GREAT WESTERN HIGHWAY HUNTINGWOOD NSW - EXISTING ADVERTISING SIGNS - STRUCTURAL ASSESSMENT

Structural Assessment

Structural Consulting Engineering Services

Prepared for
oOh! Media Operations Pty Ltd

Prepared by
JMP Consulting Engineers

A	22/03/2024	For Information	EVL		EVL		MB	
REV	DATE	STATUS	INIT	SIGN	INIT	SIGN	INIT	SIGN
			PREPARED BY		PROJECT LEADER		DESIGN REVIEWER	

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Introduction

This report has been commissioned by oOh! Media for JMP to appraise the structural design and strength of the existing advertising signage structure on the southern side of the Great Western Highway, Huntingwood, NSW.

The purpose of this appraisal is to evaluate the structure for compliance as part of the oOh! Media development application to the Department of Planning, Housing and infrastructure (DPHI) in NSW. DPHI requested oOh! Media to confirm that the specifications of the original structural design of the sign is compliant with current Design Standards and whether the "as built" structure conforms to the current relevant standards to be undertaken by a suitably registered structural engineer.

Our appraisal has been based upon information provided in the form of cloud point survey result, photos, and a Structural Condition Report included within Appendix 1 and Appendix 2 respectively.

This report is not intended to be a dilapidation survey of the condition of the existing steel structure and that JMP have not witnessed the structure in person.

We have excluded from the appraisal fitness for purpose aspects as well as OH & S, and maintenance access provisions, for conformance with the current BCA/NCC or other relevant Australian Standards.

This report has been prepared by a Qualified Structural Engineer.

Description

The signage structure is commonly referred to as a double-sided "V" shaped front-lit "Supersite" monopole having a nominal display size of 12,660mm long x 3,350mm high.

The signage structure comprises a freestanding galvanised monopole with a bolted connection for attaching a galvanized torsion beam. A series of trussed frames, six in total, are attached to the top of the torsional beam. The main top, bottom, and vertical truss frame members are fully welded to each other while the diagonal members are connected to the top and bottom with bolts. The trussed frames comprise of steel channels and steel circular hollow section members for bracing.

The structural steel framed V-shape sign has upper and lower maintenance access catwalks on each side which provide the sign installers access to the top and bottom of the sign for each face.

The monopole is connected to a 1250mm X 1250mm pilaster with bolts. Unfortunately, there are no records of footing size.

The signage was built on 2001 as per the client's record.

Design Methodology and Design Parameters

This report details the structural assessment of the existing steel framed box sign structure supporting the static screen for the Ultimate Limit State and Serviceability Limit State Loading Cases.

Wind loading used in the assessment is as per AS1170.2:2021 with the appropriate factors and wind speed particular for the region.

The weight of the advertising fixed banner skin, 12.66m x 3.35m applied on the structure is 15kgs each side. This load is equivalent to 0.35kg /m^2. Other accessories such as access catwalks are added as super imposed dead loads on the structure. Live loads on the walkways are also considered in accordance with AS1657.

There are no available existing drawings for this signage. A 3D laser scanning of the signage was conducted to get the profile and sizes of the steel framing existing signage structure.

The wall thickness of the CHS Column and torsional beam are unknown. The thickness considered in the design is 12.7mm for the torsional beam and 12mm for the columns. These values were based on the other sites which have the same framing layout and member sizes.

The design evaluation of the signage framing members was undertaken using Space Gass and Toolkit software. Steel member connections were evaluated using in-house design procedures using simplified methods.

There is no information about the existing footing however, assessment was made by investigation of the historical changes to Australian wind loading standards over the years.

Steel Parameters

E = 200,000 MPa

Yield strength of plates = 300 MPa

Yield strength of hollow sections = 350 MPa

Yield strength of all other members = 250 MPa

Weld yield strength = 480 MPa

Design Codes and References

AS/NZS 1170.0:2002 Structural Design Actions – Part 0: General Principles.

AS/NZS 1170.1:2002 Structural Design Actions – Part 1: Permanent, Imposed, and other actions.

AS/NZS 1170.2:2021 Structural Design Actions – Part 2: Wind Loads.

AS1657:2018 Fixed Platforms, Walkways, Stairways and Ladders – Design, Construction and Installation.

AS2312.1:2014 Guide to the Protection of Structural Steel against Atmospheric Corrosion by the Use of Protective Coatings.

AS4100:2020 Steel Structures

AASHTO LRFD Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals.

Load Combinations

Load Combinations are based on the requirements of AS1170.0. Refer to Space Gass Input (Section D.2) for load combinations used in this assessment.

Summary of Results

Based upon our analysis, we have found that all steel members are adequate for Ultimate Limit State Load Case.

All steel connections depicted in the photos are adequate to resist the design forces.

All predicted displacements of the frame are within the normal industry-accepted Serviceability Limit State specified in AS1170.0.

The structure was designed in the year 2000. The loads were based on Australian Standard AS/NZS 1170.2: 1989. The original wind load is higher compared to the current Standard. Therefore we can conclude that the existing footing has sufficient strength to resist the current loads.

Those recommendations nominated in the structural conditions report prepared by Arcadis should be implemented in the short term to prolong the longevity of the structure and be more serviceable.

The above-mentioned results and implementation of the recommendations ensure the structural viability of the signage structure and compliance with relevant Building Code of Australia (BCA) requirements and Australian Standards.

Site Location

Project: HUNTINGWOOD, GREAT WESTERN HIGHWAY - EXISTING ADVERTISING SIGNAGE STRUCTURE

COMPUTATION SHEET

Designer: EL Date: 18.03.2024 Project No: 4981 01

Project Leader: EL Reviewer: MB Date: 20.03.2024 Sheet of

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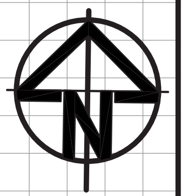
Melbourne 3000
Telephone (03) 9600 0366
jmpmelb@jmp.com.au



SITE
(APPROXIMATE
LOCATION)

AERIAL VIEW
SCALE: NOT TO SCALE

Existing Structure Geometry and Sizes

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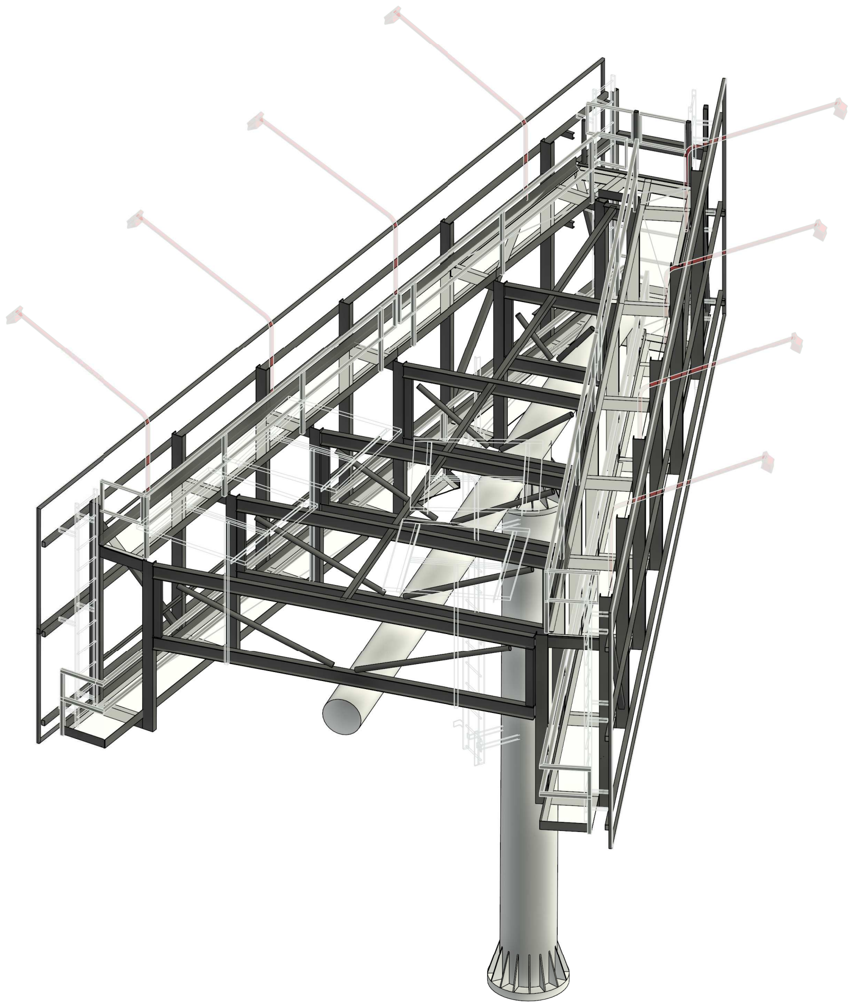
FROM POINT CLOUD SURVEY



ISOMETRIC VIEW

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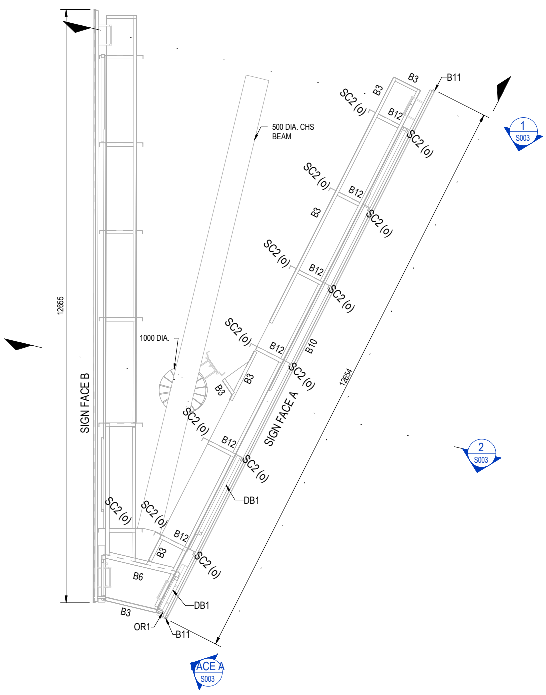
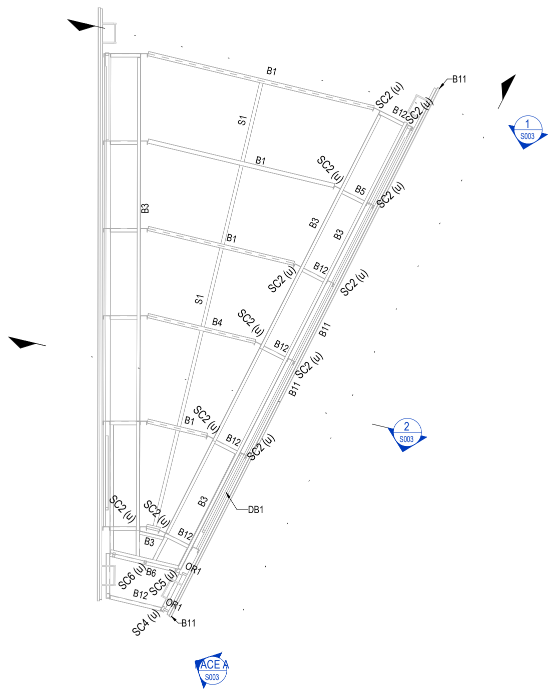


EXISTING ADVERTISEING SIGNAGE PLAN

SCALE: 1 : 50



TOP SIGN PAN

SCALE: 1 : 50

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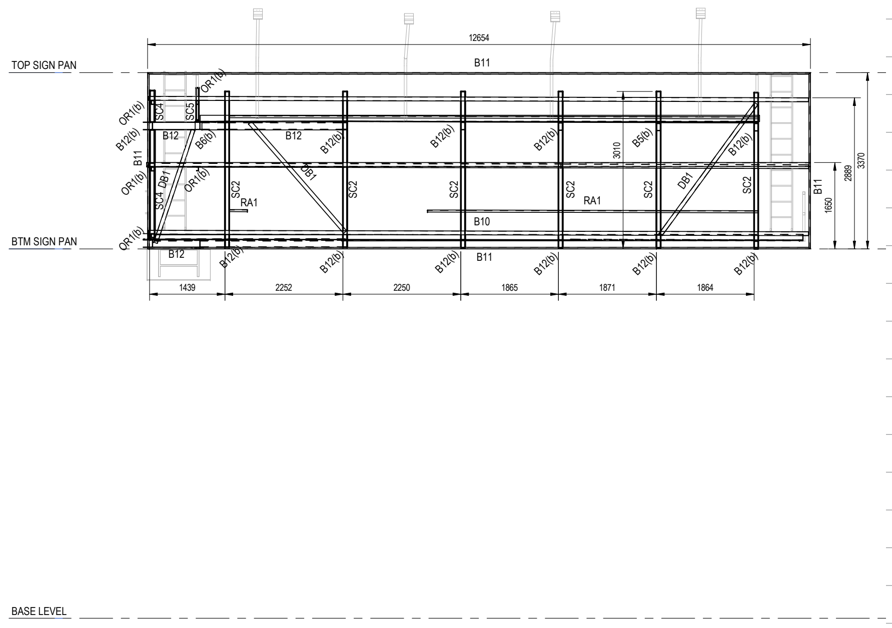
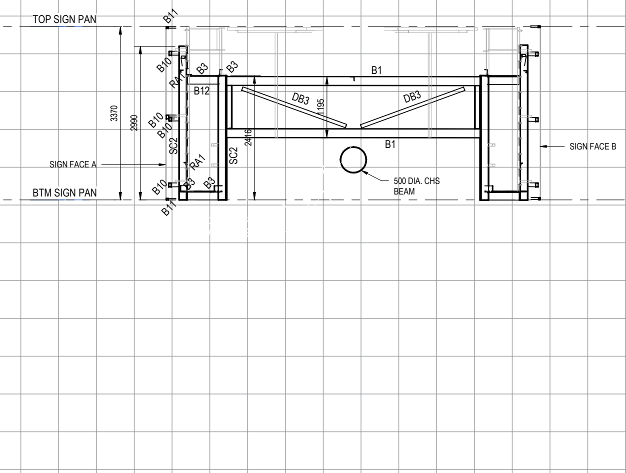


EXISTING ADVERTISING SIGN FACE A ELEVATION
SCALE: 1 : 50



SECTION 1
SCALE: 1 : 50
S002

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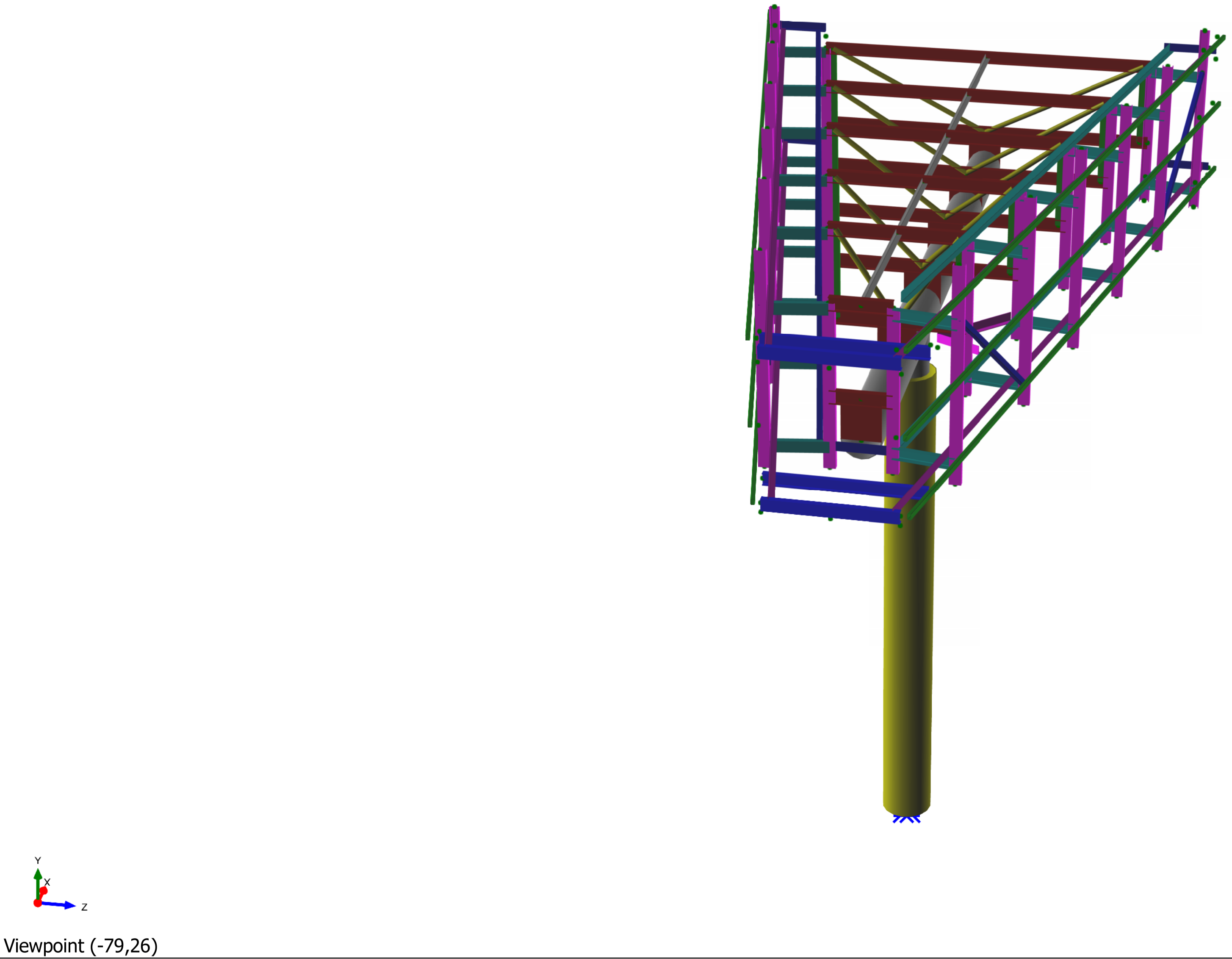
EXISTING SIGNAGE - STEEL BEAM SCHEDULE			
MARK	SIZE	Family and Type	REMARKS
B1		BM UB: 180x90x13mm	
B3		BM L-Angle: 70x120x3mm	
B4		BM UB: 170x90x13mm	
B5		BM PFC: 145x80x10mm	
B6		BM UB: 145x145x13mm	
B10		BM RHS: 50x75x3.0RHS	
B11		BM SHS: 40x30x3mm	
B12		BM PFC: 150x80x10mm	
DB1		BM SHS: 75x75x3mm	
DB2		BM SHS: 50x75x3mm	
DB3		BM CHS: Ø70x5mm	
OR1		BM PFC: 80x40x10mm	
RA1		BM L-Angle: 40x40x3mm	
S1		BM L-Angle: 75x75x3mm	

EXISTING SIGNAGE - STEEL COLUMN SCHEDULE			
MARK	SIZE	Family and Type	REMARKS
SC1		700DIA	
SC2		CL PFC: 150x80x10PFC	
SC4		CL PFC: 100x50x10PFC	
SC5		CL SHS: 45x45x8mm	
SC6		CL SHS: 50x50x8mm	
SC7		CL RHS: 50x100x3mm	



Sections:

1 Torsional Beam=508*12.7 CHS
2 B12=150 PFC
3 SC2=150 PFC
4 B1=180 UB 18.1
5 Column= 700diax12 CHS
6 B10=75*50*4 RHS
7 B3= 125*75*8 UA
8 B12=150 PFC
9 B3=125*75*8 UA
10 S1=75*8 EA
11 B6=150 UB 18.0
12 B3=125*75*8 UA
13 16thk plate
14 DB3= 76.1x3.2 CHS
15 SC4=100 PFC
16 DB1=75*4 SHS
17 B3=125*75*8 UA
18 B3=125*75*8 UA

Materials:

1 STEEL

Signage Weight and Wind Loading

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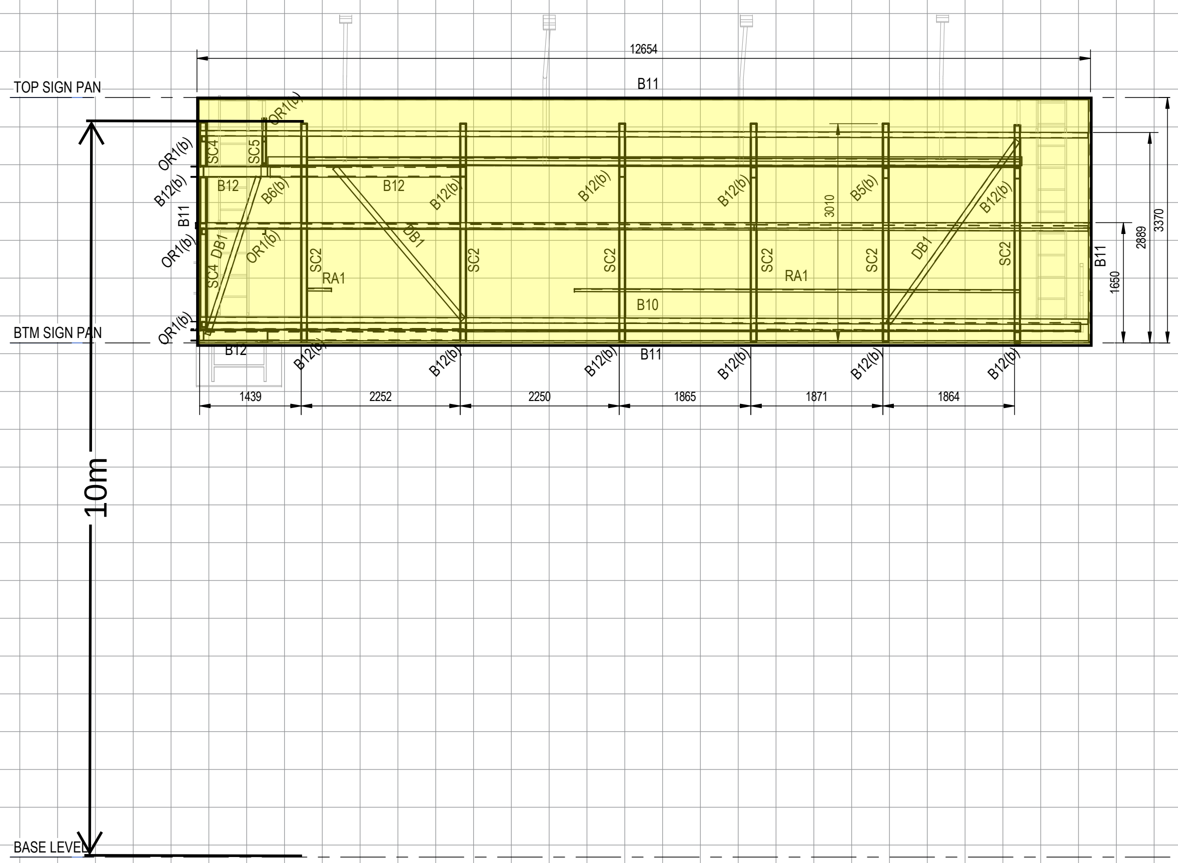

WEIGHT OF SUPERSITE STATIC SCREEN = 0.035KN/m^2

STEEL WEIGHT DENSITY =7,800 KG/M

PLATFORM LIVE LOAD=2.5kPa

REFER SPACEGASS OUTPUT.

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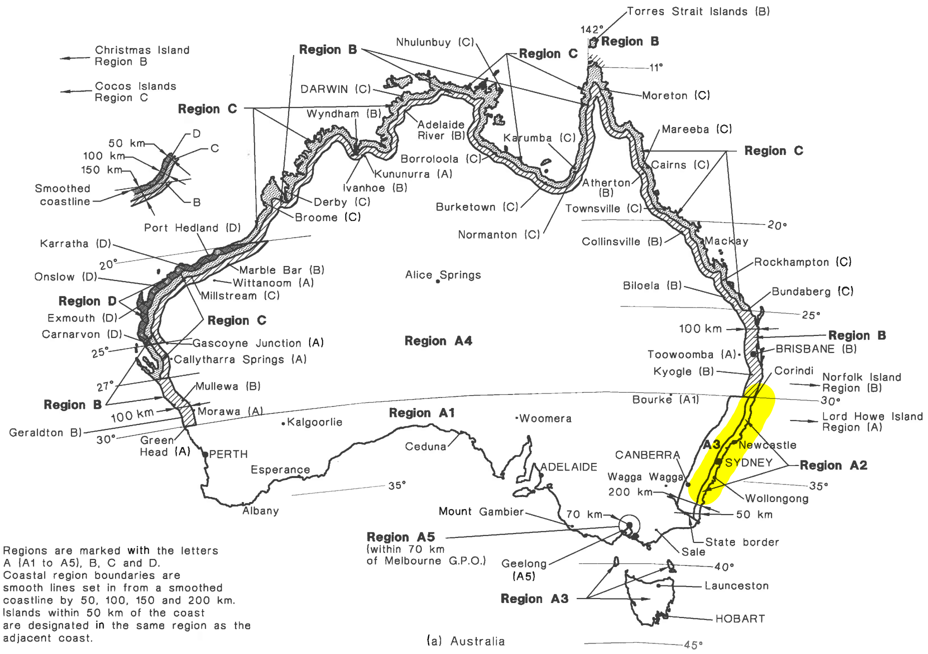


FIGURE 3.1(A) WIND REGIONS

Wind Actions

Wind Loads shall be calculated in accordance with AS1170.2:2021 Structural design actions - Wind Actions as specified below.

Parameters	**ULS (1/500)**	**SLS (1/25)**
Importance Level	IL2	
Wind Region	A2 (Sydney)	
Regional Gust Wind Speed, V_R	45 m/s	37 m/s
Terrain category	2	
Terrain/height multiplier, $M_{z,cat}$	As per Table 4.1 of AS/NZS 1170.2	
Directional multiplier, M_d	As per Table 3.2 of AS/NZS 1170.2	
Shielding multiplier, M_s	1.0	
Topographic multiplier, M_t	1.0	
Net pressure coefficient, $C_{p,n}$	As per Table B.2 of AS/NZS 1170.2	
Net porosity factor, K_p	1.0	
Aerodynamic shape factor, C_{shp}	$C_{p,n} \times K_p$	

Wind Analysis WA01

WIND V5.03 JMP

Design: (Wind Analysis WA01) Sydney, Non-temporary structure
Importance: All other structures not included in 1,3 or 4, Life = 50 years, Non-Cyclonic, APE = 500 years, APE.Serv = 25 years
Pressures: Wu.max = 1.14kPa, Ws/Wu =0.68

Location - Fig 3.1(A), 3.1(B)

Location = Sydney
Region = A Figure 3.1(A)
Sub region = 2 Figure 3.1(A)
Cyclonic = N (Y)es, (N)o Table 3.2(A)

Importance All other structures not included in 1,3 or 4

Importance level = 2 1,2,3,4,(C)ustom
Design working life = 50 Years

Annual prob. of exceedance (APE) = 1/ 500 years AS1170.0 - Table F2
Annual prob. of exceed. Serv. (APE.s) = 1/ 25 years AS1170.0 - Appendix C

Design wind speed (Vdes,q) - Cl 2.3

Ultimate regional wind speed (VR) = 45 m/s For a 1/500 APE - Table 3.1
Serv. regional wind speed (VR.s) = 37 m/s For a 1/25 APE.s - Table 3.1
Climate change multiplier(Mc) = 1.00 Table 3.3

Minimum ultimate speed (Vdes,θ) = 30 m/s - Cl 2.3
Ratio VR.s / VR = 0.82

Ratio Ws / Wu = 0.68

Design wind data for non-cyclonic areas with APE of 1:500 years

Dir (b)	Vdes,θ m/s	Wu kPa	Ws kPa
N	41.5	1.03	0.70
S	41.5	1.03	0.70
E	41.5	1.03	0.70
W	43.7	1.14	0.77

Dir (b)	Vdes.θ m/s	Wu kPa	Ws kPa
NE	37.1	0.83	0.56
SW	43.7	1.14	0.77
SE	41.5	1.03	0.70
NW	43.7	1.14	0.77

Site wind data for non-cyclonic areas with APE of 1:500 years

Dir (b)	Md (*1)	VR*Mc*Md m/s	Ave. Ht (z) m	Cat	Mz,cat	Ms	Mt	Vsit,β m/s	Wu.sit kPa
N	0.85	38.3	10.4	2.2	0.97	1.00	1.00	37.1	0.83
NE	0.75	33.8	10.4	2.2	0.97	1.00	1.00	32.7	0.64
E	0.85	38.3	10.4	2.2	0.97	1.00	1.00	37.1	0.83
SE	0.95	42.8	10.4	2.2	0.97	1.00	1.00	41.5	1.03
S	0.95	42.8	10.4	2.2	0.97	1.00	1.00	41.5	1.03
SW	0.95	42.8	10.4	2.2	0.97	1.00	1.00	41.5	1.03
W	1.00	45.0	10.4	2.2	0.97	1.00	1.00	43.7	1.14
NW	0.95	42.8	10.4	2.2	0.97	1.00	1.00	41.5	1.03

*1 - Refer to Table 3.2 and Cl 3.3, TC interpolated

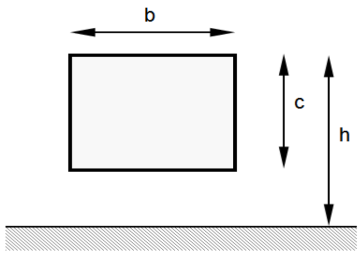
HOARDINGS V5.01

JMP

Member: (Hoarding H01) 12.7m wide x 3.4m high, 10.4m to top (7.1m gap under)
Normal: Cp,n = 1.51
Wind at θ=45: Cp,n = 1.51
Wind at θ=90: Cp,n = ±1.2 - 0 to 2c, ±0.6 - 2c to 4c, then ±0.3

Freestanding hoardings and walls - Appendix B.2

Breadth (b) =	12660	mm
Element height (c) =	3350	mm
Total height (h) =	10400	mm
Ratio (b/c) =	3.78	
Ratio (c/h) =	0.32	



Aerodynamic shape factor (Cshp) = Cp,n*Kp   Equ B.2
Cp,n = Net pressure coefficient - Cl B.2.1
Kp = Net porosity factor - Cl B.1.4

Wind normal to hoarding or wall θ = 0° - Table B.2(A)

Ratio (b/c) =	3.78	
Ratio (c/h) =	0.32	
Cp,n = 1.3 + 0.5(0.3+log10(b/c))*(0.8-c/h) =	1.51	
Vertical height of resultant (h-c/2) =	8725	mm above the surface
Horizontal eccentricity of resultant (e = 0) =	0	mm (No eccentricity)

Wind at θ = 45° to hoarding or wall - Table B.2(B) & B.2(C)

Ratio (b/c) =	3.78	
Ratio (c/h) =	0.32	
Cp,n = 1.3 + 0.5(0.3+log10(b/c))*(0.8-c/h) =	1.51	
Vertical height of resultant (h-c/2) =	8725	mm above the surface
Horizontal eccentricity of resultant (e = 0.2*b) =	2532	mm

From Table B.2(B)

Wind parallel to hoarding or wall θ = 90° - Table B.2(D)

Ratio (b/c) =	3.78
Ratio (c/h) =	0.32

Cp,n = ±1.2 - 0 to 2c, ±0.6 - 2c to 4c, then ±0.3

Net porosity factor - B.1.4

Solidity factor (δ) =	1.000	ratio of solid area to total area of structure
Net porosity factor Kp = 1-(1-δ)² =	1.000	

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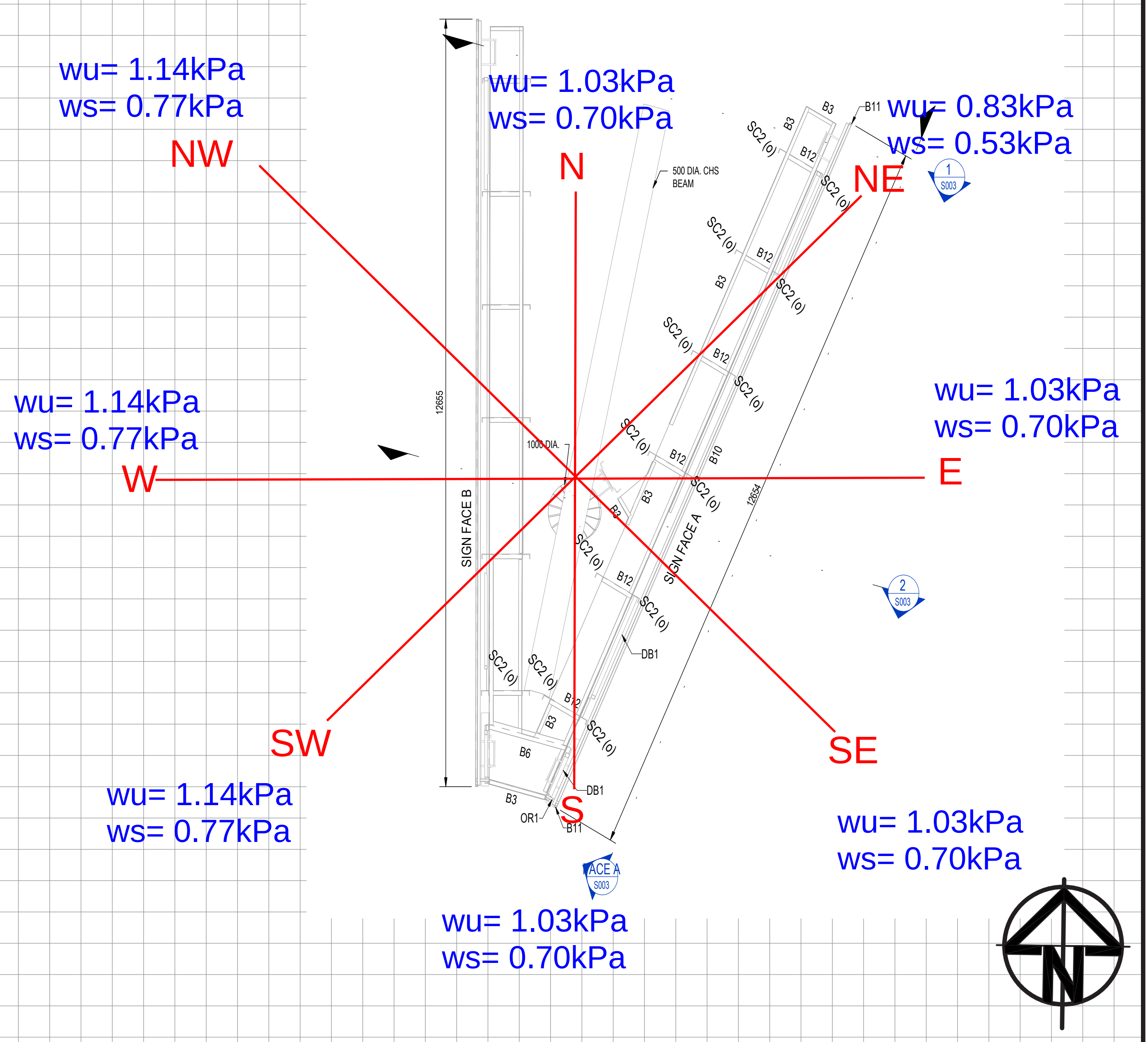

Project: PRINCESS HIGHWAY, HEATCOTE- EXISTING ADVERTISING SIGNAGE STRUCTURE

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WIND PRESSURES ON THE SIGNAGE STRUCTURE ARE CALCULATED AS FOLLOWS:

W = wu x Cshp

OPTION 1-CONSIDER AS HOARDING,

FOR WESTERLY/EASTERLY WIND:
Cshp = 1.51
HENCE,
WIND PRESSURE = 1.14 kPa x 1.51 = 1.72kPa

THE OVERALL DIMENSIONS OF THE SIGNAGE ARE APPROX. 12.66m LONG x 3.35m HIGH EACH SIDE

THEREFORE
WIND LOADING
TOP HOR MEMBER= 1.72 kPa x 1.3 = 2.24 kN/m
MIDDLE HOR MEMBER =1.72 x 1.0 =1.72 kN/m
BOTTOM HOR MEMBER =1.72 x 0.90 =1.55kN/m

FOR NORTHERLY AND SOUTHERLY WIND:
Cshp = 2.0
HENCE,
WIND PRESSURE = 1.72 kPa x 2.0 = 3.44 kPa

THIS DIRECTION IS NOT CRITICAL. THE FRAMING IS OPEN.

CONSIDER WIND ON THE POST =3.44x0.7= 2.41kN/m
WIND ON FRAME (INT) =1x3.44 =3.44kN/m; EXT =1x0.5x3.44=1.72kN/m

FOR WESTERLY/EASTERLY WIND:
:
Cpe = 0.8; wu = 1.14kPa; Cpl =0.3

OPTION 2-CONSIDER AS ELEVATED STRUCTURE

THEREFORE
WIND LOADING WEST WALL
TOP HOR MEMBER= 1.14 kPa x(0.8+0.3)x1.3 = 1.63 kN/m
MIDDLE HOR MEMBER =1.14 x(0.8+0.3)x 1.0 =1.254 kN/m
BOTTOM HOR MEMBER =1.14x(0.8+0.3)x 0.90 =1.1286kN/m
WIND LOADING EAST WALL
TOP HOR MEMBER= 1.14 kPa x(0.5+0.3)x1.3 = -1.186 kN/m
MIDDLE HOR MEMBER =1.14 x(0.5+0.3)x 1.0 =-0.912 kN/m
BOTTOM HOR MEMBER =1.14x(0.5+0.3)x 0.90 =-0.82kN/m

SPACE GASS 14.12 (64-bit) - JOHN MULLEN && PARTNERS PTY LTD
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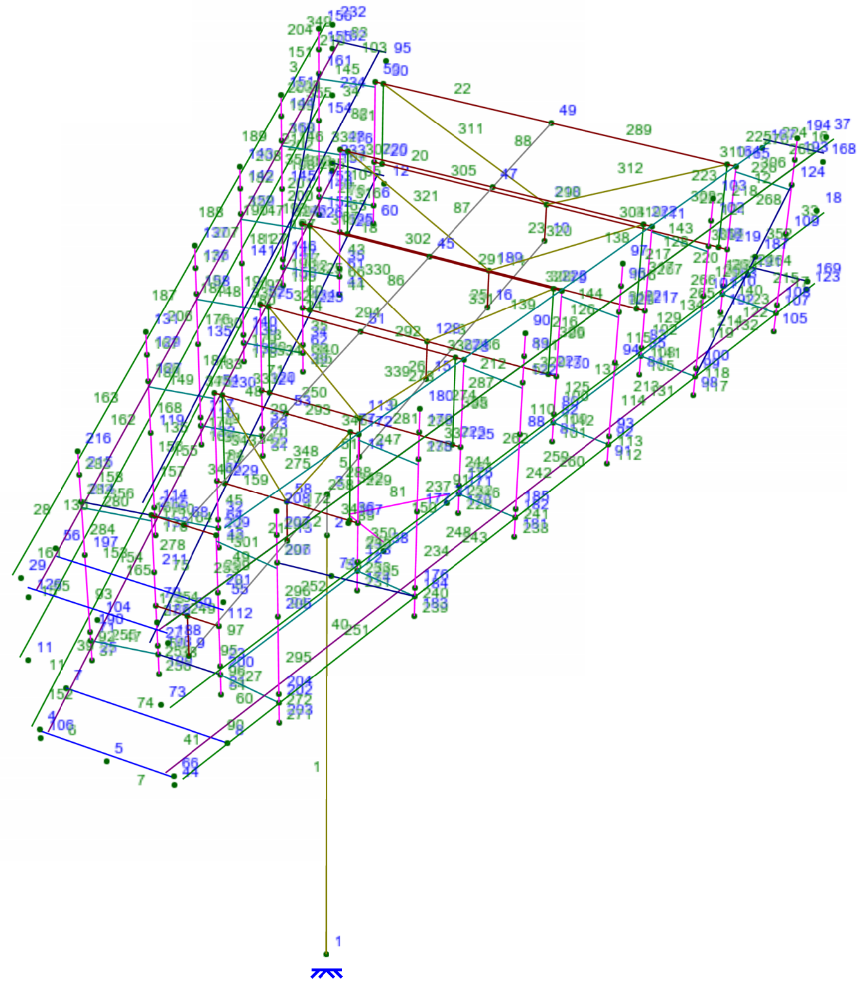


Viewpoint (-63,38)

Materials:

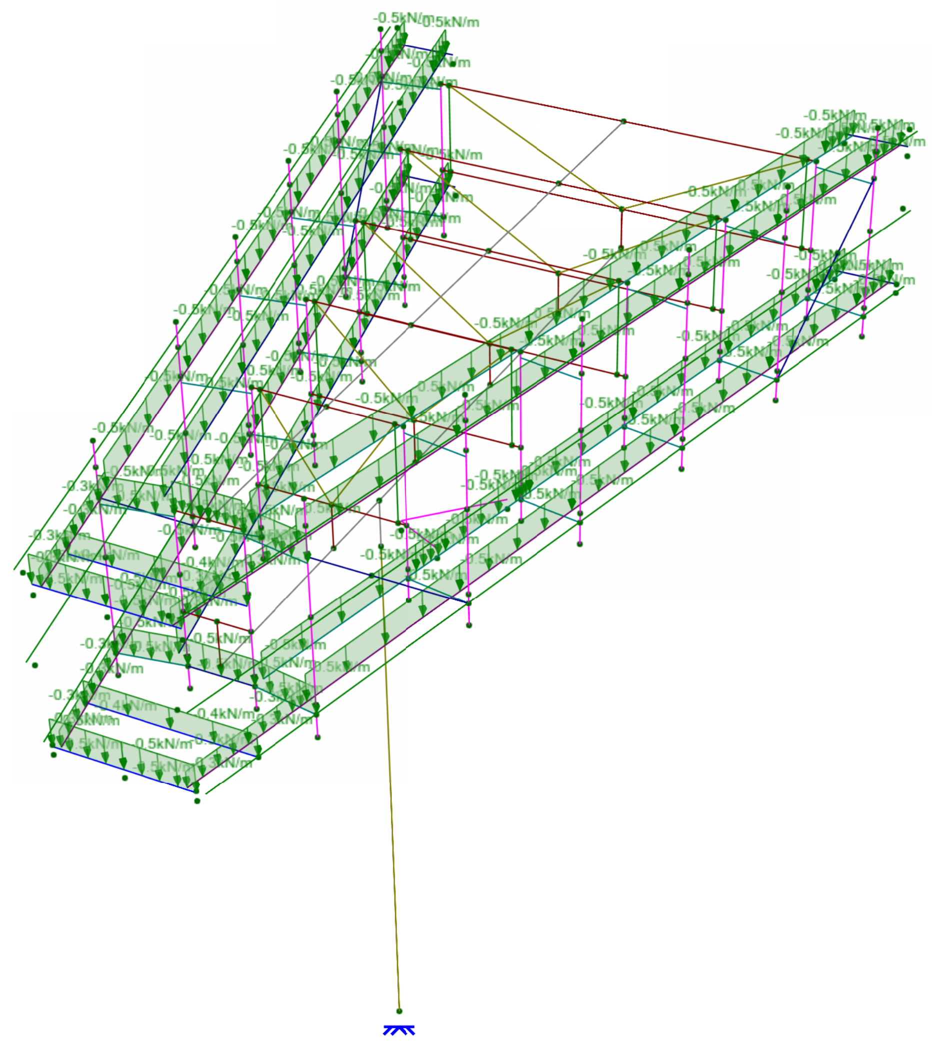
1 STEEL

Sections:

1 Torsional Beam=508*12.7 CHS
2 B12=150 PFC
3 SC2=150 PFC
4 B1=180 UB 18.1
5 Column= 700diax12 CHS
6 B10=75*50*4 RHS
7 B3= 125*75*8 UA
8 B12=150 PFC
9 B3=125*75*8 UA
10 S1=75*8 EA
11 B6=150 UB 18.0
12 B3=125*75*8 UA
13 16thk plate
14 DB3= 76.1x3.2 CHS
15 SC4=100 PFC
16 DB1=75*4 SHS
17 B3=125*75*8 UA
18 B3=125*75*8 UA

Load case 2

2 Dead Load



Viewpoint (-64,34), Loads

Materials:

1 STEEL

Sections:

1 Torsional Beam=508*12.7 CHS
2 B12=150 PFC
3 SC2=150 PFC
4 B1=180 UB 18.1
5 Column= 700diax12 CHS
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8 B12=150 PFC
9 B3=125*75*8 UA
10 S1=75*8 EA
11 B6=150 UB 18.0
12 B3=125*75*8 UA
13 16thk plate
14 DB3= 76.1x3.2 CHS
15 SC4=100 PFC
16 DB1=75*4 SHS
17 B3=125*75*8 UA
18 B3=125*75*8 UA

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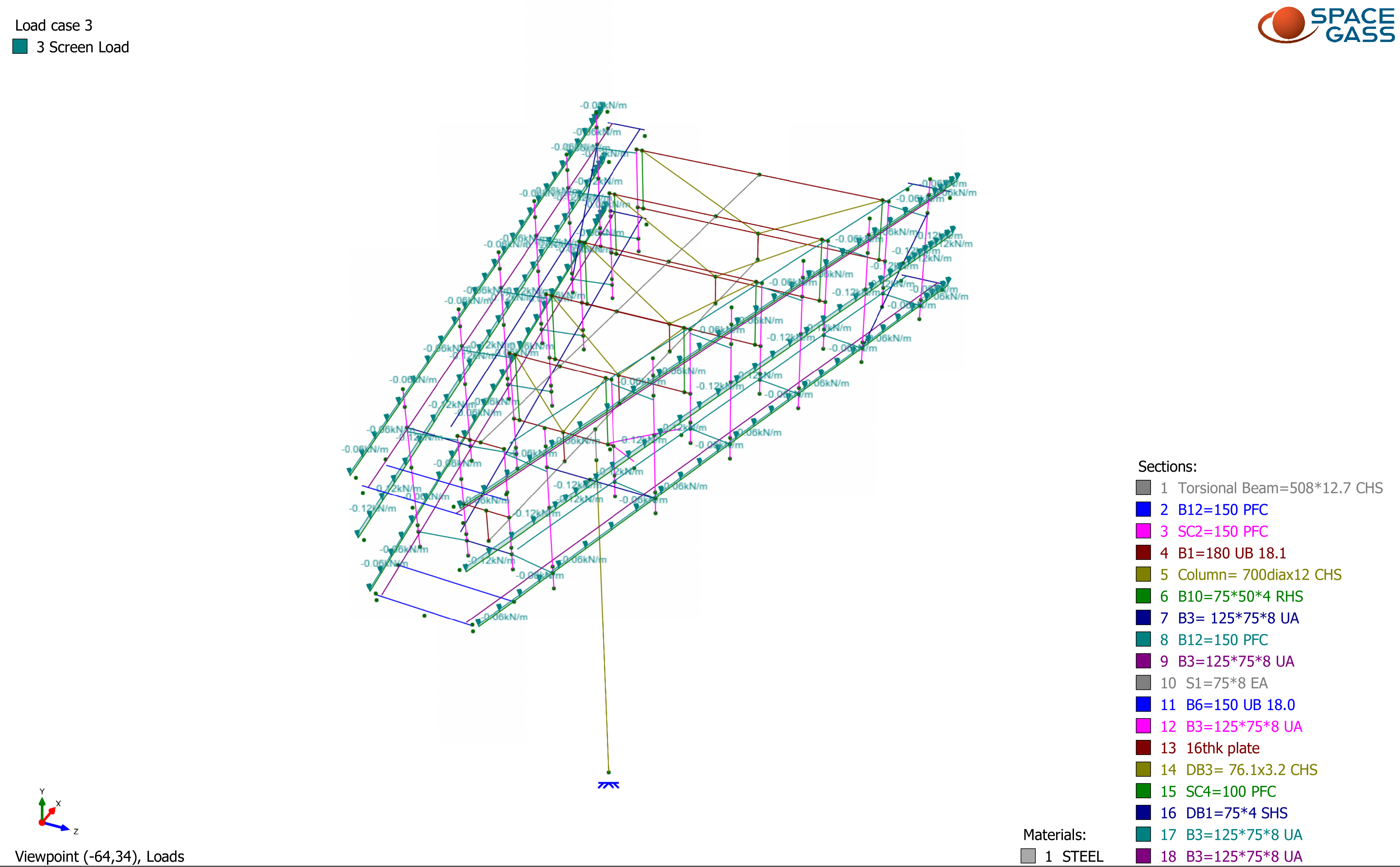

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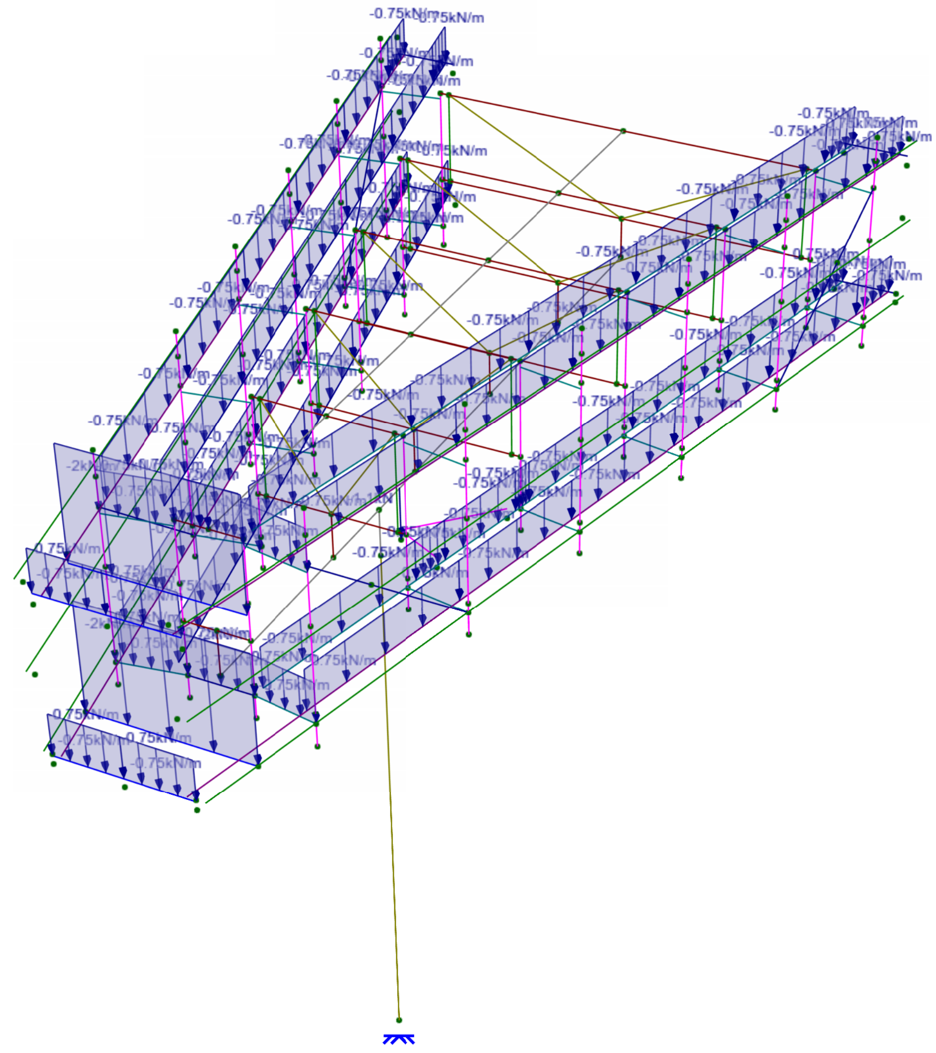
Load case 4
4 Live Load



Viewpoint (-64,34), Loads

Materials:
1 STEEL

Sections:
1 Torsional Beam=508*12.7 CHS
2 B12=150 PFC
3 SC2=150 PFC
4 B1=180 UB 18.1
5 Column= 700diax12 CHS
6 B10=75*50*4 RHS
7 B3= 125*75*8 UA
8 B12=150 PFC
9 B3=125*75*8 UA
10 S1=75*8 EA
11 B6=150 UB 18.0
12 B3=125*75*8 UA
13 16thk plate
14 DB3= 76.1x3.2 CHS
15 SC4=100 PFC
16 DB1=75*4 SHS
17 B3=125*75*8 UA
18 B3=125*75*8 UA

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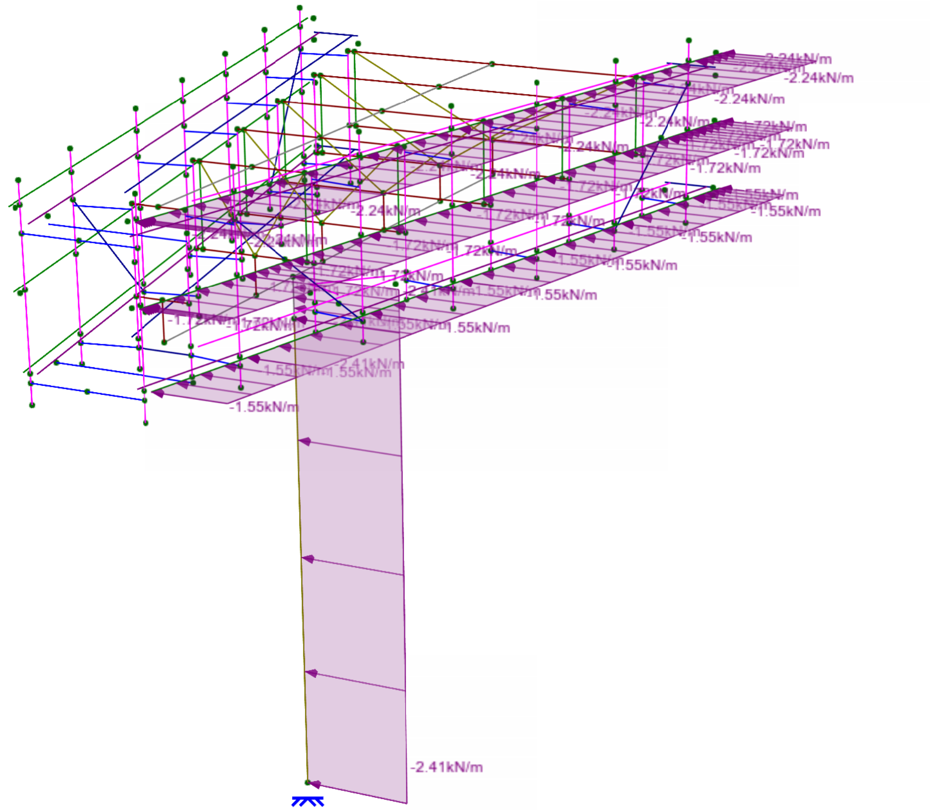
Load case 5

5 Wu(W-E)-Hoarding



Sections:

1 Torsional Beam=508*12.7 CHS
2 B12=150 PFC
3 SC2=150 PFC
4 B1=180 UB 18.1
5 Column= 700diax12 CHS
6 B10=75*50*4 RHS
7 B3= 125*75*8 UA
9 B3=125*75*8 UA
10 S1=75*8 EA
11 B6=150 UB 18.0
12 B3=125*75*8 UA
13 16thk plate
14 DB3= 76.1x3.2 CHS
15 SC4=100 PFC
16 DB1=75*4 SHS
18 B3=125*75*8 UA

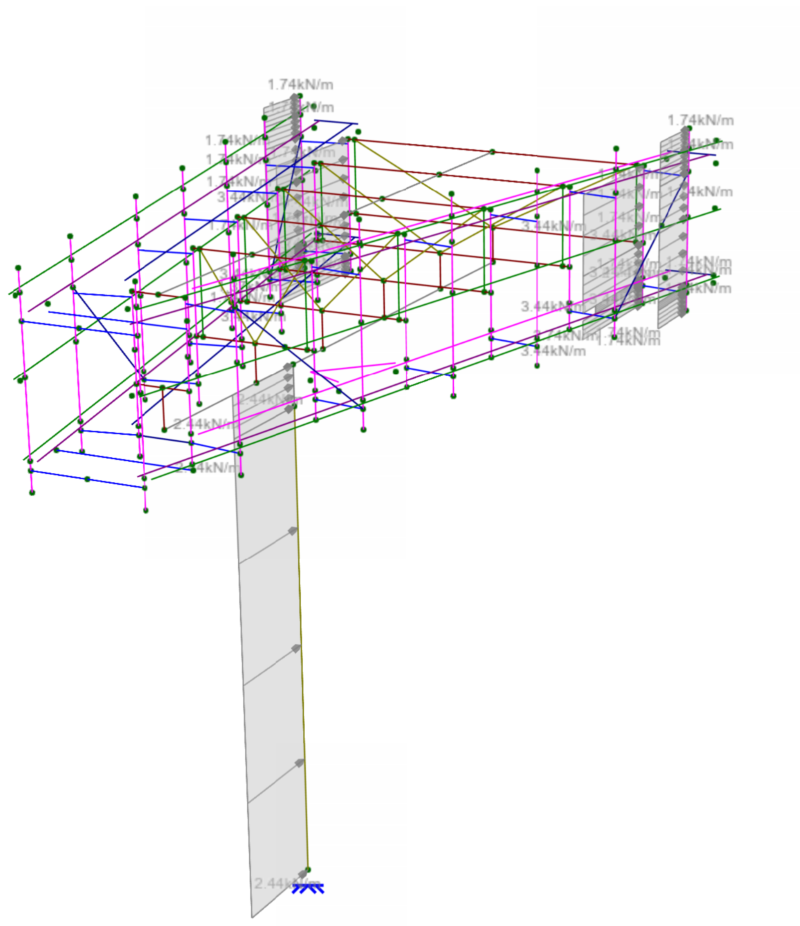
Materials:

1 STEEL

Viewpoint (-66,18), Loads

Load case 6

6 WU(N-S)-Hoarding



Sections:

1 Torsional Beam=508*12.7 CHS
2 B12=150 PFC
3 SC2=150 PFC
4 B1=180 UB 18.1
5 Column= 700diax12 CHS
6 B10=75*50*4 RHS
7 B3= 125*75*8 UA
9 B3=125*75*8 UA
10 S1=75*8 EA
11 B6=150 UB 18.0
12 B3=125*75*8 UA
13 16thk plate
14 DB3= 76.1x3.2 CHS
15 SC4=100 PFC
16 DB1=75*4 SHS
18 B3=125*75*8 UA

Materials:

1 STEEL

Viewpoint (-66,18), Loads

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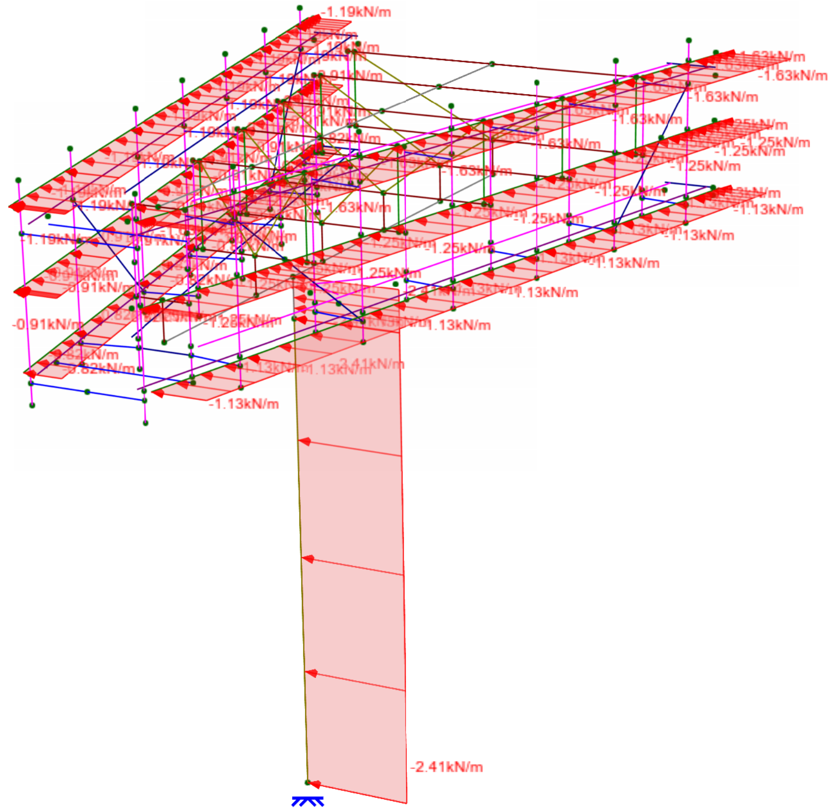
Load case 7

7 Wu(W-E)- Elevated Structure



Sections:

1 Torsional Beam=508*12.7 CHS
2 B12=150 PFC
3 SC2=150 PFC
4 B1=180 UB 18.1
5 Column= 700diax12 CHS
6 B10=75*50*4 RHS
7 B3= 125*75*8 UA
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12 B3=125*75*8 UA
13 16thk plate
14 DB3= 76.1x3.2 CHS
15 SC4=100 PFC
16 DB1=75*4 SHS
18 B3=125*75*8 UA

Materials:

1 STEEL

Viewpoint (-66,18), Loads

Serviceability Assessment

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Filter: Spine
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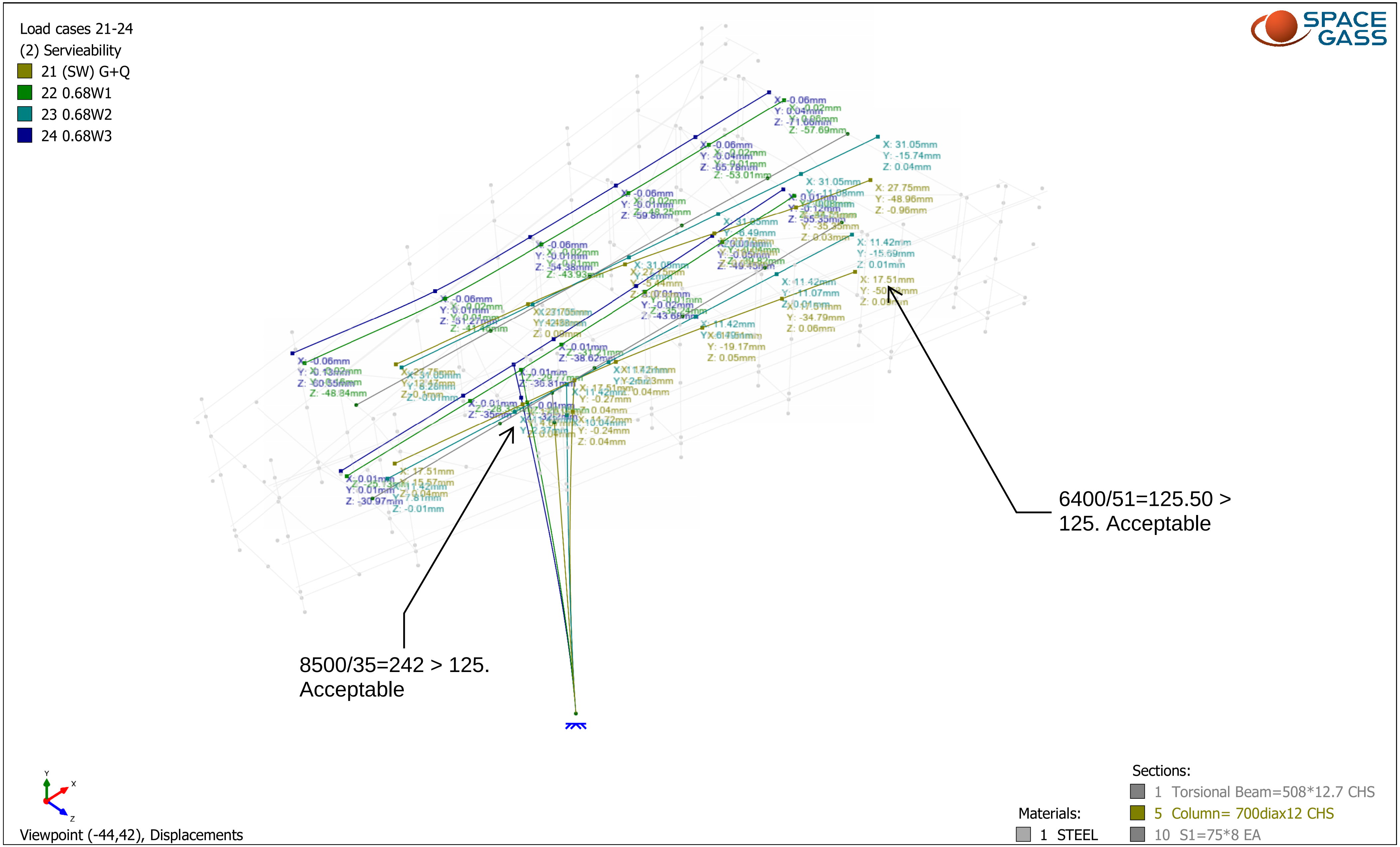

Strength Assessment

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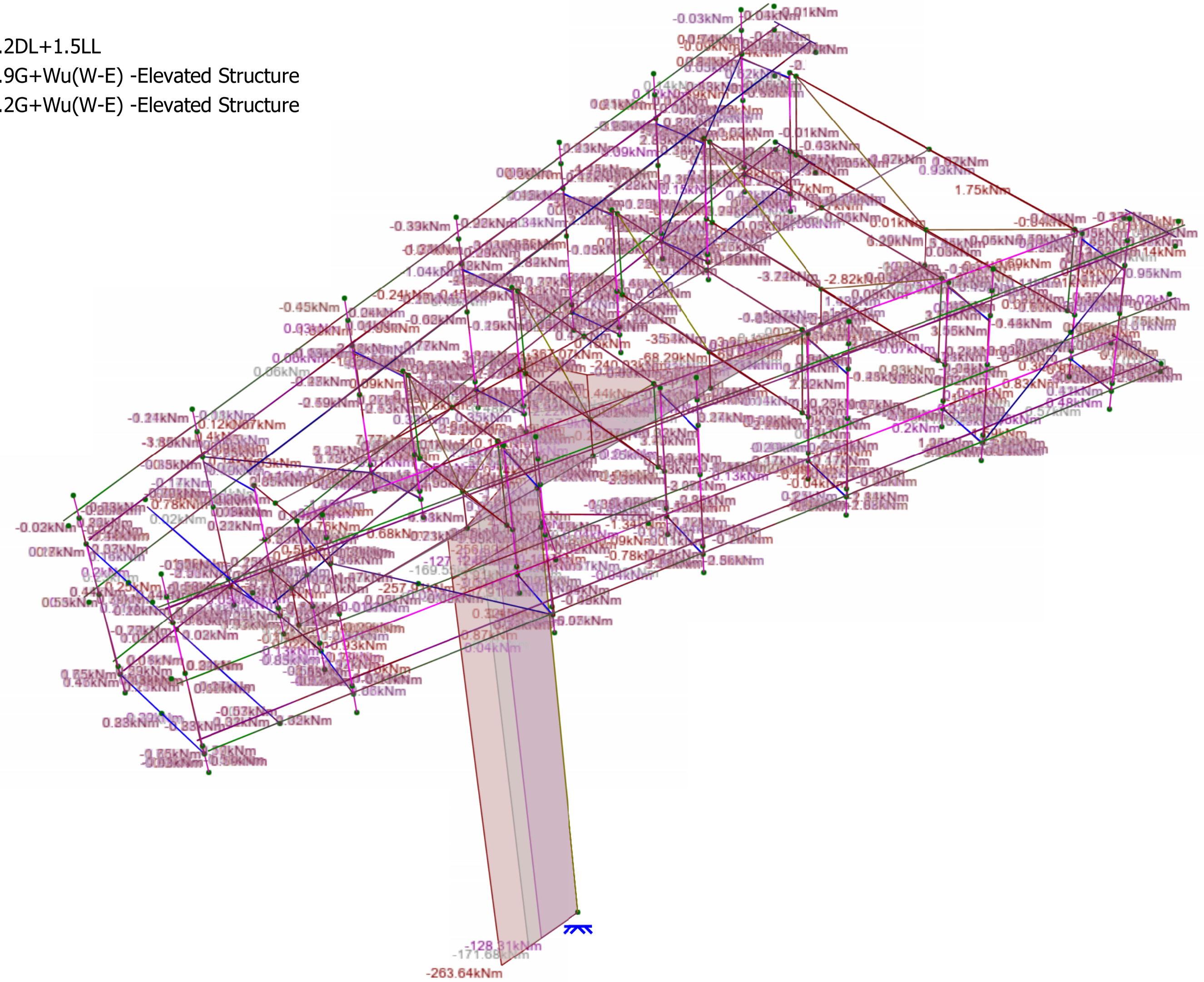
Load cases 10,15,16

(1) Strength

- 10 (SW) 1.2DL+1.5LL
- 15 (SW) 0.9G+Wu(W-E) -Elevated Structure
- 16 (SW) 1.2G+Wu(W-E) -Elevated Structure



Sections:

- 1 Torsional Beam=508*12.7 CHS
- 2 B12=150 PFC
- 3 SC2=150 PFC
- 4 B1=180 UB 18.1
- 5 Column= 700diax12 CHS
- 6 B10=75*50*4 RHS
- 7 B3= 125*75*8 UA
- 9 B3=125*75*8 UA
- 10 S1=75*8 EA
- 11 B6=150 UB 18.0
- 12 B3=125*75*8 UA
- 13 16thk plate
- 14 DB3= 76.1x3.2 CHS
- 15 SC4=100 PFC
- 16 DB1=75*4 SHS
- 18 B3=125*75*8 UA

Materials:

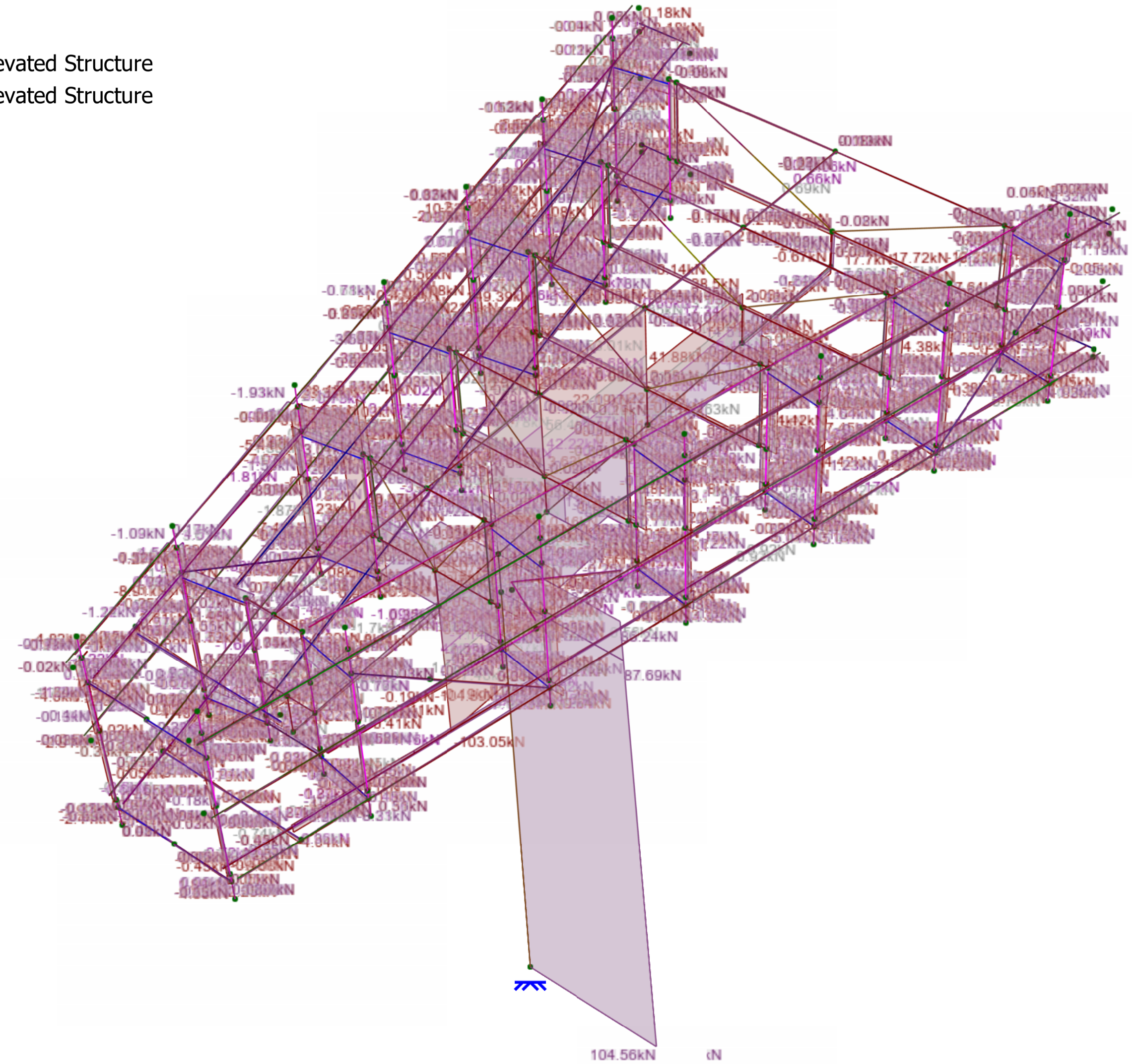
- 1 STEEL

Viewpoint (-44,42), Moments

Load cases 10,15,16

(1) Strength

- 10 (SW) 1.2DL+1.5LL
- 15 (SW) 0.9G+Wu(W-E) -Elevated Structure
- 16 (SW) 1.2G+Wu(W-E) -Elevated Structure



Sections:

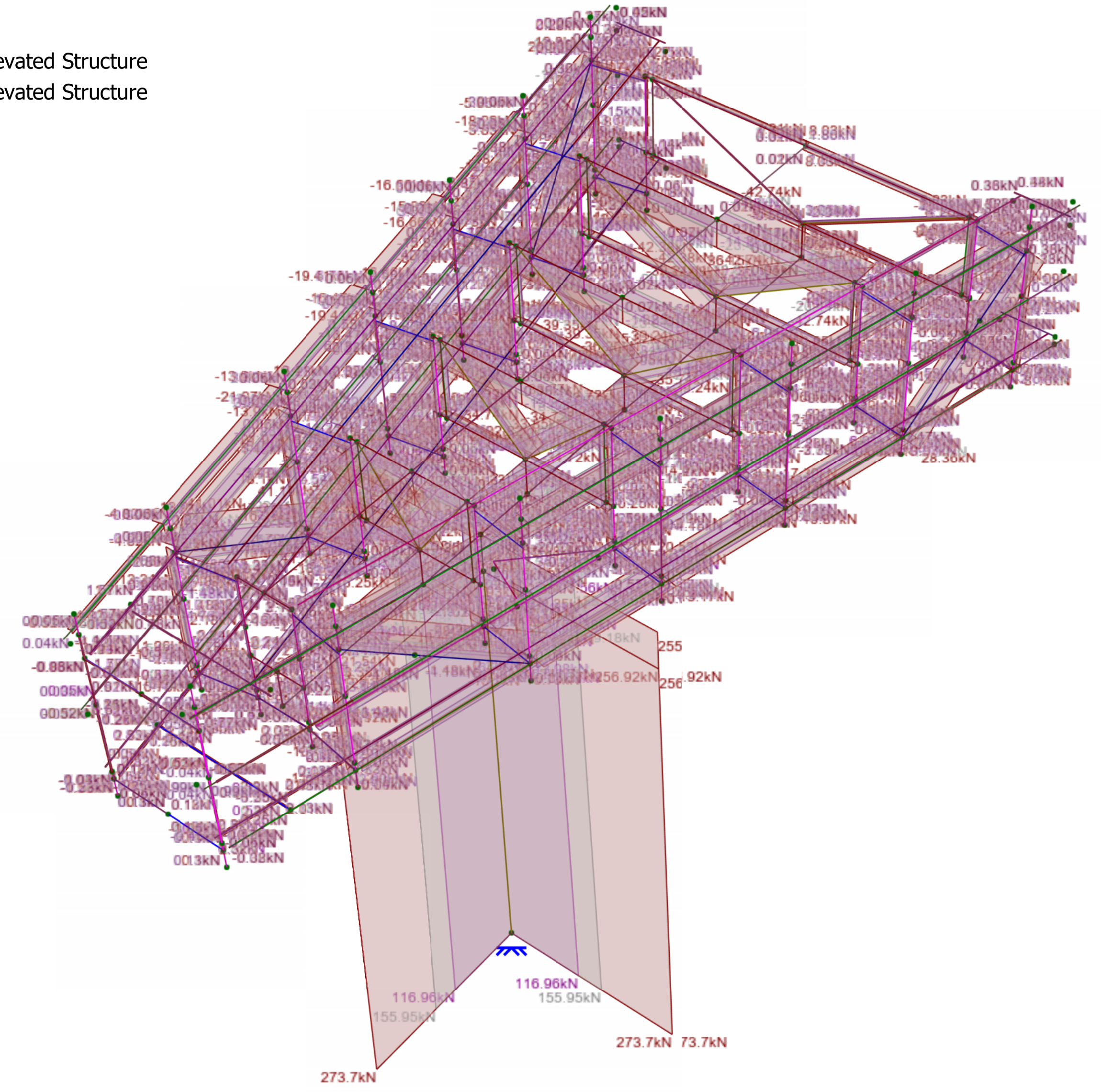
- 1 Torsional Beam=508*12.7 CHS
- 2 B12=150 PFC
- 3 SC2=150 PFC
- 4 B1=180 UB 18.1
- 5 Column= 700diax12 CHS
- 6 B10=75*50*4 RHS
- 7 B3= 125*75*8 UA
- 9 B3=125*75*8 UA
- 10 S1=75*8 EA
- 11 B6=150 UB 18.0
- 12 B3=125*75*8 UA
- 13 16thk plate
- 14 DB3= 76.1x3.2 CHS
- 15 SC4=100 PFC
- 16 DB1=75*4 SHS
- 18 B3=125*75*8 UA

Materials:

- 1 STEEL

Viewpoint (-53,45), Shears

Load cases 10,15,16
(1) Strength
10 (SW) 1.2DL+1.5LL
15 (SW) 0.9G+Wu(W-E) -Elevated Structure
16 (SW) 1.2G+Wu(W-E) -Elevated Structure

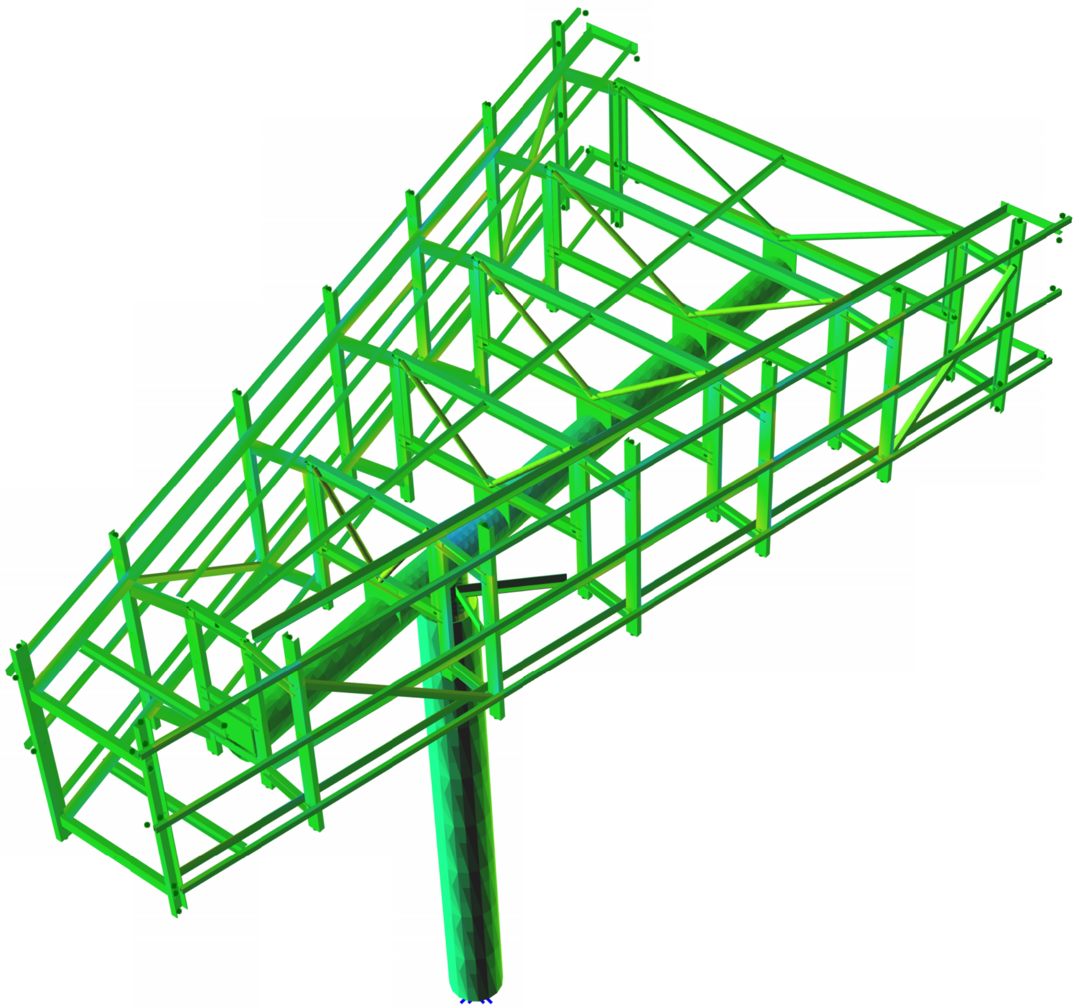


Sections:
1 Torsional Beam=508*12.7 CHS
2 B12=150 PFC
3 SC2=150 PFC
4 B1=180 UB 18.1
5 Column= 700diax12 CHS
6 B10=75*50*4 RHS
7 B3= 125*75*8 UA
9 B3=125*75*8 UA
10 S1=75*8 EA
11 B6=150 UB 18.0
12 B3=125*75*8 UA
13 16thk plate
14 DB3= 76.1x3.2 CHS
15 SC4=100 PFC
16 DB1=75*4 SHS
18 B3=125*75*8 UA

Materials:
1 STEEL

Viewpoint (-53,45), Axial forces

Load cases 10,15,16
(1) Strength
Axial + Bending Stress:
235.29 MPa
211.08 MPa
186.88 MPa
162.67 MPa
138.46 MPa
114.25 MPa
90.05 MPa
65.84 MPa
41.63 MPa
17.43 MPa
-6.78 MPa
-30.99 MPa
-55.19 MPa
-79.40 MPa
-103.61 MPa
-127.82 MPa
-152.02 MPa
-176.23 MPa
-200.44 MPa
-224.64 MPa



Sections:
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2 B12=150 PFC
3 SC2=150 PFC
4 B1=180 UB 18.1
5 Column= 700diax12 CHS
6 B10=75*50*4 RHS
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13 16thk plate
14 DB3= 76.1x3.2 CHS
15 SC4=100 PFC
16 DB1=75*4 SHS
18 B3=125*75*8 UA

Materials:
1 STEEL

Viewpoint (-53,45)

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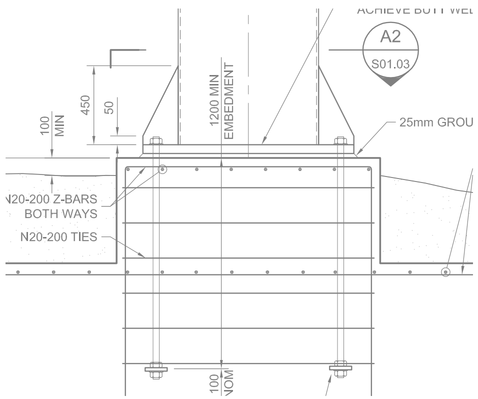
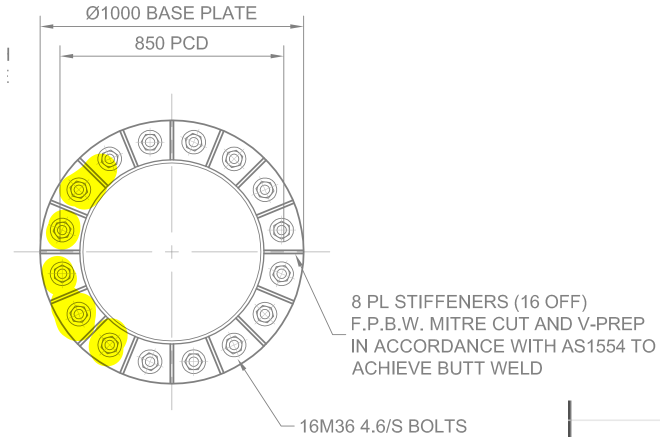
Envelope = Load Cases 10,15,16
       and Nodes 1

DISPLACEMENTS (mm,rad) (*=Maximum, #=Minimum)
-------------
    Node  Case        Tx         Ty         Tz         Rx         Ry         Rz
       1    10     0.00*#     0.00*#     0.00*#     0.00*#     0.00*#     0.00*#

REACTIONS (kN,kNm) (*=Maximum, #=Minimum)
---------
    Node  Case        Fx         Fy         Fz         Mx         My         Mz
       1    10     0.00#    273.70*     0.00#     -0.84#     0.01*    263.64*
       1    15     0.00*    116.96#   104.56*    832.33    -79.65#    128.31#
       1    16     0.00     155.95    104.56     833.94*   -79.62     171.68
```





M* = 833kN-m

T*=C* = 833/0.6 =1388kN consider 6 bolts therefore 1388/6 =231kN per bolts

Axial Tension capacity of M36 bolts 4.6/S = 261kN
Shear Capacity = 151 kN

By inspection, baseplate thickness is adequate. The stiffener helps to reduced the thickness required.

	d_b	36	mm		F_{sy}	500	MPa
	f'c	32	MPa	(Must be Less than 65 MPa)			
	Cover	50	mm				
	Clear Distance Between Bars	165	mm				
	k1	1		= 1.3 if horizontal bar with more than 300mm of concrete cast below) = 1.0 for all other bars			
	k2	0.96					
	k3	0.941667					
	$L_{sy.tb}$	1561	≥	1044			
	Bar Tension	231	kN	Min Bar area	577.5 mm²		
				Okay			
	δ_{st}	227	MPa				
Cl13.1.2.2	L_{st}	709	mm				
AS3600							

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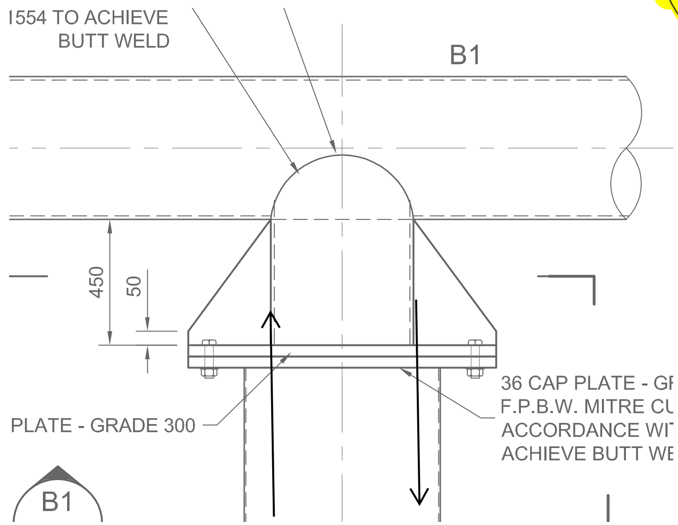
Envelope = Load Cases 10,15,16
and Members 2

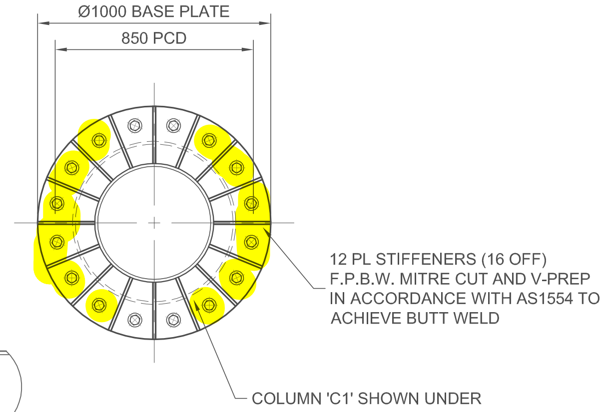
INTERMEDIATE FORCES AND MOMENTS (m,kN,kNm) (*=Maximum, #=Minimum)

Case	Member	Position Along Member	Fx	Fy	Fz	Mx	My	Mz
10	2	0.00	256.92*	0.00*	0.00#	0.01*	0.82*	-257.91#
15	2	0.00	104.38	0.00#	87.69*	-79.65#	-153.91#	-127.12
15	2	0.60	103.56#	0.00	86.24	-79.65	-101.02	-126.92*

INTERMEDIATE DISPLACEMENTS (m,mm) (*=Maximum, #=Minimum)

Case	Member	Position Along Member	Global X Transl'n	Global Y Transl'n	Global Z Transl'n	Local X Transl'n	Local Y Transl'n	Local Z Transl'n
15	2	0.00	10.22#	-0.15*	-47.65	-0.15*	-10.22*	-47.65
10	2	0.60	24.92*	-0.40#	0.08*	-0.40#	-24.92#	0.08*
16	2	0.60	16.26	-0.22	-54.59#	-0.22	-16.26	-54.59#





M* = 258kN-m

T*=C* = 258/0.5 =516kN consider 6 bolts therefore 516/6 =86kN per bolts

Axial Tension capacity of M24 bolts 8.8/S = 234kN
Shear Capacity = 133 kN

Bending on Cap plate = 86 x .070=6.02kN-m

t= 36mm
fy=300
b=150

ϕM =0.9 x (150x36^2/6*1000000) *300= 8.748kN-m OK!

Project: HUNTINGWOOD, GREAT WESTERN HIGHWAY - EXISTING ADVERTISING SIGNAGE STRUCTURE

COMPUTATION SHEET

Designer: EL Date: 18.03.2024 Project No: 4981 01

Project Leader: EL Reviewer: MB Date: 20.03.2024 Sheet of

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Melbourne 3000
Telephone (03) 9600 0366
jmpmelb@jmp.com.au

COMPARISON OF AS1170.2:1989 and AS1170.2:2021

3.2.2 Derivation of design gust wind speed (V_z). The design gust wind speeds (V_z) shall be determined from the appropriate basic wind speed shown in Figure 3.2.2 for the appropriate limit state given by Equation 3.2.2.

$$V_z = VM_{(z,cat)}M_sM_tM_i \quad \ldots\ldots\ldots\ldots \quad (3.2.2)$$

where

V_z = the design gust wind speed at height z, in metres per second

V = the basic wind speed, (V_u), (V_p) and (V_s) (see Figure 3.2.2), in metres per second

$M_{(z,cat)}$ = a gust wind speed multiplier for a terrain category at height z for upwind distance of at least ($2500 + x_i$) m (see also Clause 3.2.6, Tables 3.2.5.1 and 3.2.5.2)

M_s = a shielding multiplier (see Table 3.2.7)

M_t = a topographic multiplier for gust wind speeds (see Table 3.2.8)

M_i = a structure importance multiplier (see Table 3.2.9).

1989

TABLE 3.2.5.1
TERRAIN AND STRUCTURE HEIGHT MULTIPLIERS FOR GUST WIND SPEEDS IN FULLY DEVELOPED TERRAINS ULTIMATE LIMIT STATE AND PERMISSIBLE STRESS DESIGN — REGIONS A AND B ONLY SERVICEABILITY LIMIT STATE DESIGN — ALL REGIONS

Height (z)	Multiplier ($M_{(z,cat)}$)			
m	Terrain Category 1	Terrain Category 2	Terrain Category 3	Terrain Category 4
≤3	0.99	0.85	0.75	0.75
5	1.05	0.91	0.75	0.75
10	1.12	1.00	0.83	0.75
15	1.16	1.05	0.89	0.75
20	1.19	1.08	0.94	0.75
30	1.22	1.12	1.00	0.80
40	1.24	1.16	1.04	0.85
50	1.25	1.18	1.07	0.90
75	1.27	1.22	1.12	0.98
100	1.29	1.24	1.16	1.03
150	1.31	1.27	1.21	1.11
200	1.32	1.29	1.24	1.16
250	1.34	1.31	1.27	1.20
300	1.35	1.32	1.29	1.23
400	1.37	1.35	1.32	1.28
500	1.38	1.37	1.35	1.31

2021

Table 4.1 — Terrain/height multipliers for gust wind speeds in fully developed terrains — All regions except A0

Height (z) (m)	Terrain/height multiplier ($M_{z,cat}$)				
	Terrain Category 1	Terrain Category 2	Terrain Category 2.5	Terrain Category 3	Terrain Category 4
≤ 3	0.97	0.91	0.87	0.83	0.75
5	1.01	0.91	0.87	0.83	0.75
10	1.08	1.00	0.92	0.83	0.75
15	1.12	1.05	0.97	0.89	0.75
20	1.14	1.08	1.01	0.94	0.75
30	1.18	1.12	1.06	1.00	0.80
40	1.21	1.16	1.10	1.04	0.85
50	1.23	1.18	1.13	1.07	0.90
75	1.27	1.22	1.17	1.12	0.98
100	1.31	1.24	1.20	1.16	1.03
150	1.36	1.27	1.24	1.21	1.11
200	1.39	1.29	1.27	1.24	1.16

NOTE 1 In Region A0, use $M_{z,cat\,2}$ for all $z \leq 100$ m in all terrains. For 100 m < $z \leq 200$ m, take $M_{z,cat}$ as 1.24 in all terrains.

NOTE 2 For all other regions, for intermediate terrains use linear interpolation.

NOTE 3 For intermediate values of height z, use linear interpolation.

Project: HUNTINGWOOD, GREAT WESTERN HIGHWAY - EXISTING ADVERTISING SIGNAGE STRUCTURE

COMPUTATION SHEET

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Project Leader: EL   Reviewer: MB   Date: 20.03.2024   Sheet   of

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Melbourne 3000
Telephone (03) 9600 0366
jmpmelb@jmp.com.au

1989

TABLE 3.2.7
SHIELDING MULTIPLIER (M_s)

Building spacing parameter (D)	Shielding multiplier (M_s)
≤1.5	0.7
3.0	0.8
6.0	0.9
≥ 12.0	1.0

TABLE 3.2.8
TOPOGRAPHIC MULTIPLIER AT CREST (x = 0) FOR GUST WIND SPEEDS

Upwind slope (ϕ)	Topographic multiplier (M_t)	
	Escarpments $\phi_d \leq 0.05$	Hills and ridges $\phi_d \geq 0.10$ (see Notes 1 and 2)
0.05	1.04	1.09
0.1	1.08	1.18
0.2	1.16	1.36
≥ 0.3	1.24	1.54

Higher

2021

Table 4.2 — Shielding multiplier (M_S) (for h ≤ 25 m)

Shielding parameter (s)	Shielding multiplier (M_S)
≤ 1.5	0.7
3.0	0.8
6.0	0.9
≥ 12.0	1.0
NOTE For intermediate values of s, use linear interpolation.	

4.4 Topographic multiplier (M_t)

4.4.1 General

The topographic multiplier (M_t) shall be taken as follows:

(a) For sites in Regions A4, NZ1, NZ2, NZ3 and NZ4 over 500 m above sea level, use Equation 4.4(1):

$$M_t = M_h M_{lee}(1+0.00015E) \quad 4.4(1)$$

where

M_h = hill shape multiplier

M_{lee} = lee (effect) multiplier (taken as 1.0, except in New Zealand lee zones, see Clause 4.4.3)

E = site elevation above mean sea level, in metres

(b) For sites in Region A0, use Equation 4.4(2):

$$M_t = 0.5 + 0.5M_h \quad 4.4(2)$$

(c) Elsewhere, the larger value of the following:

(i) $M_t = M_h$

(ii) $M_t = M_{lee}$

Table 4.3 — Hill-shape multiplier at crest ($|x| = 0$), $z = 0$ (for gust wind speeds)

Upwind slope ($H/2L_u$)	M_h
< 0.05	1.0
0.05	1.08
0.10	1.16
0.20	1.32
0.30	1.48
≥ 0.45	1.71

Project: HUNTINGWOOD, GREAT WESTERN HIGHWAY - EXISTING ADVERTISING SIGNAGE STRUCTURE

COMPUTATION SHEET

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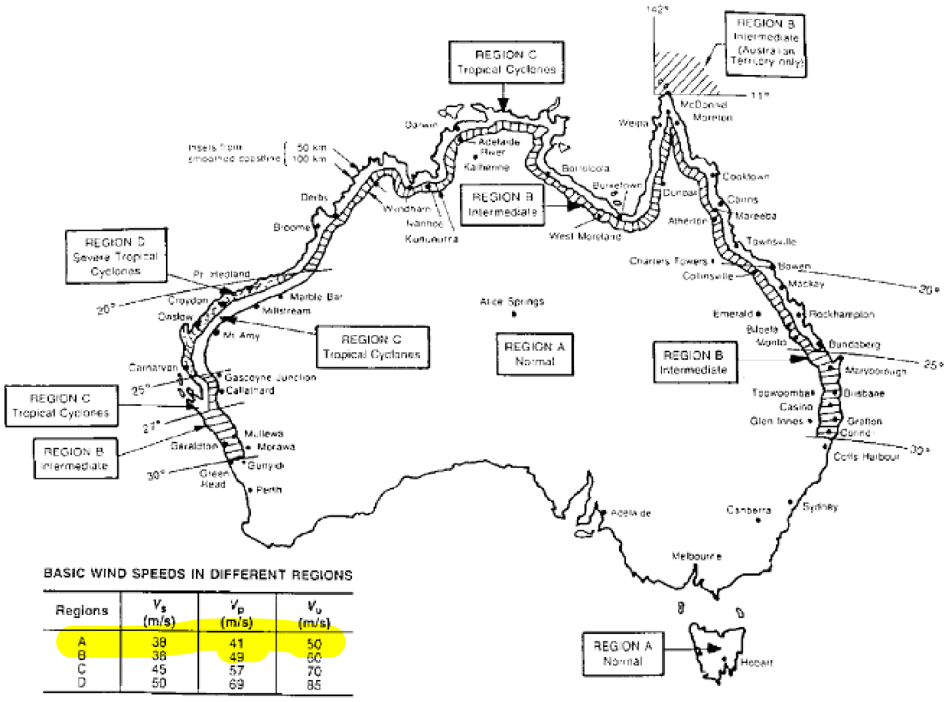


BASIC WIND SPEEDS IN DIFFERENT REGIONS

Regions	V_s (m/s)	V_p (m/s)	V_u (m/s)
A	38	41	50
B	38	49	60
C	45	57	70
D	50	69	85

FIGURE 3.2.2 BOUNDARIES OF REGIONS A, B, C AND D
(see Paragraph E3.2.1 of Appendix E)

TABLE 2.5.1
REGIONAL MULTIPLYING FACTORS (B_1)

Region	Factors (B_1)
A—Normal	1.0
B—Intermediate	1.5
C—Tropical cyclone	2.3
D—Severe tropical cyclone	3.3

By Inpections the Wind load used in the original design is higher than the current Wind Loading Code AS1170.2 :2021.

Site falls under Region A.

Appendices

Appendix 1 Point Cloud Survey Report

veris

Huntingwood Billboard Scan

PROJECT METADATA REPORT

Client reference: 203791

DEVELOP
WITH
CONFIDENCE ™

Contents

1. **Overview**

Veris Australia were contracted to perform a 3D laser scanning of the billboard located in Huntingwood

The 3D laser scanning survey was performed by the Veris Digital & Spatial team equipped with a Leica RTC360 scanner. Approx 10 scans were required to achieve maximum coverage

2. Intended use of data

The intent of the survey is to facilitate engineering design and inform new equipment installation

3. Survey Datum and Spatial Accuracy

All survey data has been provided on an assumed datum only.

Accuracy of the terrestrial laser scanning survey and derived datasets is to the order of ±5mm, with global accuracy ±20mm.

4. Limitations

Due to the nature of 3D laser scanning, all objects within line-of-sight of the instrument are captured. The nature of the structure means that some elements may be obscured by other structural objects. Best efforts have been made to ensure maximum data coverage

This survey dataset is for engineering purposes only.

5. Supplied digital data

These deliverables have been supplied

5.1. Autodesk Recap

A copy of scan data has been supplied as an Autodesk RCP. Recap RCS format point clouds enable users to directly interrogate laser scan data in a 3D environment across all Autodesk products (AutoCAD, Revit, Navisworks).

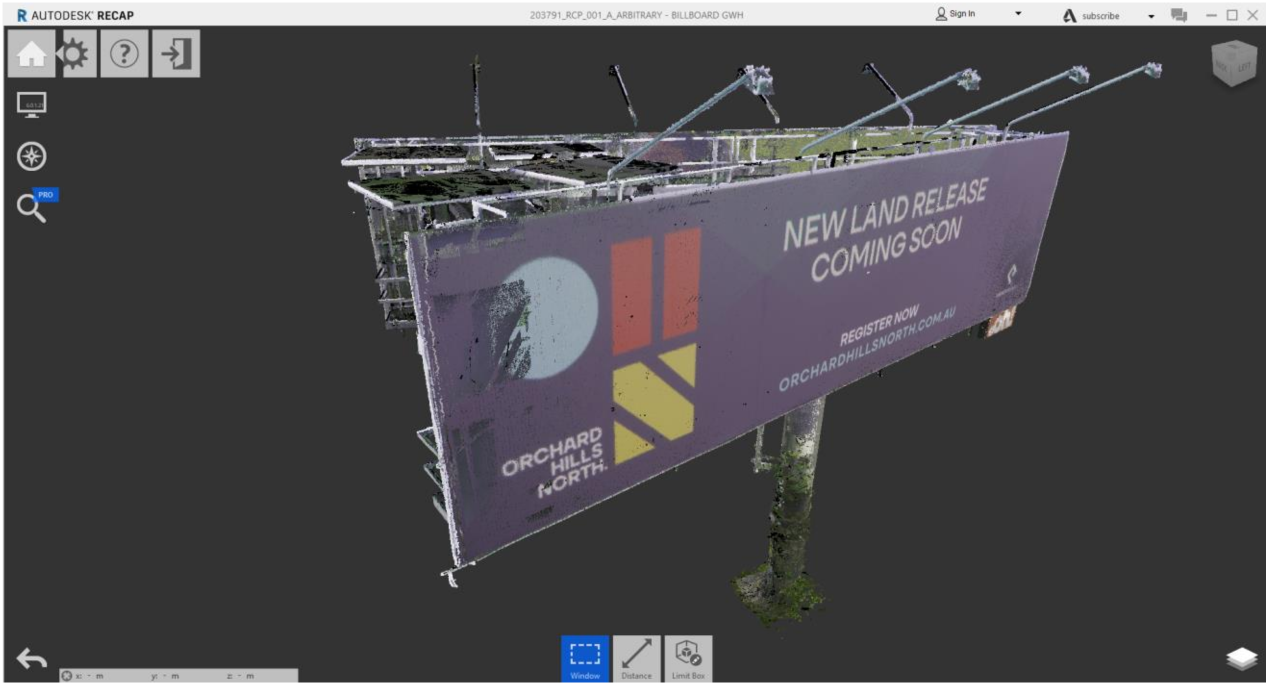
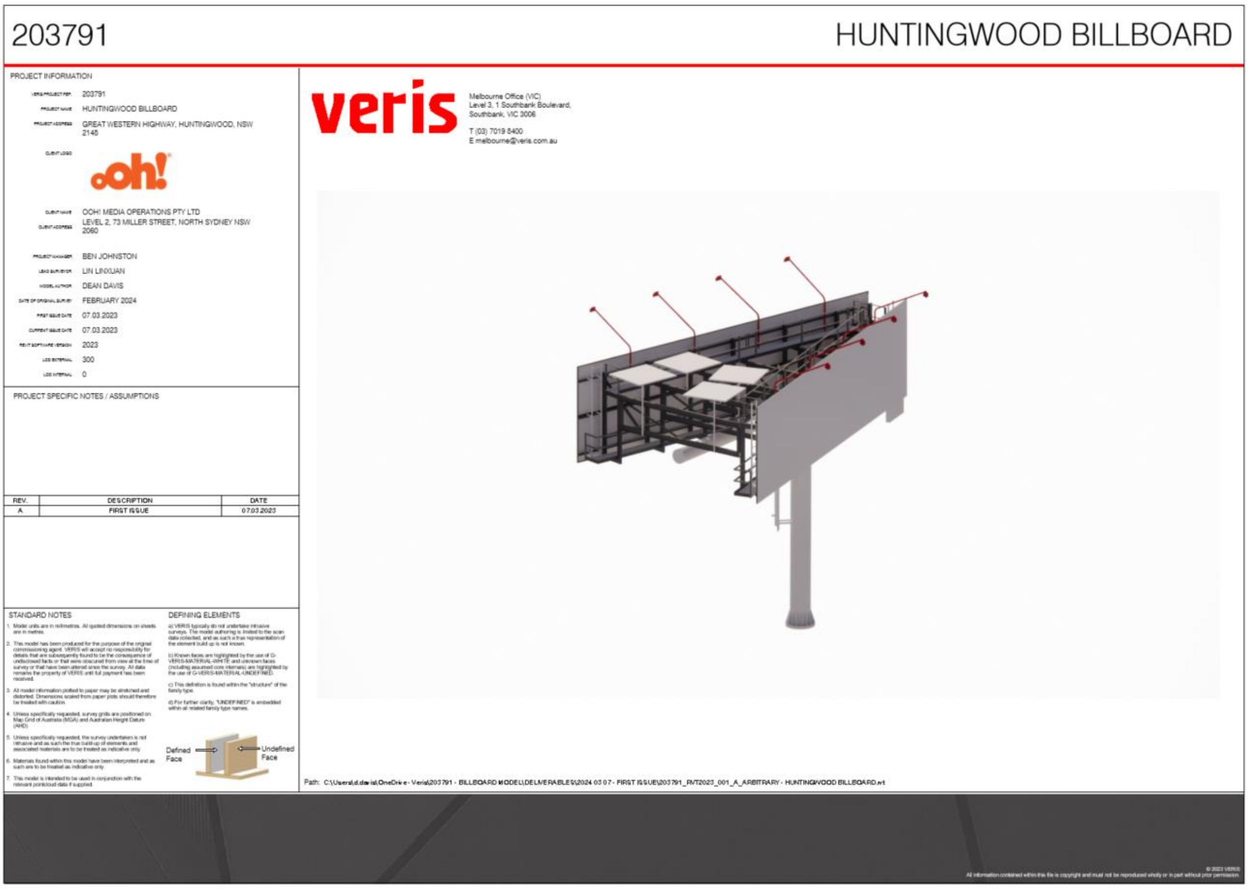


Figure 1: Example of Autodesk Recap datasets as viewed in Recap

5.2. Revit2024 model

A 3D digital representation of the structure used as a reference for design, architecture, and asset management.



6. Closing

On behalf of Veris Australia I would like to thank Ooh! Media for the opportunity to work with you on this project,

Yours sincerely,

Veris Australia

Ben Johnston

Digital and Spatial Lead NSW / ACT

Appendix 2 Structural Condition Report

ARCADIS Design & Consultancy for natural and built assets

ADVERTISING SIGNAGE STRUCTURE

Great Western Highway, Huntingwood – Inbound & Outbound

Structural Condition Report

14 JULY 2023

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OOH! MEDIA
ADVERTISING SIGNAGE STRUCTURE

Great Western Highway, Huntingwood – Inbound & Outbound - Structural Condition Report

Author	Chris Slater	Chris Slater.
Checker	Michael Cheng	
Approver	Michael Cheng	

Report No	30110779
Date	14/07/2023
Revision Text	1

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REVISIONS

Revision	Date	Description	Prepared by	Approved by
1	14/07/23	First issue	CS	MC

CONTENTS

1 INTRODUCTION

1.1 General

Arcadis Australia Pacific Pty Ltd (Arcadis) was engaged by oOh! Media to conduct a structural condition report on the monopole advertising signage structure located on the southern side of the Great Western Highway, Huntingwood.

Figure 1 Locality Plan

1.2 Site Visit

Chris Slater of Arcadis visited the site on Thursday 13th July 2023. The purpose of this visit was to undertake a detailed inspection of the advertising signage structure from all accessible areas. The inspection was achieved using a safety harness and working at height precautions in accordance with Work Health and Safety Regulations 2017.

The weather at the time of the inspection was fine and sunny.

During this visit, information and photographs were recorded regarding the condition of the fixing components, framing members, protective surfacing, and other relevant material with respect to the performance of the signage structure. All caption comments are indicative, with the true condition record being the photographic record.

2 DESCRIPTION

The signage structure is commonly referred to as a double sided 'V' shaped front lit 'Supersite' monopole, having a nominal display size of 12.660m long x 3.350m high.

The signage structure comprises a freestanding galvanised monopole with a flanged connection for attaching a galvanised torsion beam. A series of trussed frames (6 in total) are attached to the top of the torsion beam. These trussed frames are a fully welded assembly comprising channels with circular hollow section members for bracing.

Photo 1 – Monopole to torsion beam flanged connection.

Photo 2 – Typical trussed frame connected to top of torsion beam.

Cantilevering from the end of each trussed frame is a twin-level gantry. Like the trussed frames, the gantry elements (channels with angle members for bracing) are fully welded, and support and upper and lower catwalk.

Both catwalks are nominally 600mm wide, and are equipped with compliant handrails and kick rails, and have a permanent fixed ladder located at each end, providing access between the gantry levels. The ends of the upper catwalk are fitted with self-closing gates that allow the user to pass from the fixed ladder onto the catwalk, with the gate closing behind them, thus providing adequate fall protection.

Three horizontal rails (75 x 50 RHS) are connected to the front face of each gantry frame via fully welded seating angles. These rails support the respective sign faces, which comprise folded sheet metal segments, commonly referred to as `signage pans`.

The `signage pans` are separate entities, nominally 1200mm wide for the full height of the advertising sign, providing a flat backing for the vinyl advertising skin to be attached. As mentioned previously the `signage pans` are fabricated from sheet metal that has been folded to provide rigidity/stiffness, together with additional spot welded girts at the horizontal rail locations. These elements are fixed to the horizontal rails via angle brackets, and `Tek` screws (refer Fig. 6-7).

The signage structure is also equipped with four cantilever floodlights that illuminate the front of the advertising sign. These lights are solar powered and have four solar panels fixed to the trussed frames (refer Fig. 6-8).

Access to the lower catwalk is gained by a fixed vertical ladder attached to the monopole. The vertical ladder is fitted with a ‘Ladsaf’ cable vertical safety system that has been inspected and tagged.

Photo 3 – Vertical access ladder equipped with ‘Ladsaf’.

Photo 4 – 'Ladsaf' installation and service record affixed to the structure.

During the inspection no other obvious defects that might warrant further investigation were noticed. However, that does not preclude the possibility that other less obvious defects may exist and were concealed.

For the intent of this report Arcadis has assumed that the existing signage structure, and the additional solar panel support framing, has been designed in accordance with relevant Australian codes/standards, and is structurally adequate for its purpose.

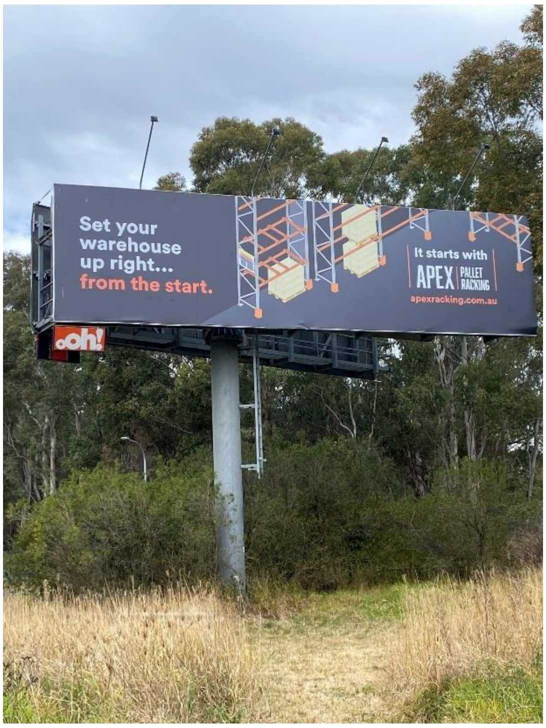

Photo 5 – General view of advertising signage structure.

3 STRUCTURAL CONDITION & OBSERVATIONS

Generally, the signage structure, including the monopole and superstructure, is in a satisfactory condition (refer photos 6 to 9).

Photo 6 – General base view

Photo 7 – General view from underside

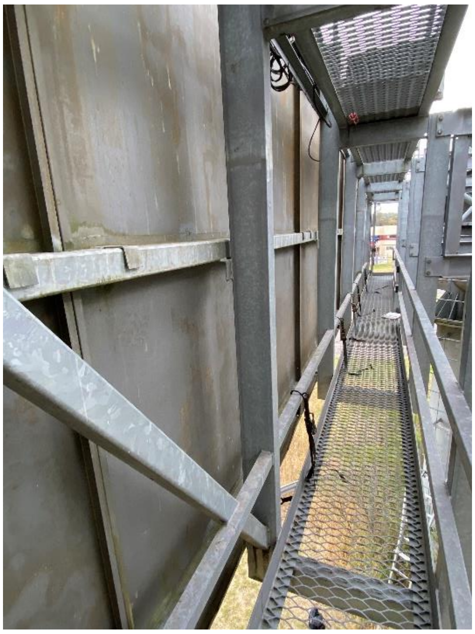

Photo 8 – General view of bottom gantry

Photo 9 – General view of top gantry

However, there are some issues that need to be addressed.

The issues observed were:

- Minor surface corrosion to knee rail welded connection.

Photo 10 – Minor surface corrosion to welded connection.

Photo 11 – Minor surface corrosion to welded connection.

- Minor surface corrosion to self-closing gate framing, and vertical ladder support framing.

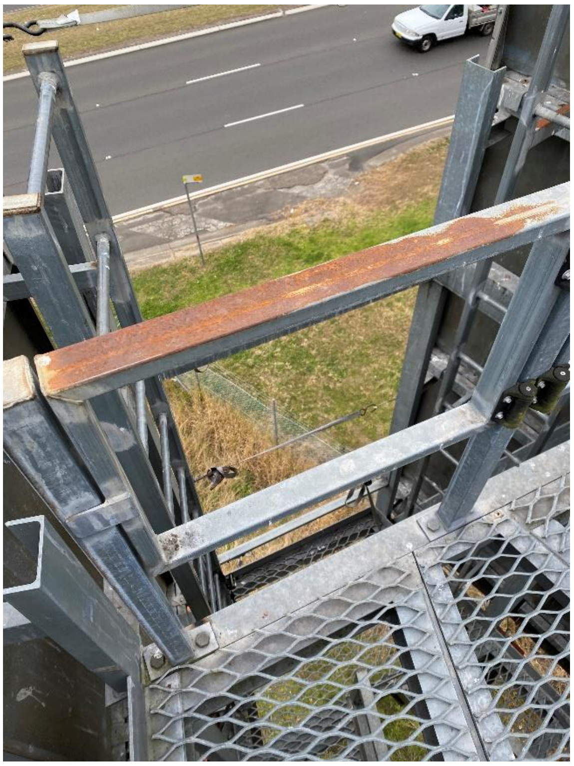

Photo 12 – Surface corrosion to self-closing gate framing.

Photo 13 – Surface corrosion to vertical ladder support framing.

- Minor surface corrosion to signage pan.

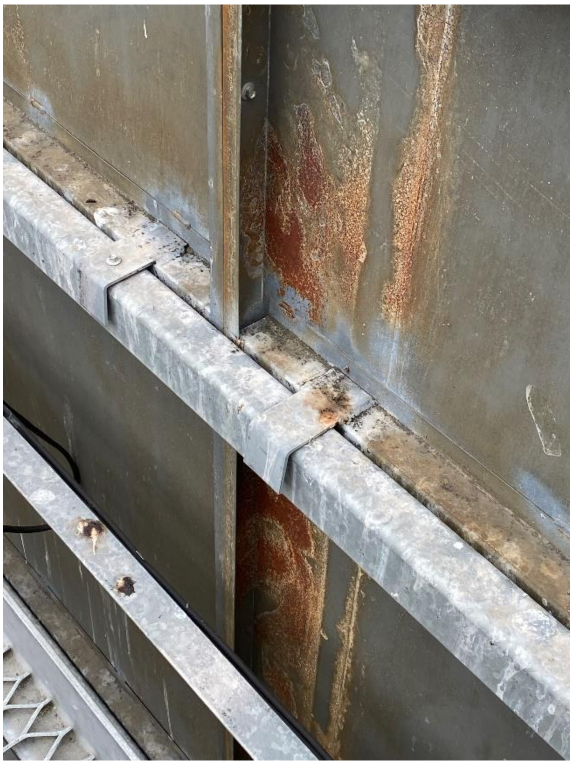

Photo 14 – Minor surface corrosion to signage pan.

- Corroding shackle bolt and wire grip ‘U’ bolts.

Photo 15 – Corroding shackle bolt.

Photo 16 – Corroding wire grip 'U' bolts.

- Deformation/buckling of the signage pans located at the top right of the west-facing sign, and both top and bottom right of the east-facing sign which has likely resulted from a combination of the cantilever distance of the pan from the horizontal rail, and the amount of tension applied to the ratchet straps during the vinyl advertising skin installation. The deformation observed is not structurally significant, although it may impact on the appearance of the advertisement.

Photo 17 – Deformation to signage pan.

Photo 18 – Deformation to signage pan.

4 RECOMMENDATIONS

We would recommend that the surface corrosion be wire brush cleaned and treated with a proprietary cold galvanising paint at the next scheduled maintenance programme, to avoid further corrosion developing and potentially more costly remediation. This may involve the complete replacement of bolts.

The deformed/damaged signage pans do not affect the overall structural performance of the signage structure. However, should the aesthetics of the advertisement be unacceptable, the signage pans could either be repaired or replaced, and a permanent strut member introduced to prevent the signage pan buckling under the tension load of the ratchet strap.

Arcadis would recommend that the signage structure be re-inspected every three (3) years from the date of this report.

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