

X Y and Partners address tel & fax nos Originated from Steel Beam © 2000-2007 Chris Buczkowski	Project		Steel Beam Design		
	Client		Made by	Date	Job No
	Description		CJB	12-8-00	2001
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Analysis

Choose steel section:

Span (m) 6.000

Load Factors	
Dead	1.4
Imposed	1.6

E (N/mm ²)	205000
I _x (cm ⁴)	8249

- ☒ UB
☐ UC
☐ RSJ
☐ PFC

Design in accordance with BS 5950 : Part 1 : 1990

Simply supported beam

Design Status		capacity ratio
Vertical shear	PASS	0.08
Moment	PASS	0.27
Buckling	FAIL	1.40
Deflection	PASS	0.20

LOADING	Dead kN	Imposed kN	Position m	Length m
UDL	25	10	-	-
Point load				-
Point load				-
Point load				-
Point load				-
Partial UDL				
Partial UDL				

RESULTS			
M max	F _v max	Max. deflection (mm)	
kNm	kN	Imposed only	Total load
40.30	26.86	-1.66	-6.15

Design

Design Strength	
p _y N/mm ²	275

section classification	
Plastic	

- ☒ grade S275
☐ grade S355

Shear Capacity	
Area A _v	capacity P _v
mm ²	kN
2094.0	345.51

cl. 4.2.3

Moment Capacity	Position m	Moment kNm	F _v kN	M _{cx} kNm	Unity Factor
Maximum Moment	3.000	40.30	0.00	149.33	0.27
Critical section	3.000	40.30	0.00	149.33	0.27

* low shear

Lateral torsional buckling

Equivalent Uniform Moment		kNm
Maximum moment	M _A	40.30
Uniform factor	m	1.00
Buckling moment	M _{bar}	40.30

cl. 4.3.7.2

Z _x (cm ³)	473
S _x (cm ³)	543

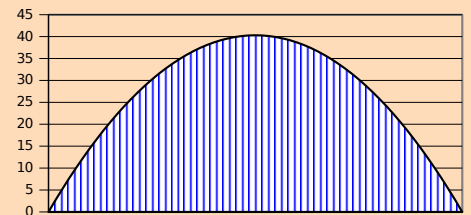
Slenderness Ratio				
Effective length		radius of gyration	slenderness	
L	factor			
m		m	r _y (cm)	λ
6.000	1.0L+2D	6.698	2.58	259.61

cl. 4.3.7.5

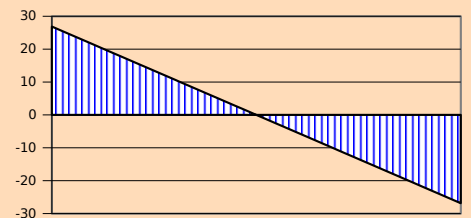
Deflection

Deflection Limits		Allowable mm
span/deflection ratios		
Imposed Loads	360	16.7
Total Loads	200	30.0

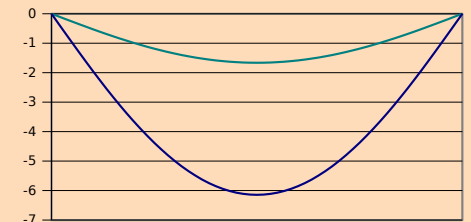
table 5



Bending Moment Diagram



Shear Force Diagram



Deflection Diagram

cl. B.2.4	limiting slenderness	λ _{Lo}	34.31
cl. 4.3.7.6	correction factor	n	1.00
	buckling parameter	u	0.863
	torsional index	χ	42.2
cl. B.2.5 (d)	slenderness factor	v	0.767
cl. B.2.5	equivalent slenderness	λ _{LT}	171.80
cl. B.2.3	Perry coefficient	η _{LT}	0.962
	Plastic moment capacity	M _p	149.33
cl. B.2.2	Elastic critical moment	M _E	37.22
	Buckling index	φ _B	111.19

cl. B.2.1	Buckling capacity	M_b	28.70
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Section used:	UB	356x127x33
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X Y and Partners address tel & fax nos Originated from Steel Beam © 2000-2007 Chris Buczkowski	Project			
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Analysis

Span (m) 6.000

Choose steel section:

☐ UB

☒ UB

☐ UC

☐ RSJ

☐ PFC

Load Factors	
Dead	1.4
Imposed	1.6

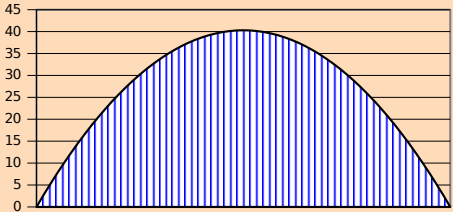
E (N/mm²)	205000
Ix (cm⁴)	8249

Design in accordance with BS 5950 : Part 1 : 1990
Simply supported beam with full lateral restraint

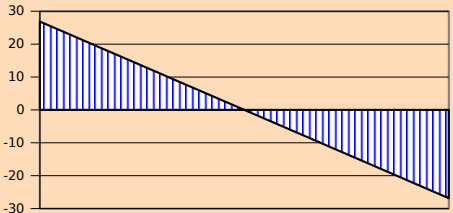
Design Status		capacity ratio
Vertical shear	PASS	0.08
Moment	PASS	0.27
Deflection	PASS	0.20

LOADING	Dead kN	Imposed kN	Position m	Length m
UDL	25	10	-	-
Point load				-
Point load				-
Point load				-
Point load				-
Partial UDL				
Partial UDL				

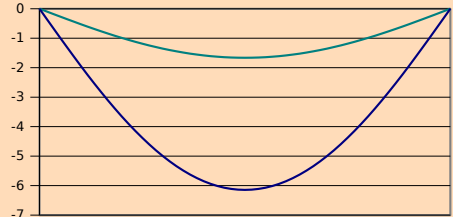
RESULTS			
M max	Fv max	Max. deflection (mm)	
kNm	kN	Imposed only	Total load
40.30	26.86	-1.66	-6.15



Bending Moment Diagram



Shear Force Diagram



Deflection Diagram

Design

Design Strength	
py N/mm²	275

section classification	
Plastic	

- ☒ grade S275
- ☐ grade S355

Shear Capacity	
Area Av	capacity Pv
mm²	kN
2094.0	345.51

cl. 4.2.3

Moment Capacity	Position m	Moment kNm	Fv kN	Mcx kNm	Unity Factor
Maximum Moment	3.000	40.30	0.00	149.33	0.27
Critical section	3.000	40.30	0.00	149.33	0.27

* low shear

Zx (cm³)	473
Sx (cm³)	543

Deflection

Deflection Limits		Allowable mm
span/deflection ratios		
Imposed Loads	360	16.7
Total Loads	200	30.0

table 5

Section used:	UB	356x127x33
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Analysis

Choose steel section:

Span (m) 2.750

- ☒ UB
☐ UC
☐ RSJ
☐ PFC

Design in accordance with BS 5950 : Part 1 : 1990

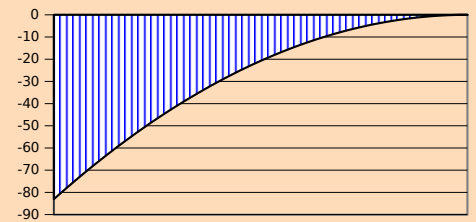
Cantilever beam

Load Factors	
Dead	1.4
Imposed	1.6

E (N/mm ²)	205000
I _x (cm ⁴)	7171

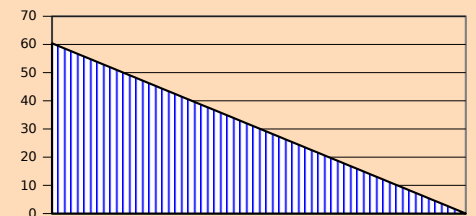
Design Status		capacity ratio
Vertical shear	PASS	0.17
Moment	PASS	0.56
Buckling	PASS	0.93
Deflection	PASS	0.47

LOADING	Dead kN	Imposed kN	Position m	Length m
UDL	25	15	-	-
Point load				-
Point load				-
Point load				-
Point load				-
Partial UDL				
Partial UDL				



Bending Moment Diagram

RESULTS			
M max	F _v max	Max. deflection (mm)	
kNm	kN	Imposed only	Total load
-83.05	60.40	-2.65	-7.25



Shear Force Diagram

Design

Design Strength	
p _y N/mm ²	275

- ☒ grade S275
☐ grade S355

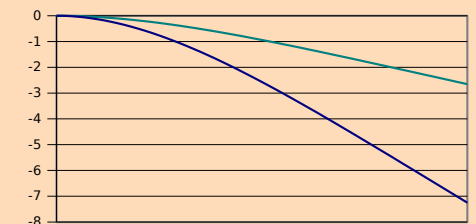
section classification
Plastic

Shear Capacity	
Area A _v	capacity P _v
mm ²	kN
2161.2	356.60

cl. 4.2.3

Moment Capacity	Position m	Moment kNm	F _v kN	M _{cx} kNm	Unity Factor
Critical section	0.000	-83.05	60.40	148.23	0.56

* low shear



Deflection Diagram

Lateral torsional buckling

Equivalent Uniform Moment	kNm
Maximum moment	M _A -83.05
Uniform factor	m 1.00
Buckling moment	M _{bar} -83.05

cl. 4.3.7.2

Z _x (cm ³)	471
S _x (cm ³)	539

Slenderness Ratio				
Effective length		radius of gyration	slenderness	
L	factor			
m		m	r _y (cm)	λ
2.750	1.00	2.750	2.67	103.00

cl. 4.3.7.5

Deflection

Deflection Limits		Allowable
span/deflection ratios		mm
Imposed Loads	180	15.3
Total Loads	180	15.3

table 5

cl. B.2.4	limiting slenderness	λ _{Lo}	34.31
cl. 4.3.7.6	correction factor	n	1.00
	buckling parameter	u	0.872
	torsional index	χ	29.7
cl. B.2.5 (d)	slenderness factor	v	0.889
cl. B.2.5	equivalent slenderness	λ _{LT}	79.84
cl. B.2.3	Perry coefficient	η _{LT}	0.319
	Plastic moment capacity	M _p	148.23
cl. B.2.2	Elastic critical moment	M _E	171.08
	Buckling index	φ _B	186.92

cl. B.2.1	Buckling capacity	M_b	89.04
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Section used:	UB	305x127x37
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Design in accordance with BS 5950 : Part 1 : 1990

Web Bearing and Buckling Design

Steel grade
☒ grade S275
☐ grade S355

Choose steel section:

- ☒ UB
☐ UC
☐ RSJ
☐ PFC

Design Status		capacity ratio
Web Buckling	PASS	0.41
Web Bearing	PASS	0.46

Design Strength of Web	
p_{yw} N/mm ²	275

E (N/mm ²)	205000
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Section Dimensions (mm)		
depth	D	311
web thickness	t	9
flange thickness	T	14
depth between fillets	d	265.2
root radius	r	8.9

FULL DESIGN LOADING (kN)	
Concentrated loading or reaction at support *	150

* factored

Web Buckling

Web Slenderness Ratio		
Flange Restrained		
d	t	(not used)
mm	mm	
265.2	9	

cl. 4.5.2.1

Flange Unrestrained	
Le factor	0.70
Le	185.64
ry (mm)	2.60
λ	71.45

☐ Tick for flange restrained

Web Buckling Resistance, P_w					
b_1	c	n_1	t	p_c	P_w
mm	mm	mm	mm	N/mm ²	kN
75	0	155.50	9	178.25	369.78

cl. 4.5.2.1

☒ Tick for support reaction

Web Compression Strength		
Perry strut formula (N/mm ²)		
design strength	p_{yw}	275
Robertson constant	a	5.5
slenderness	λ	71.45
limiting slenderness	λ_o	17.15
Perry factor	η	0.299
Euler strength	p_e	396.29
root	ϕ	394.82
compressive strength	p_c	178.25

ref: Appendix C

Web Bearing

Local Web Bearing Capacity, P_{crip}					
b_1	c	n_2	t	p_{yw}	P_{crip}
mm	mm	mm	mm	N/mm ²	kN
75	0	57.25	9	275	327.32

cl. 4.5.3

NOTES.

b_1 = stiff bearing length.
 n_1 = length obtained by load dispersion at 45 degs though half the section depth.
 n_2 = length obtained by load dispersion through the flange and root radius at a slope of 1:2.5.
c = overlap distance from end of beam section to the stiff bearing.
(If end of beam section on stiff bearing, c = 0)

Section used:	UB	305x127x48
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Factors for Lateral Torsional Buckling

Equivalent Uniform Moment Factor Calculator			
Larger end moment (M)	Smaller end moment (βM)	ratio	factor
kNm	kNm	β	m
20	-10	-0.50	0.43

ref: Table 18

Table 15. Slenderness Correction Factor C_m

Larger end moment (M)	Smaller end moment (βM)	Midspan moment
kNm	kNm	M_o
20	-10	5

Table 15. Slenderness correction factor, n , for members with applied loading concentrated within the middle fifth of the unrestrained length.

$\alpha = M/M_o$	β positive					β negative		
	1.0	0.8	0.6	0.4	0.2	0.0	-0.2	-0.4
> 50.00	1.00	0.96	0.91	0.86	0.82	0.77	0.72	0.68
50.00	1.00	0.96	0.92	0.87	0.82	0.77	0.72	0.67
10.00	0.99	0.99	0.94	0.90	0.85	0.80	0.75	0.69
5.00	0.98	0.98	0.97	0.93	0.89	0.84	0.79	0.73
2.00	0.96	0.95	0.95	0.95	0.94	0.94	0.89	0.84
1.50	0.95	0.95	0.94	0.94	0.93	0.93	0.92	0.90
1.00	0.93	0.92	0.92	0.92	0.92	0.91	0.91	0.91
0.50	0.90	0.90	0.90	0.89	0.89	0.89	0.89	0.89
0.00	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
-0.10	0.85	0.85	0.85	0.85	0.85	0.86	0.86	0.86
-0.20	0.83	0.83	0.83	0.84	0.84	0.85	0.85	0.85
-0.30	0.81	0.82	0.82	0.83	0.83	0.84	0.85	0.85
-0.40	0.79	0.80	0.81	0.81	0.82	0.83	0.84	0.85
-0.50	0.77	0.78	0.79	0.80	0.82	0.83	0.85	0.86
-0.60	0.62	0.66	0.72	0.77	0.80	0.82	0.84	0.85
-0.70	0.56	0.56	0.61	0.67	0.73	0.79	0.83	0.85
-0.80	0.56	0.53	0.54	0.59	0.65	0.71	0.77	0.83
-0.90	0.59	0.57	0.54	0.53	0.57	0.64	0.71	0.77
-1.00	0.62	0.58	0.54	0.52	0.54	0.59	0.66	0.72
-1.10	0.66	0.62	0.57	0.54	0.54	0.57	0.63	0.68
-1.20	0.70	0.66	0.60	0.55	0.54	0.55	0.60	0.65
-1.30	0.73	0.69	0.63	0.57	0.55	0.54	0.57	0.61
-1.40	0.74	0.70	0.64	0.58	0.56	0.54	0.55	0.60
-1.50	0.75	0.70	0.64	0.59	0.56	0.54	0.55	0.59
-1.60	0.76	0.72	0.65	0.60	0.57	0.55	0.55	0.58
-1.70	0.77	0.74	0.66	0.61	0.58	0.56	0.55	0.58
-1.80	0.79	0.77	0.68	0.63	0.59	0.56	0.56	0.57
-1.90	0.80	0.79	0.69	0.64	0.60	0.57	0.56	0.57
-2.00	0.81	0.81	0.70	0.65	0.61	0.58	0.56	0.56
-5.00	0.93	0.89	0.83	0.77	0.72	0.67	0.64	0.61

-50.00	0.99	0.95	0.90	0.86	0.79	0.74	0.70	0.67
< -50.00	1.00	0.96	0.91	0.86	0.82	0.77	0.72	0.68

calculator		
M/Mo	ratio	factor
α	β	n
4.00	-0.50	###

Table 16. Slenderness correction factor, n, for members with end moments
Larger end moment (M)
kNm
20

substantially		
β negative		
-0.6	-0.8	-1.0
0.65	0.65	0.65
0.66	0.66	0.65
0.68	0.68	0.67
0.71	0.70	0.70
0.79	0.77	0.76
0.85	0.80	0.80
0.91	0.92	0.92
0.88	0.88	0.88
0.86	0.86	0.86
0.86	0.86	0.86
0.86	0.86	0.86
0.86	0.86	0.87
0.85	0.86	0.87
0.86	0.87	0.88
0.86	0.87	0.88
0.87	0.88	0.89
0.89	0.90	0.90
0.84	0.88	0.91
0.80	0.85	0.92
0.76	0.83	0.89
0.73	0.80	0.87
0.69	0.77	0.83
0.66	0.74	0.81
0.65	0.73	0.80
0.64	0.72	0.80
0.63	0.70	0.78
0.62	0.69	0.76
0.61	0.67	0.75
0.60	0.66	0.74
0.60	0.62	0.65

Table 16. Slenderness correction factor, n, for members with end moments

$\alpha = M/M_o$	β positive				
	1.0	0.8	0.6	0.4	0.2
> 50.00	1.00	0.96	0.91	0.86	0.82
50.00	1.00	0.96	0.92	0.87	0.83
10.00	0.99	0.98	0.95	0.91	0.86
5.00	0.99	0.98	0.97	0.94	0.90
2.00	0.98	0.98	0.97	0.96	0.94
1.50	0.97	0.97	0.97	0.96	0.95
1.00	0.97	0.97	0.97	0.96	0.96
0.50	0.96	0.96	0.96	0.96	0.96
0.00	0.94	0.94	0.94	0.94	0.94
-0.10	0.93	0.93	0.93	0.93	0.94
-0.20	0.92	0.92	0.92	0.92	0.93
-0.30	0.91	0.91	0.92	0.92	0.93
-0.40	0.90	0.90	0.91	0.91	0.92
-0.50	0.89	0.90	0.91	0.91	0.92
-0.60	0.71	0.77	0.84	0.87	0.89
-0.70	0.57	0.64	0.70	0.77	0.82
-0.80	0.47	0.52	0.59	0.67	0.73
-0.90	0.47	0.46	0.50	0.58	0.65
-1.00	0.50	0.48	0.46	0.51	0.58
-1.10	0.54	0.51	0.48	0.49	0.54
-1.20	0.57	0.54	0.50	0.47	0.51
-1.30	0.61	0.56	0.52	0.47	0.49
-1.40	0.64	0.59	0.55	0.49	0.48
-1.50	0.67	0.62	0.57	0.51	0.47
-1.60	0.69	0.64	0.59	0.52	0.48
-1.70	0.71	0.66	0.60	0.54	0.50
-1.80	0.74	0.69	0.62	0.55	0.51
-1.90	0.76	0.71	0.63	0.57	0.53
-2.00	0.78	0.73	0.65	0.58	0.54
-5.00	0.91	0.86	0.80	0.74	0.70

0.64	0.63	0.65		-50.00	0.99	0.95	0.89	0.84	0.79
0.65	0.65	0.65		< -50.00	1.00	0.96	0.91	0.86	0.82



Bresson's Correction Factor Calculator				
Smaller end moment (βM)	Midspan moment	M/Mo	ratio	factor
kNm	Mo	α	β	n
-10	5	4.00	-0.50	###

Factors with applied loading other than as for					
	β negative				
0.0	-0.2	-0.4	-0.6	-0.8	-1.0
0.77	0.72	0.68	0.65	0.65	0.65
0.77	0.72	0.67	0.66	0.66	0.65
0.81	0.76	0.70	0.68	0.68	0.67
0.85	0.80	0.75	0.71	0.70	0.70
0.92	0.90	0.86	0.82	0.78	0.76
0.93	0.92	0.89	0.86	0.83	0.79
0.95	0.94	0.93	0.93	0.91	0.89
0.95	0.94	0.94	0.94	0.93	0.92
0.94	0.94	0.94	0.94	0.94	0.94
0.94	0.94	0.94	0.94	0.94	0.94
0.93	0.93	0.93	0.94	0.94	0.93
0.93	0.93	0.93	0.94	0.94	0.94
0.92	0.92	0.92	0.93	0.93	0.93
0.92	0.92	0.92	0.92	0.92	0.92
0.91	0.92	0.92	0.92	0.92	0.92
0.87	0.89	0.91	0.92	0.92	0.91
0.80	0.86	0.90	0.92	0.92	0.92
0.73	0.80	0.87	0.90	0.90	0.90
0.66	0.73	0.81	0.87	0.89	0.89
0.61	0.69	0.77	0.83	0.87	0.88
0.56	0.64	0.73	0.80	0.84	0.87
0.53	0.61	0.70	0.77	0.82	0.86
0.51	0.58	0.67	0.74	0.79	0.85
0.49	0.56	0.64	0.71	0.77	0.84
0.50	0.55	0.63	0.69	0.76	0.83
0.51	0.55	0.61	0.68	0.74	0.82
0.51	0.54	0.60	0.66	0.73	0.81
0.52	0.54	0.58	0.65	0.71	0.80
0.53	0.53	0.57	0.63	0.70	0.79
0.65	0.62	0.59	0.58	0.61	0.67

0.74	0.70	0.66	0.63	0.62	0.65
0.77	0.72	0.68	0.65	0.65	0.65

NOTES

FOREWORD

This spreadsheet performs an analysis and design of simply supported and cantilever beams in the X axis and subjected to gravity loads. Beams can be either with full restraint or partial restraint.

Design is in accordance with BS 5950-1:1990. Bending moments, shear forces and axial forces are calculated at positions along the span and the maximums of these values are used for the design. The design has been obtained from the Reinforced Concrete Designer's Handbook by Reynolds and Elgar. The design section is automatically included in the calculations. The moment capacity of the section is checked against the corresponding shear force and a reduction is made as necessary. A check for local buckling is required and a warning is issued. This spreadsheet also contains a calculation for the design of the buckling.

The spreadsheet uses UK steel section properties which have been directly obtained from the Corus CD released on CD in February 2000. The values were imported into Microsoft Excel and the Corus CD. No typing in of values has been carried out and therefore these values are as published by Corus.

SETUP

This spreadsheet has been formatted using Arial, Arial Black, Symbol and Tahoma fonts. The spreadsheet has been optimised for a screen resolution of 1024x768 HiColor (16 bit) using large fonts.

Use the **Zoom** button on the toolbar to reduce or enlarge the display to suit your requirements. You can permanently store your new settings. Recommended zoom settings are as follows:

Screen resolution 800x600 with large fonts:	67%
Screen resolution 800x600 with small fonts:	85%
Screen resolution 1024x768 with large fonts:	85%
Screen resolution 1024x768 with small fonts:	105%

Company Details

Enter your company name and other details in the title block on the first sheet. The details will be automatically copied to the other sheets. Company details can be changed directly.

KEY INFORMATION

Microsoft Excel

This spreadsheet has been developed for use in Microsoft Excel 97 (v8.0) on the Windows 95/98/NT system.

British Standard Specification (BSI)

This spreadsheet has been developed to comply with BS 5950 : Part 1 : 1990 as published in February 1992.

Support

Registered users may obtain support for this spreadsheet from: info@structural-engineering.co.uk

Additional Information

Refer to the accompanying README.TXT file for additional information.

USING STEEL BEAM FOR MICROSOFT EXCEL

The following colour key is a guide to using the full calculation page spreadsheet.

Input required.

Remove

Computed output

Error/ Alert

Message

Clear cell contents

To clear the contents of a cell, right click your mouse on the cell and then click

ACCURACY

This spreadsheet calculates exact values of bending moment, shear force and span of the beam. As the *actual* maximum moment may not occur at precisely value of the moment may occur.

In a simply supported beam, the shear force should be zero at the point of maximum moment. If the shear force is not zero at the point of maximum moment, a small value for shear force may be displayed, indicating an inaccuracy in determining the exact position of the maximum moment.

The above inaccuracies are no different than that displayed in software products which employ similar methods of analysis and design.

However, these inaccuracies should be viewed in the correct perspective. The spreadsheet at 61 positions along its span clearly indicates a more realistic approach to the beam with a single point load where the maximum moment is at the point of zero shear. It is justified in stating 'low shear'. Yet, just a fraction away from the point of maximum moment, the shear force may be high, resulting in 'high shear' and an under designed beam. The spreadsheet at 61 positions along the beam, would not be caught out by such mathematical analysis.

MOMENT CAPACITY

Moment capacity is calculated at 1/60th positions along the beam span taking into account the shear force. If the shear force is determined as 'high', then the corresponding moment capacity requirements. At each position the 'unity factor' is calculated. This factor is the ratio of the required moment to the capacity. A unity factor of one represents full utilisation of the beam's capacity. A unity factor greater than one indicates failure. The largest value of the unity factor determines the position of the critical section.

EFFECTIVE LENGTH

Click on the "factor" cell and choose an effective length factor from the drop-down list. If circumstances dictate a factor which is not listed, enter the factor directly into the "factor" cell. This procedure can be used when considering a portion of beam between a fixed support and a free end. Calculate the effective length in accordance with clause 4.3.5 and divide it by the effective length of a beam with fixed end support to obtain an effective length factor for entering into the "factor" cell.

LOCAL WEB BUCKLING AND BEARING**Web Slenderness Ratio**

The effective length of an unstiffened web with the flange restrained is calculated as an effective length of the web equal to $0.7d$ where d is the depth between fillet welds. This will enable the effective length of the web to be compared with the value from Table 24 of the code.

Support Reaction Tick Box

Tick this box when considering the reaction at an end support. Clear the box when considering the reaction at an internal support.

top flange of a beam. A point load applied to the top flange will disperse to either support reaction will disperse to only one side of the stiff bearing length plus a length of the beam past the stiff bearing length. (see the sketch on the Bearing & Stiffness page)

Note! If a point load is closer to the end of a beam than half the dispersal length, the reaction will disperse to only one side of the stiff bearing length.

Overlap Dimension 'c'

This is the dimension between the end of a beam and the stiff bearing length v length. (see the sketch on the Bearing & Buckling sheet). If the end of the bearing is at the end of the beam then $c = 0$.

TIPS

#1 When entering loads, the partial UDL cells can be used for point loads by e

#2 To enter project data into a number of sheets simultaneously, hold down the relevant sheets. This will 'group' the sheets and data entered into one sheet affects others. When finished, click on any other sheet tab which has not been selected.

SHORT CUTS

Entering Numerical Data

Expressions may be entered in place of numbers in cells requiring numerical input. Click on the relevant cell. Enter the following: $=4+8*3$ - This expression evaluates to 28. You can also enter the formula in the formula bar. Double click on the cell or if you have the formula bar showing (go to View -> Formula Bar) and enter the formula.

cantilever, steel beams bending about their X-X without full restraint.

Not full
restraint

and deflections are computed at 1/60th design. The equations for the analysis have been derived from the BS 5950 and Steedman. Self weight of the steel beam and the section is calculated taking into account the weight of the section. It is made to see if a shear buckling calculation is required. A sheet for checking local web bearing and

Full
restraint

obtained from the Corus Construction Manual, Steel v8.0 from the html tables contained on the website. The tables should accurately reflect the tables

in the Corus truetype fonts. The spreadsheet has been designed to use the Corus fonts.

on your computer. Use the **Save** button to save the spreadsheet to your computer. The following are the steps:

only. This is the 'Not Full Restraint' sheet. The 'Full Restraint' sheet cannot be entered in the other sheets

on the Microsoft Windows 95/98 operating system

and amendment no. AMD 6972 published 28/01/98

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ets.

value

ert

Clear Contents.

deflections at 1/60th positions along the
one of these positions, a small error in the
ximum moment. Where the critical section
played. This occurs because of the small
ed by the Steel Construction Institute which

fact that the beam is checked and designed
actual behaviour of the beam. Consider a
ero shear. According to the code, one would
ximum moment, the shear force leaps to its
n. This spreadsheet, by virtue of checking at
nomalies.

into account the co-existent shear force. If
ity is reduced in accordance with code
ratio of the applied moment to the moment
. A unity factor exceeding one indicates
cal section along the beam.

own list.
to the "factor" cell ignoring the drop-down
a lateral restraint and an end support.
the length between the restraint and the
ell..

ted from $2.5d/t$ (cl. 4.5.2.1). This is based on
ts. Clear the flange restrained tick box for a
to be calculated using L_E factors obtained

hen considering a point load applied to the

her side of the stiff bearing length. An end
partial dispersal through any overlap of the
(Buckling sheet)
th (n_1 or n_2), calculate as if for a support

when a beam overlaps the stiff bearing
m does not overlap the stiff bearing length,

entering zero in the loaded length cell.
he CTRL key and click on the sheet tabs of
et will be automatically entered into the
d to release the 'group' selection feature.

put. e.g. To enter an expression:-
evaluates to 28. You will see the expression if
menu and click Formula Bar).

STEEL BEAM

FOR MICROSOFT EXCEL

Version

Version 2.03

Please ensure you have the latest version of this software, which may be downloaded from the internet via this hyperlink : **<http://www.structural-engineering.org.uk>**
Click the Connect button to go to the web site.

If you have comments, suggestions, bug reports or require information, please email:

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* The Author is Chris Buczkowski.

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REVISION HISTORY

Date	Version	Action
8/12/2000	1.0	Initial release
11/13/2000	1.1	102x44x7 RSJ width corrected - Dr Shaiq Khan
2/11/2001	1.2	'n' factors calculator added.
5/16/2001	2.0	Number of loads increased, analysis increased to 60 not rearranged, effective length factor improved. Cantilever buckling sheet added. Other minor amendments.
8/13/2001	2.01	Amended conditional formatting error in partial UDL's.
5/29/2006	2.02	Administrative revision.
3/2/2007	2.03	Administrative revision.

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des across span, calculation sheet
r beam sheet added. Web bearing and

Other spreadsheets:

BAR SCHEDULE FOR EXCEL 97

Bar Schedule for Excel 97 is a spreadsheet for the scheduling of steel for the reinforcement of concrete developed to comply with BS 4466 : 1989 and Amendment No. 1 published 28 February 1990.

The aim of the spreadsheet is to reduce the time taken to produce a bar schedule, reduce arithmetical errors, increase compliance with the BSI specified format for bar scheduling and, eventually, become interchangeable.

The latest version of Bar Schedule may be downloaded from : <http://www.structural-engineering.fsnet.co.uk>

Other spreadsheets:

WIND DESIGN WORKBOOK

This spreadsheet implements the full Standard Method of calculating wind loads for buildings in accordance with BS 6871:1997. This method is suitable for buildings up to 100m high. The workbook contains spreadsheets which calculate wind loads and internal pressures. It also contains spreadsheets which can be used as design aids, useful for hand calculations. For Engineers new to the code, the spreadsheet can prove an invaluable teaching aid.

The latest version of Wind Design Workbook may be downloaded from :
<http://www.structural-engineering.fsnet.co.uk>

Other spreadsheets:

REINFORCED CONCRETE WORKBOOK

A spreadsheet which is a powerful aid for the reinforced concrete detailer or designer. It contains many calculators required for detailing and designing reinforced concrete such as lap lengths, minimum spacings, bar bending lengths, etc. and more! This spreadsheet could be looked on as an electronic book with an index followed by pages containing various calculators. Each calculator has a specific task to perform. The Reinforced Concrete Workbook also acts as a reminder reminding the user of the various checks to be made.

The latest version of Reinforced Concrete Workbook may be downloaded from :
<http://www.structural-engineering.fsnet.co.uk>

FREE SPREADSHEETS !! **REINFORCEMENT AREAS**

An interactive sheet for determining areas of reinforcement for concrete.

ISSUE SHEET

A must for every office, a simple but presentable document/drawing issue sheet that can be customised to suit your own name.

STRUCTURAL SECTIONS

British Steel (Corus) steel section tables in Excel format.

The latest versions may be downloaded from :
<http://www.structural-engineering.fsnet.co.uk>

Other spreadsheets:

BAR SCHEDULE 8666 FOR MICROSOFT EXCEL

Bar Schedule 8666 for Microsoft Excel is a spreadsheet for the scheduling of steel for the reinforcement of concrete. The spreadsheet has been developed to comply with BS 8666 : 2000.

The aim of the spreadsheet is to reduce the time taken to produce a bar schedule, reduce arithmetical errors, increase compliance with the BSI specified format for bar scheduling and, eventually, become interchangeable.

The latest version of Bar Schedule 8666 may be downloaded from :
<http://www.structural-engineering.fsnet.co.uk>

. The spreadsheet has been

errors, reduce scheduling
the basis for electronic data

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ance with BS 6399 : Part 2 :
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ulations or checking designs.

of the everyday calculations
nd dimensions and much
aining many individual
as an aide memoir,

ised with your company's

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errors, reduce scheduling
the basis for electronic data



Universal Beams to BS4 Part1 1993 - Dimensions & P

Designation	Mass Per metre	Depth of section	Width of section	Thickness		Root radius	Depth between fillets	Ratio Local B
				Web	Flange			Flange
				s	t			b/2t
	kg/m	mm	mm	mm	mm	mm	mm	
1016x305x487	486.6	1036.1	308.5	30	54.1	30	867.9	2.85
1016x305x437	436.9	1025.9	305.4	26.9	49	30	867.9	3.12
1016x305x393	392.7	1016	303	24.4	43.9	30	868.2	3.45
1016x305x349	349.4	1008.1	302	21.1	40	30	868.1	3.77
1016x305x314	314.3	1000	300	19.1	35.9	30	868.2	4.18
1016x305x272	272.3	990.1	300	16.5	31	30	868.1	4.84
1016x305x249	248.7	980.2	300	16.5	26	30	868.2	5.77
1016x305x222	222	970.3	300	16	21.1	30	868.1	7.11
914x419x388	388	921	420.5	21.4	36.6	24.1	799.6	5.74
914x419x343	343.3	911.8	418.5	19.4	32	24.1	799.6	6.54
914x305x289	289.1	926.6	307.7	19.5	32	19.1	824.4	4.81
914x305x253	253.4	918.4	305.5	17.3	27.9	19.1	824.4	5.47
914x305x224	224.2	910.4	304.1	15.9	23.9	19.1	824.4	6.36
914x305x201	200.9	903	303.3	15.1	20.2	19.1	824.4	7.51
838x292x226	226.5	850.9	293.8	16.1	26.8	17.8	761.7	5.48
838x292x194	193.8	840.7	292.4	14.7	21.7	17.8	761.7	6.74
838x292x176	175.9	834.9	291.7	14	18.8	17.8	761.7	7.76
762x267x197	196.8	769.8	268	15.6	25.4	16.5	686	5.28
762x267x173	173	762.2	266.7	14.3	21.6	16.5	686	6.17
762x267x147	146.9	754	265.2	12.8	17.5	16.5	686	7.58
762x267x134	133.9	750	264.4	12	15.5	16.5	686	8.53
686x254x170	170.2	692.9	255.8	14.5	23.7	15.2	615.1	5.4
686x254x152	152.4	687.5	254.5	13.2	21	15.2	615.1	6.06
686x254x140	140.1	683.5	253.7	12.4	19	15.2	615.1	6.68
686x254x125	125.2	677.9	253	11.7	16.2	15.2	615.1	7.81
610x305x238	238.1	635.8	311.4	18.4	31.4	16.5	540	4.96
610x305x179	179	620.2	307.1	14.1	23.6	16.5	540	6.51
610x305x149	149.2	612.4	304.8	11.8	19.7	16.5	540	7.74
610x229x140	139.9	617.2	230.2	13.1	22.1	12.7	547.6	5.21
610x229x125	125.1	612.2	229	11.9	19.6	12.7	547.6	5.84
610x229x113	113	607.6	228.2	11.1	17.3	12.7	547.6	6.6
610x229x101	101.2	602.6	227.6	10.5	14.8	12.7	547.6	7.69
533x210x122	122	544.5	211.9	12.7	21.3	12.7	476.5	4.97
533x210x109	109	539.5	210.8	11.6	18.8	12.7	476.5	5.61
533x210x101	101	536.7	210	10.8	17.4	12.7	476.5	6.03
533x210x92	92.14	533.1	209.3	10.1	15.6	12.7	476.5	6.71
533x210x82	82.2	528.3	208.8	9.6	13.2	12.7	476.5	7.91
457x191x98	98.3	467.2	192.8	11.4	19.6	10.2	407.6	4.92
457x191x89	89.3	463.4	191.9	10.5	17.7	10.2	407.6	5.42
457x191x82	82	460	191.3	9.9	16	10.2	407.6	5.98
457x191x74	74.3	457	190.4	9	14.5	10.2	407.6	6.57
457x191x67	67.1	453.4	189.9	8.5	12.7	10.2	407.6	7.48
457x152x82	82.1	465.8	155.3	10.5	18.9	10.2	407.6	4.11

457x152x74	74.2	462	154.4	9.6	17	10.2	407.6	4.54
457x152x67	67.2	458	153.8	9	15	10.2	407.6	5.13
457x152x60	59.8	454.6	152.9	8.1	13.3	10.2	407.6	5.75
457x152x52	52.3	449.8	152.4	7.6	10.9	10.2	407.6	6.99
406x178x74	74.2	412.8	179.5	9.5	16	10.2	360.4	5.61
406x178x67	67.1	409.4	178.8	8.8	14.3	10.2	360.4	6.25
406x178x60	60.1	406.4	177.9	7.9	12.8	10.2	360.4	6.95
406x178x54	54.1	402.6	177.7	7.7	10.9	10.2	360.4	8.15
406x140x46	46	403.2	142.2	6.8	11.2	10.2	360.4	6.35
406x140x39	39	398	141.8	6.4	8.6	10.2	360.4	8.24
356x171x67	67.1	363.4	173.2	9.1	15.7	10.2	311.6	5.52
356x171x57	57	358	172.2	8.1	13	10.2	311.6	6.62
356x171x51	51	355	171.5	7.4	11.5	10.2	311.6	7.46
356x171x45	45	351.4	171.1	7	9.7	10.2	311.6	8.82
356x127x39	39.1	353.4	126	6.6	10.7	10.2	311.6	5.89
356x127x33	33.1	349	125.4	6	8.5	10.2	311.6	7.38
305x165x54	54	310.4	166.9	7.9	13.7	8.9	265.2	6.09
305x165x46	46.1	306.6	165.7	6.7	11.8	8.9	265.2	7.02
305x165x40	40.3	303.4	165	6	10.2	8.9	265.2	8.09
305x127x48	48.1	311	125.3	9	14	8.9	265.2	4.47
305x127x42	41.9	307.2	124.3	8	12.1	8.9	265.2	5.14
305x127x37	37	304.4	123.4	7.1	10.7	8.9	265.2	5.77
305x102x33	32.8	312.7	102.4	6.6	10.8	7.6	275.9	4.74
305x102x28	28.2	308.7	101.8	6	8.8	7.6	275.9	5.78
305x102x25	24.8	305.1	101.6	5.8	7	7.6	275.9	7.26
254x146x43	43	259.6	147.3	7.2	12.7	7.6	219	5.8
254x146x37	37	256	146.4	6.3	10.9	7.6	219	6.72
254x146x31	31.1	251.4	146.1	6	8.6	7.6	219	8.49
254x102x28	28.3	260.4	102.2	6.3	10	7.6	225.2	5.11
254x102x25	25.2	257.2	101.9	6	8.4	7.6	225.2	6.07
254x102x22	22	254	101.6	5.7	6.8	7.6	225.2	7.47
203x133x30	30	206.8	133.9	6.4	9.6	7.6	172.4	6.97
203x133x25	25.1	203.2	133.2	5.7	7.8	7.6	172.4	8.54
203x102x23	23.1	203.2	101.8	5.4	9.3	7.6	169.4	5.47
178x102x19	19	177.8	101.2	4.8	7.9	7.6	146.8	6.41
152x89x16	16	152.4	88.7	4.5	7.7	7.6	121.8	5.76
127x76x13	13	127	76	4	7.6	7.6	96.6	5

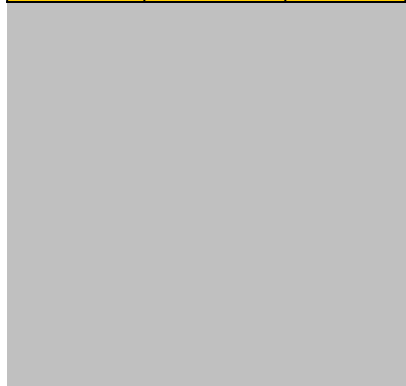
Properties

Properties for Buckling	Second Moment of Area		Radius of Gyration		Elastic Modulus		Plastic Modulus		Buckling Parameter	Torsional Index
Web	Axis x-x	Axis y-y	Axis x-x	Axis y-y	Axis x-x	Axis y-y	Axis x-x	Axis y-y		
d/s	I _x	I _y	r _x	r _y	Z _x	Z _y	S _x	S _y	u	x
	cm ⁴	cm ⁴	cm	cm	cm ³	cm ³	cm ³	cm ³		
28.9	1021400	26720	40.6	6.57	19720	1732	23200	2800	0.867	21.1
32.3	909900	23450	40.4	6.49	17740	1535	20760	2469	0.868	23.1
35.6	807700	20500	40.2	6.4	15900	1353	18540	2168	0.868	25.5
41.1	723100	18460	40.3	6.44	14350	1223	16590	1941	0.872	27.9
45.5	644200	16230	40.1	6.37	12880	1082	14850	1713	0.872	30.7
52.6	554000	14000	40	6.35	11190	934	12830	1470	0.873	35
52.6	481300	11750	39	6.09	9821	784	11350	1245	0.861	39.9
54.3	408000	9546	38	5.81	8409	636	9807	1020	0.85	45.7
37.4	719600	45440	38.2	9.59	15630	2161	17670	3341	0.885	26.7
41.2	625800	39160	37.8	9.46	13730	1871	15480	2890	0.883	30.1
42.3	504200	15600	37	6.51	10880	1014	12570	1601	0.867	31.9
47.7	436300	13300	36.8	6.42	9501	871	10940	1371	0.866	36.2
51.8	376400	11240	36.3	6.27	8269	739	9535	1163	0.861	41.3
54.6	325300	9423	35.7	6.07	7204	621	8351	982	0.854	46.8
47.3	339700	11360	34.3	6.27	7985	773	9155	1212	0.87	35
51.8	279200	9066	33.6	6.06	6641	620	7640	974	0.862	41.6
54.4	246000	7799	33.1	5.9	5893	535	6808	842	0.856	46.5
44	240000	8175	30.9	5.71	6234	610	7167	959	0.869	33.2
48	205300	6850	30.5	5.58	5387	514	6198	807	0.864	38.1
53.6	168500	5455	30	5.4	4470	411	5156	647	0.858	45.2
57.2	150700	4788	29.7	5.3	4018	362	4644	570	0.854	49.8
42.4	170300	6630	28	5.53	4916	518	5631	811	0.872	31.8
46.6	150400	5784	27.8	5.46	4374	455	5000	710	0.871	35.5
49.6	136300	5183	27.6	5.39	3987	409	4558	638	0.868	38.7
52.6	118000	4383	27.2	5.24	3481	346	3994	542	0.862	43.9
29.3	209500	15840	26.3	7.23	6589	1017	7486	1574	0.886	21.3
38.3	153000	11410	25.9	7.07	4935	743	5547	1144	0.886	27.7
45.8	125900	9308	25.7	7	4111	611	4594	937	0.886	32.7
41.8	111800	4505	25	5.03	3622	391	4142	611	0.875	30.6
46	98610	3932	24.9	4.97	3221	343	3676	535	0.873	34.1
49.3	87320	3434	24.6	4.88	2874	301	3281	469	0.87	38
52.2	75780	2915	24.2	4.75	2515	256	2881	400	0.864	43.1
37.5	76040	3388	22.1	4.67	2793	320	3196	500	0.877	27.6
41.1	66820	2943	21.9	4.6	2477	279	2828	436	0.875	30.9
44.1	61520	2692	21.9	4.57	2292	256	2612	399	0.874	33.2
47.2	55230	2389	21.7	4.51	2072	228	2360	356	0.872	36.5
49.6	47540	2007	21.3	4.38	1800	192	2059	300	0.864	41.6
35.8	45730	2347	19.1	4.33	1957	243	2232	379	0.881	25.7
38.8	41020	2089	19	4.29	1770	218	2014	338	0.88	28.3
41.2	37050	1871	18.8	4.23	1611	196	1831	304	0.877	30.9
45.3	33320	1671	18.8	4.2	1458	176	1653	272	0.877	33.9
48	29380	1452	18.5	4.12	1296	153	1471	237	0.872	37.9
38.8	36590	1185	18.7	3.37	1571	153	1811	240	0.873	27.4

42.5	32670	1047	18.6	3.33	1414	136	1627	213	0.873	30.1
45.3	28930	913	18.4	3.27	1263	119	1453	187	0.869	33.6
50.3	25500	795	18.3	3.23	1122	104	1287	163	0.868	37.5
53.6	21370	645	17.9	3.11	950	84.6	1096	133	0.859	43.9
37.9	27310	1545	17	4.04	1323	172	1501	267	0.882	27.6
41	24330	1365	16.9	3.99	1189	153	1346	237	0.88	30.5
45.6	21600	1203	16.8	3.97	1063	135	1199	209	0.88	33.8
46.8	18720	1021	16.5	3.85	930	115	1055	178	0.871	38.3
53	15690	538	16.4	3.03	778	75.7	888	118	0.871	38.9
56.3	12510	410	15.9	2.87	629	57.8	724	90.8	0.858	47.5
34.2	19460	1362	15.1	3.99	1071	157	1211	243	0.886	24.4
38.5	16040	1108	14.9	3.91	896	129	1010	199	0.882	28.8
42.1	14140	968	14.8	3.86	796	113	896	174	0.881	32.1
44.5	12070	811	14.5	3.76	687	94.8	775	147	0.874	36.8
47.2	10170	358	14.3	2.68	576	56.8	659	89.1	0.871	35.2
51.9	8249	280	14	2.58	473	44.7	543	70.3	0.863	42.2
33.6	11700	1063	13	3.93	754	127	846	196	0.889	23.6
39.6	9899	896	13	3.9	646	108	720	166	0.891	27.1
44.2	8503	764	12.9	3.86	560	92.6	623	142	0.889	31
29.5	9575	461	12.5	2.74	616	73.6	711	116	0.873	23.3
33.1	8196	389	12.4	2.7	534	62.6	614	98.4	0.872	26.5
37.4	7171	336	12.3	2.67	471	54.5	539	85.4	0.872	29.7
41.8	6501	194	12.5	2.15	416	37.9	481	60	0.866	31.6
46	5366	155	12.2	2.08	348	30.5	403	48.5	0.859	37.4
47.6	4455	123	11.9	1.97	292	24.2	342	38.8	0.846	43.4
30.4	6544	677	10.9	3.52	504	92	566	141	0.891	21.2
34.8	5537	571	10.8	3.48	433	78	483	119	0.89	24.3
36.5	4413	448	10.5	3.36	351	61.3	393	94.1	0.88	29.6
35.7	4005	179	10.5	2.22	308	34.9	353	54.8	0.874	27.5
37.5	3415	149	10.3	2.15	266	29.2	306	46	0.866	31.5
39.5	2841	119	10.1	2.06	224	23.5	259	37.3	0.856	36.4
26.9	2896	385	8.71	3.17	280	57.5	314	88.2	0.881	21.5
30.2	2340	308	8.56	3.1	230	46.2	258	70.9	0.877	25.6
31.4	2105	164	8.46	2.36	207	32.2	234	49.8	0.888	22.5
30.6	1356	137	7.48	2.37	153	27	171	41.6	0.888	22.6
27.1	834	89.8	6.41	2.1	109	20.2	123	31.2	0.89	19.6
24.1	473	55.7	5.35	1.84	74.6	14.7	84.2	22.6	0.895	16.3

Warping Constant	Torsional Constant	Area of section
H	J	A
dm ⁶	cm ⁴	cm ²
64.4	4299	620
55.9	3185	557
48.4	2330	500
43.3	1718	445
37.7	1264	400
32.2	835	347
26.8	582	317
21.5	390	283
88.9	1734	494
75.8	1193	437
31.2	926	368
26.4	626	323
22.1	422	286
18.4	291	256
19.3	514	289
15.2	306	247
13	221	224
11.3	404	251
9.39	267	220
7.4	159	187
6.46	119	171
7.42	308	217
6.42	220	194
5.72	169	178
4.8	116	159
14.5	785	303
10.2	340	228
8.17	200	190
3.99	216	178
3.45	154	159
2.99	111	144
2.52	77	129
2.32	178	155
1.99	126	139
1.81	101	129
1.6	75.7	117
1.33	51.5	105
1.18	121	125
1.04	90.7	114
0.922	69.2	104
0.818	51.8	94.6
0.705	37.1	85.5
0.591	89.2	105

0.518	65.9	94.5
0.448	47.7	85.6
0.387	33.8	76.2
0.311	21.4	66.6
0.608	62.8	94.5
0.533	46.1	85.5
0.466	33.3	76.5
0.392	23.1	69
0.207	19	58.6
0.155	10.7	49.7
0.412	55.7	85.5
0.33	33.4	72.6
0.286	23.8	64.9
0.237	15.8	57.3
0.105	15.1	49.8
0.081	8.79	42.1
0.234	34.8	68.8
0.195	22.2	58.7
0.164	14.7	51.3
0.102	31.8	61.2
0.085	21.1	53.4
0.072	14.8	47.2
0.044	12.2	41.8
0.035	7.4	35.9
0.027	4.77	31.6
0.103	23.9	54.8
0.086	15.3	47.2
0.066	8.55	39.7
0.028	9.57	36.1
0.023	6.42	32
0.018	4.15	28
0.037	10.3	38.2
0.029	5.96	32
0.015	7.02	29.4
0.01	4.41	24.3
0.005	3.56	20.3
0.002	2.85	16.5



Universal Columns to BS4 Part1 1993 - Dimensions & Properties

Designation	Mass Per metre	Depth of Section	Width of Section	Thickness		Root Radius	Depth between fillets	Ratios for Local Buckling	
				Web	Flange			Flange	Web
				s	t			b/2t	d/s
	kg/m	mm	mm	mm	mm	mm	mm		
356x406x634	633.9	474.6	424	47.6	77	15.2	290.2	2.75	6.1
356x406x551	551	455.6	418.5	42.1	67.5	15.2	290.2	3.1	6.89
356x406x467	467	436.6	412.2	35.8	58	15.2	290.2	3.55	8.11
356x406x393	393	419	407	30.6	49.2	15.2	290.2	4.14	9.48
356x406x340	339.9	406.4	403	26.6	42.9	15.2	290.2	4.7	10.9
356x406x287	287.1	393.6	399	22.6	36.5	15.2	290.2	5.47	12.8
356x406x235	235.1	381	394.8	18.4	30.2	15.2	290.2	6.54	15.8
356x368x202	201.9	374.6	374.7	16.5	27	15.2	290.2	6.94	17.6
356x368x177	177	368.2	372.6	14.4	23.8	15.2	290.2	7.83	20.2
356x368x153	152.9	362	370.5	12.3	20.7	15.2	290.2	8.95	23.6
356x368x129	129	355.6	368.6	10.4	17.5	15.2	290.2	10.5	27.9
305x305x283	282.9	365.3	322.2	26.8	44.1	15.2	246.7	3.65	9.21
305x305x240	240	352.5	318.4	23	37.7	15.2	246.7	4.22	10.7
305x305x198	198.1	339.9	314.5	19.1	31.4	15.2	246.7	5.01	12.9
305x305x158	158.1	327.1	311.2	15.8	25	15.2	246.7	6.22	15.6
305x305x137	136.9	320.5	309.2	13.8	21.7	15.2	246.7	7.12	17.9
305x305x118	117.9	314.5	307.4	12	18.7	15.2	246.7	8.22	20.6
305x305x97	96.9	307.9	305.3	9.9	15.4	15.2	246.7	9.91	24.9
254x254x167	167.1	289.1	265.2	19.2	31.7	12.7	200.3	4.18	10.4
254x254x132	132	276.3	261.3	15.3	25.3	12.7	200.3	5.16	13.1
254x254x107	107.1	266.7	258.8	12.8	20.5	12.7	200.3	6.31	15.6
254x254x89	88.9	260.3	256.3	10.3	17.3	12.7	200.3	7.41	19.4
254x254x73	73.1	254.1	254.6	8.6	14.2	12.7	200.3	8.96	23.3
203x203x86	86.1	222.2	209.1	12.7	20.5	10.2	160.8	5.1	12.7
203x203x71	71	215.8	206.4	10	17.3	10.2	160.8	5.97	16.1
203x203x60	60	209.6	205.8	9.4	14.2	10.2	160.8	7.25	17.1
203x203x52	52	206.2	204.3	7.9	12.5	10.2	160.8	8.17	20.4
203x203x46	46.1	203.2	203.6	7.2	11	10.2	160.8	9.25	22.3
152x152x37	37	161.8	154.4	8	11.5	7.6	123.6	6.71	15.5
152x152x30	30	157.6	152.9	6.5	9.4	7.6	123.6	8.13	19
152x152x23	23	152.4	152.2	5.8	6.8	7.6	123.6	11.2	21.3

Properties

Second Moment of Area		Radius of Gyration		Elastic Modulus		Plastic Modulus		Buckling Parameter	Torsional Index	Warping Constant
Axis x-x	Axis y-y	Axis x-x	Axis y-y	Axis x-x	Axis y-y	Axis x-x	Axis y-y			
I_x	I_y	r_x	r_y	Z_x	Z_y	S_x	S_y	u	x	H
cm ⁴	cm ⁴	cm	cm	cm ³	cm ³	cm ³	cm ³			dm ⁶
274800	98130	18.4	11	11580	4629	14240	7108	0.843	5.46	38.8
226900	82670	18	10.9	9962	3951	12080	6058	0.841	6.05	31.1
183000	67830	17.5	10.7	8383	3291	10000	5034	0.839	6.86	24.3
146600	55370	17.1	10.5	6998	2721	8222	4154	0.837	7.86	18.9
122500	46850	16.8	10.4	6031	2325	6999	3544	0.836	8.85	15.5
99880	38680	16.5	10.3	5075	1939	5812	2949	0.835	10.2	12.3
79080	30990	16.3	10.2	4151	1570	4687	2383	0.834	12.1	9.54
66260	23690	16.1	9.6	3538	1264	3972	1920	0.844	13.4	7.16
57120	20530	15.9	9.54	3103	1102	3455	1671	0.844	15	6.09
48590	17550	15.8	9.49	2684	948	2965	1435	0.844	17	5.11
40250	14610	15.6	9.43	2264	793	2479	1199	0.844	19.9	4.18
78870	24630	14.8	8.27	4318	1529	5105	2342	0.855	7.65	6.35
64200	20310	14.5	8.15	3643	1276	4247	1951	0.854	8.74	5.03
50900	16300	14.2	8.04	2995	1037	3440	1581	0.854	10.2	3.88
38750	12570	13.9	7.9	2369	808	2680	1230	0.851	12.5	2.87
32810	10700	13.7	7.83	2048	692	2297	1053	0.851	14.2	2.39
27670	9059	13.6	7.77	1760	589	1958	895	0.85	16.2	1.98
22250	7308	13.4	7.69	1445	479	1592	726	0.85	19.3	1.56
30000	9870	11.9	6.81	2075	744	2424	1137	0.851	8.49	1.63
22530	7531	11.6	6.69	1631	576	1869	878	0.85	10.3	1.19
17510	5928	11.3	6.59	1313	458	1484	697	0.848	12.4	0.898
14270	4857	11.2	6.55	1096	379	1224	575	0.85	14.5	0.717
11410	3908	11.1	6.48	898	307	992	465	0.849	17.3	0.562
9449	3127	9.28	5.34	850	299	977	456	0.85	10.2	0.318
7618	2537	9.18	5.3	706	246	799	374	0.853	11.9	0.25
6125	2065	8.96	5.2	584	201	656	305	0.846	14.1	0.197
5259	1778	8.91	5.18	510	174	567	264	0.848	15.8	0.167
4568	1548	8.82	5.13	450	152	497	231	0.847	17.7	0.143
2210	706	6.85	3.87	273	91.5	309	140	0.848	13.3	0.04
1748	560	6.76	3.83	222	73.3	248	112	0.849	16	0.031
1250	400	6.54	3.7	164	52.6	182	80.2	0.84	20.7	0.021

Torsional Constant		Area of Section	
J		A	
cm ⁴		cm ²	
13720		808	
9240		702	
5809		595	
3545		501	
2343		433	
1441		366	
812		299	
558		257	
381		226	
251		195	
153		164	
2034		360	
1271		306	
734		252	
378		201	
249		174	
161		150	
91.2		123	
626		213	
319		168	
172		136	
102		113	
57.6		93.1	
137		110	
80.2		90.4	
47.2		76.4	
31.8		66.3	
22.2		58.7	
19.2		47.1	
10.5		38.3	
4.63		29.2	

Joists to BS4 Part 1 1993 - Dimensions & Properties

Inside Slope = 8°

Designation	Mass Per metre	Depth of Section	Width of Section	Thickness		Radius		Depth between fillets	Ratios for Local Buckling	
				Web	Flange	Root	Toe		Flange	Web
		h	b	s	t	r ₁	r ₂	d	b/2t	d/s
mm x mm x kg/m		mm	mm	mm	mm	mm		mm		
254x203x82	82	254	203.2	10.2	19.9	19.6	9.7	166.6	5.11	16.3
203x152x52	52.3	203.2	152.4	8.9	16.5	15.5	7.6	133.2	4.62	15
152x127x37	37.3	152.4	127	10.4	13.2	13.5	6.6	94.3	4.81	9.07
127x114x29	29.3	127	114.3	10.2	11.5	9.9	4.8	79.5	4.97	7.79
127x114x27	26.9	127	114.3	7.4	11.4	9.9	5	79.5	5.01	10.7
102x102x23	23	101.6	101.6	9.5	10.3	11.1	3.2	55.2	4.93	5.81
102x44x7	7.5	101.6	44.5	4.3	6.1	6.9	3.3	74.6	3.65	17.3
89x89x19	19.5	88.9	88.9	9.5	9.9	11.1	3.2	44.2	4.49	4.65
76x76x13	12.8	76.2	76.2	5.1	8.4	9.4	4.6	38.1	4.54	7.47

Second Moment of Area		Radius of Gyration		Elastic Modulus		Plastic Modulus		Buckling Parameter	Torsional Index	Warping Constant
Axis x-x	Axis y-y	Axis x-x	Axis y-y	Axis x-x	Axis y-y	Axis x-x	Axis y-y			
cm ⁴	cm ⁴	cm	cm	cm ³	cm ³	cm ³	cm ³	u	x	H
12020	2280	10.7	4.67	947	224	1077	371	0.89	11	0.312
4798	816	8.49	3.5	472	107	541	176	0.891	10.7	0.0711
1818	378	6.19	2.82	239	59.6	279	99.8	0.866	9.33	0.0183
979	242	5.12	2.54	154	42.3	181	70.8	0.853	8.76	0.00807
946	236	5.26	2.63	149	41.3	172	68.2	0.868	9.32	0.00788
486	154	4.07	2.29	95.6	30.3	113	50.6	0.836	7.43	0.00321
153	7.82	4.01	0.907	30.1	3.51	35.4	6.03	0.872	14.9	0.000178
307	101	3.51	2.02	69	22.8	82.7	38	0.83	6.57	0.00158
158	51.8	3.12	1.79	41.5	13.6	48.7	22.4	0.852	7.22	0.000595

Torsional Constant	Area of Section
J	A
cm ⁴	cm ²
152	105
64.8	66.6
33.9	47.5
20.8	37.4
16.9	34.2
14.2	29.3
1.25	9.5
11.5	24.9
4.59	16.2

Parallel Flange Channels - Dimensions and Properties

Designation	Mass Per metre	Depth of Section	Width of Section	Thickness		Root Radius	Depth between Filletts	Ratios for Local Buckling	
				Web	Flange			Flange	Web
	Kg/m	D	B	t	T	r	d	b/T	d/t
430x100x64	64.4	430	100	11	19	15	362	5.26	32.9
380x100x54	54.0	380	100	9.5	17.5	15	315	5.71	33.2
300x100x46	45.5	300	100	9	16.5	15	237	6.06	26.3
300x90x41	41.4	300	90	9	15.5	12	245	5.81	27.2
260x90x35	34.8	260	90	8	14	12	208	6.43	26
260x75x28	27.6	260	75	7	12	12	212	6.25	30.3
230x90x32	32.2	230	90	7.5	14	12	178	6.43	23.7
230x75x26	25.7	230	75	6.5	12.5	12	181	6	27.8
200x90x30	29.7	200	90	7	14	12	148	6.43	21.1
200x75x23	23.4	200	75	6	12.5	12	151	6	25.2
180x90x26	26.1	180	90	6.5	12.5	12	131	7.2	20.2
180x75x20	20.3	180	75	6	10.5	12	135	7.14	22.5
150x90x24	23.9	150	90	6.5	12	12	102	7.5	15.7
150x75x18	17.9	150	75	5.5	10	12	106	7.5	19.3
125x65x15	14.8	125	65	5.5	9.5	12	82	6.84	14.9
100x50x10	10.2	100	50	5	8.5	9	65	5.88	13

Second Moment of Area		Radius of Gyration		Elastic Modulus		Elastic NA	Plastic Modulus		Plastic NA	Buckling Parameter
Axis x-x	Axis y-y	Axis x-x	Axis y-y	Axis x-x	Axis y-y		Axis x-x	Axis y-y		
cm ⁴	cm ⁴	cm	cm	cm ³	cm ³	C _y	cm ³	cm ³	C _{eq}	u
21940	722	16.3	2.97	1020	97.9	2.62	1222	176	0.954	0.917
15030	643	14.8	3.06	791	89.2	2.79	933	161	0.904	0.932
8229	568	11.9	3.13	549	81.7	3.05	641	148	1.31	0.944
7218	404	11.7	2.77	481	63.1	2.6	568	114	0.879	0.934
4728	353	10.3	2.82	364	56.3	2.74	425	102	1.14	0.942
3619	185	10.1	2.3	278	34.4	2.1	328	62	0.676	0.932
3518	334	9.27	2.86	306	55	2.92	355	98.9	1.69	0.95
2748	181	9.17	2.35	239	34.8	2.3	278	63.2	1.03	0.947
2523	314	8.16	2.88	252	53.4	3.12	291	94.5	2.24	0.954
1963	170	8.11	2.39	196	33.8	2.48	227	60.6	1.53	0.956
1817	277	7.4	2.89	202	47.4	3.17	232	83.5	2.36	0.949
1370	146	7.27	2.38	152	28.8	2.41	176	51.8	1.34	0.946
1162	253	6.18	2.89	155	44.4	3.3	179	76.9	2.66	0.936
861	131	6.15	2.4	115	26.6	2.58	132	47.2	1.81	0.946
483	80	5.07	2.06	77.3	18.8	2.25	89.9	33.2	1.55	0.942
208	32.3	4	1.58	41.5	9.89	1.73	48.9	17.5	1.18	0.942

Torsion Index	Warping Constant	Torsion Constant	Area of Section
x	H	J	A
	dm ⁶	cm ⁴	cm ²
22.5	0.219	63	82.1
21.2	0.15	45.7	68.7
17	0.081	36.8	58
18.4	0.058	28.8	52.7
17.2	0.038	20.6	44.4
20.5	0.02	11.7	35.1
15.1	0.028	19.3	41
17.3	0.015	11.8	32.7
12.9	0.02	18.3	37.9
14.8	0.011	11.1	29.9
12.8	0.014	13.3	33.2
15.3	0.008	7.34	25.9
10.8	0.009	11.8	30.4
13.1	0.005	6.1	22.8
11.1	0.002	4.72	18.8
10	0	2.53	13