NumberBuilding Act 1993
Section 238(1)(a)
Building Regulations 2018
REGULATION 126: CERTIFICATE OF COMPLIANCE FOR PROPOSED BUILDING WORK

This certificate is issued to:
Relevant Building Surveyor:
Postal Address:
Email Address:

This certificate is issued in relation to the proposed building work at:

Address of Building: **Various in the state**

Nature of proposed building work:
Construction of a *GAZEBO* to NCC – BCA 2022 Volume 2
- Mimosa Outdoor Timber Gazebo (4.27m x 3.69m x 3.23m (H))

Building classification as per NCC 2022:
Class 10a (Gazebo)

Prescribed classes of building work for which this certificate is issued:
Design or part of the design of building work in relation to *structural matter*

Design & Reference Documents:

Ref. No.	Rev.	Date	Document Type	Pages	Prepared By
AJN-2023-008-D	*A*	*20/03/2023*	*Structural Drawings*	*S01*	*AJN Consulting Engineers*
AJN-2023-008-C	*A*	*20/03/2023*	*Structural Design Calculations*	*71*	*AJN Consulting Engineers*

The design certified by this certificate complies with the following provisions of the Building Act 1993, Building Regulations 2018 or National Construction Code:

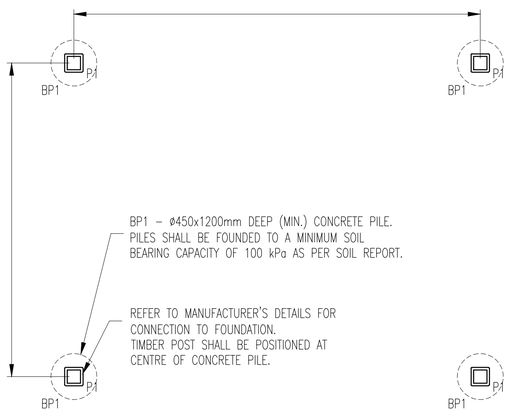
Act, Regulation or NCC	Section, Regulation, Part, Performance Requirement or other Provision
NCC – BCA Vol. 2	*PART H1*
Australian Standards	*AS/NZS1170.0-2002, AS/NZS1170.1-2002, AS/NZS1170.2-2011, AS1720.1-2010, AS3600-2018, AS4100-1998.*

I prepared the design, or part of the design, set out in the documents listed above.
I certify that the design set out in the documents listed above complies with the provisions set out above.
I believe that I hold the required skills, experience, and knowledge to issue this certificate and can demonstrate this if requested to do so.

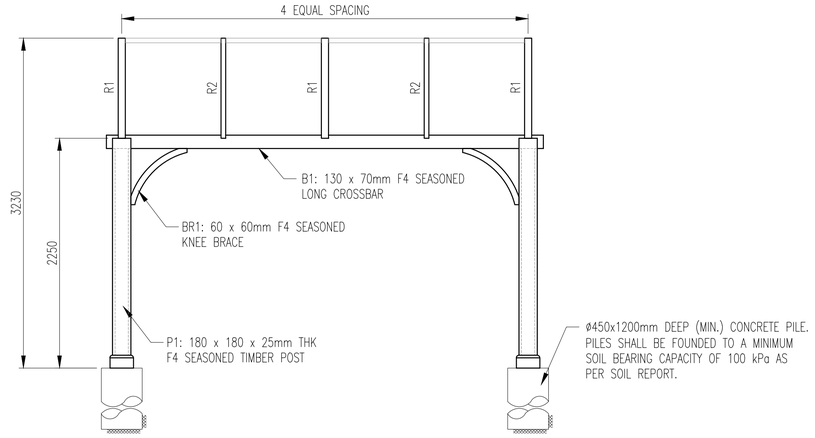
Engineer:
Name: Juan Angelo Nogoy
Category and class: Engineer (Civil)
Registration No.: PE0002241
Address: 1/7 Blossom Lane, Werribee VIC 3030
Email: angelo.nogoy@gmail.com
Date of issue of certificate: **04/12/2023**

Signed:

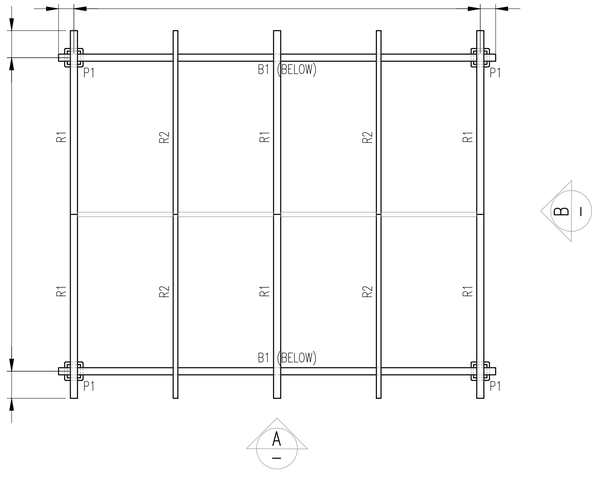
AJN-2023-008-D



FOUNDATION PLAN
SCALE: 1:30



LONGITUDINAL ELEVATION – A
SCALE: 1:30

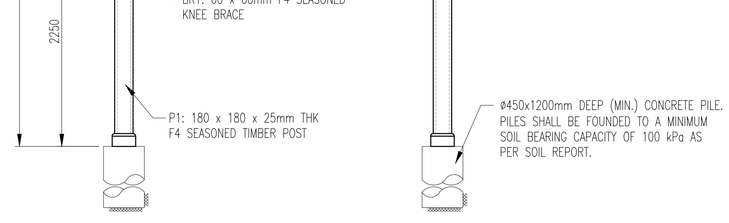


GAZEBO PLAN
SCALE: 1:30

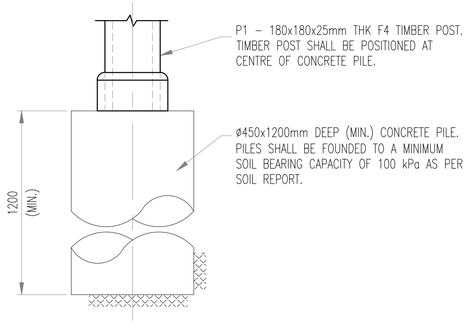
NOTE: ROOF AND TIMBER BATTENS ARE NOT SHOWN FOR CLARITY.
REFER TO MANUFACTURER'S DETAILS FOR CONNECTION DETAILS
AND EXACT SETTING OUT DIMENSIONS.

LEGEND:

B1	LONG CROSSBAR	130 x 70mm F4 SEASONED
B2	SHORT CROSSBAR	120 x 70mm F4 SEASONED
P1	POST	180 x 180 x 25mm THK F4 SEASONED
BR1	KNEE BRACE	60 x 60mm F4 SEASONED
R1	ROOF RAFTER	90 x 65mm F4 SEASONED
R2	INTERMEDIATE RAFTER	90 x 45mm F4 SEASONED



TRANSVERSE ELEVATION – B
SCALE: 1:30



TYPICAL PILE DETAIL
SCALE: 1:10

GENERAL NOTES:

1. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS AND LEVELS ON SITE, AND RESOLVE ALL DISCREPANCIES WITH THE ARCHITECT OR ENGINEER PRIOR TO COMMENCEMENT OF WORK.
2. DRAWING INDICATES GENERAL & TYPICAL DETAILS OF CONSTRUCTION. WHERE CONDITIONS ARE OF SIMILAR CHARACTER TO DETAILS SHOWN AND ALTHOUGH NOT SPECIFICALLY INDICATED, SIMILAR DETAILS OF CONSTRUCTION SHALL BE USED SUBJECT TO REVIEW AND APPROVAL BY THE ENGINEER. PRIOR TO COMMENCEMENT OF WORKS, THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS AND LEVELS IN THE CONTRACT DRAWINGS. DISCREPANCIES IN DRAWINGS ARISING FROM SUCH VERIFICATION WORKS SHALL BE BROUGHT TO THE ATTENTION OF THE ARCHITECT/ENGINEER.
3. THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR ENSURING TOTAL COORDINATION OF ALL WORKS AND SHALL TAKE SITE MEASUREMENTS PRIOR TO THE PREPARATION OF ANY SHOP DRAWINGS OR BEFORE COMMENCING FABRICATION.
4. ALL DIMENSIONS ARE IN MM UNLESS NOTED OTHERWISE.
5. FOUNDATION MATERIAL SHALL BE APPROVED PRIOR TO POURING CONCRETE FOR A MINIMUM BEARING CAPACITY OF 100kPa, UNLESS NOTED OTHERWISE.
6. ALL DETAILS SHOWN ARE FOR STRUCTURAL PURPOSES ONLY. THE ARCHITECT AND BUILDER MUST ENSURE ALL CONSTRUCTION REQUIREMENTS SET BY BCA (NCC) ARE MET.

CODES OF PRACTICE:

WHERE APPLICABLE, ALL STANDARDS FOR LOADINGS, MATERIALS AND WORKMANSHIP SHALL CONFORM TO THE CODES OF PRACTICE BELOW AND SPECIFIED IN THE BCA (NCC) APPROVED DOCUMENTS:
A) LOADING TO AS/NZS 1170.0:2002, AS/NZS 1170.1:2002, AS/NZS 1170.2:2011
B) STRUCTURAL CONCRETE TO AS 3600:2018
C) STRUCTURAL STEEL TO AS 4100:1998
D) STRUCTURAL TIMBER TO AS 1720:2010

STRUCTURAL STEELWORK:

1. QUALITY OF STRUCTURAL STEEL AND ALL WORKMANSHIP SHALL BE IN ACCORDANCE WITH AS 4100:1998.
2. ALL WELDING SHALL BE IN ACCORDANCE WITH AS 1554 WELDING CODE AND SHALL ONLY BE PERFORMED BY AN EXPERIENCED OPERATOR.
3. ALL BOLTS SHALL BE GRADE 8.8 HIGH STRENGTH BOLTS AND TIGHTENED TO A SNUG FIT, UNLESS NOTED OTHERWISE.
4. ALL STAINLESS STEEL SHALL BE OF GRADE SS 304, UNLESS NOTED OTHERWISE.

STRUCTURAL TIMBER:

1. ALL TIMBER SHALL BE THE BEST QUALITY OF THE SPECIES AND GRADES SPECIFIED, AND SHALL COMPLY WITH THE RELEVANT AUSTRALIAN STANDARDS. STRUCTURAL TIMBER SHALL COMPLY WITH AS 1720.1.
2. TIMBER SHALL BE STRAIGHT, SOUND, WELL SEASONED, FREE FROM SIGNIFICANT DEFECTS INCLUDING WHITE ANT, BORER, SAP, LOOSE KNOTS, WARP, TWIST, FRACTURES, AND HOLES.
3. TIMBER IN CONTACT WITH GROUND TO BE DURABILITY CLASS 1 AS DEFINED IN AS 1684 APPENDIX A.
4. ALL EXPOSED TIMBERS OR MEMBERS IN POORLY VENTILATED AREAS TO BE DURABILITY CLASS 2 AS DEFINED IN AS1684 APPENDIX A.
5. ALL DIMENSIONS SHOWN ARE MINIMUM REQUIREMENTS FOR STRUCTURAL DESIGN AND SHALL BE VERIFIED WITH MANUFACTURER. MINOR MEMBERS AND MEMBER PROTRUSIONS THAT DO NOT AFFECT THE STRENGTH OF THE STRUCTURE ARE NOT SHOWN FOR CLARITY. THE ENGINEER SHALL BE INFORMED OF ANY DISCREPANCY.
6. REFER TO MANUFACTURER'S DETAILS FOR EXACT MEMBER SIZES, CONNECTION DETAILS, AND SETTING OUT REQUIREMENTS.

STRUCTURAL CONCRETE

1. ALL CONCRETE WORKMANSHIP SHALL BE IN ACCORDANCE WITH SAA CONCRETE STRUCTURES CODE AS 3600:2001.
2. MINIMUM CONCRETE GRADE FOR ALL STRUCTURES SHALL BE GRADE 25MPa, UNLESS NOTED OTHERWISE.
3. CONCRETE SIZES SHOWN DO NOT INCLUDE FINISH AND MUST NOT BE REDUCED OR MEMBERS PENETRATED IN ANY WAY WITHOUT THE ENGINEER'S APPROVAL.

DESIGN LOADINGS:	
SUPERIMPOSED DEAD LOAD	0.5 kPa
LIVE LOAD	0.25 kPa
WIND LOAD (DESIGN WIND SPEED)	41 m/s

SUBMISSION DRAWING

REV	DESCRIPTION	DATE	APPD
A	SUBMISSION DRAWING	20/03/2023	AN

PROJECT TITLE :
PROPOSED MIMOSA OUTDOOR TIMBER GAZEBO
4.27M x 3.69M x 3.23M (H)

CLIENT:
EDCO International AUS PTY LTD
OFFICE 4 / LEVEL 3, 28 MAIN STREET
MORNINGTON, VIC 3931

STRUCTURAL ENGINEERING CONSULTANT :
AJN Consulting Engineers
Tel. +61 4 2434 1405
E-mail: angelo.nogoy@gmail.com

DRAWN BY:	JN	DATE:	MAR 2023
DESIGNED BY:	AN	SCALE:	AS SHOWN
APPROVED BY:	AN		

DRAWING TITLE:
GAZEBO
PLANS, ELEVATION, AND DETAILS

DRAWING NO.
AJN-2023-008-S01

STATUS: P [X] S T C A

Ref: AJN-2023-008-C (Rev A)

PROPOSED MIMOSA OUTDOOR TIMBER GAZEBO 4.27m x 3.69m x 3.23m (H)

STRUCTURAL DESIGN CALCULATION

(Revision A)

AJN Consulting Engineers

Civil & Structural Engineers

0424341405 angelo.nogoy@gmail.com

20 MARCH 2023

TABLE OF CONTENTS

STRUCTURAL DESIGN SUMMARY

1.0 DESIGN INFORMATION AND CRITERIA

1.1 Design Codes

All structural elements are designed in accordance to Australian Standards; hence the structural design of all civil and structural engineering works shall therefore be documented in accordance with, but not limited to, the latest edition of the following:

Codes/Standards	Description
AS/NZS 1170	Structural Design Actions
AS 3600	Design of Concrete Structures
AS 4100	Design of Steel Structures
AS 1720	Design of Timber Structures

Table 1. Design Code of Practice

1.2 Design Loadings

1.2.1 Permanent actions (G)

Description	Dead Load (kN/m^2)
Self-weight	as per material density
Roof	0.50

Table 2. Design Dead Loads

1.2.2 Imposed actions (Q)

Description	Dead Load (kN/m^2)
Roof	0.25

Table 3. Design Live Load

1.2.3 Wind Actions (W)

The following parameters were used in calculating the design and service wind loads applied on the structure.

Description	Value
Region Site Exposure Classification (non-cyclonic)	A5
Average Recurrence Interval (Design), R	100 years
Average Recurrence Interval (Serviceability), R	25 years

Table 4. Wind Load Parameters

1.2.4 Load Combinations

All design load combinations are in accordance to Australian Standards requirements for serviceability and ultimate limit stages.

Design Load Combinations:

a. 1.35 G
b. 1.2 G + 1.5 Q
c. 1.2 G + W
d. 0.9 G + W

Serviceability Load Combinations:

a. 0.7 Q
b. G + 0.4 Q
c. G + W

1.3 Material Strengths – Structural Timber

The minimum structural timber strengths defined in the calculation report are of an appropriate range as shown below:

Property (Grade – F4)		Value
Modulus of Elasticity	E	6,100 MPa
Modulus of Rigidity	G	410 MPa
Density	ρ	350 kg/m^3
Bending	f'_b	12 MPa
Tension – parallel to grain	f'_t	5.8 MPa
Shear	f'_s	1.3 MPa
Compression – parallel to grain	f'_c	8.6 MPa
Bearing – perpendicular to grain	f'_p	6.8 MPa
Bearing – parallel to grain	f'_l	20 MPa

Table 5. Minimum Material Strengths for Structural Timber

1.4 Soil Bearing Capacity

The minimum soil bearing capacity defined in the calculation report is 100 kPa.

Actual soil bearing capacity is required to be verified for each site.

STRUCTURAL ANALYSIS AND DESIGN

v1.0

WIND SPEED CALCULATION

(AS/NZS 1170.2:2011)

Project No.	2023-008	Project Name	Mimosa Outdoor Gazebo (4.27m x 3.69m x 3.23m)
Designed by	AN	Date	20 March 2023

SUMMARY OF RESULTS

Design Wind Speed, $V_{des,\theta}$	(ULS)	40.87	m/s
Service Wind Speed, $V_{des,\theta}$	(SLS)	36.89	m/s

1. Regional Gust Wind Speed

Region Site Exposure		A5		*Non-cyclonic* *AS/NZS 1170.2 Figure 3.1(A)*
Average Recurrance Interval, R	(ULS)	100	years	*for Ultimate Limit State*
Average Recurrance Interval, R	(SLS)	25	years	*for Serviceability Limit State*
Regional Gust Wind Speed, V_R	(ULS)	41	m/s	*AS/NZS 1170.2 Table 3.1*
Regional Gust Wind Speed, V_R	(SLS)	37	m/s	*AS/NZS 1170.2 Table 3.1*

2. Site Exposure Multipliers

a. Wind Direction Multiplier

Cardinal Direction	Any Direction		
Wind Direction Multiplier, M_d	1.00		*AS/NZS 1170.2 Table 3.2*

b. Terrain/Height Multiplier

Terrain Category	TC 1		*AS/NZS 1170.2 Sec 4.2.1*
Height of building, z	3.23	m	
Terrain/Height Multiplier, $M_{z,cat}$	0.9969		*AS/NZS 1170.2 Table 4.1*

c. Shielding Multiplier, M_s

	1.00		*No shielding* *AS/NZS 1170.2 Sec 4.3*

d. Topographic Multiplier

Hill-shape Multiplier, M_h	1.00		*AS/NZS 1170.2 Sec 4.4.2*
Lee Multiplier, M_{lee}	1.00		*AS/NZS 1170.2 Sec 4.4.3*
Site elevation above mean sea level, E	30	m	
Topographic Multiplier, M_t	1.00		*AS/NZS 1170.2 Sec 4.4*

For sites where E > 500m: $M_t = M_h \; M_{lee} \; (1 + 0.00015\,E)$

Elsewhere, M_t = larger value of M_h and M_{lee}

3. Wind Speed

AS/NZS 1170.2 Sec 2.3

Design Wind Speed, $V_{des,\theta}$	(ULS)	40.87	m/s	*for Ultimate Limit State*
Service Wind Speed, $V_{des,\theta}$	(SLS)	36.89	m/s	*for Serviceability Limit State*

$V_{des,\theta} = V_{sit,\beta} = V_R \; M_d \; (M_{z,cat} \; M_s \; M_t)$

WIND PRESSURES FOR PITCHED FREE ROOF

(AS/NZS 1170.2:2011)

Project No.	2023-008	Project Name	Mimosa Outdoor Gazebo (4.27m x 3.69m x 3.23m)
Designed by	AN	Date	20 March 2023

1. Design Information

Roof Pitch	28	°	
Knee Height	2.35	m	
Building Width, d	3.35	m	
Building Length, L	4.21	m	
Average Height, h	3.24	m	
Blockage under roof (goods or materials)	Blocked under		*Blockage > 75%*

2. Net Pressure Coefficients, $C_{p,n}$

AS/NZS 1170.2 Table D4(A)

a. Transverse Wind (θ = 0°)

Roof, Set 1

Pressure coefficient (windward), $C_{p,w}$	-0.6
Pressure coefficient (leeward), $C_{p,l}$	-1.2

Roof, Set 2

Pressure coefficient (windward), $C_{p,w}$	-0.6
Pressure coefficient (leeward), $C_{p,l}$	-1.2

c. Longitudinal Wind (θ = 90°)

Roof, Set 1

Pressure coefficient (windward), $C_{p,w}$	-1.2
Pressure coefficient (leeward), $C_{p,l}$	-0.9

Roof, Set 2

Pressure coefficient (windward), $C_{p,w}$	-1.2
Pressure coefficient (leeward), $C_{p,l}$	-0.9

3. Aerodynamic Shape Factor

Area Reduction Factor, K_a			1.0	*AS/NZS 1170.2 Appendix D1.2*
Local Pressure Factor, K_l			1.0	*AS/NZS 1170.2 Appendix D1.3*
Aerodynamic Shape Factor, C_{fig}	$C_{p,n}$ x		1.0	*for net pressure on free roofs*
$C_{fig} = C_{p,n} K_a K_l$				*AS/NZS 1170.2 Appendix D3.1*
Aerodynamic Shape Factor, C_{fig}			0.02	*for frictional drag forces*
$C_{fig} = C_f$				*AS/NZS 1170.2 Appendix D3.2*

4. Dynamic Response Factor, C_{dyn}

1.0 *AS/NZS 1170.2 Sec 6.1*

WIND PRESSURES FOR PITCHED FREE ROOF

(AS/NZS 1170.2:2011)

Project No.	2023-008	Project Name	Mimosa Outdoor Gazebo (4.27m x 3.69m x 3.23m)
Designed by	AN	Date	20 March 2023

5. Design Wind Pressure for Roof (ULS) *AS/NZS 1170.2 Sec 2.4.1*

$p_u = (0.5\ \rho_{air})\ [V_{des,\theta}]^2\ C_{fig}\ C_{dyn}$

Density of air, ρ_{air}		1.2 kg/m^3	
Design Wind Speed, $V_{des,\theta}$	(ULS)	40.87 m/s	*for Ultimate Limit State*

a. Transverse Wind (θ = 0°)

Roof, Set 1

Design wind pressure, p_u (windward half)	-0.61 kPa
Design wind pressure, p_u (leeward half)	-1.25 kPa

Roof, Set 2

Design wind pressure, p_u (windward half)	-0.61 kPa
Design wind pressure, p_u (leeward half)	-1.25 kPa

c. Longitudinal Wind (θ = 90°)

Roof, Set 1

Design wind pressure, p_u (windward half)	-1.20 kPa
Design wind pressure, p_u (leeward half)	-0.90 kPa

Roof, Set 2

Design wind pressure, p_u (windward half)	-1.20 kPa
Design wind pressure, p_u (leeward half)	-0.90 kPa

6. Service Wind Pressure for Roof (SLS) *AS/NZS 1170.2 Sec 2.4.1*

$p_s = (0.5\ \rho_{air})\ [V_{des,\theta}]^2\ C_{fig}\ C_{dyn}$

Density of air, ρ_{air}		1.2 kg/m^3	
Service Wind Speed, $V_{des,\theta}$	(SLS)	36.89 m/s	*for Serviceability Limit State*

a. Transverse Wind (θ = 0°)

Roof, Set 1

Service wind pressure, p_s (windward half)	-0.50 kPa
Service wind pressure, p_s (leeward half)	-1.02 kPa

Roof, Set 2

Service wind pressure, p_s (windward half)	-0.50 kPa
Service wind pressure, p_s (leeward half)	-1.02 kPa

c. Longitudinal Wind (θ = 90°)

Roof, Set 1

Service wind pressure, p_s (windward half)	-0.98 kPa
Service wind pressure, p_s (leeward half)	-0.73 kPa

Roof, Set 2

Service wind pressure, p_s (windward half)	-0.98 kPa
Service wind pressure, p_s (leeward half)	-0.73 kPa

v1.0

DESIGN LOADING
(AS/NZS 1170.2:2011)

Project No.	2023-008	Project Name	Mimosa Outdoor Gazebo (4.27m x 3.69m x 3.23m)
Designed by	AN	Date	20 March 2023

1. Design Information

Tributary Width 1.05 m

2. Permanent Actions (G)

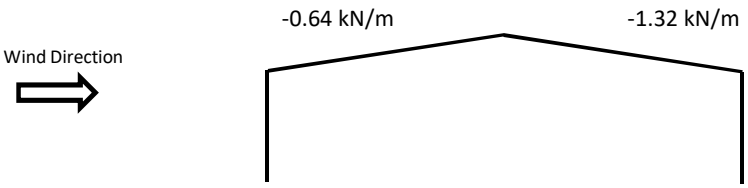
Selfweight

Roof 0.5 kPa x 1.052 = 0.53 kN/m

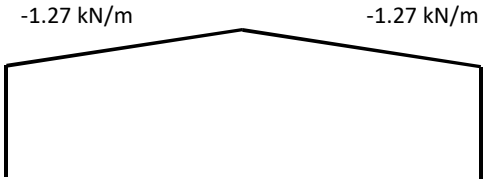
3. Imposed Actions (Q) 0.25 kPa x 1.052 = 0.26 kN/m

4. Wind Actions (W)

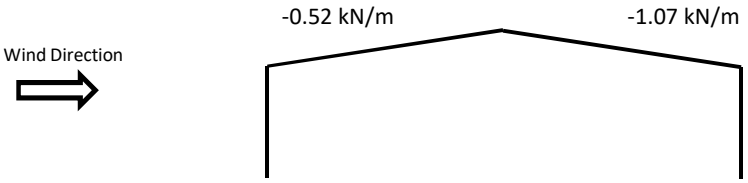
Design Transverse Wind Force (θ = 0°) *for Ultimate Limit State*



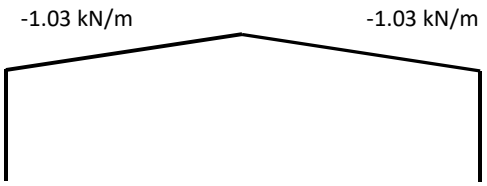
Design Longitudinal Wind Force (θ = 90°) *for Ultimate Limit State*



Service Transverse Wind Force (θ = 0°) *for Serviceability Limit State*



Service Longitudinal Wind Force (θ = 90°) *for Serviceability Limit State*

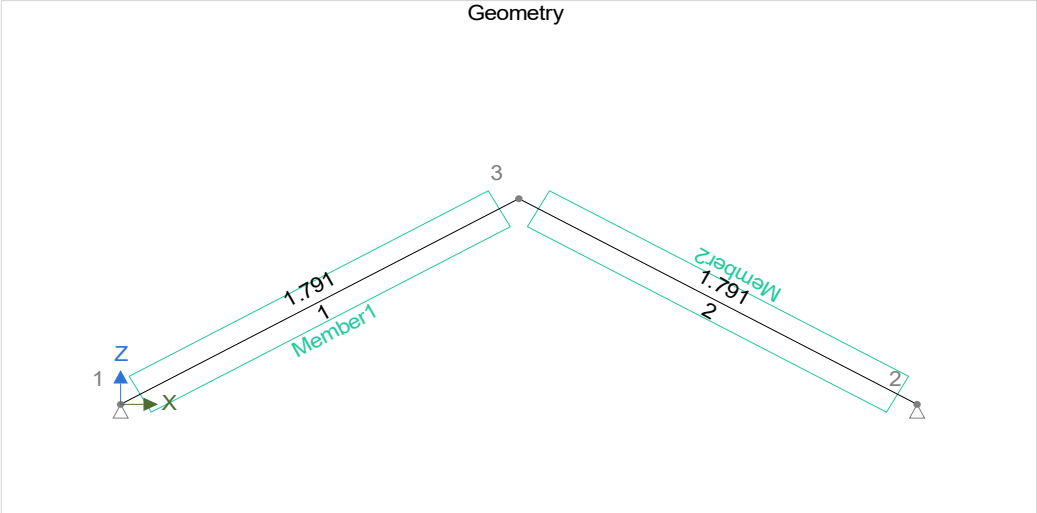


	Project				Job no.	
AJN CONSULTING ENGINEERS	Mimosa Outdoor Timber Gazebo - 4.27m x 3.69m x 3.23m (H)				2023-008	
	Calcs for				Start page no./Revision	
	Rafters				1	
	Calcs by	Calcs date	Checked by	Checked date	Approved by	Approved date
	AN	20/03/2023				

ANALYSIS

Tedds calculation version 1.0.13

Geometry



Nodes

Node	Co-ordinates		Freedom			Coordinate system		Spring		
	X (m)	Z (m)	X	Z	Rot.	Name	Angle (°)	X (kN/m)	Z (kN/m)	Rot. kNm/°
1	0	0	Fixed	Fixed	Free		0	0	0	0
2	3.12	0	Fixed	Fixed	Free		0	0	0	0
3	1.56	0.88	Free	Free	Free		0	0	0	0

Materials

Name	Density (kg/m³)	Youngs Modulus kN/mm²	Shear Modulus kN/mm²	Thermal Coefficient °C⁻¹
F4 (AS1720)	350	6.1	0.41	0

Sections

Name	Area (cm²)	Moment of inertia		Shear area	
		Major (cm⁴)	Minor (cm⁴)	A_y (cm²)	A_z (cm²)
R 45x90	41	273	68	34	34

Elements

Element	Length (m)	Nodes		Section	Material	Releases			Rotated
		Start	End			Start moment	End moment	Axial	
1	1.791	1	3	R 45x90	F4 (AS1720)	Fixed	Fixed	Fixed	
2	1.791	2	3	R 45x90	F4 (AS1720)	Fixed	Fixed	Fixed	

Members

Name	Elements	
	Start	End
Member1	1	1
Member2	2	2

Loading

Load cases

Name	Enabled	Self weight factor	Patternable
Self Weight	yes	1	no
Permanent	yes	0	no
Imposed	yes	0	no
Wind	yes	0	no

Load combinations

Load combination	Type	Enabled	Patterned
1.35D	Strength	yes	no
1.2D + 1.5I + 1.5Ir	Strength	yes	no
1.0D + ψ	Service	yes	no
1.2D + ψ	Strength	yes	no
1.2D + ψ	Service	yes	no
0.9D + 1.0W	Strength	yes	no

Load combination: 1.35D (Strength)

Load case	Factor
Self Weight	1.35
Permanent	1.35

Load combination: 1.2D + 1.5I + 1.5Ir (Strength)

Load case	Factor
Self Weight	1.2
Permanent	1.2
Imposed	1.5

Load combination: 1.0D + ψ_lI + 1.5Ir (Service)

Load case	Factor
Self Weight	1
Permanent	1
Imposed	0.4

Load combination: 1.2D + ψ_cI + ψ_cIr + 1.0W (Strength)

Load case	Factor
Self Weight	1.2
Permanent	1.2
Imposed	0.4
Wind	1

Load combination: 1.2D + ψ_lI + ψ_lIr + 1.0W (Service)

Load case	Factor
Self Weight	1
Permanent	1
Imposed	0.4
Wind	1

Load combination: 0.9D + 1.0W (Strength)

Load case	Factor
Self Weight	0.9
Permanent	0.9

Load case	Factor
Wind	1

Member UDL loads

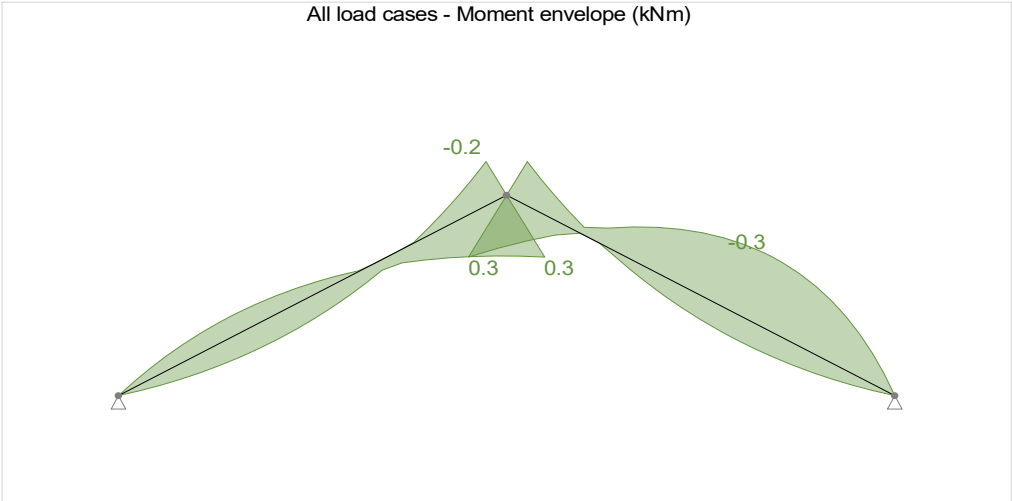
Member	Load case	Position			Load	Orientation
		Type	Start	End	(kN/m)	
Member1	Permanent	Ratio	0	1	0.53	GlobalZ
Member2	Permanent	Ratio	0	1	0.53	GlobalZ
Member1	Imposed	Ratio	0	1	0.26	GlobalZ
Member2	Imposed	Ratio	0	1	0.26	GlobalZ
Member1	Wind	Ratio	0	1	-0.64	GlobalZ
Member2	Wind	Ratio	0	1	-1.32	GlobalZ

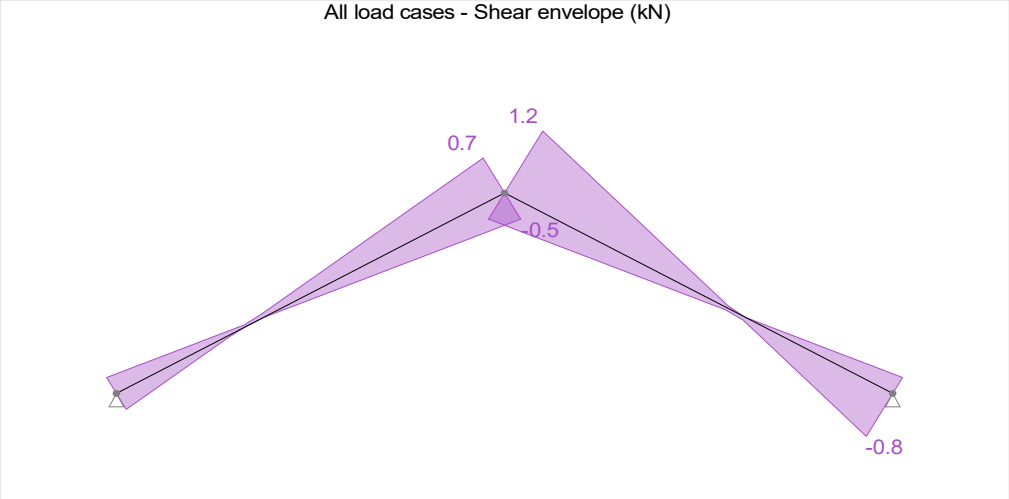
Results

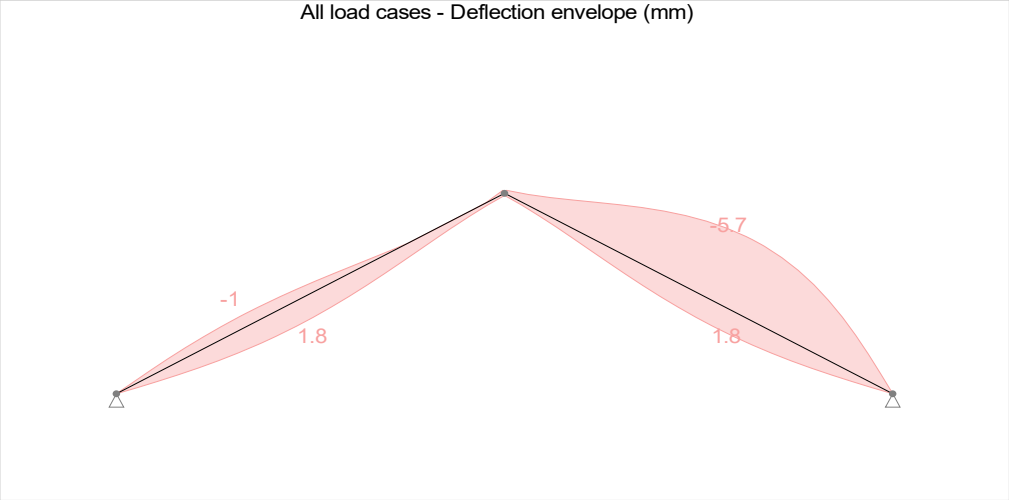
Total base reactions

Load case/combination	Force	
	FX (kN)	FZ (kN)
Self Weight	0	0
Permanent	0	1.9
Imposed	0	0.9
Wind	0	-3.5
1.35D (Strength)	0	2.6
1.2D + 1.5l + 1.5lr (Strength)	0	3.7
1.0D + ψ_ll + 1.5lr (Service)	0	2.3
1.2D + ψ_cl + $\psi_c$lr + 1.0W (Strength)	0	-0.8
1.2D + ψ_ll + $\psi_l$lr + 1.0W (Service)	0	-1.2
0.9D + 1.0W (Strength)	0	-1.8

Forces







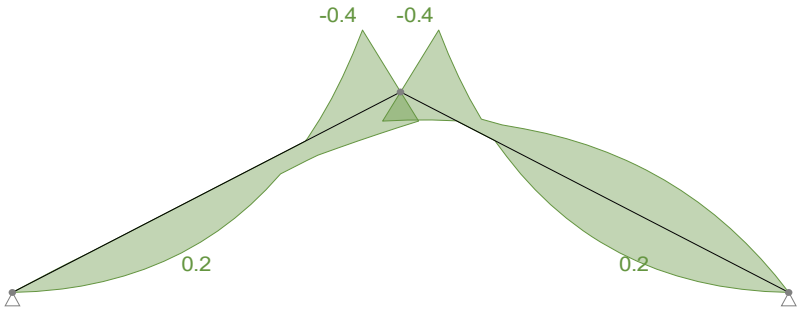
Element results

Envelope - All load cases

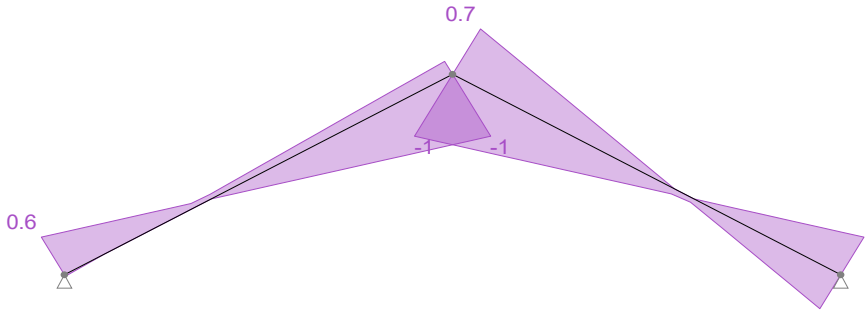
Element	Shear force		Moment			
	Pos (m)	Max abs (kN)	Pos (m)	Max (kNm)	Pos (m)	Min (kNm)
1	1.791	0.7	1.791	0.3	1.791	-0.2
2	1.791	1.2	1.791	0.3	0.733	-0.3

	Project				Job no.	
AJN CONSULTING ENGINEERS	Mimosa Outdoor Timber Gazebo - 4.27m x 3.69m x 3.23m (H)				2023-008	
	Calcs for				Start page no./Revision	
	Rafters				5	
	Calcs by	Calcs date	Checked by	Checked date	Approved by	Approved date
	AN	20/03/2023				

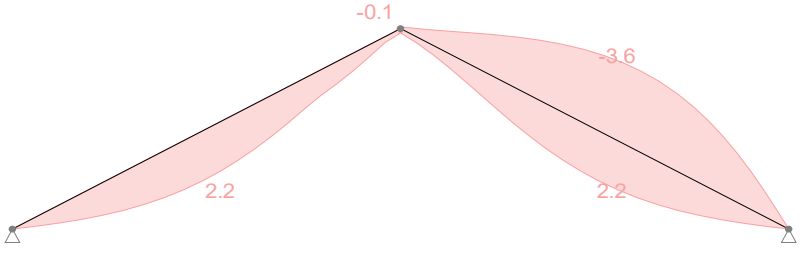
Strength combinations - Moment envelope (kNm)



Strength combinations - Shear envelope (kN)



Service combinations - Deflection envelope (mm)



Element results

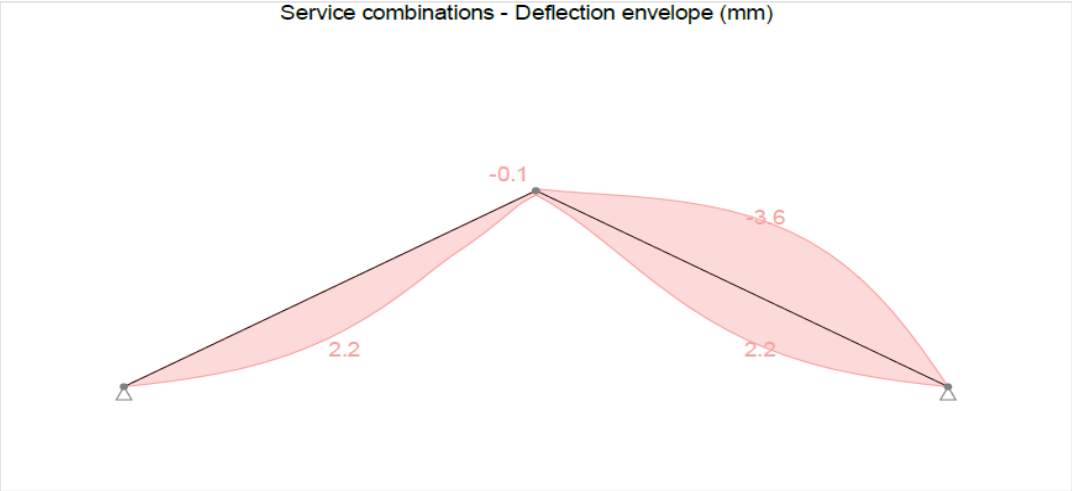
Envelope - Strength combinations

Element	Shear force		Moment			
	Pos (m)	Max abs (kN)	Pos (m)	Max (kNm)	Pos (m)	Min (kNm)
1	1.791	-1	0.677	0.2	1.791	-0.4
2	1.791	-1	0.677	0.2	1.791	-0.4

DEFLECTION CHECK

Project No.	2023-008	Project Name	Mimosa Outdoor Gazebo (4.27m x 3.69m x 3.23m)
Designed by	AN	Date	20 March 2023

Deflection Check Rafters



Max. Displacement, δ_{max}	3.6	mm
Allowable Deflection, δ_{allow} = L/300	5.20	mm

	δ_{allow}	**>**	**δ_{max}**	**PASS**
Utilization Ratio		**69.2%**		

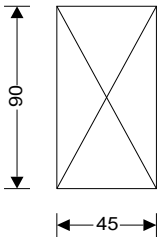
	Project				Job no.	
	Mimosa Outdoor Timber Gazebo - 4.27m x 3.69m x 3.23m (H)				2023-008	
	Calcs for				Start page no./Revision	
					1	
	Calcs by	Calcs date	Checked by	Checked date	Approved by	Approved date
	AN	20/03/2023				

TIMBER MEMBER DESIGN TO AS1720.1-2010

Tedds calculation version 1.5.05

Analysis results

Design moment in major axis	M^*_x = **0.400** kNm
Design shear	V^* = **1.000** kN
Design axial compression	N^*_c = **2.700** kN



Timber section details

Breadth of timber sections	b = **45** mm
Depth of timber sections	d = **90** mm
Number of timber sections in member	N = **1**
Overall breadth of timber member	b_b = N × b = **45** mm
Timber species	**Mixed softwood species (excl.Pinus species)**
Moisture condition	**Seasoned**
Timber strength grade - Table H2.1	**F4**

Member details

Load duration - cl.2.4.1	**Long-term**
Overall length of member	L_x = **1800** mm
Effective length factor - Table 3.2	g_{13} = **1**
Distance between lateral restraints in major axis	L_{ax} = **1800** mm
Distance between lateral restraints in minor axis	L_{ay} = **450** mm

Section properties

Cross sectional area of member	A = N × b × d = **4050** mm^2
Section modulus	Z_x = N × b × d^2 / 6 = **60750** mm^3
	Z_y = d × (N × b)^2 / 6 = **30375** mm^3
Second moment of area	I_x = N × b × d^3 / 12 = **2733750** mm^4
	I_y = d × (N × b)^3 / 12 = **683437** mm^4
Radius of gyration	r_x = √(I_x / A) = **26.0** mm
	r_y = √(I_y / A) = **13.0** mm

Modification factors

Duration of load factor for strength - Table 2.3	k_1 = **0.80**
Moisture condition factor - cl.2.4.2.3	k_4 = **1.00**
Temperature factor - cl.2.4.3	k_6 = **1.00**
Length and position of bearing factor - cl.2.4.4	k_7 = **1.00**
Strength sharing factor - Table 2.7	k_9 = **1.00**
Temporary design action ratio	r = **0.25**
Material constant - exp.E2(1)	ρ_b = 14.71 × (E / f'_b)$^{-0.480}$ × $r^{-0.061}$ = **0.80**
Distance between discrete lateral restraints	L_{ay} = **450** mm L_{ay} / d < 64 × [N × b / (ρ_b × d)]^2

Major axis slenderness coefficient - cl.3.2.3.2(b) S_1 = **0.00**

Major axis bending stability factor - exp.3.2(10) k_{12bx} = **1.00**

Minor axis slenderness coefficient - cl.3.2.3.2 (c) S_2 = **0.00**

Minor axis bending stability factor - cl.3.2.4 k_{12by} = **1.00**

Material constant - exp.E2(3) $\rho_c = 11.39 \times (E / f'_c)^{-0.408} \times r^{-0.074}$ = **0.87**

Major axis slenderness coefficient - exp.3.3(5) $S_3 = L_{ax} / d$ = **20.00**

Major axis comp.stability factor - exp.3.3(11b) $k_{12cx} = 1.5 - 0.05 \times \rho_c \times S_3$ = **0.63**

Minor axis slenderness coeff. - exp.3.3(8) & (9) $S_4 = \min(L_{ay} / (N \times b), g_{13} \times L_x / (N \times b))$ = **10.00**

Minor axis comp.stability factor - exp.3.3(11a) k_{12cy} = **1.00**

Bending strength - cl.3.2.1

Capacity factor - Table 2.1 ϕ_b = **0.9**

Design capacity in major axis bending - cl.3.2(2) $\phi M_x = \phi_b \times k_1 \times k_4 \times k_6 \times k_9 \times k_{12bx} \times f'_b \times Z_x$ = **0.525** kNm

PASS - Design capacity in bending exceeds design bending moment

Compressive strength - cl.3.3.1

Capacity factor - Table 2.1 ϕ_c = **0.9**

Cross-sectional area of member $A_c = N \times b \times d$ = **4050** mm^2

Major axis design capacity in compression - exp.3.3(2)

$\phi N_{cx} = \phi_c \times k_1 \times k_4 \times k_6 \times k_{12cx} \times f'_c \times A_c$ = **15.878** kN

Minor axis design capacity in compression - exp.3.3(2)

$\phi N_{cy} = \phi_c \times k_1 \times k_4 \times k_6 \times k_{12cy} \times f'_c \times A_c$ = **25.078** kN

PASS - Design capacity in compression exceeds design compression

Combined bending and compression - cl.3.5.1

Combined bending and compression check - exp.3.5(1) and exp.3.5(2)

$[M^*_x / \phi M_x]^2 + [N^*_c / \phi N_{cy}]$ = **0.688** < 1

$[M^*_x / \phi M_x] + [N^*_c / \phi N_{cx}]$ = **0.932** < 1

PASS - Beam design meets combined bending and compression criteria

Flexural shear strength - cl.3.2.5

Capacity factor - Table 2.1 ϕ_s = **0.9**

Shear plane area $A_s = N \times b \times d \times 2 / 3$ = **2700** mm^2

Design shear capacity - exp.3.2(14) $\phi V = \phi_s \times k_1 \times k_4 \times k_6 \times f'_s \times A_s$ = **2.527** kN

PASS - Design shear capacity exceeds design shear force

Job Information

	Engineer	Checked	Approved
Name:			
Date:	20-Mar-23		

Structure Type	PLANE FRAME

Number of Nodes	11	Highest Node	11
Number of Elements	13	Highest Beam	13

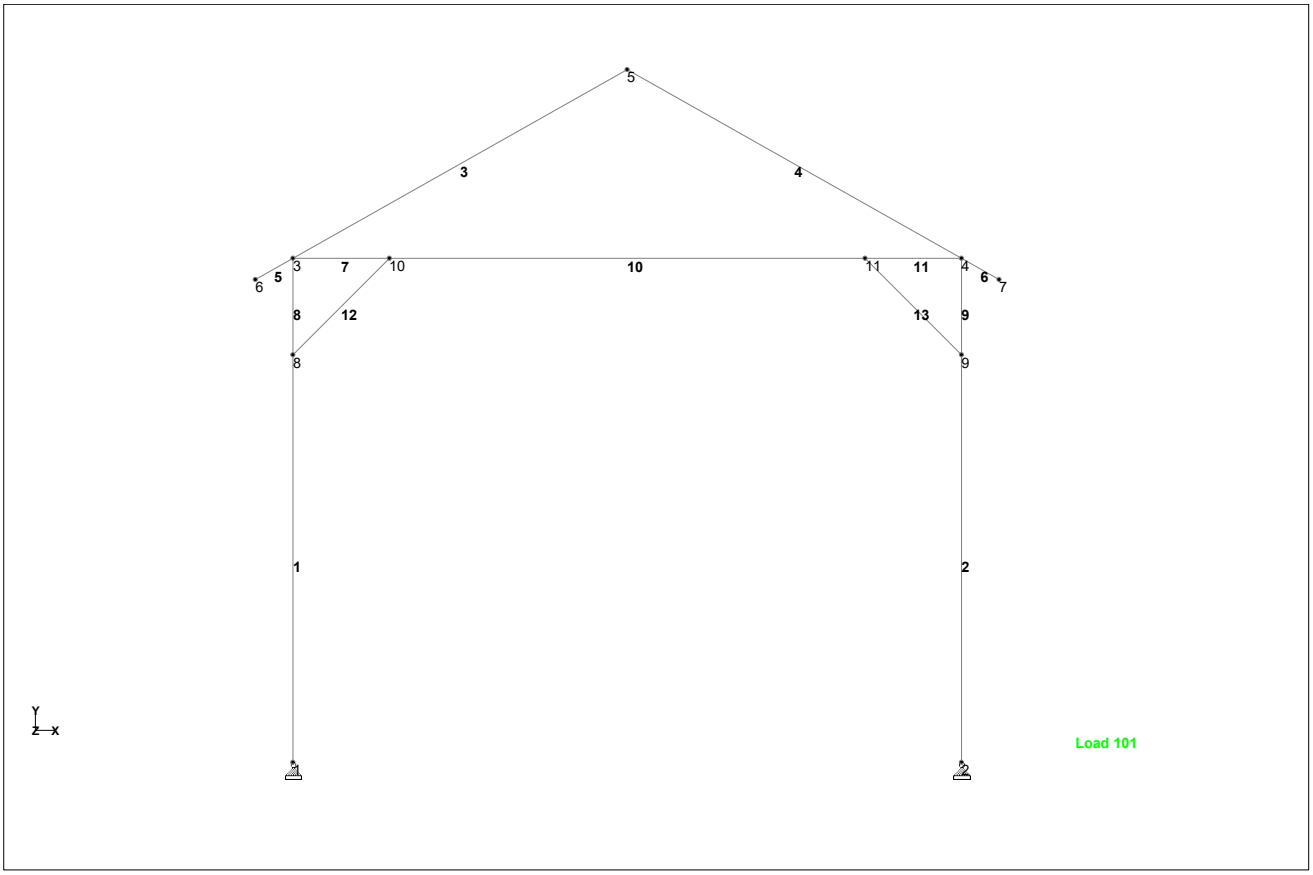
Number of Basic Load Cases	4
Number of Combination Load Cases	7

Included in this printout are data for:

All	The Whole Structure

Included in this printout are results for load cases:

Type	L/C	Name
Primary	1	PERMANENT ACTION (G)
Primary	2	IMPOSED ACTION (Q)
Primary	3	DESIGN WIND ACTION (SET 1) - TRANS
Primary	7	SERVICE WIND ACTION (SET 1) - TRAN
Combination	101	1.35G
Combination	102	1.2G + 1.5Q
Combination	103	1.2G + WU (SET 1) - TRANSVERSE
Combination	107	0.9G + WU (SET 1) - TRANSVERSE
Combination	201	0.7Q
Combination	202	G + 0.4Q
Combination	203	G + WS (SET 1) - TRANSVERSE



Whole Structure

Nodes

Node	X (m)	Y (m)	Z (m)
1	0.000	0.000	0.000
2	3.120	0.000	0.000
3	0.000	2.350	0.000
4	3.120	2.350	0.000
5	1.560	3.230	0.000
6	-0.175	2.251	0.000
7	3.295	2.251	0.000
8	0.000	1.900	0.000
9	3.120	1.900	0.000
10	0.450	2.350	0.000
11	2.670	2.350	0.000

Beams

Beam	Node A	Node B	Length (m)	Property	β (degrees)
1	1	8	1.900	5	0
2	2	9	1.900	5	0
3	3	5	1.791	2	0
4	4	5	1.791	2	0
5	6	3	0.201	2	0
6	7	4	0.201	2	0
7	3	10	0.450	1	0
8	8	3	0.450	5	0
9	9	4	0.450	5	0
10	10	11	2.220	1	0
11	11	4	0.450	1	0
12	8	10	0.636	3	0
13	9	11	0.636	3	0

Section Properties

Prop	Section	Area (cm^2)	I_{yy} (cm^4)	I_{zz} (cm^4)	J (cm^4)	Material
1	Rect 0.12x0.07	84.000	343.000	1.01E+3	872.655	TIMBERF4
2	Rect 0.09x0.03	27.000	20.250	182.250	64.007	TIMBERF4
3	Rect 0.06x0.06	36.000	108.000	108.000	182.250	TIMBERF4
5	COLUMN	155.000	6.37E+3	6.37E+3	9.31E+3	TIMBERF4

Materials

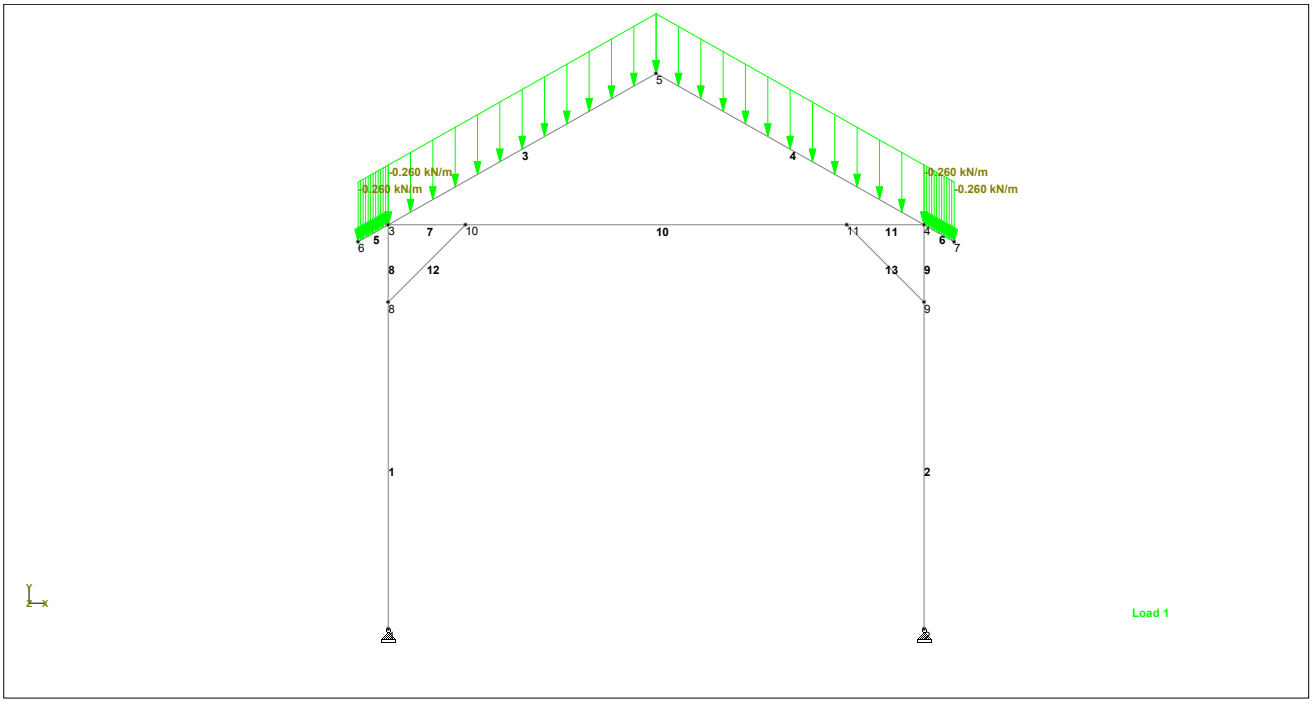
Mat	Name	E (kN/mm^2)	ν	Density (kg/m^3)	α (/°C)
1	TIMBERF4	6.100	0.400	356.901	0.000
2	STEEL	205.000	0.300	7.83E+3	12E -6
3	STAINLESSSTEEL	197.930	0.300	7.83E+3	18E -6
4	ALUMINUM	68.948	0.330	2.71E+3	23E -6
5	CONCRETE	21.718	0.170	2.4E+3	10E -6

Supports

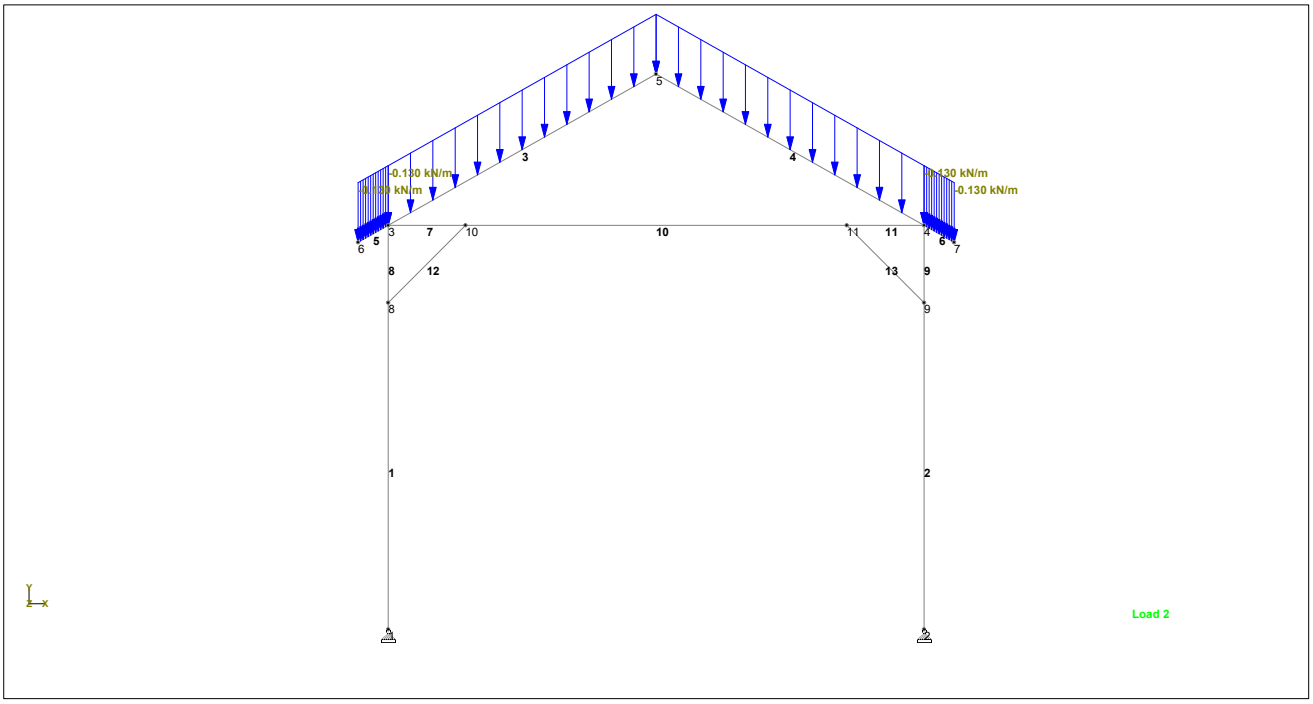
Node	X (kN/mm)	Y (kN/mm)	Z (kN/mm)	rX (kN^-m/deg)	rY (kN^-m/deg)	rZ (kN^-m/deg)
1	Fixed	Fixed	Fixed	-	-	-
2	Fixed	Fixed	Fixed	-	-	-

Primary Load Cases

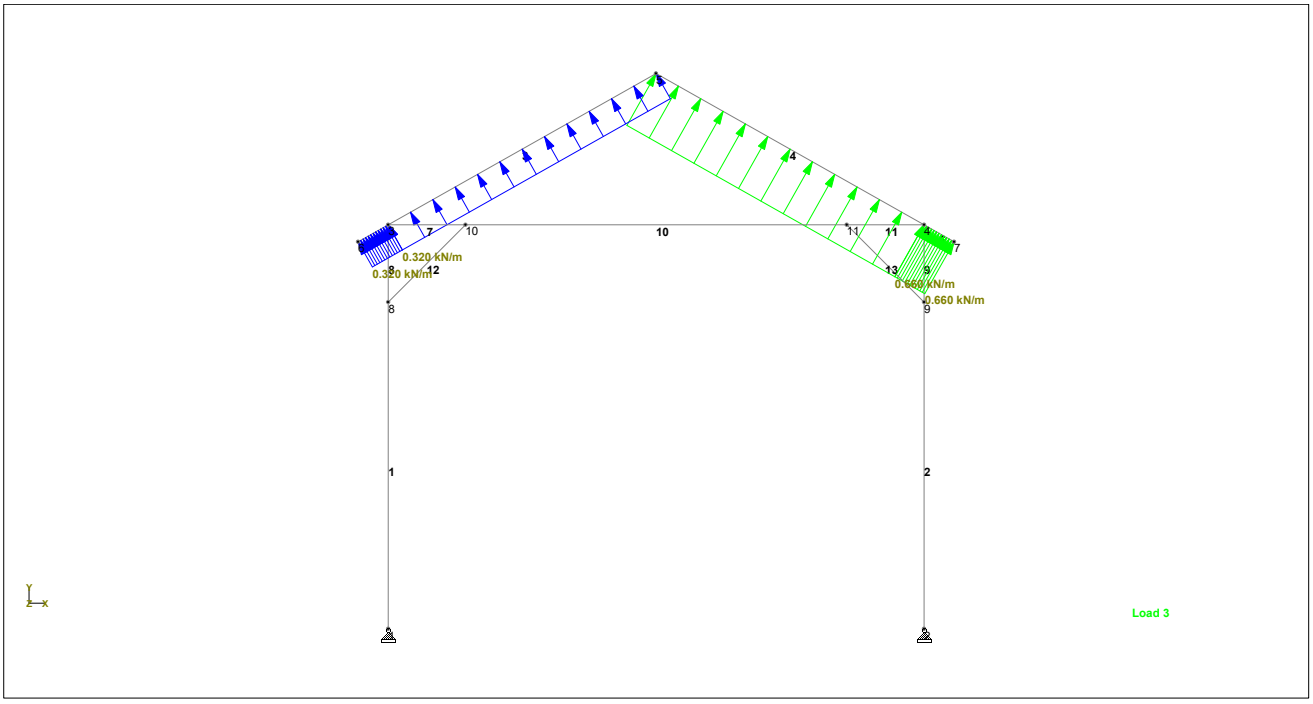
Number	Name	Type
1	PERMANENT ACTION (G)	Dead
2	IMPOSED ACTION (Q)	Roof Live
3	DESIGN WIND ACTION (SET 1) - TRANS	Wind
7	SERVICE WIND ACTION (SET 1) - TRAN	Wind



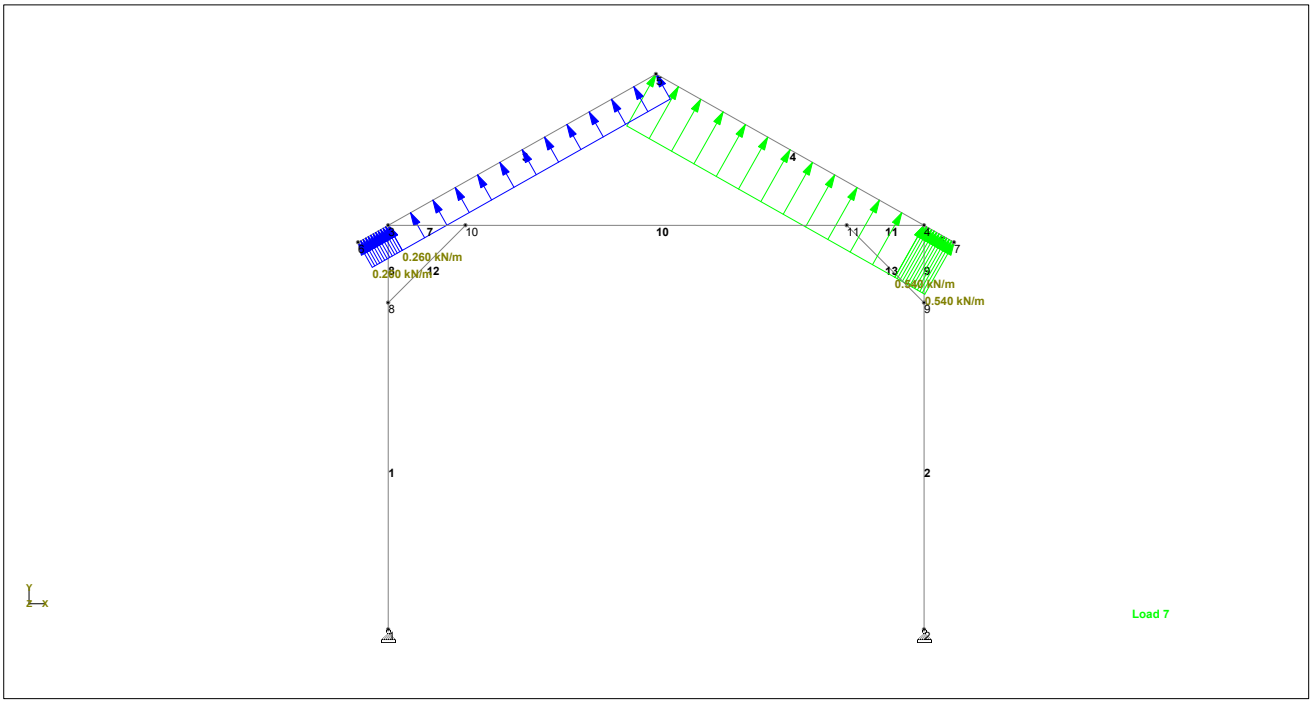
Permanent Action (G)



Imposed Action (Q)



Design Wind Action (Set 1)



Service Wind Action (Set 1)

Combination Load Cases

Comb.	Combination L/C Name	Primary	Primary L/C Name	Factor
101	1.35G	1	PERMANENT ACTION (G)	1.35
102	1.2G + 1.5Q	1	PERMANENT ACTION (G)	1.20
		2	IMPOSED ACTION (Q)	1.50
103	1.2G + WU (SET 1) - TRANSVERSE	1	PERMANENT ACTION (G)	1.20
		3	DESIGN WIND ACTION (SET 1) - TRANS	1.00
107	0.9G + WU (SET 1) - TRANSVERSE	1	PERMANENT ACTION (G)	0.90
		3	DESIGN WIND ACTION (SET 1) - TRANS	1.00
201	0.7Q	2	IMPOSED ACTION (Q)	0.70
202	G + 0.4Q	1	PERMANENT ACTION (G)	1.00
		2	IMPOSED ACTION (Q)	0.40
203	G + WS (SET 1) - TRANSVERSE	1	PERMANENT ACTION (G)	1.00
		7	SERVICE WIND ACTION (SET 1) - TRAN	1.00

1 PERMANENT ACTION (G) : Beam Loads

Beam	Type	Direction	Fa	Da (m)	Fb	Db	Ecc. (m)
3	UNI kN/m	GY	-0.260	-	-	-	-
4	UNI kN/m	GY	-0.260	-	-	-	-
5	UNI kN/m	GY	-0.260	-	-	-	-
6	UNI kN/m	GY	-0.260	-	-	-	-

1 PERMANENT ACTION (G) : Selfweight

Direction	Factor	Assigned Geometry
Y	-1.000	ALL

2 IMPOSED ACTION (Q) : Beam Loads

Beam	Type	Direction	Fa	Da (m)	Fb	Db	Ecc. (m)
3	UNI kN/m	GY	-0.130	-	-	-	-
4	UNI kN/m	GY	-0.130	-	-	-	-
5	UNI kN/m	GY	-0.130	-	-	-	-
6	UNI kN/m	GY	-0.130	-	-	-	-

3 DESIGN WIND ACTION (SET 1) - TRANSVERSE (WUX1) : Beam Loads

Beam	Type	Direction	Fa	Da (m)	Fb	Db	Ecc. (m)
3	UNI kN/m	Y	0.320	-	-	-	-
4	UNI kN/m	Y	0.660	-	-	-	-
5	UNI kN/m	Y	0.320	-	-	-	-
6	UNI kN/m	Y	0.660	-	-	-	-

7 SERVICE WIND ACTION (SET 1) - TRANSVERSE (WSX1) : Beam Loads

Beam	Type		Direction	Fa	Da (m)	Fb	Db	Ecc. (m)
3	UNI	kN/m	Y	0.260	-	-	-	-
4	UNI	kN/m	Y	0.540	-	-	-	-
5	UNI	kN/m	Y	0.260	-	-	-	-
6	UNI	kN/m	Y	0.540	-	-	-	-

Node Displacement Summary

	Node	L/C	X (mm)	Y (mm)	Z (mm)	Resultant (mm)	rX (rad)	rY (rad)	rZ (rad)
Max X	3	3:DESIGN WIN	**6.684**	0.020	0.000	6.684	0.000	0.000	-0.002
Min X	8	102:1.2G + 1.5	**-0.115**	-0.024	0.000	0.117	0.000	0.000	-0.000
Max Y	11	3:DESIGN WIN	6.657	**0.999**	0.000	6.732	0.000	0.000	-0.001
Min Y	10	103:1.2G + WL	6.663	**-0.899**	0.000	6.723	0.000	0.000	-0.001
Max Z	1	1:PERMANEN	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000
Min Z	1	1:PERMANEN	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000
Max rX	1	1:PERMANEN	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000
Min rX	1	1:PERMANEN	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000
Max rY	1	1:PERMANEN	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000
Min rY	1	1:PERMANEN	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000
Max rZ	5	3:DESIGN WIN	6.682	0.214	0.000	6.685	0.000	0.000	**0.003**
Min rZ	1	3:DESIGN WIN	0.000	0.000	0.000	0.000	0.000	0.000	**-0.003**
Max Rst	11	3:DESIGN WIN	6.657	0.999	0.000	**6.732**	0.000	0.000	-0.001

Beam Maximum Moments

Distances to maxima are given from beam end A.

Beam	Node A	Length (m)	L/C		d (m)	Max My (kNm)	d (m)	Max Mz (kNm)
1	1	1.900	1:PERMANEN	Max +ve	0.000	0.000	1.900	0.065
				Max -ve	0.000	0.000	0.000	0.000
			2:IMPOSED A(	Max +ve	0.000	0.000	1.900	0.021
				Max -ve	0.000	0.000		
			3:DESIGN WIN	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	1.900	-0.407
			7:SERVICE WI	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	1.900	-0.334
			101:1.35G	Max +ve	0.000	0.000	1.900	0.088
				Max -ve	0.000	0.000	0.000	0.000
			102:1.2G + 1.5	Max +ve	0.000	0.000	1.900	0.110
				Max -ve	0.000	0.000		
			103:1.2G + WL	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	1.900	-0.328
			107:0.9G + WL	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	1.900	-0.348
			201:0.7Q	Max +ve	0.000	0.000	1.900	0.015
				Max -ve	0.000	0.000		
			202:G + 0.4Q	Max +ve	0.000	0.000	1.900	0.074
				Max -ve	0.000	0.000		
			203:G + WS (S	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	1.900	-0.269
2	2	1.900	1:PERMANEN	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	1.900	-0.065
			2:IMPOSED A(	Max +ve	0.000	0.000		

Beam Maximum Moments Cont...

Beam	Node A	Length (m)	L/C		d (m)	Max My (kNm)	d (m)	Max Mz (kNm)
				Max -ve	0.000	0.000	1.900	-0.021
			3:DESIGN WIN	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	1.900	-0.226
			7:SERVICE WI	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	1.900	-0.187
			101:1.35G	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	1.900	-0.088
			102:1.2G + 1.5	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	1.900	-0.110
			103:1.2G + WL	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	1.900	-0.304
			107:0.9G + WL	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	1.900	-0.284
			201:0.7Q	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	1.900	-0.015
			202:G + 0.4Q	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	1.900	-0.074
			203:G + WS (S	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	1.900	-0.252
3	3	1.791	1:PERMANEN	Max +ve	0.000	0.000	1.791	0.062
				Max -ve	0.000	0.000	0.896	-0.032
			2:IMPOSED A(	Max +ve	0.000	0.000	0.000	0.030
				Max -ve	0.000	0.000	0.896	-0.015
			3:DESIGN WIN	Max +ve	0.000	0.000	0.896	0.012
				Max -ve	0.000	0.000	1.791	-0.130
			7:SERVICE WI	Max +ve	0.000	0.000	0.896	0.009
				Max -ve	0.000	0.000	1.791	-0.106
			101:1.35G	Max +ve	0.000	0.000	1.791	0.084
				Max -ve	0.000	0.000	0.896	-0.044
			102:1.2G + 1.5	Max +ve	0.000	0.000	0.000	0.119
				Max -ve	0.000	0.000	0.896	-0.062
			103:1.2G + WL	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	1.791	-0.056
			107:0.9G + WL	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	1.791	-0.074
			201:0.7Q	Max +ve	0.000	0.000	0.000	0.021
				Max -ve	0.000	0.000	0.896	-0.011
			202:G + 0.4Q	Max +ve	0.000	0.000	1.791	0.074
				Max -ve	0.000	0.000	0.896	-0.038
			203:G + WS (S	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	1.791	-0.044
4	4	1.791	1:PERMANEN	Max +ve	0.000	0.000	1.791	0.062
				Max -ve	0.000	0.000	0.896	-0.032
			2:IMPOSED A(	Max +ve	0.000	0.000	0.000	0.030
				Max -ve	0.000	0.000	0.896	-0.015
			3:DESIGN WIN	Max +ve	0.000	0.000	0.896	0.122
				Max -ve	0.000	0.000	0.000	-0.155
			7:SERVICE WI	Max +ve	0.000	0.000	0.896	0.100
				Max -ve	0.000	0.000	0.000	-0.127
			101:1.35G	Max +ve	0.000	0.000	1.791	0.084
				Max -ve	0.000	0.000	0.896	-0.044
			102:1.2G + 1.5	Max +ve	0.000	0.000	0.000	0.119
				Max -ve	0.000	0.000	0.896	-0.062
			103:1.2G + WL	Max +ve	0.000	0.000	0.896	0.083

Beam Maximum Moments Cont...

Beam	Node A	Length (m)	L/C		d (m)	Max My (kNm)	d (m)	Max Mz (kNm)
				Max -ve	0.000	0.000	0.000	-0.081
			107:0.9G + WL	Max +ve	0.000	0.000	0.896	0.093
				Max -ve	0.000	0.000	0.000	-0.100
			201:0.7Q	Max +ve	0.000	0.000	0.000	0.021
				Max -ve	0.000	0.000	0.896	-0.011
			202:G + 0.4Q	Max +ve	0.000	0.000	1.791	0.074
				Max -ve	0.000	0.000	0.896	-0.038
			203:G + WS (S	Max +ve	0.000	0.000	0.896	0.068
				Max -ve	0.000	0.000	0.000	-0.065
5	6	0.201	1:PERMANENT	Max +ve	0.000	0.000	0.201	0.005
				Max -ve	0.000	0.000		
			2:IMPOSED AC	Max +ve	0.000	0.000	0.201	0.002
				Max -ve	0.000	0.000		
			3:DESIGN WIN	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	0.201	-0.006
			7:SERVICE WI	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	0.201	-0.005
			101:1.35G	Max +ve	0.000	0.000	0.201	0.006
				Max -ve	0.000	0.000		
			102:1.2G + 1.5	Max +ve	0.000	0.000	0.201	0.009
				Max -ve	0.000	0.000		
			103:1.2G + WL	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	0.201	-0.001
			107:0.9G + WL	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	0.201	-0.002
			201:0.7Q	Max +ve	0.000	0.000	0.201	0.002
				Max -ve	0.000	0.000		
			202:G + 0.4Q	Max +ve	0.000	0.000	0.201	0.006
				Max -ve	0.000	0.000		
			203:G + WS (S	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	0.201	-0.001
6	7	0.201	1:PERMANENT	Max +ve	0.000	0.000	0.201	0.005
				Max -ve	0.000	0.000		
			2:IMPOSED AC	Max +ve	0.000	0.000	0.201	0.002
				Max -ve	0.000	0.000		
			3:DESIGN WIN	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	0.201	-0.013
			7:SERVICE WI	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.201	-0.011
			101:1.35G	Max +ve	0.000	0.000	0.201	0.006
				Max -ve	0.000	0.000		
			102:1.2G + 1.5	Max +ve	0.000	0.000	0.201	0.009
				Max -ve	0.000	0.000		
			103:1.2G + WL	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	0.201	-0.008
			107:0.9G + WL	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	0.201	-0.009
			201:0.7Q	Max +ve	0.000	0.000	0.201	0.002
				Max -ve	0.000	0.000		
			202:G + 0.4Q	Max +ve	0.000	0.000	0.201	0.006
				Max -ve	0.000	0.000		
			203:G + WS (S	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.201	-0.006
7	3	0.450	1:PERMANENT	Max +ve	0.000	0.000	0.450	0.004

Beam Maximum Moments Cont...

Beam	Node A	Length (m)	L/C		d (m)	Max My (kNm)	d (m)	Max Mz (kNm)
				Max -ve	0.000	0.000	0.000	-0.004
			2:IMPOSED A(	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-0.004
			3:DESIGN WIN	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.450	-0.287
			7:SERVICE WI	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.450	-0.236
			101:1.35G	Max +ve	0.000	0.000	0.450	0.006
				Max -ve	0.000	0.000	0.000	-0.006
			102:1.2G + 1.5	Max +ve	0.000	0.000	0.450	0.002
				Max -ve	0.000	0.000	0.000	-0.011
			103:1.2G + WL	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.450	-0.282
			107:0.9G + WL	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.450	-0.283
			201:0.7Q	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-0.003
			202:G + 0.4Q	Max +ve	0.000	0.000	0.450	0.003
				Max -ve	0.000	0.000	0.000	-0.006
			203:G + WS (S	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.450	-0.232
8	8	0.450	1:PERMANEN	Max +ve	0.000	0.000	0.000	0.065
				Max -ve	0.000	0.000		
			2:IMPOSED A(	Max +ve	0.000	0.000	0.450	0.024
				Max -ve	0.000	0.000		
			3:DESIGN WIN	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-0.407
			7:SERVICE WI	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-0.334
			101:1.35G	Max +ve	0.000	0.000	0.000	0.088
				Max -ve	0.000	0.000		
			102:1.2G + 1.5	Max +ve	0.000	0.000	0.000	0.110
				Max -ve	0.000	0.000		
			103:1.2G + WL	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-0.328
			107:0.9G + WL	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-0.348
			201:0.7Q	Max +ve	0.000	0.000	0.450	0.017
				Max -ve	0.000	0.000		
			202:G + 0.4Q	Max +ve	0.000	0.000	0.000	0.074
				Max -ve	0.000	0.000		
			203:G + WS (S	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-0.269
9	9	0.450	1:PERMANEN	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-0.065
			2:IMPOSED A(	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.450	-0.024
			3:DESIGN WIN	Max +ve	0.000	0.000	0.450	0.088
				Max -ve	0.000	0.000	0.000	-0.226
			7:SERVICE WI	Max +ve	0.000	0.000	0.450	0.072
				Max -ve	0.000	0.000	0.000	-0.187
			101:1.35G	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-0.088
			102:1.2G + 1.5	Max +ve	0.000	0.000		

Beam Maximum Moments Cont...

Beam	Node A	Length (m)	L/C		d (m)	Max My (kNm)	d (m)	Max Mz (kNm)
				Max -ve	0.000	0.000	0.000	-0.110
			103:1.2G + WL	Max +ve	0.000	0.000	0.450	0.025
				Max -ve	0.000	0.000	0.000	-0.304
			107:0.9G + WL	Max +ve	0.000	0.000	0.450	0.041
				Max -ve	0.000	0.000	0.000	-0.284
			201:0.7Q	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.450	-0.017
			202:G + 0.4Q	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-0.074
			203:G + WS (S	Max +ve	0.000	0.000	0.450	0.019
				Max -ve	0.000	0.000	0.000	-0.252
10	10	2.220	1:PERMANEN	Max +ve	0.000	0.000	0.000	0.004
				Max -ve	0.000	0.000	1.110	-0.014
			2:IMPOSED A(	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-0.002
			3:DESIGN WIN	Max +ve	0.000	0.000	2.220	0.302
				Max -ve	0.000	0.000	0.000	-0.287
			7:SERVICE WI	Max +ve	0.000	0.000	2.220	0.248
				Max -ve	0.000	0.000	0.000	-0.236
			101:1.35G	Max +ve	0.000	0.000	0.000	0.006
				Max -ve	0.000	0.000	1.110	-0.019
			102:1.2G + 1.5	Max +ve	0.000	0.000	2.220	0.002
				Max -ve	0.000	0.000	1.110	-0.019
			103:1.2G + WL	Max +ve	0.000	0.000	2.220	0.307
				Max -ve	0.000	0.000	0.000	-0.282
			107:0.9G + WL	Max +ve	0.000	0.000	2.220	0.305
				Max -ve	0.000	0.000	0.000	-0.283
			201:0.7Q	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-0.001
			202:G + 0.4Q	Max +ve	0.000	0.000	0.000	0.003
				Max -ve	0.000	0.000	1.110	-0.015
			203:G + WS (S	Max +ve	0.000	0.000	2.220	0.253
				Max -ve	0.000	0.000	0.000	-0.232
11	11	0.450	1:PERMANEN	Max +ve	0.000	0.000	0.000	0.004
				Max -ve	0.000	0.000	0.450	-0.004
			2:IMPOSED A(	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.450	-0.004
			3:DESIGN WIN	Max +ve	0.000	0.000	0.000	0.302
				Max -ve	0.000	0.000		
			7:SERVICE WI	Max +ve	0.000	0.000	0.000	0.248
				Max -ve	0.000	0.000		
			101:1.35G	Max +ve	0.000	0.000	0.000	0.006
				Max -ve	0.000	0.000	0.450	-0.006
			102:1.2G + 1.5	Max +ve	0.000	0.000	0.000	0.002
				Max -ve	0.000	0.000	0.450	-0.011
			103:1.2G + WL	Max +ve	0.000	0.000	0.000	0.307
				Max -ve	0.000	0.000		
			107:0.9G + WL	Max +ve	0.000	0.000	0.000	0.305
				Max -ve	0.000	0.000		
			201:0.7Q	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.450	-0.003
			202:G + 0.4Q	Max +ve	0.000	0.000	0.000	0.003
				Max -ve	0.000	0.000	0.450	-0.006
			203:G + WS (S	Max +ve	0.000	0.000	0.000	0.253

Beam Maximum Moments Cont...

Beam	Node A	Length (m)	L/C		d (m)	Max My (kNm)	d (m)	Max Mz (kNm)
				Max -ve	0.000	0.000		
12	8	0.636	1:PERMANEN	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	0.000	0.000
			2:IMPOSED A(	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	0.000	0.000
			3:DESIGN WIN	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	0.000	0.000
			7:SERVICE WI	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	0.000	0.000
			101:1.35G	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	0.000	0.000
			102:1.2G + 1.5	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	0.000	0.000
			103:1.2G + WL	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	0.000	0.000
			107:0.9G + WL	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	0.000	0.000
			201:0.7Q	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	0.000	0.000
			202:G + 0.4Q	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	0.000	0.000
			203:G + WS (S	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	0.000	0.000
13	9	0.636	1:PERMANEN	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	0.000	0.000
			2:IMPOSED A(	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	0.000	0.000
			3:DESIGN WIN	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	0.000	0.000
			7:SERVICE WI	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	0.000	0.000
			101:1.35G	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	0.000	0.000
			102:1.2G + 1.5	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	0.000	0.000
			103:1.2G + WL	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	0.000	0.000
			107:0.9G + WL	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	0.000	0.000
			201:0.7Q	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	0.000	0.000
			202:G + 0.4Q	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	0.000	0.000
			203:G + WS (S	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	0.000	0.000

Beam Maximum Shear Forces

Distances to maxima are given from beam end A.

Beam	Node A	Length (m)	L/C		d (m)	Max Fz (kN)	d (m)	Max Fy (kN)
1	1	1.900	1:PERMANEN	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-0.034
			2:IMPOSED A(	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-0.011
			3:DESIGN WIN	Max +ve	0.000	0.000	0.000	0.214
				Max -ve	0.000	0.000		
			7:SERVICE WI	Max +ve	0.000	0.000	0.000	0.176
				Max -ve	0.000	0.000		
			101:1.35G	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-0.046
			102:1.2G + 1.5	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-0.058
			103:1.2G + WL	Max +ve	0.000	0.000	0.000	0.173
				Max -ve	0.000	0.000		
			107:0.9G + WL	Max +ve	0.000	0.000	0.000	0.183
				Max -ve	0.000	0.000		
			201:0.7Q	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-0.008
			202:G + 0.4Q	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-0.039
			203:G + WS (S	Max +ve	0.000	0.000	0.000	0.142
				Max -ve	0.000	0.000		
2	2	1.900	1:PERMANEN	Max +ve	0.000	0.000	0.000	0.034
				Max -ve	0.000	0.000		
			2:IMPOSED A(	Max +ve	0.000	0.000	0.000	0.011
				Max -ve	0.000	0.000		
			3:DESIGN WIN	Max +ve	0.000	0.000	0.000	0.119
				Max -ve	0.000	0.000		
			7:SERVICE WI	Max +ve	0.000	0.000	0.000	0.098
				Max -ve	0.000	0.000		
			101:1.35G	Max +ve	0.000	0.000	0.000	0.046
				Max -ve	0.000	0.000		
			102:1.2G + 1.5	Max +ve	0.000	0.000	0.000	0.058
				Max -ve	0.000	0.000		
			103:1.2G + WL	Max +ve	0.000	0.000	0.000	0.160
				Max -ve	0.000	0.000		
			107:0.9G + WL	Max +ve	0.000	0.000	0.000	0.150
				Max -ve	0.000	0.000		
			201:0.7Q	Max +ve	0.000	0.000	0.000	0.008
				Max -ve	0.000	0.000		
			202:G + 0.4Q	Max +ve	0.000	0.000	0.000	0.039
				Max -ve	0.000	0.000		
			203:G + WS (S	Max +ve	0.000	0.000	0.000	0.132
				Max -ve	0.000	0.000		
3	3	1.791	1:PERMANEN	Max +ve	0.000	0.000	0.000	0.210
				Max -ve	0.000	0.000	1.791	-0.210
			2:IMPOSED A(	Max +ve	0.000	0.000	0.000	0.102
				Max -ve	0.000	0.000	1.791	-0.101
			3:DESIGN WIN	Max +ve	0.000	0.000	1.791	0.302
				Max -ve	0.000	0.000	0.000	-0.271
			7:SERVICE WI	Max +ve	0.000	0.000	1.791	0.245
				Max -ve	0.000	0.000	0.000	-0.220
			101:1.35G	Max +ve	0.000	0.000	0.000	0.283

Beam Maximum Shear Forces Cont...

Beam	Node A	Length (m)	L/C		d (m)	Max Fz (kN)	d (m)	Max Fy (kN)
				Max -ve	0.000	0.000	1.791	-0.284
			102:1.2G + 1.5	Max +ve	0.000	0.000	0.000	0.404
				Max -ve	0.000	0.000	1.791	-0.404
			103:1.2G + WL	Max +ve	0.000	0.000	1.791	0.049
				Max -ve	0.000	0.000	0.000	-0.020
			107:0.9G + WL	Max +ve	0.000	0.000	1.791	0.112
				Max -ve	0.000	0.000	0.000	-0.083
			201:0.7Q	Max +ve	0.000	0.000	0.000	0.071
				Max -ve	0.000	0.000	1.791	-0.071
			202:G + 0.4Q	Max +ve	0.000	0.000	0.000	0.251
				Max -ve	0.000	0.000	1.791	-0.251
			203:G + WS (S	Max +ve	0.000	0.000	1.791	0.035
				Max -ve	0.000	0.000	0.000	-0.010
4	4	1.791	1:PERMANEN	Max +ve	0.000	0.000	0.000	0.210
				Max -ve	0.000	0.000	1.791	-0.210
			2:IMPOSED A(	Max +ve	0.000	0.000	0.000	0.102
				Max -ve	0.000	0.000	1.791	-0.101
			3:DESIGN WIN	Max +ve	0.000	0.000	1.791	0.577
				Max -ve	0.000	0.000	0.000	-0.605
			7:SERVICE WI	Max +ve	0.000	0.000	1.791	0.472
				Max -ve	0.000	0.000	0.000	-0.495
			101:1.35G	Max +ve	0.000	0.000	0.000	0.283
				Max -ve	0.000	0.000	1.791	-0.284
			102:1.2G + 1.5	Max +ve	0.000	0.000	0.000	0.404
				Max -ve	0.000	0.000	1.791	-0.404
			103:1.2G + WL	Max +ve	0.000	0.000	1.791	0.325
				Max -ve	0.000	0.000	0.000	-0.353
			107:0.9G + WL	Max +ve	0.000	0.000	1.791	0.388
				Max -ve	0.000	0.000	0.000	-0.416
			201:0.7Q	Max +ve	0.000	0.000	0.000	0.071
				Max -ve	0.000	0.000	1.791	-0.071
			202:G + 0.4Q	Max +ve	0.000	0.000	0.000	0.251
				Max -ve	0.000	0.000	1.791	-0.251
			203:G + WS (S	Max +ve	0.000	0.000	1.791	0.262
				Max -ve	0.000	0.000	0.000	-0.285
5	6	0.201	1:PERMANEN	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	0.201	-0.047
			2:IMPOSED A(	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	0.201	-0.023
			3:DESIGN WIN	Max +ve	0.000	0.000	0.201	0.064
				Max -ve	0.000	0.000	0.000	-0.000
			7:SERVICE WI	Max +ve	0.000	0.000	0.201	0.052
				Max -ve	0.000	0.000	0.000	-0.000
			101:1.35G	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	0.201	-0.064
			102:1.2G + 1.5	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	0.201	-0.091
			103:1.2G + WL	Max +ve	0.000	0.000	0.201	0.008
				Max -ve	0.000	0.000	0.000	-0.000
			107:0.9G + WL	Max +ve	0.000	0.000	0.201	0.022
				Max -ve	0.000	0.000	0.000	-0.000
			201:0.7Q	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	0.201	-0.016
			202:G + 0.4Q	Max +ve	0.000	0.000	0.000	0.000

Beam Maximum Shear Forces Cont...

Beam	Node A	Length (m)	L/C		d (m)	Max Fz (kN)	d (m)	Max Fy (kN)
				Max -ve	0.000	0.000	0.201	-0.056
			203:G + WS (S	Max +ve	0.000	0.000	0.201	0.005
				Max -ve	0.000	0.000	0.000	-0.000
6	7	0.201	1:PERMANEN	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.201	-0.047
			2:IMPOSED A(	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.201	-0.023
			3:DESIGN WIN	Max +ve	0.000	0.000	0.201	0.133
				Max -ve	0.000	0.000	0.000	-0.000
			7:SERVICE WI	Max +ve	0.000	0.000	0.201	0.109
				Max -ve	0.000	0.000	0.000	-0.000
			101:1.35G	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.201	-0.064
			102:1.2G + 1.5	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.201	-0.091
			103:1.2G + WL	Max +ve	0.000	0.000	0.201	0.076
				Max -ve	0.000	0.000	0.000	-0.000
			107:0.9G + WL	Max +ve	0.000	0.000	0.201	0.090
				Max -ve	0.000	0.000	0.000	-0.000
			201:0.7Q	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.201	-0.016
			202:G + 0.4Q	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.201	-0.056
			203:G + WS (S	Max +ve	0.000	0.000	0.201	0.061
				Max -ve	0.000	0.000	0.000	-0.000
7	3	0.450	1:PERMANEN	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.450	-0.026
			2:IMPOSED A(	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-0.005
			3:DESIGN WIN	Max +ve	0.000	0.000	0.000	0.599
				Max -ve	0.000	0.000		
			7:SERVICE WI	Max +ve	0.000	0.000	0.000	0.493
				Max -ve	0.000	0.000		
			101:1.35G	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.450	-0.035
			102:1.2G + 1.5	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.450	-0.038
			103:1.2G + WL	Max +ve	0.000	0.000	0.000	0.584
				Max -ve	0.000	0.000		
			107:0.9G + WL	Max +ve	0.000	0.000	0.000	0.588
				Max -ve	0.000	0.000		
			201:0.7Q	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-0.003
			202:G + 0.4Q	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.450	-0.028
			203:G + WS (S	Max +ve	0.000	0.000	0.000	0.481
				Max -ve	0.000	0.000		
8	8	0.450	1:PERMANEN	Max +ve	0.000	0.000	0.000	0.028
				Max -ve	0.000	0.000		
			2:IMPOSED A(	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-0.006
			3:DESIGN WIN	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-0.650
			7:SERVICE WI	Max +ve	0.000	0.000		

Beam Maximum Shear Forces Cont...

Beam	Node A	Length (m)	L/C		d (m)	Max Fz (kN)	d (m)	Max Fy (kN)
				Max -ve	0.000	0.000	0.000	-0.536
			101:1.35G	Max +ve	0.000	0.000	0.000	0.038
				Max -ve	0.000	0.000		
			102:1.2G + 1.5	Max +ve	0.000	0.000	0.000	0.024
				Max -ve	0.000	0.000		
			103:1.2G + WL	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-0.617
			107:0.9G + WL	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-0.625
			201:0.7Q	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-0.004
			202:G + 0.4Q	Max +ve	0.000	0.000	0.000	0.025
				Max -ve	0.000	0.000		
			203:G + WS (S	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-0.508
9	9	0.450	1:PERMANEN	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-0.028
			2:IMPOSED AC	Max +ve	0.000	0.000	0.000	0.006
				Max -ve	0.000	0.000		
			3:DESIGN WIN	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-0.698
			7:SERVICE WI	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-0.575
			101:1.35G	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-0.038
			102:1.2G + 1.5	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-0.024
			103:1.2G + WL	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-0.732
			107:0.9G + WL	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-0.723
			201:0.7Q	Max +ve	0.000	0.000	0.000	0.004
				Max -ve	0.000	0.000		
			202:G + 0.4Q	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-0.025
			203:G + WS (S	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-0.603
10	10	2.220	1:PERMANEN	Max +ve	0.000	0.000	0.000	0.033
				Max -ve	0.000	0.000	2.220	-0.033
			2:IMPOSED AC	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-0.000
			3:DESIGN WIN	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-0.265
			7:SERVICE WI	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-0.218
			101:1.35G	Max +ve	0.000	0.000	0.000	0.044
				Max -ve	0.000	0.000	2.220	-0.044
			102:1.2G + 1.5	Max +ve	0.000	0.000	0.000	0.039
				Max -ve	0.000	0.000	2.220	-0.039
			103:1.2G + WL	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	2.220	-0.304
			107:0.9G + WL	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	2.220	-0.295
			201:0.7Q	Max +ve	0.000	0.000		

Beam Maximum Shear Forces Cont...

Beam	Node A	Length (m)	L/C		d (m)	Max Fz (kN)	d (m)	Max Fy (kN)
				Max -ve	0.000	0.000	0.000	-0.000
			202:G + 0.4Q	Max +ve	0.000	0.000	0.000	0.033
				Max -ve	0.000	0.000	2.220	-0.033
			203:G + WS (S	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	2.220	-0.251
11	11	0.450	1:PERMANEN	Max +ve	0.000	0.000	0.000	0.026
				Max -ve	0.000	0.000		
			2:IMPOSED A(	Max +ve	0.000	0.000	0.000	0.005
				Max -ve	0.000	0.000		
			3:DESIGN WIN	Max +ve	0.000	0.000	0.000	0.552
				Max -ve	0.000	0.000		
			7:SERVICE WI	Max +ve	0.000	0.000	0.000	0.455
				Max -ve	0.000	0.000		
			101:1.35G	Max +ve	0.000	0.000	0.000	0.035
				Max -ve	0.000	0.000		
			102:1.2G + 1.5	Max +ve	0.000	0.000	0.000	0.038
				Max -ve	0.000	0.000		
			103:1.2G + WL	Max +ve	0.000	0.000	0.000	0.582
				Max -ve	0.000	0.000		
			107:0.9G + WL	Max +ve	0.000	0.000	0.000	0.575
				Max -ve	0.000	0.000		
			201:0.7Q	Max +ve	0.000	0.000	0.000	0.003
				Max -ve	0.000	0.000		
			202:G + 0.4Q	Max +ve	0.000	0.000	0.000	0.028
				Max -ve	0.000	0.000		
			203:G + WS (S	Max +ve	0.000	0.000	0.000	0.480
				Max -ve	0.000	0.000		
12	8	0.636	1:PERMANEN	Max +ve	0.000	0.000	0.000	0.003
				Max -ve	0.000	0.000	0.636	-0.003
			2:IMPOSED A(	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	0.000	0.000
			3:DESIGN WIN	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	0.000	0.000
			7:SERVICE WI	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	0.000	0.000
			101:1.35G	Max +ve	0.000	0.000	0.000	0.004
				Max -ve	0.000	0.000	0.636	-0.004
			102:1.2G + 1.5	Max +ve	0.000	0.000	0.000	0.003
				Max -ve	0.000	0.000	0.636	-0.003
			103:1.2G + WL	Max +ve	0.000	0.000	0.000	0.003
				Max -ve	0.000	0.000	0.636	-0.003
			107:0.9G + WL	Max +ve	0.000	0.000	0.000	0.003
				Max -ve	0.000	0.000	0.636	-0.003
			201:0.7Q	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	0.000	0.000
			202:G + 0.4Q	Max +ve	0.000	0.000	0.000	0.003
				Max -ve	0.000	0.000	0.636	-0.003
			203:G + WS (S	Max +ve	0.000	0.000	0.000	0.003
				Max -ve	0.000	0.000	0.636	-0.003
13	9	0.636	1:PERMANEN	Max +ve	0.000	0.000	0.000	0.003
				Max -ve	0.000	0.000	0.636	-0.003
			2:IMPOSED A(	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	0.000	0.000
			3:DESIGN WIN	Max +ve	0.000	0.000	0.000	0.000

Beam Maximum Shear Forces Cont...

Beam	Node A	Length (m)	L/C		d (m)	Max Fz (kN)	d (m)	Max Fy (kN)
				Max -ve	0.000	0.000	0.000	0.000
			7:SERVICE WI	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	0.000	0.000
			101:1.35G	Max +ve	0.000	0.000	0.000	0.004
				Max -ve	0.000	0.000	0.636	-0.004
			102:1.2G + 1.5	Max +ve	0.000	0.000	0.000	0.003
				Max -ve	0.000	0.000	0.636	-0.003
			103:1.2G + WL	Max +ve	0.000	0.000	0.000	0.003
				Max -ve	0.000	0.000	0.636	-0.003
			107:0.9G + WL	Max +ve	0.000	0.000	0.000	0.003
				Max -ve	0.000	0.000	0.636	-0.003
			201:0.7Q	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	0.000	0.000
			202:G + 0.4Q	Max +ve	0.000	0.000	0.000	0.003
				Max -ve	0.000	0.000	0.636	-0.003
			203:G + WS (S	Max +ve	0.000	0.000	0.000	0.003
				Max -ve	0.000	0.000	0.636	-0.003

Beam Maximum Axial Forces

Distances to maxima are given from beam end A.

Beam	Node A	Length (m)	L/C		d (m)	Max Fx (kN)
1	1	1.900	1:PERMANEN	Max +ve	0.000	0.718
				Max -ve		
			2:IMPOSED AC	Max +ve	0.000	0.259
				Max -ve		
			3:DESIGN WIN	Max +ve		
				Max -ve	0.000	-0.979
			7:SERVICE WI	Max +ve		
				Max -ve	0.000	-0.800
			101:1.35G	Max +ve	0.000	0.970
				Max -ve		
			102:1.2G + 1.5	Max +ve	0.000	1.250
				Max -ve		
			103:1.2G + WL	Max +ve		
				Max -ve	1.900	-0.240
			107:0.9G + WL	Max +ve		
				Max -ve	1.900	-0.425
			201:0.7Q	Max +ve	0.000	0.181
				Max -ve		
			202:G + 0.4Q	Max +ve	0.000	0.822
				Max -ve		
			203:G + WS (S	Max +ve		
				Max -ve	1.900	-0.185
2	2	1.900	1:PERMANEN	Max +ve	0.000	0.718
				Max -ve		
			2:IMPOSED AC	Max +ve	0.000	0.259
				Max -ve		
			3:DESIGN WIN	Max +ve		
				Max -ve	0.000	-0.722
			7:SERVICE WI	Max +ve		
				Max -ve	0.000	-0.588

Beam Maximum Axial Forces Cont...

Beam	Node A	Length (m)	L/C		d (m)	Max Fx (kN)
			101:1.35G	Max +ve	0.000	0.970
				Max -ve		
			102:1.2G + 1.5	Max +ve	0.000	1.250
				Max -ve		
			103:1.2G + WL	Max +ve	0.000	0.140
				Max -ve		
			107:0.9G + WL	Max +ve		
				Max -ve	1.900	-0.168
			201:0.7Q	Max +ve	0.000	0.181
				Max -ve		
			202:G + 0.4Q	Max +ve	0.000	0.822
				Max -ve		
			203:G + WS (S	Max +ve	0.000	0.130
				Max -ve		
3	3	1.791	1:PERMANEN	Max +ve	0.000	0.610
				Max -ve		
			2:IMPOSED A(	Max +ve	0.000	0.294
				Max -ve		
			3:DESIGN WIN	Max +ve		
				Max -ve	0.000	-0.857
			7:SERVICE WI	Max +ve		
				Max -ve	0.000	-0.700
			101:1.35G	Max +ve	0.000	0.824
				Max -ve		
			102:1.2G + 1.5	Max +ve	0.000	1.173
				Max -ve		
			103:1.2G + WL	Max +ve		
				Max -ve	1.791	-0.409
			107:0.9G + WL	Max +ve		
				Max -ve	1.791	-0.521
			201:0.7Q	Max +ve	0.000	0.206
				Max -ve		
			202:G + 0.4Q	Max +ve	0.000	0.728
				Max -ve		
			203:G + WS (S	Max +ve		
				Max -ve	1.791	-0.327
4	4	1.791	1:PERMANEN	Max +ve	0.000	0.610
				Max -ve		
			2:IMPOSED A(	Max +ve	0.000	0.294
				Max -ve		
			3:DESIGN WIN	Max +ve		
				Max -ve	0.000	-0.701
			7:SERVICE WI	Max +ve		
				Max -ve	0.000	-0.572
			101:1.35G	Max +ve	0.000	0.824
				Max -ve		
			102:1.2G + 1.5	Max +ve	0.000	1.173
				Max -ve		
			103:1.2G + WL	Max +ve	0.000	0.031
				Max -ve	1.791	-0.254
			107:0.9G + WL	Max +ve		
				Max -ve	1.791	-0.366
			201:0.7Q	Max +ve	0.000	0.206
				Max -ve		

Beam Maximum Axial Forces Cont...

Beam	Node A	Length (m)	L/C		d (m)	Max Fx (kN)
			202:G + 0.4Q	Max +ve	0.000	0.728
				Max -ve		
			203:G + WS (S	Max +ve	0.000	0.038
				Max -ve	1.791	-0.199
5	6	0.201	1:PERMANEN	Max +ve	0.000	0.000
				Max -ve	0.201	-0.027
			2:IMPOSED A(	Max +ve		
				Max -ve	0.201	-0.013
			3:DESIGN WIN	Max +ve	0.000	0.000
				Max -ve		
			7:SERVICE WI	Max +ve		
				Max -ve	0.000	-0.000
			101:1.35G	Max +ve	0.000	0.000
				Max -ve	0.201	-0.036
			102:1.2G + 1.5	Max +ve	0.000	0.000
				Max -ve	0.201	-0.051
			103:1.2G + WL	Max +ve	0.000	0.000
				Max -ve	0.201	-0.032
			107:0.9G + WL	Max +ve	0.000	0.000
				Max -ve	0.201	-0.024
			201:0.7Q	Max +ve		
				Max -ve	0.201	-0.009
			202:G + 0.4Q	Max +ve	0.000	0.000
				Max -ve	0.201	-0.032
			203:G + WS (S	Max +ve		
				Max -ve	0.201	-0.027
6	7	0.201	1:PERMANEN	Max +ve	0.000	0.000
				Max -ve	0.201	-0.027
			2:IMPOSED A(	Max +ve	0.000	0.000
				Max -ve	0.201	-0.013
			3:DESIGN WIN	Max +ve	0.000	0.000
				Max -ve		
			7:SERVICE WI	Max +ve	0.000	0.000
				Max -ve		
			101:1.35G	Max +ve	0.000	0.000
				Max -ve	0.201	-0.036
			102:1.2G + 1.5	Max +ve	0.000	0.000
				Max -ve	0.201	-0.051
			103:1.2G + WL	Max +ve	0.000	0.000
				Max -ve	0.201	-0.032
			107:0.9G + WL	Max +ve	0.000	0.000
				Max -ve	0.201	-0.024
			201:0.7Q	Max +ve	0.000	0.000
				Max -ve	0.201	-0.009
			202:G + 0.4Q	Max +ve	0.000	0.000
				Max -ve	0.201	-0.032
			203:G + WS (S	Max +ve	0.000	0.000
				Max -ve	0.201	-0.027
7	3	0.450	1:PERMANEN	Max +ve		
				Max -ve	0.000	-0.456
			2:IMPOSED A(	Max +ve		
				Max -ve	0.000	-0.200
			3:DESIGN WIN	Max +ve	0.000	1.231
				Max -ve		

Beam Maximum Axial Forces Cont...

Beam	Node A	Length (m)	L/C		d (m)	Max Fx (kN)
			7:SERVICE WI	Max +ve	0.000	1.011
				Max -ve		
			101:1.35G	Max +ve		
				Max -ve	0.000	-0.616
			102:1.2G + 1.5	Max +ve		
				Max -ve	0.000	-0.847
			103:1.2G + WL	Max +ve	0.000	0.684
				Max -ve		
			107:0.9G + WL	Max +ve	0.000	0.821
				Max -ve		
			201:0.7Q	Max +ve		
				Max -ve	0.000	-0.140
			202:G + 0.4Q	Max +ve		
				Max -ve	0.000	-0.536
			203:G + WS (S	Max +ve	0.000	0.555
				Max -ve		
8	8	0.450	1:PERMANEN	Max +ve	0.000	0.549
				Max -ve		
			2:IMPOSED AC	Max +ve	0.000	0.254
				Max -ve		
			3:DESIGN WIN	Max +ve		
				Max -ve	0.000	-0.114
			7:SERVICE WI	Max +ve		
				Max -ve	0.000	-0.088
			101:1.35G	Max +ve	0.000	0.741
				Max -ve		
			102:1.2G + 1.5	Max +ve	0.000	1.040
				Max -ve		
			103:1.2G + WL	Max +ve	0.000	0.544
				Max -ve		
			107:0.9G + WL	Max +ve	0.000	0.380
				Max -ve		
			201:0.7Q	Max +ve	0.000	0.178
				Max -ve		
			202:G + 0.4Q	Max +ve	0.000	0.651
				Max -ve		
			203:G + WS (S	Max +ve	0.000	0.461
				Max -ve		
9	9	0.450	1:PERMANEN	Max +ve	0.000	0.549
				Max -ve		
			2:IMPOSED AC	Max +ve	0.000	0.254
				Max -ve		
			3:DESIGN WIN	Max +ve		
				Max -ve	0.000	-1.539
			7:SERVICE WI	Max +ve		
				Max -ve	0.000	-1.261
			101:1.35G	Max +ve	0.000	0.741
				Max -ve		
			102:1.2G + 1.5	Max +ve	0.000	1.040
				Max -ve		
			103:1.2G + WL	Max +ve		
				Max -ve	0.450	-0.909
			107:0.9G + WL	Max +ve		
				Max -ve	0.450	-1.067

Beam Maximum Axial Forces Cont...

Beam	Node A	Length (m)	L/C		d (m)	Max Fx (kN)
			201:0.7Q	Max +ve	0.000	0.178
				Max -ve		
			202:G + 0.4Q	Max +ve	0.000	0.651
				Max -ve		
			203:G + WS (S	Max +ve		
				Max -ve	0.450	-0.737
10	10	2.220	1:PERMANEN	Max +ve		
				Max -ve	0.000	-0.394
			2:IMPOSED A(	Max +ve		
				Max -ve	0.000	-0.195
			3:DESIGN WIN	Max +ve	0.000	0.367
				Max -ve		
			7:SERVICE WI	Max +ve	0.000	0.300
				Max -ve		
			101:1.35G	Max +ve		
				Max -ve	0.000	-0.532
			102:1.2G + 1.5	Max +ve		
				Max -ve	0.000	-0.765
			103:1.2G + WL	Max +ve		
				Max -ve	0.000	-0.106
			107:0.9G + WL	Max +ve	0.000	0.013
				Max -ve		
			201:0.7Q	Max +ve		
				Max -ve	0.000	-0.136
			202:G + 0.4Q	Max +ve		
				Max -ve	0.000	-0.472
			203:G + WS (S	Max +ve		
				Max -ve	0.000	-0.094
11	11	0.450	1:PERMANEN	Max +ve		
				Max -ve	0.000	-0.456
			2:IMPOSED A(	Max +ve		
				Max -ve	0.000	-0.200
			3:DESIGN WIN	Max +ve		
				Max -ve	0.000	-0.450
			7:SERVICE WI	Max +ve		
				Max -ve	0.000	-0.373
			101:1.35G	Max +ve		
				Max -ve	0.000	-0.616
			102:1.2G + 1.5	Max +ve		
				Max -ve	0.000	-0.847
			103:1.2G + WL	Max +ve		
				Max -ve	0.000	-0.997
			107:0.9G + WL	Max +ve		
				Max -ve	0.000	-0.860
			201:0.7Q	Max +ve		
				Max -ve	0.000	-0.140
			202:G + 0.4Q	Max +ve		
				Max -ve	0.000	-0.536
			203:G + WS (S	Max +ve		
				Max -ve	0.000	-0.829
12	8	0.636	1:PERMANEN	Max +ve	0.000	0.091
				Max -ve		
			2:IMPOSED A(	Max +ve	0.000	0.007
				Max -ve		

Beam Maximum Axial Forces Cont...

Beam	Node A	Length (m)	L/C		d (m)	Max Fx (kN)
			3:DESIGN WIN	Max +ve		
				Max -ve	0.000	-1.222
			7:SERVICE WI	Max +ve		
				Max -ve	0.000	-1.006
			101:1.35G	Max +ve	0.000	0.123
				Max -ve		
			102:1.2G + 1.5	Max +ve	0.000	0.119
				Max -ve		
			103:1.2G + WL	Max +ve		
				Max -ve	0.636	-1.120
			107:0.9G + WL	Max +ve		
				Max -ve	0.636	-1.145
			201:0.7Q	Max +ve	0.000	0.005
				Max -ve		
			202:G + 0.4Q	Max +ve	0.000	0.094
				Max -ve		
			203:G + WS (S	Max +ve		
				Max -ve	0.636	-0.921
13	9	0.636	1:PERMANEN	Max +ve	0.000	0.091
				Max -ve		
			2:IMPOSED A(	Max +ve	0.000	0.007
				Max -ve		
			3:DESIGN WIN	Max +ve	0.000	1.155
				Max -ve		
			7:SERVICE WI	Max +ve	0.000	0.952
				Max -ve		
			101:1.35G	Max +ve	0.000	0.123
				Max -ve		
			102:1.2G + 1.5	Max +ve	0.000	0.119
				Max -ve		
			103:1.2G + WL	Max +ve	0.000	1.264
				Max -ve		
			107:0.9G + WL	Max +ve	0.000	1.237
				Max -ve		
			201:0.7Q	Max +ve	0.000	0.005
				Max -ve		
			202:G + 0.4Q	Max +ve	0.000	0.094
				Max -ve		
			203:G + WS (S	Max +ve	0.000	1.042
				Max -ve		

Reactions

Node	L/C	Horizontal FX (kN)	Vertical FY (kN)	Horizontal FZ (kN)	Moment MX (kNm)	MY (kNm)	MZ (kNm)
1	1:PERMANEN	0.034	0.718	0.000	0.000	0.000	0.000
	2:IMPOSED A(	0.011	0.259	0.000	0.000	0.000	0.000
	3:DESIGN WIN	-0.214	-0.979	0.000	0.000	0.000	0.000
	7:SERVICE WI	-0.176	-0.800	0.000	0.000	0.000	0.000
	101:1.35G	0.046	0.970	0.000	0.000	0.000	0.000
	102:1.2G + 1.5	0.058	1.250	0.000	0.000	0.000	0.000
	103:1.2G + WL	-0.173	-0.117	0.000	0.000	0.000	0.000
	107:0.9G + WL	-0.183	-0.332	0.000	0.000	0.000	0.000
	201:0.7Q	0.008	0.181	0.000	0.000	0.000	0.000
	202:G + 0.4Q	0.039	0.822	0.000	0.000	0.000	0.000
	203:G + WS (S	-0.142	-0.082	0.000	0.000	0.000	0.000
2	1:PERMANEN	-0.034	0.718	0.000	0.000	0.000	0.000
	2:IMPOSED A(	-0.011	0.259	0.000	0.000	0.000	0.000
	3:DESIGN WIN	-0.119	-0.722	0.000	0.000	0.000	0.000
	7:SERVICE WI	-0.098	-0.588	0.000	0.000	0.000	0.000
	101:1.35G	-0.046	0.970	0.000	0.000	0.000	0.000
	102:1.2G + 1.5	-0.058	1.250	0.000	0.000	0.000	0.000
	103:1.2G + WL	-0.160	0.140	0.000	0.000	0.000	0.000
	107:0.9G + WL	-0.150	-0.075	0.000	0.000	0.000	0.000
	201:0.7Q	-0.008	0.181	0.000	0.000	0.000	0.000
	202:G + 0.4Q	-0.039	0.822	0.000	0.000	0.000	0.000
	203:G + WS (S	-0.132	0.130	0.000	0.000	0.000	0.000

Reaction Summary

	Node	L/C	Horizontal FX (kN)	Vertical FY (kN)	Horizontal FZ (kN)	Moment MX (kNm)	MY (kNm)	MZ (kNm)
Max FX	1	102:1.2G + 1.5	**0.058**	1.250	0.000	0.000	0.000	0.000
Min FX	1	3:DESIGN WIN	**-0.214**	-0.979	0.000	0.000	0.000	0.000
Max FY	1	102:1.2G + 1.5	0.058	**1.250**	0.000	0.000	0.000	0.000
Min FY	1	3:DESIGN WIN	-0.214	**-0.979**	0.000	0.000	0.000	0.000
Max FZ	1	1:PERMANEN	0.034	0.718	**0.000**	0.000	0.000	0.000
Min FZ	1	1:PERMANEN	0.034	0.718	**0.000**	0.000	0.000	0.000
Max MX	1	1:PERMANEN	0.034	0.718	0.000	**0.000**	0.000	0.000
Min MX	1	1:PERMANEN	0.034	0.718	0.000	**0.000**	0.000	0.000
Max MY	1	1:PERMANEN	0.034	0.718	0.000	0.000	**0.000**	0.000
Min MY	1	1:PERMANEN	0.034	0.718	0.000	0.000	**0.000**	0.000
Max MZ	1	1:PERMANEN	0.034	0.718	0.000	0.000	0.000	**0.000**
Min MZ	1	1:PERMANEN	0.034	0.718	0.000	0.000	0.000	**0.000**

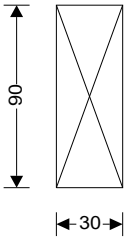
	Project				Job no.	
AJN CONSULTING ENGINEERS	Mimosa Outdoor Timber Gazebo - 4.27m x 3.69m x 3.23m (H)				2023-008	
	Calcs for				Start page no./Revision	
	Rafters (Outer)				1	
	Calcs by	Calcs date	Checked by	Checked date	Approved by	Approved date
	AN	20/03/2023				

TIMBER MEMBER DESIGN TO AS1720.1-2010

Tedds calculation version 1.5.05

Analysis results

Design moment in major axis	M^*_x = **0.200** kNm
Design shear	V^* = **0.600** kN
Design axial compression	N^*_c = **1.400** kN



Timber section details

Breadth of timber sections	b = **30** mm
Depth of timber sections	d = **90** mm
Number of timber sections in member	N = **1**
Overall breadth of timber member	b_b = N × b = **30** mm
Timber species	**Mixed softwood species (excl.Pinus species)**
Moisture condition	**Seasoned**
Timber strength grade - Table H2.1	**F4**

Member details

Load duration - cl.2.4.1	**Long-term**
Overall length of member	L_x = **1800** mm
Effective length factor - Table 3.2	g_{13} = **1**
Distance between lateral restraints in major axis	L_{ax} = **1800** mm
Distance between lateral restraints in minor axis	L_{ay} = **450** mm

Section properties

Cross sectional area of member	A = N × b × d = **2700** mm^2
Section modulus	Z_x = N × b × d^2 / 6 = **40500** mm^3
	Z_y = d × (N × b)^2 / 6 = **13500** mm^3
Second moment of area	I_x = N × b × d^3 / 12 = **1822500** mm^4
	I_y = d × (N × b)^3 / 12 = **202500** mm^4
Radius of gyration	r_x = √(I_x / A) = **26.0** mm
	r_y = √(I_y / A) = **8.7** mm

Modification factors

Duration of load factor for strength - Table 2.3	k_1 = **0.80**
Moisture condition factor - cl.2.4.2.3	k_4 = **1.00**
Temperature factor - cl.2.4.3	k_6 = **1.00**
Length and position of bearing factor - cl.2.4.4	k_7 = **1.00**
Strength sharing factor - Table 2.7	k_9 = **1.00**
Temporary design action ratio	r = **0.25**
Material constant - exp.E2(1)	ρ_b = 14.71 × (E / f'_b)$^{-0.480}$ × $r^{-0.061}$ = **0.80**
Distance between discrete lateral restraints	L_{ay} = **450** mm L_{ay} / d < 64 × [N × b / (ρ_b × d)]^2

Major axis slenderness coefficient - cl.3.2.3.2(b) S_1 = **0.00**

Major axis bending stability factor - exp.3.2(10) k_{12bx} = **1.00**

Minor axis slenderness coefficient - cl.3.2.3.2 (c) S_2 = **0.00**

Minor axis bending stability factor - cl.3.2.4 k_{12by} = **1.00**

Material constant - exp.E2(3) $\rho_c = 11.39 \times (E / f'_c)^{-0.408} \times r^{-0.074}$ = **0.87**

Major axis slenderness coefficient - exp.3.3(5) $S_3 = L_{ax} / d$ = **20.00**

Major axis comp.stability factor - exp.3.3(11b) $k_{12cx} = 1.5 - 0.05 \times \rho_c \times S_3$ = **0.63**

Minor axis slenderness coeff. - exp.3.3(8) & (9) $S_4 = \min(L_{ay} / (N \times b), g_{13} \times L_x / (N \times b))$ = **15.00**

Minor axis comp.stability factor - exp.3.3(11b) $k_{12cy} = 1.5 - 0.05 \times \rho_c \times S_4$ = **0.85**

Bending strength - cl.3.2.1

Capacity factor - Table 2.1 ϕ_b = **0.9**

Design capacity in major axis bending - cl.3.2(2) $\phi M_x = \phi_b \times k_1 \times k_4 \times k_6 \times k_9 \times k_{12bx} \times f'_b \times Z_x$ = **0.350** kNm

PASS - Design capacity in bending exceeds design bending moment

Compressive strength - cl.3.3.1

Capacity factor - Table 2.1 ϕ_c = **0.9**

Cross-sectional area of member $A_c = N \times b \times d$ = **2700** mm^2

Major axis design capacity in compression - exp.3.3(2)

$\phi N_{cx} = \phi_c \times k_1 \times k_4 \times k_6 \times k_{12cx} \times f'_c \times A_c$ = **10.585** kN

Minor axis design capacity in compression - exp.3.3(2)

$\phi N_{cy} = \phi_c \times k_1 \times k_4 \times k_6 \times k_{12cy} \times f'_c \times A_c$ = **14.209** kN

PASS - Design capacity in compression exceeds design compression

Combined bending and compression - cl.3.5.1

Combined bending and compression check - exp.3.5(1) and exp.3.5(2)

$[M^*_x / \phi M_x]^2 + [N^*_c / \phi N_{cy}]$ = **0.425** < 1

$[M^*_x / \phi M_x] + [N^*_c / \phi N_{cx}]$ = **0.704** < 1

PASS - Beam design meets combined bending and compression criteria

Flexural shear strength - cl.3.2.5

Capacity factor - Table 2.1 ϕ_s = **0.9**

Shear plane area $A_s = N \times b \times d \times 2 / 3$ = **1800** mm^2

Design shear capacity - exp.3.2(14) $\phi V = \phi_s \times k_1 \times k_4 \times k_6 \times f'_s \times A_s$ = **1.685** kN

PASS - Design shear capacity exceeds design shear force

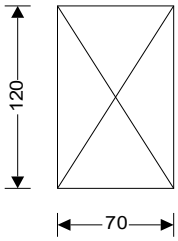
	Project				Job no.	
AJN CONSULTING ENGINEERS	Mimosa Outdoor Timber Gazebo - 4.27m x 3.69m x 3.23m (H)				2023-008	
	Calcs for				Start page no./Revision	
	Short Crossbar				1	
	Calcs by	Calcs date	Checked by	Checked date	Approved by	Approved date
	AN	20/03/2023				

TIMBER MEMBER DESIGN TO AS1720.1-2010

Tedds calculation version 1.5.05

Analysis results

Design moment in major axis	M^*_x = **0.310** kNm
Design shear	V^* = **0.590** kN
Design axial compression	N^*_c = **1.230** kN



Timber section details

Breadth of timber sections	b = **70** mm
Depth of timber sections	d = **120** mm
Number of timber sections in member	N = **1**
Overall breadth of timber member	b_b = N × b = **70** mm
Timber species	**Mixed softwood species (excl.Pinus species)**
Moisture condition	**Seasoned**
Timber strength grade - Table H2.1	**F4**

Member details

Load duration - cl.2.4.1	**Long-term**
Overall length of member	L_x = **3120** mm
Effective length factor - Table 3.2	g_{13} = **1**
Distance between lateral restraints in major axis	L_{ax} = **3120** mm
Distance between lateral restraints in minor axis	L_{ay} = **3120** mm

Section properties

Cross sectional area of member	A = N × b × d = **8400** mm^2
Section modulus	Z_x = N × b × d^2 / 6 = **168000** mm^3
	Z_y = d × (N × b)^2 / 6 = **98000** mm^3
Second moment of area	I_x = N × b × d^3 / 12 = **10080000** mm^4
	I_y = d × (N × b)^3 / 12 = **3430000** mm^4
Radius of gyration	r_x = √(I_x / A) = **34.6** mm
	r_y = √(I_y / A) = **20.2** mm

Modification factors

Duration of load factor for strength - Table 2.3	k_1 = **0.80**
Moisture condition factor - cl.2.4.2.3	k_4 = **1.00**
Temperature factor - cl.2.4.3	k_6 = **1.00**
Length and position of bearing factor - cl.2.4.4	k_7 = **1.00**
Strength sharing factor - Table 2.7	k_9 = **1.00**
Temporary design action ratio	r = **0.25**
Material constant - exp.E2(1)	ρ_b = 14.71 × (E / f'_b)$^{-0.480}$ × $r^{-0.061}$ = **0.80**
Distance between discrete lateral restraints	L_{ay} = **3120** mm	L_{ay} / d < 64 × [N × b / (ρ_b × d)]^2

Major axis slenderness coefficient - cl.3.2.3.2(b) S_1 = **0.00**

Major axis bending stability factor - exp.3.2(10) k_{12bx} = **1.00**

Minor axis slenderness coefficient - cl.3.2.3.2 (c) S_2 = **0.00**

Minor axis bending stability factor - cl.3.2.4 k_{12by} = **1.00**

Material constant - exp.E2(3) $\rho_c = 11.39 \times (E / f'_c)^{-0.408} \times r^{-0.074}$ = **0.87**

Major axis slenderness coefficient - exp.3.3(5) $S_3 = L_{ax} / d$ = **26.00**

Major axis comp.stability factor - exp.3.3(11c) $k_{12cx} = 200 / (\rho_c \times S_3)^2$ = **0.39**

Minor axis slenderness coeff. - exp.3.3(8) & (9) $S_4 = \min(L_{ay} / (N \times b), g_{13} \times L_x / (N \times b))$ = **44.57**

Minor axis comp.stability factor - exp.3.3(11c) $k_{12cy} = 200 / (\rho_c \times S_4)^2$ = **0.13**

Bending strength - cl.3.2.1

Capacity factor - Table 2.1 ϕ_b = **0.9**

Design capacity in major axis bending - cl.3.2(2) $\phi M_x = \phi_b \times k_1 \times k_4 \times k_6 \times k_9 \times k_{12bx} \times f'_b \times Z_x$ = **1.452** kNm

PASS - Design capacity in bending exceeds design bending moment

Compressive strength - cl.3.3.1

Capacity factor - Table 2.1 ϕ_c = **0.9**

Cross-sectional area of member $A_c = N \times b \times d$ = **8400** mm^2

Major axis design capacity in compression - exp.3.3(2)

$\phi N_{cx} = \phi_c \times k_1 \times k_4 \times k_6 \times k_{12cx} \times f'_c \times A_c$ = **20.480** kN

Minor axis design capacity in compression - exp.3.3(2)

$\phi N_{cy} = \phi_c \times k_1 \times k_4 \times k_6 \times k_{12cy} \times f'_c \times A_c$ = **6.969** kN

PASS - Design capacity in compression exceeds design compression

Combined bending and compression - cl.3.5.1

Combined bending and compression check - exp.3.5(1) and exp.3.5(2)

$[M^*_x / \phi M_x]^2 + [N^*_c / \phi N_{cy}]$ = **0.222** < 1

$[M^*_x / \phi M_x] + [N^*_c / \phi N_{cx}]$ = **0.274** < 1

PASS - Beam design meets combined bending and compression criteria

Flexural shear strength - cl.3.2.5

Capacity factor - Table 2.1 ϕ_s = **0.9**

Shear plane area $A_s = N \times b \times d \times 2 / 3$ = **5600** mm^2

Design shear capacity - exp.3.2(14) $\phi V = \phi_s \times k_1 \times k_4 \times k_6 \times f'_s \times A_s$ = **5.242** kN

PASS - Design shear capacity exceeds design shear force

Job Information

	Engineer	Checked	Approved
Name:			
Date:	20-Mar-23		

Structure Type	PLANE FRAME

Number of Nodes	8	Highest Node	11
Number of Elements	9	Highest Beam	13

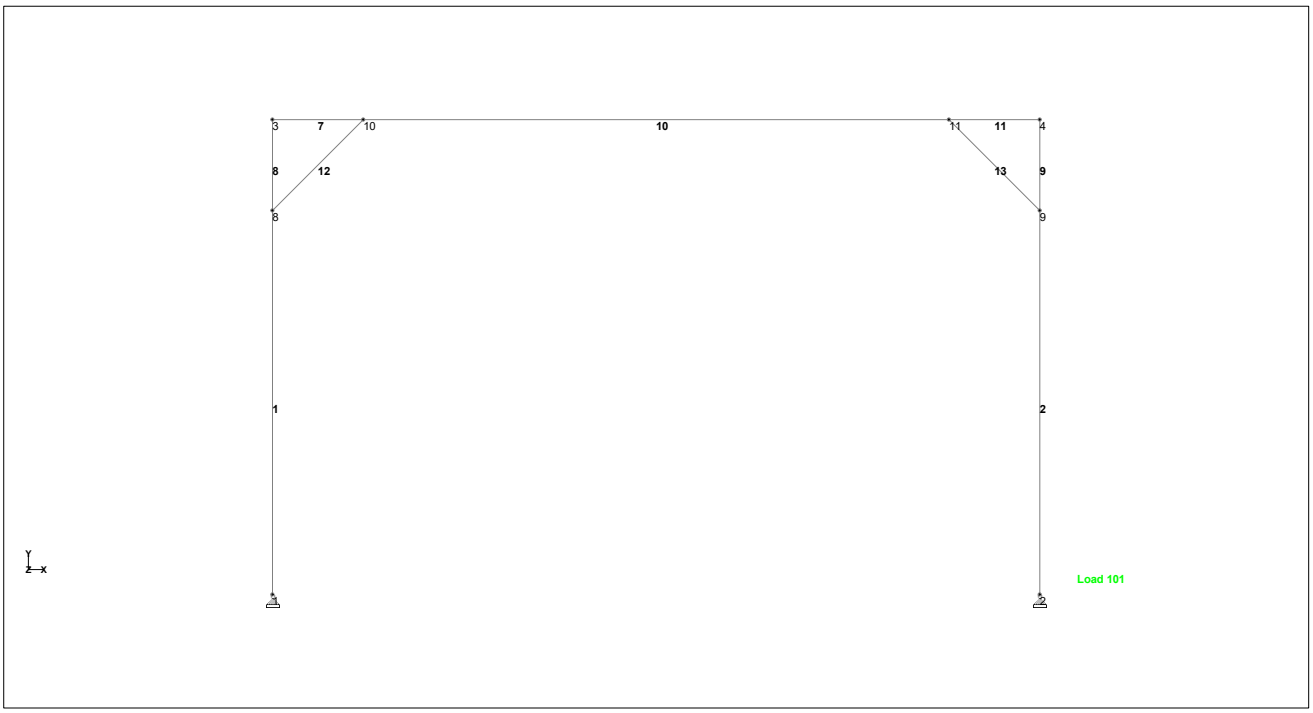
Number of Basic Load Cases	4
Number of Combination Load Cases	7

Included in this printout are data for:

All	The Whole Structure

Included in this printout are results for load cases:

Type	L/C	Name
Primary	1	PERMANENT ACTION (G)
Primary	2	IMPOSED ACTION (Q)
Primary	3	DESIGN WIND ACTION (SET 1) - TRANS
Primary	7	SERVICE WIND ACTION (SET 1) - TRAN
Combination	101	1.35G
Combination	102	1.2G + 1.5Q
Combination	103	1.2G + WU (SET 1) - TRANSVERSE
Combination	107	0.9G + WU (SET 1) - TRANSVERSE
Combination	201	0.7Q
Combination	202	G + 0.4Q
Combination	203	G + WS (SET 1) - TRANSVERSE



Whole Structure

Nodes

Node	X (m)	Y (m)	Z (m)
1	0.000	0.000	0.000
2	3.800	0.000	0.000
3	0.000	2.350	0.000
4	3.800	2.350	0.000
8	0.000	1.900	0.000
9	3.800	1.900	0.000
10	0.450	2.350	0.000
11	3.350	2.350	0.000

Beams

Beam	Node A	Node B	Length (m)	Property	β (degrees)
1	1	8	1.900	5	0
2	2	9	1.900	5	0
7	3	10	0.450	1	0
8	8	3	0.450	5	0
9	9	4	0.450	5	0
10	10	11	2.900	1	0
11	11	4	0.450	1	0
12	8	10	0.636	3	0
13	9	11	0.636	3	0

Section Properties

Prop	Section	Area (cm^2)	I_{yy} (cm^4)	I_{zz} (cm^4)	J (cm^4)	Material
1	Rect 0.12x0.07	84.000	343.000	1.01E+3	872.655	TIMBERF4
2	Rect 0.09x0.03	27.000	20.250	182.250	64.007	TIMBERF4
3	Rect 0.06x0.06	36.000	108.000	108.000	182.250	TIMBERF4
5	COLUMN	155.000	6.37E+3	6.37E+3	9.31E+3	TIMBERF4

Materials

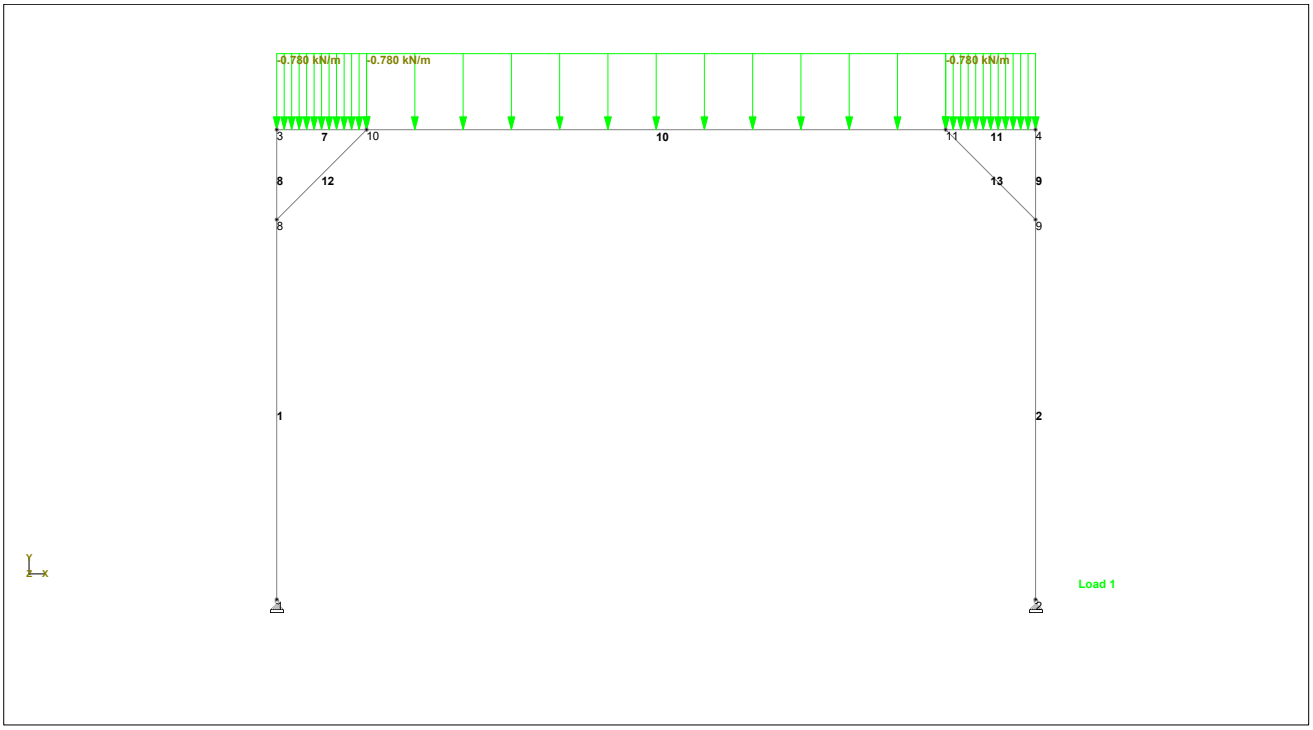
Mat	Name	E (kN/mm^2)	ν	Density (kg/m^3)	α (/°C)
1	TIMBERF4	6.100	0.400	356.901	0.000
2	STEEL	205.000	0.300	7.83E+3	12E -6
3	STAINLESSSTEEL	197.930	0.300	7.83E+3	18E -6
4	ALUMINUM	68.948	0.330	2.71E+3	23E -6
5	CONCRETE	21.718	0.170	2.4E+3	10E -6

Supports

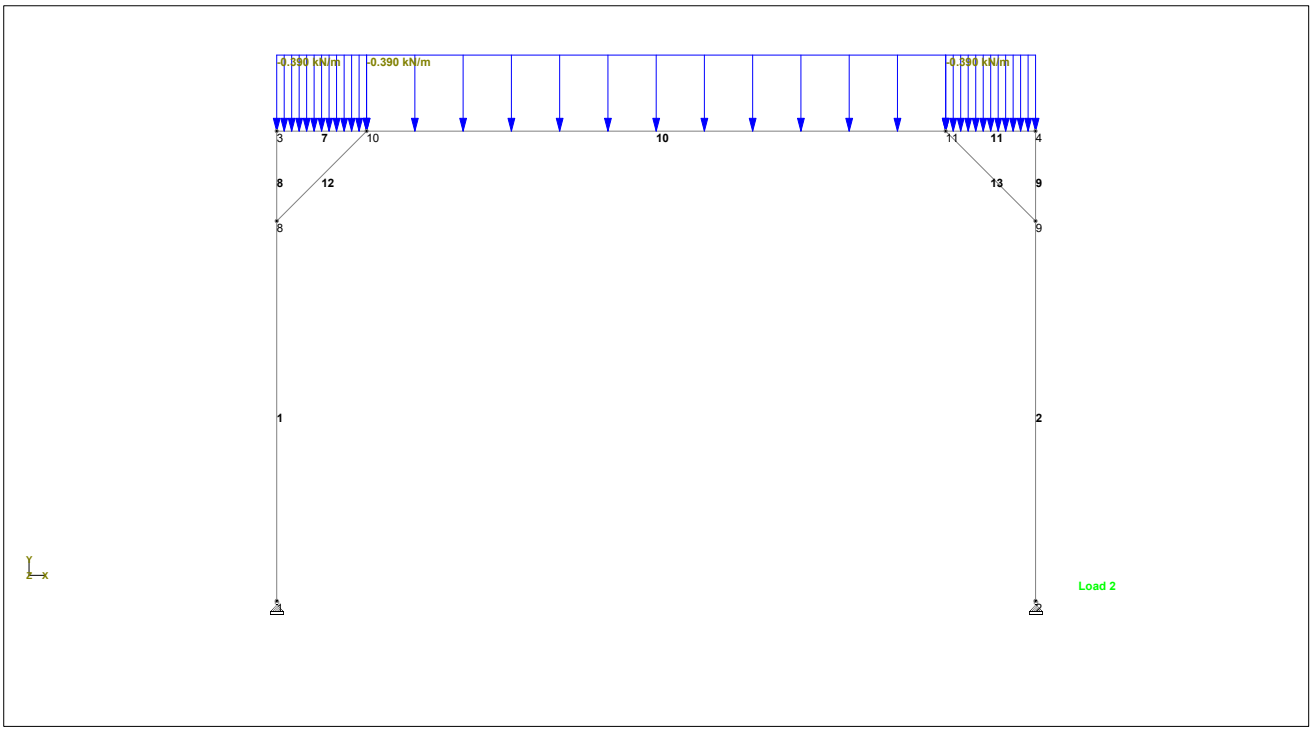
Node	X (kN/mm)	Y (kN/mm)	Z (kN/mm)	rX (kN-m/deg)	rY (kN-m/deg)	rZ (kN-m/deg)
1	Fixed	Fixed	Fixed	-	-	-
2	Fixed	Fixed	Fixed	-	-	-

Primary Load Cases

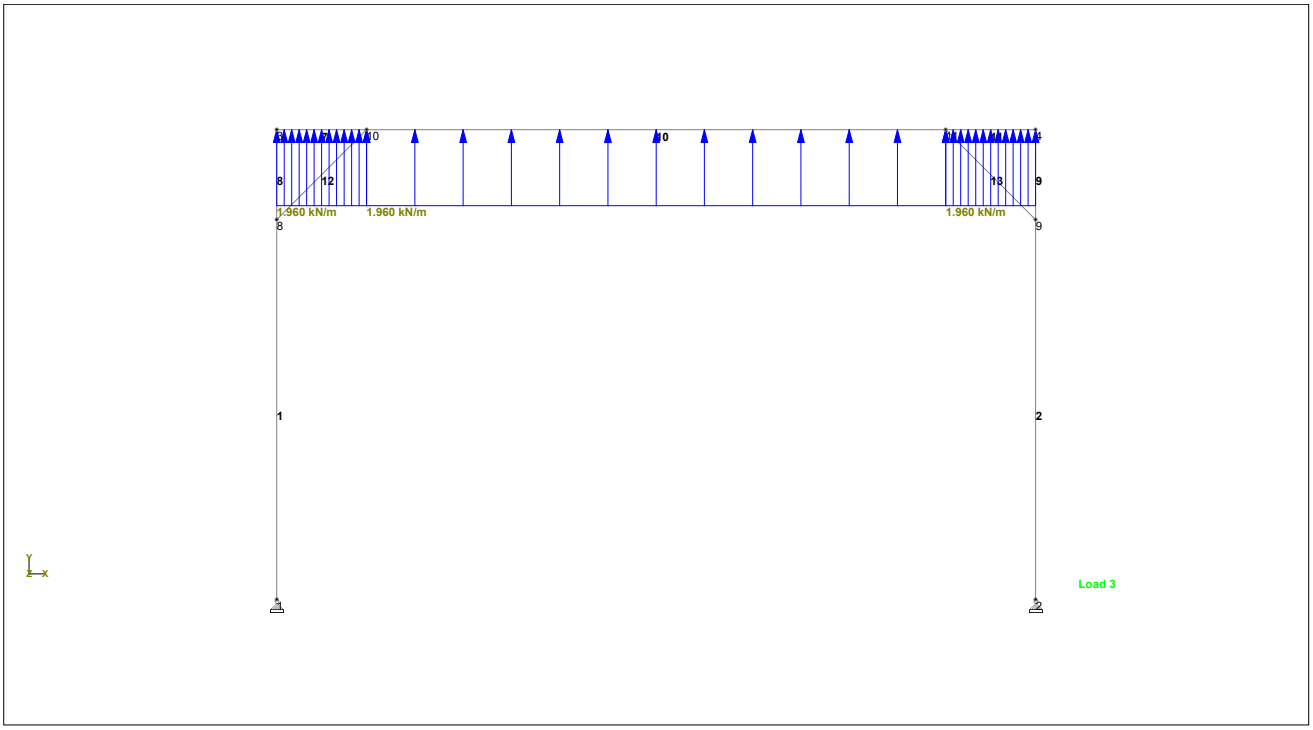
Number	Name	Type
1	PERMANENT ACTION (G)	Dead
2	IMPOSED ACTION (Q)	Roof Live
3	DESIGN WIND ACTION (SET 1) - TRANS	Wind
7	SERVICE WIND ACTION (SET 1) - TRAN	Wind



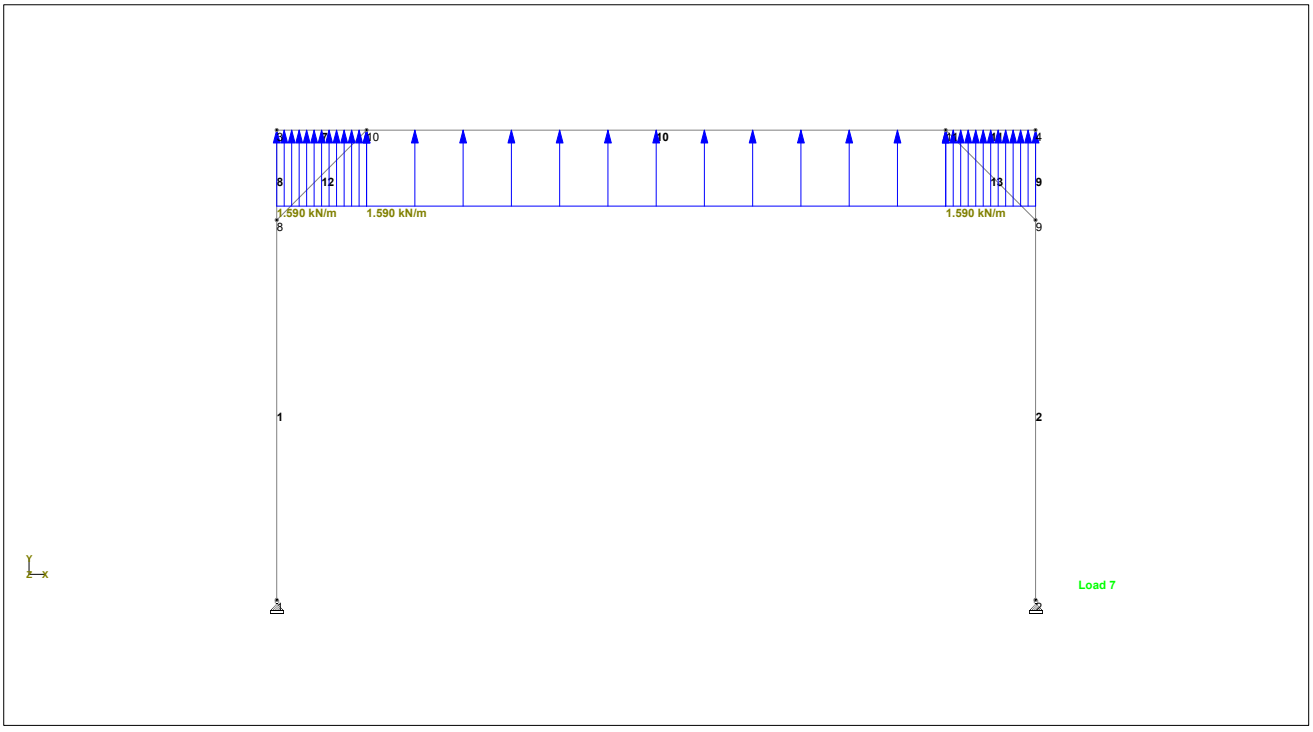
Permanent Action (G)



Imposed Action (Q)



Design Wind Action (Set 1)



Service Wind Action (Set 1)

Combination Load Cases

Comb.	Combination L/C Name	Primary	Primary L/C Name	Factor
101	1.35G	1	PERMANENT ACTION (G)	1.35
102	1.2G + 1.5Q	1	PERMANENT ACTION (G)	1.20
		2	IMPOSED ACTION (Q)	1.50
103	1.2G + WU (SET 1) - TRANSVERSE	1	PERMANENT ACTION (G)	1.20
		3	DESIGN WIND ACTION (SET 1) - TRANS	1.00
107	0.9G + WU (SET 1) - TRANSVERSE	1	PERMANENT ACTION (G)	0.90
		3	DESIGN WIND ACTION (SET 1) - TRANS	1.00
201	0.7Q	2	IMPOSED ACTION (Q)	0.70
202	G + 0.4Q	1	PERMANENT ACTION (G)	1.00
		2	IMPOSED ACTION (Q)	0.40
203	G + WS (SET 1) - TRANSVERSE	1	PERMANENT ACTION (G)	1.00
		7	SERVICE WIND ACTION (SET 1) - TRAN	1.00

1 PERMANENT ACTION (G) : Beam Loads

Beam	Type	Direction	Fa	Da (m)	Fb	Db	Ecc. (m)
7	UNI kN/m	GY	-0.780	-	-	-	-
10	UNI kN/m	GY	-0.780	-	-	-	-
11	UNI kN/m	GY	-0.780	-	-	-	-

1 PERMANENT ACTION (G) : Selfweight

Direction	Factor	Assigned Geometry
Y	-1.000	ALL

2 IMPOSED ACTION (Q) : Beam Loads

Beam	Type	Direction	Fa	Da (m)	Fb	Db	Ecc. (m)
7	UNI kN/m	GY	-0.390	-	-	-	-
10	UNI kN/m	GY	-0.390	-	-	-	-
11	UNI kN/m	GY	-0.390	-	-	-	-

3 DESIGN WIND ACTION (SET 1) - TRANSVERSE (WUX1) : Beam Loads

Beam	Type	Direction	Fa	Da (m)	Fb	Db	Ecc. (m)
7	UNI kN/m	GY	1.960	-	-	-	-
10	UNI kN/m	GY	1.960	-	-	-	-
11	UNI kN/m	GY	1.960	-	-	-	-

7 SERVICE WIND ACTION (SET 1) - TRANSVERSE (WSX1) : Beam Loads

Beam	Type	Direction	Fa	Da (m)	Fb	Db	Ecc. (m)
7	UNI kN/m	Y	1.590	-	-	-	-
10	UNI kN/m	Y	1.590	-	-	-	-
11	UNI kN/m	Y	1.590	-	-	-	-

Node Displacement Summary

	Node	L/C	X (mm)	Y (mm)	Z (mm)	Resultant (mm)	rX (rad)	rY (rad)	rZ (rad)
Max X	8	3:DESIGN WIN	**1.987**	0.075	0.000	1.989	0.000	0.000	0.003
Min X	9	3:DESIGN WIN	**-1.987**	0.075	0.000	1.989	0.000	0.000	-0.003
Max Y	10	3:DESIGN WIN	-0.030	**2.377**	0.000	2.377	0.000	0.000	0.008
Min Y	10	102:1.2G + 1.5	0.024	**-1.891**	0.000	1.891	0.000	0.000	-0.007
Max Z	1	1:PERMANEN	0.000	0.000	**0.000**	0.000	0.000	0.000	0.001
Min Z	1	1:PERMANEN	0.000	0.000	**0.000**	0.000	0.000	0.000	0.001
Max rX	1	1:PERMANEN	0.000	0.000	0.000	0.000	**0.000**	0.000	0.001
Min rX	1	1:PERMANEN	0.000	0.000	0.000	0.000	**0.000**	0.000	0.001
Max rY	1	1:PERMANEN	0.000	0.000	0.000	0.000	0.000	**0.000**	0.001
Min rY	1	1:PERMANEN	0.000	0.000	0.000	0.000	0.000	**0.000**	0.001
Max rZ	10	3:DESIGN WIN	-0.030	2.377	0.000	2.377	0.000	0.000	**0.008**
Min rZ	11	3:DESIGN WIN	0.030	2.377	0.000	2.377	0.000	0.000	**-0.008**
Max Rst	10	3:DESIGN WIN	-0.030	2.377	0.000	**2.377**	0.000	0.000	0.008

Beam Maximum Moments

Distances to maxima are given from beam end A.

Beam	Node A	Length (m)	L/C		d (m)	Max My (kNm)	d (m)	Max Mz (kNm)
1	1	1.900	1:PERMANEN	Max +ve	0.000	0.000	1.900	0.834
				Max -ve	0.000	0.000		
			2:IMPOSED A(	Max +ve	0.000	0.000	1.900	0.401
				Max -ve	0.000	0.000	0.000	-0.000
			3:DESIGN WIN	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	1.900	-2.017
			7:SERVICE WI	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	1.900	-1.636
			101:1.35G	Max +ve	0.000	0.000	1.900	1.126
				Max -ve	0.000	0.000		
			102:1.2G + 1.5	Max +ve	0.000	0.000	1.900	1.603
				Max -ve	0.000	0.000		
			103:1.2G + WL	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	1.900	-1.016
			107:0.9G + WL	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	1.900	-1.266
			201:0.7Q	Max +ve	0.000	0.000	1.900	0.281
				Max -ve	0.000	0.000	0.000	-0.000
			202:G + 0.4Q	Max +ve	0.000	0.000	1.900	0.995
				Max -ve	0.000	0.000		
			203:G + WS (S	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	1.900	-0.802
2	2	1.900	1:PERMANEN	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	1.900	-0.834
			2:IMPOSED A(	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	1.900	-0.401
			3:DESIGN WIN	Max +ve	0.000	0.000	1.900	2.017
				Max -ve	0.000	0.000		
			7:SERVICE WI	Max +ve	0.000	0.000	1.900	1.636
				Max -ve	0.000	0.000	0.000	-0.000
			101:1.35G	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	1.900	-1.126
			102:1.2G + 1.5	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	1.900	-1.603

Beam Maximum Moments Cont...

Beam	Node A	Length (m)	L/C		d (m)	Max My (kNm)	d (m)	Max Mz (kNm)
			103:1.2G + WL	Max +ve	0.000	0.000	1.900	1.016
				Max -ve	0.000	0.000		
			107:0.9G + WL	Max +ve	0.000	0.000	1.900	1.266
				Max -ve	0.000	0.000		
			201:0.7Q	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	1.900	-0.281
			202:G + 0.4Q	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	1.900	-0.995
			203:G + WS (S	Max +ve	0.000	0.000	1.900	0.802
				Max -ve	0.000	0.000	0.000	-0.000
7	3	0.450	1:PERMANEN	Max +ve	0.000	0.000	0.450	0.420
				Max -ve	0.000	0.000		
			2:IMPOSED AC	Max +ve	0.000	0.000	0.450	0.203
				Max -ve	0.000	0.000		
			3:DESIGN WIN	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.450	-1.018
			7:SERVICE WI	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.450	-0.826
			101:1.35G	Max +ve	0.000	0.000	0.450	0.567
				Max -ve	0.000	0.000		
			102:1.2G + 1.5	Max +ve	0.000	0.000	0.450	0.808
				Max -ve	0.000	0.000		
			103:1.2G + WL	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.450	-0.514
			107:0.9G + WL	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.450	-0.640
			201:0.7Q	Max +ve	0.000	0.000	0.450	0.142
				Max -ve	0.000	0.000		
			202:G + 0.4Q	Max +ve	0.000	0.000	0.450	0.501
				Max -ve	0.000	0.000		
			203:G + WS (S	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.450	-0.405
8	8	0.450	1:PERMANEN	Max +ve	0.000	0.000	0.000	0.834
				Max -ve	0.000	0.000		
			2:IMPOSED AC	Max +ve	0.000	0.000	0.000	0.401
				Max -ve	0.000	0.000		
			3:DESIGN WIN	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-2.017
			7:SERVICE WI	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-1.636
			101:1.35G	Max +ve	0.000	0.000	0.000	1.126
				Max -ve	0.000	0.000		
			102:1.2G + 1.5	Max +ve	0.000	0.000	0.000	1.603
				Max -ve	0.000	0.000		
			103:1.2G + WL	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-1.016
			107:0.9G + WL	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-1.266
			201:0.7Q	Max +ve	0.000	0.000	0.000	0.281
				Max -ve	0.000	0.000		
			202:G + 0.4Q	Max +ve	0.000	0.000	0.000	0.995
				Max -ve	0.000	0.000		
			203:G + WS (S	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-0.802

Beam Maximum Moments Cont...

Beam	Node A	Length (m)	L/C		d (m)	Max My (kNm)	d (m)	Max Mz (kNm)
9	9	0.450	1:PERMANEN	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-0.834
			2:IMPOSED A(	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-0.401
			3:DESIGN WIN	Max +ve	0.000	0.000	0.000	2.017
				Max -ve	0.000	0.000		
			7:SERVICE WI	Max +ve	0.000	0.000	0.000	1.636
				Max -ve	0.000	0.000		
			101:1.35G	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-1.126
			102:1.2G + 1.5	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-1.603
			103:1.2G + WL	Max +ve	0.000	0.000	0.000	1.016
				Max -ve	0.000	0.000		
			107:0.9G + WL	Max +ve	0.000	0.000	0.000	1.266
				Max -ve	0.000	0.000		
			201:0.7Q	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-0.281
			202:G + 0.4Q	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-0.995
			203:G + WS (S	Max +ve	0.000	0.000	0.000	0.802
				Max -ve	0.000	0.000		
10	10	2.900	1:PERMANEN	Max +ve	0.000	0.000	2.900	0.420
				Max -ve	0.000	0.000	1.450	-0.431
			2:IMPOSED A(	Max +ve	0.000	0.000	2.900	0.203
				Max -ve	0.000	0.000	1.450	-0.207
			3:DESIGN WIN	Max +ve	0.000	0.000	1.450	1.043
				Max -ve	0.000	0.000	2.900	-1.018
			7:SERVICE WI	Max +ve	0.000	0.000	1.450	0.846
				Max -ve	0.000	0.000	2.900	-0.826
			101:1.35G	Max +ve	0.000	0.000	2.900	0.567
				Max -ve	0.000	0.000	1.450	-0.581
			102:1.2G + 1.5	Max +ve	0.000	0.000	2.900	0.808
				Max -ve	0.000	0.000	1.450	-0.828
			103:1.2G + WL	Max +ve	0.000	0.000	1.450	0.526
				Max -ve	0.000	0.000	2.900	-0.514
			107:0.9G + WL	Max +ve	0.000	0.000	1.450	0.655
				Max -ve	0.000	0.000	2.900	-0.640
			201:0.7Q	Max +ve	0.000	0.000	2.900	0.142
				Max -ve	0.000	0.000	1.450	-0.145
			202:G + 0.4Q	Max +ve	0.000	0.000	2.900	0.501
				Max -ve	0.000	0.000	1.450	-0.514
			203:G + WS (S	Max +ve	0.000	0.000	1.450	0.415
				Max -ve	0.000	0.000	2.900	-0.405
11	11	0.450	1:PERMANEN	Max +ve	0.000	0.000	0.000	0.420
				Max -ve	0.000	0.000		
			2:IMPOSED A(	Max +ve	0.000	0.000	0.000	0.203
				Max -ve	0.000	0.000		
			3:DESIGN WIN	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-1.018
			7:SERVICE WI	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-0.826
			101:1.35G	Max +ve	0.000	0.000	0.000	0.567
				Max -ve	0.000	0.000		

Beam Maximum Moments Cont...

Beam	Node A	Length (m)	L/C		d (m)	Max My (kNm)	d (m)	Max Mz (kNm)
			102:1.2G + 1.5	Max +ve	0.000	0.000	0.000	0.808
				Max -ve	0.000	0.000		
			103:1.2G + WL	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-0.514
			107:0.9G + WL	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-0.640
			201:0.7Q	Max +ve	0.000	0.000	0.000	0.142
				Max -ve	0.000	0.000		
			202:G + 0.4Q	Max +ve	0.000	0.000	0.000	0.501
				Max -ve	0.000	0.000		
			203:G + WS (S	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-0.405
12	8	0.636	1:PERMANEN	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	0.000	0.000
			2:IMPOSED A(	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	0.000	0.000
			3:DESIGN WIN	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	0.000	0.000
			7:SERVICE WI	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	0.000	0.000
			101:1.35G	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	0.000	0.000
			102:1.2G + 1.5	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	0.000	0.000
			103:1.2G + WL	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	0.000	0.000
			107:0.9G + WL	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	0.000	0.000
			201:0.7Q	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	0.000	0.000
			202:G + 0.4Q	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	0.000	0.000
			203:G + WS (S	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	0.000	0.000
13	9	0.636	1:PERMANEN	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	0.000	0.000
			2:IMPOSED A(	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	0.000	0.000
			3:DESIGN WIN	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	0.000	0.000
			7:SERVICE WI	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	0.000	0.000
			101:1.35G	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	0.000	0.000
			102:1.2G + 1.5	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	0.000	0.000
			103:1.2G + WL	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	0.000	0.000
			107:0.9G + WL	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	0.000	0.000
			201:0.7Q	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	0.000	0.000
			202:G + 0.4Q	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	0.000	0.000

Beam Maximum Moments Cont...

Beam	Node A	Length (m)	L/C		d (m)	Max My (kNm)	d (m)	Max Mz (kNm)
			203:G + WS (S	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	0.000	0.000

Beam Maximum Shear Forces

Distances to maxima are given from beam end A.

Beam	Node A	Length (m)	L/C		d (m)	Max Fz (kN)	d (m)	Max Fy (kN)
1	1	1.900	1:PERMANEN	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-0.439
			2:IMPOSED A(	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-0.211
			3:DESIGN WIN	Max +ve	0.000	0.000	0.000	1.062
				Max -ve	0.000	0.000		
			7:SERVICE WI	Max +ve	0.000	0.000	0.000	0.861
				Max -ve	0.000	0.000		
			101:1.35G	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-0.593
			102:1.2G + 1.5	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-0.844
			103:1.2G + WU	Max +ve	0.000	0.000	0.000	0.535
				Max -ve	0.000	0.000		
			107:0.9G + WU	Max +ve	0.000	0.000	0.000	0.666
				Max -ve	0.000	0.000		
			201:0.7Q	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-0.148
			202:G + 0.4Q	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-0.524
			203:G + WS (S	Max +ve	0.000	0.000	0.000	0.422
				Max -ve	0.000	0.000		
2	2	1.900	1:PERMANEN	Max +ve	0.000	0.000	0.000	0.439
				Max -ve	0.000	0.000		
			2:IMPOSED A(	Max +ve	0.000	0.000	0.000	0.211
				Max -ve	0.000	0.000		
			3:DESIGN WIN	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-1.062
			7:SERVICE WI	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-0.861
			101:1.35G	Max +ve	0.000	0.000	0.000	0.593
				Max -ve	0.000	0.000		
			102:1.2G + 1.5	Max +ve	0.000	0.000	0.000	0.844
				Max -ve	0.000	0.000		
			103:1.2G + WU	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-0.535
			107:0.9G + WU	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-0.666
			201:0.7Q	Max +ve	0.000	0.000	0.000	0.148
				Max -ve	0.000	0.000		
			202:G + 0.4Q	Max +ve	0.000	0.000	0.000	0.524
				Max -ve	0.000	0.000		
			203:G + WS (S	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-0.422
7	3	0.450	1:PERMANEN	Max +ve	0.000	0.000		

Beam Maximum Shear Forces Cont...

Beam	Node A	Length (m)	L/C		d (m)	Max Fz (kN)	d (m)	Max Fy (kN)
				Max -ve	0.000	0.000	0.450	-0.853
			2:IMPOSED A(	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.450	-0.411
			3:DESIGN WIN	Max +ve	0.000	0.000	0.450	2.067
				Max -ve	0.000	0.000		
			7:SERVICE WI	Max +ve	0.000	0.000	0.450	1.677
				Max -ve	0.000	0.000		
			101:1.35G	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.450	-1.151
			102:1.2G + 1.5	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.450	-1.640
			103:1.2G + WL	Max +ve	0.000	0.000	0.450	1.044
				Max -ve	0.000	0.000		
			107:0.9G + WL	Max +ve	0.000	0.000	0.450	1.299
				Max -ve	0.000	0.000		
			201:0.7Q	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.450	-0.288
			202:G + 0.4Q	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.450	-1.017
			203:G + WS (S	Max +ve	0.000	0.000	0.450	0.824
				Max -ve	0.000	0.000		
8	8	0.450	1:PERMANEN	Max +ve	0.000	0.000	0.000	1.591
				Max -ve	0.000	0.000		
			2:IMPOSED A(	Max +ve	0.000	0.000	0.000	0.766
				Max -ve	0.000	0.000		
			3:DESIGN WIN	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-3.847
			7:SERVICE WI	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-3.121
			101:1.35G	Max +ve	0.000	0.000	0.000	2.148
				Max -ve	0.000	0.000		
			102:1.2G + 1.5	Max +ve	0.000	0.000	0.000	3.058
				Max -ve	0.000	0.000		
			103:1.2G + WL	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-1.938
			107:0.9G + WL	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-2.415
			201:0.7Q	Max +ve	0.000	0.000	0.000	0.536
				Max -ve	0.000	0.000		
			202:G + 0.4Q	Max +ve	0.000	0.000	0.000	1.897
				Max -ve	0.000	0.000		
			203:G + WS (S	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-1.530
9	9	0.450	1:PERMANEN	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-1.591
			2:IMPOSED A(	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-0.766
			3:DESIGN WIN	Max +ve	0.000	0.000	0.000	3.847
				Max -ve	0.000	0.000		
			7:SERVICE WI	Max +ve	0.000	0.000	0.000	3.121
				Max -ve	0.000	0.000		
			101:1.35G	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-2.148
			102:1.2G + 1.5	Max +ve	0.000	0.000		

Beam Maximum Shear Forces Cont...

Beam	Node A	Length (m)	L/C		d (m)	Max Fz (kN)	d (m)	Max Fy (kN)
				Max -ve	0.000	0.000	0.000	-3.058
			103:1.2G + WL	Max +ve	0.000	0.000	0.000	1.938
				Max -ve	0.000	0.000		
			107:0.9G + WL	Max +ve	0.000	0.000	0.000	2.415
				Max -ve	0.000	0.000		
			201:0.7Q	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-0.536
			202:G + 0.4Q	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-1.897
			203:G + WS (S	Max +ve	0.000	0.000	0.000	1.530
				Max -ve	0.000	0.000		
10	10	2.900	1:PERMANENT	Max +ve	0.000	0.000	0.000	1.174
				Max -ve	0.000	0.000	2.900	-1.174
			2:IMPOSED AC	Max +ve	0.000	0.000	0.000	0.566
				Max -ve	0.000	0.000	2.900	-0.566
			3:DESIGN WIN	Max +ve	0.000	0.000	2.900	2.842
				Max -ve	0.000	0.000	0.000	-2.842
			7:SERVICE WI	Max +ve	0.000	0.000	2.900	2.306
				Max -ve	0.000	0.000	0.000	-2.306
			101:1.35G	Max +ve	0.000	0.000	0.000	1.584
				Max -ve	0.000	0.000	2.900	-1.584
			102:1.2G + 1.5	Max +ve	0.000	0.000	0.000	2.257
				Max -ve	0.000	0.000	2.900	-2.257
			103:1.2G + WL	Max +ve	0.000	0.000	2.900	1.434
				Max -ve	0.000	0.000	0.000	-1.434
			107:0.9G + WL	Max +ve	0.000	0.000	2.900	1.786
				Max -ve	0.000	0.000	0.000	-1.786
			201:0.7Q	Max +ve	0.000	0.000	0.000	0.396
				Max -ve	0.000	0.000	2.900	-0.396
			202:G + 0.4Q	Max +ve	0.000	0.000	0.000	1.400
				Max -ve	0.000	0.000	2.900	-1.400
			203:G + WS (S	Max +ve	0.000	0.000	2.900	1.132
				Max -ve	0.000	0.000	0.000	-1.132
11	11	0.450	1:PERMANENT	Max +ve	0.000	0.000	0.000	0.853
				Max -ve	0.000	0.000		
			2:IMPOSED AC	Max +ve	0.000	0.000	0.000	0.411
				Max -ve	0.000	0.000		
			3:DESIGN WIN	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-2.067
			7:SERVICE WI	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-1.677
			101:1.35G	Max +ve	0.000	0.000	0.000	1.151
				Max -ve	0.000	0.000		
			102:1.2G + 1.5	Max +ve	0.000	0.000	0.000	1.640
				Max -ve	0.000	0.000		
			103:1.2G + WL	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-1.044
			107:0.9G + WL	Max +ve	0.000	0.000		
				Max -ve	0.000	0.000	0.000	-1.299
			201:0.7Q	Max +ve	0.000	0.000	0.000	0.288
				Max -ve	0.000	0.000		
			202:G + 0.4Q	Max +ve	0.000	0.000	0.000	1.017
				Max -ve	0.000	0.000		
			203:G + WS (S	Max +ve	0.000	0.000		

Beam Maximum Shear Forces Cont...

Beam	Node A	Length (m)	L/C		d (m)	Max Fz (kN)	d (m)	Max Fy (kN)
				Max -ve	0.000	0.000	0.000	-0.824
12	8	0.636	1:PERMANEN	Max +ve	0.000	0.000	0.000	0.003
				Max -ve	0.000	0.000	0.636	-0.003
			2:IMPOSED A(	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	0.000	0.000
			3:DESIGN WIN	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	0.000	0.000
			7:SERVICE WI	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	0.000	0.000
			101:1.35G	Max +ve	0.000	0.000	0.000	0.004
				Max -ve	0.000	0.000	0.636	-0.004
			102:1.2G + 1.5	Max +ve	0.000	0.000	0.000	0.003
				Max -ve	0.000	0.000	0.636	-0.003
			103:1.2G + WL	Max +ve	0.000	0.000	0.000	0.003
				Max -ve	0.000	0.000	0.636	-0.003
			107:0.9G + WL	Max +ve	0.000	0.000	0.000	0.003
				Max -ve	0.000	0.000	0.636	-0.003
			201:0.7Q	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	0.000	0.000
			202:G + 0.4Q	Max +ve	0.000	0.000	0.000	0.003
				Max -ve	0.000	0.000	0.636	-0.003
			203:G + WS (S	Max +ve	0.000	0.000	0.000	0.003
				Max -ve	0.000	0.000	0.636	-0.003
13	9	0.636	1:PERMANEN	Max +ve	0.000	0.000	0.000	0.003
				Max -ve	0.000	0.000	0.636	-0.003
			2:IMPOSED A(	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	0.000	0.000
			3:DESIGN WIN	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	0.000	0.000
			7:SERVICE WI	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	0.000	0.000
			101:1.35G	Max +ve	0.000	0.000	0.000	0.004
				Max -ve	0.000	0.000	0.636	-0.004
			102:1.2G + 1.5	Max +ve	0.000	0.000	0.000	0.003
				Max -ve	0.000	0.000	0.636	-0.003
			103:1.2G + WL	Max +ve	0.000	0.000	0.000	0.003
				Max -ve	0.000	0.000	0.636	-0.003
			107:0.9G + WL	Max +ve	0.000	0.000	0.000	0.003
				Max -ve	0.000	0.000	0.636	-0.003
			201:0.7Q	Max +ve	0.000	0.000	0.000	0.000
				Max -ve	0.000	0.000	0.000	0.000
			202:G + 0.4Q	Max +ve	0.000	0.000	0.000	0.003
				Max -ve	0.000	0.000	0.636	-0.003
			203:G + WS (S	Max +ve	0.000	0.000	0.000	0.003
				Max -ve	0.000	0.000	0.636	-0.003

Beam Maximum Axial Forces

Distances to maxima are given from beam end A.

Beam	Node A	Length (m)	L/C		d (m)	Max Fx (kN)
1	1	1.900	1:PERMANEN	Max +ve	0.000	1.673
				Max -ve		
			2:IMPOSED A(	Max +ve	0.000	0.741
				Max -ve		
			3:DESIGN WIN	Max +ve		
				Max -ve	0.000	-3.724
			7:SERVICE WI	Max +ve		
				Max -ve	0.000	-3.021
			101:1.35G	Max +ve	0.000	2.259
				Max -ve		
			102:1.2G + 1.5	Max +ve	0.000	3.120
				Max -ve		
			103:1.2G + WL	Max +ve		
				Max -ve	1.900	-1.840
			107:0.9G + WL	Max +ve		
				Max -ve	1.900	-2.311
			201:0.7Q	Max +ve	0.000	0.519
				Max -ve		
			202:G + 0.4Q	Max +ve	0.000	1.970
				Max -ve		
			203:G + WS (S	Max +ve		
				Max -ve	1.900	-1.451
2	2	1.900	1:PERMANEN	Max +ve	0.000	1.673
				Max -ve		
			2:IMPOSED A(	Max +ve	0.000	0.741
				Max -ve		
			3:DESIGN WIN	Max +ve		
				Max -ve	0.000	-3.724
			7:SERVICE WI	Max +ve		
				Max -ve	0.000	-3.021
			101:1.35G	Max +ve	0.000	2.259
				Max -ve		
			102:1.2G + 1.5	Max +ve	0.000	3.120
				Max -ve		
			103:1.2G + WL	Max +ve		
				Max -ve	1.900	-1.840
			107:0.9G + WL	Max +ve		
				Max -ve	1.900	-2.311
			201:0.7Q	Max +ve	0.000	0.519
				Max -ve		
			202:G + 0.4Q	Max +ve	0.000	1.970
				Max -ve		
			203:G + WS (S	Max +ve		
				Max -ve	1.900	-1.451
7	3	0.450	1:PERMANEN	Max +ve		
				Max -ve	0.000	-1.591
			2:IMPOSED A(	Max +ve		
				Max -ve	0.000	-0.766
			3:DESIGN WIN	Max +ve	0.000	3.847
				Max -ve		
			7:SERVICE WI	Max +ve	0.000	3.121
				Max -ve		
			101:1.35G	Max +ve		

Beam Maximum Axial Forces Cont...

Beam	Node A	Length (m)	L/C		d (m)	Max Fx (kN)
				Max -ve	0.000	-2.148
			102:1.2G + 1.5	Max +ve		
				Max -ve	0.000	-3.058
			103:1.2G + WL	Max +ve	0.000	1.938
				Max -ve		
			107:0.9G + WL	Max +ve	0.000	2.415
				Max -ve		
			201:0.7Q	Max +ve		
				Max -ve	0.000	-0.536
			202:G + 0.4Q	Max +ve		
				Max -ve	0.000	-1.897
			203:G + WS (S	Max +ve	0.000	1.530
				Max -ve		
8	8	0.450	1:PERMANEN	Max +ve		
				Max -ve	0.450	-0.489
			2:IMPOSED A(	Max +ve		
				Max -ve	0.000	-0.236
			3:DESIGN WIN	Max +ve	0.000	1.185
				Max -ve		
			7:SERVICE WI	Max +ve	0.000	0.961
				Max -ve		
			101:1.35G	Max +ve		
				Max -ve	0.450	-0.660
			102:1.2G + 1.5	Max +ve		
				Max -ve	0.450	-0.940
			103:1.2G + WL	Max +ve	0.000	0.628
				Max -ve		
			107:0.9G + WL	Max +ve	0.000	0.767
				Max -ve		
			201:0.7Q	Max +ve		
				Max -ve	0.000	-0.165
			202:G + 0.4Q	Max +ve		
				Max -ve	0.450	-0.583
			203:G + WS (S	Max +ve	0.000	0.497
				Max -ve		
9	9	0.450	1:PERMANEN	Max +ve		
				Max -ve	0.450	-0.489
			2:IMPOSED A(	Max +ve		
				Max -ve	0.000	-0.236
			3:DESIGN WIN	Max +ve	0.000	1.185
				Max -ve		
			7:SERVICE WI	Max +ve	0.000	0.961
				Max -ve		
			101:1.35G	Max +ve		
				Max -ve	0.450	-0.660
			102:1.2G + 1.5	Max +ve		
				Max -ve	0.450	-0.940
			103:1.2G + WL	Max +ve	0.000	0.628
				Max -ve		
			107:0.9G + WL	Max +ve	0.000	0.767
				Max -ve		
			201:0.7Q	Max +ve		
				Max -ve	0.000	-0.165
			202:G + 0.4Q	Max +ve		

Beam Maximum Axial Forces Cont...

Beam	Node A	Length (m)	L/C		d (m)	Max Fx (kN)
				Max -ve	0.450	-0.583
			203:G + WS (S	Max +ve	0.000	0.497
				Max -ve		
10	10	2.900	1:PERMANEN	Max +ve	0.000	0.439
				Max -ve		
			2:IMPOSED A(	Max +ve	0.000	0.211
				Max -ve		
			3:DESIGN WIN	Max +ve		
				Max -ve	0.000	-1.062
			7:SERVICE WI	Max +ve		
				Max -ve	0.000	-0.861
			101:1.35G	Max +ve	0.000	0.593
				Max -ve		
			102:1.2G + 1.5	Max +ve	0.000	0.844
				Max -ve		
			103:1.2G + WL	Max +ve		
				Max -ve	0.000	-0.535
			107:0.9G + WL	Max +ve		
				Max -ve	0.000	-0.666
			201:0.7Q	Max +ve	0.000	0.148
				Max -ve		
			202:G + 0.4Q	Max +ve	0.000	0.524
				Max -ve		
			203:G + WS (S	Max +ve		
				Max -ve	0.000	-0.422
11	11	0.450	1:PERMANEN	Max +ve		
				Max -ve	0.000	-1.591
			2:IMPOSED A(	Max +ve		
				Max -ve	0.000	-0.766
			3:DESIGN WIN	Max +ve	0.000	3.847
				Max -ve		
			7:SERVICE WI	Max +ve	0.000	3.121
				Max -ve		
			101:1.35G	Max +ve		
				Max -ve	0.000	-2.148
			102:1.2G + 1.5	Max +ve		
				Max -ve	0.000	-3.058
			103:1.2G + WL	Max +ve	0.000	1.938
				Max -ve		
			107:0.9G + WL	Max +ve	0.000	2.415
				Max -ve		
			201:0.7Q	Max +ve		
				Max -ve	0.000	-0.536
			202:G + 0.4Q	Max +ve		
				Max -ve	0.000	-1.897
			203:G + WS (S	Max +ve	0.000	1.530
				Max -ve		
12	8	0.636	1:PERMANEN	Max +ve	0.000	2.874
				Max -ve		
			2:IMPOSED A(	Max +ve	0.000	1.381
				Max -ve		
			3:DESIGN WIN	Max +ve		
				Max -ve	0.000	-6.942
			7:SERVICE WI	Max +ve		

Beam Maximum Axial Forces Cont...

Beam	Node A	Length (m)	L/C		d (m)	Max Fx (kN)
				Max -ve	0.000	-5.632
			101:1.35G	Max +ve	0.000	3.880
				Max -ve		
			102:1.2G + 1.5	Max +ve	0.000	5.521
				Max -ve		
			103:1.2G + WL	Max +ve		
				Max -ve	0.636	-3.500
			107:0.9G + WL	Max +ve		
				Max -ve	0.636	-4.361
			201:0.7Q	Max +ve	0.000	0.967
				Max -ve		
			202:G + 0.4Q	Max +ve	0.000	3.427
				Max -ve		
			203:G + WS (S	Max +ve		
				Max -ve	0.636	-2.763
13	9	0.636	1:PERMANEN	Max +ve	0.000	2.874
				Max -ve		
			2:IMPOSED AC	Max +ve	0.000	1.381
				Max -ve		
			3:DESIGN WIN	Max +ve		
				Max -ve	0.000	-6.942
			7:SERVICE WI	Max +ve		
				Max -ve	0.000	-5.632
			101:1.35G	Max +ve	0.000	3.880
				Max -ve		
			102:1.2G + 1.5	Max +ve	0.000	5.521
				Max -ve		
			103:1.2G + WL	Max +ve		
				Max -ve	0.636	-3.500
			107:0.9G + WL	Max +ve		
				Max -ve	0.636	-4.361
			201:0.7Q	Max +ve	0.000	0.967
				Max -ve		
			202:G + 0.4Q	Max +ve	0.000	3.427
				Max -ve		
			203:G + WS (S	Max +ve		
				Max -ve	0.636	-2.763

Reactions

Node	L/C	Horizontal FX (kN)	Vertical FY (kN)	Horizontal FZ (kN)	Moment MX (kNm)	MY (kNm)	MZ (kNm)
1	1:PERMANEN	0.439	1.673	0.000	0.000	0.000	0.000
	2:IMPOSED A(	0.211	0.741	0.000	0.000	0.000	0.000
	3:DESIGN WIN	-1.062	-3.724	0.000	0.000	0.000	0.000
	7:SERVICE WI	-0.861	-3.021	0.000	0.000	0.000	0.000
	101:1.35G	0.593	2.259	0.000	0.000	0.000	0.000
	102:1.2G + 1.5	0.844	3.120	0.000	0.000	0.000	0.000
	103:1.2G + WL	-0.535	-1.716	0.000	0.000	0.000	0.000
	107:0.9G + WL	-0.666	-2.218	0.000	0.000	0.000	0.000
	201:0.7Q	0.148	0.519	0.000	0.000	0.000	0.000
	202:G + 0.4Q	0.524	1.970	0.000	0.000	0.000	0.000
	203:G + WS (S	-0.422	-1.348	0.000	0.000	0.000	0.000
2	1:PERMANEN	-0.439	1.673	0.000	0.000	0.000	0.000
	2:IMPOSED A(	-0.211	0.741	0.000	0.000	0.000	0.000
	3:DESIGN WIN	1.062	-3.724	0.000	0.000	0.000	0.000
	7:SERVICE WI	0.861	-3.021	0.000	0.000	0.000	0.000
	101:1.35G	-0.593	2.259	0.000	0.000	0.000	0.000
	102:1.2G + 1.5	-0.844	3.120	0.000	0.000	0.000	0.000
	103:1.2G + WL	0.535	-1.716	0.000	0.000	0.000	0.000
	107:0.9G + WL	0.666	-2.218	0.000	0.000	0.000	0.000
	201:0.7Q	-0.148	0.519	0.000	0.000	0.000	0.000
	202:G + 0.4Q	-0.524	1.970	0.000	0.000	0.000	0.000
	203:G + WS (S	0.422	-1.348	0.000	0.000	0.000	0.000

Reaction Summary

	Node	L/C	Horizontal FX (kN)	Vertical FY (kN)	Horizontal FZ (kN)	Moment MX (kNm)	MY (kNm)	MZ (kNm)
Max FX	2	3:DESIGN WIN	**1.062**	-3.724	0.000	0.000	0.000	0.000
Min FX	1	3:DESIGN WIN	**-1.062**	-3.724	0.000	0.000	0.000	0.000
Max FY	1	102:1.2G + 1.5	0.844	**3.120**	0.000	0.000	0.000	0.000
Min FY	1	3:DESIGN WIN	-1.062	**-3.724**	0.000	0.000	0.000	0.000
Max FZ	1	1:PERMANEN	0.439	1.673	**0.000**	0.000	0.000	0.000
Min FZ	1	1:PERMANEN	0.439	1.673	**0.000**	0.000	0.000	0.000
Max MX	1	1:PERMANEN	0.439	1.673	0.000	**0.000**	0.000	0.000
Min MX	1	1:PERMANEN	0.439	1.673	0.000	**0.000**	0.000	0.000
Max MY	1	1:PERMANEN	0.439	1.673	0.000	0.000	**0.000**	0.000
Min MY	1	1:PERMANEN	0.439	1.673	0.000	0.000	**0.000**	0.000
Max MZ	1	1:PERMANEN	0.439	1.673	0.000	0.000	0.000	**0.000**
Min MZ	1	1:PERMANEN	0.439	1.673	0.000	0.000	0.000	**0.000**

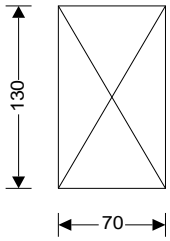
	Project				Job no.	
AJN CONSULTING ENGINEERS	Mimosa Outdoor Timber Gazebo - 4.27m x 3.69m x 3.23m (H)				2023-008	
	Calcs for				Start page no./Revision	
	Long Crossbar				1	
	Calcs by	Calcs date	Checked by	Checked date	Approved by	Approved date
	AN	20/03/2023				

TIMBER MEMBER DESIGN TO AS1720.1-2010

Tedds calculation version 1.5.05

Analysis results

Design moment in major axis	M^*_x = **0.830** kNm
Design shear	V^* = **2.260** kN
Design axial compression	N^*_c = **3.060** kN



Timber section details

Breadth of timber sections	b = **70** mm
Depth of timber sections	d = **130** mm
Number of timber sections in member	N = **1**
Overall breadth of timber member	b_b = N × b = **70** mm
Timber species	**Mixed softwood species (excl.Pinus species)**
Moisture condition	**Seasoned**
Timber strength grade - Table H2.1	**F4**

Member details

Load duration - cl.2.4.1	**Long-term**
Overall length of member	L_x = **4100** mm
Effective length factor - Table 3.2	g_{13} = **1**
Distance between lateral restraints in major axis	L_{ax} = **4100** mm
Distance between lateral restraints in minor axis	L_{ay} = **1025** mm

Section properties

Cross sectional area of member	A = N × b × d = **9100** mm^2
Section modulus	Z_x = N × b × d^2 / 6 = **197167** mm^3
	Z_y = d × (N × b)^2 / 6 = **106167** mm^3
Second moment of area	I_x = N × b × d^3 / 12 = **12815833** mm^4
	I_y = d × (N × b)^3 / 12 = **3715833** mm^4
Radius of gyration	r_x = √(I_x / A) = **37.5** mm
	r_y = √(I_y / A) = **20.2** mm

Modification factors

Duration of load factor for strength - Table 2.3	k_1 = **0.80**
Moisture condition factor - cl.2.4.2.3	k_4 = **1.00**
Temperature factor - cl.2.4.3	k_6 = **1.00**
Length and position of bearing factor - cl.2.4.4	k_7 = **1.00**
Strength sharing factor - Table 2.7	k_9 = **1.00**
Temporary design action ratio	r = **0.25**
Material constant - exp.E2(1)	ρ_b = 14.71 × (E / f'$_b$)$^{-0.480}$ × $r^{-0.061}$ = **0.80**
Distance between discrete lateral restraints	L_{ay} = **1025** mm L_{ay} / d < 64 × [N × b / (ρ_b × d)]^2

Major axis slenderness coefficient - cl.3.2.3.2(b) S_1 = **0.00**

Major axis bending stability factor - exp.3.2(10) k_{12bx} = **1.00**

Minor axis slenderness coefficient - cl.3.2.3.2 (c) S_2 = **0.00**

Minor axis bending stability factor - cl.3.2.4 k_{12by} = **1.00**

Material constant - exp.E2(3) $\rho_c = 11.39 \times (E / f'_c)^{-0.408} \times r^{-0.074}$ = **0.87**

Major axis slenderness coefficient - exp.3.3(5) $S_3 = L_{ax} / d$ = **31.54**

Major axis comp.stability factor - exp.3.3(11c) $k_{12cx} = 200 / (\rho_c \times S_3)^2$ = **0.27**

Minor axis slenderness coeff. - exp.3.3(8) & (9) $S_4 = \min(L_{ay} / (N \times b), g_{13} \times L_x / (N \times b))$ = **14.64**

Minor axis comp.stability factor - exp.3.3(11b) $k_{12cy} = 1.5 - 0.05 \times \rho_c \times S_4$ = **0.87**

Bending strength - cl.3.2.1

Capacity factor - Table 2.1 ϕ_b = **0.9**

Design capacity in major axis bending - cl.3.2(2) $\phi M_x = \phi_b \times k_1 \times k_4 \times k_6 \times k_9 \times k_{12bx} \times f'_b \times Z_x$ = **1.704** kNm

PASS - Design capacity in bending exceeds design bending moment

Compressive strength - cl.3.3.1

Capacity factor - Table 2.1 ϕ_c = **0.9**

Cross-sectional area of member $A_c = N \times b \times d$ = **9100** mm^2

Major axis design capacity in compression - exp.3.3(2)

$\phi N_{cx} = \phi_c \times k_1 \times k_4 \times k_6 \times k_{12cx} \times f'_c \times A_c$ = **15.078** kN

Minor axis design capacity in compression - exp.3.3(2)

$\phi N_{cy} = \phi_c \times k_1 \times k_4 \times k_6 \times k_{12cy} \times f'_c \times A_c$ = **48.760** kN

PASS - Design capacity in compression exceeds design compression

Combined bending and compression - cl.3.5.1

Combined bending and compression check - exp.3.5(1) and exp.3.5(2)

$[M^*_x / \phi M_x]^2 + [N^*_c / \phi N_{cy}]$ = **0.300** < 1

$[M^*_x / \phi M_x] + [N^*_c / \phi N_{cx}]$ = **0.690** < 1

PASS - Beam design meets combined bending and compression criteria

Flexural shear strength - cl.3.2.5

Capacity factor - Table 2.1 ϕ_s = **0.9**

Shear plane area $A_s = N \times b \times d \times 2 / 3$ = **6067** mm^2

Design shear capacity - exp.3.2(14) $\phi V = \phi_s \times k_1 \times k_4 \times k_6 \times f'_s \times A_s$ = **5.678** kN

PASS - Design shear capacity exceeds design shear force

v1.0

TIMBER DESIGN
(AS/NZS 1664.1:1997)

Project No.	2023-008	Project Name	Mimosa Outdoor Gazebo (4.27m x 3.69m x 3.23m)
Designed by	AN	Date	20 March 2023

SUMMARY OF RESULTS

Utilization Ratios:	
Compression	7.0%
Bending, x-axis	41.0%
Bending, y-axis	41.0%
Combined Compression and Bending	23.8%
Combined Tension and Bending	48.0%

OK

1. Member Properties (180 x 180 x 25mm thick Square Hollow Section)

Depth, d	180	mm
Width, b	180	mm
Thickness, t	25	mm
Unsupported Length of member x-axis, L_{ax}	2350	mm
Unsupported Length of member y-axis, L_{ay}	2350	mm
Effective Length Factor, g_{13}	1.0	
Cross Sectional Area, A_c	15,500	mm^2
In-plane Elastic Section Modulus, Z_x	707,546	mm^4
Out-of-plane Elastic Section Modulus, Z_y	707,546	mm^4
Area moment of inertia about x-axis, I_{xx}	63,679,167	mm^4
Area moment of inertia about x-axis, I_{yy}	63,679,167	mm^4
Readius of gyration about buckling axis (X), r_x	64.10	mm
Readius of gyration about buckling axis (Y), r_y	64.10	mm
Torsional Constant, J	93,096,875	mm^4

2. Material Properties

Timber Grade	F4	
Characteristic value, Bending, f'_b	12	MPa
Characteristic value, Tension - parallel to grain, f'_t	5.8	MPa
Characteristic value, Shear, f'_s	1.3	MPa
Characteristic value, Comp. - parallel to grain, f'_c	8.6	MPa
Modulus of Elasticity, E	6,100	MPa
Modulus of Rigidity, G	410	MPa
Capacity Factor, ϕ	0.70	
Effect of duration of load, k_1	0.80	
Effect of moisture condition, k_4	1.00	
Effect of temperature, k_6	1.00	
Modification factor for strength-sharing, k_9	1.00	

TIMBER DESIGN
(AS/NZS 1664.1:1997)

Project No.	2023-008	Project Name	Mimosa Outdoor Gazebo (4.27m x 3.69m x 3.23m)
Designed by	AN	Date	20 March 2023

Stability Factor, k_{12}

Material constant, ρ_b	0.90
x-axis slenderness coefficient, S_1	4.52
y-axis slenderness coefficient, S_2	0.00
x-axis stability factor, k_{12bx}	1.00
y-axis stability factor, k_{12by}	1.00
Material constant, ρ_c	1.02
x-axis slenderness coefficient, S_3	13.06
y-axis slenderness coefficient, S_4	13.06
x-axis stability factor, k_{12cx}	0.83
y-axis stability factor, k_{12cy}	0.83

3. Design Forces

Maximum axial forces

Compression, P	4.37	kN

Maximum bending moments

Bending about x-axis, M_x	1.95	kN-m
Bending about y-axis, M_y	1.95	kN-m

Maximum shear force, V	0.45	kN

4. Design Capacity

Axial Forces

a. Compression, parallel to the grain

$N_{d,cx} = \phi k_1 k_4 k_6 k_{12cx} f'_c A_c$ $N_{d,cx}$ = 62.27 kN *buckling about x-axis*

$N_{d,cy} = \phi k_1 k_4 k_6 k_{12cy} f'_c A_c$ $N_{d,cy}$ = 62.27 kN *buckling about y-axis*

	$N_{d,c}$	**>**	**P**	**PASS**
Utilization Ratio	**P / $N_{d,c}$ =**	**7.0%**		

Bending Moment

b. Bending about x-axis

$M_{d,x} = \phi k_1 k_4 k_6 k_9 k_{12bx} f'_b Z_x$ $M_{d,x}$ = 4.75 kNm

	$M_{d,x}$	**>**	**M_x**	**PASS**
Utilization Ratio	**M_x / $M_{d,x}$ =**	**41.0%**		

c. Bending about y-axis

$M_{d,y} = \phi k_1 k_4 k_6 k_9 k_{12by} f'_b Z_y$ $M_{d,x}$ = 4.75 kNm

	$M_{d,y}$	**>**	**M_y**	**PASS**
Utilization Ratio	**M_y / $M_{d,y}$ =**	**41.0%**		

TIMBER DESIGN
(AS/NZS 1664.1:1997)

Project No.	2023-008	Project Name	Mimosa Outdoor Gazebo (4.27m x 3.69m x 3.23m)
Designed by	AN	Date	20 March 2023

Combined Actions

f. Combined compression and bending

$$\left(\frac{M_x^*}{M_{d,x}}\right)^2 + \frac{N_c^*}{N_{d,cy}} = \mathbf{0.24} \quad \leq \mathbf{1.0} \quad \mathbf{PASS}$$

g. Combined tension and bending

$$\frac{M_x^*}{M_{d,x}} + \frac{N_c^*}{N_{d,cx}} = \mathbf{0.48} \quad \leq \mathbf{1.0} \quad \mathbf{PASS}$$

FOOTING DESIGN

v1.0

PILE DESIGN

Project No.	2023-008	Project Name	Mimosa Outdoor Gazebo (4.27m x 3.69m x 3.23m)
Designed by	AN	Date	20 March 2023

SUMMARY OF RESULTS

Required Pile Size	**450mm dia. x 1200mm deep**	
Required Ultimate Bearing Capacity of Soil	**100 kPa**	
Utilization Ratios:		
Uplift	82.0%	**OK**
Soil Bearing Pressure	55.0%	

1. Pile Properties

Diameter, D	450	mm
Depth, L	1200	mm
Cross Sectional Area, A	0.16	m^2
Unit Weight of Concrete, γ_{conc}	24	kN/m^3
Unit Weight of Soil, γ_{soil}	18	kN/m^3
Ultimate Bearing Capacity of Soil, B_n	100	kPa

2. Design Forces and Stresses

Maximum support reactions

Tension, T	3.38	kN
Compression, P	4.37	kN

3. Check against uplift

Strength reduction factor (concrete), Φ_{conc}	0.9	
Factored Weight of Concrete, ΦW_{conc}	4.12	kN

	ΦW_{conc}	**>**	**T**	**PASS**
Utilization Ratio	**ΦW_{conc} / T =**	**82.0%**		

4. Check soil bearing capacity

Maximum bearing pressure in soil, p	27.48	kPa
Strength reduction factor (soil), Φ_{soil}	0.5	
Factored Ultimate Bearing Capacity of Soil, ΦB_n	50	kPa

	ΦB_n	**>**	**p**	**PASS**
Utilization Ratio	**ΦB_n / p =**	**55.0%**		