BAE 701 Engineering Fundamental

Civil

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select one specialisation

Section 1-Civil Engineering (PDFFile Page 7)
Section 6- Water & Waste Water Engineering (PDF File Page 1041)
Section 7-Environmental Engineering (PDF File Page 1078) 2

For every topic, you need to write the short note on what you understand, formula, summary, outlines and at least 2 problems solution (Please note, each problem is solved in short form, you need to clearly reproduce them by step by step)

Section 1-Civil Engineering (PDFFile Page 7)

STRUCTURAL STEEL DESIGN

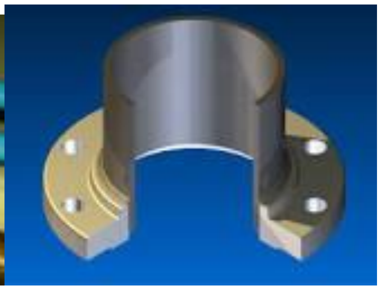
Steel Beams and Plate Girders

Notes

The notational system used conforms with that given, and it is augmented to include the following:
Aw = area of flange, in2 (cm2);
Aw = area of web, in2 (cm2);
bf = width of flange, in (mm);
d =depth of section, in (mm);
dw = depth of web, in (mm);
tf = thickness of flange, in (mm);
tw = thicknessof web, in (mm);
L′ = unbraced length of compression flange, in (mm);
fy = yield-point stress,
lb/in2 (kPa).

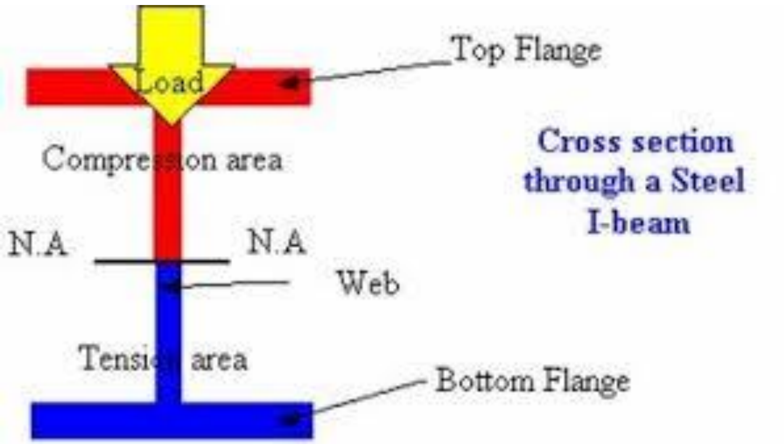
Flange?----- Internet search

A flange is an external or internal ridge, or rim, for strength, as the flange of an iron beam such as an I-beam or a T-beam; or for attachment to another object, as the flange on the end of a pipe



Web? Internet search

Images for area of web i beam



It is an example of every new technical term is described and appropriate internet research is performed so that you can understand the exact meaning.

Problem

A beam on a simple span of 30 ft (9.2 m) carries a uniform superimposed load of 1650 lb/lin ft(24,079.9 N/m). The compression flange is laterally supported along its entire length. Select the most economic section.

Calculation Procedure in the book

1. Compute the maximum bending moment and the required section modulus. Assume that the beam weighs 50 lb/lin ft (729.7 N/m) and satisfies the requirements of a compact section as set forth in the *Specification*.

The maximum bending moment is $M = (1/8)wL2 = (1/8)(1700)(30)2(12) = 2{,}295{,}000$ in·lb (259,289.1 N·m).

Referring to the *Specification* shows that the allowable bending stress is 24,000 lb/in2 (165,480.0 kPa). Then $S = M/f = 2{,}295{,}000/24{,}000 = 95.6$ in3 (1566.88 cm3).

2. Select the most economic section. Refer to the AISC *Manual*, and select the most economic section. Use W18 × 55 = 98.2 in3 (1609.50 cm3); section compact. The disparity between the assumed and actual beam weight is negligible.

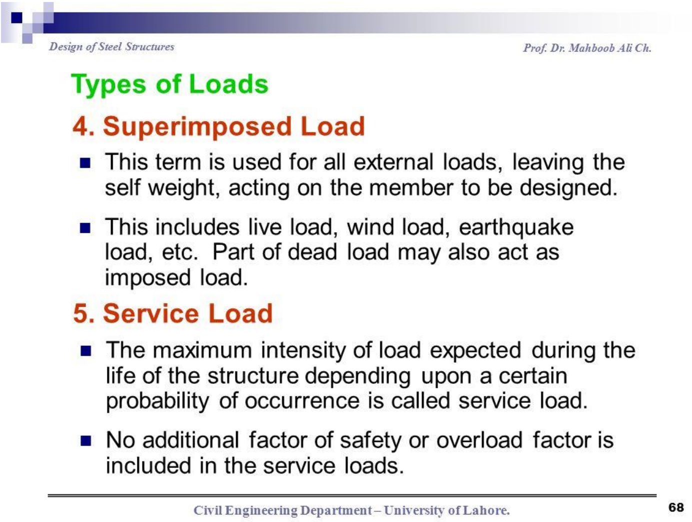
A second method for making this selection is shown below.

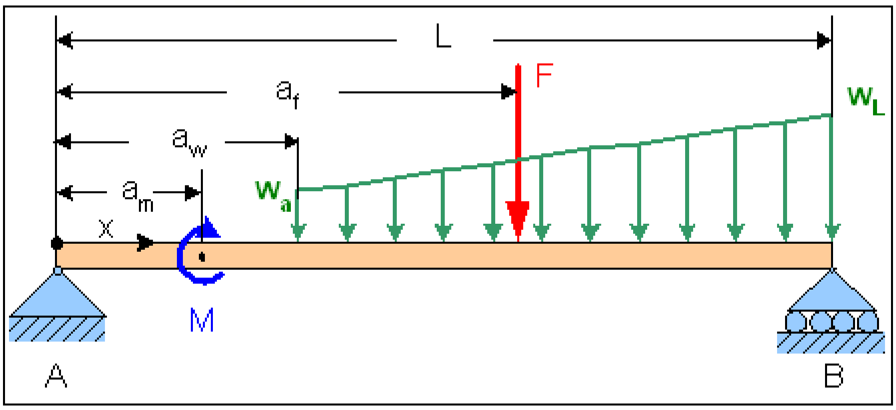
3. Calculate the total load on the member. Thus, the total load = *W* = 30(1700) = 51,000 lb (226,848.0 N).

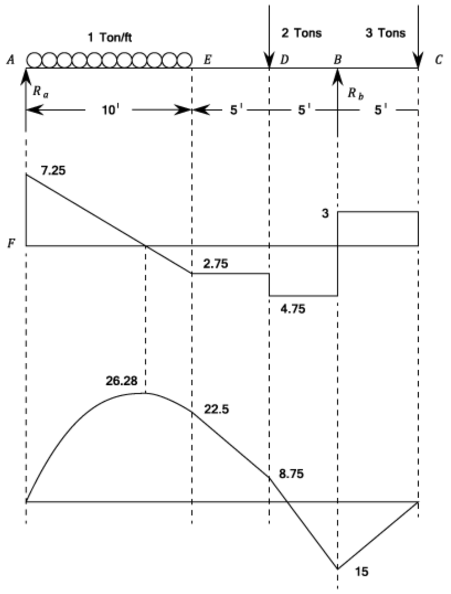
4. Select the most economic section. Refer to the tables of allowable uniform loads in the *Manual*, and select the most economic section. Thus, use W18 × 55; *W*allow = 52,000 lb (231,296.0 N). The capacity of the beam is therefore slightly greater than required.

Detailed explanation to be done (Worked Example)

Superimposed load-/ Maximum bending moment/ Section modulus -- Internet search







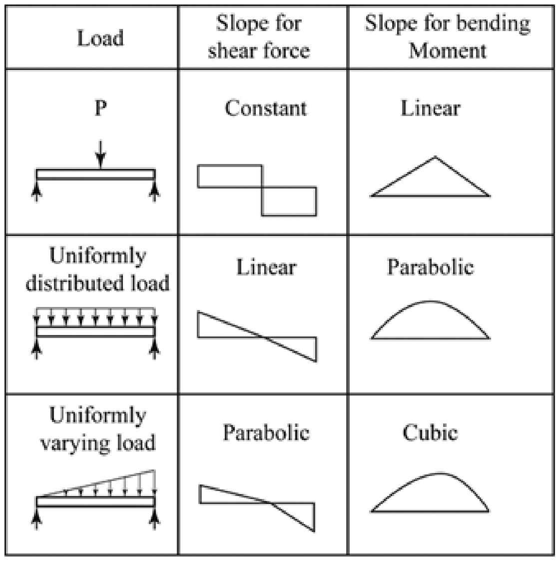


Figure-1 Slopes for various types of loads

Section modulus is a geometric property for a given cross-**section** used in the design of beams or flexural members. Other geometric properties used in design include area for tension and shear, radius of gyration for compression, and moment of inertia and polar moment of inertia for stiffness.

Calculating the section modulus

To calculate the section modulus, the following formula applies:

$Z = \frac{I}{y}$ where *I* = moment of inertia, y = distance from centroid to top or bottom edge of the rectangle $\left(\frac{d}{2}\right)$

For symmetrical sections the value of **Z** is the same above or below the centroid.

For asymmetrical sections, two values are found: **Z** max and **Z** min.

To calculate the value of **Z** for a simple symmetrical shape such as a rectangle:

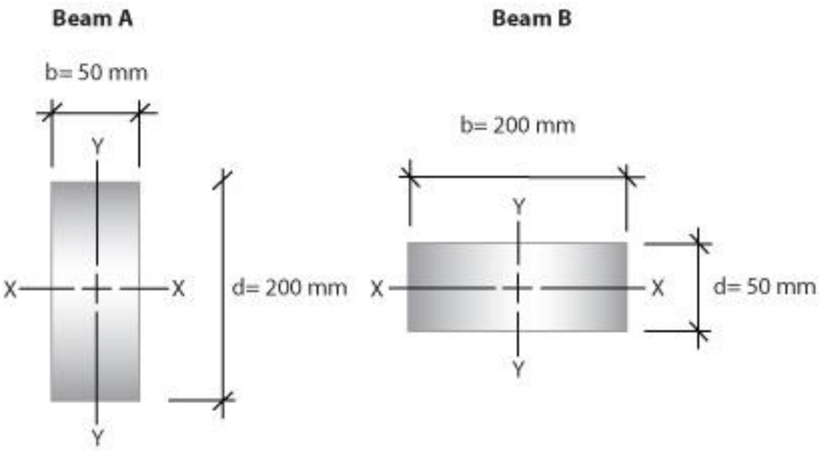
$Z_{xx} = \frac{I_{xx}}{y}$ where $I_{xx} = \frac{bd^3}{12} \text{ mm}^4$

and y = $\frac{1}{2}$ depth or $\frac{d}{2}$ mm

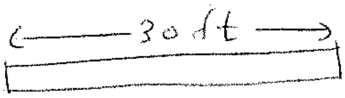
This gives the formula for **Z** as: $Z = \frac{bd^2}{6} \text{ mm}^3$

Note: The standard form of writing the value of **Z** is to write it as a number x 10^3 mm^3, eg a value of 2,086 is written as 2.086 x 10^3.

Calculating Z



WORKED EXAMPLE FOR GIVEN PROBLEM AND SHORT SOLUTION PROCESS



Superimposed load = 1650 lb / Lin ft

Take 1700

maximum bending moment = $m = \frac{wl^2}{8}$ ft-lb

$m = \frac{wl^2}{8} \times 12$ in-lb

$\therefore m = \frac{1700 \times 30^2 \times 12}{8} = 2295000$ in lb

1 in lb = 0.113 N-m (Internet search)

$\therefore$ 2295000 in lb ⇒ 2295000 × 0.113

= 259289 N-m

Allowable bending stress (as per American Steel standard specification) is 24000 lb/in²

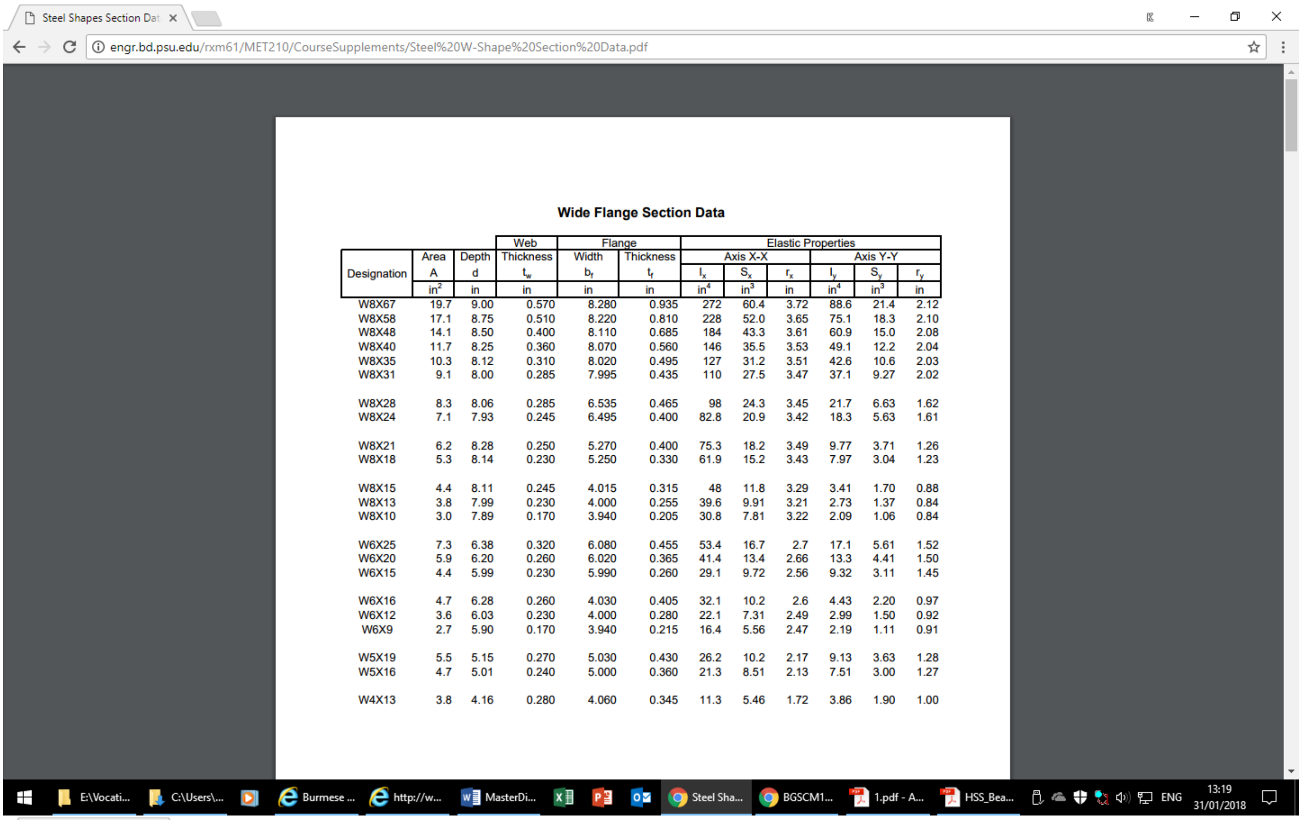
$\text{Index}(S) = \frac{\text{Bending moment}}{\text{maximum Bending Stress}}$

$S = \frac{m}{f} = \frac{2295000}{24000} = 95.6 \text{ in}^3$

(or) (1566.88 cm³)

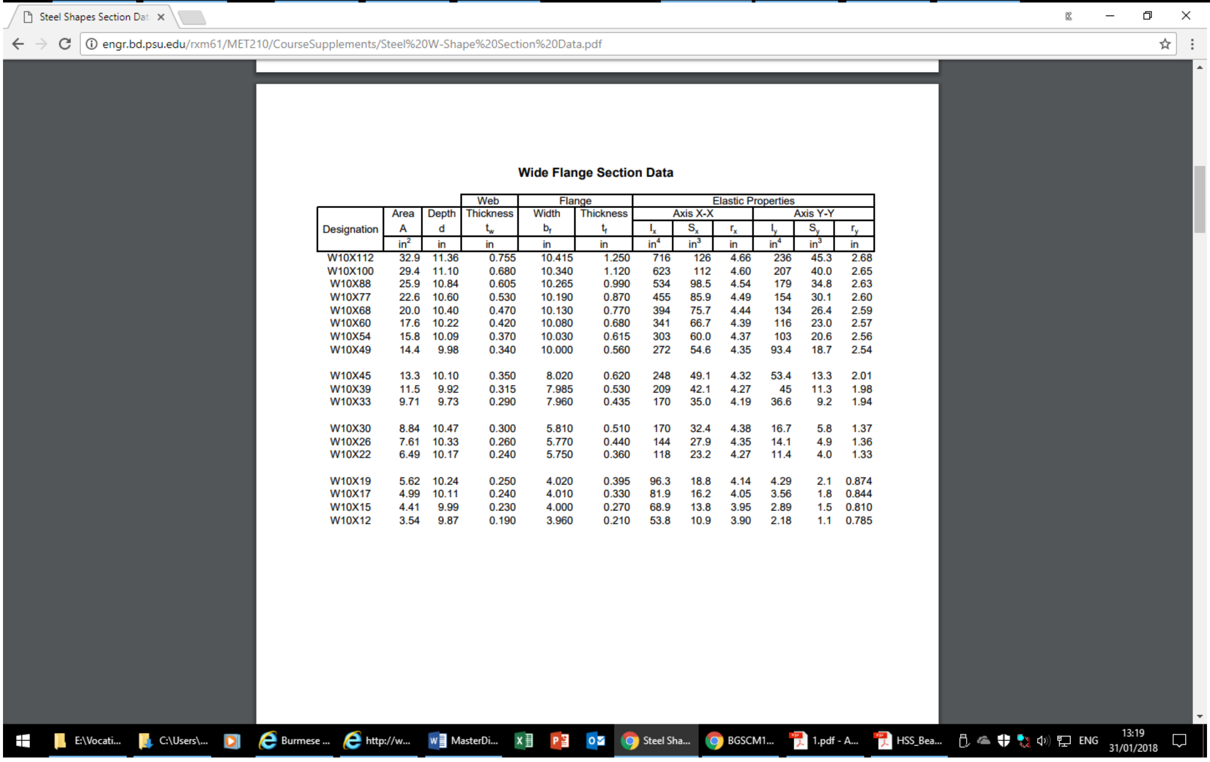
Steel shape section data

http://engr.bd.psu.edu/rxm61/MET210/CourseSupplements/Steel%20W-Shape%20Section%20Data.pdf



Wide Flange Section Data

Designation	Area	Depth	Web Thickness	Flange Width	Flange Thickness	Elastic Properties Axis X-X			Axis Y-Y		
	A	d	t_w	b_f	t_f	I_x	S_x	r_x	I_y	S_y	r_y
	in^2	in	in	in	in	in^4	in^3	in	in^4	in^3	in
W8X67	19.7	9.00	0.570	8.280	0.935	272	60.4	3.72	88.6	21.4	2.12
W8X58	17.1	8.75	0.510	8.220	0.810	228	52.0	3.65	75.1	18.3	2.10
W8X48	14.1	8.50	0.400	8.110	0.685	184	43.3	3.61	60.9	15.0	2.08
W8X40	11.7	8.25	0.360	8.070	0.560	146	35.5	3.53	49.1	12.2	2.04
W8X35	10.3	8.12	0.310	8.020	0.495	127	31.2	3.51	42.6	10.6	2.03
W8X31	9.1	8.00	0.285	7.995	0.435	110	27.5	3.47	37.1	9.27	2.02
W8X28	8.3	8.06	0.285	6.535	0.465	98	24.3	3.45	21.7	6.63	1.62
W8X24	7.1	7.93	0.245	6.495	0.400	82.8	20.9	3.42	18.3	5.63	1.61
W8X21	6.2	8.28	0.250	5.270	0.400	75.3	18.2	3.49	9.77	3.71	1.26
W8X18	5.3	8.14	0.230	5.250	0.330	61.9	15.2	3.43	7.97	3.04	1.23
W8X15	4.4	8.11	0.245	4.015	0.315	48	11.8	3.29	3.41	1.70	0.88
W8X13	3.8	7.99	0.230	4.000	0.255	39.6	9.91	3.21	2.73	1.37	0.84
W8X10	3.0	7.89	0.170	3.940	0.205	30.8	7.81	3.22	2.09	1.06	0.84
W6X25	7.3	6.38	0.320	6.080	0.455	53.4	16.7	2.7	17.1	5.61	1.52
W6X20	5.9	6.20	0.260	6.020	0.365	41.4	13.4	2.66	13.3	4.41	1.50
W6X15	4.4	5.99	0.230	5.990	0.260	29.1	9.72	2.56	9.32	3.11	1.45
W6X16	4.7	6.28	0.260	4.030	0.405	32.1	10.2	2.6	4.43	2.20	0.97
W6X12	3.6	6.03	0.230	4.000	0.280	22.1	7.31	2.49	2.99	1.50	0.92
W6X9	2.7	5.90	0.170	3.940	0.215	16.4	5.56	2.47	2.19	1.11	0.91
W5X19	5.5	5.15	0.270	5.030	0.430	26.2	10.2	2.17	9.13	3.63	1.28
W5X16	4.7	5.01	0.240	5.000	0.360	21.3	8.51	2.13	7.51	3.00	1.27
W4X13	3.8	4.16	0.280	4.060	0.345	11.3	5.46	1.72	3.86	1.90	1.00



Wide Flange Section Data

Designation	Area	Depth	Web Thickness	Flange Width	Flange Thickness	Elastic Properties Axis X-X			Axis Y-Y		
	A	d	t_w	b_f	t_f	I_x	S_x	r_x	I_y	S_y	r_y
	in^2	in	in	in	in	in^4	in^3	in	in^4	in^3	in
W10X112	32.9	11.36	0.755	10.415	1.250	716	126	4.66	236	45.3	2.68
W10X100	29.4	11.10	0.680	10.340	1.120	623	112	4.60	207	40.0	2.65
W10X88	25.9	10.84	0.605	10.265	0.990	534	98.5	4.54	179	34.8	2.63
W10X77	22.6	10.60	0.530	10.190	0.870	455	85.9	4.49	154	30.1	2.60
W10X68	20.0	10.40	0.470	10.130	0.770	394	75.7	4.44	134	26.4	2.59
W10X60	17.6	10.22	0.420	10.080	0.680	341	66.7	4.39	116	23.0	2.57
W10X54	15.8	10.09	0.370	10.030	0.615	303	60.0	4.37	103	20.6	2.56
W10X49	14.4	9.98	0.340	10.000	0.560	272	54.6	4.35	93.4	18.7	2.54
W10X45	13.3	10.10	0.350	8.020	0.620	248	49.1	4.32	53.4	13.3	2.01
W10X39	11.5	9.92	0.315	7.985	0.530	209	42.1	4.27	45	11.3	1.98
W10X33	9.71	9.73	0.290	7.960	0.435	170	35.0	4.19	36.6	9.2	1.94
W10X30	8.84	10.47	0.300	5.810	0.510	170	32.4	4.38	16.7	5.8	1.37
W10X26	7.61	10.33	0.260	5.770	0.440	144	27.9	4.35	14.1	4.9	1.36
W10X22	6.49	10.17	0.240	5.750	0.360	118	23.2	4.27	11.4	4.0	1.33
W10X19	5.62	10.24	0.250	4.020	0.395	96.3	18.8	4.14	4.29	2.1	0.874
W10X17	4.99	10.11	0.240	4.010	0.330	81.9	16.2	4.05	3.56	1.8	0.844
W10X15	4.41	9.99	0.230	4.000	0.270	68.9	13.8	3.95	2.89	1.5	0.810
W10X12	3.54	9.87	0.190	3.960	0.210	53.8	10.9	3.90	2.18	1.1	0.785

Wide Flange Section Data

			Web	Flange		Elastic Properties					
	Area	Depth	Thickness	Width	Thickness	Axis X-X			Axis Y-Y		
Designation	A	d	t_w	b_f	t_f	I_x	S_x	r_x	I_y	S_y	r_y
	in^2	in	in	in	in	in^4	in^3	in	in^4	in^3	in
W12X336	98.8	16.82	1.775	13.385	2.955	4060	483	6.41	1190	177	3.47
W12X305	89.6	16.32	1.625	13.235	2.705	3550	435	6.29	1050	159	3.42
W12X279	81.9	15.85	1.530	13.140	2.470	3110	393	6.16	937	143	3.38
W12X252	74.1	15.41	1.395	13.005	2.250	2720	353	6.06	828	127	3.34
W12X230	67.7	15.05	1.285	12.895	2.070	2420	321	5.97	742	115	3.31
W12X210	61.8	14.71	1.180	12.790	1.900	2140	292	5.89	664	104	3.28
W12X190	55.8	14.38	1.060	12.670	1.735	1890	263	5.82	589	93.0	3.25
W12X170	50.0	14.03	0.960	12.570	1.560	1650	235	5.74	517	82.3	3.22
W12X152	44.7	13.71	0.870	12.480	1.400	1430	209	5.66	454	72.8	3.19
W12X136	39.9	13.41	0.790	12.400	1.250	1240	186	5.58	398	64.2	3.16
W12X120	35.3	13.12	0.710	12.320	1.105	1070	163	5.51	345	56.0	3.13
W12X106	31.2	12.89	0.610	12.220	0.990	933	145	5.47	301	49.3	3.11
W12X96	28.2	12.71	0.550	12.160	0.900	833	131	5.44	270	44.4	3.09
W12X87	25.6	12.53	0.515	12.125	0.810	740	118	5.38	241	39.7	3.07
W12X79	23.2	12.38	0.470	12.080	0.735	662	107	5.34	216	35.8	3.05
W12X72	21.1	12.25	0.430	12.040	0.670	597	97.4	5.31	195	32.4	3.04
W12X65	19.1	12.12	0.390	12.000	0.605	533	87.9	5.28	174	29.1	3.02
W12X58	17.0	12.19	0.360	10.010	0.640	475	78.0	5.28	107	21.4	2.51
W12X53	15.6	12.06	0.345	9.995	0.575	425	70.6	5.23	95.8	19.2	2.48
W12X50	14.7	12.19	0.370	8.080	0.640	394	64.7	5.18	56.3	13.9	1.96
W12X45	13.2	12.06	0.335	8.045	0.575	350	58.1	5.15	50.0	12.4	1.94
W12X40	11.8	11.94	0.295	8.005	0.515	310	51.9	5.13	44.1	11.0	1.93
W12X35	10.3	12.50	0.300	6.560	0.520	285	45.6	5.25	24.5	7.47	1.54
W12X30	8.79	12.34	0.260	6.520	0.440	238	38.6	5.21	20.3	6.24	1.52
W12X26	7.65	12.22	0.230	6.490	0.380	204	33.4	5.17	17.3	5.34	1.51
W12X22	6.48	12.31	0.260	4.030	0.425	156	25.4	4.91	4.66	2.31	0.847
W12X19	5.57	12.16	0.235	4.005	0.350	130	21.3	4.82	3.76	1.88	0.822
W12X16	4.71	11.99	0.220	3.990	0.265	103	17.1	4.67	2.82	1.41	0.773
W12X14	4.16	11.91	0.200	3.970	0.225	88.6	14.9	4.62	2.36	1.19	0.753

			Web	Flange		Elastic Properties					
	Area	Depth	Thickness	Width	Thickness	Axis X-X			Axis Y-Y		
Designation	A	d	t_w	b_f	t_f	I_x	S_x	r_x	I_y	S_y	r_y
	in^2	in	in	in	in	in^4	in^3	in	in^4	in^3	in
W14X730	215.0	22.42	3.070	17.890	4.910	14300	1280	8.17	4720	527	4.69
W14X665	196.0	21.64	2.830	17.650	4.520	12400	1150	7.98	4170	472	4.62
W14X605	178.0	20.92	2.595	17.415	4.160	10800	1040	7.80	3680	423	4.55
W14X550	162.0	20.24	2.380	17.200	3.820	9430	931	7.63	3250	378	4.49
W14X500	147.0	19.60	2.190	17.010	3.500	8210	838	7.48	2880	339	4.43
W14X455	134.0	19.02	2.015	16.835	3.210	7190	756	7.33	2560	304	4.38
W14X426	125.0	18.67	1.875	16.695	3.035	6600	707	7.26	2360	283	4.34
W14X398	117.0	18.29	1.770	16.590	2.845	6000	656	7.16	2170	262	4.31
W14X370	109.0	17.92	1.655	16.475	2.660	5440	607	7.07	1990	241	4.27
W14X342	101.0	17.54	1.540	16.360	2.470	4900	559	6.98	1810	221	4.24
W14X311	91.4	17.12	1.410	16.230	2.260	4330	506	6.88	1610	199	4.20
W14X283	83.3	16.74	1.290	16.110	2.070	3840	459	6.79	1440	179	4.17
W14X257	75.6	16.38	1.175	15.995	1.890	3400	415	6.71	1290	161	4.13
W14X233	68.5	16.04	1.070	15.890	1.720	3010	375	6.63	1150	145	4.10
W14X211	62.0	15.72	0.980	15.800	1.560	2660	338	6.55	1030	130	4.07
W14X193	56.8	15.48	0.890	15.710	1.440	2400	310	6.50	931	119	4.05
W14X176	51.8	15.22	0.830	15.650	1.310	2140	281	6.43	838	107	4.02
W14X159	46.7	14.98	0.745	15.565	1.190	1900	254	6.38	748	96.2	4.00
W14X145	42.7	14.78	0.680	15.500	1.090	1710	232	6.33	677	87.3	3.98
W14X132	38.8	14.66	0.645	14.725	1.030	1530	209	6.28	548	74.5	3.76
W14X120	35.3	14.48	0.590	14.670	0.940	1380	190	6.24	495	67.5	3.74
W14X109	32.0	14.32	0.525	14.605	0.860	1240	173	6.22	447	61.2	3.73
W14X99	29.1	14.16	0.485	14.565	0.780	1110	157	6.17	402	55.2	3.71
W14X90	26.5	14.02	0.440	14.520	0.710	999	143	6.14	362	49.9	3.70
W14X82	24.1	14.31	0.510	10.130	0.855	882	123	6.05	148	29.3	2.48
W14X74	21.8	14.17	0.450	10.070	0.785	796	112	6.04	134	26.6	2.48
W14X68	20.0	14.04	0.415	10.035	0.720	723	103	6.01	121	24.2	2.46
W14X61	17.9	13.89	0.375	9.995	0.645	640	92.2	5.98	107	21.5	2.45
W14X53	15.6	13.92	0.370	8.060	0.660	541	77.8	5.89	57.7	14.3	1.92
W14X48	14.1	13.79	0.340	8.030	0.595	485	70.3	5.85	51.4	12.8	1.91
W14X43	12.6	13.66	0.305	7.995	0.530	428	62.7	5.82	45.2	11.3	1.89
W14X38	11.2	14.10	0.310	6.770	0.515	385	54.6	5.87	26.7	7.88	1.55
W14X34	10.0	13.98	0.285	6.745	0.455	340	48.6	5.83	23.3	6.91	1.53
W14X30	8.85	13.84	0.270	6.730	0.385	291	42.0	5.73	19.6	5.82	1.49
W14X26	7.69	13.91	0.255	5.025	0.420	245	35.3	5.65	8.91	3.54	1.08
W14X22	6.49	13.74	0.230	5.000	0.335	199	29.0	5.54	7.00	2.80	1.04

engr.bd.psu.edu/rxm61/MET210/CourseSupplements/Steel%20W-Shape%20Section%20Data.pdf

Wide Flange Section Data

Designation	Area	Depth	Web	Flange		Elastic Properties					
						Axis X-X			Axis Y-Y		
	A	d	Thickness t_w	Width b_f	Thickness t_f	I_x	S_x	r_x	I_y	S_y	r_y
	in^2	in	in	in	in	in^4	in^3	in	in^4	in^3	in
W18X119	35.1	18.97	0.655	11.265	1.060	2190	231	7.90	253	44.9	2.69
W18X106	31.1	18.73	0.590	11.200	0.940	1910	204	7.84	220	39.4	2.66
W18X97	28.5	18.59	0.535	11.145	0.870	1750	188	7.82	201	36.1	2.65
W18X86	25.3	18.39	0.480	11.090	0.770	1530	166	7.77	175	31.6	2.63
W18X76	22.3	18.21	0.425	11.035	0.680	1330	146	7.73	152	27.6	2.61
W18X71	20.8	18.47	0.495	7.635	0.810	1170	127	7.50	60.3	15.8	1.70
W18X65	19.1	18.35	0.450	7.590	0.750	1070	117	7.49	54.8	14.4	1.69
W18X60	17.6	18.24	0.415	7.555	0.695	984	108	7.47	50.1	13.3	1.69
W18X55	16.2	18.11	0.390	7.530	0.630	890	98.3	7.41	44.9	11.9	1.67
W18X50	14.7	17.99	0.355	7.495	0.570	800	88.9	7.38	40.1	10.7	1.65
W18X46	13.5	18.06	0.360	6.060	0.605	712	78.8	7.25	22.5	7.43	1.29
W18X40	11.8	17.90	0.315	6.015	0.525	612	68.4	7.21	19.1	6.35	1.27
W18X35	10.3	17.70	0.300	6.000	0.425	510	57.6	7.04	15.3	5.12	1.22
W16X100	29.4	16.97	0.585	10.425	0.985	1490	175	7.10	186	35.7	2.51
W16X89	26.2	16.75	0.525	10.365	0.875	1300	155	7.05	163	31.4	2.49
W16X77	22.6	16.52	0.455	10.295	0.760	1110	134	7.00	138	26.9	2.47
W16X67	19.7	16.33	0.395	10.235	0.665	954	117	6.96	119	23.2	2.46
W16X57	16.8	16.43	0.430	7.120	0.715	758	92.2	6.72	43.1	12.1	1.60
W16X50	14.7	16.26	0.380	7.070	0.630	659	81.0	6.68	37.2	10.5	1.59
W16X45	13.3	16.13	0.345	7.035	0.565	586	72.7	6.65	32.8	9.34	1.57
W16X40	11.8	16.01	0.305	6.995	0.505	518	64.7	6.63	28.9	8.25	1.57
W16X36	10.6	15.86	0.295	6.985	0.430	448	56.5	6.51	24.5	7.00	1.52
W16X31	9.12	15.88	0.275	5.525	0.440	375	47.2	6.41	12.4	4.49	1.17
W16X26	7.68	15.69	0.250	5.500	0.345	301	38.4	6.26	9.59	3.49	1.12

http://www.toolsforengineer.com/w18x55/

www.toolsforengineer.com/w18x55/

W18X55

July 14, 2016 admin

	Type	W
	AISC Manual Label	W18X55
W	W – Nominal weight, (kg/m)	55
A	A – Cross-sectional area,(mm2)	16.2
d	d – Overall depth of member, (mm)	18.1
ddet	ddet – Detailing value of member depth,(mm)	18.125
Ht	Ht – Overall depth of square or rectangular HSS, (mm)	□
h	h – Depth of the flat wall of square or rectangular HSS,(mm)	□
OD	OD – Outside diameter of round HSS or pipe, in. (mm)	□
bf	bf – Flange width, in. (mm)	7.53
bfdet	bfdet – Detailing value of flange width, in. (mm)	7.5
B	B – Overall width of square or rectangular HSS, in. (mm)	□
b	b – Width , in. (mm)	□
ID	ID – Inside diameter of round HSS or pipe, in. (mm)	□
tw	tw – Web thickness, in. (mm)	0.39
twdet	twdet – Detailing value of web thickness, in. (mm)	0.375
twdet/2	twdet/2 – Detailing value of tw/2, in. (mm)	0.1875
tf	tf – Flange thickness, in. (mm)	0.63
tfdet	tfdet – Detailing value of flange thickness, in. (mm)	0.625
t	t – Thickness of angle leg, in. (mm)	□
tnom	tnom – HSS and pipe nominal wall thickness, (mm)	□

Steel Section – CISC

https://www.engineeringtoolbox.com/american-wide-flange-steel-beams-d_1319.html

Designation	Dimensions						Static Parameters			
							Moment of Inertia		Elastic Section Modulus	
Imperial *(in x lb/ft)*	**Depth h** *(in)*	**Width w** *(in)*	**Web Thickness t_w** *(in)*	**Flange Thickness t_f** *(in)*	**Sectional Area** *(in^2)*	**Weight** *(lb/ft)*	I_x *(in^4)*	I_y *(in^4)*	W_x *(in^3)*	W_y *(in^3)*
W 27 x 178	27.8	14.09	0.725	1.190	52.3	178	6990	555	502	78.8
W 27 x 161	27.6	14.02	0.660	1.080	47.4	161	6280	497	455	70.9
W 27 x 146	27.4	14	0.605	0.975	42.9	146	5630	443	411	63.5
W 27 x 114	27.3	10.07	0.570	0.930	33.5	114	4090	159	299	31.5
W 27 x 102	27.1	10.02	0.515	0.830	30.0	102	3620	139	267	27.8
W 27 x 94	26.9	10	0.490	0.745	27.7	94	3270	124	243	24.8
W 27 x 84	26.7	9.96	0.460	0.640	24.8	84	2850	106	213	21.2
W 24 x 162	25	13	0.705	1.220	47.7	162	5170	443	414	68.4
W 24 x 146	24.7	12.9	0.650	1.090	43.0	146	4580	391	371	60.5
W 24 x 131	24.5	12.9	0.605	0.960	38.5	131	4020	340	329	53.0
W 24 x 117	24.3	12.8	0.55	0.850	34.4	117	3540	297	291	46.5
W 24 x 104	24.1	12.75	0.500	0.750	30.6	104	3100	259	258	40.7
W 24 x 94	24.1	9.07	0.515	0.875	27.7	94	2700	109	222	24.0
W 24 x 84	24.1	9.02	0.470	0.770	24.7	84	2370	94.4	196	20.9

Designation	Dimensions						Static Parameters			
							Moment of Inertia		Elastic Section Modulus	
Imperial ***(in x lb/ft)***	**Depth h** ***(in)***	**Width w** ***(in)***	**Web Thickness t_w** ***(in)***	**Flange Thickness t_f** ***(in)***	**Sectional Area** ***(in^2)***	**Weight** ***(lb/ft)***	**I_x** ***(in^4)***	**I_y** ***(in^4)***	**W_x** ***(in^3)***	**W_y** ***(in^3)***
W 24 x 76	23.9	9	0.440	0.680	22.4	76	2100	82.5	176	18.4
W 24 x 68	23.7	8.97	0.415	0.585	20.1	68	1830	70.4	154	15.7
W 24 x 62	23.7	7.04	0.430	0.590	18.2	62	1550	34.5	131	9.8
W 24 x 55	23.6	7.01	0.395	0.505	16.2	55	1350	29.1	114	8.3
W 21 x 147	22.1	12.51	0.720	1.150	43.2	147	3630	376	329	60.1
W 21 x 132	21.8	12.44	0.650	1.035	38.8	132	3220	333	295	53.5
W 21 x 122	21.7	12.39	0.600	0.960	35.9	122	2960	305	273	49.2
W 21 x 111	21.5	12.34	0.550	0.875	32.7	111	2670	274	249	44.5
W 21 x 101	21.4	12.29	0.500	0.800	29.8	101	2420	248	227	40.3
W 21 x 93	21.6	8.42	0.580	0.930	27.3	93	2070	92.9	192	22.1
W 21 x 83	21.4	8.36	0.515	0.835	24.3	83	1830	81.4	171	19.5
W 21 x 73	21.2	8.3	0.455	0.740	21.5	73	1600	70.6	151	17.0
W 21 x 68	21.1	8.27	0.430	0.685	20.0	68	1480	64.7	140	15.7
W 21 x 62	21	8.24	0.400	0.615	18.3	62	1330	57.5	127	13.9
W 21 x 57	21.1	6.56	0.405	0.650	16.7	57	1170	30.6	111	9.4

Designation	Dimensions						Static Parameters			
							Moment of Inertia		Elastic Section Modulus	
Imperial ***(in x lb/ft)***	**Depth h** ***(in)***	**Width w** ***(in)***	**Web Thickness t_w** ***(in)***	**Flange Thickness t_f** ***(in)***	**Sectional Area** ***(in^2)***	**Weight** ***(lb/ft)***	**I_x** ***(in^4)***	**I_y** ***(in^4)***	**W_x** ***(in^3)***	**W_y** ***(in^3)***
W 21 x 50	20.8	6.53	0.380	0.535	14.7	50	984	24.9	94.5	7.6
W 21 x 44	20.7	6.5	0.350	0.450	13.0	44	843	20.7	81.6	6.4
W 18 x 119	19	11.27	0.655	1.060	35.1	119	2190	253	231	44.9
W 18 x 106	18.7	11.2	0.590	0.940	31.1	106	1910	220	204	39.4
W 18 x 97	18.6	11.15	0.535	0.870	28.5	97	1750	201	188	36.1
W 18 x 86	18.4	11.09	0.480	0.770	25.3	86	1530	175	166	31.6
W 18 x 76	18.2	11.04	0.425	0.680	22.3	76	1330	152	146	27.6
W 18 x 71	18.5	7.64	0.495	0.810	20.8	71	1170	60.3	127	15.8
W 18 x 65	18.4	7.59	0.450	0.750	19.1	65	1070	54.8	117	14.4
W 18 x 60	18.2	7.56	0.415	0.695	17.6	60	984	50.1	108	13.3
W 18 x 55	18.1	7.53	0.390	0.630	16.2	55	890	44.9	98.3	11.9
W 18 x 50	18	7.5	0.355	0.570	14.7	50	800	40.1	88.9	10.7
W 18 x 46	18.1	6.06	0.360	0.605	13.5	46	712	22.5	78.8	7.4
W 18 x 40	17.9	6.02	0.315	0.525	11.8	40	612	19.1	68.4	6.4
W 18 x 35	17.7	6	0.300	0.425	10.3	35	510	15.3	57.6	5.1

Designation	Dimensions						Static Parameters			
							Moment of Inertia		Elastic Section Modulus	
Imperial *(in x lb/ft)*	**Depth h** *(in)*	**Width w** *(in)*	**Web Thickness t_w** *(in)*	**Flange Thickness t_f** *(in)*	**Sectional Area** *(in^2)*	**Weight** *(lb/ft)*	**I_x** *(in^4)*	**I_y** *(in^4)*	**W_x** *(in^3)*	**W_y** *(in^3)*
W 16 x 100	16.97	10.425	0.585	0.985	29.4	100	1490	186	175	35.7
W 16 x 89	16.75	10.365	0.525	0.875	26.2	89	1300	163	155	31.4
W 16 x 77	16.52	10.295	0.455	0.760	22.6	77	1100	138	134	26.9
W 16 x 67	16.33	10.235	0.395	0.665	19.7	67	954	119	117	23.2
W 16 x 57	16.43	7.120	0.430	0.715	16.8	57	758	43.1	92.2	12.1
W 16 x 50	16.26	7.070	0.380	0.630	14.7	50	659	37.2	81	10.5
W 16 x 45	16.13	7.035	0.345	0.565	13.3	45	586	32.8	72.7	9.3
W 16 x 40	16.01	6.995	0.305	0.505	11.8	40	518	28.9	64.7	8.3
W 16 x 36	15.86	6.985	0.295	0.430	10.6	36	448	24.5	56.5	7
W 16 x 31	15.88	5.525	0.275	0.440	9.12	31	375	12.4	47.2	4.5
W 16 x 26	15.69	5.5	0.250	0.345	7.68	26	301	9.6	38.4	3.5
W 14 x 132	14.66	14.725	0.645	1.030	38.8	132	1530	548	209	74.5
W 14 x 120	14.48	14.670	0.590	0.940	35.3	120	1380	495	190	67.5
W 14 x 109	14.32	14.605	0.525	0.860	32	109	1240	447	173	61.2

Designation	Dimensions						Static Parameters			
							Moment of Inertia		Elastic Section Modulus	
Imperial ***(in x lb/ft)***	**Depth h** ***(in)***	**Width w** ***(in)***	**Web Thickness** t_w ***(in)***	**Flange Thickness** t_f ***(in)***	**Sectional Area** ***(in²)***	**Weight** ***(lb/ft)***	I_x ***(in⁴)***	I_y ***(in⁴)***	W_x ***(in³)***	W_y ***(in³)***
W 14 x 99	14.16	14.565	0.485	0.780	29.1	99	1110	402	157	55.2
W 14 x 90	14.02	14.520	0.440	0.710	26.5	90	999	362	143	49.9
W 14 x 82	14.31	10.130	0.510	0.855	24.1	82	882	148	123	29.3
W 14 x 74	14.17	10.070	0.450	0.785	21.8	74	796	134	112	26.6
W 14 x 68	14.04	10.035	0.415	0.720	20.0	68	723	121	103	24.2
W 14 x 61	13.89	9.995	0.375	0.645	17.9	61	640	107	92.2	21.5
W 14 x 53	13.92	8.060	0.370	0.660	15.6	53	541	57.7	77.8	14.3
W 14 x 48	13.79	8.030	0.340	0.595	14.1	48	485	51.4	70.3	12.8
W 14 x 43	13.66	7.995	0.305	0.530	12.6	43	428	45.2	62.7	11.3
W 14 x 38	14.10	6.770	0.310	0.515	11.2	38	385	26.7	54.6	7.9
W 14 x 34	13.98	6.745	0.285	0.455	10.0	34	340	23.3	48.6	6.9
W 14 x 30	13.84	6.730	0.270	0.385	8.85	30	291	19.6	42.0	5.8
W 14 x 26	13.91	5.025	0.255	0.420	7.69	26	245	8.9	35.3	3.5
W 14 x 22	13.74	5	0.230	0.335	6.49	22	199	7	29.0	2.8
W 12 x 136	13.41	12.4	0.79	1.250	39.9	136	1240	398	186	64.2

Designation	Dimensions						Static Parameters			
							Moment of Inertia		Elastic Section Modulus	
Imperial *(in x lb/ft)*	**Depth h** *(in)*	**Width w** *(in)*	**Web Thickness t_w** *(in)*	**Flange Thickness t_f** *(in)*	**Sectional Area** *(in^2)*	**Weight** *(lb/ft)*	**I_x** *(in^4)*	**I_y** *(in^4)*	**W_x** *(in^3)*	**W_y** *(in^3)*
W 12 x 120	13.12	12.32	0.71	1.105	35.3	120	1070	345	163	56.0
W 12 x 106	12.89	12.22	0.61	0.990	31.2	106	933	301	145	49.3
W 12 x 96	12.71	12.16	0.55	0.900	28.2	96	833	270	131	44.4
W 12 x 87	12.53	12.125	0.515	0.810	25.6	87	740	241	118	39.7
W 12 x 79	12.38	12.08	0.47	0.735	23.2	79	662	216	107	35.8
W 12 x 72	12.25	12.04	0.43	0.670	21.1	72	597	195	97.4	32.4
W 12 x 65	12.12	12	0.39	0.605	19.1	65	533	174	87.9	29.1
W 12 x 58	12.19	10.01	0.36	0.640	17.0	58	475	107	78	21.4
W 12 x 53	12.06	9.995	0.345	0.575	15.6	53	425	95.8	70.6	19.2
W 12 x 50	12.19	8.08	0.37	0.640	14.7	50	394	56.3	64.7	13.9
W 12 x 45	12.06	8.045	0.335	0.575	13.2	45	350	50.0	58.1	12.4
W 12 x 40	11.94	8.005	0.295	0.515	11.8	40	310	44.1	51.9	11.0
W 12 x 35	12.50	6.56	0.3	0.520	10.3	35	285	24.5	45.6	7.5
W 12 x 30	12.34	6.52	0.26	0.440	8.8	30	238	20.3	38.6	6.2
W 12 x 26	12.22	6.490	0.23	0.380	7.7	26	204	17.3	33.4	5.3
W 12 x 22	12.31	4.03	0.26	0.425	6.5	22	156	4.7	25.4	2.3

Designation	Dimensions						Static Parameters			
							Moment of Inertia		Elastic Section Modulus	
Imperial *(in x lb/ft)*	**Depth h** *(in)*	**Width w** *(in)*	**Web Thickness t_w** *(in)*	**Flange Thickness t_f** *(in)*	**Sectional Area** *(in^2)*	**Weight** *(lb/ft)*	I_x *(in^4)*	I_y *(in^4)*	W_x *(in^3)*	W_y *(in^3)*
W 12 x 19	12.16	4.005	0.235	0.350	5.6	19	130	3.8	21.3	1.9
W 12 x 16	11.99	3.990	0.22	0.265	4.7	16	103	2.8	17.1	1.4
W 12 x 14	11.91	3.970	0.2	0.225	4.2	14	88.6	2.4	14.9	1.2
W 10 x 112	11.36	10.415	0.755	1.250	32.9	112	716	236	126	45.3
W 10 x 100	11.1	10.340	0.680	1.1120	29.4	100	623	207	112	40.0
W 10 x 88	10.84	10.265	0.605	0.990	25.9	88	534	179	98.5	34.8
W 10 x 77	10.60	10.190	0.530	0.870	22.6	77	455	154	85.9	30.1
W 10 x 68	10.40	10.130	0.470	0.770	20.0	68	394	134	75.7	26.4
W 10 x 60	10.22	10.080	0.420	0.680	17.6	60	341	116	66.7	23.0
W 10 x 54	10.09	10.030	0.370	0.615	15.8	54	303	103	60.0	20.6
W 10 x 49	9.98	10	0.340	0.560	14.4	49	272	93.4	54.6	18.7
W 10 x 45	10.10	8.020	0.350	0.620	13.3	45	248	53.4	49.1	13.3
W 10 x 39	9.92	7.985	0.315	0.530	11.5	39	209	45.0	42.1	11.3
W 10 x 33	9.73	7.960	0.290	0.435	9.71	33	170	36.6	35.0	9.2
W 10 x 30	10.47	5.81	0.3	0.510	8.84	30	170	16.7	32.4	5.8

Designation	Dimensions						Static Parameters			
							Moment of Inertia		Elastic Section Modulus	
Imperial *(in x lb/ft)*	**Depth h** *(in)*	**Width w** *(in)*	**Web Thickness t_w** *(in)*	**Flange Thickness t_f** *(in)*	**Sectional Area** *(in^2)*	**Weight** *(lb/ft)*	**I_x** *(in^4)*	**I_y** *(in^4)*	**W_x** *(in^3)*	**W_y** *(in^3)*
W 10 x 26	10.33	5.770	0.26	0.440	7.6	26	144	14.1	27.9	4.9
W 10 x 22	10.17	5.750	0.240	0.360	6.5	22	118	11.4	23.2	4
W 10 x 19	10.24	4.020	0.250	0.395	5.6	19	96.3	4.3	18.8	2.1
W 10 x 17	10.11	4.010	0.240	0.330	5	17	81.9	3.6	16.2	1.8
W 10 x 15	9.99	4	0.230	0.270	4.4	15	68.9	2.9	13.8	1.5
W 10 x 12	9.87	3.960	0.190	0.210	3.5	12	53.8	2.2	10.9	1.1
W 8 x 67	9.00	8.280	0.570	0.935	19.7	67	272	88.6	60.4	21.4
W 8 x 58	8.75	8.220	0.510	0.810	17.1	58	228	75.1	52.0	18.3
W 8 x 48	8.5	8.110	0.400	0.685	14.1	48	184	60.9	43.3	15.0
W 8 x 40	8.25	8.070	0.360	0.560	11.7	40	146	49.1	35.5	12.2
W 8 x 35	8.12	8.020	0.310	0.495	10.3	35	127	42.6	31.2	10.6
W 8 x 31	8.00	7.995	0.285	0.435	9.1	31	110	37.1	27.5	9.3
W 8 x 28	8.06	6.535	0.285	0.465	8.3	28	98.0	21.7	24.3	6.6
W 8 x 24	7.93	6.495	0.245	0.400	7.1	24	82.8	18.3	20.9	5.6
W 8 x 21	8.28	5.270	0.250	0.400	6.2	21	75.3	9.8	18.2	3.7

Designation	Dimensions						Static Parameters			
							Moment of Inertia		Elastic Section Modulus	
Imperial *(in x lb/ft)*	Depth h *(in)*	Width w *(in)*	Web Thickness t_w *(in)*	Flange Thickness t_f *(in)*	Sectional Area *(in²)*	Weight *(lb/ft)*	I_x *(in⁴)*	I_y *(in⁴)*	W_x *(in³)*	W_y *(in³)*
W 8 x 18	8.14	5.250	0.230	0.330	5.3	18	61.9	8	15.2	3
W 8 x 15	8.11	4.015	0.245	0.315	4.4	15	48.0	3.4	11.8	1.7
W 8 x 13	7.99	4	0.230	0.255	3.8	13	39.6	2.7	9.9	1.4
W 8 x 10	7.89	3.940	0.170	0.205	2.9	10	30.3	2.1	7.8	1.1
W 6 x 25	6.38	6.080	0.320	0.455	7.3	25	53.4	17.1	16.7	5.6
W 6 x 20	6.20	6.020	0.260	0.365	5.9	20	41.4	13.3	13.4	4.4
W 6 x 16	6.28	4.030	0.260	0.405	4.7	16	32.1	4.4	10.2	2.2
W 6 x 15	5.99	5.990	0.230	0.260	4.4	15	29.1	9.3	9.7	3.1
W 6 x 12	6.03	4	0.230	0.280	3.6	12	22.1	3	7.3	1.5
W 6 x 9	5.90	3.940	0.170	0.215	2.7	9	16.4	2.2	5.6	1.1
W 5 x 19	5.15	5.030	0.270	0.430	5.5	19	26.2	9.1	10.2	3.6
W 5 x 16	5.01	5	0.240	0.360	4.7	16	21.3	7.5	8.5	3
W 4 x 13	4.16	4.060	0.280	0.345	3.8	13	11.3	3.9	5.5	1.9

cont.)

Based on 95.6 in^3 (1566.82 cm^3)
select the most economic section by referring
AISC Table steel shape | section data.
W18 x 55 has 98.3 in^3 - use it.

in x lb/ft
W 18 x 55 ⟶ 98.2 in^3 (1609.50 cm^3)

Total load = W/ft x Total Length
= 1700 x 30
= 51000 lb (226848 N)

Select the most economy section
According to http://www.toolsforengineer
/w18x55/

Nominal weight for W18x55 is 55

Calculate backward

use W18x55 ; W allow = 52000
what it means?

If we Choose W 18x55 → S = 98.3

∴ m = S x f = 98.3 x 24000 = 2359200 in lb

$$m = \frac{w l^2 \times 12}{8}$$

$$\therefore w = \frac{m \times 8}{l^2 \times 12} = \frac{2359200 \times 8}{30^2 \times 12}$$

= 1747 lb/Lin ft
↑ Linear

for 30ft ⇒ 1747 x 30
= 52426 ≃ 52000 lb

original design was based on 51000 ∴ can choose W18x55

In the above worked example, based on solution outline

- Internet research was performed to exactly know the meaning of technical terms/ formula
- Internet research was performed to exactly know the details of materials usage
- Internet research was performed to exactly know the details technical table.

Although you may not have the AISC Manual, by doing appropriate search, you can have the necessary technical data.

- By using such data, the details and simplified calculation/ solution was made.
- The statement in the original outline solution was more detailly explained.

This is my worked example for **STRUCTURAL STEEL DESIGN**

You will find the sections,
STRUCTURAL STEEL DESIGN
STEEL COLUMNS AND TENSION MEMBERS
PLASTIC DESIGN OF STEEL STRUCTURES
LOAD AND RESISTANCE FACTOR METHOD
PART 2: HANGERS, CONNECTORS, AND WIND-STRESS ANALYSIS
PART 3: REINFORCED CONCRETE etc

For every topic, you need to write the short note on what you understand, formula, summary, outlines and at least 2 problems solution (Please note, each problem is solved in short form, you need to clearly reproduce them by step by step)

It means that , from

STRUCTURAL STEEL DESIGN-------------- you prepare the detailed solution like as my worked example for two problems

PLASTIC DESIGN OF STEEL STRUCTURES -------------- you prepare the detailed solution like as my worked example for two problems

BAE708 Engineering Knowledge

Civil

http://www.highlightcomputer.com/MasterofEngineeringCivilCourseWorkGraduateDiplomaSyllabus.pdf

From the list of the subject, select two subjects, ask me to send the e-Book. Then you have to do the followings

The students will have to write 20 pages study report for each of the subjects outlined below. The report needs to include

Book review- Review on each chapter of the book highlighting the key concepts, key formula, key theory & practical application concepts

Own idea on how to apply those concepts in real practical applications.

Examples of engineering designs that use the concepts & knowledge expressed in those books (If any)

Your comment on each book

BAE708 will be completed when you have done the above tasks

Text books can be downloaded from

Master Diploma resources

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Choose BAE 642-Design of Reinforce Concrete.pdf

Worked Example of BAE 642-Design of Reinforce Concrete.pdf

Book review- Review on each chapter of the book highlighting the key concepts, key formula, key theory & practical application concepts

Chapter 2 Flexural Analysis of Beams

Key concepts

the beam will go through three distinct stages before collapse occurs. These are: (1) the uncracked concrete stage, (2) the concrete cracked–elastic stresses stage, and (3)the ultimate-strength stage.

At small loads when the tensile stresses are less than the *modulus of rupture* (the bending tensile stress at which the concrete begins to crack), the entire cross section of the beam resists bending, with compression on one side and tension on the other.

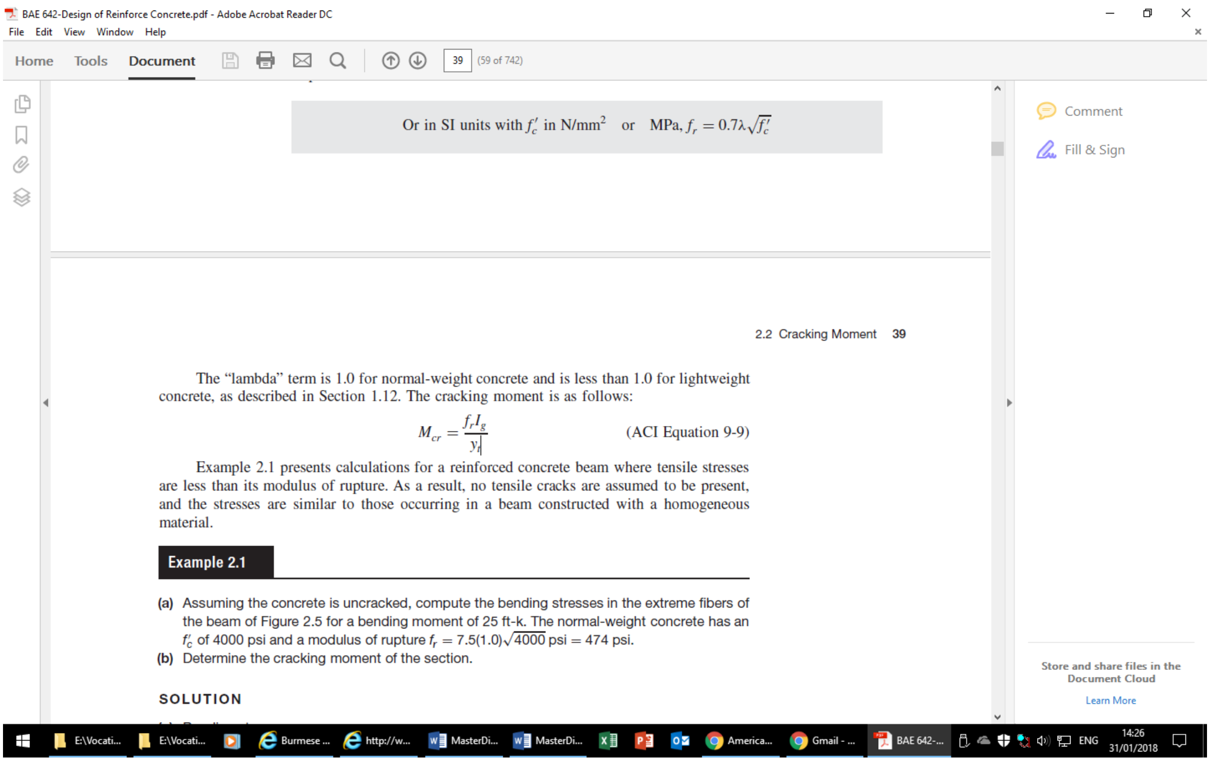
As the load is increased further so that the compressive stresses are greater than 0.50*f* _ *c*, the tensile cracks move farther upward, as does the neutral axis, and the concrete compression stresses begin to change appreciably from a straight line.

Cracking Moment

The area of reinforcing as a percentage of the total cross-sectional area of a beam is quitesmall (usually 2% or less), and its effect on the beam properties is almost negligible as long as the beam is uncracked. Therefore, an approximate calculation of the bending stresses in such a beam can be obtained based on the gross properties of the beam's cross section.

The stress in the concrete at any point a distance *y* from the neutral axis of the cross section can be determined from the following flexure formula in which *M* is the bending moment equal to or less than the cracking moment of the section and *Ig* is the gross moment of inertia of the cross section:

Key Formula / If the process is described by diagram, you can use it



Or in SI units with f'_c in N/mm^2 or MPa, $f_r = 0.7\lambda\sqrt{f'_c}$

2.2 Cracking Moment 39

The "lambda" term is 1.0 for normal-weight concrete and is less than 1.0 for lightweight concrete, as described in Section 1.12. The cracking moment is as follows:

$$M_{cr} = \frac{f_r I_g}{y_t} \qquad \text{(ACI Equation 9-9)}$$

Example 2.1 presents calculations for a reinforced concrete beam where tensile stresses are less than its modulus of rupture. As a result, no tensile cracks are assumed to be present, and the stresses are similar to those occurring in a beam constructed with a homogeneous material.

Example 2.1

(a) Assuming the concrete is uncracked, compute the bending stresses in the extreme fibers of the beam of Figure 2.5 for a bending moment of 25 ft-k. The normal-weight concrete has an f'_c of 4000 psi and a modulus of rupture $f_r = 7.5(1.0)\sqrt{4000}$ psi $= 474$ psi.

(b) Determine the cracking moment of the section.

SOLUTION

Key Theory

After the steel yields, the beam has very little additional moment capacity, and only a small additional load is required to substantially increase rotations as well as deflections. The slope of the diagram is now very flat.

2.2 Cracking Moment

The area of reinforcing as a percentage of the total cross-sectional area of a beam is quite small (usually 2% or less), and its effect on the beam properties is almost negligible as long as the beam is uncracked. Therefore, an approximate calculation of the bending stresses in such a beam can be obtained based on the gross properties of the beam's cross section. The stress in the concrete at any point a distance y from the neutral axis of the cross section can be determined from the following flexure formula in which M is the bending moment equal to or less than the cracking moment of the section and I_g is the gross moment of inertia of the cross section:

$$f = \frac{My}{I_g}$$

Section 9.5.2.3 of the ACI Code states that the cracking moment of a section may be determined with ACI Equation 9-9, in which f_r is the modulus of rupture of the concrete and y_t is the distance from the centroidal axis of the section to its extreme fiber in tension. In this section, with its equation 9-10, the code states that f_r may be taken equal to $7.5\lambda\sqrt{f'_c}$ with f'_c in psi.

Or in SI units with f'_c in N/mm^2 or MPa, $f_r = 0.7\lambda\sqrt{f'_c}$

Practical Applications

Example 2.1

(a) Assuming the concrete is uncracked, compute the bending stresses in the extreme fibers of the beam of Figure 2.5 for a bending moment of 25 ft-k. The normal-weight concrete has an f'_c of 4000 psi and a modulus of rupture $f_r = 7.5(1.0)\sqrt{4000}$ psi $= 474$ psi.

(b) Determine the cracking moment of the section.

SOLUTION

(a) Bending stresses:

$$I_g = \frac{1}{12}bh^3 \text{ with } b = 12 \text{ in. and } h = 18 \text{ in.}$$

$$I_g = \left(\frac{1}{12}\right)(12 \text{ in.})(18 \text{ in.})^3 = 5832 \text{ in.}^4$$

$$f = \frac{My}{I_g} \text{ with } M = 25 \text{ ft-k} = 25{,}000 \text{ ft-lb}$$

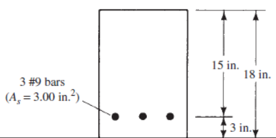
Next, multiply the 25,000 ft-lb by 12 in/ft to obtain in-lb as shown here:

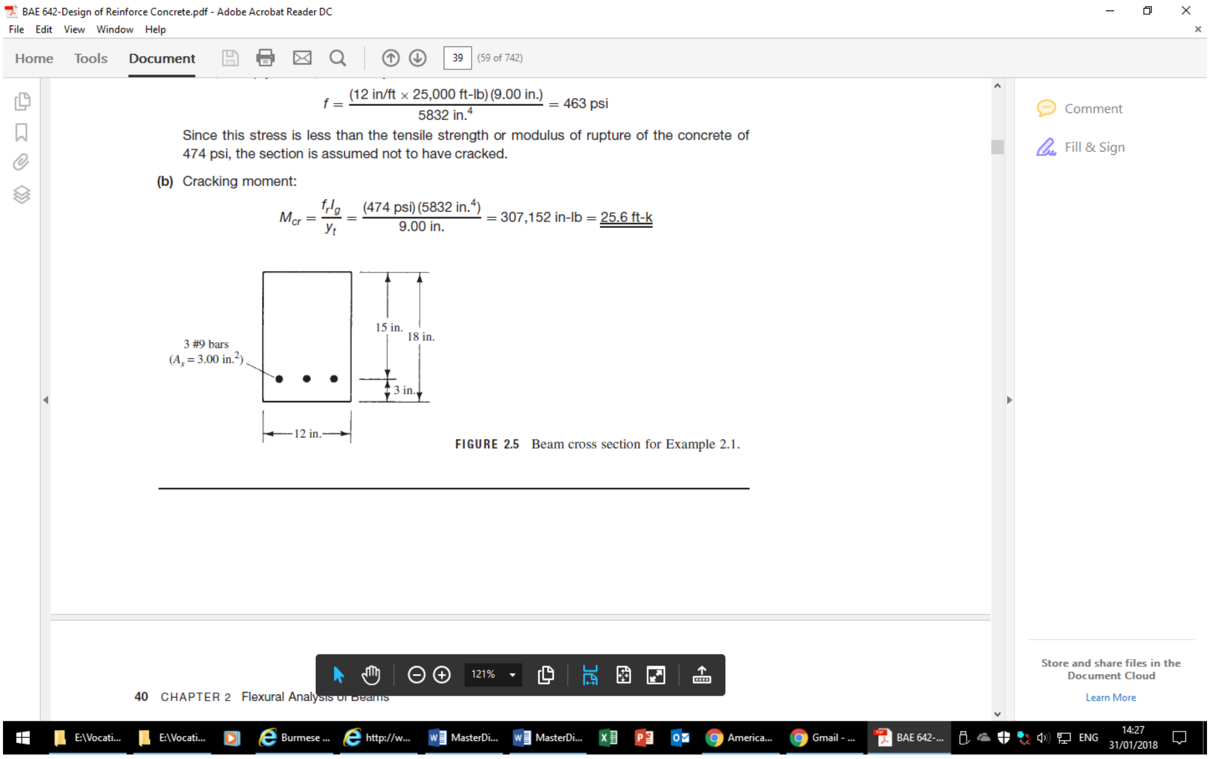
$$f = \frac{(12 \text{ in/ft} \times 25{,}000 \text{ ft-lb})(9.00 \text{ in.})}{5832 \text{ in.}^4} = 463 \text{ psi}$$

Since this stress is less than the tensile strength or modulus of rupture of the concrete of 474 psi, the section is assumed not to have cracked.

(b) Cracking moment:

$$M_{cr} = \frac{f_r I_g}{y_t} = \frac{(474 \text{ psi})(5832 \text{ in.}^4)}{9.00 \text{ in.}} = 307{,}152 \text{ in-lb} = \underline{25.6 \text{ ft-k}}$$





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$$f = \frac{(12\text{ in/ft} \times 25{,}000\text{ ft-lb})(9.00\text{ in.})}{5832\text{ in.}^4} = 463\text{ psi}$$

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FIGURE 2.5 Beam cross section for Example 2.1.

Own idea on how to apply those concepts in real practical applications.

I will follow up the following process to obtain the nominal or theoretical moment strength of a beam in the practice

Process

1. Compute total tensile force $T = As\ fy$.

2. Equate total compression force $C = 0.85f\_cab$ to $As\ fy$ and solve for a. In this expression, ab is the assumed area stressed in compression at $0.85f\_c$. The compression force C and the tensile force T must be equal to maintain equilibrium at the section.

3. Calculate the distance between the centers of gravity of T and C. (For a rectangular beam cross section, it equals $d - a/2$.)

4. Determine Mn, which equals T or C times the distance between their centers of gravity.

Your comment

- The contents in this chapter explains whether the concrete beam is strong enough to withstand the stresses and explain the analytical methods to assess the stresses in the beam

- Locating Neutral Axis, calculation of Moment of Inertia, Bending Stresses, are provided

It is my example for **BAE 642-Design of Reinforce Concrete.pdf** Chapter 2, you need to do the similar study notes for the rest of chapters if you choose to do the study report on **BAE 642-Design of Reinforce Concrete.pdf**
If you choose to do the study report on other books/ subjects, you need to follow the same way.

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For Masters part 2, design, if you are working, you can submit your workplace design work. If you are not working at the site, you need to find one engineering topic, collect the reference resources, internet search and write a paper.

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