
STRUCTURAL CALCULATIONS

FOR

MONOSLOPE TRANSPORT CANOPY

10m Wide x 6m High

Report No: 1005

September, 2001

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& ASSOCIATES**
CONSULTING ENGINEERS

EXAMPLE

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Date: 26 September 2001

Project No: 1005

Project: TRANSPORT CANOPY - STANDARD - TC2,

References:

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- AS 1111 1980 ISO Metric Hexagon Commercial Bolts and Screws
- AS 1112 1980 ISO Metric Hexagon Nuts including Thin Nuts, Slotted Nuts and Castle Nuts
- AS 1163 1991 Structural Steel Hollow Sections
- AS 1170.1 Loading Code: Dead and Live Loads
- AS 1170.1 Wind Loads
- AS 1250 SAA Steel Structures Code
- AS 1252 1983 High Strength Steel Bolts/Nuts/Washers for Structural Engineering.
- AS 1302 1991 Steel Reinforcing Bars For Concrete
- AS 1304 1991 Welded Wire Reinforcing Fabric For Concrete
- AS 1379 Ready Mixed Concrete
- AS 1397 1984 Steel sheet and strip — Hot-dipped zinc-coated or aluminium/zinc coated
- AS 1538 SAA Cold-Formed Steel Structures Code
- AS 1554 SAA Structural Steel Welding Code
- AS 1562 1992 Design and installation of sheet roof and wall cladding.
- AS 1627 1988 Metal Finishing—Preparation And Pre-treatment Of Surfaces.
- AS 1650 1989 Galvanised Coatings
- AS 2105 1992 Inorganic Zinc Silicate Paint
- AS 2312 Guide To The Protection Of Iron And Steel Against Exterior Atmospheric Corrosion
- AS 2870 Residential Slabs And Footings.
- AS 3566 Screws—Self-drilling—for the Building and Construction Industries.
- AS 3600 Concrete Structures.
- AS 4100 1990 Steel Structures.
- AS 4600 1996 Cold-Formed Steel Structures Code
- AWS D1.3-81 Structural Welding Code - Sheet Steel.
- BUILDING CODE OF AUSTRALIA
- Design of Portal Frame Buildings – S.T.Woolcock & S.Kitipornchai – AISC
- Design of Cold-Formed Steel Structures – Gregory P Hancock – AISC

Queries relating to these computations should be directed to Roy Harrison

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DESIGN:	SCH	DATE:	28-Sep-2001

TITLE :

OPEN FRONT SHELTER - Industrial; 10.0m Wide x 6.0m Eaves, 6.00m Bays - TC2

SUMMARY

Potalised Monoslope Canopy with Portalised Sway Frame

Wind Region : A
Terrain Category : TC2

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PORTAL FRAME 6m Centres

Rafter : 200 UB 22
Column : 125 X 125 x 4 SHS
Corner Columns 125 X 125 x 5 SHS
End Wall Column : 180 UB 16

ROOF

Purlins : C15019 Max. Centres 1200 at Edges, Max. 1600 (typ.)

WALLS

Girts : C15019 Max. Centres 1200 at Edges, Max. 1300 (typ.)

PIERS

End Wall + sway frame Columns : 750 Diam. Pier x 1800 Deep
Portal Columns : 750 Diam. Pier x 1000 Deep

NB: refer to drawing for locations of each pier type

BRACING

Roof : Struts 75x75x2 SHS
cross bracing DIAM. 16 ROD; THREADED M16
Wall : Struts 75x75x2 SHS
cross bracing DIAM. 16 ROD; THREADED M16

CONNECTIONS

Base C1 & C2: 250 X 250 X 20 Plate + 4M20 - 4.6/S Bolts
Base C3 200 X 20 Flat Bar + 4M20 - 4.6/S Bolts
Rafter to Column 130 X 20 Flat Bar + 4M16 - 8.8/S Bolts
Beam to Rafter 2M20 - 8.8/S Bolts

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TITLE :

OPEN FRONT SHELTER - Industrial; 10.0m Wide x 6.0m Eaves, 6.00m Bays - TC2

FRAME LOADING

DEAD

Sheeting		0.04 kPa = kN/m ²		
Purlins/Girts		0.05 kPa = kN/m ²		
		<u>ΣDL 0.09 kPa</u>	x	6 =
Swt Frame				0.56 kN/m
200 UB 22				0.22 kN/m
				<u>ΣDL 0.78 kN/m</u>

LIVE (Roof)

Projected Area of Portal Rafter A	=	6.00 x 10.00	
	=	60 m ²	
LL	=	(1.8/A + 0.12)	= 0.2 kPa
ΣLL	=	0.3 kPa x	6 = <u>1.5 kN/m</u>

OCCASSIONAL POINT LOAD (OPL)

Industrial	<u>ΣOPI =</u>	<u>4.5 kN</u>	Industrial
------------	---------------	---------------	------------

SAMPLE

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TITLE :

OPEN FRONT SHELTER - Industrial; 10.0m Wide x 6.0m Eaves, 6.00m Bays - TC2

Singly Pitched Canopy (skillion)

Alpha	3.0 degrees =	0.05 radians =	1 in 19.08
Building Eaves Hght	6 m	Building Span	10.4 m
Bay Spacing	6 m	Number of Bays	4
Building Length	24 m	Number of Columns	10

Region	A	Vp =	41 m/s	Vs =	38 m/s
Location	: Adelaide	Vu =	50 m/s	sensitivity	{static analysis acceptable}
b/d =	2.31	d/b =	0.43	h/d =	0.58

Q = 0

Wind Classification to AS1170
h = ht = 6.545 m

Tcat	2 TC2.0
M[z,cat] =	0.94
M[s] =	1 NS
M[t] =	1 T1
M[i] =	1
directional M[d] =	0.95

	Perm	Limit
Vz =	36.5	44.5 m/s
qz =	0.80	1.19 kPa

Q = 90

Wind Classification to AS1170
h = ht = 6.545 m

Tcat	2 TC2.0
M[z,cat] =	0.94
M[s] =	1 NS
M[t] =	1 T1
M[i] =	1
M[d] =	0.95

	Perm	Limit
Vz =	36.5	44.5 m/s
qz =	0.80	1.19 kPa

Wind Classification to AS4055
N3 WP41, WU50
Vz = 41 50 m/s
qz = 1.01 1.50 kPa

Wind Classification to AS4055
N3 WP41, WU50
Vz = 41 50 m/s
qz = 1.01 1.50 kPa

Design	<u>AS1170</u>	<u>Permissible</u>
Vz =	36.5 m/s	
qz =	0.80 kPa	
wz =	4.80 kN/m	

Design	<u>AS1170</u>	<u>Permissible</u>
Vz =	36.5 m/s	
qz =	0.80 kPa	
wz =	4.80 kN/m	

b = 10.40 m d = 24.00 m

local pressure extent = 'a' = min $\begin{matrix} 0.2 b \\ 0.2 d \\ ht \end{matrix}$ = 2.08 m

a/2 = 1.04 m

Length along Slope of Rafter = 10.414 m

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Area Reduction Factors

Tributary Area

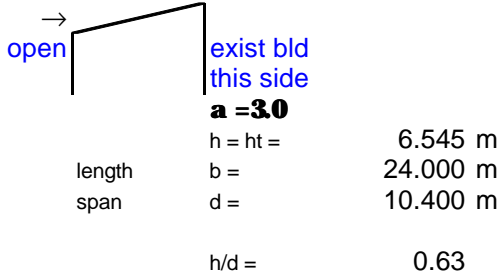
Rafter		m ²	Ka
<i>Aligned</i>	10.414 x 6.000	= 62.49	fullspan 0.85
<i>Projected</i>	10.400 x 6.000	= 62.40	0.85
Column			
<i>Aligned</i>	6.000 x 6.000	= 36.00	0.89

TITLE :

OPEN FRONT SHELTER - Industrial; 10.0m Wide x 6.0m Eaves, 6.00m Bays - TC2

Singly Pitched Canopy {skillion}

Q = 180 Transverse



State : open building/blocked canopy

	a = 3.0	-ve	+ve
Roof Cpw =		-0.65	
Roof Cpl =		-0.65	

{adopt hc/h = 1 for attached canopy}

Frictional Drag on Roof

F1 =	0.01 bd qz	
√ F1 = smooth/parallel to ribs	2.00 kN	
2F1 = across corrugations	4.00 kN	
4F1 = across ribs	7.99 kN	

Drag on Frame

Assume :

Cd	
125 SHS column	0.7
200 Channel rafter	2.05

ki	ksh
1	1

Fd = ki ksh kar Cd Az qz

l/b	Kar	Az	Fd
		m ²	kN
Column	52.36	1.00	0.82
Rafter	120.00	1.00	4.80

Wind on End Wall {leeward wall}

Cladding for 1m down to roof of adjacent building

Cpi =		
Cpl =		d/b = 0.43
Cpn =	0.700 {outwards}	

Side Wall {one side only}

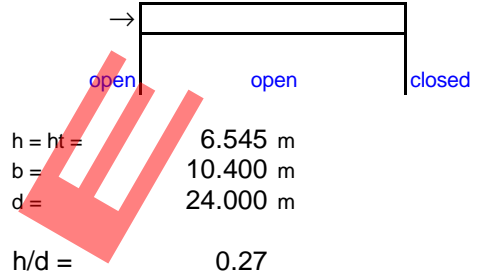
Cpi =	
Cps =	
Cpn =	0.65 {outwards}

Uplift

= bd Cpn qz	
Total =	129.1 kN
	12.9 kN/column

Singly Pitched Canopy {skillion}

Q = 90 Longitudinal



State : open building/blocked canopy

	a = 3.0	-ve	+ve
Roof 1st frame in		-0.80	
Roof 2nd frame in		-0.80	

{equivalent to canopy with theta=0, alpha=0}

Frictional Drag on Roof {d/h, d/b < 4}

F1 =	0.01 bd qz	
F1 = smooth/parallel to ribs		kN
2F1 = across corrugations		kN
√ 4F1 = across ribs		kN

Drag on Frame

Assume :

Cd	
125 SHS column	0.7
180 UB rafter	2.05

ki	ksh
1	1

Fd = ki ksh kar Cd Az qz

l/b	Kar	Az	Fd
		m ²	kN
Column	52.36	1.00	0.82
Rafter	57.78	1.00	1.87

Wind on End Wall {one end only}

d/b = 2.31

Q = 90

Q = 270

Cpi =		Cpi =	
Cpl =		Cpw =	
Cpn =		Cpn =	1.20
Full Rise of Roof =	0.545 m		
Area of Gable =	68.07 m ²		

NB: Cpi = avg cpi{-ve} + avg cpi {+ve}

Side Wall

Cladding for 1m down to roof of adjacent building

Cpi =	
Cps =	
Cpn =	0.65 {outwards}

Area of Cladding = 0.000 m

Uplift

= bd Cpn qz	
Total =	159.9 kN
	16.0 kN/column

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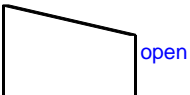
TITLE :

OPEN FRONT SHELTER - Industrial; 10.0m Wide x 6.0m Eaves, 6.00m Bays - TC2

Singly Pitched Canopy {skillion}

Q = 0 Transverse

→ exist bld this side



a = 3.0

h = ht = 6.545 m
 length b = 24.000 m
 span d = 10.400 m

 h/d = 0.63

State : open building/blocked canopy

a = 3.0	-ve	+ve
Cpw =	-0.65	0.20
Cpl =	-0.65	

{adopt hc/h = 1 for attached canopy}

Frictional Drag on Roof

F1 = 0.01 bd qz
 √ F1 = smooth/parallel to ribs 2.00 kN
 2F1 = across corrugations 4.00 kN
 4F1 = across ribs 7.99 kN

Drag on Frame

Assume :
 125 SHS column
 200 Channel rafter

Cd
0.7
2.05

ki	ksh
1	1

Fd = ki ksh kar Cd Az qz

	l/b	Kar	Az	Fd
			m ²	kN
Column	52.36	1.00	0.82	0.46
Rafter	120.00	1.00	4.80	7.88

Wind on End Wall {windward wall}

Cladding for 1m down to roof of adjacent building

Cpi =
 Cpw = d/b = 0.43
 Cpn = 0.7 {inwards}

NB: Cpi = avg cpi{-ve} + avg cpi {+ve}

Area of Cladding = 24.000 m

Side Wall {one side only}

Cpi =
 Cps =
 Cpn = 0.65 {outwards}

Uplift

= bd Cpn qz
 Total = 129.1 kN
 12.9 kN/column



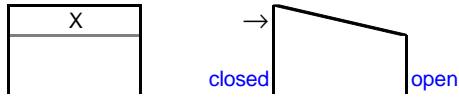
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TITLE :

OPEN FRONT SHELTER - Industrial; 10.0m Wide x 6.0m Eaves, 6.00m Bays - TC2

Singly Pitched Canopy {skillion}

Q = 0 Transverse



Loads on Single Frame supporting 1 bay

DL	0.56 kN/m
LL	1.5 kN/m
PL	4.5 kN

Drag Load Roof	0.50 kN @top of column
winward wall {for 1m}	1.68 kN {inwards}
winward roof	-2.64 kN/m
leeward roof	-2.64 kN/m
leeward column	0.00
{fully shielded from drag}}	

Singly Pitched Canopy {skillion}

Q = 90 Longitudinal

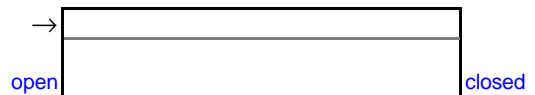


Loads on Single Frame supporting 1 bay

DL	0.56 kN/m
LL	1.5 kN/m
PL	4.5 kN

side wall {for 1m}	1.38 kN {out}
roof	-3.27 kN/m
roof	-3.27 kN/m
side column	0.00
{fully shielded from drag}}	

Loads on Longitudinal Frame



Drag Load Roof	{d/h, d/b < 4} kN/column
Drag load column	0.07 kN/m
windward wall (udl to col.)	2.50 kN/m
windward wall (cntr col.)	6.13 kN

Q = 180 Transverse

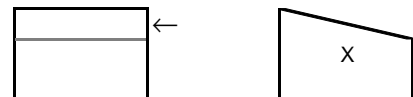


Loads on Single Frame supporting 1 bay

DL	0.56 kN/m
LL	1.5 kN/m
PL	4.5 kN

Drag Load Roof	0.50 kN @top of column
winward column	0.07 kN/m
winward fascia beam	1.97 kN @top col.
winward roof	-3.10 kN/m
leeward roof	-3.10 kN/m
leeward wall {for 1m}	1.68 kN {outwards}

Q = 270 Longitudinal

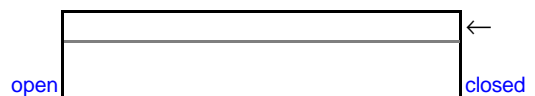


Loads on Single Frame supporting 1 bay

DL	0.56 kN/m
LL	1.5 kN/m
PL	4.5 kN

side wall {for 1m}	kN/m
roof	-3.27 kN/m
roof	-3.27 kN/m
side column	

Loads on Longitudinal Frame



Drag Load Roof	kN @top col.
Drag load column	kN/column
windward wall (udl to col.)	kN/m
windward wall (cntr col.)	kN

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TITLE :

: **OPEN FRONT SHELTER - Industrial; 10.0m Wide x 6.0m Eaves, 6.00m Bays - TC2**

Reference AS1170.2 - 1989 SAA LOADING CODE

WIND LOADS - **Determination of UDL's equivalent to Local Loadings for Simple Supports**

ROOF **PURLINS**

'a/2 local area extent		kl= 2.0
WIND	-0.65	
→	↑↑↑↑↑↑	-0.65+0.00
θ=0°	↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑	

'a' local area extent		kl= 1.5
WIND	-0.65/2	
→	↑↑↑↑↑↑	-0.65+0.00
θ=0°	↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑	

dist.	L {span}	a	b {'a/2}	x1	L-x1
	6	2.50	1	3.00	3.00
dist ²	36.00	6.25	1.00		

a	b {'a'}	x1	L-x1
2.00	2	3.00	3.00
4.00	4.00		

	kN/m	kN
w1 full	-0.65	-3.90
w2 partial	-0.65	-0.65
Σ =	-1.30	-4.55

	kN/m	kN
	-0.65	-3.90
	-0.33	-0.65
Σ =	-0.98	-4.55

Partial Load Occuring At Centre of Span	Moment	End Reactions	
	M[max]	Ra	Rb
	kNm	kN	kN
full	-2.93	-1.95	-1.95
partial at Centre ↑↑↑	-0.89	-0.33	-0.33
Σ =	-3.82	-2.28	-2.28
Equiv UDL :	Cp_n	-0.85	

Moment	End Reactions	
	M[max]	Ra
	kNm	kN
	-2.93	-1.95
	-0.81	-0.33
	-3.74	-2.28
	-0.83	

Partial Load Occuring At End of Span	Moment	End Reactions	
	M[max]	Ra	Rb
	kNm	kN	kN
full	-2.93	-1.95	-1.95
partial at end ↑↑↑	-0.27	-0.60	-0.05
Σ =	-3.20	-2.55	-2.00
Equiv UDL :	Cp_n =	-0.71	

Moment	End Reactions	
	M[max]	Ra
	kNm	kN
	-2.93	-1.95
	-0.45	-0.54
	-3.38	-2.49
	-0.75	

MAX Equiv UDL : Cp_n = -0.85

-0.83

'a/2 local area extent		kl= 2.0
WIND	-0.80	
→	↑↑↑↑↑↑	-0.80+0.00
θ=90°	↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑	

'a' local area extent		kl= 1.5
WIND	-0.8/2	
→	↑↑↑↑↑↑	-0.80+0.00
θ=90°	↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑	

	kN/m	kN
w1 full	-0.80	-4.8
w2 partial	-0.8	-0.80
Σ =	-1.60	-5.60

	kN/m	kN
	-0.80	-4.8
	-0.4	-0.8
Σ =	-1.20	-5.60

Partial Load Occuring At End of Span	Moment	End Reactions	
	M[max]	Ra	Rb
	kNm	kN	kN
full	-3.60	-2.40	-2.40
partial at end ↑↑↑	-0.34	-0.73	-0.07
Σ =	-3.94	-3.13	-2.47
Equiv UDL :	Cp_n =	-0.87	

Moment	End Reactions	
	M[max]	Ra
	kNm	kN
	-3.60	-2.40
	-0.56	-0.67
	-4.16	-3.07
	-0.92	

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OPEN FRONT SHELTER - Industrial; 10.0m Wide x 6.0m Eaves, 6.00m Bays - TC2

PURLINS *{.. Limit State ..}* span = 6000 Int = 1600 c/c
 Wind Pressures Edge = 1200 c/c

dwe = distance from windward edge a = local pressure extent
END WIND qz = 1.19[kPa] {theta = 90}

			Cpn		qz		
{ dwe	≤	1.000 m = a/2 }	-0.87	x	1.19[kPa]	=	-1.04[kPa] ↑
{ dwe	≤	2.000 m = a }	-0.92	x	1.19[kPa]	=	-1.10[kPa] ↑
{ dwe	>	2.000 m = a }	-0.80	x	1.19[kPa]	=	-0.95[kPa] ↑

SIDE WIND qz = 1.19[kPa] {theta = 0}

			Cpn		qz		
{ dwe	≤	1.000 m = a/2 }	-0.85	x	1.19[kPa]	=	-1.01[kPa] ↑
{ dwe	≤	2.000 m = a }	-0.83	x	1.19[kPa]	=	-0.99[kPa] ↑
{ dwe	>	2.000 m = a }	-0.65	x	1.19[kPa]	=	-0.77[kPa] ↑

Forces	+ ↑	- ↓
--------	-----	-----

	Spacing	Area	Wind	Live Load	Sheeting	Purlin swt	Resultant	
	m	m ²	kPa	kPa	kPa	kN/m	w*=kG+kQ	kN/m
Internal	Inwards	1.600	9.60	-0.31	-0.04	-0.06	-0.89	↓ok
	Outwards	1.600	0.95	-0.33	-0.04	-0.06	1.43	↑ok
Edge a	Inwards	1.400	8.40	-0.33	-0.04	-0.06	-0.84	↓ok
	Outwards	1.400	1.10	-0.33	-0.04	-0.06	1.45	↑ok
Edge a/2	Inwards	1.200	7.20	-0.37	-0.04	-0.06	-0.80	↓ok
	Outwards	1.200	1.04	-0.37	-0.04	-0.06	1.17	↑ok

ADOPT : **PURLINS**
 Lysaght C15019 2-Span 1-Bridge per Span
 Spacing
 @ 1200 c/c {for distance < 1000 from edges}
 @ 1400 c/c {for 1000 < distance from edges < 2000}
 @ 1600 c/c {for distance > 2000 from edges}
 @6000mm w(IN) = 1.92 kN/m ↓
 w(OUT) = 1.90 kN/m ↑
 from Lysaght Limit State Capacity Tables

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TITLE :

OPEN FRONT SHELTER - Industrial; 10.0m Wide x 6.0m Eaves, 6.00m Bays - TC2

Reference AS1170.2 - 1989 SAA LOADING CODE

WIND LOADS - Determination of UDL's equivalent to Local Loadings for Simple Supports

WALL GIRTS

Windward Wall

'a/2 local area extent	kl= 1.25
WIND	0.70/4
→	↑↑↑↑↑↑ 0.70+0.50
θ=90°	↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑

L {span}	a	b {'a/2}	x1	L-x1
dist.	5.2	2.10	1	2.60
dist ²	27.04	4.41	1.00	

	kN/m	kN
w1 full	1.2	6.24
w2 partial	0.175	0.175
Σ =		6.42

Partial Load Occuring At	Moment	End Reactions	
Centre of Span	M[max]	Ra	Rb
	kNm	kN	kN
full	4.06	3.12	3.12
partial at Centre	↑↑↑ 0.21	0.09	0.09
Σ =	4.26	3.21	3.21
Equiv UDL :	Cp_n	1.26	

Side Walls

'a/2 local area extent	kl= 2.00
WIND	0.65
→	↑↑↑↑↑↑ 0.65+0.0
θ=0°	↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑

'a' local area extent	kl= 1.5
WIND	0.65/2
→	↑↑↑↑↑↑ 0.65+0.0
θ=0°	↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑↑

a	b {'a'}
1.60	2
2.56	4.00

	kN/m	kN
w1 full	0.65	3.38
w2 partial	0.65	0.65
Σ =		4.03

	kN/m	kN
	0.65	3.38
	0.325	0.65
Σ =		4.03

Partial Load Occuring At	Moment	End Reactions	
End of Span	M[max]	Ra	Rb
	kNm	kN	kN
full	2.20	1.69	1.69
partial at end	↑↑↑ 0.27	0.59	0.06
Σ =	2.46	2.28	1.75
Equiv UDL :	Cp_n =	0.73	

Moment	End Reactions	
M[max]	Ra	Rb
	kN	kN
2.20	1.69	1.69
0.42	0.53	0.13
2.62	2.22	1.82
0.78		

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REF.:	1005	PAGE:	
DESIGN:	SCH	DATE:	27-Sep-01

TITLE :

OPEN FRONT SHELTER - Industrial; 10.0m Wide x 6.0m Eaves, 6.00m Bays - TC2

GIRTS {between portal frames} **Limit State** span = 5200
 Wind Pressures Int = 1300
 Edge = 1200

dwe = distance from windward edge a = local pressure extent
END WIND qz = 1.19 {theta = 90}

{ dwe ≤ 1 = a/2 }	Cpn	0.73 x	qz	1.19 =	0.87 ↑
{ dwe ≤ 2 = a }		0.78 x		1.19 =	0.92 ↑
{ dwe > 2 = a }		0.65 x		1.19 =	0.77 ↑

SIDE WIND qz = 1.19 {theta = 0}

{ dwe ≤ 1 = a/2 }	Cpn	1.26 x	qz	1.19 =	1.50 ↓
{ dwe > 2 = a }		1.20 x		1.19 =	1.43 ↓

Internal	Spacing m	Wind kPa	Resultant kN/m	
Inwards	1.300	1.43	1.86	↓ok
Outwards	1.300	0.77	1.01	↓ok
Edge Inwards	1.200	1.50	1.80	↓ok
Edge Outwards	1.200	0.92	1.11	↓ok

ADOPT : GIRTS

Lysaght C15019 2-Span 1-Bridge per Span

Spacing
 @ 1200 c/c {for 0 < distance from edges < 2000}
 @ 1300 c/c {for distance > 2000 from edges}

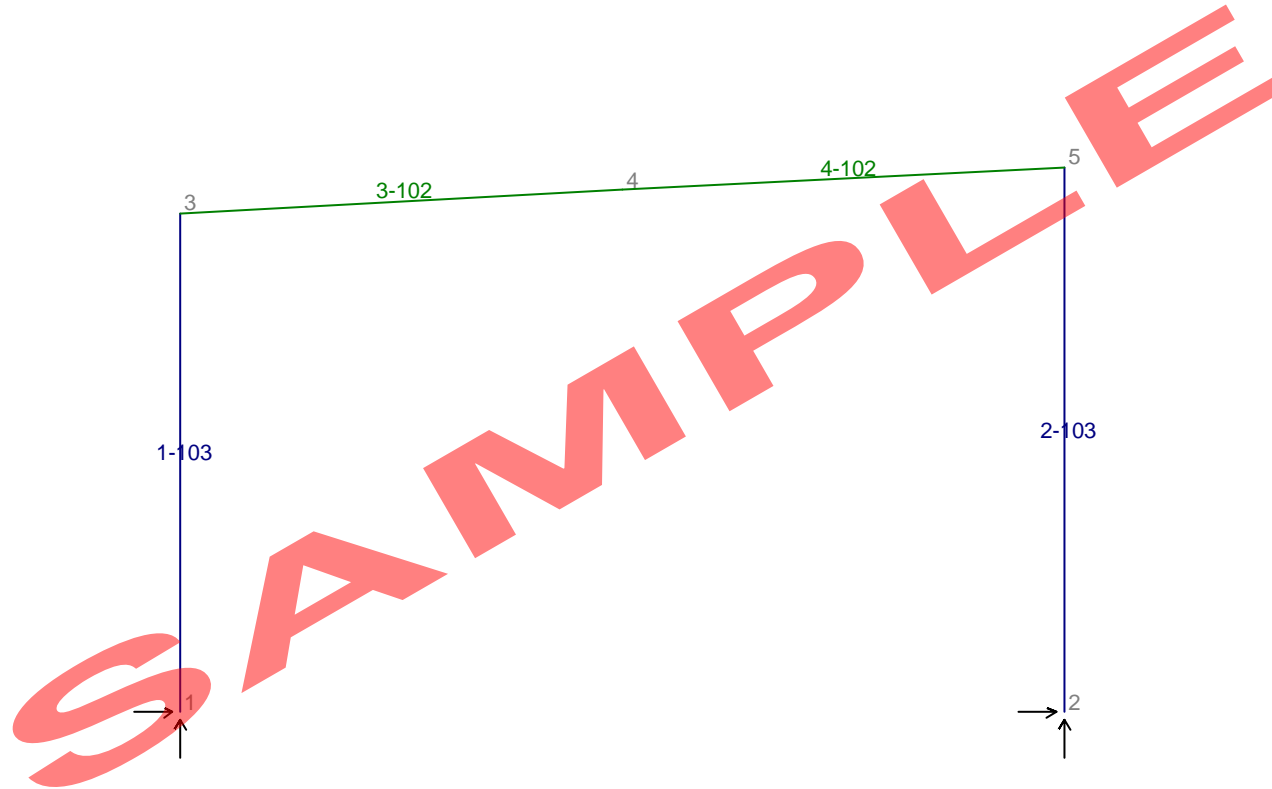
@5200mm w(IN) = 1.92 kN/m ↓
 w(OUT) = 1.90 kN/m ↑

from Lysaght Limit State Capacity Tables

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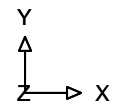
Sections:

- 102 200UB22.3 Y
- 103 125X125X4.0SHS



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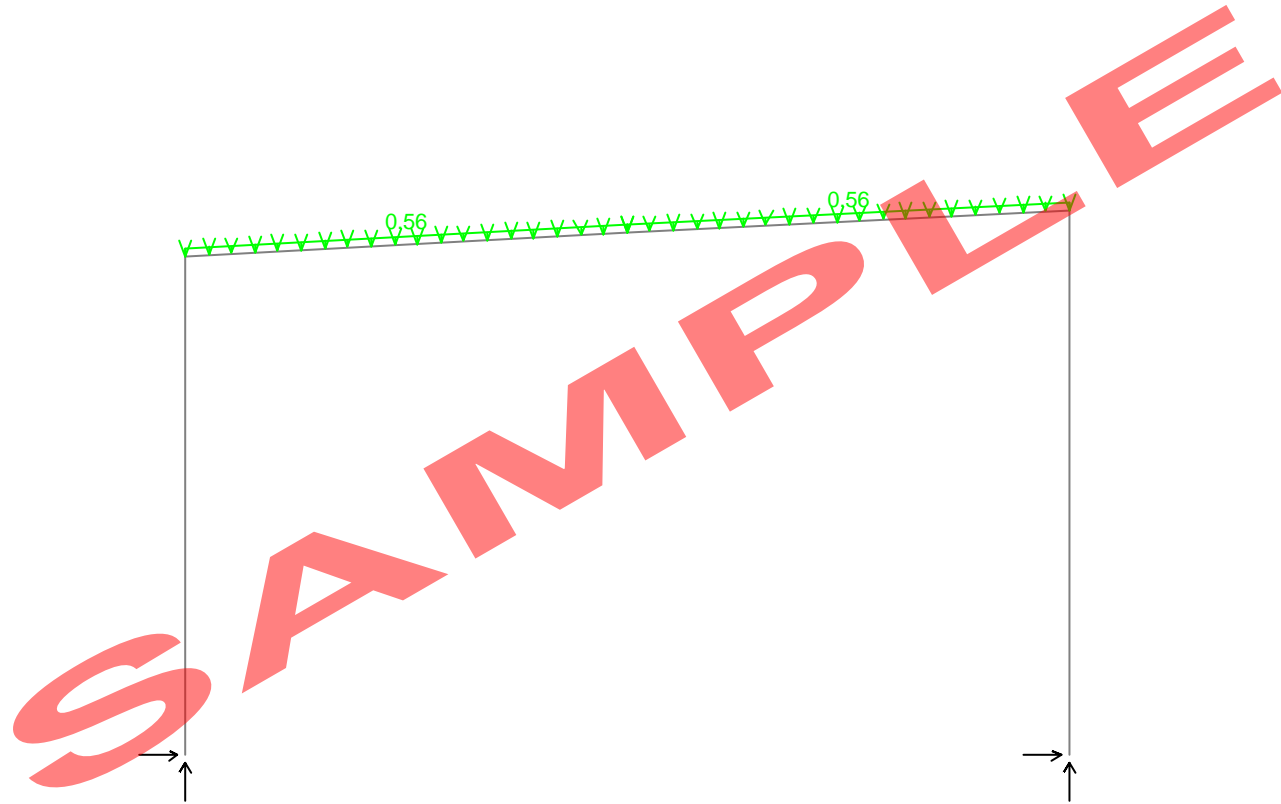


theta: 270 phi: 0

Design Geometry - Main Frame

Load Cases:

101 P DL



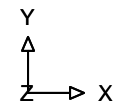
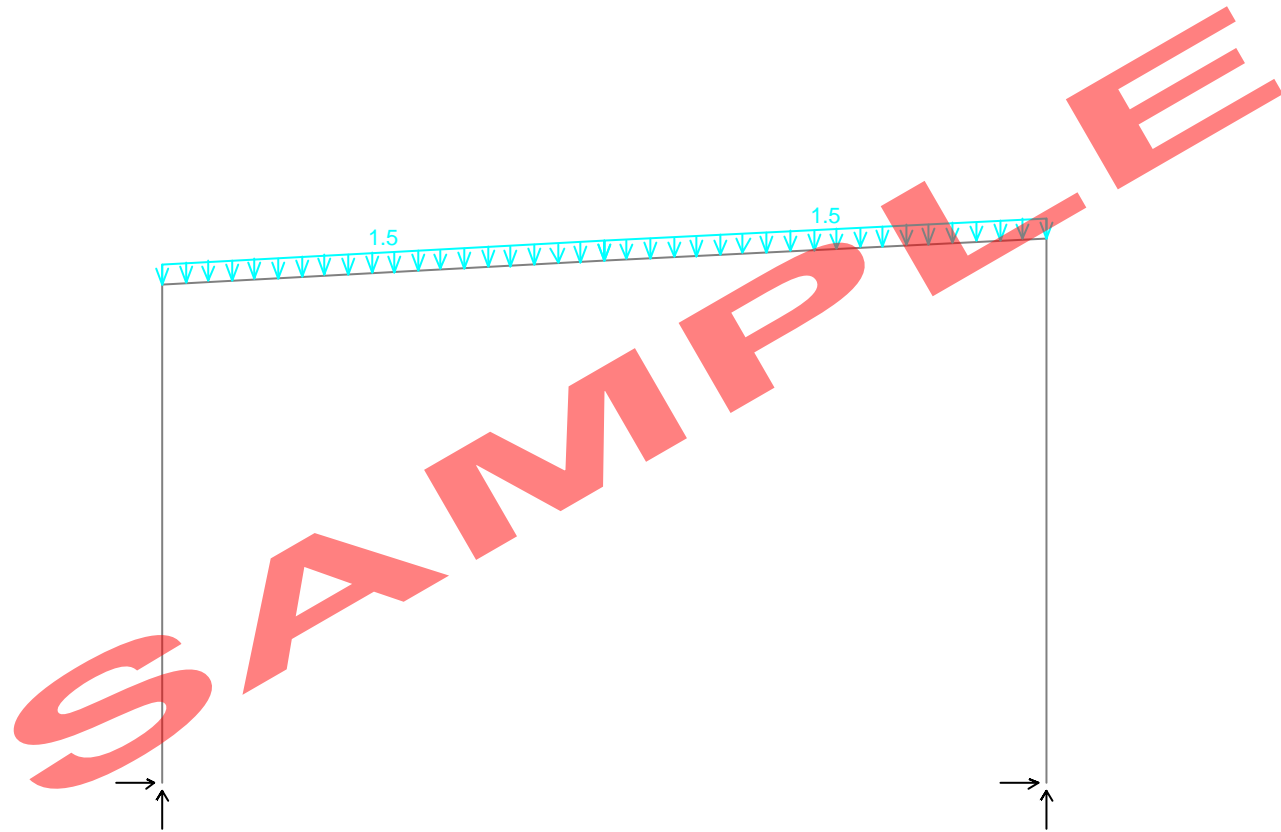
Y
↑
Z → X
theta: 270 phi: 0

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Main Frame : Dead Load

Load Cases:

201 P LL



theta: 270 phi: 0

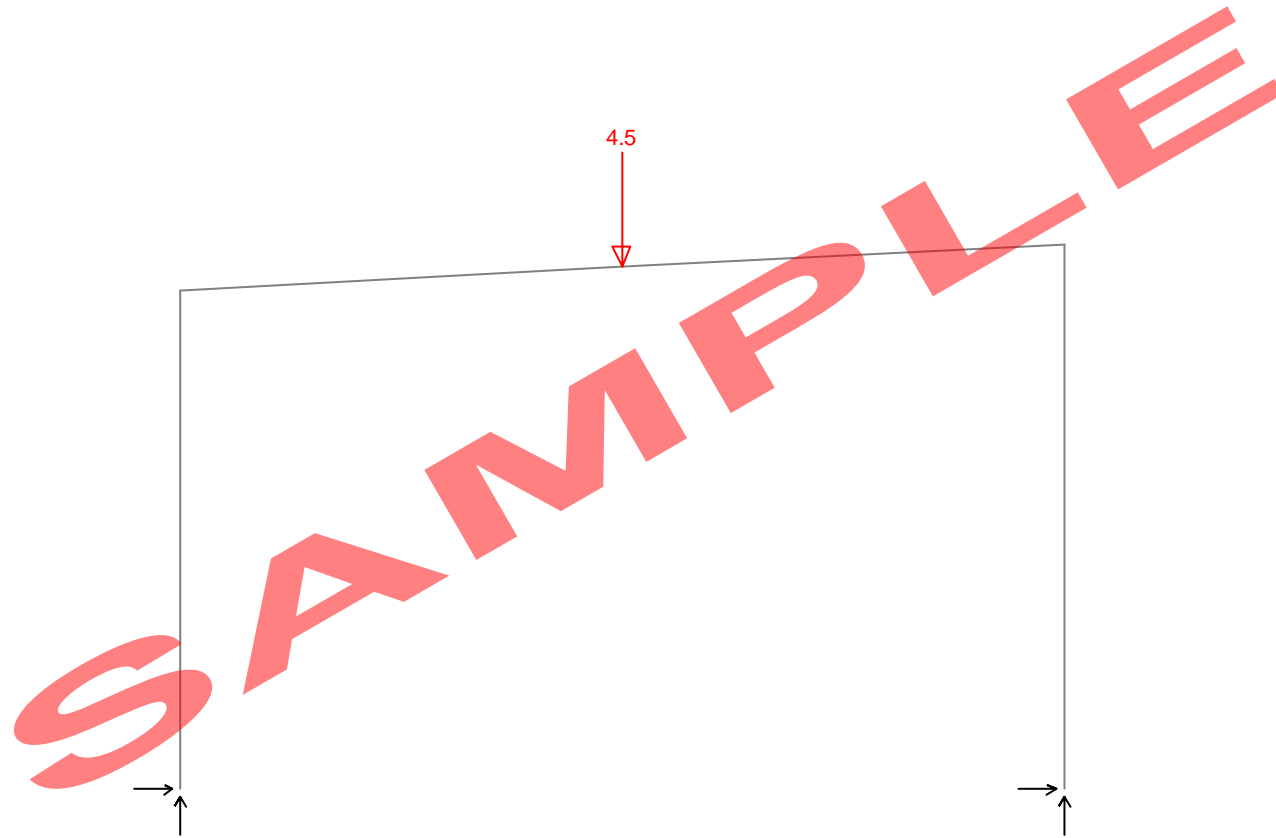
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Main Frame : Live Load

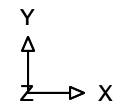
Load Cases:

— 202 P OPL



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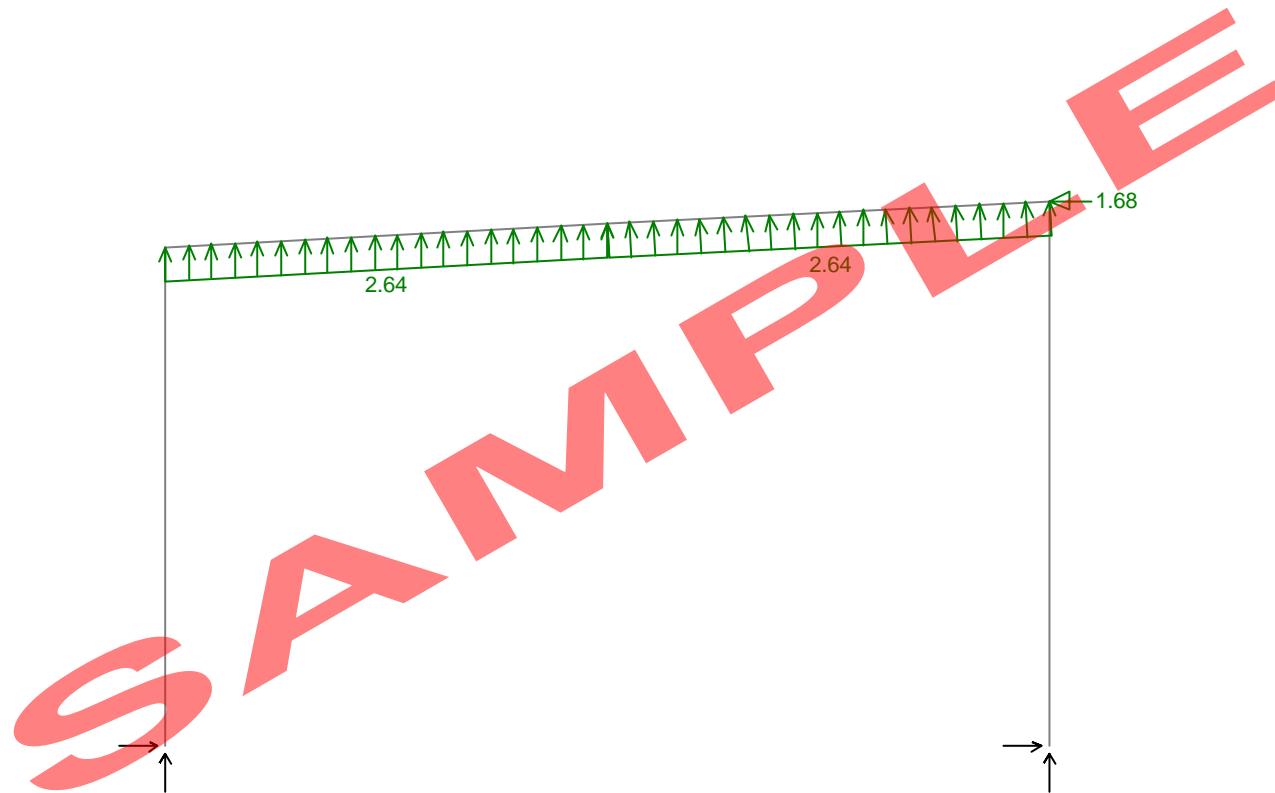


theta: 270 phi: 0

Main Frame : Occasional Point Load

Load Cases:

— 301 P WP1 THETA = 0 DEG {.. CPE ..}



EXAMPLE

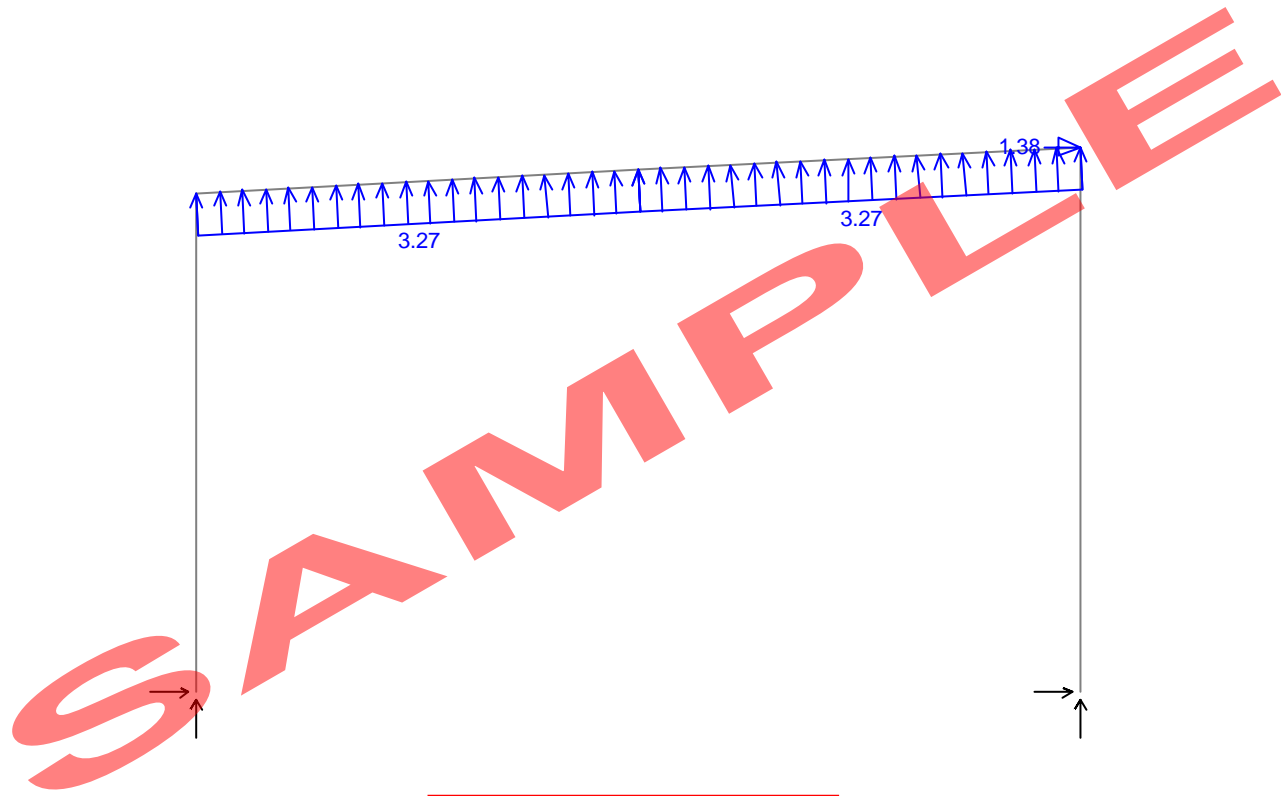
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Y
↑
Z → X
theta: 270 phi: 0

Main Frame : Wind Load (theta=0)

Load Cases:

— 302 P WP2 THETA = 90 DEG {.. CPE ..}



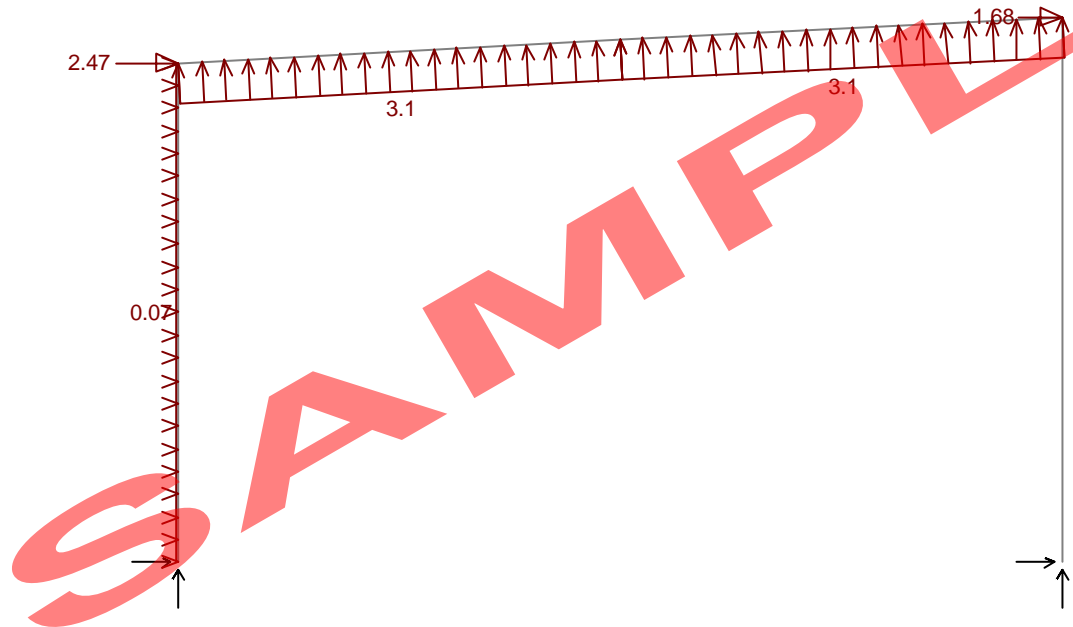
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Y
↑
Z → X
theta: 270 phi: 0

Main Frame : Wind Load (theta=90)

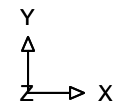
Load Cases:

— 303 P WP3 THETA=180 DEG {..Cpn..}



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theta: 270 phi: 0

Main Frame : Wind Load (theta=180)

Envelope for Axial Force

— Maximum

— Minimum

Enveloped Cases:

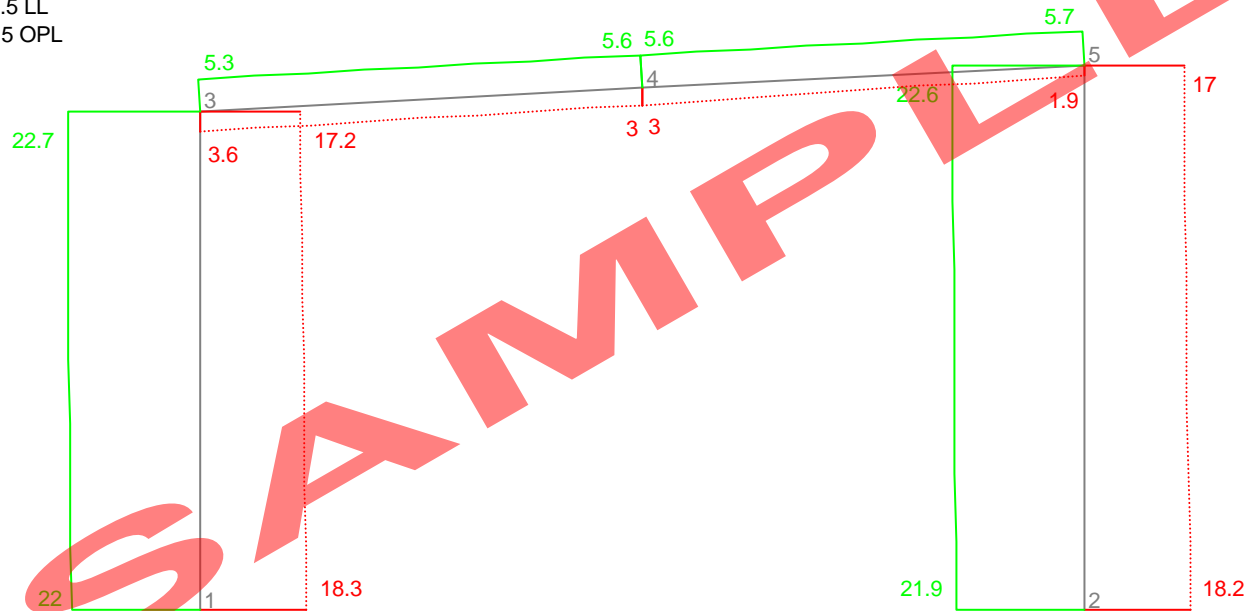
1500 C TOTAL 0.8(DL + Swt) + Wu1 (gy=-9.81)

1510 C TOTAL 0.8(DL + Swt) + Wu2

1515 C TOTAL 0.8(DL + Swt) + Wu3

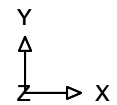
1520 C TOTAL 1.25(DL + Swt) + 1.5 LL

1521 C TOTAL 1.25(DL + Swt) + 1.5 OPL



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theta: 270 phi: 0

Design Axial Envelope

Axial Force, Fx

Envelope for Shear Fy

— Maximum

— Minimum

Enveloped Cases:

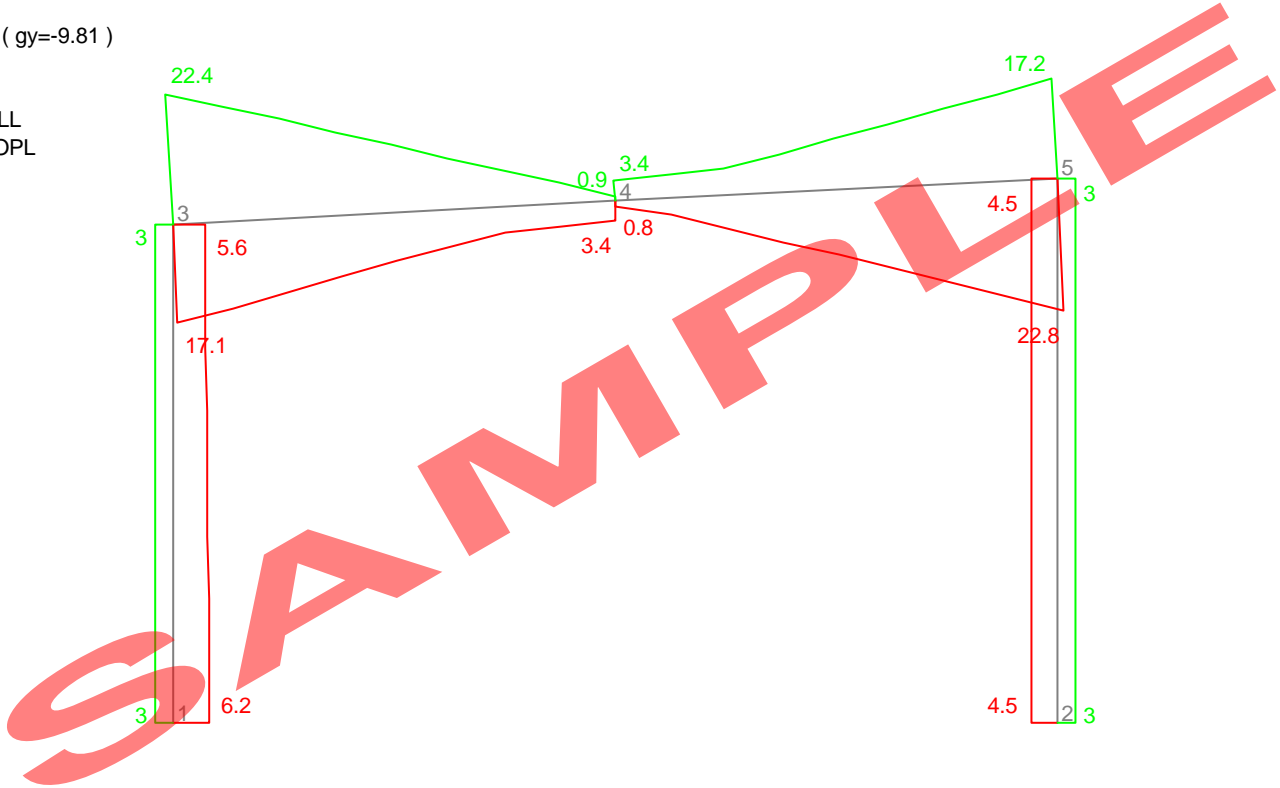
1500 C TOTAL 0.8(DL + Swt) + Wu1 (gy=-9.81)

1510 C TOTAL 0.8(DL + Swt) + Wu2

1515 C TOTAL 0.8(DL + Swt) + Wu3

1520 C TOTAL 1.25(DL + Swt) + 1.5 LL

1521 C TOTAL 1.25(DL + Swt) + 1.5 OPL



Y
↑
Z → X
theta: 270 phi: 0

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Design Shear Envelope

Shear Force, Fy

Envelope for Moment Mz

— Maximum

— Minimum

Enveloped Cases:

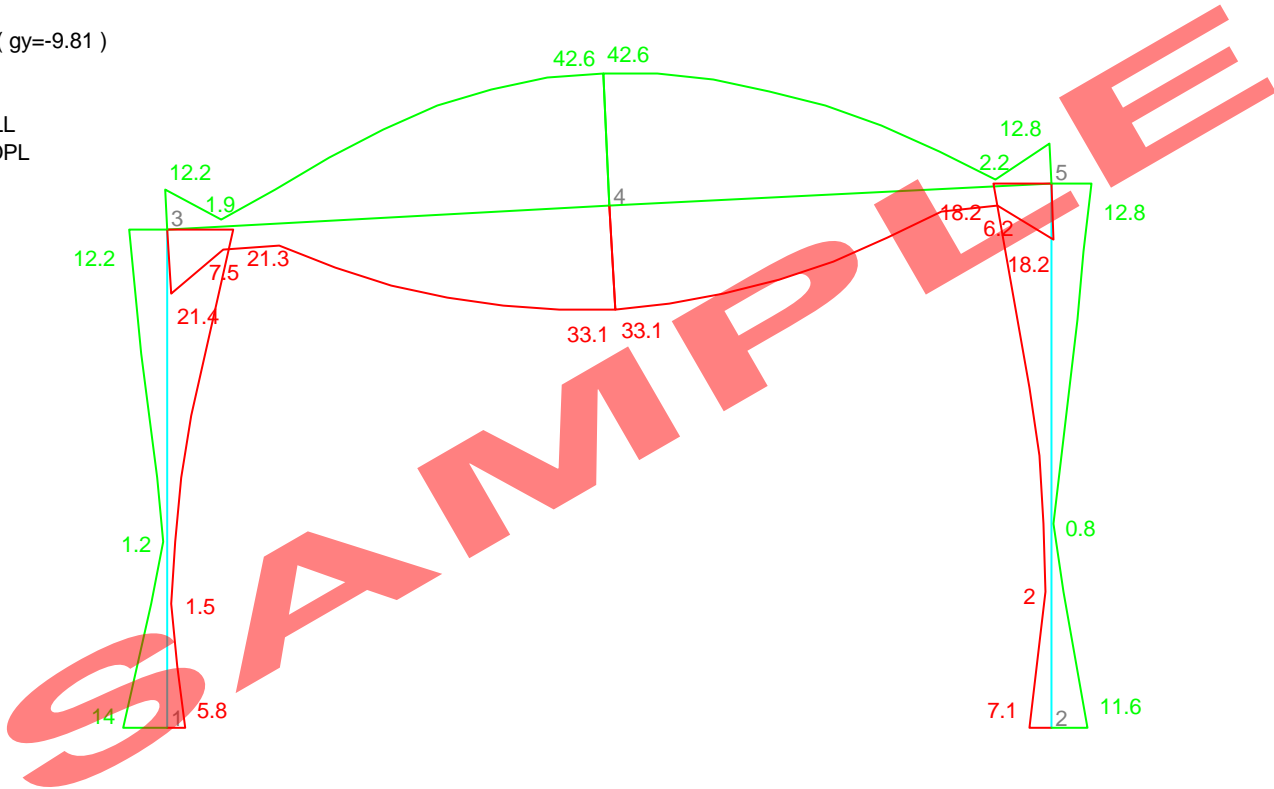
1500 C TOTAL 0.8(DL + Swt) + Wu1 (gy=-9.81)

1510 C TOTAL 0.8(DL + Swt) + Wu2

1515 C TOTAL 0.8(DL + Swt) + Wu3

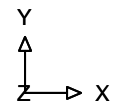
1520 C TOTAL 1.25(DL + Swt) + 1.5 LL

1521 C TOTAL 1.25(DL + Swt) + 1.5 OPL



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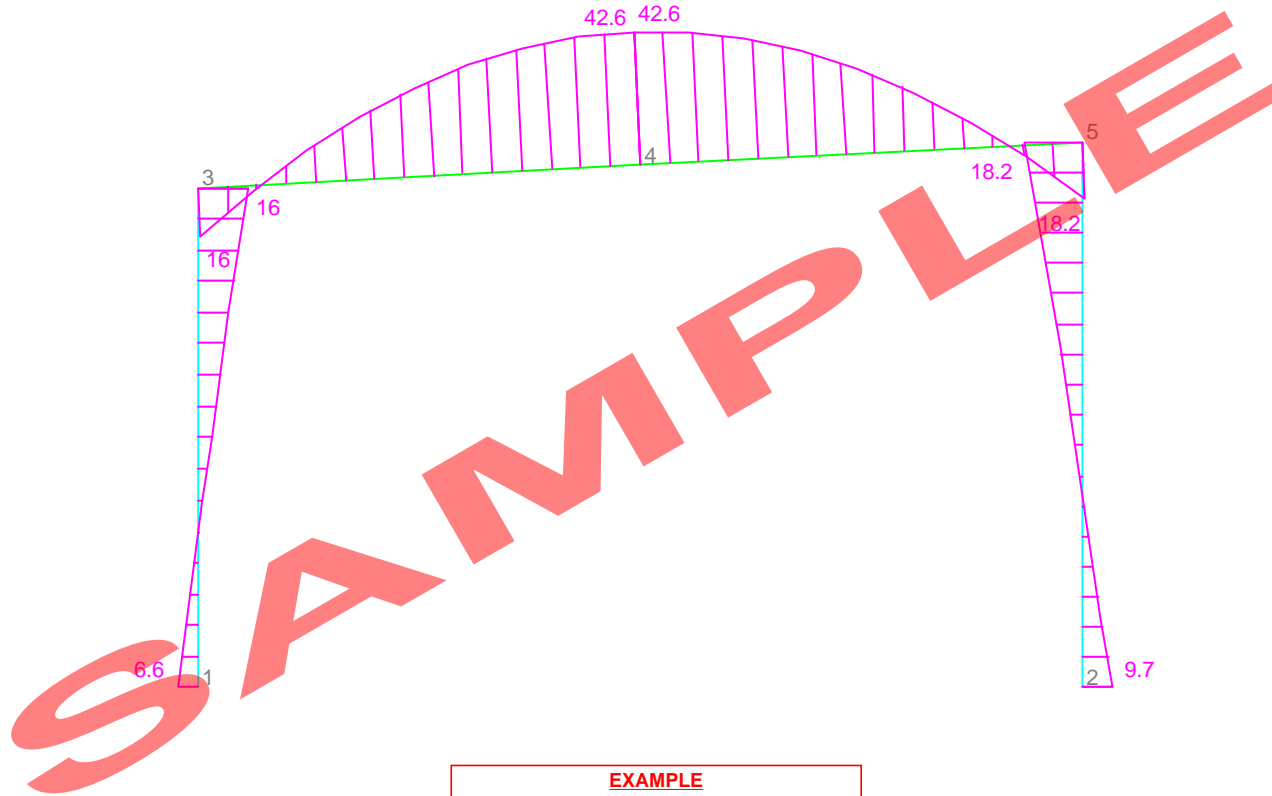
theta: 270 phi: 0

Design Moment Envelope

Bending Moment, Mz

Load Cases:

1510 C TOTAL 0.8(DL + Swt) + Wu2



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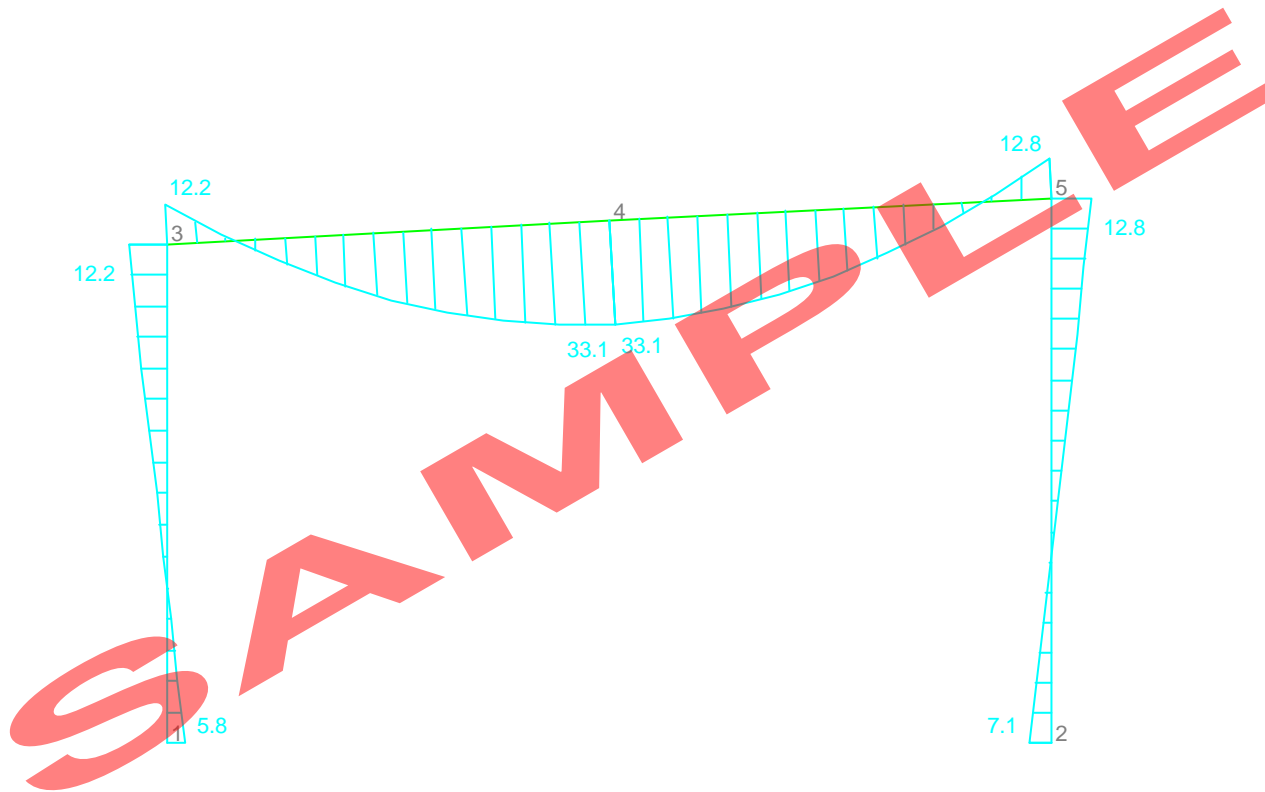
Y
↑
Z → X
theta: 270 phi: 0

Maximum Rafter Moment - due to wind

Bending Moment, Mz

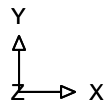
Load Cases:

1520 C TOTAL 1.25(DL + Swt) + 1.5 LL



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theta: 270 phi: 0

Maximum Rafter Moment - due to gravity loading

Bending Moment, Mz

LOAD CASES - STEEL DESIGN

Case	Type	Title
1500	C	TOTAL 0.8(DL + Swt) + Wu1
1510	C	TOTAL 0.8(DL + Swt) + Wu2
1515	C	TOTAL 0.8(DL + Swt) + Wu3
1520	C	TOTAL 1.25(DL + Swt) + 1.5 LL
1521	C	TOTAL 1.25(DL + Swt) + 1.5 OPL

STEEL MEMBERS SUMMARY REPORT

Memb	Code	Length mm	Grade	Section Name	Crit. Ratio	Load Case	Critical Condition
1	AS4100	6000	C350	125X125X4.0SHS	1.115	1515	Section N+Mx
2	AS4100	6545	C350	125X125X4.0SHS	1.299	1510	Section N+Mx
3*	AS4100	10614	300	<u>200UB22.3</u>	1.018	1510	Member out-plane T+Mx

LOAD CASES - STEEL DESIGN

Case	Type	Title
1500	C	TOTAL 0.8(DL + Swt) + Wu1
1510	C	TOTAL 0.8(DL + Swt) + Wu2
1515	C	TOTAL 0.8(DL + Swt) + Wu3
1520	C	TOTAL 1.25(DL + Swt) + 1.5 LL
1521	C	TOTAL 1.25(DL + Swt) + 1.5 OPL

STEEL MEMBERS FULL REPORT

MEMBER: 1 (Code Check to AS4100)

Section: 125X125X4.0SHS Axis: Y Grade: C350 fy: 350 fu: 430

Section dimensions and properties.

D=	125.0	B=	125.0	T=	4.0
Ag=	1880.0	rx=	49.0	Zx=	7.23E+04
		ry=	49.0	Zy=	7.23E+04
		J=	7.25E+06	Iw=	0.00E+00

Section Properties for Design:

Form Factor=	1.000	Class Mx:	Non-compact	Zex=	7.888E+04
Ae=	1880	Class My:	Non-compact	Zey=	7.888E+04

Member Restraints

No	Offset	Top	Btm	Cant	Ht	XX	kx	YY	ky
1	0.000	L	L	N	S	Y	1.00	Y	1.00
2	6.000	L	L	N					

Sideway - about XX axis: N about YY axis: N

Critical conditions for design load cases:

Case	Cap/Load	Condition
1500	2.716	Section N+Mx
1510	1.465	Section N+Mx
1515	1.115	Section N+Mx
1520	1.713	Member in-plane C+M
1521	2.892	Member in-plane C+M

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SECTION CHECKS

Case: 1515 Off: 6000 Cap/Load= 1.115 Section N+Mx (8.3.2)

Design loads:	N*= 22.47 t	M*x= 21.35	M*y= 0.00
Design capacities	øNt= 592.20	øMsx= 24.85	øMsy= 24.85
	øNs= 0.00	øMrx= 23.90	øMry= 23.90

MEMBER/SEGMENT CHECKS

Case: 1515 Off: 0/6000 Cap/Load= 1.115 Section N+Mx (8.3.2)

Design loads:	N*= 22.47 t	M*x= 21.35	M*y= 0.00
Lmx= 6000 column o/a length	βmx= 0.305		

øM_{sy}= 24.85 øM_{iy}= 0.00 øN_{oz}= 0.00
 øM_{ry}= 23.90 øM_{cx}= 0.00

SHEAR CHECKS (Appendix I excluded)
 Case: 1500 Off: 0 Cap/Load= 39.300 Section N+M_x (8.3.2)

Design loads: V*= 4.50

Design capacities

øV_v= 176.90 øM_f= 19.06

MEMBER: 3 (Code Check to AS4100)(2 members, 3-4 linked)

Section: 200UB22.3 Axis: Y Grade: 300 fyf: 320 fyw: 320 fu: 440

Section dimensions and properties.

D= 202.0 B= 133.0 Tf= 7.0 Tw= 5.0
 Ag= 2870.0 rx= 85.5 Z_x= 2.08E+05 S_x= 2.31E+05
 ry= 31.0 Z_y= 4.13E+04 S_y= 6.34E+04
 J= 4.50E+04 I_w= 2.60E+10

Section Properties for Design:

Form Factor= 1.000 Class M_x: Non-compact Z_{ex}= 2.266E+05
 Ae= 2870 Class M_y: Non-compact Z_{ey}= 6.022E+04

Member Restraints

No	Offset	/--Beam--/			Load	/-----Column-----/			
		Top	Btm	Cant		Ht	XX	kx	YY
1	0.000	L	L	N	S	Y	1.00	Y	1.00
flybrace 2	3.900	L	L		S			Y	1.00
flybrace 3	6.601	L	L		S			Y	1.00
4	10.614	L	L	N					

Sidesway - about XX axis: N about YY axis: N

Connection: Uniform and concentric

Critical conditions for design load cases:

Case	Cap/Load	Condition
1500	1.281	Member out-plane T+M _x
1510	1.018	Member out-plane T+M _x
1515	1.083	Member out-plane T+M _x
1520	1.289	Member out-plane C+M _x
1521	1.867	Member out-plane C+M _x

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SECTION CHECKS

Case: 1510 Off: 5308 Cap/Load= 1.517 Section N+M_x (8.3.2)

Design loads: N*= 5.59 t M*x= -42.58 M*y= 0.00

Design capacities øN_t= 826.56 øM_{sx}= 65.26 øM_{sy}= 17.34
 øN_s= 0.00 øM_{rx}= 64.82 øM_{ry}= 17.22

MEMBER/SEGMENT CHECKS

Case: 1510 Off: 3900/6601 Cap/Load= 1.018 Member out-plane T+M_x

Design loads: N*= 5.61 t M*x= -42.58 M*y= 0.00

L_{mx}=10614 column o/a length β_{mx}= -1.000
 L_{my}= 2701 β_{my}= 0.000
 L_x=10614 β_{me}= -0.998
 L_y= 2701 α_m= 1.000 BM modification factor
 L_e= 2701 beam eff. length α_s= 0.66 BM slend. reductn. factor
 L_z= 2701 torsion eff. length Transversely loaded.

Design capacities

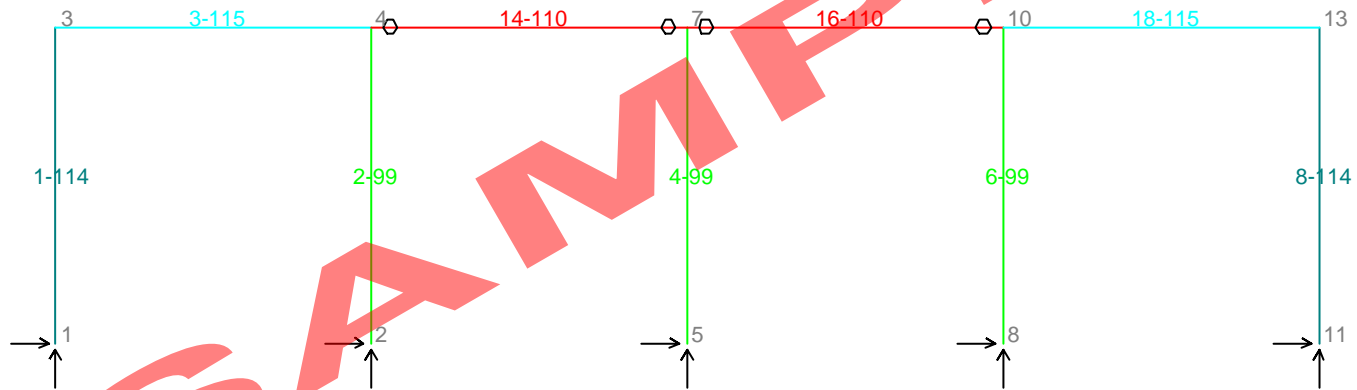
øN_t= 826.56 øM_{sx}= 65.26 øM_{bx}= 43.04 øM_{ox}= 43.33
 øM_{rx}= 64.81 øM_{ix}= 0.00 øM_{bxo}= 0.00
 øM_{sy}= 17.34 øM_{iy}= 0.00 øN_{oz}= 0.00
 øM_{ry}= 17.22 øM_{cx}= 0.00

SHEAR CHECKS (Appendix I excluded)

Case: 1510 Off: 10614 Cap/Load= 7.652 Section N+M_x (8.3.2)

Sections:

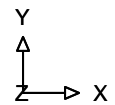
- 99 125X125X4.0SHS `
- 110 C25019
- 114 125X125X5.0SHS
- 115 150PFC Y



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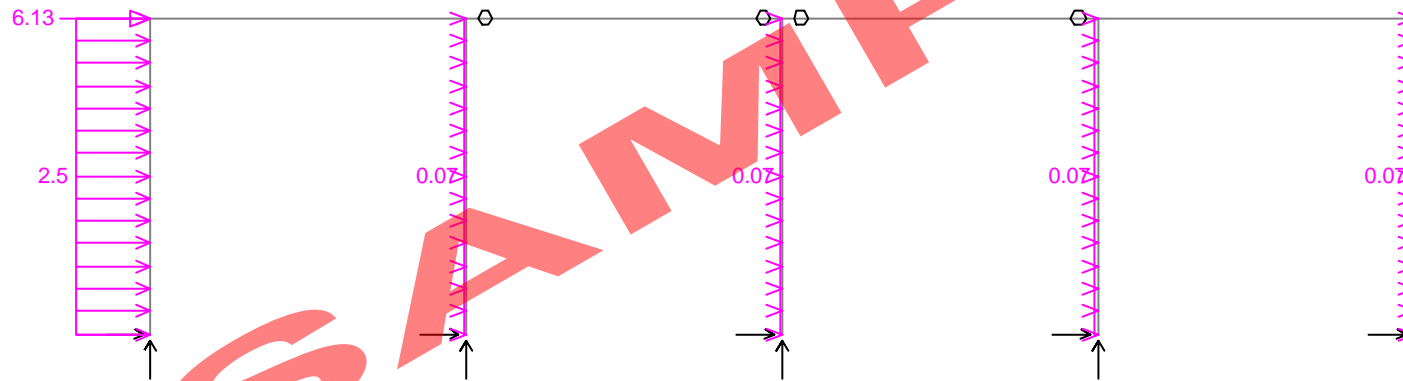
Design Geometry



theta: 270 phi: 0

Load Cases:

— 1 P Wind Sway



EXAMPLE

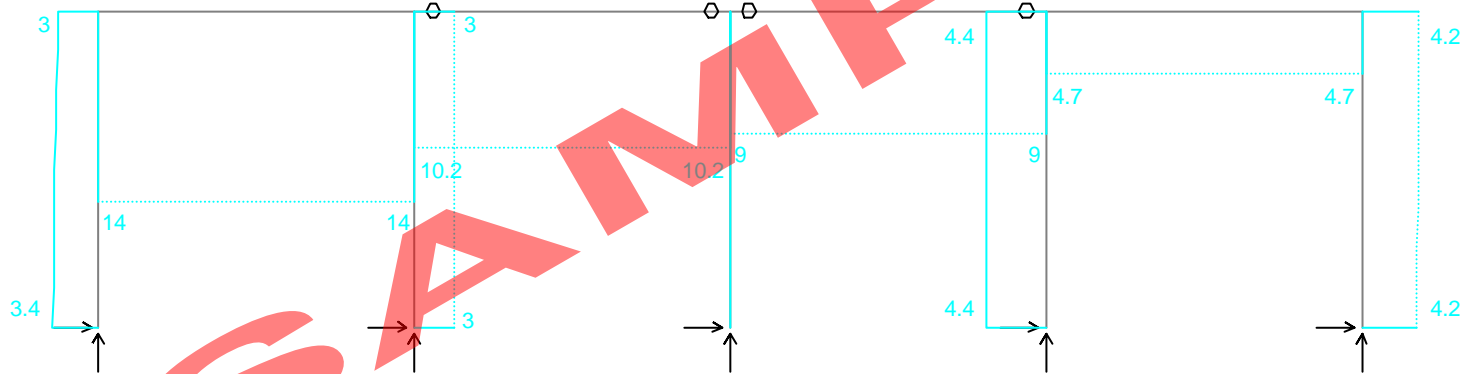
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Design Loads

Y
↑
Z → X
theta: 270 phi: 0

Load Cases:

1500 C Sway {.. Ultimate ..}



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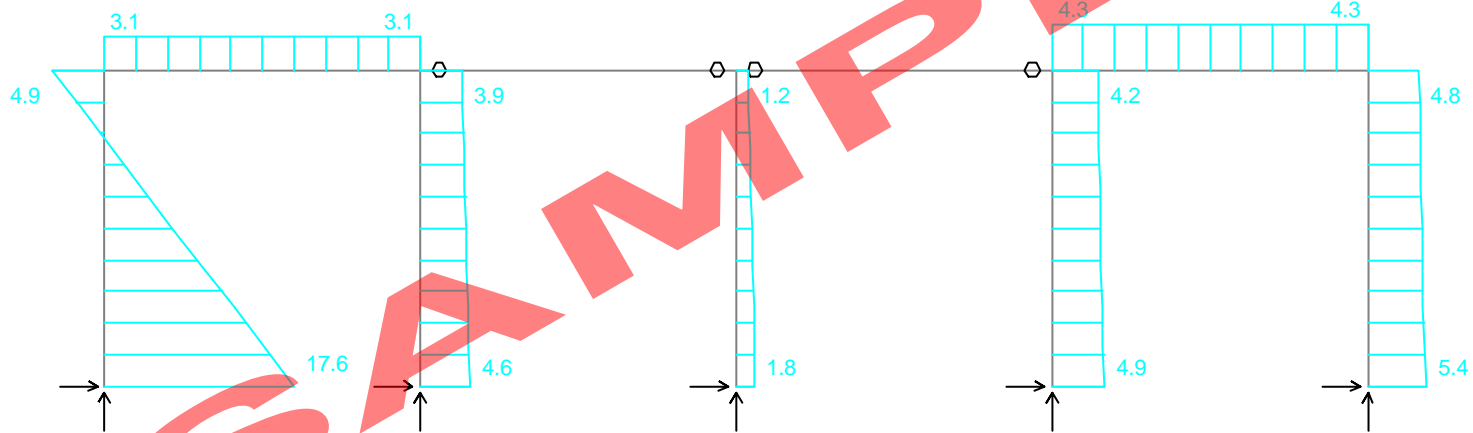
Y
↑
Z → X
theta: 270 phi: 0

Axial

Axial Force, Fx

Load Cases:

1500 C Sway {.. Ultimate ..}



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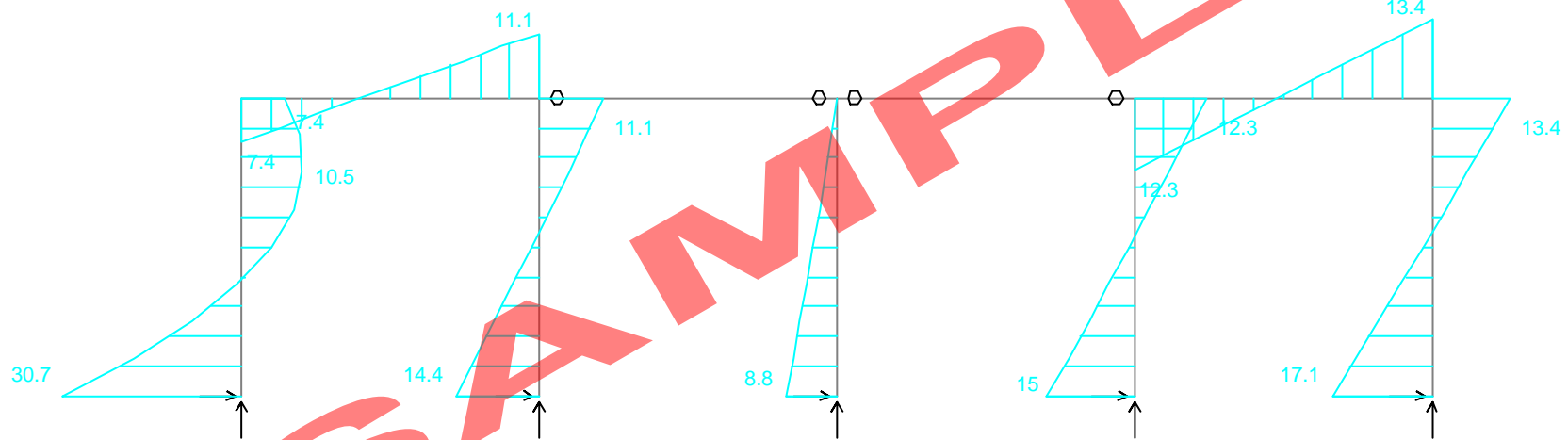
Y
↑
Z → X
theta: 270 phi: 0

Shears

Shear Force, Fy

Load Cases:

1500 C Sway {.. Ultimate ..}



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Y
↑
Z → X
theta: 270 phi: 0

Moments

Bending Moment, Mz

LOAD CASES - STEEL DESIGN

Case	Type	Title
1500	C	Sway {... Ultimate ...}

STEEL MEMBERS SUMMARY REPORT

Memb	Code	Length mm	Grade	Section Name	Crit. Ratio	Load Case	Critical Condition
1	AS4100	6000	C350	<u>125X125X5.0SHS</u>	1.057	1500	Section N+Mx
2	AS4100	6000	C350	125X125X4.0SHS	1.686	1500	Member in-plane C+M
3	AS4100	6000	300	<u>150PFC</u>	1.720	1500	Member out-plane C+Mx
4	AS4100	6000	C350	125X125X4.0SHS	2.804	1500	Section N+Mx
6	AS4100	6000	C350	125X125X4.0SHS	1.636	1500	Section N+Mx
8	AS4100	6000	C350	<u>125X125X5.0SHS</u>	1.831	1500	Member out-plane C+Mx
18	AS4100	6000	300	<u>150PFC</u>	2.020	1500	Member out-plane C+Mx

LOAD CASES - STEEL DESIGN

Case	Type	Title
1500	C	Sway {... Ultimate ...}

STEEL MEMBERS FULL REPORT

MEMBER: 1 (Code Check to AS4100)

Section: 125X125X5.0SHS Axis: Y Grade: C350 fy: 350 fu: 430

Section dimensions and properties.

D=	125.0	B=	125.0	T=	5.0
Ag=	2310.0	rx=	48.5	Zx=	8.71E+04
		ry=	48.5	Zy=	8.71E+04
		J=	8.87E+06	Iw=	0.00E+00
Sx=	1.03E+05	Sy=	1.03E+05		

Section Properties for Design:

Form Factor=	1.000	Class Mx:	Compact	Zex=	1.030E+05
Ae=	2310	Class My:	Compact	Zey=	1.030E+05

Member Restraints

No	Offset	Top	Btm	Cant	Load	XX	kx	YY	ky
1	0.000	L	L	N	S	Y	1.00	Y	1.00
2	6.000	L	L	N					

Sidesway - about XX axis: N about YY axis: N

Critical conditions for design load cases:

Case	Cap/Load	Condition
1500	1.057	Section N+Mx

SECTION CHECKS

Case: 1500 Off: 0 Cap/Load= 1.057 Section N+Mx (8.3.2)

Design loads:	N*=	<u>3.41</u> t	M*x=	<u>-30.68</u>	M*y=	0.00
Design capacities:	øNt=	<u>727.65</u>	øMsx=	<u>32.44</u>	øMsy=	32.44
	øNs=	0.00	øMrx=	32.44	øMry=	32.44

MEMBER/SEGMENT CHECKS

Case: 1500 Off: 0/6000 Cap/Load= 1.057 Section N+Mx (8.3.2)

Design loads:	N*=	3.41 t	M*x=	-30.68	M*y=	0.00
---------------	-----	--------	------	--------	------	------

Lmx=	6000 column o/a length	βmx=	0.749
Lmy=	6000	βmy=	0.000
Lx=	6000	βme=	0.242
Ly=	6000	αm=	2.500 BM modification factor
Le=	6000 beam eff. length	αs=	0.99 BM slend. reductn. factor
Lz=	6000 torsion eff. length		Transversely loaded.

Design capacities

øNt=	727.65	øMsx=	32.44	øMbx=	<u>32.44</u>	øMox=	32.44
		øMrx=	32.44	øMix=	0.00	øMbxo=	0.00

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øMsy= 32.44 øMiy= 0.00 øNoz= 0.00
 øMry= 32.44 øMcx= 0.00

SHEAR CHECKS (Appendix I excluded)

Case: 1500 Off: 0 Cap/Load= 1.380 Section N+Mx (8.3.2)

Design loads: V*= 17.60

Design capacities

øVv= 149.29 øMf= 23.62

MEMBER: 2 (Code Check to AS4100)

Section: 125X125X4.0SHS Axis: Y Grade: C350 fy: 350 fu: 430

Section dimensions and properties.

D= 125.0 B= 125.0 T= 4.0
 Ag= 1880.0 rx= 49.0 Zx= 7.23E+04 Sx= 8.45E+04
 ry= 49.0 Zy= 7.23E+04 Sy= 8.45E+04
 J= 7.25E+06 Iw= 0.00E+00

Section Properties for Design:

Form Factor= 1.000 Class Mx: Non-compact Zex= 7.888E+04
 Ae= 1880 Class My: Non-compact Zey= 7.888E+04

Member Restraints

No	Offset	/--Beam--/			Load	/-----Column-----/			
		Top	Btm	Cant	Ht	XX	kx	YY	ky
1	0.000	L	L	N	S	Y	1.00	Y	1.00
2	6.000	L	L	N					

Sidesway - about XX axis: N about YY axis: N

Critical conditions for design load cases:

Case Cap/Load Condition
 1500 1.686 Member in-plane C+M

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SECTION CHECKS

Case: 1500 Off: 0 Cap/Load= 1.715 Section N+Mx (8.3.2)

Design loads: N*= 3.00 M*x= 14.36 M*y= 0.00

Design capacities øNt= 0.00 øMsx= 24.85 øMsy= 24.85
 øNs= 592.20 øMrx= 24.72 øMry= 24.72

MEMBER/SEGMENT CHECKS

Case: 1500 Off: 0/6000 Cap/Load= 1.686 Member in-plane C+M (8.4.2.2)

Design loads: N*= 3.01 M*x= 14.36 M*y= 0.00

Lmx= 6000 column o/a length βmx= 1.000
 Lmy= 6000 βmy= 0.000
 Lx= 6000 βme= 0.770
 Ly= 6000 αm= 2.500 BM modification factor
 Le= 6000 beam eff. length αs= 1.00 BM slend. reductn. factor
 Lz= 6000 torsion eff. length Transversely loaded.

Design capacities

øNcx= 199.45 øMsx= 24.85 øNcx= 199.45 # øMox= 24.47
 øNcy= 199.45 øMrx= 24.72 øNcy= 199.45 # øMbxo= 0.00
 øMsy= 24.85 øMix= 24.47 øNoz= 0.00
 øMry= 24.72 øMiy= 24.47 øMcx= 24.47
 øMbx= 24.85 # computed with kL ≤ Lm (8.4.2.2)

SHEAR CHECKS (Appendix I excluded)

Case: 1500 Off: 0 Cap/Load= 38.870 Section N+Mx (8.3.2)

Design loads: V*= 4.55

Design capacities

øVv= 176.90 øMf= 19.06

MEMBER: 3 (Code Check to AS4100)

Section: 150PFC Axis: Y Grade: 300 fy: 320 fu: 440

Section dimensions and properties.

D= 150.0 B= 75.0 Tf= 9.5 Tw= 6.0
 Ag= 2250.0 rx= 60.8 Zx= 1.11E+05 Sx= 1.29E+05
 ry= 23.9 Zy= 2.57E+04 Sy= 4.60E+04
 J= 5.49E+04 Iw= 4.66E+09

Section Properties for Design:

Form Factor= 1.000 Class Mx: Compact Zex= 1.290E+05
 Ae= 2250 Class My: Compact Zey= 3.855E+04

Member Restraints

No	Offset	Top	Btm	Cant	Ht	XX	kx	YY	ky
1	0.000	L	L	N	S	Y	1.00	Y	1.00
2	6.000	L	L	N					

Sideways - about XX axis: N about YY axis: N

Connection: Uniform and concentric

Critical conditions for design load cases:

Case Cap/Load Condition
 1500 1.720 Member out-plane C+Mx

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SECTION CHECKS

Case: 1500 Off: 6000 Cap/Load= 3.131 Section N+Mx (8.3.2)

Design loads: N*= 14.04 c M*x= -11.06 M*y= 0.00
 Design capacities øNt= 0.00 øMsx= 37.15 øMsy= 11.10
 øNs= 648.00 øMrx= 36.35 øMry= 10.86

MEMBER/SEGMENT CHECKS

Case: 1500 Off: 0/6000 Cap/Load= 1.720 Member out-plane C+Mx

Design loads: N*= 14.04 c M*x= -11.06 M*y= 0.00
 Lmx= 6000 column o/a length βmx= 0.671
 Lmy= 6000 βmy= 0.000
 Lx= 6000 βme= 0.671
 Ly= 6000 αm= 2.500 BM modification factor
 Le= 6000 beam eff. length αs= 0.35 BM slend. reductn. factor
 Lz= 6000 torsion eff. length

Design capacities

øNcx= 274.14 øMsx= 37.15 øNcy= 274.14 # øMox= 24.68
 øNcy= 58.07 øMrx= 36.35 øNcy= 58.07 # øMbxo= 0.00
 øMsy= 11.10 øMix= 35.25 øNoz= 0.00
 øMry= 10.86 øMiy= 8.42 øMcx= 24.68
 øMbx= 32.54 # computed with kL ≤ Lm (8.4.2.2)

SHEAR CHECKS (Appendix I excluded)

Case: 1500 Off: 0 Cap/Load= 50.502 Section N+Mx (8.3.2)

Design loads: V*= 3.08

Design capacities

øVv= 155.52 øMf= 28.83

MEMBER: 4 (Code Check to AS4100)

Section: 125X125X4.0SHS Axis: Y Grade: C350 fy: 350 fu: 430

Section dimensions and properties.

D= 125.0 B= 125.0 T= 4.0
 Ag= 1880.0 rx= 49.0 Zx= 7.23E+04 Sx= 8.45E+04
 ry= 49.0 Zy= 7.23E+04 Sy= 8.45E+04
 J= 7.25E+06 Iw= 0.00E+00

Section Properties for Design:

Form Factor= 1.000 Class Mx: Non-compact Zex= 7.888E+04
 Ae= 1880 Class My: Non-compact Zey= 7.888E+04

Member Restraints

No	Offset	/--Beam--/		Load			/-----Column-----/			
		Top	Btm	Cant	Ht	XX	kx	YY	ky	
1	0.000	L	L	N	S	Y	1.00	Y	1.00	
2	6.000	L	L	N						

Sidesway - about XX axis: N about YY axis: N

Critical conditions for design load cases:

Case Cap/Load Condition
1500 2.804 Section N+Mx

SECTION CHECKS

Case: 1500 Off: 0 Cap/Load= 2.804 Section N+Mx (8.3.2)

Design loads: N*= 0.03 t M*x= 8.83 M*y= 0.00
Design capacities ϕN_t = 592.20 ϕM_{sx} = 24.85 ϕM_{sy} = 24.85
 ϕN_s = 0.00 ϕM_{rx} = 24.82 ϕM_{ry} = 24.82

MEMBER/SEGMENT CHECKS

Case: 1500 Off: 0/6000 Cap/Load= 2.813 Section N+Mx (8.3.2)

Design loads: N*= 0.03 t M*x= 8.83 M*y= 0.00
L_{mx}= 6000 column o/a length β_{mx} = 1.000
L_{my}= 6000 β_{my} = 0.000
L_x= 6000 β_{me} = 0.000
L_y= 6000 α_m = 1.967 BM modification factor
L_e= 6000 beam eff. length α_s = 1.00 BM slend. reductn. factor
L_z= 6000 torsion eff. length Transversely loaded.

Design capacities
 ϕN_t = 592.20 ϕM_{sx} = 24.85 ϕM_{bx} = 24.85 ϕM_{ox} = 24.84
 ϕM_{rx} = 24.84 ϕM_{ix} = 0.00 ϕM_{bxo} = 0.00
 ϕM_{sy} = 24.85 ϕM_{iy} = 0.00 ϕN_{oz} = 0.00
 ϕM_{ry} = 24.84 ϕM_{cx} = 0.00

SHEAR CHECKS (Appendix I excluded)

Case: 1500 Off: 0 Cap/Load= 98.980 Section N+Mx (8.3.2)

Design loads: V*= 1.79

Design capacities

ϕV_v = 176.90 ϕM_f = 19.06

MEMBER: 6 (Code Check to AS4100)

Section: 125X125X4.0SHS Axis: Y Grade: C350 fy: 350 fu: 430

Section dimensions and properties.

D= 125.0 B= 125.0 T= 4.0
Ag= 1880.0 r_x= 49.0 Z_x= 7.23E+04 S_x= 8.45E+04
r_y= 49.0 Z_y= 7.23E+04 S_y= 8.45E+04
J= 7.25E+06 I_w= 0.00E+00

Section Properties for Design:

Form Factor= 1.000 Class M_x: Non-compact Z_{ex}= 7.888E+04
A_e= 1880 Class M_y: Non-compact Z_{ey}= 7.888E+04

Member Restraints

No	Offset	/--Beam--/		Load			/-----Column-----/			
		Top	Btm	Cant	Ht	XX	kx	YY	ky	
1	0.000	L	L	N	S	Y	1.00	Y	1.00	
2	6.000	L	L	N						

Sidesway - about XX axis: N about YY axis: N

Critical conditions for design load cases:

Case Cap/Load Condition
1500 1.636 Section N+Mx

SECTION CHECKS

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Case: 1500 Off: 0 Cap/Load= 1.636 Section N+Mx (8.3.2)

Design loads: N*= 4.37 t M*x= 15.00 M*y= 0.00
 Design capacities øNt= 592.20 øMsx= 24.85 øMsy= 24.85
 øNs= 0.00 øMrx= 24.66 øMry= 24.66

MEMBER/SEGMENT CHECKS

Case: 1500 Off: 0/6000 Cap/Load= 1.636 Section N+Mx (8.3.2)

Design loads: N*= 4.37 t M*x= 15.00 M*y= 0.00
 Lmx= 6000 column o/a length ßmx= 1.000
 Lmy= 6000 ßmy= 0.000
 Lx= 6000 ßme= 0.820
 Ly= 6000 αm= 2.500 BM modification factor
 Le= 6000 beam eff. length αs= 1.00 BM slend. reductn. factor
 Lz= 6000 torsion eff. length Transversely loaded.

Design capacities
 øNt= 592.20 øMsx= 24.85 øMbx= 24.85 øMox= 24.66
 øMrx= 24.66 øMix= 0.00 øMbxo= 0.00
 øMsy= 24.85 øMiy= 0.00 øNoz= 0.00
 øMry= 24.66 øMcy= 0.00

SHEAR CHECKS (Appendix I excluded)

Case: 1500 Off: 0 Cap/Load= 36.354 Section N+Mx (8.3.2)

Design loads: V*= 4.87

Design capacities

øVv= 176.90 øMf= 19.06

MEMBER: 8 (Code Check to AS4100)

Section: 125X125X5.0SHS Axis: Y Grade: C350 fy: 350 fu: 430

Section dimensions and properties.

D= 125.0 B= 125.0 T= 5.0
 Ag= 2310.0 rx= 48.5 Zx= 8.71E+04 Sx= 1.03E+05
 ry= 48.5 Zy= 8.71E+04 Sy= 1.03E+05
 J= 8.87E+06 Iw= 0.00E+00

Section Properties for Design:

Form Factor= 1.000 Class Mx: Compact Zex= 1.030E+05
 Ae= 2310 Class My: Compact Zey= 1.030E+05

Member Restraints

No	Offset	Top	Btm	Cant	Ht	XX	kx	YY	ky
1	0.000	L	L	N	S	Y	1.00	Y	1.00
2	6.000	L	L	N					

Sidesway - about XX axis: N about YY axis: N

Critical conditions for design load cases:

Case Cap/Load Condition
 1500 1.831 Member out-plane C+Mx

SECTION CHECKS

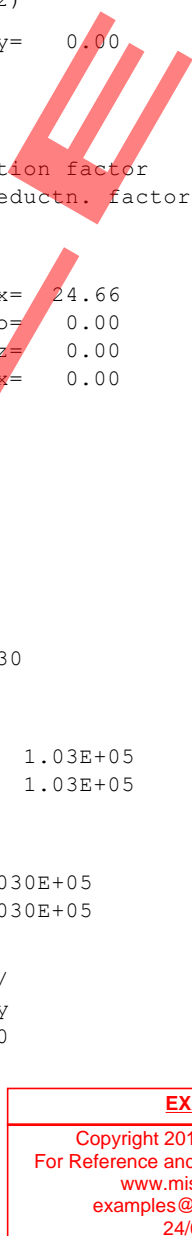
Case: 1500 Off: 0 Cap/Load= 1.892 Section N+Mx (8.3.2)

Design loads: N*= 4.18 c M*x= 17.15 M*y= 0.00
 Design capacities øNt= 0.00 øMsx= 32.44 øMsy= 32.44
 øNs= 727.65 øMrx= 32.44 øMry= 32.44

MEMBER/SEGMENT CHECKS

Case: 1500 Off: 0/6000 Cap/Load= 1.831 Member out-plane C+Mx

Design loads: N*= 4.20 c M*x= 17.15 M*y= 0.00
 Lmx= 6000 column o/a length ßmx= 1.000
 Lmy= 6000 ßmy= 0.000



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SHEAR CHECKS (Appendix I excluded)
Case: 1500 Off: 0 Cap/Load= 36.307 Section N+Mx (8.3.2)
Design loads: V*= 4.28
Design capacities $\phi V_v = 155.52$ $\phi M_f = 28.83$

SAMPLE

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TITLE :

OPEN FRONT SHELTER - Industrial; 10.0m Wide x 6.0m Eaves, 6.00m Bays - TC2

END WALL COLUMN

Assume 1 columns

Max. Height = 6.545 m

qz = 1.19
 Load Width = 5.000

WIND LOAD

INWARDS: $(-0.50 - 0.70) \times 1.19 \times 5.00 = -7.14 \text{ kN/m}$
 OUTWARDS $(0.70 - -0.50) \times 1.19 \times 5.00 = 7.14 \text{ kN/m}$

IN
 Cpe = 0.70
 Cpi = -0.50
OUT
 Cpe = -0.50
 Cpi = 0.70

DESIGN AS PROPPED CANTILEVERS

INWARD

$M[\text{base}] = wl^2/8 = -7.14 \times 6.55^2 / 8 = -38.2 \text{ kNm}$
 $M[\text{span}] = 9wl^2/128 = (9/16)M[\text{base}] = -21.5 \text{ kNm}$

Reactions

R[base]	-29.21 kN
R[prop]	-17.52 kN

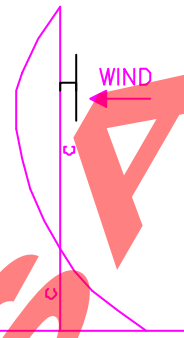
$l = 6.545$
 $l/4 = 1.636$
 $3l/4 = 4.909$

OUTWARD

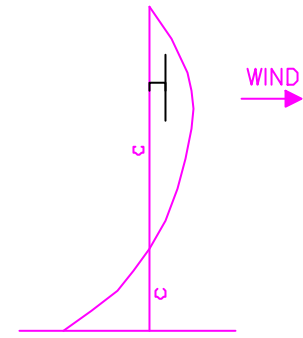
$M[\text{base}] = wl^2/8 = 7.14 \times 6.55^2 / 8 = 38.2 \text{ kNm}$
 $M[\text{span}] = 9wl^2/128 = (9/16)M[\text{base}] = 21.5 \text{ kNm}$

R[base]	29.21 kN
R[prop]	17.52 kN

INWARD



OUTWARD



	capacity		effect	load factor
base	phi.Ms = 39.74 kNm	<	38.2 kNm	1.04
base	phi.Ms = 39.74 kNm	@0.722m <	38.2 kNm	1.04 inside flange
span	phi.Ms = 21.5 kNm	@2.4m >	21.5 kNm	1.00 inside flange

ADOPT :
180 UB 16.1 ENDWALL COLUMN
 1 FLY BRACE 2400mm FROM TOP
 1 FLY BRACE AT FIRST GIRT FROM BOTTOM

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REF.: 1005	PAGE:
DESIGN: SCH	DATE: 27-Sep-2001

TITLE :

OPEN FRONT SHELTER - Industrial; 10.0m Wide x 6.0m Eaves, 6.00m Bays - TC2

WIND BRACING {.. limit state .. }

Struts for end wall column heads

w = -7.14
 l = 6.545
 L = 24
 L2 = 6

LOADS

$(3/8) \times 7.14 \times 6.55 = 17.52 \text{ kN}$

INTERNAL STRUT

Max. Load = 18 kN

ADOPT : 75x75x2 SHS 24 kN @6m Durgal DCT

EAVES STRUT

Max. Load = $(1.2 \times 1.19 \text{ kPa} \times 2.7 \text{ m}) \times 6.545 \text{ m} / 2 + 17.52 / 2 = 21.38 \text{ kN (total)}$

roof brace

ADOPT : 75x75x2 SHS 24 kN @6m Durgal DCT

DIAGONAL BRACING

ROOF = $17.52 \times 8.49 / 6.00 = 24.8 \text{ kN}$

WALL = $21.38 \times 8.88 / 6.00 = 31.6 \text{ kN}$

{Diam. 16 rod : 50.2kN on thread AISC DCT}

x = 6.000
 r1 = 8.485
 r2 = 8.879
 h = 6.545

**ADOPT : Roof : DIAM. 16 ROD; THREADED M16
 Walls : DIAM. 16 ROD; THREADED M16**

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DESIGN:	SCH	DATE:	27-Sep-2001

TITLE :

OPEN FRONT SHELTER - Industrial; 10.0m Wide x 6.0m Eaves, 6.00m Bays - TC2

Connections

Rafter to Column Connection

End Plate to SHS Column , Bolted to Bottom flange of UB rafter

M = 21.4 kNm Wind
M = 12.8 kNm Gravity

Bolt Force = M/d = 109.7 kN/bolt plane lever arm 0.195 m
54.9 kN/bolt

M16 - 8.8/s phi Ntf = 104 kN/bolt

End Plate

M = 54.9 x 0.035 /2 = 1.92 kNm

$$t = \sqrt{ (6 \times 1.92 \times 1E6 / (0.9 \times 300) / 130) }$$

$$= 18.12 \text{ mm}$$

ADOPT	4M16-8.8/s bolts 130 x 20 THICK END PLATE
--------------	--

Sway Frame Beam Connection

Bottom Flange of PFC Beam, Bolted to Top flange of UB rafter

M = 13.4 kNm

Bolt Force = M/d = 148.9 kN/bolt plane lever arm 0.090 m
148.9 kN/bolt

M20 - 8.8/s phi Ntf = 163 kN/bolt

ADOPT	2M20-8.8/s bolts
--------------	------------------

Column Base Connection

End Plate to SHS Column , anchored to footing pier

M = 30.7 kNm

Bolt Force = M/d = 157.4 kN/bolt plane lever arm 0.195 m
78.7 kN/bolt

M20 - 4.6/s phi Ntf = 78.4 kN/bolt accept

End Plate

M = 157.4 x 0.035 /2 = 2.76 kNm

$$t = \sqrt{ (6 \times 2.76 \times 1E6 / (0.9 \times 300) / 250) }$$

$$= 15.6 \text{ mm}$$

ADOPT	4M20-4.6/s bolts 250 x 250 x 16 THICK END PLATE
--------------	--

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DESIGN:	SCH	DATE:	27-Sep-01

TITLE :

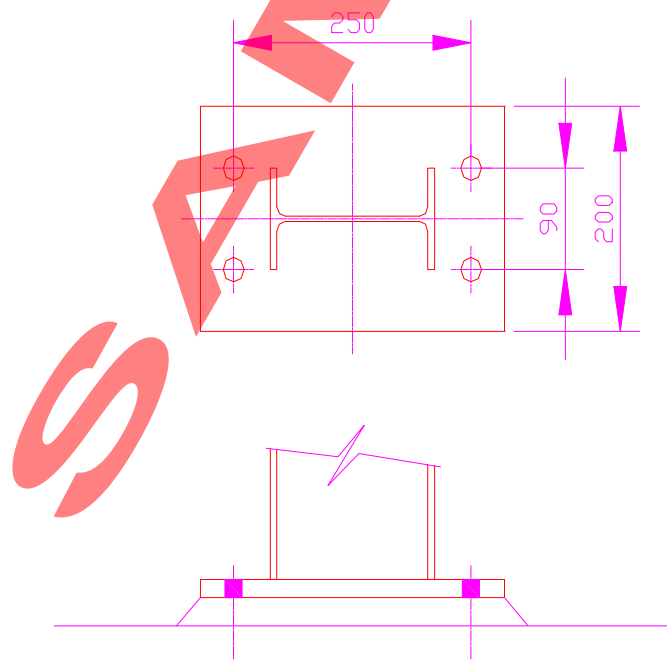
OPEN FRONT SHELTER - Industrial; 10.0m Wide x 6.0m Eaves, 6.00m Bays - TC2

END WALL COLUMN	Limit State		bolt lever arm	d3=	0.250
			clearance	d4=	0.039
			plate width	b =	200
BOLTS	M =	38.2 kNm		bolt planes	1
	T =	38.20 / 0.250 =	153 kN	No. Bolts	2
			76.40 kN/bolt	Grade	4.6/s
			153 kN/bolt plane		
	M =	152.8 x 0.039 / ; =	2.94 kNm		
END PLATE				phi	0.9
	M =	2.94 kNm		fy	300
	t =	$\sqrt{(6 \times 2.94 \times 1E6 / (0.9 \times 300)) / 200}$			
		= 18 mm			

ADOPT:

200 x 20 FLAT BAR
 4M20 - 4.6/S BOLTS

78.4 kN/bolt



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TITLE :

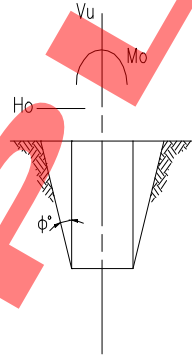
OPEN FRONT SHELTER - Industrial; 10.0m Wide x 6.0m Eaves, 6.00m Bays - TC2

PIERS FOR COLUMNS (based on end wall column)

ASSUME SANDY SOIL				Density	kg/m ³	kN/m ³
active	0.27	Total cone height {D+f}	2.34	Soil	1937.00	19.00
passive	3.69	Cone Vol {V_tot}	6.54	Concrete	2400.00	23.54
soil cone {e}	1.26	Apex vol {v2}	0.08	Limit State DL load factor = 0.80 Overturning Factor = 1.00 Diameter d = 0.75 Depth D = 1.8 Vu = 16 Vd = 0		
apex length {}	0.54	Cylinder vol {v_cyl}	0.80			
diameter {f}	3.27	$\gamma =$	1900 kN/m ³			
		c =	0.00 kPa			
$\phi =$	35		0.61 radians			
allowable bearing		pmax =	150.00 kPa			

Check Up Lift

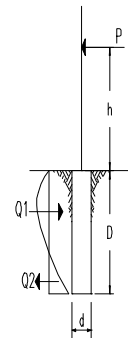
	Volume [m ³]	Force [kN]
Soil	5.67	107.69
Concrete	0.80	18.72
cohes		0.00
DL Vd		0.00
Σ		126.41 kN



$FoS = 0.80 \times 126.41 / 16.00 = 6.32 > 1.00 \text{ ok}$

Check Over Turning

$h = Mo / Ho = 38.20 / 29.21 = 1.31 \text{ m}$
 $Q2 = P(10h + 3.4D) / (5.6 D)$
 $= 29.21 \times (10 \times 1.31 + 3.4 \times 1.80) / (5.6 \times 1.80)$
 $= 55.63 \text{ kN}$



$P = Ho = 29.21$
 $Mo = 38.2$

$Q1 = Q2 + P = 84.84 \text{ kN}$
 $S1 = 84.8 / (0.68 \times 1.80 \times 0.75) = 92.42 \Rightarrow p \text{ average}$

$pa = 1.5 \times 92.42 = 138.63 < pmax \text{ ok}$

ADOPT : 750 DIAM. PIER x 1800 DEEP

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TITLE :

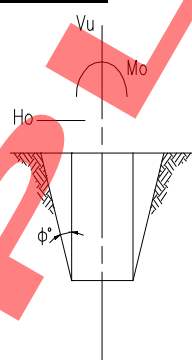
OPEN FRONT SHELTER - Industrial; 10.0m Wide x 6.0m Eaves, 6.00m Bays - TC2

PIERS FOR COLUMNS (based on main portal frame)

ASSUME SANDY SOIL				Density	kg/m ³	kN/m ³
active	0.27	Total cone height {D+f}	1.44	Soil	1937.00	19.00
passive	3.69	Cone Vol {V_tot}	1.52	Concrete	2400.00	23.54
soil cone {e}	0.63	Apex vol {v2}	0.08	Limit State DL load factor = 0.80 Overturning Factor = 1.00 Diameter d = 0.75 Depth D = 0.9 Vu = 16 Vd = 0		
apex length {}	0.54	Cylinder vol {v_cyl}	0.40			
diameter {f}	2.01	$\gamma =$	1900 kN/m ³			
		c =	0.00 kPa			
$\phi =$	35		0.61 radians			
allowable bearing		pmax =	150.00 kPa			

Check Up Lift

	Volume [m ³]	Force [kN]
Soil	1.04	19.81
Concrete	0.40	9.36
cohes		0.00
DL Vd		0.00
Σ		29.17 kN



$FoS = 0.80 \times 29.17 / 16.00 = 1.46 > 1.00 \text{ ok}$

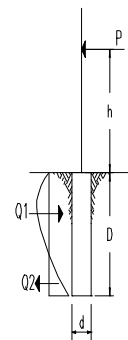
Check Over Turning

$h = Mo / Ho = 14.00 / 6.20 = 2.26 \text{ m}$

$Q2 = P(10h + 3.4D) / (5.6 D)$
 $= 6.20 \times (10 \times 2.26 + 3.4 \times 0.90) / (5.6 \times 0.90)$
 $= 31.54 \text{ kN}$

$Q1 = Q2 + P = 37.74 \text{ kN}$

$S1 = 37.7 / (0.68 \times 0.90 \times 0.75) = 82.23 \Rightarrow p \text{ average}$



$P = Ho = 6.2$
 $Mo = 14$

$pa = 1.5 \times 82.23 = 123.34 < pmax \text{ ok}$

ADOPT : 750 DIAM. PIER x 1000 DEEP

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SAMPLE

APPENDIX – A

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Queries relating to these computations should be directed to Roy Harrison

INPUT/ANALYSIS REPORT

Job: c1005_sway2
 Title: : Transport Canopy
 Sway Frame Front Elevation
 Type: Plane frame
 Date: 26 Sep 2001
 Time: 08:55 AM

Nodes 10
 Members 9
 Spring supports 0
 Sections 5
 Materials 1
 Primary load cases 1
 Combination load cases 2

Analysis: Non-linear elastic
 Update node coordinates Y
 Small displacement theory Y
 Include axial force effects Y
 Include flexural shortening N
 Convergence criterion: Residual
 Convergence tolerance 5.000E-04

LOAD CASES

Case	Type	Analysis	Title
1	P	N	Wind Sway
1000	C	N	Sway {... Serviceability ...}
1500	C	N	Sway {... Ultimate ...}

Analysis Types:
 S - Skipped (not analysed)
 L - Linear
 N - Non-linear

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NODE COORDINATES

Node	X m	Y m	Z m	Restraint
1	0.000	0.000	0.000	111111
2	6.000	0.000	0.000	111111
3	0.000	6.000	0.000	000000
4	6.000	6.000	0.000	000000
5	12.000	0.000	0.000	111111
7	12.000	6.000	0.000	000000
8	18.000	0.000	0.000	111111
10	18.000	6.000	0.000	000000
11	24.000	0.000	0.000	111111
13	24.000	6.000	0.000	000000

MEMBER DEFINITION

Member	A	B	C	Prop	Matl	Rel-A	Rel-B	Length m
1	1	3	-X	114	1	000000	000000	6.000
2	2	4	X	99	1	000000	000000	6.000
3	3	4	Y	115	1	000000	000000	6.000
4	5	7	X	99	1	000000	000000	6.000
6	8	10	X	99	1	000000	000000	6.000
8	11	13	X	114	1	000000	000000	6.000
14	4	7	Y	110	1	000001	000001	6.000
16	7	10	Y	110	1	000001	000001	6.000
18	10	13	Y	115	1	000000	000000	6.000

LIBRARY SECTIONS

Section	Library	Name	Axis	Comment
99	Asw	125X125X4.0SHS	Y	default
114	Asw	125X125X5.0SHS	Y	default
115	Asw	150PFC	Y	default

SECTIONS INPUT BY PROPERTY VALUES

Section	Name	Comment
109	C15015	Y Portal
110	C25019	Purlin

SECTION PROPERTIES

Section	Ax	Ay	Az	J	Iy	Iz	fact
	m2	m2	m2	m4	m4	m4	
99	1.880E-03	0.000E+00	0.000E+00	7.250E-06	4.520E-06	4.520E-06	
109	4.425E-04	0.000E+00	0.000E+00	3.319E-10	2.350E-07	1.598E-06	
110	8.080E-04	0.000E+00	0.000E+00	9.720E-10	5.570E-07	7.590E-06	
114	2.310E-03	0.000E+00	0.000E+00	8.870E-06	5.440E-06	5.440E-06	
115	2.250E-03	0.000E+00	0.000E+00	5.490E-08	1.290E-06	8.340E-06	

MATERIAL PROPERTIES

Material	E	u	Density	Alpha
	kN/m2		t/m3	/deg C
1	2.000E+08	0.2500	7.850E+00	1.170E-05

APPLIED LOADING

CASE 1: Wind Sway

Node Loads

Node	X Force	Y Force	Z Force	X Moment	Y Moment	Z Moment
	kN	kN	kN	kNm	kNm	kNm
3	6.130	0.000	0.000	0.000	0.000	0.000

Member Loads

Member	Form	T	A	S	F1	X1	F2	X2
1	UNIF	FX	GL		2.500			
2	UNIF	FX	GL		0.070			
4	UNIF	FX	GL		0.070			
6	UNIF	FX	GL		0.070			
8	UNIF	FX	GL		0.070			

Sum of Applied Loads (Global Axes):

FX: 22.810 FY: 0.000 FZ: 0.000

CASE 1000: Sway {... Serviceability ..}

Load Combinations

Case	Factor	
1	0.860	Wind Sway

Sum of Applied Loads (Global Axes):

FX: 19.617 FY: 0.000 FZ: 0.000

CASE 1500: Sway {... Ultimate ..}

Load Combinations

Case	Factor	
1	1.500	Wind Sway

Sum of Applied Loads (Global Axes):

FX: 34.215 FY: 0.000 FZ: 0.000

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INPUT/ANALYSIS REPORT

Job: c1005_f2
 Title: DELTA Sheds : Transport Canopy
 10.0m - Flat Roof - TC2 - 36m/s
 Type: Plane frame
 Date: 25 Sep 2001
 Time: 10:23 PM

Nodes 5
 Members 4
 Spring supports 0
 Sections 4
 Materials 1
 Primary load cases 7
 Combination load cases 15

Analysis: Non-linear elastic
 Update node coordinates Y
 Small displacement theory Y
 Include axial force effects Y
 Include flexural shortening N
 Convergence criterion: Residual
 Convergence tolerance 5.000E-04

LOAD CASES

Case	Type	Analysis	Title
100	P	S	SWT
101	P	S	DL
201	P	S	LL
202	P	S	OPL
301	P	S	WP1 THETA = 0 DEG {... CPE ..}
302	P	S	WP2 THETA = 90 DEG {... CPE ..}
303	P	S	WP3 THETA=180 DEG {...Cpn..}
900	C	S	TOTAL DL + Swt + Wp1
910	C	S	TOTAL DL + Swt + Wp2
915	C	S	TOTAL DL + Swt + Wp3
920	C	S	TOTAL DL + Swt + LL
921	C	S	TOTAL DL + Swt + OPL
1000	C	S	TOTAL DL + Swt + Ws1
1010	C	S	TOTAL DL + Swt + Ws2
1015	C	S	TOTAL DL + Swt + Ws3
1020	C	S	TOTAL DL + Swt + LL
1021	C	S	TOTAL DL + Swt + OPL
1500	C	N	TOTAL 0.8(DL + Swt) + Wu1
1510	C	N	TOTAL 0.8(DL + Swt) + Wu2
1515	C	N	TOTAL 0.8(DL + Swt) + Wu3
1520	C	N	TOTAL 1.25(DL + Swt) + 1.5 LL
1521	C	N	TOTAL 1.25(DL + Swt) + 1.5 OPL

Analysis Types:
 S - Skipped (not analysed)
 L - Linear
 N - Non-linear

NODE COORDINATES

Node	X	Y	Z	Restraint
	m	m	m	
1	0.000	0.000	0.000	111111
2	10.600	0.000	0.000	111111
3	0.000	6.000	0.000	001110
4	5.300	6.273	0.000	001110
5	10.600	6.545	0.000	001110

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MEMBER DEFINITION

Member	A	B	C	Prop	Matl	Rel-A	Rel-B	Length
								m
1	1	3	-X	103	1	000000	000000	6.000
2	2	5	X	103	1	000000	000000	6.545
3	3	4	Y	102	1	000000	000000	5.307
4	4	5	Y	102	1	000000	000000	5.307

LIBRARY SECTIONS

Section	Library	Name	Axis	Comment
101	Asw	100X100X5.0SHS	Y	default
102	Asw	200UB22.3	Y	Y Portal
103	Asw	125X125X4.0SHS	Y	default
104	Asw	180UB18.1	Y	default

SECTION PROPERTIES

Section	Ax	Ay	Az	J	Iy	Iz	fact
	m2	m2	m2	m4	m4	m4	
101	1.810E-03	0.000E+00	0.000E+00	4.420E-06	2.660E-06	2.660E-06	
102	2.870E-03	0.000E+00	0.000E+00	4.500E-08	2.750E-06	2.100E-05	
103	1.880E-03	0.000E+00	0.000E+00	7.250E-06	4.520E-06	4.520E-06	
104	2.300E-03	0.000E+00	0.000E+00	4.480E-08	9.750E-07	1.210E-05	

MATERIAL PROPERTIES

Material	E	u	Density	Alpha
	kN/m2		t/m3	/deg C
1	2.000E+08	0.2500	7.850E+00	1.170E-05

APPLIED LOADING

CASE 100: SWT

Gravitational Acceleration

X Comp	Y Comp	Z Comp
m/sec2	m/sec2	m/sec2
0.000	-9.810	0.000

Sum of Applied Loads (Global Axes):

FX: 0.000 FY: 0.000 FZ: 0.000

CASE 101: DL

Member Loads

Member	Form	T	A	S	F1	X1	F2	X2
3	UNIF	FY	GL		-0.560			
4	UNIF	FY	GL		-0.560			

Sum of Applied Loads (Global Axes):

FX: 0.000 FY: 0.000 FZ: 0.000

CASE 201: LL

Member Loads

Member	Form	T	A	S	F1	X1	F2	X2
3	UNIF	FY	GL		-1.500			
4	UNIF	FY	GL		-1.500			

Sum of Applied Loads (Global Axes):

FX: 0.000 FY: 0.000 FZ: 0.000

CASE 202: OPL

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Node Loads

Node	X Force kN	Y Force kN	Z Force kN	X Moment kNm	Y Moment kNm	Z Moment kNm
4	0.000	-4.500	0.000	0.000	0.000	0.000

Sum of Applied Loads (Global Axes):

FX: 0.000 FY: 0.000 FZ: 0.000

CASE 301: WP1 THETA = 0 DEG {... CPE ...}

Node Loads

Node	X Force kN	Y Force kN	Z Force kN	X Moment kNm	Y Moment kNm	Z Moment kNm
5	-1.680	0.000	0.000	0.000	0.000	0.000

Member Loads

Member	Form	T	A	S	F1	X1	F2	X2
3	UNIF	FY	GL		2.640			
4	UNIF	FY	LO		2.640			

Sum of Applied Loads (Global Axes):

FX: 0.000 FY: 0.000 FZ: 0.000

CASE 302: WP2 THETA = 90 DEG {... CPE ...}

Node Loads

Node	X Force kN	Y Force kN	Z Force kN	X Moment kNm	Y Moment kNm	Z Moment kNm
5	1.380	0.000	0.000	0.000	0.000	0.000

Member Loads

Member	Form	T	A	S	F1	X1	F2	X2
3	UNIF	FY	LO		3.270			
4	UNIF	FY	LO		3.270			

Sum of Applied Loads (Global Axes):

FX: 0.000 FY: 0.000 FZ: 0.000

CASE 303: WP3 THETA=180 DEG {... Cpn...}

Node Loads

Node	X Force kN	Y Force kN	Z Force kN	X Moment kNm	Y Moment kNm	Z Moment kNm
3	2.470	0.000	0.000	0.000	0.000	0.000
5	1.680	0.000	0.000	0.000	0.000	0.000

Member Loads

Member	Form	T	A	S	F1	X1	F2	X2
1	UNIF	FX	GL		0.070			
3	UNIF	FY	LO		3.100			
4	UNIF	FY	LO		3.100			

Sum of Applied Loads (Global Axes):

FX: 0.000 FY: 0.000 FZ: 0.000

CASE 900: TOTAL DL + Swt + Wp1

Load Combinations

Case	Factor	
100	1.000	SWT
101	1.000	DL
301	1.000	WP1 THETA = 0 DEG {... CPE ...}

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Sum of Applied Loads (Global Axes):
FX: 0.000 FY: 0.000 FZ: 0.000

CASE 910: TOTAL DL + Swt + Wp2

Load Combinations

Case	Factor	
100	1.000	SWT
101	1.000	DL
302	1.000	WP2 THETA = 90 DEG {... CPE ...}

Sum of Applied Loads (Global Axes):
FX: 0.000 FY: 0.000 FZ: 0.000

CASE 915: TOTAL DL + Swt + Wp3

Load Combinations

Case	Factor	
100	1.000	SWT
101	1.000	DL
303	1.000	WP3 THETA=180 DEG {...Cpn...}

Sum of Applied Loads (Global Axes):
FX: 0.000 FY: 0.000 FZ: 0.000

CASE 920: TOTAL DL + Swt + LL

Load Combinations

Case	Factor	
100	1.000	SWT
101	1.000	DL
201	1.000	LL

Sum of Applied Loads (Global Axes):
FX: 0.000 FY: 0.000 FZ: 0.000

CASE 921: TOTAL DL + Swt + OPL

Load Combinations

Case	Factor	
100	1.000	SWT
101	1.000	DL
202	1.000	OPL

Sum of Applied Loads (Global Axes):
FX: 0.000 FY: 0.000 FZ: 0.000

CASE 1000: TOTAL DL + Swt + Ws1

Load Combinations

Case	Factor	
100	1.000	SWT
101	1.000	DL
301	0.859	WP1 THETA = 0 DEG {... CPE ...}

Sum of Applied Loads (Global Axes):
FX: 0.000 FY: 0.000 FZ: 0.000

CASE 1010: TOTAL DL + Swt + Ws2

Load Combinations

Case	Factor	
100	1.000	SWT
101	1.000	DL
302	0.859	WP2 THETA = 90 DEG {... CPE ...}

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Sum of Applied Loads (Global Axes):
FX: 0.000 FY: 0.000 FZ: 0.000

CASE 1015: TOTAL DL + Swt + Ws3

Load Combinations

Case	Factor	
100	1.000	SWT
101	1.000	DL
303	0.859	WP3 THETA=180 DEG {...Cpn..}

Sum of Applied Loads (Global Axes):
FX: 0.000 FY: 0.000 FZ: 0.000

CASE 1020: TOTAL DL + Swt + LL

Load Combinations

Case	Factor	
100	1.000	SWT
101	1.000	DL
201	0.700	LL

Sum of Applied Loads (Global Axes):
FX: 0.000 FY: 0.000 FZ: 0.000

CASE 1021: TOTAL DL + Swt + OPL

Load Combinations

Case	Factor	
100	1.000	SWT
101	1.000	DL
202	0.700	OPL

Sum of Applied Loads (Global Axes):
FX: 0.000 FY: 0.000 FZ: 0.000

CASE 1500: TOTAL 0.8(DL + Swt) + Wu1

Load Combinations

Case	Factor	
100	0.800	SWT
101	0.800	DL
301	1.500	WP1 THETA = 0 DEG {... CPE ..}

Sum of Applied Loads (Global Axes):
FX: -3.254 FY: 33.934 FZ: 0.000

CASE 1510: TOTAL 0.8(DL + Swt) + Wu2

Load Combinations

Case	Factor	
100	0.800	SWT
101	0.800	DL
302	1.500	WP2 THETA = 90 DEG {... CPE ..}

Sum of Applied Loads (Global Axes):
FX: -0.603 FY: 43.897 FZ: 0.000

CASE 1515: TOTAL 0.8(DL + Swt) + Wu3

Load Combinations

Case	Factor	
100	0.800	SWT
101	0.800	DL
303	1.500	WP3 THETA=180 DEG {...Cpn..}



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Sum of Applied Loads (Global Axes):
FX: 4.321 FY: 41.196 FZ: 0.000
CASE 1520: TOTAL 1.25(DL + Swt) + 1.5 LL

Load Combinations

Case	Factor	
100	1.250	SWT
101	1.250	DL
201	1.500	LL

Sum of Applied Loads (Global Axes):
FX: 0.000 FY: -36.514 FZ: 0.000
CASE 1521: TOTAL 1.25(DL + Swt) + 1.5 OPL

Load Combinations

Case	Factor	
100	1.250	SWT
101	1.250	DL
202	1.500	OPL

Sum of Applied Loads (Global Axes):
FX: 0.000 FY: -19.382 FZ: 0.000

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APPENDIX - B

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INPUT/ANALYSIS REPORT

Job: c1005_sway2
 Title: Transport Canopy
Sway Frame Front Elevation
 Type: Plane frame
 Date: 26 Sep 2001
 Time: 08:56 AM

Nodes 10
 Members 9
 Spring supports 0
 Sections 5
 Materials 1
 Primary load cases 1
 Combination load cases 2

Analysis: Non-linear elastic
 Update node coordinates Y
 Small displacement theory Y
 Include axial force effects Y
 Include flexural shortening N
 Convergence criterion: Residual
 Convergence tolerance 5.000E-04

LOAD CASES

Case	Type	Analysis	Title
1	P	N	Wind Sway
1000	C	N	Sway {... Serviceability ...}
1500	C	N	Sway {... Ultimate ...}

Analysis Types:
 S - Skipped (not analysed)
 L - Linear
 N - Non-linear

NODE TABLE NOT PRINTED
 MEMBER TABLE NOT PRINTED
 SECTION PROPERTY TABLE NOT PRINTED
 MATERIAL TABLE NOT PRINTED

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MEMBER FORCES

CASE 1: Wind Sway

Member	Node	Axial kN	Shear-y kN	Shear-z kN	Torque kNm	Moment-y kNm	Moment-z kNm
1	1	2.198	-11.731	0.000	0.000	0.000	-20.455
	3	2.013	3.268	0.000	0.000	0.000	4.935
2	2	-2.015	3.037	0.000	0.000	0.000	9.584
	4	-2.021	2.618	0.000	0.000	0.000	-7.381
3	3	-9.373	2.053	0.000	0.000	0.000	4.935
	4	-9.373	2.053	0.000	0.000	0.000	-7.381
4	5	0.015	1.191	0.000	0.000	0.000	5.888
	7	0.010	0.771	0.000	0.000	0.000	0.000
6	8	2.896	3.242	0.000	0.000	0.000	9.991
	10	2.891	2.822	0.000	0.000	0.000	-8.203
8	11	-2.812	3.606	0.000	0.000	0.000	11.445
	13	-2.817	3.186	0.000	0.000	0.000	-8.932
14	4	-6.780	0.000	0.000	0.000	0.000	0.000
	7	-6.780	0.000	0.000	0.000	0.000	0.000
16	7	-6.009	0.000	0.000	0.000	0.000	0.000
	10	-6.009	0.000	0.000	0.000	0.000	0.000
18	10	-3.151	2.856	0.000	0.000	0.000	8.203
	13	-3.151	2.856	0.000	0.000	0.000	-8.932

Positive Forces (Member Axes):

Axial - Tension Shear - End A sagging
 Torque - Right-hand twist Moment - Sagging

SUPPORT REACTIONS

CASE 1: Wind Sway

Node	Force-X kN	Force-Y kN	Force-Z kN	Moment-X kNm	Moment-Y kNm	Moment-Z kNm
1	-11.757	-2.053	0.000	0.000	0.000	20.455
2	-3.012	2.053	0.000	0.000	0.000	9.584
5	-1.191	0.000	0.000	0.000	0.000	5.888
8	-3.278	-2.856	0.000	0.000	0.000	9.991
11	-3.571	2.856	0.000	0.000	0.000	11.445

SUM: -22.810 0.000 0.000 (all nodes)

Max. residual: 1.240E-04 at DOFN: 3

(Reactions act on structure in positive global axis directions.)

MEMBER FORCES

CASE 1000: Sway {... Serviceability ...}

Member	Node	Axial kN	Shear-y kN	Shear-z kN	Torque kNm	Moment-y kNm	Moment-z kNm
1	1	1.878	-10.088	0.000	0.000	0.000	-17.590
	3	1.740	2.811	0.000	0.000	0.000	4.242
2	2	-1.734	2.613	0.000	0.000	0.000	8.244
	4	-1.738	2.252	0.000	0.000	0.000	-6.350
3	3	-8.064	1.765	0.000	0.000	0.000	4.242
	4	-8.064	1.765	0.000	0.000	0.000	-6.350
4	5	0.015	1.025	0.000	0.000	0.000	5.064
	7	0.011	0.663	0.000	0.000	0.000	0.000
6	8	2.490	2.788	0.000	0.000	0.000	8.589
	10	2.486	2.427	0.000	0.000	0.000	-7.054
8	11	-2.419	3.102	0.000	0.000	0.000	9.845
	13	-2.422	2.741	0.000	0.000	0.000	-7.682
14	4	-5.831	0.000	0.000	0.000	0.000	0.000
	7	-5.831	0.000	0.000	0.000	0.000	0.000
16	7	-5.168	0.000	0.000	0.000	0.000	0.000
	10	-5.168	0.000	0.000	0.000	0.000	0.000
18	10	-2.715	2.456	0.000	0.000	0.000	7.054
	13	-2.715	2.456	0.000	0.000	0.000	-7.682

Positive Forces (Member Axes):

Axial - Tension Shear - End A sagging
 Torque - Right-hand twist Moment - Sagging

SUPPORT REACTIONS

CASE 1000: Sway {... Serviceability ...}

Node	Force-X kN	Force-Y kN	Force-Z kN	Moment-X kNm	Moment-Y kNm	Moment-Z kNm
1	-10.108	-1.770	0.000	0.000	0.000	17.590
2	-2.594	1.761	0.000	0.000	0.000	8.244
5	-1.025	-0.004	0.000	0.000	0.000	5.064
8	-2.814	-2.460	0.000	0.000	0.000	8.589
11	-3.076	2.451	0.000	0.000	0.000	9.845

SUM: -19.617 -0.022 0.000 (all nodes)

(Reactions act on structure in positive global axis directions.)

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MEMBER FORCES

CASE 1500: Sway {... Ultimate ..}

Member	Node	Axial kN	Shear-y kN	Shear-z kN	Torque kNm	Moment-y kNm	Moment-z kNm
1	1	3.407	-17.598	0.000	0.000	0.000	<u>-30.684</u>
	3	2.989	4.898	0.000	0.000	0.000	7.415
2	2	-2.996	4.551	0.000	0.000	0.000	14.358
	4	-3.008	3.921	0.000	0.000	0.000	-11.059
3	3	-14.037	3.080	0.000	0.000	0.000	7.417
	4	-14.037	3.080	0.000	0.000	0.000	-11.060
4	5	0.033	1.787	0.000	0.000	0.000	8.833
	7	0.021	1.157	0.000	0.000	0.000	-0.001
6	8	4.374	4.866	0.000	0.000	0.000	15.000
	10	4.363	4.236	0.000	0.000	0.000	-12.308
8	11	-4.185	5.405	0.000	0.000	0.000	17.149
	13	-4.196	4.775	0.000	0.000	0.000	-13.392
14	4	-10.171	0.000	0.000	0.000	0.000	0.000
	7	-10.171	0.000	0.000	0.000	0.000	0.000
16	7	-9.014	0.000	0.000	0.000	0.000	0.000
	10	-9.014	0.000	0.000	0.000	0.000	0.000
18	10	-4.698	4.283	0.000	0.000	0.000	12.308
	13	-4.698	4.283	0.000	0.000	0.000	-13.392

Positive Forces (Member Axes):

Axial - Tension Shear - End A sagging
 Torque - Right-hand twist Moment - Sagging

SUPPORT REACTIONS

CASE 1500: Sway {... Ultimate ..}

Node	Force-X kN	Force-Y kN	Force-Z kN	Moment-X kNm	Moment-Y kNm	Moment-Z kNm
1	-17.658	-3.080	0.000	0.000	0.000	30.684
2	-4.495	3.080	0.000	0.000	0.000	14.358
5	-1.788	0.000	0.000	0.000	0.000	8.833
8	-4.946	-4.284	0.000	0.000	0.000	15.000
11	-5.327	4.284	0.000	0.000	0.000	17.149
SUM:	-34.214	0.000	0.000	(all nodes)		

(Reactions act on structure in positive global axis directions.)

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INPUT/ANALYSIS REPORT

Job: c1005_f2
 Title: Transport Canopy
 10.0m - Flat Roof - TC2 - 36m/s
 Type: Plane frame
 Date: 25 Sep 2001
 Time: 10:26 PM

Nodes 5
 Members 4
 Spring supports 0
 Sections 4
 Materials 1
 Primary load cases 7
 Combination load cases 15

Analysis: Non-linear elastic
 Update node coordinates Y
 Small displacement theory Y
 Include axial force effects Y
 Include flexural shortening N
 Convergence criterion: Residual
 Convergence tolerance 5.000E-04

LOAD CASES

Case	Type	Analysis	Title
1500	C	N	TOTAL 0.8(DL + Swt) + Wu1
1510	C	N	TOTAL 0.8(DL + Swt) + Wu2
1515	C	N	TOTAL 0.8(DL + Swt) + Wu3
1520	C	N	TOTAL 1.25(DL + Swt) + 1.5 LL
1521	C	N	TOTAL 1.25(DL + Swt) + 1.5 OPL

Analysis Types:
 S - Skipped (not analysed)
 L - Linear
 N - Non-linear

NODE TABLE NOT PRINTED
 MEMBER TABLE NOT PRINTED
 SECTION PROPERTY TABLE NOT PRINTED
 MATERIAL TABLE NOT PRINTED

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SIGN CONVENTION

Positive Forces (Member Axes):
 Axial - Tension Shear - End A sagging
 Torque - Right-hand twist Moment - Sagging

MEMBER FORCES

CASE 1500: TOTAL 0.8(DL + Swt) + Wu1

MEMBER 1: Nodes 1 - 3 Section 103: 125X125X4.0SHS Y

Point	Offset	Axial	Shear-y	Shear-z	Torque	Moment-y	Moment-z
	m	kN	kN	kN	kNm	kNm	kNm
1	0.00	16.192	-1.496	0.000	0.000	0.000	-0.550
2	1.20	16.331	-1.497	0.000	0.000	0.000	1.097
3	2.40	16.470	-1.498	0.000	0.000	0.000	2.774
4	3.60	16.609	-1.499	0.000	0.000	0.000	4.525
5	4.80	16.748	-1.500	0.000	0.000	0.000	6.397
6	6.00	16.887	-1.501	0.000	0.000	0.000	8.440

MEMBER 2: Nodes 2 - 5 Section 103: 125X125X4.0SHS Y

Point	Offset	Axial	Shear-y	Shear-z	Torque	Moment-y	Moment-z
-------	--------	-------	---------	---------	--------	----------	----------

	m	kN	kN	kN	kNm	kNm	kNm
1	0.00	17.764	-4.501	0.000	0.000	0.000	-11.640
2	1.31	17.916	-4.500	0.000	0.000	0.000	-5.745
3	2.62	18.067	-4.499	0.000	0.000	0.000	-0.051
4	3.93	18.219	-4.498	0.000	0.000	0.000	5.640
5	5.24	18.370	-4.497	0.000	0.000	0.000	11.525
6	6.55	18.522	-4.496	0.000	0.000	0.000	17.805

MEMBER 3: Nodes 3 - 4 Section 102: 200UB22.3 Y

Point Offset	Axial	Shear-y	Shear-z	Torque	Moment-y	Moment-z
m	kN	kN	kN	kNm	kNm	kNm
1	0.00	2.516	16.766	0.000	0.000	8.440
2	1.06	2.276	13.234	0.000	0.000	-7.481
3	2.12	2.036	9.702	0.000	0.000	-19.653
4	3.18	1.796	6.170	0.000	0.000	-28.076
5	4.25	1.556	2.638	0.000	0.000	-32.750
6	5.31	1.316	-0.894	0.000	0.000	-33.676

MEMBER 4: Nodes 4 - 5 Section 102: 200UB22.3 Y

Point Offset	Axial	Shear-y	Shear-z	Torque	Moment-y	Moment-z
m	kN	kN	kN	kNm	kNm	kNm
1	0.00	1.345	-0.850	0.000	0.000	-33.676
2	1.06	1.368	-4.390	0.000	0.000	-30.895
3	2.12	1.391	-7.931	0.000	0.000	-24.356
4	3.18	1.414	-11.471	0.000	0.000	-14.060
5	4.25	1.437	-15.011	0.000	0.000	-0.006
6	5.31	1.461	-18.552	0.000	0.000	17.806

SUPPORT REACTIONS

CASE 1500: TOTAL 0.8(DL + Swt) + Wu1

Node	Force-X	Force-Y	Force-Z	Moment-X	Moment-Y	Moment-Z
	kN	kN	kN	kNm	kNm	kNm
1	-1.374	-16.203	0.000	0.000	0.000	0.550
2	4.627	-17.732	0.000	0.000	0.000	-11.640

SUM: 3.253 -33.935 0.000 (all nodes)

(Reactions act on structure in positive global axis directions.)

SIGN CONVENTION

Positive Forces (Member Axes):

- Axial - Tension
- Shear - End A sagging
- Torque - Right-hand twist
- Moment - Sagging

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MEMBER FORCES

CASE 1510: TOTAL 0.8(DL + Swt) + Wu2

MEMBER 1: Nodes 1 - 3 Section 103: 125X125X4.0SHS Y

Point Offset	Axial	Shear-y	Shear-z	Torque	Moment-y	Moment-z
m	kN	kN	kN	kNm	kNm	kNm
1	0.00	22.025	-3.763	0.000	0.000	-6.573
2	1.20	22.164	-3.763	0.000	0.000	-2.209
3	2.40	22.303	-3.763	0.000	0.000	2.076
4	3.60	22.442	-3.764	0.000	0.000	6.435
5	4.80	22.581	-3.764	0.000	0.000	11.025
6	6.00	22.720	-3.764	0.000	0.000	16.009

MEMBER 2: Nodes 2 - 5 Section 103: 125X125X4.0SHS Y

Point Offset	Axial	Shear-y	Shear-z	Torque	Moment-y	Moment-z
m	kN	kN	kN	kNm	kNm	kNm
1	0.00	21.875	-4.262	0.000	0.000	-9.711
2	1.31	22.026	-4.262	0.000	0.000	-4.226
3	2.62	22.178	-4.262	0.000	0.000	1.079
4	3.93	22.330	-4.261	0.000	0.000	6.429

5	5.24	22.481	-4.261	0.000	0.000	0.000	12.050
6	6.55	22.633	-4.260	0.000	0.000	0.000	18.182

MEMBER 3: Nodes 3 - 4 Section 102: 200UB22.3 Y

Point	Offset m	Axial kN	Shear-y kN	Shear-z kN	Torque kNm	Moment-y kNm	Moment-z kNm
1	0.00	5.340	22.401	0.000	0.000	0.000	16.010
2	1.06	5.388	17.857	0.000	0.000	0.000	-5.355
3	2.12	5.436	13.312	0.000	0.000	0.000	-21.896
4	3.18	5.484	8.767	0.000	0.000	0.000	-33.614
5	4.25	5.531	4.222	0.000	0.000	0.000	-40.508
6	5.31	5.579	-0.322	0.000	0.000	0.000	-42.578

MEMBER 4: Nodes 4 - 5 Section 102: 200UB22.3 Y

Point	Offset m	Axial kN	Shear-y kN	Shear-z kN	Torque kNm	Moment-y kNm	Moment-z kNm
1	0.00	5.588	-0.091	0.000	0.000	0.000	-42.577
2	1.06	5.608	-4.634	0.000	0.000	0.000	-40.070
3	2.12	5.628	-9.177	0.000	0.000	0.000	-32.740
4	3.18	5.649	-13.721	0.000	0.000	0.000	-20.588
5	4.25	5.669	-18.264	0.000	0.000	0.000	-3.614
6	5.31	5.689	-22.807	0.000	0.000	0.000	18.182

SUPPORT REACTIONS

CASE 1510: TOTAL 0.8(DL + Swt) + Wu2

Node	Force-X kN	Force-Y kN	Force-Z kN	Moment-X kNm	Moment-Y kNm	Moment-Z kNm
1	-3.712	-22.033	0.000	0.000	0.000	6.573
2	4.315	-21.864	0.000	0.000	0.000	-9.711
SUM:	0.603	-43.897	0.000	(all nodes)		

(Reactions act on structure in positive global axis directions.)

SIGN CONVENTION

Positive Forces (Member Axes):

- Axial - Tension
- Shear - End A sagging
- Torque - Right-hand twist
- Moment - Sagging

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MEMBER FORCES

CASE 1515: TOTAL 0.8(DL + Swt) + Wu3

MEMBER 1: Nodes 1 - 3 Section 103: 125X125X4.0SHS Y

Point	Offset m	Axial kN	Shear-y kN	Shear-z kN	Torque kNm	Moment-y kNm	Moment-z kNm
1	0.00	21.783	-6.208	0.000	0.000	0.000	-13.994
2	1.20	21.921	-6.081	0.000	0.000	0.000	-6.639
3	2.40	22.060	-5.954	0.000	0.000	0.000	0.328
4	3.60	22.198	-5.827	0.000	0.000	0.000	7.153
5	4.80	22.336	-5.700	0.000	0.000	0.000	14.079
6	6.00	22.474	-5.573	0.000	0.000	0.000	21.350

MEMBER 2: Nodes 2 - 5 Section 103: 125X125X4.0SHS Y

Point	Offset m	Axial kN	Shear-y kN	Shear-z kN	Torque kNm	Moment-y kNm	Moment-z kNm
1	0.00	19.444	-2.156	0.000	0.000	0.000	-2.764
2	1.31	19.595	-2.156	0.000	0.000	0.000	-0.134
3	2.62	19.747	-2.157	0.000	0.000	0.000	2.493
4	3.93	19.898	-2.158	0.000	0.000	0.000	5.214
5	5.24	20.050	-2.159	0.000	0.000	0.000	8.133
6	6.55	20.202	-2.160	0.000	0.000	0.000	11.360

MEMBER 3: Nodes 3 - 4 Section 102: 200UB22.3 Y

Point	Offset	Axial	Shear-y	Shear-z	Torque	Moment-y	Moment-z
-------	--------	-------	---------	---------	--------	----------	----------

	m	kN	kN	kN	kNm	kNm	kNm
1	0.00	3.605	22.235	0.000	0.000	0.000	21.350
2	1.06	3.652	17.961	0.000	0.000	0.000	0.018
3	2.12	3.699	13.687	0.000	0.000	0.000	-16.778
4	3.18	3.746	9.413	0.000	0.000	0.000	-29.038
5	4.25	3.793	5.139	0.000	0.000	0.000	-36.761
6	5.31	3.840	0.865	0.000	0.000	0.000	-39.948

MEMBER 4: Nodes 4 - 5 Section 102: 200UB22.3 Y

Point	Offset	Axial	Shear-y	Shear-z	Torque	Moment-y	Moment-z
	m	kN	kN	kN	kNm	kNm	kNm
1	0.00	3.803	1.014	0.000	0.000	0.000	-39.947
2	1.06	3.825	-3.259	0.000	0.000	0.000	-38.755
3	2.12	3.846	-7.532	0.000	0.000	0.000	-33.029
4	3.18	3.867	-11.804	0.000	0.000	0.000	-22.767
5	4.25	3.888	-16.077	0.000	0.000	0.000	-7.971
6	5.31	3.909	-20.350	0.000	0.000	0.000	11.361

SUPPORT REACTIONS

CASE 1515: TOTAL 0.8(DL + Swt) + Wu3

Node	Force-X	Force-Y	Force-Z	Moment-X	Moment-Y	Moment-Z
	kN	kN	kN	kNm	kNm	kNm
1	-6.358	-21.740	0.000	0.000	0.000	13.994
2	2.038	-19.456	0.000	0.000	0.000	-2.764

SUM: -4.320 -41.196 0.000 (all nodes)

(Reactions act on structure in positive global axis directions.)

SIGN CONVENTION

Positive Forces (Member Axes):

- Axial - Tension
- Torque - Right-hand twist
- Shear - End A sagging
- Moment - Sagging

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MEMBER FORCES

CASE 1520: TOTAL 1.25(DL + Swt) + 1.5 LL

MEMBER 1: Nodes 1 - 3 Section 103: 125X125X4.0SHS Y

Point	Offset	Axial	Shear-y	Shear-z	Torque	Moment-y	Moment-z
	m	kN	kN	kN	kNm	kNm	kNm
1	0.00	-18.302	3.001	0.000	0.000	0.000	5.787
2	1.20	-18.085	3.002	0.000	0.000	0.000	2.093
3	2.40	-17.868	3.002	0.000	0.000	0.000	-1.659
4	3.60	-17.651	3.002	0.000	0.000	0.000	-5.366
5	4.80	-17.434	3.002	0.000	0.000	0.000	-8.921
6	6.00	-17.217	3.003	0.000	0.000	0.000	-12.225

MEMBER 2: Nodes 2 - 5 Section 103: 125X125X4.0SHS Y

Point	Offset	Axial	Shear-y	Shear-z	Torque	Moment-y	Moment-z
	m	kN	kN	kN	kNm	kNm	kNm
1	0.00	-18.212	3.042	0.000	0.000	0.000	7.071
2	1.31	-17.975	3.042	0.000	0.000	0.000	3.015
3	2.62	-17.739	3.042	0.000	0.000	0.000	-1.140
4	3.93	-17.502	3.041	0.000	0.000	0.000	-5.257
5	5.24	-17.265	3.041	0.000	0.000	0.000	-9.199
6	6.55	-17.028	3.041	0.000	0.000	0.000	-12.834

MEMBER 3: Nodes 3 - 4 Section 102: 200UB22.3 Y

Point	Offset	Axial	Shear-y	Shear-z	Torque	Moment-y	Moment-z
	m	kN	kN	kN	kNm	kNm	kNm
1	0.00	-3.631	-17.095	0.000	0.000	0.000	-12.225
2	1.06	-3.510	-13.673	0.000	0.000	0.000	4.104
3	2.12	-3.389	-10.250	0.000	0.000	0.000	16.800
4	3.18	-3.268	-6.828	0.000	0.000	0.000	25.863

5	4.25	-3.147	-3.406	0.000	0.000	0.000	31.295
6	5.31	-3.026	0.016	0.000	0.000	0.000	33.093

MEMBER 4: Nodes 4 - 5 Section 102: 200UB22.3 Y

Point	Offset m	Axial kN	Shear-y kN	Shear-z kN	Torque kNm	Moment-y kNm	Moment-z kNm
1	0.00	-3.024	0.113	0.000	0.000	0.000	33.094
2	1.06	-2.793	3.530	0.000	0.000	0.000	31.161
3	2.12	-2.563	6.946	0.000	0.000	0.000	25.601
4	3.18	-2.332	10.363	0.000	0.000	0.000	16.416
5	4.25	-2.102	13.779	0.000	0.000	0.000	3.604
6	5.31	-1.871	17.196	0.000	0.000	0.000	-12.835

SUPPORT REACTIONS

CASE 1520: TOTAL 1.25(DL + Swt) + 1.5 LL

Node	Force-X kN	Force-Y kN	Force-Z kN	Moment-X kNm	Moment-Y kNm	Moment-Z kNm
1	3.025	18.298	0.000	0.000	0.000	-5.787
2	-3.025	18.215	0.000	0.000	0.000	7.071

SUM: 0.000 36.514 0.000 (all nodes)

(Reactions act on structure in positive global axis directions.)

SIGN CONVENTION

Positive Forces (Member Axes):

- Axial - Tension
- Shear - End A sagging
- Torque - Right-hand twist
- Moment - Sagging

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MEMBER FORCES

CASE 1521: TOTAL 1.25(DL + Swt) + 1.5 OPL

MEMBER 1: Nodes 1 - 3 Section 103: 125X125X4.0SHS Y

Point	Offset m	Axial kN	Shear-y kN	Shear-z kN	Torque kNm	Moment-y kNm	Moment-z kNm
1	0.00	-9.702	1.805	0.000	0.000	0.000	3.448
2	1.20	-9.484	1.805	0.000	0.000	0.000	1.255
3	2.40	-9.267	1.805	0.000	0.000	0.000	-0.957
4	3.60	-9.050	1.805	0.000	0.000	0.000	-3.156
5	4.80	-8.833	1.806	0.000	0.000	0.000	-5.308
6	6.00	-8.616	1.806	0.000	0.000	0.000	-7.383

MEMBER 2: Nodes 2 - 5 Section 103: 125X125X4.0SHS Y

Point	Offset m	Axial kN	Shear-y kN	Shear-z kN	Torque kNm	Moment-y kNm	Moment-z kNm
1	0.00	-9.681	1.817	0.000	0.000	0.000	4.171
2	1.31	-9.444	1.817	0.000	0.000	0.000	1.771
3	2.62	-9.207	1.817	0.000	0.000	0.000	-0.660
4	3.93	-8.970	1.817	0.000	0.000	0.000	-3.080
5	5.24	-8.733	1.817	0.000	0.000	0.000	-5.446
6	6.55	-8.497	1.816	0.000	0.000	0.000	-7.719

MEMBER 3: Nodes 3 - 4 Section 102: 200UB22.3 Y

Point	Offset m	Axial kN	Shear-y kN	Shear-z kN	Torque kNm	Moment-y kNm	Moment-z kNm
1	0.00	-2.166	-8.532	0.000	0.000	0.000	-7.383
2	1.06	-2.123	-7.497	0.000	0.000	0.000	1.123
3	2.12	-2.080	-6.461	0.000	0.000	0.000	8.530
4	3.18	-2.037	-5.426	0.000	0.000	0.000	14.839
5	4.25	-1.994	-4.391	0.000	0.000	0.000	20.049
6	5.31	-1.951	-3.355	0.000	0.000	0.000	24.159

MEMBER 4: Nodes 4 - 5 Section 102: 200UB22.3 Y

Point	Offset m	Axial kN	Shear-y kN	Shear-z kN	Torque kNm	Moment-y kNm	Moment-z kNm
-------	-------------	-------------	---------------	---------------	---------------	-----------------	-----------------

	m	kN	kN	kN	kNm	kNm	kNm
1	0.00	-1.604	3.421	0.000	0.000	0.000	24.159
2	1.06	-1.540	4.455	0.000	0.000	0.000	19.979
3	2.12	-1.477	5.490	0.000	0.000	0.000	14.701
4	3.18	-1.413	6.524	0.000	0.000	0.000	8.326
5	4.25	-1.350	7.558	0.000	0.000	0.000	0.852
6	5.31	-1.286	8.593	0.000	0.000	0.000	-7.719

SUPPORT REACTIONS

CASE 1521: TOTAL 1.25(DL + Swt) + 1.5 OPL

Node	Force-X kN	Force-Y kN	Force-Z kN	Moment-X kNm	Moment-Y kNm	Moment-Z kNm
1	1.812	9.700	0.000	0.000	0.000	-3.448
2	-1.812	9.682	0.000	0.000	0.000	4.171

SUM: 0.000 19.382 0.000 (all nodes)

(Reactions act on structure in positive global axis directions.)

SAMPLE

EXAMPLE

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