UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2022/2023

COURSE NAME	:	STRUCTURAL DESIGN
COURSE CODE	:	DAC 21603
PROGRAMME CODE	:	DAA
EXAMINATION DATE	:	FEBRUARY 2023
DURATION	:	3 HOURS
INSTRUCTION	:	1. ANSWER **ALL** QUESTIONS 2. THIS FINAL EXAMINATION IS CONDUCTED VIA **CLOSED BOOK.** 3. STUDENTS ARE **PROHIBITED** TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA CLOSED BOOK

THIS QUESTION PAPER CONSISTS OF **SIXTEEN (16)** PAGES

Q1 (a) Define the term of Reinforced Concrete.

(2 marks)

(b) Elaborate on **two (2)** aims of design.

(4 marks)

(c) **Figure Q1(c)** shows the steelwork structure arrangement. Determine the design load and reaction on Beam A (secondary beam). Design data as given:

Reinforced concrete (RC) slab thickness = 200 mm
Unit weight of reinforced concrete = 25 kN/m^2
Screed weight = 3.0 kN/m^2
Imposed load on slabs = 5.0 kN/m^2
Self-weight of steel beam = 0.98 kN/m

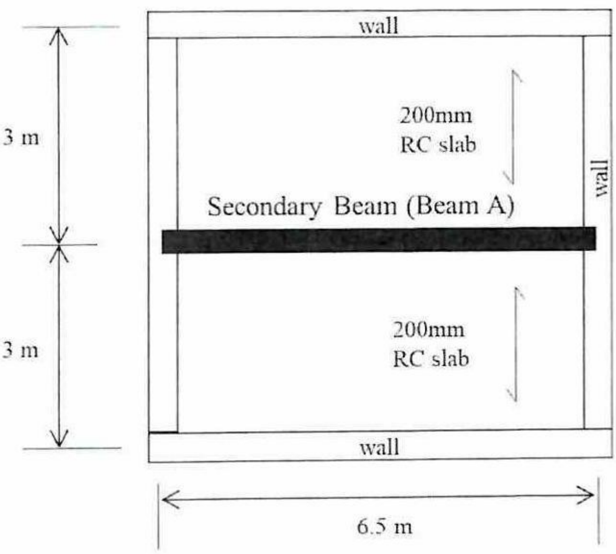

Figure Q1(c)

(9 marks)

(d) A reinforced concrete floor beam is used to support a concrete slab of 8 m width and having a thickness of 120 mm. The slab also carries a 12 mm thick plaster ceiling for the floor below. The beam also carries a brick wall of width 125 mm and 2 m in height. Determine the load on the beam as kN per metre length of the beam. Given:

The density of concrete = 25 kN/m^3
Density of brick = 22 kN/m^3
Area load of 12 mm plaster = 0.2 kN/m^2

(5 marks)

(e) A simply supported rectangular beam of 8 m span, 250 mm breadth, and 450 mm height carries characteristic dead load (excluding self-weight of beam) and imposed load of 10 kN/m and 8 kN/m respectively.

i. Calculate the design load on beam in kN/m.

(3 marks)

ii. Determine the maximum design bending moment at the centre of the span.
(2 marks)

Q2 (a) List **two (2)** types of slabs.
(2 marks)

(b) Explain **two (2)** different types of slabs based on answer Q2(a).
(4 marks)

(c) A simply supported slab of size 5 m x 7 m supports a variable load of 8 kN/m^2. Given the slab is 250 mm thick, f_{ck} = 25 N/mm^2, f_{yk} = 500 N/mm^2, and exposure conditions XC-1:

i. Determine ultimate load of the slab.
(4 marks)

ii. Design the requirement of main reinforcement for the solid slab.
(6 marks)

iii. Design the requirement of distribution reinforcement for the solid slab.
(4 marks)

iv. Determine the required minimum steel area.
(2 marks)

v. Determine deflection for solid slab.
(3 marks)

Q3 (a) The slenderness and non-slenderness of column can be classified according to the different failure mode and design considerations. List **three (3)** mechanism of column failure.
(6 marks)

(b) A braced rectangular column 350 mm x 400 mm concrete carries an axial load of 1400 kN. The column is classified as non-slender with the bending moment of 60 kNm and 85 kNm about major and minor axes respectively. Using grade C25/30 concrete and f_{yk} = 500 N/mm^2. Assume that the nominal cover for major and minor axes is 80 mm and 70 mm respectively.

i. Verify biaxial bending moment.
(10 marks)

ii. By using the Design Chart, design the area of reinforcement of the column.
(6 marks)

iii. Determine the minimum and maximum area of reinforcement.
(3 marks)

Q4 (a) **Figure Q4(a)** shows a main beam AC of size UB 406 x 178 x 74 kg/m which is simply supported on angles between two columns and carries a secondary beam at B. The design loading on the main beam AC is as shown.

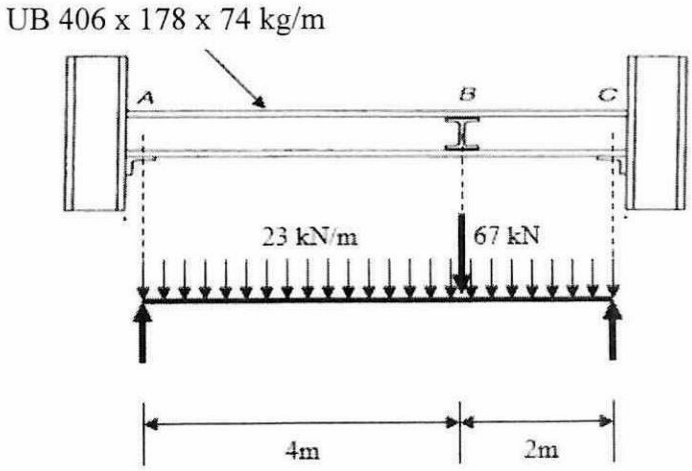

Figure Q4(a)

i. Calculate the maximum shear force and bending moment and sketch the shear force and bending moment diagram of the main beam.
(9 marks)

ii. Classify the beam cross-section.
(2 marks)

iii. Calculate the shear capacity of the beam at the support.
(3 marks)

(b) Timber can be classified into four types. List **four (4)** types of timber with an example.
(4 marks)

(c) A timber beam spanning 4.5 m and spaced at 3.0 m centres are simply supported on brick walls and support a timber floor comprising of joints and boards with plaster ceilings. Given the following data:

Timber type = Group A, dry, standard grade 1.
Weight of joists and boards = 0.23 kN/m^2
Weight of plaster ceiling = 0.22 kN/m^2
Imposed load on floor = 1.5 kN/m^2
Weight of beam (assumed) = 0.6 kN/m

i. Determine the total load on the timber beam.
(5 marks)

ii. Calculate the maximum bending moment.
(2 marks)

-END OF QUESTIONS –

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APPENDIX 1

Table 1: Cross Sectional Area (mm^2) according to Size and Numbers of Bar

Bar Size (mm)	Number of bar								Perimeter (mm)
	1	2	3	4	5	6	7	8	
H6	28.3	56.6	84.9	113	141	170	198	226	18.9
H8	50.3	101	151	201	251	302	352	402	25.1
H10	78.6	157	236	314	393	471	550	629	31.4
H12	113	226	339	453	566	679	792	905	37.7
H16	201	402	603	805	1006	1207	1408	1609	50.3
H20	314	629	943	1257	1571	1886	2200	2514	62.9
H25	491	982	1473	1964	2455	2946	3438	3929	78.6
H32	805	1609	2414	3218	4023	4827	5632	6437	100.6
H40	1257	2514	3771	5029	6286	7543	8800	10057	125.7

Table 2: Cross Sectional Area (mm^2) for every meter width at distance between bar

Bar Size (mm)	Distance between Bar (mm)									
	50	75	100	125	150	175	200	250	300	350
H6	566	377	283	226	189	162	141	113	94	81
H8	1006	670	503	402	335	287	251	201	168	144
H10	1571	1048	786	629	524	449	393	314	262	224
H12	2263	1509	1131	905	754	647	566	453	377	323
H16	4023	2682	2011	1609	1341	1149	1006	805	670	574
H20	6286	4190	3143	2514	2095	1796	1571	1257	1048	898
H25	9821	6548	4911	3929	3274	2806	2455	1964	1637	1402
H32	16091	10728	8046	6437	5364	4598	4023	3218	2682	2298
H40	25143	16762	12571	10057	8381	7184	6286	5029	4190	3590

Design Formula For Beam

$K = M/bd^2 f_{ck}$

$$z = \frac{d}{2}\left[1+\sqrt{1-3.53K}\right] \le 0.95d$$

$$A_s = \frac{M_d}{0.87 f_{yk} z}$$

$F_{cc} = 0.567\ f_{ck}\ b\ s$
$F_{st} = 0.87\ f_{yk}\ As$
$s = 0.8x$
$z = d - s/2$

If K > 0.167

$$z = \frac{d}{2}\left[1+\sqrt{1-3.53K'}\right]$$

$$A_s' = \frac{(K-K')f_{ck}bd^2}{0.87 f_{yk}(d-d')}$$

$$A_s = \frac{K' f_{ck} b d^2}{0.87 f_{yk} z_{bal}} + A_s'$$

$M = F_{st}\ z$

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APPENDIX 2

Table 3: Nominal concrete cover to reinforcement for concrete made with OPC for a 50-year design life

Exposure class	Nominal cover to all reinforcement (mm)							
	25	30	35	40	45	50	55	60
XC1	C20/25 0.7 240							
XC2			C25/30 0.65 260					
XC3/4		C40/50 0.45 340	C32/40 0.55 300	C28/35 0.6 280	C25/30 0.65 260			
XD1			C40/50 0.45 360	C32/40 0.55 320	C28/35 0.60 300			
XD2				C40/50 0.40 380	C32/40 0.50 340	C28/35 0.55 320		
XD3						C45/55 0.35 380	C40/50 0.40 380	C35/45 0.45 360
XS1				C50/60 0.35 380	C40/50 0.45 360	C35/45 0.50 340		
XS2				C40/50 0.40 380	C32/40 0.50 340	C28/35 0.55 320		
XS3							C45/55 0.35 380	C40/50 0.40 380
Key to entries:		C40/50 0.40 380	← Minimum concrete grade ← Maximum water/cement ratio ← Minimum cement content in kg/m³					

Table 4: Bending coefficients for slab spanning in two directions at right angle, simply supported on all four sides

l_y/l_x	1.0	1.1	1.2	1.3	1.4	1.5	1.75	2.0
α_{sx}	0.062	0.074	0.084	0.093	0.099	0.104	0.113	0.118
α_{sy}	0.062	0.061	0.059	0.055	0.051	0.046	0.037	0.029

Table 5: Minimum percentage of tensile reinforcement in beams and slabs

Conc. strength f_{ck} (N/mm^2)	25	28	30	32	35	40	45	50
Minimum % of reinforcement	0.14	0.15	0.15	0.16	0.17	0.19	0.20	0.22

This table uses $0.016 f_{ck}^{2/3}$ as recommended by the *IStructE manual for the design of concrete building structures to Eurocode 2* in place of $0.0156 f_{ck}^{2/3}$ in EC2.

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APPENDIX 3

Table 6: Maximum bar size or maximum bar spacing for 0.3-mm crack width limit for load-induced cracking in beams and in slabs more than 200 mm thick

Steel stress (N/mm^2): see note 1	160	200	240	280	320	360	400
Max. bar size	H32	H25	H16	H12	H10	H8	H6
Max. bar spacing (mm)	300	250	200	150	100	50	–

Notes:
(1) These rules do not apply to secondary or distribution reinforcement.
(2) The steel stress can be taken as $435(G_k + 0.8Q_k)/(1.35G_k + 1.50Q_k)$ N/mm^2, or conservatively as $320 N/mm^2$.
(3) Cracks may be controlled by meeting either the max. bar spacing requirement *or* the max. bar size requirement. It is not necessary to meet both requirements. For example, if the steel stress is $280 N/mm^2$ then either bars of size H12 or smaller can be used at any spacing or bars of any size can be used at a spacing of 150 mm or less.

Design Formula For Slab

$$m_{sx} = \alpha_{sx} n l_x^2$$
$$m_{sy} = \alpha_{sy} n l_x^2$$

where: n – total design ultimate load per unit area ($1.35G_k + 1.5 Q_k$)
l_x- length of shorter side

$$A_{sx} = M_{sx}/0.87f_{yk}z$$
$$A_{sy} = M_{sy}/0.87f_{yk}z$$

Design Formula For Column

Limiting l_0 /b ratio $= 6.19 \sqrt{(b\ h\ f_{ck} / N_{Ed})}$

$$\frac{e_z}{h} / \frac{e_y}{b} \geq 0.2 \quad \text{and} \quad \frac{e_y}{b} / \frac{e_z}{h} \geq 0.2$$

(a) if $\frac{M_z}{h'} \geq \frac{M_y}{b'}$,
then the increased single axis design moment is

$$M'_z = M_z + \beta \frac{h'}{b'} \times M_y$$

(b) if $\frac{M_z}{h'} < \frac{M_y}{b'}$,
then the increased single axis design moment is

$$M'_y = M_y + \beta \frac{b'}{h'} \times M_z$$

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APPENDIX 4

Table 7: Resistance to fire: minimum sizes and minimum axis distances for columns and for simply supported slabs

Element		R30	R60	R90	R120	R180	R240
Column exposed to fire on all sides	Minimum cross-section dimension (mm)	200	250	350	350	450	-
	Minimum axis distance (mm)	32	46	53	57	70	-
Simply supported slab with plain soffit	Minimum thickness (mm)	60	80	100	120	150	175
	Minimum axis distance (mm)	10*	20	30	40	55	65

Table 8: Factors determining minimum cover to reinforcing bars

Placing of concrete	Not less than the diameter of the bar ϕ + 10 mm
Bond between steel and concrete	Not less that the diameter of the bar ϕ + 10 mm If the bars are bundled, the minimum cover should be: • 1.4ϕ + 10 mm for a 2-bar bundle • 1.7ϕ + 10 mm for a 3-bar bundle • 2.0ϕ + 10 mm for a 4-bar bundle

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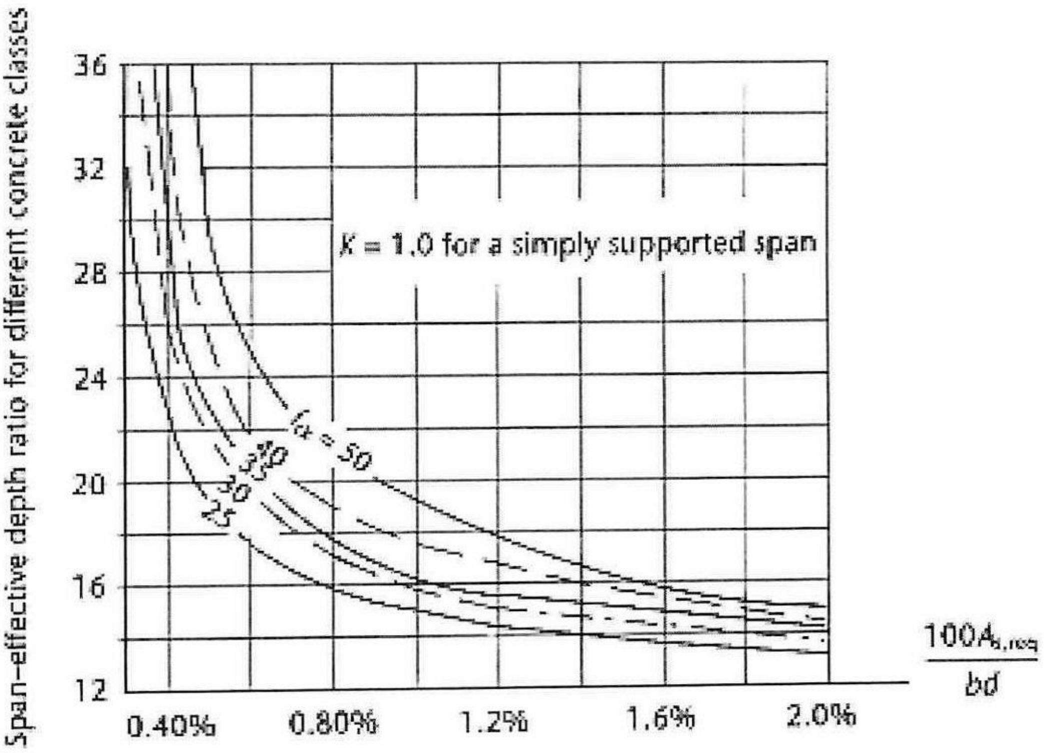
APPENDIX 5

CHART NO 1: Span-Effective Depth Ratio



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APPENDIX 6

Table 9: Ends fixity of reinforced concrete column

End condition at bottom	End condition at top		
	1	2	3
1	0.75	0.80	0.90
2	0.80	0.85	0.95
3	0.90	0.95	1.00

End fixity conditions, see Figure 3.26.
Condition 1: Column is connected monolithically to beams on each side that are at least as deep as the overall depth of the column in the plane considered. Where column is connected to a foundation this should be designed to carry moment.
Condition 2: Column connected monolithically to beams or slabs on each side that are shallower than the overall depth of the column in the plane considered but generally not less than half the column depth.
Condition 3: Column connected to members that do not provide more than nominal restraint to rotation.
Values taken from *IStructE Manual for the Design of Reinforced Concrete Building Structures to Eurocode 2.*

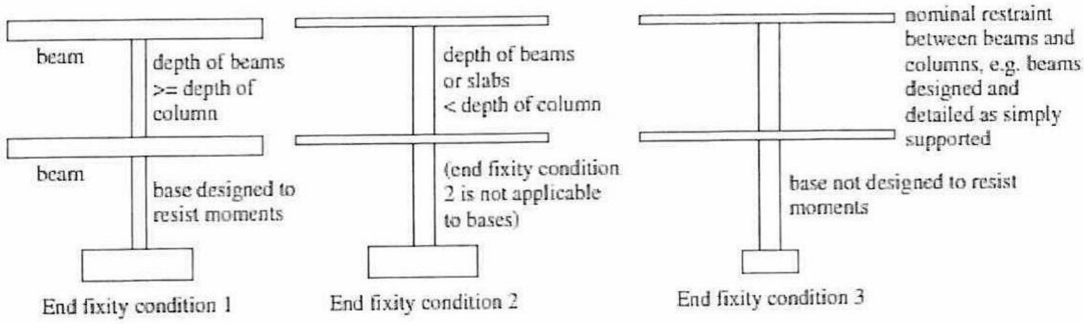

Table 10: Limits on longitudinal reinforcement in columns

Area of longitudinal reinforcement.	Not less than or Not more than or	$0.12N/f_{yk}$ $0.002bh$ $0.04bh$ generally $0.08bh$ at laps
Size of longitudinal reinforcement	Not less than	12 mm
Number of longitudinal bars	Not fewer than	4 in a square column 6 in a circular column

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APPENDIX 7

Table 11: Limits on ties in reinforced concrete columns

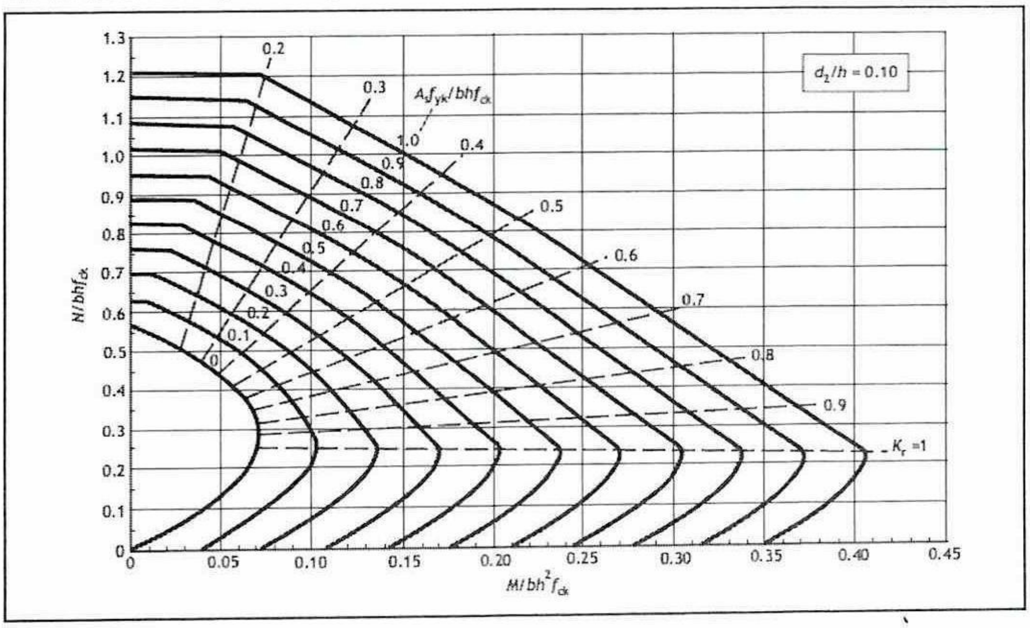
Size of ties	Not less than or	main bar size/4 6 mm
Spacing of ties generally	Not less than or or	20 × main bar diameter the least column dimension 400 mm
Spacing of ties over a height equal to the larger dimension of the column above or below a beam or slab	Not more than or or	12 × main bar diameter 0.6 × the least column dimension 240 mm
Spacing of ties where longitudinal bars exceeding 12 mm in size are lapped	Not more than or or	12 × main bar diameter 0.6 × the least column dimension 240 mm

Table 12: Coefficient of β

$\frac{N_{ED}}{bhf_{ck}}$	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	≥0.75
β	1.00	0.91	0.81	0.72	0.63	0.53	0.44	0.35	0.3

CHART NO 2

Column design chart for rectangular columns $d_2/h = 0.10$



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APPENDIX 8

CHART NO 3

Column design chart for rectangular columns $d_2/h = 0.15$

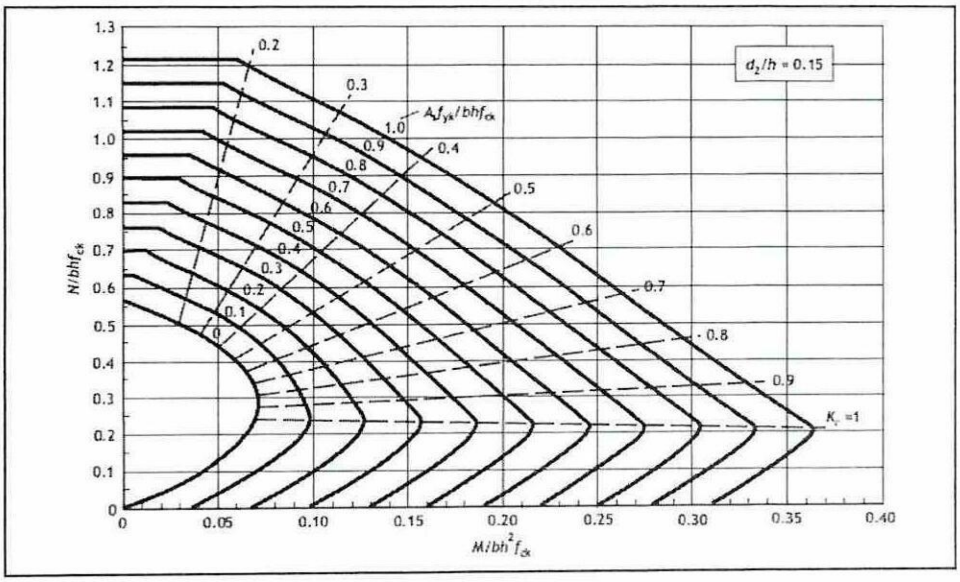
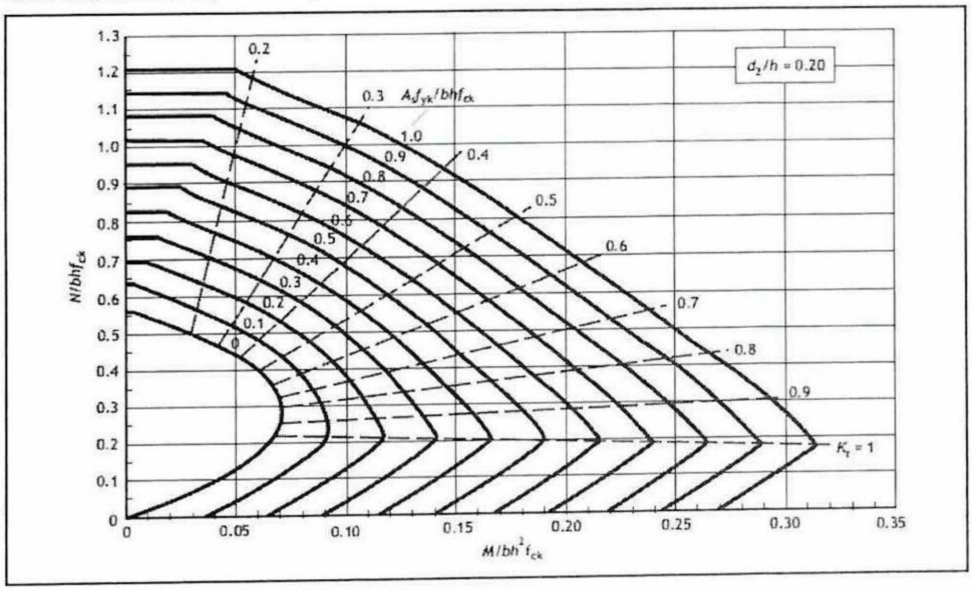


CHART NO 4

Column design chart for rectangular columns $d_2/h = 0.20$



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APPENDIX 9

Design Formula For Steel

If the web depth-to-thickness ratio $d/t \leq 62\varepsilon$ it should be assumed not to be susceptible to shear buckling.

If the web depth-to-thickness ratio $d/t > 70\varepsilon$ for a rolled section, or 62ε for a welded section, it should be assumed to be susceptible to shear buckling. The moment capacity of the cross-section should be determined taking account of the interaction of shear and moment.

The shear force F_v should not be greater than the shear capacity P_v given by:
$Pv = 0.6p_yAv$

4.2.5.2 *Low shear*

Provided that the shear force F_v does not exceed 60 % of the shear capacity P_v:

— for class 1 plastic or class 2 compact cross-sections:

$M_c = p_yS$

— for class 3 semi-compact sections:

$M_c = p_yZ$ or alternatively $M_c = p_yS_{eff}$

— for class 4 slender cross-sections:

$M_c = p_yZ_{eff}$

where

S is the plastic modulus;

S_{eff} is the effective plastic modulus, see 3.5.6;

Z is the section modulus;

Z_{eff} is the effective section modulus, see 3.6.2.

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APPENDIX 10

Design Formula For Steel

4.2.5.3 *High shear*

Where $F_v > 0.6P_v$:

— for class 1 plastic or class 2 compact cross-sections:

$M_c = p_y(S - \rho S_v)$

— for class 3 semi-compact cross-sections:

$M_c = p_y(Z - \rho S_v/1.5)$ or alternatively $M_c = p_y(S_{eff} - \rho S_v)$

— for class 4 slender cross-sections:

$M_c = p_y(Z_{eff} - \rho S_v/1.5)$

in which S_v is obtained from the following:

— for sections with unequal flanges:

$S_v = S - S_f$

in which S_f is the plastic modulus of the effective section excluding the shear area A_v defined in 4.2.3;

— otherwise:

S_v is the plastic modulus of the shear area A_v defined in 4.2.3;

and ρ is given by:

$\rho = [2(F_v/P_v) - 1]^2$

Table 13: Design strength p_y

Steel grade	Thickness[a] less than or equal to mm	Design strength p_y N/mm^2
S 275	16	275
	40	265
	63	255
	80	245
	100	235
	150	225
S 355	16	355
	40	345
	63	335
	80	325
	100	315
	150	295
S 460	16	460
	40	440
	63	430
	80	410
	100	400

[a] For rolled sections, use the specified thickness of the thickest element of the cross-section.

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APPENDIX 11

Table 14: Limiting width-to-thickness ratios for sections other than CHS and RHS

Compression element			Ratio[a]	Limiting value[b]		
				Class 1 plastic	Class 2 compact	Class 3 semi-compact
Outstand element of compression flange	Rolled section		b/T	9ε	10ε	15ε
	Welded section		b/T	8ε	9ε	13ε
Internal element of compression flange	Compression due to bending		b/T	28ε	32ε	40ε
	Axial compression		b/T	Not applicable		
Web of an I-, H- or box section[c]	Neutral axis at mid-depth		d/t	80ε	100ε	120ε
	Generally[d]	If r_1 is negative:	d/t	$\frac{80\varepsilon}{1+r_1}$ but $\geq 40\varepsilon$	$\frac{100\varepsilon}{1+r_1}$	$\frac{120\varepsilon}{1+2r_2}$ but $\geq 40\varepsilon$
		If r_1 is positive:	d/t		$\frac{100\varepsilon}{1+1.5r_1}$ but $\geq 40\varepsilon$	
	Axial compression[d]		d/t	Not applicable		
Web of a channel			d/t	40ε	40ε	40ε
Angle, compression due to bending (Both criteria should be satisfied)			b/t	9ε	10ε	15ε
			d/t	9ε	10ε	15ε
Single angle, or double angles with the components separated, axial compression (All three criteria should be satisfied)			b/t	Not applicable		15ε
			d/t			15ε
			$(b + d)/t$			24ε
Outstand leg of an angle in contact back-to-back in a double angle member			b/t	9ε	10ε	15ε
Outstand leg of an angle with its back in continuous contact with another component						
Stem of a T-section, rolled or cut from a rolled I- or H-section			D/t	8ε	9ε	18ε

[a] Dimensions b, D, d, T and t are defined in Figure 5. For a box section b and T are flange dimensions and d and t are web dimensions, where the distinction between webs and flanges depends upon whether the box section is bent about its major axis or its minor axis, see 3.5.1

[b] The parameter $\varepsilon = (275/p_y)^{0.5}$.

[c] For the web of a hybrid section ε should be based on the design strength p_{yf} of the flanges.

[d] The stress ratios r_1 and r_2 are defined in 3.5.5.

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APPENDIX 12

Table 15: Dimensions and Properties

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
		h	b	t_w	t_f	r	d	c_f / t_f	c_w / t_w	C	N	n		
	kg/m	mm	mm	mm	mm	mm	mm			mm	mm	mm	m^2	m^2
533x210x138 +	138.3	549.1	213.9	14.7	23.6	12.7	476.5	3.68	32.4	9	110	38	1.90	13.7
533x210x122	122.0	544.5	211.9	12.7	21.3	12.7	476.5	4.08	37.5	8	110	34	1.89	15.5
533x210x109	109.0	539.5	210.8	11.6	18.8	12.7	476.5	4.62	41.1	8	110	32	1.88	17.2
533x210x101	101.0	536.7	210.0	10.8	17.4	12.7	476.5	4.99	44.1	7	110	32	1.87	18.5
533x210x92	92.1	533.1	209.3	10.1	15.6	12.7	476.5	5.57	47.2	7	110	30	1.86	20.2
533x210x82	82.2	528.3	208.8	9.6	13.2	12.7	476.5	6.58	49.6	7	110	26	1.85	22.5
533x165x85 +	84.8	534.9	166.5	10.3	16.5	12.7	476.5	3.96	46.3	7	90	30	1.69	19.9
533x165x75 +	74.7	529.1	165.9	9.7	13.6	12.7	476.5	4.81	49.1	7	90	28	1.68	22.5
533x165x66 +	65.7	524.7	165.1	8.9	11.4	12.7	476.5	5.74	53.5	6	90	26	1.67	25.4
457x191x161 +	161.4	492.0	199.4	18.0	32.0	10.2	407.6	2.52	22.6	11	102	44	1.73	10.7
457x191x133 +	133.3	480.6	196.7	15.3	26.3	10.2	407.6	3.06	26.6	10	102	38	1.70	12.8
457x191x106 +	105.8	469.2	194.0	12.6	20.6	10.2	407.6	3.91	32.3	8	102	32	1.67	15.8
457x191x98	98.3	467.2	192.8	11.4	19.6	10.2	407.6	4.11	35.8	8	102	30	1.67	17.0
457x191x89	89.3	463.4	191.9	10.5	17.7	10.2	407.6	4.55	38.8	7	102	28	1.66	18.6
457x191x82	82.0	460.0	191.3	9.9	16.0	10.2	407.6	5.03	41.2	7	102	28	1.65	20.1
457x191x74	74.3	457.0	190.4	9.0	14.5	10.2	407.6	5.55	45.3	7	102	26	1.64	22.1
457x191x67	67.1	453.4	189.9	8.5	12.7	10.2	407.6	6.34	48.0	6	102	24	1.63	24.3
457x152x82	82.1	465.8	155.3	10.5	18.9	10.2	407.6	3.29	38.8	7	84	30	1.51	18.4
457x152x74	74.2	462.0	154.4	9.6	17.0	10.2	407.6	3.66	42.5	7	84	28	1.50	20.2
457x152x67	67.2	458.0	153.8	9.0	15.0	10.2	407.6	4.15	45.3	7	84	26	1.50	22.3
457x152x60	59.8	454.6	152.9	8.1	13.3	10.2	407.6	4.68	50.3	6	84	24	1.49	24.9
457x152x52	52.3	449.8	152.4	7.6	10.9	10.2	407.6	5.71	53.6	6	84	22	1.48	28.3
406x178x85 +	85.3	417.2	181.9	10.9	18.2	10.2	360.4	4.14	33.1	7	96	30	1.52	17.8
406x178x74	74.2	412.8	179.5	9.5	16.0	10.2	360.4	4.68	37.9	7	96	28	1.51	20.4
406x178x67	67.1	409.4	178.8	8.8	14.3	10.2	360.4	5.23	41.0	6	96	26	1.50	22.3
406x178x60	60.1	406.4	177.9	7.9	12.8	10.2	360.4	5.84	45.6	6	96	24	1.49	24.8
406x178x54	54.1	402.6	177.7	7.7	10.9	10.2	360.4	6.86	46.8	6	96	22	1.48	27.3
406x140x53 +	53.3	406.6	143.3	7.9	12.9	10.2	360.4	4.46	45.6	6	78	24	1.35	25.3
406x140x46	46.0	403.2	142.2	6.8	11.2	10.2	360.4	5.13	53.0	5	78	22	1.34	29.1
406x140x39	39.0	398.0	141.8	6.4	8.6	10.2	360.4	6.69	56.3	5	78	20	1.33	34.1
356x171x67	67.1	363.4	173.2	9.1	15.7	10.2	311.6	4.58	34.2	7	94	26	1.38	20.6
356x171x57	57.0	358.0	172.2	8.1	13.0	10.2	311.6	5.53	38.5	6	94	24	1.37	24.1
356x171x51	51.0	355.0	171.5	7.4	11.5	10.2	311.6	6.25	42.1	6	94	22	1.36	26.7
356x171x45	45.0	351.4	171.1	7.0	9.7	10.2	311.6	7.41	44.5	6	94	20	1.36	30.2
356x127x39	39.1	353.4	126.0	6.6	10.7	10.2	311.6	4.63	47.2	5	70	22	1.18	30.2
356x127x33	33.1	349.0	125.4	6.0	8.5	10.2	311.6	5.82	51.9	5	70	20	1.17	35.4
305x165x54	54.0	310.4	166.9	7.9	13.7	8.9	265.2	5.15	33.6	6	90	24	1.26	23.3
305x165x46	46.1	306.6	165.7	6.7	11.8	8.9	265.2	5.98	39.6	5	90	22	1.25	27.1
305x165x40	40.3	303.4	165.0	6.0	10.2	8.9	265.2	6.92	44.2	5	90	20	1.24	30.8