2705/302
2709/302
2710/302
STRUCTURES III
June/July 2019
Time: 3 hours

THE KENYA NATIONAL EXAMINATIONS COUNCIL

DIPLOMA IN BUILDING TECHNOLOGY
DIPLOMA IN ARCHITECTURE

MODULE III

STRUCTURES III

3 hours

INSTRUCTIONS TO CANDIDATES

You should have the following for this examination:
answer booklet;
scientific calculator.
*This paper consists of **EIGHT** questions.*
*Answer any **FIVE** questions.*
Maximum marks for each part of a question are as indicated.
All relevant tables for this examination are provided.
Candidates should answer the questions in English.

This paper consists of 14 printed pages.

Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.

Turn over

1. A 230 kN reaction from a beam of which a half is due to the imposed loads is supported at the top of a pin-jointed stanchion, 4 m long.
Check if a 203 x 203 x 46 kg/m U.C. in grade S275 steel is satisfactory.
Assume that the beam to stanchion connection is to the web as shown in **figure 1**.

(20 marks)

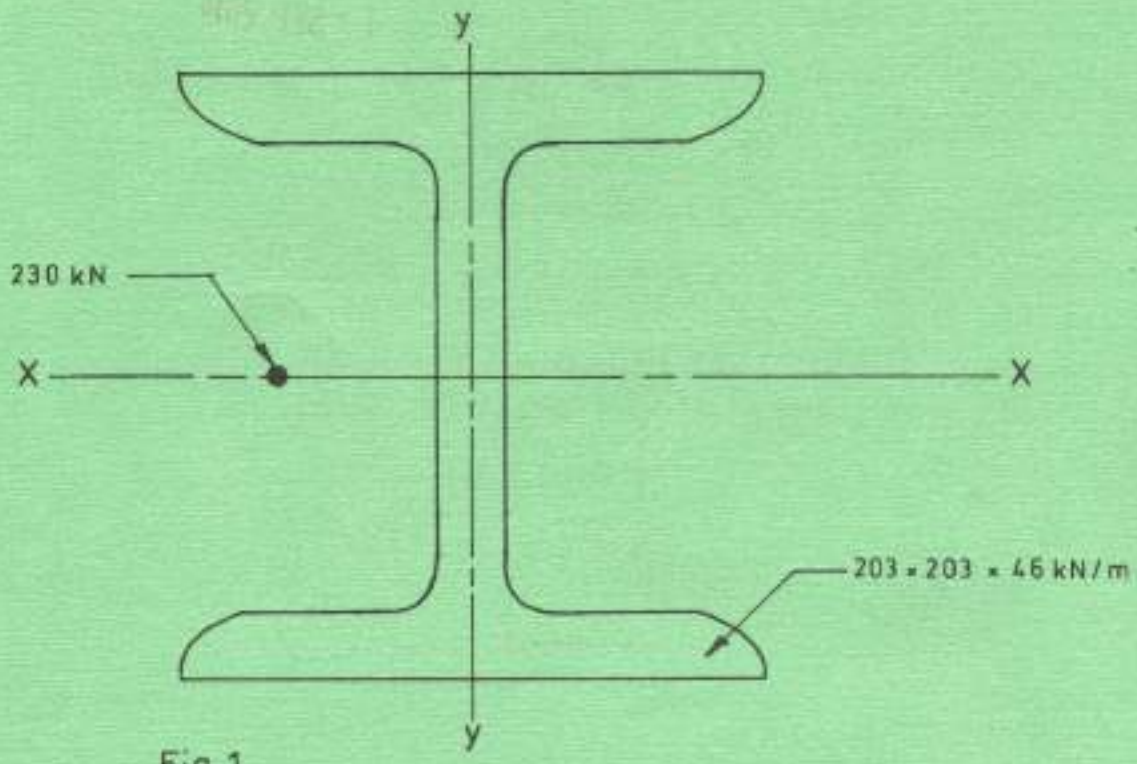


Fig. 1

(2) Using moment distribution method, analyse the loaded portal frame shown in **figure 2 and** hence draw the bending moment diagram showing values at critical points.

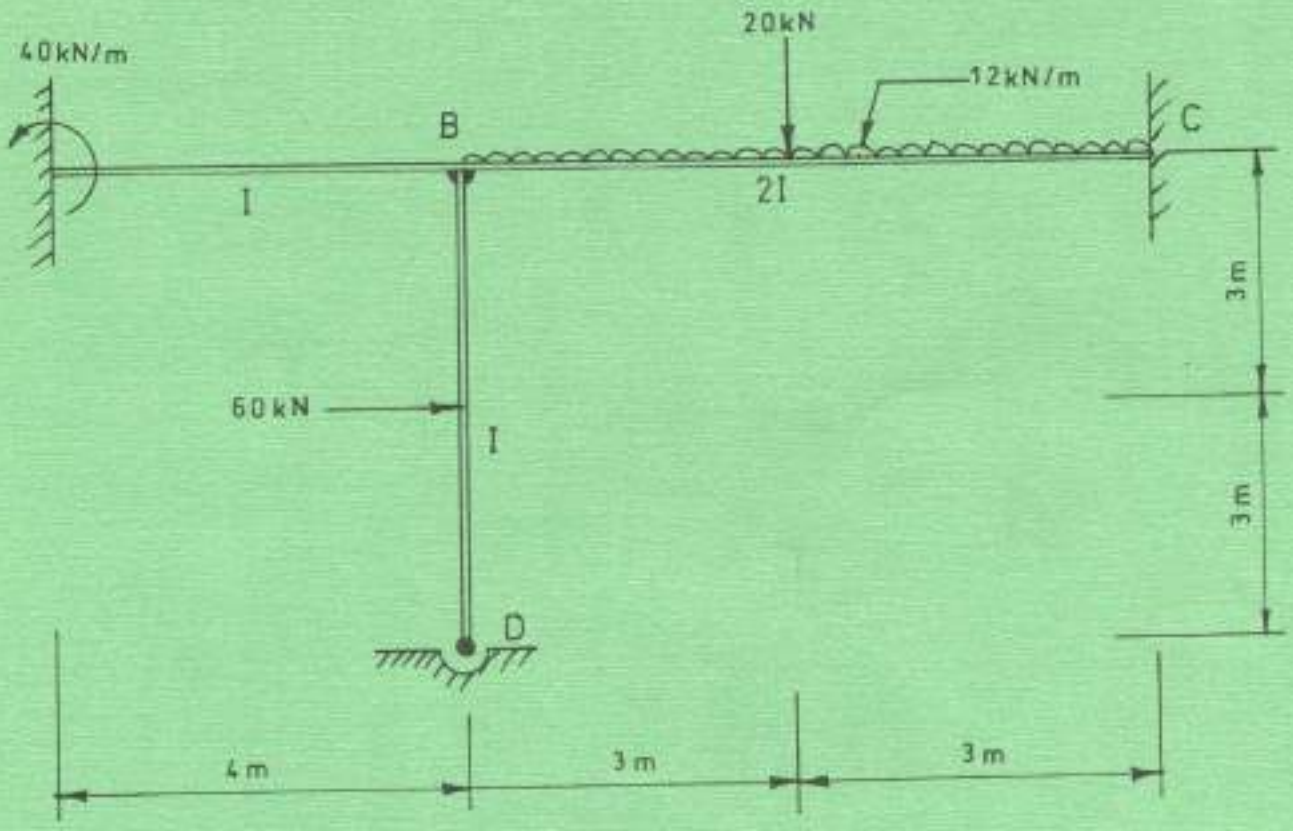


Fig. 2

3. A reinforced concrete suspended slab of a library is supported on universal beams as shown in **figure 3**. The design loading has been estimated as:

- Dead loads from slab, finishes, self weight, etc = 6 kN/m^2
- Imposed loads from furniture, books, etc = 4 kN/m^2

Determine the suitable section of universal beam for beam B_2 in grade S275 steel and hence check shear, moment capacity and deflection given that:

- permissible deflection = $\frac{1}{360}$ of span.
- E_{steel} = 210 kN/mm^2
- Allowable shear = 0.6 py

(20 marks)

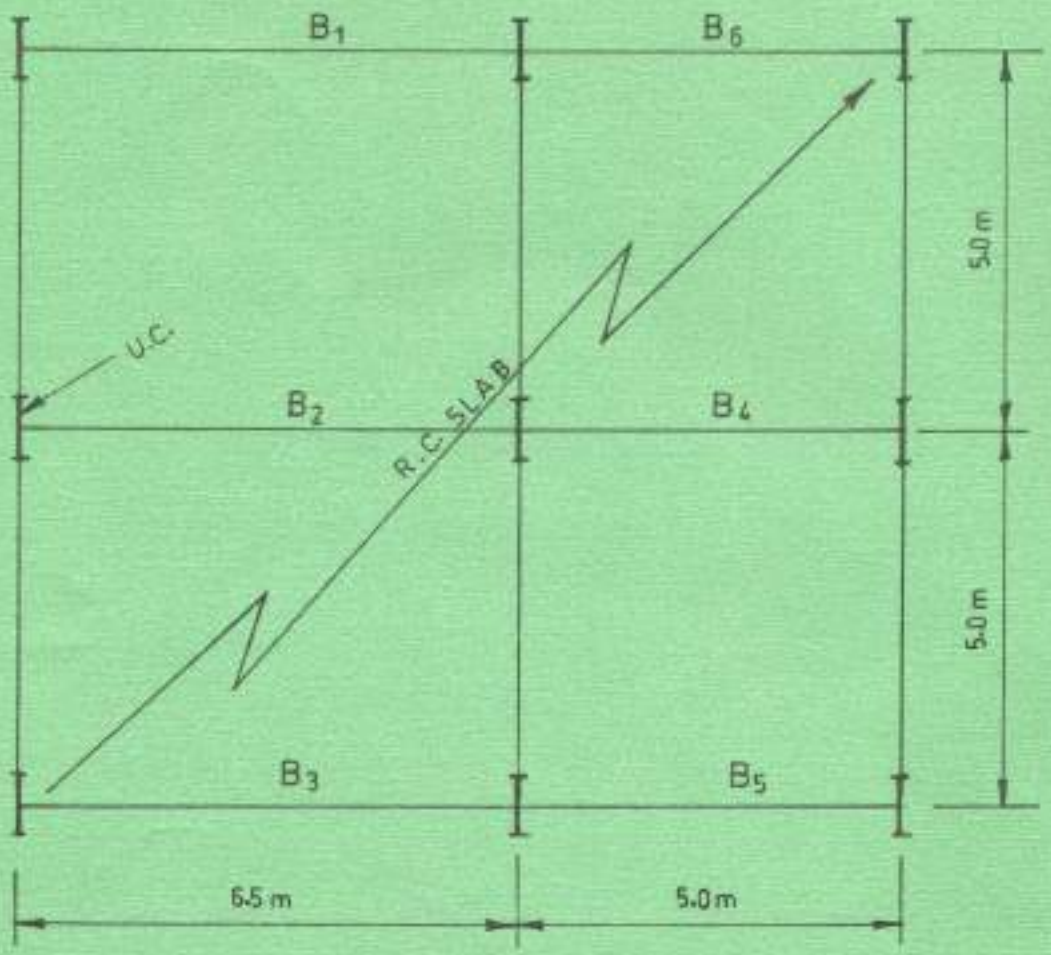


Fig. 3

4. **Figure 4** shows a loaded continuous beam. Using the three moment theorem, analyze the beam and hence plot the shear force and bending moments diagram indicating values at critical points. (20 marks)

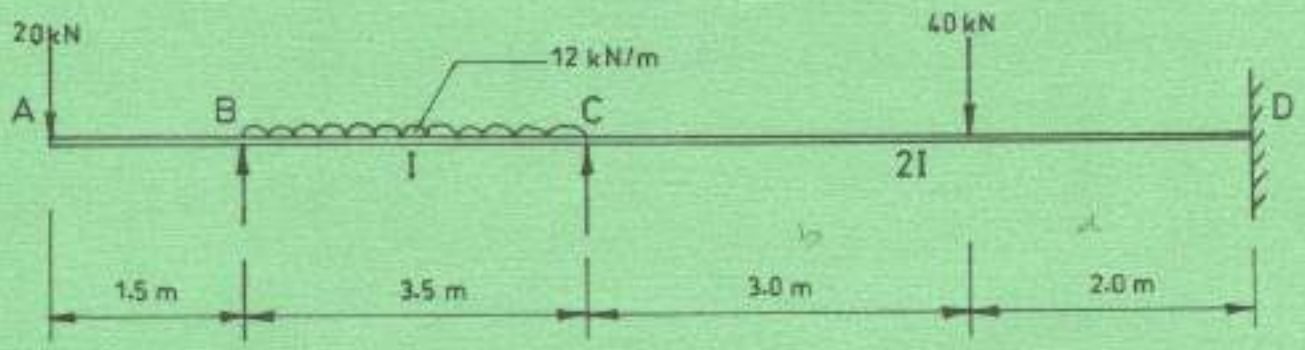


Fig. 4

5. (a) State **two** methods of grading structural timber giving one advantage of each. (4 marks)

(b) **Figure 5** shows a loaded timber joist beam. Check the adequacy of the 250 x 100 mm joist in shear, bending and deflection given the following data:

Grade stresses for C18 timber:

- In bending parallel to grain = 5.8 N/mm^2
- In shear parallel to grain = 0.67 N/mm^2

Permissible deflection = $\frac{1}{360}$ of span

Modification factors: $K_3 = 1.25$ $K_7 = 1.04$ and $K_8 = 1.1$

Actual deflection $\delta = \frac{5wl^4}{384\,EI} + \frac{Wl^3}{48\,EI}$

Where: w = imposed factored load (U.D.L)

W = Imposed factored point loads.

$E_{mean} = 9100$ N/mm^2

(16 marks)

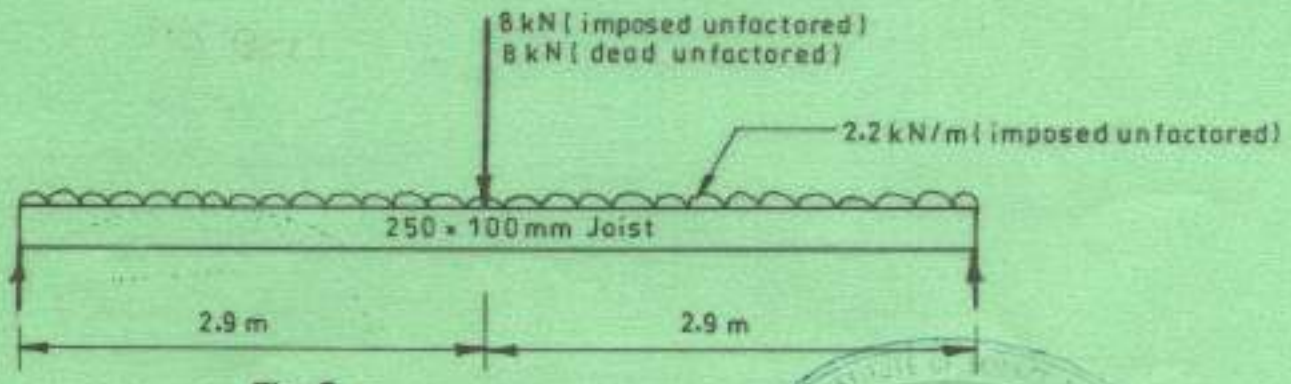


Fig. 5

6. (a) State **three** situations where influence lines can be applied in structures.

(b) A girder has a span of 40 m. Two concentrated loads of 18 kN and 25 kN at a fixed distance of 5 m, rolling along it are applied. Find the value of maximum B.M. and S.F. at 10 m, 20 m and 30 m from the left hand end. (17 marks)

7. Analyse the loaded beam shown in **figure 6** using moment distribution method and hence draw the shear force and bending moment diagrams, indicating values at all critical points. (20 marks)

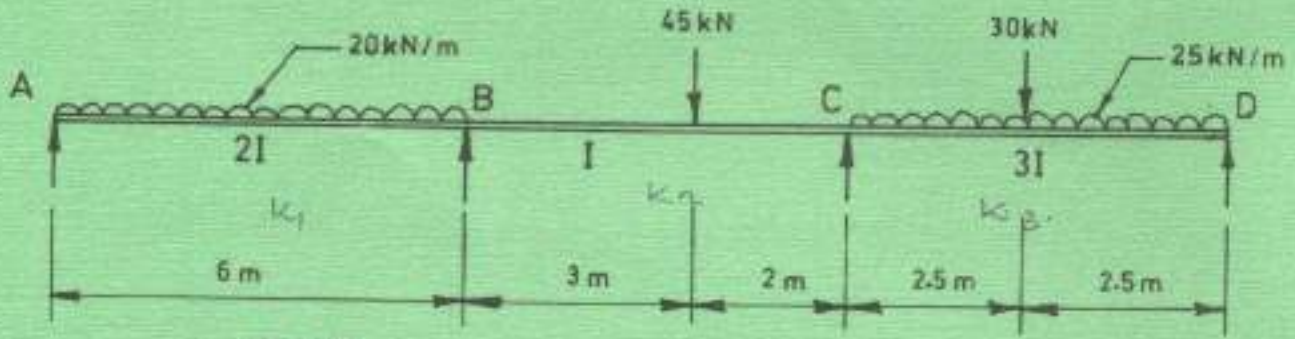


Fig. 6

8. (a) Using neat sketches, illustrate the following types of welds:

(i) Double 'U' butt weld;
(ii) Double 'V' butt weld;
(iii) Single 'J' butt weld.

(6 marks)

(b) **Figure 7(a)** shows a steel bolted joint of two tension members of size 15 x 200 mm Determine suitable sizes of bolts to be used to withstand the tensile force applied of 175 kN.

Take: Shear strength of bolts $P_s = 375$ N/mm^2

Bearing strength on plate $P_{bb} = 1000$ N/mm^2

(8 marks)

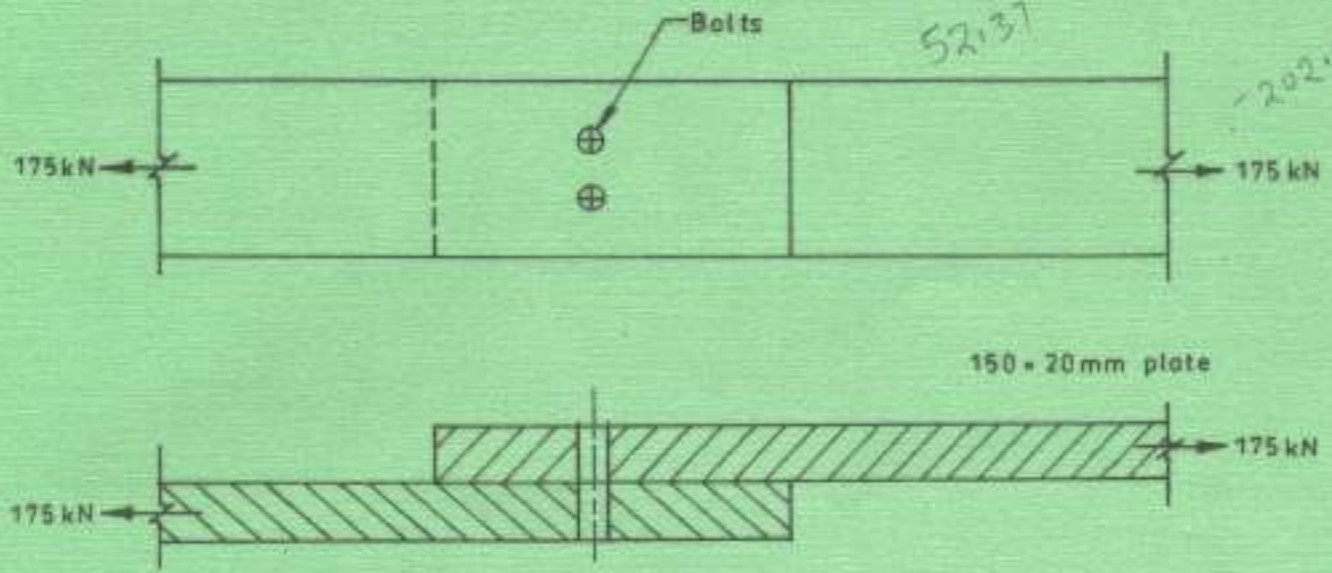


Fig. 7 (a)

(c) A single equal angle section of size 75 x 75 x 15 mm is welded to a gusset plate as shown in **figure 7(b)**. It is to transmit a load of 160 kN. Design the joint using an 8 mm fillet weld given that:

permissible shear stress in weld = 220 N/mm^2. (6 marks)

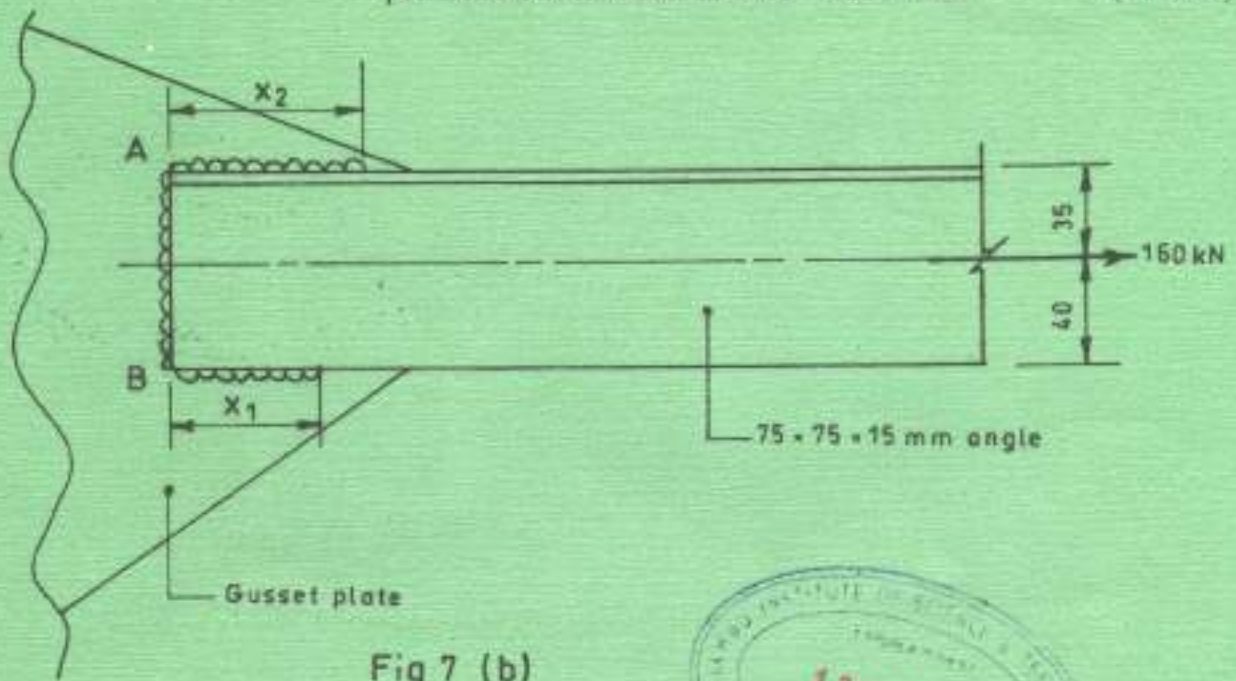


Fig 7 (b)

Strength of bolts in clearance holes

	Bolt grade (N/mm^2)	
	4.6	8.8
Shear strength, p_s	160	375
Bearing, strength, p_{sb}	460	1035
Tension strength, p_t	195	450

Strut table selection

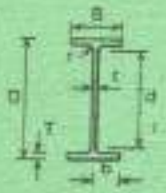
Type of section	Thickness[a]	Axis of buckling	
		x-x	y-y
Hot- rolled structural hollow section		-	-
Rolled I-section		-	-
Rolled H-section	Up to 40mm	Table 8(a)	Table 8(b)
	Over 40mm	Table 8(b)	-

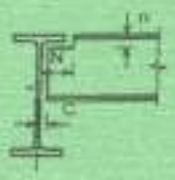
[a] For thicknesses between 40 and 50mm the value of *pc* may be taken as the average of the values for thicknesses up to 40mm and over 40mm

Areas of group of reinforcement bars (mm^2)

Bar Diameter (mm)	Number of bars									
	1	2	3	4	5	6	7	8	9	10
6	28	57	85	113	141	170	198	226	254	283
8	50	101	151	201	251	302	352	402	452	503
10	79	157	236	314	393	471	550	628	707	785
12	113	226	339	452	565	679	792	905	1017	1131
16	201	402	603	804	1005	1206	1407	1608	1809	2011
20	314	628	942	1257	1571	1885	2199	2513	2827	3142
25	491	982	1473	1963	2454	2945	3436	3927	4418	4909
32	804	1608	2412	3216	4021	4825	5629	6433	7237	8042
40	1256	2513	3769	5026	6283	7539	8796	10050	11310	12570

UNIVERSAL BEAMS





DIMENSIONS

Section Designation	Mass per Metre	Depth of Section	Width of Section	Thickness		Root Radius	Depth between Fillets	Ratios for Local Buckling		Dimensions for Detailing			Surface Area	
				Web	Flange			Flange	Web	End Clearance	Notch		Per Metre	Per Tonne
	kg/m	D mm	B mm	t mm	T mm	r mm	d mm	b/T	d/t	C mm	N mm	n mm	m^2	m^2
457 × 191 × 98	98.3	467.2	192.8	11.4	19.6	10.2	407.6	4.92	35.8	8	102	30	1.67	16.9
457 × 191 × 89	89.3	463.4	191.9	10.5	17.7	10.2	407.8	5.42	38.8	7	102	28	1.66	18.5
457 × 191 × 82	82.0	460.0	191.3	9.9	16.0	10.2	407.8	5.98	41.2	7	102	28	1.65	20.1
457 × 191 × 74	74.3	457.0	190.4	9.0	14.5	10.2	407.6	6.57	45.3	7	102	26	1.64	22.1
457 × 191 × 67	67.1	453.4	189.9	8.5	12.7	10.2	407.6	7.48	48.0	6	102	24	1.63	24.3
457 × 152 × 82	82.1	465.8	155.3	10.5	18.9	10.2	407.6	4.11	38.8	7	94	30	1.51	18.4
457 × 152 × 74	74.2	462.0	154.4	9.6	17.0	10.2	407.8	4.54	42.5	7	94	28	1.50	20.3
457 × 152 × 67	67.2	458.0	153.8	9.0	15.0	10.2	407.8	5.13	45.3	7	94	26	1.50	22.3
457 × 152 × 60	59.8	454.6	152.9	8.1	13.3	10.2	407.5	5.75	50.3	6	94	24	1.49	24.9
457 × 152 × 52	52.3	449.8	152.4	7.6	10.9	10.2	407.5	6.99	53.6	6	94	22	1.48	28.2
406 × 178 × 74	74.2	412.8	179.5	9.5	16.0	10.2	360.4	5.61	37.9	7	96	28	1.51	20.3
406 × 178 × 67	67.1	409.4	178.8	8.8	14.3	10.2	360.4	6.25	41.0	6	96	26	1.50	22.3
406 × 178 × 60	60.1	406.4	177.9	7.9	12.8	10.2	360.4	6.95	45.6	6	96	24	1.49	24.8
406 × 178 × 54	54.1	402.6	177.7	7.7	10.9	10.2	360.4	8.15	46.8	6	96	22	1.48	27.4
406 × 140 × 46	46.0	403.2	142.2	6.8	11.2	10.2	360.4	6.35	53.0	5	78	22	1.34	29.2
406 × 140 × 39	39.0	398.0	141.8	6.4	8.6	10.2	360.4	8.24	56.3	5	78	20	1.33	34.2
356 × 171 × 67	67.1	363.4	173.2	9.1	15.7	10.2	311.6	5.52	34.2	7	94	26	1.38	20.6
356 × 171 × 57	57.0	358.0	172.2	8.1	13.0	10.2	311.6	6.62	38.5	6	94	24	1.37	24.1
356 × 171 × 51	51.0	353.0	171.5	7.4	11.5	10.2	311.6	7.46	42.1	5	94	22	1.36	26.7
356 × 171 × 45	45.0	351.4	171.1	7.0	9.7	10.2	311.6	8.82	44.5	5	94	20	1.36	30.1
356 × 127 × 39	39.1	353.4	126.0	6.6	10.7	10.2	311.6	5.89	47.2	5	70	22	1.18	30.2
356 × 127 × 33	33.1	349.0	125.4	6.0	8.5	10.2	311.6	7.38	51.9	5	70	20	1.17	35.4
305 × 165 × 54	54.0	310.4	166.9	7.9	13.7	8.9	265.2	6.09	33.6	6	90	24	1.26	23.3
305 × 165 × 46	46.1	306.6	165.7	6.7	11.8	8.9	265.2	7.02	39.6	5	90	22	1.25	27.1
305 × 165 × 40	40.3	303.4	165.0	6.0	10.2	8.9	265.2	8.09	44.2	5	90	20	1.24	30.8
305 × 127 × 48	48.1	311.0	125.3	9.0	14.0	8.9	265.2	4.47	29.5	7	70	24	1.09	22.7
305 × 127 × 42	41.9	307.2	124.3	8.0	12.1	8.9	265.2	5.14	33.1	6	70	22	1.08	25.8
305 × 127 × 37	37.0	304.4	123.4	7.1	10.7	8.0	265.2	5.77	37.4	6	70	20	1.07	29.0
305 × 102 × 33	32.8	312.7	102.4	6.6	10.8	7.6	275.9	4.74	41.8	5	58	20	1.01	30.8
305 × 102 × 28	28.2	308.7	101.8	6.0	8.8	7.6	275.9	5.78	46.0	5	58	18	1.00	35.4
305 × 102 × 25	24.8	305.1	101.6	5.8	7.0	7.6	275.9	7.26	47.6	5	58	16	0.992	40.0
254 × 146 × 43	43.0	259.6	147.3	7.2	12.7	7.6	219.0	5.80	30.4	6	82	22	1.08	25.1
254 × 146 × 37	37.0	256.0	146.4	6.3	10.9	7.6	219.0	6.72	34.8	5	82	20	1.07	29.0
254 × 146 × 31	31.1	251.4	146.1	6.0	8.6	7.6	219.0	8.49	36.5	5	82	18	1.06	34.2
254 × 102 × 28	28.3	260.4	102.2	6.3	10.0	7.6	225.2	5.11	35.7	5	58	18	0.904	31.9
254 × 102 × 25	25.2	257.2	101.9	6.0	8.4	7.6	225.2	6.07	37.6	5	58	16	0.897	35.6
254 × 102 × 22	22.0	254.0	101.6	5.7	6.8	7.6	225.2	7.47	39.5	5	58	16	0.890	40.5
203 × 133 × 30	30.0	206.8	133.9	6.4	9.6	7.6	172.4	6.97	26.9	5	74	18	0.803	30.8
203 × 133 × 25	25.1	203.2	133.2	5.7	7.8	7.6	172.4	8.54	30.2	5	74	16	0.915	36.4
203 × 102 × 23	23.1	203.2	101.8	5.4	9.3	7.6	169.4	5.47	31.4	5	60	18	0.790	34.2
178 × 102 × 19	19.0	177.8	101.2	4.8	7.9	7.6	146.8	6.41	30.6	4	60	16	0.736	38.6
152 × 89 × 16	16.0	152.4	88.7	4.5	7.7	7.6	121.8	5.76	27.1	4	54	16	0.638	39.8
127 × 76 × 13	13.0	127.0	76.0	4.0	7.6	7.6	96.6	5.00	24.1	4	46	16	0.537	41.3

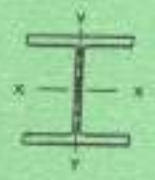
Table 8(a): Compressive strength, p_c (N/mm^2) for struts

λ \ Py	225	245	255	265	275	λ \ Py	225	245	255	265	275
15	225	245	255	265	275	96	133	140	143	146	148
20	224	243	253	263	272	98	130	137	139	142	145
25	220	239	248	258	267	100	127	133	136	138	141
30	216	234	243	253	262	102	124	130	132	135	137
35	211	229	238	247	256	104	122	127	129	131	133
40	207	224	233	241	250	106	119	124	126	128	130
42	205	222	231	239	248	108	116	121	123	125	126
44	203	220	228	237	245	110	113	118	120	121	123
46	201	218	226	234	242	112	111	115	117	118	120
48	199	215	223	231	239	114	108	112	114	115	117
50	197	213	221	229	237	116	105	109	111	112	114
52	195	210	218	226	234	118	103	106	108	109	111
54	192	208	215	223	230	120	100	104	105	107	108
56	190	205	213	220	227	122	98	101	103	104	105
58	188	202	210	217	224	124	96	99	100	101	102
60	185	200	207	214	221	126	94	96	97	99	100
62	183	197	204	210	217	128	91	94	95	96	97
64	180	194	200	207	213	130	89	92	93	94	95
66	178	191	197	203	210	135	84	86	87	88	89
68	175	188	194	200	206	140	79	81	82	83	84
70	172	185	190	196	202	145	75	77	78	78	79
72	169	181	187	193	198	150	71	72	73	74	74
74	167	178	183	189	194	155	67	69	69	70	70
76	164	175	180	185	190	160	64	65	66	66	66
78	161	171	176	181	186	165	60	61	62	63	63
80	158	168	172	177	181	170	57	58	59	59	60
82	155	164	169	173	177	175	55	56	56	56	57
84	152	161	165	169	173	180	52	53	53	54	54
86	149	157	161	165	169	185	49	50	51	51	51
88	146	154	158	161	165	190	47	48	48	48	49
90	143	150	154	157	161	195	45	46	46	46	47
92	139	147	150	153	156	200	43	44	44	44	44
94	136	143	147	150	152						

Table 8(b): Compressive strength, p_c (N/mm²) for struts

λ \ Py	225	245	255	265	275	λ \ Py	225	245	255	265	275
15	225	245	255	265	275	96	118	124	127	129	132
20	224	242	252	261	271	98	115	121	123	126	129
25	217	235	245	254	263	100	112	118	120	123	125
30	211	228	237	246	255	102	110	115	118	120	122
35	204	221	230	238	247	104	107	112	115	117	119
40	198	214	222	230	238	106	105	110	112	114	116
42	195	211	219	227	235	108	102	107	109	111	113
44	193	208	216	224	231	110	100	104	106	108	110
46	190	205	213	220	228	112	98	102	104	106	107
48	187	202	209	217	224	114	96	99	101	103	105
50	184	199	206	213	220	116	93	97	99	101	102
52	181	196	203	210	217	118	91	95	96	98	100
54	179	193	199	206	213	120	89	93	94	96	97
56	176	189	196	202	209	122	87	91	92	93	95
58	173	186	192	199	205	124	85	88	90	91	92
60	170	183	189	195	201	126	83	86	88	89	90
62	167	179	185	191	197	128	82	84	86	87	88
64	164	176	182	188	193	130	80	82	84	85	86
66	161	173	178	184	189	135	75	78	79	80	81
68	158	169	175	180	185	140	71	74	75	76	76
70	155	166	171	176	181	145	68	70	70	71	72
72	152	163	168	172	177	150	64	66	67	68	68
74	149	159	164	169	173	155	61	63	63	64	65
76	146	156	160	165	169	160	58	59	60	61	61
78	143	152	157	161	165	165	55	56	57	58	58
80	140	149	153	157	161	170	52	54	54	55	55
82	137	146	150	154	157	175	50	51	52	52	53
84	134	142	146	150	154	180	48	49	49	50	50
86	132	139	143	146	150	185	46	46	47	47	48
88	129	136	139	143	146	190	43	44	45	45	46
90	126	133	136	139	142	195	42	42	43	43	43
92	123	130	133	136	139	200	40	41	41	41	42
94	120	127	130	133	135						

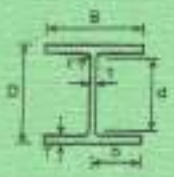
UNIVERSAL COLUMNS

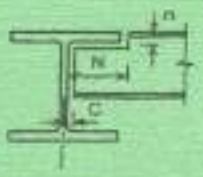


PROPERTIES

Section Designation	Second Moment of Area		Radius of Gyration		Elastic Modulus		Plastic Modulus		Buckling Parameter	Torsional Index	Warping Constant	Torsional Constant	Area of Section
	Axis x-x cm^4	Axis y-y cm^4	Axis x-x cm	Axis y-y cm	Axis x-x cm^3	Axis y-y cm^3	Axis x-x cm^3	Axis y-y cm^3	u	x	H dm^6	J cm^4	A cm^2
356 × 406 × 634 #	275000	98100	18.4	11.0	11600	4830	14200	7110	0.843	5.46	38.8	13700	808
356 × 406 × 551 #	227000	82700	18.0	10.9	9960	3950	12100	6080	0.841	6.05	31.1	9940	702
356 × 406 × 467 #	183000	67800	17.5	10.7	8280	3290	10000	5030	0.839	6.86	24.3	5810	595
356 × 406 × 393 #	147000	55400	17.1	10.5	7000	2720	8220	4150	0.837	7.87	18.9	3550	501
356 × 406 × 340 #	123000	46900	16.8	10.4	6030	2330	7000	3540	0.836	8.84	15.6	2340	433
356 × 406 × 287 #	99600	38700	16.5	10.3	5080	1940	5910	2950	0.834	10.2	12.3	1440	366
356 × 406 × 235 #	79100	31000	16.3	10.2	4150	1570	4690	2380	0.835	12.0	9.54	812	299
356 × 368 × 202 #	66300	23700	16.1	9.60	3540	1280	3970	1920	0.844	13.4	7.16	558	257
356 × 368 × 177 #	57100	20500	15.9	9.54	3100	1100	3480	1670	0.843	15.0	6.09	381	226
356 × 368 × 153 #	48800	17600	15.8	9.49	2690	948	2970	1440	0.844	17.0	5.11	251	195
356 × 368 × 129 #	40300	14600	15.8	9.43	2260	793	2480	1200	0.845	19.8	4.18	163	164
305 × 305 × 283	78900	24600	14.8	8.27	4320	1530	5110	2340	0.858	7.85	8.35	2030	360
305 × 305 × 240	64200	20300	14.5	8.15	3640	1280	4250	1950	0.854	8.74	5.03	1270	306
305 × 305 × 198	50900	16500	14.2	8.04	3000	1040	3440	1590	0.854	10.2	3.88	734	252
305 × 305 × 158	38800	12600	13.9	7.90	2370	808	2680	1230	0.852	12.5	2.87	378	201
305 × 305 × 137	32800	10700	13.7	7.83	2050	692	2300	1050	0.852	14.1	2.39	249	174
305 × 305 × 118	27700	9060	13.6	7.77	1760	589	1960	895	0.851	16.2	1.98	161	150
305 × 305 × 97	22300	7310	13.4	7.69	1450	479	1590	728	0.852	19.2	1.56	91.2	123
254 × 254 × 167	30000	9870	11.9	6.81	2260	744	2420	1140	0.851	8.50	1.63	626	213
254 × 254 × 132	22500	7530	11.6	6.69	1630	576	1870	878	0.850	10.3	1.19	319	168
254 × 254 × 107	17500	5930	11.3	6.59	1310	456	1480	697	0.849	12.4	0.898	172	136
254 × 254 × 89	14300	4850	11.2	6.55	1100	376	1220	575	0.851	14.5	0.717	102	113
254 × 254 × 73	11400	3910	11.1	6.48	896	307	992	465	0.849	17.3	0.562	57.8	93.1
203 × 203 × 86	9450	3130	9.28	5.34	850	299	977	456	0.849	10.2	0.318	137	110
203 × 203 × 71	7620	2540	9.18	5.30	706	248	799	374	0.853	11.9	0.250	80.2	90.4
203 × 203 × 60	6130	2070	8.99	5.20	584	201	659	305	0.846	14.1	0.197	47.2	76.4
203 × 203 × 52	5260	1780	8.91	5.18	510	174	567	264	0.846	15.8	0.167	31.8	66.3
203 × 203 × 46	4570	1550	8.82	5.13	450	152	497	231	0.846	17.7	0.143	22.2	58.7
152 × 152 × 37	2210	706	6.85	3.87	273	91.5	309	140	0.849	13.3	0.0399	19.2	47.1
152 × 152 × 30	1750	560	6.76	3.83	222	73.3	248	112	0.849	16.0	0.0308	10.5	38.3
152 × 152 × 23	1250	400	6.64	3.70	164	52.6	182	80.2	0.840	20.7	0.0212	4.63	29.2

UNIVERSAL COLUMNS





DIMENSIONS

Section Designation	Mass per Metre	Depth of Section	Width of Section	Thickness		Root Radius	Depth between Fillets	Ratios for Local Buckling		Dimensions for Detailing			Surface Area	
				Web	Flange			Flange	Web	End Clearance	Notch		Per Metre	Per Tonne
	kg/m	D mm	B mm	t mm	T mm	r mm	d mm	b/T	d/t	C mm	N mm	n mm	m²	m²
356 x 406 x 634 #	633.9	474.6	424.0	47.6	77.0	15.2	290.2	2.75	6.10	26	200	94	2.52	3.98
356 x 406 x 551 #	551.0	455.6	418.5	42.1	67.5	15.2	290.2	3.10	6.89	23	200	84	2.47	4.49
356 x 406 x 467 #	467.0	436.6	412.2	35.8	58.0	15.2	290.2	3.56	8.11	20	200	74	2.42	5.19
356 x 406 x 393 #	393.0	419.0	407.0	30.6	49.2	15.2	290.2	4.14	9.48	17	200	66	2.38	6.05
356 x 406 x 340 #	339.9	406.4	403.0	26.6	42.9	15.2	290.2	4.70	10.9	15	200	60	2.36	6.96
356 x 406 x 287 #	287.1	393.6	399.0	22.6	36.5	15.2	290.2	5.47	12.8	13	200	52	2.31	8.05
356 x 406 x 235 #	235.1	381.0	394.8	18.4	30.2	15.2	290.2	6.54	15.8	11	200	46	2.28	9.69
356 x 368 x 202 #	201.9	374.8	374.7	16.5	27.0	15.2	290.2	6.94	17.6	10	190	44	2.13	10.6
356 x 368 x 177 #	177.0	368.2	372.6	14.4	23.8	15.2	290.2	7.83	20.2	9	190	40	2.17	12.3
356 x 368 x 153 #	152.9	362.0	370.5	12.3	20.7	15.2	290.2	8.95	23.6	8	190	36	2.16	14.1
356 x 368 x 129 #	129.0	355.6	368.6	10.4	17.5	15.2	290.2	10.50	27.9	7	190	34	2.14	16.6
305 x 305 x 283	282.9	365.3	322.2	26.8	44.1	15.2	246.7	3.65	9.21	15	158	80	1.94	6.88
305 x 305 x 240	240.0	352.5	318.4	23.0	37.7	15.2	246.7	4.22	10.7	14	158	54	1.91	7.94
305 x 305 x 198	198.1	339.9	314.5	19.1	31.4	15.2	246.7	5.01	12.9	12	158	48	1.87	9.46
305 x 305 x 158	158.1	327.1	311.2	15.8	25.0	15.2	246.7	6.22	15.6	10	158	42	1.84	11.6
305 x 305 x 137	136.9	320.5	309.2	13.8	21.7	15.2	246.7	7.12	17.9	9	158	38	1.82	13.3
305 x 305 x 118	117.9	314.5	307.4	12.0	18.7	15.2	246.7	8.22	20.6	8	158	34	1.81	15.3
305 x 305 x 97	96.9	307.9	305.3	9.9	15.4	15.2	246.7	9.91	24.9	7	158	32	1.79	18.5
254 x 254 x 167	167.1	289.1	265.2	19.2	31.7	12.7	200.3	4.18	10.4	12	134	46	1.58	9.45
254 x 254 x 132	132.0	276.3	261.3	15.3	25.3	12.7	200.3	5.16	13.1	10	134	38	1.55	11.7
254 x 254 x 107	107.1	266.7	258.8	12.8	20.5	12.7	200.3	6.31	15.6	8	134	34	1.52	14.2
254 x 254 x 89	88.9	260.3	256.3	10.3	17.3	12.7	200.3	7.41	19.4	7	134	30	1.50	16.9
254 x 254 x 73	73.1	254.1	254.6	8.6	14.2	12.7	200.3	8.96	23.3	6	134	28	1.49	20.4
203 x 203 x 86	86.1	222.2	209.1	12.7	20.5	10.2	160.8	5.10	12.7	8	110	32	1.24	14.4
203 x 203 x 71	71.0	215.8	206.4	10.0	17.3	10.2	160.8	5.97	16.1	7	110	28	1.22	17.2
203 x 203 x 60	60.0	209.6	205.8	9.4	14.2	10.2	160.8	7.25	17.1	7	110	26	1.21	20.1
203 x 203 x 52	52.0	206.2	204.3	7.9	12.5	10.2	160.8	8.17	20.4	6	110	24	1.20	23.0
203 x 203 x 46	46.1	203.2	203.6	7.2	11.0	10.2	160.8	9.25	22.3	6	110	22	1.19	25.8
152 x 152 x 37	37.0	161.8	154.4	8.0	11.5	7.6	123.6	6.71	15.5	6	84	20	0.912	24.7
152 x 152 x 30	30.0	157.6	152.9	6.5	9.4	7.6	123.6	8.13	19.0	5	84	18	0.901	30.0
152 x 152 x 23	23.0	152.4	152.2	5.9	6.8	7.6	123.6	11.2	21.3	5	84	16	0.889	38.7

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