3227	3840	4507	5227	.60
6	356	556	800	1089	1422	1800	2222	2689	3200	3756	4356	.86
7	305	476	686	933	1219	1543	1905	2305	2743	3219	3733	1.18
8	267	417	600	817	1067	1350	1667	2017	2400	2817	3267	1.54
9	237	370	533	726	948	1200	1481	1793	2133	2504	2904	1.94
10	213	333	480	653	853	1080	1333	1613	1920	2253	2613	2.40
11	194	303	436	594	776	982	1212	1467	1745	2048	2376	2.90
12	178	278	400	544	711	900	1111	1344	1600	1878	2178	3.46
13	164	256	369	503	656	831	1026	1241	1477	1733	2010	4.06
14	152	238	343	467	610	771	952	1152	1371	1610	1867	4.70
15	142	222	320	436	569	720	889	1076	1280	1502	1742	5.40
16	133	208	300	408	533	675	833	1008	1200	1408	1633	6.14
17	125	196	282	384	502	635	784	949	1129	1325	1537	6.94
18	119	185	267	363	474	600	741	896	1067	1252	1452	7.78
19	112	175	253	344	449	568	702	849	1011	1186	1375	8.66
20	107	167	240	327	427	540	667	807	960	1127	1307	9.60
21	102	159	229	311	406	514	635	768	914	1073	1244	10.58
22	97	152	218	297	388	491	606	733	873	1024	1188	11.62
23	93	145	209	284	371	470	580	701	835	980	1136	12.70
24	89	139	200	272	356	450	556	672	800	939	1089	13.82
25	85	133	192	261	341	432	533	645	768	901	1045	15.00
26		128	185	251	328	415	513	621	738	867	1005	16.22
27		123	178	242	316	400	494	598	711	835	968	17.50
28		119	171	233	305	386	476	576	686	805	933	18.82
29		115	166	225	294	372	460	556	662	777	901	20.18
30		111	160	218	284	360	444	538	640	751	871	21.60
31		108	155	211	275	348	430	520	619	727	843	23.06
32			150	204	267	338	417	504	600	704	817	24.58
33			145	198	259	327	404	489	582	683	792	26.14
34			141	192	251	318	392	475	565	663	769	27.74
35			137	187	244	309	381	461	549	644	747	29.40

Safe loads for beams of Douglas Fir, Red Pine (Norway Pine), Cypress, Chestnut and California Spruce, ⅔ of above.

UNIFORMLY DISTRIBUTED, BEAMS ONE INCH THICK, LONG-LEAF YELLOW PINE.

Modulus of rupture 7 200 pounds per square inch.

New safe load = Safe load from table $\times \frac{6}{\text{New factor}}$.

Span in Feet.	Depth of Beam in Inches. 15	16	17	18	19	20	21	22	23	24	Deflection Coefficient. V
9	3333	3793	4281	4800	5348	5926	6533	7170	7837	8533	1.94
10	3000	3413	3853	4320	4813	5333	5880	6453	7053	7680	2.40
11	2727	3103	3503	3927	4376	4848	5355	5867	6412	6982	2.90
12	2500	2844	3211	3600	4011	4444	4900	5378	5878	6400	3.46
13	2308	2626	2964	3323	3703	4103	4523	4964	5426	5908	4.06
14	2143	2438	2752	3086	3438	3810	4200	4610	5038	5486	4.70
15	2000	2276	2569	2880	3209	3556	3920	4302	4702	5120	5.40
16	1875	2133	2408	2700	3008	3333	3675	4033	4433	4800	6.14
17	1765	2008	2267	2541	2831	3137	3459	3796	4149	4518	6.94
18	1667	1896	2141	2400	2674	2963	3267	3585	3819	4267	7.78
19	1579	1796	2027	2274	2533	2807	3095	3396	3712	4042	8.66
20	1500	1707	1927	2160	2407	2667	2940	3227	3527	3840	9.60
21	1429	1625	1835	2057	2292	2540	2800	3073	3359	3657	10.58
22	1364	1552	1752	1964	2188	2424	2678	2933	3206	3491	11.62
23	1304	1484	1675	1878	2093	2319	2557	2806	3067	3339	12.70
24	1250	1422	1606	1800	2006	2222	2450	2689	2939	3200	13.82
25	1200	1365	1541	1728	1925	2133	2352	2581	2821	3072	15.00
26	1154	1313	1482	1662	1851	2051	2262	2482	2713	2954	16.22
27	1111	1264	1427	1600	1783	1975	2178	2390	2612	2844	17.50
28	1071	1219	1376	1543	1719	1905	2100	2305	2519	2743	18.82
29	1034	1177	1329	1490	1660	1839	2028	2225	2432	2648	20.18
30	1000	1138	1284	1440	1604	1778	1960	2151	2351	2560	21.60
31	968	1101	1243	1394	1553	1720	1897	2082	2275	2477	23.06
32	938	1067	1204	1350	1504	1667	1838	2017	2217	2400	24.58
33	909	1034	1168	1309	1459	1616	1785	1956	2137	2327	26.14
34	882	1004	1133	1271	1416	1569	1729	1898	2075	2259	27.74
35	857	975	1101	1234	1375	1524	1680	1844	2013	2194	29.40
36	833	948	1070	1200	1337	1481	1633	1793	1909	2133	31.10
37	811	923	1041	1168	1301	1441	1589	1744	1906	2076	32.86
38	789	893	1014	1137	1267	1404	1547	1698	1856	2021	34.66
39	769	875	988	1108	1234	1368	1508	1655	1809	1969	36.50
40	750	853	963	1080	1203	1333	1470	1613	1763	1920	38.40

Safe loads for beams of Hemlock, ½ of above.

STRENGTH OF SOLID WOODEN COLUMNS OF DIFFERENT KINDS OF TIMBER.

For various values of $\frac{l}{d}$.

l = length of column in inches. d = least diameter in inches.

BASED ON THE FORMULA OF THE U. S. DEPARTMENT OF AGRICULTURE, DIVISION OF FORESTRY.

$$P = F \times \frac{700 + 15c}{700 + 15c + c^2}.$$

P = ultimate strength in pounds per square inch.

F = ultimate crushing strength of timber. $c = \frac{l}{d}$.

Values of F are those given in table on pages 360 and 361 herein.

	Ultimate Strength in Pounds per Square Inch.			
	White Oak and Southern Long-leaf or Georgia Yellow Pine.	Douglas Fir and Short-leaf Yellow Pine.	Red Pine (Norway Pine), Spruce or Eastern Fir, Hemlock, Cypress, Chestnut, California Redwood and California Spruce.	White Pine and Cedar.
F	5000	4500	4000	3500
$\frac{l}{d}$				
2	4973	4475	3978	3481
3	4940	4446	3952	3458
4	4897	4407	3918	3428
5	4844	4359	3875	3391
6	4782	4304	3826	3347
7	4713	4242	3770	3299
8	4638	4174	3710	3247
9	4558	4102	3646	3190
10	4474	4026	3579	3132
11	4386	3948	3509	3070
12	4297	3867	3438	3008
13	4206	3785	3365	2944
14	4114	3703	3291	2880
15	4022	3620	3217	2815
16	3930	3537	3144	2751
17	3838	3455	3071	2687
18	3748	3373	2998	2624
19	3659	3293	2927	2561

For safety factors for various classes of structures to be used in connection with the above table, see p. 358.

STRENGTH OF SOLID WOODEN COLUMNS OF DIFFERENT KINDS OF TIMBER.

For various values of $\frac{l}{d}$.

l = length of column in inches. d = least diameter in inches.

BASED ON THE FORMULA OF THE U. S. DEPARTMENT OF AGRICULTURE, DIVISION OF FORESTRY.

$$P = F \times \frac{700 + 15c}{700 + 15c + c^2}.$$

P = ultimate strength in pounds per square inch.

F = ultimate crushing strength of timber. $c = \frac{l}{d}$.

Values of F are those given in table on pages 360 and 361 herein.

	Ultimate Strength in Pounds per Square Inch.			
	White Oak and Southern Long-leaf or Georgia Yellow Pine.	Douglas Fir and Short-leaf Yellow Pine.	Red Pine (Norway Pine), Spruce or Eastern Fir, Hemlock, Cypress, Chestnut, California Redwood and California Spruce.	White Pine and Cedar.
F	5000	4500	4000	3500
$\frac{l}{d}$				
20	3571	3214	2857	2500
21	3486	3137	2788	2440
22	3402	3061	2721	2381
23	3320	2988	2656	2324
24	3240	2916	2592	2268
25	3162	2846	2529	2213
26	3086	2777	2469	2160
27	3013	2711	2410	2109
28	2941	2647	2353	2059
29	2872	2585	2298	2010
30	2805	2524	2244	1963
32	2677	2409	2142	1874
34	2557	2301	2046	1790
36	2445	2200	1956	1711
38	2340	2106	1872	1638
40	2241	2017	1793	1569
42	2149	1934	1719	1505
44	2063	1857	1650	1444
46	1982	1784	1586	1388
48	1907	1716	1525	1335
50	1835	1652	1468	1285

For safety factors for various classes of structures to be used in connection with the above table, see p. 358.

SPECIFIC GRAVITIES AND WEIGHTS OF VARIOUS SUBSTANCES.

The Basis for Specific Gravities is Pure Water at 62 Degrees Fah., Barometer 30 Inches. Weight of One Cubic Foot, 62.355 Pounds.	Average Specific Gravity. Water = 1.	Average Weight of One Cubic Foot. Pounds.
Air, atmospheric at 60 degrees F., under pressure of one atmosphere, or 14.7 pounds per square inch, weighs $\frac{1}{815}$th as much as water	.00123	.0765
Aluminum	2.6	162
Anthracite, 1.3 to 1.84; of Penna., 1.3 to 1.7.	1.5	93.5
" broken, of any size, loose	....	52 to 56
" " moderately shaken	....	56 to 60
" " heaped bushel, loose, 77 to 83 pounds	....	....
" " a ton loose occupies 40 to 43 cubic feet	....	....
Antimony, cast	6.70	418
" native	6.67	416
Ash, perfectly dry (see note p. 373)	.752	47
" American White, dry (see note p. 373)	.61	38
Ashes of soft coal, solidly packed		40 to 45
Asphaltum, 1 to 1.8	1.4	87.3
Brass (copper and zinc), cast, 7.8 to 8.4	8.1	504
" rolled	8.4	524
Brick, best pressed	....	150
" common and hard	....	125
" soft inferior	....	100
Brickwork, pressed brick, fine joints	....	140
" medium quality	....	125
" coarse, inferior, soft	....	100
" at 125 pounds per cubic foot, 1 cubic yard equals 1.507 tons, and 17.92 cubic feet equal 1 ton	....	....
Bronze, copper 8, tin 1 (gun metal)	8.5	529
Cement, hydraulic. American, Rosendale, ground and loose	....	56
" hydraulic. American, Rosendale, U. S. struck bush., 70 pounds	....	....
" hydraulic. American, Rosendale, Louisville bushel, 62 pounds	....	....
" hydraulic. American, Cumberland, ground, loose	....	65
" hydraulic. American, Cumberland, ground, thoroughly shaken	....	85
" hydraulic. English Portland (U.S. struck bushel, 100 to 128)	....	81 to 102

SPECIFIC GRAVITIES AND WEIGHTS OF VARIOUS SUBSTANCES.

The Basis for Specific Gravities is Pure Water at 62 Degrees Fah., Barometer 30 Inches. Weight of One Cubic Foot, 62.355 Pounds.	Average Specific Gravity. Water = 1.	Average Weight of One Cubic Foot. Pounds.
Cement, hydraulic. English Portland, a barrel, 400 to 430 pounds	....	....
" hydraulic. American Portland, loose	....	88
" hydraulic. American Portland, thoroughly shaken	....	110
Charcoal of pines and oaks	....	15 to 30
Chalk	2.5	156
Cherry, perfectly dry (see note p. 373)	.672	42
Clay, potters', dry, 1.8 to 2.1	1.9	119
" dry in lump, loose.................	....	63
Coal, bituminous, solid, 1.2 to 1.5..........	1.35	84
" bituminous, solid, Cambria Co., Pa., 1.27–1.34	....	79 to 84
" bituminous, broken, of any size, loose..	....	47 to 52
" bituminous, moderately shaken.......	....	51 to 56
" bituminous, a heaped bushel, loose, 70 to 78.........................	....	....
" bituminous, 1 ton occupies 43 to 48 cubic feet	....	....
Coke, loose, good quality...	....	23 to 32
" loose, a heaped bushel, 35 to 42.....	....	....
" 1 ton occupies 80 to 97 cubic feet	....	....
Corundum, pure, 3.8 to 4	3.9	....
Copper, cast, 8.6 to 8.8	8.7	542
" rolled, 8.8 to 9..................	8.9	555
Cork, dry (see note p. 373)	.24	15
Earth, common loam, perfectly dry, loose...	....	72 to 80
" " " perfectly dry, shaken..	....	82 to 92
" " " perfectly dry, rammed.	....	90 to 100
" " " slightly moist, loose ..	....	70 to 76
" " " more moist, loose	....	66 to 68
" " " more moist, shaken...	....	75 to 90
" " " more moist, packed...	....	90 to 100
" " " as soft flowing mud...	....	104 to 112
" " " as soft flowing mud well pressed......	....	110 to 120
Elm, perfectly dry (see note p. 373)	.56	35
Flint	2.6	162
Glass, 2.5 to 3.45	2.98	186
" common window	2.52	157
Gneiss, common, 2.62 to 2.76	2.69	168

SPECIFIC GRAVITIES AND WEIGHTS OF VARIOUS SUBSTANCES.

The Basis for Specific Gravities is Pure Water at 62 Degrees Fah., Barometer 30 Inches. Weight of One Cubic Foot, 62.355 Pounds.	Average Specific Gravity. Water = 1.	Average Weight of One Cubic Foot. Pounds.
Gneiss, in loose piles	....	96
Gold, cast, pure or 24 karat	19.258	1204
" pure, hammered	19.5	1217
Granite, 2.56 to 2.88	2.72	170
Greenstone, trap, 2.8 to 3.2	3.00	187
Gypsum, plaster of Paris, 2.24 to 2.30	2.27	141.6
Hickory, perfectly dry (see note p. 373)	.85	53
Ice, .917 to .922	.92	57.4
Iron, cast, 6.9 to 7.4	7.15	446
" grey foundry, cold	7.21	450
" " molten	6.94	433
" wrought	7.69	480
Lead, commercial	11.38	709.6
Lignumvitæ (dry)	.65–1.33	41 to 83
Limestone and marble	2.6	164.4
Lime, quick	1.5	95
" quick, ground, well shaken, per struck bushel 80 pounds	....	64
" quick, ground, thoroughly shaken, per struck bushel 93¾ pounds	....	75
Locust, dry (see note p. 373)	.71	44
Mahogany, Spanish, dry (see note p. 373)	.85	53
" Honduras, dry (see note p. 373)	.56	35
Maple, dry (see note p. 373)	.79	49
Marble (see Limestone).		
Masonry of granite or limestone, well-dressed	....	165
" of granite, well-scabbled mortar rubble, about $\frac{1}{5}$ of mass will be mortar	....	154
" of granite, well-scabbled dry rubble	....	138
" of granite, roughly scabbled mortar rubble, about ¼ to ⅓ of mass will be mortar	....	150
" of granite, scabbled dry rubble	....	125
" of sandstone, ⅛ less than granite	....	....
Masonry of brickwork (see Brickwork).		
Mercury, at 32 degrees Fah	13.62	849
Mica, 2.75 to 3.1	2.93	183
Mortar, hardened, 1.4 to 1.9	1.65	103
Mud, dry, close	....	80 to 110
" wet, moderately pressed	....	110 to 130
" " fluid	....	104 to 120

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Missing Pages:

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376 - 377	Weight of Sheets & Plates
378 – 382	Decimal Parts of Foot & Inch
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390 – 395	Areas of Flat Rolled Steel Bars
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