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Member Design for Combined Stresses

Task: PORTAL FRAME

Combine Ver 92.5.03
Element 1-2 Evaluate current section

Le Eff = 5.655 m Mlx = 0.60
Ly Eff = 5.655 m Mly = 1.00
Le Eff = 4.200 m M2 = 1.75
Py = 300 MPa Pu = 450 MPa
Tension area factor (Ane/Ag) = 1.00
Flange class: 2 Web class : 1

Critical Load Case : C2

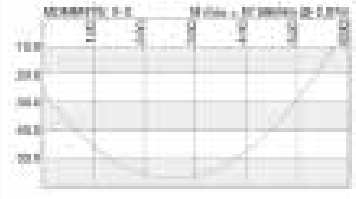
Section 254x254x73 H-sections (Web vert)

SANS 0162 - 1993 13.8.1 :
a) Cross-sectional strength (Crit. pos.= 4.200 m)
Cx Mux Mag 23.9 26.1 0.00
-- + --- + --- + ---- + ---- + ---- = 0.11
Cr Mrx Mrg 2508 267 125

b) Overall member strength
Cx UiaMax UiyMay 27.6 28.7 0.00
-- + ------ + ------ + ---- + ---- + ---- = 0.07
Cr Mrx Mry 1972 267 125

c) Lateral torsional buckling strength
Cx UlaMax UlyMay 27.6 28.1 0.00
-- + ------ + ------ + ---- + ---- + ---- = 0.11
Cr Mrx Mry 1972 267 125

Slenderness Ratio: L/r = 57



Combine Ver 92.5.03
Element 2-4 Evaluate current section

Le Eff = 5.135 m Mlx = 1.00
Ly Eff = 5.135 m Mly = 1.00
Le Eff = 5.041 m M2 = 1.00
Py = 300 MPa Pu = 450 MPa
Tension area factor (Ane/Ag) = 1.00
Flange class: 2 Web class : 1

Critical Load Case : C2

Section 254x254x73 H-sections (Web vert)

SANS 0162 - 1993 13.8.1 :
a) Cross-sectional strength (Crit. pos.= 2.517 m)
Cx Mux Mag 1.52 57.6 0.00
-- + --- + --- = ---- + ---- + ---- = 0.22
Cr Mrx Mrg 2508 267 125

b) Lateral torsional buckling strength
Mux Mag T/A 57.6 0.00 .4164
--- + --- - ------- = ---- + ---- - ------ = 0.28
Mrx Mry Mrx/Zpx 249 129 249.4

Slenderness Ratio: L/r = 79

Combine Ver 92.5.03
Element 1-2 Evaluate current section

Lx Eff = 5.655 m Mlx = 0.60
Ly Eff = 5.655 m Mly = 1.00
Le Eff = 4.200 m M2 = 1.75
Py = 300 MPa Pu = 450 MPa
Tension area factor (Ane/Ag) = 1.00
Flange class: 2 Web class : 1

Critical Load Case : C2

Section 254x254x73 H-sections (Web vert)

SANS 0162 - 1993 13.8.1 :
a) Cross-sectional strength (Crit. pos.= 4.200 m)
Cx Mux Mag 23.9 26.1 0.00
-- + --- + --- = ---- + ---- + ---- = 0.11
Cr Mrx Mrg 2508 267 125

b) Overall member strength
Cx UlaMax UlyMay 27.6 15.7 0.00
-- + ------ + ------ = ---- + ---- + ---- = 0.07
Cr Mrx Mry 1972 267 125

c) Lateral torsional buckling strength
Cx UlaMax UlyMay 27.6 25.1 0.00
-- + ------ + ------ = ---- + ---- + ---- = 0.11
Cr Mrx Mry 1972 267 125

Slenderness Ratio: L/r = 57

COLD-FORMED LIPPED CHANNEL PURLIN DESIGN

Input

Attributes

fy	200 MPa	Yield stress
E	200 Gpa	Modulus of elasticity
Span	6 m	Purlin span length
Sag bars	1	Number of sag bars
Unbraced L	3 m	Laterally unsupported length
Continuity	Simply supported	Design system choose
Spacing	1 m	Horizontal purlin spacing
Sheet brace	No	
Span /	200	Deflection ratio

Loads

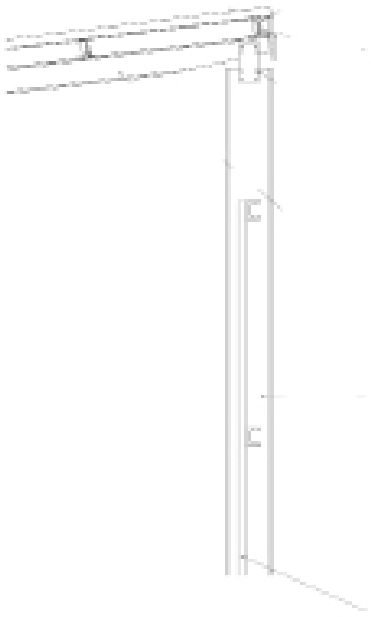
DLmax	0.43 kN/m2	Max dead load for D+L load case
LLmax	0.50 kN/m2	Max live load for D+L load case
DLmin	0.18 kN/m2	Min dead load for D+W load case
WLmax	0.63 kN/m2	Max wind uplift load for D+W load case

Load factors	ULS	SLS	
DLmax	1.2	1.1	
LLmax	1.6	1.0	
DLmin	0.9	1.0	
WLmax	1.3	0.8	

Combined loads			
D+L	1.32	0.97	kN/m
D+W	0.66	0.56	kN/m

Section selected: CFLC 150 x 75 x 20 x 2.5

Section mass 6.31 kg/m



Calculation

Simply supported

Laterally supported	M_u	$0.125\ wL^2$ 0.125 x 1.316 x 36 5.92 kN.m		(Table 8.4)
	Φ	0.9		
	Ze	38.8 10^3mm^3		(Table 8.2)
	f(Zc)	1.00		(Table 8.1)
	Zc	38.8 10^3mm^3		
	fc	200.0 MPa		fy
	Mr	6.98 kN.m		
	Mu/Mr	**0.85**		**OK**
Laterally unsupported	Mu	$0.125\ wL^2$ 0.125 x 1.316 x 36 5.92 kN.m		(Table 8.4)
	Φ	0.9		
	Cb	1.67		(Table 8.4)
	f_b	374.2 MPa		(Table 8.2)
	f'	222.0 MPa		
	fb > f/2 $f' - (f')^2/4f_b > fy$	True False		
	fc	166.1 MPa		
	Ze	38.8 10^3mm^3		(Table 8.2)
	f(Zc)	1.00		(Table 8.1)
	Zc	38.8 10^3mm^3		
	Mr	6.60 kN.m		
	Mu/Mr	**0.89**		**OK**
Deflection	δ_{max}	0.013 wL^4/Ei 89.91 mm		(Table 5.19)
	δ_{allow}	99.0 mm		
	Span /	213		
	$\delta_{max}/\delta_{allow}$	**0.84**		**OK**

Calculation

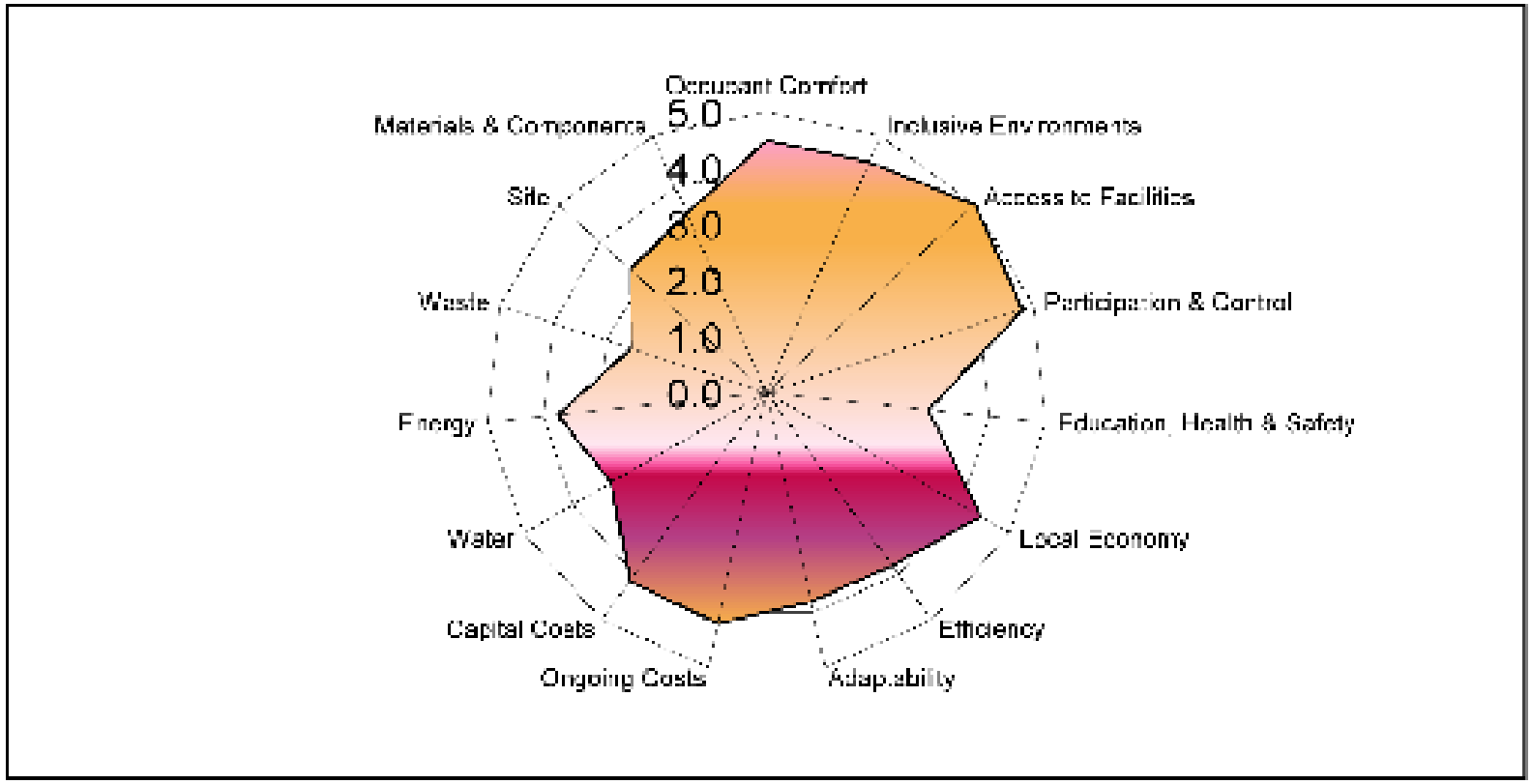
Fully continuous

Laterally supported	Mu	$0.08\ wL^2$ 0.08 x 1.316 x 36 3.78 kN.m	(Table 8.4)
	Φ	0.9	
	Ze	38.8 10^3mm^3	(Table 8.2)
	f(Zc)	1.00	(Table 8.1)
	Zc	38.8 10^3mm^3	
	fc	200.0 MPa	fy
	Mr	6.98 kN.m	
	Mu/Mr	**0.54**	**OK**
Laterally unsupported Worst case at Support	Mu	$0.11\ wL^2$ 0.11 x 1.316 x 36 5.07 kN.m	(Table 8.4)
	Φ	0.90	
	Cb	2.08	(Table 8.4)
	fb	466.1 MPa	(Table 8.2)
	f'	222.0 MPa	
	fb > f/2 $f' - (f')^2/4f_b > fy$	True False	
	fc	194.5 MPa	
	Ze	38.8 10^3mm^3	(Table 8.2)
	f(Zc)	1.00	(Table 8.1)
	Zc	38.8 10^3mm^3	
	Mr	6.79 kN.m	
	Mu/Mr	**0.75**	**OK**
Deflection	δ_{max}	0.0069 wL^4/Ei 15.8 mm	(Table 5.20)
	δ_{allow}	36.0 mm	
	Span /	401	
	$\delta_{max}/\delta_{allow}$	**0.58**	**OK**

Appendix B : Sustainable building assessment results

SUSTAINABLE BUILDING ASSESSMENT TOOL (SBAT- P) V1

PROJECT	ASSESSMENT
Project title:	Date:
Location:	Undertaken by:
Building type:	Company / organisation
Internal area (m2):	Telephone: Fax:
Number of users:	Email:



Social	4.3	Economic	4.1	Environmental	3.3
Overall	3.9	Classification	Good		

Dedication

All glory to God for His blessings and grace. My father, mother and sister for supporting me in my architectural quest. To all my friends, thank you for keeping a smile on my face when I most needed it. And my best friend and fiancé, thank you for giving me our own memories and inspiring new meaning in the years ahead.

To those we lost this year, M & A, we miss you and will keep you in our memory.

Peace and love to all!