APPENDIX

A

Properties of Structural Steel Sections

The structural designer has choice of a variety of sections, which are available in the market. This appendix provides properties of structural steel sections often used in practice. For more complete details of I-sections, channels, equal and unequal angles, and T-sections refer to IS: 808-1989. Note that IS: 808 does not give values of the plastic section modulus. Hence these values for I-sections and channels have been provided based on IS: 800. Note that there are some small differences in the values given by IS: 808 and IS: 800. Only the values given by IS: 808 have been used in this book. However, these differences in values will not affect the design much. Also included in this appendix are the wide flange sections, which have been introduced recently (more information on these sections may be obtained from M/s. Jindal Vijayanagar Steel Limited). Properties of some castellated beams (I-section and channels) have also been included. Properties of circular tubes (IS: 1161-1998), square and rectangular hollow sections (IS: 4923-1997 and Tata steel catalog), and cold-formed lipped channel and zed sections (IS: 811-1987) are also included in this appendix. More details about these sections may be found in the respective Indian Standard.

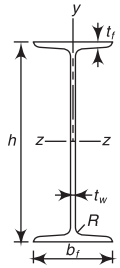
Indian Standard Rolled Steel Plates

Steel plates are available in the following widths and thicknesses.

Widths: 160, 180, 200, 220, 250, 280, 320, 355, 400, 450, 500, 560, 630, 710, 800, 900, 1000, 1100, 1250, 1400, 1600, 1800, 2000, 2200, and 2500

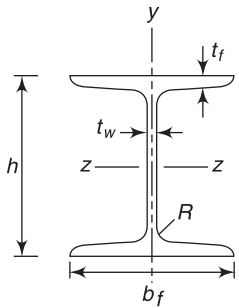
Thickness: 5.0, 5.5, 6.0, 7.0, 8, 9, 10, 11, 12, 14, 16, 18, 20, 22, 25, 28, 32, 36, 40, 45, 50, 56, 63, 71, and 80

Table A.1 Sectional properties for beams



		Sectional dimensions						Sectional properties							
Designation	*Mass N/m*	*Area (mm^2)*	*h (mm)*	*R (mm)*	*b_f (mm)*	*t_w (mm)*	*t_f (mm)*	*I_z (cm^4)*	*I_y (cm^4)*	*r_z (mm)*	*r_y (mm)*	*Z_z (cm^3)*	*Z_y (cm^3)*	*Plastic modulus Z_{pz}(cm^3)*	*Shape factor*
MB 100	89	1140	100	9	50	4.7	7	183	12.9	40	10.5	36.6	5.16	41.24	1.1268
MB 125	133	1700	125	9	70	5	8	445	38.5	51.6	15.1	71.2	11	81.85	1.1399
MB 150	150	1910	150	9	75	8	8	718	46.8	61.3	15.7	95.7	12.5	110.48	1.1401
MB 175	196	2500	175	10	85	5.8	9	1260	76.7	71.3	17.6	144	18	166.08	1.1422
MB 200	242	3080	200	11	100	5.7	10	2120	137	82.9	21.1	212	27.4	253.86	1.1358
MB 225	311	3970	225	12	110	6.5	11.8	3440	218	93.1	23.4	306	39.7	348.27	1.1385
MB 250	373	4750	250	13	125	6.9	12.5	5130	335	104	26.5	410	53.5	465.71	1.1345
MB 300	460	5860	300	14	140	7.7	13.1	8990	486	124	28.6	599	69.5	651.74	1.1362
MB 350	524	6670	350	14	140	8.1	14.2	13600	538	143	28.4	779	76.8	889.57	1.1421
MB 400	615	7840	400	14	140	8.9	16	20500	622	162	28.2	1020	88.9	1176.18	1.1498
MB 450	724	9220	450	15	150	9.4	17.4	30400	834	182	30.1	1350	111	1533.36	1.15
MB 500	869	11100	500	17	180	10.2	17.2	45200	1370	202	35.2	1810	152	2074.67	1.1471
MB 550	1040	13200	550	18	190	11.2	19.3	64900	1830	222	37.3	2360	193	2711.98	1.1492
MB 600	1230	15600	600	20	210	12	20.3	91800	2650	242	41.2	3060	252	3510.63	1.1471

Table A.2 Sectional properties of columns and heavy weight beams



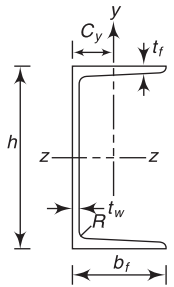
Designation	Mass (N/m)	Sectional dimensions: Area (mm^2)	h (mm)	R (mm)	b_f (mm)	t_w (mm)	t_f (mm)	Sectional properties: I_z (cm^4)	I_y (cm^4)	r_z (mm)	r_y (mm)	Z_z (cm^3)	Z_y (cm^3)	Plastic modulus, Z_{pz} (cm^3)	Shape factor
Column sections															
SC 100	200	2550	100	12	100	6	10	436	136	41.3	23.1	87.2	27.2	99.60	1.1422
SC 120	262	3340	120	12	120	6.5	11	842	255	50.2	27.6	140	42.6	159.49	1.1392
SC 140	333	4240	140	12	140	7	12	1470	438	58.9	32.1	211	62.5	238.59	1.1307
SC 150	371	4740	152	11.7	152	7.9	11.9	1970	700	64.5	38.4	259	91.9	285.87	1.1038
SC 160	419	5340	160	15	160	8	13	2420	695	67.4	36.1	303	86.8	341.67	1.1276
SC 180	505	6440	180	15	180	8.5	14	3740	1060	76.2	40.5	415	117	467.42	1.1263
SC 200	603	7680	200	18	200	9	15	5530	1530	84.8	44.6	553	153	620.03	1.1212
SC 220	704	8980	220	18	220	9.5	16	7880	2160	93.5	49	716	196	802.02	1.1201
SC 250	856	10900	250	23	250	10	17	12500	3260	107	54.6	997	260	1106.89	1.1102

(*contd*)

Table A.2 (*contd*)

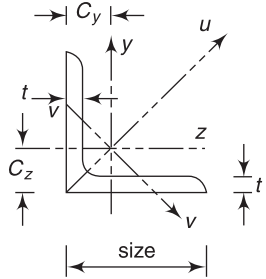
Heavy weight beams/columns															
HB 150	271	3450	150	8	150	5.4	9	1460	432	65	35.4	194	57.6	213.87	1.1024
HB 200	373	4750	200	9	200	6.1	9	3600	967	87.1	45.1	361	96.7	394.31	1.0923
HB 225	431	5490	225	10	225	6.5	9.1	5300	1350	98	49.6	469	120	511.55	1.0907
HB 250	510	6500	250	10	250	6.9	9.7	7740	1960	109	54.9	619	156	674.46	1.0896
HB 300	588	7480	300	11	250	7.6	10.6	12600	2200	130	54.1	836	175	914.60	1.0940
HB 350	674	8590	350	12	250	8.3	11.6	19200	2450	149	53.4	1090	196	1202.97	1.1036
HB 400	774	9870	400	14	250	9.1	12.7	28100	2730	169	52.6	1400	218	1548.92	1.1064
HB 450	872	11100	450	15	250	9.8	13.7	39200	3000	188	51.8	1740	239	1931.87	1.1103

Table A.3 Sectional properties of channel sections



		Sectional dimensions						Sectional properties								
Designation	*Mass (N/m)*	*Area (mm^2)*	*h (mm)*	*R (mm)*	*b_f (mm)*	*t_w (mm)*	*t_f (mm)*	*C_y (mm)*	*I_z (cm^4)*	*I_y (cm^4)*	*r_z (mm)*	*r_y (mm)*	*Z_z (cm^3)*	*Z_y (cm^3)*	*Plastic modulus, Z_{pz} (cm^3)*	*Shape factor*
MC 75	71.4	910	75	8.5	40	4.8	7.5	13.2	78.5	12.9	29.4	11.9	20.9	4.81	24.57	1.1756
MC 100	95.6	1220	100	9	50	5	7.7	15.4	192	26.7	39.7	14.8	37.3	7.71	44.48	1.1584
MC 125	131	1670	125	9.5	65	5.3	8.2	19.5	425	61.1	50.5	19.1	68.1	13.4	77.88	1.1436
MC 150	168	2130	150	10	75	5.7	9	22	788	103	60.8	22	105	19.5	120.00	1.1429
MC 175	196	2490	175	10.5	75	6	10.2	21.9	1240	122	70.4	22.1	141	23	161.92	1.1484
MC 200	223	2850	200	11	75	6.2	11.4	22	1830	141	80.2	22.2	181	26.4	209.92	1.1598
MC 225	261	3330	225	12	80	6.5	12.4	23.1	2710	188	90.2	23.7	241	33	276.03	1.1453
MC 250	306	3900	250	12	80	7.2	14.1	23	3880	211	99.2	23.7	307	38.5	354.65	1.1552
MC 300	363	4630	300	13	90	7.8	13.6	23.5	6420	313	118	26	428	47.1	495.67	1.1581
MC 350	427	5440	350	14	100	8.3	13.5	24.4	10000	434	136	28.2	576	57.3	670.76	1.1645
MC 400	501	6380	400	15	100	8.8	15.3	24.2	15200	508	154	28.2	760	67	888.79	1.1695

Table A.4 Sectional properties of equal leg angles



			Sectional dimensions			*Sectional properties*							
Designation	***Mass (N/m)***	***Area (mm^2)***	***C_z (mm)***	***C_y (mm)***	***I_z (cm^4)***	***I_y (cm^4)***	***r_z (mm)***	***r_y (mm)***	***$r_{u(max)}$ (mm)***	***$r_{v(min)}$ (mm)***	***Z_z (cm^3)***	***Z_y (cm^3)***	***Z_{pz} (cm^3)***
L20 20 × 3	9	112	5.9	5.9	0.4	0.4	5.8	5.8	7.3	3.7	0.3	0.3	0.52
× 4	11	145	6.3	6.3	0.5	0.5	5.8	5.8	7.2	3.7	0.4	0.4	0.67
L25 25 × 3	11	141	7.1	7.1	0.8	0.8	7.3	7.3	9.3	4.7	0.4	0.4	0.84
× 4	14	184	7.5	7.5	1	1	7.3	7.3	9.1	4.7	0.6	0.6	1.08
× 5	18	225	7.9	7.9	1.2	1.2	7.2	7.2	9.1	4.7	0.7	0.7	1.31
L30 30 × 3	14	173	8.3	8.3	1.4	1.4	8.9	8.9	11.3	5.7	0.6	0.6	1.23
× 4	18	226	8.7	8.7	1.8	1.8	8.9	8.9	11.2	5.7	0.8	0.8	1.59
× 5	22	277	9.2	9.2	2.1	2.1	8.8	8.8	11.1	5.7	1.0	1.0	1.93
L35 35 × 3	16	203	9.5	9.5	2.3	2.3	10.5	10.5	13.3	6.7	0.9	0.9	1.69
× 4	21	266	10.0	10.0	2.9	2.9	10.5	10.5	13.2	6.7	1.2	1.2	2.20
× 5	26	327	10.4	10.4	3.5	3.5	10.4	10.4	13.1	6.7	1.4	1.4	2.68
× 6	30	386	10.8	10.8	4.1	4.1	10.3	10.3	12.9	6.7	1.7	1.7	3.14

(*contd*)

Table A.4 (*contd*)

L40 40 × 3	18	234	10.8	10.8	3.4	3.4	12.1	12.1	15.4	7.7	1.2	1.2	2.23
× 4	24	307	11.2	11.2	4.5	4.5	12.1	12.1	15.3	7.7	1.6	1.6	2.91
× 5	30	378	11.6	11.6	5.4	5.4	12.0	12.0	15.1	7.7	1.9	1.9	3.56
× 6	35	447	12.0	12.0	6.3	6.3	11.9	11.9	15.0	7.7	2.3	2.3	4.18
L45 45 × 3	21	264	12.0	12.0	5	5	13.8	13.8	17.4	8.7	1.5	1.5	2.85
× 4	27	347	12.5	12.5	6.5	6.5	13.7	13.7	17.3	8.7	2	2	3.72
× 5	34	428	12.9	12.9	7.9	7.9	13.6	13.6	17.2	8.7	2.5	2.5	4.56
× 6	40	507	13.3	13.3	9.2	9.2	13.5	13.5	17.0	8.7	2.9	2.9	5.37
L50 50 × 3	23	295	13.2	13.2	6.9	6.9	15.3	15.3	19.4	9.7	1.9	1.9	3.54
× 4	30	388	13.7	13.7	9.1	9.1	15.3	15.3	19.3	9.7	2.5	2.5	4.63
× 5	38	479	14.1	14.1	11	11	15.2	15.2	19.2	9.7	3.1	3.1	5.68
× 6	45	568	14.5	14.5	12.9	12.9	15.1	15.1	19.0	9.6	3.6	3.6	6.70
L55 55 × 5	41	527	15.3	15.3	14.7	14.7	16.7	16.7	21.1	10.6	3.7	3.7	6.93
× 6	49	626	15.7	15.7	17.3	17.3	16.6	16.6	21.0	10.6	4.4	4.4	8.19
× 8	64	818	16.5	16.5	22	22	16.4	16.4	20.7	10.6	5.7	5.7	10.58
× 10	79	1000	17.2	17.2	26.3	26.3	16.2	16.2	20.3	10.6	7	7	12.83
L60 60 × 5	45	575	16.5	16.5	19.2	19.2	18.2	18.2	23.1	11.6	4.4	4.4	8.31
× 6	54	684	16.9	16.9	22.6	22.6	18.2	18.2	22.9	11.5	5.2	5.2	9.82
× 8	70	896	17.7	17.7	29	29	18.0	18.0	22.7	11.5	6.8	6.8	12.72
× 10	86	1100	18.5	18.5	34.8	34.8	17.8	17.8	22.3	11.5	8.4	8.4	15.46
L65 65 × 5	49	625	17.7	17.7	24.7	24.7	19.9	19.9	25.1	12.6	5.2	5.2	9.81
× 6	58	744	18.1	18.1	29.1	29.1	19.8	19.8	25.0	12.6	6.2	6.2	11.61
× 8	77	976	18.9	18.9	37.4	37.4	19.6	19.6	24.7	12.5	8.1	8.1	15.06
× 10	94	1200	19.7	19.7	45	45	19.4	19.4	24.4	12.5	9.9	9.9	18.34

(*contd*)

Table A.4 (*contd*)

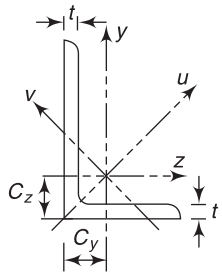
L70 70 × 5	53	677	18.9	18.9	31.1	31.1	21.5	21.5	27.1	13.6	6.1	6.1	11.44
× 6	63	806	19.4	19.4	36.8	36.8	21.4	21.4	27.0	13.6	7.3	7.3	13.54
× 8	83	1060	20.2	20.2	47.4	47.4	21.2	21.2	26.7	13.5	9.5	9.5	17.60
× 10	102	1300	21.0	21.0	57.2	57.2	21.0	21.0	26.4	13.5	11.7	11.7	21.46
L75 75 × 5	57	727	20.2	20.2	38.7	38.7	23.1	23.1	29.2	14.6	7.1	7.1	13.19
× 6	68	866	20.6	20.6	45.7	45.7	23.0	23.0	29.1	14.6	8.4	8.4	15.63
× 8	89	1140	21.4	21.4	59	59	22.8	22.8	28.8	14.5	11	11	20.34
× 10	110	1400	22.2	22.2	71.4	71.4	22.6	22.6	28.4	14.5	13.5	13.5	24.84
L80 80 × 6	73	929	21.8	21.8	56	56	24.6	24.6	31.1	15.6	9.6	9.6	17.86
× 8	96	1220	22.7	22.7	72.5	72.5	24.4	24.4	30.8	15.5	12.6	12.6	23.28
× 10	118	1500	23.4	23.4	87.7	87.7	24.1	24.1	30.4	15.5	15.5	15.5	28.47
× 12	140	1780	24.2	24.2	102	102	23.9	23.9	30.1	15.4	18.3	18.3	33.44
L90 90 × 6	82	1050	24.2	24.2	80.1	80.1	27.7	27.7	35.0	17.5	12.2	12.2	22.78
× 8	108	1380	25.1	25.1	104	104	27.5	27.5	34.7	17.5	16	16	29.76
× 10	134	1700	25.9	25.9	127	127	27.3	27.3	34.4	17.4	19.8	19.8	36.47
× 12	158	2020	26.6	26.6	148	148	27.1	27.1	34.1	17.4	23.3	23.3	42.93
L100 100 × 6	92	1170	26.7	26.7	111	111	30.9	30.9	39.1	19.5	15.2	15.2	28.30
× 8	121	1540	27.6	27.6	145	145	30.7	30.7	38.8	19.5	20	20	37.05
× 10	149	1900	28.4	28.4	177	177	30.5	30.5	38.5	19.4	24.7	24.7	45.48
× 12	177	2260	29.2	29.2	207	207	30.3	30.3	38.2	19.4	29.2	29.2	53.61
L110 110 × 8	134	1710	30.0	30.0	197	197	34.0	34.0	42.8	21.8	24.6	24.6	45.13
× 10	166	2110	30.9	30.9	240	240	33.7	33.7	42.5	21.6	30.4	30.4	55.48
× 12	197	2510	31.7	31.7	281	281	33.5	33.5	42.2	21.5	35.9	35.9	65.50
× 16	257	3280	33.2	33.2	357	357	33.0	33.0	41.5	21.4	46.5	46.5	84.62

(*contd*)

(*contd*)

L130 130 × 8	159	2030	35.0	35.0	331	331	40.4	40.4	51.0	25.9	34.9	34.9	63.69
× 10	197	2510	35.9	35.9	405	405	40.2	40.2	50.7	25.7	43.1	43.1	78.48
× 12	235	2990	36.7	36.7	476	476	39.9	39.9	50.3	25.6	51	51	92.86
× 16	307	3920	38.2	38.2	609	609	39.4	39.4	49.7	25.4	66.3	66.3	120.48
L150 150 × 10	229	2920	40.8	40.8	634	634	46.6	46.6	58.7	29.8	58	58	105.48
× 12	273	3480	41.6	41.6	746	746	46.3	46.3	58.4	29.7	68.8	68.8	125.03
× 16	358	4560	43.1	43.1	959	959	45.8	45.8	57.7	29.4	89.7	89.7	162.74
× 20	441	5620	44.6	44.6	1160	1160	45.3	45.3	57.1	29.3	110	110	198.73
L200 200 × 12	369	4690	53.9	53.9	1830	1830	62.4	62.4	78.7	39.9	125	125	226.44
× 16	485	6180	55.6	55.6	2370	2370	61.9	61.9	78.0	39.6	164	164	296.37
× 20	600	7640	57.1	57.1	2880	2880	61.4	61.4	77.3	39.3	201	201	363.80
× 25	739	9410	59.0	59.0	3470	3470	60.7	60.7	76.1	39.1	246	246	444.82

Table A.5 Sectional properties of unequal leg angles



Designation	Mass (N/m)	Sectional dimensions					Sectional properties						
		Area (mm^2)	C_z (mm)	C_y (mm)	I_z (cm^4)	I_y (cm^4)	r_z (mm)	r_y (mm)	$r_{u(max)}$ (mm)	$r_{v(min)}$ (mm)	Z_z (cm^3)	Z_y (cm^3)	Z_{pz} (cm^3)
L30 20 × 3	11	141	9.8	4.9	1.2	0.4	9.2	5.4	9.9	4.1	0.6	0.3	1.15
× 4	14	184	10.2	5.3	1.5	0.5	9.2	5.4	9.8	4.1	8	0.4	1.48
× 5	18	225	10.6	5.7	1.9	0.6	9.1	5.3	9.7	4.1	1	0.4	1.78
L40 25 × 3	15	188	13	5.7	3	0.9	12.5	6.8	13.3	5.2	1.1	0.5	2.06
× 4	19	246	13.5	6.2	3.8	1.1	12.5	6.8	13.2	5.2	1.4	0.6	2.67
× 5	24	302	13.9	6.6	4.6	1.4	12.4	6.7	13.1	5.2	1.8	0.7	3.25
× 6	28	356	14.3	6.9	5.4	1.6	12.3	6.6	12.9	5.2	2.1	0.9	3.80
L45 30 × 3	17	218	14.2	6.9	4.4	1.5	14.2	8.4	15.2	6.3	1.4	0.7	2.67
× 4	22	286	14.7	7.3	5.7	2	14.1	8.4	15.1	6.3	1.9	0.9	3.48
× 5	28	352	15.1	7.7	6.9	2.4	14	8.3	15	6.3	2.3	1.1	4.25
× 6	33	416	15.5	8.1	8	2.8	13.9	8.2	14.9	6.3	2.7	1.3	4.98
L50 30 × 3	18	234	16.3	6.6	5.9	1.6	15.9	8.3	16.7	6.5	1.7	0.7	3.23
× 4	24	307	16.8	7	7.7	2.1	15.8	8.2	16.6	6.3	2.3	0.9	4.22

(*contd*)

Table A.5 (*contd*)

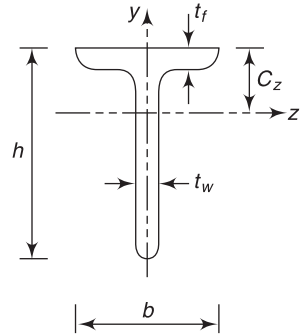
× 5	30	378	17.2	7.4	9.3	2.5	15.7	8.1	16.5	6.3	2.8	1.1	5.16
× 6	35	447	17.6	7.8	10.9	2.9	15.6	8	16.4	6.3	3.4	1.3	6.05
L60 40 × 5	37	476	19.5	9.6	16.9	6	18.9	11.2	20.2	8.5	4.2	2	7.78
× 6	44	565	19.9	10	19.9	7	18.8	11.1	20.1	8.5	5	2.3	9.17
× 8	58	737	20.7	10.8	25.4	8.8	18.6	11	19.8	8.4	6.5	3	11.81
L65 45 × 5	41	526	20.7	10.8	22.1	8.6	20.5	12.8	22.2	9.6	5	2.5	9.28
× 6	49	625	21.1	11.2	26	10.1	20.4	12.7	22.1	9.5	5.9	3	10.96
× 8	64	817	21.9	12	33.2	12.8	20.2	12.5	21.8	9.5	7.7	3.9	14.15
L70 45 × 5	43	552	22.7	10.4	27.2	8.8	22.2	12.6	23.6	9.6	5.7	2.5	10.63
× 6	52	656	23.2	10.9	32	10.3	22.1	12.5	23.5	9.6	6.8	3	12.56
× 8	67	858	24	11.6	41	13.1	21.9	12.4	23.2	9.5	8.9	3.9	16.24
× 10	83	1050	24.8	12.4	49.3	15.6	21.6	12.2	22.9	9.5	10.9	4.8	19.69
L75 50 × 5	47	602	23.9	11.6	34.1	12.2	23.8	14.2	25.6	10.7	6.7	3.2	12.38
× 6	56	716	24.4	12	40.3	14.3	23.7	14.1	25.5	10.7	8	3.8	14.64
× 8	74	938	25.2	12.8	51.8	18.3	28.5	14	25.2	10.6	10.4	4.9	18.98
× 10	90	1150	26	13.6	62.2	21.8	23.3	13.8	24.9	10.6	12.7	6	23.06
L80 50 × 5	49	627	26	11.2	40.6	12.3	25.5	14	27	10.7	7.5	3.2	13.91
× 6	59	746	26.4	11.6	48	14.4	25.4	13.9	26.9	10.7	9	3.8	16.46
× 8	77	978	27.3	12.4	61.9	18.5	25.2	13.7	26.6	10.6	11.7	4.9	21.37
× 10	94	1200	28.1	13.2	74.7	22.1	24.9	13.6	26.3	10.6	14.4	6	26.00
L90 60 × 6	68	865	28.7	13.9	70.6	25.2	28.6	17.1	30.7	12.8	11.5	5.5	21.38
× 8	89	1140	29.6	14.8	91.5	32.4	28.4	16.9	30.4	12.8	15.1	7.2	27.85
× 10	110	1400	30.4	15.5	111	39.1	28.1	16.7	30.1	12.7	18.6	8.8	34.00
× 12	130	1660	31.2	16.3	129	45.2	27.9	16.5	29.8	12.7	22	10.3	39.85
L100 65 × 6	75	955	31.9	14.7	96.7	32.4	31.8	18.4	34	13.9	14.2	6.4	26.42
× 8	99	1260	32.8	15.5	126	41.9	31.6	18.3	33.8	13.9	18.7	8.5	34.48
× 10	122	1550	33.7	16.3	153	50.7	31.4	18.1	33.5	13.8	23.1	10.4	42.19

(*contd*)

Table A.5 (*contd*)

L100 75 × 6	80	1010	30.1	17.8	101	48.7	31.5	21.9	35	15.9	14.4	8.5	27.32
× 8	105	1340	31	18.7	132	63.3	31.4	21.8	34.8	15.9	19.1	11.2	35.68
× 10	130	1650	31.9	19.5	160	76.9	31.2	21.6	34.5	15.8	23.6	13	43.69
× 12	154	1950	32.7	20.3	188	89.5	31	21.4	34.2	15.8	27.9	16.3	51.36
L125 75 × 6	92	1170	40.5	15.9	188	51.6	40.1	21	42.3	16.2	22.2	8.7	40.93
× 8	121	1540	41.5	16.8	246	67.2	40	20.9	42.1	16.1	29.4	11.5	53.63
× 10	149	1900	42.4	17.6	300	81.6	39.7	20.7	41.8	16.1	36.5	14.2	65.88
L125 95 × 6	101	1290	37.2	22.4	205	103	39.9	28.3	44.3	20.7	23.4	14.3	43.33
× 8	134	1700	38	23.2	268	135	39.7	28.1	44.1	20.5	30.9	18.8	56.83
× 10	165	2110	38.9	24	328	164	39.5	27.9	43.8	20.4	38.1	23.1	69.88
× 12	197	2500	39.7	24.8	385	192	39.2	27.7	43.5	20.3	45.1	27.3	82.48
L150 75 × 8	137	1750	52.4	15.4	410	71.1	48.8	20.2	49.9	16.2	42	11.9	74.08
× 10	170	2160	53.3	16.2	502	86.3	48.2	20	49.6	16.1	51.9	14.7	91.19
× 12	202	2570	54.2	17	590	100	47.9	19.8	49.3	16	61.6	17.3	107.76
L150 115 × 8	163	2070	44.8	27.6	474	244	47.8	34.3	53.3	25	45.1	28	82.88
× 10	201	2570	45.7	28.4	582	299	47.6	34.1	53.1	24.8	55.8	34.5	102.19
× 12	240	3050	46.5	29.2	685	351	47.4	33.9	52.8	24.7	66.2	40.8	120.96
× 16	314	4000	48.1	30.7	878	447	46.9	33.4	52.1	24.4	86.2	53	177.24
L200 100 × 10	229	2920	69.8	20.3	1230	215	64.8	27.1	66.8	21.7	94.3	26.9	165.25
× 12	273	3480	70.7	21.1	1450	251	64.6	26.9	66.5	21.6	112	31.9	196.03
× 16	358	4570	72.3	22.7	1870	320	64	26.6	65.9	21.3	147	41.3	255.42
L200 150 × 10	269	3430	60.2	35.5	1410	689	64.1	44.8	71	32.8	101	60.2	184.00

Table A.6 Sectional properties of rolled steel tee sections



Designation	*Weight (N/m)*	*Sectional area (mm^2)*	*Depth of section h (mm)*	*Width of flange b (mm)*	*Thickness of flange t_f (mm)*	*Thickness of web t_w (mm)*	*Centre of gravity C_z (mm)*	*Moment of inertia*		*Radius of gyration*		*Moduli of section*	
								I_z (cm^4)	*I_y (cm^4)*	*r_z (mm)*	*r_y (mm)*	*Z_z (cm^3)*	*Z_y (cm^3)*
ISNT 20	9	113	20	20	3	3	6	0.4	0.2	5.9	3.9	0.3	0.2
ISNT 30	14	175	30	30	3	3	8.3	1.4	0.6	8.9	5.7	0.6	0.4
ISNT 40	35	448	40	40	6	6	12	6.3	3	11.8	8.2	2.2	1.5
ISNT 50	45	570	50	50	6	6	14.4	12.7	5.9	15	10.2	3.6	2.4
ISNT 60	54	690	60	60	6	6	16.7	22.5	10.1	18.1	12.1	5.2	3.4
ISNT 80	96	1225	80	80	8	8	22.3	71.2	32.3	24.1	16.2	12.3	8.1
ISNT 100	150	1910	100	100	10	10	27.9	173.8	79.9	30.2	20.5	24.1	16
ISNT 150	228	2908	150	150	10	10	39.5	608.8	257.5	45.6	30.3	54.6	35.7
ISHT 75	153	1949	75	150	9	8.4	16.2	96.2	230.2	22.2	34.4	16.4	30.1
ISHT 100	200	2547	100	200	9	7.8	19.1	193.8	497.3	27.6	44.2	24	49.3

(*contd*)

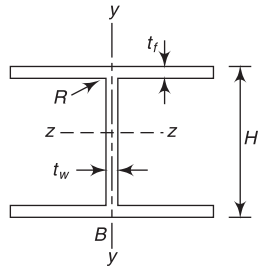
Table A.6 (*contd*)

ISHT 125	274	3485	125	250	9.7	8.8	23.7	415.4	1005.8	34.5	53.7	41	79.9
ISHT 150	294	3742	150	250	10.6	7.6	26.6	573.7	1096.8	39.2	54.1	46.5	87.7
ISST 100	81	1037	100	50	10	5.8	30.3	99	9.6	30.9	9.6	14.2	3.8
ISST 150	157	1996	150	75	11.6	8	37.5	450.2	37	47.5	13.6	43.9	9.9
ISST 200	284	3622	200	165	12.5	8	47.8	1267.8	358.2	59.2	31.5	83.3	43.4
ISST 250	375	4775	250	180	12.1	9.2	64	2774.4	532	76.2	33.4	149.2	59.1
ISLT 50	40	511	50	50	6.4	4	11.9	9.9	6.4	13.9	11.2	2.6	2.5
ISLT 75	71	904	75	80	6.8	4.8	17.2	41.9	27.6	21.5	17.5	7.2	6.9
ISLT 100	127	1616	100	100	10.8	5.7	21.3	116.6	75	26.9	21.5	14.8	15
ISJT 75	35	450	75	50	4.6	3	20	24.8	4.6	23.5	10.1	4.5	1.8
ISJT 87.5	40	514	87.5	50	4.8	3.2	25	39	4.8	27.5	9.7	6.2	1.9
ISJT 100	50	632	100	60	5	3.4	28.1	63.5	8.6	31.7	11.7	8.8	2.9
ISJT 112.5	64	814	112.5	80	5	3.7	30.1	101.6	20.2	35.3	15.8	12.3	5.1

Table A.7 Sectional properties of parallel flange beams and columns

IPE - European I-beams
HE - European wide flange beams
W - American wide flange beams
UC - British universal columns
HD - Wide flange columns

H – Depth
B - Flange width
t_w - Web thickness
t_f - Flange thickness
R - Fillet radius



Designation	*Mass (N/m)*	*Sectional area (mm^2)*	*Main dimensions (mm)*					*Moment of inertia (cm^4)*		*Radius of gyration (mm)*		*Modulus of section (cm^3)*	
			H	*B*	t_w	t_f	*R*	I_z	I_y	r_z	r_y	Z_z	Z_y
(1) Nominal size 200 mm													
IPE 200	224	2848	200	100	5.6	8.5	12	1943	142.4	82.6	22.4	194.3	28.47
HE 200 A	423	5383	190	200	6.5	10	18	3692	1336	82.8	49.8	388.6	133.6
HE 200 B	613	7808	200	200	9	15	18	5696	2003	85.4	50.7	569.6	200.3
HE 200 M	1030	13130	220	206	15	25	18	10640	3651	90.0	52.7	967.4	354.5
W 200 × 135 × 26.6	266	3400	207	133	5.8	8.4	10	2587	329.8	87.2	31.1	250	49.6
W 200 × 135 × 31.3	313	3992	210	134	6.4	10.2	10	3139	409.6	88.7	32	298.9	61.13
W 200 × 165 × 35.9	359	4575	201	165	6.2	10.2	10	3438	764.3	86.7	40.9	342.1	92.64
W 200 × 165 × 41.7	417	5317	205	166	7.2	11.8	10	4088	900.5	87.7	41.2	398.8	108.5
IPE 220	262	3337	220	110	5.9	9.2	12	2772	204.9	91.1	24.8	252	37.25
HE 220 A	505	6434	210	220	7	11	18	5410	1955	91.7	55.1	515.2	177.7
HE 220 B	715	9104	220	220	9.5	16	18	8091	2843	94.3	55.9	735.5	258.5
HE 220 M	1170	14940	240	226	15.5	26	18	14600	5012	98.9	57.9	1217	443.5

(*contd*)

Table A.7 (*contd*)

Column Sections													
UC 200 × 203 × 46	461	5873	203.2	203.6	7.2	11	10.2	4568	1548	88.2	51.3	449.6	152.1
UC 200 × 203 × 52	520	6628	206.2	204.3	7.9	12.5	10.2	5259	1778	89.1	51.8	510.1	174
UC 200 × 203 × 60	600	7637	209.6	205.8	9.4	14.2	10.2	6125	2065	89.6	52	584.4	200.6
UC 200 × 203 × 71	710	9043	215.8	206.4	10	17.3	10.2	7618	2537	91.8	53	706	245.9
UC 200 × 203 × 86	860	10960	222.2	209.1	12.7	20.5	10.2	9449	3127	92.8	53.4	850.5	299.1
UC 200 × 200 × 100	1000	12670	229	210	14.5	27.3	10	11000	3660	93.2	53.7	961	349
(2) Nominal size 250 mm													
IPE 240	307	3912	240	120	6.2	9.8	15	3892	283.6	99.7	26.9	324.3	47.27
HE 240 A	603	7684	230	240	7.5	12	21	7763	2769	100.5	60	675.1	230.7
HE 240 B	832	10600	240	240	10	17	21	11260	3923	103.1	60.8	938.3	326.9
HE 240 M	1570	19960	270	248	18	32	21	24290	8153	110.3	63.9	1799	657.5
W 250 × 145 × 32.7	327	4175	258	146	6.1	9.1	13	4895	472.6	108.3	33.6	379.4	64.74
W 250 × 145 × 38.5	385	4929	262	147	6.6	11.2	13	6014	593.7	110.5	34.7	459.1	80.77
W 250 × 145 × 44.8	448	5732	266	148	7.6	13	13	7118	703.5	111.4	35	535.2	95.06
W250 × 200 × 49.1	491	6254	247	202	7.4	11	13	7070	1510	106	49	572	150
W250 × 200 × 58	580	7426	252	203	8	13.5	13	8740	1880	108	50.3	694	185
W250 × 200 × 67	670	8559	257	204	8.9	15.7	13	10400	2220	110	50.9	809	218
HD 260 × 68.2	682	8682	250	260	7.5	12.5	24	68.2	28.76	9198	4302	10450	3668
HD 260 × 93	930	11840	260	260	10	17.5	24	93	37.59	12830	6022	14920	5135
HD 260 × 114	1140	14570	268	262	12.5	21.5	24	114	46.08	16000	7525	18910	6456
HD 260 × 142	1420	18030	278	265	15.5	26.5	24	142	56.65	20150	9505	24330	8236
HD 260 × 172	1720	21960	290	268	18	32.5	24	172	66.89	25240	11920	31310	10450
HE 280 A	764	9726	270	280	8	13	24	13670	4763	118.6	70	1013	340.2

(*contd*)

Table A.7 (*contd*)

HE 280 B	1030	13140	280	280	10.5	18	24	19270	6595	121.1	70.9	1376	471
HE 280 M	1890	24020	310	288	18.5	33	24	39550	13160	128.3	74	2551	914.1
Column Sections													
W 250 × 250 × 73	730	9299	253	254	8.6	14.2	13	11290	3880	110.2	64.6	892.1	305.5
W 250 × 250 × 80	800	10210	256	255	9.4	15.6	13	12570	4314	111	65	982.4	338.3
W 250 × 250 × 89	890	11410	260	256	10.7	17.3	13	14260	4841	111.8	65.1	1097	378.2
W 250 × 250 × 101	1010	12900	264	257	11.9	19.6	13	16380	5549	112.7	65.6	1241	431.9
W 250 × 250 × 115	1150	14620	269	259	13.5	22.1	13	18940	6405	113.8	66.2	1408	494.6
W 250 × 250 × 131	1310	16700	275	261	15.4	25.1	13	22150	7446	115.2	66.8	1611	570.6
W 250 × 250 × 149	1490	18970	282	263	17.3	28.4	13	25940	8622	116.9	67.4	1840	655.7
W 250 × 250 × 167	1670	21320	289	265	19.2	31.8	13	30020	9879	118.7	68.1	2078	745.6
(*3*) *Nominal size 300 mm*													
IPE 300	422	5381	300	150	7.1	10.7	15	8356	603.8	124.6	33.5	557.1	80.5
HE 300 A	880	11250	290	300	8.5	14	27	18260	6310	127.4	74.9	1260	420.6
HE 300 B	1170	14910	300	300	11	19	27	25170	8563	129.9	75.8	1678	570.9
HE 300 M	2380	30310	340	310	21	39	27	59200	19400	139.8	80	3482	1252
W 310 × 100 × 23.8	238	3038	305	101	5.6	6.7	8	4280	115.6	118.7	19.5	280.7	22.89
W 310 × 100 × 28.3	283	3609	309	102	6	8.9	8	5431	158.1	122.7	20.9	351.5	30.99
W 310 × 100 × 32.7	327	4181	313	102	6.6	10.8	8	6507	191.9	124.7	21.4	415.8	37.62
W 310 × 165 × 38.7	387	4953	310	165	5.8	9.7	8	8527	726.8	131.2	38.3	550.1	88.1
W 310 × 165 × 44.5	445	5691	313	166	6.6	11.2	8	9934	854.7	132.1	38.8	634.8	103
W 310 × 165 × 52	520	6678	317	167	7.6	13.2	8	11851	1026	133.2	39.2	747.7	122.9
W 310 × 200 × 60	600	7588	303	203	7.5	13.1	15	12900	1830	130	49.1	851	180
W 310 × 200 × 67	670	8503	306	204	8.5	14.6	15	14500	2070	131	49.3	948	203

(*contd*)

Table A.7 (*contd*)

W 310 × 200 × 74	740	9484	310	205	9.4	16.3	15	16500	2340	132	49.7	1060	228
W 310 × 250 × 79	790	10046	306	254	8.8	14.6	15	17700	3990	133	63	1160	314
W 310 × 250 × 86	860	10998	310	254	9.1	16.3	15	19800	4450	134	63.6	1280	350
Column Sections													
W 310 × 310 × 97	970	12330	308	305	9.9	15.4	15	22240	7286	134.3	76.9	1444	477.8
W 310 × 310 × 107	1070	13620	311	306	10.9	17	15	24790	8123	134.9	77.2	1594	530.9
W 310 × 310 × 117	1170	14970	314	307	11.9	18.7	15	27510	9024	135.6	77.6	1753	587.9
W 310 × 310 × 129	1290	16510	318	308	13.1	20.6	15	30770	10040	136.5	78	1935	651.9
W 310 × 310 × 143	1430	18230	323	309	14	22.9	15	34760	11270	138.1	78.6	2153	729.4
W 310 × 310 × 158	1580	20050	327	310	15.5	25.1	15	38630	12470	138.8	78.9	2363	804.8
W 310 × 310 × 179	1790	22770	333	313	18	28.1	15	44530	14380	139.9	79.5	2675	918.7
W 310 × 310 × 202	2020	25800	341	315	20.1	31.8	15	51982	16588	141.9	80.2	3049	1053
W 310 × 310 × 226	2260	28880	348	317	22.1	35.6	15	59560	18930	143.6	81	3423	1194
HE 320 A	976	12440	310	300	9	15.5	27	22930	6985	135.8	74.9	1479	465.7
HE 320 B	1270	16130	320	300	11.5	20.5	27	30820	9239	138.2	75.7	1926	615.9
HE 320 M	2450	31200	359	309	21	40	27	68130	19710	147.8	79.5	3796	1276
(*4*) *Nominal size 350 mm*													
HE 340 A	1050	13350	330	300	9.5	16.5	27	27690	7436	144	74.6	1678	495.7
HE 340 B	1340	17090	340	300	12	21.5	27	36660	9690	146.5	75.3	2156	646
HE 340 M	2480	31580	377	309	21	40	27	76370	19710	155.5	79	4052	1276
IPE 360	571	7273	360	170	8	12.7	18	16270	1043	149.5	37.9	903.6	122.8
HE 360 A	1120	14280	350	300	10	17.5	27	33090	7887	152.2	74.3	1891	525.8
HE 360 B	1420	18060	360	300	12.5	22.5	27	43190	10140	154.6	74.9	2400	676.1
HE 360 M	2500	31880	395	308	21	40	27	84870	19520	163.2	78.3	4297	1268

(*contd*)

Table A.7 (*contd*)

Column Sections													
W 360 × 370 × 134	1340	17060	356	369	11.2	18	20	41510	15080	156	94	2332	817.3
W 360 × 370 × 147	1470	18790	360	370	12.3	19.8	20	46290	16720	157	94.3	2572	903.9
W 360 × 370 × 162	1620	20630	364	371	13.3	21.8	20	51540	18560	158.1	94.9	2832	1001
W 360 × 370 × 179	1790	22830	368	373	15	23.9	20	57440	20680	158.6	95.2	3122	1109
W 360 × 370 × 196	1960	25030	372	374	16.4	26.2	20	63630	22860	159.4	95.6	3421	1222
W 360 × 410 × 216	2160	27550	375	394	17.3	27.7	20	71140	28250	160.7	101.3	3794	1434
W 360 × 410 × 237	2370	30090	380	395	18.9	30.2	20	78780	31040	161.8	101.6	4146	1572
W 360 × 410 × 262	2620	33460	387	398	21.1	33.3	20	89410	35020	163.5	102.3	4620	1760
W 360 × 410 × 287	2870	36630	393	399	22.6	36.6	20	99710	38780	165	102.9	5074	1944
W 360 × 410 × 314	3140	39920	399	401	24.9	39.6	20	110200	42600	166.2	103.3	5525	2125
W 360 × 410 × 347	3470	44200	407	404	27.2	43.7	20	124900	48090	168.1	104.3	6140	2380
(*5*) *Nominal size 400 mm*													
IPE 400	663	8446	400	180	8.6	13.5	21	23130	1318	165.5	39.5	1156	146.4
HE 400 A	1250	15900	390	300	11	19	27	45070	8564	168.4	73.4	2311	570.9
HE 400 B	1550	19780	400	300	13.5	24	27	57680	10820	170.8	74	2884	721.3
HE 400 M	2560	32580	432	307	21	40	27	104100	19340	178.8	77	4820	1260
W 410 × 140 × 38.8	388	4970	399	140	6.4	8.8	11	12620	403.5	159.3	28.5	632.6	57.65
W 410 × 140 × 46.1	461	5880	403	140	7	11.2	11	15550	513.6	162.6	29.5	771.9	73.37
W 410 × 180 × 53	530	6800	403	177	7.5	10.9	11	18600	1009	165.4	38.5	922.9	114
W 410 × 180 × 60	600	7580	407	178	7.7	12.8	11	21570	1205	168.7	39.9	1060	135.4
W 410 × 180 × 67	670	8580	410	179	8.8	14.4	11	24530	1379	169.1	40.1	1196	154.1
W 410 × 180 × 75	750	9520	413	180	9.7	16	11	27460	1559	169.8	40.5	1330	173.2
W 410 × 180 × 85	850	10830	417	181	10.9	18.2	11	31530	1803	170.6	40.8	1512	199.3

(*contd*)

Table A.7 (*contd*)

W 410 × 260 × 100	1000	12700	415	260	10	16.9	11	39800	4950	177	62.4	1920	381
W 410 × 260 × 114	1140	14600	420	261	11.6	19.3	11	46200	5720	178	62.6	2200	438
W 410 × 260 × 132	1320	16840	425	263	13.3	22.2	11	53900	6740	179	63.3	2540	513
W 410 × 260 × 149	1490	19030	431	265	14.9	25	11	61900	7770	180	63.9	2870	586
(*6*) *Nominal size 450 mm*													
IPE 450	776	9882	450	190	9.4	14.6	21	33740	1676	184.8	41.2	1500	176.4
HE 450 A	1400	17800	440	300	11.5	21	27	63720	9465	189.2	72.9	2896	631
HE 450 B	1710	21800	450	300	14	26	27	79890	11720	191.4	73.3	3551	781.4
HE 450 M	2630	33540	478	307	21	40	27	131500	19340	198	75.9	5501	1260
W 460 × 150 × 52	520	6620	450	152	7.6	10.8	11	21200	634	178.9	30.9	942	83.43
W 460 × 150 × 60	600	7580	455	153	8	13.3	10	25480	796.1	183.3	32.4	1120	104.1
W 460 × 150 × 68	680	8730	459	154	9.1	15.4	10	29680	940.5	184.4	32.8	1293	122.1
W 460 × 190 × 74	740	9460	457	190	9	14.5	10	33260	1661	187.5	41.9	1456	174.8
W 460 × 190 × 82	820	10440	460	191	9.9	16	10	37000	1862	188.3	42.2	1608	195
W 460 × 190 × 89	890	11390	463	192	10.5	17.7	10	40960	2093	189.6	42.9	1769	218
W 460 × 190 × 97	970	12350	466	193	11.4	19	10	44680	2282	190.2	43.1	1917	237.8
W 460 × 190 × 106	1060	13460	469	194	12.6	20.6	10	48790	2515	190.4	43.2	2081	259.2
Column Sections													
W 460 × 280 × 113	1130	14400	463	280	10.8	17.3	18	55600	6335	196.5	66.3	2402	452.5
W 460 × 280 × 128	1280	16360	467	282	12.2	19.6	18	63690	7333	197.3	67	2728	520.1
W 460 × 280 × 144	1440	18410	472	283	13.6	22.1	18	72600	8358	198.6	67.4	3076	590.7
W 460 × 280 × 158	1580	20080	476	284	15	23.9	18	79620	9137	199.1	67.5	3346	643.5
W 460 × 280 × 177	1770	22600	482	286	16.6	26.9	18	91040	10510	200.7	68.2	3777	734.7
W 460 × 280 × 193	1930	24820	489	283	17	30.5	18	103000	11500	204	68.1	4210	813

(*contd*)

Table A.7 (*contd*)

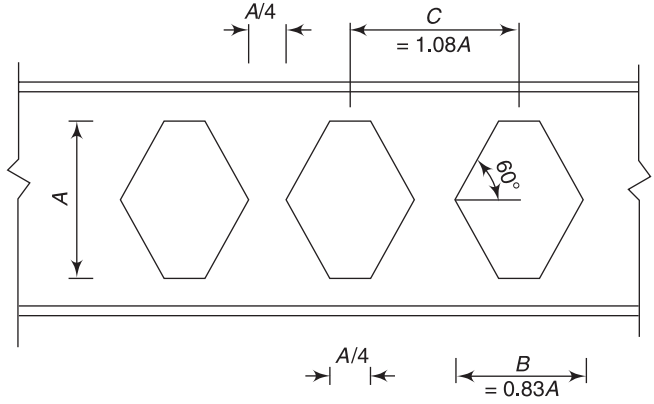
W 460 × 280 × 213	2130	27290	495	285	18.5	33.5	18	115000	13000	205	69	4650	912
W 460 × 280 × 235	2350	30100	501	287	20.6	36.6	18	128000	14500	206	69.4	5110	1010
(*7*) *Nominal size 500 mm*													
IPE 500	907	11550	500	200	10.2	16	21	48200	2142	204.3	43.1	1928	214.2
HE 500 A	1550	19750	490	300	12	23	27	86970	10370	209.8	72.4	3550	691.1
HE 500 B	1870	23860	500	300	14.5	28	27	107200	12620	211.9	72.7	4287	841.6
HE 500 M	2700	34430	524	306	21	40	27	161900	19150	216.9	74.6	6180	1252
W 530 × 210 × 92	920	11760	533	209	10.2	15.6	14	55240	2379	216.7	45	2073	227.7
W 530 × 210 × 101	1010	12940	537	210	10.9	17.4	14	61760	2692	218.5	45.6	2300	256.4
W 530 × 210 × 109	1090	13870	539	211	11.6	18.8	14	66730	2951	219.3	46.1	2476	279.7
W 530 × 210 × 123	1230	15690	544	212	13.1	21.2	14	76100	3377	220.2	46.4	2798	318.6
W 530 × 210 × 138	1380	17640	549	214	14.7	23.6	14	86160	3870	221	46.8	3139	361.7
W 530 × 310 × 150	1500	19220	543	312	12.7	20.3	14	101000	10300	229	73.2	3720	660
W 530 × 310 × 165	1650	21090	546	313	14	22.2	14	111000	11400	229	73.5	4070	728
W 530 × 310 × 182	1820	23170	551	315	15.2	24.4	14	124000	12700	231	74	4500	806
W 530 × 310 × 196	1960	25060	554	316	16.5	26.3	14	134000	13900	231	74.5	4840	880
W 530 × 310 × 213	2130	27920	560	318	18.3	29.2	14	151000	15700	233	75	5390	987
W 530 × 310 × 248	2480	31440	571	315	19	34.5	14	178000	18000	238	75.7	6230	1140
(*8*) *Nominal size 550 mm*													
IPE 550	1060	13440	550	210	11.1	17.2	24	67120	2668	223.5	44.5	2441	254.1
HE 550 A	1660	21180	540	300	12.5	24	27	111900	10820	229.9	71.5	4146	721.3
HE 550 B	1990	25410	550	300	15	29	27	136700	13080	232	71.7	4971	871.8
HE 550 M	2780	35440	572	306	21	40	27	198000	19160	236.4	73.5	6923	1252

(*contd*)

Table A.7 (*contd*)

(*9*) *Nominal size 600 mm*													
IPE 600	1220	15600	600	220	12	19	24	92080	3387	243	46.6	3069	307.9
HE 600 A	1780	22650	590	300	13	25	27	141200	11270	249.7	70.5	4787	751.4
HE 600 B	2120	27000	600	300	15.5	30	27	171000	13530	251.7	70.8	5701	902
HE 600 M	2850	36370	620	305	21	40	27	237400	18980	255.5	72.2	7660	1244
W 610 × 230 × 101	1010	12980	603	228	10.5	14.9	14	76470	2950	242.7	47.7	2536	258.8
W 610 × 230 × 113	1130	14440	608	228	11.2	17.3	14	87570	3425	246.2	48.7	2881	300.5
W 610 × 230 × 125	1250	15960	612	229	11.9	19.6	14	98650	3932	248.6	49.6	3224	343.4
W 610 × 230 × 140	1400	17850	617	230	13.1	22.2	14	111990	4514	250.5	50.3	3630	392.5
W 610 × 325 × 155	1550	19730	611	324	12.7	19	14	129000	10780	255.7	73.9	4222	666
W 610 × 325 × 174	1740	22200	616	325	14	21.6	14	147200	12370	257.4	74.6	4778	761
W 610 × 325 × 195	1950	24930	622	327	15.4	24.4	14	167900	14240	259.5	75.6	5398	871
W 610 × 325 × 217	2170	27760	628	328	16.5	27.7	14	190800	16310	262.1	76.7	6076	995
W 610 × 325 × 241	2410	30340	635	329	17.1	31	14	214200	18430	265.7	77.9	6746	1120
W 610 × 325 × 262	2620	33270	641	327	19	34	14	235990	19850	266.3	77.2	7363	1214
W 610 × 325 × 285	2850	36360	647	329	20.6	37.1	14	260700	22060	267.8	77.9	8059	1341
W 610 × 325 × 341	3410	43370	661	333	24.4	43.9	14	318300	27090	270.9	79	9630	1627
W 610 × 320 × 372	3720	47630	669	335	26.4	48	20	355000	30200	273	79.6	10600	1800
(*10*) *Nominal size 650 mm*													
HE 650 A	1900	24160	640	300	13.5	26	27	175200	11720	269.3	69.7	5474	781.6
HE 650 B	2250	28630	650	300	16	31	27	210600	13980	271.2	69.9	6480	932.3
HE 650 M	2930	37370	668	305	21	40	27	281700	18980	274.5	71.3	8433	1245
(*11*) *Nominal size 700mm*													
HE 700 A	2040	26050	690	300	14.5	27	27	215300	12180	287.5	68.4	6241	811.9
HE 700 B	2410	30640	700	300	17	32	27	256900	14440	289.6	68.7	7340	962.7
HE 700 M	3010	38300	716	304	21	40	27	329300	18800	293.2	70.1	9198	1237

Table A.8 Sectional properties of castellated beams

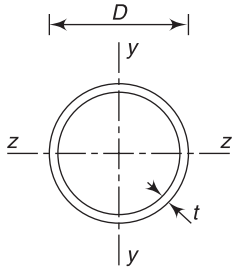


Original	*Castellated*	*Overall size (mm)*	*Weight (N/m)*	*Size of castellated holes*			*Net Moment of inertia I_Z (cm^4)*	*Design radius of gyration r_y (mm)*	*Net elastic modulus Z_z (cm^3)*
				Depth (mm) A	*Width (mm) B*	*Spacing (mm) C*			
ISMB-150	NCB-150	225 × 80	150	152	126	164	1723	15.2	152.51
ISMB-175	NCB-175	263 × 90	196	177	146	191	3012	17.0	228.63
ISMB-200	NCB-200	300 × 100	242	203	168	219	5314	19.8	352.52
ISMB-225	NCB-225	338 × 110	311	228	189	246	8168	21.5	481.91
ISMB-250	NCB-250	375 × 125	373	254	210	274	12178	24.4	646.07
ISMB-300	NCB-300	450 × 140	460	304	252	328	20297	25.9	898.1
ISMB-350	NCB-350	525 × 140	524	355	294	382	32157	25.8	1219.22
ISMB-400	NCB-400	600 × 140	615	406	336	437	48279	20.9	1601.31
ISMB-450	NCB-450	675 × 150	724	457	378	492	71693	27.1	2113.27
ISMB-500	NCB-500	750 × 180	869	508	420	547	106483	31.7	2824.49
ISMB-550	NCB-550	825 × 190	1040	558	462	601	152750	33.5	3685.16
ISMB-600	NCB-600	900 × 210	1230	609	504	656	216098	37.1	4778.29

Table A.9 Sectional properties of castellated channels

Original	*Castellated*	*Overall size (mm)*	*Weight (N/m)*	*Size of castellated holes*			*Net moment of inertia I_Z (cm^4)*	*Design radius of gyration r_y (mm)*	*Net elastic modulus Z_z (cm^3)*
				Depth (mm)	*Width (mm)*	*Spacing (mm)*			
ISMC-75	NCC-75	113 × 40	71.4	76	63	82	186	11.8	32.89
ISMC-100	NCC-100	150 × 50	95.6	102	84	109	451	14.4	59.75
ISMC-125	NCC-125	188 × 65	131	127	105	137	998	18.7	105.93
ISMC-150	NCC-150	225 × 75	168	152	126	164	1863	21.5	164.69
ISMC-175	NCC-175	263 × 75	196	178	147	192	2919	21.5	221.23
ISMC-200	NCC-200	300 × 75	223	203	168	219	4337	21.4	287.61
ISMC-225	NCC-225	338 × 80	261	229	189	246	6417	22.9	378.25
ISMC-250	NCC-250	375 × 80	306	254	210	274	9095	22.8	482.52
ISMC-300	NCC-300	450 × 90	363	305	252	328	15084	24.5	666.85
ISMC-350	NCC-350	525 × 100	427	356	294	383	23663	26.4	896.65
ISMC-400	NCC-400	600 × 100	501	406	336	438	35660	26.4	1182.35

Table A.10 Sectional properties of circular tubes



Normal bore (mm)	*Outside diameter (mm)*	*Class (mm)*	*Thickness (mm)*	*Weight (N/m)*	*Area of cross section (mm^2)*	*Surface*		*Moment of inertia (cm^4)*	*Modulus of section (cm^3)*	*Radius of gyration (mm)*	*Plastic section modulus (cm^3)*
						External (cm^2/m)	*Internal*				
15	21.3	Light	2.00	9.62	121	669	543	0.57	0.54	6.9	0.75
		Medium	2.65	12.2	155		503	0.69	0.65	6.7	0.93
		Heavy	3.25	14.5	184		465	0.77	0.73	6.5	1.07
20	26.9	Light	2.35	14.2	181	845	697	1.38	1.02	8.7	1.42
		Medium	2.65	15.8	202		679	1.5	1.12	8.6	1.57
		Heavy	3.25	19.0	241		641	1.72	1.28	8.4	1.83
25	33.7	Light	2.65	20.4	258	1059	892	3.14	1.86	11.0	2.56
		Medium	3.25	24.6	311		855	3.65	2.16	10.8	3.03
		Heavy	4.05	29.9	377		804	4.22	2.51	10.6	3.58
32	42.4	Light	2.65	26.1	331	1332	1166	6.57	3.1	14.1	4.20
		Medium	3.25	31.5	400		1128	7.71	3.64	13.9	5.00
		Heavy	4.05	38.6	488		1078	9.07	4.28	13.6	5.98

(*contd*)

Table A.10 (*contd*)

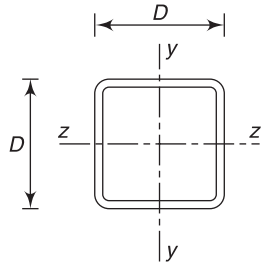
40	48.3	Light	2.9	32.7	414	1517	1335	10.7	4.43	16.1	5.99
		Medium	3.25	36.1	460		1313	11.73	4.86	16.0	6.61
		Heavy	4.05	44.3	563		1263	13.9	5.75	15.7	7.96
50	60.3	Light1	2.9	41.4	523	1894	1712	21.59	7.16	20.3	9.57
		Light2	3.25	45.7	582		1690	23.77	7.89	20.2	10.59
		Medium	3.65	51.0	650		1605	26.17	8.68	20.1	11.74
		Heavy	4.5	61.7	789		1612	30.9	10.2	19.8	14.05
65	76.1	Light	3.25	58.4	744	2391	2187	49.44	13	25.8	17.27
		Medium	3.65	65.3	831		2161	54.65	14.4	25.6	19.19
		Heavy	4.5	79.2	1010		2108	65.12	17.1	25.4	23.06
80	88.9	Light	3.25	68.6	874	2793	2589	80.31	18.1	30.3	23.85
		Medium	4.05	84.8	1080		2538	97.38	21.9	30.0	28.67
		Heavy	4.85	101.0	1280		2488	113.46	25.5	29.8	34.30
90	101.6	Light	3.65	88.2	1120	3192	2862	134.9	26.6	34.7	34.95
		Medium	4.05	97.5	1240		2937	147.9	29.1	34.5	38.55
		Heavy	4.85	116.0	1470		2887	172.9	34	34.2	45.33
100	114.3	Light	3.65	99.7	1270	3591	3361	194.4	34	39.1	44.77
		Medium	4.5	121	1550		3308	234.3	41	38.9	54.23
		Heavy	5.4	145	1850		3252	274.5	48	38.5	64.21
110	127	Light	4.5	136	1730	3990	3707	325.3	51.2	43.3	67.52
		Medium	4.85	146	1860		3685	347.7	54.8	43.2	72.39
		Heavy	5.4	162	2060		3651	382	60.2	43.0	79.83
125	139.7	Light	4.5	149	1910	4389	4106	437.2	62.6	47.8	82.27
		Medium	4.85	162	2050		4084	467.6	66.6	47.7	88.08
		Heavy	5.4	179	2280		4050	514.5	73.7	47.5	97.57

(*contd*)

Table A.10 (*contd*)

135	152.4	Light	4.5	164	2090	4788	4505	572.2	75.1	52.3	98.47
		Medium	4.85	177	2250		4483	612.5	80.4	52.2	105.77
		Heavy	5.4	195	2490		4449	674.5	88.5	52.0	116.62
150	165.1	Light	4.5	178	2270	5187	4904	732.6	88.7	56.8	116.13
		Medium	4.85	192	2440		4882	784.5	95	56.7	124.56
		Heavy	5.4	212	2710		4847	864.7	105	56.5	137.88
150	168.3	Light	4.5	181	2320	5287	5005	777.2	92.4	57.9	121.05
		Medium	4.85	196	2490		4982	832.4	98.9	57.8	129.65
		Heavy1	5.4	217	2760		4948	917.7	109	57.6	143.24
		Heavy2	6.3	253	3210		4891	1053	125	57.3	165.69
175	193.7	Light	4.85	226	2870	6085	5780	1284	133	66.8	172.65
		Medium	5.4	250	3190		5746	1417	146	66.6	191.35
		Heavy	5.9	273	3480		5715	1536	159	66.4	208.20
200	219.1	Light	4.85	257	3260	6883	6579	1874	171	75.8	222.48
		Medium	5.6	294	3760		6531	2142	195	75.5	255.71
		Heavy	5.9	310	3950		6513	2247	205	75.4	268.27
225	244.5	Heavy	5.9	342	4420	7681	7311	3149	258	84.4	335.93

Table A.11 Sectional properties of square hollow sections



Square hollow sections D × B (mm)	*Thickness t (mm)*	*Unit weight w (N/m)*	*Sectional area A (mm^2)*	*Moment of inertia*		*Radius of gyration*		*Elastic modulus*		*Plastic modulus*		*Torsional constant J (cm^4)*
				I_z (cm^4)	*I_y (cm^4)*	*r_z (mm)*	*r_y (mm)*	*Z_z (cm^3)*	*Z_y (cm^3)*	*Z_{pz} (cm^3)*	*Z_{py} (cm^3)*	
25 × 25	1.6	11.2	143	1.28	1.28	9.4	9.4	1.02	1.02	1.24	1.24	1.96
	2	13.6	174	1.48	1.48	9.2	9.2	1.19	1.19	1.48	1.48	2.29
	2.6	16.9	216	1.72	1.72	8.9	8.9	1.38	1.38	1.76	1.76	2.68
	3.2	19.8	253	1.89	1.89	8.6	8.6	1.51	1.51	2.22	2.22	2.96
32 × 32	2	18	230	3.36	3.36	12.1	12.1	2.1	2.1	2.21	2.21	5.3
	2.6	22.6	288	4.02	4.02	11.8	11.8	2.51	2.51	3.11	3.11	6.45
	3.2	26.9	342	4.54	4.54	11.5	11.5	2.84	2.84	3.59	3.59	7.41
38 × 38	2	21.8	278	5.88	5.88	14.6	14.6	3.1	3.1	3.7	3.7	9.31
	2.6	27.5	351	7.14	7.14	14.3	14.3	3.76	3.76	4.57	4.57	11.51
	3.2	32.9	419	8.18	8.18	14	14	4.3	4.3	5.34	5.34	13.45
	4	39.5	503	9.26	9.26	13.6	13.6	4.87	4.87	6.22	6.22	15.67

(*contd*)

Table A.11 (*contd*)

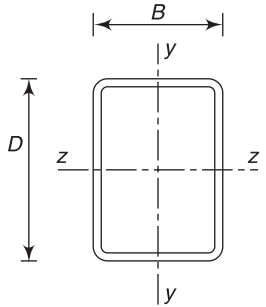
40 × 40	2.6	29.2	372	8.45	8.45	15.1	15.1	4.22	4.22	5.12	5.12	13.63
	2.9	32.1	409	9.11	9.11	14.9	14.9	4.56	4.56	5.58	5.58	14.85
	3.2	34.9	445	9.72	9.72	14.8	14.8	4.86	4.86	6.01	6.01	16
	4	42	535	11.07	11.07	14.4	14.4	5.54	5.54	7.02	7.02	18.75
49.5 × 49.5	2.6	36.9	470	16.91	16.91	19	19	6.83	6.83	8.17	8.17	27.19
	2.9	40.7	519	18.37	18.37	18.8	18.8	7.42	7.42	8.93	8.93	29.81
	3.6	49.3	628	21.42	21.42	18.5	18.5	8.66	8.66	12.81	12.81	35.54
	4.5	59.5	758	24.64	24.64	18	18	9.96	9.96	12.47	12.47	72.15
60 × 60	2.6	45.5	580	31.33	31.33	23.3	23.3	10.44	10.44	12.34	12.34	50.08
	2.9	50.3	641	34.21	34.21	23.1	23.1	11.4	11.4	13.56	13.56	56.12
	3.2	55	701	36.94	36.94	23	23	12.31	12.31	14.73	14.73	60.02
	4	67.1	855	43.55	43.55	22.6	22.6	14.52	14.52	17.64	17.64	72.41
	4.8	78.5	1001	49.22	49.22	22.2	22.2	16.41	16.41	20.27	20.27	83.86
72 × 72	3.2	67.1	854	66.32	66.32	27.9	27.9	18.42	18.42	21.8	21.8	106.81
	4	82.2	1047	79.03	79.03	27.5	27.5	21.95	21.95	26.32	26.32	129.85
	4.8	96.6	1231	90.31	90.31	27.1	27.1	25.09	25.09	30.49	30.49	151.55
91.5 × 91.5	3.6	96.7	1232	156.49	156.49	35.6	35.6	34.21	34.21	40.24	40.24	251.17
	4.5	118.8	1514	187.57	187.57	35.2	35.2	41	41	48.8	48.8	306.78
	5.4	140.1	1785	215.68	215.68	34.8	34.8	47.14	47.14	56.77	56.77	359.76
113.5 × 113.5	4.8	159.2	2028	393.3	393.3	44	44	69.3	69.3	81.81	81.81	637.45
	5.4	177.4	2260	432.58	432.58	43.8	43.8	76.23	76.23	90.55	90.55	708.69
132 × 132	4.8	187.1	2383	634.39	634.39	51.6	51.6	96.12	96.12	112.69	112.69	1018.3
	5.4	208.8	2659	700.11	700.11	51.3	51.3	106.08	106.08	125.02	125.02	1134.25

(*contd*)

Table A.11 (*contd*)

180 × 180	4	217.8	2775	1421.74	1421.74	71.6	71.6	157.97	157.97	182.21	182.21	2224.31
	5	269.7	3436	1736.87	1736.87	71.1	71.1	192.99	192.99	224.02	224.02	2747.93
	6	320.5	4083	2036.52	2036.52	70.6	70.6	226.28	226.28	264.35	264.35	3259.23
	7	370.3	4718	2321.04	2321.04	70.1	70.1	257.89	257.89	303.24	303.24	3758.53
220 × 220	4	266.1	3415	2639.14	2639.14	87.9	87.9	239.92	239.92	275.47	275.47	4099.49
	5	332.5	4236	3238.02	3238.02	87.4	87.4	294.37	294.37	339.73	339.73	5076.22
	6	395.9	5043	3813.36	3813.36	87	87	346.67	346.67	402.18	402.18	6034.53
	7	458.3	5838	4365.55	4365.55	86.5	86.5	396.67	396.67	462.83	462.83	6974.82
250 × 250	5	379.6	4836	4805.01	4805.01	99.7	99.7	384.4	384.4	442.26	442.26	7494.83
	6	452.4	5763	5672	5672	99.2	99.2	453.76	453.76	524.45	524.45	8920.44
	7	524.2	6678	6508.73	6508.73	98.7	98.7	520.7	520.7	604.58	604.58	10322.7

Table A.12 Sectional properties of rectangular hollow sections



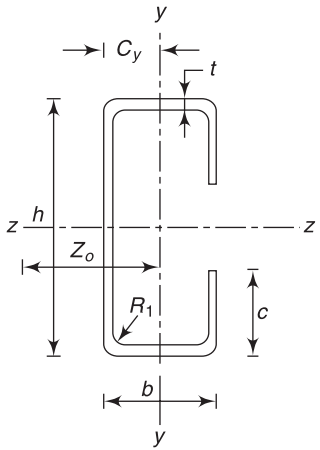
RHS D × B (mm)	*Thickness t (mm)*	*Unit weight w (N/m)*	*Area A (mm^2)*	*Moment of inertia*		*Radius of gyration*		*Elastic modulus*		*Plastic modulus*		*Torsional constant J*
				I_z (cm^4)	*I_y (cm^4)*	*r_z (mm)*	*r_y (mm)*	*Z_z (cm^3)*	*Z_y (cm^3)*	*Z_{pz} (cm^3)*	*Z_{py} (cm^3)*	*(cm^4)*
50 × 25	2	21.5	274	8.38	2.81	17.5	10.1	3.35	2.25	4.26	2.62	6.79
	2.6	27.1	346	10.16	3.36	17.1	9.9	4.06	2.69	5.26	3.17	8.27
	3.2	32.4	413	11.63	3.8	16.8	9.6	4.65	3.04	6.14	3.73	9.52
	4	38.8	495	13.13	4.23	16.3	9.2	5.25	3.38	7.13	4.29	10.86
60 × 40	2.6	37.3	476	22.76	12.09	21.9	15.9	7.59	6.05	9.36	7.07	25.59
	2.9	41.2	525	24.74	13.11	21.7	15.8	8.25	6.56	10.25	7.73	28.02
	3.6	49.8	635	28.9	15.23	21.3	15.5	9.63	7.62	12.16	9.15	33.3
	4.5	60.2	767	33.31	17.44	20.8	15.1	11.1	8.72	14.32	10.75	39.34
66 × 33	2.6	36.9	470	25.15	8.43	23.1	13.4	7.62	5.11	9.68	5.94	20.75
	2.9	40.7	519	27.33	9.12	22.9	13.3	8.28	5.53	10.59	6.49	22.65
	3.6	49.3	628	31.87	10.52	22.5	12.9	9.66	6.37	12.56	7.66	26.71
	4.5	59.5	758	36.64	11.93	22	12.5	11.1	7.23	14.77	8.94	31.21

(*contd*)

Table A.12 (*contd*)

80 × 40	2.6	45.5	580	46.58	15.74	28.4	16.5	11.65	7.87	14.64	9.01	38.5
	2.9	50.3	641	50.87	17.11	28.2	16.3	12.72	8.56	16.08	9.88	42.23
	3.2	55	701	54.94	18.41	28	16.2	13.74	9.21	17.46	10.72	45.83
	4	67.1	855	64.79	21.49	27.5	15.9	16.2	10.74	20.91	12.78	54.77
	4.8	78.5	1001	73.22	24.03	27.1	15.5	18.3	12.02	24.01	14.6	62.81
96 × 48	3.2	67.1	854	98.61	33.28	34	19.7	20.54	13.87	25.85	15.92	82.13
	4	82.2	1047	117.54	39.32	33.5	19.4	24.49	16.38	31.21	19.14	99.11
	4.8	96.6	1231	134.35	44.55	33	19	27.99	18.56	36.13	22.08	114.8
122 × 61	3.6	96.7	1232	232.61	78.83	43.4	25.3	38.13	25.84	47.71	29.43	193.91
	4.5	118.8	1514	278.94	93.78	42.9	24.9	45.73	30.75	57.85	35.56	235.39
	5.4	140.1	1785	320.83	107.03	42.4	24.5	52.6	35.09	67.29	41.22	274.29
120 × 60	3.2	85.1	1085	199.88	67.95	42.9	25	33.31	22.65	41.51	25.63	165.83
145 × 82	4.8	159.2	2028	555.16	228.5	52.3	33.6	76.57	55.73	94.93	63.93	534.27
	5.4	177.4	2260	610.85	250.59	52	33.3	84.26	61.12	105.07	70.66	592.7
172 × 92	4.8	187.1	2383	917.13	346.91	62	38.2	106.64	75.41	132.08	87.82	826.04
	5.4	208.8	2659	1012.47	381.74	61.7	37.9	117.73	82.99	146.55	94.86	918.1
220 × 140	4	217.8	2775	1892.55	947.64	82.6	58.4	172.05	135.38	206.35	151.68	2000.01
	5	269.7	3436	2313.36	1155.23	82.1	58	210.31	165.03	253.73	186.3	2467.63
	6	320.5	4083	2713.97	1351.66	81.5	57.5	246.72	193.09	299.46	219.65	2922.95
	7	370.3	4718	3094.76	1537.22	81	57.1	281.34	219.6	343.55	251.72	3366.29
260 × 180	4	268.1	3415	3357.53	1917.45	99.2	74.9	258.27	213.05	306	238.53	3822.78
	5	332.5	4236	4121.36	2349.53	98.6	74.5	317.03	261.06	377.44	294.02	4730.34
	6	395.9	5043	4855.87	2763.43	98.1	74	373.53	307.05	446.88	347.87	5619.5
	7	458.3	5838	5561.5	3159.5	97.6	73.6	427.81	351.06	514.35	400.12	6490.62
300 × 200	5	379.6	4836	6241.05	3360.92	113.6	83.4	416.07	336.09	495.65	376.37	6882.77
	6	452.4	5736	7370.23	3962.19	113.1	82.9	491.35	396.22	587.83	446.07	8186.02
	7	524.2	6678	8460.99	4540.76	112.6	82.5	564.06	454.09	677.72	513.93	9465.89

Table A.13 Sectional properties of cold-formed lipped channel sections



Designation $h \times b \times c \times t$ *(mm)*	*Weight (N/m)*	*Area A* (mm^2)	*Centre of gravity* C_y *(mm)*	*Moment of inertia*		*Radius of gyration*		*Elastic section modulus*		*Shear centre* Z_o *(mm)*	*Torsional constant,* $J\ (cm^4)$	*Warping constant* C_w (cm^6)
				$I_z\ (cm^4)$	$I_y\ (cm^4)$	r_z *(mm)*	r_y *(mm)*	$Z_z\ (cm^3)$	$Z_y\ (cm^3)$			
$30 \times 15 \times 10 \times 1.25$	6.79	86.6	6.51	1.05	0.292	11	5.81	0.697	0.344	16.6	0.004	1.03
$30 \times 15 \times 10 \times 1.60$	8.32	106	6.49	1.22	0.337	10.7	5.64	0.815	0.395	16.8	0.009	1.14
$40 \times 20 \times 10 \times 1.25$	8.76	112	7.9	2.62	0.657	15.3	7.67	1.31	0.543	20	0.006	3.06
$40 \times 20 \times 10 \times 1.60$	10.8	138	7.87	3.14	0.773	15.1	7.48	1.57	0.637	20.1	0.011	3.47
$50 \times 25 \times 10 \times 1.25$	10.7	137	9.24	5.23	1.22	19.6	9.46	2.09	0.776	23.3	0.007	7.59
$50 \times 25 \times 10 \times 1.60$	13.3	170	9.2	6.36	1.46	19.3	9.26	2.54	0.923	23.3	0.014	8.78

(*contd*)

Table A.13 (*contd*)

50 × 25 × 15 × 2.00	17.7	226	10.5	7.79	2.08	18.6	9.6	3.12	1.43	26.7	0.029	17.8
50 × 40 × 10 × 1.25	13.7	174	15.8	7.46	3.81	20.7	14.8	2.98	1.57	37.8	0.009	23.5
50 × 40 × 10 × 1.60	17.1	218	15.8	9.17	4.62	20.5	14.6	3.67	1.91	38	0.018	28
50 × 40 × 15 × 2.00	22.4	286	17.3	11.2	6.45	19.8	15	4.5	2.85	42	0.037	55.1
50 × 40 × 15 × 3.15	32.9	419	17.2	15.4	8.63	19.2	14.4	6.16	3.79	42.8	0.133	69.7
60 × 30 × 10 × 1.60	15.9	202	10.5	11.2	2.44	23.6	11	3.73	1.25	26.5	0.017	19.4
60 × 30 × 15 × 2.00	20.8	266	11.8	13.9	3.48	22.9	11.4	4.64	1.92	30	0.034	36.1
60 × 30 × 20 × 3.15	32.9	419	13	19.4	5.34	21.5	11.3	6.46	3.14	33.5	0.133	72.6
60 × 30 × 20 × 4.00	39.4	502	12.9	21.9	5.92	20.9	10.9	7.31	3.47	34	0.254	76.4
60 × 40 × 15 × 2.00	24	306	16.3	17.3	6.95	23.8	15.1	5.76	2.93	40	0.04	72.2
60 × 40 × 20 × 3.15	37.8	482	17.6	24.5	10.8	22.6	15	8.16	4.83	44	0.154	148
60 × 40 × 20 × 4.00	45.7	582	17.5	28.2	12.3	22	14.5	9.4	5.46	44.6	0.296	162
70 × 25 × 10 × 1.60	15.9	202	7.87	14.2	1.65	26.6	9.03	4.07	0.962	20.5	0.017	16.9
70 × 25 × 15 × 2.00	20.8	266	9.04	17.9	2.38	26	9.48	5.12	1.49	23.5	0.034	30
70 × 25 × 20 × 3.15	32.9	419	10	25.2	3.65	24.6	9.34	7.21	2.44	26.4	0.133	55.4
70 × 30 × 15 × 2.00	22.4	286	11.1	20.2	3.7	26.6	11.4	5.78	1.95	28.4	0.037	46.6
70 × 30 × 20 × 3.15	35.3	450	12.2	28.7	5.73	25.3	11.3	8.21	3.21	31.7	0.144	88.3
70 × 40 × 15 × 2.00	25.6	326	15.3	24.9	7.39	27.6	15.1	7.1	2.99	38.2	0.043	93.2
70 × 40 × 20 × 3.15	40.3	513	16.6	35.8	11.6	26.4	15	10.2	4.95	42	0.164	181
70 × 40 × 25 × 4.00	52	662	17.8	42.2	14.9	25.2	15	12.1	6.73	45.5	0.339	303
80 × 40 × 10 × 1.60	20.9	266	13.1	27	5.51	31.9	14.4	6.76	2.04	32.8	0.022	70.6
80 × 40 × 20 × 3.15	42.8	545	15.7	49.7	12.2	30.2	15	12.4	5.05	40.2	0.175	221
80 × 40 × 25 × 4.00	55.1	702	16.9	59.3	15.9	29.1	15	14.8	6.88	43.6	0.36	354
80 × 50 × 10 × 1.60	23.4	298	17.2	32	9.59	32.8	17.9	7.99	2.92	42.1	0.025	123
80 × 50 × 15 × 2.00	30.3	386	18.8	40.1	13.3	32.3	18.6	10	4.27	46.1	0.05	203
80 × 50 × 20 × 3.15	47.7	608	20.1	56	21.1	31.2	18.6	14.7	7.07	50.2	0.196	382

(*contd*)

Table A.13 (*contd*)

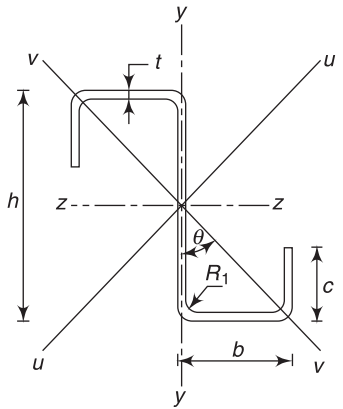
80 × 50 × 25 × 4.00	61.4	782	21.5	70.8	27.4	30.1	18.7	17.7	9.61	54	0.403	616
90 × 40 × 10 × 1.60	22.1	282	12.4	35.6	5.74	35.5	14.3	7.9	2.07	31.5	0.024	90.8
90 × 40 × 15 × 2.00	28.7	365	13.8	45	8.12	35.1	14.9	9.99	3.09	35	0.048	148
90 × 40 × 20 × 3.15	45.2	576	15	66.3	12.8	33.9	14.9	14.72	5.13	38.5	0.185	267
90 × 50 × 10 × 1.60	24.6	314	16.4	41.8	10	36.5	17.8	9.29	2.97	40.6	0.026	158
90 × 50 × 15 × 2.00	31.8	406	17.9	52.7	13.9	36	18.5	11.7	4.34	44.4	0.053	253
90 × 50 × 20 × 3.15	50.2	639	19.2	78.1	22.1	35	18.6	17.4	7.2	48.4	0.206	463
100 × 40 × 10 × 1.60	23.4	298	11.8	45.5	5.94	39.1	14.1	9.09	2.1	30.2	0.025	114
100 × 40 × 15 × 2.00	30.3	386	13.1	57.7	8.43	38.7	14.8	11.5	3.13	33.6	0.05	182
100 × 40 × 25 × 3.15	50.2	639	15.5	88.1	15.1	37.1	15.4	17.6	6.17	39.9	0.206	438
100 × 50 × 15 × 2.00	33.4	426	17.1	67.3	14.5	39.8	18.4	13.5	4.4	42.9	0.056	312
100 × 50 × 20 × 3.15	52.6	671	18.4	101	23.1	38.7	18.6	20.1	7.3	46.6	0.216	557
100 × 50 × 25 × 4.00	67.7	862	19.7	123	30.2	37.7	18.7	24.5	9.95	50.2	0.446	847
100 × 25 × 25 × 4.00	52	662	9.33	76.5	5.43	34	9.05	15.3	3.46	24.6	0.339	144
100 × 60 × 15 × 2.00	36.6	466	21.3	76.9	22.6	40.6	22	15.4	5.84	52.3	0.061	485
100 × 60 × 20 × 3.15	57.6	734	22.7	115	36.1	39.6	22.3	23.1	9.66	56.4	0.237	872
100 × 60 × 25 × 4.00	74	942	24.1	141	47.1	38.7	22.4	28.2	13.1	60.3	0.488	1330
100 × 60 × 25 × 5.00	89.1	1130	23.9	164	53.9	38	21.8	32.9	15	60.7	0.912	1460
120 × 50 × 15 × 2.00	39.9	467	15.7	103	15.4	47	18.2	17.2	4.5	40.4	0.061	453
120 × 50 × 20 × 3.15	57.6	734	17	155	24.7	46	18.4	25.9	7.48	43.6	0.237	786
120 × 50 × 25 × 4.00	74	942	18.2	192	32.5	45.1	18.6	31.9	10.2	46.9	0.488	1150
120 × 50 × 25 × 5.00	89.1	1130	18.1	223	36.8	44.3	18	39.2	11.5	47.1	0.912	1240
120 × 60 × 20 × 3.15	62.5	797	21	177	38.6	47.1	22	29.5	9.91	53	0.258	1230
120 × 60 × 25 × 4.00	80.2	1020	22.3	216	50.7	46.2	22.3	36.4	13.5	56.7	0.531	1800
120 × 60 × 25 × 5.00	96.9	1240	22.2	256	58.2	45.5	21.7	42.7	15.4	57	0.995	1990
140 × 60 × 20 × 3.15	67.5	860	19.6	255	40.8	54.4	21.8	36.4	10.1	51	0.279	1670

(*contd*)

Table A.13 (*contd*)

140 × 60 × 25 × 4.00	86.5	1100	20.9	316	53.8	53.6	22.1	45.2	13.7	53.5	0.574	2390
140 × 60 × 25 × 5.00	106	1330	20.7	373	61.8	52.8	21.5	53.2	15.7	53.4	1.08	2640
150 × 50 × 20 × 3.15	65	828	15.2	266	26.7	56.6	18	35.4	7.67	39.7	0.268	1240
150 × 50 × 25 × 4.00	83.4	1060	16.3	331	35.3	55.8	18.2	44.1	10.5	42.7	0.552	1750
150 × 50 × 25 × 5.00	102	1280	16.2	388	40.1	55	17.7	51.8	11.9	42.7	1.04	1900
180 × 50 × 20 × 3.15	72.4	923	13.8	413	28.3	66.9	17.5	45.9	7.82	36.6	0.38	1840
180 × 50 × 25 × 4.00	92.8	1180	14.9	518	37.5	66.2	17.8	57.6	10.7	33.9	0.616	2540
180 × 50 × 25 × 5.00	113	1430	14.8	611	42.6	65.3	17.2	67.9	12.1	39.2	1.16	2790
180 × 80 × 20 × 3.15	87.3	1110	24.8	561	90.7	71	28.6	62.4	16.4	62.9	0.362	5790
180 × 80 × 25 × 4.00	112	1420	26.1	704	119.4	70.4	28.9	78.2	22.2	66.5	0.744	7990
180 × 80 × 25 × 5.00	136	1730	26	841	139.4	69.6	28.4	93.4	25.8	66.6	1.14	9090
200 × 50 × 20 × 3.15	77.4	986	13	535	29.2	73.6	17.2	53.5	7.89	34.8	0.321	2320
200 × 50 × 25 × 4.00	99.1	1260	14.1	672	38.8	73	17.5	67.2	10.8	37.4	0.659	3190
200 × 50 × 25 × 5.00	120	1530	14	795	44.1	72	16.9	79.5	12.2	37.2	1.24	3510
200 × 80 × 20 × 3.15	92.2	1170	23.5	718	93.9	78.2	28.3	71.8	16.6	60.4	0.383	7230
200 × 80 × 25 × 4.00	118	1500	24.8	903	124	77.5	28.7	90.3	22.4	63.9	0.787	9970
200 × 80 × 25 × 5.00	144	1830	24.7	1080	145	76.7	28.1	108	26.1	63.8	1.49	11900
250 × 50 × 20 × 3.15	89.7	1140	11.4	927	31	90	16.5	74.1	8.03	31	0.373	3850
250 × 50 × 25 × 4.00	115	1460	12.4	1170	41.3	89.5	16.8	93.7	11	33.3	0.766	5230
250 × 50 × 25 × 5.00	140	1780	12.4	1390	47	88.4	16.2	112	12	33	1.45	5830
250 × 80 × 20 × 3.15	105	1330	20.9	1210	101	95.5	27.5	97.2	17	55.1	0.435	11900
250 × 80 × 25 × 4.00	134	1700	22.1	1530	133	94.9	28	123	23	58.2	0.894	16200
250 × 80 × 25 × 5.00	164	2080	22	1840	156	94.1	27.3	148	26.8	58	1.7	18600

Table A.14 Sectional properties of cold-formed zed sections



Designation Dimensions $h \times b \times c \times t$ *(mm)*	*Weight (N/m)*	*Area of section* (mm^2)	*Moment of inertia*		*Radius of gyration min-*r_v *(mm)*	*Angle tan* θ	*Section modulus*				*Torsional constant J* (cm^4)	*Warping constant* C_w (cm^6)
			I_Z (cm^4)	I_y (cm^4)			Z_z (cm^3)	Z_y (cm^3)	Z_u (cm^3)	Z_v (cm^3)		
$80 \times 40 \times 20 \times 1.60$	23.4	298	29.1	14.2	12.4	0.627	7.27	3.63	7.31	2.02	0.025	172
$80 \times 40 \times 20 \times 2.00$	28.7	366	35.1	17	12.3	0.623	8.77	4.35	8.89	2.4	0.048	206
$80 \times 40 \times 20 \times 2.30$	32.5	414	39.2	18.8	12.1	0.619	9.81	4.84	10	2.66	0.072	230
$80 \times 40 \times 20 \times 2.55$	35.6	454	42.5	20.2	12	0.616	10.6	5.22	10.9	2.86	0.096	248
$80 \times 40 \times 20 \times 3.15$	42.8	545	49.7	23.2	11.7	0.61	12.4	6.03	12.8	3.28	0.175	288
$85 \times 40 \times 20 \times 1.60$	24	306	33.6	14.2	12.5	0.572	7.9	3.63	7.87	2.08	0.026	195
$85 \times 40 \times 20 \times 2.00$	29.5	376	40.5	17	12.4	0.568	9.54	4.35	9.58	2.48	0.049	234
$85 \times 40 \times 20 \times 2.30$	33.4	426	45.4	18.8	12.2	0.565	10.7	4.84	10.8	2.76	0.074	260

(*contd*)

Table A.14 (*contd*)

85 × 40 × 20 × 2.55	36.6	467	49.2	20.2	12.1	0.562	11.6	5.22	11.8	2.96	0.099	281
85 × 40 × 20 × 3.15	44	560	57.6	23.2	11.8	0.555	13.6	6.03	13.9	3.4	0.18	326
90 × 40 × 20 × 1.60	24.6	314	38.5	14.2	12.6	0.526	8.55	3.36	8.47	2.15	0.026	219
90 × 40 × 20 × 2.00	30.3	386	46.5	17	12.4	0.521	10.3	4.35	10.3	2.56	0.059	263
90 × 40 × 20 × 2.30	34.3	438	52.1	18.8	12.3	0.518	11.6	4.84	11.6	2.84	0.076	293
90 × 40 × 20 × 2.55	37.6	480	56.5	20.2	12.2	0.515	12.6	5.22	12.7	3.06	0.102	317
90 × 40 × 20 × 3.15	45.2	576	66.3	23.2	11.9	0.509	14.7	6.03	15	3.51	0.185	368
95 × 40 × 20 × 1.60	25.3	322	43.7	14.2	12.6	0.485	9.2	3.63	9.08	2.2	0.027	245
95 × 40 × 20 × 2.00	31.1	396	52.9	17	12.5	0.481	11.1	4.35	11.1	2.63	0.052	294
95 × 40 × 20 × 2.30	35.2	449	59.4	18.8	12.3	0.478	12.5	4.84	12.5	2.92	0.078	328
95 × 40 × 20 × 2.55	38.6	492	64.4	20.2	12.2	0.475	13.6	5.22	13.6	3.14	0.104	355
95 × 40 × 20 × 3.15	46.5	592	75.6	23.2	11.9	0.468	15.9	6.03	16.1	3.61	0.19	412
100 × 40 × 20 × 1.60	25.9	330	49.4	14.2	12.7	0.45	9.88	3.63	9.7	2.26	0.028	272
100 × 40 × 20 × 2.00	31.8	406	59.8	17	12.5	0.446	12	4.35	11.9	2.7	0.053	327
100 × 40 × 20 × 2.30	36.2	460	67.2	18.8	12.4	0.443	13.4	4.84	13.4	2.99	0.08	365
100 × 40 × 20 × 2.55	39.6	505	73	20.2	12.2	0.44	14.6	5.22	14.6	3.22	0.107	395
100 × 40 × 20 × 3.15	47.7	608	85.7	23.2	12	0.434	17.1	6.03	17.3	3.71	0.196	459
105 × 45 × 20 × 1.60	27.8	354	59.8	19.2	14	0.482	11.4	4.34	11.1	2.67	0.03	393
105 × 45 × 20 × 2.00	34.2	436	72.6	23	13.8	0.478	13.8	5.22	13.6	3.2	0.057	474
105 × 45 × 20 × 2.30	38.9	495	81.6	25.5	13.6	0.475	15.5	5.82	15.4	3.56	0.086	530
105 × 45 × 20 × 2.55	42.6	543	88.8	27.5	13.5	0.472	16.9	6.29	16.8	3.84	0.115	574
105 × 45 × 20 × 3.15	51.4	655	105	31.7	13.2	0.466	20	7.31	20	4.44	0.211	671
110 × 45 × 20 × 1.60	28.4	362	66.7	19.2	14	0.45	12.1	4.34	11.6	2.73	0.03	433
110 × 45 × 20 × 2.00	35	446	81.1	23	13.8	0.446	14.7	5.22	14.5	3.27	0.058	522
110 × 45 × 20 × 2.30	39.8	506	91.2	25.5	13.7	0.443	16.6	5.82	16.3	3.64	0.088	585
110 × 45 × 20 × 2.55	43.6	556	99.3	27.5	13.6	0.441	18	6.29	17.9	3.93	0.118	634

(*contd*)

Table A.14 (*contd*)

110 × 45 × 20 × 3.15	52.6	671	117	31.7	13.3	0.435	21.3	7.31	21.3	4.54	0.216	742
115 × 45 × 20 × 1.60	29	370	74.1	19.2	14	0.422	12.9	4.34	12.6	2.78	0.031	476
115 × 45 × 20 × 2.00	35.8	456	90.1	23.8	13.8	0.418	15.7	5.22	15.4	3.33	0.06	574
115 × 45 × 20 × 2.30	40.7	518	101	25.5	13.7	0.415	17.6	5.82	17.4	3.71	0.09	643
115 × 45 × 20 × 2.55	44.6	569	110	27.5	13.6	0.413	19.2	6.3	19	4.01	0.121	697
115 × 45 × 20 × 3.15	53.9	686	131	31.7	13.3	0.407	22.7	7.31	22.6	4.63	0.222	816
120 × 45 × 20 × 1.60	29.7	378	82	19.2	14	0.397	13.7	4.34	13.3	2.83	0.032	521
120 × 45 × 20 × 2.00	36.6	466	99.7	23	13.9	0.393	16.6	5.22	16.3	3.39	0.061	629
120 × 45 × 20 × 2.30	41.6	530	112	25.5	13.7	0.39	18.7	5.82	18.4	3.78	0.092	704
120 × 45 × 20 × 2.55	45.6	582	122	27.5	13.6	0.388	20.4	6.3	20.1	4.08	0.124	764
120 × 45 × 20 × 3.15	55.1	702	145	31.7	13.3	0.382	24.1	7.31	24	4.72	0.227	895
125 × 45 × 20 × 1.60	30.3	386	90.3	19.2	14.1	0.374	14.4	4.34	14.1	2.88	0.033	568
125 × 45 × 20 × 2.00	37.3	476	110	23	13.9	0.37	17.6	5.22	17.2	3.45	0.062	686
125 × 45 × 20 × 2.30	42.5	541	124	25.5	13.7	0.368	19.8	5.82	19.5	3.85	0.094	769
125 × 45 × 20 × 2.55	46.6	594	135	27.5	13.6	0.365	21.6	6.3	21.3	4.15	0.126	834
125 × 45 × 20 × 3.15	56.4	718	160	31.7	13.3	0.36	25.6	7.31	25.4	4.8	0.232	977
130 × 45 × 20 × 1.60	30.9	394	99.1	19.2	14.1	0.353	15.2	4.34	14.9	2.92	0.033	618
130 × 45 × 20 × 2.00	38.1	486	121	23	13.9	0.35	18.6	5.22	18.2	3.5	0.064	746
130 × 45 × 20 × 2.30	43.4	552	136	25.5	13.7	0.347	20.9	5.82	20.6	3.91	0.096	836
130 × 45 × 20 × 2.55	47.6	607	148	27.5	13.6	0.345	22.8	6.3	22.5	4.22	0.129	908
130 × 45 × 20 × 3.15	57.6	734	176	31.7	13.3	0.34	27	7.31	26.9	4.88	0.237	1060
140 × 60 × 20 × 1.60	36	458	141	40.2	17.9	0.449	20.2	6.74	19.3	4.38	0.039	1400
140 × 60 × 20 × 2.00	44.4	566	173	48.5	17.7	0.445	24.7	8.22	23.7	5.28	0.074	1700
140 × 60 × 20 × 2.30	50.6	644	195	54.3	17.6	0.443	27.9	9.22	26.9	5.91	0.112	1910
140 × 60 × 20 × 2.55	55.7	709	213	58.8	17.4	0.441	30.5	10	29.5	6.41	0.151	2100
140 × 60 × 20 × 3.15	67.5	860	255	68.7	17.1	0.435	36.4	11.8	35.4	7.48	0.279	2500

(*contd*)

Table A.14 (*contd*)

150 × 60 × 20 × 1.60	37.2	474	166	40.2	18	0.406	22.1	6.79	21.2	4.5	0.04	1600
150 × 60 × 20 × 2.00	46	586	203	48.5	17.8	0.403	27	8.22	26	5.43	0.077	1970
150 × 60 × 20 × 2.30	52.4	668	229	54.3	17.6	0.401	30.6	9.22	29.5	6.08	0.116	2220
150 × 60 × 20 × 2.55	57.7	734	251	58.8	17.5	0.399	33.5	10	32.4	6.59	0.157	2420
150 × 60 × 20 × 3.15	70	891	300	68.7	17.2	0.394	40	11.8	38.9	7.7	0.289	2870
160 × 60 × 20 × 1.60	38.5	490	193	40.2	18	0.37	24.1	6.79	23.1	4.6	0.042	1870
160 × 60 × 20 × 2.00	47.5	606	236	48.5	17.8	0.367	29.5	8.22	28.4	5.56	0.08	2270
160 × 60 × 20 × 2.30	54.2	690	267	54.3	17.7	0.365	33.4	9.22	32.2	6.22	0.12	2560
160 × 60 × 20 × 2.55	59.7	760	292	58.8	17.6	0.363	36.5	10	35.4	6.75	0.162	2790
160 × 60 × 20 × 3.15	72.4	923	349	68.7	17.2	0.358	43.7	11.8	42.6	7.9	0.3	3310
170 × 60 × 20 × 1.60	39.7	506	222	40.2	18.1	0.339	26.1	6.79	25.1	4.7	0.043	2130
170 × 60 × 20 × 2.00	49.1	626	272	48.5	17.8	0.337	32	8.22	30.9	5.67	0.082	2600
170 × 60 × 20 × 2.30	56	714	308	54.3	17.7	0.334	36.3	9.22	35.1	6.36	0.124	2920
170 × 60 × 20 × 2.55	61.7	786	337	58.8	17.5	0.332	39.7	10	38.5	6.9	0.168	3190
170 × 60 × 20 × 3.15	74.9	954	404	68.7	17.2	0.328	47.5	11.8	46.3	8.07	0.31	3780
180 × 60 × 20 × 1.60	41	522	254	40.2	18	0.313	28.2	6.79	27.2	4.78	0.044	2430
180 × 60 × 20 × 2.00	50.7	646	311	48.5	17.8	0.31	34.6	8.22	33.5	5.78	0.085	2940
180 × 60 × 20 × 2.30	57.8	736	353	54.3	17.7	0.308	39.2	9.22	38	6.48	0.128	3320
180 × 60 × 20 × 2.55	63.7	811	386	58.8	17.6	0.306	42.9	10	41.7	7.03	0.174	3620
180 × 60 × 20 × 3.15	77.4	986	463	68.7	17.2	0.302	51.4	11.8	50.3	8.24	0.321	4290
190 × 60 × 20 × 1.60	42.2	538	289	40.2	18	0.289	30.4	6.79	29.3	4.84	0.046	2720
190 × 60 × 20 × 2.00	52.2	667	354	48.5	17.8	0.287	37.3	8.22	36.1	5.88	0.088	3310
190 × 60 × 20 × 2.30	59.6	760	401	55.3	17.6	0.285	42.2	9.22	41	6.59	0.132	3740
190 × 60 × 20 × 2.55	65.7	837	439	55.3	17.5	0.283	46.2	10	45	7.15	0.179	4070
190 × 60 × 20 × 3.15	79.8	1017	527	68.7	17.2	0.279	55.4	11.8	54.3	8.38	0.331	4840
200 × 60 × 20 × 1.60	43.5	554	326	40.2	18	0.269	32.6	6.79	31.5	4.94	0.047	3040

(*contd*)

Table A.14 (*contd*)

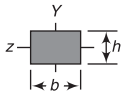
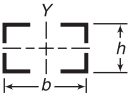
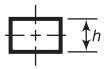
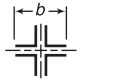
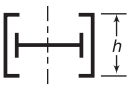
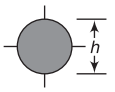
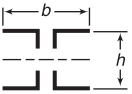
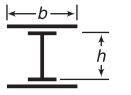
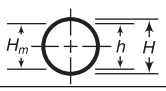
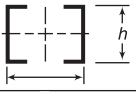
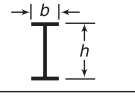
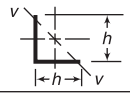
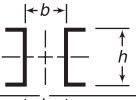
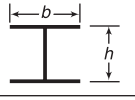
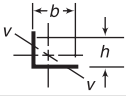
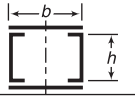
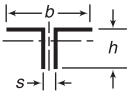
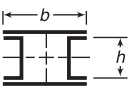
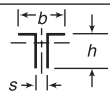
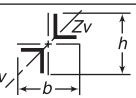
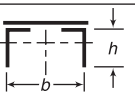
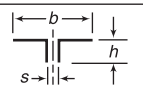
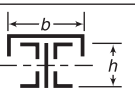
200 × 60 × 20 × 2.00	53.8	686	400	48.5	17.8	0.266	40	8.22	38.8	5.97	0.09	3710
200 × 60 × 20 × 2.30	61.4	780	453	55.3	17.6	0.265	45.3	9.22	44.1	6.7	0.136	4180
200 × 60 × 20 × 2.55	67.7	862	496	58.8	17.5	0.263	49.6	10	48.5	7.27	0.184	4560
200 × 60 × 20 × 3.15	82.3	1049	596	68.7	17.2	0.259	59.6	11.8	58.4	8.52	0.341	5420
210 × 60 × 20 × 1.60	44.7	570	366	40.2	17.9	0.251	34.9	6.79	33.8	5.01	0.048	3390
210 × 60 × 20 × 2.00	55.4	706	449	48.5	17.7	0.248	42.8	8.22	41.6	6.06	0.093	4130
210 × 60 × 20 × 2.30	63.2	805	509	54.3	17.6	0.247	48.5	9.22	47.3	6.79	0.14	4650
210 × 60 × 20 × 2.55	69.7	888	558	58.8	17.4	0.245	53.1	10	52	7.37	0.19	5080
210 × 60 × 20 × 3.15	88.4	1080	667	68.7	17.1	0.241	63.8	11.8	62.7	8.65	0.352	6030
220 × 60 × 20 × 1.60	46	586	409	40.2	17.9	0.235	37.2	6.79	36.1	5.07	0.05	3750
220 × 60 × 20 × 2.00	57	726	502	48.5	17.6	0.232	45.6	8.22	44.5	6.13	0.096	4570
220 × 60 × 20 × 2.30	65	828	569	55.3	17.5	0.231	51.8	9.22	50.6	6.88	0.145	5160
220 × 60 × 20 × 2.55	71.7	913	624	58.8	17.4	0.229	56.7	10	55.6	7.47	0.196	5620
220 × 60 × 20 × 3.15	87.3	1110	750	68.8	17	0.226	68.1	11.8	67.1	8.76	0.362	6680
230 × 75 × 20 × 1.60	51	650	517	72.1	22	0.29	45	9.72	43.1	7.01	0.055	6990
230 × 75 × 20 × 2.00	63.2	806	636	87.5	21.8	0.287	55.3	11.8	53.2	8.52	0.106	8550
230 × 75 × 20 × 2.30	72.3	920	723	98.3	21.6	0.285	62.9	13.3	60.5	9.58	0.161	9670
230 × 75 × 20 × 2.55	79.7	1020	793	107	21.4	0.284	69	14.5	66.6	10.4	0.218	10600
230 × 75 × 20 × 3.15	97.2	1240	956	126	21.1	0.28	83.2	17.2	80.6	12.3	0.404	12600
240 × 75 × 20 × 1.60	52.3	666	512	72.1	21.9	0.272	47.6	9.72	45.7	7.1	0.056	7680
240 × 75 × 20 × 2.00	64.8	826	703	87.5	21.7	0.27	58.6	11.8	56.5	8.62	0.109	9390
240 × 75 × 20 × 2.30	74.1	944	799	98.3	21.6	0.269	66.6	13.3	64.3	9.7	0.165	10600
240 × 75 × 20 × 2.55	81.7	1040	878	107	21.4	0.267	73.1	14.5	70.7	10.6	0.223	11600
240 × 75 × 20 × 3.15	99.6	1270	1060	126	21.1	0.264	88.2	17.2	85.7	12.5	0.414	13900
250 × 75 × 20 × 1.60	53.5	682	629	72.1	21.9	0.257	50.3	9.72	48.5	7.17	0.058	8400
250 × 75 × 20 × 2.00	66.4	846	775	87.5	21.7	0.255	62	11.8	59.8	8.71	0.112	10300

(*contd*)

Table A.14 (*contd*)

250 × 75 × 20 × 2.30	75.9	966	881	98.3	21.5	0.253	70.5	13.3	68.2	9.81	0.169	11600
250 × 75 × 20 × 2.55	83.7	1070	967	107	21.4	0.252	77.4	14.5	75	10.7	0.229	12700
250 × 75 × 20 × 3.15	102	1300	1170	126	21	0.249	93.3	17.2	90.8	12.6	0.428	15200
260 × 75 × 20 × 1.60	54.8	698	697	72.1	21.8	0.234	53.1	9.72	51.3	7.24	0.059	9160
260 × 75 × 20 × 2.00	68	866	850	87.5	21.6	0.241	65.4	11.8	63.3	8.8	0.114	11200
260 × 75 × 20 × 2.30	77.7	990	967	98.3	21.4	0.279	74.4	13.3	72.1	9.91	0.173	12700
260 × 75 × 20 × 2.55	85.7	1090	1060	107	21.3	0.2338	81.7	14.5	79.3	10.8	0.234	13900
260 × 75 × 20 × 3.15	105	1330	1280	126	21	0.235	98.6	17.2	96.1	12.7	0.435	16600
270 × 75 × 20 × 1.60	56	714	755	72.1	21.8	0.23	55.9	9.72	54.1	7.31	0.061	9960
270 × 75 × 20 × 2.00	69.5	886	930	87.5	21.6	0.228	68.9	11.8	66.8	8.89	0.117	12200
270 × 75 × 20 × 2.30	79.5	1010	1060	98.3	21.4	0.227	78.3	13.3	76.1	10	0.177	13800
270 × 75 × 20 × 2.55	87.7	1120	1160	107	21.2	0.225	86.1	14.5	83.7	10.9	0.24	15100
270 × 75 × 20 × 3.15	107	1360	1400	126	20.9	0.222	104	17.2	102	12.9	0.446	18100
280 × 75 × 20 × 1.60	57.3	730	823	72.1	21.7	0.219	58.8	9.72	57	7.38	0.062	10800
280 × 75 × 20 × 2.00	71.1	906	1010	87.5	21.5	0.217	72.5	11.8	70.4	8.97	0.12	13200
280 × 75 × 20 × 2.30	81.3	1040	1150	98.3	21.3	0.215	82.4	13.3	80.2	10.1	0.181	15000
280 × 75 × 20 × 2.55	89.7	1140	1270	106.9	21.2	0.214	90.5	14.5	88.3	11	0.245	16400
280 × 75 × 20 × 3.15	110	1400	1530	126	20.8	0.211	109	17.2	107	13	0.456	19600
290 × 75 × 20 × 1.60	58.6	746	895	72.1	21.6	0.208	61.7	9.72	59.2	7.44	0.063	11700
290 × 75 × 20 × 2.00	72.7	926	1100	87.5	21.4	0.206	76.1	11.8	74	9.04	0.122	14300
290 × 75 × 20 × 2.30	83.7	1060	1250	98.3	21.3	0.205	86.5	13.3	84.4	10.2	0.185	16200
290 × 75 × 20 × 2.55	91.7	1170	1380	107	21.1	0.203	95.1	14.5	92.9	11.1	0.251	17700
290 × 75 × 20 × 3.15	112	1430	1670	126	20.8	0.2	115	17.2	113	13.1	0.466	21200
300 × 75 × 20 × 1.60	59.8	762	970	72.1	21	0.198	64.7	9.72	62.9	7.5	0.065	12600
300 × 75 × 20 × 2.00	74.2	946	1200	87.5	21.4	0.196	79.81	11.6	77.8	9.11	0.125	15400
300 × 75 × 20 × 2.30	84.9	1080	1360	98.3	21.2	0.195	90.8	13.3	88.7	10.3	0.189	17400
300 × 75 × 20 × 2.55	93.7	1190	1500	107	21	0.194	99.7	14.5	97.6	11.2	0.256	19100
300 × 75 × 20 × 3.15	115	1460	1810	126	20.7	0.191	121	17.2	118	13.2	0.477	22800

Table A.15 Approximate radius of gyration

 $r_z = 0.29h$ $r_y = 0.29b$	 $r_z = 0.42h$ $r_y = 0.42b$	 $r_z = 0.31h$
 $r_z = 0.40h$ r_y = mean h	 r_y = same as for 2 L	 $r_z = 0.31h$
 $r_z = 0.25h$	 $r_z = 0.42h$ r_y = same as for 2 L	 $r_z = 0.40h$ $r_y = 0.21b$
 $r = \sqrt{\frac{H^2 + h^2}{16}}$ $r = 0.35H_m$	 $r_z = 0.36h$ $r_y = 0.45b$	 $r_z = 0.38h$ $r_y = 0.22b$
 $r_z = 0.31h$ $r_y = 0.31h$ $r_v = 0.197h$	 $r_z = 0.36h$ $r_y = 0.60b$	 $r_z = 0.435h$ $r_y = 0.25b$
 $r_z = 0.29h$ $r_y = 0.32b$ $r_v = 0.18\,\frac{h+b}{2}$	 $r_z = 0.36h$ $r_y = 0.53b$	 $r_z = 0.42h$
 $r_z = 0.31h$ $r_y = 0.21b$ $= b(0.21 + 0.02s)$	 $r_z = 0.42h$ $r_y = 0.32b$	 $r_z = 0.42h$
 $r_z = 0.32h$ $r_y = 0.21b$ $= b(0.19 + 0.02s)$	 $r_z = 0.21h$ $r_y = 0.21b$ $r_v = 0.19b$	 $r_z = 0.285h$ $r_y = 0.37b$
 $r_z = 0.29h$ $r_y = 0.24b$ $= b(0.23 + 0.02s)$		 $r_z = 0.42h$ $r_y = 0.23b$

*J.A.L. Waddell. *Bridge Engineering*, Vol. 1. New York: John Wiley & Sons. Inc., 1916, p. 504.