CARNEGIE POCKET COMPANION

ABRIDGED EDITION

INFORMATION AND TABLES

FOR

ENGINEERS AND DESIGNERS

Complete – includes material in Brown Leather edition and additions to "Series" third Edition

CARNEGIE STEEL COMPANY

PITTSBURGH, PA.

FIRST EDITION

A. I. A. FILE NO. 13b1

CARNEGIE

POCKET COMPANION

ABRIDGED EDITION

INFORMATION AND TABLES

FOR

ENGINEERS AND DESIGNERS

AND OTHER DATA

PERTAINING TO

STRUCTURAL STEEL

MANUFACTURED BY

CARNEGIE STEEL COMPANY

SUBSIDIARY OF UNITED STATES STEEL CORPORATION

PITTSBURGH, PA.

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FOREWORD

PENDING major revisions in the Carnegie Pocket Companion, publication of the 24th Edition will probably not be possible until sometime in 1931. In the meantime, to meet the requirements of Designers and Fabricators of structural steel, the present abridged temporary Edition is offered to fill the gap until such time as the complete 24th Edition can be prepared and issued.

This book contains complete data pertaining to Carnegie Beams, American Standard and other structural sections most suitable for use in bridge, building, car and ship construction.

Safe loads and other data for structural sections are in accordance with the standard specifications of the American Institute of Steel Construction, revised November 1st, 1928.

In order to restrict the size of this book and yet include all the useful engineering data possible, dimensioned profile drawings have been omitted. These, however, will be found in the Carnegie Shape Book, 10th Edition, issued July 1st, 1929.

TOPICAL INDEX

		Page
ELEMENTS, PROPERTIES, DIMENSIONS	Formulas	6-17
	Carnegie Beam Sections	18-31
	Standard Beams, Etc.	32-37
	Channels	38-45
	Angles, Tees, Zees, Etc.	46-57
	Cover-Plated Columns	58-63
	Miscellaneous	64-81
BEAM SAFE LOADS	Explanatory Notes, Etc.	82-97
	Web Resistances, Etc.	98-113
	Loads, Beams	114-187
PLATE GIRDER	Explanatory Notes	188-197
	Tables of Elements	198-200
COLUMN SAFE LOADS	Explanatory Notes	200-207
	Loads—Beams	208-228
	Cover-Plated Beams	222-227
STRUCTURAL DETAILS	Rivets, Pins and Bolts	229-242
	Miscellaneous	243-257
	Beam Details, Connections	250-255

ELEMENTS OF SECTIONS

In the computation of the values of structural shapes for the various conditions under which they are subjected to stress, certain mathematical expressions are used. In the tables of Elements of Sections, which follow, these values or properties are given in inch-units.

Neutral Axis. The line, in the cross section of a beam or column in a state of flexure, on which there is neither tension nor compression; the neutral axis passes through the center of gravity of the section when unit stresses do not exceed the elastic limit of the material. In the usual position of structural sections there are two neutral axes, perpendicular to each other, their normal distance from extreme fiber of the section being designated by x and y.

Moment of Inertia—I. The sum of the products obtained by multiplying each of the elementary areas of which the section is composed, by the square of its normal distance from a neutral axis of the section or from any axis of moments assumed for purposes of calculation.

Section Modulus—S. The moment of inertia divided by the normal distance from the axis to which it refers to extreme fiber of the section. For the two moments of inertia, corresponding to the two principal axes of a section, there are also two section moduli.

The section modulus is used to determine the stress in the extreme fiber of a section, subjected to bending stresses, by dividing the bending moment by the section modulus referred to neutral axis normal to line of force, both values being expressed in like units of measure; the section modulus of a section, is obtained by dividing the bending stress by the allowable fiber stress, both values also in like units of measure; the proper section is then obtained from this section modulus by reference to the tables of Elements of Sections.

Radius of Gyration—r. The normal distance from a neutral axis to the center of gyration, the point where the entire area is considered to be concentrated and have the same moment of inertia as the actual area. The radius of gyration of a section referred to a neutral axis, or any axis of moments, is equal to the square root of moment of inertia, referred to that axis, divided by the area.

The radius of gyration of a section is used to ascertain the safe load this section will sustain when used in compression, as a strut or column. The unbraced length of the section in compression, divided by the least radius of gyration l/r, is denominated the ratio of slenderness.

General Notation in Formulas

The following notation applies to formulas and tables for elements or physical properties of sections, also to flexure formulas and other data given for beams under various loading conditions:

A =Area of section, in square inches.
n =Distance from center line of gravity to extreme fiber, in inches.
I =Moment of inertia about center line of gravity, in inches^4.
M_s=Static moment, in inches^3.
S =Section modulus, in inches^3.
r =Radius of gyration, in inches.
f =Bending stress in extreme fiber, in pounds per square inch.
f_b =Resistance of web, in pounds per square inch.
E =Modulus of elasticity, in pounds per square inch.
L =Length of section, in feet.
l =Length of section, in inches.
W, W_1, W_2=Superimposed loads supported by beam, in pounds.
w =Superimposed load, in pounds per unit length or area.
W_{max} =Maximum safe load at point given, in pounds.
R, R_1 =Reactions at points of support, in pounds.
V =Vertical shear, in pounds.
M, M_1, M_2=Bending moments at points given, in inch pounds.
M_{max} =Maximum bending moment, in inch pounds.
M_r =Maximum resisting moment, in inch pounds.
D, D_1 =Deflections at points given, in inches.
D_{max} =Maximum deflection at point given, in inches.

The common relations existing between the properties of any shape of uniform cross section are the following:

$$I = Ar^2 \qquad r = \sqrt{\frac{I}{A}} \qquad S = \frac{I}{n}$$

The moment of inertia, I^1, referred to an axis not coincident with but parallel to the neutral axis of the section, when z is the perpendicular distance between these two axes, is: $I^1 = I + Az^2$

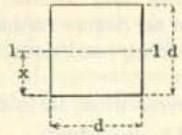
The moment of resistance of the internal stresses of a beam resisting flexure must be equal to the moment of the external forces producing bending.

$$M_r = M_{max} = f\frac{I}{n} = f\,S.$$

The moment of resistance and the bending moment must, therefore, be expressed in same units of moment, force x length, generally in inch-pounds.

The modulus of elasticity is the ratio between unit stress and the elongation caused by that stress in one unit of length, up to the elastic limit; for steel the modulus of elasticity is 29,000,000 pounds per square inch.

SQUARE
Axis of moments through center



$$A = d^2$$

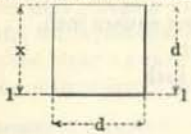
$$x = \frac{d}{2}$$

$$I_{1\text{-}1} = \frac{d^4}{12}$$

$$S_{1\text{-}1} = \frac{d^3}{6}$$

$$r_{1\text{-}1} = \frac{d}{\sqrt{12}} = 0.288675\,d$$

SQUARE
Axis of moments on base



$$A = d^2$$

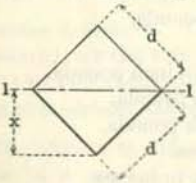
$$x = d$$

$$I_{1\text{-}1} = \frac{d^4}{3}$$

$$S_{1\text{-}1} = \frac{d^3}{3}$$

$$r_{1\text{-}1} = \frac{d}{\sqrt{3}} = 0.577350\,d$$

SQUARE
Axis of moments on diagonal



$$A = d^2$$

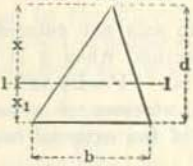
$$x = \frac{d}{\sqrt{2}} = 0.707107\,d$$

$$I_{1\text{-}1} = \frac{d^4}{12}$$

$$S_{1\text{-}1} = \frac{d^3}{6\sqrt{2}} = 0.117851\,d^3$$

$$r_{1\text{-}1} = \frac{d}{\sqrt{12}} = 0.288675\,d$$

TRIANGLE
Axis of moments through center of gravity



$$A = \frac{bd}{2}$$

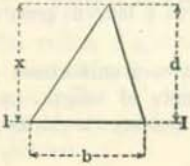
$$x = \frac{2d}{3} \qquad x_1 = \frac{d}{3}$$

$$I_{1\text{-}1} = \frac{bd^3}{36}$$

$$S_{1\text{-}1} = \frac{bd^2}{24}$$

$$r_{1\text{-}1} = \frac{d}{\sqrt{18}} = 0.235702\,d$$

TRIANGLE
Axis of moments on base



$$A = \frac{bd}{2}$$

$$x = d$$

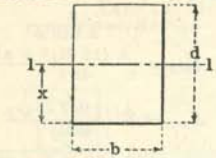
$$I_{1\text{-}1} = \frac{bd^3}{12}$$

$$S_{1\text{-}1} = \frac{bd^2}{12}$$

$$r_{1\text{-}1} = \frac{d}{\sqrt{6}} = 0.408248\,d$$

RECTANGLE

Axis of moments through center



$$A = bd$$

$$x = \frac{d}{2}$$

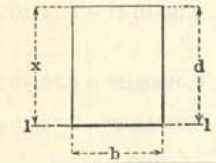
$$I_{1\text{-}1} = \frac{bd^3}{12}$$

$$S_{1\text{-}1} = \frac{bd^2}{6}$$

$$r_{1\text{-}1} = \frac{d}{\sqrt{12}} = 0.288675\,d$$

RECTANGLE

Axis of moments on base



$$A = bd$$

$$x = d$$

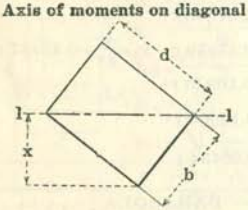
$$I_{1\text{-}1} = \frac{bd^3}{3}$$

$$S_{1\text{-}1} = \frac{bd^2}{3}$$

$$r_{1\text{-}1} = \frac{d}{\sqrt{3}} = 0.577350\,d$$

RECTANGLE

Axis of moments on diagonal



$$A = bd$$

$$x = \frac{bd}{\sqrt{b^2+d^2}}$$

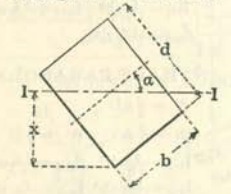
$$I_{1\text{-}1} = \frac{b^3\,d^3}{6\,(b^2+d^2)}$$

$$S_{1\text{-}1} = \frac{b^2\,d^2}{6\sqrt{b^2+d^2}}$$

$$r_{1\text{-}1} = \frac{bd}{\sqrt{6\,(b^2+d^2)}}$$

RECTANGLE

Axis of moments any line through center of gravity



$$A = bd$$

$$x = \frac{b \sin \alpha + d \cos \alpha}{2}$$

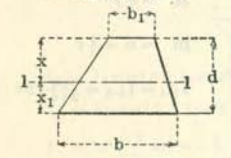
$$I_{1\text{-}1} = \frac{bd\,(b^2 \sin^2 \alpha + d^2 \cos^2 \alpha)}{12}$$

$$S_{1\text{-}1} = \frac{bd\,(b^2 \sin^2 \alpha + d^2 \cos^2 \alpha)}{6\,(b \sin \alpha + d \cos \alpha)}$$

$$r_{1\text{-}1} = \sqrt{\frac{b^2 \sin^2 \alpha + d^2 \cos^2 \alpha}{12}}$$

TRAPEZOID

Axis of moments through center of gravity



$$A = \frac{d(b + b_1)}{2}$$

$$x = \frac{d(b_1 + 2b)}{3(b + b_1)} \qquad x_1 = \frac{d\,(b + 2b_1)}{3\,(b + b_1)}$$

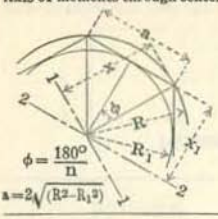
$$I_{1\text{-}1} = \frac{d^3\,(b^2 + 4\,bb_1 + b_1^2)}{36\,(b + b_1)}$$

$$S_{1\text{-}1} = \frac{d^2\,(b^2 + 4\,bb_1 + b_1^2)}{12\,(b_1 + 2\,b)}$$

$$r_{1\text{-}1} = \frac{d}{6\,(b + b_1)}\sqrt{2\,(b^2 + 4\,bb_1 + b_1^2)}$$

REGULAR POLYGON

Axis of moments through center



n = Number of Sides

$A = \frac{1}{4} n a^2 \cot \phi = \frac{1}{2} n R^2 \sin 2\phi = n R_1^2 \tan \phi$

$x = R = \frac{a}{2 \sin \phi}$ $\quad x_1 = R_1 = \frac{a}{2 \tan \phi}$

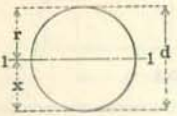
$I_{1\text{-}1} = \frac{A\,(6\,R^2 - a^2)}{24} = I_{2\text{-}2} = \frac{A\,(12\,R_1^2 + a^2)}{48}$

$S_{1\text{-}1} = \frac{A(6R^2 - a^2)}{24R}$ $\quad S_{2\text{-}2} = \frac{A(12R_1^2 + a^2)}{48R_1}$

$r_{1\text{-}1} = \sqrt{\frac{6\,R^2 - a^2}{24}} = r_{2\text{-}2} = \sqrt{\frac{12\,R_1^2 + a^2}{48}}$

CIRCLE

Axis of moments through center



$A = \frac{\pi\, d^2}{4} = \pi r^2$ $\quad 0.78540\ d^2 = 3.14159\ r^2$

$x = \frac{d}{2} = r$

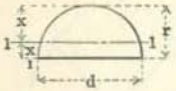
$I_{1\text{-}1} = \frac{\pi\, d^4}{64} = \frac{\pi r^4}{4}$ $\quad 0.04909\ d^4 = 0.78540\ r^4$

$S_{1\text{-}1} = \frac{\pi\, d^3}{32} = \frac{\pi r^3}{4}$ $\quad 0.09818\ d^3 = 0.78540\ r^3$

$r_{1\text{-}1} = \frac{d}{4} = \frac{r}{2}$

HALF CIRCLE

Axis of moments through center of gravity



$A = \frac{\pi\, r^2}{2} = 1.57080\ r^2$

$x = r\left(1 - \frac{4}{3\pi}\right) = 0.57559\ r$ $\quad x_1 = \frac{4r}{3\pi} = 0.42441\ r$

$I_{1\text{-}1} = r^4\left(\frac{\pi}{8} - \frac{8}{9\pi}\right) = 0.10976\ r^4$

$S_{1\text{-}1} = \frac{r^3\,(9\,\pi^2 - 64)}{24\,(3\,\pi - 4)} = 0.19069\ r^3$

$r_{1\text{-}1} = r\sqrt{\frac{9\pi^2 - 64}{6\pi}} = 0.26434\ r$

HALF ELLIPSE

$A = \frac{1}{2}\pi ab$

$m = \frac{4}{3}\frac{a}{\pi}$

$I_{1\text{-}1} = \frac{1}{8}\pi ab^3$ $\quad I_{2\text{-}2} = \frac{1}{8}\pi a^3 b$

$I_{3\text{-}3} = a^3 b\left(\frac{\pi}{8} - \frac{8}{9\pi}\right)$

QUARTER ELLIPSE

$A = \frac{1}{4}\pi ab$

$m = \frac{4}{3}\frac{a}{\pi}$ $\quad n = \frac{4}{3}\frac{b}{\pi}$

$I_{1\text{-}1} = \frac{1}{16}\pi ab^3$ $\quad I_{2\text{-}2} = \frac{1}{16}\pi a^3 b$

$I_{3\text{-}3} = ab^3\left(\frac{\pi}{16} - \frac{4}{9\pi}\right)$ $\quad I_{4\text{-}4} = a^3 b\left(\frac{\pi}{16} - \frac{4}{9\pi}\right)$

p = parameter

$y^2 = 2px - \frac{px^2}{a}$

ELLIPTIC COMPLEMENT

$A = ab\left(1 - \frac{\pi}{4}\right)$

$m = \frac{a}{6\left(1 - \frac{\pi}{4}\right)}$ $\quad n = \frac{b}{6\left(1 - \frac{\pi}{4}\right)}$

$I_{1\text{-}1} = ab^3\left(\frac{1}{8} - \frac{\pi}{16} - \frac{1}{6\left(1 - \frac{\pi}{4}\right)}\right)$

$I_{2\text{-}2} = a^3 b\left(\frac{1}{8} - \frac{\pi}{16} - \frac{1}{6\left(1 - \frac{\pi}{4}\right)}\right)$

Circular Complement Radius, r = a = b

PARABOLA

$A = \frac{4}{3}ab$

$m = \frac{3}{5}a$

$I_{1\text{-}1} = \frac{4}{15}ab^3$ $\quad I_{2\text{-}2} = \frac{32}{105}a^3 b$

$I_{3\text{-}3} = \frac{16}{175}a^3 b$

HALF PARABOLA

$A = \frac{2}{3}ab$

$m = \frac{3}{8}a$ $\quad n = \frac{3}{5}b$

$I_{1\text{-}1} = \frac{2}{15}ab^3$ $\quad I_{2\text{-}2} = \frac{16}{105}a^3 b$

$I_{3\text{-}3} = \frac{16}{480}ab^3$ $\quad I_{4\text{-}4} = \frac{8}{175}a^3 b$

p = parameter

$y^2 = 2px$

PARABOLIC COMPLEMENT

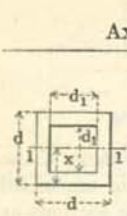
$A = \frac{1}{3}r^2$

$m = n = \frac{1}{5}r$

$I_{1\text{-}1} = I_{2\text{-}2} = \frac{11}{2100}r^4$

MISCELLANEOUS SECTIONS

Axis of Moments through Center of Gravity



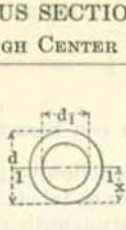
$$A = d^2 - d_1^2$$

$$x = \frac{d}{2}$$

$$I_{1\text{-}1} = \frac{d^4 - d_1^4}{12}$$

$$S_{1\text{-}1} = \frac{d^4 - d_1^4}{6d}$$

$$r_{1\text{-}1} = \sqrt{\frac{d^2 + d_1^2}{12}}$$



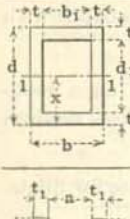
$$A = \frac{\pi(d^2 - d_1^2)}{4}$$

$$x = \frac{d}{2}$$

$$I_{1\text{-}1} = \frac{\pi(d^4 - d_1^4)}{64}$$

$$S_{1\text{-}1} = \frac{\pi(d^4 - d_1^4)}{32d}$$

$$r_{1\text{-}1} = \frac{\sqrt{d^2 + d_1^2}}{4}$$



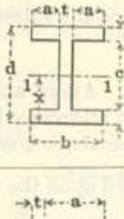
$$A = bd - b_1d_1$$

$$x = \frac{d}{2}$$

$$I_{1\text{-}1} = \frac{bd^3 - b_1d_1^3}{12}$$

$$S_{1\text{-}1} = \frac{bd^3 - b_1d_1^3}{6d}$$

$$r_{1\text{-}1} = \sqrt{\frac{bd^3 - b_1d_1^3}{12A}}$$



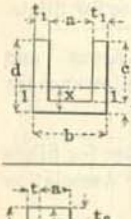
$$A = bd - 2ac$$

$$x = \frac{d}{2}$$

$$I_{1\text{-}1} = \frac{bd^3 - 2ac^3}{12}$$

$$S_{1\text{-}1} = \frac{bd^3 - 2ac^3}{6d}$$

$$r_{1\text{-}1} = \sqrt{\frac{bd^3 - 2ac^3}{12A}}$$



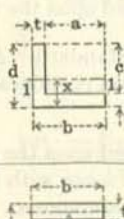
$$A = 2dt_1 + at$$

$$x = \frac{d^2t_1 + \frac{1}{2}t^2a}{A}$$

$$I_{1\text{-}1} = \frac{2t_1d^3 + at^3}{3} - Ax^2$$

$$S_{1\text{-}1} = \frac{I}{d - x}$$

$$r_{1\text{-}1} = \sqrt{\frac{I}{A}}$$



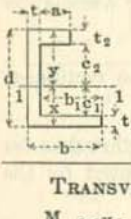
$$A = t(a + b)$$

$$x = \frac{\frac{1}{2}d^2t + \frac{1}{2}t^2a}{A}$$

$$I_{1\text{-}1} = \frac{td^3 + at^3}{3} - Ax^2$$

$$S_{1\text{-}1} = \frac{I}{d - x}$$

$$r_{1\text{-}1} = \sqrt{\frac{I}{A}}$$



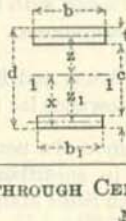
$$A = dt + b_1t_1 + at_2$$

$$x = \frac{\frac{1}{2}d^2t + \frac{1}{2}t_1^2b_1 + at_2(d - \frac{1}{2}t_2)}{A}$$

$$I_{1\text{-}1} = \frac{b_2y^3 - b_1c_1^3 + (a + t)y^3 - ac_2^3}{3}$$

$$S_{1\text{-}1} = \frac{I}{d - x}$$

$$r_{1\text{-}1} = \sqrt{\frac{I}{A}}$$



$$A = bt + b_1t_1$$

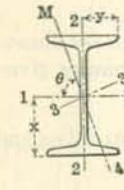
$$x = \frac{bt(d - \frac{1}{2}t) + \frac{1}{2}b_1t_1^2}{A}$$

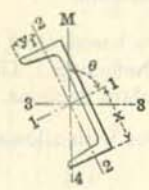
$$I_{1\text{-}1} = \frac{bt^3}{12} + btz^2 + \frac{b_1t_1^3}{12} + b_1t_1z_1^2$$

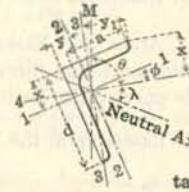
$$S_{1\text{-}1} = \frac{I}{x}$$

$$r_{1\text{-}1} = \sqrt{\frac{I}{A}}$$

Transverse Force oblique through Center of Gravity







$$\tan 2\phi = \frac{2J}{I_2 - I_1}$$

$$J = \frac{t[d(2y - t)(d - 2x) + a(2x - t)(a + 2t - 2y)]}{4}$$

$$I_2 = I_1 \sin^2\theta + I_2 \cos^2\theta$$

$$I_3 = I_2 - J\tan\phi$$

$$I_4 = I_1 + J\tan\phi$$

$$I_4 = I_1 \cos^2\theta + I_2 \sin^2\theta$$

$$\tan\chi = \frac{x_1}{y_1} = -\frac{I_4}{I_3}\cot\theta$$

$$f = M\left(\frac{x}{I_1}\sin\theta + \frac{y}{I_2}\cos\theta\right)$$

$$f = M\left(\frac{x_1}{I_4}\sin\theta + \frac{y_1}{I_3}\cos\theta\right)$$

Formulas for Elements of Rolled Sections

The formulas on the following pages are for the computation of the elements of the sections as tabulated on pages 18 to 55, and are based upon the theoretical straight-line dimensions, treating the sections as made of simple geometrical figures, rectangles, triangles, etc., with or without an allowance for fillets and roundings in accordance with the following rules:

Carnegie Beam Sections. Areas and Elements are based upon rectilinear dimensions, with allowance for fillets, which with these sections are assumed to be of parabolic contour.

The weights are based upon the total area with allowance for fillets.

Beams and Channels. Standard American Sections. Areas and Elements are based upon rectilinear dimensions, without allowance for fillets and roundings.

The weights are based upon the total area with allowance for fillets and roundings, in accordance with the rules adopted by the Association of American Steel Manufacturers.

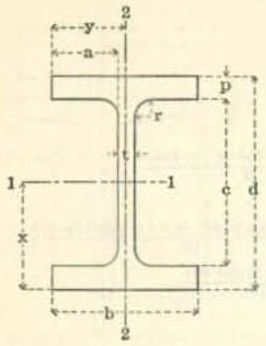
Angles, Tees and Zees. Areas and Elements are based upon rectilinear dimensions, without allowance for fillets and roundings.

Weights are based upon the net area with a certain allowance for fillets and roundings, in accordance with the rules adopted by the Association of American Steel Manufacturers.

Bulb Angles. Areas and Elements are based upon rectilinear dimensions with allowance for fillets and roundings. The formulas given are applicable only to the British Standard Sections.

Weights are based upon the total area with allowance for fillets and roundings.

CARNEGIE BEAM SECTIONS



$$A = dt + 4ap + \frac{4}{3}r^2$$

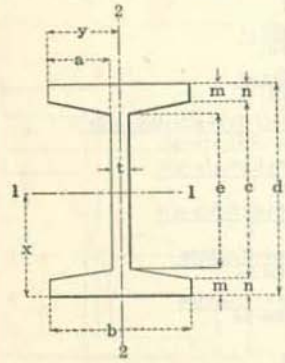
$$x = \frac{d}{2}$$

$$y = \frac{b}{2}$$

$$I_{1\text{-}1} = \frac{bd^3 - 2ac^3}{12} + 4\left[\frac{11}{2100}r^4 + \frac{1}{8}r^2\left(\frac{c}{2} - \frac{r}{5}\right)^2\right]$$

$$I_{2\text{-}2} = \frac{2pb^3 + ct^3}{12} + 4\left[\frac{11}{2100}r^4 + \frac{1}{8}r^2\left(\frac{t}{2} + \frac{r}{5}\right)^2\right]$$

BEAMS



$$A = dt + 2a(m+n)$$

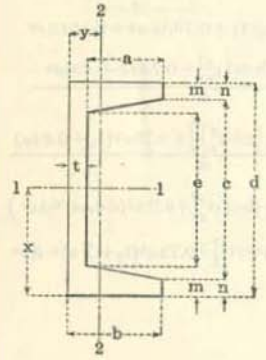
$$x = \frac{d}{2}$$

$$y = \frac{b}{2}$$

$$I_{1\text{-}1} = \frac{bd^3 - \frac{a}{4(m-n)}(c^4 - e^4)}{12}$$

$$I_{2\text{-}2} = \frac{2nb^3 + et^3 + \frac{m-n}{4a}(b^4 - t^4)}{12}$$

CHANNELS



$$A = dt + a(m+n)$$

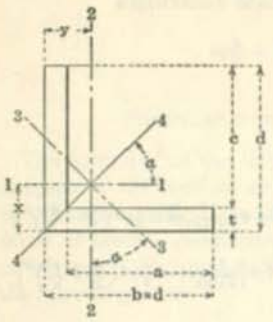
$$x = \frac{d}{2}$$

$$y = \frac{b^2n + \frac{ct^2}{2} + \frac{a(m-n)}{3}(b+2t)}{A}$$

$$I_{1\text{-}1} = \frac{bd^3 - \frac{a}{8(m-n)}(c^4 - e^4)}{12}$$

$$I_{2\text{-}2} = \frac{2nb^3 + et^3 + \frac{m-n}{2a}(b^4 - t^4)}{3} - Ay^2$$

EQUAL ANGLES



$$A = t\,(b+c)$$

$$x = \frac{b^2+ct}{2(b+c)}$$

$$y = x$$

$$\alpha = 45^\circ$$

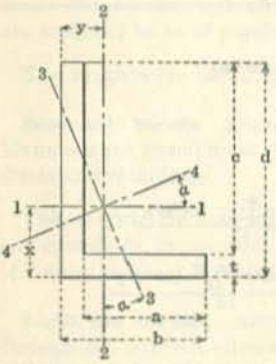
$$I_{1\text{-}1} = \frac{t(b-x)^3+bx^3-a\,(x-t)^3}{3}$$

$$I_{2\text{-}2} = I_{1\text{-}1}$$

$$I_{3\text{-}3} = \frac{ct^3+c^3t+3ct(b-4x+2t)^2+t^4+6t^2(2x-t)^2}{12}$$

$$I_{4\text{-}4} = \frac{ct^3+c^3t+3ctb^2+t^4}{12}$$

UNEQUAL ANGLES



$$A = t(b+c)$$

$$x = \frac{t(b+2c)+c^2}{2(b+c)}$$

$$y = \frac{t(2a+d)+a^2}{2(a+d)}$$

$$\text{Tan}2\alpha = \frac{t[(2y-t)d(d-2x)+a(2x-t)(b+t-2y)]}{2(I_{1\text{-}1}-I_{2\text{-}2})}$$

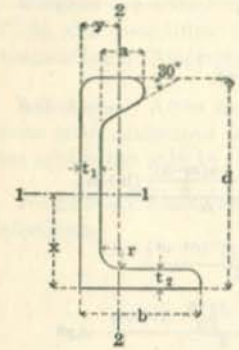
$$I_{1\text{-}1} = \frac{t(d-x)^3+bx^3-a(x-t)^3}{3}$$

$$I_{2\text{-}2} = \frac{t(b-y)^3+dy^3-c(y-t)^3}{3}$$

$$I_{3\text{-}3} = \frac{I_{2\text{-}2}\cos^2\alpha-I_{1\text{-}1}\sin^2\alpha}{\cos 2\alpha}$$

$$I_{4\text{-}4} = \frac{I_{1\text{-}1}\cos^2\alpha-I_{2\text{-}2}\sin^2\alpha}{\cos 2\alpha}$$

BULB ANGLES—British Standard



$$A = dt_1 + (b-t_1)\,t_2 + 0.7334\,a^2 + 0.1610\,r^2$$

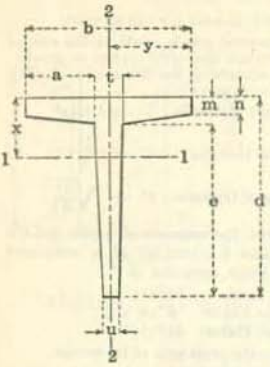
$$x = \frac{\frac{1}{2}\left[d^2t_1+(b-t_1)\,t_2^2\right]+0.73\,(d-0.4a)a^2}{A}$$

$$y = \frac{\frac{1}{2}\left[dt_1^2+t_2\left(b^2-t_1^2\right)\right]+0.73a^2(t_1+0.44a)}{A}$$

$$I_{1\text{-}1} = 0.34\left(\left[d^3t_1+(b-t_1)t_2^3\right]+0.72a^2(d-0.4a)^2-Ax^2\right)$$

$$I_{2\text{-}2} = \frac{1}{3}\left[b^3t^2+(d-t^2)t_1^3\right]+0.73a^2(t_1+\tfrac{1}{2}\,a)^2-Ay^2$$

TEES



$$A = \frac{e(t+u)}{2} + mt + a(m+n)$$

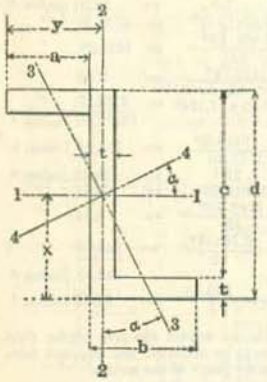
$$x = \frac{6an^2 + 2a(m-n)(m+2n) + 3td^2 - e(t-u)(3d-e)}{6A}$$

$$y = \frac{b}{2}$$

$$I_{1\text{-}1} = \frac{e^3(3u+t) + 4bm^3 - 2a(m-n)^3}{12} - A(x-m)^2$$

$$I_{2\text{-}2} = \frac{nb^3 + (m-n)t^3 + eu^3}{12} + \frac{a(m-n)[2a^2 + (2a+3t)^2]}{36} + \frac{e(t-u)[(t-u)^2 + 2(t+2u)^2]}{144}$$

ZEES



$$A = t(d+2a)$$

$$x = \frac{d}{2}$$

$$y = \frac{2b-t}{2}$$

$$\text{Tan } 2a = \frac{(dt-t^2)(b^2-bt)}{I_{1\text{-}1} - I_{2\text{-}2}}$$

$$I_{1\text{-}1} = \frac{bd^3 - a(d-2t)^3}{12}$$

$$I_{2\text{-}2} = \frac{d(b+a)^3 - 2a^3c - 6ab^2c}{12}$$

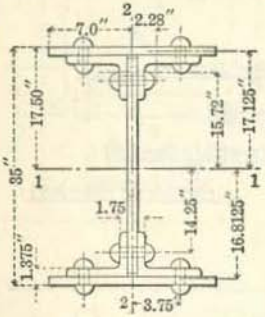
$$I_{3\text{-}3} = \frac{I_{2\text{-}2}\cos^2 a - I_{1\text{-}1}\sin^2 a}{\cos 2a}$$

$$I_{4\text{-}4} = \frac{I_{1\text{-}1}\cos^2 a - I_{2\text{-}2}\sin^2 a}{\cos 2a}$$

COMPOUND SECTIONS

Moments of Inertia, Section Moduli, and Radii of Gyration

The moment of inertia of a compound section about its neutral axis is equal to the sum of the moment of inertia, I, of the component parts about axes through their own centers of gravity, plus the areas A, of the component parts multiplied by the squares of the distances z, of their own centers of gravity from the neutral axis of the compound section, or



$$\text{Moment of Inertia} \quad I^1 = I + Az^2$$

$$\text{Section Modulus} \quad S^1 = \frac{I^1}{n}$$

$$\text{Radius of Gyration} \quad r^1 = \sqrt{\frac{I^1}{A^1}}$$

Example 1. Required the moments of inertia and the section moduli about axes 1-1 and 2-2 of a compound section to be used as a girder, composed of

1 Web Plate 33″x½″
4 Flange Angles 6″x4″x⅝″
2 Flange Plates 14″x¾″

basing the properties on the gross area of the section.

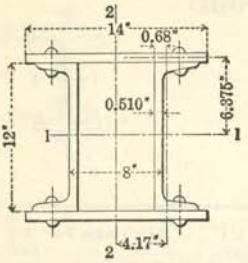
Determine the distances, z, of the center lines of gravity of plates and angles, from the neutral axes of the compound section, from the dimensions given, then for

AXIS 1-1	$I_{1\text{-}1}$ of 4-6″x4″x⅝″ Angles	$= 4 \times$	7.5	$=$	30.00	Inches⁴
	Az^2 of 4-6″x4″x⅝″ "	$= 4 \times$	5.86×15.72^2	$=$	5792.46	"
	$I_{1\text{-}1}$ of 1-33″x½″ Plate	$= 1 \times$	$\frac{0.50 \times 33^3}{12}$	$=$	1497.38	"
	$I_{1\text{-}1}$ of 2-14″x¾″ "	$= 2 \times$	$\frac{14 \times 0.75^3}{12}$	$=$	0.98	"
	Az^2 of 2-14″x¾″ "	$= 2 \times$	10.50×17.125^2	$=$	6158.58	"
	Moment of Inertia, gross section				13479.40	Inches⁴
	Section Modulus, " "	$=$	$\frac{13479.40}{17.50}$	$=$	770.26	Inches³
AXIS 2-2	$I_{2\text{-}2}$ of 4-6″x4″x⅝″ Angles	$= 4 \times$	21.1	$=$	84.40	Inches⁴
	Az^2 of 4-6″x4″x⅝″ "	$= 4 \times$	5.86×2.28^2	$=$	121.85	"
	$I_{2\text{-}2}$ of 1-33″x½″ Plate	$= 1 \times$	$\frac{33 \times 0.50^3}{12}$	$=$	0.34	"
	$I_{2\text{-}2}$ of 2-14″x¾″ "	$= 2 \times$	$\frac{0.75 \times 14^3}{12}$	$=$	343.00	"
	Moment of Inertia, gross section				549.59	Inches⁴
	Section Modulus, " "	$=$	$\frac{549.59}{7}$	$=$	78.51	Inches³

If it is desired to calculate the properties of the net section, viz., to deduct the area of the rivet holes, proceed as follows, assuming that 1″ holes for ⅞″ rivets are to be deducted and that not more than one rivet will be driven in any one leg of the angles in the same plane of the section.

AXIS 1-1	$I_{1\text{-}1}$ of gross section			$=$	13479.40	Inches⁴
Deduct	$I_{1\text{-}1}$ of 4-1″x1.375″ Rectangles	$= 4 \times$	$\frac{1 \times 1.375^3}{12}$	$=$	0.87	"
"	Az^2 of 4-1″x1.375″ "	$= 4 \times$	1.375×16.8125^2	$=$	1554.63	"
"	$I_{1\text{-}1}$ of 2-1″x1.75″ "	$= 2 \times$	$\frac{1.75 \times 1^3}{12}$	$=$	0.29	"
"	Az^2 of 2-1″x1.75″ "	$=$	$2 \times 1.75 \times 14.25^2$	$=$	710.72	"
	Moment of Inertia, net section				11212.89	Inches⁴
	Section Modulus, " "	$=$	$\frac{11212.89}{17.50}$	$=$	640.74	Inches³
AXIS 2-2	$I_{2\text{-}2}$ of gross section			$=$	549.59	Inches⁴
Deduct	$I_{2\text{-}2}$ of 4-1″x1.375″ Rectangles	$= 4 \times$	$\frac{1.375 \times 1^3}{12}$	$=$	0.46	"
"	Az^2 of 4-1″x1.375″ "	$= 4 \times$	1.375×3.75^2	$=$	77.34	"
"	$I_{2\text{-}2}$ of 2-1″x1.75″ "	$= 2 \times$	$\frac{1 \times 1.75^3}{12}$	$=$	0.89	"
	Moment of Inertia, net section				470.90	Inches⁴
	Section Modulus, " "	$=$	$\frac{470.90}{7}$	$=$	67.27	Inches³

COMPOUND SECTIONS—Concluded



EXAMPLE 2. Required the moments of inertia and radii of gyration about axes 1-1 and 2-2 of a column section composed as follows:—

2 Channels 12″x30 pounds per foot,
2 Flange Plates 14″x¾″,

properties to be based on the gross section, no deduction being made for holes.

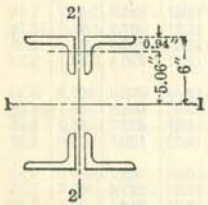
Determine the distances, z, of center lines of gravity for the various sections from the neutral axes 1-1 and 2-2, in accordance with the dimensions given, then for

AXIS 1-1

$I_{1\text{-}1}$ of 2-12″ Channels 30 lbs.	$= 2 \times$	161.2	$=$	322.40 Inches⁴
$I_{1\text{-}1}$ of 2-14″x¾″ Plates	$= 2 \times \frac{14 \times 0.75^3}{12}$		$=$	0.98 "
Az^2 of 2-14″x¾″ "	$= 2 \times 10.5 \times 6.375^2$		$=$	853.45 "
Moment of Inertia, gross section				1176.83 Inches⁴
Radius of Gyration, " "	$= \sqrt{\frac{1176.83}{38.58}}$		$=$	5.52 Inches

AXIS 2-2

$I_{2\text{-}2}$ of 2-12″ Channels 30 lbs.	$= 2 \times$	5.2	$=$	10.40 Inches⁴
Az^2 of 2-12″ Channels 30 lbs.	$= 2 \times$	8.79×4.17^2	$=$	305.70 "
$I_{2\text{-}2}$ of 2-14″x¾″ Plates	$= 2 \times \frac{0.75 \times 14^3}{12}$		$=$	343.00 "
Moment of Inertia, gross section				659.10 Inches⁴
Radius of Gyration, " "	$= \sqrt{\frac{659.10}{38.58}}$		$=$	4.13 Inches



EXAMPLE 3. Required the radii of gyration about axes 1-1 and 2-2 of a strut section composed as follows:—

4-6″x4″x⅜″ Angles latticed by 5/16″ bars,

properties to be based on the gross section of angles, no deductions being made for rivet holes nor any allowance for lattice bars.

Determine the distances, z, of center lines of gravity of angles from neutral axes 1-1 and 2-2 in accordance with the dimensions given, then for

AXIS 1-1

$I_{1\text{-}1}$ of 4-6″x4″x⅜″ Angles	$= 4 \times$	4.9	$=$	19.60 Inches⁴
Az^2 of 4-6″x4″x⅜″ "	$= 4 \times 3.61 \times 5.06^2$		$=$	369.72 "
Moment of Inertia, gross section				389.32 Inches⁴
Radius of Gyration, " "	$= \sqrt{\frac{389.32}{14.44}}$		$=$	5.19 Inches

AXIS 2-2 From tables of radii of gyration for 2 angles placed back to back axis 2-2, ⅝″ apart, $r_{2\text{-}2}$ of 4-6″x4″x⅜″ angles = 2.97 Inches.

Where sections are assembled without any web or flange plates, as, for example, latticed channel columns or latticed angle struts, the radius of gyration, $r_{1\text{-}1}$ can be readily obtained, without considering the moment of inertia, from the radius of gyration, r of one section about its neutral axis, and the distance, z, between the center of gravity of the section and the neutral axis parallel to the axis of section.

$$r_{1\text{-}1} = \sqrt{\frac{I + Az^2}{A}}, \text{ where } \frac{I}{A} = r^2, \text{ and } r_{1\text{-}1} = \sqrt{r^2 + z^2}$$

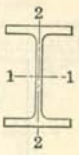
Thus, in the above example,

$$r_{1\text{-}1} = \sqrt{1.17^2 + 5.06^2} = 5.19 \text{ Inches}$$

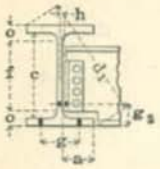
ELEMENTS

CARNEGIE BEAM SECTION

ELEMENTS OF SECTIONS



Section Index and Nominal Size	Depth of Section	Weight per Foot	Area of Section	Flange Width	Web Thickness	Axis 1-1			Axis 2-2		
						I	S	r	I	S	r
	In.	Lbs.	In.^{2}	In.	In.	In.^{4}	In.^{3}	In.	In.^{4}	In.^{3}	In.
	36.851	300	88.23	16.189	.958	20317.7	1102.7	15.18	1215.9	150.2	3.71
CB 362	36.550	275	80.87	16.121	.890	18400.2	1006.8	15.08	1095.1	135.9	3.68
36 x 16	36.243	250	73.53	16.055	.824	16499.3	910.5	14.98	975.4	121.5	3.64
	36.000	230	67.65	16.000	.769	15012.9	834.0	14.90	882.2	110.3	3.61
	36.645	192	56.47	12.150	.740	12208.5	666.3	14.70	377.2	62.1	2.58
CB 361	36.395	175	51.47	12.096	.686	10978.8	603.3	14.61	335.0	55.4	2.55
36 x 12	36.183	160	47.06	12.045	.635	9033.2	549.1	14.53	299.8	49.8	2.52
	36.000	147	43.23	12.000	.590	9040.4	502.2	14.46	269.9	45.0	2.50
	33.786	260	76.47	16.150	.870	15037.7	890.2	14.02	1068.0	132.3	3.74
CB 332	33.546	240	70.58	16.090	.810	13750.6	819.8	13.96	972.5	120.9	3.71
33 x 16	33.272	220	64.70	16.046	.766	12385.5	744.5	13.84	870.0	108.4	3.67
	33.000	200	58.82	16.000	.720	11049.6	669.7	13.71	769.5	96.2	3.62
	33.530	167	49.12	12.179	.719	8836.1	527.1	13.41	321.0	52.7	2.56
CB 331	33.342	152	44.69	12.115	.655	7998.5	479.8	13.38	287.8	47.5	2.54
33 x 12	33.161	138	40.58	12.056	.596	7223.0	435.6	13.34	257.5	42.7	2.52
	33.000	125	36.75	12.000	.540	6514.3	394.8	13.31	230.1	38.4	2.50
	30.781	240	70.58	14.218	.888	11356.0	737.9	12.69	766.9	107.9	3.30
CB 302	30.522	220	64.70	14.146	.816	10320.4	676.3	12.63	693.9	98.1	3.28
30 x 14	30.263	200	58.82	14.073	.743	9305.7	615.0	12.58	622.7	88.5	3.25
	30.000	180	52.93	14.000	.670	8301.4	553.4	12.52	552.7	79.0	3.23
	30.742	165	48.52	10.725	.755	7326.7	476.7	12.29	258.7	48.2	2.31
CB 301	30.538	151	44.41	10.662	.692	6663.7	436.4	12.25	233.4	43.8	2.29
30 x 10½	30.344	138	40.58	10.604	.634	6049.5	398.7	12.21	210.1	39.6	2.28
	30.162	126	37.05	10.551	.581	5486.7	363.8	12.17	189.0	35.8	2.26
	30.000	115	33.81	10.500	.530	4985.3	332.4	12.14	170.6	32.5	2.25



CARNEGIE BEAM SECTIONS

DIMENSIONS OF SECTIONS

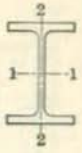
I
DIMENSIONS

Section Index and Nominal Depth	Weight per Foot	Depth of Section	Flange		Web		Distance							Usual Gage g
			Width	Thickness	Thickness	$\frac{1}{2}$ Thickness +	a	c	f	o	d^1	Min. g_2	Clear h	
	Lbs.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.
CB 362 36	300	36⅛	16¼	1¾	1	½	7⅜	33 7/16	31⅛	2¾	40 5/16	4	9/16	5½
	275	36 9/16	16⅛	1 9/16	15/16	½	7⅜	33 7/16	31⅛	2 9/16	40	4	9/16	5½
	250	36¼	16 1/16	1 3/16	⅞	7/16	7⅜	33 7/16	31⅛	2 7/16	39 11/16	4	½	5½
	230	36	16	1 5/16	13/16	7/16	7⅜	33 7/16	31⅛	2 5/16	39 7/16	4	½	5½
CB 361 36	192	36 1 1/16	12 5/16	1 5/16	¾	⅜	5¾	34⅛	32⅛	2 5/16	38 1 1/16	3½	7/16	5½
	175	36 1/16	12⅛	1 3/16	1 1/16	⅜	5¾	34⅛	32⅛	2 3/16	38 1/16	3½	7/16	5½
	160	36 1/16	12 1/16	1 1/16	1 1/16	⅜	5¾	34⅛	32⅛	2 1/16	38 1/16	3½	7/16	5
	147	36	12	15/16	⅞	5/16	5¾	34⅛	32⅛	1 15/16	38	3½	⅝	5
CB 332 33	260	33 1 5/16	16 5/16	1 9/16	⅞	7/16	7 1 1/16	30¾	28¾	2 9/16	37½	4	½	5½
	240	33 9/16	16⅛	1 3/16	1 3/16	7/16	7 1 1/16	30¾	28¾	2 7/16	37¼	4	½	5½
	220	33 1/16	16 1/16	1 1/16	1 1/16	7/16	7 1 1/16	30¾	28¾	2 1/16	37	4	½	5½
	200	33	16	1⅛	¾	⅜	7 1 1/16	30¾	28¾	2⅛	36 1 1/16	4	7/16	5
CB 331 33	167	33 9/16	12 5/16	1 1/16	¾	⅜	5¾	31⅜	29⅜	2 1/16	35¾	3½	7/16	5
	152	33⅛	12⅛	1	¾	⅜	5¾	31⅜	29⅜	2	35 9/16	3½	7/16	5
	138	33 1/16	12 1/16	⅞	⅝	5/16	5¾	31⅜	29⅜	1 15/16	35 1/16	3½	⅜	5
	125	33	12	15/16	9/16	5/16	5¾	31⅜	29⅜	1 15/16	35⅛	3½	⅜	5
CB 302 30	240	30¾	14 3/16	1 9/16	⅞	½	6 1 1/16	27 9/16	25½	2⅝	33 15/16	4	9/16	5½
	220	30½	14⅛	1 7/16	1 3/16	7/16	6 1 1/16	27 9/16	25½	2½	33⅝	4	½	5½
	200	30¼	14 1/16	1 3/16	¾	⅜	6 1 1/16	27 9/16	25½	2⅜	33⅜	4	7/16	5½
	180	30	14	1 5/16	1 1/16	⅜	6 1 1/16	27 9/16	25½	2¼	33¼	4	7/16	5½
CB 301 30	165	30¾	10¾	1¼	¾	7/16	5	28 5/16	26¾	2	32 9/16	3¼	½	5½
	151	30 5/16	10 1/16	1 5/16	1 1/16	⅝	5	28 5/16	26¾	1⅞	32⅝	3¼	7/16	5½
	138	30¼	10¼	1 1/16	⅝	⅝	5	28 5/16	26¾	1 13/16	32 9/16	3¼	7/16	5
	126	30 5/16	10 1/16	15/16	9/16	5/16	5	28 5/16	26¾	1 1/16	32	3	⅜	5
	115	30	10½	⅞	½	5/16	5	28 5/16	26¾	1⅝	31 13/16	3	⅜	5

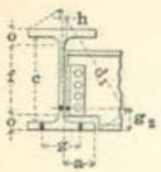
ELEMENTS

CARNEGIE BEAM SECTIONS

ELEMENTS OF SECTIONS



Section Index and Nominal Size	Depth of Section	Weight per Foot	Area of Section	Flange Width	Web Thickness	Axis 1-1			Axis 2-2		
						I	S	r	I	S	r
	In.	Lbs.	In.^{2}	In.	In.	In.^{4}	In.^{3}	In.	In.^{4}	In.^{3}	In.
	27.598	190	55.87	14.176	.756	7376.9	534.6	11.49	610.7	86.2	3.31
CB 272	27.400	175	51.47	14.118	.698	6746.8	492.5	11.45	556.6	78.9	3.29
27 x 14	27.200	160	47.04	14.059	.639	6121.8	450.1	11.41	503.2	71.6	3.27
	27.000	145	42.64	14.000	.580	5508.7	408.1	11.37	451.0	64.4	3.25
	27.742	137	40.29	9.977	.688	4975.9	358.7	11.11	187.1	37.5	2.16
	27.536	124	36.47	9.913	.624	4472.1	324.8	11.07	166.7	33.6	2.14
CB 271	27.340	112	32.94	9.855	.566	4007.6	293.2	11.03	148.0	30.0	2.12
27 x 9¾	27.166	101	29.70	9.799	.510	3595.7	264.7	11.00	131.7	26.9	2.11
	27.000	91	26.76	9.750	.461	3217.0	238.3	10.97	116.9	24.0	2.09
	26.820	85	25.00	9.750	.461	2899.3	216.2	10.77	103.0	21.1	2.03
	24.664	160	47.06	14.123	.670	5065.7	410.8	10.38	526.0	74.5	3.34
CB 244	24.526	150	44.10	14.082	.629	4720.5	384.9	10.35	489.3	69.5	3.33
24 x 14	24.388	140	41.16	14.041	.588	4380.4	359.2	10.32	453.1	64.5	3.32
	24.250	130	38.23	14.000	.547	4045.1	333.6	10.29	417.5	59.6	3.31
	24.310	120	35.29	12.089	.539	3669.7	301.9	10.20	277.8	46.0	2.81
CB 243	24.156	110	32.34	12.044	.494	3343.5	276.8	10.17	252.2	41.9	2.79
24 x 12	24.000	100	29.41	12.000	.450	3020.5	251.7	10.14	226.9	37.8	2.78
	24.308	94	27.64	9.844	.499	2734.9	225.0	9.95	130.2	26.4	2.17
CB 242	24.154	85	24.99	9.797	.452	2457.2	203.5	9.92	116.2	23.7	2.16
24 x 9¾	24.000	76	22.35	9.750	.405	2184.4	182.0	9.89	102.6	21.0	2.14
CB 241 24 x 8½	24.000	70	20.58	8.500	.400	1953.8	162.8	9.74	68.0	16.0	1.82
	21.492	136	40.09	13.141	.606	3313.7	308.4	9.10	401.7	61.1	3.17
CB 213	21.372	128	37.65	13.105	.570	3103.4	290.4	9.08	375.9	57.4	3.16
21 x 13	21.248	120	35.28	13.070	.535	2890.9	272.1	9.05	349.7	53.5	3.15
	21.126	112	32.93	13.034	.499	2683.7	254.1	9.03	324.3	49.8	3.14
	21.000	104	30.57	13.000	.465	2475.3	235.7	9.00	298.7	45.9	3.13
	21.358	98	28.82	9.097	.535	2234.5	209.2	8.80	125.0	27.5	2.08
CB 212	21.240	92	27.05	9.064	.502	2086.4	196.5	8.78	116.3	25.7	2.07
21 x 9	21.120	86	25.28	9.032	.470	1939.3	183.6	8.76	107.7	23.8	2.06
	21.000	80	23.53	9.000	.438	1794.4	170.9	8.73	99.2	22.0	2.05
	21.370	76	22.34	8.109	.469	1684.0	157.6	8.68	70.67	17.4	1.78
	21.248	70	20.59	8.073	.433	1542.9	145.2	8.66	64.3	15.9	1.77
CB 211	21.126	64	18.82	8.036	.396	1403.3	132.9	8.64	58.2	14.5	1.76
21 x 8	21.000	58	17.05	8.000	.360	1263.2	120.3	8.61	52.0	13.0	1.75
	20.890	55	16.17	8.000	.360	1166.7	111.7	8.49	47.29	11.8	1.71



CARNEGIE BEAM SECTIONS

DIMENSIONS OF SECTIONS

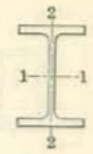
I
DIMENSIONS

Section Index and Nominal Depth	Weight per Foot	Depth of Section	Flange		Web		Distance							Usual Gage g
			Width	Thickness	Thickness	½ Thickness +	a	c	f	o	d¹	Min. g_2	Clear h	
	Lbs.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.
	190	27⅝	14⅜16	1¼	⅝	7/16	6¾	25	23¼	2⅝16	31⅛16	3½	½	5½
CB 272	175	27⅝	14¼	1⅛16	1⅛16	⅝	6¾	25	23¼	2⅛16	30¹³⁄₁₆	3½	7/16	5½
27	160	27⅜16	14⅛16	1⅛16	⅝	⅝	6¾	25	23¼	2	30⅝	3½	7/16	5
	145	27	14	1	9/16	5/16	6¾	25	23¼	1⅞	30⅞16	3½	⅜	5
	137	27¾	10	1⅛	1⅛16	⅝	4¹¹⁄₁₆	25⅞16	24⅛	1¹³⁄₁₆	29½	3¼	7/16	5
	124	27⅜16	9¹³⁄₁₆	1	⅝	5/16	4¹¹⁄₁₆	25⅞16	24⅛	1¹¹⁄₁₆	29¼	3	⅜	5
CB 271	112	27⅜	9⅞	15/16	9/16	5/16	4¹¹⁄₁₆	25⅞16	24⅛	1⅝	29⅛16	3	⅜	5
27	101	27⅜16	9¹³⁄₁₆	15/16	½	5/16	4¹¹⁄₁₆	25⅞16	24⅛	1½	28⅞	3	⅜	5
	91	27	9¾	¾	7/16	¼	4¹¹⁄₁₆	25⅞16	24⅛	1⅜16	28¹¹⁄₁₆	3	9/16	5
	85	26¹³⁄₁₆	9¾	1¹¹⁄₁₆	7/16	¼	4¹¹⁄₁₆	25⅞16	24⅛	1⅝16	28⅝16	3	9/16	5
	160	24¹¹⁄₁₆	14⅛	1⅛	1⅛16	⅝	6¾	22¾	20¾	1¹³⁄₁₆	28⅞16	3¼	7/16	5
CB 244	150	24½	14⅛16	1⅛16	⅝	⅝	6¾	22⅜	20¾	1⅞	28⅝16	3¼	7/16	5
24	140	24⅜	14⅛16	1	9/16	5/16	6¾	22⅝	20¾	1¹³⁄₁₆	28⅛	3¼	⅜	5
	130	24¼	14	15/16	9/16	5/16	6¾	22⅜	20¾	1¾	28	3¼	⅜	5
	120	24⅝16	12⅛16	1⅜16	9/16	5/16	5¹³⁄₁₆	22¾	20¾	1¾	27⅜16	3	⅜	5
CB 243	110	24⅜	12⅛16	⅞	½	¼	5¹³⁄₁₆	22¾	20¾	1¹¹⁄₁₆	27	3	9/16	5
24	100	24	12	1⅜16	7/16	¼	5¹³⁄₁₆	22⅜	20¾	1⅝	26⅞	3	9/16	5
	94	24⅝16	9⅞	1⅜16	½	¼	4¹¹⁄₁₆	22¾	21⅜	1⅞16	26¼	2¾	9/16	5
CB 242	85	24⅛	9¹³⁄₁₆	¾	7/16	¼	4¹¹⁄₁₆	22¾	21⅜	1¾	26⅛16	2¾	9/16	5
24	76	24	9¾	1⅜16	⅜	¼	4¹¹⁄₁₆	22⅝	21⅜	1⅝16	25¹⁵⁄₁₆	2¾	9/16	5
CB 241 24	70	24	8½	1⅜16	⅜	¼	4⅝16	22⅝	21⅜	1⅝16	25½	2¾	9/16	5
	136	21½	13¼	1⅝16	⅝	5/16	6⅝16	19⅝16	17⅞	1¹³⁄₁₆	25¼	3	⅝	5
CB 213	128	21⅜	13¼	1	9/16	5/16	6⅝16	19⅝16	17⅞	1¾	25⅛	3	⅝	5
21	120	21¼	13⅛16	1⅝16	9/16	5/16	6⅝16	19⅝16	17⅞	1¹¹⁄₁₆	24¹⁵⁄₁₆	3	⅝	5
	112	21⅛	13⅛16	⅞	½	¼	6⅝16	19⅝16	17⅞	1⅝	24¹³⁄₁₆	3	5/16	5
	104	21	13	1⅜16	7/16	¼	6⅝16	19⅝16	17⅞	1⅝16	24¹³⁄₁₆	3	9/16	5
	98	21¾	9¼	1	9/16	5/16	4⅝16	19⅝16	17⅞	1¾	23¼	3	⅝	5
CB 212	92	21¼	9⅛16	15/16	½	¼	4⅝16	19⅝16	17⅞	1¹¹⁄₁₆	23⅛	3	⅝	5
21	86	21⅛	9⅛16	⅞	½	¼	4⅝16	19⅝16	17⅞	1⅝	23	3	5/16	5
	80	21	9	1⅜16	7/16	¼	4⅝16	19⅝16	17⅞	1⅝16	22⅞	3	5/16	5
	76	21⅜	8⅛	1⅜16	½	¼	3¹³⁄₁₆	19¾	18⅝	1⅜	22⅞	2¾	5/16	5
CB 211	70	21¼	8⅛16	¾	7/16	¼	3¹³⁄₁₆	19¾	18⅝	1⅝16	22¾	2¾	5/16	5
21	64	21⅛	8⅛16	1⅛16	⅜	¼	3¹³⁄₁₆	19¾	18⅝	1¼	22⅝	2¾	7/16	5
	58	21	8	⅝	⅜	5/16	3¹³⁄₁₆	19¾	18⅝	1⅛16	22½	2¾	¼	5
	55	27⅞	8	9/16	⅜	5/16	3¹³⁄₁₆	19¾	18⅝	1⅛	22⅞16	2¾	¼	5

ELEMENTS

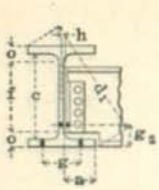
CARNEGIE BEAM SECTIONS

ELEMENTS OF SECTIONS



Section Index and Nominal Size	Depth of Section	Weight per Foot	Area of Section	Flange Width	Web Thickness	Axis 1-1			Axis 2-2		
						I	S	r	I	S	r
	In.	Lbs.	In.^{2}	In.	In.	In.^{4}	In.^{3}	In.	In.^{4}	In.^{3}	In.
CB 183 18 x 12	18.238	100	29.40	12.069	.498	1783.4	195.6	7.79	253.4	42.0	2.94
	18.120	93	27.35	12.034	.463	1648.4	181.9	7.76	234.0	38.9	2.93
	18.000	86	25.29	12.000	.429	1514.1	168.2	7.74	214.7	35.8	2.91
CB 182 18 x 8½	18.242	78	22.94	8.565	.471	1318.8	144.6	7.58	90.9	21.2	1.99
	18.110	72	21.17	8.530	.436	1208.1	133.4	7.55	82.9	19.4	1.98
	18.000	67	19.69	8.500	.406	1117.1	124.1	7.53	76.4	18.0	1.97
CB 181 18 x 7½	18.252	58	17.05	7.573	.393	960.8	105.3	7.51	49.0	13.0	1.70
	18.114	52	15.30	7.534	.354	855.1	94.4	7.48	43.3	11.5	1.68
	18.024	*51	15.00	7.555	.375	810.0	89.9	7.35	40.5	10.7	1.64
	18.000	47	13.82	7.500	.320	768.6	85.4	7.46	38.7	10.3	1.67
CB 165 16 x 14	16.236	115	33.82	14.068	.532	1665.6	205.2	7.02	426.2	60.6	3.55
	16.110	107	31.46	14.032	.496	1537.2	190.8	6.99	393.9	56.1	3.54
	16.000	100	29.41	14.000	.464	1426.8	178.3	6.97	366.0	52.3	3.53
CB 164 16 x 12	16.240	90	26.46	12.076	.495	1275.5	157.1	6.94	230.0	38.1	2.95
	16.120	83	24.41	12.039	.458	1167.7	144.9	6.92	210.4	35.0	2.94
	16.000	76	22.34	12.000	.419	1061.3	132.7	6.89	191.1	31.8	2.92
CB 163 16 x 8½	16.226	68	20.00	8.563	.438	923.7	113.9	6.80	81.3	19.0	2.02
	16.114	63	18.52	8.531	.406	849.9	105.5	6.77	74.6	17.5	2.01
	16.000	58	17.06	8.500	.375	776.6	97.1	6.75	68.0	16.0	2.00
CB 162 16 x 7	16.254	50	14.70	7.072	.362	666.0	81.9	6.73	38.2	10.8	1.61
	16.128	45	13.23	7.036	.326	595.0	73.8	6.71	34.0	9.7	1.60
	15.934	*43	12.65	7.085	.375	523.8	65.7	6.44	28.9	8.2	1.51
	16.000	40	11.75	7.000	.290	524.6	65.6	6.68	29.8	8.5	1.59
CB 161 16 x 6	16.012	38	11.17	6.024	.314	475.1	59.3	6.52	19.2	6.4	1.31
	15.930	35	10.29	6.000	.290	435.5	54.7	6.50	17.5	5.8	1.30

*Special Section—Web Thickness ⅝".



CARNEGIE BEAM SECTIONS

DIMENSIONS OF SECTIONS

I
DIMENSIONS

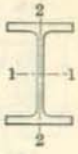
Section Index and Nominal Depth	Weight per Foot	Depth of Section	Flange		Web		Distance							Usual Gage g
			Width	Thickness	Thickness	½ Thickness +	a	c	f	o	d^1	Min. g_2	Clear h	
	Lbs.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.
CB 183	100	18¼	12 1/16	⅞	½	¼	5 13/16	16½	15⅛	1 9/16	21⅞	3	5/16	5
18	93	18⅛	12 1/16	13/16	7/16	¼	5 13/16	16½	15⅛	1½	21¾	3	5/16	5
	86	18	12	¾	7/16	¼	5 13/16	16½	15⅛	1 7/16	21⅝	3	5/16	5
CB 182	78	18¼	8 9/16	⅞	½	¼	4 1/16	16½	15⅛	1 9/16	20⅛	3	5/16	5
18	72	18⅛	8½	13/16	7/16	¼	4 1/16	16½	15⅛	1½	20	3	5/16	5
	67	18	8½	¾	7/16	¼	4 1/16	16½	15⅛	1 7/16	19 15/16	3	5/16	5
	58	18¼	7 9/16	1 1/16	⅜	¼	3⅝	16⅞	15⅞	1 9/16	19¾	2¾	5/16	5
CB 181	52	18⅛	7 9/16	⅝	⅜	5/16	3⅜	16⅞	15⅞	1⅛	19⅝	2¾	¼	5
18	*51	18	7 9/16	9/16	⅜	5/16	3⅜	16⅞	15⅞	1 1/16	19 9/16	2¾	¼	5
	47	18	7½	9/16	5/16	5/16	3⅜	16⅞	15⅞	1 1/16	19½	2¾	¼	5
CB 165	115	16¼	14 1/16	1 5/16	9/16	5/16	6 13/16	14⅜	13	1⅝	21½	3¼	⅜	5
16	107	16⅛	14	⅞	½	¼	6 13/16	14⅜	13	1 9/16	21⅜	3¼	5/16	5
	100	16	14	13/16	7/16	¼	6 15/16	14⅜	13	1½	21¼	3¼	5/16	5
CB 164	90	16¼	12 1/16	13/16	½	¼	5 13/16	14⅜	13⅜	1 7/16	20¼	3	5/16	5
16	83	16⅛	12 1/16	¾	7/16	¼	5 13/16	14⅜	13⅜	1⅜	20⅛	3	5/16	5
	76	16	12	11/16	7/16	¼	5 13/16	14⅜	13⅜	1 5/16	20	3	5/16	5
CB 163	68	16¼	8 9/16	¾	7/16	¼	4 1/16	14⅜	13⅜	1 7/16	18⅜	2¾	5/16	5
16	63	16⅛	8½	¾	⅜	¼	4 1/16	14⅜	13⅜	1⅜	18¼	2¾	5/16	5
	58	16	8½	11/16	⅜	5/16	4 1/16	14⅜	13⅜	1 5/16	18⅛	2¾	¼	5
	50	16¼	7 1/16	⅝	⅜	5/16	3⅜	14 13/16	14	1⅛	17¾	2½	¼	4
CB 162	45	16⅛	7 1/16	9/16	5/16	5/16	3⅜	14 13/16	14	1 1/16	17⅝	2½	¼	4
16	*43	15 13/16	7 1/16	½	⅜	5/16	3⅜	14 13/16	14	1	17 1/16	2½	¼	4
	40	16	7	½	5/16	5/16	3⅜	14 13/16	14	1	17½	2½	¼	4
CB 161	38	16	6	½	5/16	5/16	2⅞	14 13/16	14	1	17¼	2½	¼	3½
16	35	15 13/16	6	½	5/16	5/16	2⅞	14 13/16	14	15/16	17 1/16	2½	¼	3½

*Special Section—Web Thickness ⅜".

ELEMENTS

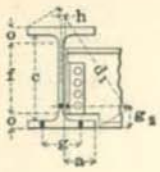
CARNEGIE BEAM SECTIONS

ELEMENTS OF SECTIONS



Section Index and Nominal Size	Depth of Section	Weight per Foot	Area of Section	Flange Width	Web Thickness	Axis 1-1			Axis 2-2		
						I	S	r	I	S	r
	In.	Lbs.	In.²	In.	In.	In.⁴	In.³	In.	In.⁴	In.³	In.
	18.510	425	124.99	16.506	1.912	6420.5	693.7	7.17	2301.0	278.8	4.29
	18.246	405	119.12	16.423	1.829	6010.5	658.8	7.10	2168.2	264.0	4.27
	17.978	385	113.22	16.340	1.746	5609.4	624.0	7.04	2037.4	249.4	4.24
	17.710	365	107.34	16.255	1.661	5221.4	589.7	6.97	1909.1	234.9	4.22
	17.438	345	101.47	16.172	1.578	4843.4	555.5	6.91	1783.5	220.6	4.19
	17.164	325	95.58	16.087	1.493	4475.9	521.6	6.84	1659.9	206.4	4.17
	16.890	305	89.70	16.000	1.406	4121.5	488.0	6.78	1539.1	192.4	4.14
	16.752	295	86.76	15.956	1.362	3948.1	471.4	6.75	1479.4	185.4	4.13
	16.614	285	83.82	15.912	1.318	3778.1	454.8	6.71	1420.7	178.6	4.12
	16.472	275	80.87	15.870	1.276	3607.8	438.1	6.68	1362.0	171.6	4.10
	16.332	265	77.93	15.826	1.232	3442.4	421.6	6.65	1304.2	164.8	4.09
	16.192	255	74.99	15.781	1.187	3280.0	405.1	6.61	1247.1	158.0	4.08
	16.050	245	72.06	15.738	1.144	3119.6	388.7	6.58	1190.6	151.3	4.06
	15.908	235	69.11	15.693	1.099	2961.9	372.4	6.55	1134.5	144.6	4.05
CB 146	15.764	225	66.17	15.650	1.056	2806.2	356.0	6.51	1079.1	137.9	4.04
14 x 15	15.622	215	63.23	15.604	1.010	2654.7	339.9	6.48	1024.5	131.3	4.03
	15.478	205	60.28	15.559	.965	2505.0	323.7	6.45	970.3	124.7	4.01
	15.334	195	57.34	15.513	.919	2358.2	307.6	6.41	916.8	118.2	4.00
	15.188	185	54.41	15.469	.875	2213.5	291.5	6.38	863.9	111.7	3.98
	15.042	175	51.47	15.424	.830	2071.7	275.5	6.34	811.6	105.2	3.97
	14.896	165	48.52	15.377	.783	1932.6	259.5	6.31	759.9	98.8	3.96
	14.750	155	45.58	15.330	.736	1796.8	243.6	6.28	709.0	92.5	3.94
	14.602	145	42.64	15.284	.690	1662.7	227.7	6.24	658.5	86.2	3.93
	14.452	135	39.70	15.239	.645	1530.4	211.8	6.21	608.4	79.9	3.92
	14.162	131	38.52	15.468	.874	1358.4	191.8	5.94	547.3	70.8	3.77
	14.304	125	36.75	15.191	.597	1402.1	196.0	6.18	559.4	73.7	3.90
	14.154	115	33.82	15.145	.551	1275.9	180.3	6.14	510.9	67.5	3.89
	14.018	106	31.18	15.103	.509	1164.1	166.1	6.11	467.6	61.9	3.87
	13.866	96	28.23	15.056	.462	1042.1	150.3	6.08	419.9	55.8	3.86
	13.714	86	25.28	15.008	.414	923.0	134.6	6.04	373.1	49.7	3.84
CB 145	14.370	105	30.88	12.101	.536	1169.6	162.8	6.15	292.6	48.4	3.08
14 x 12	14.186	95	27.93	12.050	.485	1044.0	147.2	6.11	262.0	43.5	3.06
	14.000	85	24.99	12.000	.435	921.3	131.6	6.07	232.0	38.7	3.05
CB 144	14.382	75	22.05	10.086	.468	823.5	114.5	6.11	134.5	26.7	2.47
14 x 10	14.238	68	19.99	10.043	.425	738.8	103.8	6.08	120.6	24.0	2.46
	14.094	61	17.94	10.000	.382	656.2	93.1	6.05	107.1	21.4	2.44
CB 143	14.242	58	17.05	8.070	.413	609.4	85.6	5.98	62.8	15.6	1.92
14 x 8	14.122	53	15.59	8.035	.378	552.5	78.2	5.95	56.8	14.1	1.91
	14.000	48	14.12	8.000	.343	496.0	70.9	5.93	50.8	12.7	1.90
	14.240	42	12.35	6.822	.342	431.5	60.6	5.91	30.2	8.8	1.56
CB 142	14.160	39	11.47	6.798	.318	398.3	56.3	5.89	27.7	8.2	1.56
14 x 6¾	14.000	*38	11.18	6.855	.375	357.5	51.1	5.66	24.2	7.1	1.47
	14.080	36	10.58	6.774	.294	365.6	51.9	5.88	25.4	7.5	1.55
	14.000	33	9.71	6.750	.270	333.4	47.6	5.86	23.0	6.8	1.54
CB 141											
14 x 6	13.964	30	8.82	6.000	.270	292.0	41.8	5.75	15.5	5.2	1.33

*Special Section—Web Thickness 5/16".



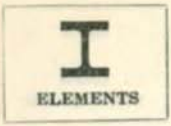
CARNEGIE BEAM SECTIONS

DIMENSIONS OF SECTIONS

I
DIMENSIONS

Section Index and Nominal Depth	Weight per Foot	Depth of Section	Flange		Web		Distance							Usual Gage g
			Width	Thickness	Thickness	½ Thickness +	a	c	f	o	d^1	Min. g_2	Clear h	
	Lbs.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.
	425	18½	16½	3 1/16	1 15/16	1	7 3/16	12⅜	11	3¾	24 13/16			5½
	405	18¼	16 7/16	2 15/16	1 13/16	15/16	7 3/16	12⅜	11	3⅝	24 9/16			5½
	385	18	16⅜	2 13/16	1¾	⅞	7 3/16	12⅜	11	3½	24 5/16			5½
	365	17 11/16	16¼	2 11/16	1 11/16	13/16	7 3/16	12⅜	11	3⅜	24			5½
	345	17 5/16	16 5/16	2½	1⅝	13/16	7 3/16	12⅜	11	3 5/16	23 13/16			5½
	325	17 3/16	16 1/16	2 5/16	1½	¾	7 3/16	12⅜	11	3 1/16	23½			5½
	305	16⅞	16	2¼	1⅜	¾	7 3/16	12⅜	11	2 15/16	23 5/16			5½
	295	16¾	15 15/16	2 5/16	1⅜	11/16	7 3/16	12⅜	11	2⅞	23⅛			5½
	285	16⅝	15 15/16	2⅛	1 5/16	11/16	7 3/16	12⅜	11	2 13/16	23			5½
	275	16½	15⅞	2 1/16	1¼	1 1/16	7 3/16	12⅜	11	2¾	22⅞			5½
	265	16 5/16	15 13/16	2	1¼	⅝	7 3/16	12⅜	11	2 11/16	22¾			5½
	255	16 1/16	15¾	1 15/16	1 3/16	⅝	7 3/16	12⅜	11	2⅝	22⅝			5½
	245	16 1/16	15¾	1 13/16	1⅛	⅝	7 3/16	12⅜	11	2 9/16	22½			5½
	235	15 13/16	15 11/16	1¾	1⅛	9/16	7 3/16	12⅜	11	2½	22⅜			5½
CB 146	225	15¾	15⅝	1 11/16	1 1/16	9/16	7 3/16	12⅜	11	2⅜	22¼			5½
14	215	15⅝	15⅝	1⅝	1	9/16	7 3/16	12⅜	11	2 5/16	22⅛			5½
	205	15½	15 5/16	1 5/16	15/16	½	7 3/16	12⅜	11	2¼	21 15/16			5½
	195	15 5/16	15½	1½	15/16	½	7 3/16	12⅜	11	2 3/16	21 13/16			5½
	185	15 5/16	15½	1⅜	⅞	7/16	7 3/16	12⅜	11	2⅛	21 11/16			5½
	175	15 1/16	15 1/16	1 5/16	13/16	7/16	7 3/16	12⅜	11	2 1/16	21 9/16			5½
	165	14⅞	15⅜	1¼	13/16	7/16	7 3/16	12⅜	11	1 15/16	21 7/16			5½
	155	14¾	15 5/16	1 5/16	¾	⅜	7 3/16	12⅜	11	1⅞	21 5/16			5½
	145	14⅝	15 5/16	1⅛	11/16	⅜	7 3/16	12⅜	11	1 13/16	21⅛			5
	135	14 7/16	15¼	1	⅝	⅜	7 3/16	12⅜	11	1¾	21			5
	131	14 5/16	15 1/16	⅞	⅞	7/16	7 3/16	12⅜	11	1⅝	21			5
	125	14 5/16	15 3/16	15/16	⅝	5/16	7 3/16	12⅜	11	1 11/16	20⅞			5
	115	14⅛	15⅛	⅞	9/16	5/16	7 3/16	12⅜	11	1 9/16	20¾			5
	106	14	15⅛	13/16	½	5/16	7 3/16	12⅜	11	1½	20⅝	3	⅜	5
	96	13⅞	15 1/16	¾	7/16	¼	7 3/16	12⅜	11	1 7/16	20½	3	5/16	5
	86	13 15/16	15	13/16	7/16	¼	7 3/16	12⅜	11	1⅜	20 5/16	3	5/16	5
	105	14⅜	12¼	1	9/16	5/16	5 13/16	12¾	11	1 11/16	18 13/16	3	⅜	5
CB 145	95	14 5/16	12 1/16	⅞	½	¼	5 13/16	12⅜	11	1⅝	18⅝	3	5/16	5
14	85	14	12	13/16	7/16	¼	5 13/16	12⅜	11	1½	18 7/16	3	5/16	5
	75	14⅜	10 1/16	13/16	7/16	¼	4 13/16	12¾	11⅝	1⅜	17 9/16	2¾	5/16	5
CB 144	68	14¼	10 1/16	11/16	5/16	¼	4 13/16	12¾	11⅝	1 5/16	17 5/16	2¾	5/16	5
14	61	14⅛	10	⅝	⅜	¼	4 13/16	12¾	11⅝	1¼	17 1/16	2¾	5/16	5
	58	14¼	8 1/16	11/16	7/16	¼	3⅞	12¾	11⅝	1 5/16	16⅝	2¾	5/16	5
CB 143	53	14⅛	8 1/16	⅝	⅜	¼	3⅞	12¾	11⅝	1¼	16¼	2¾	5/16	5
14	48	14	8	⅝	5/16	5/16	3⅞	12¾	11⅝	1 3/16	16⅛	2¾	¼	5
	42	14¼	6 13/16	9/16	5/16	5/16	3¼	13 1/16	12¼	1	15 13/16	2½	¼	4
	39	14 5/16	6 13/16	½	5/16	5/16	3¼	13 1/16	12¼	1	15 11/16	2½	¼	4
CB 142	*38	14	6⅞	7/16	⅜	5/16	3¼	13 1/16	12¼	⅞	15⅝	2½	¼	4
14	36	14 1/16	6¾	½	9/16	5/16	3¼	13 1/16	12¼	15/16	15⅝	2½	¼	4
	33	14	6¾	7/16	¼	5/16	3¼	13 1/16	12¼	⅞	15 9/16	2½	¼	4
CB 141														
14	30	13 15/16	6	7/16	¼	5/16	2⅞	13 1/16	12¼	⅞	15 9/16	2½	¼	3½

*Special Section—Web Thickness ⅜".

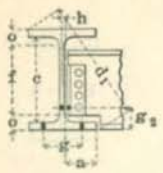


CARNEGIE BEAM SECTIONS

ELEMENTS OF SECTIONS

Section Index and Nominal Size	Depth of Section	Weight per Foot	Area of Section	Flange Width	Web Thickness	Axis 1-1			Axis 2-2		
						I	S	r	I	S	r
	In.	Lbs.	In.²	In.	In.	In.⁴	In.³	In.	In.⁴	In.³	In.
CB 127 12 x 14	12.000	230	67.64	14.980	1.980	1461.9	243.7	4.65	945.5	126.2	3.74
	12.000	220	64.70	14.735	1.735	1426.6	237.8	4.70	898.2	121.9	3.73
	12.000	210	61.76	14.490	1.490	1391.3	231.9	4.75	852.9	117.7	3.72
	12.000	200	58.82	14.245	1.245	1356.1	226.0	4.80	809.5	113.7	3.71
	12.000	190	55.88	14.000	1.000	1320.8	220.1	4.86	767.8	109.7	3.71
CB 126 12 x 14	12.000	180	52.94	14.735	1.492	1218.1	203.0	4.80	702.4	95.3	3.64
	12.000	170	50.00	14.490	1.247	1182.8	197.1	4.86	666.9	92.1	3.65
	12.000	160	47.06	14.245	1.002	1147.5	191.3	4.94	633.0	88.9	3.67
	12.000	150	44.12	14.000	.757	1112.2	185.4	5.02	600.4	85.8	3.69
CB 125 12 x 12	12.000	140	41.18	12.736	1.376	934.8	155.8	4.76	372.4	58.5	3.01
	12.000	130	38.24	12.491	1.131	899.5	149.9	4.85	350.5	56.1	3.03
	12.000	120	35.28	12.245	.885	864.1	144.0	4.95	329.6	53.8	3.06
	12.000	110	32.34	12.000	.640	828.8	138.1	5.06	309.9	51.6	3.10
CB 124C 12 x 12	12.000	102	29.99	12.490	.943	721.4	120.2	4.90	260.6	41.7	2.95
	12.000	95	27.93	12.318	.771	696.6	116.1	4.99	249.7	40.5	2.99
	12.000	88	25.88	12.147	.600	672.0	112.0	5.10	239.2	39.4	3.04
	12.000	82	24.11	12.000	.453	650.8	108.5	5.20	230.5	38.4	3.09
CB 124B 12 x 12	12.000	76	22.35	12.270	.670	560.2	93.4	5.01	187.5	30.6	2.90
	12.000	70	20.58	12.123	.523	539.0	89.8	5.12	180.7	29.8	2.96
	12.000	65	19.11	12.000	.400	521.3	86.9	5.22	175.2	29.2	3.03
CB 123B 12 x 9	12.260	66	19.41	9.073	.448	525.7	85.8	5.20	99.1	21.8	2.26
	12.118	60	17.65	9.034	.409	472.0	77.9	5.17	89.0	19.7	2.25
	12.000	55	16.17	9.000	.375	428.4	71.4	5.15	80.9	18.0	2.24
CB 123 12 x 8	12.258	50	14.69	8.071	.361	400.5	65.4	5.22	57.5	14.2	1.98
	12.130	45	13.23	8.036	.326	356.9	58.8	5.19	51.2	12.7	1.97
	12.000	40	11.76	8.000	.290	313.7	52.3	5.17	44.9	11.2	1.95
CB 122 12 x 6½	12.236	36	10.59	6.568	.308	280.1	45.8	5.14	25.4	7.7	1.55
	12.022	*34	9.99	6.635	.375	238.1	39.6	4.88	21.0	6.3	1.45
	12.118	32	9.40	6.534	.274	246.3	40.7	5.12	22.3	6.8	1.54
	12.000	28	8.22	6.500	.240	213.4	35.6	5.10	19.2	5.9	1.53
CB 121 12 x 6	11.924	25	7.34	6.000	.240	183.0	30.7	4.99	13.8	4.6	1.37

*Special Section—Web Thickness 5/16".



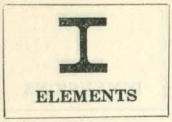
CARNEGIE BEAM SECTIONS

DIMENSIONS OF SECTIONS

I
DIMENSIONS

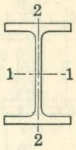
Section Index and Nominal Depth	Weight per Foot	Depth of Section	Flange		Web		Distance							Usual Gage g
			Width	Thickness	Thickness	½Thickness +	a	c	f	o	d1	Min. g2	Clear h	
	Lbs.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.
	230	12	15	1 11/16	2	1	6½	8⅝	7¼	2⅝	19 3/16			5½
CB 127	220	12	14¾	1 11/16	1¾	⅞	6½	8⅝	7¼	2⅝	19			5½
12	210	12	14½	1 11/16	1½	¾	6½	8⅝	7¼	2⅝	18 13/16			5½
	200	12	14¼	1 11/16	1¼	⅝	6½	8⅝	7¼	2⅝	18⅝			5½
	190	12	14	1 11/16	1	½	6½	8⅝	7¼	2⅝	18 7/16			5½
	180	12	14¾	1 5/16	1 1/16	¾	6⅝	9⅜	8	2	19			5½
CB 126	170	12	14½	1 5/16	1¼	⅝	6⅝	9⅜	8	2	18 13/16			5½
12	160	12	14¼	1 5/16	1	9/16	6⅛	9⅜	8	2	18⅜			5½
	150	12	14	1 5/16	¾	7/16	6⅛	9⅜	8	2	18 7/16			5½
	140	12	12¼	1 1/16	1⅜	¾	5 11/16	9 13/16	8⅝	1 11/16	17½			5
CB 125	130	12	12½	1 1/16	1⅛	⅝	5 11/16	9 13/16	8⅝	1 11/16	17⅜			5
12	120	12	12¼	1 1/16	⅞	½	5 11/16	9 13/16	8⅝	1 11/16	17⅛			5
	110	12	12	1 1/16	⅝	⅜	5 11/16	9 13/16	8⅝	1 11/16	17			5
	102	12	12⅛	15/16	15/16	½	5 13/16	10⅜	9¼	1⅜	17⅜	2¾	9/16	5
CB 124C	95	12	12 5/16	15/16	¾	7/16	5 13/16	10⅜	9¼	1⅜	17¼	2¾	½	5
12	88	12	12 3/16	15/16	⅝	5/16	5 13/16	10⅜	9¼	1⅜	17⅛	2¾	⅜	5
	82	12	12	15/16	½	¼	5 13/16	10⅜	9¼	1⅜	17	2¾	5/16	5
	76	12	12¼	⅝	1 1/16	⅜	5 13/16	10¾	9⅝	1 5/16	17 3/16	2¾	7/16	5
CB 124B	70	12	12⅛	⅝	9/16	5/16	5 13/16	10¾	9⅝	1 5/16	17 1/16	2¾	⅜	5
12	65	12	12	⅝	7/16	¼	5 13/16	10¾	9⅝	1 5/16	17	2¾	5/16	5
	66	12¼	9¼	15/16	½	¼	4 13/16	10⅜	9½	1⅜	15 13/16	2¾	5/16	5
CB 123B	60	12⅛	9 1/16	¾	7/16	¼	4 13/16	10⅜	9½	1 5/16	15⅛	2¾	5/16	5
12	55	12	9	1 1/16	⅝	5/16	4 13/16	10⅜	9½	1¼	15	2¾	¼	5
	50	12¼	8 1/16	⅝	⅜	5/16	3⅞	10 11/16	9⅞	1 3/16	14 11/16	2¾	¼	5
CB 123	45	12⅛	8 1/16	9/16	5/16	5/16	3⅞	10 11/16	9⅞	1⅛	14 9/16	2¾	¼	5
12	40	12	8	½	5/16	5/16	3⅞	10 11/16	9⅞	1 1/16	14 7/16	2¾	¼	5
	36	12¼	6 15/16	9/16	5/16	5/16	3 13/16	11⅛	10⅜	15/16	13⅞	2½	¼	4
CB 122	*34	12	6⅞	11/16	⅜	5/16	3 13/16	11⅛	10⅜	1 5/16	13¾	2½	¼	4
12	32	12⅛	6 15/16	½	¼	5/16	3 13/16	11⅛	10⅜	⅞	13 13/16	2½	¼	4
	28	12	6½	7/16	¼	⅜	3 13/16	11⅛	10⅜	1 5/16	13 11/16	2½	5/16	4
CB 121 12	25	11 15/16	6	⅜	¼	⅜	2 13/16	11⅛	10⅜	1 5/16	13⅜	2½	5/16	3½

*Special Section—Web Thickness ⅜".

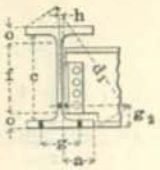


CARNEGIE BEAM SECTIONS

ELEMENTS OF SECTIONS



Section Index and Nominal Size	Depth of Section	Weight per Foot	Area of Section	Flange Width	Web Thickness	Axis 1-1			Axis 2-2		
						I	S	r	I	S	r
	In.	Lbs.	In.^{2}	In.	In.	In.^{4}	In.^{3}	In.	In.^{4}	In.^{3}	In.
	10.000	140	41.17	13.177	1.777	623.2	124.6	3.89	391.4	59.4	3.08
	10.000	132	38.81	12.941	1.541	603.5	120.7	3.94	369.6	57.1	3.09
CB 105	10.000	124	36.46	12.706	1.306	583.9	116.8	4.00	349.0	54.9	3.09
10 x 12	10.000	116	34.11	12.471	1.071	564.3	112.9	4.07	329.4	52.8	3.11
	10.000	108	31.76	12.236	.836	544.8	109.0	4.14	310.7	50.8	3.13
	10.000	100	29.40	12.000	.600	525.1	105.0	4.23	292.8	48.8	3.16
	10.000	92	27.06	10.647	1.162	423.2	84.6	3.96	163.1	30.6	2.46
CB 104	10.000	84	24.70	10.411	.926	403.6	80.7	4.04	152.0	29.2	2.48
10 x 10	10.000	77	22.65	10.206	.721	386.5	77.3	4.13	142.9	28.0	2.51
	10.000	70	20.59	10.000	.515	369.3	73.9	4.24	134.3	26.9	2.55
	10.000	64	18.81	10.441	.791	308.8	61.8	4.05	106.3	20.4	2.38
CB 103A	10.000	59	17.34	10.294	.644	296.5	59.3	4.13	101.7	19.8	2.42
10 x 10	10.000	54	15.87	10.147	.497	284.3	56.9	4.23	97.3	19.2	2.48
	10.000	49	14.40	10.000	.350	272.0	54.4	4.35	93.0	18.6	2.54
	10.000	42	12.35	8.324	.644	190.4	38.1	3.93	36.8	8.9	1.73
CB 102	10.000	36	10.58	8.147	.467	175.6	35.1	4.07	34.4	8.5	1.80
10 x 8	10.000	31	9.11	8.000	.320	163.4	32.7	4.23	32.5	8.1	1.89
	10.228	30	8.82	6.068	.298	163.2	31.9	4.30	18.5	6.1	1.45
CB 101	10.098	26	7.64	6.029	.259	139.5	27.6	4.27	15.7	5.2	1.43
10 x 6	10.000	23	6.76	6.000	.230	122.2	24.4	4.25	13.7	4.6	1.43
	9.902	21	6.17	6.000	.230	107.6	21.7	4.18	12.0	4.0	1.39
	9.242	48	14.11	9.082	.398	221.1	47.8	3.96	73.8	16.3	2.29
CB 93	9.122	43	12.65	9.041	.357	195.5	42.9	3.93	65.4	14.5	2.28
9 x 9	9.000	38	11.17	9.000	.316	170.4	37.9	3.91	57.1	12.7	2.26
	9.192	35	10.29	6.556	.335	155.4	33.8	3.89	26.6	8.1	1.61
CB 92	9.096	32	9.40	6.528	.307	140.5	30.9	3.87	24.0	7.4	1.60
9 x 6½	9.000	29	8.53	6.500	.279	126.0	28.0	3.84	21.5	6.6	1.59



CARNEGIE BEAM SECTIONS

DIMENSIONS OF SECTIONS

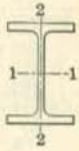
I
DIMENSIONS

Section Index and Nominal Depth	Weight per Foot	Depth of Section	Flange		Web		Distance							Usual Gage g
			Width	Thickness	Thickness	½ Thickness +	a	c	f	o	d^1	Min. g_2	Clear h	
	Lbs.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.
	140	10	13 3/16	1	1 5/16	15/16	5 3/16	7 13/16	6 3/16	1 3/8	16 5/16			5
	132	10	12 15/16	1	1 5/16	13/16	5 3/16	7 13/16	6 3/16	1 3/8	16 5/16			5
CB 105	124	10	12 11/16	1	1 5/16	11/16	5 3/16	7 13/16	6 3/16	1 3/8	16 5/16			5
10	116	10	12 1/2	1	1 1/16	9/16	5 3/16	7 13/16	6 3/16	1 3/8	16			5
	108	10	12 1/4	1	15/16	7/16	5 3/16	7 13/16	6 3/16	1 3/8	15 13/16			5
	100	10	12	1	7/8	7/16	5 3/16	7 13/16	6 3/16	1 3/8	15 3/8			5
	92	10	10 5/8	13/16	1 3/16	5/8	4 3/16	8 3/16	7 3/16	1 5/16	14 5/8			5
CB 104	84	10	10 7/16	13/16	1 1/16	1/2	4 3/16	8 3/16	7 3/16	1 5/16	14 3/16			5
10	77	10	10 5/16	13/16	3/4	3/8	4 3/16	8 3/16	7 3/16	1 5/16	14 5/16			5
	70	10	10	13/16	1/2	7/16	4 3/16	8 3/16	7 3/16	1 5/16	14 3/16			5
	64	10	10 7/16	9/16	1 3/16	7/16	4 7/16	8 7/16	7 7/16	1 1/16	14 1/2	2 1/16	1/2	5
CB 103A	59	10	10 5/16	9/16	1 1/16	3/8	4 7/16	8 7/16	7 7/16	1 1/16	14 3/8	2 1/16	7/16	5
10	54	10	10 5/16	9/16	1/2	1/4	4 7/16	8 7/16	7 7/16	1 1/16	14 1/4	2 1/16	5/16	5
	49	10	10	9/16	5/8	5/16	4 7/16	8 7/16	7 7/16	1 1/16	14 3/16	2 1/16	1/4	5
	42	10	8 5/16	5/8	5/8	3/8	3 7/16	9 5/16	8 5/16	1 1/16	13 1/16	2 1/16	7/16	5
CB 102	36	10	8 1/16	5/8	7/16	1/4	3 7/16	9 5/16	8 5/16	1 1/16	12 13/16	2 1/16	5/16	5
10	31	10	8	5/8	5/16	5/16	3 7/16	9 5/16	8 5/16	1 1/16	12 13/16	2 1/16	1/4	5
	30	10 1/4	6 1/16	1/2	5/16	5/16	2 15/16	9 5/16	8 5/16	13/16	11 15/16	2 1/16	1/4	3 1/2
CB 101	26	10 1/8	6	7/16	1/4	5/16	2 15/16	9 5/16	8 5/16	3/4	11 13/16	2 1/16	1/4	3 1/2
10	23	10	6	3/8	1/4	1/4	2 15/16	9 5/16	8 5/16	1 1/16	11 13/16	2 1/16	3/16	3 1/2
	21	9 7/8	6	5/16	1/4	1/4	2 15/16	9 5/16	8 5/16	5/8	11 5/8	2 1/16	3/16	3 1/2
	48	9 1/4	9 1/16	9/16	5/8	1/4	4 3/16	8	7	1 1/16	13	2 1/16	5/16	5
CB 93	43	9 1/8	9 1/16	1/2	3/8	5/16	4 3/16	8	7	1 1/16	12 7/8	2 1/16	1/4	5
9	38	9	9	1/2	5/16	5/16	4 3/16	8	7	1	12 3/4	2 1/16	1/4	5
	35	9 1/16	6 15/16	9/16	5/16	5/16	3 1/16	8	7	1 1/16	11 5/16	2 1/16	1/4	4
CB 92	32	9 1/16	6 1/16	1/2	5/16	5/16	3 1/16	8	7	1 1/16	11 5/16	2 1/16	1/4	4
9	29	9	6 1/16	1/2	1/4	5/16	3 1/16	8	7	1	11 1/16	2 1/16	1/4	4

ELEMENTS

CARNEGIE BEAM SECTIONS

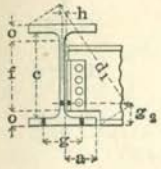
ELEMENTS
OF
SECTIONS



Section Index and Nominal Size	Depth of Section	Weight per Foot	Area of Section	Flange Width	Web Thickness	Axis 1-1			Axis 2-2		
						I	S	r	I	S	r
	In.	Lbs.	In.²	In.	In.	In.⁴	In.³	In.	In.⁴	In.³	In.
CB 83 8 x 8	9.606	90	26.47	8.520	.810	391.2	81.4	3.84	124.4	29.2	2.17
	9.456	84	24.71	8.469	.759	358.6	75.8	3.81	114.5	27.0	2.15
	9.302	78	22.93	8.418	.708	326.5	70.2	3.77	104.7	24.9	2.14
	9.150	72	21.17	8.366	.656	295.9	64.7	3.74	95.3	22.8	2.12
	8.994	66	19.40	8.314	.604	265.9	59.1	3.70	86.1	20.7	2.11
	8.838	60	17.63	8.261	.551	237.1	53.7	3.67	77.1	18.7	2.09
	8.680	54	15.87	8.208	.498	209.2	48.2	3.63	68.3	16.6	2.07
	8.520	48	14.10	8.155	.445	182.2	42.8	3.59	59.7	14.6	2.06
	8.360	42	12.34	8.100	.390	156.2	37.4	3.56	51.4	12.7	2.04
	8.198	36	10.58	8.046	.336	131.3	32.0	3.52	43.4	10.8	2.02
	8.060	31	9.10	8.000	.290	110.9	27.5	3.49	36.7	9.2	2.01
CB 82 8 x 6½	8.196	30	8.81	6.559	.298	107.8	26.3	3.50	23.4	7.1	1.63
	8.098	27	7.93	6.529	.268	95.9	23.7	3.48	20.8	6.4	1.62
	8.000	24	7.06	6.500	.239	84.3	21.1	3.46	18.3	5.6	1.61

STANDARD MILL SECTIONS

Section Index and Nominal Size	Depth of Section	Weight per Foot	Area of Section	Flange Width	Web Thickness	Axis 1-1			Axis 2-2		
						I	S	r	I	S	r
	In.	Lbs.	In.²	In.	In.	In.⁴	In.³	In.	In.⁴	In.³	In.
B 40 9 x 5¼	9.000	25.0	7.34	5.380	.380	95.5	21.2	3.61	8.8	3.3	1.09
	9.000	20.5	6.02	5.234	.234	86.6	19.2	3.79	8.0	3.1	1.15
B 39 8 x 5	8.000	21.0	6.17	5.110	.360	63.4	15.9	3.21	6.6	2.6	1.03
	8.000	17.5	5.14	4.981	.231	57.4	14.5	3.36	6.0	2.4	1.08
H-Beams											
H 4 8 x 8	8.000	37.7	11.00	8.125	.500	120.8	30.2	3.31	36.9	9.1	1.83
	8.000	34.3	10.00	8.000	.375	115.5	28.9	3.40	35.1	8.8	1.87
	8.000	32.6	9.50	7.938	.313	112.8	28.2	3.45	34.2	8.6	1.90
H 3A 6 x 6	6.000	27.5	8.08	6.063	.438	49.3	16.4	2.47	16.0	5.3	1.41
	6.000	25.0	7.33	5.938	.313	47.0	15.7	2.53	14.9	5.0	1.43
H 3 6 x 6	6.000	22.5	6.61	6.063	.375	41.0	13.7	2.49	12.2	4.0	1.36
	6.000	20.0	5.86	5.938	.250	38.8	12.9	2.57	11.4	3.8	1.39
H 2 5 x 5	5.000	18.9	5.47	5.000	.313	23.8	9.5	2.08	7.8	3.1	1.20
H 1 4 x 4	4.000	13.8	3.99	4.000	.313	10.7	5.3	1.64	3.6	1.8	0.95



CARNEGIE BEAM SECTIONS

DIMENSIONS OF SECTIONS

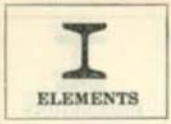
I
DIMENSIONS

Section Index and Nominal Depth	Weight per Foot	Depth of Section	Flange		Web		Distance							Usual Gage g
			Width	Thickness	Thickness	½ Thickness +	a	c	f	o	d^1	Min. g_2	Clear h	
	Lbs.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.
CB 8	90	9 5/8	8 1/2	1 3/16	1 3/16	7/16	3 7/8	7 3/16	6 1/4	1 11/16	12 7/8			5 1/2
	84	9 7/16	8 1/2	1 1/8	3/4	7/16	3 7/8	7 3/16	6 1/4	1 5/8	12 3/4			5
	78	9 5/16	8 7/16	1 1/16	1 1/16	3/8	3 7/8	7 3/16	6 1/4	1 9/16	12 9/16			5
	72	9 1/8	8 3/8	1	1 1/16	3/8	3 7/8	7 3/16	6 1/4	1 7/16	12 7/16			5
	66	9	8 5/16	7/8	5/8	5/16	3 7/8	7 3/16	6 1/4	1 3/8	12 1/4			5
	60	8 13/16	8 1/4	1 3/16	9/16	5/16	3 7/8	7 3/16	6 1/4	1 5/16	12 1/8			5
	54	8 11/16	8 3/16	3/4	1/2	1/4	3 7/8	7 3/16	6 1/4	1 1/4	11 15/16			5
	48	8 1/2	8 1/8	1 1/16	7/16	1/4	3 7/8	7 3/16	6 1/4	1 1/8	11 13/16			5
	42	8 3/8	8 1/8	9/16	5/8	1/4	3 7/8	7 3/16	6 1/4	1 1/16	11 11/16	2 1/2	5/16	5
	36	8 3/16	8 1/16	1/2	5/16	3/16	3 7/8	7 3/16	6 1/4	1	11 1/2	2 1/2	1/4	5
	31	8 1/16	8	7/16	5/16	3/16	3 7/8	7 3/16	6 1/4	7/8	11 3/8	2 1/2	1/4	5
CB 8	30	8 3/16	6 9/16	1/2	5/16	3/16	3 3/16	7 3/16	6 1/4	1	10 1/2	2 1/2	1/4	4
	27	8 1/8	6 1/2	7/16	1/4	3/16	3 3/16	7 3/16	6 1/4	15/16	10 7/16	2 1/2	1/4	4
	24	8	6 1/2	3/8	1/4	1/8	3 3/16	7 3/16	6 1/4	7/8	10 5/16	2 1/2	3/16	4

STANDARD MILL SECTIONS

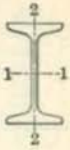
Section Index and Nominal Depth	Weight per Foot	Depth of Section	Flange		Web		Distance							Usual Gage g	Max. Flange Rivet
			Width	Thickness	Thickness	½ Thickness +	a	c	f	o	d^1	Min. g_2	Clear h		
	Lbs.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.
B 40	25.0	9	5 3/8	3/8	3/8	1/4	2 1/2	...	7 1/2	3/4	10 1/2	2 1/4	5/16	3	7/8
9	20.5	9	5 1/4	3/8	1/4	1/8	2 1/2	...	7 1/2	3/4	10 7/16	2 1/4	5/16	3	7/8
B 39	21.0	8	5 1/8	5/16	3/8	3/16	2 3/8	...	6 5/8	1 1/16	9 1/2	2 1/4	1/4	3	3/4
8	17.5	8	5	5/16	1/4	1/8	2 3/8	...	6 5/8	1 1/16	9 7/16	2 1/4	3/16	3	3/4
H-Beams															
H 4	37.7	8	8 1/8	7/16	1/2	1/4	3 13/16	...	6 1/4	7/8	11 7/16	....	.....	5	7/8
8	34.3	8	8	7/16	3/8	3/16	3 13/16	...	6 1/4	7/8	11 5/16	.....	.....	5	7/8
	32.6	8	7 15/16	7/16	5/16	3/16	3 13/16	...	6 1/4	7/8	11 1/4	.....	.....	5	7/8
H 3A	27.5	6	6 1/16	1/2	7/16	1/4	2 13/16	...	4 1/4	7/8	8 9/16	.....	.....	3 1/2	7/8
6	25.0	6	5 15/16	1/2	5/16	3/16	2 13/16	...	4 1/4	7/8	8 1/2	.....	.....	3 1/2	7/8
H 3	22.5	6	6 1/16	3/8	3/8	3/16	2 7/8	...	4 7/16	3/4	8 9/16	.....	.....	3 1/2	7/8
6	20.0	6	5 15/16	3/8	1/4	1/8	2 7/8	...	4 7/16	3/4	8 1/2	.....	.....	3 1/2	7/8
H 2 5	18.9	5	5	7/16	5/16	3/16	2 3/8	...	3 3/8	1 3/16	7 1/16	.....	.....	2 3/4	3/4
H 1 4	13.8	4	4	3/8	5/16	3/16	1 7/8	...	2 1/2	3/4	5 11/16	.....	.....	2 1/4	5/8

Dimensions for Flange Thickness of Standard Mill Sections are the averages between dimensions toe and root of Flanges.

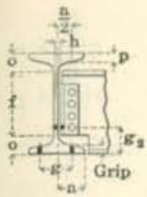


AMERICAN STANDARD BEAMS

ELEMENTS OF SECTIONS



Section Index and Nominal Size	Depth of Beam	Weight per Foot	Area of Section	Width of Flange	Web Thickness	Axis 1-1			Axis 2-2		
						I	S	r	I	S	r
	In.	Lbs.	In.²	In.	In.	In.⁴	In.³	In.	In.⁴	In.³	In.
B 18 24x7⅞	24	120.0	35.13	8.048	.798	3010.8	250.9	9.26	84.9	21.1	1.56
		115.0	33.67	7.987	.737	2940.5	245.0	9.35	82.8	20.7	1.57
		110.0	32.18	7.925	.675	2869.1	239.1	9.44	80.6	20.3	1.58
		105.9	30.98	7.875	.625	2811.5	234.3	9.53	78.9	20.0	1.60
B 1 24x7	24	100.0	29.25	7.247	.747	2371.8	197.6	9.05	48.4	13.4	1.29
		95.0	27.79	7.186	.686	2301.5	191.8	9.08	47.0	13.0	1.30
		90.0	26.30	7.124	.624	2230.1	185.8	9.21	45.5	12.8	1.32
		85.0	24.84	7.063	.563	2159.8	180.0	9.33	44.2	12.5	1.33
		79.9	23.33	7.000	.500	2087.2	173.9	9.46	42.9	12.2	1.36
B 2 20x7	20	100.0	29.20	7.273	.873	1648.3	164.8	7.51	52.4	14.4	1.34
		95.0	27.74	7.200	.800	1599.7	160.0	7.59	50.5	14.0	1.35
		90.0	26.26	7.126	.726	1550.3	155.0	7.68	48.7	13.7	1.36
		85.0	24.80	7.053	.653	1501.7	150.2	7.78	47.0	13.3	1.38
		81.4	23.74	7.000	.600	1466.3	146.6	7.86	45.8	13.1	1.39
B 3 20x6¼	20	75.0	21.90	6.391	.641	1263 5	126 3	7 60	30.1	9.4	1.17
		70.0	20.42	6.317	.567	1214.2	121.4	7.71	28.9	9.2	1.19
		65.4	19.08	6.250	.500	1169.5	116.9	7.83	27.9	8.9	1.21
B 19 18x7	18	90.0	26.29	7.236	.796	1256.5	139.6	6.91	51.9	14.3	1.40
		85.0	24.81	7.154	.714	1216.6	135.2	7.00	49.8	14.0	1.42
		80.0	23.34	7.072	.632	1176.8	130.8	7.10	47.9	13.6	1.43
		75.6	22.04	7.000	.560	1141.8	126.9	7.20	46.3	13.2	1.45
B 4 18x6	18	70 0	20.46	6.251	.711	917.5	101.9	6.70	24.5	7.8	1.09
		65.0	18.98	6.169	.629	877.7	97.5	6.80	23.4	7.6	1.11
		60.0	17.50	6.087	.547	837.8	93.1	6.92	22.3	7.3	1.13
		54.7	15.94	6.000	.460	795.5	88.4	7.07	21.2	7.1	1.15
B 5 15x6⅜	15	100.0	29.08	6.767	1.167	892.4	119.0	5.54	50.2	14.8	1.31
		95.0	27.59	6.668	1.068	864.5	115.3	5.60	47.7	14.3	1.31
		90.0	26.12	6.570	.970	837.0	111.6	5.66	45.2	13.8	1.32
		85.0	24.65	6.472	.872	809.4	107.9	5.73	42.9	13.3	1.32
		81.3	23.57	6.400	.800	789.1	105.2	5.79	41.3	12.9	1.32
B 6 15x6	15	75.0	21.85	6.278	.868	687.2	91.6	5.61	30.6	9.8	1.18
		70.0	20.38	6.180	.770	659.6	87.9	5.69	28.8	9.3	1.19
		65.0	18.91	6.082	.672	632.1	84.3	5.78	27.2	8.9	1.20
		60.8	17.68	6.000	.590	609.0	81.2	5.87	26.0	8.7	1.21
B 7 15x5½	15	55.0	16.06	5.738	.648	508.7	67.8	5.63	17.0	5.9	1.03
		50.0	14.59	5.640	.550	481.1	64.2	5.74	16.0	5.7	1.05
		45.0	13.12	5.542	.452	453.6	60.5	5.88	15.0	5.4	1.07
		42.9	12.49	5.500	.410	441.8	58.9	5.95	14.6	5.3	1.08



AMERICAN STANDARD BEAMS

DIMENSIONS OF SECTIONS

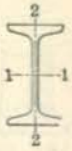
I

DIMENSIONS

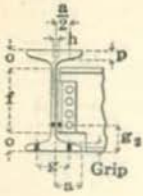
Section Index and Depth	Weight per Foot	Flange		Web		Distance			Standards for Connections				
		Width	Thickness, p	Thickness, t	½ Thickness	a	f	o	Min. g_2	Clear. h	Gage g	Grip	Max. Flange Rivet
	Lb.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	
B 18 24	120.0	8 1/16	1 3/16	13/16	5/16	3 5/8	20 1/4	1 7/8	3 1/4	1/2	5	1 1/8	7/8
	115.0	8	1 1/8	3/4	3/8	3 5/8	20 1/4	1 7/8	3 1/4	5/16	5	1 1/8	7/8
	110.0	7 15/16	1 1/8	11/16	3/8	3 5/8	20 1/4	1 7/8	3 1/4	5/16	5	1 1/8	7/8
	105.9	7 7/8	1 1/8	5/8	5/16	3 5/8	20 1/4	1 7/8	3 1/4	3/8	5	1 1/8	7/8
B 1 24	100.0	7 1/4	7/8	3/4	3/8	3 1/4	20 3/4	1 5/8	3	5/16	4	7/8	7/8
	95.0	7 1/16	7/8	11/16	3/8	3 1/4	20 3/4	1 5/8	3	5/16	4	7/8	7/8
	90.0	7 1/8	7/8	5/8	5/16	3 1/4	20 3/4	1 5/8	3	3/8	4	7/8	7/8
	85.0	7 1/16	7/8	9/16	5/16	3 1/4	20 3/4	1 5/8	3	3/8	4	7/8	7/8
	79.9	7	7/8	1/2	1/4	3 1/4	20 3/4	1 5/8	3	5/16	4	7/8	7/8
B 2 20	100.0	7 1/4	15/16	7/8	7/16	3 5/16	16 1/2	1 3/4	3 1/4	1/2	4	1	7/8
	95.0	7 1/16	15/16	13/16	7/16	3 5/16	16 1/2	1 3/4	3 1/4	1/2	4	1	7/8
	90.0	7 1/8	15/16	3/4	3/8	3 5/16	16 1/2	1 3/4	3 1/4	5/16	4	1	7/8
	85.0	7 1/16	15/16	5/8	3/8	3 5/16	16 1/2	1 3/4	3 1/4	3/8	4	1	7/8
	81.4	7	15/16	5/8	5/16	3 5/16	16 1/2	1 3/4	3 1/4	3/8	4	1	7/8
B 3 20	75.0	6 3/8	13/16	5/8	3/8	2 7/8	17	1 1/2	3	5/16	4	3/4	7/8
	70.0	6 1/16	13/16	9/16	5/16	2 7/8	17	1 1/2	3	3/8	4	3/4	7/8
	65.4	6 1/4	13/16	1/2	1/4	2 7/8	17	1 1/2	3	5/16	4	3/4	7/8
B 19 18	90.0	7 1/4	15/16	13/16	7/16	3 1/4	14 1/2	1 3/4	3 1/4	1/2	4	1	7/8
	85.0	7 1/8	15/16	11/16	3/8	3 1/4	14 1/2	1 3/4	3 1/4	5/16	4	1	7/8
	80.0	7 1/16	15/16	5/8	3/8	3 1/4	14 1/2	1 3/4	3 1/4	5/16	4	1	7/8
	75.6	7	15/16	9/16	5/16	3 1/4	14 1/2	1 3/4	3 1/4	3/8	4	1	7/8
B 4 18	70.0	6 1/4	11/16	11/16	3/8	2 3/4	15 1/4	1 3/8	2 3/4	5/16	3 1/2	3/4	7/8
	65.0	6 1/16	11/16	5/8	3/8	2 3/4	15 1/4	1 3/8	2 3/4	5/16	3 1/2	3/4	7/8
	60.0	6 1/8	11/16	9/16	5/16	2 3/4	15 1/4	1 3/8	2 3/4	3/8	3 1/2	3/4	7/8
	54.7	6	11/16	7/16	1/4	2 3/4	15 1/4	1 3/8	2 3/4	5/16	3 1/2	3/4	7/8
F 5 15	100.0	6 3/4	1 1/16	1 1/16	5/8	2 13/16	11	2	3 1/4	1 1/16	4	1	7/8
	95.0	6 11/16	1 1/16	1 1/16	9/16	2 13/16	11	2	3 1/4	5/8	4	1	7/8
	90.0	6 9/16	1 1/16	1	1/2	2 13/16	11	2	3 1/4	9/16	4	1	7/8
	85.0	6 1/2	1 1/16	7/8	7/16	2 13/16	11	2	3 1/4	1/2	4	1	7/8
	81.3	6 3/4	1 1/16	15/16	7/16	2 13/16	11	2	3 1/4	1/2	3 1/2	1	7/8
B 6 15	75.0	6 1/4	13/16	7/8	7/16	2 11/16	11 3/4	1 5/8	3	1/2	3 1/2	7/8	3/4
	70.0	6 1/16	13/16	3/4	7/16	2 11/16	11 3/4	1 5/8	3	1/2	3 1/2	7/8	3/4
	65.0	6 1/16	13/16	13/16	3/8	2 11/16	11 3/4	1 5/8	3	5/16	3 1/2	7/8	3/4
	60.8	6	13/16	9/16	5/16	2 11/16	11 3/4	1 5/8	3	3/8	3 1/2	7/8	3/4
B 7 15	55.0	5 3/4	5/8	5/8	5/16	2 9/16	12 1/2	1 1/4	2 3/4	5/16	3 1/2	3/4	3/4
	50.0	5 5/8	5/8	9/16	5/16	2 9/16	12 1/2	1 1/4	2 3/4	3/8	3 1/2	3/4	3/4
	45.0	5 1/16	5/8	1/2	1/4	2 9/16	12 1/2	1 1/4	2 3/4	5/16	3 1/2	3/4	3/4
	42.9	5 1/2	5/8	7/16	1/4	2 9/16	12 1/2	1 1/4	2 3/4	5/16	3 1/2	3/4	3/4

AMERICAN STANDARD BEAMS

ELEMENTS OF SECTIONS DECIMAL



Section Index and Nominal Size	Depth of Beam	Weight per Foot	Area of Section	Width of Flange	Web Thickness	Axis 1-1			Axis 2-2		
						I	S	r	I	S	r
	In.	Lbs.	In.²	In.	In.	In.⁴	In.³	In.	In.⁴	In.³	In.
B 8 12x5 ¼	12	55.0	16.04	5.600	.810	319.3	53.2	4.46	17.3	6.2	1.04
		50.0	14.57	5.477	.687	301.6	50.3	4.55	16.0	5.8	1.05
		45.0	13.10	5.355	.565	284.1	47.3	4.66	14.8	5.5	1.06
		40.8	11.84	5.250	.460	268.9	44.8	4.77	13.8	5.3	1.08
B 9 12x5	12	35.0	10.20	5.078	.428	227.0	37.8	4.72	10.0	3.9	0.99
		31.8	9.26	5.000	.350	215.8	36.0	4.83	9.5	3.8	1.01
B 10 10x4 ⅝	10	40.0	11.69	5.091	.741	158.0	31.6	3.68	9.4	3.7	0.90
		35.0	10.22	4.944	.594	145.8	29.2	3.78	8.5	3.4	0.91
		30.0	8.75	4.797	.447	133.5	26.7	3.91	7.6	3.2	0.93
		25.4	7.38	4.660	.310	122.1	24.4	4.07	6.9	3.0	0.97
B 11 9x4 ⅜	9	35.0	10.22	4.764	.724	111.3	24.7	3.30	7.3	3.0	0.84
		30.0	8.76	4.601	.561	101.4	22.5	3.40	6.4	2.8	0.85
		25.0	7.28	4.437	.397	91.4	20.3	3.54	5.6	2.5	0.88
		21.8	6.32	4.330	.290	84.9	18.9	3.67	5.2	2.4	0.90
B 12 8x4	8	25.5	7.43	4.262	.532	68.1	17.0	3.03	4.7	2.2	0.80
		23.0	6.71	4.171	.441	64.2	16.0	3.09	4.4	2.1	0.81
		20.5	5.97	4.079	.349	60.2	15.1	3.18	4.0	2.0	0.82
		18.4	5.34	4.000	.270	56.9	14.2	3.26	3.8	1.9	0.84
B 13 7x3 ⅝	7	20.0	5.83	3.860	.450	41.9	12.0	2.68	3.1	1.6	0.74
		17.5	5.09	3.755	.345	38.9	11.1	2.77	2.9	1.6	0.76
		15.3	4.43	3.660	.250	36.2	10.4	2.86	2.7	1.5	0.78
B 14 6x3 ⅝	6	17.25	5.02	3.565	.465	26.0	8.7	2.28	2.3	1.3	0.68
		14.75	4.29	3.443	.343	23.8	7.9	2.36	2.1	1.2	0.69
		12.5	3.61	3.330	.230	21.8	7.3	2.46	1.8	1.1	0.72
B 15 5x3	5	14.75	4.29	3.284	.494	15.0	6.0	1.87	1.7	1.0	0.63
		12.25	3.56	3.137	.347	13.5	5.4	1.95	1.4	0.91	0.63
		10.0	2.87	3.000	.210	12.1	4.8	2.05	1.2	0.82	0.65
B 16 4x2 ⅝	4	10.5	3.05	2.870	.400	7.1	3.5	1.52	1.0	0.70	0.57
		9.5	2.76	2.796	.326	6.7	3.3	1.56	0.91	0.65	0.58
		8.5	2.46	2.723	.253	6.3	3.2	1.60	0.83	0.61	0.58
		7.7	2.21	2.660	.190	6.0	3.0	1.64	0.77	0.58	0.59
B 17 3x2 ⅝	3	7.5	2.17	2.509	.349	2.9	1.9	1.15	0.59	0.47	0.52
		6.5	1.88	2.411	.251	2.7	1.8	1.19	0.51	0.43	0.52
		5.7	1.64	2.330	.170	2.5	1.7	1.23	0.46	0.40	0.53



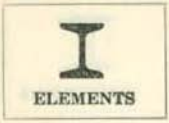
AMERICAN STANDARD BEAMS

DIMENSIONS OF SECTIONS

I

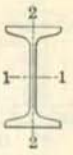
DIMENSIONS

Section Index and Depth	Weight per Foot	Flange		Web		Distance			Standards for Connections				
		Width	Thickness, p	Thickness, t	½ Thickness	a	f	o	Min. g_2	Clear. h	Gage g	Grip p	Max. Flange Rivet
	Lb.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	
B 8 12	55.0	5 5/8	1 1/16	1 3/16	3/16	2 3/4	9 1/4	1 3/8	2 3/4	3/8	3 1/2	3/4	3/4
	50.0	5 1/2	1 1/16	1 1/16	3/8	2 3/4	9 1/4	1 3/8	2 3/4	7/16	3 1/2	3/4	3/4
	45.0	5 3/8	1 1/16	9/16	5/16	2 3/4	9 1/4	1 3/8	2 3/4	3/8	3	3/4	3/4
	40.8	5 1/4	1 1/16	7/16	1/4	2 3/4	9 1/4	1 3/8	2 3/4	5/16	3	3/4	3/4
B 9 12	35.0	5 1/16	9/16	7/16	1/4	2 5/16	9 3/4	1 3/8	2 1/2	5/16	3	9/16	3/4
	31.8	5	9/16	3/8	5/16	2 5/16	9 3/4	1 3/8	2 1/2	1/4	3	9/16	3/4
B 10 10	40.0	5 1/16	1/2	3/4	3/8	2 5/16	8	1	2 1/2	7/16	2 3/4	1/2	3/4
	35.0	4 15/16	1/2	5/8	5/16	2 5/16	8	1	2 1/2	3/8	2 3/4	1/2	3/4
	30.0	4 15/16	1/2	7/16	1/4	2 5/16	8	1	2 1/2	5/16	2 3/4	1/2	3/4
	25.4	4 1/16	1/2	5/16	5/16	2 5/16	8	1	2 1/2	1/4	2 3/4	1/2	3/4
B 11 9	35.0	4 3/4	7/16	3/4	3/8	2	7	1	2 1/2	7/16	2 1/2	1/2	3/4
	30.0	4 5/8	7/16	9/16	5/16	2	7	1	2 1/2	3/8	2 1/2	1/2	3/4
	25.0	4 7/16	7/16	3/8	1/4	2	7	1	2 1/2	5/16	2 1/2	1/2	3/4
	21.8	4 3/16	7/16	5/16	5/16	2	7	1	2 1/2	1/4	2 1/2	1/2	3/4
B 12 8	25.5	4 1/4	7/16	9/16	5/16	1 7/8	6 1/4	3/8	2 1/4	3/8	2 1/4	1/2	3/4
	23.0	4 1/16	7/16	7/16	1/4	1 7/8	6 1/4	3/8	2 1/4	5/16	2 1/4	7/16	3/4
	20.5	4 1/16	7/16	3/8	3/16	1 7/8	6 1/4	3/8	2 1/4	1/4	2 1/4	7/16	3/4
	18.4	4	7/16	1/4	3/16	1 7/8	6 1/4	3/8	2 1/4	1/4	2 1/4	7/16	3/4
B 13 7	20.0	3 7/8	3/8	7/16	1/4	1 11/16	5 1/4	3/8	2	5/16	2 1/4	3/8	3/8
	17.5	3 3/4	3/8	3/8	3/16	1 11/16	5 1/4	3/8	2	1/4	2 1/4	3/8	3/8
	15.3	3 11/16	3/8	1/4	1/8	1 11/16	5 1/4	3/8	2	3/16	2 1/4	3/8	3/8
B 14 6	17.25	3 9/16	3/8	7/16	1/4	1 9/16	4 1/2	3/4	2	5/16	2	3/8	3/8
	14.75	3 7/16	3/8	3/8	3/16	1 9/16	4 1/2	3/4	2	1/4	2	3/8	3/8
	12.5	3 5/16	3/8	1/4	1/8	1 9/16	4 1/2	3/4	2	3/16	2	3/8	3/8
B 15 5	14.75	3 5/16	5/16	1/2	1/4	1 3/8	3 1/2	3/4	2	5/16	1 3/4	3/8	1/2
	12.25	3 1/4	5/16	3/8	3/16	1 3/8	3 1/2	3/4	2	1/4	1 3/4	3/8	1/2
	10.0	3	5/16	5/16	1/8	1 3/8	3 1/2	3/4	2	3/16	1 3/4	3/8	1/2
B 16 4	10.5	2 3/4	5/16	7/16	1/4	1 1/4	2 3/4	5/8	1 3/4	5/16	1 1/2	5/16	1/2
	9.5	2 13/16	5/16	5/16	3/16	1 1/4	2 3/4	5/8	1 3/4	1/4	1 1/2	5/16	1/2
	8.5	2 3/4	5/16	1/4	5/16	1 1/4	2 3/4	5/8	1 3/4	1/4	1 1/2	5/16	1/2
	7.7	2 11/16	5/16	5/16	1/8	1 1/4	2 3/4	5/8	1 3/4	3/16	1 1/2	5/16	1/2
B 17 3	7.5	2 1/2	1/4	3/8	3/16	1 1/16	1 3/4	5/8		1/4	1 1/2	5/16	3/8
	6.5	2 7/16	1/4	1/4	3/16	1 1/16	1 3/4	5/8		1/4	1 1/2	5/16	3/8
	5.7	2 5/16	1/4	3/16	1/8	1 1/16	1 3/4	5/8		3/16	1 1/2	5/16	3/8



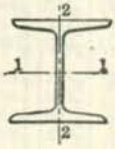
STANDARD MILL BEAMS

ELEMENTS OF SECTIONS DECIMAL

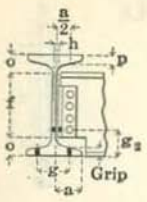


Section Index and Nominal Size	Depth of Beam	Weight per Foot	Area of Section	Flange Width	Web Thickness	Axis 1-1			Axis 2-2		
						I	S	r	I	S	r
	In.	Lbs.	In.²	In.	In.	In.⁴	In.³	In.	In.⁴	In.³	In.
B 40	9	25	7.34	5.380	.380	95.5	21.2	3.61	8.8	3.3	1.09
9x5 ¼		20.5	6.02	5.234	.234	86.6	19.2	3.79	8.0	3.1	1.15
B 39	8	21	6.17	5.110	.360	63.4	15.9	3.21	6.6	2.6	1.03
8x5		17.5	5.14	4.981	.231	57.4	14.5	3.36	6.0	2.4	1.08

H BEAMS



Section Index and Nominal Size	Depth of Beam	Weight per Foot	Area of Section	Flange Width	Web Thickness	Axis 1-1			Axis 2-2		
						I	S	r	I	S	r
	In.	Lbs.	In.²	In.	In.	In.⁴	In.³	In.	In.⁴	In.³	In.
H 4	8	37.7	11.00	8.125	.500	120.8	30.2	3.31	36.9	9.1	1.83
8x8		34.3	10.00	8.000	.375	115.5	28.9	3.40	35.1	8.8	1.87
		32.6	9.50	7.938	.313	112.8	28.2	3.45	34.2	8.6	1.90
H 3A	6	27.5	8.08	6.063	.438	49.3	16.4	2.47	16.0	5.3	1.41
6x6		25.0	7.33	5.938	.313	47.0	15.7	2.53	14.9	5.0	1.43
H 3	6	22.5	6.61	6.063	.375	41.0	13.7	2.49	12.2	4.0	1.36
6x6		20.0	5.86	5.938	.250	38.8	12.9	2.57	11.4	3.8	1.39
H 2	5	18.9	5.47	5.000	.313	23.8	9.5	2.08	7.8	3.1	1.20
5x5											
H 1	4	13.8	3.99	4.000	.313	10.7	5.3	1.64	3.6	1.8	0.95
4x4											



STANDARD MILL BEAMS

DIMENSIONS
OF
SECTIONS

I
DIMENSIONS

Section Index and Depth	Weight per Foot	Flange		Web		Distance			Standards for Connections				
		Width	Thickness	Thickness, t	½Thickness +	a	f	o	Min. g_2	Clear. h	Gage g	Grip	Max. Flange Rivet
	Lb.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	
B 40	25	5⅜	⅜	⅜	¼	2½	7½	¾	2¼	5/16	3	⅜	⅞
9	20.5	5¼	⅜	¼	⅛	2½	7½	¾	2¼	5/16	3	⅜	⅞
B 39	21	5⅛	5/16	⅜	5/16	2⅜	6⅝	1 1/16	2¼	¼	3	5/16	¾
8	17.5	5	5/16	¼	⅛	2⅜	6⅝	1 1/16	2¼	5/16	3	5/16	¾

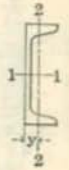
H-BEAMS

Section Index and Depth	Weight per Foot	Flange		Web		Distance			Standards for Connections			
		Width	Thickness	Thickness t	½Thickness +	a	f	o	Min. g_2	Gage g	Grip	Max. Flange Rivet
	Lb.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	
H 4	37.7	8⅛	7/16	½	¼	3 13/16	6¼	⅞	2¼	5	7/16	⅞
8	34.3	8	7/16	⅜	3/16	3 13/16	6¼	⅞	2¼	5	7/16	⅞
	32.6	7 15/16	7/16	5/16	3/16	3 13/16	6¼	⅞	2¼	5	7/16	⅞
H3 A	27.5	6 1/16	½	7/16	¼	2 13/16	4¼	⅞	2	3½	½	⅞
6	25.0	5 15/16	½	5/16	3/16	2 13/16	4¼	⅞	2	3½	½	⅞
H 3	22.5	6 1/16	⅜	⅜	5/16	2⅞	4 7/16	¾	2	3½	⅜	⅞
6	20	5 15/16	⅜	¼	⅛	2⅞	4 7/16	¾	2	3½	⅜	⅞
H 2	18.9	5	7/16	5/16	3/16	2⅜	3⅜	1 3/16	2	2¾	7/16	¾
5												
H 1	13.8	4	⅜	5/16	3/16	1⅞	2½	¾	1¾	2¼	⅜	⅝
4												

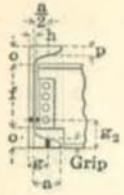
ELEMENTS

AMERICAN STANDARD CHANNELS

ELEMENTS
OF
SECTIONS



Section Index and Nominal Size	Depth of Channel	Weight per Foot	Area of Section	Width of Flange	Web Thickness	Axis 1-1			Axis 2-2			
						I	S	r	I	S	r	y
	In.	Lbs.	In.²	In.	In.	In.⁴	In.³	In.	In.⁴	In.³	In.	In.
C 1 15x3 3/8	15	55.0	16.11	3.814	.814	429.0	57.2	5.16	12.1	4.1	0.87	0.82
		50.0	14.64	3.716	.716	401.4	53.6	5.24	11.2	3.8	0.87	0.80
		45.0	13.17	3.618	.618	373.9	49.8	5.33	10.3	3.6	0.88	0.79
		40.0	11.70	3.520	.520	346.3	46.2	5.44	9.3	3.4	0.89	0.78
		35.0	10.23	3.422	.422	318.7	42.5	5.58	8.4	3.2	0.91	0.79
		33.9	9.90	3.400	.400	312.6	41.7	5.62	8.2	3.2	0.91	0.79
C 2 12x3	12	40.0	11.73	3.415	.755	196.5	32.8	4.09	6.6	2.5	0.75	0.72
		35.0	10.26	3.292	.632	178.8	29.8	4.18	5.9	2.3	0.76	0.69
		30.0	8.79	3.170	.510	161.2	26.9	4.28	5.2	2.1	0.77	0.68
		25.0	7.32	3.047	.387	143.5	23.9	4.43	4.5	1.9	0.79	0.68
		20.7	6.03	2.940	.280	128.1	21.4	4.61	3.9	1.7	0.81	0.70
C 3 10x2 5/8	10	35.0	10.27	3.180	.820	115.2	23.0	3.34	4.6	1.9	0.67	0.69
		30.0	8.80	3.033	.673	103.0	20.6	3.42	4.0	1.7	0.67	0.65
		25.0	7.33	2.886	.526	90.7	18.1	3.52	3.4	1.5	0.68	0.62
		20.0	5.86	2.739	.379	78.5	15.7	3.66	2.8	1.3	0.70	0.61
		15.3	4.47	2.600	.240	66.9	13.4	3.87	2.3	1.2	0.72	0.64
C 4 9x2 1/2	9	25.0	7.33	2.812	.612	70.5	15.7	3.10	3.0	1.4	0.64	0.61
		20.0	5.86	2.648	.448	60.6	13.5	3.22	2.4	1.2	0.65	0.59
		15.0	4.39	2.485	.285	50.7	11.3	3.40	1.9	1.0	0.67	0.59
		13.4	3.89	2.430	.230	47.3	10.5	3.49	1.8	0.97	0.67	0.61
C 5 8x2 1/4	8	21.25	6.23	2.619	.579	47.6	11.9	2.77	2.2	1.1	0.60	0.59
		18.75	5.49	2.527	.487	43.7	10.9	2.82	2.0	1.0	0.60	0.57
		16.25	4.76	2.435	.395	39.8	9.9	2.89	1.8	0.94	0.61	0.56
		13.75	4.02	2.343	.303	35.8	9.0	2.99	1.5	0.86	0.62	0.56
		11.5	3.36	2.260	.220	32.3	8.1	3.10	1.3	0.79	0.63	0.58
C 6 7x2	7	19.75	5.79	2.509	.629	33.1	9.4	2.39	1.8	0.96	0.56	0.58
		17.25	5.05	2.404	.524	30.1	8.6	2.44	1.6	0.86	0.56	0.55
		14.75	4.32	2.299	.419	27.1	7.7	2.51	1.4	0.79	0.57	0.53
		12.25	3.58	2.194	.314	24.1	6.9	2.59	1.2	0.71	0.58	0.53
		9.8	2.85	2.090	.210	21.1	6.0	2.72	0.98	0.63	0.59	0.55
C 7 6x2	6	15.5	4.54	2.279	.559	19.5	6.5	2.07	1.3	0.73	0.53	0.55
		13.0	3.81	2.157	.437	17.3	5.8	2.13	1.1	0.65	0.53	0.52
		10.5	3.07	2.034	.314	15.1	5.0	2.22	0.87	0.57	0.53	0.50
		8.2	2.39	1.920	.200	13.0	4.3	2.34	0.70	0.50	0.54	0.52
C 8 5x1 3/4	5	11.5	3.36	2.032	.472	10.4	4.1	1.76	0.82	0.54	0.49	0.51
		9.0	2.63	1.885	.325	8.8	3.5	1.83	0.64	0.45	0.49	0.48
		6.7	1.95	1.750	.190	7.4	3.0	1.95	0.48	0.38	0.50	0.49



AMERICAN STANDARD CHANNELS

DIMENSIONS
OF
SECTIONS

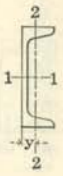
DIMENSIONS

Section Index and Depth	Weight per Foot	Flange		Web		Distance			Standards for Connections				
		Width	Thickness, p	Thickness, t	½ Thickness	a	f	o	Min. g_2	Clear h	Gage g	Grip	Max. Flange Rivet
	Lbs.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	
C 1 15	55.0	3 13/16	5/8	1 3/16	7/16	3	12 1/4	1 3/4	2 3/4	1 5/16	2 1/4	1 1/16	1
	50.0	3 11/16	5/8	1 1/16	7/16	3	12 1/4	1 3/4	2 3/4	1 5/16	2 1/4	1 1/16	1
	45.0	3 5/8	5/8	5/8	5/16	3	12 1/4	1 3/4	2 3/4	1 5/16	2	5/8	1
	40.0	3 1/2	5/8	1/2	5/16	3	12 1/4	1 3/4	2 3/4	5/8	2	5/8	1
	35.0	3 5/16	5/8	5/16	1/4	3	12 1/4	1 3/4	2 3/4	1/2	2	5/8	1
	33.9	3 3/8	5/8	3/8	1/4	3	12 1/4	1 3/4	2 3/4	1/2	2	5/8	1
C 2 12	40.0	3 5/16	1/2	3/4	7/16	2 11/16	10	1	2 1/2	7/8	2	5/8	7/8
	35.0	3 5/16	1/2	5/8	3/8	2 11/16	10	1	2 1/2	3/4	2	5/8	7/8
	30.0	3 5/16	1/2	1/2	5/16	2 11/16	10	1	2 1/2	5/8	1 3/4	1/2	7/8
	25.0	3 1/16	1/2	3/8	1/4	2 11/16	10	1	2 1/2	1/2	1 3/4	1/2	7/8
	20.7	2 15/16	1/2	1/4	5/16	2 11/16	10	1	2 1/2	3/8	1 3/4	1/2	7/8
C 3 10	35.0	3 5/16	7/16	1 5/16	5/16	2 3/8	8 1/4	7/8	2 1/2	1 5/16	1 3/4	1/2	3/4
	30.0	3 1/16	7/16	1 1/16	1/2	2 3/8	8 1/4	7/8	2 1/2	3/4	1 3/4	1/2	3/4
	25.0	2 7/8	7/16	1/2	5/16	2 3/8	8 1/4	7/8	2 1/2	5/8	1 3/4	1/2	3/4
	20.0	2 3/4	7/16	3/8	1/4	2 3/8	8 1/4	7/8	2 1/2	1/2	1 1/2	7/16	3/4
	15.3	2 5/8	7/16	1/4	1/8	2 3/8	8 1/4	7/8	2 1/2	5/16	1 1/2	7/16	3/4
C 4 9	25.0	2 13/16	7/16	3/8	5/16	2 5/16	7 1/4	7/8	2 1/2	1 5/16	1 1/2	1/2	3/4
	20.0	2 5/8	7/16	7/16	1/4	2 5/16	7 1/4	7/8	2 1/2	9/16	1 1/2	1/2	3/4
	15.0	2 1/2	7/16	5/16	5/16	2 5/16	7 1/4	7/8	2 1/2	3/8	1 3/8	7/16	3/4
	13.4	2 7/16	7/16	3/4	1/8	2 5/16	7 1/4	7/8	2 1/2	5/16	1 3/8	7/16	3/4
C 5 8	21.25	2 5/8	3/8	9/16	5/16	2 1/16	6 1/4	7/8	2 1/4	1 5/16	1 1/2	7/16	3/4
	18.75	2 1/2	3/8	1/2	1/4	2 1/16	6 1/4	7/8	2 1/4	9/16	1 1/2	7/16	3/4
	16.25	2 7/16	3/8	3/8	1/4	2 1/16	6 1/4	7/8	2 1/4	1/2	1 1/2	7/16	3/4
	13.75	2 5/16	3/8	5/16	5/16	2 1/16	6 1/4	7/8	2 1/4	3/8	1 3/8	3/8	3/4
	11.5	2 1/4	3/8	1/4	1/8	2 1/16	6 1/4	7/8	2 1/4	5/16	1 3/8	3/8	3/4
C 6 7	19.75	2 1/2	3/8	3/8	3/8	1 7/8	5 1/2	3/4	2	3/4	1 1/2	7/16	5/8
	17.25	2 3/8	3/8	1/2	5/16	1 7/8	5 1/2	3/4	2	5/8	1 1/2	7/16	5/8
	14.75	2 5/16	3/8	7/16	1/4	1 7/8	5 1/2	3/4	2	1/2	1 1/4	7/16	5/8
	12.25	2 3/16	3/8	5/16	5/16	1 7/8	5 1/2	3/4	2	7/16	1 1/4	3/8	5/8
	9.8	2 1/16	3/8	5/16	1/8	1 7/8	5 1/2	3/4	2	5/16	1 1/4	3/8	3/8
C 7 6	15.5	2 1/4	3/8	9/16	5/16	1 3/4	4 1/2	3/4	2	3/8	1 3/8	3/8	3/8
	13.0	2 1/16	3/8	7/16	1/4	1 3/4	4 1/2	3/4	2	1/2	1 3/8	3/8	3/8
	10.5	2 1/16	3/8	5/16	5/16	1 3/4	4 1/2	3/4	2	7/16	1 1/2	3/8	3/8
	8.2	1 15/16	3/8	3/16	1/8	1 3/4	4 1/2	3/4	2	5/16	1 1/2	5/16	3/8
C 8 5	11.5	2 1/16	5/16	1/2	1/4	1 9/16	3 3/4	5/8	2	9/16	1 1/2	5/16	1/2
	9.0	1 7/8	5/16	5/16	5/16	1 9/16	3 3/4	5/8	2	7/16	1 1/2	5/16	1/2
	6.7	1 3/4	5/16	3/16	1/8	1 9/16	3 3/4	5/8	2	5/16	1 1/2	5/16	1/2

ELEMENTS

AMERICAN STANDARD CHANNELS

ELEMENTS OF SECTIONS

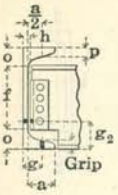


Section Index and Nominal Size	Depth of Channel	Weight per Foot	Area of Section	Width of Flange	Web Thickness	Axis 1-1			Axis 2-2			
						I	S	r	I	S	r	y
	In.	Lb.	In.^{2}	In.	In.	In.^{4}	In.^{3}	In.	In.^{4}	In.^{3}	In.	In.
C 9	4	7.25	2.12	1.720	.320	4.5	2.3	1.47	0.44	0.35	0.46	0.46
4 x 1⅝		6.25	1.82	1.647	.247	4.1	2.1	1.50	0.38	0.32	0.45	0.46
		5.4	1.56	1.580	.180	3.8	1.9	1.56	0.32	0.29	0.45	0.46
C 10	3	6.0	1.75	1.596	.356	2.1	1.4	1.08	0.31	0.27	0.42	0.46
3 x 1½		5.0	1.46	1.498	.258	1.8	1.2	1.12	0.25	0.24	0.41	0.44
		4.1	1.19	1.410	.170	1.6	1.1	1.17	0.20	0.21	0.41	0.44

CAR BUILDING CHANNELS

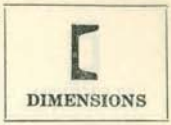
C 20	13	50.0	14.66	4.412	.787	312.9	48.1	4.62	16.7	4.9	1.07	0.98
		45.0	13.18	4.298	.673	292.0	44.9	4.71	15.3	4.6	1.08	0.97
13 x 4		40.0	11.71	4.185	.560	271.4	41.7	4.82	13.9	4.3	1.09	0.97
		37.0	10.82	4.117	.492	258.9	39.8	4.89	13.0	4.2	1.10	0.98
		35.0	10.24	4.072	.447	250.7	38.6	4.95	12.5	4.0	1.10	0.99
		31.8	9.30	4.000	.375	237.5	36.5	5.05	11.6	3.9	1.11	1.01
C 170	12	50.0	14.64	4.135	.835	268.1	44.7	4.28	17.8	5.8	1.10	1.06
		48.6	14.22	4.100	.800	263.0	43.8	4.30	17.3	5.7	1.10	1.05
12 x 4		46.6	13.62	4.050	.750	255.8	42.6	4.33	16.6	5.5	1.11	1.05
		44.5	**13.02**	**4.000**	**.700**	**248.6**	**41.4**	**4.37**	**16.0**	**5.4**	**1.11**	**1.05**
		40.0	11.70	3.890	.590	232.8	38.8	4.46	14.5	5.1	1.12	1.05
		35.0	10.23	3.767	.467	215.1	35.8	4.59	12.9	4.8	1.12	1.07
C 211	7	18.8	5.48	4.000	.350	42.9	12.2	2.80	8.3	3.0	1.23	1.23
7 x 4												
C 200	4	13.8	4.00	2.500	.500	8.8	4.4	1.49	2.2	1.4	0.74	0.86
4 x 2½												
C 192	3	10.3	3.02	2.250	.625	3.4	2.3	1.06	1.16	0.76	0.62	0.73
		9.0	2.64	2.125	.500	3.1	2.1	1.09	0.97	0.68	0.61	0.71
3 x 1⅜		7.1	2.08	1.938	.313	2.7	1.8	1.14	0.71	0.56	0.58	0.68
		6.5	**1.89**	**1.875**	**.250**	**2.6**	**1.7**	**1.17**	**0.63**	**0.52**	**0.58**	**0.67**
		5.8	1.68	1.805	.180	2.4	1.6	1.20	0.53	0.47	0.56	0.68
C 221	2⅜	3.87	1.14	1.188	.250	0.87	0.73	0.88	0.14	0.18	0.35	0.40
2⅜ x 1¼												

Dimensions and properties of the British Standard Sections are indicated in **bold type.**



AMERICAN STANDARD CHANNELS

DIMENSIONS
OF
SECTIONS



Section Index and Depth	Weight per Foot	Flange		Web		Distance			Standards for Connections				
		Width	Thick-ness, p	Thick-ness, t	½Thick-ness	a	f	o	Min. g_2	Clear. h	Gage g	Grip	Max. Flange Rivet
	Lb.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	
C 9 4	7.25	1¾	5/16	5/16	3/16	1⅜	2¾	5/8	1¾	7/16	1	5/16	½
	6.25	1⅜	5/16	¼	⅛	1⅜	2¾	5/8	1¾	5/16	1	5/16	½
	5.4	1 9/16	5/16	3/16	⅛	1⅜	2¾	5/8	1¾	¼	1	5/16	½
C 10 3	6.0	1⅝	¼	⅜	3/16	1¼	1¾	5/8	.....	7/16	⅞	¼	½
	5.0	1½	¼	¼	⅛	1¼	1¾	5/8	.....	5/16	⅞	¼	½
	4.1	1 7/16	¼	3/16	⅛	1¼	1¾	5/8	.....	¼	⅞	¼	½

CAR BUILDING CHANNELS

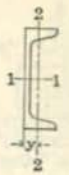
C 20 13	50.0	4 7/16	5/8	13/16	7/16	3 5/8	10 3/8	1 5/16	2¾	⅞	2½	5/8	⅞
	45.0	4 5/16	5/8	1 1/16	⅝	3 5/8	10 3/8	1 5/16	2¾	¾	2½	5/8	⅞
	40.0	4 3/16	5/8	9/16	5/16	3 5/8	10 3/8	1 5/16	2¾	5/8	2½	5/8	⅞
	37.0	4⅛	5/8	½	¼	3 5/8	10 3/8	1 5/16	2¾	9/16	2½	9/16	⅞
	35.0	4 1/16	5/8	7/16	¼	3 5/8	10 3/8	1 5/16	2¾	½	2½	9/16	⅞
	31.8	4	5/8	⅜	3/16	3 5/8	10 3/8	1 5/16	2¾	7/16	2½	9/16	⅞
C 170 12	50.0	4⅛	1 1/16	13/16	7/16	3 5/16	9½	1¼	2½	1 5/16	2½	1 1/16	⅞
	48.6	4⅛	1 1/16	13/16	7/16	3 5/16	9½	1¼	2½	⅞	2½	1 1/16	⅞
	46.6	4 1/16	1 1/16	¾	⅜	3 5/16	9½	1¼	2½	13/16	2½	1 1/16	⅞
	44.5	4	1 1/16	1 1/16	⅜	3 5/16	9½	1¼	2½	13/16	2½	1 1/16	⅞
	40.0	3⅞	1 1/16	9/16	5/16	3 5/16	9½	1¼	2½	1 1/16	2½	1 1/16	⅞
	35.0	3¾	1 1/16	7/16	¼	3 5/16	9½	1¼	2½	9/16	2½	1 1/16	⅞
C 211 7	18.8	4	7/16	⅜	3/16	3 5/8	5¼	⅞	2	7/16	2½	7/16	⅞
C 200 4	13.8	2½	½	½	¼	2	2⅜	1 3/16	1¾	9/16	1½	½	5/8
C 192 3	10.3	2¼	⅜	5/8	5/16	1 5/8	1¾	5/8	.....	1 1/16	1	⅜	5/8
	9.0	2⅛	⅜	½	¼	1 5/8	1¾	5/8	.....	9/16	1	⅜	5/8
	7.1	1 15/16	⅜	5/16	3/16	1 5/8	1¾	5/8	.....	⅜	1	⅜	5/8
	6.5	1⅞	⅜	¼	⅛	1 5/8	1¾	5/8	.....	5/16	1	⅜	5/8
	5.8	1 13/16	⅜	5/16	⅛	1 5/8	1¾	5/8	.....	¼	1	⅜	5/8
C 221 2⅝	3.9	1 3/16	5/16	¼	⅛	1 5/16	1⅛	5/8	.....	5/16	¾	5/16	⅜

Dimensions for flange thickness are the averages between dimensions of toe and root of flanges.
Dimensions f, o and h, provide working clearances.
Gages, g, are usual standard gages, but may be varied if conditions require.
Gages for outstanding legs of connection angles on channels are determined by ½ web thickness of channels given in tables.

ELEMENTS

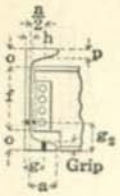
SHIP BUILDING CHANNELS

ELEMENTS
OF
SECTIONS



Section Index and Nominal Size	Depth of Channel	Weight per Foot	Area of Section	Width of Flange	Web Thickness	Axis 1-1			Axis 2-2			
						I	S	r	I	S	r	y
	In.	Lbs.	In.²	In.	In.	In.⁴	In.³	In.	In.⁴	In.³	In.	In.
C 60	18	58.0	16.98	4.200	.700	670.7	74.5	6.29	18.5	5.6	1.04	0.88
18 x 4		51.9	15.18	4.100	.600	622.1	69.1	6.40	17.1	5.3	1.06	0.87
		45.8	**13.38**	**4.000**	**.500**	**573.5**	**63.7**	**6.55**	**15.8**	**5.1**	**1.09**	**0.89**
		42.7	12.48	3.950	.450	549.2	61.0	6.64	15.0	4.9	1.10	0.90
C 21	12	44.7	13.05	4.200	.725	245.0	40.8	4.33	16.8	5.3	1.14	1.04
(BSC 26)		40.6	11.85	4.100	.625	230.6	38.4	4.41	15.5	5.1	1.15	1.04
12 x 4		**36.5**	**10.65**	**4.000**	**.525**	**216.2**	**36.0**	**4.51**	**14.2**	**4.8**	**1.16**	**1.06**
		34.5	10.05	3.950	.475	209.0	34.8	4.57	13.5	4.7	1.16	1.07
C 171	12	41.1	12.00	3.700	.700	217.8	36.3	4.26	11.3	4.0	0.97	0.89
(BSC 25)		37.0	10.80	3.600	.600	203.4	33.9	4.34	10.3	3.8	0.98	0.89
12 x 3½		**32.9**	**9.60**	**3.500**	**.500**	**189.0**	**31.5**	**4.44**	**9.4**	**3.6**	**0.99**	**0.89**
		30.9	9.00	3.450	.450	181.8	30.3	4.50	8.9	3.5	0.99	0.90
C 26	10	37.0	10.81	4.200	.675	146.3	29.3	3.68	14.9	4.8	1.18	1.10
(BSC 21)		33.6	9.81	4.100	.575	138.0	27.6	3.75	13.7	4.6	1.18	1.11
10 x 4		**30.2**	**8.81**	**4.000**	**.475**	**129.7**	**25.9**	**3.84**	**12.5**	**4.3**	**1.19**	**1.13**
		28.5	8.31	3.950	.425	125.5	25.1	3.89	11.8	4.2	1.19	1.15
C 27	10	35.1	10.23	3.700	.675	133.6	26.7	3.61	10.4	3.8	1.01	0.95
(BSC 20)		31.7	9.23	3.600	.575	125.2	25.0	3.69	9.5	3.6	1.01	0.95
10 x 3½		**28.3**	**8.23**	**3.500**	**.475**	**116.9**	**23.4**	**3.77**	**8.6**	**3.4**	**1.02**	**0.96**
		26.6	7.73	3.450	.425	112.7	22.5	3.82	8.1	3.3	1.02	0.97
		24.9	7.23	3.400	.375	108.6	21.7	3.88	7.6	3.2	1.03	0.98
C 28	10	25.3	7.38	3.550	.425	106.0	21.2	3.79	7.9	3.0	1.04	0.94
(BSC 19)		**23.6**	**6.88**	**3.500**	**.375**	**101.8**	**20.4**	**3.85**	**7.5**	**2.9**	**1.04**	**0.96**
10 x 3½		21.9	6.38	3.450	.325	97.6	19.5	3.91	7.0	2.8	1.05	0.98
C 31	9	34.7	10.13	4.200	.675	113.0	25.1	3.34	14.5	4.8	1.20	1.15
(BSC 18)		31.7	9.23	4.100	.575	106.9	23.8	3.40	13.3	4.5	1.20	1.16
9 x 4		**28.6**	**8.33**	**4.000**	**.475**	**100.9**	**22.4**	**3.48**	**12.1**	**4.3**	**1.20**	**1.18**
		27.1	7.88	3.950	.425	97.8	21.7	3.52	11.4	4.2	1.20	1.20
C 32	9	31.6	9.21	3.700	.650	99.4	22.1	3.29	9.7	3.6	1.03	0.98
(BSC 17)		28.5	8.31	3.600	.550	93.4	20.7	3.35	8.8	3.4	1.03	0.98
9 x 3½		**25.4**	**7.41**	**3.500**	**.450**	**87.3**	**19.4**	**3.43**	**8.0**	**3.2**	**1.04**	**1.00**
		23.9	6.96	3.450	.400	84.3	18.7	3.48	7.5	3.1	1.04	1.01

Dimensions and properties of the British Standard Sections are indicated in **bold type.**



SHIP BUILDING CHANNELS

DIMENSIONS OF SECTIONS

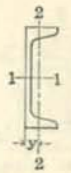
DIMENSIONS

Section Index and Depth	Weight per Foot	Flange		Web		Distance			Standards for Connections				
		Width	Thickness, p	Thickness, t	½Thickness +	a	f	o	Min. g_2	Clear. h	Gage g	Grip	Max. Flange Rivet
	Lb.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	
C 60 18	58.0	4 3/16	5/8	1 1/16	5/8	3 1/2	15 5/8	1 5/16	2 3/4	1 3/16	2 1/2	5/8	1
	51.9	4 1/8	5/8	5/8	5/16	3 1/2	15 5/8	1 5/16	2 3/4	1 1/16	2 1/2	5/8	1
	45.8	4	5/8	1/2	1/4	3 1/2	15 5/8	1 5/16	2 3/4	9/16	2 1/2	5/8	1
	42.7	3 15/16	5/8	7/16	1/4	3 1/2	15 5/8	1 5/16	2 3/4	9/16	2 1/2	5/8	1
C 21 (BSC26) 12	44.7	4 3/16	5/8	5/8	5/8	3 1/2	9 5/8	1 5/16	2 1/2	1 3/16	2 1/2	5/8	1
	40.6	4 1/8	5/8	5/8	5/16	3 1/2	9 5/8	1 5/16	2 1/2	1 1/16	2 1/2	5/8	1
	36.5	4	5/8	1/2	5/16	3 1/2	9 5/8	1 5/16	2 1/2	5/8	2 1/2	5/8	1
	34.5	3 15/16	5/8	1/2	1/4	3 1/2	9 5/8	1 5/16	2 1/2	9/16	2 1/2	5/8	1
C 171 (BSC25) 12	41.1	3 11/16	5/8	1 1/16	5/8	3	9 1/2	1 1/4	2 1/2	1 3/16	2	5/8	7/8
	37.0	3 5/8	5/8	5/8	5/16	3	9 1/2	1 1/4	2 1/2	1 1/16	2	5/8	7/8
	32.9	3 1/2	5/8	1/2	1/4	3	9 1/2	1 1/4	2 1/2	9/16	2	5/8	7/8
	30.9	3 7/16	5/8	7/16	1/4	3	9 1/2	1 1/4	2 1/2	9/16	2	5/8	7/8
C 26 (BSC21) 10	37.0	4 3/16	9/16	1 1/16	5/8	3 1/2	7 1/2	1 1/4	2 1/2	3/4	2 1/2	9/16	7/8
	33.6	4 1/8	9/16	9/16	5/16	3 1/2	7 1/2	1 1/4	2 1/2	1 3/16	2 1/2	9/16	7/8
	30.2	4	9/16	1/2	1/4	3 1/2	7 1/2	1 1/4	2 1/2	9/16	2 1/2	9/16	7/8
	28.5	3 15/16	9/16	7/16	1/4	3 1/2	7 1/2	1 1/4	2 1/2	1/2	2 1/2	9/16	7/8
C 27 (BSC20) 10	35.1	3 11/16	9/16	1 1/16	5/8	3	7 5/8	1 5/16	2 1/2	3/4	2	9/16	7/8
	31.7	3 5/8	9/16	9/16	5/16	3	7 5/8	1 5/16	2 1/2	1 1/16	2	9/16	7/8
	28.3	3 1/2	9/16	1/2	1/4	3	7 5/8	1 5/16	2 1/2	9/16	2	9/16	7/8
	26.6	3 7/16	9/16	7/16	1/4	3	7 5/8	1 5/16	2 1/2	1/2	2	9/16	7/8
	24.9	3 3/8	9/16	3/8	5/16	3	7 5/8	1 5/16	2 1/2	7/16	2	9/16	7/8
C 28 (BSC19) 10	25.3	3 9/16	1/2	7/16	1/4	3 1/8	7 3/8	1 5/16	2 1/2	1/2	2	1/2	7/8
	23.6	3 1/2	1/2	3/8	5/16	3 1/8	7 3/8	1 5/16	2 1/2	7/16	2	1/2	7/8
	21.9	3 7/16	1/2	7/16	5/16	3 1/8	7 3/8	1 5/16	2 1/2	7/16	2	1/2	7/8
C 31 (BSC18) 9	34.7	4 3/16	9/16	1 1/16	5/8	3 1/2	6 1/2	1 1/4	2 1/2	3/4	2 1/2	9/16	7/8
	31.7	4 1/8	9/16	9/16	5/16	3 1/2	6 1/2	1 1/4	2 1/2	1 3/16	2 1/2	9/16	7/8
	28.6	4	9/16	1/2	1/4	3 1/2	6 1/2	1 1/4	2 1/2	9/16	2 1/2	9/16	7/8
	27.1	3 15/16	9/16	7/16	1/4	3 1/2	6 1/2	1 1/4	2 1/2	1/2	2 1/2	9/16	7/8
C 32 (BSC17) 9	31.6	3 11/16	9/16	5/8	5/8	3 1/16	6 1/16	1 5/16	2 1/2	3/4	2	9/16	7/8
	28.5	3 5/8	9/16	9/16	5/16	3 1/16	6 1/16	1 5/16	2 1/2	5/8	2	9/16	7/8
	25.4	3 1/2	9/16	7/16	1/4	3 1/16	6 1/16	1 5/16	2 1/2	9/16	2	9/16	7/8
	23 9	3 7/16	9/16	3/8	1/4	3 1/16	6 1/16	1 5/16	2 1/2	1/2	2	9/16	7/8

ELEMENTS

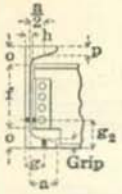
SHIP BUILDING CHANNELS

ELEMENTS OF SECTIONS



Section Index and Nominal Size	Depth of Channel	Wt. per Foot	Area of Section	Width of Flange	Web Thickness	Axis 1-1			Axis 2-2			
						I	S	r	I	S	r	y
	In.	Lbs.	In.²	In.	In.	In.⁴	In.³	In.	In.⁴	In.³	In.	In.
C 36		28.2	8.23	3.700	.625	71.8	18.0	2.95	9.0	3.4	1.05	1.02
(BSC 13)	8	25.5	7.43	3.600	.525	67.6	16.9	3.02	8.2	3.2	1.05	1.02
8 x 3½		**22.8**	**6.63**	**3.500**	**.425**	**63.3**	**15.8**	**3.09**	7.4	**3.0**	**1.05**	**1.04**
		21.4	6.23	3.450	.375	61.2	15.3	3.13	6.9	2.9	1.05	1.05
		25.5	7.43	3.225	.600	62.6	15.6	2.90	5.8	2.5	0.89	0.86
C 37		22.7	6.63	3.125	.500	58.3	14.6	2.97	5.3	2.3	0.89	0.85
(BSC 12)	8	20.0	5.83	3.025	.400	54.0	13.5	3.05	4.7	2.2	0.90	0.86
8 x 3		**19.3**	**5.63**	**3.000**	**.375**	**53.0**	**13.2**	**3.07**	**4.5**	**2.1**	**0.90**	**0.87**
		18.7	5.43	2.975	.350	51.9	13.0	3.09	4.4	2.1	0.90	0.88
		25.0	7.30	3.700	.600	49.9	14.3	2.62	8.3	3.2	1.07	1.06
C 41		22.7	6.60	3.600	.500	47.1	13.5	2.67	7.5	3.0	1.07	1.07
(BSC 10)	7	**20.3**	**5.90**	**3.500**	**.400**	**44.2**	**12.6**	**2.74**	**6.7**	**2.8**	**1.07**	**1.09**
7 x 3½		19.1	5.55	3.450	.350	42.8	12.2	2.78	6.3	2.7	1.07	1.11
C 42		20.0	5.82	3.100	.475	40.2	11.5	2.63	4.7	2.1	0.90	0.88
(BSC 9)	7	**17.6**	**5.12**	**3.000**	**.375**	**37.3**	**10.7**	**2.70**	**4.2**	**2.0**	**0.90**	**0.90**
7 x 3		16.4	4.77	2.950	.325	35.9	10.2	2.74	3.9	1.9	0.90	0.91
C 46		22.0	6.42	3.700	.575	33.0	11.0	2.27	7.6	2.9	1.09	1.12
(BSC 8)	6	20.0	5.82	3.600	.475	31.2	10.4	2.32	6.9	2.8	1.09	1.13
6 x 3½		**18.0**	**5.22**	**3.500**	**.375**	**29.4**	**9.8**	**2.38**	**6.1**	**2.6**	**1.08**	**1.15**
		16.9	4.92	3.450	.325	28.5	9.5	2.41	5.7	2.5	1.08	1.17
C 109												
6 x 3½	6	15.3	4.48	3.500	.340	25.3	8.4	2.38	5.1	2.1	1.08	1.08
C 47		**16.3**	**4.75**	**3.000**	**.375**	**25.8**	**8.6**	**2.33**	**4.0**	**1.9**	**0.91**	**0.95**
(BSC 7)	6	15.1	4.37	2.938	.313	24.7	8.2	2.38	3.6	1.8	0.91	0.97
6 x 3												
C 48		13.3	3.90	2.563	.375	19.7	6.6	2.25	2.1	1.2	0.74	0.71
(BSC 5)	6	**12.0**	**3.52**	**2.500**	**.313**	**18.6**	**6.2**	**2.30**	**2.0**	**1.1**	**0.75**	**0.72**
6 x 2½												

Dimensions and properties of the British Standard Sections are indicated in **bold type.**



SHIP BUILDING CHANNELS

DIMENSIONS OF SECTIONS

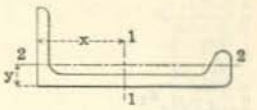
DIMENSIONS

Section Index and Depth	Weight per Foot	Flange		Web		Distance			Standards for Connections				
		Width	Thickness, p	Thickness, t	½Thickness+	a	f	o	Min. g_2	Clear. h	Gage g	Grip	Max. Flange Rivet
	Lb.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	
C 36	28.2	3 1/16	½	7/8	9/16	3 1/16	5 3/4	1 1/8	2 1/4	1 5/16	2	½	7/8
(BSC 13)	25.5	3 5/8	½	½	9/16	3 1/16	5 3/4	1 1/8	2 1/4	5/8	2	½	7/8
8	22.8	3 1/2	½	7/16	¼	3 1/16	5 3/4	1 1/8	2 1/4	½	2	½	7/8
	21.4	3 7/16	½	7/8	9/16	3 1/16	5 3/4	1 1/8	2 1/4	7/16	2	½	7/8
C 37	25.5	3 1/4	½	7/8	9/16	2 5/8	5 3/8	1 1/16	2 1/4	1 5/16	1 3/4	½	7/8
(BSC 12)	22.7	3 1/8	½	½	¼	2 5/8	5 3/8	1 1/16	2 1/4	9/16	1 3/4	½	7/8
8	20.0	3	½	7/16	¼	2 5/8	5 3/8	1 1/16	2 1/4	½	1 3/4	½	7/8
	19.3	3	½	7/8	9/16	2 5/8	5 3/8	1 1/16	2 1/4	7/16	1 3/4	½	7/8
	18.7	3	½	7/8	9/16	2 5/8	5 3/8	1 1/16	2 1/4	7/16	1 3/4	½	7/8
C 41	25.0	3 1/16	½	7/8	9/16	3 1/8	4 7/8	1 1/16	2	1 5/16	2	½	7/8
(BSC 10)	22.7	3 5/8	½	½	¼	3 1/8	4 7/8	1 1/16	2	9/16	2	½	7/8
7	20.3	3 1/2	½	7/16	¼	3 1/8	4 7/8	1 1/16	2	½	2	½	7/8
	19.1	3 7/16	½	7/8	9/16	3 1/8	4 7/8	1 1/16	2	7/16	2	½	7/8
C 42	20.0	3 1/4	½	½	¼	2 5/8	5	1	2	9/16	1 7/8	½	7/8
(BSC 9)	17.6	3	½	7/8	9/16	2 5/8	5	1	2	7/16	1 7/8	½	7/8
7	16.4	2 13/16	½	7/16	9/16	2 5/8	5	1	2	3/8	1 7/8	½	7/8
C 46	22.0	3 1/16	½	9/16	9/16	3 1/8	4	1	2	1 5/16	2	½	7/8
(BSC 8)	20.0	3 1/4	½	½	¼	3 1/8	4	1	2	9/16	2	½	7/8
6	18.0	3 1/2	½	7/8	9/16	3 1/8	4	1	2	7/16	2	½	7/8
	16.9	3 7/16	½	7/16	9/16	3 1/8	4	1	2	7/16	2	½	7/8
C 109	15.3	3 1/2	3/4	7/16	9/16	3 7/16	4 3/8	1 3/16	2	7/16	2	3/8	7/8
6													
C 47	16.3	3	½	7/8	9/16	2 5/8	4	1	2	7/16	1 7/8	½	7/8
(BSC 7)	15.1	2 13/16	½	7/16	9/16	2 5/8	4	1	2	3/8	1 7/8	½	7/8
6													
C 48	13.3	2 9/16	3/4	7/8	9/16	2 5/16	4 1/4	1 3/16	2	7/16	1 1/2	3/8	7/8
(BSC 5)	12.0	2 1/2	3/4	7/16	9/16	2 5/16	4 1/4	1 3/16	2	3/8	1 1/2	3/8	7/8
6													

Dimensions for flange thickness are the averages between dimensions of toe and root of flanges.
Dimensions f, o and h, provide working clearances.
Gages, g, are usual standard gages, but may be varied if conditions require.
Gages for outstanding legs of connection angles on channels are determined by ½ web thickness of channels given in tables.

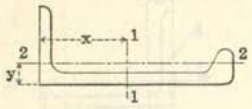
SHIP BUILDING BULB ANGLES

ELEMENTS OF SECTIONS

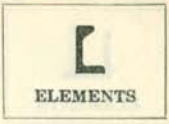


Section Index and Nominal Size	Thickness		Weight per Foot	Area of Section	Axis 1-1				Axis 2-2			
	Web	Flange			I	S	r	x	I	S	r	y
	In.	In.	Lb.	In.^{2}	In.^{4}	In.^{3}	In.	In.	In.^{4}	In.^{3}	In.	In.
	.70	.64	34.7	10.20	125.6	23.4	3.51	4.69	6.8	2.4	0.81	0.79
	.64	.61	32.3	9.49	118.1	22.1	3.53	4.69	6.2	2.2	0.81	0.77
BA 313	.58	.58	29.9	8.78	110.7	20.9	3.55	4.70	5.6	2.0	0.80	0.75
10 x 3½	.52	.485	27.2	7.98	102.9	19.6	3.59	4.80	5.1	1.8	0.80	0.72
	.46	.455	24.8	7.28	95.4	18.4	3.62	4.82	4.6	1.6	0.80	0.70
	.40	.425	22.4	6.57	88.0	17.2	3.66	4.85	4.1	1.5	0.79	0.68
	.68	.62	30.8	9.03	90.1	18.2	3.16	4.11	6.3	2.2	0.83	0.80
	.62	.59	28.6	8.38	84.6	17.2	3.18	4.10	5.7	2.1	0.83	0.78
BA 312	.56	.56	26.4	7.74	79.0	16.1	3.20	4.10	5.2	1.9	0.82	0.75
9 x 3½	.50	.465	23.8	7.00	73.3	15.1	3.24	4.19	4.7	1.7	0.82	0.72
	.44	.435	21.6	6.35	67.7	14.1	3.27	4.21	4.2	1.5	0.82	0.70
	.38	.405	19.4	5.70	62.2	13.1	3.30	4.22	3.7	1.4	0.81	0.68
	.58	.55	24.3	7.14	57.0	12.7	2.83	3.53	5.2	1.9	0.85	0.78
BA 311	.52	.52	22.3	6.55	53.0	11.8	2.85	3.52	4.7	1.7	0.84	0.76
8 x 3½	.46	.43	20.0	5.87	48.9	11.1	2.89	3.61	4.2	1.5	0.85	0.72
	.40	.40	18.0	5.28	44.9	10.2	2.92	3.61	3.7	1.3	0.84	0.70
	.34	.37	16.0	4.70	40.9	9.4	2.95	3.62	3.3	1.2	0.84	0.69
	.58	.55	23.3	6.85	53.9	12.4	2.80	3.67	3.4	1.4	0.70	0.68
BA 310	.52	.52	21.4	6.28	50.1	11.5	2.82	3.66	3.0	1.3	0.70	0.66
8 x 3	.46	.43	19.2	5.64	46.2	10.8	2.86	3.74	2.8	1.1	0.70	0.63
	.40	.40	17.3	5.07	42.4	10.0	2.89	3.75	2.4	1.0	0.69	0.61
	.34	.37	15.4	4.50	38.5	9.2	2.92	3.77	2.1	0.90	0.69	0.59
	.56	.54	21.1	6.19	37.5	9.2	2.46	2.95	4.8	1.8	0.88	0.80
BA 309	.50	.51	19.3	5.67	34.7	8.6	2.48	2.93	4.3	1.6	0.87	0.78
7 x 3½	.44	.41	17.1	5.03	32.0	8.0	2.52	3.03	3.9	1.4	0.88	0.74
	.38	.38	15.3	4.50	29.2	7.3	2.55	3.02	3.4	1.2	0.87	0.72
	.32	.35	13.6	3.98	26.4	6.7	2.58	3.01	3.0	1.1	0.87	0.71
	.56	.54	20.2	5.91	35.4	9.0	2.45	3.08	3.1	1.3	0.72	0.69
BA 308	.50	.51	18.4	5.40	32.8	8.3	2.46	3.07	2.8	1.2	0.72	0.67
7 x 3	.44	.41	16.4	4.81	30.2	7.8	2.50	3.15	2.5	1.0	0.72	0.64
	.38	.38	14.7	4.30	27.5	7.1	2.53	3.15	2.2	0.93	0.72	0.62
	.32	.35	12.9	3.79	24.9	6.5	2.56	3.15	1.9	0.82	0.71	0.60
	.52	.49	17.4	5.12	22.7	6.3	2.10	2.42	4.3	1.6	0.92	0.82
BA 307	.46	.46	15.9	4.65	20.8	5.8	2.12	2.40	3.9	1.4	0.91	0.80
6 x 3½	.40	.365	13.9	4.06	19.0	5.3	2.16	2.47	3.4	1.2	0.91	0.76
	.34	.335	12.3	3.60	17.2	4.8	2.19	2.46	3.0	1.1	0.91	0.74
	.28	.305	10.7	3.13	15.3	4.4	2.21	2.45	2.6	0.94	0.91	0.73

SHIP BUILDING BULB ANGLES

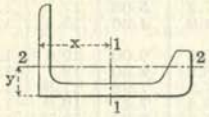


ELEMENTS OF SECTIONS



Section Index and Nominal Size	Thickness		Weight per Foot	Area of Section	Axis 1-1				Axis 2-2			
	Web	Flange			I	S	r	x	I	S	r	y
	In.	In.	Lb.	In.^{2}	In.^{4}	In.^{3}	In.	In.	In.^{4}	In.^{3}	In.	In.
BA 306 6 x 3	.52	.49	16.6	4.86	21.4	6.1	2.10	2.53	2.8	1.2	0.76	0.70
	.46	.46	15.0	4.41	19.7	5.6	2.11	2.51	2.5	1.1	0.75	0.68
	.40	.365	13.2	3.87	17.9	5.2	2.15	2.59	2.2	0.91	0.75	0.64
	.34	.335	11.7	3.42	16.2	4.7	2.18	2.58	1.9	0.80	0.75	0.63
	.28	.305	10.1	2.97	14.5	4.3	2.21	2.58	1.6	0.70	0.74	0.61
BA 305 5½ x 3	.50	.46	14.9	4.37	16.1	4.9	1.92	2.27	2.6	1.1	0.78	0.71
	.44	.43	13.4	3.94	14.7	4.5	1.93	2.25	2.3	1.0	0.77	0.69
	.38	.345	11.7	3.44	13.4	4.1	1.97	2.31	2.0	0.85	0.77	0.65
	.32	.315	10.3	3.02	12.0	3.7	2.00	2.30	1.8	0.75	0.77	0.63
	.26	.285	8.9	2.60	10.6	3.3	2.02	2.28	1.5	0.65	0.76	0.62
BA 303 5 x 2½	.48	.44	12.6	3.68	11.1	3.8	1.74	2.12	1.5	0.75	0.63	0.61
	.42	.41	11.3	3.30	10.1	3.5	1.75	2.10	1.3	0.67	0.63	0.58
	.36	.33	9.8	2.88	9.1	3.1	1.78	2.06	1.1	0.56	0.63	0.55
	.30	.30	8.5	2.50	8.1	2.7	1.81	2.03	0.97	0.49	0.62	0.53
	.24	.27	7.3	2.13	7.1	2.4	1.83	2.01	0.81	0.42	0.62	0.51

CAR BUILDING BULB ANGLES

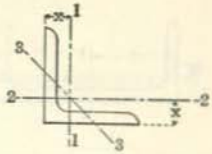


Section Index and Nominal Size	Thickness		Weight per Foot	Area of Section	Axis 1-1				Axis 2-2			
	Web	Flange			I	S	r	x	I	S	r	y
	In.	In.	Lb.	In.^{2}	In.^{4}	In.^{3}	In.	In.	In.^{4}	In.^{3}	In.	In.
BA 125 5 x 4½	.438	.438	19.3	5.66	20.8	7.9	1.91	2.39	7.9	2.4	1.18	1.23
BA 124 5 x 3½	.375	.375	13.2	3.82	13.5	4.9	1.88	2.22	3.3	1.2	0.92	0.86
BA 122 4 x 3½	.500	.500	14.3	4.21	8.7	3.7	1.44	1.65	3.9	1.5	0.96	0.99
BA 123 4 x 3½	.375	.375	11.9	3.48	7.9	3.5	1.50	1.77	3.1	1.2	0.94	0.94

ELEMENTS

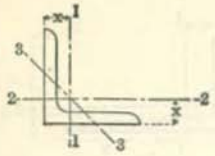
EQUAL ANGLES

ELEMENTS OF SECTIONS



Section Index	Size	Thickness	Weight per Foot	Area of Section	Axis 1-1 and Axis 2-2				Axis 3-3
					I	r	S	x	r min.
	Inches	In.	Pounds	In.²	In.⁴	In.	In.³	In.	In.
		1 1/8	56.9	16.73	98.0	2.42	17.5	2.41	1.55
		1 1/16	54.0	15.87	93.5	2.43	16.7	2.39	1.56
		1	51.0	15.00	89.0	2.44	15.8	2.37	1.56
		15/16	48.1	14.12	84.3	2.44	14.9	2.34	1.56
		7/8	45.0	13.23	79.6	2.45	14.0	2.32	1.56
A 1	8 x 8	13/16	42.0	12.34	74.7	2.46	13.1	2.30	1.57
		3/4	38.9	11.44	69.7	2.47	12.2	2.28	1.57
		11/16	35.8	10.53	64.6	2.48	11.2	2.25	1.58
		5/8	32.7	9.61	59.4	2.49	10.3	2.23	1.58
		9/16	29.6	8.68	54.1	2.50	9.3	2.21	1.58
		1/2	26.4	7.75	48.6	2.51	8.4	2.19	1.58
		1	37.4	11.00	35.5	1.80	8.6	1.86	1.16
		15/16	35.3	10.37	33.7	1.80	8.1	1.84	1.16
		7/8	33.1	9.73	31.9	1.81	7.6	1.82	1.17
		13/16	31.0	9.09	30.1	1.82	7.2	1.80	1.17
		3/4	28.7	8.44	28.2	1.83	6.7	1.78	1.17
A 2	6 x 6	11/16	26.5	7.78	26.2	1.83	6.2	1.75	1.17
		5/8	24.2	7.11	24.2	1.84	5.7	1.73	1.17
		9/16	21.9	6.43	22.1	1.85	5.1	1.71	1.18
		1/2	19.6	5.75	19.9	1.86	4.6	1.68	1.18
		7/16	17.2	5.06	17.7	1.87	4.1	1.66	1.19
		3/8	14.9	4.36	15.4	1.88	3.5	1.64	1.19
		1	30.6	9.00	19.6	1.48	5.8	1.61	0.96
		15/16	28.9	8.50	18.7	1.48	5.5	1.59	0.96
		7/8	27.2	7.98	17.8	1.49	5.2	1.57	0.96
		13/16	25.4	7.47	16.8	1.50	4.9	1.55	0.97
		3/4	23.6	6.94	15.7	1.50	4.5	1.52	0.97
A 3	5 x 5	11/16	21.8	6.40	14.7	1.51	4.2	1.50	0.97
		5/8	20.0	5.86	13.6	1.52	3.9	1.48	0.97
		9/16	18.1	5.31	12.4	1.53	3.5	1.46	0.98
		1/2	16.2	4.75	11.3	1.54	3.2	1.43	0.98
		7/16	14.3	4.18	10.0	1.55	2.8	1.41	0.98
		3/8	12.3	3.61	8.7	1.56	2.4	1.39	0.99
		15/16	19.9	5.84	8.1	1.18	3.0	1.29	0.77
		3/4	18.5	5.44	7.7	1.19	2.8	1.27	0.77
		11/16	17.1	5.03	7.2	1.19	2.6	1.25	0.77
		5/8	15.7	4.61	6.7	1.20	2.4	1.23	0.77
A 4	4 x 4	9/16	14.3	4.18	6.1	1.21	2.2	1.21	0.78
		1/2	12.8	3.75	5.6	1.22	2.0	1.18	0.78
		7/16	11.3	3.31	5.0	1.23	1.8	1.16	0.78
		3/8	9.8	2.86	4.4	1.23	1.5	1.14	0.79
		5/16	8.2	2.40	3.7	1.24	1.3	1.12	0.79
		1/4	6.6	1.94	3.0	1.25	1.0	1.09	0.79

EQUAL ANGLES



ELEMENTS
OF
SECTIONS

L
ELEMENTS

Section Index	Size	Thickness	Weight per Foot	Area of Section	Axis 1-1 and Axis 2-2				Axis 3-3
					I	r	S	x	r min.
	Inches	In.	Pounds	In.²	In.⁴	In.	In.³	In.	In.
		15/16	17.1	5.03	5.3	1.02	2.3	1.17	0.67
		7/8	16.0	4.69	5.0	1.03	2.1	1.15	0.67
		13/16	14.8	4.34	4.7	1.04	2.0	1.12	0.67
		5/8	13.6	3.98	4.3	1.04	1.8	1.10	0.68
		9/16	12.4	3.62	4.0	1.05	1.6	1.08	0.68
A 5	3½ x 3½	½	11.1	3.25	3.6	1.06	1.5	1.06	0.68
		7/16	9.8	2.87	3.3	1.07	1.3	1.04	0.68
		3/8	8.5	2.48	2.9	1.07	1.2	1.01	0.69
		5/16	7.2	2.09	2.5	1.08	0.98	0.99	0.69
		¼	5.8	1.69	2.0	1.09	0.79	0.97	0.69
		5/8	11.5	3.36	2.6	0.88	1.3	0.98	0.57
		9/16	10.4	3.06	2.4	0.89	1.2	0.95	0.58
		½	9.4	2.75	2.2	0.90	1.1	0.93	0.58
A 7	3 x 3	7/16	8.3	2.43	2.0	0.91	0.95	0.91	0.58
		3/8	7.2	2.11	1.8	0.91	0.83	0.89	0.58
		5/16	6.1	1.78	1.5	0.92	0.71	0.87	0.59
		¼	4.9	1.44	1.2	0.93	0.58	0.84	0.59
		½	7.7	2.25	1.2	0.74	0.73	0.81	0.47
		7/16	6.8	2.00	1.1	0.75	0.65	0.78	0.48
		3/8	5.9	1.73	0.98	0.75	0.57	0.76	0.48
A 9	2½ x 2½	5/16	5.0	1.47	0.85	0.76	0.48	0.74	0.49
		¼	4.1	1.19	0.70	0.77	0.39	0.72	0.49
		3/16	3.07	0.90	0.55	0.78	0.30	0.69	0.49
		⅛	2.08	0.61	0.38	0.79	0.20	0.67	0.50
		7/16	5.3	1.56	0.54	0.59	0.40	0.66	0.39
		3/8	4.7	1.36	0.48	0.59	0.35	0.64	0.39
		5/16	3.92	1.15	0.42	0.60	0.30	0.61	0.39
A 11	2 x 2	¼	3.19	0.94	0.35	0.61	0.25	0.59	0.39
		3/16	2.44	0.71	0.28	0.62	0.19	0.57	0.40
		⅛	1.65	0.48	0.19	0.63	0.13	0.55	0.40
		7/16	4.6	1.34	0.35	0.51	0.30	0.59	0.33
		3/8	3.99	1.17	0.31	0.51	0.26	0.57	0.34
		5/16	3.39	1.00	0.27	0.52	0.23	0.55	0.34
A 12	1¾ x 1¾	¼	2.77	0.81	0.23	0.53	0.19	0.53	0.34
		3/16	2.12	0.62	0.18	0.54	0.14	0.51	0.35
		⅛	1.44	0.42	0.13	0.55	0.10	0.48	0.35
		3/8	3.35	0.98	0.19	0.44	0.19	0.51	0.29
		5/16	2.86	0.84	0.16	0.44	0.16	0.49	0.29
A 13	1½ x 1½	¼	2.34	0.69	0.14	0.45	0.13	0.47	0.29
		3/16	1.80	0.53	0.11	0.46	0.10	0.44	0.29
		⅛	1.23	0.36	0.08	0.46	0.07	0.42	0.30
		5/16	2.33	0.68	0.09	0.36	0.11	0.42	0.24
		¼	1.92	0.56	0.08	0.37	0.09	0.40	0.24
A 15	1¼ x 1¼	3/16	1.48	0.43	0.06	0.38	0.07	0.38	0.24
		⅛	1.01	0.30	0.04	0.38	0.05	0.35	0.25
		¼	1.49	0.44	0.04	0.29	0.06	0.34	0.19
A 16	1 x 1	3/16	1.16	0.34	0.03	0.30	0.04	0.32	0.19
		⅛	0.80	0.23	0.02	0.31	0.03	0.30	0.19

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ELEMENTS

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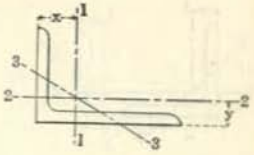
ELEMENTS
OF
SECTIONS



Section Index	Size	Thickness	Weight per Foot	Area of Section	Axis 1-1				Axis 2-2				Axis 3-3
					I	r	S	x	I	r	S	y	r min.
	Inches	In.	Lbs.	In.²	In.⁴	In.	In.³	In.	In.⁴	In.	In.³	In.	In.
		1	44.2	13.00	80.8	2.49	15.1	2.65	38.8	1.73	8.9	1.65	1.28
		15/16	41.7	12.25	76.6	2.50	14.3	2.63	36.8	1.73	8.4	1.63	1.28
		7/8	39.1	11.48	72.3	2.51	13.4	2.61	34.9	1.74	7.9	1.61	1.28
		13/16	36.5	10.72	67.9	2.52	12.5	2.59	32.8	1.75	7.4	1.59	1.29
		3/4	33.8	9.94	63.4	2.53	11.7	2.56	30.7	1.76	6.9	1.56	1.29
A 18	8 x 6	11/16	31.2	9.15	58.8	2.54	10.8	2.54	28.6	1.77	6.4	1.54	1.29
		5/8	28.5	8.36	54.1	2.54	9.9	2.52	26.3	1.77	5.9	1.52	1.30
		9/16	25.7	7.56	49.3	2.55	8.9	2.50	24.0	1.78	5.3	1.50	1.30
		1/2	23.0	6.75	44.3	2.56	8.0	2.47	21.7	1.79	4.8	1.47	1.30
		7/16	20.2	5.93	39.2	2.57	7.1	2.45	19.3	1.80	4.2	1.45	1.30
		1	35.7	10.50	66.2	2.51	13.7	3.17	7.8	0.86	3.0	0.92	0.73
		15/16	33.7	9.90	62.9	2.52	12.9	3.14	7.4	0.87	2.9	0.89	0.73
		7/8	31.7	9.30	59.4	2.53	12.2	3.12	7.1	0.87	2.7	0.87	0.73
		13/16	29.6	8.68	55.9	2.54	11.4	3.10	6.7	0.88	2.5	0.85	0.73
		3/4	27.5	8.06	52.3	2.55	10.6	3.07	6.3	0.88	2.3	0.82	0.73
A 53	8 x 3½	11/16	25.3	7.43	48.5	2.56	9.8	3.05	5.9	0.89	2.2	0.80	0.73
		5/8	23.2	6.80	44.7	2.57	9.0	3.03	5.4	0.90	2.0	0.78	0.74
		9/16	21.0	6.15	40.8	2.57	8.2	3.00	5.0	0.90	1.8	0.75	0.74
		1/2	18.7	5.50	36.7	2.58	7.3	2.98	4.5	0.91	1.6	0.73	0.74
		7/16	16.5	4.84	32.5	2.59	6.4	2.95	4.1	0.92	1.5	0.70	0.74
		1	32.3	9.50	45.4	2.19	10.6	2.71	7.5	0.89	3.0	0.96	0.74
		15/16	30.5	8.97	43.1	2.19	10.0	2.69	7.2	0.89	2.8	0.94	0.74
		7/8	28.7	8.42	40.8	2.20	9.4	2.66	6.8	0.90	2.6	0.91	0.74
		13/16	26.8	7.87	38.4	2.21	8.8	2.64	6.5	0.91	2.5	0.89	0.74
		3/4	24.9	7.31	36.0	2.22	8.2	2.62	6.1	0.91	2.3	0.87	0.74
A 19	7 x 3½	11/16	23.0	6.75	33.5	2.23	7.6	2.60	5.7	0.92	2.1	0.85	0.74
		5/8	21.0	6.17	30.9	2.24	7.0	2.57	5.3	0.93	2.0	0.82	0.75
		9/16	19.1	5.59	28.2	2.25	6.3	2.55	4.9	0.93	1.8	0.80	0.75
		1/2	17.0	5.00	25.4	2.25	5.7	2.53	4.4	0.94	1.6	0.78	0.75
		7/16	15.0	4.40	22.6	2.26	5.0	2.50	4.0	0.95	1.4	0.75	0.76
		3/8	13.0	3.80	19.6	2.27	4.3	2.48	3.5	0.96	1.3	0.73	0.76
		1	30.6	9.00	30.8	1.85	8.0	2.17	10.8	1.09	3.8	1.17	0.85
		15/16	28.9	8.50	29.3	1.86	7.6	2.14	10.3	1.10	3.6	1.14	0.85
		7/8	27.2	7.98	27.7	1.86	7.2	2.12	9.8	1.11	3.4	1.12	0.86
		13/16	25.4	7.47	26.1	1.87	6.7	2.10	9.2	1.11	3.2	1.10	0.86
		3/4	23.6	6.94	24.5	1.88	6.2	2.08	8.7	1.12	3.0	1.08	0.86
A 20	6 x 4	11/16	21.8	6.40	22.8	1.89	5.8	2.06	8.1	1.13	2.8	1.06	0.86
		5/8	20.0	5.86	21.1	1.90	5.3	2.03	7.5	1.13	2.5	1.03	0.86
		9/16	18.1	5.31	19.3	1.90	4.8	2.01	6.9	1.14	2.3	1.01	0.87
		1/2	16.2	4.75	17.4	1.91	4.3	1.99	6.3	1.15	2.1	0.99	0.87
		7/16	14.3	4.18	15.5	1.92	3.8	1.96	5.6	1.16	1.8	0.96	0.87
		3/8	12.3	3.61	13.5	1.93	3.3	1.94	4.9	1.17	1.6	0.94	0.88

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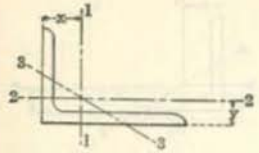

ELEMENTS
OF
SECTIONS

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ELEMENTS

Section Index	Size	Thickness	Weight per Foot	Area of Section	Axis 1-1				Axis 2-2				Axis 3-3
					I	r	S	x	I	r	S	y	r min.
	Inches	In.	Lbs.	In.²	In.⁴	In.	In.³	In.	In.⁴	In.	In.³	In.	In.
		1	28.9	8.50	29.2	1.85	7.8	2.26	7.2	0.92	2.9	1.01	0.74
		15/16	27.3	8.03	27.8	1.86	7.4	2.24	6.9	0.93	2.7	0.99	0.74
		7/8	25.7	7.55	26.4	1.87	7.0	2.22	6.6	0.93	2.6	0.97	0.75
		13/16	24.0	7.06	24.9	1.88	6.6	2.20	6.2	0.94	2.4	0.95	0.75
		3/4	22.4	6.56	23.3	1.89	6.1	2.18	5.8	0.94	2.3	0.93	0.75
A 21	6 x 3½	11/16	20.6	6.06	21.7	1.89	5.6	2.15	5.5	0.95	2.1	0.90	0.75
		5/8	18.9	5.55	20.1	1.90	5.2	2.13	5.1	0.96	1.9	0.88	0.75
		9/16	17.1	5.03	18.4	1.91	4.7	2.11	4.7	0.96	1.8	0.86	0.75
		1/2	15.3	4.50	16.6	1.92	4.2	2.08	4.3	0.97	1.6	0.83	0.76
		7/16	13.5	3.97	14.8	1.93	3.7	2.06	3.8	0.98	1.4	0.81	0.76
		3/8	11.7	3.42	12.9	1.94	3.3	2.04	3.3	0.99	1.2	0.79	0.77
		5/16	9.8	2.87	10.9	1.95	2.7	2.01	2.9	1.00	1.0	0.76	0.77
		7/8	24.2	7.11	16.4	1.52	5.0	1.71	9.2	1.14	3.3	1.21	0.84
		13/16	22.7	6.65	15.5	1.53	4.7	1.68	8.7	1.15	3.1	1.18	0.84
		3/4	21.1	6.19	14.6	1.54	4.4	1.66	8.2	1.15	2.9	1.16	0.84
		11/16	19.5	5.72	13.6	1.54	4.1	1.64	7.7	1.16	2.7	1.14	0.84
A 22	5 x 4	5/8	17.8	5.23	12.6	1.55	3.7	1.62	7.1	1.17	2.5	1.12	0.84
		9/16	16.2	4.75	11.6	1.56	3.4	1.60	6.6	1.18	2.3	1.10	0.85
		1/2	14.5	4.25	10.5	1.57	3.1	1.57	6.0	1.18	2.0	1.07	0.85
		7/16	12.8	3.75	9.3	1.58	2.7	1.55	5.3	1.19	1.8	1.05	0.85
		3/8	11.0	3.23	8.1	1.59	2.3	1.53	4.7	1.20	1.6	1.03	0.86
		5/16	9.3	2.72	6.9	1.60	2.0	1.51	4.0	1.21	1.3	1.01	0.86
		7/8	22.7	6.67	15.7	1.53	4.9	1.79	6.2	0.96	2.5	1.04	0.75
		13/16	21.3	6.25	14.8	1.54	4.6	1.77	5.9	0.97	2.4	1.02	0.75
		3/4	19.8	5.81	13.9	1.55	4.3	1.75	5.6	0.98	2.2	1.00	0.75
		11/16	18.3	5.37	13.0	1.56	4.0	1.72	5.2	0.98	2.1	0.97	0.75
		5/8	16.8	4.92	12.0	1.56	3.7	1.70	4.8	0.99	1.9	0.95	0.75
A 23	5 x 3½	9/16	15.2	4.47	11.0	1.57	3.3	1.68	4.4	1.00	1.7	0.93	0.75
		1/2	13.6	4.00	10.0	1.58	3.0	1.66	4.0	1.01	1.6	0.91	0.75
		7/16	12.0	3.53	8.9	1.59	2.6	1.63	3.6	1.01	1.4	0.88	0.76
		3/8	10.4	3.05	7.8	1.60	2.3	1.61	3.2	1.02	1.2	0.86	0.76
		5/16	8.7	2.56	6.6	1.61	1.9	1.59	2.7	1.03	1.0	0.84	0.76
		13/16	19.9	5.84	14.0	1.55	4.5	1.86	3.7	0.80	1.7	0.86	0.64
		3/4	18.5	5.44	13.2	1.55	4.2	1.84	3.5	0.80	1.6	0.84	0.64
		11/16	17.1	5.03	12.3	1.56	3.9	1.82	3.3	0.81	1.5	0.82	0.64
		5/8	15.7	4.61	11.4	1.57	3.5	1.80	3.1	0.81	1.4	0.80	0.64
A 24	5 x 3	9/16	14.3	4.18	10.4	1.58	3.2	1.77	2.8	0.82	1.3	0.77	0.65
		1/2	12.8	3.75	9.5	1.59	2.9	1.75	2.6	0.83	1.1	0.75	0.65
		7/16	11.3	3.31	8.4	1.60	2.6	1.73	2.3	0.84	1.0	0.73	0.65
		3/8	9.8	2.86	7.4	1.61	2.2	1.70	2.0	0.84	0.89	0.70	0.65
		5/16	8.2	2.40	6.3	1.61	1.9	1.68	1.8	0.85	0.75	0.68	0.66

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ELEMENTS

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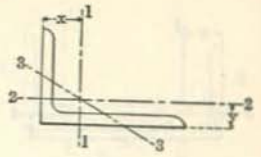
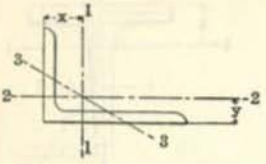
ELEMENTS OF SECTIONS



Section Index	Size	Thickness	Weight per Foot	Area of Section	Axis 1-1				Axis 2-2				Axis 3-3
					I	r	S	x	I	r	S	y	r min.
	Inches	In.	Lbs.	In.²	In.⁴	In.	In.³	In.	In.⁴	In.	In.³	In.	In.
		15/16	18.5	5.43	10.3	1.38	3.6	1.65	3.6	0.81	1.7	0.90	0.64
		7/8	17.3	5.06	9.7	1.39	3.4	1.63	3.4	0.82	1.6	0.88	0.64
		11/16	16.0	4.68	9.1	1.39	3.1	1.60	3.2	0.83	1.5	0.85	0.64
A 25	4½x 3	5/8	14.7	4.30	8.4	1.40	2.9	1.58	3.0	0.83	1.4	0.83	0.64
		9/16	13.3	3.90	7.8	1.41	2.6	1.56	2.8	0.85	1.3	0.81	0.64
		1/2	11.9	3.50	7.0	1.42	2.4	1.54	2.5	0.85	1.1	0.79	0.65
		7/16	10.6	3.09	6.3	1.43	2.1	1.51	2.3	0.85	1.0	0.76	0.65
		3/8	9.1	2.67	5.5	1.44	1.8	1.49	2.0	0.86	0.88	0.74	0.66
		5/16	7.7	2.25	4.7	1.44	1.5	1.47	1.7	0.87	0.75	0.72	0.66
		13/16	18.5	5.43	7.8	1.19	2.9	1.36	5.5	1.01	2.3	1.11	0.72
		3/4	17.3	5.06	7.3	1.20	2.8	1.34	5.2	1.01	2.1	1.09	0.72
		11/16	16.0	4.68	6.9	1.21	2.6	1.32	4.9	1.02	2.0	1.07	0.72
		5/8	14.7	4.30	6.4	1.22	2.4	1.29	4.5	1.03	1.8	1.04	0.72
A 26	4 x3½	9/16	13.3	3.90	5.9	1.23	2.1	1.27	4.2	1.03	1.7	1.02	0.72
		1/2	11.9	3.50	5.3	1.23	1.9	1.25	3.8	1.04	1.5	1.00	0.72
		7/16	10.6	3.09	4.8	1.24	1.7	1.23	3.4	1.05	1.3	0.98	0.72
		3/8	9.1	2.67	4.2	1.25	1.5	1.21	3.0	1.06	1.2	0.96	0.73
		5/16	7.7	2.25	3.6	1.26	1.3	1.18	2.6	1.07	1.0	0.93	0.73
		13/16	17.1	5.03	7.3	1.21	2.9	1.44	3.5	0.83	1.7	0.94	0.64
		3/4	16.0	4.69	6.9	1.22	2.7	1.42	3.3	0.84	1.6	0.92	0.64
		11/16	14.8	4.34	6.5	1.22	2.5	1.39	3.1	0.84	1.5	0.89	0.64
		5/8	13.6	3.98	6.0	1.23	2.3	1.37	2.9	0.85	1.4	0.87	0.64
		9/16	12.4	3.62	5.6	1.24	2.1	1.35	2.7	0.86	1.2	0.85	0.64
A 27	4 x 3	1/2	11.1	3.25	5.0	1.25	1.9	1.33	2.4	0.86	1.1	0.83	0.64
		7/16	9.8	2.87	4.5	1.25	1.7	1.30	2.2	0.87	1.0	0.80	0.64
		3/8	8.5	2.48	4.0	1.26	1.5	1.28	1.9	0.88	0.87	0.78	0.64
		5/16	7.2	2.09	3.4	1.27	1.2	1.26	1.7	0.89	0.74	0.76	0.65
		1/4	5.8	1.69	2.8	1.28	1.0	1.24	1.4	0.89	0.60	0.74	0.65
		15/16	15.8	4.62	5.0	1.04	2.2	1.23	3.3	0.85	1.7	0.98	0.62
		7/8	14.7	4.31	4.7	1.04	2.1	1.21	3.1	0.85	1.5	0.96	0.62
		13/16	13.6	4.00	4.4	1.05	1.9	1.19	3.0	0.86	1.4	0.94	0.62
		3/4	12.5	3.67	4.1	1.06	1.8	1.17	2.8	0.87	1.3	0.92	0.62
A 28	3½x 3	11/16	11.4	3.34	3.8	1.07	1.6	1.15	2.5	0.87	1.2	0.90	0.62
		1/2	10.2	3.00	3.5	1.07	1.5	1.13	2.3	0.88	1.1	0.88	0.62
		7/16	9.1	2.65	3.1	1.08	1.3	1.10	2.1	0.89	0.98	0.85	0.62
		3/8	7.9	2.30	2.7	1.09	1.1	1.08	1.8	0.90	0.85	0.83	0.62
		5/16	6.6	1.93	2.3	1.10	0.96	1.06	1.6	0.90	0.72	0.81	0.63
		1/4	5.4	1.56	1.9	1.11	0.78	1.04	1.3	0.91	0.58	0.79	0.63
		11/16	12.5	3.65	4.1	1.06	1.9	1.27	1.7	0.69	0.99	0.77	0.53
		5/8	11.5	3.36	3.8	1.07	1.7	1.25	1.6	0.69	0.92	0.75	0.53
		9/16	10.4	3.06	3.6	1.08	1.6	1.23	1.5	0.70	0.84	0.73	0.53
A 29	3½x2½	1/2	9.4	2.75	3.2	1.09	1.4	1.20	1.4	0.70	0.76	0.70	0.53
		7/16	8.3	2.43	2.9	1.09	1.3	1.18	1.2	0.71	0.68	0.68	0.54
		3/8	7.2	2.11	2.6	1.10	1.1	1.16	1.1	0.72	0.59	0.66	0.54
		5/16	6.1	1.78	2.2	1.11	0.93	1.14	0.94	0.73	0.50	0.64	0.54
		1/4	4.9	1.44	1.8	1.12	0.75	1.11	0.78	0.74	0.41	0.61	0.54

UNEQUAL ANGLES



ELEMENTS
OF
SECTIONS

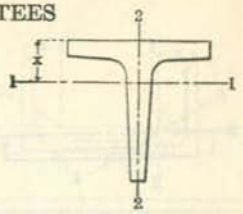
L
ELEMENTS

Section Index	Size	Thickness	Weight per Foot	Area of Section	Axis 1-1				Axis 2-2				Axis 3-3
					I	r	S	x	I	r	S	y	rmin.
	Inches	In.	Lbs.	In.	In.⁴	In.	In.³	In.	In.⁴	In.	In.³	In.	In.
		9/16	9.5	2.78	2.3	0.91	1.2	1.02	1.4	0.72	0.82	0.77	0.52
		1/2	8.5	2.50	2.1	0.91	1.0	1.00	1.3	0.72	0.74	0.75	0.52
A 32	3 x2½	7/16	7.6	2.21	1.9	0.92	0.93	0.98	1.2	0.73	0.66	0.73	0.52
		3/8	6.6	1.92	1.7	0.93	0.81	0.96	1.0	0.74	0.58	0.71	0.52
		5/16	5.6	1.62	1.4	0.94	0.69	0.93	0.90	0.74	0.49	0.68	0.53
		1/4	4.5	1.31	1.2	0.95	0.56	0.91	0.74	0.75	0.40	0.66	0.53
		1/2	7.7	2.25	1.9	0.92	1.0	1.08	0.67	0.55	0.47	0.58	0.43
		7/16	6.8	2.00	1.7	0.93	0.89	1.06	0.61	0.55	0.42	0.56	0.43
A 33	3 x 2	3/8	5.9	1.73	1.5	0.94	0.78	1.04	0.54	0.56	0.37	0.54	0.43
		5/16	5.0	1.47	1.3	0.95	0.66	1.02	0.47	0.57	0.32	0.52	0.43
		1/4	4.1	1.19	1.1	0.95	0.54	0.99	0.39	0.57	0.26	0.49	0.43
		1/2	6.8	2.00	1.1	0.75	0.70	0.88	0.64	0.56	0.46	0.63	0.42
		7/16	6.1	1.78	1.0	0.76	0.62	0.85	0.58	0.57	0.41	0.60	0.42
		3/8	5.3	1.55	0.91	0.77	0.55	0.83	0.51	0.58	0.36	0.58	0.42
A 35	2½x 2	5/16	4.5	1.31	0.79	0.78	0.47	0.81	0.45	0.58	0.31	0.56	0.42
		1/4	3.62	1.06	0.65	0.78	0.38	0.79	0.37	0.59	0.25	0.54	0.42
		3/16	2.75	0.81	0.51	0.79	0.29	0.76	0.29	0.60	0.20	0.51	0.43
		1/8	1.86	0.55	0.35	0.80	0.20	0.74	0.20	0.61	0.13	0.49	0.43
		5/16	3.92	1.15	0.71	0.79	0.44	0.90	0.19	0.41	0.17	0.40	0.32
A 48	2½x1½	1/4	3.19	0.94	0.59	0.79	0.36	0.88	0.16	0.41	0.14	0.38	0.32
		3/16	2.44	0.72	0.46	0.80	0.28	0.85	0.13	0.42	0.11	0.35	0.33
		1/2	5.6	1.63	0.75	0.68	0.54	0.86	0.26	0.40	0.26	0.48	0.32
		7/16	5.0	1.45	0.68	0.69	0.48	0.83	0.24	0.41	0.23	0.46	0.32
A 270	2¼x1½	3/8	4.4	1.27	0.61	0.69	0.42	0.81	0.21	0.41	0.20	0.44	0.32
		5/16	3.66	1.07	0.53	0.70	0.36	0.79	0.19	0.42	0.17	0.42	0.32
		1/4	2.98	0.88	0.44	0.71	0.30	0.77	0.16	0.42	0.14	0.39	0.32
		3/16	2.28	0.67	0.34	0.72	0.23	0.75	0.12	0.43	0.11	0.37	0.33
		3/8	3.99	1.17	0.43	0.61	0.34	0.71	0.21	0.42	0.20	0.46	0.32
		5/16	3.39	1.00	0.38	0.62	0.29	0.69	0.18	0.42	0.17	0.44	0.32
A 37	2 x1½	1/4	2.77	0.81	0.32	0.62	0.24	0.66	0.15	0.43	0.14	0.41	0.32
		3/16	2.12	0.62	0.25	0.63	0.18	0.64	0.12	0.44	0.11	0.39	0.32
		1/8	1.44	0.42	0.17	0.64	0.13	0.62	0.09	0.45	0.08	0.37	0.33
A 645	2 x1¼	1/4	2.55	0.75	0.30	0.63	0.23	0.71	0.09	0.34	0.10	0.33	0.27
		3/16	1.96	0.57	0.23	0.64	0.18	0.69	0.07	0.35	0.08	0.31	0.27
		1/4	2.34	0.69	0.20	0.54	0.18	0.60	0.09	0.35	0.10	0.35	0.27
A 39	1¾x1¼	3/16	1.80	0.53	0.16	0.55	0.14	0.58	0.07	0.36	0.08	0.33	0.27
		1/8	1.23	0.36	0.11	0.56	0.09	0.56	0.05	0.37	0.05	0.31	0.27
		5/16	2.59	0.76	0.16	0.45	0.16	0.52	0.10	0.35	0.11	0.40	0.26
A624	1½x1¼	1/4	2.13	0.63	0.13	0.46	0.13	0.50	0.08	0.36	0.09	0.38	0.26
		3/16	1.64	0.48	0.10	0.46	0.10	0.48	0.07	0.37	0.07	0.35	0.26

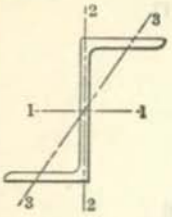
T
ELEMENTS

EQUAL AND UNEQUAL TEES

ELEMENTS
OF
SECTIONS



Section Index	Size				Weight per Foot	Area of Section	Axis 1-1				Axis 2-2		
	Flange	Stem	Minimum Thickness				I	S	r	x	I	S	r
			Flange	Stem									
	In.	In.	In.	In.	Lbs.	In.^{2}	In.^{4}	In.^{3}	In.	In.	In.^{4}	In.^{3}	In.
EQUAL TEES													
T 40	6½	6½	0.40	0.45	19.8	5.80	23.5	5.0	2.01	1.76	10.1	3.1	1.32
T 1	4	4	½	½	13.5	3.97	5.7	2.0	1.20	1.18	2.8	1.4	0.84
T 2	4	4	⅝	⅝	10.5	3.09	4.5	1.6	1.21	1.13	2.1	1.1	0.83
T 8	3	3	⅝	⅝	7.8	2.27	1.8	0.86	0.90	0.88	0.90	0.60	0.63
T 9	3	3	9/16	9/16	6.7	1.95	1.6	0.74	0.90	0.86	0.75	0.50	0.62
T 10	2½	2½	⅝	⅝	6.4	1.87	1.0	0.59	0.74	0.76	0.52	0.42	0.53
T 11	2½	2½	9/16	9/16	5.5	1.60	0.88	0.50	0.74	0.74	0.44	0.35	0.52
T 12	2¼	2¼	9/16	9/16	4.9	1.43	0.65	0.41	0.67	0.68	0.33	0.29	0.48
T 13	2¼	2¼	¼	¼	4.1	1.19	0.52	0.32	0.66	0.65	0.25	0.22	0.46
T 14	2	2	9/16	9/16	4.3	1.26	0.44	0.31	0.59	0.61	0.23	0.23	0.43
T 15	2	2	¼	¼	3.56	1.05	0.37	0.26	0.59	0.59	0.18	0.18	0.42
UNEQUAL TEES													
T 50	5	3½	½	13/32	13.6	4.00	2.7	1.1	0.82	0.76	5.2	2.1	1.14
	5	3	⅝	13/32	11.5	3.37	2.4	1.1	0.84	0.76	3.9	1.6	1.10
T 57	4	5	½	½	15.3	4.50	10.8	3.1	1.55	1.56	2.8	1.4	0.79
T 58	4	5	⅝	⅝	11.9	3.49	8.5	2.4	1.56	1.51	2.1	1.1	0.78
T 59	4	4½	½	½	14.4	4.23	7.9	2.5	1.37	1.37	2.8	1.4	0.81
T 60	4	4½	⅝	⅝	11.2	3.29	6.3	2.0	1.39	1.31	2.1	1.1	0.80
T 61	4	3	⅝	⅝	9.2	2.68	2.0	0.90	0.86	0.78	2.1	1.1	0.89
T 44	4	3	9/16	9/16	7.8	2.29	1.7	0.77	0.87	0.75	1.8	0.88	0.88
T 62	4	2½	⅝	⅝	8.5	2.48	1.2	0.62	0.69	0.62	2.1	1.0	0.92
T 63	4	2½	9/16	9/16	7.2	2.12	1.0	0.53	0.69	0.60	1.8	0.88	0.91
T 79	3	2½	9/16	9/16	6.1	1.77	0.94	0.52	0.73	0.68	0.75	0.50	0.65
T 83	2½	3	9/16	9/16	6.1	1.77	1.5	0.72	0.92	0.92	0.44	0.35	0.50
T519	1½	2	9/16	9/16	2.45	0.72	0.27	0.19	0.61	0.63	0.06	0.08	0.92
T605	1½	1¼	⅛	⅛	1.25	0.37	0.05	0.05	0.37	0.33	0.04	0.05	0.32



ZEES

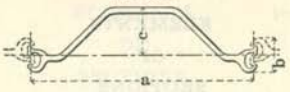
ELEMENTS OF SECTIONS

ELEMENTS

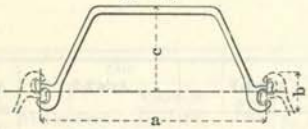
Section Index	Size			Weight per Foot	Area of Section	Axis 1-1			Axis 2-2			Axis 3-3
	Depth	Flanges	Thickness			I	S	r	I	S	r	r min.
	In.	In.	In.	Lbs.	In.^{2}	In.^{4}	In.^{3}	In.	In.^{4}	In.^{3}	In.	In.
Z 3	6⅛	3⅝	7/8	34.6	10.17	50.2	16.4	2.22	19.2	6.0	1.37	0.83
	6 1/16	3 9/16	13/16	32.0	9.40	46.1	15.2	2.22	17.3	5.5	1.36	0.82
	6	3½	¾	29.4	8.63	42.1	14.0	2.21	15.4	4.9	1.34	0.81
Z 2	6⅛	3⅝	11/16	28.1	8.25	43.2	14.1	2.29	16.3	5.0	1.41	0.84
	6 1/16	3 9/16	⅝	25.4	7.46	38.9	12.8	2.28	14.4	4.4	1.39	0.82
	6	3½	9/16	22.8	6.68	34.6	11.5	2.28	12.6	3.9	1.37	0.81
Z 1	6⅛	3⅝	½	21.1	6.19	34.4	11.2	2.36	12.9	3.8	1.44	0.84
	6 1/16	3 9/16	7/16	18.4	5.39	29.8	9.8	2.35	11.0	3.3	1.43	0.83
	6	3½	⅜	15.7	4.59	25.3	8.4	2.35	9.1	2.8	1.41	0.83
Z 6	5⅛	3⅝	13/16	28.4	8.33	28.7	11.2	1.86	14.4	4.8	1.31	0.76
	5 1/16	3 9/16	¾	26.0	7.64	26.2	10.3	1.85	12.8	4.4	1.30	0.74
	5	3¼	11/16	23.7	6.96	23.7	9.5	1.84	11.4	3.9	1.28	0.73
Z 5	5⅛	3⅜	5/8	22.6	6.64	24.5	9.6	1.92	12.1	3.9	1.35	0.76
	5 1/16	3 5/16	9/16	20.2	5.94	21.8	8.6	1.91	10.5	3.5	1.33	0.75
	5	3¼	½	17.9	5.25	19.2	7.7	1.91	9.1	3.0	1.31	0.74
Z 4	5⅛	3⅜	7/16	16.4	4.81	19.1	7.4	1.99	9.2	2.9	1.38	0.77
	5 1/16	3 5/16	⅜	14.0	4.10	16.2	6.4	1.99	7.7	2.5	1.37	0.76
	5	3¼	5/16	11.6	3.40	13.4	5.3	1.98	6.2	2.0	1.35	0.75
Z 9	4⅛	3 1/16	¾	23.0	6.75	15.0	7.3	1.49	11.2	4.0	1.29	0.68
	4 1/16	3⅛	11/16	20.9	6.14	13.5	6.7	1.48	10.0	3.6	1.27	0.67
	4	3 1/16	⅝	18.9	5.55	12.1	6.1	1.48	8.7	3.2	1.25	0.66
Z 8	4⅛	3 1/16	9/16	18.0	5.27	12.7	6.2	1.55	9.3	3.2	1.33	0.68
	4 1/16	3¼	½	15.9	4.66	11.2	5.5	1.55	8.0	2.8	1.31	0.67
	4	3 1/16	7/16	13.8	4.05	9.7	4.8	1.55	6.7	2.4	1.29	0.66
Z 7	4⅛	3 1/16	⅜	12.5	3.66	9.6	4.7	1.62	6.8	2.3	1.36	0.69
	4 1/16	3¼	5/16	10.3	3.03	7.9	3.9	1.62	5.5	1.8	1.34	0.68
	4	3 1/16	¼	8.2	2.41	6.3	3.1	1.62	4.2	1.4	1.33	0.67
Z 12	3 1/16	2¾	9/16	14.3	4.18	5.3	3.4	1.12	5.7	2.3	1.17	0.54
	3	2 11/16	½	12.6	3.69	4.6	3.1	1.12	4.9	2.0	1.15	0.53
Z 11	3 1/16	2¾	7/16	11.5	3.36	4.6	3.0	1.17	4.8	1.9	1.19	0.55
	3	2 11/16	⅜	9.8	2.86	3.9	2.6	1.16	3.9	1.6	1.17	0.54
Z 10	3 1/16	2¾	5/16	8.5	2.48	3.6	2.4	1.21	3.6	1.4	1.21	0.56
	3	2 11/16	¼	6.7	1.97	2.9	1.9	1.21	2.8	1.1	1.19	0.55

CARNEGIE STEEL SHEET PILING

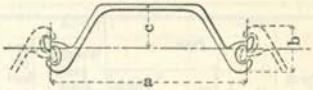
M 111



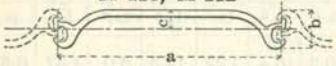
M 110



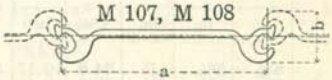
M 106



M 113, M 112

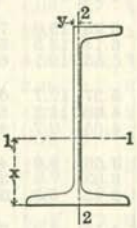


M 107, M 108



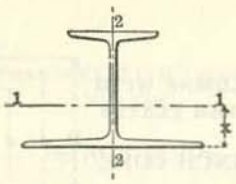
Section Index	Nominal Width	Web Thickness	Weight per Foot	Area of Section	Single Section I	Single Section S	Section, Horizontal Foot of Wall Dimensions a	b	c	S	Weight Lbs. per Sq. Ft.
	In.	In.	Lbs.	In.^{2}	In.^{4}	In.^{3}				In.^{3}	
M 111	16	5/8	29.3	8.63	18.66	7.74	16	2 9/16	3 5/8	5.80	22.0
M 110	16	31/64	42.6	12.51	86.84	20.34	16	2 11/16	6	15.26	32.0
M 106	14	5/8	36.9	10.84	25.74	10.34	14	3 1/4	3 1/8	8.86	31.6
M 112	16	3/8	30.6	8.99	4.51	2.50	16	2 11/16	1 11/32	1.88	23.0
M 113	16	1/4	36.2	10.65	6.06	3.28	16	2 11/16	1 11/32	2.46	27.2
M 107	15	3/8	38.4	11.29	6.23	4.10	15	3 11/16	....	3.28	30.7
M 108	15	1/2	42.8	12.58	6.25	4.10	15	3 11/16	....	3.28	34.2

CAR CENTER SILL SECTION

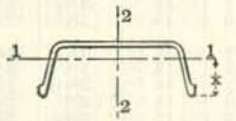


Section Index	Depth	Weight per Foot	Area	Width of Flange	Thickness of Web	Axis 1-1 I	Axis 1-1 S	Axis 1-1 r	Axis 1-1 x	Axis 2-2 I	Axis 2-2 S	Axis 2-2 r	Axis 2-2 y
	In.	Lb.	In.^{2}	In.	In.	In.^{4}	In.^{3}	In.	In.	In.^{4}	In.^{3}	In.	In.
B112	12	40.3	11.72	3 1/4.7	1 13/32	238.1	31.9	4.51	4.54	21.8	5.9	1.36	0.43

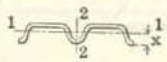
CROSS TIES



Section Index	Depth of Section	Weight per Foot	Area of Section	Width of Flange		Thickness of Web	Axis 1-1				Axis 2-2		
				Top	Bottom		I	S	r	x	I	S	r
	In.	Lbs.	In.²	In.	In.	In.	In.⁴	In.³	In.	In.	In.⁴	In.³	In.
M 29	5.50	24.0	7.01	5.0	8.0	.375	35.4	11.3	2.25	2.38	16.8	4.2	1.55
M 21	5.50	20.0	5.71	4.5	8.0	.250	30.9	9.7	2.33	2.33	14.9	3.7	1.62
M 25	4.25	14.5	4.10	4.0	6.0	.250	13.0	5.5	1.78	1.88	6.1	2.0	1.22
M 24	3.00	9.4	2.77	3.0	4.5	.203	4.2	2.5	1.24	1.32	2.9	1.3	1.03



Section Index	Depth of Section	Weight per Foot	Area of Section	Width of Section		Thickness	Axis 1-1				Axis 2-2		
				Top	Bottom		I	S	r	x	I	S	r
	In.	Lbs.	In.²	In.	In.	In.	In.⁴	In.³	In.	In.	In.⁴	In.³	In.
M 27	2.25	9.0	2.62	5.5	7.0	.250	1.28	0.79	0.70	1.62	16.8	4.8	2.53
M 20	2.00	6.0	1.72	4.5	6.0	.188	0.71	0.51	0.64	1.41	8.4	2.8	2.22
M 18	1.50	4.2	1.21	3.4	5.0	.156	0.31	0.31	0.50	1.00	3.6	1.5	1.73



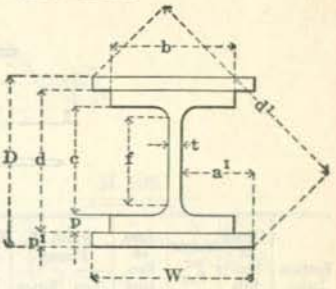
Section Index	Depth of Section	Weight per Foot	Area of Section	Width of Section	Thickness	Axis 1-1				Axis 2-2		
						I	S	r	x	I	S	r
	In.	Lbs.	In.²	In.	In.	In.⁴	In.³	In.	In.	In.⁴	In.³	In.
M 26A	1 3/16	3.25	0.95	4 3/4	.141	0.068	0.136	0.27	0.50	1.94	0.82	1.43
M 19A	1 1/16	2.50	0.74	4 1/4	.125	0.034	0.077	0.21	0.44	1.23	0.58	1.29

DIMENSIONS

CARNEGIE BEAM SECTIONS

COLUMNS WITH COVER PLATES

14-INCH CORE

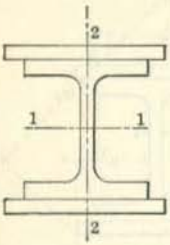


Core Section Index Weight per Foot	Weight of Column per Foot, Lbs.	Area Sq. In.	Cover Plate Size		Total Depth of Column "D"	Diagonal d^1	Dimensions, Inches
			Width W	Thickness p^1			
	914.6	269.0	18	4	26 9/16	32 1/16	
CB 146	891.6	262.2	18	3 13/16	26 3/16	31 5/8	
425 lbs.	868.7	255.5	18	3 5/8	25 13/16	31 7/16	a^1 = 8.044
	845.7	248.7	18	3 7/16	25 7/16	31 1/8	t = 1.912
	822.8	242.0	18	3 1/4	25 1/16	30 7/8	f = 11.00
							c = 12.39
	799.8	235.2	18	3 1/16	24 11/16	30 9/16	d = 18.51
CB 146	776.9	228.5	18	2 7/8	24 5/16	30 1/4	b = 16.506
425 lbs.	753.9	221.7	18	2 11/16	23 15/16	29 15/16	p = 3.060
	731.0	215.0	18	2 1/2	23 9/16	29 5/8	
	708.0	208.2	18	2 5/16	23 3/16	29 5/16	
							a^1 = 8.2535
	684.5	201.3	18	2 15/16	23 1/16	29 1/4	t = 1.493
	661.6	194.6	18	2 3/4	22 11/16	29	f = 11.00
CB 146	638.6	187.8	18	2 9/16	22 5/16	28 11/16	c = 12.39
325 lbs.	615.7	181.1	18	2 3/8	21 15/16	28 3/8	d = 17.164
	592.7	174.3	18	2 3/16	21 9/16	28 1/8	b = 16.087
	569.8	167.6	18	2	21 3/16	27 13/16	p = 2.387
							a^1 = 7.7535
	548.9	161.5	17	1 15/16	21 1/16	27 1/16	t = 1.493
	527.3	155.1	17	1 3/4	20 11/16	26 13/16	f = 11.00
CB 146	505.6	148.7	17	1 9/16	20 5/16	26 1/2	c = 12.39
325 lbs.	483.9	142.3	17	1 3/8	19 15/16	26 3/16	d = 17.164
	462.2	136.0	17	1 3/16	19 9/16	25 11/16	b = 16.087
	440.6	129.6	17	1	19 3/16	25 5/8	p = 2.387

NOTE:—Weights do not include rivets.

CARNEGIE BEAM SECTIONS

ELEMENTS



COLUMNS WITH COVER PLATES

14-INCH CORE

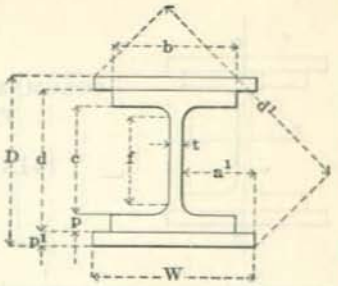
Total Depth of Column "D"	Weight of Column per Foot, Lbs.	Area Sq. In.	Axis 1-1				Axis 2-2			
			I In.⁴	S In.³	r In.	Bending Factor, A÷S	I In.⁴	S In.³	r In.	Bending Factor, A÷S
26 3/16	914.6	269.0	24854	1875	9.61	.143	6189	688	4.80	.391
26 1/16	891.6	262.2	23684	1812	9.50	.145	6007	667	4.79	.393
25 15/16	868.7	255.5	22548	1751	9.39	.146	5825	647	4.77	.395
25 7/16	845.7	248.7	21445	1690	9.29	.147	5642	627	4.76	.397
25 1/16	822.8	242.0	20373	1629	9.18	.149	5460	607	4.75	.399
24 11/16	799.8	235.2	19333	1570	9.07	.150	5278	586	4.74	.401
24 5/16	776.9	228.5	18325	1511	8.96	.151	5096	566	4.72	.404
23 15/16	753.9	221.7	17347	1453	8.84	.153	4913	546	4.71	.406
23 9/16	731.0	215.0	16399	1395	8.73	.154	4731	526	4.69	.409
23 3/16	708.0	208.2	15481	1338	8.62	.156	4549	505	4.67	.412
23 1/16	684.5	201.3	15230	1322	8.70	.152	4515	502	4.74	.401
22 11/16	661.6	194.6	14350	1266	8.59	.154	4333	481	4.72	.404
22 3/16	638.6	187.8	13498	1211	8.48	.155	4151	461	4.70	.407
21 15/16	615.7	181.1	12674	1157	8.37	.157	3968	441	4.68	.411
21 9/16	592.7	174.3	11878	1103	8.25	.158	3786	421	4.66	.414
21 3/16	569.8	167.6	11109	1050	8.14	.160	3604	400	4.64	.418
21 1/16	548.9	161.5	10505	999	8.07	.162	3246	382	4.48	.423
20 11/16	527.3	155.1	9813	950	7.95	.163	3093	364	4.47	.426
20 5/16	505.6	148.7	9144	901	7.84	.165	2939	346	4.45	.430
19 15/16	483.9	142.3	8500	854	7.73	.167	2786	328	4.42	.434
19 9/16	462.2	136.0	7880	807	7.61	.169	2632	310	4.40	.439
19 3/16	440.6	129.6	7283	760	7.50	.170	2479	292	4.37	.444

DIMENSIONS

CARNEGIE BEAM SECTIONS

COLUMNS WITH COVER PLATES

14-INCH CORE

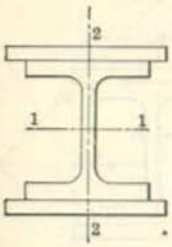


Core Section Index Weight per Foot	Weight of Column per Foot, Lbs.	Area Sq. In.	Cover Plate Size: Width W	Cover Plate Size: Thickness p^1	Total Depth of Column "D"	Diagonal d^1	Dimensions, Inches
	348.6	102.5	16	2	18 3/16	24 1/4	
	341.8	100.5	16	1 15/16	18 1/16	24 1/8	
	335.0	98.5	16	1 7/8	17 15/16	24 1/16	
	328.2	96.5	16	1 13/16	17 13/16	23 15/16	
	321.4	94.5	16	1 3/4	17 11/16	23 7/8	
	314.6	92.5	16	1 11/16	17 9/16	23 3/4	
	307.8	90.5	16	1 5/8	17 7/16	23 11/16	
	301.0	88.5	16	1 9/16	17 5/16	23 9/16	a^1 = 7.563
	294.2	86.5	16	1 1/2	17 5/16	23 1/2	
	287.4	84.5	16	1 7/16	17 1/16	23 3/8	t = 0.874
	280.6	82.5	16	1 3/8	16 15/16	23 5/16	
	273.8	80.5	16	1 5/16	16 13/16	23 1/4	f =11.00
CB 146	267.0	78.5	16	1 1/4	16 11/16	23 1/8	
131 lbs.	260.2	76.5	16	1 3/16	16 9/16	23 1/16	c =12.39
	253.4	74.5	16	1 1/8	16 7/16	22 15/16	
	246.6	72.5	16	1 1/16	16 5/16	22 7/8	d =14.162
	239.8	70.5	16	1	16 5/16	22 3/4	
	233.0	68.5	16	15/16	16 1/16	22 11/16	b =15.468
	226.2	66.5	16	7/8	15 15/16	22 5/8	
	219.4	64.5	16	13/16	15 13/16	22 1/2	p = 0.886
	212.6	62.5	16	3/4	15 11/16	22 5/16	
	205.8	60.5	16	11/16	19 9/16	22 5/16	
	199.0	58.5	16	5/8	15 7/16	22 1/4	
	192.2	56.5	16	9/16	15 5/16	22 1/8	
	185.4	54.5	16	1/2	15 5/16	22 1/16	
	178.6	52.5	16	7/16	15 1/16	22	
	171.8	50.5	16	3/8	14 15/16	21 7/8	

NOTE:—Weights do not include rivets.

CARNEGIE BEAM SECTIONS

ELEMENTS



COLUMNS WITH COVER PLATES

14-INCH CORE

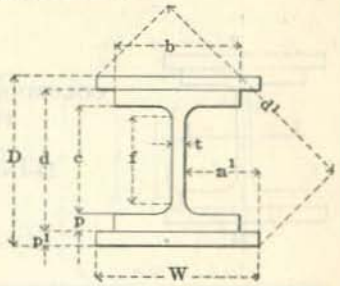
Total Depth of Column "D"	Weight of Column per Foot, Lbs.	Area Sq. In.	Axis 1-1				Axis 2-2			
			I In.⁴	S In.³	r In.	Bending Factor, A÷S	I In.⁴	S In.³	r In.	Bending Factor, A÷S
18 3/16	348.6	102.5	5559	612	7.36	.167	1913	239	4.32	.429
18 1/16	341.8	100.5	5395	598	7.33	.168	1870	234	4.31	.430
17 13/16	335.0	98.5	5234	584	7.29	.169	1827	228	4.31	.431
17 13/16	328.2	96.5	5074	571	7.25	.169	1785	223	4.30	.433
17 11/16	321.4	94.5	4917	557	7.21	.170	1742	218	4.29	.434
17 9/16	314.6	92.5	4763	543	7.17	.170	1699	212	4.29	.436
17 7/16	307.8	90.5	4610	530	7.14	.171	1657	207	4.28	.437
17 5/16	301.0	88.5	4459	516	7.10	.172	1614	202	4.27	.439
17 3/16	294.2	86.5	4311	502	7.06	.172	1571	196	4.26	.441
17 1/16	287.4	84.5	4165	489	7.02	.173	1529	191	4.25	.442
16 15/16	280.6	82.5	4021	475	6.98	.174	1486	186	4.24	.444
16 13/16	273.8	80.5	3879	462	6.94	.174	1443	180	4.23	.446
16 11/16	267.0	78.5	3739	449	6.90	.175	1401	175	4.22	.448
16 9/16	260.2	76.5	3601	436	6.86	.176	1358	170	4.21	.451
16 7/16	253.4	74.5	3465	422	6.82	.176	1315	164	4.20	.453
16 5/16	246.6	72.5	3332	409	6.78	.177	1273	159	4.19	.456
16 3/16	239.8	70.5	3200	396	6.74	.178	1230	154	4.18	.459
16 1/16	233.0	68.5	3071	383	6.69	.179	1187	148	4.16	.462
15 15/16	226.2	66.5	2943	370	6.65	.180	1145	143	4.15	.465
15 14/16	219.4	64.5	2817	357	6.61	.181	1102	138	4.13	.468
15 11/16	212.6	62.5	2694	344	6.56	.182	1059	132	4.12	.472
15 9/16	205.8	60.5	2572	331	6.52	.183	1017	127	4.10	.476
15 7/16	199.0	58.5	2452	318	6.47	.184	974	122	4.08	.481
15 5/16	192.2	56.5	2335	305	6.43	.185	931	116	4.06	.486
15 3/16	185.4	54.5	2219	293	6.38	.186	889	111	4.04	.491
15 1/16	178.6	52.5	2105	280	6.33	.188	846	106	4.01	.497
14 15/16	171.8	50.5	1993	267	6.28	.189	803	100	3.99	.503

DIMENSIONS

CARNEGIE BEAM SECTIONS

COLUMNS WITH COVER PLATES

14-INCH CORE

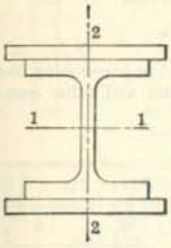


Core Section Index Weight per Foot	Weight of Column per Foot, Lbs.	Area Sq. In.	Cover Plate Size		Total Depth of Column "D"	Diagonal d^1	Dimensions, Inches
			Width W	Thickness p^1			
	914.6	269.0	24	3	24 3/16	34 1/16	
	894.2	263.0	24	2 7/8	24 1/16	34 3/16	
	873.8	257.0	24	2 3/4	24 1/16	34	a^1 = 11.044
	853.4	251.0	24	2 5/8	23 15/16	33 15/16	t = 1.912
	833.0	245.0	24	2 1/2	23 9/16	33 5/8	f = 11.00
CB 146	812.6	239.0	24	2 3/8	23 5/16	33 7/16	c = 12.39
425 lbs.	792.2	233.0	24	2 1/4	23 1/16	33 1/4	d = 18.510
	771.8	227.0	24	2 1/8	22 13/16	33 1/8	b = 16.506
	751.4	221.0	24	2	22 9/16	32 15/16	p = 3.060
	731.0	215.0	24	1 7/8	22 5/16	32 3/4	
	710.6	209.0	24	1 3/4	22 1/16	32 5/8	
	690.2	203.0	24	1 5/8	21 13/16	32 7/16	
	671.8	197.6	24	2 1/8	21 7/16	32 3/16	
	651.4	191.6	24	2	21 5/16	32	a^1 = 11.2535
	631.0	185.6	24	1 7/8	20 15/16	31 7/8	t = 1.493
CB 146	610.6	179.6	24	1 3/4	20 11/16	31 11/16	f = 11.00
325 lbs.	590.2	173.6	24	1 5/8	20 7/16	31 9/16	c = 12.39
	569.8	167.6	24	1 1/2	20 5/16	31 3/8	d = 17.164
	549.4	161.6	24	1 3/8	19 15/16	31 5/16	b = 16.087
	529.0	155.6	24	1 1/4	19 11/16	31 1/16	p = 2.387
	514.8	151.4	22	1 15/16	19 11/16	29 1/2	a^1 = 10.472
	496.1	145.9	22	1 13/16	19 7/16	29 3/8	t = 1.056
CB 146	477.4	140.4	22	1 11/16	19 3/16	29 3/16	f = 11.00
225 lbs.	458.7	134.9	22	1 9/16	18 15/16	29	c = 12.39
	440.0	129.4	22	1 7/16	18 11/16	28 7/8	d = 15.764
							b = 15.650
							p = 1.687

NOTE:—Weights do not include rivets.

CARNEGIE BEAM SECTIONS

ELEMENTS



COLUMNS WITH COVER PLATES

14-INCH CORE

Total Depth of Column "D"	Weight of Column per Foot, Lbs.	Area Sq. In.	Axis 1-1				Axis 2-2			
			I In.⁴	S In.³	r In.	Bending Factor, A÷S	I In.⁴	S In.³	r In.	Bending Factor, A÷S
24 9/16	914.6	269.0	23185	1892	9.28	.142	9213	768	5.85	.350
24 5/16	894.2	263.0	22293	1838	9.21	.143	8925	744	5.83	.354
24 1/16	873.8	257.0	21419	1784	9.13	.144	8637	720	5.80	.357
23 13/16	853.4	251.0	20564	1731	9.05	.145	8349	696	5.77	.361
23 9/16	833.0	245.0	19726	1678	8.97	.146	8061	672	5.74	.365
23 5/16	812.6	239.0	18905	1626	8.89	.147	7773	648	5.70	.369
23 1/16	792.2	233.0	18102	1573	8.81	.148	7485	624	5.67	.374
22 13/16	771.8	227.0	17317	1522	8.73	.149	7197	600	5.63	.378
22 9/16	751.4	221.0	16548	1470	8.65	.150	6909	576	5.59	.384
22 5/16	731.0	215.0	15797	1419	8.57	.151	6621	552	5.55	.390
22 1/16	710.6	209.0	15062	1369	8.49	.153	6333	528	5.50	.396
21 13/16	690.2	203.0	14343	1318	8.41	.154	6045	504	5.46	.403
21 7/16	671.8	197.6	14002	1308	8.42	.151	6556	546	5.76	.362
21 5/16	651.4	191.6	13322	1259	8.34	.152	6268	522	5.72	.367
20 15/16	631.0	185.6	12658	1210	8.26	.153	5980	498	5.68	.372
20 11/16	610.6	179.6	12010	1162	8.18	.154	5692	474	5.63	.379
20 7/16	590.2	173.6	11377	1115	8.10	.156	5404	450	5.58	.385
20 3/16	569.8	167.6	10760	1067	8.01	.157	5116	426	5.53	.393
19 15/16	549.4	161.6	10157	1020	7.93	.158	4828	402	5.47	.402
19 11/16	529.0	155.6	9570	973	7.84	.160	4540	378	5.40	.411
19 11/16	514.8	151.4	9511	969	7.93	.156	4517	411	5.46	.369
19 7/16	496.1	145.9	8987	927	7.85	.157	4296	391	5.43	.374
19 3/16	477.4	140.4	8477	886	7.77	.159	4074	370	5.39	.379
18 15/16	458.7	134.9	7980	845	7.69	.160	3852	350	5.34	.385
18 11/16	440.0	129.4	7496	804	7.61	.161	3630	330	5.30	.392

MOMENTS OF INERTIA OF RECTANGLES

In Widths from ¼ to ⅝ Inch and 1 Inch

Neutral Axis Through Center Normal to Depth

This and the following table may be used in computing the Moments of Inertia of Plate Girders, Columns and other compound sections in which plates are used.

Depth, Inches	Width, Inches							
	¼	5/16	⅜	7/16	½	9/16	⅝	1
1	.021	.026	.031	.037	.042	.047	.052	.083
2	.167	.208	.250	.292	.333	.375	.417	.667
3	.563	.703	.844	.984	1.125	1.266	1.406	2.250
4	1.333	1.667	2.000	2.333	2.667	3.000	3.333	5.333
5	2.604	3.255	3.906	4.557	5.208	5.859	6.510	10.417
6	4.500	5.625	6.750	7.875	9.000	10.125	11.250	18.000
7	7.146	8.932	10.719	12.505	14.292	16.078	17.865	28.583
8	10.667	13.333	16.000	18.667	21.333	24.000	26.667	42.667
9	15.188	18.984	22.781	26.578	30.375	34.172	37.969	60.750
10	20.833	26.042	31.250	36.458	41.667	46.875	52.083	83.333
11	27.729	34.662	41.594	48.526	55.458	62.391	69.323	110.917
12	36.000	45.000	54.000	63.000	72.000	81.000	90.000	144.000
13	45.771	57.214	68.656	80.099	91.542	102.984	114.427	183.083
14	57.167	71.458	85.750	100.042	114.333	128.625	142.917	228.667
15	70.313	87.891	105.469	123.047	140.625	158.203	175.781	281.250
16	85.333	106.667	128.000	149.333	170.667	192.000	213.333	341.333
17	102.354	127.943	153.531	179.120	204.708	230.297	255.885	409.417
18	121.500	151.875	182.250	212.625	243.000	273.375	303.750	486.000
19	142.896	178.620	214.344	250.068	285.792	321.516	357.240	571.583
20	166.667	208.333	250.000	291.667	333.333	375.000	416.667	666.667
21	192.938	241.172	289.406	337.641	385.875	434.109	482.344	771.750
22	221.833	277.292	332.750	388.208	443.667	499.125	554.583	887.333
23	253.479	316.849	380.219	443.589	506.958	570.328	633.698	1013.917
24	288.000	360.000	432.000	504.000	576.000	648.000	720.000	1152.000
25	325.521	406.901	488.281	569.662	651.042	732.422	813.802	1302.083
26	366.167	457.708	549.250	640.792	732.333	823.875	915.417	1464.667
27	410.063	512.578	615.094	717.609	820.125	922.641	1025.156	1640.250
28	457.333	571.667	686.000	800.333	914.667	1029.000	1143.333	1829.333
29	508.104	635.130	762.156	889.182	1016.208	1143.234	1270.260	2032.417
30	562.500	703.125	843.750	984.375	1125.000	1265.625	1406.250	2250.000
32	682.667	853.333	1024.000	1194.667	1365.333	1536.000	1706.667	2730.667
34	818.833	1023.542	1228.250	1432.958	1637.667	1842.375	2047.083	3275.333
36	972.000	1215.000	1458.000	1701.000	1944.000	2187.000	2430.000	3888.000
38	1143.167	1428.958	1714.750	2000.542	2286.333	2572.125	2857.917	4572.667
40	1333.333	1666.667	2000.000	2333.333	2666.667	3000.000	3333.333	5333.333
42	1543.500	1929.375	2315.250	2701.125	3087.000	3472.875	3858.750	6174.000
44	1774.667	2218.333	2662.000	3105.667	3549.333	3993.000	4436.667	7098.667
46	2027.833	2534.792	3041.750	3548.708	4055.667	4562.625	5069.583	8111.333
48	2304.000	2880.000	3456.000	4032.000	4608.000	5184.000	5760.000	9216.000
50	2604.167	3255.208	3906.250	4557.292	5208.333	5859.375	6510.417	10416.667
52	2929.333	3661.667	4394.000	5126.333	5858.667	6591.000	7323.333	11717.333
54	3280.500	4100.625	4920.750	5740.875	6561.000	7381.125	8201.250	13122.000
56	3658.667	4573.333	5488.000	6402.667	7317.333	8232.000	9146.667	14634.667
58	4064.833	5081.042	6097.250	7113.458	8129.667	9145.875	10162.083	16259.333
60	4500.000	5625.000	6750.000	7875.000	9000.000	10125.000	11250.000	18000.000

MOMENTS OF INERTIA OF RECTANGLES

In Widths of 1 Inch

Neutral Axis Through Center Normal to Depth

To obtain the Moment of Inertia of any rectangle, multiply the tabular value for its depth by its width in inches. For deeper rectangles of tabular thickness, multiply the tabular values for half their depth by 8; or for one-third their depth by 27, etc.

Depth, Inches	$I_{1\text{-}1}$ Inches^4	Depth, Inches	$I_{1\text{-}1}$ Inches^4	Depth, Inches	$I_{1\text{-}1}$ Inches^4	Depth, Inches	$I_{1\text{-}1}$ Inches^4	Depth, Inches	$I_{1\text{-}1}$ Inches^4	Depth, Inches	$I_{1\text{-}1}$ Inches^4
0	.000	6	18.000	12	144.000	18	486.000	24	1152.000	30	2250.000
1/8	.000	1/8	19.149	1/8	148.547	1/8	496.195	1/8	1170.094	1/8	2278.243
1/4	.001	1/4	20.345	1/4	153.189	1/4	506.533	1/4	1188.376	1/4	2306.721
3/8	.004	3/8	21.590	3/8	157.926	3/8	517.012	3/8	1206.848	3/8	2335.434
1/2	.010	1/2	22.885	1/2	162.760	1/2	527.635	1/2	1225.510	1/2	2364.385
5/8	.020	5/8	24.231	5/8	167.692	5/8	538.403	5/8	1244.364	5/8	2393.575
3/4	.035	3/4	25.629	3/4	172.723	3/4	549.317	3/4	1263.410	3/4	2423.004
7/8	.056	7/8	27.079	7/8	177.853	7/8	560.376	7/8	1282.650	7/8	2452.674
1	.083	7	28.583	13	183.083	19	571.583	25	1302.083	31	2482.583
1/8	.119	1/8	30.142	1/8	188.416	1/8	582.939	1/8	1321.713	1/8	2512.737
1/4	.163	1/4	31.757	1/4	193.850	1/4	594.444	1/4	1341.538	1/4	2543.132
3/8	.217	3/8	33.428	3/8	199.389	3/8	606.099	3/8	1361.561	3/8	2573.771
1/2	.281	1/2	35.156	1/2	205.031	1/2	617.906	1/2	1381.781	1/2	2604.656
5/8	.358	5/8	36.944	5/8	210.779	5/8	629.866	5/8	1402.202	5/8	2635.787
3/4	.447	3/4	38.790	3/4	216.634	3/4	641.978	3/4	1422.821	3/4	2667.165
7/8	.549	7/8	40.698	7/8	222.596	7/8	654.245	7/8	1443.644	7/8	2698.792
2	.667	8	42.667	14	228.667	20	666.667	26	1464.667	32	2730.667
1/8	.800	1/8	44.698	1/8	234.847	1/8	679.245	1/8	1485.893	1/8	2762.792
1/4	.949	1/4	46.793	1/4	241.137	1/4	691.840	1/4	1507.324	1/4	2795.168
3/8	1.116	3/8	48.952	3/8	247.538	3/8	704.874	3/8	1528.961	3/8	2827.797
1/2	1.302	1/2	51.177	1/2	254.052	1/2	717.927	1/2	1550.802	1/2	2860.677
5/8	1.507	5/8	53.468	5/8	260.679	5/8	731.141	5/8	1572.851	5/8	2893.812
3/4	1.733	3/4	55.827	3/4	267.421	3/4	744.514	3/4	1595.108	3/4	2927.202
7/8	1.980	7/8	58.254	7/8	274.277	7/8	758.051	7/8	1617.575	7/8	2960.849
3	2.250	9	60.750	15	281.250	21	771.750	27	1640.250	33	2994.750
1/8	2.543	1/8	63.317	1/8	288.340	1/8	785.613	1/8	1663.136	1/8	3028.911
1/4	2.861	1/4	65.954	1/4	295.548	1/4	799.652	1/4	1686.236	1/4	3063.329
3/8	3.204	3/8	68.665	3/8	302.875	3/8	813.836	3/8	1709.547	3/8	3098.009
1/2	3.573	1/2	71.448	1/2	310.323	1/2	828.198	1/2	1733.073	1/2	3132.948
5/8	3.970	5/8	74.305	5/8	317.891	5/8	842.727	5/8	1756.814	5/8	3168.150
3/4	4.395	3/4	77.238	3/4	325.582	3/4	857.426	3/4	1780.770	3/4	3203.614
7/8	4.849	7/8	80.247	7/8	333.396	7/8	872.294	7/8	1804.943	7/8	3239.341
4	5.333	10	83.333	16	341.333	22	887.333	28	1829.333	34	3275.333
1/8	5.849	1/8	86.498	1/8	349.396	1/8	902.545	1/8	1853.943	1/8	3311.592
1/4	6.397	1/4	89.741	1/4	357.585	1/4	917.928	1/4	1878.773	1/4	3348.117
3/8	6.978	3/8	93.064	3/8	365.900	3/8	933.486	3/8	1903.823	3/8	3384.909
1/2	7.594	1/2	96.469	1/2	374.344	1/2	949.219	1/2	1929.094	1/2	3421.969
5/8	8.244	5/8	99.955	5/8	382.916	5/8	965.127	5/8	1954.588	5/8	3459.300
3/4	8.931	3/4	103.525	3/4	391.618	3/4	981.212	3/4	1980.305	3/4	3496.900
7/8	9.655	7/8	107.178	7/8	400.452	7/8	997.475	7/8	2006.249	7/8	3534.772
5	10.417	11	110.917	17	409.417	23	1013.917	29	2032.417	35	3572.917
1/8	11.218	1/8	114.741	1/8	418.515	1/8	1030.538	1/8	2058.811	1/8	3611.334
1/4	12.059	1/4	118.652	1/4	427.746	1/4	1047.340	1/4	2085.434	1/4	3650.027
3/8	12.941	3/8	122.652	3/8	437.113	3/8	1064.323	3/8	2112.285	3/8	3688.994
1/2	13.865	1/2	126.740	1/2	446.615	1/2	1081.490	1/2	2139.365	1/2	3728.240
5/8	14.832	5/8	130.918	5/8	456.253	5/8	1098.839	5/8	2166.676	5/8	3767.763
3/4	15.843	3/4	135.186	3/4	466.030	3/4	1116.374	3/4	2194.218	3/4	3807.561
7/8	16.898	7/8	139.547	7/8	475.945	7/8	1134.094	7/8	2221.992	7/8	3847.641
6	18.000	12	144.000	18	486.000	24	1152.000	30	2250.000	36	3888.000

RADII OF GYRATION FOR TWO ANGLES

The following tables of Radii of Gyration for Two Angles are used for computing the safe resistance to compressive stress of two angles, back to back, when used as a strut or a compression chord of a roof truss or a similar member.

The two angles must be held together securely by stay rivets, so spaced that the two angles act as a unit.

The resistance of a compressive member is determined by its ratio of slenderness, l/r, that is the ratio of the unbraced length of the compression member to its least radius of gyration, see page 6.

To obtain the allowable compressive stress, compute, from the compression formula in use, the allowable unit stress corresponding to the ratio of slenderness derived from the least radius of gyration of the two angles in consideration, and multiply that value by the area of the two angles.

In the two examples which follow the least radius of the two angles in Example 1 is taken about axis 1-1, and the least radius of the two angles in Example 2 is taken about axis 2-2.

Example 1. Section given. Required the safe load in compression on a strut composed of two angles 4″ x 4″ x ⅜″, back to back, with an unsupported length of 9 feet.

Area of Section, A = 2 x 2.86 = 5.72 square inches.

Least Radius, Axis 1-1, r = 1.23, by interpolation.

Ratio of Slenderness, l/r = 9 x 12 ÷ 1.23 = 87.8.

Allowed Unit Stress f, by A. I. S. C. formula = 12,603 pounds per sq. inch.

Safe Load, A x f = 5.72 x 12,603 = 72,100 pounds.

Example 2. Load given. Required a section for a member in compression 12′-3″ long, made of two angles separated by ½ inch gusset plates, to resist a total load of 68,000 pounds; ratio of slenderness not to exceed 120.

A. I. S. C. formula, Unit Stress f = 10,000 pounds for l/r = 120.

Approximate Area of Angles, A = 68,000 ÷ 10,000 = 6.80 square inches.

Assume 2 Angles, 5″ x 3″ x 7/16″, 5-inch legs, back to back.

Area of Section, A = 2 x 3.31 = 6.62 square inches.

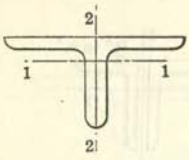
Least Radius, Axis 2-2, r = 1.29 inches, by interpolation.

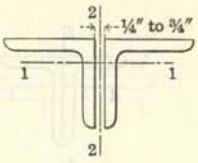
Ratio of Slenderness, l/r = 12.25 x 12 ÷ 1.29 = 114.0.

Allowed Unit Stress f, by A. I. S. C. formula = 10,453 pounds per sq. inch.

Safe Load, A x f = 6.62 x 10,453 = 69,200 pounds.

RADII OF GYRATION FOR TWO EQUAL ANGLES



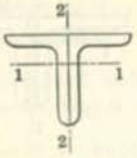


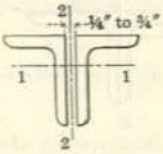
Single Angle			Area of Two Angles, Inches²	Radii of Gyration of Two Angles, Inches					
				Axis 1-1	Axis 2-2				
Size, Inches	Thickness, Inches	Weight, Pounds per Foot			In Contact	¼" Apart	⅜" Apart	½" Apart	¾" Apart
8 x 8	1⅛	56.9	33.46	2.42	3.42	3.51	3.55	3.60	3.69
	13/16	42.0	24.68	2.46	3.37	3.46	3.50	3.55	3.64
	½	26.4	15.50	2.50	3.33	3.41	3.45	3.50	3.59
6 x 6	1	37.4	22.00	1.80	2.59	2.68	2.72	2.77	2.87
	11/16	26.5	15.56	1.83	2.54	2.63	2.67	2.71	2.81
	⅜	14.9	8.72	1.88	2.49	2.58	2.62	2.66	2.75
5 x 5	1	30.6	18.00	1.48	2.19	2.28	2.33	2.38	2.47
	11/16	21.8	12.80	1.51	2.13	2.22	2.26	2.31	2.40
	⅜	12.3	7.22	1.56	2.09	2.17	2.21	2.26	2.35
4 x 4	13/16	19.9	11.68	1.18	1.75	1.85	1.89	1.94	2.04
	½	12.8	7.50	1.22	1.70	1.78	1.83	1.88	1.98
	¼	6.6	3.88	1.25	1.66	1.75	1.79	1.84	1.93
3½x3½	13/16	17.1	10.06	1.02	1.55	1.65	1.70	1.75	1.85
	½	11.1	6.50	1.06	1.50	1.59	1.64	1.69	1.78
	¼	5.8	3.38	1.09	1.46	1.55	1.59	1.64	1.73
3 x 3	⅝	11.5	6.72	0.88	1.32	1.41	1.46	1.51	1.61
	¼	4.9	2.88	0.93	1.25	1.34	1.38	1.43	1.53
2½x2½	½	7.7	4.50	0.74	1.09	1.19	1.24	1.29	1.39
	¼	4.1	2.38	0.77	1.05	1.14	1.19	1.24	1.34
2 x 2	7/16	5.3	3.12	0.59	0.88	0.98	1.03	1.08	1.19
	¼	3.19	1.88	0.61	0.85	0.94	0.99	1.04	1.14

Values of Radii of Gyration for intermediate thickness of angles in above and preceding tables may be obtained by interpolation.

RADII OF GYRATION FOR TWO UNEQUAL ANGLES

Long Legs Vertical

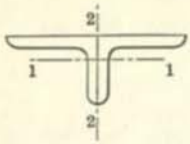


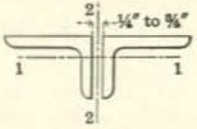


Single Angle			Area of Two Angles, Inches²	Radii of Gyration of Two Angles, Inches					
					Axis 2-2				
Size, Inches	Thickness, Inches	Weight, Pounds per Foot		Axis 1-1	In Contact	¼" Apart	⅜" Apart	½" Apart	¾" Apart
8 x 6	1	44.2	26.00	2.49	2.39	2.48	2.52	2.57	2.66
	¾	33.8	19.88	2.53	2.35	2.44	2.48	2.52	2.61
	7/16	20.2	11.86	2.57	2.31	2.39	2.43	2.48	2.56
8 x3½	1	35.7	21.00	2.51	1.26	1.35	1.40	1.45	1.55
	¾	27.5	16.12	2.55	1.20	1.29	1.34	1.39	1.49
	7/16	16.5	9.68	2.59	1.15	1.23	1.28	1.32	1.41
7 x3½	1	32.3	19.00	2.19	1.31	1.40	1.45	1.50	1.60
	11/16	23.0	13.50	2.23	1.25	1.34	1.39	1.44	1.53
	⅝	13.0	7.60	2.27	1.20	1.28	1.33	1.37	1.46
6 x 4	1	30.6	18.00	1.85	1.60	1.69	1.74	1.79	1.89
	11/16	21.8	12.80	1.89	1.55	1.63	1.68	1.73	1.82
	⅝	12.3	7.22	1.93	1.50	1.58	1.62	1.67	1.76
6 x3½	1	28.9	17.00	1.85	1.37	1.47	1.51	1.56	1.66
	11/16	20.6	12.12	1.89	1.31	1.41	1.45	1.49	1.60
	5/16	9.8	5.74	1.95	1.25	1.33	1.37	1.42	1.50
5 x 4	⅞	24.2	14.22	1.52	1.66	1.76	1.80	1.85	1.95
	⅝	11.0	6.46	1.59	1.58	1.66	1.70	1.75	1.85
5 x3½	⅞	22.7	13.34	1.53	1.42	1.51	1.56	1.61	1.71
	5/16	8.7	5.12	1.61	1.33	1.41	1.45	1.50	1.59
5 x 3	13/16	19.9	11.68	1.55	1.18	1.27	1.32	1.37	1.47
	5/16	8.2	4.80	1.61	1.09	1.17	1.22	1.26	1.35
4½x 3	13/16	18.5	10.86	1.38	1.21	1.31	1.36	1.41	1.51
	5/16	7.7	4.50	1.44	1.13	1.22	1.26	1.30	1.40
4 x3½	13/16	18.5	10.86	1.19	1.50	1.59	1.64	1.69	1.79
	5/16	7.7	4.50	1.26	1.42	1.51	1.55	1.60	1.69
4 x 3	13/16	17.1	10.06	1.21	1.25	1.35	1.40	1.45	1.55
	¼	5.8	3.38	1.28	1.16	1.24	1.28	1.33	1.43
3½x 3	13/16	15.8	9.24	1.04	1.30	1.40	1.45	1.50	1.60
	¼	5.4	3.12	1.11	1.20	1.29	1.34	1.38	1.48
3½x2½	11/16	12.5	7.30	1.06	1.03	1.13	1.18	1.23	1.33
	¼	4.9	2.88	1.12	0.95	1.04	1.09	1.13	1.23
3 x2½	9/16	9.5	5.56	0.91	1.05	1.15	1.20	1.25	1.35
	¼	4.5	2.64	0.95	1.00	1.09	1.13	1.18	1.28
3 x 2	½	7.7	4.50	0.92	0.80	0.89	0.94	1.00	1.10
	¼	4.1	2.38	0.95	0.74	0.84	0.88	0.93	1.03
2½x 2	½	6.8	4.00	0.75	0.84	0.94	0.99	1.04	1.15
	¼	3.62	2.12	0.78	0.80	0.89	0.93	0.98	1.08

RADII OF GYRATION FOR TWO UNEQUAL ANGLES

Short Legs Vertical





Single Angle			Area of Two Angles, Inches²	Radii of Gyration of Two Angles, Inches					
Size, Inches	Thickness, Inches	Weight, Pounds per Foot		Axis 1-1	Axis 2-2				
					In Contact	1/4" Apart	3/8" Apart	1/2" Apart	3/4" Apart
8 x 6	1	44.2	26.00	1.73	3.64	3.73	3.78	3.83	3.92
	3/4	33.8	19.88	1.76	3.60	3.69	3.73	3.78	3.87
	7/16	20.2	11.86	1.80	3.55	3.64	3.68	3.73	3.82
8 x3½	1	35.7	21.00	0.86	4.04	4.14	4.19	4.24	4.34
	3/4	27.5	16.12	0.88	3.99	4.09	4.13	4.18	4.28
	7/16	16.5	9.68	0.92	3.93	4.02	4.07	4.12	4.22
7 x3½	1	32.3	19.00	0.89	3.48	3.58	3.63	3.68	3.78
	11/16	23.0	13.50	0.92	3.42	3.52	3.57	3.62	3.72
	3/8	13.0	7.60	0.96	3.36	3.46	3.50	3.55	3.65
6 x 4	1	30.6	18.00	1.09	2.85	2.95	2.99	3.04	3.14
	11/16	21.8	12.80	1.13	2.79	2.89	2.93	2.98	3.08
	3/8	12.3	7.22	1.17	2.74	2.83	2.87	2.92	3.02
6 x3½	1	28.9	17.00	0.92	2.92	3.02	3.07	3.12	3.22
	11/16	20.6	12.12	0.95	2.87	2.96	3.01	3.06	3.16
	5/16	9.8	5.74	1.00	2.81	2.90	2.95	3.00	3.09
5 x 4	7/8	24.2	14.22	1.14	2.29	2.38	2.43	2.48	2.58
	3/8	11.0	6.46	1.20	2.20	2.29	2.34	2.38	2.48
5 x3½	7/8	22.7	13.34	0.96	2.36	2.45	2.50	2.55	2.65
	5/16	8.7	5.12	1.03	2.26	2.35	2.39	2.44	2.54
5 x 3	13/16	19.9	11.68	0.80	2.42	2.52	2.57	2.62	2.72
	5/16	8.2	4.80	0.85	2.33	2.42	2.47	2.52	2.61
4½x 3	13/16	18.5	10.86	0.81	2.15	2.25	2.30	2.35	2.45
	5/16	7.7	4.50	0.87	2.06	2.15	2.20	2.25	2.34
4 x3½	13/16	18.5	10.86	1.01	1.81	1.91	1.96	2.01	2.11
	5/16	7.7	4.50	1.07	1.73	1.81	1.86	1.91	2.00
4 x 3	13/16	17.1	10.06	0.83	1.88	1.98	2.03	2.08	2.18
	1/4	5.8	3.38	0.89	1.78	1.87	1.92	1.96	2.06
3½x 3	13/16	15.8	9.24	0.85	1.61	1.71	1.76	1.81	1.91
	1/4	5.4	3.12	0.91	1.52	1.61	1.65	1.70	1.80
3½x2½	11/16	12.5	7.30	0.69	1.66	1.75	1.80	1.86	1.96
	1/4	4.9	2.88	0.74	1.58	1.67	1.71	1.76	1.86
3 x2½	9/16	9.5	5.56	0.72	1.37	1.46	1.51	1.56	1.66
	1/4	4.5	2.64	0.75	1.31	1.40	1.45	1.50	1.59
3 x 2	1/2	7.7	4.50	0.55	1.42	1.52	1.57	1.62	1.72
	1/4	4.1	2.38	0.57	1.38	1.47	1.52	1.57	1.67
2½x 2	1/2	6.8	4.00	0.56	1.15	1.25	1.30	1.35	1.46
	1/4	3.62	2.12	0.59	1.11	1.20	1.25	1.30	1.40

RECTANGULAR UNIVERSAL PLATES—CARBON STEEL

UNIVERSAL MILL PLATES, ONE-FOURTH INCH AND OVER—EXTREME SIZES

Thickness, Inches	Weight, Lbs. per Sq. Ft.	Widths and Lengths in Inches												
		48-46	45-41	40-39	38-37	36-35	34-31	30-26	25-20	19-17	16-15	14-12	11-10	9⅞-6⅛
¼	10.20					720	840	1080	1080	1080	1080	1080	1080	1080
5/16	12.75	1200	1200	1260	1320	1320	1320	1380	1380	1200	1200	1200	1200	1080
⅜	15.30	1320	1320	1380	1440	1500	1500	1500	1500	1308	1308	1200	1200	1080
7/16	17.85	1428	1428	1500	1500	1500	1500	1500	1500	1356	1356	1356	1356	1080
½	20.40	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1080
9/16	22.95	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1080
⅝	25.50	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1080
¾	30.60	1248	1332	1500	1476	1500	1320	1500	1500	1500	1500	1500	1500	1080
⅞	35.70	1068	1140	1284	1260	1332	1128	1332	1392	1416	1452	1500	1500	1080
1	40.80	936	996	1128	1104	1164	996	1164	1212	1248	1260	1452	1500	1020
1⅛	45.90	828	888	996	984	1032	876	1032	1080	1104	1128	1284	1500	960
1¼	51.00	744	804	900	876	924	792	924	972	996	1008	1152	1476	900
1⅜	56.10	684	720	816	804	840	720	840	888	900	924	1056	1344	780
1½	61.20	624	660	744	732	768	660	768	804	828	840	960	1224	720
1⅝	66.30	576	612	696	672	708	612	708	744	768	780	888	1128	660
1¾	71.40	528	564	636	624	660	564	660	696	708	720	828	1056	600
1⅞	76.50	492	528	600	588	624	528	624	648	660	672	768	984	600
2	81.60	468	492	564	552	576	492	576	600	624	624	720	924	540

Plates of greater dimensions than shown in above table may be submitted for special consideration.

RECTANGULAR AND CIRCULAR PLATES—CARBON STEEL

SHEARED PLATES, THREE-SIXTEENTH INCH AND OVER—EXTREME SIZES

Thickness, Inches	Weight, Lbs. per Sq. Ft.	Widths and Lengths in Inches										Diam., Inches
		128	126	120	114	108	102	96	90	84	78	
3/16	7.65								270	320	345	90
1/4	10.20				175	250	280	300	330	375	400	115
5/16	12.75			240	270	320	360	380	420	440	460	120
3/8	15.30	220	240	270	320	365	380	410	450	500	550	130
7/16	17.85	240	270	300	360	370	410	430	460	510	550	130
1/2	20.40	260	270	320	365	400	450	480	510	550	580	130
9/16	22.95	260	270	330	373	420	470	500	530	570	600	130
5/8	25.50	260	300	350	390	450	500	520	540	600	620	130
11/16	28.05	260	300	360	420	450	500	520	540	600	620	130
3/4	30.60	260	300	360	400	450	490	520	540	600	620	130
13/16	33.15	260	300	340	385	440	490	510	530	600	620	130
7/8	35.70	260	300	330	375	440	480	510	530	600	620	130
1	40.80	250	300	300	340	440	460	500	530	580	600	130
1 1/8	45.90	250	300	300	330	410	440	450	500	550	580	130
1 1/4	51.00	240	270	300	310	380	400	420	490	530	550	130
1 1/2	61.20	220	230	260	280	330	320	340	420	440	480	130
1 3/4	71.40	200	200	220	240	280	270	300	380	380	410	130
2	81.60	180	180	190	210	240	240	260	320	330	360	130
2 1/4	91.80	150	160	170	190	210	210	230	280	295	320	130

Thickness, Inches	Weight, Lbs. per Sq. Ft.	Widths and Lengths in Inches									Diam., Inches
		72	66	60	54	48	42	36	30	24	
3/16	7.65	375	420	470	480	480	480	480	480	480	90
1/4	10.20	430	475	525	530	530	530	530	530	500	115
5/16	12.75	480	500	560	550	575	550	550	550	550	120
3/8	15.30	600	600	620	620	620	600	600	600	550	130
7/16	17.85	600	630	630	640	640	600	600	600	600	130
1/2	20.40	610	630	630	640	640	600	600	600	600	130
9/16	22.95	620	640	640	640	640	600	600	600	600	130
5/8	25.50	620	640	640	640	640	600	600	600	600	130
11/16	28.05	620	640	640	640	640	600	600	600	580	130
3/4	30.60	620	640	640	640	640	600	600	600	580	130
13/16	33.15	620	640	640	640	640	600	580	570	550	130
7/8	35.70	620	640	640	640	640	600	580	550	550	130
1	40.80	600	630	630	640	640	580	580	520	500	130
1 1/8	45.90	580	620	620	640	640	580	580	520	500	130
1 1/4	51.00	550	600	600	600	600	560	560	520	450	130
1 1/2	61.20	530	600	*600	600	600	540	540	470	430	130
1 3/4	71.40	450	490	550	550	550	540	540	430	380	130
2	81.60	400	440	480	500	500	500	500	400	350	130
2 1/4	91.80	350	390	420	450	450	450	450	300	200	130

Plates 36″ wide and under by 1/4″ thick and heavier, also plates up to 48″ wide and 5/16″ thick and heavier, can be rolled on Universal Mills.

For greater length and Universal Mill Sizes, see Universal Mill Plate Table.

Plates of greater dimensions than shown in above tables may be submitted for special consideration.

RECTANGULAR PLATES—NICKEL STEEL

SHEARED PLATES, ONE-FOURTH INCH AND OVER—EXTREME SIZES

Thickness, Inches	Widths and Lengths in Inches													
	102	96	90	84	78	72	66	60	54	50	48	42	36	30	24
¼						240	240	260	280	280	280	280	280	260	260
5/16					260	260	270	300	310	310	340	340	340	310	310
⅜		280	340	390	420	450	500	500	500	500	480	450	450	430	430
7/16	260	300	360	400	430	480	520	520	520	520	500	490	490	480	480
½	270	320	380	420	460	485	520	520	520	520	500	490	490	480	480
9/16	270	320	380	420	460	485	520	520	520	520	500	490	490	480	480
5/8	270	300	355	390	440	480	520	520	520	520	500	500	500	480	450
11/16	260	300	355	390	440	460	490	500	500	500	500	500	480	480	450
¾	260	300	355	390	440	450	460	500	500	500	500	500	480	480	450
13/16	260	300	355	390	440	440	460	480	500	500	500	500	480	460	440
⅞	260	300	355	390	440	440	460	480	480	480	480	480	480	450	440
1	260	290	320	370	400	430	440	460	480	480	480	480	440	420	420
1⅛	250	270	295	330	375	400	410	420	440	440	440	440	440	420	420
1¼	240	260	290	315	330	350	360	380	390	400	400	420	420	400	400
1½	230	260	290	290	310	330	350	370	390	390	390	390	380	380	360
1¾	220	230	250	270	300	310	330	350	370	390	390	360	340	340	320
2	210	230	250	260	290	295	310	330	350	370	370	340	320	320	290

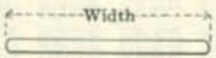
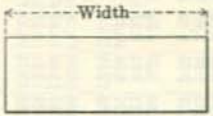
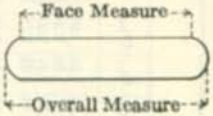
RECTANGULAR PLATES—NICKEL STEEL

UNIVERSAL MILL PLATES, ONE-FOURTH INCH AND OVER—EXTREME SIZES

Thickness, Inches	Widths and Lengths in Inches									
	48-46	45-41	40-36	35-31	30-26	25-20	19-17	16-15	14-12	11-10
¼							660	660	660	660
5/16	540	540	600	660	720	780	780	780	780	780
⅜	720	720	780	840	960	960	1020	1020	1020	1020
7/16	840	840	960	1020	1080	1080	1020	1020	1020	1020
½	960	960	1080	1140	1200	1200	1020	1020	1020	1020
9/16	960	960	1080	1140	1200	1200	1020	1020	1020	1020
5/8	900	900	1020	1080	1140	1140	1000	1000	1020	1020
¾	840	840	960	1020	1080	1080	1000	1000	1020	1020
⅞	780	780	840	960	960	960	1000	1000	1000	1000
1	720	750	780	816	840	900	1000	1000	1000	1000
1⅛	640	667	693	725	744	800	1000	1000	1000	770
1¼	575	600	624	652	672	720	1000	1000	1000	880
1⅜	525	545	567	593	600	655	970	1000	1000	840
1½	480	500	520	544	540	600	890	1000	980	840
1⅝	444	461	480	502	504	554	820	978	980	840
1¾	410	428	445	466	480	514	765	908	980	720
1⅞	384	400	416	435	444	480	710	847	968	660
2	360	375	390	408	420	450	670	794	908	600

All sizes of Rectangular Nickel Steel Plates given in above tables under ½″ thick should be specified to gage only. Plates ½″ thick and over can be rolled to either gage or weight per square foot.

FLAT ROLLED STEEL

Width, Inches	BAND EDGE	SQUARE EDGE	ROUND EDGE
			
	Thickness, B. W. G.	Thickness, Inches	Thickness, Inches
⅜ to ⅞	No. 23 to No. 10	⅛ to 5/16	⅛ to ¼—Face Measure only
Over ⅞ to 1	No. 23 to No. 6	⅛ to ⅜	⅛ to ⅛—Face or Overall Measure
Over 1 to 2	No. 23 to No. 6	5/16 to 1¾	5/16 to 1 — " " " "
Over 2 to 3½	No. 22 to No. 6	¼ to 2½	¼ to 1 — " " " "
Over 3½ to 5	No. 18 to No. 6	¼ to 2½	¼ to 1 — " " " "
Over 5 to 6	No. 16 to No. 1	¼ to 2½	5/16 to 1 — " " " "
Over 6 to 8	No. 16 to No. 1	¼ to 3½	5/16 to ¾— " " " "
Over 8 to 10	No. 14 to No. 1	¼ to 3½ *	The Over-all Measure is determined by adding to Face Measure:
Over 10 to 15½	No. 13 to No. 1	¼ to 2 *	One-half of the thickness for all sizes up to ½", inclusive, in thickness.
Over 15½ to 18	No. 12 to No. 1	¼ to 2 *	5/16" for all sizes over ½" to ¾", inclusive, in thickness.
Over 18 to 18¾	No. 11 to No. 1	¼ to 2 *	⅜" for all sizes over ¾" in thickness.
Over 18¾ to 24		¼ to 2 *	

*Sizes 10 inches and wider are furnished with Universal Mill Edges.
Sizes not listed will be considered.

WEIGHTS OF RECTANGULAR SECTIONS

POUNDS PER LINEAL FOOT

Width, Inches	Thickness, Inches															
	1/16	1/8	3/16	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
1/4	.053	.106	.159	.213	.27	.32	.37	.43	.48	.53	.58	.64	.69	.74	.80	.85
1/2	.106	.213	.319	.425	.53	.64	.74	.85	.96	1.06	1.17	1.28	1.38	1.49	1.59	1.70
3/4	.159	.319	.478	.638	.80	.96	1.12	1.28	1.43	1.59	1.75	1.91	2.07	2.23	2.39	2.55
1	.213	.425	.638	.850	1.06	1.28	1.49	1.70	1.91	2.13	2.34	2.55	2.76	2.98	3.19	3.40
1 1/4	.266	.531	.797	1.063	1.33	1.59	1.86	2.13	2.39	2.66	2.92	3.19	3.45	3.72	3.98	4.25
1 1/2	.319	.638	.956	1.275	1.59	1.91	2.23	2.55	2.87	3.19	3.51	3.83	4.14	4.46	4.78	5.10
1 3/4	.372	.744	1.116	1.488	1.86	2.23	2.60	2.98	3.35	3.72	4.09	4.46	4.83	5.21	5.58	5.95
2	.425	.850	1.275	1.700	2.13	2.55	2.98	3.40	3.83	4.25	4.68	5.10	5.53	5.95	6.38	6.80
2 1/4	.478	.956	1.434	1.913	2.39	2.87	3.35	3.83	4.30	4.78	5.26	5.74	6.22	6.69	7.17	7.65
2 1/2	.531	1.063	1.594	2.125	2.66	3.19	3.72	4.25	4.78	5.31	5.84	6.38	6.91	7.44	7.97	8.50
2 3/4	.584	1.169	1.753	2.338	2.92	3.51	4.09	4.68	5.26	5.84	6.43	7.01	7.60	8.18	8.77	9.35
3	.638	1.275	1.913	2.550	3.19	3.83	4.46	5.10	5.74	6.38	7.01	7.65	8.29	8.93	9.56	10.20
3 1/4	.691	1.381	2.072	2.763	3.45	4.14	4.83	5.53	6.22	6.91	7.60	8.29	8.98	9.67	10.36	11.05
3 1/2	.744	1.488	2.231	2.975	3.72	4.46	5.21	5.95	6.69	7.44	8.18	8.93	9.67	10.41	11.16	11.90
3 3/4	.797	1.594	2.391	3.188	3.98	4.78	5.58	6.38	7.17	7.97	8.77	9.56	10.36	11.16	11.95	12.75
4	.850	1.700	2.550	3.400	4.25	5.10	5.95	6.80	7.65	8.50	9.35	10.20	11.05	11.90	12.75	13.60
4 1/4	.903	1.806	2.709	3.613	4.52	5.42	6.32	7.23	8.13	9.03	9.93	10.84	11.74	12.64	13.55	14.45
4 1/2	.956	1.913	2.869	3.825	4.78	5.74	6.69	7.65	8.61	9.56	10.52	11.48	12.43	13.39	14.34	15.30
4 3/4	1.000	2.019	3.028	4.038	5.05	6.06	7.07	8.08	9.08	10.09	11.10	12.11	13.12	14.13	15.14	16.15
5	1.063	2.125	3.188	4.250	5.31	6.38	7.44	8.50	9.56	10.63	11.69	12.75	13.81	14.88	15.94	17.00
5 1/4	1.116	2.231	3.347	4.463	5.58	6.69	7.81	8.93	10.04	11.16	12.27	13.39	14.50	15.62	16.73	17.85
5 1/2	1.169	2.338	3.506	4.675	5.84	7.01	8.18	9.35	10.52	11.69	12.86	14.03	15.19	16.36	17.53	18.70
5 3/4	1.222	2.444	3.666	4.888	6.11	7.33	8.55	9.78	11.00	12.22	13.44	14.66	15.88	17.11	18.33	19.55
6	1.275	2.550	3.825	5.100	6.38	7.65	8.93	10.20	11.48	12.75	14.03	15.30	16.58	17.85	19.13	20.40
6 1/4	1.328	2.656	3.984	5.313	6.64	7.97	9.30	10.63	11.95	13.28	14.61	15.94	17.27	18.59	19.92	21.25
6 1/2	1.381	2.763	4.144	5.525	6.91	8.29	9.67	11.05	12.43	13.81	15.19	16.58	17.96	19.34	20.72	22.10
6 3/4	1.434	2.869	4.303	5.738	7.17	8.61	10.04	11.48	12.91	14.34	15.78	17.21	18.65	20.08	21.52	22.95
7	1.488	2.975	4.463	5.950	7.44	8.93	10.41	11.90	13.39	14.88	16.36	17.85	19.34	20.83	22.31	23.80
7 1/4	1.541	3.081	4.622	6.163	7.70	9.24	10.78	12.33	13.87	15.41	16.95	18.49	20.03	21.57	23.11	24.65
7 1/2	1.594	3.188	4.781	6.375	7.97	9.56	11.16	12.75	14.34	15.94	17.53	19.13	20.72	22.31	23.91	25.50
7 3/4	1.647	3.294	4.941	6.588	8.23	9.88	11.53	13.18	14.82	16.47	18.12	19.76	21.41	23.06	24.70	26.35
8	1.700	3.400	5.100	6.800	8.50	10.20	11.90	13.60	15.30	17.00	18.70	20.40	22.10	23.80	25.50	27.20
8 1/4	1.753	3.506	5.259	7.013	8.77	10.52	12.27	14.03	15.78	17.53	19.28	21.04	22.79	24.54	26.30	28.05
8 1/2	1.806	3.613	5.419	7.225	9.03	10.84	12.64	14.45	16.26	18.06	19.87	21.68	23.48	25.29	27.09	28.90
8 3/4	1.859	3.719	5.578	7.438	9.30	11.16	13.02	14.88	16.73	18.59	20.45	22.31	24.17	26.03	27.89	29.75
9	1.913	3.825	5.738	7.650	9.56	11.48	13.39	15.30	17.21	19.13	21.04	22.95	24.86	26.78	28.69	30.60
9 1/4	1.966	3.931	5.897	7.863	9.83	11.79	13.76	15.73	17.69	19.66	21.62	23.59	25.55	27.52	29.48	31.45
9 1/2	2.019	4.038	6.056	8.075	10.09	12.11	14.13	16.15	18.17	20.19	22.21	24.23	26.24	28.26	30.28	32.30
9 3/4	2.072	4.144	6.216	8.288	10.36	12.43	14.50	16.58	18.65	20.72	22.79	24.86	26.93	29.01	31.08	33.15
10	2.125	4.250	6.375	8.500	10.63	12.75	14.88	17.00	19.13	21.25	23.38	25.50	27.63	29.75	31.88	34.00
10 1/4	2.178	4.356	6.534	8.713	10.89	13.07	15.25	17.43	19.60	21.78	23.96	26.14	28.32	30.49	32.67	34.85
10 1/2	2.231	4.463	6.694	8.925	11.16	13.39	15.62	17.85	20.08	22.31	24.54	26.78	29.01	31.24	33.47	35.70
10 3/4	2.284	4.569	6.853	9.138	11.42	13.71	15.99	18.28	20.56	22.84	25.13	27.41	29.70	31.98	34.27	36.55
11	2.338	4.675	7.013	9.350	11.69	14.03	16.36	18.70	21.04	23.38	25.71	28.05	30.39	32.73	35.06	37.40
11 1/4	2.391	4.781	7.172	9.563	11.95	14.34	16.73	19.13	21.52	23.91	26.30	28.69	31.08	33.47	35.86	38.25
11 1/2	2.444	4.888	7.331	9.775	12.22	14.66	17.11	19.55	21.99	24.44	26.88	29.33	31.77	34.21	36.66	39.10
11 3/4	2.497	4.994	7.491	9.988	12.48	14.98	17.48	19.98	22.47	24.97	27.47	29.96	32.46	34.96	37.45	39.95
12	2.550	5.100	7.650	10.20	12.75	15.30	17.85	20.40	22.95	25.50	28.05	30.60	33.15	35.70	38.25	40.80

AREAS OF RECTANGULAR SECTIONS

SQUARE INCHES

Width, Inches	Thickness, Inches															
	1/16	1/8	3/16	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
1/4	.016	.031	.047	.063	.078	.094	.109	.125	.141	.156	.172	.188	.203	.22	.23	.25
1/2	.031	.063	.094	.125	.156	.188	.219	.250	.281	.313	.344	.375	.406	.44	.47	.50
3/4	.047	.094	.141	.188	.234	.281	.328	.375	.422	.469	.516	.563	.609	.66	.70	.75
1	.063	.125	.188	.250	.313	.375	.438	.500	.563	.625	.688	.750	.813	.88	.94	1.00
1 1/4	.078	.156	.234	.313	.391	.469	.547	.625	.703	.781	.859	.938	1.016	1.09	1.17	1.25
1 1/2	.094	.188	.281	.375	.469	.563	.656	.750	.844	.938	1.031	1.125	1.219	1.31	1.41	1.50
1 3/4	.109	.219	.328	.438	.547	.656	.766	.875	.984	1.094	1.203	1.313	1.422	1.53	1.64	1.75
2	.125	.250	.375	.500	.625	.750	.875	1.000	1.125	1.250	1.375	1.500	1.625	1.75	1.88	2.00
2 1/4	.141	.281	.422	.563	.703	.844	.984	1.125	1.266	1.406	1.547	1.688	1.828	1.97	2.11	2.25
2 1/2	.156	.313	.469	.625	.781	.938	1.094	1.250	1.406	1.563	1.719	1.875	2.031	2.19	2.34	2.50
2 3/4	.172	.344	.516	.688	.859	1.031	1.203	1.375	1.547	1.719	1.891	2.063	2.234	2.41	2.58	2.75
3	.188	.375	.563	.750	.938	1.125	1.313	1.500	1.688	1.875	2.063	2.250	2.438	2.63	2.81	3.00
3 1/4	.203	.406	.609	.813	1.016	1.219	1.422	1.625	1.828	2.031	2.234	2.438	2.641	2.84	3.05	3.25
3 1/2	.219	.438	.656	.875	1.094	1.313	1.531	1.750	1.969	2.188	2.406	2.625	2.844	3.06	3.28	3.50
3 3/4	.234	.469	.703	.938	1.172	1.406	1.641	1.875	2.109	2.344	2.578	2.813	3.047	3.28	3.52	3.75
4	.250	.500	.750	1.000	1.250	1.500	1.750	2.000	2.250	2.500	2.750	3.000	3.250	3.50	3.75	4.00
4 1/4	.266	.531	.797	1.063	1.328	1.594	1.859	2.125	2.391	2.656	2.922	3.188	3.453	3.72	3.98	4.25
4 1/2	.281	.563	.844	1.125	1.406	1.688	1.969	2.250	2.531	2.813	3.094	3.375	3.656	3.94	4.22	4.50
4 3/4	.297	.594	.891	1.188	1.484	1.781	2.078	2.375	2.672	2.969	3.266	3.563	3.859	4.16	4.45	4.75
5	.313	.625	.938	1.250	1.563	1.875	2.188	2.500	2.813	3.125	3.438	3.750	4.063	4.38	4.69	5.00
5 1/4	.328	.656	.984	1.313	1.641	1.969	2.297	2.625	2.953	3.281	3.609	3.938	4.266	4.59	4.92	5.25
5 1/2	.344	.688	1.031	1.375	1.719	2.063	2.406	2.750	3.094	3.438	3.781	4.125	4.469	4.81	5.16	5.50
5 3/4	.359	.719	1.078	1.438	1.797	2.156	2.516	2.875	3.234	3.594	3.953	4.313	4.672	5.03	5.39	5.75
6	.375	.750	1.125	1.500	1.875	2.250	2.625	3.000	3.375	3.750	4.125	4.500	4.875	5.25	5.63	6.00
6 1/4	.391	.781	1.172	1.563	1.953	2.344	2.734	3.125	3.516	3.906	4.297	4.688	5.078	5.47	5.86	6.25
6 1/2	.406	.813	1.219	1.625	2.031	2.438	2.844	3.250	3.656	4.063	4.469	4.875	5.281	5.69	6.09	6.50
6 3/4	.422	.844	1.266	1.688	2.109	2.531	2.953	3.375	3.797	4.219	4.641	5.063	5.484	5.91	6.33	6.75
7	.438	.875	1.313	1.750	2.188	2.625	3.063	3.500	3.938	4.375	4.813	5.250	5.688	6.13	6.56	7.00
7 1/4	.453	.906	1.359	1.813	2.266	2.719	3.172	3.625	4.078	4.531	4.984	5.438	5.891	6.34	6.80	7.25
7 1/2	.469	.938	1.406	1.875	2.344	2.813	3.281	3.750	4.219	4.688	5.156	5.625	6.094	6.56	7.03	7.50
7 3/4	.484	.969	1.453	1.938	2.422	2.906	3.391	3.875	4.359	4.844	5.328	5.813	6.297	6.78	7.27	7.75
8	.500	1.000	1.500	2.000	2.500	3.000	3.500	4.000	4.500	5.000	5.500	6.000	6.500	7.00	7.50	8.00
8 1/4	.516	1.031	1.547	2.063	2.578	3.094	3.609	4.125	4.641	5.156	5.672	6.188	6.703	7.22	7.73	8.25
8 1/2	.531	1.063	1.594	2.125	2.656	3.188	3.719	4.250	4.781	5.313	5.844	6.375	6.906	7.44	7.97	8.50
8 3/4	.547	1.094	1.641	2.188	2.734	3.281	3.828	4.375	4.922	5.469	6.016	6.563	7.109	7.66	8.20	8.75
9	.563	1.125	1.688	2.250	2.813	3.375	3.938	4.500	5.063	5.625	6.188	6.750	7.313	7.88	8.44	9.00
9 1/4	.578	1.156	1.734	2.313	2.891	3.469	4.047	4.625	5.203	5.781	6.359	6.938	7.516	8.09	8.67	9.25
9 1/2	.594	1.188	1.781	2.375	2.969	3.563	4.156	4.750	5.344	5.938	6.531	7.125	7.719	8.31	8.91	9.50
9 3/4	.609	1.219	1.828	2.438	3.047	3.656	4.266	4.875	5.484	6.094	6.703	7.313	7.922	8.53	9.14	9.75
10	.625	1.250	1.875	2.500	3.125	3.750	4.375	5.000	5.625	6.250	6.875	7.500	8.125	8.75	9.38	10.00
10 1/4	.641	1.281	1.922	2.563	3.203	3.844	4.484	5.125	5.766	6.406	7.047	7.688	8.328	8.97	9.61	10.25
10 1/2	.656	1.313	1.969	2.625	3.281	3.938	4.594	5.250	5.906	6.563	7.219	7.875	8.531	9.19	9.84	10.50
10 3/4	.672	1.344	2.016	2.688	3.359	4.031	4.703	5.375	6.047	6.719	7.391	8.063	8.734	9.41	10.08	10.75
11	.688	1.375	2.063	2.750	3.438	4.125	4.813	5.500	6.188	6.875	7.563	8.250	8.938	9.63	10.31	11.00
11 1/4	.703	1.406	2.109	2.813	3.516	4.219	4.922	5.625	6.328	7.031	7.734	8.438	9.141	9.84	10.55	11.25
11 1/2	.719	1.438	2.156	2.875	3.594	4.313	5.031	5.750	6.469	7.188	7.906	8.625	9.344	10.06	10.78	11.50
11 3/4	.734	1.469	2.203	2.938	3.672	4.406	5.141	5.875	6.609	7.344	8.078	8.813	9.547	10.28	11.02	11.75
12	.750	1.500	2.250	3.000	3.750	4.500	5.250	6.000	6.750	7.500	8.250	9.000	9.750	10.50	11.25	12.00

WEIGHTS OF RECTANGULAR SECTIONS—Continued

POUNDS PER LINEAL FOOT

Width, Inches	Thickness, Inches																
	1/16	1/8	3/16	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
12½	2.66	5.31	7.97	10.63	13.28	15.94	18.59	21.25	23.91	26.56	29.2	31.9	34.5	37.2	39.8	42.5
13	2.76	5.53	8.29	11.05	13.81	16.58	19.34	22.10	24.86	27.63	30.4	33.2	35.9	38.7	41.4	44.2
13½	2.87	5.74	8.61	11.48	14.34	17.21	20.08	22.95	25.82	28.69	31.6	34.4	37.3	40.2	43.0	45.9
14	2.98	5.95	8.93	11.90	14.88	17.85	20.83	23.80	26.78	29.75	32.7	35.7	38.7	41.7	44.6	47.6
14½	3.08	6.16	9.24	12.33	15.41	18.49	21.57	24.65	27.73	30.81	33.9	37.0	40.1	43.1	46.2	49.3
15	3.19	6.38	9.56	12.75	15.94	19.13	22.31	25.50	28.69	31.88	35.1	38.3	41.4	44.6	47.8	51.0
15½	3.29	6.59	9.88	13.18	16.47	19.76	23.06	26.35	29.64	32.94	36.2	39.5	42.8	46.1	49.4	52.7
16	3.40	6.80	10.20	13.60	17.00	20.40	23.80	27.20	30.60	34.00	37.4	40.8	44.2	47.6	51.0	54.4
16½	3.51	7.01	10.52	14.03	17.53	21.04	24.54	28.05	31.56	35.06	38.6	42.1	45.6	49.1	52.6	56.1
17	3.61	7.23	10.84	14.45	18.06	21.68	25.29	28.90	32.51	36.13	39.7	43.4	47.0	50.6	54.2	57.8
17½	3.72	7.44	11.16	14.88	18.59	22.31	26 03	29.75	33.47	37.19	40.9	44.6	48.3	52.1	55.8	59.5
18	3.83	7.65	11.48	15.30	19.13	22.95	26.78	30.60	34.43	38.25	42.1	45.9	49.7	53.6	57.4	61.2
18½	3.93	7.86	11.79	15.73	19.66	23.59	27.52	31.45	35.38	39.31	43.2	47.2	51.1	55.0	59.0	62.9
19	4.04	8.08	12.11	16.15	20.19	24.23	28.26	32.30	36.34	40.38	44.4	48.5	52.5	56.5	60.6	64.6
19½	4.14	8.29	12.43	16.58	20.72	24.86	29.01	33.15	37.29	41.44	45.6	49.7	53.9	58.0	62.2	66.3
20	4.25	8.50	12.75	17.00	21.25	25.50	29.75	34.00	38.25	42.50	46.8	51.0	55.3	59.5	63.8	68.0
20½	4.36	8.71	13.07	17.43	21.78	26.14	30.49	34.85	39.21	43.56	47.9	52.3	56.6	61.0	65.3	69.7
21	4.46	8.93	13.39	17.85	22.31	26.78	31.24	35.70	40.16	44.63	49.1	53.6	58.0	62.5	66.9	71.4
21½	4.57	9.14	13.71	18.28	22.84	27.41	31.98	36.55	41.12	45.69	50.3	54.8	59.4	64.0	68.5	73.1
22	4.68	9.35	14.03	18.70	23.38	28.05	32.73	37.40	42.08	46.75	51.4	56.1	60.8	65.5	70.1	74.8
22½	4.78	9.56	14.34	19.13	23.91	28.69	33.47	38.25	43.03	47.81	52.6	57.4	62.2	66.9	71.7	76.5
23	4.89	9.78	14.66	19.55	24.44	29.33	34.21	39.10	43.99	48.88	53.8	58.7	63.5	68.4	73.3	78.2
23½	4.99	9.99	14.98	19.98	24.97	29.96	34.96	39.95	44.94	49.94	54.9	59.9	64.9	69.9	74.9	79.9
24	5.10	10.20	15.30	20.40	25.50	30.60	35.70	40.80	45.90	51.00	56.1	61.2	66.3	71.4	76.5	81.6
25	5.31	10.63	15.94	21.25	26.56	31.88	37.19	42.50	47.81	53.13	58.4	63.8	69.1	74.4	79.7	85.0
26	5.53	11.05	16.58	22.10	27.63	33.15	38.68	44.20	49.73	55.25	60.8	66.3	71.8	77.4	82.9	88.4
27	5.74	11.48	17.21	22.95	28.69	34.43	40.16	45.90	51.64	57.38	63.1	68.9	74.6	80.3	86.1	91.8
28	5.95	11.90	17.85	23.80	29.75	35.70	41.65	47.60	53.55	59.50	65.5	71.4	77.4	83.3	89.3	95.2
29	6.16	12.33	18.49	24.65	30.81	36.98	43.14	49.30	55.46	61.63	67.8	74.0	80.1	86.3	92.4	98.6
30	6.38	12.75	19.13	25.50	31.88	38.25	44.63	51.00	57.38	63.75	70.1	76.5	82.9	89.3	95.6	102.0
31	6.59	13.18	19.76	26.35	32.94	39.53	46.11	52.70	59.29	65.88	72.5	79.1	85.6	92.2	98.8	105.4
32	6.80	13.60	20.40	27.20	34.00	40.80	47.60	54.40	61.20	68.00	74.8	81.6	88.4	95.2	102.0	108.8
33	7.01	14.03	21.04	28.05	35.06	42.08	49.09	56.10	63.11	70.13	77.1	84.2	91.2	98.2	105.2	112.2
34	7.23	14.45	21.68	28.90	36.13	43.35	50.58	57.80	65.03	72.25	79.5	86.7	93.9	101.2	108.4	115.6
35	7.44	14.88	22.31	29.75	37.19	44.63	52.06	59.50	66.94	74.38	81.8	89.3	96.7	104.1	111.6	119.0
36	7.65	15.30	22.95	30.60	38.25	45.90	53.55	61.20	68.85	76.50	84.2	91.8	99.5	107.1	114.8	122.4
37	7.86	15.73	23.59	31.45	39.31	47.18	55.04	62.90	70.76	78.63	86.5	94.4	102.2	110.1	117.9	125.8
38	8.08	16.15	24.23	32.30	40.38	48.45	56.53	64.60	72.68	80.75	88.8	96.9	105.0	113.1	121.1	129.2
39	8.29	16.58	24.86	33.15	41.44	49.73	58.01	66.30	74.59	82.88	91.2	99.5	107.7	116.0	124.3	132.6
40	8.50	17.00	25.50	34.00	42.50	51.00	59.50	68.00	76.50	85.00	93.5	102.0	110.5	119.0	127.5	136.0
41	8.71	17.43	26.14	34.85	43.56	52.28	60.99	69.70	78.41	87.13	95.8	104.6	113.3	122.0	130.7	139.4
42	8.93	17.85	26.78	35.70	44.63	53.55	62.48	71.40	80.33	89.25	98.2	107.1	116.0	125.0	133.9	142.8
43	9.14	18.28	27.41	36.55	45.69	54.83	63.96	73.10	82.24	91.38	100.5	109.7	118.8	127.9	137.1	146.2
44	9.35	18.70	28.05	37.40	46.75	56.10	65.45	74.80	84.15	93.50	102.9	112.2	121.6	130.9	140.3	149.6
45	9.56	19.13	28.69	38.25	47.81	57.38	66.94	76.50	86.06	95.63	105.2	114.8	124.3	133.9	143.4	153.0
46	9.78	19.55	29.33	39.10	48.88	58.65	68.43	78.20	87.98	97.75	107.5	117.3	127.1	136.9	146.6	156.4
47	9.99	19.98	29.96	39.95	49.94	59.93	69.91	79.90	89.89	99.88	109.9	119.9	129.8	139.8	149.8	159.8
48	10.20	20.40	30.60	40.80	51.00	61.20	71.40	81.60	91.80	102.0	112.2	122.4	132.6	142.8	153.0	163.2

AREAS OF RECTANGULAR SECTIONS

SQUARE INCHES

Width, Inches	Thickness, Inches															
	1/16	1/8	3/16	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
12½	.781	1.563	2.344	3.13	3.91	4.69	5.47	6.25	7.03	7.81	8.59	9.38	10.16	10.94	11.72	12.50
13	.813	1.625	2.438	3.25	4.06	4.88	5.69	6.50	7.31	8.13	8.94	9.75	10.56	11.38	12.19	13.00
13½	.844	1.688	2.531	3.38	4.22	5.06	5.91	6.75	7.59	8.44	9.28	10.13	10.97	11.81	12.66	13.50
14	.875	1.750	2.625	3.50	4.38	5.25	6.13	7.00	7.88	8.75	9.63	10.50	11.38	12.25	13.13	14.00
14½	.906	1.813	2.719	3.63	4.53	5.44	6.34	7.25	8.16	9.06	9.97	10.88	11.78	12.69	13.59	14.50
15	.938	1.875	2.813	3.75	4.69	5.63	6.56	7.50	8.44	9.38	10.31	11.25	12.19	13.13	14.06	15.00
15½	.969	1.938	2.906	3.88	4.84	5.81	6.78	7.75	8.72	9.69	10.66	11.63	12.59	13.56	14.53	15.50
16	1.000	2.000	3.000	4.00	5.00	6.00	7.00	8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00
16½	1.031	2.063	3.094	4.13	5.16	6.19	7.22	8.25	9.28	10.31	11.34	12.38	13.41	14.44	15.47	16.50
17	1.063	2.125	3.188	4.25	5.31	6.38	7.44	8.50	9.56	10.63	11.69	12.75	13.81	14.88	15.94	17.00
17½	1.094	2.188	3.281	4.38	5.47	6.56	7.66	8.75	9.84	10.94	12.03	13.13	14.22	15.31	16.41	17.50
18	1.125	2.250	3.375	4.50	5.63	6.75	7.88	9.00	10.13	11.25	12.38	13.50	14.63	15.75	16.88	18.00
18½	1.156	2.313	3.469	4.63	5.78	6.94	8.09	9.25	10.41	11.56	12.72	13.88	15.03	16.19	17.34	18.50
19	1.188	2.375	3.563	4.75	5.94	7.13	8.31	9.50	10.69	11.88	13.06	14.25	15.44	16.63	17.81	19.00
19½	1.219	2.438	3.656	4.88	6.09	7.31	8.53	9.75	10.97	12.19	13.41	14.63	15.84	17.06	18.28	19.50
20	1.250	2.500	3.750	5.00	6.25	7.50	8.75	10.00	11.25	12.50	13.75	15.00	16.25	17.50	18.75	20.00
20½	1.281	2.563	3.844	5.13	6.41	7.69	8.97	10.25	11.53	12.81	14.09	15.38	16.66	17.94	19.22	20.50
21	1.313	2.625	3.938	5.25	6.56	7.88	9.19	10.50	11.81	13.13	14.44	15.75	17.06	18.38	19.69	21.00
21½	1.344	2.688	4.031	5.38	6.72	8.06	9.41	10.75	12.09	13.44	14.78	16.13	17.47	18.81	20.16	21.50
22	1.375	2.750	4.125	5.50	6.88	8.25	9.63	11.00	12.38	13.75	15.13	16.50	17.88	19.25	20.63	22.00
22½	1.406	2.813	4.219	5.63	7.03	8.44	9.84	11.25	12.66	14.06	15.47	16.88	18.28	19.69	21.09	22.50
23	1.438	2.875	4.313	5.75	7.19	8.63	10.06	11.50	12.94	14.38	15.81	17.25	18.69	20.13	21.56	23.00
23½	1.469	2.938	4.406	5.88	7.34	8.81	10.28	11.75	13.22	14.69	16.16	17.63	19.09	20.56	22.03	23.50
24	1.500	3.000	4.500	6.00	7.50	9.00	10.50	12.00	13.50	15.00	16.50	18.00	19.50	21.00	22.50	24.00
25	1.563	3.125	4.688	6.25	7.81	9.38	10.94	12.50	14.06	15.63	17.19	18.75	20.31	21.88	23.44	25.00
26	1.625	3.250	4.875	6.50	8.13	9.75	11.38	13.00	14.63	16.25	17.88	19.50	21.13	22.75	24.38	26.00
27	1.688	3.375	5.063	6.75	8.44	10.13	11.81	13.50	15.19	16.88	18.56	20.25	21.94	23.63	25.31	27.00
28	1.750	3.500	5.250	7.00	8.75	10.50	12.25	14.00	15.75	17.50	19.25	21.00	22.75	24.50	26.25	28.00
29	1.813	3.625	5.438	7.25	9.06	10.88	12.69	14.50	16.31	18.13	19.94	21.75	23.56	25.38	27.19	29.00
30	1.875	3.750	5.625	7.50	9.38	11.25	13.13	15.00	16.88	18.75	20.63	22.50	24.38	26.25	28.13	30.00
31	1.938	3.875	5.813	7.75	9.69	11.63	13.56	15.50	17.44	19.38	21.31	23.25	25.19	27.13	29.06	31.00
32	2.000	4.000	6.000	8.00	10.00	12.00	14.00	16.00	18.00	20.00	22.00	24.00	26.00	28.00	30.00	32.00
33	2.063	4.125	6.188	8.25	10.31	12.38	14.44	16.50	18.56	20.63	22.69	24.75	26.81	28.88	30.94	33.00
34	2.125	4.250	6.375	8.50	10.63	12.75	14.88	17.00	19.13	21.25	23.38	25.50	27.63	29.75	31.88	34.00
35	2.188	4.375	6.563	8.75	10.94	13.13	15.31	17.50	19.69	21.88	24.06	26.25	28.44	30.63	32.81	35.00
36	2.250	4.500	6.750	9.00	11.25	13.50	15.75	18.00	20.25	22.50	24.75	27.00	29.25	31.50	33.75	36.00
37	2.313	4.625	6.938	9.25	11.56	13.88	16.19	18.50	20.81	23.13	25.44	27.75	30.06	32.38	34.69	37.00
38	2.375	4.750	7.125	9.50	11.88	14.25	16.63	19.00	21.38	23.75	26.13	28.50	30.88	33.25	35.63	38.00
39	2.438	4.875	7.313	9.75	12.19	14.63	17.06	19.50	21.94	24.38	26.81	29.25	31.69	34.13	36.56	39.00
40	2.500	5.000	7.500	10.00	12.50	15.00	17.50	20.00	22.50	25.00	27.50	30.00	32.50	35.00	37.50	40.00
41	2.563	5.125	7.688	10.25	12.81	15.38	17.94	20.50	23.06	25.63	28.19	30.75	33.31	35.88	38.44	41.00
42	2.625	5.250	7.875	10.50	13.13	15.75	18.38	21.00	23.63	26.25	28.88	31.50	34.13	36.75	39.38	42.00
43	2.688	5.375	8.063	10.75	13.44	16.13	18.81	21.50	24.19	26.88	29.56	32.25	34.94	37.63	40.31	43.00
44	2.750	5.500	8.250	11.00	13.75	16.50	19.25	22.00	24.75	27.50	30.25	33.00	35.75	38.50	41.25	44.00
45	2.813	5.625	8.438	11.25	14.06	16.88	19.69	22.50	25.31	28.13	30.94	33.75	36.56	39.38	42.19	45.00
46	2.875	5.750	8.625	11.50	14.38	17.25	20.13	23.00	25.88	28.75	31.63	34.50	37.38	40.25	43.13	46.00
47	2.938	5.875	8.813	11.75	14.69	17.63	20.56	23.50	26.44	29.38	32.31	35.25	38.19	41.13	44.06	47.00
48	3.000	6.000	9.000	12.00	15.00	18.00	21.00	24.00	27.00	30.00	33.00	36.00	39.00	42.00	45.00	48.00

WEIGHTS OF RECTANGULAR SECTIONS

POUNDS PER LINEAL FOOT

Width, Inches	Thickness, Inches															
	1/16	1/8	3/16	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
49	10.4	20.8	31.2	41.7	52.1	62.5	72.9	83.3	93.7	104.1	114.5	125.0	135.4	145.8	156.2	166.6
50	10.6	21.3	31.9	42.5	53.1	63.8	74.4	85.0	95.6	106.3	116.9	127.5	138.1	148.8	159.4	170.0
51	10.8	21.7	32.5	43.4	54.2	65.0	75.9	86.7	97.5	108.4	119.2	130.1	140.9	151.7	162.6	173.4
52	11.1	22.1	33.2	44.2	55.3	66.3	77.4	88.4	99.5	110.5	121.6	132.6	143.7	154.7	165.8	176.8
53	11.3	22.5	33.8	45.1	56.3	67.6	78.8	90.1	101.4	112.6	123.9	135.2	146.4	157.7	168.9	180.2
54	11.5	23.0	34.4	45.9	57.4	68.9	80.3	91.8	103.3	114.8	126.2	137.7	149.2	160.7	172.1	183.6
55	11.7	23.4	35.1	46.8	58.4	70.1	81.8	93.5	105.2	116.9	128.6	140.3	151.9	163.6	175.3	187.0
56	11.9	23.8	35.7	47.6	59.5	71.4	83.3	95.2	107.1	119.0	130.9	142.8	154.7	166.6	178.5	190.4
57	12.1	24.2	36.3	48.5	60.6	72.7	84.8	96.9	109.0	121.1	133.2	145.4	157.5	169.6	181.7	193.8
58	12.3	24.7	37.0	49.3	61.6	74.0	86.3	98.6	110.9	123.3	135.6	147.9	160.2	172.6	184.9	197.2
59	12.5	25.1	37.6	50.2	62.7	75.2	87.8	100.3	112.8	125.4	137.9	150.5	163.0	175.5	188.1	200.6
60	12.8	25.5	38.3	51.0	63.8	76.5	89.3	102.0	114.8	127.5	140.3	153.0	165.8	178.5	191.3	204.0
61	13.0	25.9	38.9	51.9	64.8	77.8	90.7	103.7	116.7	129.6	142.6	155.6	168.5	181.5	194.4	207.4
62	13.2	26.4	39.5	52.7	65.9	79.1	92.2	105.4	118.6	131.8	144.9	158.1	171.3	184.5	197.6	210.8
63	13.4	26.8	40.2	53.6	66.9	80.3	93.7	107.1	120.5	133.9	147.3	160.7	174.0	187.4	200.8	214.2
64	13.6	27.2	40.8	54.4	68.0	81.6	95.2	108.8	122.4	136.0	149.6	163.2	176.8	190.4	204.0	217.6
65	13.8	27.6	41.4	55.3	69.1	82.9	96.7	110.5	124.3	138.1	151.9	165.8	179.6	193.4	207.2	221.0
66	14.0	28.1	42.1	56.1	70.1	84.2	98.2	112.2	126.2	140.3	154.3	168.3	182.3	196.4	210.4	224.4
67	14.2	28.5	42.7	57.0	71.2	85.4	99.7	113.9	128.1	142.4	156.6	170.9	185.1	199.3	213.6	227.8
68	14.5	28.9	43.4	57.8	72.3	86.7	101.2	115.6	130.1	144.5	159.0	173.4	187.9	202.3	216.8	231.2
69	14.7	29.3	44.0	58.7	73.3	88.0	102.6	117.3	132.0	146.6	161.3	176.0	190.6	205.3	219.9	234.6
70	14.9	29.8	44.6	59.5	74.4	89.3	104.1	119.0	133.9	148.8	163.6	178.5	193.4	208.3	223.1	238.0
71	15.1	30.2	45.3	60.4	75.4	90.5	105.6	120.7	135.8	150.9	166.0	181.1	196.1	211.2	226.3	241.4
72	15.3	30.6	45.9	61.2	76.5	91.8	107.1	122.4	137.7	153.0	168.3	183.6	198.9	214.2	229.5	244.8
73	15.5	31.0	46.5	62.1	77.6	93.1	108.6	124.1	139.6	155.1	170.6	186.2	201.7	217.2	232.7	248.2
74	15.7	31.5	47.2	62.9	78.6	94.4	110.1	125.8	141.5	157.3	173.0	188.7	204.4	220.2	235.9	251.6
75	15.9	31.9	47.8	63.8	79.7	95.6	111.6	127.5	143.4	159.4	175.3	191.3	207.2	223.1	239.1	255.0
76	16.2	32.3	48.5	64.6	80.8	96.9	113.1	129.2	145.4	161.5	177.7	193.8	210.0	226.1	242.3	258.4
77	16.4	32.7	49.1	65.5	81.8	98.2	114.5	130.9	147.3	163.6	180.0	196.4	212.7	229.1	245.4	261.8
78	16.6	33.2	49.7	66.3	82.9	99.5	116.0	132.6	149.2	165.8	182.3	198.9	215.5	232.1	248.6	265.2
79	16.8	33.6	50.4	67.2	83.9	100.7	117.5	134.3	151.1	167.9	184.7	201.5	218.2	235.0	251.8	268.6
80	17.0	34.0	51.0	68.0	85.0	102.0	119.0	136.0	153.0	170.0	187.0	204.0	221.0	238.0	255.0	272.0
81	17.2	34.4	51.6	68.9	86.1	103.3	120.5	137.7	154.9	172.1	189.3	206.6	223.8	241.0	258.2	275.4
82	17.4	34.9	52.3	69.7	87.1	104.6	122.0	139.4	156.8	174.3	191.7	209.1	226.5	244.0	261.4	278.8
83	17.6	35.3	52.9	70.6	88.2	105.8	123.5	141.1	158.7	176.4	194.0	211.7	229.3	246.9	264.6	282.3
84	17.9	35.7	53.6	71.4	89.3	107.1	125.0	142.8	160.7	178.5	196.4	214.2	232.1	249.9	267.8	285.6
85	18.1	36.1	54.2	72.3	90.3	108.4	126.4	144.5	162.6	180.6	198.7	216.8	234.8	252.9	270.9	289.0
86	18.3	36.6	54.8	73.1	91.4	109.7	127.9	146.2	164.5	182.8	201.0	219.3	237.6	255.9	274.1	292.4
87	18.5	37.0	55.5	74.0	92.4	110.9	129.4	147.9	166.4	184.9	203.4	221.9	240.3	258.8	277.3	295.8
88	18.7	37.4	56.1	74.8	93.5	112.2	130.9	149.6	168.3	187.0	205.7	224.4	243.1	261.8	280.5	299.2
89	18.9	37.8	56.7	75.7	94.6	113.5	132.4	151.3	170.2	189.1	208.0	227.0	245.9	264.8	283.7	302.6
90	19.1	38.3	57.4	76.5	95.6	114.8	133.9	153.0	172.1	191.3	210.4	229.5	248.6	267.8	286.9	306.0
91	19.3	38.7	58.0	77.4	96.7	116.0	135.4	154.7	174.0	193.4	212.7	232.1	251.4	270.7	290.1	309.4
92	19.6	39.1	58.7	78.2	97.8	117.3	136.9	156.4	176.0	195.5	215.1	234.6	254.2	273.7	293.3	312.8
93	19.8	39.5	59.3	79.1	98.8	118.6	138.3	158.1	177.9	197.6	217.4	237.2	256.9	276.7	296.4	316.2
94	20.0	40.0	59.9	79.9	99.9	119.9	139.8	159.8	179.8	199.8	219.7	239.7	259.7	279.7	299.6	319.6
95	20.2	40.4	60.6	80.8	100.9	121.1	141.3	161.5	181.7	201.9	222.1	242.3	262.4	282.6	302.8	323.0
96	20.4	40.8	61.2	81.6	102.0	122.4	142.8	163.2	183.6	204.0	224.4	244.8	265.2	285.6	306.0	326.4
97	20.6	41.2	61.8	82.5	103.1	123.7	144.3	164.9	185.5	206.1	226.7	247.4	268.0	288.6	309.2	329.8
98	20.8	41.7	62.5	83.3	104.1	125.0	145.8	166.6	187.4	208.3	229.1	249.9	270.7	291.6	312.4	333.2
99	21.0	42.1	63.1	84.2	105.2	126.2	147.3	168.3	189.3	210.4	231.4	252.5	273.5	294.5	315.6	336.6
100	21.3	42.5	63.8	85.0	106.3	127.5	148.8	170.0	191.3	212.5	233.8	255.0	276.3	297.5	318.8	340.0

AREAS OF RECTANGULAR SECTIONS

SQUARE INCHES

Width, Inches	Thickness, Inches																
	1/16	1/8	3/16	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
49	3.06	6.13	9.19	12.25	15.31	18.38	21.44	24.50	27.56	30.63	33.69	36.75	39.81	42.88	45.94	49.00
50	3.13	6.25	9.38	12.50	15.63	18.75	21.88	25.00	28.13	31.25	34.38	37.50	40.63	43.75	46.88	50.00
51	3.19	6.38	9.56	12.75	15.94	19.13	22.31	25.50	28.69	31.88	35.06	38.25	41.44	44.63	47.81	51.00
52	3.25	6.50	9.75	13.00	16.25	19.50	22.75	26.00	29.25	32.50	35.75	39.00	42.25	45.50	48.75	52.00
53	3.31	6.63	9.94	13.25	16.56	19.88	23.19	26.50	29.81	33.13	36.44	39.75	43.06	46.38	49.69	53.00
54	3.38	6.75	10.13	13.50	16.88	20.25	23.63	27.00	30.38	33.75	37.13	40.50	43.88	47.25	50.63	54.00
55	3.44	6.88	10.31	13.75	17.19	20.63	24.06	27.50	30.94	34.38	37.81	41.25	44.69	48.13	51.56	55.00
56	3.50	7.00	10.50	14.00	17.50	21.00	24.50	28.00	31.50	35.00	38.50	42.00	45.50	49.00	52.50	56.00
57	3.56	7.13	10.69	14.25	17.81	21.38	24.94	28.50	32.06	35.63	39.19	42.75	46.31	49.88	53.44	57.00
58	3.63	7.25	10.88	14.50	18.13	21.75	25.38	29.00	32.63	36.25	39.88	43.50	47.13	50.75	54.38	58.00
59	3.69	7.38	11.06	14.75	18.44	22.13	25.81	29.50	33.19	36.88	40.56	44.25	47.94	51.63	55.31	59.00
60	3.75	7.50	11.25	15.00	18.75	22.50	26.25	30.00	33.75	37.50	41.25	45.00	48.75	52.50	56.25	60.00
61	3.81	7.63	11.44	15.25	19.06	22.88	26.69	30.50	34.31	38.13	41.94	45.75	49.56	53.38	57.19	61.00
62	3.88	7.75	11.63	15.50	19.38	23.25	27.13	31.00	34.88	38.75	42.63	46.50	50.38	54.25	58.13	62.00
63	3.94	7.88	11.81	15.75	19.69	23.63	27.56	31.50	35.44	39.38	43.31	47.25	51.19	55.13	59.06	63.00
64	4.00	8.00	12.00	16.00	20.00	24.00	28.00	32.00	36.00	40.00	44.00	48.00	52.00	56.00	60.00	64.00
65	4.06	8.13	12.19	16.25	20.31	24.38	28.44	32.50	36.56	40.63	44.69	48.75	52.81	56.88	60.94	65.00
66	4.13	8.25	12.38	16.50	20.63	24.75	28.88	33.00	37.13	41.25	45.38	49.50	53.63	57.75	61.88	66.00
67	4.19	8.38	12.56	16.75	20.94	25.13	29.31	33.50	37.69	41.88	46.06	50.25	54.44	58.63	62.81	67.00
68	4.25	8.50	12.75	17.00	21.25	25.50	29.75	34.00	38.25	42.50	46.75	51.00	55.25	59.50	63.75	68.00
69	4.31	8.63	12.94	17.25	21.56	25.88	30.19	34.50	38.81	43.13	47.44	51.75	56.06	60.38	64.69	69.00
70	4.38	8.75	13.13	17.50	21.88	26.25	30.63	35.00	39.38	43.75	48.13	52.50	56.88	61.25	65.63	70.00
71	4.44	8.88	13.31	17.75	22.19	26.63	31.06	35.50	39.94	44.38	48.81	53.25	57.69	62.13	66.56	71.00
72	4.50	9.00	13.50	18.00	22.50	27.00	31.50	36.00	40.50	45.00	49.50	54.00	58.50	63.00	67.50	72.00
73	4.56	9.13	13.69	18.25	22.81	27.38	31.94	36.50	41.06	45.63	50.19	54.75	59.31	63.88	68.44	73.00
74	4.63	9.25	13.88	18.50	23.13	27.75	32.38	37.00	41.63	46.25	50.88	55.50	60.13	64.75	69.38	74.00
75	4.69	9.38	14.06	18.75	23.44	28.13	32.81	37.50	42.19	46.88	51.56	56.25	60.94	65.63	70.31	75.00
76	4.75	9.50	14.25	19.00	23.75	28.50	33.25	38.00	42.75	47.50	52.25	57.00	61.75	66.50	71.25	76.00
77	4.81	9.63	14.44	19.25	24.06	28.88	33.69	38.50	43.31	48.13	52.94	57.75	62.56	67.38	72.19	77.00
78	4.88	9.75	14.63	19.50	24.38	29.25	34.13	39.00	43.88	48.75	53.63	58.50	63.38	68.25	73.13	78.00
79	4.94	9.88	14.81	19.75	24.69	29.63	34.56	39.50	44.44	49.38	54.31	59.25	64.19	69.13	74.06	79.00
80	5.00	10.00	15.00	20.00	25.00	30.00	35.00	40.00	45.00	50.00	55.00	60.00	65.00	70.00	75.00	80.00
81	5.06	10.13	15.19	20.25	25.31	30.38	35.44	40.50	45.56	50.63	55.69	60.75	65.81	70.88	75.94	81.00
82	5.13	10.25	15.38	20.50	25.63	30.75	35.88	41.00	46.13	51.25	56.38	61.50	66.63	71.75	76.88	82.00
83	5.19	10.38	15.56	20.75	25.94	31.13	36.31	41.50	46.69	51.88	57.06	62.25	67.44	72.63	77.81	83.00
84	5.25	10.50	15.75	21.00	26.25	31.50	36.75	42.00	47.25	52.50	57.75	63.00	68.25	73.50	78.75	84.00
85	5.31	10.63	15.94	21.25	26.56	31.88	37.19	42.50	47.81	53.13	58.44	63.75	69.06	74.38	79.69	85.00
86	5.38	10.75	16.13	21.50	26.88	32.25	37.63	43.00	48.38	53.75	59.13	64.50	69.88	75.25	80.63	86.00
87	5.44	10.88	16.31	21.75	27.19	32.63	38.06	43.50	48.94	54.38	59.81	65.25	70.69	76.13	81.56	87.00
88	5.50	11.00	16.50	22.00	27.50	33.00	38.50	44.00	49.50	55.00	60.50	66.00	71.50	77.00	82.50	88.00
89	5.56	11.13	16.69	22.25	27.81	33.38	38.94	44.50	50.06	55.63	61.19	66.75	72.31	77.88	83.44	89.00
90	5.63	11.25	16.88	22.50	28.13	33.75	39.38	45.00	50.63	56.25	61.88	67.50	73.13	78.75	84.38	90.00
91	5.69	11.38	17.06	22.75	28.44	34.13	39.81	45.50	51.19	56.88	62.56	68.25	73.94	79.63	85.31	91.00
92	5.75	11.50	17.25	23.00	28.75	34.50	40.25	46.00	51.75	57.50	63.25	69.00	74.75	80.50	86.25	92.00
93	5.81	11.63	17.44	23.25	29.06	34.88	40.69	46.50	52.31	58.13	63.94	69.75	75.56	81.38	87.19	93.00
94	5.88	11.75	17.63	23.50	29.38	35.25	41.13	47.00	52.88	58.75	64.63	70.50	76.38	82.25	88.13	94.00
95	5.94	11.88	17.81	23.75	29.69	35.63	41.56	47.50	53.44	59.38	65.31	71.25	77.19	83.13	89.06	95.00
96	6.00	12.00	18.00	24.00	30.00	36.00	42.00	48.00	54.00	60.00	66.00	72.00	78.00	84.00	90.00	96.00
97	6.06	12.13	18.19	24.25	30.31	36.38	42.44	48.50	54.56	60.63	66.69	72.75	78.81	84.88	90.94	97.00
98	6.13	12.25	18.38	24.50	30.63	36.75	42.88	49.00	55.13	61.25	67.38	73.50	79.63	85.75	91.88	98.00
99	6.19	12.38	18.56	24.75	30.94	37.13	43.31	49.50	55.69	61.88	68.06	74.25	80.44	86.63	92.81	99.00
100	6.25	12.50	18.75	25.00	31.25	37.50	43.75	50.00	56.25	62.50	68.75	75.00	81.25	87.50	93.75	100.0

SQUARE AND ROUND BARS

WEIGHTS AND AREAS

Size, Inches	Weight, Lbs. per Foot		Area, Square Inches		Size, Inches	Weight, Lbs. per Foot		Area, Square Inches	
	□	○	□	○		□	○	□	○
0					3	30.60	24.03	9.000	7.069
1/16	.013	.010	.0039	.0031	1/16	31.89	25.05	9.379	7.366
1/8	.053	.042	.0156	.0123	1/8	33.20	26.08	9.766	7.670
3/16	.120	.094	.0352	.0276	3/16	34.54	27.13	10.160	7.980
1/4	.213	.167	.0625	.0491	1/4	35.91	28.21	10.563	8.296
5/16	.332	.261	.0977	.0767	5/16	37.31	29.30	10.973	8.618
3/8	.478	.376	.1406	.1105	3/8	38.73	30.42	11.391	8.946
7/16	.651	.511	.1914	.1503	7/16	40.18	31.55	11.816	9.281
1/2	.850	.668	.2500	.1963	1/2	41.65	32.71	12.250	9.621
9/16	1.076	.845	.3164	.2485	9/16	43.15	33.89	12.691	9.968
5/8	1.328	1.043	.3906	.3068	5/8	44.68	35.09	13.141	10.321
11/16	1.607	1.262	.4727	.3712	11/16	46.23	36.31	13.598	10.680
3/4	1.913	1.502	.5625	.4418	3/4	47.81	37.55	14.063	11.045
13/16	2.245	1.763	.6602	.5185	13/16	49.42	38.81	14.535	11.416
7/8	2.603	2.044	.7656	.6013	7/8	51.05	40.10	15.016	11.793
15/16	2.988	2.347	.8789	.6903	15/16	52.71	41.40	15.504	12.177
1	3.400	2.670	1.0000	.7854	4	54.40	42.73	16.000	12.566
1/16	3.838	3.015	1.1289	.8866	1/16	56.11	44.07	16.504	12.962
1/8	4.303	3.380	1.2656	.9940	1/8	57.85	45.44	17.016	13.364
3/16	4.795	3.766	1.4102	1.1075	3/16	59.62	46.83	17.535	13.772
1/4	5.313	4.172	1.5625	1.2272	1/4	61.41	48.23	18.063	14.186
5/16	5.857	4.600	1.7227	1.3530	5/16	63.23	49.66	18.598	14.607
3/8	6.428	5.049	1.8906	1.4849	3/8	65.08	51.11	19.141	15.033
7/16	7.026	5.518	2.0664	1.6230	7/16	66.95	52.58	19.691	15.466
1/2	7.650	6.008	2.2500	1.7671	1/2	68.85	54.07	20.250	15.904
9/16	8.301	6.519	2.4414	1.9175	9/16	70.78	55.59	20.816	16.349
5/8	8.978	7.051	2.6406	2.0739	5/8	72.73	57.12	21.391	16.800
11/16	9.682	7.604	2.8477	2.2365	11/16	74.71	58.67	21.973	17.257
3/4	10.413	8.178	3.0625	2.4053	3/4	76.71	60.25	22.563	17.721
13/16	11.170	8.773	3.2852	2.5802	13/16	78.74	61.85	23.160	18.190
7/8	11.953	9.388	3.5156	2.7612	7/8	80.80	63.46	23.766	18.665
15/16	12.763	10.024	3.7539	2.9483	15/16	82.89	65.10	24.379	19.147
2	13.600	10.681	4.0000	3.1416	5	85.00	66.76	25.000	19.635
1/16	14.463	11.359	4.2539	3.3410	1/16	87.14	68.44	25.629	20.129
1/8	15.353	12.058	4.5156	3.5466	1/8	89.30	70.14	26.266	20.629
3/16	16.270	12.778	4.7852	3.7583	3/16	91.49	71.86	26.910	21.135
1/4	17.213	13.519	5.0625	3.9761	1/4	93.71	73.60	27.563	21.648
5/16	18.182	14.280	5.3477	4.2000	5/16	95.96	75.36	28.223	22.166
3/8	19.178	15.062	5.6406	4.4301	3/8	98.23	77.15	28.891	22.691
7/16	20.201	15.866	5.9414	4.6664	7/16	100.53	78.95	29.566	23.221
1/2	21.250	16.690	6.2500	4.9087	1/2	102.85	80.78	30.250	23.758
9/16	22.326	17.534	6.5664	5.1572	9/16	105.20	82.62	30.941	24.301
5/8	23.428	18.400	6.8906	5.4119	5/8	107.58	84.49	31.641	24.850
11/16	24.557	19.287	7.2227	5.6727	11/16	109.98	86.38	32.348	25.406
3/4	25.713	20.195	7.5625	5.9396	3/4	112.41	88.29	33.063	25.967
13/16	26.895	21.123	7.9102	6.2126	13/16	114.87	90.22	33.785	26.535
7/8	28.103	22.072	8.2656	6.4918	7/8	117.35	92.17	34.516	27.109
15/16	29.338	23.042	8.6289	6.7771	15/16	119.86	94.14	35.254	27.688
3	30.600	24.033	9.0000	7.0686	6	122.40	96.13	36.000	28.274

SQUARE AND ROUND BARS

WEIGHTS AND AREAS

Size, Inches	Weight, Lbs. per Foot		Area, Square Inches		Size, Inches	Weight, Lbs. per Foot		Area, Square Inches	
	□	○	□	○		□	○	□	○
6	122.40	96.13	36.000	28.274	9	275.40	216.30	81.000	63.617
1/16	124.96	98.15	36.754	28.866	1/16	279.24	219.31	82.129	64.504
1/8	127.55	100.18	37.516	29.465	1/8	283.10	222.35	83.266	65.397
3/16	130.17	102.23	38.285	30.069	3/16	286.99	225.41	84.410	66.296
1/4	132.81	104.31	39.063	30.680	1/4	290.91	228.48	85.563	67.201
5/16	135.48	106.41	39.848	31.296	5/16	294.86	231.58	86.723	68.112
3/8	138.18	108.53	40.641	31.919	3/8	298.83	234.70	87.891	69.029
7/16	140.90	110.66	41.441	32.548	7/16	302.83	237.84	89.066	69.953
1/2	143.65	112.82	42.250	33.183	1/2	306.85	241.00	90.250	70.882
9/16	146.43	115.00	43.066	33.824	9/16	310.90	244.18	91.441	71.818
5/8	149.23	117.20	43.891	34.472	5/8	314.98	247.38	92.641	72.760
11/16	152.06	119.43	44.723	35.125	11/16	319.08	250.61	93.848	73.708
3/4	154.91	121.67	45.563	35.785	3/4	323.21	253.85	95.063	74.662
13/16	157.79	123.93	46.410	36.450	13/16	327.37	257.12	96.285	75.622
7/8	160.70	126.22	47.266	37.122	7/8	331.55	260.40	97.516	76.589
15/16	163.64	128.52	48.129	37.800	15/16	335.76	263.71	98.754	77.561
7	166.60	130.85	49.000	38.485	10	340.00	267.04	100.000	78.540
1/16	169.59	133.19	49.879	39.175	1/16	344.26	270.38	101.254	79.525
1/8	172.60	135.56	50.766	39.871	1/8	348.55	273.75	102.516	80.516
3/16	175.64	137.95	51.660	40.574	3/16	352.87	277.14	103.785	81.513
1/4	178.71	140.36	52.563	41.282	1/4	357.21	280.55	105.063	82.516
5/16	181.81	142.79	53.473	41.997	5/16	361.58	283.99	106.348	83.525
3/8	184.93	145.24	54.391	42.718	3/8	365.98	287.44	107.641	84.541
7/16	188.07	147.71	55.316	43.445	7/16	370.40	290.91	108.941	85.563
1/2	191.25	150.21	56.250	44.179	1/2	374.85	294.41	110.250	86.590
9/16	194.45	152.72	57.191	44.918	9/16	379.33	297.92	111.566	87.624
5/8	197.68	155.26	58.141	45.664	5/8	383.83	301.46	112.891	88.664
11/16	200.93	157.81	59.098	46.415	11/16	388.36	305.02	114.223	89.710
3/4	204.21	160.39	60.063	47.173	3/4	392.91	308.59	115.563	90.763
13/16	207.52	162.99	61.035	47.937	13/16	397.49	312.19	116.910	91.821
7/8	210.85	165.60	62.016	48.707	7/8	402.10	315.81	118.266	92.886
15/16	214.21	168.24	63.004	49.483	15/16	406.74	319.45	119.629	93.957
8	217.60	170.90	64.000	50.265	11	411.40	323.11	121.000	95.033
1/16	221.01	173.58	65.004	51.054	1/16	416.09	326.80	122.379	96.116
1/8	224.45	176.29	66.016	51.849	1/8	420.80	330.50	123.766	97.205
3/16	227.92	179.01	67.035	52.649	3/16	425.54	334.22	125.160	98.301
1/4	231.41	181.75	68.063	53.456	1/4	430.31	337.97	126.563	99.402
5/16	234.93	184.52	69.098	54.269	5/16	435.11	341.73	127.973	100.510
3/8	238.48	187.30	70.141	55.088	3/8	439.93	345.52	129.391	101.623
7/16	242.05	190.11	71.191	55.914	7/16	444.78	349.33	130.816	102.743
1/2	245.65	192.93	72.250	56.745	1/2	449.65	353.16	132.250	103.869
9/16	249.28	195.78	73.316	57.583	9/16	454.55	357.00	133.691	105.001
5/8	252.93	198.65	74.391	58.426	5/8	459.48	360.87	135.141	106.139
11/16	256.61	201.54	75.473	59.276	11/16	464.43	364.76	136.598	107.284
3/4	260.31	204.45	76.563	60.132	3/4	469.41	368.68	138.063	108.434
13/16	264.04	207.38	77.660	60.994	13/16	474.42	372.61	139.535	109.591
7/8	267.80	210.33	78.766	61.863	7/8	479.45	376.56	141.016	110.754
15/16	271.59	213.31	79.879	62.737	15/16	484.51	380.54	142.504	111.923
9	275.40	216.30	81.000	63.617	12	489.60	384.53	144.000	113.098

STRESSES IN BEAMS

In the application of the principles of structural mechanics to determine what sections should be used safely to sustain superimposed loads under specified conditions of loading, it is necessary to ascertain, first, the effects produced on the structure by the loads under those conditions; second, to decide what unit strength the material, the use of which is contemplated, has to resist the stresses produced within the structure by the loading; and, third, to select a section whose section modulus is equivalent to the ratio found to exist between the stresses tending to cause deformation within the structure and the unit strength of the material to resist them.

Reactions. In the simple case of a beam supported at both ends, each support reacts with an upward pressure called the reaction of the support. The sum of these two reactions is equal to the total load on the beam.

Shear. The loads and the reactions of the supports are vertical forces tending to shear or cut the beam across and the stresses they produce within the beam are, therefore, called shearing stresses. The shear at each support is equal to the reaction of the support; the shear at any point between the supports is equal to the reaction of a support less the total load between that support and the point; or, if the reaction acting upward is considered as positive and the loads, acting downwards, as negative, the shear at any point is the algebraic sum of the vertical forces acting on the beam between that point and either support.

If such a simple beam supported at both ends carries a load uniformly distributed over its entire length, the reaction and the shear at each support is equal to one-half the total load on the beam, but the shear decreases uniformly to zero at the center of the span; if the load is concentrated at the center of the span, the reaction and the shear at each support are also equal to one-half the total load, but the shear is uniform throughout the entire length of the beam.

Bending Moment. The loads on the beam and the reactions of the supports constitute external forces which produce bending stress in the beam. The summation of the moments of the external forces about any point is called the bending moment and varies from point to point. It attains a maximum value at a point where the shear is either zero or changes from positive to negative or vice versa. If the loads are concentrated at several points, the maximum bending moment always occurs at the point of application of

one of the loads so located that the sum of all the loads on the beam between one support up to and including that load is equal to or greater than the reaction of the support.

Vertical Deflection. Bending stress within a beam produces flexure, and the deflection, or the amount of its departure from a straight line, is the measure of the deformation which the beam has undergone in its resistance to bending stress. So long as the stress is within the safe limits allowed for the material, the deflection is negligible so far as concerns the beam itself; it may, however, be of sufficient magnitude to cause the disruption of other materials in contact with or supported by the beam but of less strength, such as plaster. In such cases the limit of allowable deflection may determine or at least influence the choice of a section.

Lateral Deflection. The stresses within a beam under transverse loading are compressive on one side of the neutral axis and tensile on the other. The tensile stresses tend to hold the beam in a straight line between the supports, while the compressive stresses tend to deflect it in a lateral direction, just as the bending stresses as a whole tend to deflect it in a vertical plane. On long spans unsupported against sidewise deflection, this consideration may influence the choice of sections.

Method of Computation. A complete investigation of the strength of beams under transverse loading must take into account all the elements, the bending moment, the vertical deflection, the lateral deflection and the shearing stress; though under the usual loading conditions the first alone determines the size and weight of section.

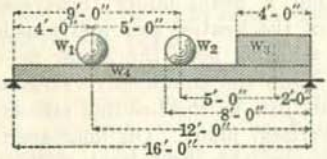
In the calculation of bending stresses, the loads are usually expressed in pounds, the span length and the distance between the loads in feet; the resulting bending moments are in terms of foot pounds, which necessitates conversion to inch pounds before the section can be selected from the tables. The section modulus of the required section is obtained by dividing the maximum bending moment in inch pounds by the allowed unit stress in pounds per square inch. In such calculations it is assumed that the neutral axis of the section is normal to the line of action of the load. When this is not the case, correction must be made for the eccentricity of the loading.

In the pages which immediately follow are given general formulas for the bending moments and vertical deflections of beams under the usual conditions of loading, and also diagrams illustrative of those conditions. The general method for the computation of the maximum bending moment of a beam supported at its ends and loaded at various points is as follows:—

First. Find the reaction at the left (right) support by multiplying each load by its distance from the right (left) support and dividing the sum of these products by the length of the span.

Second. Starting from the left (right) end of the beam, add the successive loads until a point is reached where the sum of the loads equals or exceeds the reaction of the left (right) support; the point of maximum bending moment is located at this point.

Third. Multiply the reaction at the left (right) support by its distance from the point of maximum bending moment and subtract the sum of the products of all loads to the left (right) of this point by the corresponding distance from this point; the difference between these moments is then the maximum bending moment.



Example: Required the size of a steel beam to support the following quiescent loads over a clear span of 16 feet between supports, at a maximum unit stress not to exceed 18000 pounds per square inch.

W_1 = 16000 pounds, 4 feet from left support.
W_2 = 18000 " 9 " " " "
W_3 = 2000 " per foot, uniform up to 4 feet from right support.
W_4 = 60 " " " assumed weight of beam uniformly distributed over entire span.

Left Reaction, $\frac{16000 \times 12 + (60 \times 16)8 + 18000 \times 7 + (2000 \times 4) \times 2}{16} = 21355$ lbs.

Right Reaction, $\frac{16000 \times 4 + (60 \times 16)8 + 18000 \times 9 + (2000 \times 4) \times 14}{16} = 21605$ lbs.

Sum of reactions = sum of loads = $W_1 + W_2 + W_3 + W_4 = 42960$ lbs.

Points of maximum moment $(60 \times 4) + 16000 = 16240 < 21355$
$(60 \times 9) + 16000 + 18000 = 34540 > 21355$

therefore the point of maximum bending moment is at point of load W_2.

Maximum bending moment, $21355 \times 9 - 16000 \times 5 - (60 \times 9) \times 4.5 = 109765$ ft. lbs.
or, $21605 \times 7 - (2000 \times 4) \times 5 - (60 \times 7) \times 3.5 = 109765$ ft. lbs.

Required section modulus $= \frac{109765 \times 12}{18000} = \frac{1317180}{18000} = 73.2$ in.^{3}

As the section modulus of the 18 inch 54.7 pound, American Standard, or the 16 inch 45 pound Carnegie Beam is greater than this, either of these sections may be used.

If the allowed unit stress were 16000 pounds per square inch, the required section modulus would be $\frac{109765 \times 12}{16000} = \frac{1317180}{16000} = 82.4$ in.^{3}

COMPARISON OF VARIOUS LOADING CONDITIONS

The formulas and diagrams on the following pages give the various stresses in sections used as beams, resulting from usual conditions of loading.

Taking as a unit of comparison a uniformly distributed safe load on beams of equal length and section, supported at the extreme ends, the following table gives the relative maximum safe loads or bending moments and deflections.

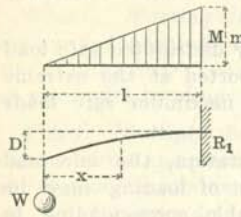
As a check on the accuracy of a computation, the safe load obtained from the formula for any condition of loading may be multiplied by the reciprocal given in the table corresponding to such loading condition; the result should be the maximum allowable uniform load as taken from beam safe load tables.

Conditions of Loading	Case No.	Maximum Safe Load		Maximum Deflection
		Relative	Reciprocal	Relative
BEAM SUPPORTED AT ENDS				
Load uniformly distributed over span	IX	1	1	1
Load concentrated at center of span	V	½	2	.80
Two equal loads symmetrically concentrated	VII	$l/4a$	$4a/l$	
Load increasing uniformly to one end	X	.9743	1.0264	.976
Load increasing uniformly to center	XII	¾	1⅓	.96
Load decreasing uniformly to center	XI	½	⅔	1.08
BEAM FIXED AT ONE END, CANTILEVER				
Load uniformly distributed over span	II	¼	4	2.40
Load concentrated at end	I	⅛	8	3.20
Load increasing uniformly to fixed end	III	⅜	2⅔	1.92
BEAM CONTINUOUS OVER TWO SUPPORTS EQUIDISTANT FROM ENDS				
Load uniformly distributed over span	XVI			
1. If distance $a > 0.2071\ l$		$l^2/4a^2$	$4a^2/l^2$	
2. If distance $a < 0.2071\ l$		$\frac{l}{l-4a}$	$\frac{l-4a}{l}$	
3. If distance $a = 0.2071\ l$		5.8285	.1716	
Two equal loads concentrated at ends	XV	$l/4a$	$4a/l$	

BEAMS UNDER VARIOUS LOADING CONDITIONS

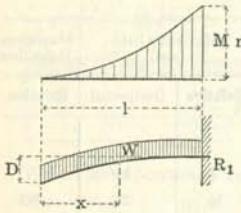
Bending Moments and Deflections

I. CANTILEVER BEAM—Concentrated load at free end



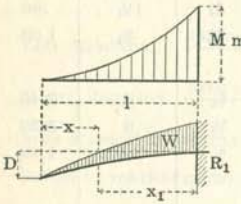
R_1 (max. shear)	$= W$
M, distance x	$= Wx$
M max, at R_1	$= Wl$
W max.	$= \frac{fS}{l}$
D max.	$= \frac{Wl^3}{3EI}$

II. CANTILEVER BEAM—Uniformly distributed load



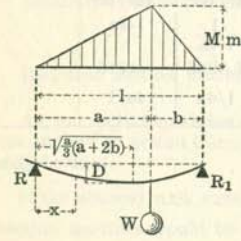
R_1 (max. shear)	$= W$
M, distance x	$= \frac{Wx^2}{2l}$
M max. at R_1	$= \frac{Wl}{2}$
W max.	$= \frac{2fS}{l}$
D max.	$= \frac{Wl^3}{8EI}$

III. CANTILEVER BEAM—Load increasing uniformly to fixed end



R_1 (max. shear)	$= W$
M, distance x	$= \frac{W}{3} \frac{x^3}{l^2}$
M max. at R_1	$= \frac{Wl}{3}$
W max.	$= \frac{3fS}{l}$
D max.	$= \frac{Wl^3}{15EI}$

IV. BEAM SUPPORTED AT ENDS—Concentrated load near one end

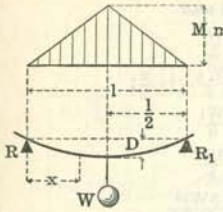


R (max. shear if b>a)	$= \frac{Wb}{l}$
R_1 (max. shear if a>b)	$= \frac{Wa}{l}$
M, distance x	$= \frac{Wbx}{l}$
M max., at point of load	$= \frac{Wab}{l}$
W max.	$= \frac{fSl}{ab}$
D max.	$= \frac{Wab\,(a+2b)\sqrt{3a\,(a+2b)}}{27EIl}$

BEAMS UNDER VARIOUS LOADING CONDITIONS

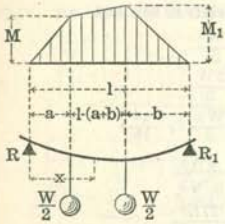
Bending Moments and Deflections

V. BEAM SUPPORTED AT ENDS—Concentrated load at center



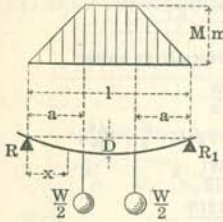
R (max. shear) $=R_1$	$=\frac{W}{2}$
M, distance x	$=\frac{Wx}{2}$
M max., at point of load	$=\frac{Wl}{4}$
W max.	$=\frac{4fS}{l}$
D max.	$=\frac{Wl^3}{48EI}$

VI. BEAM SUPPORTED AT ENDS—Two unsymmetrical concentrated loads



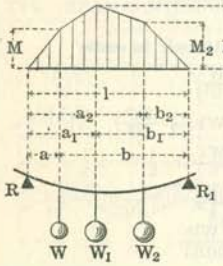
R (max. shear if a<b)	$=\frac{W}{2l}(l-a+b)$
R_1	$=\frac{W}{2l}(l+a-b)$
M, distance a	$=Ra=\frac{Wa}{2l}(l-a+b)$
M_1 max., distance b (b>a)	$=R_1b=\frac{Wb}{2l}(l+a-b)$
M_2, distance x	$=Rx-\frac{W}{2}(x-a)$
W max. (b>a)	$=\frac{2lfS}{b(l+a-b)}$

VII. BEAM SUPPORTED AT ENDS—Two symmetrical concentrated loads



R (max. shear) $=R_1$	$=\frac{W}{2}$
M, distance x	$=\frac{Wx}{2}$
M max. at and between loads	$=\frac{Wa}{2}$
W max.	$=\frac{2fS}{a}$
D max.	$=\frac{Wa}{12EI}(\frac{3}{4}l^2-a^2)$

VIII. BEAM SUPPORTED AT ENDS—Three concentrated loads

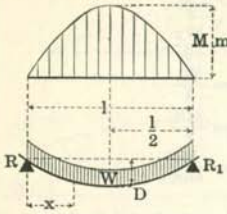


R	$=\frac{Wb+W_1b_1+W_2b_2}{l}$
R_1	$=\frac{Wa+W_1a_1+W_2a_2}{l}$
M at W	$=Ra.$
M max. if W	$=$ or $>R$
M at W_1	$=Ra_1-W(a_1-a)$
M max. if W_1+W	$=R$ or $>R$
M max. if W_1+W_2	$=R_1$ or $>R_1$
M at W_2	$=Ra_2-W(a_2-a)-W_1(a_2-a_1)$
M max. if W_2	$=R_1$ or $>R_1$

BEAMS UNDER VARIOUS LOADING CONDITIONS

Bending Moments and Deflections

IX. BEAM SUPPORTED AT ENDS—Uniformly distributed load



R(max. shear)=R_1 $= \frac{W}{2}$

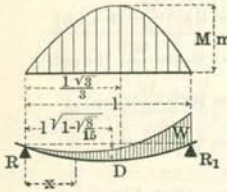
M, distance x $= \frac{Wx}{2}\left(1-\frac{x}{l}\right)$

M max. at center $= \frac{Wl}{8}$

W max. $= \frac{8fS}{l}$

D max. $= \frac{5Wl^3}{384EI}$

X. BEAM SUPPORTED AT ENDS—Load increasing uniformly to one end



R $= \frac{W}{3}$

R_1(max. shear) $= \frac{2W}{3}$

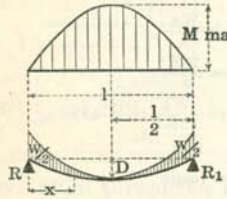
M, distance x $= \frac{Wx}{3}\left(1-\frac{x^2}{l^2}\right)$

M max., distance $\frac{l\sqrt{3}}{3}$ $= \frac{2Wl}{9\sqrt{3}}$

W max. $= \frac{27fS}{2l\sqrt{3}}$

D max. $= \frac{.013044\ Wl^3}{EI}$

XI. BEAM SUPPORTED AT ENDS—Load decreasing uniformly to center



R(max. shear)=R_1 $= \frac{W}{2}$

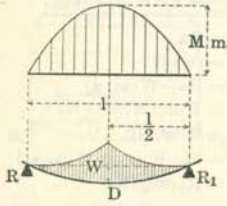
M, distance x $= Wx\left(\frac{1}{2}-\frac{x}{l}+\frac{2x^2}{3l^2}\right)$

M max., distance $\frac{l}{2}$ $= \frac{Wl}{12}$

W max. $= \frac{12fS}{l}$

D max. $= \frac{3Wl^3}{320EI}$

XII. BEAM SUPPORTED AT ENDS—Load increasing uniformly to center



R(max. shear)=R_1 $= \frac{W}{2}$

M, distance x $= Wx\left(\frac{1}{2}-\frac{2x^2}{3l^2}\right)$

M max., distance $\frac{l}{2}$ $= \frac{Wl}{6}$

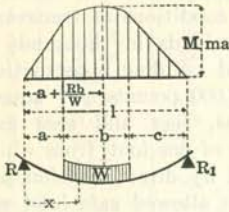
W max. $= \frac{6fS}{l}$

D max. $= \frac{Wl^3}{60EI}$

BEAMS UNDER VARIOUS LOADING CONDITIONS

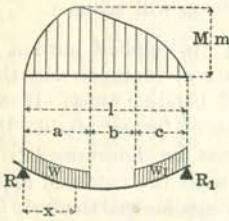
Bending Moments and Deflections—Concluded

XIII. BEAM SUPPORTED AT ENDS—Uniform load partially distributed



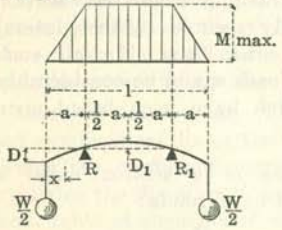
R (max. shear if a<c)	$= \frac{W(2c+b)}{2l}$
R_1	$= \frac{W(2a+b)}{2l}$
M, dist. x=a or <a,	$= Rx$
M_1 dist. x>a,	$= Rx - \frac{W(x-a)^2}{2b}$
M_2, dist. x>(a+b),	$= Rx - \frac{W(2x-2a-b)}{2}$
M max., dist. $a + \frac{Rb}{W}$,	$= \frac{W(2c+b)[4al+b(2c+b)]}{8l^2}$
W max.	$= \frac{8l^2fS}{(2c+b)[4al+b(2c+b)]}$

XIV. BEAM SUPPORTED AT ENDS—Uniform load partially discontinuous



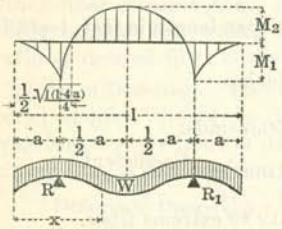
R (max. shear if $W > W_1$)	$= \frac{W(2l-a)+W_1c}{2l}$
R_1	$= \frac{W_1(2l-c)+Wa}{2l}$
M, distance x <a,	$= Rx - \frac{Wx^2}{2a}$
M_1 distance x >a,	$= Rx - \frac{W(2x-a)}{2}$
M max. dist. $x \frac{2Wal-Wa^2+W_1ca}{2Wl}$ & $Wa > W_1c$	$= \frac{R^2a}{2W}$
W max.	$= \frac{R^2a}{2fS}$

XV. BEAM CONTINUOUS OVER TWO SUPPORTS—Two exterior symmetrical loads



R (max. shear) = R_1	$= \frac{W}{2}$
M, distance x	$= \frac{Wx}{2}$
M max., from R to R_1	$= \frac{Wa}{2}$
W max.	$= \frac{2fS}{a}$
D, distance a	$= \frac{Wa(3al-4a^2)}{12\,EI}$
D_1, distance $\frac{1}{2} - a$	$= \frac{Wa(1-2a)^2}{16EI}$

XVI. BEAM CONTINUOUS OVER TWO SUPPORTS—Uniformly distributed load



R = R_1	$= \frac{W}{2}$, max. shear $\frac{Wa}{l}$ or $\frac{W}{l}(\frac{l}{2}-a)$	
M, distance x	$= \frac{W(x^2-lx+al)}{2l}$	o, if $x = \frac{1}{2} \pm \sqrt{\frac{l(l-4a)}{4}}$
M_1 at R and R_1	$= \frac{Wa^2}{2l}$	max. if $a > l(\sqrt{1/2}-1/2)$
M_2 at center	$= \frac{W(l-4a)}{8}$	max. if $a < l(\sqrt{1/2}-1/2)$
W_1 max.	$= \frac{2lfS}{a^2}$	max. if $a > l(\sqrt{1/2}-1/2)$
W_2 max.	$= \frac{8fS}{l-4a}$	max. if $a < l(\sqrt{1/2}-1/2)$

SAFE LOADS FOR SECTIONS USED AS BEAMS

EXPLANATION OF TABLES

The tables of safe loads for structural beams, channels, H-beams and cross tie sections, used as beams under conditions of transverse loading, give the uniformly distributed safe loads in thousands of pounds for spans customary in bridge and building construction, based upon an extreme unit stress of 18,000 pounds per square inch. The tables of safe loads for angles, tees and zees give the values at the same unit stresses on spans of one foot, from which the safe load for any length may be obtained by direct division, and also the values for those spans at which the allowed safe load will produce a deflection of $\frac{1}{360}$ of the span length. The loads in all cases include the weight of the section, which should be deducted in order to arrive at the net load which the section will support.

It is assumed in all cases that the loads are applied normal to the axis 1-1 as shown in the tables of elements of sections, and that the beam deflects vertically in the plane of bending only. If the conditions of loading involve the introduction of forces outside this plane of loading, the allowable safe loads must be determined from the general theory of flexure, in accordance with the mode of application of the load and its character. This applies particularly to unsymmetrical sections, such as zee bars and angles, which should be used only under those conditions of loading where the section can deflect vertically only, being rigidly secured against lateral deflection or twisting throughout the entire span. In all such cases of eccentric loading, the actual safe loads would be considerably lower than the tabulated safe loads which have been based upon the most favorable conditions of loading.

Vertical Deflection. The vertical deflection of a section under a uniformly distributed load is determined from formula:

$$\text{Deflection, } D=\frac{5}{384}\frac{Wl^3}{EI}\ ;\ Wl=8\,f\,\frac{I}{n}$$

$$\text{“} \qquad D=\frac{40}{384}\frac{fl^2}{En};\ \text{for span length in feet, } l=12\ L$$

$$\text{“} \qquad D=\frac{15\,fL^2}{En}\ \text{inches}$$

Steel, E=29,000,000; for unit stress of 18,000 pounds:

$$\text{Deflection, } D=\frac{0.01862L^2}{2n} \qquad \text{Deflection, } D=\frac{\text{Coefficient}}{2n}$$

n=distance from center line of gravity to extreme fiber.

Deflection Coefficients for Unit Stress of 18,000 Pounds

Span, Feet	Coefficient 18,000	Span, Feet	Coefficient 18,000	Span, Feet	Coefficient 18,000	Span, Feet	Coefficient 18,000
1	0.019	21	8.212	41	31.301	61	69.288
2	0.074	22	9.012	42	32.847	62	71.578
3	0.168	23	9.850	43	34.430	63	73.906
4	0.298	24	10.726	44	36.050	64	76.270
5	0.466	25	11.638	45	37.707	65	78.672
6	0.670	26	12.588	46	39.401	66	81.112
7	0.912	27	13.574	47	41.133	67	83.588
8	1.192	28	14.599	48	42.902	68	86.102
9	1.508	29	15.660	49	44.708	69	88.653
10	1.862	30	16.759	50	46.552	70	91.241
11	2.253	31	17.894	51	48.432	71	83.867
12	2.681	32	19.068	52	50.350	72	96.530
13	3.147	33	20.278	53	52.306	73	99.230
14	3.650	34	21.526	54	54.298	74	101.967
15	4.190	35	22.810	55	56.328	75	104.741
16	4.767	36	24.132	56	58.395	76	107.553
17	5.381	37	25.492	57	60.499	77	110.402
18	6.033	38	26.888	58	62.640	78	113.288
19	6.722	39	28.322	59	64.819	79	116.212
20	7.448	40	29.793	60	67.035	80	119.172

The deflection, in inches, of sections subjected to transverse stresses due to uniformly distributed loads are obtained as follows:

Symmetrical Sections. To find the deflection in inches of a section symmetrical about the neutral axis, such as beams, channels, zees, etc., divide the coefficient in the table corresponding to given span and fiber stress by the depth of the section in inches.

Unsymmetrical Sections. To find the deflection in inches of a section not symmetrical about the neutral axis, such as angles, tees, etc., divide the coefficient corresponding to given span and unit stress by twice the distance of extreme fiber from neutral axis obtained from table of elements of sections.

Other Fiber Stresses. To find the deflection of any section for other fiber stresses than those given, multiply the coefficient for 18000 pounds unit stress corresponding to the span given by the ratio of desired fiber stress and 18000.

Limits of Deflection. The deflection of floor beams carrying plastered ceilings should be limited to not more than $\frac{1}{360}$ of the span length; this limit is indicated in the safe load tables by lower zigzag line, is derived from the following formulas:

$$\text{Deflection, } D_{max} = \frac{12L}{360} = \frac{15fL^2}{En} \qquad f = 18{,}000,\ L_{max.} = 3.580n$$

Lateral Deflection of Beams. In the usual construction of buildings the compression flanges of beams are secured against lateral deflection by the floor system, by tie rods placed at proper intervals, or by other means, and upon this assumption the full tabular loads may be applied.

When lateral bracing is not provided and the unbraced span length as compared with the flange width of the beam is excessive, it may be found economical to use two beams or a beam and channel securely fastened together; in crane girder construction a channel with flanges turned downward and riveted to the top flange of a beam will make a very efficient construction.

If, however, a single section is to be used for an excessive ratio of span length to flange width, the full tabular safe loads must be reduced, various permissible ratios of span length to flange width, l/b, and formulas for reduction of stresses being in use.

The table on opposite side gives the reduction in per cent of the tabular safe loads in accordance with the Specification of the American Institute of Steel Construction. The maximum allowable ratio of l/b is limited to 40.

thus:

$$f_c = \frac{20{,}000}{1 + \frac{1}{2000}(l/b)^2}$$

Full stress 18,000 lbs., up to ratio, l/b=15

Maximum allowable ratio, l/b=40

In addition to lateral deflection due to vertical loading, lateral deflection may be induced by the thrust of floor arches or by other forces not coincident with axis of principal bending stress.

Stresses due to horizontal thrust should either be neutralized by tie rods, or the safe resistance of the beam should be computed to provide for the combined stresses due to the action of both vertical and horizontal forces, so as not to exceed the allowable fiber stress.

REDUCTION OF TABULAR SAFE LOADS DUE TO LATERAL DEFLECTION

Various Ratios of Span Length to Flange Width of Beam, l/b.
American Institute of Steel Construction Code.

Ratio, Length to Width l/b	Per Cent. Tabular Safe Load A. I. S. C. 18,000	Ratio, Length to Width l/b	Per Cent. Tabular Safe Load A. I. S. C. 18,000	Ratio, Length to Width l/b	Per Cent. Tabular Safe Load A. I. S. C. 18,000	Ratio, Length to Width l/b	Per Cent. Tabular Safe Load A. I. S. C. 18,000
	100	21	91.0	27.5	80.6	34	70.4
15	100.0	21.5	90.3	28	79.8	34.5	69.7
15.5	99.2	22	89.5	28.5	79.0	35	68.9
16	98.5	22.5	88.7	29	78.2	35.5	68.2
16.5	97.8	23	87.9	29.5	77.4	36	67.4
17	97.1	23.5	87.1	30	76.6	36.5	66.7
17.5	96.4	24	86.3	30.5	75.8	37	66.0
18	95.6	24.5	85.5	31	75.1	37.5	65.2
18.5	94.9	25	84.7	31.5	74.3	38	64.5
19	94.1	25.5	83.9	32	73.5	38.5	63.8
19.5	93.4	26	83.0	32.5	72.7	39	63.1
20	92.6	26.5	82.2	33	71.9	39.5	62.4
20.5	91.8	27	81.4	33.5	71.2	40	61.7

Shearing Stresses. The safe load tables for beams and channels are computed solely with reference to safe unit stresses due to flexure, and the safe loads uniformly distributed on the spans given will not produce excessive shearing stresses in the web.

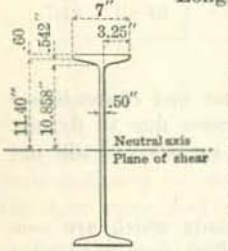
When, however, beams must support heavy loads which are concentrated near the supports, or when beams of short span are loaded with uniformly distributed loads to their full carrying capacity as regards flexure, the bending moments may be small in comparison with the reactions at the supports, and the beams may fail along the neutral plane as a result of longitudinal shearing stresses, or may buckle as a result of the combined longitudinal and vertical web stresses. On such spans the safe shearing or buckling strength of the web may limit the carrying capacity of the beam, so that the deciding factor will often be the resistance of the web to shearing stresses, rather than the resistance of the flanges to bending stresses.

Longitudinal Shear. At any point in any section of a beam, the horizontal and vertical components of the web stress are equal to each other and proportional to the vertical shear; their intensities are dependent upon the distance of the point from the neutral axis. In order to determine the intensity of the vertical shearing stress at a given point in a vertical section of the beam, therefore, it is sufficient to find the equal intensity of the horizontal shearing stress at the same point in the horizontal plane.

The longitudinal unit shear is zero at the upper and lower flanges of the beam and a maximum at the neutral plane. It is greatest at the supports and zero where there is no vertical shear.

The intensity of the longitudinal shear at any point in any section is the product of the vertical shear, V, for that section and the static moment, M_s, of the section included between the horizontal plane of shear through that point and the extreme fibers on the same side of the neutral plane divided by the product of the moment of inertia of the beam and the thickness at the plane of shear; or

$$\text{Longitudinal unit shear} = \frac{V\,M_s}{t\,I}.$$



Example—Required the maximum longitudinal shear per square inch in a 24" 79.9 lb. beam loaded with two symmetrical loads of 100,000 pounds each, disregarding the weight of the beam.

M_s of Flange Rectangle = 7x.60x11.7 = 49.1
M_s of Flange Triangles = 3.25x.542x11.22 = 19.8
M_s of Web = 11.40x.50x5.70 = 32.5
Total Static Moment 101.4 in.^{3}
Moment of Inertia of Beam, Axis I-I, I = 2087.2 in.^{4}

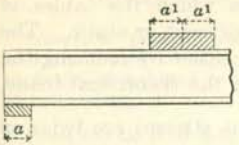
$$\text{Longitudinal Shear} = \frac{100000 \times 101.4}{2087.2 \times .50} = 9716 \text{ lb. per sq. in.}$$

Under usual conditions of loading, the longitudinal shear need not be taken into consideration.

Buckling Values of Beam Webs. The vertical shearing stresses or the vertical compressive components of the web stress may, under some conditions, exceed the safe resistance of the beam to buckling, so that a web, which is amply secure as against the safe allowed shear, will not be of sufficient strength when considered as a column.

In such cases provision must be made for security against buckling either by web stiffeners or by increasing the thickness of the web.

Experiments with beams of various depths and web thicknesses have demonstrated that the length of the web which can be assumed to resist buckling stresses is equal to the end bearing plus one-fourth of the depth of the beam; the following formulas have been deduced:



Safe end reaction $R = f_b \times t \left(a + \frac{d}{4}\right)$

Safe interior load $W = 2 f_b \times t \left(a^1 + \frac{d}{4}\right)$

In the formulas R is the end reaction, W the concentrated load, t the web thickness, d the depth of the beam, a^1 half the distance over which the concentrated load is applied and a the whole distance over which the end reaction is applied, while f_b is the safe resistance of the web to buckling.

The first formula is general and applies to any condition of loading. The second formula is for a single load concentrated at the center of a span; it can be extended for a system of concentrated loads, provided the sum of the distances a^1 is not less than a.

For computation of f_b the following formulas are used in the tables, corresponding to a maximum shearing stress of 12,000 pounds f_b maximum not to exceed 15,000 pounds per square inch.

$$f_b = \frac{18000}{1 + \frac{1}{18000}(l/r)^2}, \qquad l = \tfrac{1}{2}d \qquad r^2 = \tfrac{1}{12}t^2, \qquad f_b = \frac{18000}{1 + \frac{1}{6000}(d/t)^2}$$

The tables give for beams and channels with unsupported webs:

1. The allowable shear V, on the gross area of beam or channel webs at 12,000 pounds per square inch; also span limit.

2. The allowable web resistance f_b, in pounds per square inch.

3. The distance a, or the distance over which the end reaction must be distributed when the shearing stress, V, in the web is the maximum allowable.

4. The allowable end reaction (R) when a is taken at $3\frac{1}{2}''$, which is the usual bearing of beam on the 4″ angles, ordinarily used in building construction for beam seats.

Maximum Bending Moments. In addition to data referring to maximum loads on beams and channels as computed from the web resistance, the tables also give the maximum bending moment in foot pounds, which may be used instead of the section moduli to ascertain the proper size section in any particular instance.

Effect of Impact on Stresses. The formulas upon which the tables of safe loads are based assume all loads to be quiescent or static. The effect of moving loads may be taken care of either by reducing the allowable unit stresses, or else by increasing the theoretical loads.

When a load is suddenly applied, the resultant stresses are twice as great as those due to an equal quiescent load.

When an instantaneously applied load produces impact or percussion, the resultant stresses are dynamic and are measured by the laws governing the energy of bodies in motion.

The following formulas give the unit stress and deflection due to a load falling on center of a beam rigidly supported at both ends when the weight of beam is negligible as compared with that of falling load, and when no account is taken of the local distortion due to impact or percussion at point of application of load.

W =Weight of falling load, in pounds.

h =Height of fall, in inches.

f =Extreme unit stress due to static effect of load, W, in pounds per square inch.

f_d =Extreme unit stress due to impact of load, W, in pounds per square inch.

D =Deflection due to static effect of load, W, in inches.

D_d=Deflection due to impact of load, W, in inches.

$$f_d = f\left(1 + \sqrt{\frac{2h}{D} + 1}\right) \qquad D_d = D\left(1 + \sqrt{\frac{2h}{D} + 1}\right)$$

It must be noted, however, that when the weight of the beam is a real factor, theoretical formulas do not agree with observed results and practical tests give values which are far less than those indicated by theoretical formulas; this is notably true in drop-tests of axles.

Examples of the Use of Beam Safe Load Tables

Transverse Loads—Fixed Spans. Required the proper size of a beam laterally braced to support a superimposed or net load of 90,000 pounds uniformly distributed over a clear span of 42 feet, assuming a unit stress of 18,000 pounds.

From the table of safe loads on page 118, it is found that beam CB 301, 30″ x 10½″—115 pounds, will support a gross load of 95,000 pounds. The weight of beam is 42 x 115=4830 pounds. The net safe load is, therefore, 95,000—4800=90,170 pounds.

Transverse Loads—Free Spans. Required the reduced safe load on beam CB 212, 21″ x 9″—80 pounds, for a span of 21 feet without any lateral support or bracing, in accordance with A. I. S. C. formula for 18,000 pounds.

Tabular load, page 124,=97,700 pounds. Ratio, $l/b = \frac{21 \times 12}{9} = 28.0$

Reduced safe load, page 91, 97,700 x 0.798=78,000 pounds.

Vertical Shear. Required the maximum load which beam B 5, 15″ x 85 pounds, can support without exceeding web resistance of 12,000 pounds.

From tables on page 104 the maximum end reaction is 156,960 pounds and the maximum load is 2 x 156,960=313,920 pounds.

Vertical Deflection. 1. Required the proper size and the deflection of a beam supporting a net load of 12,500 pounds concentrated in the middle of a 21-foot span, for a unit stress of 18,000 pounds, assuming that the beam is braced against lateral deflection.

The specified concentrated load is equivalent to a uniformly distributed oad of 2 x 12,500 = 25,000 pounds.

In table on page 136, it is found that beam CB 142, 14″ x 6¾″—33 pounds, will support a gross load of 27,200 pounds or a net load of 27,200—21 x 33= 26,500 pounds.

The deflection produced by a uniformly distributed load of 27,200 pounds is found from the coefficient given in the same table and page 91 to be 8.21 ÷14=0.59″. The deflection for the specified load concentrated in the middle of the span, page 85, is approximately 0.59 x 4/5=0.47″.

2. Required the deflection of a riveted girder, 37 inches deep, for a span of 35 feet and a unit stress of 14,000 pounds.

Required deflection, table on page 91,= $\frac{22.81}{37} \times \frac{14000}{18000} = 0.48''$.

3. Required the deflection of angle 6 x 4 x 7/16″ about an axis parallel to the short leg, rigidly secured laterally, and loaded to capacity of 3287 pounds, for a span of 14 feet and a unit stress of 18,000 pounds.

Required deflection, page 91, is $\frac{3.65}{2 \times (6-1.96)} = 0.45''$.

4. Required the deflection of channel C 3, 10″ x 15.3 pounds, laid flat and loaded to capacity of 1300 pounds, for a span of 12 feet and a unit stress of 20,000 pounds.

Required deflection, page 91,= $\frac{2.68}{2\ (2.60-0.64)} \times \frac{20,000}{18,000} = 0.76''$.

BEAM I VALUES

CARNEGIE BEAM SECTIONS

Maximum Bending Moments and Web Resistances

Bending Stress **18,000** Pounds—Shearing Stress **12,000** Pounds

Section Index and Nominal Depth	Depth of Beam	Weight per Foot	Web Thickness	Maximum Bending Moment	Values for End Reaction, V				End Reaction a=3½"
					Web Shearing		Web Buckling		
					End Reaction	Span Limit	Unit Stress	End Bearing	
	d		t	M max.	V max.	L min.	fb	a min.	R max.
	Inches	Pounds	Inches	Foot Pounds	Pounds	Feet	Pounds per Sq. In.	Inches	Pounds
CB 362 36″	36.851	300	.958	1,654,050	423,640	15.62	14,439	21.41	175,860
	36.550	275	.890	1,510,300	390,360	15.48	14,050	22.08	158,040
	36.243	250	.824	1,365,700	358,370	15.24	13,612	22.89	140,880
	36.000	230	.769	1,251,050	332,210	15.06	13,184	23.77	126,730
CB 361 36″	36.645	192	.740	999,450	325,400	12.29	12,778	25.25	119,720
	36.395	175	.686	904,950	299,600	12.08	12,252	26.55	105,900
	36.183	160	.635	823,600	275,710	11.95	11,680	28.13	93,050
	36.000	147	.590	753,350	254,880	11.82	11,108	29.89	81,930
CB 332 33″	33.786	260	.870	1,335,250	352,730	15.14	14,384	19.74	149,510
	33.546	240	.810	1,229,700	326,060	15.09	13,998	20.37	134,780
	33.272	220	.766	1,116,750	305,830	14.61	13,694	20.84	123,970
	33.000	200	.720	1,004,500	285,120	14.09	13.332	21.45	112,790
CB 331 33″	33.530	167	.719	790,600	289,300	10.93	13,211	22.07	112,880
	33.342	152	.655	719,700	262,070	10.99	12,571	23.49	97,460
	33.164	138	.596	653,400	237,190	11.02	11,873	25.23	83,430
	33.000	125	.540	592,200	213,840	11.08	11,095	27.44	70,390
CB 302 30″	30.781	240	.888	1,106,850	328,000	13.50	14,997	16.93	149,090
	30.522	220	.816	1,014,450	298,870	13.58	14,596	17.46	132,570
	30.263	200	.743	922,500	269,820	13.68	14,101	18.19	115,940
	30.000	180	.670	830,100	241,200	13.77	13,492	19.18	99,440
CB 301 30″	30.742	165	.755	715,050	278,520	10.27	14,103	18.47	119,110
	30.538	151	.692	654,600	253,590	10.32	13,589	19.33	104,710
	30.344	138	.634	598,050	230,860	10.36	13,027	20.37	91,560
	30.162	126	.581	545,700	210,290	10.38	12,421	21.60	79,680
	30.000	115	.530	498,600	190,800	10.45	11,734	23.18	68,410
CB 272 27″	27.598	190	.756	801,900	250,370	12.81	14,729	15.59	115,800
	27.400	175	.698	738,750	229,500	12.88	14,322	16.11	103,470
	27.200	160	.639	675,150	208,570	12.95	13,825	16.81	90,990
	27.000	145	.580	612,150	187,920	13.03	13,224	17.75	78,620
CB 271 27″	27.742	137	.688	538,050	229,040	9.40	14,162	16.57	101,680
	27.536	124	.624	487,200	206,190	9.45	13,590	17.43	88,060
	27.340	112	.566	439,800	185,690	9.47	12,960	18.48	75,810
	27.166	101	.510	397,050	166,260	9.55	12,221	19.88	64,140
	27.000	91	.461	357,450	149,360	9.57	11,453	21.54	54,120
	26.820	85	.461	324,300	148,370	8.74	11,508	21.26	54,140

CARNEGIE BEAM SECTIONS

MAXIMUM BENDING MOMENTS AND WEB RESISTANCES

Bending Stress **18,000** Pounds—Shearing Stress **12,000** Pounds

BEAM I VALUES

Section Index and Nominal Depth	Depth of Beam	Weight per Foot	Web Thickness	Maximum Bending Moment	Values for End Reaction, V				End Reaction a=3½"
					Web Shearing		Web Buckling		
					End Reaction	Span Limit	Unit Stress	End Bearing	
	d		t	M max.	V max.	L min.	fb	a min.	R max.
	Inches	Pounds	Inches	Foot Pounds	Pounds	Feet	Pounds per Sq. In.	Inches	Pounds
	24.664	160	.670	616,200	198,300	12.43	14,684	13.99	95,100
CB 244 24″	24.526	150	.629	577,350	185,120	12.47	14,361	14.36	87,000
	24.388	140	.588	538,800	172,080	12.52	13,989	14.82	78,940
	24.250	130	.547	500,460	159,180	12.57	13,559	15.40	70,920
	24.310	120	.539	452,850	157,240	11.52	13,443	15.62	69,400
CB 243 24″	24.156	110	.494	415,200	143,200	11.60	12,871	16.48	60,650
	24.000	100	.450	377,550	129,600	11.65	12,211	17.59	52,200
	24.308	94	.499	337,500	145,560	9.27	12,899	16.54	61,640
CB 242 24″	24.154	85	.452	305,250	131,010	9.32	12,196	17.73	52,580
	24.000	76	.405	273,000	116,640	9.36	11,354	19.37	43,680
CB 241 24″	24.000	70	.400	244,200	115,200	8.48	11,250	19.60	42,750
	21.492	136	.606	462,550	156,290	11.84	14,881	11.96	80,020
	21.372	128	.570	435,600	146,180	11.92	14,583	12.24	73,500
CB 213 21″	21.248	120	.535	408,150	136,410	11.97	14,253	12.58	67,190
	21.126	112	.499	381,150	126,500	12.05	13,860	13.01	60,730
	21.000	104	.465	353,550	117,180	12.07	13,434	13.51	54,660
	21.358	98	.535	313,850	137,120	9.16	14,223	12.68	67,260
CB 212 21″	21.240	92	.502	294,750	127,950	9.21	13,864	13.07	61,320
	21.120	86	.470	275,400	119,120	9.25	13,468	13.54	55,580
	21.000	80	.438	256,350	110,380	9.29	13,014	14.11	49,880
	21.370	76	.469	236,400	120,280	7.86	13,373	13.83	55,460
	21.248	70	.433	217,800	110,400	7.89	12,845	14.54	49,010
CB 211 21″	21.126	64	.396	199,350	100,390	7.94	12,209	15.48	42,460
	21.000	58	.360	180,450	90,720	7.96	11,486	16.69	36,180
	20.890	55	.360	167,550	90,240	7.43	11,530	16.52	36,210
	18.238	100	.498	293,400	108,990	10.77	14,711	10.32	59,040
CB 183 18″	18.120	93	.463	272,850	100,670	10.84	14,340	10.63	53,310
	18.000	86	.429	252,300	92,660	10.89	13,917	11.02	47,760
	18.242	78	.471	216,900	103,100	8.41	14,400	10.64	54,670
CB 182 18″	18.110	72	.436	200,100	94,750	8.45	13,980	11.02	48,930
	18.000	67	.406	186,150	87,700	8.49	13,558	11.43	44,040
	18.252	58	.393	157,950	86,080	7.34	13,240	11.98	41,950
CB 181 18″	18.114	52	.354	141,600	76,950	7.36	12,531	12.82	35,610
	18.024	*51	.375	134,850	81,110	6.65	12,996	12.14	39,020
	18.000	47	.320	128,100	69,120	7.41	11,785	13.83	30,170

*Special Section—Web Thickness ⅜″.

BEAM I VALUES

CARNEGIE BEAM SECTIONS

Maximum Bending Moments and Web Resistances

Bending Stress **18,000** Pounds—Shearing Stress **12,000** Pounds

Section Index and Nominal Depth	Depth of Beam	Weight per Foot	Web Thickness	Maximum Bending Moment	Values for End Reaction, V				End Reaction a=3½"
					Web Shearing		Web Buckling		
					End Reaction	Span Limit	Unit Stress	End Bearing	
	d		t	M max.	V max.	L min.	fb	a min.	R max.
	Inches	Pounds	Inches	Foot Pounds	Pounds	Feet	Pounds per Sq. In.	Inches	Pounds
CB 165 16″	16.236	115	.532	307,800	103,650	11.88	15,000	8.93	60,320
	16.110	107	.496	286,200	95,890	11.94	15,000	8.86	56,000
	16.000	100	.464	267,450	89,090	12.01	15,000	8.80	52,200
CB 164 16″	16.240	90	.495	235,650	96,470	9.77	15,000	8.93	56,130
	16.120	83	.458	217,350	88,600	9.81	14,920	8.94	51,450
	16.000	76	.419	199,050	80,450	9.90	14,481	9.26	45,510
CB 163 16″	16.226	68	.438	170,850	85,280	8.01	14,649	9.24	48,480
	16.114	63	.406	158,250	78,510	8.06	14,257	9.54	43,580
	16.000	58	.375	145,650	72,000	8.09	13,810	9.90	38,840
CB 162 16″	16.254	50	.362	122,850	70,610	6.96	13,473	10.41	36,890
	16.128	45	.326	110,700	63,090	7.02	12,785	11.11	31,390
	15.934	*43	.375	98,550	71,700	5.50	13,836	9.84	38,830
	16.000	40	.290	98,400	55,680	7.07	11,942	12.08	25,970
CB 161 16″	16.012	38	.314	88,950	60,330	5.90	12,558	11.30	29,590
	15.930	35	.290	82,050	55,440	5.92	11,977	11.98	25,990
CB 145 14″	14.370	105	.536	244,200	92,430	10.57	15,000	7.90	57,020
	14.186	95	.485	220,800	82,560	10.70	15,000	7.80	51,260
	14.000	85	.435	197,400	73,080	10.80	15,000	7.70	45,670
CB 144 14″	14.382	75	.468	171,750	80,770	8.51	15,000	7.91	49,810
	14.238	68	.425	155,700	72,610	8.58	15,000	7.83	45,000
	14.094	61	.382	139,650	64,610	8.65	14,671	8.01	39,360
CB 143 14″	14.242	58	.413	128,400	70,580	7.28	15,000	7.83	43,740
	14.122	53	.378	117,300	64,060	7.32	14,603	8.07	38,810
	14.000	48	.343	106,350	57,620	7.38	14,088	8.43	33,820
CB 142 14″	14.240	42	.342	90,900	58,440	6.22	13,965	8.68	33,720
	14.160	39	.318	84,450	54,030	6.25	13,529	9.02	30,290
	14.000	*38	.375	76,650	63,000	4.87	14,607	8.00	38,340
	14.080	36	.294	77,850	49,670	6.27	13,022	9.46	26,880
	14.000	33	.270	71,400	45,360	6.30	12,430	10.02	23,490
CB 141 14″	13.964	30	.270	62,700	45,240	5.54	12,450	9.97	23,500

*Special Section—Web Thickness 5/16″.

CARNEGIE BEAM SECTIONS

MAXIMUM BENDING MOMENTS AND WEB RESISTANCES

Bending Stress **18,000** Pounds—Shearing Stress **12,000** Pounds

BEAM I VALUES

Section Index and Nominal Depth	Depth of Beam	Weight per Foot	Web Thickness	Maximum Bending Moment	Values for End Reaction, V				End Reaction a=3½"
					Web Shearing		Web Buckling		
					End Reaction	Span Limit	Unit Stress	End Bearing	
	d		t	M max.	V max.	L min.	fb	a min.	R max.
	Inches	Pounds	Inches	Foot Pounds	Pounds	Feet	Pounds per Sq. In.	Inches	Pounds
	12.000	102	.943	180,300	135,790	5.31	15,000	6.60	91,940
CB 124C 12″	12.000	95	.771	174,150	111,020	6.27	15,000	6.60	75,170
	12.000	88	.600	168,000	86,400	7.78	15,000	6.60	58,500
	12.000	82	.453	162,750	65,230	9.98	15,000	6.60	44,170
	12.000	76	.670	140,100	96,480	5.81	15,000	6.60	65,320
CB 124B 12″	12.000	70	.523	134,700	75,310	7.15	15,000	6.60	50,990
	12.000	65	.400	130,350	57,600	9.05	15,000	6.60	39,000
	12.260	66	.448	128,700	65,910	7.81	15,000	6.74	44,120
CB 123B 12″	12.118	60	.409	116,850	59,470	7.86	15,000	6.66	40,060
	12.000	55	.375	107,100	54,000	7.93	15,000	6.60	36,560
	12.258	50	.361	98,100	53,100	7.39	15,000	6.74	35,550
CB 123 12″	12.130	45	.326	88,200	47,450	7.43	14,625	6.92	31,140
	12.000	40	.290	78,450	41,760	7.51	14,004	7.28	26,400
	12.236	36	.308	68,700	45,220	6.08	14,251	7.24	28,790
CB 122 12″	12.022	*34	.375	59,400	54,100	4.39	15,000	6.61	36,590
	12.118	32	.274	61,050	39,840	6.13	13,575	7.68	24,290
	12.000	28	.240	53,400	34,560	6.18	12,706	8.33	19,820
CB 121 12″	11.924	25	.240	46,050	34,340	5.36	12,753	8.24	19,840
	10.000	64	.791	92,700	94,920	3.91	15,000	5.50	71,190
CB 103A 10″	10.000	59	.644	88,950	77,280	4.60	15,000	5.50	57,960
	10.000	54	.497	85,350	59,640	5.72	15,000	5.50	44,730
	10.000	49	.350	81,600	42,000	7.77	15,000	5.50	31,500
	10.000	42	.644	57,150	77,280	2.96	15,000	5.50	57,960
CB 102 10″	10.000	36	.467	52,650	56,040	3.76	15,000	5.50	42,030
	10.000	31	.320	49,050	38,400	5.11	15,000	5.50	28,800
	10.228	30	.298	47,850	36,570	5.23	15,000	5.63	27,070
CB 101 10″	10.098	26	.259	41,400	31,380	5.28	14,362	5.91	22,410
	10.000	23	.230	36,600	27,600	5.30	13,688	6.27	18,890
	9.902	21	.230	32,550	27,330	4.76	13,752	6.17	18,900

*Special Section—Web Thickness 5/16″.

BEAM I VALUES

CARNEGIE BEAM SECTIONS

Maximum Bending Moments and Web Resistances

Bending Stress **18,000** Pounds—Shearing Stress **12,000** Pounds

Section Index and Nominal Depth	Depth of Beam	Weight per Foot	Web Thickness	Maximum Bending Moment	Values for End Reaction, V				End Reaction a = 3½"
					Web Shearing		Web Buckling		
					End Reaction	Span Limit	Unit Stress	End Bearing	
	d		t	M max.	V max.	L min.	f b	a min.	R max.
	Inches	Pounds	Inches	Foot Pounds	Pounds	Feet	Pounds per Sq. In.	Inches	Pounds
CB 93 9″	9.242	48	.398	71,700	44,140	6.50	15,000	5.08	34,690
	9.122	43	.357	64,350	39,080	6.59	15,000	5.02	30,950
	9.000	38	.316	56,850	34,130	6.66	15,000	4.95	27,250
CB 92 9″	9.192	35	.335	50,700	36,950	5.49	15,000	5.06	29,130
	9.096	32	.307	46,350	33,510	5.53	15,000	5.00	26,590
	9.000	29	.279	42,000	30,130	5.58	15,000	4.95	24,060
CB 83 8″	8.360	42	.390	56,100	39,120	5.74	15,000	4.60	32,700
	8.198	36	.336	48,000	33,050	5.81	15,000	4.51	27,970
	8.060	31	.290	41,250	28,050	5.88	15,000	4.43	23,990
CB 82 8″	8.196	30	.298	39,450	29,310	5.38	15,000	4.51	24,800
	8.098	27	.268	35,550	26,040	5.46	15,000	4.45	22,210
	8.000	24	.239	31,650	22,940	5.52	15,000	4.40	19,720

STANDARD MILL SECTIONS

Maximum Bending Moments and Web Resistances

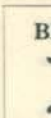
Bending Stress **18,000** Pounds—Shearing Stress **12,000** Pounds

BEAM

VALUES

Section Index and Nominal Depth	Depth of Beam	Weight per Foot	Web Thickness	Maximum Bending Moment	Values for End Reaction, V				End Reaction a = 3½″
					Web Shearing		Web Buckling		
					End Reaction	Span Limit	Unit Stress	End Bearing	
	d		t	Mmax.	Vmax.	Lmin.	fb	a min.	Rmax.
	Inches	Pounds	Inches	Foot Pounds	Pounds	Feet	Pounds per Sq.In.	Inches	Pounds
B 40	9.000	25.0	.380	31,800	41,040	3.10	15,000	4.95	32,770
9″	9.000	20.5	.234	28,800	25,270	4.56	14,440	5.23	19,430
B 39	8.000	21.0	.360	23,850	34,560	2.76	15,000	4.40	29,700
8″	8.000	17.5	.231	21,450	22,180	3.87	15,000	4.40	19,460
				H-Beams					
H 4	8.000	37.7	.500	45,300	48,000	3.78	15,000	4.40	41,250
8″	8.000	34.3	.375	43,350	36,000	4.82	15,000	4.40	30,940
	8.000	32.6	.313	42,300	30,050	5.63	15,000	4.40	25,820
H 3A	6.000	27.5	.438	24,600	31,540	3.12	15,000	3.30	32,850
6″	6.000	25.0	.313	23,550	22,540	4.18	15,000	3.30	23,480
H 3	6.000	22.5	.375	20,550	27,000	3.04	15,000	3.30	28,130
6″	6.000	20.0	.250	19,350	18,000	4.30	15,000	3.30	18,750
H 2 5″	5.000	18.9	.313	14,250	18,780	3.04	15,000	2.75	22,300
H 1 4″	4.000	13.8	.313	7,950	15,020	2.12	15,000	2.20	21,130

BEAM



VALUES

AMERICAN STANDARD BEAMS

Maximum Bending Moments and Web Resistances

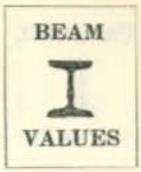
Bending Stress **18,000** Pounds—Shearing Stress **12,000** Pounds

Section Index and Nominal Depth	Depth of Beam	Weight per Foot	Web Thickness	Maximum Bending Moment	Values for End Reaction, V				End Reaction a=3½"
					Web Shearing		Web Buckling		
					End Reaction	Span Limit	Unit Stress	End Bearing	
	d		t	M max.	V max.	L min.	fb	a min.	R max.
	Inches	Pounds	Inches	Foot Pounds	Pounds	Feet	Pounds per Sq. In.	Inches	Pounds
B 18	24	120.0	.798	376,350	229,820	6.55	15,000	13.20	113,720
		115.0	.737	367,550	212,260	6.93	15,000	13.20	105,020
		110.0	.675	358,650	194,400	7.38	14,867	13.37	95,330
		105.9	.625	351,450	180,000	7.81	14,449	13.95	85,800
B 1	24	100.0	.747	296,450	215,140	5.51	15,000	13.20	106,450
		95.0	.686	287,700	197,570	5.82	14,950	13.26	97,430
		90.0	.624	278,750	179,710	6.20	14,439	13.95	85,600
		85.0	.563	270,000	162,140	6.66	13,815	14.85	73,920
		79.9	.500	260,900	144,000	7.25	13,006	16.14	61,780
B 2	20	100.0	.873	247,250	209,520	4.72	15,000	11.00	111,310
		95.0	.800	239,950	192,000	5.00	15,000	11.00	102,000
		90.0	.726	232,550	174,240	5.34	15,000	11.00	92,570
		85.0	.653	225,250	156,720	5.75	15,000	11.00	83,260
		81.4	.600	219,950	144,000	6.11	15,000	11.00	76,500
B 3	20	75.0	.641	189,500	153,840	4.93	15,000	11.00	81,730
		70.0	.567	182,100	136,080	5.35	14,908	11.10	71,850
		65.4	.500	175,400	120,000	5.85	14,210	11.89	60,390
B 19	18	90.0	.796	209,400	171,940	4.87	15,000	9.90	95,520
		85.0	.714	202,750	154,220	5.26	15,000	9.90	85,680
		80.0	.632	196,150	136,510	5.75	15,000	9.90	75,840
		75.6	.560	190,300	120,960	6.29	15,000	9.90	67,200
B 4	18	70.0	.711	152,900	153,580	3.98	15,000	9.90	85,320
		65.0	.629	146,300	135,860	4.31	15,000	9.90	75,480
		60.0	.547	139,650	118,150	4.73	15,000	9.90	65,640
		54.7	.460	132,600	99,360	5.34	14,340	10.56	52,770
B 5	15	100.0	1.167	178,450	210,060	3.40	15,000	8.25	126 910
		95.0	1.068	172,900	192,240	3.60	15,000	8.25	116,150
		90.0	.970	167,400	174,600	3.83	15,000	8.25	105,490
		85.0	.872	161,900	156,960	4.13	15,000	8.25	94,830
		81.3	.800	157,850	144,000	4.38	15,000	8.25	87,000
B 6	15	75.0	.868	137,450	156,240	3.52	15,000	8.25	94,400
		70.0	.770	131,900	138,600	3.81	15,000	8.25	83,740
		65.0	.672	126,400	120,960	4.18	15,000	8.25	73,080
		60.8	.590	121,800	106,200	4.59	15,000	8.25	64,160
B 7	15	55.0	.648	101,750	116,640	3.49	15,000	8.25	70,470
		50.0	.550	96,250	99,000	3.89	15,000	8.25	59,810
		45.0	.452	90,700	81,360	4.46	15,000	8.25	49,160
		42.9	.410	88,350	73,800	4.79	14,717	8.48	43,750

AMERICAN STANDARD BEAMS

Maximum Bending Moments and Web Resistances

Bending Stress **18,000** Pounds—Shearing Stress **12,000** Pounds



Section Index and Nominal Depth	Depth of Beam	Weight per Foot	Web Thickness	Maximum Bending Moment	Values for End Reaction, V				End Reaction a=3½"
					Web Shearing		Web Buckling		
					End Reaction	Span Limit	Unit Stress	End Bearing	
	d		t	M max.	V max.	L min.	fb	a min.	R max.
	Inches	Pounds	Inches	Foot Pounds	Pounds	Feet	Pounds per Sq. In.	Inches	Pounds
B 8	12	55.0	.810	79,850	116,640	2.74	15,000	6.60	78,980
		50.0	.687	75,400	98,930	3.05	15,000	6.60	66,980
		45.0	.565	71,000	81,360	3.49	15,000	6.60	55,090
		40.8	.460	67,250	66,240	4.06	15,000	6.60	44,850
B 9	12	35.0	.428	56,750	61,630	3.68	15,000	6.60	41,730
		31.8	.350	53,950	50,400	4.28	15,000	6.60	34,130
B 10	10	40.0	.741	47,400	88,920	2.13	15,000	5.50	66,690
		35.0	.594	43,750	71,280	2.45	15,000	5.50	53,460
		30.0	.447	40,050	53,640	2.99	15,000	5.50	40,230
		25.4	.310	36,650	37,200	3.94	15,000	5.50	27,900
B 11	9	35.0	.724	37,100	78,190	1.90	15,000	4.95	62,450
		30.0	.561	33,800	60,590	2.23	15,000	4.95	48,390
		25.0	.397	30,450	42,880	2.84	15,000	4.95	34,240
		21.8	.290	28,300	31,320	3.62	15,000	4.95	25,010
B 12	8	25.5	.532	25,500	51,070	2.00	15,000	4.40	43,890
		23.0	.441	24,050	42,340	2.27	15,000	4.40	36,380
		20.5	.349	22,600	33,500	2.70	15,000	4.40	28,790
		18.4	.270	21,350	25,920	3.29	15,000	4.40	22,280
B 13	7	20.0	.450	18,000	37,800	1.90	15,000	3.85	35,440
		17.5	.345	16,700	28,980	2.30	15,000	3.85	27,170
		15.3	.250	15,530	21,000	2.96	15,000	3.85	19,690
B 14	6	17.25	.465	13,000	33,480	1.55	15,000	3.30	34,880
		14.75	.343	11,900	24,700	1.93	15,000	3.30	25,730
		12.50	.230	10,900	16,560	2.63	15,000	3.30	17,250
B 15	5	14.75	.494	9,050	29,640	1.22	15,000	2.75	35,200
		12.25	.347	8,100	20,820	1.56	15,000	2.75	24,720
		10.0	.210	7,250	12,600	2.30	15,000	2.75	14,960
B 16	4	10.5	.400	5,300	19,200	1.11	15,000	2.20	27,000
		9.5	.326	5,000	15,650	1.28	15,000	2.20	22,010
		8.5	.253	4,750	12,140	1.56	15,000	2.20	17,080
		7.7	.190	4,450	9,120	1.96	15,000	2.20	12,830
B 17	3	7.5	.349	2,900	12,560	0.92	15,000	1.75	22,250
		6.5	.251	2,650	9,040	1.18	15,000	1.75	16,000
		5.7	.170	2,500	6,120	1.62	15,000	1.75	10,840

CHANNEL [VALUES

AMERICAN STANDARD CHANNELS

Maximum Bending Moments and Web Resistances

Bending Stress **18,000** Pounds—Shearing Stress **12,000** Pounds

Section Index and Nominal Depth	Depth of Beam	Weight per Foot	Web Thickness	Maximum Bending Moment	Values for End Reaction, V				End Reaction a=3½"
					Web Shearing		Web Buckling		
					End Reaction	Span Limit	Unit Stress	End Bearing	
	d		t	M max.	V max.	L min.	fb	a min.	R max.
	Inches	Pounds	Inches	Foot Pounds	Pounds	Feet	Pounds per Sq. In.	Inches	Pounds
		58.0	.700	111,800	151,200	2.96	15,000	9.90	84,000
*C 60	18	51.9	.600	103,700	129,600	3.20	15,000	9.90	72,000
		45.8	.500	95,600	108,000	3.54	14,803	10.09	59,210
		42.7	.450	91,550	97,200	3.77	14,210	10.70	51,160
		55.0	.814	85,800	146,520	2.34	15,000	8.25	88,520
		50.0	.716	80,350	128,880	2.49	15,000	8.25	77,870
C 1	15	45.0	.618	74,750	111,240	2.69	15,000	8.25	67,210
		40.0	.520	69,250	93,600	2.96	15,000	8.25	56,550
		35.0	.422	63,750	75,960	3.36	14,869	8.36	45,490
		33.9	.400	62,500	72,000	3.47	14,582	8.59	42,290
		50.0	.787	72,200	122,770	2.35	15,000	7.15	79,680
		45.0	.673	67,400	104,990	2.57	15,000	7.15	68,140
		40.0	.560	62,600	87,360	2.87	15,000	7.15	56,700
†C 20	13	37.0	.492	59,750	76,750	3.11	15,000	7.15	49,820
		35.0	.447	57,850	69,730	3.32	15,000	7.15	45,260
		31.8	.375	54,800	58,500	3.75	14,996	7.15	37,960
		40.0	.755	49,150	108,720	1.81	15,000	6.60	73,610
		35.0	.632	44,700	91,010	1.96	15,000	6.60	61,620
C 2	12	30.0	.510	40,300	73,440	2.20	15,000	6.60	49,730
		25.0	.387	35,900	55,730	2.58	15,000	6.60	37,730
		20.7	.280	32,050	40,320	3.18	13,781	7.45	25,080
		35.0	.820	34,550	98,400	1.41	15,000	5.50	73,800
		30.0	.673	30,900	80,760	1.53	15,000	5.50	60,570
C 3	10	25.0	.526	27,200	63,120	1.72	15,000	5.50	47,340
		20.0	.379	23,550	45,480	2.07	15,000	5.50	34,110
		15.3	.240	20,050	28,800	2.79	13,960	6.10	20,100
		25.0	.612	23,500	66,100	1.42	15,000	4.95	52,790
C 4	9	20.0	.448	20,200	48,380	1.67	15,000	4.95	38,640
		15.0	.285	16,900	30,780	2.19	15,000	4.95	24,580
		13.4	.230	15,750	24,840	2.54	14,340	5.28	18,960
		21.25	.579	17,850	55,580	1.29	15,000	4.40	47,770
		18.75	.487	16,400	46,750	1.40	15,000	4.40	40,180
C 5	8	16.25	.395	14,900	37,920	1.57	15,000	4.40	32,590
		13.75	.303	13,450	29,090	1.85	15,000	4.40	25,000
		11.5	.220	12,100	21,120	2.29	14,749	4.51	17,850

*C 60-18" Channel, is a Ship Building Channel, not American Standard.
†C 20-13" Channel, is a Car Building Channel, not American Standard.

AMERICAN STANDARD CHANNELS

Maximum Bending Moments and Web Resistances

Bending Stress **18,000** Pounds—Shearing Stress **12,000** Pounds

CHANNEL [VALUES

Section Index	Depth of Channel	Weight per Foot	Web Thickness	Maximum Bending Moment	Values for End Reaction, V				End Reaction, a=3½"
					Web Shearing		Web Buckling		
					End Reaction	Span Limit	Unit Stress	End Bearing	
	d		t	M max.	V max.	L min.	fb	a min.	R max.
	Inches	Pounds	Inches	Foot Pounds	Pounds	Feet	Pounds perSq.In.	Inches	Pounds
		19.75	.629	14150	52840	1.07	15000	3.85	49530
		17.25	.524	12900	44020	1.17	15000	3.85	41270
C 6	7	14.75	.419	11600	35200	1.32	15000	3.85	33000
		12.25	.314	10300	26380	1.56	15000	3.85	24730
		9.8	.210	9050	17640	2.05	15000	3.85	16540
		15.5	.559	9750	40250	0.97	15000	3.30	41930
C 7	6	13.0	.437	8650	31460	1.10	15000	3.30	32780
		10.5	.314	7550	22610	1.33	15000	3.30	23550
		8.2	.200	6500	14400	1.81	15000	3.30	15000
		11.5	.472	6200	28320	0.88	15000	2.75	33630
C 8	5	9.0	.325	5300	19500	1.09	15000	2.75	23160
		6.7	.190	4450	11400	1.56	15000	2.75	13540
		7.25	.320	3400	15360	0.89	15000	2.20	21600
C 9	4	6.25	.247	3100	11860	1.05	15000	2.20	16670
		5.4	.180	2850	8640	1.32	15000	2.20	12150
		6.0	.356	2050	12820	0.64	15000	1.75	22700
C 10	3	5.0	.258	1850	9290	0.79	15000	1.75	16450
		4.1	.170	1650	6120	1.07	15000	1.75	10840

SECTION I MODULI

CARNEGIE BEAM SECTIONS AND AMERICAN STANDARD BEAMS

Comparative Table of Section Moduli

1102.7 to 332.4

Bending Stress **18,000** Pounds—Shearing Stress **12,000** Pounds

Section Index	Section Modulus	Weight per Foot	DEPTH Nominal				DEPTH Actual	Web Thickness	Flange Width	Max. Bending Moment	SAFE END REACTION Web Shearing End Reaction	Web Shearing Span Limit	Web Buckling Unit Stress	Web Buckling End Bearing	End Reaction with 3½" Bearing Pounds
	In.³	Lbs.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ft. Lbs.	Pounds	Feet	Lbs. Sq. In.	Inches	
CB 362	1102.7	300	36				36⅛	1	16½	1654040	423640	15.62	14439	21.41	175860
CB 362	1006.8	275	36				36⅛	15/16	16⅜	1510280	390360	15.48	14050	22.08	158040
CB 362	910.5	250	36				36¼	⅞	16⅛	1365720	358370	15.24	13612	22.89	140880
CB 332	890.2	260		33			33⅜	⅞	16⅝	1335260	352730	15.14	14384	19.74	149510
CB 362	834.0	230	36				36	15/16	16	1251070	332210	15.06	13184	23.77	126730
CB 332	819.8	240		33			33⅛	15/16	16⅛	1229720	326060	15.09	13998	20.37	134780
CB 332	744.5	220		33			33⅛	15/16	16⅛	1116750	305830	14.61	13694	20.84	123970
CB 302	737.9	240			30		30¼	⅞	14⅜	1106850	328000	13.50	14997	16.93	149090
CB 302	676.3	220			30		30⅛	13/16	14⅜	1014450	298870	13.58	14596	17.46	132570
CB 332	669.7	200		33			33	¾	16	1004510	285120	14.09	13332	21.45	112790
CB 361	666.3	192	36				36 1/16	¾	12⅜	999470	325400	12.29	12778	25.25	119720
CB 302	615.0	200			30		30¼	¾	14⅛	922500	269820	13.68	14101	18.19	115940
CB 361	603.3	175	36				36⅛	11/16	12⅜	904970	299600	12.08	12252	26.55	105900
CB 302	553.4	180			30		30	11/16	14	830100	241200	13.77	13492	19.18	99440
CB 361	549.1	160	36				36⅛	11/16	12⅛	823580	275710	11.95	11680	28.13	93050
CB 272	534.6	190				27	27⅜	¾	14⅜	801900	250370	12.81	14729	15.59	115800
CB 331	527.1	167		33			33⅛	¾	12⅝	790580	289300	10.93	13211	22.07	112880
CB 361	502.2	147	36				36	⅝	12	753370	254880	11.82	11108	29.89	81930
CB 272	492.5	175				27	27⅜	11/16	14⅜	738750	229500	12.88	14322	16.11	103470
CB 331	479.8	152		33			33⅛	⅝	12⅜	719680	262070	10.99	12571	23.49	97460
CB 301	476.7	165			30		30⅛	¾	10⅜	715050	278520	10.27	14103	18.47	119110
CB 272	450.1	160				27	27⅛	⅝	14⅜	675150	208370	12.95	13825	16.81	90990
CB 301	436.4	151			30		30⅛	11/16	10 11/16	654600	253590	10.32	13589	19.33	104710
CB 331	435.6	138		33			33⅛	⅝	12⅛	653390	237190	11.02	11873	25.23	83430
CB 244	410.8	160	24				24 1/16	11/16	14⅜	616200	198300	12.43	14684	13.99	95100
CB 272	408.1	145				27	27	9/16	14	612150	187920	13.03	13224	17.75	78620
CB 301	398.7	138			30		30⅛	⅝	10⅜	598050	230860	10.36	13027	20.37	91560
CB 331	394.8	125		33			33	⅝	12	592210	213840	11.08	11095	27.44	70390
CB 244	384.9	150	24				24½	⅝	14⅛	577350	185120	12.47	14361	14.36	87000
CB 301	363.8	126			30		30⅛	9/16	10⅜	545700	210290	10.38	12421	21.60	79680
CB 244	359.2	140	24				24⅜	⅝	14⅛	538800	172080	12.52	13989	14.82	78940
CB 271	358.7	137				27	27¼	11/16	10	538050	229040	9.40	14162	16.57	101680
CB 244	333.6	130	24				24¼	9/16	14	500400	159180	12.57	13559	15.40	70920
CB 301	332.4	115			30		30	½	10½	498600	190800	10.45	11734	23.18	68410

CARNEGIE BEAM SECTIONS
AND
AMERICAN STANDARD BEAMS

Comparative Table of Section Moduli

SECTION
I
MODULI

324.8
to
162.8

Bending Stress **18,000** Pounds—Shearing Stress **12,000** Pounds

Section Index	Section Modulus	Weight per Foot	DEPTH Nominal				DEPTH Actual	Web Thickness	Flange Width	Max. Bending Moment	SAFE END REACTION Web Shearing End Reaction	Web Shearing Span Limit	Web Buckling Unit Stress	Web Buckling End Bearing	End Reaction 3½" Bearing Pounds
	In.³	Lbs.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ft. Lbs.	Pounds	Feet	Lbs. Sq. In.	Inches	
CB 271	**324.8**	124				27	27⅛	⅝	9⅛	487200	206190	9.45	13590	17.43	88060
CB 213	**308.4**	136		21			21½	⅝	13⅝	462550	156290	11.84	14881	11.96	80020
CB 243	**301.9**	120	24				24⅛	⅝	12⅛	452850	157240	11.52	13443	15.62	69400
CB 271	**293.2**	112				27	27⅛	⅝	9⅛	439800	185690	9.47	12960	18.48	75810
CB 213	**290.4**	128		21			21⅛	⅝	13⅛	435620	146180	11.92	14583	12.24	73500
CB 243	**276.8**	110	24				24⅛	½	12⅛	415200	143200	11.60	12871	16.48	60650
CB 213	**272.1**	120		21			21¼	⅝	13⅛	408150	136410	11.97	14253	12.58	67190
CB 271	**264.7**	101				27	27⅛	½	9⅛	397050	166260	9.55	12221	19.88	64140
CB 213	**254.1**	112		21			21⅛	½	13⅛	381150	126500	12.05	13860	13.01	60730
CB 243	**251.7**	100	24				24	⅜	12	377550	129600	11.65	12211	17.59	52200
B 18	**250.9**	120	(24)				24	11/16	8⅛	376350	229820	6.55	15000	13.20	113720
B 18	**245.0**	115	(24)				24	¾	8	367570	212260	6.93	15000	13.20	105020
B 18	**239.1**	110	(24)				24	11/16	7 11/16	358640	194400	7.38	14867	13.37	95330
CB 271	**238.3**	91				27	27	⅛	9¼	357450	149360	9.57	11453	21.54	54120
CB 213	**235.7**	104		21			21	⅝	13	353550	117180	12.07	13434	13.51	54660
B 18	**234.3**	105.9	(24)				24	⅝	7⅞	351440	180000	7.81	14449	13.93	85800
CB 242	**225.0**	94	24				24⅛	½	9⅞	337500	145560	9.27	12899	16.54	61640
CB 271	**216.2**	85				27	26 13/16	⅛	9¼	324310	148370	8.74	11508	21.26	54140
CB 212	**209.2**	98		21			21⅛	⅝	9⅛	313870	137120	9.16	14223	12.68	67260
CB 165	**205.2**	115				16	16¼	⅝	14⅛	307800	103650	11.88	15000	8.93	60320
CB 242	**203.5**	85	24				24⅛	⅛	9 11/16	305250	131010	9.32	12196	17.73	52580
B 1	**197.6**	100	(24)				24	¾	7¼	296470	215140	5.51	15000	13.20	106450
CB 212	**196.5**	92		21			21¼	½	9⅛	294750	127950	9.21	13864	13.07	61320
CB 183	**195.6**	100			18		18¼	½	12⅛	293400	108990	10.77	14711	10.32	59040
B 1	**191.8**	95	(24)				24	11/16	7⅛	287690	197370	5.82	14950	13.26	97430
CB 165	**190.8**	107				16	16¼	½	14	286200	95890	11.94	15000	8.86	56000
B 1	**185.8**	90	(24)				24	½	7¼	278760	179710	6.20	14439	13.95	85600
CB 212	**183.6**	86		21			21¼	½	9⅛	275400	119120	9.25	13468	13.54	55580
CB 242	**182.0**	76	24				24	½	9¼	273000	116640	9.36	11354	19.37	43680
CB 183	**181.9**	93			18		18¼	⅝	12⅛	272850	100670	10.84	14340	10.63	53310
B 1	**180.0**	85	(24)				24	⅝	7⅛	269980	162140	6.66	13815	14.85	73890
CB 165	**178.3**	100				16	16	⅝	14	267450	89090	12.01	15000	8.80	52200
B 1	**173.9**	79.9	(24)				24	½	7	260900	144000	7.25	13006	16.14	61780
CB 212	**170.9**	80		21			21	⅝	9	256350	110380	9.29	13014	14.11	49880
CB 183	**168.2**	86			18		18	⅝	12	252300	92660	10.89	13917	11.02	47760
B 2	**164.8**	100	(20)				20	¾	7¼	247250	209520	4.72	15000	11.00	111310
CB 241	**162.8**	70	24				24	⅝	8½	244200	115200	8.48	11250	19.00	42750

SECTION I MODULI

162.8 to 103.8

CARNEGIE BEAM SECTIONS AND AMERICAN STANDARD BEAMS

Comparative Table of Section Moduli

Bending Stress **18,000** Pounds—Shearing Stress **12,000** Pounds

Section Index	Section Modulus	Weight per Foot	DEPTH Nominal				DEPTH Actual	Web Thickness	Flange Width	Max. Bending Moment	SAFE END REACTION Web Straining End Reaction	Web Straining Span Limit	Web Buckling Unit Stress	Web Buckling End Bearing	End Reaction 3½" Bearing Pounds
	In.³	Lbs.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ft. Lbs.	Pounds	Feet	Lbs. Sq. In.	Inches	
CB 145	162.8	105				14	14⅜	⅝	12½	244200	92430	10.57	15000	7.90	57020
B 2	160.0	95	(20)				20	1⅛	7⅛	239950	192000	5.00	15000	11.00	102000
CB 211	157.6	76		21			21⅜	½	8½	236400	120280	7.86	13373	13.83	55460
CB 164	157.1	90				16	16¼	½	12½	235650	96470	9.77	15000	8.93	56130
B 2	155.0	90	(20)				20	⅝	7⅛	232550	174240	5.34	15000	11.00	92570
B 2	150.2	85	(20)				20	⅝	7⅛	225250	156720	5.75	15000	11.00	83200
CB 145	147.2	95				14	14⅜	½	12½	220800	82560	10.70	15000	7.80	51260
B 2	146.6	81.4	(20)				20	⅝	7	219950	144000	6.11	15000	11.00	76500
CB 211	145.2	70		21			21¼	⅛	8⅛	217800	110400	7.89	12845	14.54	49010
CB 164	144.9	83				16	16¼	⅛	12½	217350	88600	9.81	14920	8.94	51450
CB 182	144.6	78			18		18¼	½	8⅝	216900	103100	8.41	14400	10.64	54070
B 19	139.6	90			(18)		18	1⅜	7½	209410	171940	4.87	15000	9.90	95520
B 19	135.2	85			(18)		18	1⅛	7½	202770	154220	5.26	15000	9.90	85680
CB 182	133.4	72			18		18½	⅝	8½	200100	94750	8.45	13980	11.02	48930
CB 211	132.9	64		21			21⅛	¾	8⅛	199350	100390	7.94	12209	15.48	42460
CB 164	132.7	76				16	16	⅛	12	199050	80450	9.90	14481	9.26	45510
CB 145	131.6	85				14	14	⅛	12	197400	73080	10.80	15000	7.70	45670
B 19	130.8	80			(18)		18	¾	7⅛	196130	136510	5.75	15000	9.90	73840
B 19	126.9	75.6			(18)		18	⅝	7	190300	120960	6.29	15000	9.90	67200
B 3	126.3	75	(20)				20	⅝	6¾	189520	153840	4.93	15000	11.00	81730
CB 182	124.1	67			18		18	⅜	8½	186150	87700	8.49	13558	11.43	44040
B 3	121.4	70	(20)				20	⅝	6⅛	182120	136080	5.35	14908	11.10	71850
CB 211	120.3	58		21			21	⅜	8	180450	90720	7.96	11486	16.60	36180
CB 124C	120.2	102	12				12	1⅜	12½	180300	135790	5.31	15000	6.60	91940
B 5	119.9	100				(15)	15	1⅛	6¾	179870	210060	3.40	15000	8.25	126910
B 3	116.9	65.4	(20)				20	½	6¼	175420	120000	5.85	14210	11.89	60290
CB 124C	116.1	95	12				12	¾	12⅛	174150	111020	6.27	15000	6.60	75170
B 5	115.3	95				(15)	15	1½	6⅛	172900	192240	3.60	15000	8.25	116150
CB 144	114.5	75				14	14⅜	⅝	10⅛	171750	80770	8.51	15000	7.91	49810
CB 163	113.9	68				16	16¼	⅛	8⅛	170850	85280	8.01	14649	9.24	48480
CB 124C	112.0	88	12				12	⅝	12⅛	168000	86400	7.78	15000	6.60	58500
CB 211	111.7	55		21			20⅛	⅜	8	167550	90240	7.43	11530	16.52	36200
B 5	111.6	90				(15)	15	1	6⅛	167390	174600	3.83	15000	8.25	105490
CB 124C	108.5	82	12				12	½	12	162750	65230	9.98	15000	6.60	44170
B 5	107.9	85				(15)	15	⅝	6½	161880	156960	4.13	15000	8.25	94830
CB 163	105.5	63				16	16⅛	⅜	8½	158250	78510	8.06	14257	9.54	43580
CB 181	105.3	58			18		18¼	⅜	7⅝	157950	86080	7.34	13240	11.98	41950
B 5	105.2	81.3				(15)	15	1⅛	6¾	157830	14400	4.38	15000	8.25	87000
CB 144	103.8	68				14	14¼	⅝	10⅛	155700	72610	8.58	15000	7.83	45000

CARNEGIE BEAM SECTIONS AND AMERICAN STANDARD BEAMS

Comparative Table of Section Moduli

Bending Stress **18,000** Pounds—Shearing Stress **12,000** Pounds

SECTION I MODULI

101.9 to 54.7

Section Index	Section Modulus	Weight per Foot	DEPTH Nominal				DEPTH Actual	Web Thickness	Flange Width	Max. Bending Moment	SAFE END REACTION When Sheared		When Bearing		End Reaction 8½" Bearing Pounds
											End Reaction	Span Limit	Unit Stress	End Bearing	
	In.³	Lbs.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ft. Lbs.	Pounds	Feet	Lbs. Sq. In.	Inches	
B 4	101.9	70			(18)		18	11/16	6¼	152920	153580	3.98	15000	9.90	85320
B 4	97.5	65			(18)		18	5/8	6⅛	146280	135860	4.31	15000	9.90	75480
CB 163	97.1	58				16	16	5/8	8½	145650	72000	8.09	13810	9.90	38840
CB 181	94.4	52			18		18⅛	5/8	7⅝	141600	76950	7.36	12531	12.82	35610
CB 124B	93.4	76	12				12	11/16	12¼	140100	96480	5.81	15000	6.60	65320
CB 144	93.1	61				14	14⅛	3/4	10	139650	64610	8.65	14671	8.01	39360
B 4	93.1	60			(18)		18	9/16	6¼	139640	118150	4.73	15000	9.90	65440
B 6	91.6	75				(15)	15	3/4	6¼	137440	156240	3.52	15000	8.25	94400
CB 181	89.9	51			18		18	5/8	7⅝	134850	81110	6.65	12996	12.14	39020
CB 124B	89.8	70	12				12	9/16	12¼	134700	75310	7.15	15000	6.60	50990
B 4	88.4	54.7			(18)		18	7/16	6	132590	99360	5.34	14340	10.56	52770
B 6	87.9	70				(15)	15	3/4	6½	131920	138600	3.81	15000	8.25	83740
CB 124B	86.9	65	12				12	7/16	12	130350	57600	9.05	15000	6.60	39000
CB 123B	85.8	66	12				12¼	½	9½	128700	65910	7.81	15000	6.74	44120
CB 143	85.6	58				14	14¼	7/16	8½	128400	70580	7.28	15000	7.83	43740
CB 181	85.4	47			18		18	7/16	7½	128100	69120	7.41	11785	13.83	30170
B 6	84.3	65				(15)	15	11/16	6⅛	126410	120960	4.18	15000	8.25	73080
CB 162	81.9	50				16	16¼	5/8	7⅛	122850	70610	6.96	13473	10.41	36890
B 6	81.2	60.8				(15)	15	9/16	6	121800	106200	4.59	15000	8.25	64160
CB 143	78.2	53				14	14¼	5/8	8⅛	117300	64060	7.22	14603	8.67	38810
CB 123B	77.9	60	12				12¼	7/16	9⅛	116850	59470	7.86	15000	6.66	40060
CB 162	73.8	45				16	16¼	9/16	7⅛	110700	63090	7.02	12785	11.11	31300
CB 123B	71.4	55	12				12	5/8	9	107100	54000	7.93	15000	6.60	36560
CB 143	70.9	48				14	14	9/16	8	106350	57620	7.38	14088	8.43	33820
B 7	67.8	55				(15)	15	5/8	5¾	101740	116640	3.49	15000	8.25	70470
CB 162	65.7	43				16	15¹⁵/₁₆	5/8	7⅛	98550	71700	5.50	13826	9.34	38830
CB 162	65.6	40				16	16	9/16	7	98400	55680	7.07	11942	12.08	25970
CB 123	65.4	50	12				12¼	5/8	8⅛	98100	53100	7.39	15000	6.74	35550
B 7	64.2	50				(15)	15	9/16	5½	96230	99000	3.89	15000	8.25	59810
CB 103A	61.8	64		10			10	11/16	10⅛	92700	94920	3.91	15000	5.50	71190
CB 142	60.6	42				14	14¼	7/16	6¹⁵/₁₆	90900	58440	6.22	13965	8.68	33720
B 7	60.5	45				(15)	15	7/16	5⅝	90690	81360	4.46	15000	8.25	49160
CB 103A	59.3	59		10			10	11/16	10⅛	88950	77280	4.60	15000	5.50	57960
CB 161	59.3	38				16	16	7/16	6	88950	60330	5.90	12558	11.30	29590
B 7	58.9	42.9				(15)	15	7/16	5½	88350	73800	4.79	14717	8.48	43750
CB 123	58.8	45	12				12¼	7/16	8⅛	88200	47450	7.43	14625	6.92	31140
CB 103A	56.9	54		10			10	½	10⅛	85350	59640	5.72	15000	5.50	44730
CB 142	56.3	39				14	14⅛	7/16	6¹⁵/₁₆	84450	54030	6.25	13529	9.02	30290
CB 161	54.7	35				16	15¹⁵/₁₆	7/16	6	82050	55440	5.92	11977	11.98	25990

SECTION

I

MODULI

54.4 to 21.7

CARNEGIE BEAM SECTIONS AND AMERICAN STANDARD BEAMS

Comparative Table of Section Moduli

Bending Stress **18,000** Pounds—Shearing Stress **12,000** Pounds

Section Index	Section Modulus	Weight per Foot.	DEPTH					Web Thickness	Flange Width	Max. Bending Moment	SAFE END REACTION				End Reaction 3½" Bearing Pounds
			Nominal				Actual				With Shearing		With Buckling		
											End Reaction	Span Limit	Unit Stress	End Bearing	
	In.³	Lbs.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ft. Lbs.	Pounds	Feet	Lbs. Sq. In.	Inches	
CB 103A	54.4	49		10			10	5/8	10	81600	42000	7.77	15000	5.50	31500
B 8	53.2	55	(12)				12	15/16	5 3/4	79840	116640	2.74	15000	6.60	73980
CB 123	52.3	40	12				12	5/8	8	78450	41760	7.51	14094	7.28	26400
CB 142	51.9	36				14	14 1/8	5/8	6 3/4	77850	49670	6.27	13022	9.46	26880
CB 142	51.1	38				14	14	3/4	6 3/4	76650	63000	4.87	14607	8.00	38340
B 8	50.3	50	(12)				12	15/16	5 1/2	75410	98930	3.05	15000	6.60	66980
CB 93	47.8	48			9		9 1/4	3/4	9 1/8	71700	44140	6.50	15000	5.08	34690
CB 142	47.6	33				14	14	1/4	6 3/4	71400	45360	6.30	12430	10.02	23490
B 8	47.3	45	(12)				12	5/8	5 3/4	71020	81360	3.49	15000	6.60	55090
CB 122	45.8	36	12				12 1/4	5/8	6 1/8	68700	45220	6.08	14251	7.24	28790
B 8	44.8	40.8	(12)				12	7/8	5 1/4	67240	66240	4.06	15000	6.60	44850
CB 93	42.9	43			9		9 1/4	3/4	9 1/8	64350	39080	6.59	15000	5.02	30950
CB 141	41.8	30				14	13 15/16	1/4	6	62700	45240	5.54	12450	9.97	23500
CB 122	40.7	32	12				12 1/4	1/4	6 1/8	61050	39840	6.13	13575	7.68	24290
CB 122	39.6	34	12				12	3/4	6 1/8	59400	54100	4.39	15000	6.61	36590
CB 102	38.1	42		10			10	5/8	8 1/8	57150	77280	2.96	15000	5.50	57960
CB 93	37.9	38			9		9	7/8	9	56850	34130	6.66	15000	4.95	27250
B 9	37.8	35	(12)				12	7/8	5 1/8	56760	61630	3.68	15000	6.60	41730
CB 83	37.4	42				8	8 1/4	5/8	8 1/8	56100	39120	5.74	15000	4.60	32700
B 9	36.0	31.8	(12)				12	3/8	5	53950	50400	4.28	15000	6.60	34130
CB 122	35.6	28	12				12	1/4	6 1/8	53400	34560	6.18	12706	8.33	19820
CB 102	35.1	36		10			10	7/8	8 1/8	52650	56040	3.76	15000	5.50	42030
CB 92	33.8	35			9		9 1/8	7/8	8 1/8	50700	36950	5.49	15000	5.06	29130
CB 102	32.7	31		10			10	3/8	8	49050	38400	5.11	15000	5.50	28800
CB 83	32.0	36				8	8 1/8	7/8	8 1/8	48000	33050	5.81	15000	4.51	27970
CB 101	31.9	30		10			10 1/4	5/8	6 1/8	47850	36570	5.23	15000	5.63	27070
B 10	31.6	40		(10)			10	3/4	5 1/8	47400	88920	2.13	15000	5.50	66690
CB 92	30.9	32			9		9 1/4	5/8	6 1/8	46350	33510	5.53	15000	5.00	26590
CB 121	30.7	25	12				11 15/16	1/4	6	46050	34340	5.36	12753	8.24	19840
B 10	29.2	35		(10)			10	3/4	4 15/16	43730	71280	2.45	15000	5.50	53460
CB 92	28.0	29			9		9	1/4	6 1/8	42000	30130	5.58	15000	4.95	24060
CB 101	27.6	26		10			10 1/4	1/4	6	41400	31380	5.28	14362	5.91	22410
CB 83	27.5	31				8	8 1/8	3/8	8	41250	28050	5.88	15000	4.43	23990
B 10	26.7	30		(10)			10	5/8	4 15/16	40050	53640	2.99	15000	5.50	40230
CB 82	26.3	30				8	8 1/8	5/8	6 1/8	39450	29310	5.38	15000	4.51	24800
B 11	24.7	35			(9)		9	3/4	4 3/4	37100	78190	1.90	15000	4.95	62450
CB 101	24.4	23		10			10	1/4	6	36600	27600	5.30	13688	6.27	18890
B 10	24.4	25.4		(10)			10	5/8	4 15/16	36630	37200	3.94	15000	5.50	27900
CB 82	23.7	27				8	8 1/8	1/4	6 1/8	35550	26040	5.46	15000	4.45	22210
B 11	22.5	30			(9)		9	5/8	4 3/4	33800	60590	2.23	15000	4.95	48390
CB 101	21.7	21		10			9 7/8	1/4	6	32550	27330	4.76	13752	6.17	18900

CARNEGIE BEAM SECTIONS
AND
AMERICAN STANDARD BEAMS

SECTION
I
MODULI

Comparative Table of Section Moduli

21.2 to 1.7

Bending Stress **18,000** Pounds—Shearing Stress **12,000** Pounds

Section Index	Section Modulus	Weight per Foot	DEPTH Nominal				DEPTH Actual	Web Thickness	Flange Width	Max. Bending Moment	SAFE END REACTION: Web Shearing End Reaction	Web Shearing Span Limit	Web Buckling Unit Stress	Web Buckling End Bearing	End Reaction 3½" Bearing Pounds
	In.³	Lbs.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ft. Lbs.	Pounds	Feet	Lbs. Sq. In.	Inches	
B 40	21.2	25			9		9	⅜	5⅜	31800	41040	3.10	15000	4.95	32780
CB 82	21.1	24				8	8	¼	6½	31650	22940	5.52	15000	4.40	19720
B 11	20.3	25			(9)		9	⅜	4⅞	30470	42880	2.84	15000	4.95	34240
B 40	19.2	20.5			9		9	¼	5¼	28800	25270	4.56	14439	5.23	19430
B 11	18.9	21.8			(9)		9	⅜	4⅝	28310	31320	3.62	15000	4.95	25010
B 12	17.0	25.5				(8)	8	⅜	4¼	25520	51070	2.00	15000	4.40	43890
B 12	16.0	23				(8)	8	⅜	4⅛	24060	42340	2.27	15000	4.40	36380
B 39	15.9	21				8	8	⅜	5⅛	23850	34560	2.76	15000	4.40	29700
B 12	15.1	20.5				(8)	8	⅜	4⅛	22590	33500	2.70	15000	4.40	28790
B 39	14.5	17.5				8	8	¼	5	21450	22180	3.87	15000	4.40	19060
B 12	14.2	18.4				(8)	8	¼	4	21330	25920	3.29	15000	4.40	22280
B 13	12.0	20				(7)	7	⅜	3⅞	17980	37800	1.90	15000	3.85	35440
B 13	11.1	17.5				(7)	7	⅜	3¾	16690	28980	2.30	15000	3.85	27170
B 13	10.4	15.3				(7)	7	¼	3½	15530	21000	2.96	15000	3.85	19690
B 14	8.7	17.25				(6)	6	⅜	3⅝	13010	33480	1.55	15000	3.30	34880
B 14	7.9	14.75				(6)	6	⅜	3½	11910	24700	1.93	15000	3.30	25730
B 14	7.3	12.5				(6)	6	¼	3⅝	10890	16560	2.63	15000	3.30	17250
B 15	6.0	14.75				(5)	5	½	3⅝	9030	29640	1.22	15000	2.75	35200
B 15	5.4	12.25				(5)	5	⅜	3⅛	8110	20820	1.56	15000	2.75	24720
B 15	4.8	10				(5)	5	⅜	3	7250	12600	2.30	15000	2.75	14960
B 16	3.5	10.5				(4)	4	⅜	2⅞	5310	19200	1.11	15000	2.20	27000
B 16	3.3	9.5				(4)	4	⅜	2¹³⁄₁₆	5020	15650	1.28	15000	2.20	22010
B 16	3.2	8.5				(4)	4	¼	2¾	4730	12140	1.56	15000	2.20	17080
B 16	3.0	7.7				(4)	4	⅜	2¹¹⁄₁₆	4470	9120	1.96	15000	2.20	12830
B 17	1.9	7.5				(3)	3	⅜	2½	2880	12560	0.92	15000	1.65	22250
B 17	1.8	6.5				(3)	3	¼	2⅜	2660	9040	1.18	15000	1.65	16000
B 17	1.7	5.7				(3)	3	⅜	2⅜	2480	6120	1.62	15000	1.65	10840

BEAM 36″ I LOADS

CARNEGIE BEAM SECTIONS AS BEAMS

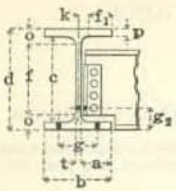
Allowable Uniform Loads in Thousands of Pounds

Applicable only when sections are braced against lateral deflection
For unbraced sections safe loads must be reduced, see page 93

Maximum Bending Stress, **18,000** Pounds per Square Inch

Span in Feet	Nominal Depth and Flange Width—Weight per Foot								Coefficient of Deflection
	CB 362 36″ x 16″				CB 361 36″ x 12″				
	300 lbs.	275 lbs.	250 lbs.	230 lbs.	192 lbs.	175 lbs.	160 lbs.	147 lbs.	
							551.4	509.8	
12					650.8	599.2	549.1	502.2	2.68
13					615.0	556.9	506.9	463.6	3.15
14					571.1	517.1	470.7	430.5	3.65
15	847.3	780.7	716.7	664.4	533.0	482.6	439.3	401.8	4.19
16	827.0	755.1	682.9	625.5	499.7	452.5	411.8	376.7	4.77
17	778.4	710.7	642.7	588.7	470.3	425.9	387.6	354.5	5.38
18	735.1	671.2	607.0	556.0	444.2	402.2	366.1	334.8	6.03
19	696.4	635.9	575.1	526.7	420.8	381.0	346.8	317.2	6.72
20	661.6	604.1	546.3	500.4	399.8	362.0	330.0	301.3	7.45
21	630.1	575.3	520.3	476.6	380.7	344.7	313.8	287.0	8.21
22	601.5	549.2	496.6	454.9	363.4	329.1	299.5	273.9	9.01
23	575.3	525.3	475.0	435.1	347.6	314.8	286.5	262.0	9.85
24	551.4	503.5	455.3	417.0	333.2	301.7	274.6	251.1	10.73
25	529.3	483.3	437.0	400.3	319.8	289.6	263.6	241.1	11.64
26	508.9	464.7	420.2	384.9	307.5	278.4	253.4	231.8	12.59
27	490.1	447.5	404.7	370.7	296.1	268.1	244.0	223.2	13.57
28	472.6	431.5	390.2	357.4	285.6	258.6	235.3	215.2	14.60
29	456.3	416.6	376.8	345.1	275.7	249.6	227.2	207.8	15.67
30	441.1	402.7	364.2	333.6	266.5	241.3	219.6	200.9	16.76
31	426.9	389.7	352.5	322.8	257.9	233.5	212.6	194.4	17.89
32	413.5	377.6	341.4	312.8	249.9	226.2	205.9	188.3	19.07
33	401.0	366.1	331.1	303.2	242.3	219.4	199.7	182.6	20.28
34	389.2	355.3	321.4	294.4	235.2	212.9	193.8	177.2	21.53
35	378.1	345.2	312.2	285.9	228.4	206.8	188.3	172.2	22.81
36	367.6	335.6	303.5	278.0	222.1	201.1	183.0	167.4	24.13
37	357.6	326.5	295.3	270.5	216.1	195.7	178.1	162.9	25.49
38	348.2	317.9	287.5	263.4	210.4	190.5	173.4	158.6	26.89
39	339.3	309.8	280.2	256.6	205.0	185.6	169.0	154.5	28.32
40	330.8	302.0	273.2	250.2	199.9	181.0	164.7	150.7	29.79
42	315.1	287.7	260.1	238.3	190.4	172.4	156.9	143.5	32.85
44	300.7	274.6	248.3	227.5	181.7	164.5	149.8	137.0	36.05
46	287.7	262.6	237.6	217.6	173.8	157.4	143.2	131.0	39.40
48	276.7	251.7	227.6	208.5	166.6	150.8	137.3	125.6	42.90
50	264.6	241.6	218.5	200.2	159.9	144.8	131.8	120.5	46.55
52	254.5	232.3	210.1	192.5	153.8	139.2	126.7	115.9	50.35
54	245.0	223.7	202.3	185.3	148.1	134.1	122.0	111.6	54.30
56	236.3	215.7	195.1	178.7	142.8	129.3	117.7	107.6	58.40
58	228.1	208.3	188.4	172.6	137.9	124.8	113.6	103.9	62.64
60	220.5	201.4	182.1	166.8	133.3	120.7	109.8	100.4	67.04
62	213.4	194.9	176.2	161.4	129.0	116.8	106.3	97.2	71.58
64	206.8	188.8	170.7	156.4	124.9	113.1	103.0	94.2	76.27
66	200.5	183.1	165.5	151.6	121.1	109.7	99.8	91.3	81.11
68	194.6	177.7	160.7	147.2	117.6	106.5	96.9	88.6	86.10

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.



CARNEGIE BEAM SECTIONS AS BEAMS

ESSENTIAL DATA

Maximum Shear, **12,000** Pounds per Square Inch

BEAM I 36″ DATA

Maximum Bending Stress, **18,000** Pounds per Square Inch

Notation	Nominal Depth and Flange Width—Weight per Foot							
	CB 362 36″ x 16″				CB 361 36″ x 12″			
	300 lbs.	275 lbs.	250 lbs.	230 lbs.	192 lbs.	175 lbs.	160 lbs.	147 lbs.
ELEMENTS								
I_{1-1}	20317.7	18400.2	16499.3	15012.9	12208.5	10978.8	9933.2	9040.4
S_{1-1}	**1102.7**	**1006.8**	**910.5**	**834.0**	**666.3**	**603.3**	**549.1**	**502.2**
I_{2-2}	1215.9	1095.1	975.4	882.2	377.2	335.0	299.8	269.9
S_{2-2}	150.2	135.9	121.5	110.3	62.1	55.4	49.8	45.0
DIMENSIONS AND GAUGES IN INCHES								
d	36⅞	36 9/16	36¼	36	36 1/16	36 1/16	36 1/16	36
b	16¼	16⅛	16 1/16	16	12 3/16	12⅛	12 1/16	12
t	1	15/16	⅞	13/16	¾	11/16	11/16	⅝
p	1¾	1 9/16	1 7/16	1 5/16	1 5/16	1 3/16	1 1/16	15/16
a	7⅞	7⅞	7⅞	7⅞	5¾	5¾	5¾	5¾
c	33 1/16	33 1/16	33 1/16	33 1/16	34⅛	34⅛	34⅛	34⅛
f	31⅜	31⅜	31⅜	31⅜	32⅛	32⅛	32⅛	32⅛
f_1	6 9/16	6 9/16	6 9/16	6 9/16	4 1/16	4 1/16	4 1/16	4 1/16
o	2¾	2 9/16	2 7/16	2 5/16	2 5/16	2 3/16	2 1/16	1 15/16
k	1½	1½	1⅜	1⅜	1⅜	1⅜	1⅜	1¼
g min.	4¾	4¾	4½	4½	4½	4½	4½	4½
g usual	5½	5½	5½	5½	5½	5½	5	5
g_2	4	4	4	4	3½	3½	3½	3½

f, f_1, o and k—Provide usual working clearances.

MAXIMUM BENDING MOMENTS, WEB RESISTANCES, ETC.								
Mmax	1654	1510	1366	1251	999	905	824	753
Vmax	424	390	358	332	325	300	276	255
Lmin	15.62	15.48	15.24	15.06	12.29	12.08	11.95	11.82
fb	14439	14050	13612	13184	12778	12252	11680	11108
fbt	13833	12505	11216	10138	9456	8405	7417	6554
a_1 min	21.41	22.08	22.89	23.77	25.25	26.55	28.13	29.89
Rmax	176	158	141	127	120	106	93	82
R_1	162	162	162	162	162	162	162	155
LR_1	40.84	37.29	33.72	30.89	24.68	22.34	20.34	19.44
Wt. C.	61	61	61	61	61	61	61	61
Q	13232	12082	10926	10008	7996	7240	6589	6026

Mmax = Maximum Bending Moment in thousands of foot pounds.
Vmax = Maximum Web Shear in thousands of pounds.
Lmin = Minimum Span to develop V max. in feet.
fb = Allowable Unit Stress for Web Buckling in pounds per square inch.
fbt = Value of Web in Buckling per inch of length in pounds.
a_1 min = Minimum End Bearing to develop V in inches.
Rmax = Maximum End Reaction when $a_1 = 3\frac{1}{2}$ inches in thousands of pounds.
R_1 = Maximum value of one Standard Connection, page 250, in thousands of pounds.
LR_1 = Minimum Span in feet to develop R_1.
Wt.C. = Weight of one Standard Connection including web rivets in pounds.
Q = Coefficient of Strength = 12 S_{1-1}.
To obtain safe uniformly distributed load in thousands of pounds, divide Q by the required span in feet.

BEAM
33" I
LOADS

CARNEGIE BEAM SECTIONS AS BEAMS

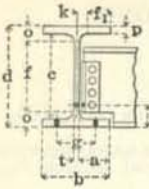
Allowable Uniform Loads in Thousands of Pounds

Applicable only when sections are braced against lateral deflection
For unbraced sections safe loads must be reduced, see page 93

Maximum Bending Stress, **18,000** Pounds per Square Inch

Span in Feet	Nominal Depth and Flange Width—Weight per Foot								Coefficient of Deflection
	CB 332 33" x 16"				CB 331 33" x 12"				
	260 lbs.	240 lbs.	220 lbs.	200 lbs.	167 lbs.	152 lbs.	138 lbs.	125 lbs.	
11					578.6 575.0	524.1 523.4	474.4	427.7	2.25
12					527.1	479.8	435.6	394.8	2.68
13					486.6	442.9	402.1	364.4	3.15
14			611.7	570.2	451.8	411.3	373.4	338.4	3.65
15	705.5	652.1	595.6	535.8	421.7	383.8	348.5	315.8	4.19
16	667.7	614.9	558.4	502.3	395.3	359.9	326.7	296.1	4.77
17	628.4	578.7	525.5	472.7	372.1	338.7	307.5	278.7	5.38
18	593.5	546.5	496.3	446.5	351.4	319.9	290.4	263.2	6.03
19	562.2	517.8	470.2	423.0	332.9	303.0	275.1	249.3	6.72
20	534.1	491.9	446.7	401.8	316.3	287.9	261.4	236.9	7.45
21	508.7	468.5	425.4	382.7	301.2	274.2	248.9	225.6	8.21
22	485.6	447.2	406.1	365.3	287.5	261.7	237.6	215.3	9.01
23	464.5	427.7	388.4	349.4	275.0	250.3	227.3	206.0	9.85
24	445.1	409.9	372.3	334.9	263.6	239.9	217.8	197.4	10.73
25	427.3	393.5	357.4	321.5	253.0	230.3	209.1	189.5	11.64
26	410.9	378.4	343.6	309.1	243.3	221.4	201.0	182.2	12.59
27	395.6	364.4	330.9	297.6	234.3	213.2	193.6	175.5	13.57
28	381.5	351.3	319.1	287.0	225.9	205.6	186.7	169.2	14.60
29	368.4	339.2	308.1	277.1	218.1	198.5	180.2	163.4	15.66
30	356.1	327.9	297.8	267.9	210.8	191.9	174.2	157.9	16.76
31	344.6	317.3	288.2	259.2	204.0	185.7	168.6	152.8	17.89
32	333.8	307.4	279.2	251.1	197.7	179.9	163.4	148.1	19.07
33	323.7	298.1	270.7	243.5	191.7	174.5	158.4	143.6	20.28
34	314.2	289.3	262.8	236.4	186.0	169.3	153.7	139.3	21.53
35	305.2	281.1	255.3	229.6	180.7	164.5	149.3	135.4	22.81
36	296.7	273.3	248.2	223.2	175.7	159.9	145.2	131.6	24.13
37	288.7	265.9	241.5	217.2	171.0	155.6	141.3	128.0	25.49
38	281.1	258.9	235.1	211.5	166.5	151.5	137.6	124.7	26.89
39	273.9	252.2	229.1	206.1	162.2	147.6	134.0	121.5	28.32
40	267.1	245.9	223.4	200.9	158.1	143.9	130.7	118.4	29.79
42	254.3	234.2	212.7	191.3	150.6	137.1	124.5	112.8	32.85
44	242.8	223.6	203.0	182.6	143.8	130.9	118.8	107.7	36.05
46	232.2	213.9	194.2	174.7	137.5	125.2	113.6	103.0	39.40
48	222.6	205.0	186.1	167.4	131.8	120.0	108.9	98.7	42.90
50	213.6	196.8	178.7	160.7	126.5	115.2	104.5	94.8	46.55
52	205.4	189.2	171.8	154.5	121.6	110.7	100.5	91.1	50.35
54	197.8	182.2	165.4	148.8	117.1	106.6	96.8	87.7	54.30
56	190.8	175.7	159.5	143.5	113.0	102.8	93.3	84.6	58.40
58	184.2	169.6	154.0	138.6	109.1	99.3	90.1	81.7	62.64
60	178.0	164.0	148.9	133.9	105.4	96.0	87.1	79.0	67.04
62	172.3	158.7	144.1	129.6	102.0	92.9	84.3	76.4	71.58
64	166.9	153.7	139.6	125.6	98.8	90.0	81.7	74.0	76.27

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.



CARNEGIE BEAM SECTIONS AS BEAMS

ESSENTIAL DATA

Maximum Shear, **12,000** Pounds per Square Inch

BEAM I 33″ DATA

Maximum Bending Stress, **18,000** Pounds per Square Inch

Notation	Nominal Depth and Flange Width—Weight per Foot							
	CB 332 33″ x 16″				CB 331 33″ x 12″			
	260 lbs.	240 lbs.	220 lbs.	200 lbs.	167 lbs.	152 lbs.	138 lbs.	125 lbs.
ELEMENTS								
$I_{1\text{-}1}$	15037.7	13750.6	12385.5	11049.6	8836.1	7998.5	7223.0	6514.3
$S_{1\text{-}1}$	**890.2**	**819.8**	**744.5**	**669.7**	**527.1**	**479.8**	**435.6**	**394.8**
$I_{2\text{-}2}$	1068.0	972.5	870.0	769.5	321.0	287.8	257.5	230.1
$S_{2\text{-}2}$	132.3	120.9	108.4	96.2	52.7	47.5	42.7	38.4
DIMENSIONS AND GAUGES IN INCHES								
d	33 13/16	33 9/16	33 5/16	33	33 3/16	33 3/8	33 5/16	33
b	16 3/16	16 1/8	16 1/16	16	12 3/16	12 1/8	12 1/16	12
t	7/8	13/16	3/4		3/4	3/4	5/8	9/16
p	1 9/16	1 7/16	1 5/16	1 1/8	1 1/16	1	7/8	13/16
a	7 11/16	7 11/16	7 11/16	7 11/16	5 3/4	5 3/4	5 3/4	5 3/4
e	30 3/4	30 3/4	30 3/4	30 3/4	31 3/8	31 3/8	31 3/8	31 3/8
f	28 3/4	28 3/4	28 3/4	28 3/4	29 3/8	29 3/8	29 3/8	29 3/8
f_1	6 5/8	6 5/8	6 5/8	6 5/8	4 11/16	4 11/16	4 11/16	4 11/16
o	2 9/16	2 7/16	2 5/16	2 1/8	2 1/16	2	1 15/16	1 13/16
k	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 1/4	1 1/4
g min.	4 1/2	4 1/2	4 1/2	4 1/2	4 1/2	4 1/2	4 1/2	4 1/2
g usual	5 1/2	5 1/2	5 1/2	5	5	5	5	5
g_2	4	4	4	4	3 1/2	3 1/2	3 1/2	3 1/2
MAXIMUM BENDING MOMENTS, WEB RESISTANCES, ETC.								
Mmax	1335	1230	1117	1005	791	720	653	592
Vmax	353	326	306	285	289	262	237	214
Lmin	15.14	15.09	14.61	14.09	10.93	10.99	11.02	11.08
fb	14384	13998	13694	13332	13211	12571	11873	11095
fbt	12514	11338	10490	9599	9499	8234	7076	5991
a_1 min	19.74	20.37	20.84	21.45	22.07	23.49	25.23	27.44
Rmax	150	135	124	113	113	97	83	70
R_1	146	146	146	146	146	146	141	128
LR_1	36.58	33.69	30.60	27.52	21.66	19.72	18.54	18.51
Wt.C.	54	54	54	54	54	54	54	54
Q	10682	9838	8934	8036	6325	5758	5227	4738

f, f_1, o and k—Provide usual working clearances.

Mmax = Maximum Bending Moment in thousands of foot pounds.
Vmax = Maximum Web Shear in thousands of pounds.
Lmin = Minimum Span to develop V max. in feet.
fb = Allowable Unit Stress for Web Buckling in pounds per square inch.
fbt = Value of Web in Buckling per inch of length in pounds.
a_1 min = Minimum End Bearing to develop V in inches.
Rmax = Maximum End Reaction when $a_1 = 3\frac{1}{2}$ inches in thousands of pounds.
R_1 = Maximum Value of one Standard Connection, page 250, in thousands of pounds.
LR_1 = Minimum Span in feet to develop R_1.
Wt.C. = Weight of one Standard Connection including web rivets in pounds.
Q = Coefficient of Strength = 12 $S_{1\text{-}1}$.
To obtain safe uniformly distributed load in thousands of pounds, divide Q by the required span in feet.

BEAM 30″ I LOADS

CARNEGIE BEAM SECTIONS AS BEAMS

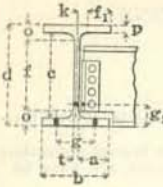
Allowable Uniform Loads in Thousands of Pounds

Applicable only when sections are braced against lateral deflection
For unbraced sections safe loads must be reduced, see page 93

Maximum Bending Stress, **18,000** Pounds per Square Inch

Span in Feet	Nominal Depth and Flange Width—Weight per Foot									Coefficient of Deflection
	CB 302 30″ x 14″				CB 301 30″ x 10½″					
	240 lbs.	220 lbs.	200 lbs.	180 lbs.	165 lbs.	151 lbs.	138 lbs.	126 lbs.	115 lbs.	
					557.0	507.2	461.7	420.6	381.6	
11					520.0	476.1	434.9	396.9	362.6	2.25
12					476.7	436.4	398.7	363.8	332.4	2.68
13	656.0	597.7	539.6	482.4	440.0	402.8	368.0	335.8	306.8	3.15
14	632.5	579.7	527.1	474.4	408.6	374.1	341.7	311.8	284.9	3.65
15	590.3	541.0	492.0	442.7	381.4	349.1	319.0	291.0	265.9	4.19
16	553.4	507.2	461.2	415.1	357.5	327.3	299.0	272.9	249.3	4.77
17	520.8	477.4	434.1	390.7	336.5	308.0	281.4	256.8	234.6	5.38
18	491.9	450.8	410.0	369.0	317.8	290.9	265.8	242.5	221.6	6.03
19	466.0	427.1	388.4	349.5	301.1	275.6	251.8	229.8	209.9	6.72
20	442.7	405.8	369.0	332.1	286.0	261.8	239.2	218.3	199.4	7.45
21	421.6	386.4	351.4	316.2	272.4	249.4	227.8	207.9	189.9	8.21
22	402.5	368.9	335.5	301.9	260.0	238.0	217.5	198.4	181.3	9.01
23	385.0	352.8	320.9	288.7	248.7	227.7	208.0	189.8	173.4	9.85
24	368.9	338.1	307.5	276.7	238.4	218.2	199.4	181.9	166.2	10.73
25	354.2	324.6	295.2	265.6	228.8	209.5	191.4	174.6	159.5	11.64
26	340.6	312.1	283.8	255.4	220.0	201.4	184.0	167.9	153.4	12.59
27	327.9	300.6	273.3	246.0	211.9	194.0	177.2	161.7	147.7	13.57
28	316.2	289.8	263.6	237.2	204.3	187.0	170.9	155.9	142.4	14.60
29	305.3	279.8	254.5	229.0	197.3	180.6	165.0	150.5	137.5	15.66
30	295.1	270.5	246.0	221.4	190.7	174.6	159.5	145.2	132.9	16.76
31	285.6	261.8	238.1	214.2	184.5	168.9	154.3	140.8	128.7	17.89
32	276.7	253.6	230.6	207.5	178.8	163.7	149.5	136.4	124.6	19.07
33	268.3	245.9	223.6	201.2	173.3	158.7	145.0	132.3	120.9	20.28
34	260.4	238.7	217.1	195.3	168.2	154.0	140.7	128.4	117.3	21.53
35	253.0	231.9	210.9	189.7	163.4	149.6	136.7	124.7	113.9	22.81
36	246.0	225.4	205.0	184.5	158.9	145.5	132.9	121.3	110.8	24.13
37	239.3	219.3	199.5	179.5	154.6	141.5	129.3	118.0	107.8	25.49
38	233.0	213.6	194.2	174.8	150.5	137.8	125.9	114.9	105.0	26.89
39	227.0	208.1	189.2	170.3	146.7	134.3	122.7	111.9	102.3	28.32
40	221.4	202.9	184.5	166.0	143.0	130.9	119.6	109.1	99.7	29.79
42	210.8	193.2	175.7	158.1	136.2	124.7	113.9	103.9	95.0	32.85
44	201.2	184.4	167.7	150.9	130.0	119.0	108.7	99.2	90.6	36.05
46	192.5	176.4	160.4	144.4	124.4	113.8	104.0	94.9	86.7	39.40
48	184.5	169.1	153.7	138.4	119.2	109.1	99.7	91.0	83.1	42.90
50	177.1	162.3	147.6	132.8	114.4	104.7	95.7	87.3	79.8	46.55
52	170.3	156.1	141.9	127.7	110.0	100.7	92.0	84.0	76.7	50.35
54	164.0	150.3	136.7	123.0	105.9	97.0	88.6	80.8	73.9	54.30
56	158.1	144.9	131.8	118.6	102.2	93.5	85.4	78.0	71.2	58.40
58	152.7	139.9	127.2	114.5	98.6	90.3	82.5	75.3	68.8	62.64
60	147.6	135.3	123.0	110.7	95.3	87.3	79.7	72.6	66.5	67.04

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.



CARNEGIE BEAM SECTIONS AS BEAMS

ESSENTIAL DATA

Maximum Shear, **12,000** Pounds per Square Inch

BEAM I 30″ DATA

Maximum Bending Stress, **18,000** Pounds per Square Inch

Notation	Nominal Depth and Flange Width—Weight per Foot								
	CB 302 30″ x 14″				CB 301 30″ x 10½″				
	240 lbs.	220 lbs.	200 lbs.	180 lbs.	165 lbs.	151 lbs.	138 lbs.	126 lbs.	115 lbs.
ELEMENTS									
I_{1-1}	11356.0	10320.4	9305.7	8301.4	7326.7	6663.7	6049.5	5486.7	4985.3
S_{1-1}	**737.9**	**676.3**	**615.9**	**553.4**	**476.7**	**436.4**	**398.7**	**363.8**	**332.4**
I_{2-2}	766.9	693.9	622.7	552.7	258.7	233.4	210.1	189.0	170.6
S_{2-2}	107.9	98.1	88.5	79.0	48.2	43.8	39.6	35.8	32.5
DIMENSIONS AND GAUGES IN INCHES									
d	30¾	30½	30¼	30	30¾	30 9/16	30⅜	30 5/16	30
b	14 5/16	14⅛	14 1/16	14	10¾	10 11/16	10⅝	10 9/16	10½
t	⅞	13/16	¾	11/16	¾	11/16	⅝	9/16	½
p	1 9/16	1 7/16	1 5/16	1 3/16	1¼	1 3/16	1 1/16	1 5/16	⅞
a	6 11/16	6 11/16	6 11/16	6 11/16	5	5	5	5	5
c	27 9/16	27 9/16	27 9/16	27 9/16	28 5/16	28 5/16	28 5/16	28 5/16	28 5/16
f	25½	25½	25½	25½	26¾	26¾	26¾	26¾	26¾
f_1	5⅝	5⅝	5⅝	5⅝	4¼	4¼	4¼	4¼	4¼
o	2⅝	2½	2⅜	2¼	2	1⅞	1 13/16	1 11/16	1⅝
k	1½	1⅜	1⅜	1⅜	1⅛	1	1	1	1
g min.	4½	4½	4½	4½	3¾	3¾	3¾	3¾	3¾
g usual	5	5	5	5	5	5	5	5	5
g_2	4	4	4	4	3¼	3¼	3¼	3	3

f, f_1, o and k—Provide usual working clearances.

MAXIMUM BENDING MOMENTS, WEB RESISTANCES, ETC.									
Mmax	1107	1014	923	830	715	655	598	546	499
Vmax	328	299	270	241	279	254	231	210	191
Lmin	13.50	13.58	13.68	13.77	10.27	10.32	10.36	10.38	10.45
fb	14997	14596	14101	13492	14103	13589	13027	12421	11734
fbt	13317	11910	10477	9040	10648	9404	8259	7217	6219
a_1 min	16.93	17.46	18.19	19.18	18.47	19.33	20.37	21.60	23.18
Rmax	149	133	116	99	119	105	92	80	68
R_1	130	130	130	130	130	130	130	122	111
LR_1	34.06	31.21	28.38	25.54	22.00	20.14	18.40	17.89	17.97
Wt.C.	48	48	48	48	48	48	48	48	48
Q	8855	8116	7380	6641	5720	5237	4784	4366	3989

Mmax = Maximum Bending Moment in thousands of foot pounds.
Vmax = Maximum Web Shear in thousands of pounds.
Lmin = Minimum Span to develop V max. in feet.
fb = Allowable Unit Stress for Web Buckling in pounds per square inch.
fbt = Value of Web in Buckling per inch of length in pounds.
a_1 min = Minimum End Bearing to develop V in inches.
Rmax = Maximum End Reaction when $a_1 = 3\frac{1}{2}$ inches in thousands of pounds.
R_1 = Maximum Value of one Standard Connection, page 250, in thousands of pounds.
LR_1 = Minimum Span in feet to develop R_1.
Wt.C. = Weight of one Standard Connection including web rivets in pounds.
Q = Coefficient of Strength = $12\ S_{1-1}$.
To obtain safe uniformly distributed load in thousands of pounds, divide Q by the required span in feet.

BEAM 27″ I LOADS

CARNEGIE BEAM SECTIONS AS BEAMS

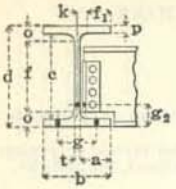
Allowable Uniform Loads in Thousands of Pounds

Applicable only when sections are braced against lateral deflection
For unbraced sections safe loads must be reduced, see page 93

Maximum Bending Stress, **18,000** Pounds per Square Inch

Span in Feet	Nominal Depth and Flange Width—Weight per Foot										Coefficient of Deflection
	CB 272 27″ x 14″				CB 271 27″ x 9¾″						
	190 lbs.	175 lbs.	160 lbs.	145 lbs.	137 lbs.	124 lbs.	112 lbs.	101 lbs.	91 lbs.	85 lbs.	
										296.7	
9					458.1	412.4	371.4	332.5	298.7	288.3	1.51
10					422.6	389.8	351.8	317.7	286.0	259.4	1.86
11					384.2	354.3	319.8	288.8	260.0	235.9	2.25
12	500.7	459.0	417.1		352.2	324.8	293.2	264.7	238.3	216.2	2.68
13	493.5	454.6	415.5	375.8	325.1	299.8	270.6	244.4	220.0	199.6	3.15
14	458.2	422.1	385.8	349.8	301.9	278.4	251.3	226.9	204.3	185.3	3.65
15	427.7	394.0	360.1	326.4	281.8	259.8	234.5	211.8	190.6	173.0	4.19
16	400.9	369.4	337.6	306.0	264.2	243.6	219.9	198.5	178.7	162.2	4.77
17	377.4	347.6	317.7	288.0	248.6	229.3	206.9	186.9	168.2	152.6	5.38
18	356.4	328.3	300.1	272.0	234.8	216.5	195.4	176.5	158.9	144.1	6.03
19	337.6	311.0	284.3	257.7	222.4	205.1	185.2	167.2	150.5	136.5	6.72
20	320.8	295.5	270.1	244.8	211.3	194.9	175.9	158.8	143.0	129.7	7.45
21	305.5	281.4	257.2	233.2	201.3	185.6	167.5	151.3	136.2	123.5	8.21
22	291.6	268.6	245.5	222.6	192.1	177.2	159.9	144.4	130.0	117.9	9.01
23	278.9	256.9	234.8	212.9	183.8	169.5	153.0	138.1	124.3	112.8	9.85
24	267.3	246.2	225.1	204.0	176.1	162.4	146.6	132.4	119.1	108.1	10.73
25	256.6	236.4	216.1	195.9	169.1	155.9	140.7	127.1	114.4	103.8	11.64
26	246.7	227.3	207.8	188.3	162.6	149.9	135.3	122.2	110.0	99.8	12.59
27	237.6	218.9	200.1	181.4	156.5	144.4	130.3	117.7	105.9	96.1	13.57
28	229.1	211.1	192.9	174.9	150.9	139.2	125.6	113.4	102.1	92.7	14.60
29	221.2	203.8	186.3	168.9	145.7	134.4	121.3	109.5	98.6	89.5	15.66
30	213.8	197.0	180.1	163.2	140.9	129.9	117.3	105.9	95.3	86.5	16.76
31	206.9	190.6	174.2	158.0	136.3	125.7	113.5	102.5	92.2	83.7	17.89
32	200.5	184.7	168.8	153.0	132.1	121.8	109.9	99.3	89.4	81.1	19.07
33	194.4	179.1	163.7	148.4	128.1	118.1	106.6	96.3	86.7	78.6	20.28
34	188.7	173.8	158.9	144.0	124.3	114.6	103.5	93.4	84.1	76.3	21.53
35	183.3	168.8	154.3	139.9	120.8	111.4	100.5	90.8	81.7	74.1	22.81
36	178.2	164.2	150.0	136.0	117.4	108.3	97.7	88.2	79.4	72.1	24.13
37	173.4	159.7	146.0	132.3	114.2	105.3	95.1	85.9	77.3	70.1	25.49
38	168.8	155.5	142.1	128.9	111.2	102.6	92.6	83.6	75.3	68.3	26.89
39	164.5	151.5	138.5	125.6	108.4	99.9	90.2	81.5	73.3	66.5	28.32
40	160.4	147.7	135.0	122.4	105.7	97.4	88.0	79.4	71.5	64.9	29.79
42	152.7	140.7	128.6	116.6	100.6	92.8	83.8	75.6	68.1	61.8	32.85
44	145.8	134.3	122.8	111.3	96.1	88.6	80.0	72.2	65.0	59.0	36.05
46	139.5	128.5	117.4	106.4	91.9	84.7	76.5	69.1	62.2	56.4	39.40
48	133.6	123.1	112.5	102.0	88.1	81.2	73.3	66.2	59.6	54.1	42.90
50	128.3	118.2	108.0	97.9	84.5	78.0	70.4	63.5	57.2	51.9	46.55
52	123.4	113.6	103.9	99.2	81.3	75.0	67.7	61.1	55.0	50.9	50.35

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.



CARNEGIE BEAM SECTIONS AS BEAMS

Essential Data

Maximum Shear, **12,000** Pounds per Square Inch

BEAM I 27" DATA

Maximum Bending Stress, **18,000** Pounds per Square Inch

Notation	Nominal Depth and Flange Width—Weight per Foot									
	CB 272 27" x 14"				CB 271 27" x 9¾"					
	190 lbs.	175 lbs.	160 lbs.	145 lbs.	137 lbs.	124 lbs.	112 lbs.	101 lbs.	91 lbs.	85 lbs.
Elements										
I_{1-1}	7376.9	6746.8	6121.8	5508.7	4975.9	4472.1	4007.6	3595.7	3217.0	2899.3
S_{1-1}	**534.6**	**492.5**	**450.1**	**408.1**	**358.7**	**324.8**	**293.2**	**264.7**	**238.3**	**216.2**
I_{2-2}	610.7	556.6	503.2	451.0	187.1	166.7	148.0	131.7	116.9	103.0
S_{2-2}	86.2	78.9	71.6	64.4	37.5	33.6	30.0	26.9	24.0	21.1
Dimensions and Gauges in Inches										
d	27⅝	27⅜	27 3/16	27	27¾	27 9/16	27⅜	27 3/16	27	26 13/16
b	14 5/16	14⅜	14 1/16	14	10	9 15/16	9⅞	9 13/16	9¾	9¾
t	¾	11/16	⅝	9/16	11/16	⅝	9/16	½	7/16	7/16
p	1¼	1 3/16	1 1/16	1	1⅛	1	15/16	13/16	¾	11/16
a	6¾	6¾	6¾	6¾	4 11/16	4 11/16	4 11/16	4 11/16	4 11/16	4 11/16
c	25	25	25	25	25 7/16	25 7/16	25 7/16	25 7/16	25 7/16	25 7/16
f	23¼	23¼	23¼	23¼	24⅛	24⅛	24⅛	24⅛	24⅛	24⅛
f_1	5 13/16	5 13/16	5 13/16	5 13/16	4	4	4	4	4	4
o	2 3/16	2 1/16	2	1 15/16	1 13/16	1 11/16	1⅝	1½	1 7/16	1 5/16
k	1¼	1¼	1¼	1¼	1	1	⅞	⅞	⅞	⅞
g min.	4	4	4	4	3¾	3¾	3½	3½	3½	3½
g usual	5	5	5	5	5	5	5	5	5	5
g_2	3½	3½	3½	3½	3¼	3	3	3	3	3

f, f_1, o and k—Provide usual working clearances.

Maximum Bending Moments, Web Resistances, Etc.										
Mmax	802	739	675	612	538	487	440	397	357	324
Vmax	250	230	209	188	229	206	186	166	149	148
Lmin	12.81	12.88	12.95	13.03	9.40	9.45	9.47	9.55	9.57	8.74
fb	14729	14322	13825	13224	14162	13590	12960	12221	11453	11508
fbt	11135	9997	8834	7670	9743	8480	7335	6233	5280	5305
a_1 min	15.59	16.11	16.81	17.75	16.57	17.43	18.48	19.88	21.54	21.26
Rmax	116	103	91	79	102	88	76	64	54	54
R_1	114	114	114	107	114	114	105	94	85	85
LR_1	28.14	25.92	23.69	22.88	18.88	17.09	16.75	16.90	16.82	15.26
Wt. C.	42	42	42	42	42	42	42	42	42	42
Q	6415	5910	5401	4897	4304	3898	3518	3176	2860	2594

Mmax = Maximum Bending Moment in thousands of foot pounds.
Vmax = Maximum Web Shear in thousands of pounds.
Lmin = Minimum Span to develop V max. in feet.
fb = Allowable Unit Stress for Web Buckling in pounds per square inch.
fbt = Value of Web in Buckling per inch of length in pounds.
a_1 min = Minimum End Bearing to develop V in inches.
Rmax = Maximum End Reaction when $a_1 = 3\frac{1}{2}$ inches in thousands of pounds.
R_1 = Maximum value of one Standard Connection, page 250, in thousands of pounds.
LR_1 = Minimum Span in feet to develop R_1.
Wt. C. = Weight of one Standard Connection including web rivets in pounds.
Q = Coefficient of Strength = 12 S_{1-1}.
To obtain safe uniformly distributed load in thousands of pounds, divide Q by the required span in feet.

BEAM 24" I LOADS

CARNEGIE BEAM SECTIONS AS BEAMS

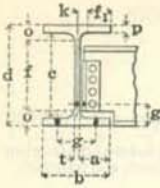
Allowable Uniform Loads in Thousands of Pounds

Applicable only when sections are braced against lateral deflection
For unbraced sections safe loads must be reduced, see page 93.

Maximum Bending Stress, **18,000** Pounds per Square Inch

Span in Feet	Nominal Depth and Flange Width—Weight per Foot										Coefficient of Deflection
	CB 244 24" x 14"				CB 243 24" x 12"			CB 242 24" x 9¾"			
	160 lbs.	150 lbs.	140 lbs.	130 lbs.	120 lbs.	110 lbs.	100 lbs.	94 lbs.	85 lbs.	76 lbs.	
10								291.1 270.0	262.0 244.2	233.3 218.4	1.86
11					314.5	286.4	259.2	245.5	222.0	198.6	2.25
12	396.6	370.2	344.2	318.4	301.9	276.8	251.7	225.0	203.5	182.0	2.68
13	379.1	355.3	331.6	308.0	278.7	255.5	232.3	207.7	187.8	168.0	3.15
14	352.1	330.0	307.9	286.0	258.8	237.3	215.7	192.9	174.4	156.0	3.65
15	328.6	308.0	287.4	266.9	241.5	221.5	201.4	180.0	162.8	145.6	4.19
16	308.1	288.7	269.4	250.2	226.4	207.6	188.8	168.8	152.6	136.5	4.77
17	289.9	271.7	253.6	235.5	213.1	195.4	177.7	158.8	143.6	128.5	5.38
18	273.8	256.6	239.5	222.4	201.3	184.6	167.8	150.0	135.6	121.4	6.03
19	259.4	243.1	226.9	210.7	190.7	174.8	159.0	142.1	128.5	115.0	6.72
20	246.4	231.0	215.5	200.2	181.1	166.1	151.0	135.0	122.1	109.2	7.45
21	234.7	220.0	205.3	190.6	172.5	158.2	143.8	128.6	116.3	104.0	8.21
22	224.0	210.0	195.9	182.0	164.7	151.0	137.3	122.7	111.0	99.3	9.01
23	214.3	200.8	187.4	174.1	157.5	144.4	131.3	117.4	106.2	95.0	9.85
24	205.4	192.5	179.6	166.8	151.0	138.4	125.9	112.5	101.7	91.0	10.73
25	197.2	184.8	172.4	160.1	144.9	132.9	120.8	108.0	97.7	87.4	11.64
26	189.6	177.7	165.8	154.0	139.3	127.8	116.2	103.9	93.9	84.0	12.59
27	182.6	171.1	159.7	148.3	134.2	123.0	111.9	100.0	90.4	80.9	13.57
28	176.0	165.0	154.0	143.0	129.4	118.6	107.9	96.4	87.2	78.0	14.60
29	170.0	159.3	148.6	138.1	124.9	114.5	104.2	93.1	84.2	75.3	15.66
30	164.3	154.0	143.7	133.4	120.8	110.7	100.7	90.0	81.4	72.8	16.76
31	159.0	149.0	139.1	129.1	116.9	107.2	97.4	87.1	78.8	70.5	17.89
32	154.0	144.4	134.7	125.1	113.2	103.8	94.4	84.4	76.3	68.3	19.07
33	149.4	140.0	130.6	121.3	109.8	100.7	91.5	81.8	74.0	66.2	20.28
34	145.0	135.9	126.8	117.7	106.6	97.7	88.8	79.4	71.8	64.2	21.53
35	140.8	132.0	123.2	114.4	103.5	94.9	86.3	77.2	69.8	62.4	22.81
36	136.9	128.3	119.7	111.2	100.6	92.3	83.9	75.0	67.8	60.7	24.13
37	133.2	124.8	116.5	108.2	97.9	89.8	81.6	73.0	66.0	59.0	25.49
38	129.7	121.6	113.4	105.4	95.3	87.4	79.5	71.1	64.3	57.5	26.89
39	126.4	118.4	110.5	102.7	92.9	85.2	77.4	69.2	62.6	56.0	28.32
40	123.2	115.5	107.8	100.1	90.6	83.0	75.5	67.5	61.0	54.6	29.79
42	117.4	110.0	102.6	95.3	86.3	79.1	71.9	64.3	58.1	52.0	32.85
44	112.0	105.0	98.0	91.0	82.3	75.5	68.6	61.4	55.5	49.6	36.05
46	107.2	100.4	93.7	87.0	78.8	72.2	65.7	58.7	53.1	47.5	39.40

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.



CARNEGIE BEAM SECTIONS AS BEAMS

ESSENTIAL DATA

Maximum Shear, **12,000** Pounds per Square Inch

BEAM I 24″ DATA

Maximum Bending Stress, **18,000** Pounds per Square Inch

Notation	Nominal Depth and Flange Width—Weight per Foot									
	CB 244 24″ x 14″				CB 243 24″ x 12″			CB 242 24″ x 9¾″		
	160 lbs.	150 lbs.	140 lbs.	130 lbs.	120 lbs.	110 lbs.	100 lbs.	94 lbs.	85 lbs.	76 lbs.
ELEMENTS										
I_{1-1}	5065.7	4720.5	4380.4	4045.1	3669.7	3343.5	3020.5	2734.9	2457.2	2184.4
S_{1-1}	**410.8**	**384.9**	**359.2**	**333.6**	**301.9**	**276.8**	**251.7**	**225.0**	**203.5**	**182.0**
I_{2-2}	526.0	489.3	453.1	417.5	277.8	252.2	226.9	130.2	116.2	102.6
S_{2-2}	74.5	69.5	64.5	59.6	46.0	41.9	37.8	26.4	23.7	21.0
DIMENSIONS AND GAUGES IN INCHES										
d	24 1/16	24 1/2	24 3/8	24 1/4	24 5/16	24 1/8	24	24 5/16	24 1/8	24
b	14 1/8	14 1/16	14 1/16	14	12 1/16	12 1/16	12	9 7/8	9 13/16	9 3/4
t	1 1/16	15/16	15/16	15/16	15/16	1/2	7/16	1/2	7/16	5/16
p	1 1/16	1 1/16	1	1 1/16	1 5/16	7/8	1 3/16	1 3/16	3/4	1 1/16
a	6 3/4	6 3/4	6 3/4	6 3/4	5 13/16	5 13/16	5 13/16	4 11/16	4 11/16	4 11/16
c	22 3/8	22 3/8	22 3/8	22 3/8	22 3/8	22 3/8	22 3/8	22 3/8	22 3/8	22 3/8
f	20 3/4	20 3/4	20 3/4	20 3/4	20 3/4	20 3/4	20 3/4	21 3/8	21 3/8	21 3/8
f_1	5 3/8	5 3/8	5 3/8	5 3/8	4 13/16	4 13/16	4 13/16	4 1/16	4 1/16	4 1/16
o	1 15/16	1 7/8	1 13/16	1 3/4	1 3/4	1 11/16	1 5/8	1 7/16	1 3/8	1 5/16
k	1 1/8	1 1/8	1 1/8	1 1/8	1 1/8	1	1	7/8	7/8	3/4
g min.	3 3/4	3 3/4	3 3/4	3 3/4	3 3/4	3 3/4	3 3/4	3 1/2	3 1/2	3 1/2
g usual	5	5	5	5	5	5	5	5	5	5
g_2	3 1/4	3 1/4	3 1/4	3 1/4	3	3	3	2 3/4	2 3/4	2 3/4
MAXIMUM BENDING MOMENTS, WEB RESISTANCES, ETC.										
Mmax	616	577	539	500	453	415	378	338	305	273
Vmax	198	185	172	159	157	143	130	146	131	117
Lmin	12.43	12.47	12.52	12.57	11.52	11.60	11.65	9.27	9.32	9.36
fb	14684	14361	13989	13559	13443	12871	12211	12899	12196	11354
fbt	9838	9033	8226	7417	7246	6358	5495	6437	5513	4598
a_1 min	13.99	14.36	14.82	15.40	15.62	16.48	17.59	16.54	17.73	19.37
Rmax	95	87	79	71	69	61	52	62	53	44
R_1	97	97	93	87	85	77	71	79	71	65
LR_1	25.41	23.81	23.17	23.01	21.31	21.57	21.27	17.09	17.20	16.80
Wt. C.	36	36	36	36	36	36	36	36	36	36
Q	4930	4619	4310	4003	3623	3322	3020	2700	2442	2184

f, f_1, o and k—Provide usual working clearances.

Mmax = Maximum Bending Moment in thousands of foot pounds.
Vmax = Maximum Web Shear in thousands of pounds.
Lmin = Minimum Span to develop V max. in feet.
fb = Allowable Unit Stress for Web Buckling in pounds per square inch.
fbt = Value of Web in Buckling per inch of length in pounds.
a_1 min = Minimum End Bearing to develop V in inches.
Rmax = Maximum End Reaction when $a_1 = 3\frac{1}{2}$ inches in thousands of pounds.
R_1 = Maximum Value of one Standard Connection, page 250, in thousands of pounds.
LR_1 = Minimum Span in feet to develop R_1.
Wt. C. = Weight of one Standard Connection including web rivets in pounds.
Q = Coefficient of Strength = 12 S_{1-1}.
To obtain safe uniformly distributed load in thousands of pounds, divide Q by the required span in feet.

BEAM
24″
21″ I
LOADS

CARNEGIE BEAM SECTIONS
AS
BEAMS

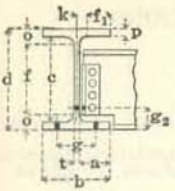
ALLOWABLE UNIFORM LOADS IN THOUSANDS OF POUNDS

Applicable only when sections are braced against lateral deflection
For unbraced sections safe loads must be reduced, see page 93

Maximum Bending Stress, **18,000** Pounds per Square Inch

Span in Feet	CB 241 24x8½	Nominal Depth and Flange Width—Weight per Foot									Coefficient of Deflection
		CB 213 21″ x 13″					CB 212 21″ x 9″				
	70 lbs.	136 lbs.	128 lbs.	120 lbs.	112 lbs.	104 lbs.	98 lbs.	92 lbs.	86 lbs.	80 lbs.	
9	230.4 / 217.1						274.2	255.9	238.2	220.8	1.51
10	195.4						251.0	235.8	220.4	205.1	1.86
11	177.6	312.6	292.4	272.8			228.2	214.3	200.3	186.4	2.25
12	162.8	308.4	290.4	272.1	253.0	234.4	209.2	196.5	183.6	170.9	2.68
13	150.3	284.7	268.1	251.2	234.5	217.6	193.1	181.3	169.5	157.8	3.15
14	139.6	264.3	248.9	233.2	217.8	202.1	179.3	168.4	157.4	146.5	3.65
15	130.3	246.7	232.3	217.7	203.3	188.6	167.4	157.2	146.9	136.7	4.19
16	122.1	231.3	217.8	204.1	190.5	176.8	156.9	147.3	137.7	128.2	4.77
17	114.9	217.7	205.0	192.1	179.3	166.4	147.7	138.7	129.6	120.6	5.38
18	108.5	205.6	193.6	181.4	169.4	157.2	139.5	131.0	122.4	113.9	6.03
19	102.8	194.8	183.4	171.9	160.5	148.9	132.1	124.1	116.0	107.9	6.72
20	97.7	185.0	174.2	163.3	152.4	141.4	125.5	117.9	110.2	102.5	7.45
21	93.0	176.2	165.9	155.5	145.2	134.7	119.5	112.3	104.9	97.7	8.21
22	88.8	168.2	158.4	148.4	138.6	128.6	114.1	107.2	100.2	93.2	9.01
23	84.9	160.9	151.5	142.0	132.6	123.0	109.1	102.5	95.8	89.2	9.85
24	81.4	154.2	145.2	136.1	127.0	117.9	104.6	98.2	91.8	85.5	10.73
25	78.2	148.0	139.4	130.6	122.0	113.2	100.4	94.3	88.2	82.0	11.64
26	75.1	142.3	134.0	125.6	117.3	108.8	96.6	90.7	84.8	78.9	12.59
27	72.4	137.1	129.1	120.9	112.9	104.8	93.0	87.3	81.6	76.0	13.57
28	69.8	132.2	124.5	116.6	108.9	101.0	89.7	84.2	78.7	73.2	14.60
29	67.4	127.6	120.2	112.6	105.1	97.5	86.6	81.3	76.0	70.7	15.66
30	65.1	123.4	116.2	108.8	101.6	94.3	83.7	78.6	73.5	68.4	16.76
31	63.0	119.4	112.4	105.3	98.3	91.3	81.0	76.0	71.1	66.2	17.89
32	61.1	115.7	108.9	102.0	95.3	88.4	78.5	73.7	68.9	64.1	19.07
33	59.2	112.1	105.6	98.9	92.4	85.7	76.1	71.4	66.8	62.1	20.28
34	57.5	108.9	102.5	96.0	89.7	83.2	73.8	69.3	64.8	60.3	21.53
35	55.8	105.7	99.6	93.3	87.1	80.8	71.7	67.4	63.0	58.6	22.81
36	54.3	102.8	96.8	90.7	84.7	78.6	69.7	65.5	61.2	57.0	24.13
37	52.8	100.0	94.2	88.3	82.4	76.5	67.8	63.7	59.6	55.4	25.49
38	51.4	97.4	91.7	85.9	80.2	74.4	66.1	62.0	58.0	54.0	26.89
39	50.1	94.9	89.4	83.7	78.2	72.5	64.4	60.4	56.5	52.6	28.32
40	48.8	92.5	87.1	81.6	76.2	70.7	62.8	58.9	55.1	51.3	29.79
42	46.5										32.85
44	44.4										36.05
46	42.5										39.40

Laods above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.



CARNEGIE BEAM SECTIONS AS BEAMS

ESSENTIAL DATA

Maximum Shear, **12,000** Pounds per Square Inch

BEAM I 24″ 21″ DATA

Maximum Bending Stress, **18,000** Pounds per Square Inch

Notation	Nominal Depth and Flange Width—Weight per Foot									
	CB 241 24″ x 8½″	CB 213 21″ x 13″					CB 212 21″ x 9″			
	70 lbs.	136 lbs.	128 lbs.	120 lbs.	112 lbs.	104 lbs.	98 lbs.	92 lbs.	86 lbs.	80 lbs.
ELEMENTS										
I_{1-1}	1953.8	3313.7	3103.4	2890.9	2683.7	2475.3	2234.5	2086.4	1939.3	1794.4
S_{1-1}	**162.8**	**308.4**	**290.4**	**272.1**	**254.1**	**235.7**	**209.2**	**196.5**	**183.6**	**170.9**
I_{2-2}	68.0	401.7	375.9	349.7	324.3	298.7	125.0	116.3	107.7	99.2
S_{2-2}	16.0	61.1	57.4	53.5	49.8	45.9	27.5	25.7	23.8	22.0
DIMENSIONS AND GAUGES IN INCHES										
d	24	21½	21⅜	21¼	21⅛	21	21⅜	21¼	21⅛	21
b	8½	13⅜₁₆	13⅛	13⅛₁₆	13⅛₁₆	13	9⅛	9⅛₁₆	9⅛₁₆	9
t	⅝	⅝	⅝	9/16	½	7/16	9/16	½	½	7/16
p	1 1/16	1 1/16	1	1 1/16	⅞	1 1/16	1	1 1/16	⅞	1 1/16
a	4 1/16	6 5/16	6 5/16	6 5/16	6 5/16	6 5/16	4 5/16	4 5/16	4 5/16	4 5/16
c	22⅝	19 5/16	19 5/16	19 5/16	19 5/16	19 5/16	19 5/16	19 5/16	19 5/16	19 5/16
f	21⅝	17⅞	17⅞	17⅞	17⅞	17⅞	17⅞	17⅞	17⅞	17⅞
f_1	3 3/16	5½	5½	5½	5½	5½	3½	3½	3½	3½
o	1 3/16	1 3/16	1¾	1 1/16	1⅝	1 5/16	1¾	1 1/16	1⅝	1 5/16
k	¾	1	1	1	1	1	1	1	1	1
g min.	3½	3¾	3¾	3½	3½	3½	3½	3½	3½	3½
g usual	5	5	5	5	5	5	5	5	5	5
g_2	2¾	3	3	3	3	3	3	3	3	3

f, f_1, o and k—Provide usual working clearances.

MAXIMUM BENDING MOMENTS, WEB RESISTANCES, ETC.

Mmax	244	463	436	408	381	354	314	295	275	256
Vmax	115	156	146	136	127	117	137	128	119	110
Lmin	8.48	11.84	11.92	11.97	12.05	12.07	9.16	9.21	9.25	9.29
fb	11250	14881	14583	14253	13860	13434	14223	13864	13468	13014
fbt	4500	9018	8312	7625	6916	6247	7609	6960	6330	5700
a_1 min	19.60	11.96	12.24	12.58	13.01	13.51	12.68	13.07	13.54	14.11
Rmax	43	80	74	67	61	55	67	61	56	50
R_1	63	72	72	71	66	62	70	66	62	58
LR_1	15.50	25.70	24.20	22.99	23.10	22.81	17.93	17.86	17.77	17.68
Wt. C.	36	30	30	30	30	30	30	30	30	30
Q	1954	3701	3485	3265	3049	2828	2510	2358	2203	2051

Mmax = Maximum Bending Moment in thousands of foot pounds.
Vmax = Maximum Web Shear in thousands of pounds.
Lmin = Minimum Span to develop V max. in feet.
fb = Allowable Unit Stress for Web Buckling in pounds per square inch.
fbt = Value of Web in Buckling per inch of length in pounds.
a_1 min = Minimum End Bearing to develop V in inches.
Rmax = Maximum End Reaction when $a_1 = 3\frac{1}{2}$ inches in thousands of pounds.
R_1 = Maximum Value of one Standard Connection, page 250, in thousands of pounds.
LR_1 = Minimum Span in feet to develop R_1.
Wt. C. = Weight of one Standard Connection including web rivets in pounds.
Q = Coefficient of Strength = 12 S_{1-1}.
To obtain safe uniformly distributed load in thousands of pounds, divide Q by the required span in feet.

CARNEGIE BEAM SECTIONS AS BEAMS

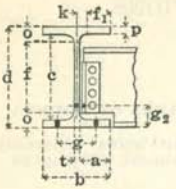
Allowable Uniform Loads in Thousands of Pounds

Applicable only when sections are braced against lateral deflection
For unbraced sections safe loads must be reduced, see page 93

Maximum Bending Stress, **18,000** Pounds per Square Inch

Span in Feet	Nominal Depth and Flange Width—Weight per Foot								Coefficient of Deflection
	CB 211 21″ x 8″					CB 183 18″ x 12″			
	76 lbs.	70 lbs.	64 lbs.	58 lbs.	55 lbs.	100 lbs.	93 lbs.	86 lbs.	
	240.6	220.8	200.8	181.4	180.5				
8	236.4	217.8	199.3	180.5	167.6				1.19
9	210.1	193.6	177.1	160.4	148.9				1.51
10	189.1	174.3	159.4	144.4	134.0	218.0	201.3	185.3	1.86
11	171.9	158.4	144.9	131.2	121.9	213.3	198.5	183.5	2.25
12	157.6	145.2	132.8	120.3	111.7	195.6	181.9	168.2	2.68
13	145.5	134.1	122.6	111.1	103.1	180.5	167.9	155.3	3.15
14	135.1	124.5	113.9	103.1	95.7	167.6	156.0	144.2	3.65
15	126.1	116.2	106.3	96.2	89.4	156.5	145.6	134.6	4.19
16	118.2	108.9	99.6	90.2	83.8	146.7	136.5	126.2	4.77
17	111.2	102.5	93.8	84.9	78.8	138.1	128.4	118.8	5.38
18	105.1	96.8	88.6	80.2	74.5	130.4	121.3	112.2	6.03
19	99.5	91.7	83.9	76.0	70.5	123.5	114.9	106.3	6.72
20	94.6	87.1	79.7	72.2	67.0	117.3	109.2	100.9	7.45
21	90.1	83.0	75.9	68.7	63.8	111.8	104.0	96.1	8.21
22	86.0	79.2	72.5	65.6	60.9	106.7	99.2	91.8	9.01
23	82.2	75.8	69.3	62.8	58.3	102.0	94.9	87.8	9.85
24	78.8	72.6	66.4	60.2	55.9	97.8	91.0	84.1	10.73
25	75.6	69.7	63.8	57.7	53.6	93.9	87.3	80.8	11.64
26	72.7	67.0	61.3	55.5	51.6	90.3	84.0	77.6	12.59
27	70.0	64.5	59.0	53.5	49.6	86.9	80.9	74.8	13.57
28	67.5	62.2	56.9	51.6	47.9	83.8	78.0	72.1	14.60
29	65.2	60.1	55.0	49.8	46.2	80.9	75.3	69.6	15.66
30	63.0	58.1	53.1	48.1	44.7	78.2	72.8	67.3	16.76
31	61.0	56.2	51.4	46.6	43.2	75.7	70.4	65.1	17.89
32	59.1	54.5	49.8	45.1	41.9	73.3	68.2	63.1	19.07
33	57.3	52.8	48.3	43.7	40.6	71.1	66.2	61.2	20.28
34	55.6	51.3	46.9	42.5	39.4	69.0	64.2	59.4	21.53
35	54.0	49.8	45.5	41.2	38.3	67.1	62.4	57.7	22.81
36	52.5	48.4	44.3	40.1	37.2				24.13
37	51.1	47.1	43.1	39.0	36.2				25.49
38	49.8	45.9	42.0	38.0	35.3				26.89
39	48.5	44.7	40.9	37.0	34.4				28.32
40	47.3	43.6	39.9	36.1	33.5				29.79

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.



CARNEGIE BEAM SECTIONS AS BEAMS

ESSENTIAL DATA

Maximum Shear, **12,000** Pounds per Square Inch

BEAM I 21″ 18″ DATA

Maximum Bending Stress, **18,000** Pounds per Square Inch

Notation	Nominal Depth and Flange Width—Weight per Foot							
	CB 211 21″ x 8″					CB 183 18″ x 12″		
	76 lbs.	70 lbs.	64 lbs.	58 lbs.	55 lbs.	100 lbs.	93 lbs.	86 lbs.
ELEMENTS								
I_{1-1}	1684.0	1542.9	1403.3	1263.2	1166.7	1783.4	1648.4	1514.1
S_{1-1}	**157.6**	**145.2**	**132.9**	**120.3**	**111.7**	**195.6**	**181.9**	**168.2**
I_{2-2}	70.67	64.3	58.2	52.0	47.29	253.4	234.0	214.7
S_{2-2}	17.4	15.9	14.5	13.0	11.8	42.0	38.9	35.8
DIMENSIONS AND GAUGES IN INCHES								
d	21⅜	21¼	21⅛	21	20 15/16	18¼	18⅛	18
b	8⅛	8 1/16	8 1/16	8	8	12 1/16	12 1/16	12
t	½	7/16	⅜	⅜	⅜	½	7/16	7/16
p	1 3/16	¾	1 1/16	⅝	9/16	⅜	1 3/16	¾
a	3 13/16	3 13/16	3 13/16	3 13/16	3 13/16	5 13/16	5 13/16	5 13/16
c	19¾	19¾	19¾	19¾	19¾	16½	16½	16½
f	18⅝	18⅝	18⅝	18⅝	18⅝	15⅛	15⅛	15⅛
f_1	3¼	3¼	3¼	3¼	3¼	5 1/16	5 1/16	5 1/16
o	1⅜	1 5/16	1¼	1 5/16	1¼	1 9/16	1½	1 7/16
k	¾	¾	¾	¾	¾	1	⅞	⅞
g min.	3¼	3¼	3¼	3¼	3¼	3½	3½	3½
g usual	5	5	5	5	5	5	5	5
g_2	2¾	2¾	2¾	2¾	2¾	3	3	3
MAXIMUM BENDING MOMENTS, WEB RESISTANCES, ETC.								
Mmax	236	218	199	180	168	293	273	252
Vmax	120	110	100	91	90	109	101	93
Lmin	7.86	7.89	7.94	7.96	7.43	10.77	10.84	10.89
fb	13373	12845	12209	11486	11530	14711	14340	13917
fbt	6272	5562	4835	4135	4151	7326	6639	5970
a_1 min	13.83	14.54	15.48	16.69	16.52	10.32	10.63	11.02
Rmax	55	49	42	36	36	59	53	48
R_1	62	56	53	47	47	52	48	45
LR_1	15.25	15.56	15.05	15.36	14.26	22.57	22.74	22.43
Wt. C.	30	30	30	30	30	21	21	21
Q	1891	1742	1595	1444	1340	2347	2183	2018

f, f_1, o and k—Provide usual working clearances.

Mmax = Maximum Bending Moment in thousands of foot pounds.
Vmax = Maximum Web Shear in thousands of pounds.
Lmin = Minimum Span to develop V max. in feet.
fb = Allowable Unit Stress for Web Buckling in pounds per square inch.
fbt = Value of Web in Buckling per inch of length in pounds.
a_1 min = Minimum End Bearing to develop V in inches.
Rmax = Maximum End Reaction when $a_1 = 3\frac{1}{2}$ inches in thousands of pounds.
R_1 = Maximum value of one Standard Connection, page 250, in thousands of pounds.
LR_1 = Minimum Span in feet to develop R_1.
Wt. C. = Weight of one Standard Connection including web rivets in pounds.
Q = Coefficient of Strength = $12\ S_{1-1}$.
To obtain safe uniformly distributed load in thousands of pounds, divide Q by the required span in feet.

BEAM
18″ I
LOADS

CARNEGIE BEAM SECTIONS
AS
BEAMS

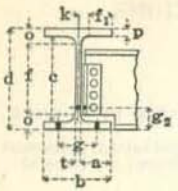
Allowable Uniform Loads in Thousands of Pounds

Applicable only when sections are braced against lateral deflection
For unbraced sections safe loads must be reduced, see page 93

Maximum Bending Stress, **18,000** Pounds per Square Inch

Span in Feet	Nominal Depth and Flange Width—Weight per Foot							Coefficient of Deflection
	CB 182 18″ x 8½″			CB 181 18″ x 7½″				
	78 lbs.	72 lbs.	67 lbs.	58 lbs.	52 lbs.	51 lbs.	47 lbs.	
7				172.2	153.9	162.2 154.1	138.2	0.91
8	206.2	189.5	175.4	157.9	141.6	134.8	128.1	1.19
9	192.8	177.9	165.5	140.4	125.9	119.8	113.9	1.51
10	173.5	160.1	148.9	126.3	113.3	107.9	102.5	1.86
11	157.7	145.5	135.4	114.9	103.0	98.1	93.2	2.25
12	144.6	133.4	124.1	105.3	94.4	89.9	85.4	2.68
13	133.5	123.2	114.6	97.2	87.2	83.0	78.8	3.15
14	123.9	114.4	106.4	90.2	80.9	77.0	73.2	3.65
15	115.6	106.7	99.3	84.2	75.5	71.9	68.3	4.19
16	108.4	100.1	93.1	79.0	70.8	67.4	64.0	4.77
17	102.1	94.2	87.6	74.3	66.6	63.4	60.3	5.38
18	96.4	88.9	82.7	70.2	62.9	59.9	56.9	6.03
19	91.3	84.3	78.4	66.5	59.6	56.8	53.9	6.72
20	86.8	80.1	74.4	63.2	56.6	53.9	51.2	7.45
21	82.6	76.2	70.9	60.2	54.0	51.4	48.8	8.21
22	78.9	72.8	67.7	57.4	51.5	49.0	46.6	9.01
23	75.4	69.6	64.8	54.9	49.3	46.9	44.6	9.85
24	72.3	66.7	62.1	52.6	47.2	44.9	42.7	10.73
25	69.4	64.0	59.6	50.5	45.3	43.1	41.0	11.64
26	66.7	61.6	57.3	48.6	43.6	41.5	39.4	12.59
27	64.3	59.3	55.2	46.8	42.0	39.9	38.0	13.57
28	62.0	57.2	53.2	45.1	40.5	38.5	36.6	14.60
29	59.8	55.2	51.4	43.6	39.1	37.2	35.3	15.66
30	57.8	53.4	49.6	42.1	37.8	36.0	34.2	16.76
31	56.0	51.6	48.0	40.8	36.5	34.8	33.1	17.89
32	54.2	50.0	46.5	39.5	35.4	33.7	32.0	19.07
33	52.6	48.5	45.1	38.3	34.3	32.7	31.1	20.28
34	51.0	47.1	43.8	37.2	33.3	31.7	30.1	21.53
35	49.6	45.7	42.6	36.1	32.4	30.8	29.3	22.81

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.



CARNEGIE BEAM SECTIONS AS BEAMS

ESSENTIAL DATA

Maximum Shear, **12,000** Pounds per Square Inch

BEAM I 18″ DATA

Maximum Bending Stress, **18,000** Pounds per Square Inch

Notation	Nominal Depth and Flange Width—Weight per Foot						
	CB 182 18″ x 8½″			CB 181 18″ x 7½″			
	78 lbs.	72 lbs.	67 lbs.	58 lbs.	52 lbs.	51 lbs.	47 lbs.
ELEMENTS							
I_{1-1}	1318.8	1208.1	1117.1	960.8	855.1	810.0	768.6
S_{1-1}	144.6	133.4	124.1	105.3	94.4	89.9	85.4
I_{2-1}	90.9	82.9	76.4	49.0	43.3	40.5	38.7
S_{2-1}	21.2	19.4	18.0	13.0	11.5	10.7	10.3
DIMENSIONS AND GAUGES IN INCHES							
d	18¼	18⅛	18	18¼	18⅛	18	18
b	8 9/16	8½	8½	7 9/16	7 9/16	7 9/16	7½
t	½	7/16	⅜	⅜	⅜	⅜	5/16
p	⅜	13/16	¾	13/16	⅝	9/16	9/16
a	4 1/16	4 1/16	4 1/16	3⅝	3⅝	3⅝	3⅝
e	16½	16½	16½	16⅞	16⅞	16⅞	16⅞
f	15⅛	15⅛	15⅛	15⅞	15⅞	15⅞	15⅞
f_1	3 5/16	3 5/16	3 5/16	3 1/16	3 1/16	3 1/16	3 1/16
o	1 9/16	1½	1 7/16	1 9/16	1⅛	1 1/16	1 1/16
k	⅞	⅞	⅞	¾	⅝	⅝	⅝
g min.	3½	3½	3½	3	3	3	3
g usual	5	5	5	5	5	5	5
g_2	3	3	3	2¾	2¾	2¾	2¾

f, f_1, o and k—Provide usual working clearances.

MAXIMUM BENDING MOMENTS, WEB RESISTANCES, ETC.							
Mmax	217	200	186	158	142	135	128
Vmax	103	95	88	86	77	81	69
Lmin	8.41	8.45	8.49	7.34	7.36	6.65	7.41
fb	14400	13980	13558	13240	12531	12996	11785
fbt	6782	6095	5505	5203	4436	4874	3771
a_1 min	10.64	11.02	11.43	11.98	12.82	12.14	13.83
Rmax	55	49	44	42	36	39	30
R_1	49	46	43	41	37	40	34
LR_1	17.71	17.40	17.32	15.41	15.31	13.49	15.07
Wt. C.	21	21	21	21	21	21	21
Q	1735	1601	1489	1264	1133	1079	1025

Mmax = Maximum Bending Moment in thousands of foot pounds.
Vmax = Maximum Web Shear in thousands of pounds.
Lmin = Minimum Span to develop V max. in feet.
fb = Allowable Unit Stress for Web Buckling in pounds per square inch.
fbt = Value of Web in Buckling per inch of length in pounds.
a_1 min = Minimum End Bearing to develop V in inches.
Rmax = Maximum End Reaction when $a_1 = 3\frac{1}{2}$ inches in thousands of pounds.
R_1 = Maximum Value of one Standard Connection, page 250, in thousands of pounds.
LR_1 = Minimum Span in feet to develop R_1.
Wt. C. = Weight of one Standard Connection including web rivets in pounds.
Q = Coefficient of Strength = 12 S_{1-1}.
To obtain safe uniformly distributed load in thousands of pounds, divide Q by the required span in feet.

BEAM 16" I LOADS

CARNEGIE BEAM SECTIONS AS BEAMS

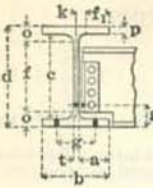
Allowable Uniform Loads in Thousands of Pounds

Applicable only when sections are braced against lateral deflection
For unbraced sections safe loads must be reduced, see page 93

Maximum Bending Stress, **18,000** Pounds per Square Inch

Span in Feet	Nominal Depth and Flange Width—Weight per Foot									Coefficient of Deflection
	CB 165 16" x 14"			CB 164 16" x 12"			CB 163 16" x 8½"			
	115 lbs.	107 lbs.	100 lbs.	90 lbs.	83 lbs.	76 lbs.	68 lbs.	63 lbs.	58 lbs.	
							170.6	157.0	144.0	
9				192.9	177.2	160.9	151.8	140.6	129.4	1.51
10				188.5	173.9	159.2	136.6	126.6	116.5	1.86
11	207.3	191.8		171.4	158.1	144.7	124.2	115.1	105.9	2.25
12	205.2	190.8	178.2	157.1	144.9	132.7	113.9	105.5	97.1	2.68
13	189.4	176.2	164.6	145.0	133.7	122.5	105.1	97.4	89.6	3.15
14	175.9	163.6	152.9	134.6	124.2	113.7	97.6	90.4	83.2	3.65
15	164.1	152.7	142.7	125.7	115.9	106.1	91.1	84.4	77.7	4.19
16	153.9	143.1	133.8	117.8	108.7	99.5	85.4	79.1	72.8	4.77
17	144.8	134.7	125.9	110.9	102.3	93.6	80.4	74.5	68.5	5.38
18	136.8	127.2	118.9	104.7	96.6	88.4	75.9	70.3	64.7	6.03
19	129.6	120.5	112.6	99.2	91.5	83.8	71.9	66.6	61.3	6.72
20	123.1	114.5	107.0	94.2	86.9	79.6	68.3	63.3	58.2	7.45
21	117.2	109.0	101.9	89.8	82.8	75.8	65.1	60.3	55.5	8.21
22	111.9	104.1	97.3	85.7	79.0	72.4	62.1	57.5	53.0	9.01
23	107.0	99.6	93.0	82.0	75.6	69.2	59.4	55.0	50.6	9.85
24	102.6	95.4	89.2	78.5	72.4	66.3	56.9	52.7	48.5	10.73
25	98.5	91.6	85.6	75.4	69.5	63.7	54.7	50.6	46.6	11.64
26	94.7	88.0	82.3	72.5	66.9	61.2	52.6	48.7	44.8	12.59
27	91.2	84.8	79.3	69.8	64.4	59.0	50.6	46.9	43.1	13.57
28	87.9	81.8	76.4	67.3	62.1	56.9	48.8	45.2	41.6	14.60
29	84.9	79.0	73.8	65.0	60.0	54.9	47.1	43.6	40.2	15.66
30	82.1	76.3	71.3	62.8	58.0	53.1	45.5	42.2	38.8	16.76
31	79.4	73.9	69.0	60.8	56.1	51.4	44.1	40.8	37.6	17.89
32	76.9	71.6	66.9	58.9			42.7			19.07

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.



CARNEGIE BEAM SECTIONS AS BEAMS

ESSENTIAL DATA

Maximum Shear, **12,000** Pounds per Square Inch

BEAM I 16″ DATA

Maximum Bending Stress, **18,000** Pounds per Square Inch

Notation	Nominal Depth and Flange Width—Weight per Foot								
	CB 165 16″ x 14″			CB 164 16″ x 12″			CB 163 16″ x 8½″		
	115 lbs.	107 lbs.	100 lbs.	90 lbs.	83 lbs.	76 lbs.	68 lbs.	63 lbs.	58 lbs.
ELEMENTS									
I_{1-1}	1665.6	1537.2	1426.8	1275.5	1167.7	1061.3	923.7	849.9	776.6
S_{1-1}	**205.2**	**190.8**	**178.3**	**157.1**	**144.9**	**132.7**	**113.9**	**105.5**	**97.1**
I_{2-2}	426.2	393.9	366.0	230.0	210.4	191.1	81.3	74.6	68.0
S_{2-2}	60.6	56.1	52.3	38.1	35.0	31.8	19.0	17.5	16.0
DIMENSIONS AND GAUGES IN INCHES									
d	16¼	16⅛	16	16¼	16⅛	16	16¼	16⅛	16
b	14 1/16	14	14	12 1/16	12 1/16	12	8 9/16	8½	8½
t	9/16	½	7/16	½	7/16	7/16	7/16	⅜	⅜
p	15/16	⅞	13/16	13/16	¾	11/16	¾	¾	11/16
a	6 13/16	6 13/16	6 13/16	5 13/16	5 13/16	5 13/16	4 11/16	4 11/16	4 11/16
c	14⅜	14⅜	14⅜	14⅜	14⅜	14⅜	14⅜	14⅜	14⅜
f	13	13	13	13⅜	13⅜	13⅜	13⅜	13⅜	13⅜
f_1	6 1/16	6 1/16	6 1/16	5⅛	5⅛	5⅛	3⅜	3⅜	3⅜
o	1⅝	1 9/16	1½	1 7/16	1⅜	1 5/16	1 7/16	1⅜	1 5/16
k	1	1	1	⅞	⅞	⅞	⅞	⅞	⅞
g min.	3½	3½	3½	3½	3½	3½	3½	3½	3½
g usual	5	5	5	5	5	5	5	5	5
g_2	3¼	3¼	3¼	3	3	3	2¾	2¾	2¾

f, f_1, o and k—Provide usual working clearances.

MAXIMUM BENDING MOMENTS, WEB RESISTANCES, ETC.

Mmax	308	286	267	236	217	199	171	158	146
Vmax	104	96	89	96	89	80	85	79	72
Lmin	11.88	11.94	12.01	9.77	9.81	9.90	8.01	8.06	8.09
fb	15000	15000	15000	15000	14920	14481	14649	14257	13810
fbt	7980	7440	6960	7425	6833	6068	6416	5788	5179
a_1 min	8.93	8.86	8.80	8.93	8.94	9.26	9.24	9.54	9.90
Rmax	60	56	52	56	51	46	48	44	39
R_1	56	52	48	52	48	44	46	43	40
LR_1	21.99	22.02	22.29	18.13	18.11	18.10	14.86	14.72	14.57
Wt. C.	21	21	21	21	21	21	21	21	21
Q	2462	2290	2140	1885	1739	1592	1367	1266	1165

Mmax = Maximum Bending Moment in thousands of foot pounds.
Vmax = Maximum Web Shear in thousands of pounds.
Lmin = Minimum Span to develop V max. in feet.
fb = Allowable Unit Stress for Web Buckling in pounds per square inch.
fbt = Value of Web in Buckling per inch of length in pounds.
a_1 min = Minimum End Bearing to develop V in inches.
Rmax = Maximum End Reaction when $a_1 = 3\frac{1}{2}$ inches in thousands of pounds.
R_1 = Maximum Value of one Standard Connection, page 250, in thousands of pounds.
LR_1 = Minimum Span in feet to develop R_1.
Wt. C. = Weight of one Standard Connection including web rivets in pounds.
Q = Coefficient of Strength = $12\,S_{1-1}$.
To obtain safe uniformly distributed load in thousands of pounds, divide Q by the required span in feet.

BEAM
16″ I
LOADS

CARNEGIE BEAM SECTIONS
AS
BEAMS

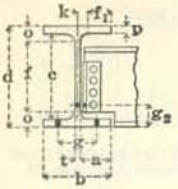
Allowable Uniform Loads in Thousands of Pounds

Applicable only when sections are braced against lateral deflection
For unbraced sections safe loads must be reduced, see page 93

Maximum Bending Stress, **18,000** Pounds per Square Inch

Span in Feet	Nominal Depth and Flange Width—Weight per Foot						Coefficient of Deflection
	CB 162 16″ x 7″				CB 161 16″ x 6″		
	50 lbs.	45 lbs.	43 lbs.	40 lbs.	38 lbs.	35 lbs.	
			143.4		120.7	110.9	
6	141.2		131.7		118.4	109.4	0.67
7	140.4	126.2	112.9	111.4	101.5	93.8	0.91
8	122.9	110.7	98.8	98.4	88.8	82.1	1.19
9	109.2	98.4	87.8	87.5	79.0	73.0	1.51
10	98.3	88.6	79.0	78.7	71.1	65.7	1.86
11	89.3	80.5	71.8	71.6	64.6	59.7	2.25
12	81.9	73.8	65.8	65.6	59.2	54.7	2.68
13	75.6	68.1	60.8	60.6	54.7	50.5	3.15
14	70.2	63.3	56.4	56.2	50.8	46.9	3.65
15	65.5	59.0	52.7	52.5	47.4	43.8	4.19
16	61.4	55.4	49.4	49.2	44.4	41.0	4.77
17	57.8	52.1	46.5	46.3	41.8	38.6	5.38
18	54.6	49.2	43.9	43.7	39.5	36.5	6.03
19	51.7	46.6	41.6	41.4	37.4	34.6	6.72
20	49.1	44.3	39.5	39.4	35.5	32.8	7.45
21	46.8	42.2	37.6	37.5	33.8	31.3	8.21
22	44.7	40.3	35.9	35.8	32.3	29.8	9.01
23	42.7	38.5	34.4	34.2	30.9	28.5	9.85
24	41.0	36.9	32.9	32.8	29.6	27.4	10.73
25	39.3	35.4	31.6	31.5	28.4	26.3	11.64
26	37.8	34.1	30.4	30.3	27.3	25.3	12.59
27	36.4	32.8	29.3	29.2	26.3	24.3	13.57
28	35.1	31.6	28.2	28.1	25.4	23.5	14.60
29	33.9	30.5	27.2	27.1	24.5	22.6	15.66
30	32.8	29.5	26.3	26.2	23.7	21.9	16.76
31	31.7	28.6	25.5	25.4	22.9	21.2	17.89
32	30.7						19.07

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.



CARNEGIE BEAM SECTIONS AS BEAMS

ESSENTIAL DATA

Maximum Shear, **12,000** Pounds per Square Inch

BEAM I 16″ DATA

Maximum Bending Stress, **18,000** Pounds per Square Inch

Notation	Nominal Depth and Flange Width—Weight per Foot					
	CB 162 16″ x 7″				CB 161 16″ x 6″	
	50 lbs.	**45** lbs.	**43** lbs.	**40** lbs.	**38** lbs.	**35** lbs.
ELEMENTS						
I_{1-1}	666.0	595.0	523.8	524.6	475.1	435.5
S_{1-1}	**81.9**	**73.8**	**65.7**	**65.6**	**59.3**	**54.7**
I_{2-2}	38.2	34.0	28.9	29.8	19.2	17.5
S_{2-2}	10.8	9.7	8.2	8.5	6.4	5.8
DIMENSIONS AND GAUGES IN INCHES						
d	16¼	16⅛	15 15/16	16	16	15 15/16
b	7 1/16	7 1/16	7 1/16	7	6	6
t	⅝	5/16	⅝	5/16	5/16	5/16
p	⅝	9/16	½	½	½	½
a	3⅝	3⅝	3⅝	3⅝	2⅝	2⅝
c	14 15/16	14 15/16	14 15/16	14 15/16	14 15/16	14 15/16
f	14	14	14	14	14	14
f_1	2⅜	2⅜	2⅜	2⅜	2⅜	2⅜
o	1⅛	1 1/16	1	1	1	15/16
k	⅝	⅝	⅝	⅝	⅝	⅝
g min.	3	3	3	3	3	3
g usual	4	4	4	4	3½	3½
g_2	2½	2½	2½	2½	2½	2½

f, f_1, o and k—Provide usual working clearances.

MAXIMUM BENDING MOMENTS, WEB RESISTANCES, ETC.						
Mmax	123	111	99	98	89	82
Vmax	71	63	72	56	60	55
Lmin	6.96	7.02	5.50	7.07	5.90	5.92
fb	13473	12785	13836	11942	12558	11977
fbt	4877	4168	5189	3463	3943	3473
a_1 min	10.41	11.11	9.84	12.08	11.30	11.98
Rmax	37	31	39	26	30	26
R_1	38	34	40	30	33	30
LR_1	12.93	13.02	9.86	13.12	10.78	10.94
Wt. C.	21	21	21	21	21	21
Q	983	886	788	787	712	656

Mmax = Maximum Bending Moment in thousands of foot pounds.
Vmax = Maximum Web Shear in thousands of pounds.
Lmin = Minimum Span to develop V max. in feet.
fb = Allowable Unit Stress for Web Buckling in pounds per square inch.
fbt = Value of Web in Buckling per inch of length in pounds.
a_1 min = Minimum End Bearing to develop V in inches.
Rmax = Maximum End Reaction when $a_1 = 3\frac{1}{2}$ inches in thousands of pounds.
R_1 = Maximum Value of one Standard Connection, page 250, in thousands of pounds.
LR_1 = Minimum Span in feet to develop R_1.
Wt. C. = Weight of one Standard Connection including web rivets in pounds.
Q = Coefficient of Strength = 12 S_{1-1}.
To obtain safe uniformly distributed load in thousands of pounds, divide Q by the required span in feet.

BEAM 14″ I LOADS

CARNEGIE BEAM SECTIONS AS BEAMS

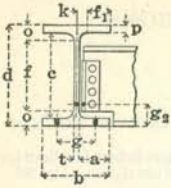
Allowable Uniform Loads in Thousands of Pounds

Applicable only when sections are braced against lateral deflection
For unbraced sections safe loads must be reduced, see page 93

Maximum Bending Stress, **18,000** Pounds per Square Inch

Span in Feet	Nominal Depth and Flange Width—Weight per Foot						Coefficient of Deflection
	CB 145 14″ x 12″			CB 144 14″ x 10″			
	105 lbs.	95 lbs.	85 lbs.	75 lbs.	68 lbs.	61 lbs.	
				161.5	145.2	129.2	
9				152.7	138.4	124.2	1.51
10	184.9	165.1	146.2	137.4	124.5	111.7	1.86
11	177.6	160.6	143.6	124.9	113.2	101.6	2.25
12	162.8	147.2	131.6	114.5	103.8	93.1	2.68
13	150.3	135.9	121.5	105.7	95.8	86.0	3.15
14	139.5	126.2	112.8	98.2	89.0	79.8	3.65
15	130.2	117.8	105.3	91.6	83.0	74.5	4.19
16	122.1	110.4	98.7	85.9	77.8	69.8	4.77
17	114.9	103.9	92.9	80.8	73.3	65.7	5.38
18	108.5	98.1	87.7	76.3	69.2	62.1	6.03
19	102.8	93.0	83.1	72.3	65.5	58.8	6.72
20	97.7	88.3	79.0	68.7	62.3	55.9	7.45
21	93.0	84.1	75.2	65.4	59.3	53.2	8.21
22	88.8	80.3	71.8	62.5	56.6	50.8	9.01
23	84.9	76.8	68.7	59.7	54.1	48.6	9.85
24	81.4	73.6	65.8	57.3	51.9	46.6	10.73
25	78.1	70.7	63.2	55.0	49.8	44.7	11.64
26	75.1	67.9	60.7	52.9	47.9	43.0	12.59
27	72.4	65.4	58.5	50.9	46.1	41.4	13.57
28	69.8	63.1	56.4	49.1	44.5	39.9	14.60

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.



CARNEGIE BEAM SECTIONS AS BEAMS

ESSENTIAL DATA

Maximum Shear, **12,000** Pounds per Square Inch

BEAM I 14″ DATA

Maximum Bending Stress, **18,000** Pounds per Square Inch

Notation	Nominal Depth and Flange Width—Weight per Foot					
	CB 145 14″ x 12″			CB 144 14″ x 10″		
	105 lbs.	**95** lbs.	**85** lbs.	**75** lbs.	**68** lbs.	**61** lbs.
	ELEMENTS					
I_{1-1}	1169.6	1044.0	921.3	823.5	738.8	656.2
S_{1-1}	**162.8**	**147.2**	**131.6**	**114.5**	**103.8**	**93.1**
I_{2-2}	292.6	262.0	232.0	134.5	120.6	107.1
S_{2-2}	48.4	43.5	38.7	26.7	24.0	21.4
	DIMENSIONS AND GAUGES IN INCHES					
d	14⅜	14⅜16	14	14⅜	14¼	14⅛
b	12⅛	12⅛16	12	10⅛16	10⅛16	10
t	9/16	½	7/16	7/16	7/16	⅜
p	1	⅞	13/16	13/16	11/16	⅝
a	5 1 3/16	5 1 3/16	5 1 3/16	4 1 3/16	4 1 3/16	4 1 3/16
c	12⅜	12⅜	12⅜	12¾	12¾	12¾
f	11	11	11	11⅝	11⅝	11⅝
f_1	5⅛	5⅛	5⅛	4¼	4¼	4¼
o	1 1 1/16	1⅛	1½	1⅜	1 5/16	1¼
k	⅞	⅞	⅞	¾	¾	¾
g min.	3½	3½	3½	3¼	3¼	3¼
g usual	5	5	5	5	5	5
g_2	3	3	3	2¾	2¾	2¾

f, f_1, o and k—Provide usual working clearances.

	MAXIMUM BENDING MOMENTS, WEB RESISTANCES, ETC.					
Mmax	244	221	197	172	156	140
Vmax	92	83	73	81	73	65
Lmin	10.57	10.70	10.80	8.51	8.58	8.65
fb	15000	15000	15000	15000	15000	14671
fbt	8040	7275	6525	7020	6375	5604
a_1 min	7.90	7.80	7.70	7.91	7.83	8.01
Rmax	57	51	46	50	45	39
R_1	42	38	34	37	34	30
LR_1	23.26	23.24	23.22	18.57	18.32	18.62
Wt. C.	15	15	15	15	15	15
Q	1954	1766	1579	1374	1246	1117

Mmax = Maximum Bending Moment in thousands of foot pounds.
Vmax = Maximum Web Shear in thousands of pounds.
Lmin = Minimum Span to develop V max. in feet.
fb = Allowable Unit Stress for Web Buckling in pounds per square inch.
fbt = Value of Web in Buckling per inch of length in pounds.
a_1 min = Minimum End Bearing to develop V in inches.
Rmax = Maximum End Reaction when $a_1 = 3\frac{1}{2}$ inches in thousands of pounds.
R_1 = Maximum Value of one Standard Connection, page 250, in thousands of pounds.
LR_1 = Minimum Span in feet to develop R_1.
Wt. C. = Weight of one Standard Connection including web rivets in pounds.
Q = Coefficient of Strength = 12 S_{1-1}.
To obtain safe uniformly distributed load in thousands of pounds, divide Q by the required span in feet.

BEAM 14" I LOADS

CARNEGIE BEAM SECTIONS AS BEAMS

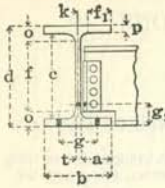
Allowable Uniform Loads in Thousands of Pounds

Applicable only when sections are braced against lateral deflection
For unbraced sections safe loads must be reduced, see page 93

Maximum Bending Stress, **18,000** Pounds per Square Inch

Span in Feet	Nominal Depth and Flange Width—Weight per Foot									Coefficient of Deflection
	CB 143 14" x 8"			CB 142 14" x 6¾"					CB 141 14"x6"	
	58 lbs.	53 lbs.	48 lbs.	42 lbs.	39 lbs.	38 lbs.	36 lbs.	33 lbs.	30 lbs.	
4						126.0				0.30
5						122.6			99.5	0.47
6				116.9	108.1	102.1	99.3	90.7	83.6	0.67
7	141.2	128.1	115.2	103.9	96.4	87.5	89.0	81.7	71.7	0.91
8	128.4	117.4	106.3	90.9	84.4	76.6	77.9	71.5	62.7	1.19
9	114.1	104.3	94.5	80.8	75.0	68.1	69.2	63.5	55.8	1.51
10	102.7	93.9	85.0	72.7	67.5	61.3	62.3	57.2	50.2	1.86
11	93.4	85.4	77.3	66.1	61.4	55.7	56.7	52.0	45.6	2.25
12	85.6	78.2	70.9	60.6	56.3	51.1	51.9	47.6	41.8	2.68
13	79.0	72.2	65.4	55.9	51.9	47.1	47.9	44.0	38.6	3.15
14	73.4	67.1	60.7	51.9	48.2	43.8	44.5	40.8	35.8	3.65
15	68.5	62.6	56.7	48.5	45.0	40.9	41.6	38.1	33.5	4.19
16	64.2	58.7	53.1	45.5	42.2	38.3	39.0	35.7	31.4	4.77
17	60.4	55.2	50.0	42.8	39.7	36.0	36.7	33.6	29.5	5.38
18	57.1	52.2	47.2	40.4	37.5	34.0	34.6	31.8	27.9	6.03
19	54.0	49.4	44.8	38.3	35.5	32.3	32.8	30.1	26.4	6.72
20	51.3	46.9	42.5	36.4	33.8	30.6	31.2	28.6	25.1	7.45
21	48.9	44.7	40.5	34.6	32.1	29.2	29.7	27.2	23.9	8.21
22	46.7	42.7	38.7	33.1	30.7	27.9	28.3	26.0	22.8	9.01
23	44.6	40.8	37.0	31.6	29.4	26.6	27.1	24.9	21.8	9.85
24	42.8	39.1	35.4	30.3	28.1	25.5	26.0	23.8	20.9	10.73
25	41.1	37.6	34.0	29.1	27.0	24.5	24.9	22.9	20.1	11.64
26	39.5	36.1	32.7	28.0	26.0	23.6	24.0	22.0	19.3	12.59
27	38.0	34.8	31.5	26.9	25.0	22.7	23.1	21.2	18.6	13.57
28	36.7	33.5	30.4	26.0	24.1	21.9	22.3	20.4	17.9	14.60

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.



CARNEGIE BEAM SECTIONS AS BEAMS

ESSENTIAL DATA

Maximum Shear, **12,000** Pounds per Square Inch

BEAM I 14″ DATA

Maximum Bending Stress, **18,000** Pounds per Square Inch

Notation	Nominal Depth and Flange Width—Weight per Foot								
	CB 143 14″ x 8″			CB 142 14″ x 6¾″					CB 141 14″ x 6″
	58 lbs.	53 lbs.	48 lbs.	42 lbs.	39 lbs.	38 lbs.	36 lbs.	33 lbs.	30 lbs.
ELEMENTS									
I_{1-1}	609.4	552.5	496.0	431.5	398.3	357.5	365.6	333.4	292.0
S_{1-1}	85.6	78.2	70.9	60.6	56.3	51.1	51.9	47.6	41.8
I_{2-2}	62.8	56.8	50.8	30.2	27.7	24.2	25.4	23.0	15.5
S_{2-2}	15.6	14.1	12.7	8.8	8.2	7.1	7.5	6.8	5.2
DIMENSIONS AND GAUGES IN INCHES									
d	14¼	14⅛	14	14¼	14 3/16	14	14 1/16	14	13 15/16
b	8 1/16	8 1/16	8	6 13/16	6 13/16	6⅞	6¾	6¾	6
t	7/16	⅜	5/16	5/16	5/16	⅜	5/16	¼	¼
p	1 1/16	⅝	⅝	9/16	½	7/16	½	7/16	7/16
a	3⅛	3⅛	3⅛	3¼	3¼	3¼	3¼	3¼	2⅜
c	12¾	12¾	12¾	13 1/16	13 1/16	13 1/16	13 1/16	13 1/16	13 1/16
f	11⅝	11⅝	11⅝	12¼	12¼	12¼	12¼	12¼	12¼
f_1	3¼	3¼	3¼	2 13/16	2 13/16	2 13/16	2 13/16	2 13/16	2 7/16
o	1 5/16	1¼	1 3/16	1	1	⅞	1 5/16	⅞	⅞
k	¾	¾	¾	5/8	½	5/8	½	½	½
g min.	3¼	3¼	3¼	3	3	3	3	3	3
g usual	5	5	5	4	4	4	4	4	3½
g_2	2¾	2¾	2¾	2½	2½	2½	2½	2½	2½
f, f_1, o and k—Provide usual working clearances.									
MAXIMUM BENDING MOMENTS, WEB RESISTANCES, ETC.									
Mmax	128	117	106	91	84	77	78	71	63
Vmax	71	64	58	58	54	63	50	45	45
Lmin	7.28	7.32	7.38	6.22	6.25	4.87	6.27	6.30	5.54
fb	15000	14603	14088	13965	13529	14607	13022	12430	12450
fbt	6195	5520	4832	4776	4302	5478	3828	3356	3362
a_1 min	7.83	8.07	8.43	8.68	9.02	8.00	9.46	10.02	9.97
Rmax	44	39	34	34	30	38	27	23	24
R_1	32	30	27	27	25	30	23	21	21
LR_1	16.05	15.64	15.76	13.47	13.51	10.22	13.54	13.60	11.94
Wt. C.	15	15	15	15	15	15	15	15	15
Q	1027	938	851	727	676	613	623	571	502

Mmax = Maximum Bending Moment in thousands of foot pounds.
Vmax = Maximum Web Shear in thousands of pounds.
Lmin = Minimum Span to develop V max. in feet.
fb = Allowable Unit Stress for Web Buckling in pounds per square inch.
fbt = Value of Web in Buckling per inch of length in pounds.
a_1 min = Minimum End Bearing to develop V in inches.
Rmax = Maximum End Reaction when $a_1 = 3\frac{1}{2}$ inches in thousands of pounds.
R_1 = Maximum Value of one Standard Connection, page 250, in thousands of pounds.
LR_1 = Minimum Span in feet to develop R_1.
Wt. C. = Weight of one Standard Connection including web rivets in pounds.
Q = Coefficient of Strength = $12\ S_{1-1}$.
To obtain safe uniformly distributed load in thousands of pounds, divide Q by the required span in feet.

BEAM
12″ I
LOADS

CARNEGIE BEAM SECTIONS
AS
BEAMS

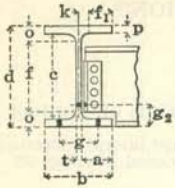
ALLOWABLE UNIFORM LOADS IN THOUSANDS OF POUNDS

Applicable only when sections are braced against lateral deflection
For unbraced sections safe loads must be reduced, see page 93

Maximum Bending Stress, **18,000** Pounds per Square Inch

Span in Feet	Nominal Depth and Flange Width—Weight per Foot							Coefficient of Deflection
	CB 124C 12″ x 12″				CB 124B 12″ x 12″			
	102 lbs.	**95** lbs.	**88** lbs.	**82** lbs.	**76** lbs.	**70** lbs.	**65** lbs.	
	271.6				193.0			
6	240.4	222.0			186.8			0.67
7	206.1	199.0	172.8		160.1	150.6		0.91
8	180.3	174.2	168.0		140.1	134.7		1.19
9	160.3	154.8	149.3	130.5	124.5	119.7	115.2	1.51
10	144.2	139.3	134.4	130.2	112.1	107.8	104.3	1.86
11	131.1	126.7	122.2	118.4	101.9	98.0	94.8	2.25
12	120.2	116.1	112.0	108.5	93.4	89.8	86.9	2.68
13	111.0	107.2	103.4	100.2	86.2	82.9	80.2	3.15
14	103.0	99.5	96.0	93.0	80.1	77.0	74.5	3.65
15	96.2	92.9	89.6	86.8	74.7	71.8	69.5	4.19
16	90.2	87.1	84.0	81.4	70.1	67.4	65.2	4.77
17	84.8	82.0	79.1	76.6	65.9	63.4	61.3	5.38
18	80.1	77.4	74.7	72.3	62.3	59.9	57.9	6.03
19	75.9	73.3	70.7	68.5	59.0	56.7	54.9	6.72
20	72.1	69.7	67.2	65.1	56.0	53.9	52.1	7.45
21	68.7	66.3	64.0	62.0	53.4	51.3	49.7	8.21
22	65.6	63.3	61.1	59.2	50.9	49.0	47.4	9.01
23	62.7	60.6	58.4	56.6	48.7	46.9	45.3	9.85
24	60.1	58.1	56.0	54.3	46.7	44.9	43.5	10.73

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.



CARNEGIE BEAM SECTIONS AS BEAMS

Essential Data

Maximum Shear, **12,000** Pounds per Square Inch

BEAM I 12″ DATA

Maximum Bending Stress, **18,000** Pounds per Square Inch

Notation	Nominal Depth and Flange Width—Weight per Foot						
	CB 124C 12″ x 12″				CB 124B 12″ x 12″		
	102 lbs.	**95** lbs.	**88** lbs.	**82** lbs.	**76** lbs.	**70** lbs.	**65** lbs.
Elements							
$I_{1\text{-}1}$	721.4	696.6	672.0	650.8	560.2	539.0	521.3
$S_{1\text{-}1}$	**120.2**	**116.1**	**112.0**	**108.5**	**93.4**	**89.8**	**86.9**
$I_{2\text{-}2}$	260.6	249.7	239.2	230.5	187.5	180.7	175.2
$S_{2\text{-}2}$	41.7	40.5	39.4	38.4	30.6	29.8	29.2
Dimensions and Gauges in Inches							
d	12	12	12	12	12	12	12
b	12½	12⅝	12⅜	12	12¼	12⅛	12
t	1 5/16	¾	⅝	½	1 1/16	9/16	7/16
p	1 3/16	1 3/16	1 3/16	1 3/16	⅝	⅝	⅝
a	5 13/16	5 13/16	5 13/16	5 13/16	5 13/16	5 13/16	5 13/16
c	10⅜	10⅜	10⅜	10⅜	10¾	10¾	10¾
f	9¼	9¼	9¼	9¼	9⅝	9⅝	9⅝
f_1	5 5/16	5 5/16	5 5/16	5 5/16	5 5/16	5 5/16	5 5/16
o	1⅜	1⅜	1⅜	1⅜	1 3/16	1 3/16	1 3/16
k	1	⅞	⅞	¾	⅞	¾	¾
g min.	3¾	3½	3½	3½	3½	3½	3¼
g usual	5	5	5	5	5	5	5
g_2	2¾	2¾	2¾	2¾	2¾	2¾	2¾
Maximum Bending Moments, Web Resistances, Etc.							
Mmax	180	174	168	163	140	135	130
Vmax	136	111	86	65	96	75	58
Lmin	5.31	6.27	7.78	9.98	5.81	7.15	9.05
fb	15000	15000	15000	15000	15000	15000	15000
fbt	14145	11565	9000	6795	10050	7845	6000
a_1 min	6.60	6.60	6.60	6.60	6.60	6.60	6.60
Rmax	92	75	59	44	65	51	39
R_1	49	49	47	36	49	41	32
LR_1	14.72	14.22	14.30	18.08	11.44	13.14	16.29
Wt. C.	15	15	15	15	15	15	15
Q	1442	1393	1344	1302	1121	1078	1043

f, f_1, o and k—Provide usual working clearances.

Mmax = Maximum Bending Moment in thousands of foot pounds.
Vmax = Maximum Web Shear in thousands of pounds.
Lmin = Minimum Span to develop V max. in feet.
fb = Allowable Unit Stress for Web Buckling in pounds per square inch.
fbt = Value of Web in Buckling per inch of length in pounds.
a_1 min = Minimum End Bearing to develop V in inches.
Rmax = Maximum End Reaction when $a_1 = 3\frac{1}{2}$ inches in thousands of pounds.
R_1 = Maximum Value of one Standard Connection, page 250, in thousands of pounds.
LR_1 = Minimum Span in feet to develop R_1.
Wt. C. = Weight of one Standard Connection including web rivets in pounds.
Q = Coefficient of Strength = 12 $S_{1\text{-}1}$.
To obtain safe uniformly distributed load in thousands of pounds, divide Q by the required span in feet.

BEAM 12" I LOADS

CARNEGIE BEAM SECTIONS AS BEAMS

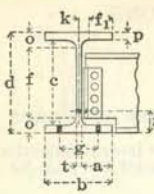
Allowable Uniform Loads in Thousands of Pounds

Applicable only when sections are braced against lateral deflection
For unbraced sections safe loads must be reduced, see page 93

Maximum Bending Stress, **18,000** Pounds per Square Inch

Span in Feet	Nominal Depth and Flange Width—Weight per Foot											Coefficient of Deflection
	CB123B 12"x9"			CB123 12"x8"			CB 122 12" x 6½"				CB 121 12"x6"	
	66 lbs.	60 lbs.	55 lbs.	50 lbs.	45 lbs.	40 lbs.	36 lbs.	34 lbs.	32 lbs.	28 lbs.	25 lbs.	
5								108.2 / 95.1			68.7	0.47
6							90.4	79.2	79.7	69.1	61.4	0.67
7	121.8	119.0	108.0	106.2	94.9	83.5	78.5	67.9	69.7	61.0	52.6	0.91
8	128.7	116.9	107.1	98.0	88.3	78.4	68.7	59.4	61.0	53.4	46.0	1.19
9	114.4	103.9	95.2	87.1	78.5	69.7	61.0	52.8	54.2	47.4	40.9	1.51
10	103.0	93.5	85.7	78.4	70.6	62.7	54.9	47.5	48.8	42.7	36.8	1.86
11	93.6	85.0	77.9	71.3	64.2	57.0	49.9	43.2	44.4	38.8	33.5	2.25
12	85.8	77.9	71.4	65.4	58.8	52.3	45.8	39.6	40.7	35.6	30.7	2.68
13	79.2	71.9	65.9	60.3	54.3	48.3	42.3	36.6	37.5	32.8	28.3	3.15
14	73.5	66.8	61.2	56.0	50.4	44.8	39.2	34.0	34.8	30.5	26.3	3.65
15	68.6	62.3	57.1	52.3	47.1	41.8	36.6	31.7	32.5	28.5	24.6	4.19
16	64.4	58.4	53.6	49.0	44.1	39.2	34.3	29.7	30.5	26.7	23.0	4.77
17	60.6	55.0	50.4	46.1	41.5	36.9	32.3	28.0	28.7	25.1	21.7	5.38
18	57.2	51.9	47.6	43.6	39.2	34.9	30.5	26.4	27.1	23.7	20.5	6.03
19	54.2	49.2	45.1	41.3	37.2	33.0	28.9	25.0	25.7	22.5	19.4	6.72
20	51.5	46.7	42.8	39.2	35.3	31.4	27.5	23.8	24.4	21.3	18.4	7.45
21	49.0	44.5	40.8	37.3	33.6	29.9	26.2	22.6	23.2	20.3	17.5	8.21
22	46.8	42.5	39.0	35.6	32.1	28.5	25.0	21.6	22.2	19.4	16.7	9.01
23	44.8	40.6	37.3	34.1	30.7	27.3	23.9	20.7	21.2	18.6	16.0	9.85
24	42.9	39.0	35.7	32.7	29.4	26.1	22.9	19.8	20.3	17.8	15.3	10.73

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.



CARNEGIE BEAM SECTIONS AS BEAMS

Essential Data

Maximum Shear, **12,000** Pounds per Square Inch

BEAM I 12″ DATA

Maximum Bending Stress, **18,000** Pounds per Square Inch

Notation	Nominal Depth and Flange Width—Weight per Foot										
	CB 123B 12″ x 9″			CB 123 12″ x 8″			CB 122 12″ x 6½″				CB 121 12″ x 6″
	66 lbs.	60 lbs.	55 lbs.	50 lbs.	45 lbs.	40 lbs.	36 lbs.	34 lbs.	32 lbs.	28 lbs.	25 lbs.
Elements											
I_{1-1}	525.7	472.0	428.4	400.5	356.9	313.7	280.1	238.1	246.3	213.4	183.0
S_{1-1}	85.8	77.9	71.4	65.4	58.8	52.3	45.8	39.6	40.7	35.6	30.7
I_{2-2}	99.1	89.0	80.9	57.5	51.2	44.9	25.4	21.0	22.3	19.2	13.8
S_{2-2}	21.8	19.7	18.0	14.2	12.7	11.2	7.7	6.3	6.8	5.9	4.6
Dimensions and Gauges in Inches											
d	12 1/4	12 1/8	12	12 1/4	12 1/8	12	12 1/4	12	12 1/8	12	11 5/16
b	9 1/8	9 1/16	9	8 1/16	8 1/16	8	6 5/16	6 5/16	6 5/16	6 1/2	6
t	1/2	7/16	3/8	3/8	5/16	5/16	5/16	5/16	1/4	1/4	1/4
p	15/16	3/4	11/16	5/8	5/16	1/2	5/16	7/16	1/2	7/16	3/8
a	4 5/16	4 5/16	4 5/16	3 7/8	3 7/8	3 7/8	3 5/16	3 5/16	3 5/16	3 5/16	2 15/16
c	10 5/8	10 5/8	10 5/8	10 15/16	10 15/16	10 15/16	11 1/8	11 1/8	11 1/8	11 1/8	11 1/8
f	9 1/2	9 1/2	9 1/2	9 7/8	9 7/8	9 7/8	10 3/8	10 3/8	10 3/8	10 3/8	10 3/8
f_1	3 3/4	3 3/4	3 3/4	3 5/16	3 5/16	3 5/16	2 3/4	2 3/4	2 3/4	2 3/4	2 1/2
o	1 3/8	1 5/16	1 1/4	1 5/16	1 1/8	1 1/16	15/16	15/16	7/8	7/8	13/16
k	3/4	3/4	3/4	5/8	5/8	5/8	1/2	1/2	1/2	1/2	1/2
g min.	3 1/4	3 1/4	3 1/4	3	3	3	3	3	3	3	3
g usual	5	5	5	5	5	5	4	4	4	4	3 1/2
g_2	2 3/4	2 3/4	2 3/4	2 3/4	2 3/4	2 3/4	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2

f, f_1, o and k—Provide usual working clearances.

	Maximum Bending Moments, Web Resistances, Etc.										
Mmax	129	117	107	98	88	78	69	59	61	53	46
Vmax	66	59	54	53	47	42	45	54	40	35	34
Lmin	7.81	7.86	7.93	7.39	7.43	7.51	6.08	4.39	6.13	6.18	5.36
fb	15000	15000	15000	15000	14625	14004	14251	15000	13575	12706	12753
fbt	6720	6135	5625	5415	4768	4061	4389	5625	3720	3049	3061
a_1 min	6.74	6.66	6.60	6.74	6.92	7.28	7.24	6.61	7.68	8.33	8.24
Rmax	44	40	37	36	31	26	29	36	24	20	20
R_1	35	32	30	28	26	23	24	30	22	19	19
LR_1	14.71	14.61	14.28	14.01	13.57	13.64	11.45	7.92	11.10	11.24	9.69
Wt. C.	15	15	15	15	15	15	15	15	15	15	15
Q	1030	935	857	785	706	628	550	475	488	427	368

Mmax = Maximum Bending Moment in thousands of foot pounds.
Vmax = Maximum Web Shear in thousands of pounds.
Lmin = Minimum Span to develop V max. in feet.
fb = Allowable Unit Stress for Web Buckling in pounds per square inch.
fbt = Value of Web in Buckling per inch of length in pounds.
a_1 min = Minimum End Bearing to develop V in inches.
Rmax = Maximum End Reaction when $a_1 = 3\frac{1}{2}$ inches in thousands of pounds.
R_1 = Maximum Value of one Standard Connection, page 250, in thousands of pounds.
LR_1 = Minimum Span in feet to develop R_1.
Wt. C. = Weight of one Standard Connection including web rivets in pounds.
Q = Coefficient of Strength = 12 S_{1-1}.
To obtain safe uniformly distributed load in thousands of pounds, divide Q by the required span in feet.

BEAM
10″ I
LOADS

CARNEGIE BEAM SECTIONS
AS
BEAMS

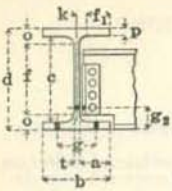
Allowable Uniform Loads in Thousands of Pounds

Applicable only when sections are braced against lateral deflection
For unbraced sections safe loads must be reduced, see page 93

Maximum Bending Stress, **18,000** Pounds per Square Inch

Span in Feet	Nominal Depth and Flange Width—Weight per Foot											Coefficient of Deflection
	CB 103A 10″ x 10″				CB 102 10″x8″			CB 101 10″ x 6″				
	64 lbs.	59 lbs.	54 lbs.	49 lbs.	42 lbs.	36 lbs.	31 lbs.	30 lbs.	26 lbs.	23 lbs.	21 lbs.	
3	189.9				154.6 152.3	112.1						0.17
4	185.4	134.6			114.2	105.4					84.7	0.30
5	148.3	142.3	119.3		91.4	84.3	76.8	73.1	62.8	55.2	52.2	0.47
6	123.6	118.6	113.8		76.1	70.2	65.3	63.8	55.3	48.9	43.5	0.67
7	105.9	101.7	97.5	84.0	65.3	60.2	56.0	54.7	47.4	41.9	37.3	0.91
8	92.7	89.0	85.4	81.6	57.1	52.7	49.0	47.9	41.4	36.7	32.6	1.19
9	82.4	79.1	75.9	72.5	50.8	46.8	43.6	42.6	36.8	32.6	29.0	1.51
10	74.2	71.2	68.3	65.3	45.7	42.1	39.2	38.3	33.2	29.3	26.1	1.86
11	67.4	64.7	62.1	59.3	41.5	38.3	35.6	34.8	30.1	26.7	23.7	2.25
12	61.8	59.3	56.9	54.4	38.1	35.1	32.7	31.9	27.6	24.4	21.7	2.68
13	57.0	54.7	52.5	50.2	35.1	32.4	30.2	29.5	25.5	22.6	20.1	3.15
14	53.0	50.8	48.8	46.6	32.6	30.1	28.0	27.4	23.7	20.9	18.6	3.65
15	49.4	47.4	45.5	43.5	30.5	28.1	26.1	25.5	22.1	19.5	17.4	4.19
16	46.4	44.5	42.7	40.8	28.6	26.3	24.5	23.9	20.7	18.3	16.3	4.77
17	43.6	41.9	40.2	38.4	26.9	24.8	23.1	22.5	19.5	17.2	15.3	5.38
18	41.2	39.5	37.9	36.3	25.4	23.4	21.8	21.3	18.4	16.3	14.5	6.03
19	39.0	37.5	35.9	34.4	24.0	22.2	20.6	20.2	17.5	15.4	13.7	6.72
20	37.1	35.6	34.1	32.6	22.8	21.1	19.6	19.2	16.6	14.7	13.0	7.45

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.



CARNEGIE BEAM SECTIONS AS BEAMS

Essential Data

Maximum Shear, **12,000** Pounds per Square Inch

BEAM I 10″ DATA

Maximum Bending Stress, **18,000** Pounds per Square Inch

Notation	Nominal Depth and Flange Width—Weight per Foot										
	CB 103A 10″ x 10″				CB 102 10″ x 8″			CB 101 10″ x 6″			
	64 lbs.	59 lbs.	54 lbs.	49 lbs.	42 lbs.	36 lbs.	31 lbs.	30 lbs.	26 lbs.	23 lbs.	21 lbs.
Elements											
I_{1-1}	308.8	296.5	284.3	272.0	190.4	175.6	163.4	163.2	139.5	122.2	107.6
S_{1-1}	61.8	59.3	56.9	54.4	38.1	35.1	32.7	31.9	27.6	24.4	21.7
I_{2-2}	106.3	101.7	97.3	93.0	36.8	34.4	32.5	18.5	15.7	13.7	12.0
S_{2-2}	20.4	19.8	19.2	18.6	8.9	8.5	8.1	6.1	5.2	4.6	4.0
Dimensions and Gauges in Inches											
d	10	10	10	10	10	10	10	10¼	10⅛	10	9⅞
b	10 ⅜	10 ⅜	10 ⅜	10	8 ⅛	8 ⅛	8	6 ⅛	6	6	6
t	⅝	⅝	½	⅝	⅝	⅝	⅝	⅝	¼	¼	¼
p	⅝	⅝	⅝	⅝	⅝	⅝	⅝	½	⅝	⅝	⅝
a	4 ⅞	4 ⅞	4 ⅞	4 ⅞	3 ⅞	3 ⅞	3 ⅞	2 ⅝	2 ⅝	2 ⅝	2 ⅝
c	8 ⅜	8 ⅜	8 ⅜	8 ⅜	9 ⅝	9 ⅝	9 ⅝	9 ⅜	9 ⅜	9 ⅜	9 ⅜
f	7 ⅝	7 ⅝	7 ⅝	7 ⅝	8 ⅝	8 ⅝	8 ⅝	8 ⅝	8 ⅝	8 ⅝	8 ⅝
f_1	4 ⅜	4 ⅜	4 ⅜	4 ⅜	3 ½	3 ½	3 ½	2 ⅝	2 ⅝	2 ⅝	2 ⅝
o	1 ⅛	1 ⅛	1 ⅛	1 ⅛	1 ⅛	1 ⅛	1 ⅛	1 ⅛	¾	1 ⅛	⅝
k	⅞	¾	¾	⅝	⅝	½	½	½	⅝	⅝	⅝
g min.	3 ½	3 ½	3 ¼	3 ¼	3	3	3	3	3	3	3
g usual	5	5	5	5	5	5	5	3 ½	3 ½	3 ½	3 ½
g_2	2 ½	2 ½	2 ½	2 ½	2 ½	2 ½	2 ½	2 ½	2 ½	2 ½	2 ½

f, f_1, o and k—Provide usual working clearances.

Maximum Bending Moments, Web Resistances, Etc.

Mmax	93	89	85	82	57	53	49	48	41	37	33
Vmax	95	77	60	42	77	56	38	37	31	28	27
Lmin	3.91	4.60	5.72	7.77	2.96	3.76	5.11	5.23	5.28	5.30	4.76
fb	15000	15000	15000	15000	15000	15000	15000	15000	14362	13688	13752
fbt	11865	9660	7455	5250	9660	7005	4800	4470	3720	3148	3163
a_1 min	5.50	5.50	5.50	5.50	5.50	5.50	5.50	5.63	5.91	6.27	6.17
Rmax	71	58	45	32	58	42	29	27	22	19	19
R_1	65	65	52	37	58	49	34	31	27	24	24
LR_1	5.70	5.47	6.57	8.82	3.94	4.30	5.77	6.17	6.13	6.10	5.43
Wt. C.	15	15	15	15	15	15	15	15	15	15	15
Q	742	712	683	653	457	421	392	383	331	293	260

Mmax = Maximum Bending Moment in thousands of foot pounds.
Vmax = Maximum Web Shear in thousands of pounds.
Lmin = Minimum Span to develop V max. in feet.
fb = Allowable Unit Stress for Web Buckling in pounds per square inch.
fbt = Value of Web in Buckling per inch of length in pounds.
a_1 min = Minimum End Bearing to develop V in inches.
Rmax = Maximum End Reaction when $a_1 = 3\frac{1}{2}$ inches in thousands of pounds.
R_1 = Maximum Value of one Standard Connection, page 250, in thousands of pounds.
LR_1 = Minimum Span in feet to develop R_1.
Wt. C. = Weight of one Standard Connection including web rivets in pounds.
Q = Coefficient of Strength = 12 S_{1-1}.
To obtain safe uniformly distributed load in thousands of pounds, divide Q by the required span in feet.

BEAM
9″
8″ I
LOADS

CARNEGIE BEAM SECTIONS
AS
BEAMS

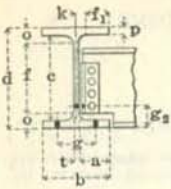
Allowable Uniform Loads in Thousands of Pounds

Applicable only when sections are braced against lateral deflection
For unbraced sections safe loads must be reduced, see page 93

Maximum Bending Stress, 18,000 Pounds per Square Inch

Span in Feet	Nominal Depth and Flange Width—Weight per Foot												Coefficient of Deflection
	CB 93 9″x9″			CB 92 9″x6½″			CB 83 8″x8″			CB 82 8″x6½″			
	48 lbs.	43 lbs.	38 lbs.	35 lbs.	32 lbs.	29 lbs.	42 lbs.	36 lbs.	31 lbs.	30 lbs.	27 lbs.	24 lbs.	
										58.6	52.1	45.9	
				73.9	67.0	60.3	78.2	66.1	56.1				
6	88.3	78.2	68.3	67.6	61.8	56.0	74.8	64.1	55.0	52.6	47.3	42.1	0.67
7	82.0	73.5	64.9	58.0	53.0	48.0	64.1	54.9	47.2	45.1	40.6	36.1	0.91
8	71.8	64.3	56.8	50.7	46.4	42.0	56.1	48.0	41.3	39.5	35.5	31.6	1.19
9	63.8	57.2	50.5	45.1	41.2	37.3	49.8	42.7	36.7	35.1	31.6	28.1	1.51
10	57.4	51.4	45.4	40.6	37.1	33.6	44.9	38.4	33.0	31.6	28.4	25.3	1.86
11	52.2	46.8	41.3	36.9	33.7	30.5	40.8	34.9	30.0	28.7	25.8	23.0	2.25
12	47.8	42.9	37.9	33.8	30.9	28.0	37.4	32.0	27.5	26.3	23.7	21.1	2.68
13	44.2	39.6	35.0	31.2	28.5	25.8	34.5	29.6	25.4	24.3	21.9	19.4	3.15
14	41.0	36.7	32.5	29.0	26.5	24.0	32.0	27.5	23.6	22.6	20.3	18.1	3.65
15	38.3	34.3	30.3	27.1	24.7	22.4	29.9	25.6	22.0	21.1	18.9	16.9	4.19
16	35.9	32.2	28.4	25.4	23.2	21.0	28.0	24.0	20.6	19.7	17.8	15.8	4.77
17	33.8	30.3	26.7	23.9	21.8	19.8	26.4	22.6	19.4	18.6	16.7	14.9	5.38
18	31.9	28.6	25.2	22.5	20.6	18.7	24.9						6.03
19	30.2	27.1	23.9	21.4	19.5	17.7							6.72

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.



CARNEGIE BEAM SECTIONS AS BEAMS

Essential Data

Maximum Shear, **12,000** Pounds per Square Inch

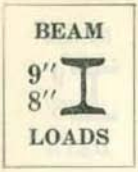
BEAM I 9″ 8″ DATA

Maximum Bending Stress, **18,000** Pounds per Square Inch

Notation	Nominal Depth and Flange Width—Weight per Foot											
	CB 93 9″ x 9″			CB 92 9″ x 6½″			CB 83 8″ x 8″			CB 82 8″ x 6½″		
	48 lbs.	43 lbs.	38 lbs.	35 lbs.	32 lbs.	29 lbs.	42 lbs.	36 lbs.	31 lbs.	30 lbs.	27 lbs.	24 lbs.
Elements												
I_{1-1}	221.1	195.5	170.4	155.4	140.5	126.0	156.2	131.3	110.9	107.8	95.9	84.3
S_{1-1}	47.8	42.9	37.9	33.8	30.9	28.0	37.4	32.0	27.5	26.3	23.7	21.1
I_{2-2}	73.8	65.4	57.1	26.6	24.0	21.5	51.4	43.4	36.7	23.4	20.8	18.3
S_{2-2}	16.3	14.5	12.7	8.1	7.4	6.6	12.7	10.8	9.2	7.1	6.4	5.6
Dimensions and Gauges in Inches												
d	9 1/4	9 1/4	9	9 3/8	9 1/4	9	8 3/4	8 1/8	8 1/8	8 1/8	8 1/8	8
b	9 1/8	9 1/8	9	6 3/8	6 1/2	6 1/2	8 1/8	8 1/8	8	6 3/8	6 1/2	6 1/2
t	3/8	3/8	5/16	3/8	5/16	1/4	3/8	5/16	1/4	5/16	1/4	1/4
p	3/16	1/2	1/2	3/16	1/2	1/2	3/16	1/2	1/2	1/2	3/16	3/16
a	4 3/8	4 3/8	4 3/8	3 1/8	3 1/8	3 1/8	3 7/8	3 7/8	3 7/8	3 3/8	3 3/8	3 3/8
e	8	8	8	8	8	8	7 5/8	7 5/8	7 5/8	7 5/8	7 5/8	7 5/8
f	7	7	7	7	7	7	6 1/4	6 1/4	6 1/4	6 1/4	6 1/4	6 1/4
f_1	3 5/16	3 5/16	3 5/16	2 3/8	2 5/8	2 5/8	3 3/4	3 3/8	3 3/8	2 5/8	2 5/8	2 5/8
o	1 1/8	1 1/8	1	1 1/8	1 1/8	1	1 1/8	1	1	1	15/16	15/16
k	3/4	5/8	5/8	5/8	5/8	5/8	5/8	5/8	5/8	5/8	5/8	5/8
g min.	3	3	3	3	3	3	3	3	3	3	3	3
g usual	5	5	5	4	4	4	5	5	5	4	4	4
g_2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2
Maximum Bending Moments, Web Resistances, Etc.												
Mmax	72	64	57	51	46	42	56	48	41	39	36	32
Vmax	44	39	34	37	34	30	39	33	28	29	26	23
Lmin	6.50	6.59	6.66	5.49	5.53	5.58	5.74	5.81	5.88	5.38	5.46	5.52
fb	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000
fbt	5970	5355	4740	5025	4605	4185	5850	5040	4350	4470	4020	3585
a_1 min	5.08	5.02	4.95	5.06	5.00	4.95	4.60	4.51	4.43	4.51	4.45	4.40
Rmax	35	31	27	29	27	24	33	28	24	25	22	20
R_1	42	37	33	35	33	29	41	36	30	32	28	25
LR_1	6.83	6.96	6.89	5.79	5.62	5.79	5.47	5.33	5.50	4.93	5.08	5.06
Wt. C.	15	15	15	15	15	15	15	15	15	15	15	15
Q	574	515	455	406	371	336	449	384	330	316	284	253

f, f_1, o and k—Provide usual working clearances.

Mmax = Maximum Bending Moment in thousands of foot pounds.
Vmax = Maximum Web Shear in thousands of pounds.
Lmin = Minimum Span to develop V max. in feet.
fb = Allowable Unit Stress for Web Buckling in pounds per square inch.
fbt = Value of Web in Buckling per inch of length in pounds.
a_1 min = Minimum End Bearing to develop V in inches.
Rmax = Maximum End Reaction when $a_1 = 3\frac{1}{2}$ inches in thousands of pounds.
R_1 = Maximum Value of one Standard Connection, page 250, in thousands of pounds.
LR_1 = Minimum Span in feet to develop R_1.
Wt. C. = Weight of one Standard Connection including web rivets in pounds.
Q = Coefficient of Strength = $12\ S_{1-1}$.
To obtain safe uniformly distributed load in thousands of pounds, divide Q by the required span in feet.



STANDARD MILL SECTIONS AS BEAMS

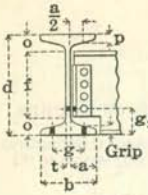
Allowable Uniform Loads in Thousands of Pounds

Applicable only when sections are braced against lateral deflection
For unbraced sections safe loads must be reduced, see page 93

Maximum Bending Stress, **18,000** Pounds per Square Inch

Span in Feet	Nominal Depth and Flange Width—Weight per Foot				Coefficient of Deflection
	B 40 9″ x 5¼″		B 39 8″ x 5″		
	25 lbs.	20.5 lbs.	21 lbs.	17.5 lbs.	
			60.1		
3	82.1		63.4	44.4	0.17
4	63.7	50.5	47.6	42.9	0.30
5	50.9	46.1	38.1	34.3	0.47
6	42.4	38.4	31.7	28.6	0.67
7	36.4	32.9	27.2	24.5	0.91
8	31.8	28.8	23.8	21.5	1.19
9	28.3	25.6	21.1	19.1	1.51
10	25.5	23.0	19.0	17.2	1.86
11	23.1	20.9	17.3	15.6	2.25
12	21.2	19.2	15.9	14.3	2.68
13	19.6	17.7	14.6	13.2	3.15
14	18.2	16.5	13.6	12.3	3.65
15	17.0	15.4	12.7	11.4	4.19
16	15.9	14.4	11.9	10.7	4.77
17	15.0	13.6	11.2	10.1	5.38
18	14.1	12.8			6.03
19	13.4	12.1			6.72

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.



STANDARD MILL SECTIONS AS BEAMS

ESSENTIAL DATA

Maximum Shear, **12,000** Pounds per Square Inch

BEAM I 9″ 8″ DATA

Maximum Bending Stress, **18,000** Pounds per Square Inch

Notation	Depth and Weight of Sections			
	B 40 9″ x 5¼″		B 39 8″ x 5″	
	25 lbs.	20.5 lbs.	21 lbs.	17.5 lbs.
ELEMENTS				
I_{1-1}	95.5	86.6	63.4	57.4
S_{1-1}	**21.2**	**19.2**	**15.9**	**14.5**
I_{2-2}	8.8	8.0	6.6	6.0
S_{2-2}	3.3	3.1	2.6	2.4
DIMENSIONS AND GAUGES IN INCHES				
d	9	9	8	8
b	5⅜	5¼	5⅛	5
t	⅝	¼	⅜	¼
p	⅜	⅜	5/16	5/16
a	2½	2½	2⅜	2⅜
Grip	⅜	⅜	5/16	5/16
f	7½	7½	6⅝	6⅝
o	¾	¾	1 1/16	1 1/16
g usual	3	3	3	3
g_2	2¼	2¼	2¼	2¼

f and o—Provide usual working clearances.

MAXIMUM BENDING MOMENTS, WEB RESISTANCES, ETC.				
Mmax	32	29	24	21
Vmax	41	25	35	22
Lmin	3.10	4.56	2.76	3.87
fb	15000	14440	15000	15000
fbt	5700	3379	5400	3465
a_1 min	4.95	5.23	4.40	4.40
Rmax	33	19	30	19
R_1	40	25	38	24
LR_1	3.18	4.61	2.51	3.63
Wt. C.	15	15	15	15
Q	254	230	191	174

Mmax = Maximum Bending Moment in thousands of foot pounds.
Vmax = Maximum Web Shear in thousands of pounds.
Lmin = Minimum Span to develop V max. in feet.
fb = Allowable Unit Stress for Web Buckling in pounds per square inch.
fbt = Value of Web in Buckling per inch of length in pounds.
a_1 min = Minimum End Bearing to develop V in inches.
Rmax = Maximum End Reaction when $a_1 = 3\frac{1}{2}$ inches in thousands of pounds.
R_1 = Maximum Value of one Standard Connection, page 250, in thousands of pounds.
LR_1 = Minimum Span in feet to develop R_1.
Wt. C. = Weight of one Standard Connection including web rivets in pounds.
Q = Coefficient of Strength = 12 S_{1-1}.
To obtain safe uniformly distributed load in thousands of pounds, divide Q by the required span in feet.

H-BEAM 8″ to 4″ LOADS

H-BEAMS AS BEAMS

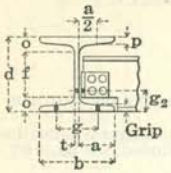
Allowable Uniform Loads in Thousands of Pounds

Applicable only when sections are braced against lateral deflection
For unbraced sections safe loads must be reduced, see page 93

Maximum Bending Stress, **18,000** Pounds per Square Inch

Span in Feet	Nominal Depth and Flange Width—Weight per Foot									Coefficient of Deflection
	H 4 8″ x 8″			H 3 A 6″ x 6″		H 3 6″ x 6″		H 2 5″x5″	H 1 4″x4″	
	37.7 lbs.	34.3 lbs.	32.6 lbs.	27.5 lbs.	25 lbs.	22.5 lbs.	20 lbs.	18.9 lbs.	13.8 lbs.	
									30.0	
3	96.0			63.1		54.0		37.6	21.2	0.17
4	90.6	72.0		49.3	45.1	41.0	36.0	28.5	15.9	0.30
5	72.5	69.4	60.1	39.4	37.6	32.8	31.0	22.8	12.7	0.47
6	60.4	57.8	56.4	32.9	31.4	27.4	25.9	19.0	10.6	0.67
7	51.8	49.5	48.3	28.2	26.9	23.4	22.2	16.3	9.1	0.91
8	45.3	43.4	42.3	24.6	23.5	20.5	19.4	14.3	8.0	1.19
9	40.3	38.5	37.6	21.9	20.9	18.2	17.2	12.7	7.1	1.51
10	36.2	34.7	33.8	19.7	18.8	16.4	15.5	11.4	6.4	1.86
11	32.9	31.5	30.8	17.9	17.1	14.9	14.1	10.4		2.25
12	30.2	28.9	28.2	16.4	15.7	13.7	12.9			2.68
13	27.9	26.7	26.0	15.2	14.5	12.6	11.9			3.15
14	25.9	24.8	24.2							3.65
15	24.2	23.1	22.6							4.19
16	22.7	21.7	21.2							4.77
17	21.3	20.4	19.9							5.38

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.



H-BEAMS AS BEAMS

Essential Data

Maximum Shear, **12,000** Pounds per Square Inch

H-BEAM I **8″ to 4″ DATA**

Maximum Bending Stress, **18,000** Pounds per Square Inch

Notation	Depth and Weight of Sections								
	H 4 8″ x 8″			H 3A 6″ x 6″		H 3 6″ x 6″		H 2 5″x5″	H 1 4″x4″
	37.7 lbs.	34.3 lbs.	32.6 lbs.	27.5 lbs.	25 lbs.	22.5 lbs.	20 lbs.	18.9 lbs.	13.8 lbs.
Elements									
$I_{1\text{-}1}$	120.8	115.5	112.8	49.3	47.0	41.0	38.8	23.8	10.7
$S_{1\text{-}1}$	**30.2**	**28.9**	**28.2**	**16.4**	**15.7**	**13.7**	**12.9**	**9.5**	**5.3**
$I_{2\text{-}2}$	36.9	35.1	34.2	16.0	14.9	12.2	11.4	7.8	3.6
$S_{2\text{-}2}$	9.1	8.8	8.6	5.3	5.0	4.0	3.8	3.1	1.8
Dimensions and Gauges in Inches									
d	8	8	8	6	6	6	6	5	4
b	8⅛	8	7 15/16	6 1/16	5 15/16	6 1/16	5 15/16	5	4
t	½	⅜	5/16	7/16	5/16	⅜	¼	5/16	5/16
p	7/16	7/16	7/16	½	½	⅜	⅜	7/16	⅜
a	3 13/16	3 13/16	3 13/16	2 13/16	2 13/16	2⅞	2⅞	2⅜	1⅞
Grip	7/16	7/16	7/16	½	½	⅜	⅜	7/16	⅜
f	6¼	6¼	6¼	4¼	4¼	4⅜	4⅜	3⅜	2½
o	⅞	⅞	⅞	⅞	⅞	1 3/16	1 3/16	1 3/16	¾
g usual	5	5	5	3½	3½	3½	3½	2¾	2¼

f and o—Provide usual working clearances.

Maximum Bending Moments, Web Resistances, Etc.

Mmax	45	43	42	25	24	21	19	14	8
Vmax	48	36	30	32	23	27	18	19	15
Lmin	3.78	4.82	5.63	3.12	4.18	3.04	4.30	3.04	2.12
fb	15000	15000	15000	15000	15000	15000	15000	15000	15000
fbt	7500	5625	4563	6570	4695	5625	3712	4695	4695
a_1 min	4.40	4.40	4.40	3.30	3.30	3.30	3.30	2.75	2.20
Rmax	41	31	26	33	23	28	19	22	21
R_1	53	39	33	23	16	20	13	16	
LR_1	3.42	4.45	5.13	4.28	5.89	4.11	5.95	3.56	
Wt. C.	15	15	15	8	8	8	8	8	
Q	362	347	338	197	188	164	155	114	64

Mmax = Maximum Bending Moment in thousands of foot pounds.
Vmax = Maximum Web Shear in thousands of pounds.
Lmin = Minimum Span to develop V max. in feet.
fb = Allowable Unit Stress for Web Buckling in pounds per square inch.
fbt = Value of Web in Buckling per inch of length in pounds.
a_1 min = Minimum End Bearing to develop V in inches.
Rmax = Maximum End Reaction when $a_1 = 3\frac{1}{2}$ inches in thousands of pounds.
R_1 = Maximum Value of one Standard Connection, page 250, in thousands of pounds.
LR_1 = Minimum Span in feet to develop R_1.
Wt. C. = Weight of one Standard Connection including web rivets in pounds.
Q = Coefficient of Strength = $12\ S_{1\text{-}1}$.
To obtain safe uniformly distributed load in thousands of pounds, divide Q by the required span in feet.

AMERICAN STANDARD BEAMS
AS
BEAMS

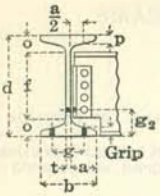
ALLOWABLE UNIFORM LOAD IN THOUSANDS OF POUNDS

Applicable only when sections are braced against lateral deflection
For unbraced sections safe loads must be reduced, see page 93

Maximum Bending Stress, **18,000** Pounds per Square Inch

Span in Feet	Depth and Weight of Sections									Coefficient of Deflection
	B 18 24" x 7⅜"				B 1 24" x 7"					
	120 lbs.	115 lbs.	110 lbs.	105.9 lbs.	100 lbs.	95 lbs.	90 lbs.	85 lbs.	79.9 lbs.	
6	495.6	424.5			430.3	395.1				
					395.3	383.6	359.4	324.3		0.67
7	430.1	420.1	388.8	360.0	338.8	328.8	318.6	308.6	288.0	0.91
8	376.4	367.6	358.6	351.4	296.5	287.7	278.8	270.0	260.9	1.19
9	334.5	326.7	318.8	312.4	263.5	255.7	247.8	240.0	231.9	1.51
10	301.1	294.1	286.9	281.2	237.2	230.2	223.0	216.0	208.7	1.86
11	273.7	267.3	260.8	255.6	215.6	209.2	202.7	196.4	189.7	2.25
12	250.9	245.0	239.1	234.3	197.7	191.8	185.8	180.0	173.9	2.68
13	231.6	226.2	220.7	216.3	182.4	177.0	171.5	166.1	160.6	3.15
14	215.1	210.0	204.9	200.8	169.4	164.4	159.3	154.3	149.1	3.65
15	200.7	196.0	191.3	187.4	158.1	153.4	148.7	144.0	139.1	4.19
16	188.2	183.8	179.3	175.7	148.2	143.8	139.4	135.0	130.5	4.77
17	177.1	173.0	168.8	165.4	139.5	135.4	131.2	127.0	122.8	5.38
18	167.3	163.4	159.4	156.2	131.8	127.9	123.9	120.0	116.0	6.03
19	158.5	154.8	151.0	148.0	124.8	121.1	117.4	113.7	109.9	6.72
20	150.5	147.0	143.5	140.6	118.6	115.1	111.5	108.0	104.4	7.45
21	143.4	140.0	136.6	133.9	112.9	109.6	106.2	102.8	99.4	8.21
22	136.9	133.7	130.4	127.8	107.8	104.6	101.4	98.2	94.9	9.01
23	130.9	127.8	124.7	122.2	103.1	100.1	97.0	93.9	90.7	9.85
24	125.5	122.5	119.5	117.1	98.8	95.9	92.9	90.0	87.0	10.73
25	120.4	117.6	114.8	112.5	94.9	92.1	89.2	86.4	83.5	11.64
26	115.8	113.1	110.4	108.1	91.2	88.5	85.8	83.1	80.3	12.59
27	111.5	108.9	106.3	104.1	87.8	85.2	82.6	80.0	77.3	13.57
28	107.5	105.0	102.5	100.4	84.7	82.2	79.6	77.1	74.5	14.60
29	103.8	101.4	98.9	96.9	81.8	79.4	76.9	74.5	72.0	15.66
30	100.4	98.0	95.6	93.7	79.1	76.7	74.3	72.0	69.6	16.76
31	97.1	94.9	92.6	90.7	76.5	74.2	71.9	69.7	67.3	17.89
32	94.1	91.9	89.7	87.9	74.1	71.9	69.7	67.5	65.2	19.07
33	91.2	89.1	86.9	85.2	71.9	69.7	67.6	65.4	63.3	20.28
34	88.6	86.5	84.4	82.7	69.8	67.7	65.6	63.5	61.4	21.53
35	86.0	84.0	82.0	80.3	67.8	65.8	63.7	61.7	59.6	22.81
36	83.6	81.7	79.7	78.1	65.9	63.9	61.9	60.0	58.0	24.13
37	81.4	79.5	77.5	76.0	64.1	62.2	60.3	58.4	56.4	25.49
38	79.2	77.4	75.5	74.0	62.4	60.6	58.7	56.8	54.9	26.89
39	77.2	75.4	73.6	72.1	60.8	59.0	57.2	55.4	53.5	28.32
40	75.3	73.5	71.7	70.3	59.3	57.5	55.8	54.0	52.2	29.79
42	71.7	70.0	68.3	66.9	56.5	54.8	53.1	51.4	49.7	32.85
44	68.4	66.8	65.2	63.9	53.9	52.3	50.7	49.1	47.4	36.05
46	65.5	63.9	62.4	61.1	51.6	50.0	48.5	47.0	45.4	39.40
48	62.7	61.3	59.8	58.6	49.4	47.9	46.5	45.0	43.5	42.90

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.



AMERICAN STANDARD BEAMS AS BEAMS

ESSENTIAL DATA

Maximum Shear, **12,000** Pounds per Square Inch

BEAM I 24" DATA

Maximum Bending Stress, **18,000** Pounds per Square Inch

Notation	Depth and Flange Width—Weight per Foot								
	B 18 24" x 7⅞"				B I 24" x 7"				
	120 lbs.	**115** lbs.	**110** lbs.	**105.9** lbs.	**100** lbs.	**95** lbs.	**90** lbs.	**85** lbs.	**79.9** lbs.
ELEMENTS									
I_{1-1}	3010.8	2940.5	2869.1	2811.5	2371.8	2301.5	2230.1	2159.8	2087.2
S_{1-1}	**250.9**	**245.0**	**239.1**	**234.3**	**197.6**	**191.8**	**185.8**	**180.0**	**173.9**
I_{2-2}	84.9	82.8	80.6	78.9	48.4	47.0	45.5	44.2	42.9
S_{2-2}	21.1	20.7	20.3	20.0	13.4	13.0	12.8	12.5	12.2
DIMENSIONS AND GAUGES IN INCHES									
d	24	24	24	24	24	24	24	24	24
b	8 1/16	8	7 15/16	7⅞	7¼	7 3/16	7⅛	7 1/16	7
t	1 3/16	¾	1 1/16	⅝	¾	1 1/16	⅝	9/16	½
p	1⅛	1⅛	1⅛	1⅛	⅞	⅞	⅞	⅞	⅞
a	3⅝	3⅝	3⅝	3⅝	3¼	3¼	3¼	3¼	3¼
Grip	1½	1½	1½	1½	⅞	⅞	⅞	⅞	⅞
f	20¼	20¼	20¼	20¼	20¾	20¾	20¾	20¾	20¾
o	1⅞	1⅞	1⅞	1⅞	1⅝	1⅝	1⅝	1⅝	1⅝
g usual	5	5	5	5	4	4	4	4	4
g_2	3¼	3¼	3¼	3¼	3	3	3	3	3

f and o—Provide usual working clearances.

MAXIMUM BENDING MOMENTS, WEB RESISTANCES, ETC.

Mmax	376	368	359	351	296	288	279	270	261
Vmax	230	212	194	180	215	198	180	162	144
Lmin	6.55	6.93	7.38	7.81	5.51	5.82	6.20	6.66	7.25
fb	15000	15000	14867	14449	15000	14950	14439	13815	13006
fbt	11970	11055	10035	9031	11205	10256	9010	7778	6503
a_1 min	13.20	13.20	13.37	13.93	13.20	13.26	13.95	14.85	16.14
Rmax	114	105	95	86	106	97	86	74	62
R_1	97	97	97	97	97	97	97	88	79
LR_1	15.52	15.15	14.79	14.49	12.22	11.86	11.49	12.27	13.21
Wt.C.	36	36	36	36	36	36	36	36	36
Q	3011	2940	2869	2812	2371	2302	2230	2160	2087

Mmax = Maximum Bending Moment in thousands of foot pounds.
Vmax = Maximum Web Shear in thousands of pounds.
Lmin = Minimum Span to develop V max. in feet.
fb = Allowable Unit Stress for Web Buckling in pounds per square inch.
fbt = Value of Web in Buckling per inch of length in pounds.
a_1 min = Minimum End Bearing to develop V in inches.
Rmax = Maximum End Reaction when a_1 = 3½ inches in thousands of pounds.
R_1 = Maximum Value of one Standard Connection, page 250, in thousands of pounds.
LR_1 = Minimum Span in feet to develop R_1.
Wt.C. = Weight of one Standard Connection including web rivets in pounds.
Q = Coefficient of Strength = 12 S_{1-1}.
To obtain safe uniformly distributed load in thousands of pounds, divide Q by the required span in feet.

BEAM 20″ I LOADS

AMERICAN STANDARD BEAMS AS BEAMS

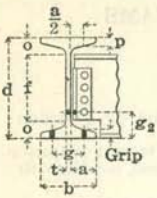
Allowable Uniform Load in Thousands of Pounds

Applicable only when sections are braced against lateral deflection
For unbraced sections safe loads must be reduced, see page 93

Maximum Bending Stress, **18,000** Pounds per Square Inch

Span in Feet	Depth and Weight of Sections								Coefficient of Deflection
	B 2 20″ x 7″					B 3 20″ x 6¼″			
	100 lbs.	95 lbs.	90 lbs.	85 lbs.	81.4 lbs.	75 lbs.	70 lbs.	65.4 lbs.	
	419.0	384.0				307.7			
5	395.6	383.9	348.3	313.4		303.2	272.3	240.0	0.47
6	329.7	319.9	310.1	300.3	288.0	252.7	242.8	233.9	0.67
7	282.6	274.2	265.8	257.4	251.4	216.6	208.1	200.5	0.91
8	247.2	239.9	232.5	225.2	219.9	189.5	182.1	175.4	1.19
9	219.8	213.3	206.7	200.2	195.5	168.5	161.9	155.9	1.51
10	197.8	192.0	186.0	180.2	176.0	151.6	145.7	140.3	1.86
11	179.8	174.5	169.1	163.8	160.0	137.8	132.5	127.6	2.25
12	164.8	160.0	155.0	150.2	146.6	126.3	121.4	116.9	2.68
13	152.2	147.7	143.1	138.6	135.3	116 6	112.1	108.0	3.15
14	141.3	137.1	132.9	128.7	125.7	108.3	104.1	100.2	3.65
15	131.9	128.0	124.0	120.1	117.3	101.1	97.1	93.6	4.19
16	123.6	120.0	116.3	112.6	110 0	94.8	91.1	87.7	4.77
17	116.4	112.9	109.4	106.0	103.5	89 2	85.7	82.6	5.38
18	109.9	106.6	103.4	100.1	97.8	84.2	80.9	78.0	6.03
19	104.1	101.0	97.9	94.8	92.6	79.8	76.7	73.9	6.72
20	98.9	96.0	93.0	90.1	88.0	75 8	72.8	70.2	7.45
21	94.2	91.4	88.6	85.8	83.8	72.2	69.4	66.8	8.21
22	89.9	87.2	84.6	81.9	80.0	68.9	66.2	63.8	9.01
23	86.0	83.5	80.9	78.3	76.5	65.9	63.3	61.0	9.85
24	82.4	80.0	77.5	75.1	73.3	63.2	60.7	58.5	10.73
25	79.1	76.8	74.4	72.1	70.4	60.6	58.3	56.1	11.64
26	76.1	73.8	71.6	69.3	67.7	58.3	56.0	54.0	12.59
27	73.3	71.1	68.9	66.7	65.2	56.2	54 0	52.0	13.57
28	70.6	68.6	66.4	64.4	62.8	54.2	52.0	50.1	14.60
29	68.2	66.2	64.2	62.1	60.7	52.3	50.2	48.4	15.66
30	65.9	64.0	62.0	60.1	58.7	50.5	48.6	46.8	16.76
31	63.8	61.9	60.0	58.1	56.8	48.9	47.0	45.3	17.89
32	61.8	60.0	58.1	56.3	55.0	47.4	45.5	43.9	19.07
33	59.9	58.2	56.4	54.6	53.3	45.9	44.2	42.5	20.28
34	58.2	56.5	54.7	53.0	51.8	44.6	42.9	41.3	21.53
35	56.5	54.8	53.2	51.5	50.3	43.3	41.6	40.1	22.81
36	54.9	53.3	51.7	50.1	48.9	42.1	40.5	39.0	24.13
37	53.5	51.9	50.3	48.7	47.6	41.0	39.4	37.9	25.49
38	52.1	50.5	49.0	47.4	46.3	39.9	38.3	36.9	26.89
39	50.7	49.2	47.7	46.2	45.1	38.9	37.4	36.0	28.32
40	49.4	48.0	46.5	45.0	44.0	37.9	36.4	35.1	29.79

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.



AMERICAN STANDARD BEAMS AS BEAMS

ESSENTIAL DATA

Maximum Shear, **12,000** Pounds per Square Inch

BEAM I 20″ DATA

Maximum Bending Stress, **18,000** Pounds per Square Inch

Notation	Depth and Flange Width—Weight per Foot							
	B 2 20″ x 7″					B 3 20″ x 6¼″		
	100 lbs.	95 lbs.	90 lbs.	85 lbs.	81.4 lbs.	75 lbs.	70 lbs.	65.4 lbs.
ELEMENTS								
I_{1-1}	1648.3	1599.7	1550.3	1501.7	1466.3	1263.5	1214.2	1169.5
S_{1-1}	**164.8**	**160.0**	**155.0**	**150.2**	**146.6**	**126.3**	**121.4**	**116.9**
I_{2-2}	52.4	50.5	48.7	47.0	45.8	30.1	28.9	27.9
S_{2-2}	14.4	14.0	13.7	13.3	13.1	9.4	9.2	8.9
DIMENSIONS AND GAUGES IN INCHES								
d	20	20	20	20	20	20	20	20
b	7¼	7 3/16	7⅛	7 1/16	7	6⅜	6 5/16	6¼
t	⅞	13/16	¾	5/8	⅝	⅝	9/16	½
p	1 5/16	1 5/16	1 5/16	1 5/16	1 5/16	1 5/16	1 5/16	1 5/16
a	3 3/16	3 3/16	3 3/16	3 3/16	3 3/16	2⅞	2⅞	2⅞
Grip	1	1	1	1	1	¾	¾	¾
f	16½	16½	16½	16½	16½	17	17	17
o	1¾	1¾	1¾	1¾	1¾	1½	1½	1½
g min.	2¾	2¾	2¾	2½	2½	2½	2⅜	2⅜
g usual	4	4	4	4	4	4	4	4
g_2	3¼	3¼	3¼	3¼	3¼	3	3	3

f and o—Provide usual working clearances.

	MAXIMUM BENDING MOMENTS, WEB RESISTANCES, ETC.							
Mmax	247	240	233	225	220	190	182	175
Vmax	210	192	174	157	144	154	136	120
Lmin	4.72	5.00	5.34	5.75	6.11	4.93	5.35	5.85
fb	15000	15000	15000	15000	15000	15000	14908	14210
fbt	13095	12000	10890	9795	9000	9615	8453	7105
a_1 min	11.00	11.00	11.00	11.00	11.00	11.00	11.10	11.89
Rmax	111	102	93	83	77	82	72	60
R_1	81	81	81	81	79	81	74	66
LR_1	12.21	11.85	11.48	11.13	11.13	9.36	9.84	10.63
Wt.C.	30	30	30	30	30	30	30	30
Q	1978	1920	1860	1802	1759	1516	1457	1403

Mmax = Maximum Bending Moment in thousands of foot pounds.
Vmax = Maximum Web Shear in thousands of pounds.
Lmin = Minimum Span to develop V max. in feet.
fb = Allowable Unit Stress for Web Buckling in pounds per square inch.
fbt = Value of Web in Buckling per inch of length in pounds.
a_1 min = Minimum End Bearing to develop V in inches.
Rmax = Maximum End Reaction when $a_1 = 3\frac{1}{2}$ inches in thousands of pounds.
R_1 = Maximum Value of one Standard Connection, page 250, in thousands of pounds.
LR_1 = Minimum Span in feet to develop R_1.
Wt.C. = Weight of one Standard Connection including web rivets in pounds.
Q = Coefficient of Strength = $12\ S_{1-1}$.
To obtain safe uniformly distributed load in thousands of pounds, divide Q by the required span in feet.

BEAM 18" I LOADS

AMERICAN STANDARD BEAMS AS BEAMS

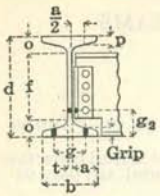
Allowable Uniform Load in Thousands of Pounds

Applicable only when sections are braced against lateral deflection
For unbraced sections safe loads must be reduced, see page 93

Maximum Bending Stress, **18,000** Pounds per Square Inch

Span in Feet	Depth and Weight of Sections								Coefficient of Deflection
	B 19 18" x 7"				B 4 18" x 6"				
	90 lbs.	85 lbs.	80 lbs.	75.6 lbs.	70 lbs.	65 lbs.	60 lbs.	54.7 lbs.	
4	343.9				307.2 305.8	271.7	236.3		0.30
5	335.1				244.7	234.0	223.4		0.47
		308.4	273.0					198.7	
6	279.2	270.4	261.5	241.9	203.9	195.0	186.2	176.8	0.67
7	239.3	231.7	224.1	217.5	174.8	167.2	159.6	151.5	0.91
8	209.4	202.8	196.1	190.3	152.9	146.3	139.6	132.6	1.19
9	186.1	180.2	174.3	169.2	135.9	130.0	124.1	117.9	1.51
10	167.5	162.2	156.9	152.2	122.3	117.0	111.7	106.1	1.86
11	152.3	147.5	142.6	138.4	111.2	106.4	101.6	96.4	2.25
12	139.6	135.2	130.8	126.9	101.9	97.5	93.1	88.4	2.68
13	128.9	124.8	120.7	117.1	94.1	90.0	85.9	81.6	3.15
14	119.7	115.9	112.1	108.7	87.4	83.6	79.8	75.8	3.65
15	111.7	108.1	104.6	101.5	81.6	78.0	74.5	70.7	4.19
16	104.7	101.4	98.1	95.1	76.5	73.1	69.8	66.3	4.77
17	98.6	95.4	92.3	89.6	72.0	68.8	65.7	62.4	5.38
18	93.1	90.1	87.2	84.6	68.0	65.0	62.1	58.9	6.03
19	88.2	85.4	82.6	80.1	64.4	61.6	58.8	55.8	6.72
20	83.8	81.1	78.5	76.1	61.2	58.5	55.9	53.0	7.45
21	79.8	77.3	74.7	72.5	58.3	55.7	53.2	50.5	8.21
22	76.2	73.7	71.3	69.2	55.6	53.2	50.8	48.2	9.01
23	72.8	70.5	68.2	66.2	53.2	50.9	48.6	46.1	9.85
24	69.8	67.6	65.4	63.4	51.0	48.8	46.5	44.2	10.73
25	67.0	64.9	62.8	60.9	48.9	46.8	44.7	42.4	11.64
26	64.4	62.4	60.4	58.6	47.1	45.0	43.0	40.8	12.59
27	62.1	60.1	58.1	56.4	45.3	43.3	41.4	39.3	13.57
28	59.8	57.9	56.0	54.4	43.7	41.8	39.9	37.9	14.60
29	57.8	55.9	54.1	52.5	42.2	40.4	38.5	36.6	15.66
30	55.8	54.1	52.3	50.7	40.8	39.0	37.2	35.4	16.76
31	54.0	52.3	50.6	49.1	39.5	37.8	36.0	34.2	17.89
32	52.4	50.7	49.0	47.6	38.2	36.6	34.9	33.1	19.07
33	50.8	49.2	47.5	46.1	37.1	35.5	33.8	32.1	20.28
34	49.3	47.7	46.2	44.8	36.0	34.4	32.9	31.2	21.53
35	47.9	46.4	44.8	43.5	35.0	33.4	31.9	30.3	22.81
36	46.5	45.1	43.6	42.3	34.0	32.5	31.0	29.5	24.13
37	45.3	43.9	42.4	41.2	33.1	31.6	30.2	28.7	25.49
38	44.1	42.7	41.3	40.1	32.2	30.8	29.4	27.9	26.89

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.



AMERICAN STANDARD BEAMS AS BEAMS

ESSENTIAL DATA

Maximum Shear, **12,000** Pounds per Square Inch

BEAM I 18″ DATA

Maximum Bending Stress, **18,000** Pounds per Square Inch

Notation	Depth and Flange Width—Weight per Foot							
	B 19 18″ x 7″				B 4 18″ x 6″			
	90 lbs.	85 lbs.	80 lbs.	75.6 lbs.	70 lbs.	65 lbs.	60 lbs.	54.7 lbs.
ELEMENTS								
I_{1-1}	1256.5	1216.6	1176.8	1141.8	917.5	877.7	837.8	795.5
S_{1-1}	139.6	135.2	130.8	126.9	101 9	97.5	93.1	88.4
I_{2-2}	51.9	49.8	47.9	46.3	24.5	23.4	22.3	21.2
S_{2-2}	14.3	14.0	13.6	13.2	7.8	7.6	7.3	7.1
DIMENSIONS AND GAUGES IN INCHES								
d	18	18	18	18	18	18	18	18
b	7¼	7⅛	7 1/16	7	6¼	6 3/16	6 1/16	6
t	13/16	11/16	5/8	9/16	11/16	5/8	9/16	7/16
p	15/16	15/16	15/16	15/16	1 1/16	1 1/16	1 1/16	1 1/16
a	3¼	3¼	3¼	3¼	2¾	2¾	2¾	2¾
Grip	1	1	1	1	¾	¾	¾	¾
f	14½	14½	14½	14½	15¼	15¼	15¼	15¼
o	1¾	1¾	1¾	1¾	1⅜	1⅜	1⅜	1⅜
g min.	2½	2½	2½	2½	2⅜	2⅜	2¼	2¼
g usual	4	4	4	4	3½	3½	3½	3½
g_2	3¼	3¼	3¼	3¼	2¾	2¾	2¾	2¾

f and o—Provide usual working clearances.

MAXIMUM BENDING MOMENTS, WEB RESISTANCES, ETC.								
Mmax	209	203	196	190	153	146	140	133
Vmax	172	154	137	121	154	136	118	99
Lmin	4.87	5.26	5.75	6.29	3.98	4.31	4.73	5.34
fb	15000	15000	15000	15000	15000	15000	15000	14340
fbt	11940	10710	9480	8400	10665	9435	8205	6596
a_1 min	9.90	9.90	9.90	9.90	9.90	9.90	9.90	10.56
Rmax	96	86	76	67	85	75	66	53
R_1	65	65	65	59	65	65	58	48
LR_1	12.89	12.48	12.06	12.91	9.41	9.00	9.63	11.05
Wt.C.	21	21	21	21	21	21	21	21
Q	1675	1622	1570	1523	1223	1170	1117	1061

Mmax = Maximum Bending Moment in thousands of foot pounds.
Vmax = Maximum Web Shear in thousands of pounds.
Lmin = Minimum Span to develop V max. in feet.
fb = Allowable Unit Stress for Web Buckling in pounds per square inch.
fbt = Value of Web in Buckling per inch of length in pounds.
a_1 min = Minimum End Bearing to develop V in inches.
Rmax = Maximum End Reaction when $a_1 = 3\frac{1}{2}$ inches in thousands of pounds.
R_1 = Maximum Value of one Standard Connection, page 250, in thousands of pounds.
LR_1 = Minimum Span in feet to develop R_1.
Wt.C. = Weight of one Standard Connection including web rivets in pounds.
Q = Coefficient of Strength = 12 S_{1-1}.
To obtain safe uniformly distributed load in thousands of pounds, divide Q by the required span in feet.

BEAM 15″  LOADS

AMERICAN STANDARD BEAMS AS BEAMS

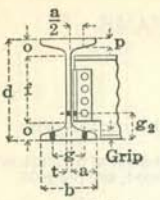
Allowable Uniform Load in Thousands of Pounds

Applicable only when sections are braced against lateral deflection
For unbraced sections safe loads must be reduced, see page 93

Maximum Bending Stress, **18,000** Pounds per Square Inch

Span in Feet	Depth and Weight of Sections									Coefficient of Deflection
	B 5 15″ x 6⅜″					B 6 15″ x 6″				
	100 lbs.	95 lbs.	90 lbs.	85 lbs.	81.3 lbs.	75 lbs.	70 lbs.	65 lbs.	60.8 lbs.	
3	420.1	384.5	349.2			312.5	277.2			0.17
4	356.9	345.8	344.8	313.9	288.0	274.9	263.8	241.9	212.4	0.30
5	285.6	276.6	267.8	259.0	252.5	219.9	211.1	202.3	194.9	0.47
6	238.0	230.5	223.2	215.8	210.4	183.3	175.9	168.5	162.4	0.67
7	204.0	197.6	191.3	185.0	180.4	157.1	150.8	144.5	139.2	0.91
8	178.5	172.9	167.4	161.9	157.8	137.4	131.9	126.4	121.8	1.19
9	158.6	153.7	148.8	143.9	140.3	122.2	117.3	112.4	108.3	1.51
10	142.8	138.3	133.9	129.5	126.3	110.0	105.5	101.1	97.4	1.86
11	129.8	125.7	121.7	117.7	114.8	100.0	95.9	91.9	88.6	2.25
12	119.0	115.3	111.6	107.9	105.2	91.6	88.0	84.3	81.2	2.68
13	109.8	106.4	103.0	99.6	97.1	84.6	81.2	77.8	75.0	3.15
14	102.0	98.8	95.7	92.5	90.2	78.5	75.4	72.2	69.6	3.65
15	95.2	92.2	89.3	86.3	84.2	73.3	70.4	67.4	65.0	4.19
16	89.2	86.5	83.7	80.9	78.9	68.7	66.0	63.2	60.9	4.77
17	84.0	81.4	78.8	76.2	74.3	64.7	62.1	59.5	57.3	5.38
18	79.3	76.8	74.4	71.9	70.1	61.1	58.6	56.2	54.1	6.03
19	75.1	72.8	70.5	68.2	66.4	57.9	55.5	53.2	51.3	6.72
20	71.4	69.2	67.0	64.8	63.1	55.0	52.8	50.6	48.7	7.45
21	68.0	65.9	63.8	61.7	60.1	52.4	50.3	48.2	46.4	8.21
22	64.9	62.9	60.9	58.9	57.4	50.0	48.0	46.0	44.3	9.01
23	62.1	60.1	58.2	56.3	54.9	47.8	45.9	44.0	42.4	9.85
24	59.5	57.6	55.8	54.0	52.6	45.8	44.0	42.1	40.6	10.73
25	57.1	55.3	53.6	51.8	50.5	44.0	42.2	40.5	39.0	11.64
26	54.9	53.2	51.5	49.8	48.6	42.3	40.6	38.9	37.5	12.59
27	52.9	51.2	49.6	48.0	46.8	40.7	39.1	37.5	36.1	13.57
28	51.0	49.4	47.8	46.3	45.1	39.3	37.7	36.1	34.8	14.60
29	49.2	47.7	46.2	44.7	43.5	37.9	36.4	34.9	33.6	15.66
30	47.6	46.1	44.6	43.2	42.1	36.7	35.2	33.7	32.5	16.76
31	46.1	44.6	43.2	41.8	40.7	35.5	34.0	32.6	31.4	17.89
32	44.6	43.2	41.8	40.5	39.5	34.4	33.0	31.6	30.4	19.07

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.



AMERICAN STANDARD BEAMS AS BEAMS

ESSENTIAL DATA

Maximum Shear, **12,000** Pounds per Square Inch

BEAM I 15″ DATA

Maximum Bending Stress, **18,000** Pounds per Square Inch

Notation	Depth and Flange Width—Weight per Foot								
	B 5 15″ x 6⅜″					B 6 15″ x 6″			
	100 lbs.	95 lbs.	90 lbs.	85 lbs.	81.3 lbs.	75 lbs.	70 lbs.	65 lbs.	60.8 lbs.
ELEMENTS									
I_{1-1}	892.4	864.5	837.0	809.4	789.1	687.2	659.6	632.1	609.0
S_{1-1}	119.0	115.3	111.6	107.9	105.2	91.6	87.9	84.3	81.2
I_{2-2}	50.2	47.7	45.2	42.9	41.3	30.6	28.8	27.2	26.0
S_{2-2}	14.8	14.3	13.8	13.3	12.9	9.8	9.3	8.9	8.7
DIMENSIONS AND GAUGES IN INCHES									
d	15	15	15	15	15	15	15	15	15
b	6¾	6 11/16	6 9/16	6½	6⅜	6¼	6 5/16	6 1/16	6
t	1 3/16	1 1/16	1	⅞	13/16	⅞	¾	11/16	9/16
p	1 1/16	1 1/16	1 1/16	1 1/16	1 1/16	1 3/16	1 3/16	1 3/16	1 3/16
a	2 13/16	2 13/16	2 13/16	2 13/16	2 13/16	2 11/16	2 11/16	2 11/16	2 11/16
Grip	1	1	1	1	1	⅞	⅞	⅞	⅞
f	11	11	11	11	11	11¾	11¾	11¾	11¾
o	2	2	2	2	2	1⅝	1⅝	1⅝	1⅝
g usual	4	4	4	4	4	3½	3½	3½	3½
g_2	3¼	3¼	3¼	3¼	3¼	3	3	3	3
MAXIMUM BENDING MOMENTS, WEB RESISTANCES, ETC.									
Mmax	178	173	167	162	158	137	132	126	122
Vmax	210	192	175	157	144	156	139	121	106
Lmin	3.40	3.60	3.83	4.13	4.38	3.52	3.81	4.18	4.59
fb	15000	15000	15000	15000	15000	15000	15000	15000	15000
fbt	17505	16020	14550	13080	12000	13020	11550	10080	8850
a_1 min	8.25	8.25	8.25	8.25	8.25	8.25	8.25	8.25	8.25
Rmax	127	116	105	95	87	94	84	73	64
R_1	65	65	65	65	65	65	65	65	62
LR_1	10.98	10.64	10.30	9.96	9.71	8.46	8.11	7.78	7.86
Wt.C.	21	21	21	21	21	21	21	21	21
Q	1428	1384	1339	1295	1262	1099	1055	1012	974

f and o—Provide usual working clearances.

Mmax = Maximum Bending Moment in thousands of foot pounds.
Vmax = Maximum Web Shear in thousands of pounds.
Lmin = Minimum Span to develop V max. in feet.
fb = Allowable Unit Stress for Web Buckling in pounds per square inch.
fbt = Value of Web in Buckling per inch of length in pounds.
a_1 min = Minimum End Bearing to develop V in inches.
Rmax = Maximum End Reaction when $a_1 = 3\frac{1}{2}$ inches in thousands of pounds.
R_1 = Maximum Value of one Standard Connection, page 250, in thousands of pounds.
LR_1 = Minimum Span in feet to develop R_1.
Wt.C. = Weight of one Standard Connection including web rivets in pounds.
Q = Coefficient of Strength = $12\,S_{1-1}$.
To obtain safe uniformly distributed load in thousands of pounds, divide Q by the required span in feet.

BEAM
15″ I
12″
LOADS

AMERICAN STANDARD BEAMS
AS
BEAMS

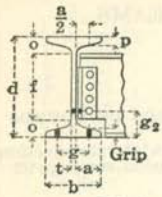
Allowable Uniform Load in Thousands of Pounds

Applicable only when sections are braced against lateral deflection
For unbraced sections safe loads must be reduced, see page 93

Maximum Bending Stress, **18,000** Pounds per Square Inch

Span in Feet	Depth and Weight of Sections								Coefficient of Deflection
	B 7 15″ x 5½″				B 8 12″ x 5¼″				
	55 lbs.	50 lbs.	45 lbs.	42.9 lbs.	55 lbs.	50 lbs.	45 lbs.	40.8 lbs.	
3	233.3	198.0			233.3 212.9	197.9	162.7		0.17
4	203.5	192.5	162.7	147.6	159.7	150.8	142.0	132.5	0.30
5	162.8	154.0	145.1	141.4	127.7	120.7	113.6	107.6	0.47
6	135.7	128.3	120.9	117.8	106.5	100.5	94.7	89.7	0.67
7	116.3	110.0	103.6	101.0	91.3	86.2	81.2	76.8	0.91
8	101.7	96.2	90.7	88.4	79.8	75.4	71.0	67.2	1.19
9	90.4	85.5	80.6	78.5	71.0	67.0	63.1	59.8	1.51
10	81.4	77.0	72.6	70.7	63.9	60.3	56.8	53.8	1.86
11	74.0	70.0	66.0	64.3	58.1	54.8	51.6	48.9	2.25
12	67.8	64.2	60.5	58.9	53.2	50.3	47.3	44.8	2.68
13	62.6	59.2	55.8	54.4	49.1	46.4	43.7	41.4	3.15
14	58.1	55.0	51.8	50.5	45.6	43.1	40.6	38.4	3.65
15	54.3	51.3	48.4	47.1	42.6	40.2	37.9	35.9	4.19
16	50.9	48.1	45.3	44.2	39.9	37.7	35.5	33.6	4.77
17	47.9	45.3	42.7	41.6	37.6	35.5	33.4	31.6	5.38
18	45.2	42.8	40.3	39.3	35.5	33.5	31.6	29.9	6.03
19	42.8	40.5	38.2	37.2	33.6	31.8	29.9	28.3	6.72
20	40.7	38.5	36.3	35.3	31.9	30.2	28.4	26.9	7.45
21	38.8	36.7	34.5	33.7	30.4	28.7	27.1	25.6	8.21
22	37.0	35.0	33.0	32.1	29.0	27.4	25.8	24.4	9.01
23	35.4	33.5	31.5	30.7	27.8	26.2	24.7	23.4	9.85
24	33.9	32.1	30.2	29.5	26.6	25.1	23.7	22.4	10.73
25	32.6	30.8	29.0	28.3	25.5	24.1	22.7	21.5	11.64
26	31.3	29.6	27.9	27.2					12.59
27	30.1	28.5	26.9	26.2					13.57
28	29.1	27.5	25.9	25.2					14.60
29	28.1	26.5	25.0	24.4					15.66
30	27.1	25.7	24.2	23.6					16.76
31	26.3	24.8	23.4	22.8					17.89
32	25.4	24.1	22.7	22.1					19.07

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.



AMERICAN STANDARD BEAMS AS BEAMS

ESSENTIAL DATA

Maximum Shear, **12,000** Pounds per Square Inch

BEAM I 15″ 12″ DATA

Maximum Bending Stress, **18,000** Pounds per Square Inch

Notation	Depth and Flange Width—Weight per Foot							
	B 7 15″ x 5½″				B 8 12″ x 5¼″			
	55 lbs.	50 lbs.	45 lbs.	42.9 lbs.	55 lbs.	50 lbs.	45 lbs.	40.8 lbs.
ELEMENTS								
I_{1-1}	508.7	481.1	453.6	441.8	319.3	301.6	284.1	268.9
S_{1-1}	**67.8**	**64.2**	**60.5**	**58.9**	**53.2**	**50.3**	**47.3**	**44.8**
I_{2-2}	17.0	16.0	15.0	14.6	17.3	16.0	14.8	13.8
S_{2-2}	5.9	5.7	5.4	5.3	6.2	5.8	5.5	5.3
DIMENSIONS AND GAUGES IN INCHES								
d	15	15	15	15	12	12	12	12
b	5¾	5⅝	5 9/16	5½	5⅝	5½	5⅜	5¼
t	⅝	9/16	7/16	7/16	13/16	11/16	9/16	7/16
p	⅝	⅝	⅝	⅝	11/16	11/16	11/16	11/16
a	2 5/16	2 5/16	2 5/16	2 5/16	2⅜	2⅜	2⅜	2⅜
Grip	⅝	⅝	⅝	⅝	¾	¾	¾	¾
f	12½	12½	12½	12½	9¼	9¼	9¼	9¼
o	1¼	1¼	1¼	1¼	1⅜	1⅜	1⅜	1⅜
g usual	3½	3½	3½	3½	3½	3½	3	3
g_2	2¾	2¾	2¾	2¾	2¾	2¾	2¾	2¾
MAXIMUM BENDING MOMENTS, WEB RESISTANCES, ETC.								
Mmax	102	96	91	88	80	75	71	67
Vmax	117	99	81	74	117	99	81	66
Lmin	3.49	3.89	4.46	4.79	2.74	3.05	3.49	4.06
fb	15000	15000	15000	14717	15000	15000	15000	15000
fbt	9720	8250	6780	6034	12150	10305	8475	6900
a_1 min	8.25	8.25	8.25	8.48	6.60	6.60	6.60	6.60
Rmax	70	60	49	44	79	67	55	45
R_1	65	58	47	43	49	49	45	36
LR_1	6.26	6.64	7.72	8.22	6.51	6.16	6.31	7.47
Wt.C.	21	21	21	21	15	15	15	15
Q	814	770	726	707	638	604	568	538

f and o—Provide usual working clearances.

Mmax = Maximum Bending Moment in thousands of foot pounds.
Vmax = Maximum Web Shear in thousands of pounds.
Lmin = Minimum Span to develop V max. in feet.
fb = Allowable Unit Stress for Web Buckling in pounds per square inch.
fbt = Value of Web in Buckling per inch of length in pounds.
a_1 min = Minimum End Bearing to develop V in inches.
Rmax = Maximum End Reaction when $a_1 = 3\frac{1}{2}$ inches in thousands of pounds.
R_1 = Maximum value of one Standard Connection, page 250, in thousands of pounds.
LR_1 = Minimum Span in feet to develop R_1.
Wt.C. = Weight of one Standard Connection including web rivets in pounds.
Q = Coefficient of Strength = $12\ S_{1-1}$.
To obtain safe uniformly distributed load in thousands of pounds, divide Q by the required span in feet.

BEAM
12″
10″
LOADS

AMERICAN STANDARD BEAMS
AS
BEAMS

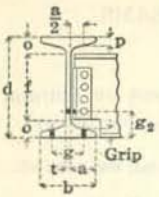
Allowable Uniform Load in Thousands of Pounds

Applicable only when sections are braced against lateral deflection
For unbraced sections safe loads must be reduced, see page 93

Maximum Bending Stress, **18,000** Pounds per Square Inch

Span in Feet	Depth and Weight of Sections						Coefficient of Deflection
	B 9 12″ x 5″		B 10 10″ x 4⅝″				
	35 lbs.	31.8 lbs.	40 lbs.	35 lbs.	30 lbs.	25.4 lbs.	
			177.8	142.6	107.3		
3	123.3		126.4	116.6	106.8	74.4	0.17
4	113.5	100.8	94.8	87.5	80.1	73.3	0.30
5	90.8	86.3	75.8	70.0	64.1	58.6	0.47
6	75.7	71.9	63.2	58.3	53.4	48.8	0.67
7	64.9	61.7	54.2	50.0	45.8	41.9	0.91
8	56.8	54.0	47.4	43.7	40.1	36.6	1.19
9	50.5	48.0	42.1	38.9	35.6	32.6	1.51
10	45.4	43.2	37.9	35.0	32.0	29.3	1.86
11	41.3	39.2	34.5	31.8	29.1	26.6	2.25
12	37.8	36.0	31.6	29.2	26.7	24.4	2.68
13	34.9	33.2	29.2	26.9	24.6	22.5	3.15
14	32.4	30.8	27.1	25.0	22.9	20.9	3.65
15	30.3	28.8	25.3	23.3	21.4	19.5	4.19
16	28.4	27.0	23.7	21.9	20.0	18.3	4.77
17	26.7	25.4	22.3	20.6	18.8	17.2	5.38
18	25.2	24.0	21.1	19.4	17.8	16.3	6.03
19	23.9	22.7	20.0	18.4	16.9	15.4	6.72
20	22.7	21.6	19.0	17.5	16.0	14.7	7.45
21	21.6	20.6	18.1	16.7	15.3	14.0	8.21
22	20.6	19.6	17.2	15.9	14.6	13.3	9.01
23	19.7	18.8					9.85
24	18.9	18.0					10.73
25	18.2	17.3					11.64

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.



AMERICAN STANDARD BEAMS

AS

BEAMS

ESSENTIAL DATA

Maximum Shear, **12,000** Pounds per Square Inch

BEAM I **12″ 10″ DATA**

Maximum Bending Stress, **18,000** Pounds per Square Inch

Notation	Depth and Flange Width—Weight per Foot					
	B 9 12″ x 5″		B 10 10″ x 4⅝″			
	35 lbs.	31.8 lbs.	40 lbs.	35 lbs.	30 lbs.	25.4 lbs.
ELEMENTS						
I_{1-1}	227.0	215.8	158.0	145.8	133.5	122.1
S_{1-1}	**37.8**	**36.0**	**31.6**	**29.2**	**26.7**	**24.4**
I_{2-2}	10.0	9.5	9.4	8.5	7.6	6.9
S_{2-2}	3.9	3.8	3.7	3.4	3.2	3.0
DIMENSIONS AND GAUGES IN INCHES						
d	12	12	10	10	10	10
b	5 1/16	5	5 1/16	4 15/16	4 13/16	4 11/16
t	7/16	7/16	5/16	5/16	5/16	5/16
p	9/16	9/16	1/2	1/2	1/2	1/2
a	2 3/16	2 3/16	2 3/16	2 3/16	2 3/16	2 3/16
Grip	9/16	9/16	1/2	1/2	1/2	1/2
f	9 3/4	9 3/4	8	8	8	8
o	1 1/8	1 1/8	1	1	1	1
g usual	3	3	2 3/4	2 3/4	2 3/4	2 3/4
g_2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2

f and o—Provide usual working clearances.

MAXIMUM BENDING MOMENTS, WEB RESISTANCES, ETC.

Mmax	57	54	47	44	40	37
Vmax	62	50	89	71	54	37
Lmin	3.68	4.28	2.13	2.45	2.99	3.94
fb	15000	15000	15000	15000	15000	15000
fbt	6420	5250	11115	8910	6705	4650
a_1 min	6.60	6.60	5.50	5.50	5.50	5.50
Rmax	42	34	67	53	40	28
R_1	34	28	65	62	47	33
LR_1	6.67	7.71	2.92	2.83	3.41	4.44
Wt.C.	15	15	15	15	15	15
Q	454	432	379	350	320	293

Mmax = Maximum Bending Moment in thousands of foot pounds.
Vmax = Maximum Web Shear in thousands of pounds.
Lmin = Minimum Span to develop V max. in feet.
fb = Allowable Unit Stress for Web Buckling in pounds per square inch.
fbt = Value of Web in Buckling per inch of length in pounds.
a_1 min = Minimum End Bearing to develop V in inches.
Rmax = Maximum End Reaction when $a_1 = 3\frac{1}{2}$ inches in thousands of pounds.
R_1 = Maximum Value of one Standard Connection, page 250, in thousands of pounds.
LR_1 = Minimum Span in feet to develop R_1.
Wt.C. = Weight of one Standard Connection including web rivets in pounds.
Q = Coefficient of Strength = $12\ S_{1-1}$.
To obtain safe uniformly distributed load in thousands of pounds, divide Q by the required span in feet.

BEAM
9″ 
LOADS

AMERICAN STANDARD BEAMS
AS
BEAMS

ALLOWABLE UNIFORM LOADS IN THOUSANDS OF POUNDS

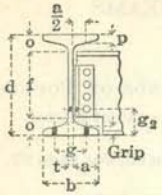
Applicable only when sections are braced against lateral deflection.

For unbraced sections safe loads must be reduced, see page 93.

Maximum Bending Stress, **18,000** Pounds per Square Inch

Span in Feet	Nominal Depth and Flange Width—Weight per Foot						Coefficient of Deflection
	*B 40 9″ x 5¼″		B 11 9″ x 4⅜″				
	25 lbs.	20.5 lbs.	35 lbs.	30 lbs.	25 lbs.	21.8 lbs.	
			156.4				
2			148.4	121.2	85.8		0.07
3	82.1		98.9	90.1	81.3	62.6	0.17
4	63.7	50.5	74.2	67.6	60.9	56.6	0.30
5	50.9	46.1	59.4	54.1	48.8	45.3	0.47
6	42.4	38.4	49.5	45.1	40.6	37.7	0.67
7	36.4	32.9	42.4	38.6	34.8	32.4	0.91
8	31.8	28.8	37.1	33.8	30.5	28.3	1.19
9	28.3	25.6	33.0	30.0	27.1	25.2	1.51
10	25.5	23.0	29.7	27.0	24.4	22.6	1.86
11	23.1	20.9	27.0	24.6	22.2	20.6	2.25
12	21.2	19.2	24.7	22.5	20.3	18.9	2.68
13	19.6	17.7	22.8	20.8	18.8	17.4	3.15
14	18.2	16.5	21.2	19.3	17.4	16.2	3.65
15	17.0	15.4	19.8	18.0	16.3	15.1	4.19
16	15.9	14.4	18.5	16.9	15.2	14.2	4.77
17	15.0	13.6	17.5	15.9	14.3	13.3	5.38
18	14.1	12.8	16.5	15.0	13.5	12.6	6.03
19	13.4	12.1	15.6	14.2	12.8	11.9	6.72
20			14.8	13.5	12.2	11.3	7.45

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.
*B 40, 9″ Beam, is a Standard Mill Section, not American Standard.



AMERICAN STANDARD BEAMS AS BEAMS

ESSENTIAL DATA

Maximum Shear, **12,000** Pounds per Square Inch

BEAM I 9″ DATA

Maximum Bending Stress, **18,000** Pounds per Square Inch

Notation	Depth and Flange Width—Weight per Foot					
	*B 40 9″ x 5¼″		B 11 9″ x 4⅜″			
	25 lbs.	20.5 lbs.	35 lbs.	30 lbs.	25 lbs.	21.8 lbs.
ELEMENTS						
$I_{1\text{-}1}$	95.5	86.6	111.3	101.4	91.4	84.9
$S_{1\text{-}1}$	**21.2**	**19.2**	**24.7**	**22.5**	**20.3**	**18.9**
$I_{2\text{-}2}$	8.8	8.0	7.3	6.4	5.6	5.2
$S_{2\text{-}2}$	3.3	3.1	3.0	2.8	2.5	2.4
DIMENSIONS AND GAUGES IN INCHES						
d	9	9	9	9	9	9
b	5⅜	5¼	4¾	4⅝	4 7/16	4 5/16
t	⅜	¼	¾	9/16	⅜	5/16
p	⅜	⅜	7/16	7/16	7/16	7/16
a	2½	2½	2	2	2	2
Grip	⅜	⅜	½	½	½	½
f	7½	7½	7	7	7	7
o	¾	¾	1	1	1	1
g usual	3	3	2½	2½	2½	2½
g_2	2¼	2¼	2½	2½	2½	2½
MAXIMUM BENDING MOMENTS, WEB RESISTANCES, ETC.						
Mmax	32	29	37	34	30	28
Vmax	41	25	78	61	43	31
Lmin	3.10	4.56	1.90	2.23	2.84	3.62
fb	15000	14440	15000	15000	15000	15000
fbt	5700	3379	10860	8415	5955	4350
a_1 min	4.95	5.23	4.95	4.95	4.95	4.95
Rmax	33	19	62	48	34	25
R_1	40	25	65	59	42	30
LR_1	3.18	4.61	2.28	2.29	2.90	3.78
Wt.C.	15	15	15	15	15	15
Q	254	230	296	270	244	227

f and o—Provide usual working clearances.

Mmax = Maximum Bending Moment in thousands of foot pounds.
Vmax = Maximum Web Shear in thousands of pounds.
Lmin = Minimum Span to develop V max. in feet.
fb = Allowable Unit Stress for Web Buckling in pounds per square inch.
fbt = Value of Web in Buckling per inch of length in pounds.
a_1 min = Minimum End Bearing to develop V in inches.
Rmax = Maximum End Reaction when $a_1 = 3\frac{1}{2}$ inches in thousands of pounds.
R_1 = Maximum Value of one Standard Connection, page 250, in thousands of pounds.
LR_1 = Minimum Span in feet to develop R_1.
Wt.C. = Weight of one Standard Connection including web rivets in pounds.
Q = Coefficient of Strength = $12\ S_{1\text{-}1}$.
To obtain safe uniformly distributed load in thousands of pounds, divide Q by the required span in feet.

*B 40, 9″ Beam, is a Standard Mill Section, not American Standard.

BEAM
8″ I
7″
LOADS

AMERICAN STANDARD BEAMS AS BEAMS

Allowable Uniform Loads in Thousands of Pounds

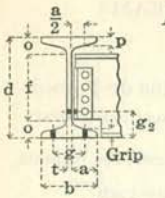
Applicable only when sections are braced against lateral deflection.

For unbraced sections safe loads must be reduced, see page 93.

Maximum Bending Stress, **18,000** Pounds per Square Inch

Span in Feet	Nominal Depth and Flange Width—Weight per Foot									Coefficient of Deflection
	*B 39	8″ x 5″	B 12		8″ x 4″		B 13	7″ x 3⅝″		
	21 lbs.	17.5 lbs.	25.5 lbs.	23 lbs.	20.5 lbs.	18.4 lbs.	20 lbs.	17.5 lbs.	15.3 lbs.	
			102.1				75.6			
2	69.1		102.1	84.7	67.0		71.9	58.0	42.0	0.07
3	63.4	44.4	68.1	64.2	60.2	51.8	47.9	44.5	41.4	0.17
4	47.6	42.9	51.0	48.1	45.2	42.7	36.0	33.4	31.1	0.30
5	38.1	34.3	40.8	38.5	36.1	34.1	28.8	26.7	24.8	0.47
6	31.7	28.6	34.0	32.1	30.1	28.4	24.0	22.3	20.7	0.67
7	27.2	24.5	29.2	27.5	25.8	24.4	20.5	19.1	17.7	0.91
8	23.8	21.5	25.5	24.1	22.6	21.3	18.0	16.7	15.5	1.19
9	21.1	19.1	22.7	21.4	20.1	19.0	16.0	14.8	13.8	1.51
10	19.0	17.2	20.4	19.3	18.1	17.1	14.4	13.4	12.4	1.86
11	17.3	15.6	18.6	17.5	16.4	15.5	13.1	12.1	11.3	2.25
12	15.9	14.3	17.0	16.0	15.1	14.2	12.0	11.1	10.4	2.68
13	14.6	13.2	15.7	14.8	13.9	13.1	11.1	10.3	9.6	3.15
14	13.6	12.3	14.6	13.7	12.9	12.2	10.3	9.5	8.9	3.65
15	12.7	11.4	13.6	12.8	12.0	11.4	9.6	8.9	8.3	4.19
16	11.9	10.7	12.8	12.0	11.3	10.7				4.77
17	11.2	10.1	12.0	11.3	10.6	10.0				5.38
18			11.3	10.7	10.0	9.5				6.03

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.
*B 39, 8″ Beam, is a Standard Mill Section, not American Standard.



AMERICAN STANDARD BEAMS AS BEAMS

Essential Data

Maximum Shear, **12,000** Pounds per Square Inch

BEAM I 8″ 7″ DATA

Maximum Bending Stress, **18,000** Pounds per Square Inch

Notation	Depth and Flange Width—Weight per Foot								
	*B 39	8″ x 5″	B 12		8″ x 4″		B 13	7″ x 3⅝″	
	21 lbs.	17.5 lbs.	25.5 lbs.	23 lbs.	20.5 lbs.	18.4 lbs.	20 lbs.	17.5 lbs.	15.3 lbs.
Elements									
I_{1-1}	63.4	57.4	68.1	64.2	60.2	56.9	41.9	38.9	36.2
S_{1-1}	**15.9**	**14.5**	**17.0**	**16.0**	**15.1**	**14.2**	**12.0**	**11.1**	**10.4**
I_{2-2}	6.6	6.0	4.7	4.4	4.0	3.8	3.1	2.9	2.7
S_{2-2}	2.6	2.4	2.2	2.1	2.0	1.9	1.6	1.6	1.5
Dimensions and Gauges in Inches									
d	8	8	8	8	8	8	7	7	7
b	5⅛	5	4¼	4 3/16	4 1/16	4	3⅞	3¾	3 1/16
t	⅜	¼	9/16	7/16	⅜	¼	7/16	⅜	¼
p	5/16	5/16	7/16	7/16	7/16	7/16	⅜	⅜	⅜
a	2⅜	2⅜	1⅞	1⅞	1⅞	1⅞	1 1/16	1 1/16	1 1/16
Grip	5/16	5/16	½	7/16	7/16	7/16	⅜	⅜	⅜
f	6⅜	6⅜	6¼	6¼	6¼	6¼	5¼	5¼	5¼
o	1 1/16	1 1/16	⅞	⅞	⅞	⅞	⅞	⅞	⅞
g usual	3	3	2¼	2¼	2¼	2¼	2¼	2¼	2¼
g_2	2¼	2¼	2¼	2¼	2¼	2¼	2	2	2

f and o—Provide usual working clearances.

Maximum Bending Moments, Web Resistances, Etc.

Mmax	24	21	26	24	23	21	18	17	16
Vmax	35	22	51	42	34	26	38	29	21
Lmin	2.76	3.87	2.00	2.27	2.70	3.29	1.90	2.30	2.96
fb	15000	15000	15000	15000	15000	15000	15000	15000	15000
fbt	5400	3465	7980	6615	5235	4050	6750	5175	3750
a_1 min	4.40	4.40	4.40	4.40	4.40	4.40	3.85	3.85	3.85
Rmax	30	19	44	36	29	22	35	27	20
R_1	38	24	56	46	37	28	24	18	13
LR_1	2.51	3.63	1.82	2.09	2.45	3.04	3.00	3.70	4.80
Wt.C.	15	15	15	15	15	15	8	8	8
Q	191	174	204	192	181	170	144	133	125

Mmax = Maximum Bending Moment in thousands of foot pounds.
Vmax = Maximum Web Shear in thousands of pounds.
Lmin = Minimum Span to develop V max. in feet.
fb = Allowable Unit Stress for Web Buckling in pounds per square inch.
fbt = Value of Web in Buckling per inch of length in pounds.
a_1 min = Minimum End Bearing to develop V in inches.
Rmax = Maximum End Reaction when a_1 = 3½ inches in thousands of pounds.
R_1 = Maximum Value of one Standard Connection, page 250, in thousands of pounds.
LR_1 = Minimum Span in feet to develop R_1.
Wt.C. = Weight of one Standard Connection including web rivets in pounds.
Q = Coefficient of Strength = 12 S_{1-1}.
To obtain safe uniformly distributed load in thousands of pounds, divide Q by the required span in feet.

*B 39, 8″ Beam, is a Standard Mill Section, not American Standard.

BEAM
6″
5″
LOADS

AMERICAN STANDARD BEAMS AS BEAMS

ALLOWABLE UNIFORM LOAD IN THOUSANDS OF POUNDS

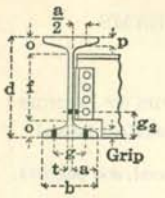
Applicable only when sections are braced against lateral deflection.

For unbraced sections safe loads must be reduced, see page 93.

Maximum Bending Stress, **18,000** Pounds per Square Inch

Span in Feet	Depth and Weight of Sections						Coefficient of Deflection
	B 14 6″ x 3⅝″			B 15 5″ x 3″			
	17.25 lbs.	14.75 lbs.	12.5 lbs.	14.75 lbs.	12.25 lbs.	10 lbs.	
1	67.0	49.4		59.3	41.6		
2	52.0	47.6	33.1	36.1	32.4	25.2	0.07
3	34.7	31.8	29.0	24.1	21.6	19.3	0.17
4	26.0	23.8	21.8	18.1	16.2	14.5	0.30
5	20.8	19.1	17.4	14.4	13.0	11.6	0.47
6	17.3	15.9	14.5	12.0	10.8	9.7	0.67
7	14.9	13.6	12.4	10.3	9.3	8.3	0.91
8	13.0	11.9	10.9	9.0	8.1	7.3	1.19
9	11.6	10.6	9.7	8.0	7.2	6.4	1.51
10	10.4	9.5	8.7	7.2	6.5	5.8	1.86
11	9.5	8.7	7.9	6.6	5.9	5.3	2.25
12	8.7	7.9	7.3	6.0	5.4	4.8	2.68
13	8.0	7.3	6.7				3.15
14	7.4	6.8	6.2				3.65

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.



AMERICAN STANDARD BEAMS AS BEAMS

ESSENTIAL DATA

Maximum Shear, **12,000** Pounds per Square Inch

BEAM I 6″ 5″ DATA

Maximum Bending Stress, **18,000** Pounds per Square Inch

Notation	Depth and Flange Width—Weight per Foot					
	B 14 6″ x 3⅝″			B 15 5″ x 3″		
	17.25 lbs.	14.75 lbs.	12.5 lbs.	14.75 lbs.	12.25 lbs.	10.0 lbs.
ELEMENTS						
I_{1-1}	26.0	23.8	21.8	15.0	13.5	12.1
S_{1-1}	8.7	7.9	7.3	6.0	5.4	4.8
I_{2-2}	2.3	2.1	1.8	1.7	1.4	1.2
S_{2-2}	1.3	1.2	1.1	1.0	0.91	0.82
DIMENSIONS AND GAUGES IN INCHES						
d	6	6	6	5	5	5
b	3 9/16	3 7/16	3 5/16	3 5/16	3 1/8	3
t	7/16	3/8	1/4	1/2	3/8	5/16
p	3/8	3/8	3/8	5/16	5/16	5/16
a	1 9/16	1 9/16	1 9/16	1 3/8	1 3/8	1 3/8
Grip	3/8	3/8	3/8	3/8	3/8	3/8
f	4 1/2	4 1/2	4 1/2	3 1/2	3 1/2	3 1/2
o	3/4	3/4	3/4	3/4	3/4	3/4
g usual	2	2	2	1 3/4	1 3/4	1 3/4
g_2	2	2	2	2	2	2

f and o—Provide usual working clearances.

MAXIMUM BENDING MOMENTS, WEB RESISTANCES, ETC.

Mmax	13	12	11	9.0	8.1	7.3
Vmax	33	25	17	30	21	13
Lmin	1.55	1.93	2.63	1.22	1.56	2.30
fb	15000	15000	15000	15000	15000	15000
fbt	6975	5145	3450	7410	5205	3150
$a_1$min	3.30	3.30	3.30	2.75	2.75	2.75
Rmax	35	26	17	35	25	15
R_1	24	18	12	26	18	11
LR_1	2.18	2.63	3.65	1.38	1.80	2.62
Wt.C.	8	8	8	8	8	8
Q	104	95	88	72	65	58

Mmax = Maximum Bending Moment in thousands of foot pounds.
Vmax = Maximum Web Shear in thousands of pounds.
Lmin = Minimum Span to develop V max. in feet.
fb = Allowable Unit Stress for Web Buckling in pounds per square inch.
fbt = Value of Web in Buckling per inch of length in pounds.
a_1 min = Minimum End Bearing to develop V in inches.
Rmax = Maximum End Reaction when $a_1 = 3\frac{1}{2}$ inches in thousands of pounds.
R_1 = Maximum Value of one Standard Connection, page 250, in thousands of pounds.
LR_1 = Minimum Span in feet to develop R_1.
Wt.C. = Weight of one Standard Connection including web rivets in pounds.
Q = Coefficient of Strength = 12 S_{1-1}.
To obtain safe uniformly distributed load in thousands of pounds, divide Q by the required span in feet.

BEAM
4″ I
3″
LOADS

AMERICAN STANDARD BEAMS AS BEAMS

ALLOWABLE UNIFORM LOAD IN THOUSANDS OF POUNDS

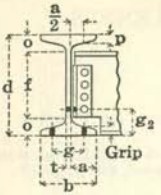
Applicable only when sections are braced against lateral deflection.

For unbraced sections safe loads must be reduced, see page 93.

Maximum Bending Stress, **18,000** Pounds per Square Inch

Span in Feet	Depth and Weight of Sections							Coefficient of Deflection
	B 16 4″ x 2⅝″				B 17 3″ x 2⅜″			
	10.5 lbs.	9.5 lbs.	8.5 lbs.	7.7 lbs.	7.5 lbs.	6.5 lbs.	5.7 lbs.	
1	28.4	21.3	24.3	18.2	25.1 23.1	18.1	12.2	0.02
2	21.3	20.1	18.9	17.9	11.5	10.7	9.9	0.07
3	14.2	13.4	12.6	11.9	7.7	7.1	6.6	0.17
4	10.6	10.0	9.5	8.9	5.8	5.3	5.0	0.30
5	8.5	8.0	7.6	7.2	4.6	4.3	4.0	0.47
6	7.1	6.7	6.3	6.0	3.9	3.6	3.3	0.67
7	6.1	5.7	5.4	5.1	3.3	3.0	2.8	0.91
8	5.3	5.0	4.7	4.5	2.9	2.7	2.5	1.19
9	4.7	4.5	4.2	4.0				1.51
10	4.3	4.0	3.8	3.6				1.86

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.



AMERICAN STANDARD BEAMS

AS

BEAMS

ESSENTIAL DATA

Maximum Shear, **12,000** Pounds per Square Inch

BEAM I 4″ 3″ DATA

Maximum Bending Stress, **18,000** Pounds per Square Inch

Notation	Depth and Flange Width—Weight per Foot						
	B 16 4″ x 2⅝″				B 17 3″ x 2⅜″		
	10.5 lbs.	9.5 lbs.	8.5 lbs.	7.7 lbs.	7.5 lbs.	6.5 lbs.	5.7 lbs.
ELEMENTS							
I_{1-1}	7.1	6.7	6.3	6.0	2.9	2.7	2.5
S_{1-1}	3.5	3.3	3.2	3.0	1.9	1.8	1.7
I_{2-2}	1.0	0.91	0.83	0.77	0.59	0.51	0.46
S_{2-2}	0.70	0.65	0.61	0.58	0.47	0.43	0.40
DIMENSIONS AND GAUGES IN INCHES							
d	4	4	4	4	3	3	3
b	2⅜	2 1⅜₁₆	2¾	2 1⅛₁₆	2½	2⅞₁₆	2⅝₁₆
t	⅜	5⁄16	¼	3⁄16	⅜	¼	3⁄16
P	5⁄16	5⁄16	5⁄16	3⁄16	¼	¼	¼
a	1¼	1¼	1¼	1¼	1 1⁄16	1 1⁄16	1 1⁄16
Grip	5⁄16	5⁄16	5⁄16	5⁄16	5⁄16	5⁄16	5⁄16
f	2¾	2¾	2¾	2¾	1¾	1¾	1¾
o	⅝	⅝	⅝	⅝	⅝	⅝	⅝
g usual	1½	1½	1½	1½	1½	1½	1½
g_2	1¾	1¾	1¾	1¾			

f and o—Provide usual working clearances.

MAXIMUM BENDING MOMENTS, WEB RESISTANCES, ETC.

Mmax	5.3	5.0	4.7	4.5	2.9	2.7	2.5
Vmax	19	16	12	9.1	13	9.0	6.1
Lmin	1.11	1.28	1.56	1.96	0.92	1.18	1.62
fb	15000	15000	15000	15000	15000	15000	15000
fbt	6000	4890	3795	2850	5235	3765	2550
a_1 min	2.20	2.20	2.20	2.20	1.65	1.65	1.65
Rmax	27	22	17	13	22	16	11
Q	42	40	38	36	23	22	20

Mmax = Maximum Bending Moment in thousands of foot pounds.
Vmax = Maximum Web Shear in thousands of pounds.
Lmin = Minimum Span to develop V max. in feet.
fb = Allowable Unit Stress for Web Buckling in pounds per square inch.
fbt = Value of Web in Buckling per inch of length in pounds.
a_1 min = Minimum End Bearing to develop V in inches.
Rmax = Maximum End Reaction when $a_1 = 3\frac{1}{2}$ inches in thousands of pounds.
Q = Coefficient of Strength = 12 S_{1-1}.
To obtain safe uniformly distributed load in thousands of pounds, divide Q by the required span in feet.

CHANNEL
18″ [
15″
LOADS

AMERICAN STANDARD CHANNELS AS BEAMS

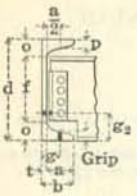
Allowable Uniform Load in Thousands of Pounds

Applicable only when sections are braced against lateral deflection
For unbraced sections safe loads must be reduced, see page 93.

Maximum Bending Stress, **18,000** Pounds per Square Inch

Span in Feet	Depth and Weight of Sections										Coefficient of Deflection
	*C 60 18″ x 4″				C 1 15″ x 3⅜″						
	58.0 lbs.	51.9 lbs.	45.8 lbs.	42.7 lbs.	55 lbs.	50 lbs.	45 lbs.	40 lbs.	35 lbs.	33.9 lbs.	
	302.4				293.0	257.8	222.5	187.2			
3	298.1	259.2	216.0	194.4	228.8	214.2	199.4	184.7	151.9	144.0	0.17
4	223.6	207.4	191.2	183.1	171.6	160.7	149.5	138.5	127.5	125.0	0.30
5	178.9	165.9	152 9	146.5	137.3	128.5	119.6	110.8	102.0	100.0	0.47
6	149.1	138.3	127.5	122.1	114.4	107.1	99.7	92.4	85.0	83.4	0.67
7	127.8	118.5	109.2	104.6	98.1	91.8	85.5	79.2	72.9	71.4	0.91
8	111.8	103.7	95.6	91.5	85.8	80.3	74.8	69.3	63.7	62.5	1.19
9	99.4	92.2	85.0	81.4	76.3	71.4	66.5	61.6	56.7	55.6	1.51
10	89.4	83.0	76.5	73.2	68.6	64.3	59.8	55.4	51.0	50.0	1.86
11	81.3	75.4	69.5	66.6	62.4	58.4	54.4	50.4	46.4	45.5	2.25
12	74.5	69.1	63.7	61.0	57.2	53.6	49.8	46.2	42.5	41.7	2.68
13	68.8	63.8	58.8	56.3	52.8	49.4	46.0	42.6	39.2	38.5	3.15
14	63.9	59.3	54.6	52.3	49.0	45.9	42.7	39.6	36.4	35.7	3.65
15	59.6	55.3	51.0	48.8	45.8	42.8	39.9	36.9	34.0	33.3	4.19
16	55.9	51.8	47.8	45.8	42.9	40.2	37.4	34.6	31.9	31.3	4.77
17	52.6	48.8	45.0	43.1	40.4	37.8	35.2	32.6	30.0	29.4	5.38
18	49.7	46.1	42.5	40.7	38.1	35.7	33.2	30.8	28.3	27.8	6.03
19	47.1	43.7	40.2	38.5	36.1	33.8	31.5	29.2	26.8	26.3	6.72
20	44.7	41.5	38.2	36.6	34.3	32.1	29.9	27.7	25.5	25.0	7.45
21	42.6	39.5	36.4	34.9	32.7	30.6	28.5	26.4	24.3	23.8	8.21
22	40.7	37.7	34.8	33.3	31.2	29.2	27.2	25.2	23.2	22.7	9.01
23	38.9	36.1	33.2	31.8	29.8	27.9	26.0	24.1	22.2	21.7	9.85
24	37.3	34.6	31.9	30.5	28.6	26.8	24.9	23.1	21.2	20.8	10.73
25	35.8	33.2	30.6	29.3	27.5	25.7	23.9	22.2	20.4	20.0	11.64
26	34.4	31.9	29.4	28.2	26.4	24.7	23.0	21.3	19.6	19.2	12.59
27	33.1	30.7	28.3	27.1	25.4	23.8	22.2	20.5	18.9	18.5	13.57
28	31.9	29.6	27.3	26.2	24.5	23.0	21.4	19.8	18.2	17.9	14.60
29	30.8	28.6	26.4	25.3	23.7	22.2	20.6	19.1	17.6	17.2	15.66
30	29.8	27.7	25.5	24.4	22.9	21.4	19.9	18.5	17.0	16.7	16.76
31	28.8	26.8	24.7	23.6	22.1	20.7	19.3	17.9	16.5	16.1	17.89
32	28.0	25.9	23.9	22.9	21.4	20.1	18.7	17.3	15.9	15.6	19.07
33	27.1	25.1	23.2	22.2							20.28
34	26.3	24.4	22.5	21.5							21.53
35	25.5	23.7	21.8	20.9							22.81

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.
*C 60-18″ Channel, is a Ship Building Channel, not American Standard.



AMERICAN STANDARD CHANNELS AS BEAMS

ESSENTIAL DATA

Maximum Shear, **12,000** Pounds per Square Inch

Maximum Bending Stress, **18,000** Pounds per Square Inch

CHANNEL [18″ 15″ **DATA**

Notation	Depth and Flange Width—Weight per Foot									
	*C 60 18″ x 4″				C 1 15″ x 3⅜″					
	58 lbs.	51.9 lbs.	45.8 lbs.	42.7 lbs.	55 lbs.	50 lbs.	45 lbs.	40 lbs.	35 lbs.	33.9 lbs.
ELEMENTS										
I_{1-1}	670.7	622.1	573.5	549.2	429.0	401.4	373.9	346.3	318.7	312.6
S_{1-1}	**74.5**	**69.1**	**63.7**	**61.0**	**57.2**	**53.6**	**49.8**	**46.2**	**42.5**	**41.7**
I_{2-2}	18.5	17.1	15.8	15.0	12.1	11.2	10.3	9.3	8.4	8.2
S_{2-2}	5.6	5.3	5.1	4.9	4.1	3.8	3.6	3.4	3.2	3.2
DIMENSIONS AND GAUGES IN INCHES										
d	18	18	18	18	15	15	15	15	15	15
b	4 3/16	4 1/8	4	3 15/16	3 13/16	3 11/16	3 5/8	3 1/2	3 7/16	3 3/8
t	11/16	5/8	1/2	7/16	13/16	11/16	5/8	1/2	7/16	3/8
p	5/8	5/8	5/8	5/8	5/8	5/8	5/8	5/8	5/8	5/8
a	3 1/2	3 1/2	3 1/2	3 1/2	3	3	3	3	3	3
Grip	5/8	5/8	5/8	5/8	11/16	11/16	5/8	5/8	5/8	5/8
f	15 1/2	15 1/2	15 1/2	15 1/2	12 1/4	12 1/4	12 1/4	12 1/4	12 1/4	12 1/4
o	1 1/4	1 1/4	1 1/4	1 1/4	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8
g usual	2 1/2	2 1/2	2 1/2	2 1/2	2 1/4	2 1/4	2	2	2	2
g_2	2 3/4	2 3/4	2 3/4	2 3/4	2 3/4	2 3/4	2 3/4	2 3/4	2 3/4	2 3/4

f and o—Provide usual working clearances.

MAXIMUM BENDING MOMENTS, WEB RESISTANCES, ETC.

Mmax	112	104	96	92	86	80	75	69	64	63
Vmax	151	130	108	97	147	129	111	94	76	72
Lmin	2.96	3.19	3.54	3.77	2.34	2.49	2.69	2.96	3.36	3.47
fb	15000	15000	14803	14210	15000	15000	15000	15000	14869	14582
fbt	10500	9000	7402	6395	12210	10740	9270	7800	6275	5833
a_1 min	9.90	9.90	10.09	10.70	8.25	8.25	8.25	8.25	8.36	8.59
Rmax	84	72	59	51	89	78	67	57	45	42
R_1	65	63	53	47	65	65	65	55	44	42
LR_1	6.88	6.58	7.21	7.79	5.28	4.95	4.60	5.04	5.80	5.96
Wt.C.	21	21	21	21	21	21	21	21	21	21
Q	894	829	764	732	686	643	598	554	510	500

Mmax = Maximum Bending Moment in thousands of foot pounds.
Vmax = Maximum Web Shear in thousands of pounds.
Lmin = Minimum Span to develop V max. in feet.
fb = Allowable Unit Stress for Web Buckling in pounds per square inch.
fbt = Value of Web in Buckling per inch of length in pounds.
a_1 min = Minimum End Bearing to develop V in inches.
Rmax = Maximum End Reaction when $a_1 = 3\frac{1}{2}$ inches in thousands of pounds.
R_1 = Maximum value of one Standard Connection, page 250, in thousands of pounds.
LR_1 = Minimum Span in feet to develop R_1.
Wt.C. = Weight of one Standard Connection including web rivets in pounds.
Q = Coefficient of Strength = $12\,S_{1-1}$.
To obtain safe uniformly distributed load in thousands of pounds, divide Q by the required span in feet.

*C 60—18″ is a Ship Building Channel, not American Standard.

CHANNEL
13″
12″ [
LOADS

AMERICAN STANDARD CHANNELS AS BEAMS

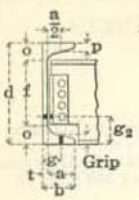
Allowable Uniform Load in Thousands of Pounds

Applicable only when sections are braced against lateral deflection
For unbraced sections safe loads must be reduced, see page 93.

Maximum Bending Stress, **18,000** Pounds per Square Inch

Span in Feet	Depth and Weight of Sections										Coefficient of Deflection
	*C 20 13″ x 4″						C 2 12″ x 3″				
	50 lbs.	45 lbs.	40 lbs.	37 lbs.	35 lbs.	31.8 lbs.	40 lbs.	35 lbs.	30 lbs.	25 lbs.	20.7 lbs.	
2	245.5	210.0	174.7				217.4 196.5	182.0 178.8	146.9	111.5		0.07
3	192.6	179.7	167.0	153.5	139.5	117.0	131.0	119.2	107.5	95.7	80.6	0.17
4	144.4	134.8	125.2	119.5	115.7	109.6	98.3	89.4	80.6	71.8	64.1	0.30
5	115.5	107.8	100.2	95.6	92.6	87.7	78.6	71.5	64.5	57.4	51.2	0.47
6	96.3	89.9	83.5	79.7	77.1	73.1	65.5	59.6	53.7	47.8	42.7	0.67
7	82.5	77.0	71.6	68.3	66.1	62.6	56.2	51.1	46.1	41.0	36.6	0.91
8	72.2	67.4	62.6	59.7	57.8	54.8	49.1	44.7	40.3	35.9	32.0	1.19
9	64.2	59.9	55.7	53.1	51.4	48.7	43.7	39.7	35.8	31.9	28.5	1.51
10	57.8	53.9	50.1	47.8	46.3	43.8	39.3	35.8	32.2	28.7	25.6	1.86
11	52.5	49.0	45.5	43.5	42.1	39.9	35.7	32.5	29.3	26.1	23.3	2.25
12	48.1	44.9	41.7	39.8	38.6	36.5	32.8	29.8	26.9	23.9	21.4	2.68
13	44.4	41.5	38.5	36.8	35.6	33.7	30.2	27.5	24.8	22.1	19.7	3.15
14	41.3	38.5	35.8	34.1	33.1	31.3	28.1	25.5	23.0	20.5	18.3	3.65
15	38.5	35.9	33.4	31.9	30.9	29.2	26.2	23.8	21.5	19.1	17.1	4.19
16	36.1	33.7	31.3	29.9	28.9	27.4	24.6	22.3	20.2	17.9	16.0	4.77
17	34.0	31.7	29.5	28.1	27.2	25.8	23.1	21.0	19.0	16.9	15.1	5.38
18	32.1	30.0	27.8	26.6	25.7	24.4	21.8	19.9	17.9	15.9	14.2	6.03
19	30.4	28.4	26.4	25.2	24.4	23.1	20.7	18.8	17.0	15.1	13.5	6.72
20	28.9	27.0	25.0	23.9	23.1	21.9	19.7	17.9	16.1	14.4	12.8	7.45
21	27.5	25.7	23.9	22.8	22.0	20.9	18.7	17.0	15.4	13.7	12.2	8.21
22	26.3	24.5	22.8	21.7	21.0	19.9	17.9	16.3	14.7	13.0	11.6	9.01
23	25.1	23.4	21.8	20.8	20.1	19.1	17.1	15.5	14.0	12.5	11.1	9.85
24	24.1	22.5	20.9	19.9	19.3	18.3	16.4	14.9	13.4	12.0	10.7	10.73
25	23.1	21.6	20.0	19.1	18.5	17.5	15.7	14.3	12.9	11.5	10.2	11.64
26	22.2	20.7	19.3	18.4	17.8	16.9						12.59
27	21.4	20.0	18.6	17.7	17.1	16.2						13.57
28	20.6	19.3	17.9	17.1	16.5	15.7						14.60

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.
*C 20-13″ Channel, is a Car Building Channel, not American Standard.



AMERICAN STANDARD CHANNELS AS BEAMS

Essential Data

Maximum Shear, **12,000** Pounds per Square Inch

CHANNEL [13″ 12″ DATA

Maximum Bending Stress, **18,000** Pounds per Square Inch

Notation	Depth and Flange Width—Weight per Foot										
	*C 20 13″ x 4″						C 2 12″ x 3″				
	50 lbs.	45 lbs.	40 lbs.	37 lbs.	35 lbs.	31.8 lbs.	40 lbs.	35 lbs.	30 lbs.	25 lbs.	20.7 lbs.
Elements											
I_{1-1}	312.9	292.0	271.4	258.9	250.7	237.5	196.5	178.8	161.2	143.5	128.1
S_{1-1}	48.1	44.9	41.7	39.8	38.6	36.5	32.8	29.8	26.9	23.9	21.4
I_{2-2}	16.7	15.3	13.9	13.0	12.5	11.6	6.6	5.9	5.2	4.5	3.9
S_{2-2}	4.9	4.6	4.3	4.2	4.0	3.9	2.5	2.3	2.1	1.9	1.7
Dimensions and Gauges in Inches											
d	13	13	13	13	13	13	12	12	12	12	12
b	4 7/16	4 5/16	4 3/16	4 1/8	4 1/16	4	3 3/16	3 5/16	3 3/16	3 1/16	2 15/16
t	13/16	11/16	9/16	1/2	7/16	3/8	3/4	5/8	1/2	3/8	1/4
p	5/8	5/8	5/8	5/8	5/8	5/8	1/2	1/2	1/2	1/2	1/2
a	3 5/8	3 5/8	3 5/8	3 5/8	3 5/8	3 5/8	2 11/16	2 11/16	2 11/16	2 11/16	2 11/16
Grip	5/8	5/8	5/8	9/16	9/16	9/16	5/8	5/8	1/2	1/2	1/2
f	10 1/2	10 1/2	10 1/2	10 1/2	10 1/2	10 1/2	10	10	10	10	10
o	1 1/4	1 1/4	1 1/4	1 1/4	1 1/4	1 1/4	1	1	1	1	1
g usual	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	2	2	1 3/4	1 3/4	1 3/4
g_2	2 3/4	2 3/4	2 3/4	2 3/4	2 3/4	2 3/4	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2

f and o—Provide usual working clearances.

Maximum Bending Moments, Web Resistances, Etc.

Mmax	72	67	63	60	58	55	49	45	40	36	32
Vmax	123	105	87	77	70	59	109	91	73	56	40
Lmin	2.35	2.57	2.87	3.11	3.32	3.75	1.81	1.96	2.20	2.58	3.18
fb	15000	15000	15000	15000	15000	14996	15000	15000	15000	15000	13781
fbt	11805	10095	8400	7830	6705	5624	11325	9480	7650	5805	3859
a_1 min	7.15	7.15	7.15	7.15	7.15	7.15	6.60	6.60	6.60	6.60	7.45
Rmax	80	68	57	50	45	38	74	62	50	38	25
R_1	49	49	44	39	35	30	49	49	40	30	22
LR_1	5.89	5.50	5.69	6.12	6.62	7.30	4.02	3.65	4.04	4.78	5.84
Wt.C.	15	15	15	15	15	15	15	15	15	15	15
Q	577	539	500	478	463	438	394	358	323	287	257

Mmax = Maximum Bending Moment in thousands of foot pounds.
Vmax = Maximum Web Shear in thousands of pounds.
Lmin = Minimum Span to develop V max. in feet.
fb = Allowable Unit Stress for Web Buckling in pounds per square inch.
fbt = Value of Web in Buckling per inch of length in pounds.
a_1 min = Minimum End Bearing to develop V in inches.
Rmax = Maximum End Reaction when $a_1 = 3\frac{1}{2}$ inches in thousands of pounds.
R_1 = Maximum Value of one Standard Connection, page 250, in thousands of pounds.
LR_1 = Minimum Span in feet to develop R_1.
Wt.C. = Weight of one Standard Connection including web rivets in pounds.
Q = Coefficient of Strength = 12 S_{1-1}.
To obtain safe uniformly distributed load in thousands of pounds, divide Q by the required span in feet.

*C 20—13″ Channel is a Car Building Channel, not American Standard.

CHANNEL
10″ [
9 ″
LOADS

AMERICAN STANDARD CHANNELS AS BEAMS

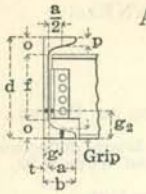
Allowable Uniform Load in Thousands of Pounds

Applicable only when sections are braced against lateral deflection
For unbraced sections safe loads must be reduced, see page 93.

Maximum Bending Stress, **18,000** Pounds per Square Inch

Span in Feet	Depth and Weight of Sections									Coefficient of Deflection
	C 3 10″ x 2⅝″					C 4 9″ x 2½″				
	35 lbs.	30 lbs.	25 lbs.	20 lbs.	15.3 lbs.	25 lbs.	20 lbs.	15 lbs.	13.4 lbs.	
	196.8	161.5	126.2			132.2	96.8			
2	138.3	123.6	108.9	91.0	57.6	94.0	80.8	61.6	49.7	0.07
3	92.2	82.4	72.6	62.8	53.5	62.7	53.8	45.0	42.1	0.17
4	69.1	61.8	54.4	47.1	40.1	47.0	40.4	33.8	31.5	0.30
5	55.3	49.4	43.5	37.7	32.1	37.6	32.3	27.0	25.2	0.47
6	46.1	41.2	36.3	31.4	26.8	31.4	26.9	22.5	21.0	0.67
7	39.5	35.3	31.1	26.9	22.9	26.9	23.1	19.3	18.0	0.91
8	34.6	30.9	27.2	23.5	20.1	23.5	20.2	16.9	15.8	1.19
9	30.7	27.5	24.2	20.9	17.8	20.9	17.9	15.0	14.0	1.51
10	27.7	24.7	21.8	18.8	16.1	18.8	16.2	13.5	12.6	1.86
11	25.1	22.5	19.8	17.1	14.6	17.1	14.7	12.3	11.5	2.25
12	23.0	20.6	18.1	15.7	13.4	15.7	13.5	11.3	10.5	2.68
13	21.3	19.0	16.7	14.5	12.3	14.5	12.4	10.4	9.7	3.15
14	19.8	17.7	15.6	13.5	11.5	13.4	11.5	9.7	9.0	3 65
15	18.4	16.5	14.5	12.6	10.7	12.5	10.8	9.0	8.4	4.19
16	17.3	15.4	13.6	11.8	10.0	11.8	10.1	8.4	7.9	4.77
17	16.3	14.5	12.8	11.1	9.4	11.1	9.5	8.0	7.4	5.38
18	15.4	13.7	12.1	10.5	8.9	10.4	9.0	7.5	7.0	6.03
19	14.6	13.0	11.5	9.9	8.4	9.9	8.5	7.1	6.6	6.72
20	13.8	12.4	10.9	9.4	8.0	9.4	8.1	6.8	6.3	7.45
21	13.2	11.8	10.4	9.0	7.6					8.21
22	12.6	11.2	9.9	8.6	7.3					9.01

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.



AMERICAN STANDARD CHANNELS AS BEAMS

ESSENTIAL DATA

Maximum Shear, **12,000** Pounds per Square Inch

Maximum Bending Stress, **18,000** Pounds per Square Inch

CHANNEL [10″ 9″ **DATA**

Notation	Depth and Flange Width—Weight per Foot								
	C 3 10″ x 2⅝″					C 4 9″ x 2½″			
	35 lbs.	**30 lbs.**	**25 lbs.**	**20 lbs.**	**15.3 lbs.**	**25 lbs.**	**20 lbs.**	**15 lbs.**	**13.4 lbs.**
ELEMENTS									
I_{1-1}	115.2	103.0	90.7	78.5	66.9	70.5	60.6	50.7	47.3
S_{1-1}	**23.0**	**20.6**	**18.1**	**15.7**	**13.4**	**15.7**	**13.5**	**11.3**	**10.5**
I_{2-2}	4.6	4.0	3.4	2.8	2.3	3.0	2.4	1.9	1.8
S_{2-2}	1.9	1.7	1.5	1.3	1.2	1.4	1.2	1.0	0.97
DIMENSIONS AND GAUGES IN INCHES									
d	10	10	10	10	10	9	9	9	9
b	3 3/16	3 1/16	2 7/8	2 3/4	2 5/8	2 13/16	2 5/8	2 1/2	2 7/16
t	13/16	11/16	½	3/8	¼	3/8	7/16	5/16	¼
p	7/16	7/16	7/16	7/16	7/16	7/16	7/16	7/16	7/16
a	2 3/8	2 3/8	2 3/8	2 3/8	2 3/8	2 3/16	2 3/16	2 3/16	2 3/16
Grip	½	½	½	7/16	7/16	½	½	7/16	7/16
f	8¼	8¼	8¼	8¼	8¼	7¼	7¼	7¼	7¼
o	⅞	⅞	⅞	⅞	⅞	⅞	⅞	⅞	⅞
g usual	1¾	1¾	1¾	1½	1½	1½	1½	7/16	7/16
g_2	2½	2½	2½	2½	2½	2½	2½	2½	2½

f and o—Provide usual working clearances.

MAXIMUM BENDING MOMENTS, WEB RESISTANCES, ETC.									
Mmax	35	31	27	24	20	24	20	17	16
Vmax	98	81	63	45	29	66	48	31	25
Lmin	1.41	1.53	1.72	2.07	2.79	1.42	1.67	2.19	2.54
fb	15000	15000	15000	15000	13960	15000	15000	15000	14340
fbt	12300	10095	7890	5685	3350	9180	6720	4275	3298
a_1 min	5.50	5.50	5.50	5.50	6.10	4.95	4.95	4.95	5.28
Rmax	74	61	47	34	20	53	39	25	19
R_1	65	65	55	40	25	64	47	30	24
LR_1	2.12	1.90	1.97	2.36	3.22	1.47	1.72	2.26	2.63
Wt. C.	15	15	15	15	15	15	15	15	15
Q	276	247	217	188	161	188	162	136	126

Mmax = Maximum Bending Moment in thousands of foot pounds.
Vmax = Maximum Web Shear in thousands of pounds.
Lmin = Minimum Span to develop V max. in feet.
fb = Allowable Unit Stress for Web Buckling in pounds per square inch.
fbt = Value of Web in Buckling per inch of length in pounds.
a_1 min = Minimum End Bearing to develop V in inches.
Rmax = Maximum End Reaction when $a_1 = 3\frac{1}{2}$ inches in thousands of pounds.
R_1 = Maximum Value of one Standard Connection, page 250, in thousands of pounds.
LR_1 = Minimum Span in feet to develop R_1.
Wt. C. = Weight of one Standard Connection including web rivets in pounds.
Q = Coefficient of Strength = $12\ S_{1-1}$.
To obtain safe uniformly distributed load in thousands of pounds, divide Q by the required span in feet.

CHANNEL
8″
7″
LOADS

AMERICAN STANDARD CHANNELS AS BEAMS

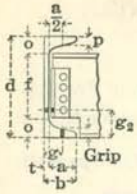
Allowable Uniform Load in Thousands of Pounds

Applicable only when sections are braced against lateral deflection
For unbraced sections safe loads must be reduced, see page 93.

Maximum Bending Stress, **18,000** Pounds per Square Inch

Span in Feet	Depth and Weight of Sections										Coefficient of Deflection
	C 5 8″ x 2¼″					C 6 7″ x 2⅛″					
	21.25 lbs.	18.75 lbs.	16.25 lbs.	13.75 lbs.	11.5 lbs.	19.75 lbs.	17.25 lbs.	14.75 lbs.	12.25 lbs.	9.8 lbs.	
	111.2	93.5	75.8	58.2		105.7	88.0	70.4	52.8		
2	71.4	65.5	59.7	53.8	42.2	56.7	51.5	46.4	41.2	35.3	0.07
3	47.6	43.7	39.8	35.8	32.3	37.8	34.3	30.9	27.5	24.1	0.17
4	35.7	32.8	29.8	26.9	24.2	28.3	25.8	23.2	20.6	18.1	0.30
5	28.6	26.2	23.9	21.5	19.4	22.7	20.6	18.6	16.5	14.5	0.47
6	23.8	21.9	19.9	17.9	16.2	18.9	17.2	15.5	13.7	12.0	0.67
7	20.4	18.7	17.0	15.4	13.8	16.2	14.7	13.3	11.8	10.3	0.91
8	17.9	16.4	14.9	13.4	12.1	14.2	12.9	11.6	10.3	9.0	1.19
9	15.9	14.6	13.3	11.9	10.8	12.6	11.4	10.3	9.2	8.0	1.51
10	14.3	13.1	11.9	10.8	9.7	11.3	10.3	9.3	8.2	7.2	1.86
11	13.0	11.9	10.8	9.8	8.8	10.3	9.4	8.4	7.5	6.6	2.25
12	11.9	10.9	9.9	9.0	8.1	9.4	8.6	7.7	6.9	6.0	2.68
13	11.0	10.1	9.2	8.3	7.5	8.7	7.9	7.1	6.3	5.6	3.15
14	10.2	9.4	8.5	7.7	6.9	8.1	7.4	6.6	5.9	5.2	3.65
15	9.5	8.7	8.0	7.2	6.5	7.6	6.9	6.2	5.5	4.8	4.19
16	8.9	8.2	7.5	6.7	6.1						4.77
17	8.4	7.7	7.0	6.3	5.7						5.38
18	7.9	7.3	6.6	6.0	6.4						6.03

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.



AMERICAN STANDARD CHANNELS AS BEAMS

ESSENTIAL DATA

Maximum Shear, **12,000** Pounds per Square Inch

CHANNEL [8″ 7″ **DATA**

Maximum Bending Stress, **18,000** Pounds per Square Inch

Notation	Depth and Flange Width—Weight per Foot									
	C 5 8″ x 2¼″					C 6 7″ x 2⅛″				
	21.25 lbs.	18.75 lbs.	16.25 lbs.	13.75 lbs.	11.5 lbs.	19.75 lbs.	17.25 lbs.	14.75 lbs.	12.25 lbs.	9.8 lbs.
ELEMENTS										
I_{1-1}	47.6	43.7	39.8	35.8	32.3	33.1	30.1	27.1	24.1	21.1
S_{1-1}	**11.9**	**10.9**	**9.9**	**9.0**	**8.1**	**9.4**	**8.6**	**7.7**	**6.9**	**6.0**
I_{2-2}	2.2	2.0	1.8	1.5	1.3	1.8	1.6	1.4	1.2	0.98
S_{2-2}	1.1	1.0	0.94	0.86	0.79	0.96	0.86	0.79	0.71	0.63
DIMENSIONS AND GAUGES IN INCHES										
d	8	8	8	8	8	7	7	7	7	7
b	2⅝	2½	2 7/16	2 5/16	2¼	2½	2⅜	2 5/16	2 3/16	2 1/16
t	9/16	½	7/16	5/16	¼	7/16	½	7/16	5/16	5/16
p	⅜	⅜	⅜	⅜	⅜	⅜	⅜	⅜	⅜	⅜
a_1	2 1/16	2 1/16	2 1/16	2 1/16	2 1/16	1⅞	1⅞	1⅞	1⅞	1⅞
Grip	7/16	7/16	7/16	⅜	⅜	7/16	7/16	7/16	⅜	⅜
f	6¼	6¼	6¼	6¼	6¼	5½	5½	5½	5½	5½
o	⅞	⅞	⅞	⅞	⅞	¾	¾	¾	¾	¾
g usual	1½	1½	1½	1⅜	1⅜	1½	1½	1¼	1¼	1¼
g_2	2¼	2¼	2¼	2¼	2¼	2	2	2	2	2

f and o—Provide usual working clearances.

MAXIMUM BENDING MOMENTS, WEB RESISTANCES, ETC.

Mmax	18	16	15	13	12	14	13	12	10	9.0
V max	56	47	38	29	21	53	44	35	26	18
L min	1.29	1.40	1.57	1.85	2.29	1.07	1.17	1.32	1.56	2.05
fb	15000	15000	15000	15000	14749	15000	15000	15000	15000	15000
fbt	8685	7305	5925	4545	3245	9435	7860	6285	4710	3150
a_1 min	4.40	4.40	4.40	4.40	4.51	3.85	3.85	3.85	3.85	3.85
Rmax	48	40	33	25	18	50	41	33	25	17
R_1	61	51	41	32	23	32	28	22	16	11
LR_1	1.17	1.28	1.45	1.69	2.11	1.76	1.84	2.10	2.59	3.27
Wt.C.	15	15	15	15	15	8	8	8	8	8
Q	143	131	119	108	97	113	103	92	83	72

Mmax = Maximum Bending Moment in thousands of foot pounds.
Vmax = Maximum Web Shear in thousands of pounds.
Lmin = Minimum Span to develop V max. in feet.
fb = Allowable Unit Stress for Web Buckling in pounds per square inch.
fbt = Value of Web in Buckling per inch of length in pounds.
a_1 min = Minimum End Bearing to develop V in inches.
Rmax = Maximum End Reaction when a_1 = 3½ inches in thousands of pounds.
R_1 = Maximum Value of one Standard Connection, page 250, in thousands of pounds.
LR_1. = Minimum Span in feet to develop R_1.
Wt. C. = Weight of one Standard Connection including web rivets in pounds.
Q = Coefficient of Strength = 12 S_{1-1}.
To obtain safe uniformly distributed load in thousands of pounds, divide Q by the required span in feet.

CHANNEL
6″ [
5″
LOADS

AMERICAN STANDARD CHANNELS AS BEAMS

ALLOWABLE UNIFORM LOAD IN THOUSANDS OF POUNDS

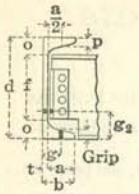
Applicable only when sections are braced against lateral deflection

For unbraced sections safe loads must be reduced, see page 93.

Maximum Bending Stress, **18,000** Pounds per Square Inch

Span in Feet	Depth and Weight of Sections							Coefficient of Deflection
	C 7 6″ x 1⅛″				C 8 5″ x 1¾″			
	15.5 lbs.	13 lbs.	10.5 lbs.	8.2 lbs.	11.5 lbs.	9 lbs.	6.7 lbs.	
	80.5				56.6			
1	77.8	62.9	45.2	28.8	49.7	39.0	22.8	0.02
2	38.9	34.5	30.1	26.0	24.8	21.2	17.8	0.07
3	25.9	23.0	20.1	17.3	16.6	14.1	11.9	0.17
4	19.5	17.3	15.1	13.0	12.4	10.6	8.9	0.30
5	15.6	13.8	12.0	10.4	9.9	8.5	7.1	0.47
6	13.0	11.5	10.0	8.7	8.3	7.1	5.9	0.67
7	11.1	9.9	8.6	7.4	7.1	6.0	5.1	0.91
8	9.7	8.6	7.5	6.5	6.2	5.3	4.4	1.19
9	8.6	7.7	6.7	5.8	5.5	4.7	4.0	1.51
10	7.8	6.9	6.0	5.2	5.0	4.2	3.6	1.86
11	7.1	6.3	5.5	4.7	4.5	3.8	3.2	2.25
12	6.5	5.8	5.0	4.3	4.1	3.5	3.0	2.68
13	6.0	5.3	4.6	4.0				3.15
14	5.6	4.9	4.3	3.7				3.65

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.



AMERICAN STANDARD CHANNELS AS BEAMS

ESSENTIAL DATA

Maximum Shear, **12,000** Pounds per Square Inch

CHANNEL [6″ 5″ **DATA**

Maximum Bending Stress, **18,000** Pounds per Square Inch

Notation	Depth and Flange Width—Weight per Foot						
	C 7 6″ x 1⅞″				C 8 5″ x 1¾″		
	15.5 lbs.	13 lbs.	10.5 lbs.	8.2 lbs.	11.5 lbs.	9 lbs.	6.7 lbs.
ELEMENTS							
$I_{1\text{-}1}$	19.5	17.3	15.1	13.0	10.4	8.8	7.4
$S_{1\text{-}1}$	**6.5**	**5.8**	**5.0**	**4.3**	**4.1**	**3.5**	**3.0**
$I_{2\text{-}2}$	1.3	1.1	0.87	0.70	0.82	0.64	0.48
$S_{2\text{-}2}$	0.73	0.65	0.57	0.50	0.54	0.45	0.38
DIMENSIONS AND GAUGES IN INCHES							
d	6	6	6	6	5	5	5
b	2¼	2 3/16	2 1/16	1 15/16	2 1/16	1⅞	1¾
t	5/16	5/16	5/16	5/16	½	5/16	5/16
p	5/16	5/16	5/16	5/16	5/16	5/16	5/16
a_1	1¾	1¾	1¾	1¾	1 9/16	1 9/16	1 9/16
Grip	⅜	⅜	⅜	5/16	5/16	5/16	5/16
f	4½	4½	4½	4½	3¾	3¾	3¾
o	¾	¾	¾	¾	⅝	⅝	⅝
g usual	1⅜	1⅜	1⅛	1⅛	1⅛	1⅛	1⅛
g_2	2	2	2	2	2	2	2
MAXIMUM BENDING MOMENTS, WEB RESISTANCES, ETC.							
Mmax	9.7	8.6	7.5	6.5	6.2	5.3	4.5
V max	40	31	23	14	28	20	11
L min	0.97	1.10	1.33	1.81	0.88	1.09	1.56
fb	15000	15000	15000	15000	15000	15000	15000
fbt	8385	6555	4710	3000	7080	4875	2850
a_1 min	3.30	3.30	3.30	3.30	2.75	2.75	2.75
Rmax	42	33	24	15	34	23	14
R_1	29	23	16	11	25	17	10
LR_1	1.34	1.51	1.88	2.35	0.98	1.24	1.80
Wt.C.	8	8	8	8	8	8	8
Q	78	70	60	52	49	42	36

f and o—Provide usual working clearances.

Mmax = Maximum Bending Moment in thousands of foot pounds.
Vmax = Maximum Web Shear in thousands of pounds.
Lmin = Minimum Span to develop V max. in feet.
fb = Allowable Unit Stress for Web Buckling in pounds per square inch.
fbt = Value of Web in Buckling per inch of length in pounds.
a_1 min = Minimum End Bearing to develop V in inches.
Rmax = Maximum End Reaction when $a_1 = 3\frac{1}{2}$ inches in thousands of pounds.
R_1 = Maximum Value of one Standard Connection, page 250, in thousands of pounds.
LR_1 = Minimum Span in feet to develop R_1.
Wt. C. = Weight of one Standard Connection including web rivets in pounds.
Q = Coefficient of Strength = $12\ S_{1\text{-}1}$.
To obtain safe uniformly distributed load in thousands of pounds, divide Q by the required span in feet.

CHANNEL
4″ [
3″
LOADS

AMERICAN STANDARD CHANNELS AS BEAMS

ALLOWABLE UNIFORM LOAD IN THOUSANDS OF POUNDS

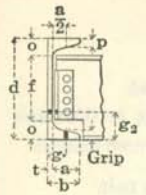
Applicable only when sections are braced against lateral deflection

For unbraced sections safe loads must be reduced, see page 93.

Maximum Bending Stress, **18,000** Pounds per Square Inch

Span in Feet	Depth and Weight of Sections						Coefficient of Deflection
	C 9 4″ x 1⅝″			C 10 3″ x 1⅜″			
	7.25 lbs.	6.25 lbs.	5.4 lbs.	6 lbs.	5 lbs.	4.1 lbs.	
	30.7			25.6	18.6		
1	27.3	23.7	17.3	16.4	14.7	12.2	0.02
2	13.6	12.5	11.4	8.2	7.3	6.5	0.07
3	9.1	8.3	7.6	5.5	4.9	4.4	0.17
4	6.8	6.2	5.7	4.1	3.7	3.3	0.30
5	5.5	5.0	4.6	3.3	2.9	2.6	0.47
6	4.5	4.2	3.8	2.7	2.4	2.2	0.67
7	3.9	3.6	3.3	2.3	2.1	1.9	0.91
8	3.4	3.1	2.8	2.1	1.8	1.6	1.19
9	3.0	2.8	2.5				1.51
10	2.7	2.5	2.3				1.86
11							2.25
12							2.68
13							3.15
14							3.65

Loads above upper horizontal lines will produce maximum allowable shear in webs.
Loads below lower horizontal lines will produce excessive deflections.



AMERICAN STANDARD CHANNELS AS BEAMS

ESSENTIAL DATA

Maximum Shear, **12,000** Pounds per Square Inch

Maximum Bending Stress, **18,000** Pounds per Square Inch

CHANNEL [4″ 3″ **DATA**

Notation	Depth and Flange Width—Weight per Foot					
	C 9 4″ x 1⅝″			C 10 3″ x 1⅜″		
	7.25 lbs.	**6.25** lbs.	**5.4** lbs.	**6** lbs.	**5** lbs.	**4.1** lbs.
	ELEMENTS					
$I_{1\text{-}1}$	4.5	4.1	3.8	2.1	1.8	1.6
$S_{1\text{-}1}$	**2.3**	**2.1**	**1.9**	**1.4**	**1.2**	**1.1**
$I_{2\text{-}2}$	0.44	0.38	0.32	0.31	0.25	0.20
$S_{2\text{-}2}$	0.35	0.32	0.29	0.27	0.24	0.21
	DIMENSIONS AND GAUGES IN INCHES					
d	4	4	4	3	3	3
b	1¾	1⅝	1 9/16	1 9/16	1½	1 7/16
t	5/16	¼	5/16	⅜	¼	5/16
p	5/16	5/16	5/16	¼	¼	¼
a_1	1⅜	1⅜	1⅜	1¼	1¼	1¼
Grip	5/16	5/16	5/16	¼	¼	¼
f	2¾	2¾	2¾	1¾	1¾	1¾
o	⅝	⅝	⅝	⅝	⅝	⅝
g usual	1	1	1	⅞	⅞	⅞
g_2	1¾	1¾	1¾			

f and o—Provides usual working clearance.

	MAXIMUM BENDING MOMENTS, WEB RESISTANCES, ETC.					
Mmax	3.4	3.1	2.8	2.1	1.8	1.6
V max	15	12	8.6	13	9.3	6.1
L min	0.89	1.05	1.32	0.64	0.79	1.07
fb	15000	15000	15000	15000	15000	15000
fbt	4800	3705	2700	5340	3870	2550
a_1 min	2.20	2.20	2.20	1.65	1.65	1.65
Rmax	22	17	12	23	16	11
Q	28	25	23	17	14	13

Mmax = Maximum Bending Moment in thousands of foot pounds.
Vmax = Maximum Web Shear in thousands of pounds.
Lmin = Minimum Span to develop V max. in feet.
fb = Allowable Unit Stress for Web Buckling in pounds per square inch.
fbt = Value of Web in Buckling per inch of length in pounds.
a_1 min = Minimum End Bearing to develop V in inches.
Rmax = Maximum End Reaction when $a_1 = 3\frac{1}{2}$ inches in thousands of pounds.
Q = Coefficient of Strength = 12 $S_{1\text{-}1}$.
To obtain safe uniformly distributed load in thousands of pounds, divide Q by the required span in feet.

ANGLE L LOADS

UNEQUAL ANGLES AS BEAMS

Neutral Axis Parallel to Shorter Leg

ALLOWABLE UNIFORM LOAD IN THOUSANDS OF POUNDS

Applicable only when sections are rigidly secured against lateral deflection

Maximum Bending Stress, **18,000** Pounds per Square Inch

Size, Inches	Thickness, Inches	1 Foot Span	Maximum Span 360 x Deflection		Size, Inches	Thickness, Inches	1 Foot Span	Maximum Span 360 x Deflection	
		Safe Load	Safe Load	Length, Feet			Safe Load	Safe Load	Length, Feet
	1	181.32	9.47	19.2		1	93.96	7.02	13.4
	15/16	171.24	8.91	19.2		15/16	88.92	6.61	13.5
	7/8	160.92	8.34	19.3		7/8	83.76	6.19	13.5
	13/16	150.60	7.77	19.4		13/16	78.60	5.78	13.6
	3/4	140.04	7.19	19.5		3/4	73.20	5.35	13.7
8 x6	11/16	129.24	6.61	19.5		11/16	67.80	4.92	13.8
	5/8	118.44	6.03	19.6	6 x3 1/2	5/8	62.28	4.49	13.9
	9/16	107.40	5.45	19.7		9/16	56.64	4.07	13.9
	1/2	96.24	4.86	19.8		1/2	50.88	3.63	14.0
	7/16	84.84	4.27	19.9		7/16	45.00	3.19	14.1
	1	164.28	9.50	17.3		3/8	39.00	2.75	14.2
	15/16	155.28	8.93	17.4		5/16	32.88	2.30	14.3
	7/8	146.16	8.37	17.5					
	13/16	136.80	7.80	17.5		7/8	59.88	5.08	11.8
	3/4	127.32	7.22	17.7		13/16	56.28	4.74	11.9
8 x3 1/2	11/16	117.60	6.64	17.7		3/4	52.44	4.39	12.0
	5/8	107.76	6.06	17.8		11/16	48.60	4.04	12.0
	9/16	97.80	5.47	17.9	5 x4	5/8	44.76	3.70	12.1
	1/2	87.72	4.88	18.0		9/16	40.68	3.34	12.2
	7/16	77.40	4.28	18.1		1/2	36.60	2.98	12.3
	1	126.96	8.25	15.4		7/16	32.40	2.62	12.4
	15/16	120.00	7.78	15.4		3/8	28.08	2.26	12.4
	7/8	113.04	7.28	15.5					
	13/16	105.84	6.78	15.6		7/8	58.56	5.10	11.5
	3/4	98.64	6.29	15.7		15/16	54.96	4.75	11.6
7 x3 1/2	11/16	91.20	5.79	15.8		3/4	51.36	4.41	11.6
	5/8	83.64	5.28	15.9		11/16	47.64	4.06	11.7
	9/16	75.96	4.77	15.9		5/8	43.80	3.71	11.8
	1/2	68.16	4.26	16.0	5 x3 1/2	9/16	39.84	3.35	11.9
	7/16	60.12	3.73	16.1		1/2	35.88	3.00	12.0
	3/8	51.96	3.21	16.2		7/16	31.68	2.63	12.1
	1	96.24	7.02	13.7		3/8	27.48	2.26	12.1
	15/16	91.08	6.59	13.8		5/16	23.28	1.91	12.2
	7/8	85.80	6.18	13.9					
	13/16	80.40	5.76	14.0		13/16	53.40	4.75	11.2
	3/4	75.00	5.35	14.0		3/4	49.92	4.41	11.3
6 x4	11/16	69.36	4.92	14.1		11/16	46.32	4.07	11.4
	5/8	63.72	4.49	14.2	5 x3	5/8	42.60	3.72	11.5
	9/16	57.96	4.06	14.3		9/16	38.76	3.35	11.6
	1/2	52.08	3.63	14.4		1/2	34.92	3.00	11.6
	7/16	45.96	3.18	14.5		7/16	30.96	2.64	11.7
	3/8	39.84	2.74	14.5		3/8	26.88	2.28	11.8
						5/16	22.68	1.91	11.9

UNEQUAL ANGLES AS BEAMS

Neutral Axis Parallel to Shorter Leg

ALLOWABLE UNIFORM LOAD IN THOUSANDS OF POUNDS

Applicable only when sections are rigidly secured against lateral deflection

Maximum Bending Stress, **18,000** Pounds per Square Inch

ANGLE L LOADS

Size, Inches	Thickness, Inches	1 Foot Span	Maximum Span 360 x Deflection		Size, Inches	Thickness, Inches	1 Foot Span	Maximum Span 360 x Deflection	
		Safe Load	Safe Load	Length, Feet			Safe Load	Safe Load	Length, Feet
	15/16	43.44	4.26	10.2		9/16	13.80	1.95	7.1
	3/4	40.56	3.95	10.3		1/2	12.48	1.74	7.2
	11/16	37.68	3.63	10.4	3 x2 1/2	7/16	11.16	1.54	7.2
	5/8	34.68	3.32	10.5		3/8	9.72	1.33	7.3
4 1/2x3	9/16	31.68	3.01	10.5		5/16	8.28	1.12	7.4
	1/2	28.44	2.68	10.6		1/4	6.72	0.90	7.5
	7/16	25.20	2.36	10.7					
	3/8	21.96	2.04	10.8		1/2	12.00	1.75	6.9
	5/16	18.48	1.70	10.9		7/16	10.68	1.54	6.9
					3 x2	3/8	9.36	1.33	7.0
	15/16	35.04	3.71	9.5		5/16	7.92	1.12	7.1
	3/4	33.00	3.47	9.5		1/4	6.48	0.90	7.2
	11/16	30.72	3.20	9.6					
	5/8	28.20	2.91	9.7		1/2	8.40	1.45	5.8
4 x3 1/2	9/16	25.80	2.64	9.8		7/16	7.56	1.28	5.9
	1/2	23.16	2.35	9.9		3/8	6.60	1.10	6.0
	7/16	20.64	2.08	9.9	2 1/2x2	5/16	5.64	0.93	6.1
	3/8	18.00	1.80	10.0		1/4	4.56	0.75	6.1
	5/16	15.12	1.50	10.1		3/16	3.48	0.56	6.2
						1/8	2.40	0.38	6.3
	15/16	34.44	3.76	9.2					
	3/4	32.16	3.48	9.2		5/16	5.28	0.92	5.7
	11/16	29.88	3.20	9.3	2 1/2x1 1/2	1/4	4.32	0.75	5.8
	5/8	27.60	2.93	9.4		3/16	3.36	0.57	5.9
	9/16	25.20	2.66	9.5					
4 x3	1/2	22.68	2.37	9.6		1/2	6.48	1.30	5.0
	7/16	20.16	2.08	9.7		7/16	5.76	1.13	5.1
	3/8	17.52	1.80	9.7		3/8	5.04	0.98	5.2
	5/16	14.76	1.51	9.8	2 1/4x1 1/2	5/16	4.32	0.83	5.2
	1/4	12.00	1.22	9.9		1/4	3.60	0.68	5.3
						3/16	2.76	0.51	5.4
	15/16	26.40	3.25	8.1					
	3/4	24.60	3.00	8.2					
	11/16	22.92	2.77	8.3		3/8	4.08	0.88	4.6
	5/8	21.12	2.53	8.3		5/16	3.48	0.74	4.7
3 1/2x3	9/16	19.32	2.30	8.4	2 x1 1/2	1/4	2.88	0.60	4.8
	1/2	17.40	2.05	8.5		3/16	2.16	0.44	4.9
	7/16	15.48	1.80	8.6		1/8	1.50	0.30	4.9
	3/8	13.56	1.57	8.7					
	5/16	11.52	1.32	8.7		1/4	2.75	0.60	4.6
	1/4	9.36	1.06	8.8	2 x1 1/4	3/16	2.12	0.45	4.7
	11/16	22.20	2.78	8.0					
	5/8	20.52	2.55	8.1		1/4	2.11	0.51	4.1
	9/16	18.72	2.30	8.1	1 3/4x1 1/4	3/16	1.64	0.39	4.2
3 1/2x2 1/2	1/2	16.92	2.06	8.2		1/8	1.13	0.27	4.3
	7/16	15.12	1.82	8.3					
	3/8	13.20	1.57	8.4		5/16	1.92	0.55	3.5
	5/16	11.16	1.32	8.4	1 1/2x1 1/4	1/4	1.56	0.44	3.6
	1/4	9.00	1.05	8.6		3/16	1.21	0.33	3.7

ANGLE

LOADS

UNEQUAL ANGLES AS BEAMS

Neutral Axis Parallel to Longer Leg

ALLOWABLE UNIFORM LOAD IN THOUSANDS OF POUNDS

Applicable only when sections are rigidly secured against lateral deflection

Maximum Bending Stress, **18,000** Pounds per Square Inch

Size, Inches	Thickness, Inches	1 Foot Span	Maximum Span 360 x Deflection		Size, Inches	Thickness, Inches	1 Foot Span	Maximum Span 360 x Deflection	
		Safe Load	Safe Load	Length, Feet			Safe Load	Safe Load	Length, Feet
	1	107.04	6.87	15.6		1	34.80	3.91	8.9
	15/16	101.16	6.47	15.6		15/16	32.88	3.66	9.0
	7/8	95.28	6.06	15.7		7/8	31.08	3.43	9.1
	13/16	89.28	5.65	15.8		13/16	29.16	3.19	9.1
	3/4	83.16	5.23	15.9		3/4	27.24	2.96	9.2
8 x6	11/16	76.92	4.82	16.0		11/16	25.32	2.72	9.3
	5/8	70.56	4.40	16.0	6 x3 1/2	5/8	23.28	2.48	9.4
	9/16	64.08	3.98	16.1		9/16	21.24	2.25	9.5
	1/2	57.48	3.55	16.2		1/2	19.08	2.00	9.6
	7/16	50.76	3.12	16.3		7/16	16.92	1.76	9.6
	1	36.24	3.92	9.2		3/8	14.76	1.51	9.7
	15/16	34.20	3.67	9.3		5/16	12.48	1.27	9.8
	7/8	32.28	3.43	9.4					
	13/16	30.24	3.19	9.5		7/8	39.72	3.98	10.0
	3/4	28.20	2.94	9.6		13/16	37.32	3.70	10.1
8 x3 1/2	11/16	26.04	2.69	9.7		3/4	34.80	3.42	10.2
	5/8	24.00	2.46	9.7		11/16	32.28	3.15	10.2
	9/16	21.84	2.22	9.9	5 x4	5/8	29.76	2.89	10.3
	1/2	19.68	1.98	9.9		9/16	27.12	2.61	10.4
	7/16	17.52	1.75	10.0		1/2	24.48	2.33	10.5
	1	35.52	3.91	9.1		7/16	21.72	2.06	10.6
	15/16	33.60	3.67	9.2		3/8	18.84	1.77	10.6
	7/8	31.68	3.42	9.3					
	13/16	29.76	3.19	9.3		7/8	30.24	3.43	8.8
	3/4	27.72	2.94	9.4		13/16	28.44	3.20	8.9
7 x3 1/2	11/16	25.68	2.71	9.5		3/4	26.64	2.98	9.0
	5/8	23.64	2.47	9.6		11/16	24.72	2.73	9.1
	9/16	21.60	2.23	9.7		5/8	22.80	2.50	9.1
	1/2	19.44	2.00	9.7		9/16	20.76	2.26	9.2
	7/16	17.28	1.75	9.9	5 x3 1/2	1/2	18.72	2.02	9.3
	3/8	15.12	1.52	9.9		7/16	16.68	1.78	9.4
	1	45.48	4.49	10.1		3/8	14.52	1.54	9.5
	15/16	43.08	4.21	10.2		5/16	12.24	1.29	9.5
	7/8	40.68	3.95	10.3					
	13/16	38.16	3.68	10.4		13/16	20.88	2.73	7.7
	3/4	35.64	3.41	10.5		3/4	19.56	2.53	7.7
6 x4	11/16	33.12	3.14	10.5		11/16	18.12	2.32	7.8
	5/8	30.48	2.87	10.6		5/8	16.68	2.12	7.9
	9/16	27.72	2.59	10.7	5 x3	9/16	15.24	1.91	8.0
	1/2	24.96	2.32	10.8		1/2	13.80	1.71	8.1
	7/16	22.20	2.04	10.9		7/16	12.24	1.51	8.1
	3/8	19.20	1.75	11.0		3/8	10.68	1.30	8.2
						5/16	9.00	1.08	8.3

UNEQUAL ANGLES AS **BEAMS**

Neutral Axis Parallel to Longer Leg

ALLOWABLE UNIFORM LOAD IN THOUSANDS OF POUNDS

Applicable only when sections are rigidly secured against lateral deflection

ANGLE

LOADS

Maximum Bending Stress, **18,000** Pounds per Square Inch

Size, Inches	Thickness, Inches	1 Foot Span	Maximum Span 360 x Deflection		Size, Inches	Thickness, Inches	1 Foot Span	Maximum Span 360 x Deflection	
		Safe Load	Safe Load	Length, Feet			Safe Load	Safe Load	Length, Feet
	13/16	20.52	2.73	7.5		9/16	9.84	1.59	6.2
	3/4	19.20	2.53	7.6		1/2	8.88	1.42	6.3
	11/16	17.88	2.32	7.7		7/16	7.92	1.25	6.3
	5/8	16.44	2.11	7.8	3 x2 1/2	3/8	6.96	1.08	6.4
4 1/2x3	9/16	15.00	1.90	7.8		5/16	5.88	0.90	6.5
	1/2	13.56	1.71	7.9		1/4	4.80	0.73	6.6
	7/16	12.12	1.51	8.0					
	3/8	10.56	1.31	8.1		1/2	5.64	1.11	5.1
	5/16	9.00	1.10	8.2		7/16	5.04	0.98	5.2
						3/8	4.44	0.85	5.2
	13/16	27.60	3.22	8.6	3 x2	5/16	3.84	0.72	5.3
	3/4	25.80	2.99	8.6		1/4	3.00	0.58	5.4
	11/16	24.00	2.76	8.7					
	5/8	22.08	2.51	8.8		1/2	5.52	1.12	4.9
4 x3 1/2	9/16	20.16	2.27	8.9		7/16	4.92	0.98	5.0
	1/2	18.24	2.04	9.0		3/8	4.32	0.85	5.1
	7/16	16.20	1.80	9.0	2 1/2x2	5/16	3.72	0.72	5.2
	3/8	14.16	1.56	9.1		1/4	3.00	0.58	5.2
	5/16	12.00	1.31	9.2		3/16	2.40	0.45	5.3
						1/8	1.62	0.30	5.4
	13/16	20.16	2.74	7.4					
	3/4	18.84	2.53	7.4		5/16	2.04	0.52	3.9
	11/16	17.52	2.32	7.6		1/4	1.68	0.41	4.1
	5/8	16.20	2.12	7.6	2 1/2x1 1/2	3/16	1.32	0.32	4.1
4 x3	9/16	14.76	1.92	7.7					
	1/2	13.32	1.71	7.8		1/2	3.12	0.85	3.7
	7/16	11.88	1.51	7.9		7/16	2.76	0.74	3.7
	3/8	10.44	1.31	7.9		3/8	2.40	0.63	3.8
	5/16	8.88	1.11	8.0	2 1/4x1 1/2	5/16	2.04	0.53	3.9
	1/4	7.20	.89	8.1		1/4	1.68	0.42	4.0
						3/16	1.32	0.33	4.0
	13/16	19.80	2.74	7.2					
	3/4	18.48	2.53	7.3		3/8	2.40	0.65	3.7
	11/16	17.28	2.34	7.4		5/16	2.04	0.54	3.8
	5/8	15.96	2.14	7.4		1/4	1.68	0.43	3.9
3 1/2x3	9/16	14.52	1.93	7.5	2 x1 1/2	3/16	1.32	0.33	4.0
	1/2	13.20	1.74	7.6		1/8	0.90	0.22	4.0
	7/16	11.76	1.53	7.7					
	3/8	10.20	1.31	7.8		1/4	1.16	0.35	3.3
	5/16	8.64	1.10	7.8	2 x1 1/4	3/16	0.90	0.27	3.4
	1/4	6.96	0.88	7.9					
						1/4	1.14	0.35	3.2
	11/16	11.88	1.92	6.2		3/16	0.90	0.27	3.3
	5/8	11.04	1.76	6.3	1 3/4x1 1/4	1/8	0.62	0.19	3.4
	9/16	10.08	1.59	6.3					
3 1/2x2 1/2	1/2	9.12	1.42	6.4		5/16	1.36	0.45	3.0
	7/16	8.16	1.25	6.5		1/4	1.12	0.36	3.1
	3/8	7.08	1.07	6.6	1 1/2x1 1/4	3/16	0.88	0.27	3.2
	5/16	6.00	0.90	6.7					
	1/4	4.92	0.73	6.8					

ANGLE

LOADS

EQUAL ANGLES AS BEAMS

Neutral Axis Parallel to Either Leg

ALLOWABLE UNIFORM LOAD IN THOUSANDS OF POUNDS

Applicable only when sections are rigidly secured against lateral deflection

Maximum Bending Stress, **18,000** Pounds per Square Inch

Size, Inches	Thickness, Inches	1 Foot Span	Maximum Span 360 x Deflection		Size, Inches	Thickness, Inches	1 Foot Span	Maximum Span 360 x Deflection	
		Safe Load	Safe Load	Length, Feet			Safe Load	Safe Load	Length, Feet
	1⅛	210.36	10.51	20.0		1⅝₁₆	27.00	3.24	8.3
	1⅛₁₆	200.04	9.96	20.1		¾	25.32	3.01	8.4
	1	189.60	9.40	20.2		1⅛₁₆	23.52	2.76	8.5
	1⅝₁₆	179.04	8.84	20.2		⅝	21.72	2.53	8.6
	⅞	168.24	8.28	20.3	3 ½x3 ½	9⁄16	19.80	2.29	8.7
8 x8	1⅝₁₆	157.32	7.71	20.4		½	17.88	2.05	8.7
	¾	146.28	7.14	20.5		7⁄16	15.84	1.80	8.8
	1⅛₁₆	135.00	6.56	20.6		⅜	13.80	1.55	8.9
	⅝	123.60	5.98	20.7		5⁄16	11.76	1.31	9.0
	9⁄16	112.08	5.41	20.7		¼	9.48	1.05	9.1
	½	100.44	4.83	20.8		⅝	15.60	2.16	7.2
	1	102.84	6.94	14.8		9⁄16	14.28	1.95	7.3
	1⅝₁₆	97.32	6.54	14.9		½	12.84	1.73	7.4
	⅞	91.56	6.12	15.0	3 x3	7⁄16	11.40	1.52	7.5
	1⅝₁₆	85.80	5.70	15.0		⅜	9.96	1.32	7.6
	¾	79.92	5.29	15.1		5⁄16	8.52	1.12	7.6
6 x6	1⅛₁₆	74.04	4.87	15.2		¼	6.96	0.90	7.7
	⅝	67.92	4.44	15.3		½	8.76	1.45	6.1
	9⁄16	61.68	4.02	15.4	2 ½x2 ½	7⁄16	7.80	1.27	6.2
	½	55.32	3.58	15.5		⅜	6.84	1.10	6.2
	7⁄16	48.84	3.14	15.5		5⁄16	5.76	0.92	6.3
	⅜	42.36	2.71	15.6		¼	4.68	0.74	6.4
	1	69.60	5.73	12.1		3⁄16	3.60	0.55	6.5
	1⅝₁₆	65.88	5.39	12.2		⅛	2.40	0.37	6.6
	⅞	62.04	5.05	12.3		7⁄16	4.80	1.00	4.8
	1⅝₁₆	58.20	4.71	12.4		⅜	4.20	.86	4.9
	¾	54.36	4.36	12.5	2 x2	5⁄16	3.60	.72	5.0
5 x5	1⅛₁₆	50.40	4.02	12.5		¼	3.00	.59	5.1
	⅝	46.32	3.68	12.6		3⁄16	2.28	.45	5.1
	9⁄16	42.12	3.32	12.7	1 ¾x1 ¾	⅛	1.56	.30	5.2
	½	37.80	2.96	12.8		7⁄16	3.60	.87	4.2
	7⁄16	33.48	2.61	12.9		⅜	3.12	.74	4.2
	⅜	29.04	2.25	12.9		5⁄16	2.76	.64	4.3
	1⅝₁₆	36.12	3.72	9.7		¼	2.28	.52	4.4
	¾	33.72	3.45	9.8	1 ½x1 ½	3⁄16	1.68	.38	4.4
	1⅛₁₆	31.32	3.18	9.8		⅛	1.20	.26	4.6
	⅝	28.80	2.91	9.9		⅜	2.28	.64	3.5
	9⁄16	26.28	2.63	10.0		5⁄16	1.94	.54	3.6
4 x4	½	23.64	2.34	10.1		¼	1.61	.44	3.7
	7⁄16	21.00	2.06	10.2	1 ¼x1 ¼	3⁄16	1.25	.33	3.8
	⅜	18.24	1.78	10.2		⅛	0.86	.22	3.9
	5⁄16	15.48	1.50	10.3		5⁄16	1.31	.44	3.0
	¼	12.60	1.21	10.4		¼	1.09	.36	3.0
						3⁄16	0.85	.27	3.1
						⅛	0.59	.18	3.2
						¼	0.67	.28	2.4
					1 x1	3⁄16	0.53	.22	2.4
						⅛	0.37	.15	2.5

TEES AND ZEES

Neutral Axis Parallel to Flanges

ALLOWABLE UNIFORM LOAD IN THOUSANDS OF POUNDS

Applicable only when sections are rigidly secured against lateral deflection

Maximum Bending Stress, **18,000** Pounds per Square Inch

T L
LOADS

TEES

Size Flange x Stem, Inches	Weight per Foot, Pounds	1 Foot Span	Maximum Span 360 x Deflection		Size Flange x Stem, Inches	Weight per Foot, Pounds	1 Foot Span	Maximum Span 360 x Deflection	
		Safe Load	Safe Load	Length, Feet			Safe Load	Safe Load	Length, Feet
6 ½x6 ½	19.8	59.40	3.50	17.0	5 x3 ⅛	13.6	13.55	1.60	8.5
4 x4	13.5	24.24	2.40	10.1	5 x3	11.5	12.75	1.59	8.0
4 x4	10.5	18.96	1.85	10.3	4 x5	15.3	37.56	3.05	12.3
3 x3	7.8	10.32	1.36	7.6	4 x5	11.9	29.16	2.33	12.5
3 x3	6.7	8.88	1.16	7.7	4 x4 ½	14.4	30.48	2.72	11.2
2 ½x2 ½	6.4	7.08	1.14	6.2	4 x4 ½	11.2	23.76	2.08	11.4
2 ½x2 ½	5.5	6.00	0.95	6.3	4 x3	9.2	10.80	1.36	7.9
2 ¼x2 ¼	4.9	4.92	0.88	5.6	4 x3	7.8	9.24	1.15	8.1
2 ¼x2 ¼	4.1	3.84	0.67	5.7	4 x2 ½	8.5	7.44	1.11	6.7
2 x2	4.3	3.72	0.75	5.0	4 x2 ½	7.2	6.36	0.94	6.8
2 x2	3.56	3.12	0.62	5.0	3 x2 ½	6.1	6.24	0.96	6.5
					2 ½x3	6.1	8.64	1.16	7.4
					1 ½x2	2.45	2.34	0.48	4.9
					1 ½x1 ¼	1.25	0.64	0.19	3.3

ZEES

Size Depth x Flange, Inches	Thick-ness, Inches	1 Foot Span	Maximum Span 360 x Deflection		Size Depth x Flange, Inches	Thick-ness, Inches	1 Foot Span	Maximum Span 360 x Deflection	
		Safe Load	Safe Load	Length, Feet			Safe Load	Safe Load	Length, Feet
6⅛ x3⅝	⅞	196.80	17.95	11.0	4⅛ x3 13/16	¾	87.12	11.80	7.4
6 1/16x3 9/16	13/16	182.64	16.83	10.9	4 1/16x3⅛	1 1/16	79.80	10.97	7.3
6 x3½	¾	168.48	15.68	10.7	4 x3 1/16	5/8	72.60	10.14	7.2
6⅛ x3⅝	1 1/16	169.20	15.43	11.0	4⅛ x3 1/16	9/16	74.16	10.04	7.4
6 1/16x3 9/16	5/8	153.84	14.18	10.9	4 1/16x3⅛	½	66.00	9.08	7.3
6 x3½	9/16	138.60	12.91	10.7	4 x3 1/16	7/16	57.96	8.10	7.2
6⅛ x3⅝	½	134.64	12.28	11.0	4⅛ x3 1/16	⅜	56.04	7.59	7.4
6 1/16x3 9/16	7/16	117.96	10.87	10.9	4 1/16x3⅛	5/16	46.92	6.45	7.3
6 x3½	⅜	101.28	9.43	10.7	4 x3 1/16	¼	37.68	5.26	7.2
5⅛ x3⅜	13/16	134.40	14.65	9.2					
5 1/16x3 5/16	¾	124.08	13.69	9.1					
5 x3¼	1 1/16	113.64	12.70	9.0	3 1/16x2¾	9/16	41.16	7.51	5.5
5⅛ x3⅜	5/8	114.84	12.52	9.2	3 x2 11/16	½	36.72	6.84	5.4
5 1/16x3 5/16	9/16	103.44	11.42	9.1	3 1/16x2¾	7/16	35.76	6.52	5.5
5 x3¼	½	92.16	10.30	9.0	3 x2 11/16	⅜	30.84	5.74	5.4
5⅛ x3⅜	7/16	89.28	9.73	9.2	3 1/16x2¾	5/16	28.56	5.21	5.5
5 1/16x3 5/16	⅜	76.68	8.46	9.1	3 x2 11/16	¼	23.04	4.29	5.4
5 x3¼	5/16	64.08	7.16	9.0					

PLATE AND ANGLE GIRDERS

Girders, built up of plates and angles are used for heavy loads and long spans, where rolled sections are insufficient.

Loads upon a plate and angle girder develop compressive and tensile stresses resisted by the upper and lower flanges, and shearing stresses resisted by the web plate.

The most economical section is the single web girder; box girders with double or triple webs are used where great length of span combined with lateral stiffness require them.

WEB. The web plate governs the depth of the girder which, to avoid excessive deflection, should not be less than 1/15 of the span, the thickness depends upon the shear which is greatest at the point of support and should not be less than 1/160 of the unsupported distance between the flanges; the web is reinforced by stiffeners at intervals to prevent buckling.

Web Shear and Stiffeners. Web plates subjected to direct vertical shear must resist buckling; the allowable vertical shear may be obtained from the table on page 194, based on a maximum shearing stress of 12000 pounds, giving allowable unit web shear, V/A, total vertical shear÷gross area of web, for various ratios of h/t, distance between flanges÷thickness of web.

Stiffeners are required at the ends and at points of concentrated loads and at other points where the clear distance between flange angles, h, exceeds allowable safe stresses obtained from table, and also where h is greater than 60 times the thickness of the web; stiffeners are generally in pairs, one on each side of the web, bearing closely against the projecting leg of the flange angles; the pitch of rivets in stiffeners should not exceed 6 inches.

FLANGES. The flange area is so proportioned that the extreme compressive or tensile stress, $f=\frac{n\,M}{I}$, does not exceed the maximum allowable limit, being so proportioned that the unit stress on the net section does not exceed the maximum unit stress as determined by the moment of inertia of the net section of the girder.

When the flanges are alike, as they usually are, the preliminary investigation is simplified by assuming that the stresses in the flanges are uniformly distributed, and their resultants act at the center of gravity of the flanges.

A=Area of one flange d=Effective depth t=Web thickness

Total Moment of Resistance, $M = f\,(A\,d + \frac{d^2\,t}{6}) = f\,d\,(A + \frac{d\,t}{6})$.

The net moment of resistance of the web plate, with allowance for reduction of area due to web splices is generally taken as $\frac{d\,t}{8}$, or:

Net Moment of Resistance, $M = f\,(A\,d + \frac{d^2\,t}{8}) = f\,d\,(A + \frac{d\,t}{8})$.

d is the approximate distance between centers of gravity of flange angles, or distance out to out of angles when flange plates are used.

The final design of the girder is obtained in accordance with the method given for the computation of compound sections.

Flange Plates. When the girder carries a uniformly distributed load, the flange areas vary as the ordinates of a parabola, and the theoretical length of the flange plate is

$$L_1 = L\sqrt{\frac{a_1}{A}} \qquad L_2 = L\sqrt{\frac{a_2}{A}} \qquad L_3 = L\sqrt{\frac{a_3}{A}}$$

L = Length of girder. A = Total Area of Flange.

L_1, L_2, L_3 = Length of flange plates, beginning with outside plate.

a_1, a_2, a_3 = Total area of flange plates, from outer to inner plates.

Sufficient length, usually from 12 to 18 inches, is added to each end of plate to take up the shear; the plate next to the flange angle is extended to full length of the girder, to resist lateral deflection.

EXAMPLE. Required the length of flange plates of a 60-inch girder, 60 feet long, the flange including flange angles, two flange plates and one-eighth of web plate; rivets ⅞″ dia.

2—Angles	6″ x 3½″ x ½″	Net Area	9.00—2.00	= 7.00 sq. in.	Total Area: 19.57 sq. in.
1—Inner Flange Plate	14″ x 7/16″	"	6.13—8.75	= 5.26 "	
1—Outer Flange Plate	14″ x ⅜″	"	5.25—0.75	= 4.50 "	
⅛—Web Plate	60″ x ⅜″	"	2.81	= 2.81 "	

Outer plate, $L_1 = 60\sqrt{\frac{4.50}{19.57}} = 28.8$ ft. say 32 ft. Inner plate, $L_2 = 60\sqrt{\frac{4.50+5.26}{19.57}} = 42.4$ ft. full length.

Maximum End Flange Stress. In addition to a girder having sufficient flange area to resist the maximum bending moment, it must also be capable of withstanding stresses at the ends.

The end resistance of a riveted girder depends on: First, the resistance of the web plate to shearing; second, the resistance of the flange rivets to bearing, it being assumed that the bearing value of rivets does not exceed twice their value in single shear.

The difference in flange stress between any two points is the horizontal shear to be transmitted into the web by the flange rivets between those points, and can not be greater than that of the end reaction considered to be distributed along the flange within a length equal to the distance, a, between the center of the rivets in upper and lower flange with one line of rivets, or between the center lines of two lines of rivets, according to design.

Web Stress: $d \times t \times f$ = Maximum End Resistance if less than flange stress.

d = Depth. t = Thickness of web. f = Allowable unit shearing stress.

Flange Stress: $\frac{a\,R}{p}$ = Maximum End Resistance if less than web stress.

a = Effective distance (d + ½″) — 2 x distance from back of angles, for one or two rivet lines.
R = Bearing value of one rivet. p = Minimum pitch between two rivets.
Required the maximum end resistance of a girder, properly stiffened at ends.

EXAMPLE 1. Girder composed of 1—Web Plate, 36″ x 5/16″ 4—Flange Angles, 5″ x 3½″.
Web Stress: 36 x 5/16 x 12000 = 135,000 pounds.
Flange Rivets: a = (36″ + ½″) — 4½″ = 32″; 32 ÷ 2½ = 13 Rivets.
Bearing value of ⅞″ Dia. Rivet: ⅞ x 5/16 x 30000 = 8200 pounds.
Flange Stress: 8200 x 13 = 106,600 pounds = Maximum End Resistance.

EXAMPLE 2. Girder composed of 1—Web Plate, 48″ x ⅜″ 4—Flange Angles, 6″ x 6″.
Web Stress: 48 x ⅜ x 12000 = 216,000 pounds = Maximum End Resistance.
Flange Rivets: a = (48″ + ½″) — 7″ = 41½″; 41½ ÷ 1¾ = 24 Rivets.
Bearing value of ⅞″ Dia. Rivet: ⅞ x ⅜ x 30000 = 9840 pounds.
Flange Stress: 9840 x 24 = 236,160 pounds.

Rivet Spacing in Flanges. It follows that the rivets connecting the web plate with the flange angles are required to transmit the horizontal shearing stress from the web to the flange, which horizontal shear in any panel is equal to the vertical shear at center of panel multiplied by its length and divided by the vertical distance, a.

As the shear increases from the point of greatest bending moment towards the supports, the number of rivets in vertical legs of the flange angles must also increase as the supports are approached.

Pitch of rivets in flange angles, $p = \frac{a\,R}{V}$

V = Total vertical shear at the panel under consideration.
R = Resistance of one rivet, i. e., the bearing or shearing value, whichever is smaller.
a = Effective distance between upper and lower lines of rivets.

The formula gives the theoretical rivet spacing for any point in the flanges due to the total shear, but in practice the pitch is computed from the maximum stress in each panel, in nearest ¼ inch.

EXAMPLE. A girder composed of 5″ x 3½″ angles and 36″ x 5/16″ web, 30 ft. long, divided into 3-foot panels, supports a uniformly distributed load of 72 tons, or 4800 pounds per foot.

Required rivet pitch in panels, when distance between rivet lines = 32 inches.

	Shearing Stress, Pounds	Horizontal Stress, Pounds per Inch
Panel 1.	144000 ÷ 2 = 72000	72000 ÷ 32 = 2250
" 2.	72000 — (4800 x 3) = 57600	57600 ÷ 32 = 1800
" 3.	72000 — (4800 x 6) = 43200	43200 ÷ 32 = 1350
" 4.	72000 — (4800 x 9) = 28800	28800 ÷ 32 = 900

Bearing value of ⅞″ Dia. Rivet: ⅞ x 5/16 x 30000 = 8200 pounds.

Panel 1.	Rivet Pitch	8200 ÷ 2250 = 3.6	say 3½″ spacing
" 2.	" "	8200 ÷ 1800 ÷ 4.5	" 4½″ "
" 3.	" "	8200 ÷ 1350 = 6.1	" 6″ maximum spacing
" 4.	" "	8200 ÷ 900 = 9.1	" 6″ " "

When the load rests directly on the top or bottom flanges, the rivets connecting this flange with the web plate are also required to distribute the load; then the resultant stress on rivets on the loaded flange is represented by the resultant of horizontal shear and vertical load.

EXAMPLE. Loads bearing directly on one flange only, then first panel, foregoing example:
Horizontal Shear 2250 pounds per inch. Vertical Load 400 pounds per inch.
Resultant Stress $\sqrt{2250^2+400^2}$ =2285 pounds. Rivet Pitch 8200÷2285=3.58".

Flange Plates. At the end of each flange plate, sufficient rivets must be provided to transmit the allowable stress on the net section of the plate to the adjacent members.

EXAMPLE. Required number of rivets, ⅞" Dia., for 14" x 7/16" Inner Flange Plate.
14" x 7/16" Inner Flange Plate, net area: (6.13—.875)=5.26 sq. in.
Resistance 5.26 x 18000=94680 pounds.
Shearing value of ⅞" Dia. Rivet: .6013 x 13500=8120 pounds.
94680÷8120=12 rivets, or:
Two lines of 6 rivets each end of plate, spaced 3 inches to 3½ inches.

SPLICES. In long and deep girders or in girders to be made from stock lengths, it is often necessary to splice the web plate or also flange angles and plates.

The resistance of all splice plates must be such as to develop the full resisting strength of the rivets in the splice, in particular when rivet stresses are to be transmitted through narrow plates.

Web Splices. As there is no vertical shearing stress in the middle of the girder under a uniformly distributed load, web splices are sometimes made at that point, but, generally, the web is spliced in two places equidistant from the center.

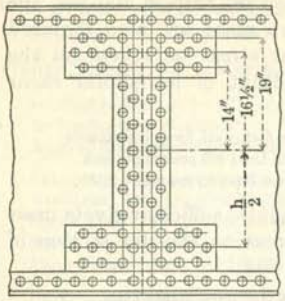
The rivets in the web splice must transmit the web stresses so that no additional stresses are imparted to the flange rivets, these stresses being most effectively transmitted by two pairs of horizontal plates next to the flange angles to resist bending and one pair of vertical plates to resist shearing stresses.

Bending Stress—Horizontal Plates,

Moment of Resistance, $M=\frac{R\,h}{2}=\frac{A\,h\,f}{2}$

R =Total rivet value, one side of splice
A =Total sectional area of splice plate
h =Distance between centers
f =Fiber stress

The rivets are not equally stressed, the stress is zero at the neutral axis and increases uniformly to a maximum at extreme distance, d; the moment stress of each rivet is as its distance from neutral axis, and the moment of resistance as the square of its distance from neutral axis.



EXAMPLE. Required the web splice in a 48-inch girder with ⅜-inch web plate, capable of resisting the bending moment in web at 18,000 pounds fiber stress. Horizontal plates to transmit bending stress in web, based on one-eighth of the web action.

Bending Moment in web plate:
(48x⅜x½)x48 x 18,000=1,944,000 inch-pounds.

Investigating the value of rivets assumed:
Bearing value of ⅞" Dia. rivet:
⅞ x ⅜ x 30,000=9840 pounds.

Distance from neutral axis to top or bottom of girder=24 inches.

Value of one rivet, one inch from neutral axis: 9840÷24=410 pounds.
Moment of Resistance of rivets one side of joint above and below neutral axis is
$M=410\ (6 \times 14.0^2+8 \times 16.5^2+6 \times 19.0^2)=2{,}263{,}000$ pounds.
The resistance of plates should not be less than the required resistance of the rivets in same:
Stress in center of plates, 16½" from neutral axis:
18,000 x 16.5÷24=12,375 lb. per sq. in.
Moment of resistance, when A is the total area of the two pairs of plates:
12,375 x A x 16.5=204,200A A=1,944,000÷204,200=9.52 sq. in.
Net Area of 4—8" x 7/16" plates: A=(14.0-3.5)=10.5 sq. in.

Shearing Stress—Vertical Plates.

Shearing Resistance, $V=\frac{W}{R}$, W=Load Producing Shear in web.

EXAMPLE. The 10 rivets, ⅞" Dia., shown in vertical plates are sufficiently strong to resist in bearing a load of 10 x ⅞ x ⅜ x 30,000=98,440 pounds.

Flange Splices. Splices for flange angles and flange plates must develop the full bending moment of the girder at the joint.

Flange splices should be made at points of least flange stress, and joints in component parts of the flange should not be made at the same points.

EXAMPLE. Required top and bottom splices at separate points, for flange angles and inner flange plate as given; Rivets ⅞" Diameter.

2 Angles	6" x 4" x ½"	Net Area 9.50—2	=7.50 sq. in.
1 Inner Flange Plate	14" x 7/16"	" " 6.13— .875	=5.26 "
1 Outer Flange Plate	14" x ⅜"	" " 5.25— .75	=4.50 "

Splices for Flange Angles, Top and Bottom.
Stress in Angles 6" x 4" x ½" 7.5 x 18,000=135,000 pounds.
Shearing Value of ⅞" Dia. Rivet: .6013 x 13,500=8,120 pounds.
Rivets required: 135,000÷8,120=17 rivets in single shear, each side of joint.
Splice: 1—plate 14" x 7/16", 12 rivets, resistance 12 x 8,120= 97,440 pounds.
2—plates 3" x 1 1/16," 3 " " 3 x 16,240= 48,720 "
Total resistance of angle splice 146,160 "
Total Area of splice should not be less than that of the angles:
(6.13—.875)+(4.125—1.375)=8.00 sq. in.
Resistance of the two side plates not less than that of the 3 rivets in double shear,
3 x 16,240=48,720 pounds:
2 plates 3" x 1 1/16", net area 2.75 x 18,000=49,500 pounds.
Splices for Inner Flange Plates, Top and Bottom.
Stress in Inner Flange Plate 14" x 7/16" net area 5.26 x 18,000=94,680 pounds.
Rivets required: 94,680÷8,120=12 rivets in single shear, each side of joint.
Splice: 1 plate 14" x 7/16", 12 rivets, resistance 12 x 8,120=97,440 pounds.

GENERAL REQUIREMENTS FOR RIVETING.

1. In proportioning rivets the nominal diameter of the rivet shall be used, and in deducting rivet holes they shall be taken ⅛ inch greater than the nominal diameter of the rivets.

2. The minimum distance between centers of rivet holes shall be three diameters of the rivet, but the distance shall preferably be not less than:

4½″—1¼″ rivets	3½″—1″ rivets	2½″—¾″ rivets	1¾″—½″ rivets
4″ —1⅛″ "	3″ — ⅞″ "	2″ —⅝″ "	

3. The maximum pitch in the line of stress of compression members composed of plates and shapes shall not exceed 16 times the thinnest outside plate or shape, nor 20 times the thinnest enclosed plate with a maximum of 12 inches, and at right angles to the direction of stress the distance between lines of rivets shall not exceed 30 times the thinnest plate or shape.

4. For angles in built-up sections with two gage lines, with rivets staggered, the maximum pitch in the line of stress in each gage line shall not exceed 24 times the thinnest plate, with a maximum of 18 inches.

5. The minimum distance from the center of any rivet hole to a sheared edge shall be:

2¼″—1¼″ rivets	1¾″—1″ rivets	1¼″—¾″ rivets	1″—½″ rivets
2″ —1⅛″ "	1½″— ⅞″ "	1⅛″—⅝″ "	

The maximum distance from any edge shall be 8 times the thickness of the plate.

6. The pitch of the rivets at the end of built compression members shall not exceed 4 times the diameters of the rivets for a length equal to 1½ times the maximum width of the member.

Allowable Web Shear, V/A for Various Ratios of h/t

h/t	V/A	h/t	V/A	h/t	V/A	h/t	V/A
60	12000	75	10105	90	8471	105	7111
61	11867	76	9988	91	8372	106	7030
62	11734	77	9871	92	8274	107	6950
63	11604	78	9756	93	8177	108	6870
64	11473	79	9642	94	8082	109	6792
65	11343	80	9529	95	7988	110	6715
66	11215	81	9418	96	7895	115	6345
67	11087	82	9308	97	7803	120	6000
68	10961	83	9199	98	7712	125	5678
69	10835	84	9091	99	7623	130	5378
70	10711	85	8984	100	7535	135	5098
71	10587	86	8879	101	7448	140	4836
72	10465	87	8775	102	7362	145	4592
73	10344	88	8672	103	7277	150	4364
74	10224	89	8571	104	7194	155	4151
						160	3951

Ratio h/t = Distance between Flanges ÷ Thickness of Web Plate, inches.

Ratio V/A = Vertical Shear, pounds ÷ Gross Area of Web, sq. inches.

PLATE AND ANGLE GIRDERS—APPROXIMATE DESIGN.

In prelimary design of a symmetrical girder or in cases where extreme accuracy is not essential it is sufficient to base the transverse resistance of the section on the moment of inertia of the two flanges, obtained from the general formula:

$$M = f\frac{I}{n} = f\,A\,d, \qquad A = \frac{M}{f\,d}, \qquad 2\,A = \frac{2\,M}{f\,d}$$

where A is the area of either top or bottom flanges, and 2 A the combined area of top and bottom flange angles and plates and d is the total depth of the girder.

The tables which follow give the moment of inertia of four flange angles and two flange plates of various sizes for depths of girders from 36 to 84 inches, sizes not given can be obtained by interpolation of nearest values.

In proportioning the flange angles and plates it is desirable to allow at least one-third of the flange area required for flange angles.

The results correspond nearly to the net moment of inertia of the section, the omission of the section modulus of the web plate offsetting a reduction for rivet holes.

EXAMPLE. Angle and Plate Girder, limited to a depth of 38½ inches, to resist a maximum bending moment of 1,000,000 foot pounds, fiber stress 18,000 pounds:

$$2\,A = \frac{2\,M}{f\,d} = \frac{2 \times 12 \times 1{,}000{,}000}{18{,}000 \times 38} = 35.1 \text{ sq. in.;} \quad \text{then from table:}$$

4—Flange Angles, 6″ x 4″ x 7/16″	A = 16.7 sq. in.
2—Flange Plates, 14″ x ¾″	A = 21.0 "
	37.7 sq. in.

Including for a more exact computation a web plate, 36″ x 5/16″, with proper reduction of 1″ dia. holes; when

$$I = \frac{M\,d}{2\,f} = \frac{12 \times 1{,}000{,}000 \times 38}{2 \times 18{,}000} = 12{,}667 \text{ in.}^4\text{, from table.}$$

4—Flange Angles,	6″ x 4″ x 7/16″	$d^1 = 36\frac{1}{2}$″	I = 5,040 in.⁴
2—Flange Plates,	14″ x ¾″	$d^1 = 36\frac{1}{2}$″	I = 7,280 in.⁴
1—Web Plate,	36″ x 5/16″	d = 36″	I = 2,430 in.⁴
			14,750 in.⁴
4—Flange Holes,	1″ x 13/16″	= 18″	I = 1540 in.⁴
2—Web Holes,	1″ x 13/16″	$1^1 = 16$″	I = 704 in.⁴
			12,506 in.⁴

CRANE-RUNWAY GIRDERS.

Design. In the design of crane-runway girders the following conditions of loading must be provided for:

1. Bending moment due to maximum reaction of crane load, being the sum of moving load at extreme end of crane and half the weight of the crane girder, in center of span of the crane-runway girder.

2. Provision must be made against lateral deflection in case of an excessive ratio of span length to flange width; generally by a channel with flanges turned downward and riveted to the top flange of girder.

3. In addition to the lateral deflection due to total transverse load provision must also be made against a lateral impact due to the reaction of crane load, when suddenly started or stopped; this reaction is transmitted directly to the top flange of girder, and is generally assumed to be equal to 1/20 of the bending moment due to the transverse load.

4. The web of girder must be of sufficient strength to resist the total reaction from crane occurring at extreme end or point of bearing of runway girder.

5. The unit stress should not exceed the maximum stress allowable for moving loads.

The computations of the bending moment and the lateral deflection due to transverse loading are made in accordance with usual practice in the design of girders; the lateral impact against top flange of girder may be computed from formulas given in the following. Let:

M^1 = Bending Moment due to transverse load.
$\frac{1}{20} M^1$ = Bending Moment due to lateral impact.
S = Section Modulus of girder section, Axis 1-1.
s = Section Modulus of top flange, Axis 2-2.
f^1 = Unit Stress for transverse load.
f^2 = Unit Stress for lateral impact load.

$$M^1 : \tfrac{1}{20} M^1 = f^1 S : f^2 s, \; f^1 : f^2 = 1 : \frac{S}{20\,s}$$

M max = Maximum Bending Moment $= M^1 + \frac{1}{20} M^1$.

$$f \max = \text{Combined Unit Stress} = f^1 + f^2 \frac{S}{20\,s}$$

$$f\left(1 + \frac{S}{20s}\right), \text{ if } f^1 = f^2 = f, \text{ assumed unit stress.} \quad M \max = \frac{f\,S}{1 + \frac{S}{20s}}$$

For symmetrical sections, where top and bottom flanges are of equal, section modulus, $s = \frac{1}{2} S_{2\text{-}2}$, and formulas are

$$f \max = f\left(1 + \frac{S_{1\text{-}1}}{10\,S_{2\text{-}2}}\right) \qquad M \max = \frac{f\,S_{1\text{-}1}}{1 + \frac{S_{1\text{-}1}}{10\,S_{2\text{-}2}}}$$

EXAMPLE. Crane-Runway Girder is to support a moving load of 36,000 pounds, the sum of total crane load and half the weight of the crane, in the center of span of 25 feet. Crane-runway girder to be a 30″-Beam provided with a 15″-Channel riveted to top flange, assuming sections:

C B 301, 30″ x 115 lb. and C 1, 15″ x 33.9 lb.

M^1 for transverse load $= \frac{36{,}000 \times 25}{4} = 225{,}000$ ft. lbs.

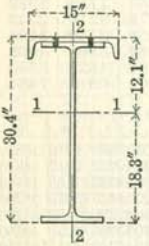
M^2 for dead load of girder $= \frac{148.9 \times 25^2}{8} = 11{,}633$ ft. lbs.

M for transverse and dead load 236,633 ft. lbs.

Load reduction for lateral deflection for ratio $\frac{25 \times 12}{15} = 20 : 92.6\%$.

Maximum Bending Moment, $\frac{236{,}633}{92.6} = 255{,}600$ ft. lbs.

Bending Stresses. The Moment of Inertia and Section Modulus are for the net sections, with allowance for 1″ dia. holes. Unit stress for transverse load and lateral impact 12,000 pounds.



Total Section, Axis 1-1

$I = 6628.1 - 336.8 = 6291.3$ in.^{4}

$S = \frac{6291.3}{18.3} = 343.8$ in.^{3}

Top Flange, Axis 2-2

$I = 397.7 - 23.1 = 374.6$ in.^{4}

$S = \frac{374.6}{7.5} = 50.0$ in.^{3}

$$M \text{ max.} = f \frac{S}{1 + \frac{S}{20\,S}}$$

$$M = 12000 \frac{343.8}{1 + \frac{346.1}{20 \times 50.3}} = 3{,}069{,}636 \text{ in. lb.}$$

The section will therefore resist $\frac{3{,}069{,}640}{12} = 255{,}803$ ft. lb.

Web Resistance. Total load at point of bearing=36,000 pounds From table page 98, the web resistance of CB 301, 115.0 lb. is 68,410 pounds for web buckling at minimum end bearing of 3½ inches.

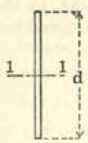
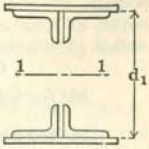


PLATE GIRDERS

MOMENTS OF INERTIA AND AREAS OF COMPONENT PARTS



Depth d	One Web Plate Axis 1-1 Thickness in Inches								
	5/16	3/8	7/16	1/2	5/8	3/4	7/8	1	1 1/8
36	243	1458	1701	1944	2430	2916	3402	3888	4374
42	385	2315	2701	3087	3859	4631	5402	6174	6946
48	576	3456	4032	4608	5760	6912	8064	9216	10368
54	820	4921	5741	6561	8201	9842	11482	13122	14762
60	1125	6750	7875	9000	11250	13500	15750	18000	20250
72	1944	11664	13608	15552	19440	23328	27216	31104	34992
84	3087	18522	21609	24696	30869	37042	43220	49392	55564

Depth d_1	Two Cover Plates Axis 1-1 Thickness in Inches (For One Inch of Width)										
	3/8	7/16	1/2	5/8	3/4	7/8	1	1 1/4	1 1/2	1 3/4	2
36 1/2	255	297	342	431	520	611	703	891	1084	1281	1484
42 1/2	345	402	462	581	702	823	946	1197	1453	1714	1982
48 1/2	448	523	600	754	910	1067	1225	1547	1876	2210	2552
54 1/2	565	659	756	950	1145	1342	1540	1943	2353	2769	3194
60 1/2	695	811	926	1158	1407	1648	1891	2383	2884	3392	3908
72 1/2	996	1162	1328	1660	2012	2356	2701	3400	4108	4825	5552
84 1/2	1351	1576	1800	2251	2725	3189	3655	4596	4801	6510	7484

Size	Depth d_1	4 Flange Angles Axis 1-1 Thickness in Inches						Size	Depth d_1						
		3/8	7/16	1/2	5/8	3/4	7/8			3/8	7/16	1/2	5/8	3/4	7/8
	36 1/2	4350	5040	5690	6980	8220	9410		36 1/2	4870	5640	6400	7860	9270	10630
	42 1/2	5980	6920	7820	9610	11330	12970		42 1/2	6770	7840	8890	10930	12910	14820
	48 1/2	7870	9110	10310	12670	14940	17120		48 1/2	8980	10400	11800	14520	17160	19710
6 x 4	54 1/2	10020	11560	13130	16150	19050	21830	6 x 6	54 1/2	11500	13320	15120	18620	22010	25300
	60 1/2	12430	14380	16290	20040	23660	27130		60 1/2	14340	16610	18850	23230	27480	31590
	72 1/2	18020	20860	23650	29110	34370	39430		72 1/2	20950	24280	27570	33990	40230	46260
	84 1/2	24660	28540	32370	39860	47090	54040		84 1/2	28820	33420	37940	46790	55410	63750

Size	Depth d_1	4 Flange Angles Axis 1-1 Thickness in Inches							Size	Depth d_1						
		7/16	1/2	5/8	3/4	7/8	1			1/2	5/8	3/4	7/8	1	1 1/8
	36 1/2	6770	7690	9470	11200	12850	14480		36 1/2	8190	10100	11950	13750	15490	17180
	42 1/2	9380	10650	13120	15540	17850	20130		42 1/2	11460	14140	16750	19280	21740	24150
	48 1/2	12410	14100	17380	20590	23680	26720		48 1/2	15280	18880	22370	25770	29080	32310
8 x 6	54 1/2	15870	18030	22240	26360	30330	34230	8 x 8	54 1/2	19660	24300	28810	33210	37500	41680
	60 1/2	19750	22450	27710	32850	37810	42690		60 1/2	24600	30420	36080	41600	46990	52260
	72 1/2	28800	32750	40440	47970	55240	62410		72 1/2	36160	44730	53080	61240	69230	77030
	84 1/2	39560	44990	55580	65950	75980	85870		84 1/2	49940	61800	73390	84690	95780	106610

Size	Area Four Angles Thickness							
	3/8	7/16	1/2	5/8	3/4	7/8	1	1 1/8
6 x 4	14.4	16.7	19.0	23.4	27.8	31.9		
6 x 6	17.4	20.2	23.0	28.4	33.8	38.9		
8 x 6		23.7	27.0	33.4	39.8	45.9	52.0	
8 x 8			31.0	38.4	45.8	52.9	60.0	66.9

Width	Area Two Flange Plates Thickness									Depth	Area One Web Plate Thickness			
	3/8	1/2	5/8	3/4	7/8	1	1 1/4	1 1/2	5/16		5/16	1/4	3/8	1/2
12	9.0	12.0	15.0	18.0	21.0	24.0	30.0	36.0	1.50	36	2.25	9.0	13.5	18.0
14	10.5	14.0	17.5	21.0	24.5	28.0	35.0	42.0	1.75	42	2.63	10.5	15.8	21.0
16	12.0	16.0	20.0	24.0	28.0	32.0	40.0	48.0	2.00	48	3.00	12.0	18.0	24.0
18	13.5	18.0	22.5	27.0	31.5	36.0	45.0	54.0	2.25	54	3.38	13.5	20.3	27.0
20	15.0	20.0	25.0	30.0	35.0	40.0	50.0	60.0	2.50	60	3.75	15.0	22.5	30.0
24	18.0	24.0	30.0	36.0	42.0	48.0	60.0	72.0	3.00	72	4.50	18.0	27.0	36.0
										84	5.25	21.0	31.5	42.0

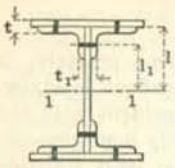
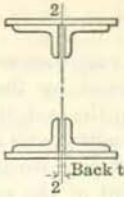


PLATE GIRDERS

Moments of Inertia of Holes and Component Parts



Distance l or l¹	Thickness of Metal t or t¹ and Area of ⅞″ Holes—Axis 1-1														
	¾	⅞	1	1⅛	1¼	1⅜	1½	1⅝	1¾	1⅞	2	2¼	2½	2¾	3
	0.75	0.88	1.00	1.13	1.25	1.38	1.50	1.63	1.75	1.88	2.00	2.25	2.50	2.75	3.00
16	192	224	256	288	320	352	384	416	448	480	512	576	640	704	768
18	243	284	324	365	405	446	486	527	567	608	648	729	810	891	972
18½	257	299	342	385	428	471	513	556	599	642	685	770	856	941	1027
19	271	316	361	406	451	496	542	587	632	677	722	812	903	993	1083
21	331	386	441	496	551	606	662	717	772	827	882	992	1103	1213	1323
21½	347	404	462	520	578	636	693	751	809	867	925	1040	1156	1271	1387
22	363	424	484	545	605	666	726	787	847	908	968	1089	1210	1331	1452
24	432	504	576	648	720	792	864	936	1008	1080	1152	1296	1440	1584	1728
24½	450	525	600	675	750	825	900	975	1050	1125	1201	1351	1501	1651	1801
25	469	547	625	703	781	859	938	1016	1094	1172	1250	1406	1563	1719	1875
27	547	638	729	820	911	1002	1094	1185	1276	1367	1458	1640	1823	2005	2187
27½	567	662	756	851	945	1040	1134	1229	1323	1418	1513	1702	1891	2080	2269
28	588	686	784	882	980	1078	1176	1274	1372	1470	1568	1764	1960	2156	2352
30	675	788	900	1013	1125	1238	1350	1463	1575	1688	1800	2025	2250	2475	2700
30½	698	814	930	1047	1163	1279	1395	1512	1628	1744	1861	2093	2326	2558	2791
31	721	841	961	1081	1201	1321	1442	1562	1682	1802	1922	2162	2403	2643	2883
34	867	1012	1156	1301	1445	1590	1734	1879	2023	2168	2312	2601	2890	3179	3468
36	972	1134	1296	1458	1620	1782	1944	2106	2268	2430	2592	2916	3240	3564	3888
36½	999	1166	1332	1499	1665	1832	1998	2165	2331	2498	2665	2998	3331	3664	3997
37	1027	1198	1369	1540	1711	1882	2054	2225	2396	2567	2738	3080	3423	3765	4107
40	1200	1400	1600	1800	2000	2200	2400	2600	2800	3000	3200	3600	4000	4400	4800
42	1323	1544	1764	1985	2205	2426	2646	2867	3087	3308	3528	3969	4410	4851	5292
42½	1355	1580	1806	2032	2258	2484	2709	2935	3161	3387	3613	4064	4516	4967	5419
43	1387	1618	1849	2080	2311	2542	2774	3005	3236	3467	3698	4160	4623	5085	5547

Two Cover Plates Axis 2-2 Thickness in Inches

Width	⅜	7/16	½	⅝	¾	⅞	1	1¼	1½	1¾	2
12	108	126	144	180	216	252	288	360	432	504	576
14	172	200	229	286	343	401	458	572	686	802	916
16	256	299	341	426	512	597	682	852	1024	1194	1364
18	365	425	486	608	729	851	972	1216	1458	1702	1944
20	500	583	667	834	1000	1167	1334	1668	2000	2234	2668
24	864	1008	1152	1440	1728	2016	2304	2880	3456	4032	4608

Four Angles 6 x 4 Axis 2-2

Dist. b to b	Thickness					
	⅜	7/16	½	⅝	¾	⅞
⅜	120	140	160	200	240	280
7/16	121	141	162	203	245	295
½	123	144	165	206	250	290
⅝	127	148	170	213	257	300
¾	130	153	176	220	265	310
⅞	136	158	180	227	274	320

Four Angles 6 x 6 Axis 2-2

Dist. b to b	Thickness					
	⅜	7/16	½	⅝	¾	⅞
⅜	120	140	160	200	243	285
7/16	122	142	162	204	247	289
½	124	144	165	208	252	294
⅝	128	149	170	215	260	305
¾	132	154	177	223	270	315
⅞	137	160	183	230	280	326

Four Angles 8 x 6 Axis 2-2

Dist. b to b	Thickness					
	7/16	½	⅝	¾	⅞	1
⅜	322	368	462	554	650	742
7/16	326	372	467	561	657	751
½	330	377	473	568	665	760
⅝	338	386	485	582	680	780
¾	346	396	497	596	698	800
⅞	355	405	510	610	716	820

Four Angles 8 x 8 Axis 2-2

Dist. b to b	Thickness					
	½	⅝	¾	⅞	1	1⅛
⅜	370	462	558	650	748	843
7/16	375	468	565	659	758	854
½	380	474	572	668	768	865
⅝	390	486	586	685	788	888
¾	398	498	602	703	808	910
⅞	408	510	617	720	830	934

COLUMNS AND STRUTS

A compression member, subjected to longitudinal pressure, is shortened by the compression and also tends to deflect laterally, due to the fact that the load cannot be applied coincident with the longitudinal axis and that the material is not perfectly homogeneous. This flexure occurs generally in the direction of the least resisting moment of the section; the load which will cause a column to fail decreases in the ratio of length to least lateral resistance of the section, the ultimate failure being the result of combined stresses due to compression, transverse shear and flexure.

Column Formulas. Under ideal conditions, when it can be assumed that the load is applied axially and that the material is perfectly homogeneous, the resistance of the column would equal its resistance to compressive forces up to the elastic limit, and there would not be any flexure; if, however, a deflection be imparted to the column by a lateral force, the column would ultimately fail by bending.

Euler's Formula, $P=k\frac{\pi^2 E I}{l^2}$ or $\frac{P}{A}=k\frac{\pi^2 E}{(l/r)^2}$, is based upon the foregoing theory, and gives results close to the ultimate strength found for long and slender struts, when k is a constant varying with the condition of end bearing, (k=4 for columns fixed both ends). For shorter and heavier columns, or for lower ratios of l/r the results do not correspond with actual tests.

Rankine's Formula, $P=\frac{Af}{1+c\,(l/r)^2}$ or $\frac{P}{A}=\frac{f}{1+c\,(l/r)^2}$, represents the type of formula now in general use and the various formulas for proportioning columns which are based upon this general formula agree with actual tests within certain limits. In this formula a certain compressive unit stress for direct crushing is assumed and reduced in ratio of length of column and least radius of gyration, l/r; value of c is an empirical factor, varying with the resistance of the material and with conditions of end bearing.

Straight Line Formulas. In practice, compression members of a greater ratio of slenderness, l/r, than 120 are rarely used, and within this limit the curve can be represented by a straight line, the general formula assuming the simpler form: $\frac{P}{A}=f-c\,(\frac{l}{r})$.

Compression formulas determining the resistance of webs in rolled beams or riveted girders against buckling, or the necessary reduction of safe loads due to lateral deflection of unbraced beams, are likewise based on one or the other type of column formulas.

Ratio of Slenderness. l/r is ratio of the unsupported length of a compression member to its radius of gyration, generally the least radius, excepting when the unsupported length is rigidly braced to prevent deflection in the direction which corresponds to the least radius of gyration. It is, therefore, necessary to determine the radii of gyration and to use the proper ratio of slenderness in any particular case.

Usual practice limits the maximum ratio of l/r for main members under permanent stress, permitting a higher ratio for secondary members under temporary stress, as in wind bracing.

Compressive Unit Stresses. The tables of allowable loads of column sections have been computed in accordance with the formula for steel columns of American Institute of Steel Construction, 1923—Revised 1928.

$$f = \frac{18{,}000}{1 + \frac{1}{18{,}000}(l/r)^2}.$$

Maximum unit stress at l/r=60 : 15,000 lb. per sq. inch.

Maximum l/r: Primary members=120; Secondary members=200.

Explanation of Tables. The tables give the concentric safe loads in thousands of pounds for Carnegie Beam Sections of the Variable-Depth and Constant-Depth Type, also of a selected line of 14-inch column sections with cover plates, the values having been computed based upon for the least radius of gyration.

In addition to the safe loads, tables give the moments of inertia and the radii of gyration about both axes of symmetry, for use with other compression formulas or for use in computation of the safe strength of a column braced against flexure in such a manner that the greater radius of gyration may be used.

Combined Compression and Bending Stresses. Generally the loads are concentric and equally distributed over the cross section of the column or balanced on opposite sides thereof. In the case of beams carried on brackets or other forms of eccentric loading, bending stresses are produced which should be taken into consideration and the column sections so proportioned that the combined stresses do not exceed the allowable compressive and bending stresses in accordance with the formulas given in the following:

P =Concentric load. P_1=Eccentric Load.
l =Length of column = $l_1 + l_2$, end distances of eccentric load.
λ =Greater distance of eccentric load from either end of column.
f_c =Unit compressive stress for length l of column.
f_{c1}=Unit compressive stress for length $\lambda = l_1 > l_2$ or $= l_2 > l_1$.
f_s =Unit bending stress.
M =Bending moment due to eccentric load.
x =Distance of eccentric load from center of column.
n =Distance of extreme fiber from center of column.
r =Radius of gyration of section in plane of bending.
A =Cross sectional area of section.

Compression due to concentric and eccentric load:

$P = Af_c$, $P_1 = Af_{c1}$.

Bending stress due to bending at point of eccentric load:

$$M = Px\frac{l_1}{l} \text{ from top and } Px\frac{l_2}{l} \text{ from bottom.}$$

$$M_{max} = Px\frac{\lambda}{l} = f_s\frac{I}{n} = f_s\frac{Ar^2}{n}$$

Total area required for combined compressive and bending stresses:

$$A = \frac{P}{f_c} + \frac{P_1}{f_c} + Px\,\frac{\lambda}{l} \div \frac{f_s r^2.}{n}$$

When the eccentric load is in center, $l_1 = l_2 = \frac{1}{2}l$. $M_{max} = \frac{1}{2}Px$ and

$$A = \frac{P}{f_c} + \frac{P_1}{f_{c1}} + \tfrac{1}{2}\,Px \div \frac{f_s r_2.}{n}$$

When the eccentric load is at the top or bottom, formula reduces to $A = (P + P_1) \div f_c + Pxn \div f_s r^2$.

EXAMPLE: Required a Carnegie Beam column, 25 feet in length, to support a concentric load of 425,000 pounds and an eccentric load of 50,000 pounds acting at a distance of 19 inches from center of section, in plane of greatest resistance, axis 1-1, and at a distance of 5 feet from top of Column.

Unit compression and bending stresses in accordance with A. I. S. C. requirements.

Assuming CB 146, 145 pounds, with the following properties:

A = 42.64 sq. in. n = 7.30 in. $r_{1\text{-}1}$ = 6.24 in. $r_{2\text{-}2}$ = 3.93 in.

f_c for L/r = 25 x 12 ÷ 3.93 = 76.4 13,590 lb. per sq. in.
f_{c1} for λ/r = 20 x 12 ÷ 3.93 = 61.1 14,910 lb. per sq. in.

$$A = \frac{425{,}000}{13{,}590} + \frac{50{,}000}{14{,}910} + 50{,}000 \times 19 \times \frac{20}{25} \times \frac{7.30}{18{,}000 \times 6.24^2} = 42.53 \text{ sq. in.}$$

NOTE: The bending factor, A/S, given with the properties of column sections may be used to advantage in the computation of columns with eccentric load, substituting the value of A/S for n/r^2 in formula.

In the example the value of A/S, axis 1-1 = 42.64 ÷ 227.7 = 0.1873.

$$A = \frac{425{,}000}{13{,}590} + \frac{50{,}000}{14{,}910} + \frac{50{,}000 \times 19 \times 0.1873}{18{,}000} \times \frac{20}{25} = 42.53 \text{ sq. in.}$$

COMPARISON OF COMPRESSION FORMULAS

Allowable Unit Stresses in Pounds per Square Inch

Ratio	Rankine	*A. I. S. C., 1928	Chicago, 1924
	Flat Bearing	Building Code Formulas:	
$\frac{l}{r}$	$\frac{12500}{1+\frac{l^2}{36000r^2}}$	$\frac{18000}{1+\frac{l^2}{18000r^2}}$	$16000-70\frac{l}{r}$
0	12500		
5	12491		
10	12465		
15	12422		
20	12363		Maximum
25	12287		14000
30	12195		13900
35	12089		13550
40	11968		13200
45	11834		12850
50	11688		12500
55	11531	Maximum	12150
60	11364	15000	11800
65	11187	14578	11450
70	11002	14148	11100
75	10811	13714	10750
80	10613	13279	10400
85	10410	12844	10050
90	10204	12414	9700
95	9995	11989	9350
100	9784	11571	9000
105	9571	11163	8650
110	9356	10764	8300
115	9142	10376	7950
120	8929	10000	7600
125	8717	9636	7250
130	8507	9284	6900
135	8299	8944	6550
140	8094	8617	6200
145	7892	8302	5850
150	7692	8000	5500
155	7496	7710	
160	7305	7431	
165	7118	7164	
170	6934	6908	
175	6754	6663	
180	6579	6429	
185	6408	6204	
190	6242	5989	
195	6080	5783	
200	5921	5586	

*A. I. S. C. formula adopted by principal cities in the United States, excepting the above.

Maximum Ratio of l/r	Main Members	Secondary Members
A. I. S. C. Formula.....	120	200
Chicago Bldg. Law, 1924.	120	150

Allowable Unit Stresses in Pounds per Square Inch

by Compression Formula of

American Institute of Steel Construction: $f = \dfrac{18{,}000}{1+\dfrac{1}{18{,}000}(l/r)^2}$

The following tables give the unit stresses for ratios of l/r in intervals of 5/10. Intermediate values may be found by interpolation from the figures given for the tenth units of l/r by adding or deducting from the nearest tabulated figure the corresponding multiple.

Example: Unit stress for l/r=94.7 and l/r=150.8

l/r= 94.7 11989 +3x8.4 or 12031—2x8.4=12014

l/r=150.8 7941 +2x5.9 or 7971—3x5.9= 7953

MAIN MEMBERS—Ratios of l/r up to 120

Ratio, l/r	Unit Stress, Pounds	Diff. 0.10	Ratio, l/r	Unit Stress, Pounds	Diff. 0.10	Ratio, l/r	Unit Stress, Pounds	Diff. 0.10	Ratio, l/r	Unit Stress, Pounds	Diff. 0.10
60	15000		75	13714		90	12414		105	11163	
.5	14958	8.4	.5	13671	8.7	.5	12371	8.6	.5	11122	8.1
61	14916		76	13627		91	12328		106	11082	
.5	14874	8.4	.5	13584	8.7	.5	12286	8.5	.5	11042	8.0
62	14832		77	13540		92	12243		107	11002	
.5	14790	8.4	.5	13496	8.7	.5	12201	8.5	.5	10962	8.0
63	14748		78	13453		93	12158		108	10922	
.5	14705	8.5	.5	13409	8.7	.5	12116	8.5	.5	10883	7.9
64	14663		79	13366		94	12073		109	10843	
.5	14621	8.5	.5	13322	8.7	.5	12031	8.4	.5	10804	7.9
65	14578		80	13279		95	11989		110	10764	
.5	14535	8.5	.5	13235	8.7	.5	11947	8.4	.5	10725	7.9
66	14493		81	13192		96	11905		111	10686	
.5	14450	8.6	.5	13148	8.7	.5	11863	8.4	.5	10647	7.8
67	14407		82	13105		97	11821		112	10608	
.5	14364	8.6	.5	13061	8.7	.5	11779	8.4	.5	10569	7.8
68	14321		83	13018		98	11737		113	10530	
.5	14278	8.6	.5	12974	8.7	.5	11696	8.3	.5	10491	7.7
69	14235		84	12931		99	11654		114	10453	
.5	14192	8.7	.5	12888	8.7	.5	11613	8.3	.5	10415	7.7
70	14148		85	12844		100	11571		115	10376	
.5	14105	8.7	.5	12801	8.6	.5	11530	8.2	.5	10338	7.6
71	14062		86	12758		101	11489		116	10300	
.5	14019	8.7	.5	12715	8.6	.5	11448	8.2	.5	10262	7.6
72	13975		87	12672		102	11407		117	10224	
.5	13932	8.7	.5	12629	8.6	.5	11366	8.2	.5	10187	7.5
73	13888		88	12585		103	11325		118	10149	
.5	13845	8.7	.5	12542	8.6	.5	11284	8.2	.5	10112	7.5
74	13801		89	12500		104	11244		119	10074	
.5	13758	8.7	.5	12457	8.6	.5	11203	8.1	.5	10037	7.4
75	13714		90	12414		105	11163		120	10000	

Allowable Unit Stresses in Pounds per Square Inch by Compression Formula of American Institute of Steel Construction: $f = \dfrac{18{,}000}{1 + \frac{1}{18{,}000}(l/r)^2}$

SECONDARY MEMBERS—Ratios of l/r up to 200

Ratio, l/r	Unit Stress, Pounds	Diff. 0.10	Ratio, l/r	Unit Stress, Pounds	Diff. 0.10	Ratio, l/r	Unit Stress, Pounds	Diff. 0.10	Ratio, l/r	Unit Stress, Pounds	Diff. 0.10
120	10000		140	8617		160	7431		180	6429	
.5	9963	7.4	.5	8585	6.4	.5	7404	5.4	.5	6406	4.6
121	9926		141	8553		161	7377		181	6383	
.5	9890	7.3	.5	8521	6.3	.5	7350	5.4	.5	6360	4.5
122	9853		142	8490		162	7323		182	6338	
.5	9816	7.3	.5	8458	6.3	.5	7296	5.4	.5	6315	4.5
123	9780		143	8427		163	7269		183	6293	
.5	9744	7.2	.5	8396	6.3	.5	7243	5.3	.5	6270	4.5
124	9708		144	8364		164	7217		184	6248	
.5	9672	7.2	.5	8333	6.2	.5	7190	5.3	.5	6226	4.4
125	9636		145	8302		165	7164		185	6204	
.5	9600	7.1	.5	8272	6.1	.5	7138	5.2	.5	6182	4.4
126	9564		146	8241		166	7112		186	6160	
.5	9529	7.1	.5	8210	6.1	.5	7086	5.2	.5	6139	4.3
127	9493		147	8180		167	7061		187	6117	
.5	9458	7.0	.5	8150	6.1	.5	7035	5.1	.5	6095	4.3
128	9423		148	8119		168	7009		188	6074	
.5	9388	7.0	.5	8089	6.0	.5	6984	5.1	.5	6053	4.3
129	9353		149	8060		169	6959		189	6031	
.5	9318	6.9	.5	8030	6.0	.5	6934	5.0	.5	6010	4.2
130	9284		150	8000		170	6908		190	5989	
.5	9249	6.9	.5	7971	5.9	.5	6883	5.0	.5	5968	4.2
131	9215		151	7941		171	6858		191	5947	
.5	9181	6.8	.5	7912	5.9	.5	6834	4.9	.5	5926	4.2
132	9146		152	7882		172	6809		192	5906	
.5	9112	6.8	.5	7853	5.8	.5	6785	4.9	.5	5885	4.1
133	9078		153	7824		173	6760		193	5864	
.5	9045	6.7	.5	7796	5.8	.5	6736	4.9	.5	5844	4.1
134	9011		154	7767		174	6711		194	5824	
.5	8978	6.7	.5	7738	5.7	.5	6687	4.8	.5	5803	4.0
135	8944		155	7710		175	6663		195	5783	
.5	8911	6.6	.5	7681	5.7	.5	6639	4.8	.5	5763	4.0
136	8878		156	7653		176	6615		196	5743	
.5	8845	6.6	.5	7625	5.6	.5	6592	4.7	.5	5723	3.9
137	8812		157	7597		177	6568		197	5703	
.5	8779	6.5	.5	7569	5.6	.5	6545	4.7	.5	5684	3.9
138	8746		158	7541		178	6521		198	5664	
.5	8714	6.5	.5	7514	5.5	.5	6498	4.7	.5	5643	3.9
139	8681		159	7486		179	6475		199	5624	
.5	8649	6.4	.5	7459	5.5	.5	6452	4.6	.5	5606	3.9
140	8617		160	7431		180	6429		200	5586	

COMPARATIVE H TABLE

CARNEGIE BEAM SECTIONS AS COLUMNS

Comparative Table of Areas, Weights and Maximum Loads

Unit Stress—American Institute of Steel Construction—1928

Section Index	Area	Weight Per Foot	Maximum Allowable Load	Maximum Allowable Unbraced Length	Least Rad. of Gyration	NOMINAL DEPTHS	Dimensions Depth	Dimensions Flange Width
	Sq. Ins.	Pounds	Thousands of Pounds	Feet	Ins.		Ins.	Ins.
CB 146	124.99	425	1875	21.45	4.29	14	18½	16½
CB 146	119.12	405	1787	21.35	4.27	14	18¼	16⅜
CB 146	113.22	385	1698	21.20	4.24	14	18	16⅜
CB 146	107.34	365	1610	21.10	4.22	14	17¹⁵⁄₁₆	16¼
CB 146	101.47	345	1522	20.95	4.19	14	17⅞	16⅜
CB 146	95.58	325	1434	20.85	4.17	14	17⅝	16⅛
CB 146	89.70	305	1346	20.70	4.14	14	16⅞	16
CB 146	86.76	295	1301	20.65	4.13	14	16¾	15¹⁵⁄₁₆
CB 146	83.82	285	1257	20.60	4.12	14	16⅝	15¹⁵⁄₁₆
CB 146	80.87	275	1213	20.50	4.10	14	16½	15⅞
CB 146	77.93	265	1169	20.45	4.09	14	16⅜	15¹³⁄₁₆
CB 146	74.99	255	1125	20.40	4.08	14	16⅜	15¾
CB 146	72.06	245	1081	20.30	4.06	14	16⅛	15¾
CB 146	69.11	235	1037	20.25	4.05	14	15¹⁵⁄₁₆	15¹¹⁄₁₆
CB 127	67.64	230	1015	18.70	3.74	12	12	15
CB 146	66.17	225	993	20.20	4.04	14	15¾	15⅝
CB 127	64.70	220	971	18.65	3.73	12	12	14¾
CB 146	63.23	215	949	20.15	4.03	14	15⅝	15⅝
CB 127	61.76	210	926	18.60	3.72	12	12	14½
CB 146	60.28	205	904	20.05	4.01	14	15½	15⅜
CB 127	58.82	200	882	18.55	3.71	12	12	14¼
CB 146	57.34	195	860	20.00	4.00	14	15⅜	15½
CB 127	55.88	190	838	18.55	3.71	12	12	14
CB 146	54.41	185	816	19.90	3.98	14	15⅜	15½
CB 126	52.94	180	794	18.20	3.64	12	12	14¾
CB 146	51.47	175	772	19.85	3.97	14	15⅛	15⅛
CB 126	50.00	170	750	18.25	3.65	12	12	14½
CB 146	48.52	165	728	19.80	3.96	14	14⅞	15⅛
CB 126	47.06	160	706	18.35	3.67	12	12	14¼
CB 146	45.58	155	684	19.70	3.94	14	14¾	15⅛
CB 126	44.12	150	662	18.45	3.69	12	12	14
CB 146	42.64	145	640	19.65	3.93	14	14⅝	15⅛
CB 125	41.18	140	618	15.05	3.01	12	12	12¼
CB 105	41.17	140	618	15.40	3.08	10	10	13⅛
CB 146	39.70	135	596	19.60	3.92	14	14⅜	15⅛
CB 105	38.81	132	582	15.45	3.09	10	10	12¹⁵⁄₁₆
CB 146	38.52	131	578	18.85	3.77	14	14⅜	15⅛
CB 125	38.24	130	574	15.15	3.03	12	12	12½
CB 146	36.75	125	551	19.50	3.90	14	14⅛	15⅛
CB 105	36.46	124	547	15.45	3.09	10	10	12¹⁵⁄₁₆
CB 125	35.28	120	529	15.30	3.06	12	12	12¼
CB 105	34.11	116	512	15.55	3.11	10	10	12½
CB 146	33.82	115	507	19.45	3.89	14	14⅛	15⅛
CB 125	32.34	110	485	15.50	3.10	12	12	12
CB 105	31.76	108	476	15.65	3.13	10	10	12¼
CB 146	31.18	106	468	19.35	3.87	14	14	15⅛
CB 145	30.88	105	463	15.40	3.08	14	14⅜	12⅛
CB 124 C	29.99	102	450	14.75	2.95	12	12	12½
CB 105	29.40	100	441	15.80	3.16	10	10	12
CB 146	28.23	96	423	19.30	3.86	14	13⅞	15¹⁄₁₆

NOTE 1. Maximum Allowable Load = Area x 15000 in Pounds.
2. Maximum Allowable Unbraced Length in Feet = Least Radius of Gyration x 60 ÷ 12.

CARNEGIE BEAM SECTIONS AS COLUMNS

COMPARATIVE H TABLE

Comparative Table of Areas, Weights and Maximum Loads

Unit Stress—American Institute of Steel Construction—1928

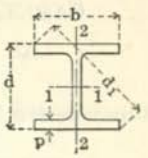
Section Index	Area	Weight Per Foot	Maximum Allowable Load	Maximum Allowable Unbraced Length	Least Rad. of Gyration	NOMINAL DEPTHS						Dimensions Depth	Dimensions Flange Width
	Sq. Ins.	Pounds	Thousands of Pounds	Feet	Ins.							Ins.	Ins.
CB 145	27.93	95	419	15.30	3.06	14						14 3/16	12 3/16
CB 124 C	27.93	95	419	14.95	2.99		12					12	12 3/16
CB 104	27.06	92	406	12.30	2.46			10				10	10 1/4
CB 83	26.47	90	397	10.85	2.17				8			9 1/8	8 1/2
CB 124 C	25.88	88	388	15.20	3.04		12					12	12 3/16
CB 61	25.87	88	388	13.00	2.60					6		6 13/16	10 1/16
CB 146	25.28	86	379	19.20	3.84	14						13 1 1/16	15
CB 145	24.99	85	375	15.25	3.05	14						14	12
CB 83	24.71	84	371	10.75	2.15				8			9 7/16	8 1/4
CB 104	24.70	84	371	12.40	2.48			10				10	10 7/16
CB 124 C	24.11	82	362	15.45	3.09		12					12	12
CB 61	23.52	80	353	12.90	2.58					6		6 1 1/16	9 15/16
CB 83	22.93	78	344	10.70	2.14				8			9 5/16	8 3/16
CB 104	22.65	77	340	12.55	2.51			10				10	10 3/16
CB 124 B	22.35	76	335	14.50	2.90		12					12	12 1/4
CB 144	22.05	75	331	12.35	2.47	14						14 3/4	10 1/16
CB 83	21.17	72	318	10.60	2.12				8			9 1/8	8 3/8
CB 104	20.59	70	309	12.75	2.55			10				10	10
CB 124 B	20.58	70	309	14.80	2.96		12					12	12 1/4
CB 61	20.58	70	308	12.70	2.54					6		6 7/16	9 3/8
CB 144	19.99	68	300	12.30	2.46	14						14 1/4	10 1/16
CB 123 B	19.41	66	291	11.30	2.26		12					12 1/4	9 1/4
CB 83	19.40	66	291	10.55	2.11				8			9	8 5/16
CB 124 B	19.11	65	287	15.15	3.03		12					12	12
CB 103 A	18.81	64	282	11.90	2.38			10				10	10 3/16
CB 144	17.94	61	269	12.20	2.44	14						14 1/4	10
CB 123 B	17.65	60	265	11.25	2.25		12					12 1/4	9 1/16
CB 83	17.63	60	264	10.45	2.09				8			8 15/16	8 1/4
CB 61	17.63	60	264	12.55	2.51					6		6 7/16	9 3/4
CB 103 A	17.34	59	260	12.10	2.42			10				10	10 3/16
CB 123 B	16.17	55	243	11.25	2.24		12					12	9
CB 103 A	15.87	54	238	12.40	2.48			10				10	10 3/16
CB 83	15.87	54	238	10.35	2.07				8			8 1 1/16	8 3/16
CB 61	14.70	50	221	12.40	2.48					6		6	9 1/8
CB 123	14.69	50	220	9.90	1.98		12					12 1/4	8 1/16
CB 103 A	14.40	49	216	12.70	2.54			10				10	10
CB 83	14.10	48	212	10.30	2.06				8			8 1/2	8 1/4
CB 123	13.23	45	198	9.85	1.97		12					12 1/8	8 1/16
CB 102	12.35	42	185	8.65	1.73			10				10	8 3/16
CB 83	12.34	42	185	10.20	2.04				8			8 3/8	8 1/4
CB 123	11.76	40	176	9.75	1.95		12					12	8
CB 61	11.76	40	176	12.15	2.43					6		5 3/4	9 1/2
CB 102	10.58	36	159	9.00	1.80			10				10	8 1/4
CB 83	10.58	36	159	10.10	2.02				8			8 5/16	8 1/16
CB 102	9.11	31	137	9.45	1.89			10				10	8
CB 83	9.10	31	137	10.05	2.01				8			8 1/16	8
CB 82	8.81	30	132	8.15	1.63				8			8 5/16	6 15/16
CB 82	7.93	27	119	8.10	1.62				8			8 1/8	6 1/2
CB 82	7.06	24	106	8.05	1.61				8			8	6 1/2

NOTE 1. Maximum Allowable Load = Area x 15000 in Pounds.
2. Maximum Allowable Unbraced Length in Feet = Least Radius of Gyration x 60 ÷ 12.

COLUMN 18" H LOADS

CARNEGIE BEAM SECTIONS AS COLUMNS

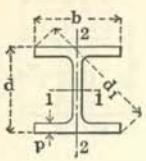
ALLOWABLE CONCENTRIC LOADS
THOUSANDS OF POUNDS



Unit Stress—American Institute of Steel Construction—1928

Effective Length in Feet	Nominal Depth and Flange Width—Weight per Foot									
	CB 183 18" x 12"			CB 182 18" x 8½"			CB 181 18" x 7½"			
	100 lbs.	93 lbs.	86 lbs.	78 lbs.	72 lbs.	67 lbs.	58 lbs.	52 lbs.	51 lbs.	47 lbs.
8	441	410	379	344	318	296	256	230	225	207
9	441	410	379	344	318	296	251	224	218	202
10	441	410	379	344	316	294	240	215	208	193
11	441	410	379	332	306	284	230	205	199	185
12	441	410	379	320	295	273	219	196	189	176
13	441	410	379	308	283	263	209	186	180	168
14	441	410	379	296	272	252	199	177	171	159
15	438	407	375	284	261	242	189	168	162	151
16	428	397	367	272	250	232	180	160	153	143
17	417	388	358	261	240	222	171	151	145	136
18	407	378	349	250	229	212	162	144	137	129
19	396	368	339	239	219	203	154	136	130	122
20	386	358	330	228	210	194	146	129	123	116
21	375	349	321	218	201	186	138	122	117	110
22	365	339	312	209	192	177	131	116	111	104
23	355	329	304	200	183	170	125	110	105	99
24	345	320	295	191	175	162	118	105	100	94
25	335	311	286	182	167	155	112	99	94	89
26	325	302	278	175	160	148	107	94	90	85
27	316	293	270	167	153	142	102	90	85	80
28	306	284	262	160	147	135	97	85		
29	297	276	254	153	140	130				
30	288	267	246	147	134	124				
Area, in.[2]	29.40	27.35	25.29	22.94	21.17	19.69	17.05	15.30	15.00	13.82
I_{1-1}, in.[4]	1783.4	1648.4	1514.1	1318.8	1208.1	1117.1	960.8	855.1	810.0	768.6
S_{1-1}, in.[3]	195.6	181.9	168.2	144.6	133.4	124.1	105.3	94.4	89.9	85.4
r_{1-1}, in.	7.79	7.76	7.74	7.58	7.55	7.53	7.51	7.48	7.35	7.46
A/S_{1-1}	.150	.150	.150	.159	.159	.159	.162	.162	.167	.162
I_{2-2}, in.[4]	253.4	234.0	214.7	90.9	82.9	76.4	49.0	43.3	40.5	38.7
S_{2-2}, in.[3]	42.0	38.9	35.8	21.2	19.4	18.0	13.0	11.5	10.7	10.3
r_{2-2}, in.	2.94	2.93	2.91	1.99	1.98	1.97	1.70	1.68	1.64	1.67
A/S_{2-2}	.700	.703	.707	1.081	1.089	1.096	1.316	1.329	1.399	1.339
d in.	18¼	18⅛	18	18¼	18⅛	18	18¼	18⅛	18	18
d_1 in.	21⅞	21¾	21⅝	20¼	20	19 15/16	19¾	19⅝	19 9/16	19½
b in.	12 1/16	12 1/16	12	8 9/16	8½	8½	7 9/16	7 9/16	7 9/16	7½
t in.	½	7/16	7/16	½	7/16	⅜	⅜	⅜	⅜	5/16
p in.	⅜	13/16	¾	⅜	13/16	¾	1 1/16	⅝	9/16	9/16

Safe load values above upper zig-zag line are for ratios of l/r not over 60, those between zig-zag lines are for ratios up to 120 l/r and those below lower zig-zag line are for ratios not over 200 l/r.



CARNEGIE BEAM SECTIONS AS COLUMNS

ALLOWABLE CONCENTRIC LOADS
THOUSANDS OF POUNDS

COLUMN H 16″ LOADS

Unit Stress—American Institute of Steel Construction—1928

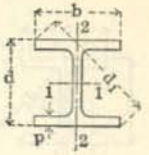
Effective Length in Feet	Nominal Depth and Flange Width—Weight per Foot														
	CB 165 16″ x 14″			CB 164 16″ x 12″			CB 163 16″ x 8½″			CB 162 16″ x 7″				CB 161 16″ x 6″	
	115 lbs.	107 lbs.	100 lbs.	90 lbs.	83 lbs.	76 lbs.	68 lbs.	63 lbs.	58 lbs.	50 lbs.	45 lbs.	43 lbs.	40 lbs.	38 lbs.	35 lbs.
6	507	472	441	397	366	335	300	278	256	221	198	190	176	168	154
7	507	472	441	397	366	335	300	278	256	221	198	190	176	164	150
8	507	472	441	397	366	335	300	278	256	221	198	186	176	155	142
9	507	472	441	397	366	335	300	278	256	212	190	177	168	146	134
10	507	472	441	397	366	335	300	278	256	202	181	169	161	137	126
11	507	472	441	397	366	335	291	269	247	193	173	160	153	129	118
12	507	472	441	397	366	335	281	259	238	183	164	151	145	120	110
13	507	472	441	397	366	335	270	250	230	174	156	143	138	112	103
14	507	472	441	397	366	335	260	240	221	165	148	135	131	105	96
15	507	472	441	395	364	332	250	231	212	156	140	127	124	98	90
16	507	472	441	386	355	324	240	221	203	148	132	120	117	92	84
17	507	472	441	376	347	316	230	212	195	140	125	113	110	86	78
18	505	469	438	367	338	308	220	203	186	132	118	107	104	80	73
19	495	460	430	358	329	300	211	194	178	125	112	100	99	75	68
20	485	451	421	348	321	292	202	186	171	118	106	95	93	70	64
21	476	442	413	339	312	284	193	178	163	112	100	89	88	66	60
22	466	433	404	330	303	277	185	170	156	106	95	84	84		
23	456	423	395	320	295	269	177	163	149	101	90	80	79		
24	446	414	386	311	287	261	169	156	143	95	85	75	75		
25	436	405	378	302	278	253	162	149	136	90	81	71	71		
26	426	396	369	294	270	246	155	143	131	86	77				
27	416	386	361	285	262	239	148	136	125						
28	406	377	352	277	255	232	142	131	120						
29	397	368	344	269	247	225	136	125	114						
30	387	360	336	261	240	218	130	120	110						
Area, in.²	33.82	31.46	29.41	26.46	24.41	22.34	20.00	18.52	17.06	14.70	13.23	12.65	11.75	11.17	10.29
I_{1-1}, in.⁴	1665.6	1537.2	1426.8	1275.5	1167.7	1061.3	923.7	849.9	776.6	666.0	595.0	523.8	524.6	475.1	435.5
S_{1-1}, in.³	205.2	190.8	178.3	157.1	144.9	132.7	113.9	105.5	97.1	81.9	73.8	65.7	65.6	59.3	54.7
r_{1-1}, in.	7.02	6.99	6.97	6.94	6.92	6.89	6.80	6.77	6.75	6.73	6.71	6.44	6.68	6.52	6.50
A/S 1-1	.165	.165	.165	.168	.169	.168	.176	.176	.176	.179	.179	.192	.179	.188	.188
I_{2-2}, in.⁴	426.2	393.9	366.0	230.0	210.4	191.1	81.3	74.6	68.0	38.2	34.0	28.9	29.8	19.2	17.5
S_{2-2}, in.³	60.6	56.1	52.3	38.1	35.0	31.8	19.0	17.5	16.0	10.8	9.7	8.2	8.5	6.4	5.8
r_{2-2}, in.	3.55	3.54	3.53	2.95	2.94	2.92	2.02	2.01	2.00	1.61	1.60	1.51	1.59	1.31	1.30
A/S 2-2	.558	.560	.562	.695	.698	.702	1.053	1.059	1.067	1.361	1.371	1.548	1.382	1.751	1.765
d in.	16¼	16⅛	16	16¼	16⅛	16	16¼	16⅛	16	16¼	16⅛	15⅝	16	16	15⅝
d_1 in.	21½	21⅜	21¼	20¼	20⅛	20	18⅜	18⅛	18⅛	17¾	17⅝	17⅜	17½	17⅛	17⅛
b in.	14⅛	14	14	12⅛	12⅛	12	8⅝	8½	8½	7⅛	7⅛	7⅛	7	6	6
t in.	⅝	½	⅜	½	⅜	⅜	⅞	⅝	⅝	⅝	½	⅝	½	½	½
p in.	⅝	⅞	⅝	⅝	¾	¾	¾	¾	⅞	⅝	⅝	½	½	½	½

Safe load values above upper zig-zag line are for ratios of l/r not over 60, those between zig-zag lines are for ratios up to 120 l/r and those below lower zig-zag line are for ratios not over 200 l/r.

COLUMN 14" H LOADS

CARNEGIE BEAM SECTIONS AS COLUMNS

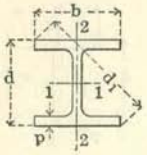
ALLOWABLE CONCENTRIC LOADS
THOUSANDS OF POUNDS



Unit Stress—American Institute of Steel Construction—1928

Effective Length in Feet	Nominal Depth and Flange Width—Weight per Foot CB 146 14" x 15"									
	425 lbs.	405 lbs.	385 lbs.	365 lbs.	345 lbs.	325 lbs.	305 lbs.	295 lbs.	285 lbs.	275 lbs.
18	1875	1787	1698	1610	1522	1434	1346	1301	1257	1213
19	1875	1787	1698	1610	1522	1434	1346	1301	1257	1213
20	1875	1787	1698	1610	1522	1434	1346	1301	1257	1213
21	1875	1787	1698	1610	1521	1430	1339	1294	1249	1203
22	1859	1769	1677	1587	1496	1407	1317	1273	1229	1183
23	1829	1740	1650	1561	1472	1384	1295	1251	1208	1163
24	1799	1712	1622	1535	1447	1360	1272	1229	1187	1143
25	1769	1683	1594	1509	1422	1336	1250	1208	1165	1122
26	1739	1654	1567	1482	1396	1312	1227	1186	1144	1101
27	1708	1625	1539	1455	1371	1288	1205	1164	1123	1081
28	1678	1595	1511	1429	1346	1264	1182	1142	1102	1060
29	1647	1566	1483	1402	1320	1240	1159	1120	1080	1040
30	1617	1537	1455	1376	1295	1217	1137	1098	1059	1019
31	1587	1508	1427	1349	1270	1193	1115	1077	1038	999
32	1557	1479	1400	1323	1245	1170	1092	1055	1018	979
33	1527	1451	1373	1297	1221	1146	1070	1034	997	959
34	1497	1423	1346	1272	1196	1123	1049	1013	977	939
35	1468	1395	1319	1246	1172	1100	1027	992	957	920
36	1439	1367	1293	1221	1148	1078	1006	971	937	900
37	1411	1340	1266	1196	1125	1056	985	951	917	881
38	1382	1313	1241	1172	1102	1034	965	931	898	863
39	1354	1286	1215	1148	1079	1012	944	911	879	844
40	1327	1260	1190	1124	1056	991	924	892	860	826
Area, in.^{2}	124.99	119.12	113.22	107.34	101.47	95.58	89.70	86.76	83.82	80.87
I_{1-1}, in.^{4}	6420.5	6010.5	5609.4	5221.4	4843.4	4475.9	4121.5	3948.1	3778.1	3607.8
S_{1-1}, in.^{3}	693.7	658.8	624.0	589.7	555.5	521.6	488.0	471.4	454.8	438.1
r_{1-1}, in.	7.17	7.10	7.04	6.97	6.91	6.84	6.78	6.75	6.71	6.68
A/S 1-1	.180	.181	.181	.182	.183	.183	.184	.184	.184	.185
I_{2-2}, in.^{4}	2301.0	2168.2	2037.4	1909.1	1783.5	1659.9	1539.1	1479.4	1420.7	1362.0
S_{2-2}, in.^{3}	278.8	264.0	249.4	234.9	220.6	206.4	192.4	185.4	178.6	171.6
r_{2-2}, in.	4.29	4.27	4.24	4.22	4.19	4.17	4.14	4.13	4.12	4.10
A/S 2-2	.448	.451	.454	.457	.460	.463	.466	.468	.469	.471
d in.	18½	18¼	18	17 11/16	17 7/16	17 3/16	16 7/8	16 3/4	16 5/8	16½
d^1 in.	24 13/16	24 9/16	24 5/16	24 1/16	23 13/16	23 9/16	23 5/16	23 1/8	23	22 7/8
b in.	16½	16 7/16	16⅜	16¼	16 3/16	16 1/16	16	15 15/16	15 15/16	15⅞
t in.	1 15/16	1 13/16	1¾	1 11/16	1⅝	1½	1⅜	1⅜	1 5/16	1¼
p in.	3 1/16	2 15/16	2 13/16	2 11/16	2½	2 5/16	2¼	2 3/16	2⅛	2 1/16

Safe load values above upper zig-zag line are for ratios of l/r not over 60, those between zig-zag lines are for ratios up to 120 l/r and those below lower zig-zag line are for ratios not over 200 l/r.



CARNEGIE BEAM SECTIONS AS COLUMNS

ALLOWABLE CONCENTRIC LOADS
THOUSANDS OF POUNDS

COLUMN H 14" LOADS

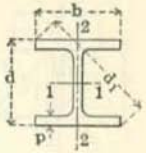
Unit Stress—American Institute of Steel Construction—1928

Effective Length in Feet	Nominal Depth and Flange Width—Weight per Foot CB 146 14" x 15"									
	265 lbs.	255 lbs.	245 lbs.	235 lbs.	225 lbs.	215 lbs.	205 lbs.	195 lbs.	185 lbs.	175 lbs.
18	1169	1125	1081	1037	993	949	904	860	816	772
19	1169	1125	1081	1037	993	949	904	860	816	772
20	1169	1125	1081	1037	993	949	904	860	815	770
21	1158	1114	1069	1024	979	935	890	846	801	757
22	1139	1095	1051	1006	963	919	874	831	787	744
23	1120	1076	1033	989	946	902	859	816	773	730
24	1100	1057	1014	971	929	886	843	801	759	717
25	1080	1038	996	953	912	870	828	786	745	703
26	1060	1019	977	936	895	853	812	771	731	690
27	1040	1000	959	918	878	837	796	756	716	676
28	1020	980	940	900	860	821	781	741	702	663
29	1000	961	922	882	843	804	765	727	688	649
30	981	942	903	864	826	788	749	712	674	636
31	961	923	885	847	810	772	734	697	660	623
32	942	905	867	830	793	756	719	683	646	610
33	922	886	849	812	777	740	704	668	632	597
34	903	868	832	795	760	725	689	654	619	584
35	885	850	814	779	744	709	674	640	606	571
36	866	832	797	762	728	694	660	626	593	559
37	848	814	780	746	713	679	645	613	580	547
38	830	797	763	730	697	664	631	599	567	535
39	812	780	747	714	682	650	618	586	554	523
40	795	763	731	699	668	636	604	573	542	511
Area, in.^{2}	77.93	74.99	72.06	69.11	66.17	63.23	60.28	57.34	54.41	51.47
I_{1-1}, in.^{4}	3442.4	3280.0	3119.6	2961.9	2806.2	2654.7	2505.0	2358.2	2213.5	2071.7
S_{1-1}, in.^{3}	421.6	405.1	388.7	372.4	356.0	339.9	323.7	307.6	291.5	275.5
r_{1-1}, in.	6.65	6.61	6.58	6.55	6.51	6.48	6.45	6.41	6.38	6.34
A/S_{1-1}	.185	.185	.185	.186	.186	.186	.186	.186	.187	.187
I_{2-2}, in.^{4}	1304.2	1247.1	1190.6	1134.5	1079.1	1024.5	970.3	916.8	863.9	811.6
S_{2-2}, in.^{3}	164.8	158.0	151.3	144.6	137.9	131.3	124.7	118.2	111.7	105.2
r_{2-2}, in.	4.09	4.08	4.06	4.05	4.04	4.03	4.01	4.00	3.98	3.97
A/S_{2-2}	.473	.474	.476	.478	.480	.482	.483	.485	.487	.489
d in.	16 5/16	16 3/16	16 1/16	15 15/16	15 3/4	15 5/8	15 1/2	15 5/16	15 3/16	15 1/16
d^1 in.	22 3/4	22 5/8	22 1/2	22 3/8	22 1/4	22 1/8	21 15/16	21 13/16	21 11/16	21 9/16
b in.	15 13/16	15 3/4	15 3/4	15 11/16	15 5/8	15 5/8	15 9/16	15 1/2	15 1/2	15 7/16
t in.	1 1/4	1 3/16	1 1/8	1 1/8	1 1/16	1	15/16	15/16	7/8	13/16
p in.	2	1 7/8	1 13/16	1 3/4	1 11/16	1 5/8	1 9/16	1 1/2	1 3/8	1 5/16

Safe load values above upper zig-zag line are for ratios of l/r not over 60, those between zig-zag lines are for ratios up to 120 l/r and those below lower zig-zag line are for ratios not over 200 l/r.

COLUMN 14" H LOADS

CARNEGIE BEAM SECTIONS AS COLUMNS

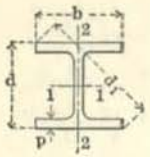


ALLOWABLE CONCENTRIC LOADS
THOUSANDS OF POUNDS

Unit Stress—American Institute of Steel Construction—1928

Effective Length in Feet	Nominal Depth and Flange Width—Weight per Foot CB 146 14" x 15"									
	165 lbs.	155 lbs.	145 lbs.	135 lbs.	131 lbs.	125 lbs.	115 lbs.	106 lbs.	96 lbs.	86 lbs.
18	728	684	640	596	578	551	507	468	423	379
19	728	684	640	596	576	551	507	468	423	379
20	725	680	636	591	566	547	502	462	418	374
21	713	668	625	581	555	537	494	454	411	367
22	700	657	614	570	545	527	485	446	403	360
23	688	645	602	560	534	518	476	438	396	354
24	675	633	591	549	524	508	467	429	388	347
25	662	621	580	539	513	498	458	421	380	340
26	649	608	568	528	502	488	448	412	373	333
27	637	596	557	518	492	478	439	404	365	326
28	624	584	546	507	481	468	430	396	358	319
29	611	572	535	497	471	459	421	387	350	312
30	599	560	523	486	460	449	413	379	343	306
31	586	549	512	476	450	439	404	371	335	299
32	574	537	502	466	440	430	395	363	328	293
33	561	526	491	456	430	421	386	355	321	286
34	549	514	480	446	420	411	378	347	314	280
35	538	503	470	436	410	402	369	339	307	273
36	526	492	459	426	401	393	361	332	300	267
37	514	481	449	417	392	385	353	324	293	261
38	503	470	439	407	382	376	345	317	286	255
39	492	460	429	398	374	368	337	310	280	249
40	481	450	420	389	365	359	330	303	273	244
Area, in.^{2}	48.52	45.58	42.64	39.70	38.52	36.75	33.82	31.18	28.23	25.28
$I_{1\text{-}1}$, in.^{4}	1932.6	1796.8	1662.7	1530.4	1358.4	1402.1	1275.9	1164.1	1042.1	923.0
$S_{1\text{-}1}$, in.^{3}	259.5	243.6	237.7	211.8	191.8	196.0	180.3	166.1	150.3	136.6
$r_{1\text{-}1}$, in.	6.31	6.28	6.24	6.21	5.94	6.18	6.14	6.11	6.08	6.04
A/S $_{1\text{-}1}$	.187	.187	.187	.187	.201	.187	.188	.188	.188	.188
$I_{2\text{-}2}$, in.^{4}	759.9	709.0	658.5	608.4	547.3	559.4	510.9	467.6	419.9	373.1
$S_{2\text{-}2}$, in.^{3}	98.8	92.5	86.2	79.9	70.8	73.7	67.5	61.9	55.8	49.7
$r_{2\text{-}2}$, in.	3.96	3.94	3.93	3.92	3.77	3.90	3.89	3.87	3.86	3.84
A/S $_{2\text{-}2}$	.491	.493	.495	.497	.544	.499	.501	.504	.506	.509
d in.	14 3/8	14 3/4	14 5/8	14 7/16	14 3/16	14 5/16	14 1/8	14	13 7/8	13 11/16
d^1 in.	21 7/16	21 5/16	21 1/8	21	21	20 7/8	20 3/4	20 5/8	20 1/2	20 3/8
b in.	15 3/8	15 5/16	15 5/16	15 1/4	15 7/16	15 3/16	15 1/4	15 1/4	15 1/16	15
t in.	1 3/16	3/4	1 1/16	5/8	7/8	3/4	9/16	1/2	7/16	7/16
p in.	1 1/4	1 3/16	1 1/8	1	7/8	1 5/16	7/8	1 3/16	3/4	1 1/16

Safe load values above upper zig-zag line are for ratios of l/r not over 60, those between zig-zag lines are for ratios up to 120 l/r and those below lower zig-zag line are for ratios not over 200 l/r.



CARNEGIE BEAM SECTIONS AS COLUMNS

ALLOWABLE CONCENTRIC LOADS
THOUSANDS OF POUNDS

COLUMN H 14″ LOADS

Unit Stress—American Institute of Steel Construction—1928

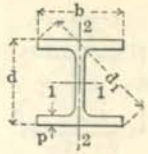
Effective Length in Feet	Nominal Depth and Flange Width—Weight per Foot														
	CB 145 14″ x 12″			CB 144 14″ x 10″			CB 143 14″ x 8″			CB 142 14″ x 6¾″					CB 141 14x6
	105 lbs.	95 lbs.	85 lbs.	75 lbs.	68 lbs.	61 lbs.	58 lbs.	53 lbs.	48 lbs.	42 lbs.	39 lbs.	38 lbs.	36 lbs.	33 lbs.	30 lbs.
6	463	419	375	331	300	269	256	234	212	185	172	168	159	146	132
7	463	419	375	331	300	269	256	234	212	185	172	168	159	146	130
8	463	419	375	331	300	269	256	234	212	184	171	163	157	144	123
9	463	419	375	331	300	269	256	234	212	176	163	155	150	137	116
10	463	419	375	331	300	269	252	230	208	167	155	147	143	131	109
11	463	419	375	331	300	269	243	222	200	159	148	139	136	124	103
12	463	419	375	331	300	269	234	213	193	151	140	131	129	118	96
13	463	419	375	325	294	263	225	205	185	143	133	124	122	111	90
14	463	419	375	316	286	256	215	196	177	135	126	117	115	105	84
15	463	419	375	306	277	248	206	188	170	128	119	110	109	99	79
16	457	413	369	297	269	240	197	180	162	121	112	103	103	94	74
17	447	403	360	288	260	233	189	172	155	114	106	97	97	88	69
18	437	394	352	279	252	225	180	164	148	108	100	91	92	84	64
19	426	384	343	269	244	217	172	157	141	102	94	86	86	79	60
20	416	375	335	260	235	210	164	149	135	96	89	81	82	74	57
21	405	365	326	251	227	203	157	143	129	91	84	76	77	70	53
22	395	356	318	243	219	196	150	136	123	86	80	72	73	66	50
23	384	346	309	234	212	189	143	130	117	81	75	68	69	63	
24	374	337	301	226	204	182	136	124	112	77	71	64	65	59	
25	364	328	293	218	197	175	130	118	107	73	68		62	56	
26	354	319	284	210	190	169	124	113	102	69	64				
27	344	310	276	203	183	163	119	108	97						
28	335	301	269	196	177	157	114	103	93						
29	325	293	261	189	170	152	109	99	89						
30	316	284	254	182	164	146	104	94	85						
Area, in.²	30.88	27.93	24.99	22.05	19.99	17.94	17.05	15.59	14.12	12.35	11.47	11.18	10.58	9.71	8.82
I_{1-1}, in.⁴	1169.6	1044.0	921.3	823.5	738.8	656.2	609.4	552.5	496.0	431.5	398.3	357.5	365.6	333.4	292.0
S_{1-1}, in.³	162.8	147.2	131.6	114.5	103.8	93.1	85.6	78.2	70.9	60.6	56.3	51.1	51.9	47.6	41.8
r_{1-1}, in.	6.15	6.11	6.07	6.11	6.08	6.05	5.98	5.95	5.93	5.91	5.89	5.66	5.88	5.86	5.75
A/S 1-1	.190	.190	.190	.193	.193	.193	.199	.199	.199	.204	.204	.219	.204	.204	.211
I_{2-2}, in.⁴	292.6	262.0	232.0	134.5	120.6	107.1	62.8	56.8	50.8	30.2	27.7	24.2	25.4	23.0	15.5
S_{2-2}, in.³	48.4	43.5	38.7	26.7	24.0	21.4	15.6	14.1	12.7	8.8	8.2	7.1	7.5	6.8	5.2
r_{2-2}, in.	3.08	3.06	3.05	2.47	2.46	2.44	1.92	1.91	1.90	1.56	1.56	1.47	1.55	1.54	1.33
A/S 2-2	.639	.642	.646	.827	.832	.837	1.095	1.103	1.111	1.397	1.405	1.585	1.413	1.422	1.702
d in.	14⅛	14⅛	14	14⅛	14¼	14⅛	14¼	14¼	14	14¼	14⅛	14	14⅛	14	13⅞
d_1 in.	18⅝	18⅝	18⅜	17⅞	17⅞	17⅞	16⅝	16¼	16⅛	15⅝	15⅝	15⅝	15⅝	15⅝	15⅝
b in.	12⅛	12⅛	12	10⅛	10⅛	10	8⅛	8⅛	8	6⅝	6⅝	6¾	6¾	6¾	6
t in.	⅝	½	⅜	⅝	½	⅜	⅝	½	⅜	⅝	½	⅜	⅝	¼	¼
p in.	1	⅞	⅝	⅝	⅝	⅝	⅝	⅝	⅝	⅝	½	⅜	½	⅜	⅜

Safe load values above upper zig-zag line are for ratios of l/r not over 60, those between zig-zag lines are for ratios up to 120 l/r and those below lower zig-zag line are for ratios not over 200 l/r.

COLUMN 12" H LOADS

CARNEGIE BEAM SECTIONS AS COLUMNS

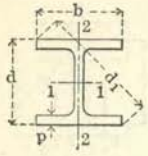
ALLOWABLE CONCENTRIC LOADS
THOUSANDS OF POUNDS



Unit Stress—American Institute of Steel Construction—1928

Effective Length in Feet	Nominal Depth and Flange Width—Weight per Foot											
	CB 127 12" x 14"					CB 126 12" x 14"				CB 125 12" x 12"			
	230 lbs.	220 lbs.	210 lbs.	200 lbs.	190 lbs.	180 lbs.	170 lbs.	160 lbs.	150 lbs.	140 lbs.	130 lbs.	120 lbs.	110 lbs.
15	1015	971	926	882	838	794	750	706	662	618	574	529	485
16	1015	971	926	882	838	794	750	706	662	605	563	521	480
17	1015	971	926	882	838	794	750	706	662	591	550	509	469
18	1015	971	926	882	838	794	750	706	662	576	537	497	458
19	1009	964	920	875	831	782	740	698	655	562	524	485	448
20	991	947	903	859	816	768	726	684	643	548	510	473	437
21	972	929	886	843	801	753	712	671	631	533	497	461	426
22	954	911	869	826	785	737	697	658	618	519	484	449	415
23	935	893	851	810	769	722	683	645	606	505	471	437	404
24	916	875	834	793	754	707	669	631	593	491	458	426	393
25	897	857	817	777	738	692	654	618	581	478	446	414	383
26	878	839	799	760	722	677	640	604	568	464	433	403	373
27	859	821	782	744	706	662	626	591	556	451	421	391	362
28	841	803	765	727	691	647	612	578	544	438	409	380	352
29	822	785	748	711	676	632	598	565	532	425	397	370	342
30	804	767	731	695	660	617	584	552	519	413	386	359	333
31	786	750	715	679	645	603	571	539	508	401	375	349	323
32	768	733	698	664	631	589	557	527	496	389	364	339	314
33	750	716	682	648	616	575	544	514	484	378	353	329	305
34	733	700	666	633	602	561	531	502	473	367	343	319	297
35	716	683	651	618	588	548	519	490	462	356	333	310	288
36	699	667	636	604	574	535	506	479	451	346	323	301	280
37	683	652	621	590	560	522	494	467	440	336	314	293	272
38	667	636	606	576	547	509	482	456	430	326	305	284	264
39	651	621	592	562	534	497	470	445	419	316	296	276	257
40	636	607	578	549	521	485	459	434	409	307	287	268	250
Area, in.^{2}	67.64	64.70	61.76	58.82	55.88	52.94	50.00	47.06	44.12	41.18	38.24	35.28	32.34
I_{1-1}, in.^{4}	1461.9	1426.6	1391.3	1356.1	1320.8	1218.1	1182.8	1147.5	1112.2	934.8	899.5	864.1	828.8
S_{1-1}, in.^{3}	243.6	237.8	231.9	226.0	220.1	203.0	197.1	191.3	185.4	155.8	149.9	144.0	138.1
r_{1-1}, in.	4.65	4.70	4.75	4.80	4.86	4.80	4.86	4.94	5.02	4.76	4.85	4.95	5.06
A/S 1-1	.278	.272	.266	.260	.254	.261	.254	.246	.238	.264	.255	.245	.234
I_{2-2}, in.^{4}	945.5	898.2	852.9	809.5	767.8	702.4	666.9	633.0	600.4	372.4	350.5	329.6	309.9
S_{2-2}, in.^{3}	126.2	121.9	117.7	113.7	109.7	95.3	92.1	88.9	85.8	58.5	56.1	53.8	51.6
r_{2-2}, in.	3.74	3.73	3.72	3.71	3.71	3.64	3.65	3.67	3.69	3.01	3.03	3.06	3.10
A/S 2-2	.536	.531	.525	.518	.510	.555	.543	.529	.514	.704	.681	.655	.626
d in.	12	12	12	12	12	12	12	12	12	12	12	12	12
d^1 in.	19 3/16	19	18 13/16	18 5/8	18 7/16	19	18 13/16	18 5/8	18 7/16	17 1/2	17 3/8	17 1/8	17
b in.	15	14 3/4	14 1/2	14 1/4	14	14 3/4	14 1/2	14 1/4	14	12 3/4	12 1/2	12 1/4	12
t in.	2	1 3/4	1 1/2	1 1/4	1	1 1/2	1 1/4	1	3/4	1 3/8	1 1/8	7/8	5/8
p in.	1 11/16	1 11/16	1 11/16	1 11/16	1 11/16	1 5/16	1 5/16	1 5/16	1 5/16	1 1/16	1 1/16	1 1/16	1 1/16

Safe load values above upper zig-zag line are for ratios of l/r not over 60, those between zig-zag lines are for ratios up to 120 l/r and those below lower zig-zag line are for ratios not over 200 l/r.



CARNEGIE BEAM SECTIONS AS COLUMNS

ALLOWABLE CONCENTRIC LOADS
THOUSANDS OF POUNDS

COLUMN H 12″ LOADS

Unit Stress—American Institute of Steel Construction—1928

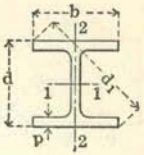
Effective Length in Feet	Nominal Depth and Flange Width—Weight per Foot									
	CB 124C 12″ x 12″				CB 124B 12″ x 12″			CB 123B 12″ x 9″		
	102 lbs.	95 lbs.	88 lbs.	82 lbs.	76 lbs.	70 lbs.	65 lbs.	66 lbs.	60 lbs.	55 lbs.
11	450	419	388	362	335	309	287	291	265	243
12	450	419	388	362	335	309	287	285	259	237
13	450	419	388	362	335	309	287	276	251	229
14	450	419	388	362	335	309	287	267	243	222
15	447	418	388	362	331	307	287	258	234	214
16	437	409	381	357	324	300	281	249	226	207
17	427	399	373	349	316	293	275	241	218	199
18	416	390	364	341	308	286	268	232	210	192
19	405	380	355	333	299	279	262	223	202	185
20	395	370	346	325	291	271	255	215	195	178
21	384	360	337	317	283	264	248	207	187	171
22	374	351	328	309	275	257	242	199	180	164
23	363	341	320	301	268	250	235	191	173	158
24	353	332	311	293	260	243	229	184	166	152
25	343	322	302	285	252	236	223	177	160	146
26	333	313	294	277	245	229	216	170	154	140
27	323	304	286	269	238	222	210	163	148	135
28	314	295	278	262	230	216	204	157	142	129
29	304	287	270	255	224	210	199	151	136	124
30	295	278	262	247	217	203	193	145	131	120
31	287	270	254	240	210	197	187	139	126	115
32	278	262	247	234	204	191	182	134	121	111
33	270	255	240	227	198	186	177	129	117	106
34	262	247	233	220	192	180	171	124	112	102
35	254	240	226	214	186	175	166	120	108	99
Area, in.^{2}	29.99	27.93	25.88	24.11	22.35	20.58	19.11	19.41	17.65	16.17
I_{1-1}, in.^{4}	721.4	696.6	672.0	650.8	560.2	539.0	521.3	525.7	472.0	428.4
S_{1-1}, in.^{3}	120.2	116.1	112.0	108.5	93.4	89.8	86.9	85.8	77.9	71.4
r_{1-1}, in.	4.90	4.99	5.10	5.20	5.01	5.12	5.22	5.20	5.17	5.15
A/S $_{1-1}$	.249	.241	.231	.222	.239	.229	.220	.226	.227	.227
I_{2-2}, in.^{4}	260.6	249.7	239.2	230.5	187.5	180.7	175.2	99.1	89.0	80.9
S_{2-2}, in.^{3}	41.7	40.5	39.4	38.4	30.6	29.8	29.2	21.8	19.7	18.0
r_{2-2}, in.	2.95	2.99	3.04	3.09	2.90	2.96	3.03	2.26	2.25	2.24
A/S $_{2-2}$	.719	.689	.657	.628	.731	.690	.654	.889	.895	.900
d in.	12	12	12	12	12	12	12	12¼	12⅛	12
d^1 in.	17⅜	17¼	17⅛	17	17 3/16	17 1/16	17	15 5/16	15⅛	15
b in.	12½	12 5/16	12 3/16	12	12¼	12⅛	12	9⅛	9 1/16	9
t in.	15/16	¾	5/8	½	1 1/16	9/16	7/16	½	7/16	⅜
p in.	13/16	13/16	13/16	13/16	5/8	5/8	5/8	13/16	¾	11/16

Safe load values above upper zig-zag line are for ratios of l/r not over 60, those between zig-zag lines are for ratios up to 120 l/r and those below lower zig-zag line are for ratios not over 200 l/r.

COLUMN 12″ H LOADS

CARNEGIE BEAM SECTIONS AS COLUMNS

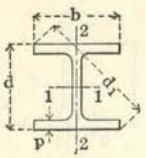
ALLOWABLE CONCENTRIC LOADS
THOUSANDS OF POUNDS



Unit Stress—American Institute of Steel Construction—1928

Effective Length in Feet	Nominal Depth and Flange Width—Weight per Foot							
	CB 123 12″ x 8″			CB 122 12″ x 6½″				CB 121 12″ x 6″
	50 lbs.	45 lbs.	40 lbs.	36 lbs.	34 lbs.	32 lbs.	28 lbs.	25 lbs.
6	220	198	176	159	150	141	123	110
7	220	198	176	159	150	141	123	109
8	220	198	176	157	145	139	121	104
9	220	198	176	150	137	133	116	98
10	220	197	175	143	130	127	110	93
11	212	191	169	136	123	120	105	87
12	204	184	163	129	116	114	99	82
13	197	177	156	122	109	108	94	77
14	189	170	150	115	103	102	89	72
15	181	163	144	109	97	96	84	67
16	174	156	138	103	91	91	79	63
17	166	149	132	97	86	86	74	59
18	159	143	125	92	81	81	70	55
19	152	137	121	87	76	76	66	52
20	146	131	115	82	71	72	63	49
21	139	125	110	77	67	68	59	46
22	133	119	105	73	63	64	56	43
23	127	114	100	69	60	61	53	
24	122	109	96	65	56	57	50	
25	116	104	92	62		54	47	
26	111	99	88					
27	106	95	84					
28	102	91	80					
29	97	87	77					
30	93	83	73					
Area, in.^{2}	14.69	13.23	11.76	10.59	9.99	9.40	8.22	7.34
I_{1-1}, in.^{4}	400.5	356.9	313.7	280.1	238.1	246.3	213.4	183.0
S_{1-1}, in.^{3}	65.4	58.8	52.3	45.8	39.6	40.7	35.6	30.7
r_{1-1}, in.	5.22	5.19	5.17	5.14	4.88	5.12	5.10	4.99
A/S_{1-1}	.225	.225	.225	.231	.252	.231	.231	.239
I_{2-2}, in.^{4}	57.5	51.2	44.9	25.4	21.0	22.3	19.2	13.8
S_{2-2}, in.^{3}	14.2	12.7	11.2	7.7	6.3	6.8	5.9	4.6
r_{2-2}, in.	1.98	1.97	1.95	1.55	1.45	1.54	1.53	1.37
A/S_{2-2}	1.032	1.039	1.047	1.367	1.575	1.377	1.389	1.600
d in.	12¼	12⅛	12	12¼	12	12⅛	12	11 15/16
d^1 in.	14 1/16	14 9/16	14 7/16	13⅞	13¾	13 13/16	13 1/16	13⅜
b in.	8 1/16	8 1/16	8	6 9/16	6⅝	6 9/16	6½	6
t in.	⅜	5/16	5/16	5/16	⅜	¼	¼	¼
p in.	⅝	9/16	½	9/16	7/16	½	7/16	⅜

Safe load values above upper zig-zag line are for ratios of l/r not over 60, those between zig-zag lines are for ratios up to 120 l/r and those below lower zig-zag line are for ratios not over 200 l/r.



CARNEGIE BEAM SECTIONS AS COLUMNS

ALLOWABLE CONCENTRIC LOADS
THOUSANDS OF POUNDS

COLUMN H 10″ LOADS

Unit Stress—American Institute of Steel Construction—1928

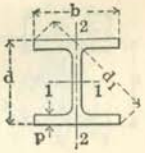
Effective Length in Feet	Nominal Depth and Flange Width—Weight per Foot													
	CB 105 10″ x 12″						CB 104 10″ x 10″				CB 103A 10″ x 10″			
	140 lbs.	132 lbs.	124 lbs.	116 lbs.	108 lbs.	100 lbs.	92 lbs.	84 lbs.	77 lbs.	70 lbs	64 lbs.	59 lbs.	54 lbs.	49 lbs.
11	618	582	547	512	476	441	406	371	340	309	282	260	238	216
12	618	582	547	512	476	441	406	371	340	309	281	260	238	216
13	618	582	547	512	476	441	400	364	336	307	273	254	234	214
14	618	582	547	512	476	441	389	354	326	299	265	246	228	209
15	618	582	547	512	476	441	378	344	317	290	257	239	221	203
16	609	575	540	507	473	439	367	334	308	282	249	231	214	197
17	596	562	528	496	463	430	356	323	298	273	240	224	208	191
18	582	549	516	484	452	420	344	313	289	265	232	216	201	185
19	568	536	504	473	442	410	333	303	280	257	224	209	194	179
20	554	523	492	461	431	401	322	292	270	248	216	202	188	173
21	540	510	479	450	420	391	311	283	261	240	209	195	182	168
22	526	497	467	438	410	381	301	273	253	232	201	188	175	162
23	512	484	455	427	399	372	290	263	244	225	194	181	169	157
24	499	472	443	416	389	362	280	254	235	217	187	175	163	151
25	485	458	431	405	378	353	271	245	227	210	180	168	158	146
26	472	446	419	394	368	343	261	237	219	202	173	162	152	141
27	459	434	407	383	358	334	252	228	212	195	167	156	147	136
28	446	422	396	372	349	325	243	220	204	189	161	151	141	131
29	434	410	385	362	339	316	235	212	197	182	155	145	136	127
30	421	398	374	352	330	307	226	205	190	176	149	140	132	123
31	409	387	364	342	320	299	218	198	184	170	144	135	127	118
32	398	376	353	332	311	291	211	191	177	164	138	130	123	114
33	386	365	343	323	303	283	203	184	171	158	133	125	118	110
34	375	355	333	314	294	275	196	178	165	153	129	121	114	107
35	364	345	324	305	286	267	190	171	160	148	124	117	110	103
Area, in.^{2}	41.17	38.81	36.46	34.11	31.76	29.40	27.06	24.70	22.65	20.59	18.81	17.34	15.87	14.40
I 1-1, in.^{4}	623.2	603.5	583.9	564.3	544.8	525.1	423.2	403.6	386.5	369.3	308.8	296.5	284.3	272.0
S1-1, in.^{3}	124.6	120.7	116.8	112.9	109.0	105.0	84.6	80.7	77.3	73.9	61.8	59.3	56.9	54.4
r 1-1, in.	3.89	3.94	4.00	4.07	4.14	4.23	3.96	4.04	4.13	4.24	4.05	4.13	4.23	4.35
A/S 1-1	.330	.322	.312	.302	.292	.280	.320	.306	.293	.279	.305	.292	.279	.265
I 2-2, in.^{4}	391.4	369.6	349.0	329.4	310.7	292.8	163.1	152.0	142.9	134.3	106.3	101.7	97.3	93.0
S2-2, in.^{3}	59.4	57.1	54.9	52.8	50.8	48.8	30.6	29.2	28.0	26.9	20.4	19.8	19.2	18.6
r 2-2, in.	3.08	3.09	3.09	3.11	3.13	3.16	2.46	2.48	2.51	2.55	2.38	2.42	2.48	2.54
A/S 2-2	.633	.630	.664	.646	.626	.603	.883	.846	.809	.767	.924	.878	.828	.774
d in.	10	10	10	10	10	10	10	10	10	10	10	10	10	10
d^1 in.	16⅝	16⅜	16⅛	16	15⅞	15⅝	14⅝	14⅜	14⅛	14⅜	14½	14⅜	14¼	14⅛
b in.	13⅜	12⅝	12⅝	12½	12¼	12	10⅝	10⅜	10⅛	10	10⅜	10⅛	10⅛	10
t in.	1¾	1⅝	1⅝	1⅜	⅝	⅝	1⅜	⅝	¾	½	⅝	⅝	½	⅜
p in.	1	1	1	1	1	1	⅝	⅝	⅝	⅝	⅝	⅝	⅝	⅝

Safe load values above upper zig-zag line are for ratios of l/r not over 60, those between zig-zag lines are for ratios up to 120 l/r and those below lower zig-zag line are for ratios not over 200 l/r.

COLUMN
10″ H
9″
LOADS

CARNEGIE BEAM SECTIONS AS COLUMNS

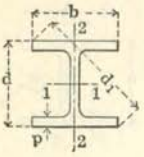
ALLOWABLE CONCENTRIC LOADS
THOUSANDS OF POUNDS



Unit Stress—American Institute of Steel Construction—1928

Effective Length in Feet	Nominal Depth and Flange Width—Weight per Foot												
	CB 102 10″x8″			CB 101 10″ x 6″				CB 93 9″ x 9″			CB 92 9″ x 6½″		
	42 lbs.	36 lbs.	31 lbs.	30 lbs.	26 lbs.	23 lbs.	21 lbs	48 lbs	43 lbs.	38 lbs.	35 lbs.	32 lbs.	29 lbs.
6	185	159	137	132	115	101	93	212	190	168	154	141	128
7	185	159	137	132	115	101	92	212	190	168	154	141	128
8	185	159	137	128	110	97	88	212	190	168	154	141	128
9	183	159	137	121	104	92	83	212	190	168	148	135	122
10	175	153	134	115	99	87	79	212	190	168	142	129	117
11	168	147	129	109	93	83	74	212	190	168	135	123	111
12	161	140	124	103	88	78	70	208	186	164	128	117	105
13	153	134	119	97	83	73	65	202	181	159	122	111	100
14	146	128	114	91	78	69	61	196	175	154	115	105	95
15	139	122	109	86	73	65	57	189	169	149	109	99	90
16	132	117	104	80	69	61	54	183	163	144	103	94	85
17	125	111	100	76	65	57	51	176	157	138	98	89	80
18	119	106	95	71	61	54	47	170	152	133	93	84	76
19	113	101	91	69	57	50	45	164	146	128	88	80	72
20	107	96	86	63	54	47	42	158	141	124	83	75	68
21	102	91	83	59	50	45	39	152	135	119	78	71	64
22	97	87	79	56	48	42	37	146	130	114	74	67	61
23	92	83	75	53	45	40	35	141	125	110	70	64	57
24	88	79	72	50	42			135	120	106	67	60	54
25	83	75	68					130	116	102	63	57	52
26	79	71	65					125	111	95	60	54	49
27	75	68	62					120	107	94			
28	72	65	60					116	103	90			
29		62	57					111	99	87			
30		59	54					107	95	83			
Area, in.^{2}	12.35	10.58	9.11	8.82	7.64	6.76	6.17	14.11	12.65	11.17	10.29	9.40	8.53
$I_{1\text{-}1}$, in.^{4}	190.4	175.6	163.4	163.2	139.5	122.2	107.6	221.1	195.5	170.4	155.4	140.5	126.0
$S_{1\text{-}1}$, in.^{3}	38.1	35.1	32.7	31.9	27.6	24.4	21.7	47.8	42.9	37.9	33.8	30.9	28.0
$r_{1\text{-}1}$, in.	3.93	4.07	4.23	4.30	4.27	4.25	4.18	3.96	3.93	3.91	3.89	3.87	3.84
A/S 1-1	.324	.301	.279	.276	.276	.277	.284	.295	.295	.295	.304	.304	.304
$I_{2\text{-}2}$, in.^{4}	36.8	34.4	32.5	18.5	15.7	13.7	12.0	73.8	65.4	57.1	26.6	24.0	21.5
$S_{2\text{-}2}$, in.^{3}	8.9	8.5	8.1	6.1	5.2	4.6	4.0	16.3	14.5	12.7	8.1	7.4	6.6
$r_{2\text{-}2}$, in.	1.73	1.80	1.89	1.45	1.43	1.43	1.39	2.29	2.28	2.26	1.61	1.60	1.59
A/S 2-2	1.396	1.252	1.120	1.450	1.464	1.477	1.547	.868	.873	.880	1.267	1.276	1.286
d in.	10	10	10	10¼	10⅛	10	9⅞	9¼	9⅛	9	9⅛	9⅛	9
d_1 in.	13⅛	12⅝	12⅝	11⅝	11⅝	11⅝	11⅝	13	12⅞	12¾	11⅝	11⅝	11⅛
b in.	8⅛	8⅛	8	6⅛	6	6	6	9⅛	9⅛	9	6⅝	6½	6½
t in.	⅝	⅞	⅝	⅝	¼	¼	¼	⅜	⅜	⅝	⅝	⅝	¼
p in.	⅜	⅜	⅜	½	⅜	⅜	⅜	⅝	½	½	⅝	½	½

Safe load values above upper zig-zag line are for ratios of l/r not over 60, those between zig-zag lines are for ratios up to 120 l/r and those below lower zig-zag line are for ratios not over 200 l/r.



CARNEGIE BEAM SECTIONS AS COLUMNS

ALLOWABLE CONCENTRIC LOADS
THOUSANDS OF POUNDS

COLUMN H 8″ LOADS

Unit Stress—American Institute of Steel Construction—1928

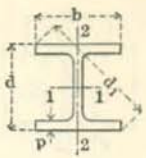
Effective Length in Feet	Nominal Depth and Flange Width—Weight per Foot													
	CB 83 8″ x 8″											CB 82 8″x6½″		
	90 lbs.	84 lbs.	78 lbs.	72 lbs.	66 lbs.	60 lbs.	54 lbs.	48 lbs.	42 lbs.	36 lbs.	31 lbs.	30 lbs.	27 lbs.	24 lbs.
6												132	119	106
7	397	371	344	318	291	264	238	212	185	159	137	132	119	106
8	397	371	344	318	291	264	238	212	185	159	137	132	119	106
9	397	371	344	318	291	264	238	212	185	159	137	127	114	102
10	397	371	344	318	291	264	238	212	185	159	137	122	109	97
11	395	368	341	314	287	260	233	207	180	154	132	116	104	93
12	383	356	330	303	277	251	225	200	174	149	127	111	99	88
13	370	344	319	293	268	242	217	192	168	143	123	105	94	84
14	357	332	307	282	258	234	209	185	161	138	118	100	89	79
15	345	320	296	272	249	225	201	178	155	132	113	95	85	75
16	332	308	285	262	239	216	193	171	149	127	109	90	80	71
17	320	296	274	252	230	208	186	164	143	122	104	85	76	67
18	307	285	264	242	221	199	178	158	137	116	100	80	72	64
19	295	274	253	232	212	191	171	151	131	112	96	76	68	60
20	284	263	243	223	203	183	164	145	126	107	91	72	64	57
21	272	252	233	213	195	176	157	139	120	102	87	68	61	54
22	261	242	224	205	187	168	150	133	115	98	84	65	58	51
23	251	232	215	196	179	161	144	127	110	93	80	61	55	48
24	241	223	206	188	172	154	138	122	105	89	77	58	52	46
25	231	214	197	180	164	148	132	117	101	86	73	55	49	43
26	222	205	189	173	158	142	126	112	97	82	70	52	47	41
27	213	197	182	166	151	136	121	107	93	78	67	50	44	
28	204	189	174	159	145	130	116	102	89	75	64			
29	196	181	167	153	139	125	111	98	85	72	61			
30	188	174	160	146	133	120	107	94	81	69	59			
Area, in.^{2}	26.47	24.71	22.93	21.17	19.40	17.63	15.87	14.10	12.34	10.58	9.10	8.81	7.93	7.06
I_{1-1}, in.^{4}	391.2	358.6	326.5	295.9	265.9	237.1	209.2	182.2	156.2	131.3	110.9	107.8	95.9	84.3
S_{1-1}, in.^{3}	81.4	75.8	70.2	64.7	59.1	53.7	48.2	42.8	37.4	32.0	27.5	26.3	23.7	21.1
r_{1-1}, in.	3.84	3.81	3.77	3.74	3.70	3.67	3.63	3.59	3.56	3.52	3.49	3.50	3.48	3.46
A/S $_{1-1}$	.325	.326	.327	.327	.328	.329	.329	.330	.330	.330	.331	.335	.335	.335
I_{2-2}, in.^{4}	124.4	114.5	104.7	95.3	86.1	77.1	68.3	59.7	51.4	43.4	36.7	23.4	20.8	18.3
S_{2-2}, in.^{3}	29.2	27.0	24.9	22.8	20.7	18.7	16.6	14.6	12.7	10.8	9.2	7.1	6.4	5.6
r_{2-2}, in.	2.17	2.15	2.14	2.12	2.11	2.09	2.07	2.06	2.04	2.02	2.01	1.63	1.62	1.61
A/S $_{2-2}$	.907	.914	.921	.929	.937	.945	.954	.963	.972	.982	.992	1.233	1.241	1.251
d in.	9⅝	9⅜	9⅝	9⅛	9	8⅞	8⅝	8½	8⅜	8⅛	8⅛	8⅛	8⅛	8
d^1 in.	12⅞	12¾	12⅝	12⅜	12¼	12⅛	11⅞	11⅝	11⅜	11½	11⅜	10½	10⅜	10⅛
b in.	8½	8½	8⅜	8⅜	8⅛	8¼	8⅛	8⅛	8⅛	8⅛	8	6⅝	6½	6½
t in.	⅝	¾	11/16	11/16	⅝	⅝	½	7/16	⅜	⅜	⅜	⅜	¼	¼
p in.	1⅝	1⅜	1⅛	1	⅞	¾	⅝	½	7/16	⅜	⅜	½	⅜	⅜

Safe load values above upper zig-zag line are for ratios of l/r not over 60, those between zig-zag lines are for ratios up to 120 l/r and those below lower zig-zag line are for ratios not over 200 l/r.

COLUMN H 6″ LOADS

CARNEGIE BEAM SECTIONS AS COLUMNS

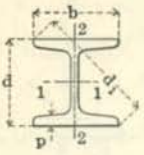
ALLOWABLE CONCENTRIC LOADS
THOUSANDS OF POUNDS



Unit Stress—American Institute of Steel Construction—1928

Effective Length in Feet	Nominal Depth and Flange Width—Weight per Foot CB 61 6″ x 9½″					
	88 lbs.	80 lbs.	70 lbs.	60 lbs.	50 lbs.	40 lbs.
11	388	353	308	264	221	176
12	388	353	308	264	221	176
13	388	352	306	261	217	172
14	378	343	298	254	211	167
15	368	333	290	247	205	162
16	358	324	281	240	198	157
17	347	314	273	232	192	152
18	337	305	265	225	186	147
19	327	295	256	218	180	142
20	316	286	248	211	174	137
21	306	277	240	203	168	133
22	296	268	232	197	162	128
23	287	259	224	190	157	123
24	277	250	216	183	151	119
25	268	242	209	177	146	115
26	259	233	202	171	141	111
27	250	225	195	165	136	107
28	242	218	188	159	131	103
29	234	210	182	154	126	99
30	226	203	175	148	122	96
31	218	196	169	143	117	92
32	211	190	164	138	113	89
33	204	183	158	133	109	86
34	197	177	153	129	105	83
35	190	171	147	124	102	80
Area, in.²	25.87	23.52	20.58	17.63	14.70	11.76
I_{1-1}, in.⁴	187.3	164.9	138.7	113.9	91.0	69.6
S_{1-1}, in.³	54.7	49.5	43.0	36.7	30.4	24.2
r_{1-1}, in.	2.69	2.65	2.60	2.54	2.49	2.43
A/S 1-1	.473	.475	.478	.481	.483	.486
I_{2-2}, in.⁴	175.4	156.3	133.3	111.1	90.1	69.9
S_{2-2}, in.³	34.9	31.4	27.1	22.8	18.7	14.7
r_{2-2}, in.	2.60	2.58	2.54	2.51	2.48	2.44
A/S 2-2	.744	.749	.760	.772	.785	.799
d in.	6 13/16	6 1/16	6 7/16	6 3/16	6	5 3/4
d_1 in.	12 3/16	12	11 13/16	11 9/16	11 3/8	11 1/8
b in.	10 1/16	9 15/16	9 7/8	9 3/4	9 5/8	9 1/2
t in.	1 1/16	15/16	7/8	3/4	5/8	1/2
p in.	1 1/16	15/16	7/8	3/4	5/8	1/2

Safe load values above upper zig-zag line are for ratios of l/r not over 60, those between zig-zag lines are for ratios up to 120 l/r and those below lower zig-zag line are for ratios not over 200 l/r.



STANDARD MILL SECTIONS AS MISCELLANEOUS SMALL COLUMNS

ALLOWABLE CONCENTRIC LOADS
THOUSANDS OF POUNDS

COLUMN H 9" to 4" LOADS

Unit Stress—American Institute of Steel Construction—1928

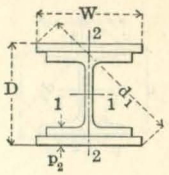
Effective Length in Feet	Nominal Depth and Flange Width—Weight per Foot												
	B 40 9"		B 39 8"		H 4 8" x 8"			H 3 A 6" x 6"		H 3 6" x 6"		H 2 5"x5"	H 1 4"x4"
	25 lbs.	20.5 lbs.	21 lbs.	17.5 lbs.	37.7 lbs.	34.3 lbs.	32.6 lbs.	27.5 lbs.	25 lbs.	22.5 lbs.	20 lbs.	18.9 lbs.	13.8 lbs.
3	110	90.3	93	77.1	165	150	143	121	110	99	88	82	60
4	110	90.3	93	77.1	165	150	143	121	110	99	88	82	60
5	110	90.3	93	77.1	165	150	143	121	110	99	88	82	59
6	106	89.0	87	74.2	165	150	143	121	110	99	88	82	54
7	99	83.6	81	69.2	165	150	143	121	110	98	88	77	50
8	92	78.1	75	64.3	165	150	143	116	106	93	83	73	46
9	85	72.7	69	59.5	165	150	143	110	100	88	79	68	42
10	79	67.5	63	54.9	160	146	140	104	95	83	75	63	38
11	73	62.6	58	50.6	154	141	135	98	90	78	70	59	35
12	67	57.9	53	46.5	147	135	130	92	84	73	66	55	32
13	62	53.6	49	42.9	141	130	124	87	79	69	62	51	29
14	57	49.6	45	39.5	135	124	119	81	75	64	58	47	26
15	53	45.9	41	36.4	129	119	114	76	70	60	55	44	24
16	49	42.5	38	33.6	123	114	109	72	66	56	51	41	
17	45	39.4	35	31.0	117	108	104	67	62	53	48	38	
18	42	36.6		28.7	112	103	100	63	58	50	45	35	
19					106	99	95	59	55	46	42	33	
20					101	94	91	56	51	44	40	31	
21					96	90	86	52	48	41	37		
22					92	85	83	49	46	38	35		
23					87	81	79	46	43		33		
24					83	78	75						
25					79	74	72						
Area, in.^{2}	7.34	6.02	6.17	5.14	11.00	10.00	9.50	8.08	7.33	6.61	5.86	5.47	3.99
I_{1-1}, in.^{4}	95.5	86.6	63.4	57.9	120.8	115.5	112.8	49.3	47.0	41.0	38.8	23.8	10.7
S_{1-1}, in.^{3}	21.2	19.2	15.9	14.5	30.2	28.9	28.2	16.4	15.7	13.7	12.9	9.5	5.3
r_{1-1}, in.	3.61	3.79	3.21	3.36	3.31	3.40	3.45	2.47	2.53	2.49	2.57	2.08	1.64
A/S 1-1	.346	.313	.389	.355	.364	.346	.337	.492	.468	.483	.453	.576	.753
I_{2-2}, in.^{4}	8.8	8.0	6.6	6.0	36.9	35.1	34.2	16.0	14.9	12.2	11.4	7.8	3.6
S_{2-2}, in.^{3}	3.3	3.1	2.6	2.4	9.1	8.8	8.6	5.3	5.0	4.0	3.8	3.1	1.8
r_{2-2}, in.	1.09	1.15	1.03	1.08	1.83	1.87	1.90	1.41	1.43	1.36	1.39	1.20	0.95
A/S 2-2	2.254	1.850	2.402	2.142	1.209	1.136	1.105	1.535	1.458	1.648	1.531	1.765	2.217
d in.	9	9	8	8	8	8	8	6	6	6	6	5	4
d^1 in.	10½	10⅞	9½	9⅞	11⅞	11⅝	11½	8⅝	8½	8⅝	8½	7½	5⅝
b in.	5⅛	5¼	5½	5	8⅛	8	7⅞	6⅛	5⅝	6⅛	5⅝	5	4
t in.	⅜	¼	⅜	¼	½	⅜	⅜	⅜	⅜	⅜	¼	⅜	⅜
p in.	⅜	⅜	⅜	⅜	⅜	⅜	⅜	½	½	⅜	⅜	⅜	⅜

Safe load values above upper zig-zag line are for ratios of l/r not over 60, those between zig-zag lines are for ratios up to 120 l/r and those below lower zig-zag line are for ratios not over 200 l/r.

COLUMN
LOADS

CARNEGIE BEAM SECTIONS AS COLUMNS WITH COVER PLATES

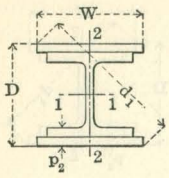
ALLOWABLE CONCENTRIC LOADS
THOUSANDS OF POUNDS



Unit Stress—American Institute of Steel Construction—1928

Effective Length in Feet	CORE—CB 146—425 Lbs. 14″ x 15″ COVER PLATES—WIDTH BY THICKNESS—INCHES											
	24x3	24x2⅞	24x2¾	24x2⅝	24x2½	24x2⅜	24x2¼	24x2⅛	24x2	24x1⅞	24x1¾	24x1⅝
20	4035	3945	3855	3765	3675	3585	3495	3405	3315	3225	3135	3045
21	4035	3945	3855	3765	3675	3585	3495	3405	3315	3225	3135	3045
22	4035	3945	3855	3765	3675	3585	3495	3405	3315	3225	3135	3045
23	4035	3945	3855	3765	3675	3585	3495	3405	3315	3225	3135	3045
24	4035	3945	3855	3765	3675	3585	3495	3405	3315	3225	3135	3045
25	4035	3945	3855	3765	3675	3585	3495	3405	3315	3225	3135	3045
26	4035	3945	3855	3765	3675	3585	3495	3405	3315	3225	3135	3045
27	4035	3945	3855	3765	3675	3585	3495	3405	3315	3225	3135	3045
28	4035	3945	3855	3765	3675	3585	3495	3405	3313	3215	3116	3019
29	4035	3945	3855	3758	3662	3564	3468	3370	3273	3176	3077	2981
30	4000	3906	3810	3714	3619	3522	3426	3329	3233	3137	3039	2943
31	3954	3861	3765	3670	3576	3479	3384	3288	3192	3097	2999	2905
32	3907	3814	3720	3626	3532	3435	3342	3247	3152	3057	2960	2866
33	3859	3794	3674	3581	3488	3392	3300	3205	3111	3017	2921	2827
34	3812	3721	3628	3536	3443	3349	3257	3163	3069	2976	2881	2789
35	3764	3674	3582	3491	3399	3305	3214	3121	3028	2936	2841	2750
36	3716	3627	3536	3445	3354	3261	3171	3079	2987	2895	2802	2711
37	3668	3580	3490	3399	3310	3217	3128	3037	2946	2855	2762	2672
38	3620	3533	3443	3354	3265	3174	3085	2994	2904	2814	2722	2633
39	3572	3486	3397	3309	3220	3130	3042	2952	2863	2774	2683	2595
40	3524	3439	3351	3263	3176	3086	3000	2910	2822	2734	2643	2556
42	3428	3345	3259	3173	3087	2999	2914	2827	2740	2654	2565	2480
44	3333	3252	3167	3083	3000	2913	2830	2745	2660	2575	2488	2405
46	3239	3160	3077	2995	2913	2828	2747	2664	2580	2497	2412	2331
48	3147	3069	2989	2908	2828	2745	2666	2584	2502	2421	2338	2258
50	3056	2980	2901	2822	2744	2663	2585	2505	2425	2346	2265	2187
Area, in.²	269.0	263.0	257.0	251.0	245.0	239.0	233.0	227.0	221.0	215.0	209.0	203.0
I_{1-1}, in.⁴	23185	22293	21419	20564	19726	18905	18102	17317	16548	15797	15062	14343
S_{1-1}, in.³	1892	1838	1784	1731	1678	1626	1573	1522	1470	1419	1369	1318
r_{1-1}, in.	9.28	9.21	9.13	9.05	8.97	8.89	8.81	8.73	8.65	8.57	8.49	8.41
A/S 1-1	.142	.143	.144	.145	.146	.147	.148	.149	.150	.151	.153	.154
I_{2-2}, in.⁴	9213	8925	8637	8349	8061	7773	7485	7197	6909	6621	6333	6045
S_{2-2}, in.³	768	744	720	696	672	648	624	600	576	552	528	504
r_{2-2}, in.	5.85	5.83	5.80	5.77	5.74	5.70	5.67	5.63	5.59	5.55	5.50	5.46
A/S 2-2	.350	.354	.357	.361	.365	.369	.374	.378	.384	.390	.396	.403
D in.	24⅝	24⅝	24⅛	23⅝	23⅝	23⅝	23⅛	22⅝	22⅝	22⅝	22⅛	21⅝
d^1 in.	34⅝	34⅝	34	33⅝	33⅝	33⅞	33¼	33⅛	32⅝	32¾	32⅝	32⅞
W in.	24	24	24	24	24	24	24	24	24	24	24	24
t in.	1⅝	1⅝	1⅝	1⅝	1⅝	1⅝	1⅝	1⅝	1⅝	1⅝	1⅝	1⅝
p_2 in.	6⅛	5⅝	5⅛	5¹¹⁄₁₆	5⅜	5⅞	5⅝	5⅜	5⅛	4⅞	4⅝	4¹¹⁄₁₆

Safe load values above upper zig-zag line are for ratios of l/r not over 60, those below zig-zag lines are for ratios not over 120 l/r.



CARNEGIE BEAM SECTIONS AS COLUMNS WITH COVER PLATES

ALLOWABLE CONCENTRIC LOADS
THOUSANDS OF POUNDS

COLUMN LOADS

Unit Stress—American Institute of Steel Construction—1928

Effective Length in Feet	CORE CB 146—325 Lbs. 14″ x 15″								Core CB146—225 Lbs. 14″x15″				
	COVER PLATES—WIDTH BY THICKNESS—INCHES												
	24x2 1/16	24x2	24x1 7/8	24x1 3/4	24x1 5/8	24x1 1/2	24x1 3/8	24x1 1/4	22x1 5/16	22x1 1/16	22x1 1/16	22x1 1/16	22x1 1/16
20	2964	2874	2784	2694	2604	2514	2424	2334	2271	2189	2106	2024	1941
21	2964	2874	2784	2694	2604	2514	2424	2334	2271	2189	2106	2024	1941
22	2964	2874	2784	2694	2604	2514	2424	2334	2271	2189	2106	2024	1941
23	2964	2874	2784	2694	2604	2514	2424	2334	2271	2189	2106	2024	1941
24	2964	2874	2784	2694	2604	2514	2424	2334	2271	2189	2106	2024	1941
25	2964	2874	2784	2694	2604	2514	2424	2334	2271	2189	2106	2024	1941
26	2964	2874	2784	2694	2604	2514	2424	2334	2271	2189	2106	2024	1941
27	2964	2874	2784	2694	2604	2514	2424	2334	2271	2189	2105	2016	1929
28	2964	2874	2784	2694	2601	2503	2404	2305	2252	2166	2079	1991	1904
29	2957	2860	2764	2666	2569	2472	2375	2276	2224	2139	2052	1965	1879
30	2922	2826	2731	2634	2538	2442	2344	2246	2195	2111	2026	1939	1854
31	2887	2792	2698	2601	2506	2410	2314	2216	2167	2083	1999	1913	1829
32	2852	2758	2664	2569	2474	2379	2283	2186	2138	2055	1972	1887	1804
33	2817	2723	2630	2535	2441	2348	2253	2156	2109	2028	1944	1860	1778
34	2781	2688	2596	2502	2409	2316	2222	2126	2080	1999	1917	1834	1753
35	2746	2654	2562	2469	2376	2284	2191	2096	2051	1971	1890	1807	1727
36	2710	2619	2528	2436	2344	2253	2160	2066	2022	1943	1863	1781	1701
37	2674	2584	2494	2402	2311	2221	2129	2036	1993	1915	1836	1755	1676
38	2638	2549	2460	2369	2279	2189	2098	2006	1964	1887	1808	1728	1651
39	2602	2516	2426	2336	2246	2158	2068	1976	1936	1859	1781	1702	1625
40	2566	2479	2392	2303	2214	2126	2037	1946	1907	1831	1755	1676	1600
42	2495	2409	2324	2237	2150	2064	1976	1887	1850	1776	1701	1625	1551
44	2425	2341	2257	2171	2087	2002	1917	1829	1794	1722	1649	1574	1502
46	2355	2273	2191	2107	2024	1942	1858	1772	1738	1669	1597	1524	1454
48	2286	2206	2126	2044	1963	1882	1800	1716	1684	1616	1546	1475	1407
50	2219	2140	2062	1982	1902	1824	1743	1661	1631	1565	1497	1427	1361
Area, in.^{2}	197.6	191.6	185.6	179.6	173.6	167.6	161.6	155.6	151.4	145.9	140.4	134.9	129.4
I_{1-1}, in.^{4}	14002	13322	12658	12010	11377	10760	10157	9570	9511	8987	8477	7980	7496
S_{1-1}, in.^{3}	1308	1259	1210	1162	1115	1067	1020	973	969	927	886	845	804
r_{1-1}, in.	8.42	8.34	8.26	8.18	8.10	8.01	7.93	7.84	7.93	7.85	7.77	7.69	7.61
A/S 1-1	.151	.152	.153	.154	.156	.157	.158	.160	.156	.157	.159	.160	.161
I_{2-2}, in.^{4}	6556	6268	5980	5692	5404	5116	4828	4540	4517	4296	4074	3852	3630
S_{2-2}, in.^{3}	546	522	498	474	450	426	402	378	411	391	370	350	330
r_{2-2}, in.	5.76	5.72	5.68	5.63	5.58	5.53	5.47	5.40	5.46	5.43	5.39	5.34	5.30
A/S 2-2	.362	.367	.372	.379	.385	.393	.402	.411	.369	.374	.379	.385	.392
D in.	21 7/16	21 3/16	20 15/16	20 11/16	20 7/16	20 3/16	19 15/16	19 11/16	19 11/16	19 7/16	19 3/16	18 15/16	18 11/16
d^1 in.	32 5/16	32	31 7/8	31 11/16	31 1/16	31 3/8	31 1/16	31 1/16	29 1/2	29 3/8	29 3/16	29	28 7/8
W in.	24	24	24	24	24	24	24	24	22	22	22	22	22
t in.	1 1/2	1 1/2	1 1/2	1 1/2	1 1/2	1 1/2	1 1/2	1 1/2	1 1/16	1 1/16	1 1/16	1 1/16	1 1/16
p_2 in.	4 9/16	4 7/16	4 5/16	4 3/16	4 1/16	3 15/16	3 13/16	3 11/16	3 5/8	3 1/2	3 3/8	3 1/4	3 1/8

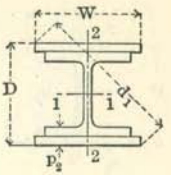
Safe load values above upper zig-zag line are for ratios of l/r not over 60, those below zig-zag lines are for ratios not over 120 l/r.

COLUMN

LOADS

CARNEGIE BEAM SECTIONS AS COLUMNS WITH COVER PLATES

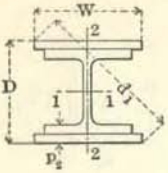
ALLOWABLE CONCENTRIC LOADS
THOUSANDS OF POUNDS



Unit Stress—American Institute of Steel Construction—1928

Effective Length in Feet	CORE—CB 146—425 Lbs. 14″ x 15″ COVER PLATES—WIDTH BY THICKNESS—INCHES									
	18x4	18x3 1⅝/16	18x3⅜	18x3 7/16	18x3¼	18x3 1/16	18x2⅞	18x2 1⅛/16	18x2⅛	18x2 5/16
20	4035	3934	3832	3731	3630	3529	3427	3326	3225	3124
21	4035	3934	3832	3731	3630	3529	3427	3326	3225	3124
22	4035	3934	3832	3731	3630	3529	3427	3326	3225	3124
23	4035	3934	3832	3731	3630	3529	3427	3326	3225	3124
24	4035	3931	3824	3721	3617	3514	3408	3305	3199	3094
25	3978	3876	3770	3668	3566	3463	3359	3257	3153	3049
26	3921	3820	3716	3615	3514	3413	3309	3209	3106	3003
27	3864	3764	3661	3561	3461	3362	3260	3160	3059	2957
28	3806	3707	3605	3507	3409	3310	3209	3112	3011	2911
29	3748	3650	3549	3452	3355	3259	3159	3062	2963	2865
30	3689	3593	3493	3398	3302	3207	3108	3013	2915	2818
31	3630	3536	3437	3343	3249	3155	3058	2964	2868	2771
32	3572	3478	3381	3288	3195	3103	3007	2915	2820	2725
33	3513	3421	3325	3234	3142	3051	2957	2866	2772	2678
34	3455	3364	3270	3180	3089	3000	2906	2817	2724	2632
35	3397	3308	3214	3125	3037	2948	2856	2768	2677	2586
36	3339	3251	3159	3072	2984	2897	2807	2720	2630	2541
37	3282	3195	3104	3018	2932	2847	2757	2672	2584	2495
38	3225	3140	3050	2965	2881	2797	2709	2625	2537	2450
39	3168	3084	2996	2913	2830	2747	2660	2578	2492	2406
40	3112	3030	2943	2861	2779	2697	2612	2531	2446	2362
42	3003	2923	2838	2759	2680	2601	2518	2440	2357	2276
44	2895	2818	2736	2660	2583	2506	2426	2350	2271	2192
46	2791	2716	2637	2563	2489	2415	2337	2264	2187	2110
48	2690	2617	2541	2469	2397	2326	2251	2180	2105	2031
50	2592	2522	2448	2378	2309	2240	2167	2099	2027	1955
Area, in.^{2}	269.0	262.2	255.5	248.7	242.0	235.2	228.5	221.7	215.0	208.2
$I_{1\text{-}1}$, in.^{4}	24854	23684	22548	21445	20373	19333	18325	17347	16399	15481
$S_{1\text{-}1}$, in.^{3}	1875	1812	1751	1690	1629	1570	1511	1453	1395	1338
$r_{1\text{-}1}$, in.	9.61	9.50	9.39	9.29	9.18	9.07	8.96	8.84	8.73	8.62
A/S $_{1\text{-}1}$	.143	.145	.146	.147	.149	.150	.151	.153	.154	.156
$I_{2\text{-}2}$, in.^{4}	6189	6007	5825	5642	5460	5278	5096	4913	4731	4549
$S_{2\text{-}2}$, in.^{3}	688	667	647	627	607	586	566	546	526	505
$r_{2\text{-}2}$, in.	4.80	4.79	4.77	4.76	4.75	4.74	4.72	4.71	4.69	4.67
A/S $_{2\text{-}2}$	.391	.393	.395	.397	.399	.401	.404	.406	.409	.412
D in.	26 9/16	26 3/16	25 13/16	25 7/16	25 1/16	24 11/16	24 5/16	23 15/16	23 9/16	23 3/16
d^1 in.	32 1/16	31 3/4	31 7/16	31 1/8	30 7/8	30 9/16	30 1/4	29 15/16	29 5/8	29 5/16
W in.	18	18	18	18	18	18	18	18	18	18
t in.	1 15/16	1 15/16	1 15/16	1 15/16	1 15/16	1 15/16	1 15/16	1 15/16	1 15/16	1 15/16
P_2-in.	7 1/16	6 7/8	6 11/16	6 1/2	6 5/16	6 1/8	5 15/16	5 3/4	5 9/16	5 3/8

Safe load values above upper zig-zag line are for ratios of l/r not over 60, those between zig-zag lines are for ratios up to 120 l/r and these below lower zig-zag line are for ratios not over 200 l/r.



CARNEGIE BEAM SECTIONS
AS
COLUMNS WITH COVER PLATES
ALLOWABLE CONCENTRIC LOADS
THOUSANDS OF POUNDS

COLUMN
H
LOADS

Unit Stress—American Institute of Steel Construction—1928

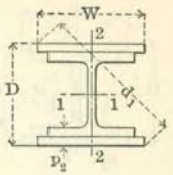
Effective Length in Feet	CORE CB 146—325 Lbs. 14" x 15"						CORE CB 146—325 Lbs. 14" x 15"					
	COVER PLATES—WIDTH BY THICKNESS—INCHES											
	18x2⅝	18x2¾	18x2⅞	18x3	18x2⅝	18x2	17x1⅝	17x1¾	17x1⅞	17x1⅞	17x1⅝	17x1
20	3020	2919	2817	2716	2615	2514	2422	2326	2231	2135	2039	1944
21	3020	2919	2817	2716	2615	2514	2422	2326	2231	2135	2039	1944
22	3020	2919	2817	2716	2615	2514	2422	2326	2231	2135	2039	1939
23	3020	2919	2817	2716	2615	2514	2400	2304	2205	2106	2008	1909
24	3007	2902	2797	2693	2589	2485	2363	2268	2171	2073	1977	1879
25	2964	2861	2757	2654	2551	2448	2326	2233	2137	2040	1945	1848
26	2921	2818	2716	2614	2512	2411	2289	2197	2102	2007	1913	1818
27	2877	2776	2675	2574	2474	2373	2252	2161	2068	1973	1881	1787
28	2833	2733	2633	2534	2435	2336	2214	2125	2033	1939	1848	1756
29	2789	2690	2592	2493	2396	2298	2177	2088	1998	1906	1816	1725
30	2745	2647	2550	2453	2357	2260	2139	2052	1963	1872	1784	1694
31	2700	2604	2508	2413	2318	2223	2101	2016	1928	1838	1752	1663
32	2656	2561	2466	2372	2278	2185	2064	1980	1893	1805	1719	1632
33	2611	2518	2425	2332	2239	2148	2027	1944	1859	1772	1688	1602
34	2567	2475	2383	2292	2201	2110	1989	1908	1825	1739	1656	1571
35	2523	2432	2342	2252	2162	2073	1953	1873	1790	1706	1625	1541
36	2480	2390	2301	2212	2124	2036	1916	1838	1757	1674	1594	1512
37	2436	2348	2260	2173	2086	1999	1880	1803	1723	1642	1563	1482
38	2393	2307	2220	2134	2048	1963	1844	1769	1690	1610	1533	1453
39	2351	2265	2180	2095	2011	1927	1809	1735	1658	1579	1503	1425
40	2309	2224	2141	2057	1974	1892	1774	1702	1626	1548	1473	1396
42	2226	2144	2063	1982	1902	1822	1706	1636	1563	1487	1415	1341
44	2145	2066	1987	1909	1832	1754	1640	1573	1502	1429	1360	1288
46	2067	1990	1914	1839	1763	1689	1576	1511	1443	1373	1306	1236
48	1991	1917	1843	1770	1697	1625	1515	1452	1386	1318	1254	1187
50	1917	1846	1774	1704	1633	1564	1456	1395	1332	1266	1204	1139
Area, in.^{2}	201.3	194.6	187.8	181.1	174.3	167.6	161.5	155.1	148.7	142.3	136.0	129.6
I_{1-1}, in.^{4}	15230	14350	13498	12674	11878	11109	10505	9813	9144	8500	7880	7283
S_{1-1}, in.^{3}	1322	1266	1211	1157	1103	1050	999	950	901	854	807	760
r_{1-1}, in.	8.70	8.59	8.48	8.37	8.25	8.14	8.07	7.95	7.84	7.73	7.61	7.50
A/S_{1-1}	.152	.154	.155	.157	.158	.160	.162	.163	.165	.167	.169	.170
I_{2-2} in.^{4}	4515	4333	4.51	3968	3786	3604	3246	3093	2939	2786	2632	2479
S_{2-2}, in.^{3}	502	481	461	441	421	400	382	364	346	328	310	292
r_{2-2}, in.	4.74	4.72	4.70	4.68	4.66	4.64	4.48	4.47	4.45	4.42	4.40	4.37
A/S_{2-2}	.401	.404	.407	.411	.414	.418	.423	.426	.430	.434	.439	.444
D in.	23⅛	22⅞	22⅝	21⅞	21⅝	21⅜	21⅛	20⅞	20⅝	19⅞	19⅝	19⅜
d^1 in.	29¼	29	28⅞	28⅜	28⅛	27⅞	27⅛	26⅝	26½	26⅛	25⅞	25⅝
W in.	18	18	18	18	18	18	17	17	17	17	17	17
t in.	1½	1½	1½	1½	1½	1½	1½	1½	1½	1½	1½	1½
p_2 in.	5⅜	5⅛	5	4⅞	4⅝	4⅜	4⅜	4⅛	4	3⅞	3⅝	3⅜

Safe load values above upper zig-zag line are for ratios of l/r not over 60, those between zig-zag lines are for ratios up to 120 l/r and those below lower zig-zag line are for ratios not over 200 l/r.

COLUMN
H
LOADS

CARNEGIE BEAM SECTIONS AS COLUMNS WITH COVER PLATES

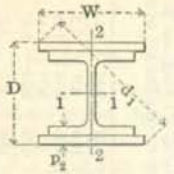
ALLOWABLE CONCENTRIC LOADS
THOUSANDS OF POUNDS



Unit Stress—American Institute of Steel Construction—1928

Effective Length in Feet	CORE CB 146—131 Lbs.													
	COVER PLATES—WIDTH BY THICKNESS—INCHES													
	16x2	16x1 5/16	16x1 7/8	16x1 5/16	16x1 3/4	16x1 11/16	16x1 5/8	16x1 3/8	16x1 1/2	16x1 7/16	16x1 3/8	16x1 5/16	16x1 1/4	16x1 3/16
20	1538	1508	1478	1448	1418	1388	1358	1328	1298	1268	1238	1208	1178	1148
21	1538	1508	1478	1448	1418	1388	1358	1328	1298	1268	1238	1208	1178	1148
22	1528	1497	1467	1437	1406	1376	1345	1314	1284	1253	1222	1192	1161	1130
23	1504	1474	1444	1414	1383	1354	1324	1293	1263	1233	1202	1172	1142	1112
24	1480	1450	1421	1391	1361	1332	1302	1272	1242	1212	1182	1153	1123	1093
25	1455	1426	1397	1368	1338	1310	1280	1250	1221	1192	1162	1133	1104	1074
26	1431	1401	1373	1344	1315	1287	1258	1229	1200	1171	1142	1113	1084	1055
27	1406	1377	1350	1321	1292	1265	1236	1207	1179	1150	1122	1093	1065	1036
28	1381	1353	1326	1297	1269	1242	1214	1186	1157	1129	1101	1073	1045	1017
29	1356	1328	1302	1274	1246	1220	1192	1164	1136	1108	1081	1053	1026	998
30	1332	1304	1278	1250	1223	1197	1170	1142	1115	1088	1061	1033	1006	979
31	1307	1280	1254	1227	1200	1175	1148	1121	1094	1067	1040	1014	987	961
32	1282	1256	1231	1204	1177	1152	1126	1099	1073	1047	1020	994	968	942
33	1258	1232	1207	1181	1155	1130	1104	1078	1052	1026	1000	975	949	923
34	1234	1208	1184	1158	1132	1108	1083	1057	1032	1006	981	956	930	905
35	1210	1184	1161	1136	1110	1087	1062	1036	1011	986	961	936	912	887
36	1186	1161	1135	1113	1088	1065	1040	1016	991	967	942	918	893	869
37	1163	1138	1116	1091	1067	1044	1020	995	971	947	923	899	875	851
38	1140	1116	1093	1069	1045	1023	999	975	952	928	904	881	857	834
39	1117	1093	1072	1048	1024	1003	979	956	932	909	886	863	840	817
40	1095	1071	1050	1027	1003	982	959	936	913	890	868	845	822	800
42	1051	1028	1008	985	963	943	920	898	876	854	832	810	788	767
44	1008	987	967	945	924	904	883	862	840	819	798	777	756	735
46	968	947	928	907	886	867	847	826	806	785	765	745	725	705
48	928	908	890	870	850	832	812	792	773	753	733	714	695	675
50	891	871	854	835	815	798	779	760	741	722	703	684	666	647
Area, in.^{2}	102.5	100.5	98.5	96.5	94.5	92.5	90.5	88.5	86.5	84.5	82.5	80.5	78.5	76.5
I_{1-1}, in.^{4}	5559	5395	5234	5074	4917	4763	4610	4459	4311	4165	4021	3879	3739	3601
S_{1-1}, in.^{3}	612	598	584	571	557	543	530	516	502	489	475	462	449	436
r_{1-1}, in.	7.36	7.33	7.29	7.25	7.21	7.17	7.14	7.10	7.06	7.02	6.98	6.94	6.90	6.86
A/S 1-1	.167	.168	.169	.169	.170	.170	.171	.172	.172	.173	.174	.174	.175	.176
I_{2-2}, in.^{4}	1913	1870	1827	1785	1742	1699	1657	1614	1571	1529	1486	1443	1401	1358
S_{2-2}, in.^{3}	239	234	228	223	218	212	207	202	196	191	186	180	175	170
r_{2-2}, in.	4.32	4.31	4.31	4.30	4.29	4.29	4.28	4.27	4.26	4.25	4.24	4.23	4.22	4.21
A/S 2-2	.429	.430	.431	.433	.434	.436	.437	.439	.441	.442	.444	.446	.448	.451
D in.	18 5/16	18 1/16	17 13/16	17 9/16	17 5/16	17 1/16	16 13/16	16 9/16	16 5/16	16 1/16	15 13/16	15 9/16	15 5/16	15 1/16
d_1 in.	24 1/4	24 1/8	24 1/16	23 15/16	23 7/8	23 3/4	23 11/16	23 9/16	23 1/2	23 3/8	23 5/16	23 1/4	23 1/8	23 1/16
W in.	16	16	16	16	16	16	16	16	16	16	16	16	16	16
t in.	7/8	7/8	7/8	7/8	7/8	7/8	7/8	7/8	7/8	7/8	7/8	7/8	7/8	7/8
p_2 in.	2 5/16	2 7/8	2 5/16	2 3/4	2 11/16	2 5/8	2 1/16	2 1/2	2 7/16	2 3/8	2 5/16	2 1/4	2 1/16	2 1/8

Safe load values above upper zig-zag line are for ratios of l/r not over 60, those between zig-zag lines are for ratios up to 120 l/r and those below lower zig-zag line are for ratios not over 200 l/r.



CARNEGIE BEAM SECTIONS AS COLUMNS WITH COVER PLATES

ALLOWABLE CONCENTRIC LOADS
THOUSANDS OF POUNDS

COLUMN LOADS

Unit Stress—American Institute of Steel Construction—1928

Effective Length in Feet	CORE CB 146—131 Lbs. COVER PLATES—WIDTH BY THICKNESS—INCHES												
	16x1½	16x1⅜	16x1	16x⅞	16x¾	16x⅝	16x¾	16x⅝	16x⅝	16x⅝	16x½	16x⅜	16x⅜
20	1118	1088	1058	1028	998	968	938	908	878	848	818	788	757
21	1118	1087	1056	1025	994	962	932	900	869	838	807	775	744
22	1100	1069	1039	1008	978	947	916	885	855	824	793	762	731
23	1082	1052	1022	991	961	931	901	870	840	810	779	748	718
24	1064	1034	1004	974	945	914	885	855	825	795	765	735	705
25	1045	1016	987	957	928	898	869	840	810	781	751	721	692
26	1027	998	969	940	911	882	853	824	795	766	737	707	679
27	1008	980	952	922	894	865	838	809	780	751	723	694	666
28	990	962	934	905	878	849	822	793	765	737	709	680	652
29	971	944	916	888	861	833	806	778	750	722	695	666	639
30	953	926	899	871	844	817	790	763	735	708	681	653	626
31	934	908	882	854	828	801	775	747	721	694	667	640	613
32	916	890	864	837	811	785	759	732	706	680	653	626	600
33	898	872	847	820	795	769	744	718	691	666	640	613	588
34	880	855	830	804	779	753	728	703	677	652	626	600	575
35	862	838	813	787	763	738	713	688	663	638	613	587	563
36	845	821	797	771	747	722	699	674	649	625	600	575	551
37	828	804	780	755	732	707	684	660	635	611	587	562	539
38	811	787	764	740	717	692	670	646	622	598	575	550	527
39	794	771	748	724	702	678	655	632	609	585	562	538	515
40	777	755	733	709	687	663	642	618	596	573	550	526	504
42	745	724	702	679	658	636	615	592	570	548	526	504	482
44	714	694	673	651	630	609	588	567	546	525	504	482	461
46	684	665	645	623	604	583	563	543	522	502	482	461	441
48	656	637	618	597	578	558	539	520	500	480	461	440	421
50	629	610	592	572	554	535	517	497	478	460	441	421	403
Area, in.^{2}	74.5	72.5	70.5	68.5	66.5	64.5	62.5	60.5	58.5	56.5	54.5	52.5	50.5
I_{1-1}, in.^{4}	3465	3332	3200	3071	2943	2817	2694	2572	2452	2335	2219	2105	1993
S_{1-1}, in.^{3}	422	409	396	383	370	357	344	331	318	305	293	280	267
r_{1-1}, in.	6.82	6.78	6.74	6.69	6.65	6.61	6.56	6.52	6.47	6.43	6.38	6.33	6.28
A/S 1-1	.176	.177	.178	.179	.180	.181	.182	.183	.184	.185	.186	.188	.189
I_{2-2}, in.^{4}	1315	1273	1230	1187	1145	1102	1059	1017	974	931	889	846	803
S_{2-2}, in.^{3}	164	159	154	148	143	138	132	127	122	116	111	106	100
r_{2-2}, in.	4.20	4.19	4.18	4.16	4.15	4.13	4.12	4.10	4.08	4.06	4.04	4.01	3.99
A/S 2-2	.453	.456	.459	.462	.465	.468	.472	.476	.481	.486	.491	.497	.503
D in.	16⅞	16⅞	16⅞	16⅞	15⅝	15⅝	15⅝	15⅝	15⅜	15⅜	15⅜	15⅛	14⅝
d^1 in.	22⅜	22⅞	22¾	22⅜	22⅛	22⅛	22⅞	22⅝	22¼	22⅛	22⅛	22	21⅞
W in.	16	16	16	16	16	16	16	16	16	16	16	16	16
t in.	⅞	⅞	¾	¾	¾	¾	¾	¾	¾	¾	¾	¾	¾
p_2 in.	2⅛	2	1⅞	1¾	1⅝	1¾	1⅝	1⅝	1⅜	1½	1⅜	1⅜	1⅜

Safe load values above upper zig-zag line are for ratios of l/r not over 60, those between zig-zag lines are for ratios up to 120 l/r and those below lower zig-zag line are for ratios not over 200 l/r.

BEAM COLUMNS—American Standard Sections

Safe Loads in Thousands of Pounds

Depth, In.		24	24	20	20	18	18	15	15	12	12	10	9	8	7	6	5	4	3
Weight lb./ft.		105.9	79.9	81.4	65.4	75.6	54.7	60.8	42.9	40.8	31.8	25.4	21.8	18.4	15.3	12.5	10.0	7.7	5.7
Effective Length in feet	3	464.7	350.0	356.1	286.2	330.6	239.1	265.2	187.4	177.6	138.9	110.7	94.8	80.1	66.5	54.2	43.1	33.3	24.6
	4	464.7	350.0	356.1	286.2	330.6	239.1	265.2	187.4	177.6	138.9	110.7	94.8	80.1	65.9	52.1	39.7	33.0	23.5
	5	464.7	350.0	356.1	286.2	330.6	239.1	265.2	187.4	177.6	138.9	109.5	91.2	74.9	60.0	46.9	35.1	29.1	20.3
	6	464.7	350.0	356.1	286.2	330.6	235.6	265.2	180.3	170.9	130.0	101.7	83.9	68.3	54.1	41.8	30.7	25.3	17.2
	7	464.7	346.4	355.3	271.0	330.6	221.2	251.1	168.2	159.5	120.4	93.8	76.7	61.8	48.5	37.0	26.8	21.8	14.6
	8	464.7	328.9	337.7	254.5	319.1	206.8	235.8	156.2	148.1	110.9	86.0	69.7	55.7	43.3	32.7	23.4	18.7	12.3
	9	445.0	311.0	320.0	238.0	303.4	192.6	220.5	144.5	137.0	102.0	78.7	63.2	50.1	38.6	28.9	20.4	16.1	10.5
	10	424.9	293.2	302.3	222.0	287.3	178.7	205.7	133.4	126.4	93.4	71.8	57.2	45.0	34.5	25.5	17.9	13.9	
	11	404.6	275.6	284.5	206.7	271.7	165.6	191.6	122.9	116.5	85.5	65.5	51.8	40.5	30.8	22.6			
	12	384.6	258.7	267.7	192.2	256.3	153.3	178.1	113.1	107.2	78.3	59.7	47.0	36.5	27.6	20.2			
	13	364.9	242.6	251.4	178.6	241.4	141.8	165.5	104.1	98.7	71.7	54.5	42.6	33.0	24.7				
	14	345.8	227.3	235.8	165.9	227.2	131.2	153.7	95.8	90.9	65.7	49.8	38.7	29.8					
	15	327.4	212.9	221.2	154.0	213.8	121.5	142.7	88.4	83.8	60.3	45.6	35.3						
	16	309.8	199.2	207.5	143.2	201.0	112.6	132.6	81.6	77.3	55.4	41.8							
	17	293.0	186.6	194.6	133.2	188.9	104.4	123.4	75.4	71.4									
	18	277.1	174.9	182.5	124.0	177.6	96.9	114.9	69.8	66.1									
	19	262.0	163.9	171.3	115.5	167.1	90.1	107.1											
	20	247.7	153.8	160.8	107.8	157.3		99.9											
	21	234.5	144.4	151.2		148.1													
	22	222.0	135.8	142.3		139.5													
	23	210.2		133.9		131.6													
	24	199.2				124.4													
	25	188.8																	
	26	179.1																	
Area, in.²		30.98	23.33	23.74	19.08	22.04	15.94	17.68	12.49	11.84	9.26	7.38	6.32	5.34	4.43	3.61	2.87	2.21	1.64
I_{1-1}, in.⁴		2811.5	2087.2	1466.3	1169.5	1141.8	795.5	609.0	441.8	268.9	215.8	122.1	84.9	56.9	36.2	21.8	12.1	6.0	2.5
r_{1-1}, in.		9.53	9.46	7.86	7.83	7.20	7.07	5.87	5.95	4.77	4.83	4.07	3.67	3.26	2.86	2.46	2.05	1.64	1.23
I_{2-2}, in.⁴		78.9	42.9	45.8	27.9	46.3	21.2	26.0	14.6	13.8	9.5	6.9	5.2	3.8	2.7	1.8	1.2	0.77	0.46
r_{2-2}, in.		1.60	1.36	1.39	1.21	1.45	1.15	1.21	1.08	1.08	1.01	0.97	0.90	0.84	0.78	0.72	0.65	0.59	0.53
Weight, lb./ft.		105.9	79.9	81.4	65.4	75.6	54.7	60.8	42.9	40.8	31.8	25.4	21.8	18.4	15.3	12.5	10.0	7.7	5.7

Safe loads in accordance with A. I. S. C. Column Formula, maximum 15,000 pounds for lengths of 60 radii and under.

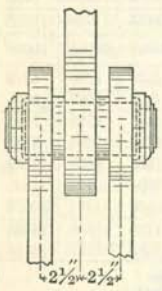
Safe loads above upper zigzag line are for ratios of l/r not over 60, between zigzag lines up to 120 l/r, and below lower zigzag line not over 200 l/r.

STRESSES IN RIVETS AND PINS

Rivets. In transmitting stresses between riveted pieces, it is customary to disregard friction and to proportion rivets to the entire stress to be transmitted. They must be of sufficient size and number to resist shear and to afford such bearing area as not to cause distortion of the metal at the rivet holes. In the case of beams which frame opposite and of single web girders, this latter condition often necessitates a greater thickness of web than required by the shearing stresses. In a plate girder with $\frac{5}{16}''$ web, $\frac{3}{4}''$ rivets connecting the web with the flange angles would have a bearing value at 24,000 pounds unit stress of 5,630 pounds per rivet, while their value in double shear at 12,000 pounds unit stress is 10,600 pounds per rivet; and it might be necessary to increase the web thickness to $\frac{3}{8}''$ or more in order that the pressure of the rivets upon the metal be not excessive.

Pins. Pins must be calculated for shearing, bending and bearing stresses, but one of the latter two will in most cases determine the size. When groups of bars are connected to the same pin, as in the lower chord of truss bridges, the size of the bars must be so chosen and the bars so placed that at no point on the pin will there be any excessive bending stress. When the size of pin has been determined from the bending stress, the thickness of the bars or web of the post should be investigated to provide sufficient bearing area, the bars being thickened or pin plates added if necessary.

The following is the formula for flexure applied to pins: $M = f \pi d^3 \div 32$ or $= f A d \div 8$, in which M = moment of forces for any section through pin, f = fiber stress per square inch in bending, A = the area of section, d = diameter, $\pi = 3.14159$. The forces are assumed to act in a plane passing through the axis of the pin.



EXAMPLE 1.—Required the size of a pin carrying a load of 64,000 pounds, at a distance of 5 inches between points of support; maximum fiber stress 24,000 pounds per square inch.

Bending moment = 64,000 x 5 ÷ 4 = 80,000 inch pounds; use a 3¼ inch pin; allowed moment: 80,900 inch pounds.

EXAMPLE 2.—Required the thickness of metal in the top chord of a bridge to give sufficient bearing area to a 3⅜-inch pin, having to transmit a stress of 121,400 pounds; maximum bearing pressure 24,000 pounds per square inch.

The bearing value of a 3⅜-inch pin for 1 inch thickness of metal is 81,000 pounds; therefore, the thickness of metal required = 121,400 ÷ 81,000 = 1½ inch, or each web of the chord must be ¾ inch thick, including pin plates.

RIVETS

Shearing and Bearing Values, in Pounds

½-INCH RIVETS—Area 0.19635 Square Inch

Shearing	Unit, Lbs. per Sq. In.	7500	8000	9000	10000	11000	12000	13500	15000
	Single Shear per Rivet	1473	1571	1767	1964	2160	2356	2651	2945
	Double Shear per Rivet	2945	3142	3534	3927	4320	4712	5301	5890
Bearing	Unit, Lbs. per Sq. In.	15000	16000	18000	20000	22000	24000	27000	30000
	Thickness, in Inches: ⅛	938	1000	1125	1250	1375	1500	1688	1875
	3/16	1406	1500	1688	1875	2063	2250	2531	2813
	¼	1875	2000	2250	2500	2750	3000	3375	3750
	5/16	2344	2500	2813	3125	3438	3750	4219	4688
	⅜	2813	3000	3375	3750	4125	4500	5062	5625
	7/16	3281	3500	3938	4375	4813	5250	5906	6563
	½	3750	4000	4500	5000	5500	6000	6750	7500

⅝-INCH RIVETS—Area 0.30680 Square Inch

Shearing	Unit, Lbs. per Sq. In.	7500	8000	9000	10000	11000	12000	13500	15000
	Single Shear per Rivet	2301	2454	2761	3068	3375	3682	4142	4602
	Double Shear per Rivet	4602	4908	5522	6136	6750	7363	8284	9204
Bearing	Unit, Lbs. per Sq. In.	15000	16000	18000	20000	22000	24000	27000	30000
	Thickness, in Inches: ⅛	1172	1250	1406	1563	1719	1875	2109	2344
	3/16	1758	1875	2109	2344	2578	2813	3164	3516
	¼	2344	2500	2813	3125	3438	3750	4219	4688
	5/16	2930	3125	3516	3906	4297	4688	5273	5859
	⅜	3516	3750	4219	4688	5156	5625	6328	7031
	7/16	4102	4375	4922	5469	6016	6563	7383	8203
	½	4688	5000	5625	6250	6875	7500	8438	9375
	9/16	5273	5625	6328	7031	7734	8438	9492	10547

¾-INCH RIVETS—Area 0.44179 Square Inch

Shearing	Unit, Lbs. per Sq. In.	7500	8000	9000	10000	11000	12000	13500	15000
	Single Shear per Rivet	3313	3534	3976	4418	4860	5301	5964	6627
	Double Shear per Rivet	6627	7069	7952	8836	9719	10603	11928	13254
Bearing	Unit, Lbs. per Sq. In.	15000	16000	18000	20000	22000	24000	27000	30000
	Thickness, in Inches: 3/16	2109	2250	2531	2813	3094	3375	3797	4219
	¼	2813	3000	3375	3750	4125	4500	5063	5625
	5/16	3516	3750	4219	4688	5156	5625	6328	7031
	⅜	4219	4500	5063	5625	6188	6750	7594	8438
	7/16	4922	5250	5906	6563	7219	7875	8859	9844
	½	5625	6000	6750	7500	8250	9000	10125	11250
	9/16	6328	6750	7594	8438	9281	10125	11391	12656
	⅝	7031	7500	8438	9375	10313	11250	12656	14063
	11/16	7734	8250	9281	10313	11343	12375	13922	15469

Values above upper dotted lines are less than single shear.
Values below lower dotted lines are greater than double shear.

RIVETS

Shearing and Bearing Values, in Pounds

⅞-INCH RIVETS—Area 0.60132 Square Inch

Shearing	Unit, Lbs. per Sq. In.	7500	8000	9000	10000	11000	12000	13500	15000
	Single Shear per Rivet	4510	4811	5412	6013	6615	7216	8118	9020
	Double Shear per Rivet	9020	9621	10824	12026	13229	14432	16236	18040
Bearing	Unit, Lbs. per Sq. In.	15000	16000	18000	20000	22000	24000	27000	30000
Thickness, in Inches	¼	3281	3500	3938	4375	4813	5250	5906	6563
	5/16	4102	4375	4922	5469	6016	6563	7383	8203
	⅜	4922	5250	5906	6563	7219	7875	8859	9844
	7/16	5742	6125	6891	7656	8422	9188	10336	11484
	½	6563	7000	7875	8750	9625	10500	11813	13125
	9/16	7383	7875	8859	9844	10828	11813	13289	14766
	⅝	8203	8750	9844	10938	12031	13125	14766	16406
	11/16	9023	9625	10828	12031	13234	14438	16242	18047
	¾	9844	10500	11813	13125	14438	15750	17719	19688

1-INCH RIVETS—Area 0.78540 Square Inch

Shearing	Unit, Lbs. per Sq. In.	7500	8000	9000	10000	11000	12000	13500	15000
	Single Shear per Rivet	5891	6283	7069	7854	8639	9425	10603	11781
	Double Shear per Rivet	11781	12566	14137	15708	17279	18850	21206	23562
Bearing	Unit, Lbs. per Sq. In.	15000	16000	18000	20000	22000	24000	27000	30000
Thickness, in Inches	5/16	4688	5000	5625	6250	6875	7500	8438	9375
	⅜	5625	6000	6750	7500	8250	9000	10125	11250
	7/16	6563	7000	7875	8750	9625	10500	11813	13125
	½	7500	8000	9000	10000	11000	12000	13500	15000
	9/16	8438	9000	10125	11250	12375	13500	15188	16875
	⅝	9375	10000	11250	12500	13750	15000	16875	18750
	11/16	10313	11000	12375	13750	15125	16500	18563	20625
	¾	11250	12000	13500	15000	16500	18000	20250	22500
	13/16	12188	13000	14625	16250	17875	19500	21938	24375

1⅛-INCH RIVETS—Area 0.99402 Square Inch

Shearing	Unit, Lbs. per Sq. In.	7500	8000	9000	10000	11000	12000	13500	15000
	Single Shear per Rivet	7455	7952	8946	9940	10934	11928	13419	14910
	Double Shear per Rivet	14910	15904	17892	19880	21868	23856	26839	29821
Bearing	Unit, Lbs. per Sq. In.	15000	16000	18000	20000	22000	24000	27000	30000
Thickness, in Inches	7/16	7383	7875	8859	9844	10828	11813	13289	14766
	½	8438	9000	10125	11250	12375	13500	15188	16875
	9/16	9492	10125	11391	12656	13922	15188	17086	18984
	⅝	10547	11250	12656	14063	15469	16875	18984	21094
	11/16	11602	12375	13922	15469	17016	18563	20883	23203
	¾	12656	13500	15188	16875	18563	20250	22781	25313
	13/16	13711	14625	16453	18281	20109	21938	24680	27422
	⅞	14766	15750	17719	19688	21656	23625	26578	29531
	15/16	15820	16875	18984	21094	23203	25313	28477	31641

Values above upper dotted lines are less than single shear.
Values below lower dotted lines are greater than double shear.

PINS

Bearing Values on Metal One Inch Thick, in Pounds

Dia. x 1 x Unit Stress

Pin		Fiber Stress in Pounds per Square Inch								
Dia., Inches	Area, Sq. In.	15000	16000	18000	20000	22000	24000	25000	27000	30000
1	.785	15000	16000	18000	20000	22000	24000	25000	27000	30000
1 ¼	1.227	18750	20000	22500	25000	27500	30000	31250	33750	37500
1 ½	1.767	22500	24000	27000	30000	33000	36000	37500	40500	45000
1 ¾	2.405	26250	28000	31500	35000	38500	42000	43750	47250	52500
2	3.142	30000	32000	36000	40000	44000	48000	50000	54000	60000
2 ¼	3.976	33750	36000	40500	45000	49500	54000	56250	60750	67500
2 ½	4.909	37500	40000	45000	50000	55000	60000	62500	67500	75000
2 ¾	5.940	41250	44000	49500	55000	60500	66000	68750	74250	82500
3	7.069	45000	48000	54000	60000	66000	72000	75000	81000	90000
3 ¼	8.296	48750	52000	58500	65000	71500	78000	81250	87750	97500
3 ½	9.621	52500	56000	63000	70000	77000	84000	87500	94500	105000
3 ¾	11.045	56250	60000	67500	75000	82500	90000	93750	101250	112500
4	12.566	60000	64000	72000	80000	88000	96000	100000	108000	120000
4 ¼	14.186	63750	68000	76500	85000	93500	102000	106250	114750	127500
4 ½	15.904	67500	72000	81000	90000	99000	108000	112500	121500	135000
4 ¾	17.721	71250	76000	85500	95000	104500	114000	118750	128250	142500
5	19.635	75000	80000	90000	100000	110000	120000	125000	135000	150000
5 ¼	21.648	78750	84000	94500	105000	115500	126000	131250	141750	157500
5 ½	23.758	82500	88000	99000	110000	121000	132000	137500	148500	165000
5 ¾	25.967	86250	92000	103500	115000	126500	138000	143750	155250	172500
6	28.274	90000	96000	108000	120000	132000	144000	150000	162000	180000
6 ¼	30.680	93750	100000	112500	125000	137500	150000	156250	168750	187500
6 ½	33.183	97500	104000	117000	130000	143000	156000	162500	175500	195000
6 ¾	35.785	101250	108000	121500	135000	148500	162000	168750	182250	202500
7	38.485	105000	112000	126000	140000	154000	168000	175000	189000	210000
7 ¼	41 282	108750	116000	130500	145000	159500	174000	181250	195750	217500
7 ½	44.179	112500	120000	135000	150000	165000	180000	187500	202500	225000
7 ¾	47.173	116250	124000	139500	155000	170500	186000	193750	209250	232500
8	50.265	120000	128000	144000	160000	176000	192000	200000	216000	240000
8 ¼	53.456	123750	132000	148500	165000	181500	198000	206250	222750	247500
8 ½	56.745	127500	136000	153000	170000	187000	204000	212500	229500	255000
8 ¾	60.132	131250	140000	157500	175000	192500	210000	218750	236250	262500
9	63.617	135000	144000	162000	180000	198000	216000	225000	243000	270000
9 ¼	67.201	138750	148000	166500	185000	203500	222000	231250	249750	277500
9 ½	70.882	142500	152000	171000	190000	209000	228000	237500	256500	285000
9 ¾	74.662	146250	156000	175500	195000	214500	234000	243750	263250	292500
10	78.540	150000	160000	180000	200000	220000	240000	250000	270000	300000
10 ¼	82.516	153750	164000	184500	205000	225500	246000	256250	276750	307500
10 ½	86.590	157500	168000	189000	210000	231000	252000	262500	283500	315000
10 ¾	90.763	161250	172000	193500	215000	236500	258000	268750	290250	322500
11	95.033	165000	176000	198000	220000	242000	264000	275000	297000	330000
11 ¼	99.402	168750	180000	202500	225000	247500	270000	281250	303750	337500
11 ½	103.869	172500	184000	207000	230000	253000	276000	287500	310500	345000
11 ¾	108.434	176250	188000	211500	235000	258500	282000	293750	317250	352500
12	113.097	180000	192000	216000	240000	264000	288000	300000	324000	360000

PINS

Bending Moments in Thousands of Inch Pounds

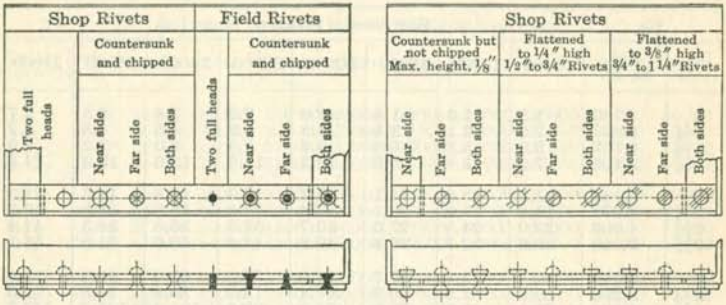
Dia.^{3} x 0.098175 x Unit Stress

Pin		Fiber Stress in Pounds per Square Inch							
Dia., Inches	Area, Sq. In.	15000	16000	18000	20000	22000	24000	25000	27000
1	.785	1.5	1.6	1.8	2.0	2.2	2.4	2.5	2.7
1¼	1.227	2.9	3.1	3.5	3.8	4.2	4.6	4.8	5.2
1½	1.767	5.0	5.3	6.0	6.6	7.3	8.0	8.3	8.9
1¾	2.405	7.9	8.4	9.5	10.5	11.6	12.6	13.2	14.2
2	3.142	11.8	12.6	14.1	15.7	17.3	18.8	19.6	21.2
2¼	3.976	16.8	17.9	20.1	22.4	24.6	26.8	28.0	30.2
2½	4.909	23.0	24.5	27.6	30.7	33.7	36.8	38.3	41.4
2¾	5.940	30.6	32.7	36.8	40.8	44.9	49.0	51.0	55.1
3	7.069	39.8	42.4	47.7	53.0	58.3	63.6	66.3	71.6
3¼	8.296	50.6	53.9	60.7	67.4	74.1	80.9	84.3	91.0
3½	9.621	63.1	67.3	75.8	84.2	92.6	101.0	105.2	113.7
3¾	11.045	77.7	82.8	93.2	103.5	113.9	124.3	129.4	139.8
4	12.566	94.2	100.5	113.1	125.7	138.2	150.8	157.1	169.6
4¼	14.186	113.0	120.6	135.7	150.7	165.8	180.9	188.4	203.5
4½	15.904	134.2	143.1	161.0	178.9	196.8	214.7	223.7	241.6
4¾	17.721	157.8	168.3	189.4	210.4	231.5	252.5	263.0	284.1
5	19.635	184.1	196.4	220.9	245.4	270.0	294.5	306.8	331.3
5¼	21.648	213.1	227.3	255.7	284.1	312.5	340.9	355.2	383.6
5½	23.758	245.0	261.3	294.0	326.7	359.3	392.0	408.3	441.0
5¾	25.967	280.0	298.6	336.0	373.3	410.6	447.9	466.6	503.9
6	28.274	318.1	339.3	381.7	424.1	466.5	508.9	530.1	572.6
6¼	30.680	359.5	383.5	431.4	479.4	527.3	575.2	599.2	647.1
6½	33.183	404.4	431.4	485.3	539.2	593.1	647.1	674.0	728.0
6¾	35.785	452.9	483.1	543.5	603.9	664.3	724.6	754.8	815.2
7	38.485	505.1	538.8	606.1	673.5	740.8	808.2	841.8	909.2
7¼	41.282	561.2	598.6	673.4	748.2	823.1	897.9	935.3	1010.1
7½	44.179	621.3	662.7	745.5	828.4	911.2	994.0	1035.4	1118.3
7¾	47.173	685.5	731.2	822.6	914.0	1005.4	1096.8	1142.5	1233.9
8	50.265	754.0	804.3	904.8	1005.3	1105.8	1206.4	1256.6	1357.2
8¼	53.456	826.9	882.0	992.3	1102.5	1212.8	1323.0	1378.2	1488.4
8½	56.745	904.4	964.7	1085.3	1205.8	1326.4	1447.0	1507.3	1627.9
8¾	60.132	986.5	1052.3	1183.9	1315.4	1446.9	1578.5	1644.2	1775.8
9	63.617	1073.5	1145.1	1288.3	1431.4	1574.5	1717.7	1789.2	1932.4
9¼	67.201	1165.5	1243.2	1398.6	1554.0	1709.4	1864.8	1942.5	2097.9
9½	70.882	1262.6	1346.8	1515.1	1683.5	1851.8	2020.1	2104.3	2272.7
9¾	74.662	1364.9	1455.9	1637.9	1819.9	2001.9	2183.9	2274.9	2456.8
10	78.540	1472.6	1570.8	1767.1	1963.5	2159.8	2356.2	2454.4	2650.7
10¼	82.516	1585.9	1691.6	1903.0	2114.5	2325.9	2537.4	2643.1	2854.5
10½	86.590	1704.7	1818.4	2045.7	2273.0	2500.3	2727.6	2841.2	3068.5
10¾	90.763	1829.4	1951.4	2195.3	2439.2	2683.2	2927.1	3049.1	3293.0
11	95.033	1960.1	2090.7	2352.1	2613.4	2874.8	3136.1	3266.8	3528.1
11¼	99.402	2096.8	2236.5	2516.1	2795.7	3075.2	3354.8	3494.6	3774.2
11½	103.869	2239.7	2389.0	2687.6	2986.2	3284.9	3583.5	3732.8	4031.4
11¾	108.434	2388.9	2548.2	2866.7	3185.3	3503.8	3822.3	3981.6	4300.1
12	113.097	2544.7	2714.3	3053.6	3392.9	3732.2	4071.5	4241.2	4580.5

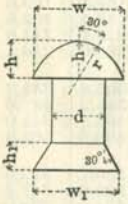
DETAILS FOR PUNCHING AND RIVETING

AMERICAN BRIDGE COMPANY STANDARD

CONVENTIONAL SIGNS FOR RIVETING



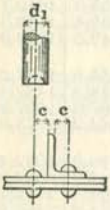
DIMENSIONS OF STRUCTURAL RIVETS



	Diameter of Rivet, d, Inches									
	3/8	1/2	5/8	3/4	7/8	1	1 1/8	1 1/4	1 3/8	1 1/2
w	1 1/16	7/8	1 1/16	1 1/4	1 7/16	1 5/8	1 13/16	2	2 3/16	2 3/8
h	5/16	3/8	7/16	1/2	5/8	1 1/16	3/4	7/8	1 5/16	1
r	7/16	9/16	1 1/16	1 3/16	1 5/16	1	1 1/8	1 1/4	1 3/8	1 1/2
w1	9/16	3/4	1	1 3/16	1 3/8	1 9/16	1 3/4	2	2 3/16	2 3/8
h1	3/16	1/4	5/16	3/8	7/16	1/2	9/16	5/8	1 1/16	3/4

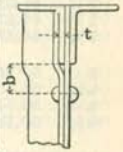
$w = 1\frac{1}{2}\,d + \frac{1}{8}''$ $\quad h = 0.425\,w$ $\quad r = 1\frac{1}{2}\,h.$

DRIVING CLEARANCE



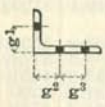
	Diameter of Rivet, d, Inches									
	3/8	1/2	5/8	3/4	7/8	1	1 1/8	1 1/4	1 3/8	1 1/2
d1	1 1/2	1 3/4	2	2 1/4	2 1/2	2 3/4	3	3 1/4	3 1/2	3 3/4
c	7/8	1	1 1/8	1 1/4	1 3/8	1 1/2	1 5/8	1 3/4	1 7/8	2

CRIMPS



$b = t + 1\frac{1}{2}''$ (min. 2″)

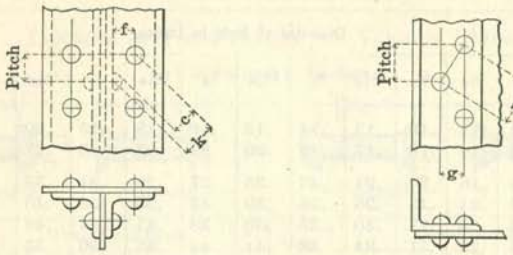
GAGES FOR ANGLES



	Width of Leg, Inches													
	8	7	6	5	4	3 1/2	3	2 1/2	2	1 3/4	1 1/2	1 3/8	1 1/4	1	3/4
g1	4 1/2	4	3 1/2	3	2 1/2	2	1 3/4	1 3/8	1 1/8	1	7/8	7/8	3/4	5/8	1/2
g2	3	2 1/2	2 1/2	2											
g3	3	3	2 1/4	1 3/4											
Max. rivet	1 1/8	1	7/8	7/8	7/8	7/8	7/8	3/4	5/8	1/2	3/8	3/8	3/8	1/4	1/4

RIVET SPACING

AMERICAN BRIDGE COMPANY STANDARD



MINIMUM PITCH FOR MACHINE RIVETING

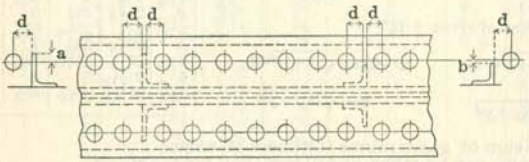
Dia. of Rivet	c	k	Distance, f, Inches												
			1 1/8	1 1/4	1 3/8	1 1/2	1 5/8	1 3/4	1 7/8	2	2 1/8	2 1/4	2 3/8	2 1/2	2 3/4	3
3/4	7/8	1 3/16	1/4	0												
7/8	1	1 3/8	3/4	1/2	0											
1 1/2	1 1/8	1 9/16	1 1/8	1	3/4	3/8	0									
5/8	1 1/4	1 3/4		1 1/4	1 1/8	1	3/4	0								
3/4	1 3/8	2			1 1/2	1 3/8	1 1/8	7/8	5/8	0						
7/8	1 1/2	2 3/16				1 5/8	1 1/2	1 3/8	1 1/8	7/8	1/2	0				
1	1 5/8	2 3/8					1 3/4	1 5/8	1 1/2	1 1/8	1 1/8	7/8	0			
1 1/8	1 3/4	2 5/8						2	1 7/8	1 3/4	1 1/2	1 1/4	1	5/8	0	
1 3/8	1 7/8	2 13/16							2 1/8	2	1 7/8	1 3/4	1 1/2	1 1/4	1/2	0
1 1/2	2	3								2 1/4	2 1/8	2	1 7/8	1 5/8	1 1/8	0

MINIMUM PITCH TO MAINTAIN 3 DIAMETERS C. TO C.

Dia. of Rivet	m	Distance, g, Inches														
		1	1 1/4	1 1/2	1 3/4	2	2 1/4	2 1/2	2 3/4	3	3 1/4	3 1/2	3 3/4	4	4 1/4	4 1/2
3/8	1 1/8	1/2	0													
1/2	1 1/2	1 1/8	7/8	0												
5/8	1 7/8	1 5/8	1 3/8	1 1/8	5/8	0										
3/4	2 1/4	2	1 7/8	1 5/8	1 3/8	1	0									
7/8	2 5/8	2 1/2	2 3/8	2 1/8	2	1 3/4	1 3/8	3/4	0							
1	3	2 7/8	2 3/4	2 5/8	2 1/4	2	1 5/8	1 1/8	0							
1 1/8	3 3/8	3 1/4	3 1/8	3	2 7/8	2 3/4	2 1/2	2 1/4	2	1 1/2	7/8	0				
1 1/4	3 3/4	3 5/8	3 1/2	3 3/8	3 3/8	3 1/4	3	2 3/4	2 1/2	2 1/4	1 7/8	1 3/8	0			
1 3/8	4 1/8	4	4	3 7/8	3 3/4	3 5/8	3 1/2	3 1/4	3 1/8	2 7/8	2 1/2	2 1/8	1 3/4	1	0	
1 1/2	4 1/2	4 3/8	4 3/8	4 1/4	4 1/8	4	3 7/8	3 3/4	3 1/2	3 3/8	3 1/8	2 7/8	2 1/2	2	1 1/2	0

COVER PLATE RIVETING

a, Ins.	d, Ins.
1/2	2 1/2
1	2 5/8
1 1/2	2 3/4
2	2 3/4
2 1/2	2 7/8
3	2 7/8
3 1/2	3
4	3 1/8
5	3 1/4
6	3 3/8



b, Ins.	d, Ins.
	2 1/2
1/2	2 5/8
3/4	2 1/4
1	2 1/4
1 1/4	2 1/8
1 1/2	2
1 3/4	1 3/4
2	1 1/2
2 1/4	1
2 1/2	

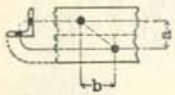
REDUCTION OF AREA FOR RIVET HOLES

Area in Square Inches=Diameter of Hole by Thickness of Metal

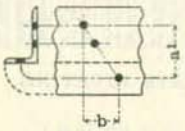
Thickness of Metal, Inches	Diameter of Hole in Inches											
	½	9/16	5/8	11/16	¾	13/16	⅞	15/16	1	1 1/16	1 1/8	1 1/4
5/16	.09	.11	.12	.13	.14	.15	.16	.18	.19	.20	.21	.23
¼	.13	.14	.16	.17	.19	.20	.22	.23	.25	.27	.28	.31
5/16	.16	.18	.20	.21	.23	.25	.27	.29	.31	.33	.35	.39
⅜	.19	.21	.23	.26	.28	.30	.33	.35	.38	.40	.42	.47
7/16	.22	.25	.27	.30	.33	.36	.38	.41	.44	.46	.49	.55
½	.25	.28	.31	.34	.38	.41	.44	.47	.50	.53	.56	.63
9/16	.28	.32	.35	.39	.42	.46	.49	.53	.56	.60	.63	.70
⅝	.31	.35	.39	.43	.47	.51	.55	.59	.63	.66	.70	.78
11/16	.34	.39	.43	.47	.52	.56	.60	.64	.69	.73	.77	.86
¾	.38	.42	.47	.52	.56	.61	.66	.70	.75	.80	.84	.94
13/16			.51	.56	.61	.66	.71	.76	.81	.86	.91	1.02
⅞			.55	.60	.66	.71	.77	.82	.88	.93	.98	1.09
15/16			.59	.64	.70	.76	.82	.88	.94	1.00	1.05	1.17
1			.63	.69	.75	.81	.88	.94	1.00	1.06	1.13	1.25
1 1/16					.80	.86	.93	1.00	1.06	1.13	1.20	1.33
1⅛					.84	.91	.98	1.05	1.13	1.20	1.27	1.41
1 3/16					.89	.96	1.04	1.11	1.19	1.26	1.34	1.48
1¼					.94	1.02	1.09	1.17	1.25	1.33	1.41	1.56
1 5/16							1.15	1.23	1.31	1.39	1.48	1.64
1⅜							1.20	1.29	1.38	1.46	1.55	1.72
1 7/16							1.26	1.35	1.44	1.53	1.62	1.80
1½							1.31	1.41	1.50	1.59	1.69	1.88

PITCH OF RIVETS TO MAINTAIN NET SECTION

1 Hole Out



2 Holes Out



y=diameter of rivet + ⅛″

$a-y=\sqrt{a^2+b^2}-2y$ $\quad a^1-2y=\sqrt{a^2+b^2}-3y$

$b=\sqrt{2ay+y^2}$ $\quad b=\sqrt{2ay+y^2}$

Dimensions in Inches

a	¾″ Rivet b	⅞″ Rivet b	a^1	¾″ Rivet b	⅞″ Rivet b
1	1⅝	1¾	5	3 1/16	3 5/16
1½	1⅞	2	5½	3¼	3½
2	2 1/16	2¼	6	3⅝	3⅝
2½	2¼	2 7/16	6½	3½	3¾
3	2 7/16	2⅝	7	3⅝	3⅞
3½	2⅝	2 13/16	7½	3¾	4
4	2 13/16	3	8	3⅞	4 1/8
4½	2 15/16	3 3/16	8½	4	4¼

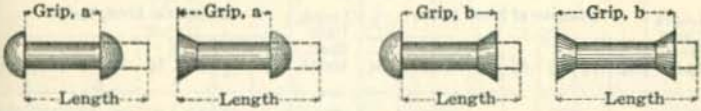
a, a^1 = sum of gages minus thickness of angle.
⅝″ rivets, can be taken at 1/16″ less than for ¾″ rivets.
1″ rivets, can be taken at ⅛″ more than for ⅞″ rivets.

STRUCTURAL RIVETS

AMERICAN BRIDGE COMPANY STANDARD

Lengths of Field Rivets for Various Grips

Dimensions in Inches



Grip, a	Diameter of Rivet				
	½	⅝	¾	⅞	1
⅛	1 5/16	1 ¾	1 7/16	2	2 ⅛
¼	1 ⅜	1 ½	2	2 ⅛	2 ¼
⅜	1 7/16	2	2 ⅛	2 ¼	2 ⅜
½	2	2 ⅛	2 ¼	2 ⅜	2 ½
⅝					
¾					
⅞					
1	2 ¼	2 ⅜	2 ⅜	2 ½	2 ⅝
⅛	2 ⅜	2 ½	2 ½	2 ⅝	2 ¾
¼	2 ½	2 ⅝	2 ⅝	2 ¾	2 ⅞
⅜	2 ⅝	2 ¾	2 ¾	2 ⅞	3
½	2 ¾	2 ⅞	2 ⅞	3	3 ⅛
⅝	2 ⅞	3	3	3 ⅛	3 ¼
¾	3	3 ⅛	3 ⅛	3 ¼	3 ⅜
⅞	3 ⅛	3 ¼	3 ¼	3 ⅜	3 ½
	3 ¼	3 ⅜	3 ⅜	3 ½	3 ⅝
2	3 ⅜	3 ½	3 ½	3 ⅝	3 ¾
⅛	3 ½	3 ⅝	3 ⅝	3 ¾	3 ⅞
¼	3 ⅝	3 ¾	3 ¾	3 ⅞	4
⅜	3 ¾	3 ⅞	3 ⅞	4	4 ⅛
½	3 ⅞	4	4	4 ⅛	4 ¼
⅝	4	4 ⅛	4 ⅛	4 ¼	4 ⅜
¾	4 ⅛	4 ¼	4 ¼	4 ⅜	4 ½
⅞	4 ¼	4 ⅜	4 ⅜	4 ½	4 ⅝
	4 ⅜	4 ½	4 ½	4 ⅝	4 ¾
3		4 ¾	4 ¾	4 ⅞	4 7/16
⅛		4 ⅞	4 ⅞	5	5 1/16
¼		5	5	5 1/16	5 1/16
⅜		5 1/16	5 1/16	5 1/16	5 1/16
½		5 1/16	5 1/16	5 1/16	5 1/16
⅝		5 1/16	5 1/16	5 1/16	5 1/16
¾		5 1/16	5 1/16	5 1/16	5 1/16
⅞		5 1/16	5 1/16	5 1/16	5 1/16
4			5 7/16	6	6 1/16
⅛			6	6 1/16	6 1/16
¼			6 1/16	6 1/16	6 1/16
⅜			6 1/16	6 1/16	6 1/16
½			6 1/16	6 1/16	6 1/16
⅝			6 1/16	6 1/16	6 1/16
¾			6 1/16	6 1/16	6 1/16
⅞			6 7/16	7	7
5				7 1/16	7 1/16
⅛				7 1/16	7 1/16
¼				7 1/16	7 1/16
⅜				7 1/16	7 1/16
½				7 1/16	7 1/16
⅝				7 1/16	7 1/16
¾				7 1/16	7 1/16
⅞				8	8 1/16

Grip, b	Diameter of Rivet				
	½	⅝	¾	⅞	1
⅛	1	1	1 1/16	1 1/16	1 1/16
¼	1 1/16	1 1/16	1 1/16	1 1/16	1 1/16
⅜	1 1/16	1 1/16	1 1/16	1 1/16	1 1/16
½	1 1/16	1 1/16	1 1/16	1 1/16	1 1/16
⅝					
¾					
⅞					
1	1 1/16	1 1/16	1 1/16	1 1/16	1 1/16
⅛	1 ¾	1 ¾	1 7/8	1 7/8	1 7/8
¼	2	2	2	2	2
⅜	2 1/16	2 1/16	2 1/16	2 1/16	2 1/16
½	2 1/16	2 1/16	2 1/16	2 1/16	2 1/16
⅝	2 1/16	2 1/16	2 1/16	2 1/16	2 1/16
¾	2 1/16	2 1/16	2 1/16	2 1/16	2 1/16
⅞	2 1/16	2 1/16	2 1/16	2 1/16	2 1/16
2	2 7/16	2 7/16	2 7/16	2 7/16	2 7/16
⅛	3	3	3	3	3
¼	3 1/16	3 1/16	3 1/16	3 1/16	3 1/16
⅜	3 1/16	3 1/16	3 1/16	3 1/16	3 1/16
½	3 1/16	3 1/16	3 1/16	3 1/16	3 1/16
⅝	3 1/16	3 1/16	3 1/16	3 1/16	3 1/16
¾	3 1/16	3 1/16	3 1/16	3 1/16	3 1/16
⅞	3 1/16	3 1/16	3 1/16	3 1/16	3 1/16
3		4 1/16	4 1/16	4 1/16	4 1/16
⅛		4 1/16	4 1/16	4 1/16	4 1/16
¼		4 1/16	4 1/16	4 1/16	4 1/16
⅜		4 1/16	4 1/16	4 1/16	4 1/16
½		4 1/16	4 1/16	4 1/16	4 1/16
⅝		4 1/16	4 1/16	4 1/16	4 1/16
¾		4 1/16	4 1/16	4 1/16	4 1/16
⅞		4 1/16	4 1/16	4 1/16	4 1/16
4			5	5	5
⅛			5 1/16	5 1/16	5 1/16
¼			5 1/16	5 1/16	5 1/16
⅜			5 1/16	5 1/16	5 1/16
½			5 1/16	5 1/16	5 1/16
⅝			5 1/16	5 1/16	5 1/16
¾			5 1/16	5 1/16	5 1/16
⅞			5 1/16	5 1/16	5 1/16
5				6 1/16	6 1/16
⅛				6 1/16	6 1/16
¼				6 1/16	6 1/16
⅜				6 1/16	6 1/16
½				6 1/16	6 1/16
⅝				6 1/16	6 1/16
¾				6 1/16	6 1/16
⅞				7	7
				7 1/16	7 1/16
				7 1/16	7 1/16

STRUCTURAL RIVETS

AMERICAN BRIDGE COMPANY STANDARD

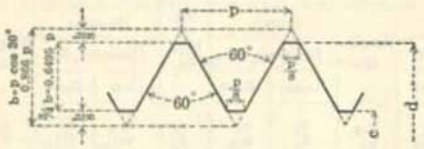
Weight in Pounds per 100 Rivets with Button Heads

Length Under Head, Inches	Diameter of Rivet, Inches								Length Under Head, Inches	Diameter of Rivet, Inches							
	⅝	½	⅝	¾	⅞	1	1⅛	1¼		⅝	½	⅝	¾	⅞	1	1⅛	1¼
									5	18	33	53	78	109	146	190	252
									⅛	18	34	54	80	111	149	193	256
1¼	6	12							¼	19	34	55	82	113	152	197	260
⅜	7	13							⅜	19	35	56	83	115	155	200	265
½	7	13	23	35	50	68	91	130	½	20	36	57	85	118	157	204	269
⅝	7	14	24	36	52	71	95	134	⅝	20	36	58	86	120	160	207	273
¾	8	15	25	37	54	74	98	139	¾	20	37	60	88	122	163	211	278
⅞	8	15	26	39	56	77	102	143	⅞	21	38	61	89	124	166	214	282
2	9	16	27	41	58	80	105	148	6	21	38	62	91	126	169	218	287
⅛	9	17	28	43	60	82	109	152	⅛	22	39	63	93	128	171	222	291
¼	9	18	29	44	62	85	112	156	¼	22	40	64	94	130	174	225	295
⅜	10	18	30	46	64	88	116	161	⅜	22	40	65	96	132	177	229	300
½	10	19	31	47	67	91	119	165	½	23	41	66	97	135	180	232	304
⅝	11	20	32	49	69	93	123	169	⅝	23	42	67	99	137	182	236	308
¾	11	20	34	50	71	96	126	174	¾	24	43	68	100	139	185	239	313
⅞	11	21	35	52	73	99	130	178	⅞	24	43	69	102	141	188	243	317
3	12	22	36	54	75	102	133	182	7	24	44	70	104	143	191	246	321
⅛	12	22	37	55	77	105	137	187	⅛	25	45	71	105	145	194	250	326
¼	13	23	38	57	79	107	141	191	¼	25	45	73	107	147	196	253	330
⅜	13	24	39	58	81	110	144	195	⅜	26	46	74	108	149	199	257	334
½	13	24	40	60	84	113	148	200	½	26	47	75	110	152	202	260	339
⅝	14	25	41	61	86	116	151	204	⅝	26	47	76	111	154	205	264	343
¾	14	26	42	63	88	118	155	208	¾	27	48	77	113	156	207	267	347
⅞	15	27	43	64	90	121	158	213	⅞	27	49	78	114	158	210	271	352
4	15	27	44	66	92	124	162	217	8	27	50	79	116	160	213	274	356
⅛	15	28	45	68	94	127	165	221	⅛	28	50	80	118	162	216	278	360
¼	16	29	47	69	96	130	169	226	¼	28	51	81	119	164	219	281	365
⅜	16	29	48	71	98	132	172	230	⅜	29	52	82	121	166	221	285	369
½	16	30	49	72	101	135	176	234	½	29	52	83	122	169	224	288	373
⅝	17	31	50	74	103	138	179	239	⅝	29	53	84	124	171	227	292	378
¾	17	31	51	75	105	141	183	243	¾	30	54	86	125	173	230	295	382
⅞	18	32	52	77	107	143	186	247	⅞	30	54	87	127	175	232	299	386

Button Heads	Diameter of Rivets, Inches							
	⅝	½	⅝	¾	⅞	1	1⅛	1¼
100 Heads as made on rivets, Pounds.....	2.4	5.0	9.7	16.0	24.0	35.0	49.0	78.0
100 Heads as driven in work, Pounds.....	1.9	4.0	7.5	12.5	18.5	27.0	37.5	51.0

SCREW THREADS

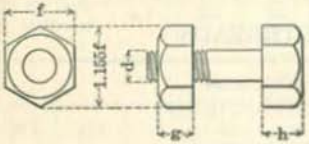
UNITED STATES AND AMERICAN BRIDGE COMPANY STANDARD

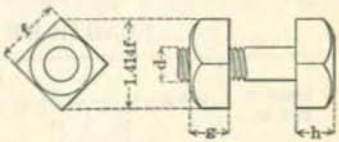


Diameter		Area		Number of Threads per Inch	Diameter		Area		Number of Threads per Inch
Total d, In.	Net, c, In.	Total Dia., d, Sq. In.	Net Dia., c, Sq. In.		Total, d, In.	Net, c, In.	Total Dia., d, Sq. In.	Net Dia., c, Sq. In.	
¼	.185	.049	.027	20	2½	2.175	4.909	3.716	4
⅜	.294	.110	.068	16	2¾	2.425	5.940	4.619	4
½	.400	.196	.126	13	3	2.629	7.069	5.428	3½
⅝	.507	.307	.202	11	3¼	2.879	8.296	6.509	3½
¾	.620	.442	.302	10	3½	3.100	9.621	7.549	3¼
⅞	.731	.601	.419	9	3¾	3.317	11.045	8.641	3
1	.838	.785	.551	8	4	3.567	12.566	9.993	3
1⅛	.939	.994	.693	7	4¼	3.798	14.186	11.330	2⅞
1¼	1.064	1.227	.890	7	4½	4.028	15.904	12.741	2¾
1⅜	1.158	1.485	1.054	6	4¾	4.255	17.721	14.221	2⅝
1½	1.283	1.767	1.294	6	5	4.480	19.635	15.766	2½
1⅝	1.389	2.074	1.515	5½	5¼	4.730	21.648	17.574	2½
1¾	1.490	2.405	1.744	5	5½	4.953	23.758	19.268	2⅜
1⅞	1.615	2.761	2.049	5	5¾	5.203	25.967	21.262	2⅜
2	1.711	3.142	2.300	4½	6	5.423	28.274	23.095	2¼
2¼	1.961	3.976	3.021	4½					

BOLT HEADS AND NUTS

UNITED STATES AND AMERICAN BRIDGE COMPANY STANDARD





Heads and Nuts		U. S. Standard	A. B. Co. Standard
Head	Height, h	0.75 d + 1/16″	0.75 d
	Short Dia., f	1.50 d + ⅛″	1.50 d
Nut	Height, g	d	d
	Short Dia., f	1.50 d + ⅛″	1.50 d + ⅛″

Heads for Bolts 1½″ and under, A. B. Co. Standard.
Heads for Bolts 1⅝″ and over, U. S. Standard.

BOLT HEADS AND NUTS

AMERICAN BRIDGE COMPANY STANDARD

Dia. of Bolt, In.	Head					Dia. of Bolt, In.	Nut				
	Hexagon		Height, In.	Square			Hexagon		Height, In.	Square	
	Diameter, In.			Diameter, In.			Diameter, In.			Diameter, In.	
	Long	Short		Long	Short		Long	Short		Long	Short
¼	7/16	3/8	5/16	½	3/8	¼	9/16	½	¼	11/16	½
5/16	5/8	9/16	¼	3/4	9/16	5/16	15/16	11/16	5/16	1	11/16
⅜	7/8	¾	8/16	1 1/16	¾	⅜	1	7/8	⅜	1 1/4	7/8
7/16	1 1/16	15/16	½	1 3/16	1 1/16	7/16	1 1/4	1 1/16	7/16	1 1/2	1 1/16
½	1 1/4	1 1/8	9/16	1 5/16	1 1/4	½	1 1/2	1 1/4	½	1 3/4	1 1/4
9/16	1 7/16	1 5/16	5/8	1 7/16	1 5/16	9/16	1 5/8	1 7/16	9/16	2	1 7/16
⅝	1 5/8	1 1/2	¾	2 1/16	1 1/2	⅝	1 7/8	1 5/8	⅝	2 1/4	1 5/8
¾	2	1 11/16	7/8	2 5/16	1 11/16	¾	2 1/16	1 13/16	¾	2 5/8	1 13/16
7/8	2 1/16	1 7/8	15/16	2 5/8	1 7/8	7/8	2 1/4	2	7/8	3	2
1	2 1/8	2 1/16	1	2 7/8	2 1/16	1	2 1/2	2 1/16	1	3 1/4	2 1/16
1 1/8	2 5/16	2 1/4	1 1/16	3 1/16	2 1/4	1 1/8	2 3/4	2 1/8	1 1/16	3 5/8	2 1/8
1 1/4	2 1/2	2 7/16	1 1/8	3 5/16	2 7/16	1 1/4	3	2 5/16	1 1/8	3 7/8	2 5/16
1 3/8	2 11/16	2 5/8	1 1/4	3 1/2	2 5/8	1 3/8	3 1/4	2 1/2	1 1/4	4 1/4	2 1/2
1 ½	2 7/8	2 13/16	1 3/8	3 3/4	2 13/16	1 ½	3 1/2	2 11/16	1 3/8	4 1/2	2 11/16
1 5/8	3 1/16	2 15/16	1 7/16	3 15/16	2 15/16	1 5/8	3 3/4	2 7/8	1 7/16	4 3/4	2 7/8
1 ¾	3 1/4	3 1/8	1 ½	4 1/8	3 1/8	1 ¾	3 15/16	3 1/16	1 ½	5	3 1/16
1 7/8	3 7/16	3 5/16	1 5/8	4 3/8	3 5/16	1 7/8	4 1/8	3 3/16	1 5/8	5 1/4	3 3/16
2	3 5/8	3 1/2	1 11/16	4 5/8	3 1/2	2	4 5/16	3 3/8	1 11/16	5 1/2	3 3/8
2 1/4	4	3 7/8	1 7/8	5 1/8	3 7/8	2 1/4	4 3/4	3 11/16	1 7/8	6 1/4	3 11/16
2 ½	4 3/8	4 1/4	2 1/16	5 5/8	4 1/4	2 ½	5 3/16	4 1/16	2 1/16	6 3/4	4 1/16
2 ¾	4 3/4	4 5/8	2 1/4	6 1/8	4 5/8	2 ¾	5 5/8	4 7/16	2 1/4	7 1/4	4 7/16
3	5 1/8	5	2 7/16	6 5/8	5	3	6 1/16	4 13/16	2 7/16	7 3/4	4 13/16
3 ¼	5 1/2	5 3/8	2 5/8	7 1/8	5 3/8	3 ¼	6 1/2	5 3/16	2 5/8	8 1/4	5 3/16
3 ½	5 7/8	5 3/4	2 13/16	7 5/8	5 3/4	3 ½	6 15/16	5 9/16	2 13/16	8 3/4	5 9/16
3 ¾	6 1/4	6 1/8	3	8 1/8	6 1/8	3 ¾	7 3/8	5 15/16	3	9 1/4	5 15/16
4	6 5/8	6 1/2	3 3/16	8 5/8	6 3/8	4	7 13/16	6 5/16	3 3/16	9 3/4	6 5/16
4 ¼	7	6 7/8	3 7/16	9 1/8	6 3/4	4 ¼	8 1/4	6 11/16	3 7/16	10 1/4	6 11/16
4 ½	7 3/8	7 1/4	3 11/16	9 5/8	7 1/8	4 ½	8 11/16	7 1/16	3 11/16	10 3/4	7 1/16
4 ¾	7 3/4	7 5/8	3 15/16	10 1/8	7 1/2	4 ¾	9 1/8	7 7/16	3 15/16	11 1/4	7 7/16
5	8 1/8	8	4 1/8	10 5/8	7 7/8	5	9 9/16	7 13/16	4 1/8	11 3/4	7 13/16
5 ¼	8 1/2	8 3/8	4 5/16	11 1/8	8 1/4	5 ¼	10	8 3/16	4 5/16	12 1/4	8 3/16
5 ½	8 7/8	8 3/4	4 1/2	11 5/8	8 5/8	5 ½	10 7/16	8 9/16	4 1/2	12 3/4	8 9/16
5 ¾	9 1/4	9 1/8	4 11/16	12 1/8	8 7/8	5 ¾	10 7/8	8 15/16	4 11/16	13 1/4	8 15/16
6	9 5/8	9 1/2	4 7/8	12 5/8	9 1/4	6	11 5/16	9 5/16	4 7/8	13 3/4	9 5/16

LENGTH OF BOLT THREADS

Length of Bolt, In.	Diameter of Bolt, Inches								
	¼	5/16	⅜	7/16	½	9/16	⅝	¾	⅞	1	1 1/8	1 ¼
1 to 1 ½	¾	¾	1	1 ¼								
1 ¾ to 2	¾	¾	1	1 ¼	1 ½	1 ½						
2 ¼ to 2 ½	¾	¾	1	1 ¼	1 ½	1 ½	1 ¾					
2 ¾ to 3	⅞	⅞	1	1 ¼	1 ½	1 ½	1 ¾	1 ¾		2 ¼		
3 ¼ to 4	⅞	⅞	1 ¼	1 ¼	1 ½	1 ½	1 ¾	1 ¾		2 ¼	2 ½	2 ½
4 ¼ to 8	1	1	1 ¼	1 ½	1 ¾	2	2	2 ¼		2 ½	2 ¾	2 ¾
8 ¼ to 12	1	1	1 ½	1 ¾	2	2	2 ¼	2 ½		3	3	3
12 ¼ to 20	1	1	1 ½	2	2	2 ¼	2 ½	3		3	3	3

Bolts not listed are threaded about 3 times the diameter; in no case are standard bolts threaded closer to the head than ¼ inch.

BOLTS WITH SQUARE HEADS AND NUTS

AMERICAN BRIDGE COMPANY STANDARD

Weight in Pounds per 100 Bolts

Length Under Head, Inches	Diameter of Bolt, Inches								
	¼	5/16	⅜	7/16	½	⅝	¾	⅞	1
1	4	7	11	15	22	37	56		
1¼	4	7	11	16	23	39	59		
1½	5	8	12	17	24	41	62		
1¾	5	8	13	18	26	43	64		
2	5	9	14	19	27	45	67	101	144
2¼	6	9	15	20	28	47	71	104	150
2½	6	10	15	21	30	49	74	109	155
2¾	6	10	16	22	31	51	77	113	161
3	7	11	17	24	33	54	80	117	167
3½	7	12	18	25	35	58	86	126	178
4	8	13	20	28	38	62	92	134	189
4½	9	14	21	30	41	66	98	142	198
5	10	15	23	32	43	71	104	151	209
5½	10	16	25	34	46	75	111	159	220
6	11	17	26	36	49	79	117	168	232
6½			28	38	52	84	123	176	243
7			29	40	55	88	129	185	254
7½			31	42	57	92	136	193	265
8			32	45	60	97	142	202	276
9			34	49	65	105	154	218	298
10				53	71	114	167	235	320
12				61	82	131	192	269	364
14					93	148	217	303	409
Per Inch Additional	1.4	2.2	3.1	4.3	5.6	8.7	12.5	17.0	22.3

SQUARE NUTS AND BOLT HEADS

AMERICAN BRIDGE COMPANY STANDARD

Weight in Pounds for One Head and One Nut

Diameter of Bolt, Inches	1¼	1½	1¾	2	2½	3
Square Head and Nut....	2.05	3.51	5.48	8.08	15.5	26.2
Weight of Shank per Inch	.3477	.5007	.6815	.8900	1.391	2.003

BOLTS WITH HEXAGON HEADS AND NUTS

AMERICAN BRIDGE COMPANY STANDARD

Weight in Pounds per 100 Bolts

Length Under Head, Inches	Diameter of Bolt, Inches					Length Under Head, Inches	Diameter of Bolt, Inches				
	½	⅝	¾	⅞	1		½	⅝	¾	⅞	1
1	19	33	52			8	58	92	137	194	264
1¼	20	34	54			8½	60	96	143	202	274
1½	22	36	57			9	63	100	149	210	285
1¾	23	38	60			9½	66	105	156	219	296
2	24	40	63	93	132	10	68	109	162	227	307
2¼	26	43	66	97	137	10½	71	114	168	236	318
2½	27	45	69	101	143	11	74	118	174	244	329
2¾	29	47	72	105	148	11½	77	122	181	253	341
3	30	49	75	109	154	12	80	127	187	261	352
3¼	31	51	78	114	160	12½	82	131	193	270	363
3½	33	54	82	118	165	13	85	135	199	278	374
3¾	34	56	85	122	171	13½	88	139	206	287	385
4	35	58	88	126	176	14	91	144	212	295	396
4¼	37	60	90	130	180	14½	93	148	218	304	407
4½	38	62	94	134	186	15	96	152	225	312	418
4¾	39	64	97	138	191	15½	99	157	231	321	430
5	41	66	100	143	197	16	102	161	237	329	441
5¼	42	68	103	147	202	16½	105	165	243	338	452
5½	44	71	106	151	208	17	107	170	250	346	463
5¾	45	73	109	156	213	17½	110	174	256	355	474
6	46	75	112	160	219	18	113	177	262	364	485
6¼	48	77	115	164	225	18½	116	183	268	372	496
6½	49	79	119	168	230	19	119	187	275	381	507
6¾	51	81	122	173	236	19½	121	191	281	389	519
7	52	84	125	177	241	20	124	196	287	398	530
7¼	53	86	128	181	247						
7½	55	88	131	185	252						
7¾	56	90	134	190	258						
Per Inch Additional	5.6	8.7	12.5	17.0	22.3	Per Inch Additional	5.6	8.7	12.5	17.0	22.3

HEXAGON NUTS AND BOLT HEADS

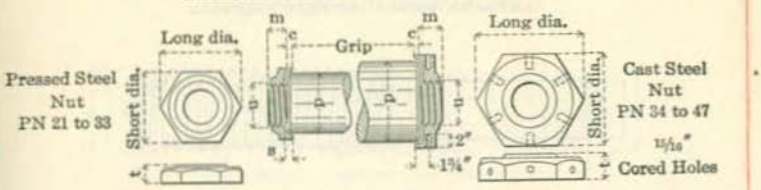
AMERICAN BRIDGE COMPANY STANDARD

Weight in Pounds for One Head and One Nut

Diameter of Bolt, Inches	1¼	1½	1¾	2	2½	3
Hexagon Head and Nut..	1.73	2.95	4.61	6.79	13.0	22.0
Weight of Shank per Inch	.3477	.5007	.6815	.8900	1.391	2.003

RECESSED PIN NUTS AND COTTER PINS

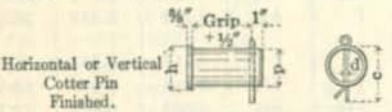
AMERICAN BRIDGE COMPANY STANDARD



Thread: Shape, U. S. Standard. Pitch, 6 per Inch.

Diameter of Pin p	Pin Thread u	Pin Thread m	Pin c	Nut Thickness t	Nut Diameter Short Dia.	Nut Diameter Long Dia.	Nut Recess Rough Dia.	Nut Recess s	Diameter Rough Hole	Weight, Pounds	Pattern No.
2, 2¼	1½	1	¼	⅞	3	3⅜	2⅝	¼	1¼	1	PN 21
2½, 2¾	2	1⅛	⅛	1	3⅝	4⅛	3⅛	¼	1⅝	2	PN 22
3, *3¼, 3½	2½	1¼	⅛	1⅛	4⅜	5	3⅞	⅛	2⅛	3	PN 23
*3¾, 4	3	1⅜	¼	1¼	4⅞	5⅝	4⅜	⅛	2⅝	4	PN 24
*4¼, 4½, *4¾	3½	1½	¼	1⅜	5⅜	6⅛	5¼	½	3¼	5	PN 25
5, *5¼	4	1⅝	¼	1½	6¼	7¼	5⅞	½	3¾	6	PN 26
5½, *5¾, 6	4½	1¾	¼	1⅝	7	8⅛	6½	⅝	4¼	8	PN 27
*6¼, *6½	5	1⅞	¼	1¾	7⅝	8⅞	7	⅝	4¾	10	PN 28
*6¾, 7	5½	2	⅜	1⅞	8⅛	9⅜	7½	¾	5¼	12	PN 29
*7¼, *7½	5½	2	⅜	1⅞	8⅝	10	8	¾	5¼	14	PN 30
*7¾, 8, *8¼	6	2¼	⅜	2⅛	9⅜	10⅞	8¼	¾	5¾	19	PN 31
*8½, *8¾, 9	6	2¼	⅜	2⅛	10¼	11⅞	9⅝	¾	5¾	24	PN 32
*9¼, *9½	6	2⅜	⅜	2¼	11⅛	13	10⅝	¾	5¾	32	PN 33
*9¾, 10	6	2⅜	⅜	2¼	11¼	13	10⅝	¾	5¾	32	PN 33
11	6	2½	½	2⅜	12⅛	14⅜	11¾	¾	5¾	60	PN 34
12	6	2⅝	½	2⅜	13½	15⅝	12⅝	¾	5¾	73	PN 35
13	7	2¾	½	2⅜	14½	16¾	13⅝	¾	6¾	81	PN 36
14	7	3	½	2⅜	15½	17⅞	14⅝	¾	6¾	94	PN 37
15	8	3	½	2⅜	16½	19	15⅝	¾	7¾	103	PN 38
16	8	3⅛	½	3	17½	20⅛	16⅝	¾	7¾	126	PN 39
17	9	3¼	½	3⅛	18½	21¼	17⅝	¾	8¾	145	PN 40
18	9	3⅜	½	3⅛	19½	22⅜	18¾	¾	8¾	173	PN 41
19	10	3½	½	3⅜	20½	23½	19¾	¾	9¾	196	PN 42
20	10	3½	½	3⅜	21½	24¾	20¾	¾	9¾	222	PN 43
21	11	3½	½	3⅜	22½	26	21¾	¾	10¾	240	PN 44
22	11	3½	½	3⅜	23½	27⅛	22¾	¾	10¾	266	PN 45
23	12	3½	½	3⅜	24½	28¼	23¾	¾	11¾	282	PN 46
24	12	3½	½	3⅜	25½	29⅜	24¾	¾	11¾	310	PN 47

Sizes marked * are special.



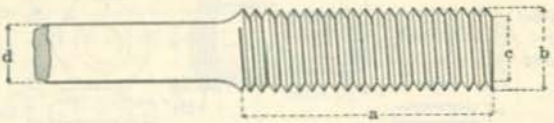
Horizontal or Vertical Cotter Pin Finished.

Horizontal Cotter Pin Over 2" Finished

Pin p	Head h	Cotter c	Cotter d	Pin p	Head h	Cotter c	Cotter d
1⅛	1½	2	¼	2¾	3⅛	4	⅜
1½	1¾	2½	¼	3	3½	5	½
1¾	2	2¾	¼	3¼	3¾	5	½
2	2⅜	3	⅜	3½	4	6	½
2¼	2⅝	3¼	⅜	3¾	4¼	6	½
2½	2⅞	3¾	⅜				

UPSET SCREW ENDS FOR SQUARE BARS

AMERICAN BRIDGE COMPANY STANDARD



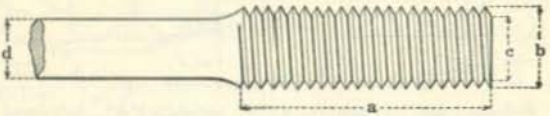
Thread: Shape and Pitch, U. S. Standard.

BAR			UPSET					
							Area	
Side of Square d, Inches	Area, Sq. Inches	Weight per Foot, Lbs.	Diameter b, Inches	Length a, Inches	Additional Length for Upset +10%, Inches	Diameter at Root of Thread c, Inches	At Root of Thread, Sq. Inches	Excess Over Area of Bar, %
* ¾	0.563	1.91	1⅛	4	4	0.939	0.693	23.2
* ⅞	0.766	2.60	1¼	4	4	1.064	0.890	16.2
1	1.000	3.40	1½	4	4	1.283	1.294	29.4
1⅛	1.266	4.30	1⅝	4	3½	1.389	1.515	19.7
1¼	1.563	5.31	1⅞	4½	4½	1.615	2.049	31.1
1⅜	1.891	6.43	2	4½	4	1.711	2.300	21.7
1½	2.250	7.65	2¼	5	5	1.961	3.021	34.3
1⅝	2.641	8.98	2⅜	5	4½	2.086	3.419	29.5
1¾	3.063	10.41	2½	5½	4½	2.175	3.716	21.3
1⅞	3.516	11.95	2¾	5½	5	2.425	4.619	31.4
2	4.000	13.60	2⅞	6	5	2.550	5.108	27.7
2⅛	4.516	15.35	3	6	4½	2.629	5.428	20.2
2¼	5.063	17.21	3¼	6½	5½	2.879	6.509	28.6
2⅜	5.641	19.18	3½	7	6½	3.100	7.549	33.8
2½	6.250	21.25	3¾	7	7	3.317	8.641	38.3
2⅝	6.891	23.43	3¾	7	5½	3.317	8.641	25.4
2¾	7.563	25.71	4	7½	6½	3.567	9.993	32.1
2⅞	8.266	28.10	4¼	8	7½	3.798	11.330	37.1
3	9.000	30.60	4¼	8	6	3.798	11.330	25.9
3⅛	9.766	33.20	4½	8½	7	4.028	12.741	30.5
3¼	10.563	35.91	4¾	8½	7½	4.255	14.221	34.6

*Upsets are special.

UPSET SCREW ENDS FOR ROUND BARS

AMERICAN BRIDGE COMPANY STANDARD



Thread: Shape and Pitch, U. S. Standard.

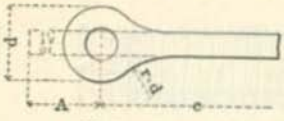
BAR			UPSET					
							Area	
Diameter d, Inches	Area, Sq. Inches	Weight per Foot, Lbs.	Diameter b, Inches	Length a, Inches	Additional Length for Upset +10%, Inches	Diameter at Root of Thread c, Inches	At Root of Thread, Sq. Inches	Excess Over Area of Bar, %
* ¾	0.442	1.50	1	4	5	0.838	0.551	24.7
* ⅞	0.601	2.04	1¼	4	5½	1.064	0.890	48.0
1	0.785	2.67	1⅜	4	4	1.158	1.054	34.2
1⅛	0.994	3.38	1½	4	4	1.283	1.294	30.2
1¼	1.227	4.17	1⅝	4	4	1.389	1.515	23.5
1⅜	1.485	5.05	1¾	4	4	1.490	1.744	17.5
1½	1.767	6.01	2	4½	4½	1.711	2.300	30.2
1⅝	2.074	7.05	2⅛	4½	4	1.836	2.649	27.7
1¾	2.405	8.18	2¼	5	4	1.961	3.021	25.6
1⅞	2.761	9.39	2⅜	5	4	2.086	3.419	23.8
2	3.142	10.68	2½	5½	4	2.175	3.716	18.3
2⅛	3.547	12.06	2⅝	5½	3½	2.300	4.156	17.2
2¼	3.976	13.52	2¾	6	4½	2.550	5.108	28.4
2⅜	4.430	15.06	3	6	4½	2.629	5.428	22.5
2½	4.909	16.69	3¼	6½	5½	2.879	6.509	32.6
2⅝	5.412	18.40	3¼	6½	4½	2.879	6.509	20.3
2¾	5.940	20.19	3½	7	5½	3.100	7.549	27.1
2⅞	6.492	22.07	3¾	7	6	3.317	8.641	33.1
3	7.069	24.03	3¾	7	5	3.317	8.641	22.2
3⅛	7.670	26.08	4	7½	6	3.567	9.993	30.3
3¼	8.296	28.21	4	7½	5	3.567	9.993	20.5
3⅜	8.946	30.42	4¼	8	5½	3.798	11.330	26.6
3½	9.621	32.71	4¼	8	5	3.798	11.330	17.8
3⅝	10.321	35.09	4½	8½	5½	4.028	12.741	23.4
3¾	11.045	37.55	4¾	8½	6	4.255	14.221	28.8
3⅞	11.793	40.10	4¼	8½	5½	4.255	14.221	20.6

*Upsets are special.

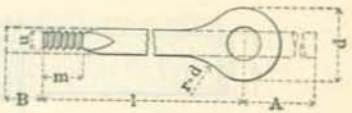
EYE BARS

AMERICAN BRIDGE COMPANY STANDARD

ORDINARY EYE BAR



ADJUSTABLE EYE BAR



Minimum length, l, for short end is 6′-6″, preferably 7′-0″. Left thread.

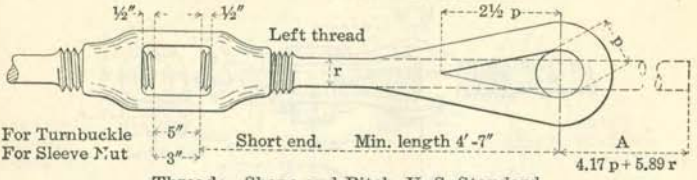
Thread: Shape and Pitch, U. S. Standard.

BAR			HEAD					BAR	SCREW END				
Width In.	Thickness		Dia. d, In.	Maximum Pin		Additional Material, A, Ft. and In.		Width In.	Min. thickness In.	Dia. u, In.	Excess Upset over Bar %	Length m, In.	Additional Material, B, Ft. and In.
	Max. In.	Min. In.		Dia. In.	Excess Head over Bar, %	For ordering Bar	For figuring Weight						For ordering Bar	For figuring Wt.
2	1	½	4½	1¾	37.5	0-10½	0- 7	2	* ⅝	1¾	39.6	4	1- 0	8
			5½	2¾		1- 2½	0-11		¾	1⅞	36.6	4½	1- 0	7½
			* 6½	3¾		1- 7½	1- 4		⅞	2	31.4	4½	0-11	7½
2½	1	⅝	6	2½	40.0	1- 1¾	0-10	2½	* ¾	2⅛	41.2	4½	1- 0	8
			7	3½		1- 5¾	1- 2		⅞	2¼	38.1	5	1- 0	8
			* 8	4½		1-10¾	1- 7		1	2⅜	36.7	5	1- 0	7½
3	1½	⅝	7½	3¼	41.7	1- 4½	1- 1	3	* ¾	2¼	34.3	5	1- 0	7½
			8½	4¼		1- 9½	1- 5		⅞	2¼	41.6	5	1 -1	9½
			* 9½	5¼		2- 2½	1-10		1	2½	23.9	5½	1- 1	8½
4	1¾	¾	10	4½	37.5	1- 9	1- 6	4	* ¾	2½	23.9	5½	1- 1	8½
		⅞	11	5½		2- 3	1-10		⅞	2¾	32.0	5½	0-11	7½
		1	*12	6½		2- 8	2- 2		1	3	35.7	6	1- 1	8½
									1⅛	3¼	44.6	6½	1- 2	9½
5	2	¾	12	5¼	35.0	1-10½	1- 8	5	* ¾	2⅞	36.2	6	1- 0	8
		1	13½	6¾		2- 6	2- 2		⅞	3	24.1	6	0-11	7
		1	*15	8¼		3- 3	2- 9		1	3¼	30.2	6½	1- 0	8
									1⅛	3½	34.2	7	1- 1	8¼
6	2	¾	14	5¾	37.5	2- 1	1-10		1¼	3¾	38.3	7	1- 2	9
		1	14¾	6½		2- 4	2- 1	6	*1	3½	25.8	7	1- 0	7½
		1	*16½	8¾		3- 2	2- 8		1⅛	3¾	28.0	7	1- 0	8
7	2	1	16½	7	35.7	2- 6½	2- 2		1¼	4	33.2	7½	1- 1	8½
		1⅛	17½	8		2-11	2- 6		1⅜	4¼	37.3	8	1- 2	9½
		1⅜	*18½	9		3- 4	2-11	7	*1⅛	4	26.9	7½	1- 0	8
8	2	1	18	7	37.5	2- 5½	2- 3		1¼	4¼	29.5	8	1- 1	8½
		1⅛	19	8		2- 9½	2- 6		1⅜	4½	32.4	8½	1- 2	9
		1¼	*20	9		3- 4	2-11		1½	4¾	35.4	8½	1- 2	9½
9	2	1⅛	20	7½	38.9	2- 8½	2- 6	8	*1⅛	4¼	25.9	8	1- 0	8
		1¼	22	9½		3- 4½	3- 1		1¼	4½	27.4	8½	1- 1	8½
10	2	1⅛	22½	9	35.0	3- 2½	2-10		1⅜	4¾	29.3	8½	1- 1	8½
		1¼	24	10½		3- 9	3- 3		1½	5	31.4	9	1- 2	9
		1⅜	*25	11½		4- 1	3- 7		1⅝	5¼	35.2	9½	1- 3	10
12	2	1¼	26½	10	37.5	3- 4	3- 3	9	*1⅛	5	28.3	9¼	1- 2	9
		1⅜	28	11½		4- 2	3- 8		1½	5¼	30.2	9¼	1- 1	8
		1½	*29½	13		4- 8	4- 1		1⅝	5½	31.7	9¾	1- 1	8
14	2	1⅜	31	12	35.7	3-11	3- 9	10	*1⅜	5¼	27.8	9¾	1- 1	7½
		1½	†33	14		4- 7	4- 4		1½	5½	28.4	9¾	1- 1	8
		1⅝	*34	15		5- 5	4- 8		1⅝	5¾	30.8	10	1- 1	8
16	2	1⅜	36	14	37.5	4- 7	4- 5	12	*1½	6	28.3	10½	1- 1	8
		1⅝	*37½	16	34.4	4-11	4-10		1⅝	6¼	29.6	10¾	1- 1	8
									1¾	6½	29.7	11	1- 1	8

*Bars are special. †33″, 14″, 1¾″ and over, add 4′-5½″ for material, 4′-2″ for weight. Pin hole to be deducted in estimating weight of Eye Bars.

LOOP RODS AND STUB ENDS

AMERICAN BRIDGE COMPANY STANDARD

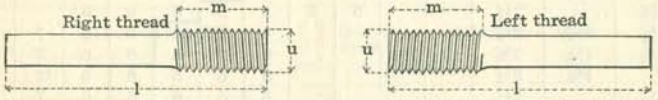


Thread: Shape and Pitch, U. S. Standard.

LENGTH A FOR ONE LOOP IN FEET AND INCHES

Diam. of Pin, p	Size of Square or Round Bar, in Inches										
	¾	⅞	1	1⅛	1¼	1⅜	1½	1⅝	1¾	1⅞	2
1⅛	0- 9½	0-10	0-11	0-11½							
1¼	0-10	0-10½	0-11½	1- 0	1- 1						
1½	0-11	0-11½	1- 0½	1- 1	1- 2	1- 2½					
1¾	1- 0	1- 0½	1- 1½	1- 2	1- 3	1- 3½	1- 4½	1- 5	1- 6		
2	1- 1	1- 1½	1- 2½	1- 3	1- 4	1- 4½	1- 5½	1- 6	1- 7	1- 7½	1- 8½
2¼	1- 2	1- 3	1- 3½	1- 4½	1- 5	1- 5½	1- 6½	1- 7	1- 8	1- 8½	1- 9½
2½	1- 3	1- 4	1- 4½	1- 5½	1- 6	1- 7	1- 7½	1- 8	1- 9	1- 9½	1-10½
2¾	1- 4	1- 5	1- 5½	1- 6½	1- 7	1- 8	1- 8½	1- 9½	1-10	1-11	1-11½
3	1- 5	1- 6	1- 6½	1- 7½	1- 8	1- 9	1- 9½	1-10½	1-11	2- 0	2- 0½
*3¼	1- 6	1- 7	1- 7½	1- 8½	1- 9	1-10	1-10½	1-11½	2- 0	2- 1	2- 1½
3½	1- 7½	1- 8	1- 8½	1- 9½	1-10	1-11	1-11½	2- 0½	2- 1	2- 2	2- 2½
*3¾	1- 8½	1- 9	1-10	1-10½	1-11	2- 0	2- 0½	2- 1½	2- 2	2- 3	2- 3½
4	1- 9½	1-10	1-11	1-11½	2- 0½	2- 1	2- 2	2- 2½	2- 3	2- 4	2- 4½
*4¼		1-11	2- 0	2- 0½	2- 1½	2- 2	2- 3	2- 3½	2- 4½	2- 5	2- 6
4½		2- 0	2- 1	2- 1½	2- 2½	2- 3	2- 4	2- 4½	2- 5½	2- 6	2- 7
*4¾		2- 1	2- 2	2- 2½	2- 3½	2- 4	2- 5	2- 5½	2- 6½	2- 7	2- 8
5		2- 2½	2- 3	2- 3½	2- 4½	2- 5	2- 6	2- 6½	2- 7½	2- 8	2- 9
*5¼			2- 4	2- 5	2- 5½	2- 6	2- 7	2- 7½	2- 8½	2- 9	2-10
5½			2- 5	2- 6	2- 6½	2- 7½	2- 8	2- 9	2- 9½	2-10	2-11
*5¾			2- 6	2- 7	2- 7½	2- 8½	2- 9	2-10	2-10½	2-11½	3- 0
6			2- 7	2- 8	2- 8½	2- 9½	2-10	2-11	2-11½	3- 0½	3- 1
*6¼				2- 9	2- 9½	2-10½	2-11	3- 0	3- 0½	3- 1½	3- 2
6½				2-10	2-10½	2-11½	3- 0	3- 1	3- 1½	3- 2½	3- 3
*6¾				2-11	3- 0	3- 0½	3- 1	3- 2	3- 2½	3- 3½	3- 4
7				3- 0	3- 1	3- 1½	3- 2½	3- 3	3- 3½	3- 4½	3- 5

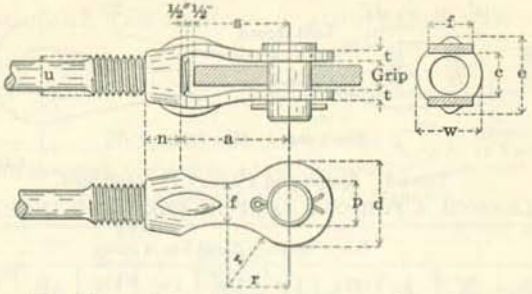
*Pins are special. Maximum shipping length of long end = 35 feet.



Dia. of Round	¾		⅞	1	1⅛	1¼	1⅜		1½	1⅝	1¾	1⅞	2
Side of Square		¾	⅞		1	1⅛		1¼	1⅜		1½	1⅝	1¾
Dia. of Upset, u	1	1⅛	1¼	1⅜	1½	1⅝	1¾	1⅞	2	2⅛	2¼	2⅜	2½
Length of Upset, m	4	4	4	4	4	4	4	4½	4½	4½	5	5	5½
Length, l	9½	9½	10	10½	10½	11	11½	11½	11½	11½	12	12½	13

CLEVISES

AMERICAN BRIDGE COMPANY STANDARD



Grip = thickness of plate + ¼" but must not exceed dimension, c.

Thread: Shape and Pitch, U. S. Standard.

Clevis Number	Upset		Pin		Head			Fork				Nut			Weight, Pounds
	Min.	Max.	Min.	Max.											
	u	u	p	p	d	t	r	f	s	c	a	n	w	e	
3	1	1 1/16	1	1 1/2	3	1/2	2 1/4	1 1/2	4	1 1/4	5	1 1/2	2 1/4	3 1/16	4
4	1 1/16	1 5/16	1 1/4	2	4	1/2	3	2	5	1 3/4	6	1 3/4	2 7/8	3 5/8	8
5	1 1/2	2 1/16	1 1/2	2 1/2	5	5/8	3 3/4	2 1/2	6	2 1/4	7	2 1/4	3 3/4	4 1/2	17
6	2	2 5/16	2	3	6	3/4	4 1/2	3	7	2 3/4	8	2 1/2	4 3/8	5 3/8	26
7	2 1/4	3	2 1/2	3 1/2	7	7/8	5 1/4	3 1/2	8	3 1/4	9	3	5	6 3/16	40

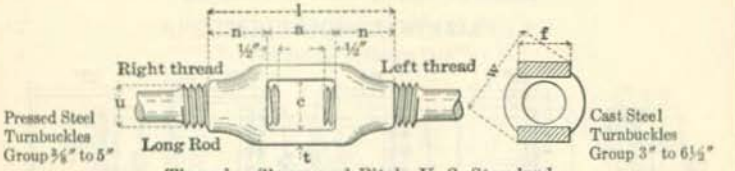
CLEVIS NUMBERS FOR VARIOUS RODS AND PINS

Rods			Pins										
Round	Square	Upset	1	1 1/8	1 1/2	1 3/4	2	2 1/4	2 1/2	2 3/4	3	3 1/4	3 1/2
3/4	.....	1	3	3	3								
.....	3/4	1 3/16	3	3	3	4	4						
7/8	7/8	1 1/4		4	4	4	4						
1	.....	1 3/16		4	4	4	4						
1 1/16	1	1 1/2		4	4	4	4	5	5				
1 1/4	1 1/16	1 5/16		4	4	4	4	5	5				
1 3/16	.....	1 3/4			5	5	5	5	5				
.....	1 1/4	1 7/8			5	5	5	5	5				
1 1/2	1 3/16	2			5	5	5	5	5	6	6		
1 5/16	.....	2 1/16			5	5	5	5	5	6	6		
1 3/4	1 1/2	2 1/4					6	6	6	6	6	7	7
1 7/8	1 5/8	2 3/8					6	6	6	6	6	7	7
2	1 3/4	2 1/2					6	6	6	6	6	7	7
2 1/16	.....	2 5/8					6	6	6	6	6	7	7
.....	1 7/8	2 3/4							7	7	7	7	7
2 1/4	2	2 7/8							7	7	7	7	7
2 5/16	2 1/16	3							7	7	7	7	7

Clevises above and to right of zigzag line may be used with forks straight, clevices below and to left of this line should have forks closed so as not to overstrain pin.

TURNBUCKLES AND SLEEVE NUTS

AMERICAN BRIDGE COMPANY STANDARD



Thread: Shape and Pitch, U. S. Standard.

Dia. of Screw, u	Dimensions in Inches						Weight, Pounds
	w	l	n	c	t	f	
⅜	1 1/16	7 1/2	2 1/16	9 1/16	5 1/16	1 1/2	0.4
7/16	1 1/8	7 3/4	2 1/8	5/8	1/4	3/8	0.4
½	1 3/8	7 1/2	2 1/4	5/8	1/4	3/8	0.6
9/16	1 9/16	7 3/4	2 3/8	1 3/16	5/16	3/4	0.6
⅝	1 9/16	8	1	1 5/16	5/16	3/4	1.0
¾	2	8 1/4	1 1/8	1 1/16	3/8	7/8	1.4
⅞	2 1/4	8 1/2	1 1/4	1 1/4	3/8	1	1.7
1	2 3/16	9	1 1/2	1 5/16	7/16	1 1/4	2.3
1 1/8	2 9/16	9 1/2	1 3/4	1 7/16	1/2	1 1/4	3.2
1 1/4	2 3/4	9 3/4	1 7/8	1 9/16	1/2	1 3/8	4.0
1 3/8	3 1/16	10	2	1 11/16	1/2	1 5/8	4.9
1 1/2	3 5/16	10 1/2	2 1/4	1 3/4	9/16	1 3/4	6.3
1 5/8	3 1/2	11	2 1/2	2	9/16	1 7/8	7.0
1 3/4	3 3/4	11 1/4	2 5/8	2 1/8	5/8	2	8.4
1 7/8	3 7/8	11 1/2	2 3/4	2 3/16	11/16	2 1/8	10.5
2	4 1/4	12	3	2 3/8	11/16	2 1/4	11.9
2 1/8	4 3/4	12 3/4	3 3/8	2 11/16	13/16	2 1/2	18.6
2 1/4	4 3/4	12 3/4	3 3/8	2 11/16	13/16	2 1/2	18.6
2 3/8	5 3/8	13 1/2	3 3/4	3 1/16	7/8	2 3/4	25.5
2 1/2	5 3/8	13 1/2	3 3/4	3 1/16	7/8	2 3/4	25.5
2 5/8	5 3/4	14 1/4	4 1/8	3 1/4	15/16	3	34.2
2 3/4	5 3/4	14 1/4	4 1/8	3 1/4	15/16	3	34.2
2 7/8	6 3/8	15	4 1/2	3 5/8	1	3 1/4	40.5
3	6 3/8	15	4 1/2	3 5/8	1	3 1/4	40.5
3 1/4	7	15 3/4	4 3/8	3 3/4	1 1/8	4	
3 1/2	7 1/16	16 1/2	5 1/4	3 7/8	1 5/16	4 1/2	
3 3/4	8 3/16	17 1/4	5 5/8	4 3/8	1 1/4	5 1/4	
4	9 3/16	18	6	4 5/8	1 3/8	6	
4 1/4	10 1/16	21 1/2	6 1/4	5	1 1/2	6 1/2	
4 1/2	10 3/4	22 1/2	6 3/4	5 3/8	1 3/4	6 1/2	
4 3/4	11 3/16	23 1/2	7 1/4	5 1/2	2	6 1/2	
5	12	24	7 1/2	5 7/8	2 1/4	6 1/2	
3	7 1/4	15	4 1/2	3 5/8	1 1/4	4	50
3 1/4	7 3/4	15 3/4	4 7/8	3 7/8	1 3/8	4 1/4	62
3 1/2	8 1/4	16 1/2	5 1/4	4 1/4	1 1/2	4 3/8	79
3 3/4	9	17 1/4	5 5/8	4 1/2	1 5/8	4 3/4	94
4	9 1/2	18	6	4 3/4	1 3/4	5 1/4	116
4 1/4	10 1/2	21 3/4	6 3/8	5 1/4	1 7/8	5 3/8	158
4 1/2	11	22 1/2	6 3/4	5 1/2	1 7/8	6 1/2	173
4 3/4	11 1/2	23 1/4	7 1/8	5 3/4	2	6 1/2	198
5	12	24	7 1/2	6	2	7	231
5 1/4	12 1/2	24 3/4	7 3/8	6 1/4	2 1/8	7 3/8	264
5 1/2	13 1/4	25 1/2	8 1/4	6 1/2	2 1/4	7 3/4	301
5 3/4	13 3/4	26 1/4	8 3/8	6 3/4	2 3/8	8	344
6	14 1/2	27	9	7	2 3/8	8 1/4	400
6 1/4	15	27 3/4	9 3/8	7 1/4	2 3/4	8 1/2	487
6 1/2	15 1/2	28 1/2	9 3/4	7 1/2	2 7/8	8 3/4	583

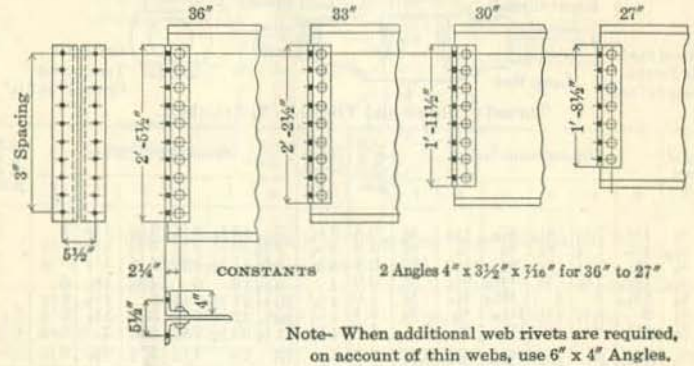
a=6" for screws 4" or under. a=9" for screws 4¼" or over.

Dia. of Screw, u	Dimensions in Inches						Weight, Pounds
	w	l	n	c	t	s	
4	7 3/8	13	4 1/2	4 1/4	1 5/16	6 1/8	63
4 1/4	7 1/2	13 1/2	4 5/8	4 1/2	1	6 1/2	73
4 1/2	8	14	5	4 3/4	1 1/16	6 7/8	84
4 3/4	8 3/8	14 1/2	5 1/4	5	1 1/8	7 1/4	98
5	8 7/8	15	5 1/2	5 1/4	1 3/16	7 5/8	110
5 1/4	9 1/4	15 1/2	5 3/4	5 1/2	1 1/4	8	122
5 1/2	9 3/4	16	6	5 3/4	1 5/16	8 3/8	142
5 3/4	10 1/4	16 1/2	6 1/4	6	1 3/8	8 3/4	157
6	10 5/8	17	6 1/2	6 1/4	1 7/16	9 1/8	176

BEAM CONNECTIONS

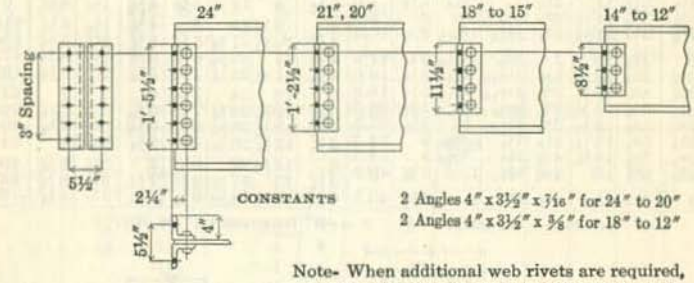
AMERICAN BRIDGE COMPANY STANDARD

RIVETS ⅞"—HOLES 15/16"



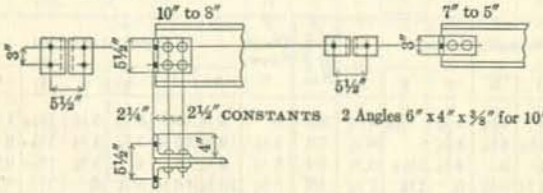
CONSTANTS — 2 Angles 4" x 3½" x 7/16" for 36" to 27"

Note- When additional web rivets are required, on account of thin webs, use 6" x 4" Angles.



CONSTANTS — 2 Angles 4" x 3½" x 7/16" for 24" to 20"
2 Angles 4" x 3½" x ⅜" for 18" to 12"

Note- When additional web rivets are required, on account of thin webs, use 6" x 4" Angles.



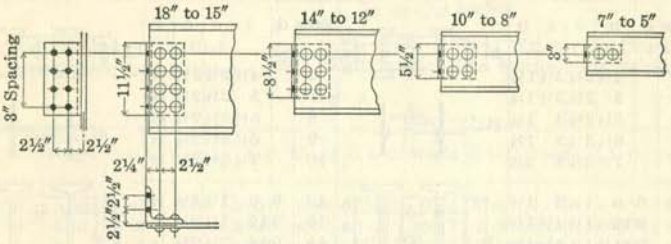
CONSTANTS — 2 Angles 6" x 4" x ⅜" for 10" to 5"

BEAM CONNECTIONS

AMERICAN BRIDGE COMPANY STANDARD

SPECIAL CONNECTION ANGLES

Rivets ⅞″—Holes 15/16″



VALUES OF CONNECTIONS

Beams	Number Rivets	Coefficient	Beams	Number Rivets	Coefficient
18, 16, 15	8	6.0	10, 9, 8	4	2.3
14, 13, 12	6	4.0	7, 6, 5	2	0.8

Connection angles shown above to be used only where construction prevents the use of double angles.

For beams over 18″, avoid one-sided connections where practicable.

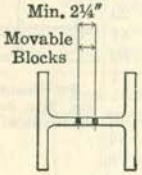
Value of connection = coefficient given in table, multiplied by value of one rivet or bolt.

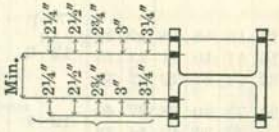
Use value in whichever leg the value of rivet is the smaller.

Considering bearing value of metal connected, for large duplication where the connections shown here would have a considerable excess value, special connections may be used.

PUNCH GAGES

For the Minimum Gages of each Section see Tables of Beam Safe Loads.

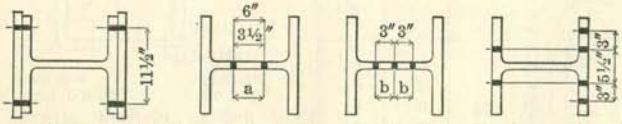




Standard Die Blocks

DRILL GAGES

Longitudinal Spacing should be 3″ or Multiples of 3″



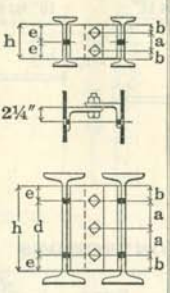
NOTE:—Max. a and b as large as column will permit but variations from figures given should be avoided if possible.

BEAM SEPARATORS

AMERICAN BRIDGE COMPANY STANDARD

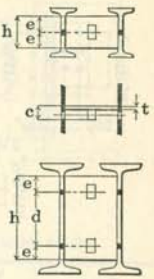
ANGLE SEPARATORS

Beams	d	h	e	a	b
6″		4½	2¼	2¼	1⅛
7		5	2½	2½	1¼
8		5½	2¾	3	1¼
9		6½	3¼	3	1¾
10		7½	3¾	3	2¼
12	6	9	1½	3	1½
15	9	12	1½	4½	1½
15	9	11¼	1⅛	4½	1⅛
18	9	14	2½	4½	2½
20	12	16	2	6	2
24	12	20	4	6	4



CAST IRON SEPARATORS

Beams	d	h	e	c	t
6″		4½	2¼	2¼	½
7		5	2½	2¼	½
8		5½	2¾	2¼	½
9		6½	3¼	2¼	½
10		7½	3¾	2¼	½
12	6	9	1½	2¼	½
15	9	12	1½	2¼	½
18	9	14	2½	2⅜	⅝
20	12	16	2	2⅜	⅝
24	12	20	4	2⅜	⅝



CAST IRON SEPARATORS

Weight of one, with ¾″ bolts

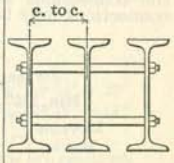
Beams	C. to C. of beams					
	7″	8″	9″	10″	11″	12″
6″	7	8	9	9	10	11
7	8	8	9	10	11	12
8	8	9	9	10	11	12
9	8	9	10	11	12	13
10	10	11	12	13	14	15
12	13	15	16	18	19	21
15	16	17	19	21	23	25
18	22	24	27	29	32	34
20	24	27	30	33	37	40
24		32	36	40	44	48

PIPE SEPARATORS AND RODS

Total weight for Beam girders and Grillages

Length of Beams	No. of Bms.	C. to C. of beams					
		7″	8″	9″	10″	11″	12″
7′–0 or less	2	10	11	12	13	14	15
	3	17	19	21	23	25	27
	4	24	27	30	33	36	39
	5	31	35	39	43	47	51
7′–1 to 12′–0	2	15	17	18	20	21	23
	3	26	29	32	35	38	41
	4	36	41	45	50	54	59
	5	47	53	59	65	71	77
12′–1 to 17′–0	2	20	22	24	26	28	30
	3	34	38	42	46	50	54
	4	48	54	60	66	72	78
	5	62	70	78	86	94	102

1″ Pipe ¾″ Rods

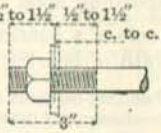


For beams 10″ or less, take one-half of the tabulated weight.

TIE RODS AND ANCHORS

AMERICAN BRIDGE COMPANY STANDARD

¾—INCH TIE RODS



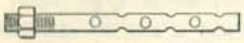
Total Lengths of Tie Rods = C. to C. Lengths + 3 Inches

Total Weights, in Pounds, Two Square Nuts included

C. to C.	Weight	C. to C.	Weight	C. to C.	Weight	C. to C.	Weight	C. to C.	Weight	C. to C.	Weight
3′-0″	5.30	4′-0″	6.80	5′-0″	8.30	6′-0″	9.80	7′-0″	11.30	8′-0″	12.80
3′-3″	5.67	4′-3″	7.17	5′-3″	8.67	6′-3″	10.17	7′-3″	11.67	8′-3″	13.17
3′-6″	6.05	4′-6″	7.55	5′-6″	9.05	6′-6″	10.55	7′-6″	12.05	8′-6″	13.55
3′-9″	6.42	4′-9″	7.92	5′-9″	9.42	6′-9″	10.92	7′-9″	12.42	8′-9″	13.92

ANCHORS

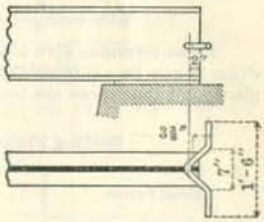
Swedge Bolt



Diameter Inches	Length Feet - Inches	Weight Pounds
1	1-0	3.1
1¼	1-3	6.1
1½	1-3	8.9

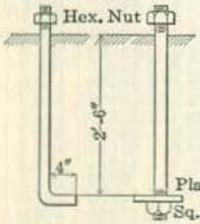
Weight includes Nut

Government Anchor



¾" Rod 1′ 9" long. Wt., 3 lbs.

Built-In Anchor Bolts



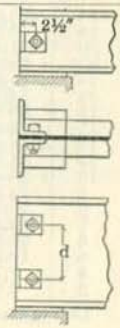
Anchors 2½" and Under — Anchors over 2½"

In general, Built-In Anchor Bolts should extend into the Masonry not less than 2′-6", and further when necessary.

Angle Wall Anchors

Depth of Beam	D	Wt. with Bolts
10" & Under		7
12	6	
15	9	
18	9	14
20	12	
24	12	

Angles, 6 x 4 x ⅜ x 3, Bolts ¾"

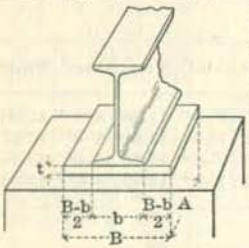


BEARING PLATES

Steel Bearing Plates are provided for the ends of beams resting on masonry, to distribute the pressure over a sufficient area, the allowable unit pressure depending upon the class of masonry used.

The size, area and thickness of a bearing plate depends on the end reaction, the length and width of bearing and allowable unit stress.

Assuming that the maximum bending moment occurs in the center of bearing:



A =Length of bearing plate, in inches.
B =Width of bearing plate, in inches.
t =Thickness of bearing plate, in inches.
b =Flange width of beam, in inches.
w =Allowable unit pressure on masonry.
R =Reaction on bearing plates in pounds = $w \times A \times B$

$$M = \frac{R}{2} \times \frac{B}{4} - \frac{R}{2} \times \frac{b}{4} = \frac{R(B-b)}{8}$$

$$= \frac{w\,A\,B\,(B-b)}{8} = \frac{f\,A\,t^2}{6}$$

$$t = \sqrt{\frac{3\,w\,B\,(B-b)}{4\,f}}, \quad B(B-b) = \frac{4\,f\,t^2}{3\,w}$$

Taking moments at toe of beam flange, for cantilever projection $\frac{B-b}{2}$

$$M = \frac{w\,A(B-b)^2}{8} = \frac{f\,A\,t^2}{6} \qquad t = \tfrac{1}{2}\,(B-b)\sqrt{\frac{3\,w}{f}}$$

These formulas give lower values for M and t, and are applicable only when it can be assumed that middle part, b, of the plate is rigidly held in place, and that there are no bending stresses in center of plate.

Bearing Plates—For Beams—American Standard.

Beam Section			Bearing Plates				Fiber Stress 18,000 Pounds		
Depth	Weight	Flange, b	Dimensions			Weight	Total Pressure	Pressure	Min. Span
			A	B	t				
Ins.	Lbs.	Ins.	Inches			Lbs.	Lbs.	Lbs. per Sq. In.	Feet
24	105.9	7.88	16	16	1	72.5	47262	184.6	29.74
24	79.9	7.0	16	16	1	72.5	42667	166.7	24.46
20	81.4	7.0	16	16	1	72.5	42667	166.7	20.62
20	65.4	6.25	16	16	1	72.5	39385	153.8	17.82
18	75.6	7.0	16	16	1	72.5	42667	166.7	17.84
18	54.7	6.0	16	16	1	72.5	38400	150.0	13.81
15	60.8	6.0	16	16	1	72.5	38400	150.0	12.69
15	42.9	5.5	12	16	1	54.4	27429	142.9	12.88
12	40.8	5.25	12	12	1¼	30.6	24000	166.7	11.21
12	31.8	5.0	12	12	1¼	30.6	23143	160.7	9.32
10	25.4	4.66	8	12	1¼	20.4	14714	153.3	9.96
9	21.8	4.33	8	12	1¼	17.0	9778	101.9	11.58
8	18.4	4.0	8	8	1¼	11.3	18750	293.0	4.55
7	15.3	3.66	8	8	1¼	11.3	17281	270.0	3.59
6	12.5	3.33	6	6	1¼	5.1	13483	374.5	3.23
5	10.0	3.0	6	6	1¼	5.1	12000	333.3	2.42
4	7.7	2.66	4	4	1¼	1.7	10075	629.7	1.78
3	5.7	2.33	4	4	1¼	1.7	8084	505.3	1.23

Limiting Span = 4 x Bending Moment of Beam ÷ Total Pressure on Bearing Plate.

Special Bearing Plates

Plates of special sizes may be computed from the foregoing formulas or from the Projection Coefficients, B(B-b), after the required surface of the bearing plate has been determined from the reaction of the beam and the allowable pressure on the masonry.

Example: Required a bearing plate with a wall bearing of 20 inches on masonry sustaining a safe unit pressure of 250 pounds per square inch, to distribute the end reaction of a 24″—100 lb. beam, supporting a uniformly distributed load over a span of 11 feet, beam and plates calculated for fiber stress of 18000 pounds.

Reaction, R, of 24″—100 lb. beam, 11 ft. span = 107,800 pounds.
Area of Plate = Reaction ÷ Unit Pressure, 107,800 ÷ 250 = 431.2 sq. inches.
Dimensions of Bearing Plate: A = 22″, B = 20″, Area = 440 sq. inches.
Projection Coefficient: B (B-b), 20 (20—7.25) = 255.0.
Referring to table of Projection Coefficients: nearest value for unit pressure of 250 pounds and fiber stress of 18000 pounds is 253.5, given for a 1⅝″-plate.

Exact value from formula:—$f = \sqrt{\frac{3\ w\ B\ (B-b)}{4\ f}}$

$$= \sqrt{\frac{3 \times 250 \times 20\ (20-7.25)}{4 \times 18000}} = 1.63''.$$

Projection Coefficients, B (B-b), for various values of w and t

Thickness, Inch	Unit Pressure, w, in Pounds per Square Inch													
	75	100	125	150	175	200	225	250	275	300	325	350	375	400
t	Fiber Stress 18,000 Pounds													
⅜	45.0	33.8	27.0	22.5										
½	80.0	60.0	48.0	40.0	34.3	30.0								
⅝	125.0	93.8	75.0	62.5	53.6	46.9	41.7	37.5	34.1	31.3				
¾	180.0	135.0	108.0	90.0	77.1	67.5	60.0	54.0	49.1	45.0	41.5	38.6	36.0	33.8
⅞	245.0	183.8	147.0	122.5	105.0	91.9	81.7	73.5	66.8	61.3	56.5	52.5	49.0	45.9
1	320.0	240.0	192.0	160.0	137.1	120.0	106.7	96.0	87.3	80.0	73.8	68.6	64.0	60.0
1⅛	405.0	303.8	243.0	202.5	173.6	151.9	135.0	121.5	110.5	101.3	93.4	86.8	81.0	75.9
1¼	500.0	375.0	300.0	250.0	214.3	187.5	166.7	150.0	136.4	125.0	115.4	107.1	100.0	93.8
1⅜		453.8	363.0	302.5	259.3	226.9	201.7	181.5	165.0	151.3	139.6	129.6	121.0	113.4
1½			432.0	360.0	308.6	270.0	240.0	216.0	196.4	180.0	166.2	154.3	144.0	135.0
1⅝				422.5	362.1	316.9	281.7	253.5	230.5	211.3	195.0	181.1	169.0	158.4
1¾				490.0	420.0	367.5	326.7	294.0	267.3	245.0	226.2	210.0	196.0	183.8
1⅞					482.1	421.9	375.0	337.5	306.8	281.3	259.6	241.1	225.0	210.9
2						480.0	426.7	384.0	349.1	320.0	295.4	274.3	256.0	240.0

FLOOR PLATES

Flat Rectangular Plates

Rectangular steel plates, plain, checkered or indented, are frequently used in mill floor construction, supported by the floor beams on two sides or on all four sides and more or less securely fixed to the flanges of the supporting beams.

The resistance of rectangular plates to superimposed loads may be obtained from the formulas given below; the formulas given for plates supported on four sides apply generally to rectangular plates subjected to pressures normal to surface of plates.

M = Bending moment, due to uniform or concentrated load, inch-pounds.
f = Unit fiber stress, pounds per square inch.
w = Unit load, pounds per square inch.
a, b = Sides of plate, inches, ($a < b$) t = Thickness of plate, inches.
c = Perpendicular distance, from corner to diagonal, d, of plate, inches.
ϕ = Limiting values for steel plates, fixed and not fixed to supports (v. Bach).

Plate supported on two sides, a—Uniformly distributed load.

$$M = \frac{w\ a\ b^2}{8} = f\ S \qquad S = \frac{a\ t^2}{6} \qquad f = \tfrac{3}{4}\ b^2\ \frac{w}{t^2}$$

Plate supported on four sides, a, b—Uniformly distributed load.

$$f = \phi\ \tfrac{1}{2}\ \frac{a^2\ b^2}{a^2 + b^2}\ \frac{w}{t^2} \qquad f = \phi\ \tfrac{1}{2}\ c^2\ \frac{w}{t^2} \qquad \phi = 9/16 \text{ to } \tfrac{3}{4}$$

Plate supported on four sides, a, b—Concentrated load in center.

$$f = \phi\ \tfrac{3}{2}\ \frac{ab}{a^2 + b^2}\ \frac{P}{t^2} \qquad f = \phi\ \tfrac{3}{2}\ \frac{c}{d}\ \frac{P}{t^2} \qquad \phi = 1\tfrac{1}{4} \text{ to } 1\tfrac{1}{3}$$

Buckle Plates

Buckle plates are generally used on highway bridges with paved floors, and may be subjected to concentrated live loads, due to the weight of truck wheels and to a uniform load due to the paving.

The resistance of buckle plates, when the buckle is turned up and in compression may be computed from the formulas (Winkler):

Total uniformly distributed load

$W = 4\ f\ d\ t$, pounds per buckle.

Total concentrated load, in addition to uniform dead load.

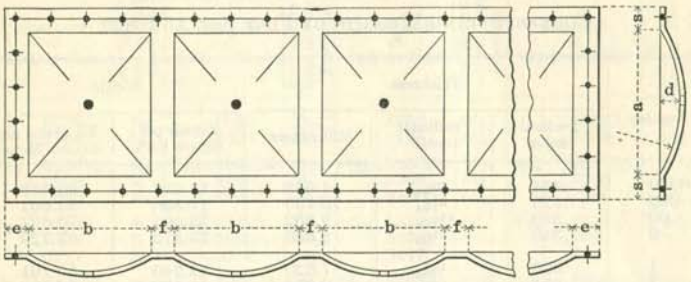
$$P = \frac{t\ (100\ f\ d\ t - 25.2\ w\ a\ b)}{6\ d + 15\ t}, \text{ pounds per buckle}$$

a, b = Sides. t = Thickness. d = Rise of Buckle, inches.
w = Unit load, pounds per square inch. f = Allowable fiber stress, 9000 lbs. per sq. inch.

Buckle plates are generally placed with the convex side of the buckle turned down and in tension, in which case the strength of the buckle plates is about three times greater.

BUCKLE PLATES

AMERICAN BRIDGE COMPANY STANDARD



Size of Buckle, Inches			Die No.	Size of Buckle, Inches			Die No.	Size of Buckle, Inches			Die No.
a	b	d		a	b	d		a	b	d	
21	21	2½	39	36	36	2	13	45	37	3	6
				36	37	3	29	45	42	3	24
23½	24	2½	38					45	45	3	5
23½	28½	2½	36	37	36	3	28				
23½	47	2½	18	37	38	3	26	47	23½	2½	17
				37	45	3	7	47	42	3	4
24	23½	2½	37					47	54	3½	2
24	30	2½	30	38	37	3	27				
								48	48	3	34
26	44	2	12	41	42	3	23				
								51¼	61	4	16
28½	23½	2½	35	42	41	3	22				
				42	45	3	25	54	47	3½	1
30	24	2½	31	42	47	3	3				
30	30	2½	21	42	66	3½	32	61	51¼	4	15
30	33	2½	20								
				44	26	2	11	66	42	3½	33
32	44	2	10	44	32	2	9				
				44	44	2	8				
33	30	2½	19								
33	33	3	14								

MAXIMUM WIDTH = 94″ for plates not over 12 ft. long. 71″ for plates not over 35 ft. long.
MAXIMUM LENGTH = 35 ft. Plates of greater length can be obtained by splicing.
ALLOWABLE OVERRUN in length or width must be given on drawing, where clearance is close.

END FLANGES	e = 2″ Minimum	18″	Maximum	
SIDE FLANGES	s = 2″ Minimum	6½″	Maximum	4″ or less, preferred.
FILLETS	f = 2″ Minimum	6″	Maximum	4″ or less, preferred.

END FLANGES to be made alike if possible. If over 18″, stiffen with angles across plate.

SIDE FLANGES to be made alike if possible. When side flanges must be of unequal width, the plate should be ordered wide enough to make two flanges of the greater width. After plate is buckled, it will be sheared to required width.

BUCKLES can be lengthwise or crosswise of plate, but different sizes should not be used in the same plate. Plates are buckled one buckle at a time, and the number of buckles is determined by size of buckles, fillets and end flanges, and by length of plate that can be fabricated.
A plate 35 ft. long could have:—14 buckles No. 11, b = 2′-2″, with f = 3½″ and e = 5¼″
or, 9 buckles No. 12, b = 3′-8″, with f = 2¾″ and e = 3″

CONNECTION HOLES are usually for ⅝″, ¾″ or ⅞″ rivets or bolts. Holes of different sizes in the same plate increase the cost. SPACING: Crosswise, usually 6″, with 4½″ Min. Lengthwise, from 6″ to 12″. Odd spaces at ends, in even ¼″.

DRAWING must show **Top View** of plate, give **Die Number,** and state whether buckles are turned **up** or **down.** When buckles are turned **down,** the drawing must show a **Drain Hole** in the center of each buckle.

BIRMINGHAM WIRE GAGE (B. W. G.)

Equivalents in Inches and Millimeters
Corresponding Weights of Flat Rolled Steel

Gage Number	Thickness			Weight	
	Decimal Inches	Fractional Inches	Millimeters	Pounds per Square Foot	Kilograms per Square Meter
0000	.454	29/64	11.532	18.523	90.438
000	.425	27/64	10.795	17.340	84.661
00	.380	49/128	9.652	15.504	75.697
0	.340	11/32	8.636	13.872	67.729
1	.300	19/64	7.620	12.240	59.761
2	.284	9/32	7.214	11.587	56.573
3	.259	33/128	6.579	10.567	51.593
4	.238	15/64	6.045	9.710	47.410
5	.220	7/32	5.588	8.976	43.825
6	.203	13/64	5.156	8.282	40.438
7	.180	23/128	4.572	7.344	35.856
8	.165	21/128	4.191	6.731	32.868
9	.148	19/128	3.759	6.038	29.482
10	.134	17/128	3.404	5.467	26.693
11	.120	15/128	3.048	4.896	23.904
12	.109	7/64	2.769	4.447	21.713
13	.095	5/32	2.413	3.876	18.924
14	.083	21/256	2.108	3.386	16.534
15	.072	37/512	1.829	2.938	14.343
16	.065	33/512	1.651	2.652	12.948
17	.058	15/256	1.473	2.366	11.554
18	.049	25/512	1.245	1.999	9.761
19	.042	11/256	1.067	1.714	8.366
20	.035	9/256	.889	1.428	6.972
21	.032	1/32	.813	1.306	6.374
22	.028	7/256	.711	1.142	5.578
23	.025	13/512	.635	1.020	4.980
24	.022	11/512	.559	0.898	4.382
25	.020	5/256	.508	0.816	3.984
26	.018	9/512	.457	0.734	3.586
27	.016	1/64	.406	0.653	3.187
28	.014	7/512	.356	0.571	2.789
29	.013	13/1024	.330	0.530	2.590
30	.012	3/256	.305	0.490	2.390
31	.010	5/512	.254	0.408	1.992
32	.009	9/1024	.229	0.367	1.793
33	.008	1/128	.203	0.326	1.594
34	.007	7/1024	.178	0.286	1.394
35	.005	5/1024	.127	0.204	0.996
36	.004	1/256	.102	0.163	0.797

Unless otherwise specified, all orders for flat rolled steel in gages will be executed by Carnegie Steel Company to Birmingham Wire Gage.

DECIMAL OF AN INCH AND OF A FOOT

Fractions of Inch or Foot		Inch Equivalents to Foot Fractions	Fractions of Inch or Foot		Inch Equivalents to Foot Fractions	Fractions of Inch or Foot		Inch Equivalents to Foot Fractions	Fractions of Inch or Foot		Inch Equivalents to Foot Fractions
	.0052	1/16		.2552	3 1/16		.5052	6 1/16		.7552	9 1/16
	.0104	1/8		.2604	3 1/8		.5104	6 1/8		.7604	9 1/8
1/64	.015625	3/16	17/64	.265625	3 3/16	33/64	.515625	6 3/16	49/64	.765625	9 3/16
	.0208	1/4		.2708	3 1/4		.5208	6 1/4		.7708	9 1/4
	.0260	5/16		.2760	3 5/16		.5260	6 5/16		.7760	9 5/16
1/32	.03125	3/8	9/32	.28125	3 3/8	17/32	.53125	6 3/8	25/32	.78125	9 3/8
	.0365	7/16		.2865	3 7/16		.5365	6 7/16		.7865	9 7/16
	.0417	1/2		.2917	3 1/2		.5417	6 1/2		.7917	9 1/2
3/64	.046875	9/16	19/64	.296875	3 9/16	35/64	.546875	6 9/16	51/64	.796875	9 9/16
	.0521	5/8		.3021	3 5/8		.5521	6 5/8		.8021	9 5/8
	.0573	11/16		.3073	3 11/16		.5573	6 11/16		.8073	9 11/16
1/16	.0625	3/4	5/16	.3125	3 3/4	9/16	.5625	6 3/4	13/16	.8125	9 3/4
	.0677	13/16		.3177	3 13/16		.5677	6 13/16		.8177	9 13/16
	.0729	7/8		.3229	3 7/8		.5729	6 7/8		.8229	9 7/8
5/64	.078125	15/16	21/64	.328125	3 15/16	37/64	.578125	6 15/16	53/64	.828125	9 15/16
	.0833	1		.3333	4		.5833	7		.8333	10
	.0885	1 1/16		.3385	4 1/16		.5885	7 1/16		.8385	10 1/16
3/32	.09375	1 1/8	11/32	.34375	4 1/8	19/32	.59375	7 1/8	27/32	.84375	10 1/8
	.0990	1 3/16		.3490	4 3/16		.5990	7 3/16		.8490	10 3/16
	.1042	1 1/4		.3542	4 1/4		.6042	7 1/4		.8542	10 1/4
7/64	.109375	1 5/16	23/64	.359375	4 5/16	39/64	.609375	7 5/16	55/64	.859375	10 5/16
	.1146	1 3/8		.3646	4 3/8		.6146	7 3/8		.8646	10 3/8
	.1198	1 7/16		.3698	4 7/16		.6198	7 7/16		.8698	10 7/16
1/8	.1250	1 1/2	3/8	.3750	4 1/2	5/8	.6250	7 1/2	7/8	.8750	10 1/2
	.1302	1 9/16		.3802	4 9/16		.6302	7 9/16		.8802	10 9/16
	.1354	1 5/8		.3854	4 5/8		.6354	7 5/8		.8854	10 5/8
9/64	.140625	1 11/16	25/64	.390625	4 11/16	41/64	.640625	7 11/16	57/64	.890625	10 11/16
	.1458	1 3/4		.3958	4 3/4		.6458	7 3/4		.8958	10 3/4
	.1510	1 13/16		.4010	4 13/16		.6510	7 13/16		.9010	10 13/16
5/32	.15625	1 7/8	13/32	.40625	4 7/8	21/32	.65625	7 7/8	29/32	.90625	10 7/8
	.1615	1 15/16		.4115	4 15/16		.6615	7 15/16		.9115	10 15/16
	.1667	2		.4167	5		.6667	8		.9167	11
11/64	.171875	2 1/16	27/64	.421875	5 1/16	43/64	.671875	8 1/16	59/64	.921875	11 1/16
	.1771	2 1/8		.4271	5 1/8		.6771	8 1/8		.9271	11 1/8
	.1823	2 3/16		.4323	5 3/16		.6823	8 3/16		.9323	11 3/16
3/16	.1875	2 1/4	7/16	.4375	5 1/4	11/16	.6875	8 1/4	15/16	.9375	11 1/4
	.1927	2 5/16		.4427	5 5/16		.6927	8 5/16		.9427	11 5/16
	.1979	2 3/8		.4479	5 3/8		.6979	8 3/8		.9479	11 3/8
13/64	.203125	2 7/16	29/64	.453125	5 7/16	45/64	.703125	8 7/16	61/64	.953125	11 7/16
	.2083	2 1/2		.4583	5 1/2		.7083	8 1/2		.9583	11 1/2
	.2135	2 9/16		.4635	5 9/16		.7135	8 9/16		.9635	11 9/16
7/32	.21875	2 5/8	15/32	.46875	5 5/8	23/32	.71875	8 5/8	31/32	.96875	11 5/8
	.2240	2 11/16		.4740	5 11/16		.7240	8 11/16		.9740	11 11/16
	.2292	2 3/4		.4792	5 3/4		.7292	8 3/4		.9792	11 3/4
15/64	.234375	2 13/16	31/64	.484375	5 13/16	47/64	.734375	8 13/16	63/64	.984375	11 13/16
	.2396	2 7/8		.4896	5 7/8		.7396	8 7/8		.9896	11 7/8
	.2448	2 15/16		.4948	5 15/16		.7448	8 15/16		.9948	11 15/16
1/4	.2500	3	1/2	.5000	6	3/4	.7500	9	1	1.0000	12

SUBJECT INDEX

PAGE

Elements of Sections

Explanatory Notes 6– 7
Formulas, Elementary, Rolled and Compound Sections 8– 17

Structural Sections, Elements, Properties and Dimensions

Beams —Carnegie Beam Sections 18– 31
" —American Standard Sections 32– 35
" —Standard Mill Sections 36– 37
" —H-Beams 36– 37
Channels —American Standard Sections 38– 41
" —Car Building Sections 40– 41
" —Ship Building Sections 42– 45
Bulb Angles—Ship Building Sections 46– 47
" " —Car Building Sections 47
Angles —Equal Legs 48– 49
" —Unequal Legs 50– 53
Tees —Equal and Unequal Legs 54
Zees 55
Sheet Piling Sections 56
Center Sill Section 56
Cross Tie Sections 57
Column Sections—Carnegie Beams with Cover Plates 58– 63
Rectangles—Moments of Inertia 64– 65
Angles, Back to Back—Radii of Gyration 66– 69

Flat Rolled Steel—Sizes

Universal Mill Plates—Carbon Steel 70
Sheared Plates—Carbon Steel 71
Sheared Plates—Nickel Steel 72
Flats—Band Edge, Square Edge, Round Edge 73

Rectangular, Square and Round Sections

Tables of Weights and Areas 74– 81

Stresses in Beams

Explanatory Notes 82– 85
Flexure Formulas 86– 89

Sections as Beams

Explanatory Notes 90– 97

Bending Moments and Web Resistances

Beams—Carnegie Beam Sections 98–102
" —Standard Mill Sections 103
" —H-Beams 103
" —American Standard Sections 104–105
Channels—American Standard Sections 106–107

Comparative Tables of Section Moduli

Carnegie and American Standard Beam Sections 108–113

PAGE

Beam Safe Loads and Detailing Data

Beams —Carnegie Beam Sections....114–145
" —Standard Mill Sections....146–147
" —H-Beams....148–149
" —American Standard Sections....150–169
Channels—American Standard Sections....170–181
Angles —Unequal and Equal Legs....182–186
Tees and Zees.... 187

Plate and Angle Girders

Explanatory Notes and Design....188–195
Crane Runway Girder....196–197
Elements of Component Parts....198–199

Columns and Struts

Explanatory Notes and Design....200–202
Tables of Unit Compressive Stresses....203–205

Column Safe Loads

Carnegie Beam Sections—Comparative Values....206–207
Carnegie Beam Sections—Columns....208–220
Miscellaneous Small Columns.... 221
Carnegie Beam Sections—Cover Plates....222–227
Beams—American Standard.... 228

Rivets and Pins—Stresses

Explanatory Notes.... 229
Rivets—Shearing and Bearing Values....230–231
Pins —Bearing Values and Bending Moments....232–233

Structural Details—Rivets and Bolts

Rivets—Details for Punching and Riveting.... 234
" —Spacing of Rivets.... 235
" —Reduction of Area for Rivet Holes.... 236
" —Pitch of Rivets.... 236
" —Length of Field Rivets.... 237
" —Weight of Structural Rivets.... 238
Bolts —Screw Threads.... 239
" —Bolt Heads and Nuts.... 240
" —Weight of Bolts and Nuts....241–242

Structural Details—Miscellaneous

Recessed Pin Nuts and Cotter Pins.... 243
Upset Screw Ends—Square and Round Bars....244–245
Eye Bars and Loop Rods....246–247
Clevises, Turnbuckles and Sleeve Nuts....248–249

Structural Details—Beam Design

Beam Connection Angles....250–251
Beam Separators.... 252
Tie Rods and Anchors.... 253
Bearing Plates....254–255

Floor Plates

Flat Rectangular and Buckle Plates....256–257

Tables of Measure

Birmingham Wire Gage.... 258
Decimals of an Inch and of a Foot.... 259

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