Date: 05th January 2023
Revision – R1

DESIGN CALCULATION REPORT

FOR

ED SHEERAN STAGE

STRUCTURE

AT

DUBAI RUGBY 7'S

FOR

AL LAITH

Submitted By

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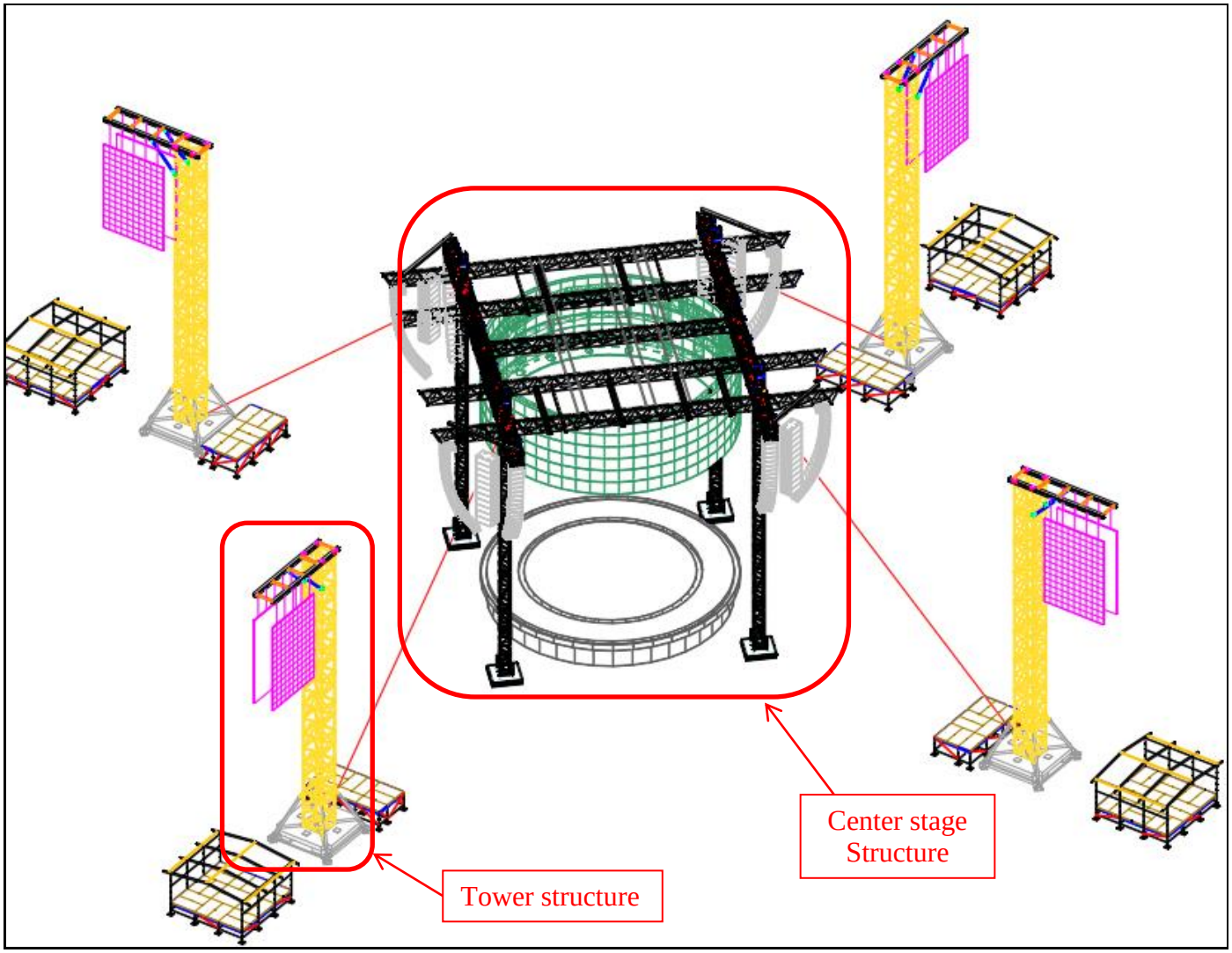
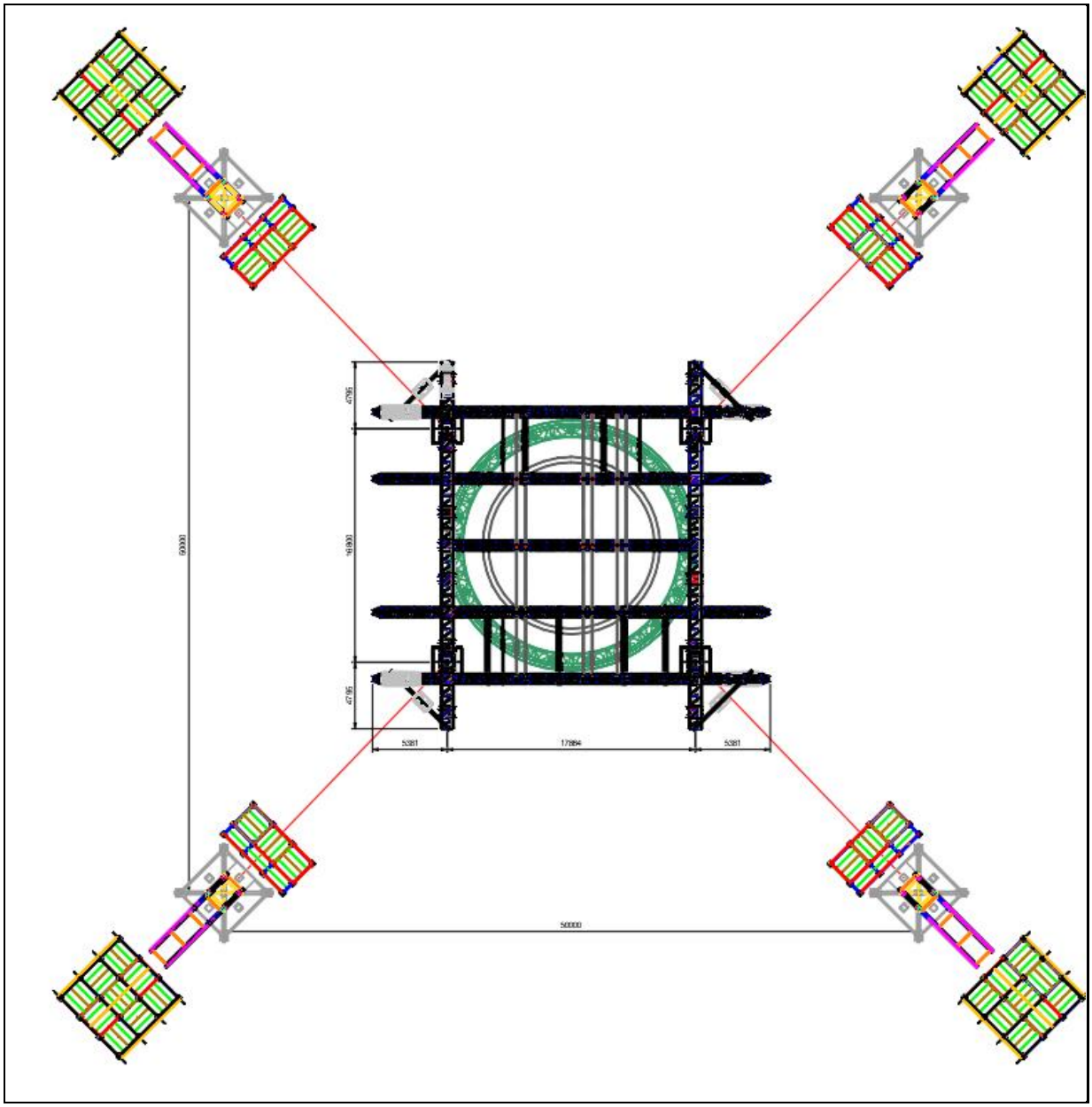
1. INTRODUCTION

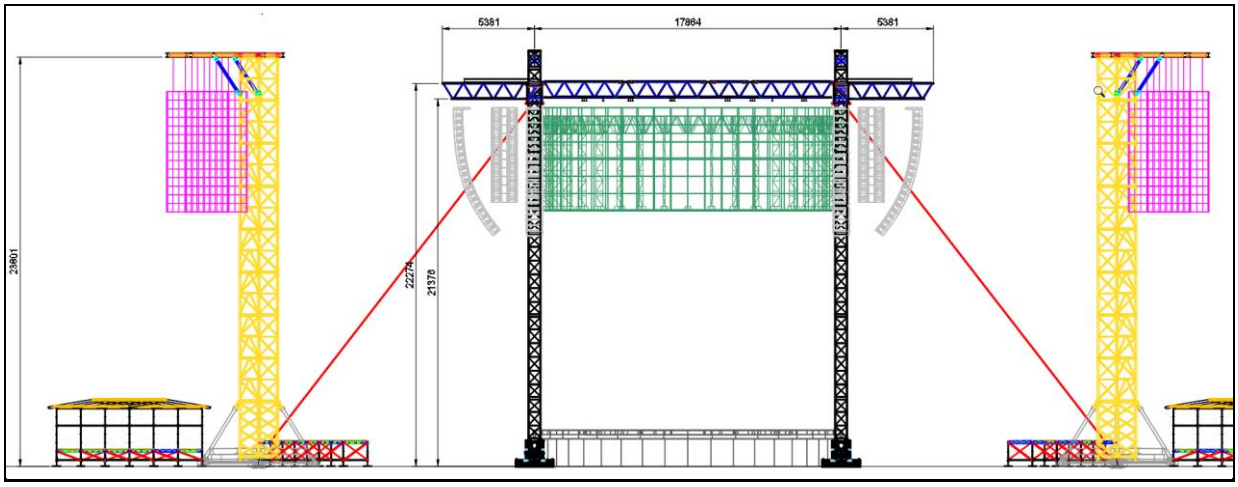
This design report presents analysis and design of Ed Sheeran stage structure at Dubai rugby 7's. The Ed Sheeran stage structure consists of center stage structure and four tower structure at each corner. It includes codes referred for analysis & loading considerations, STAAD modeling, loading data, analysis & design results. Refer below images showing layout and structural systems of proposed staging structure.



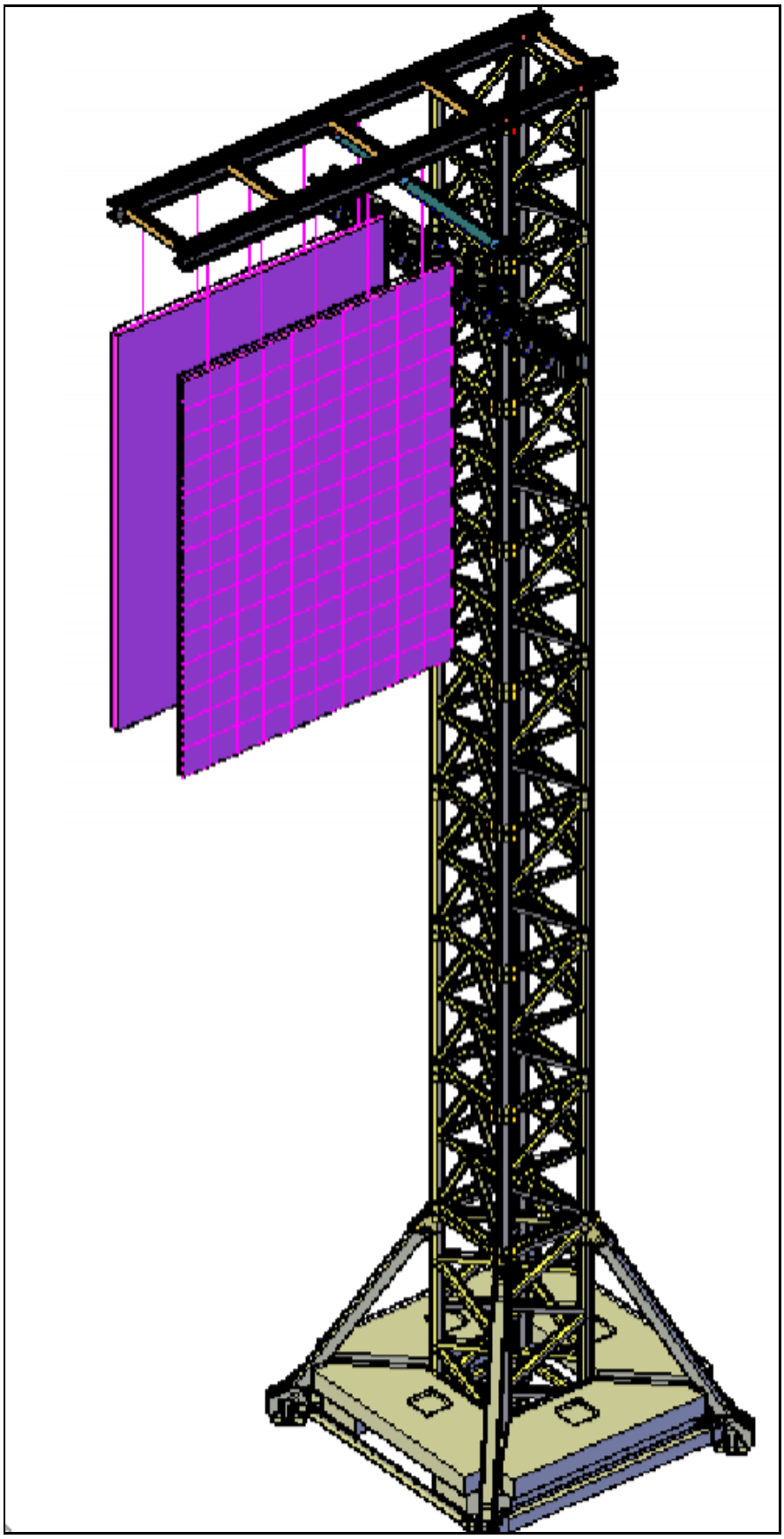
Proposed 3D Layout of Ed sheeran stage



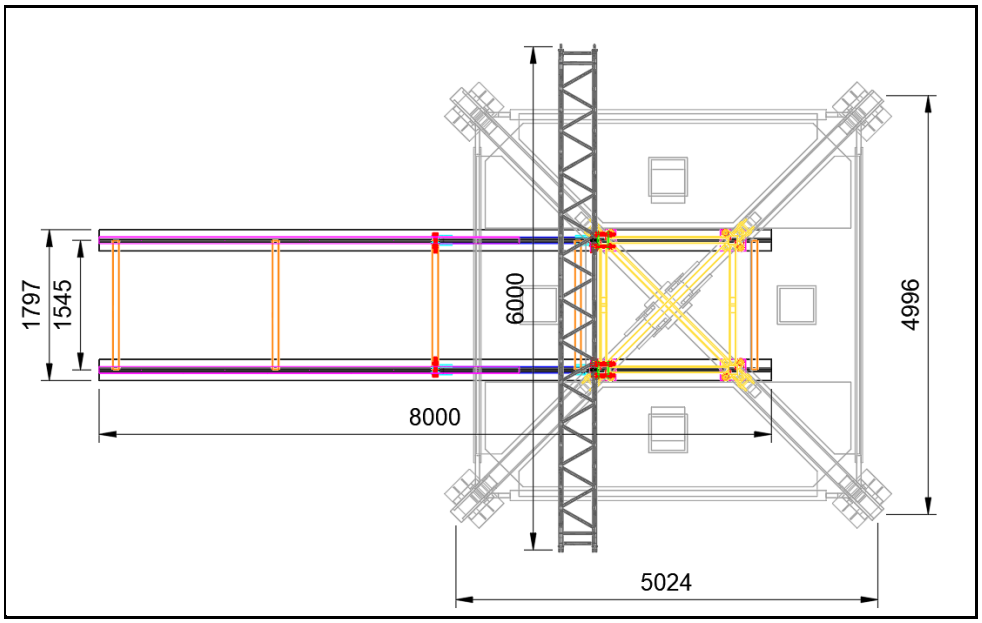
Proposed Plan Layout of Ed sheeran stage



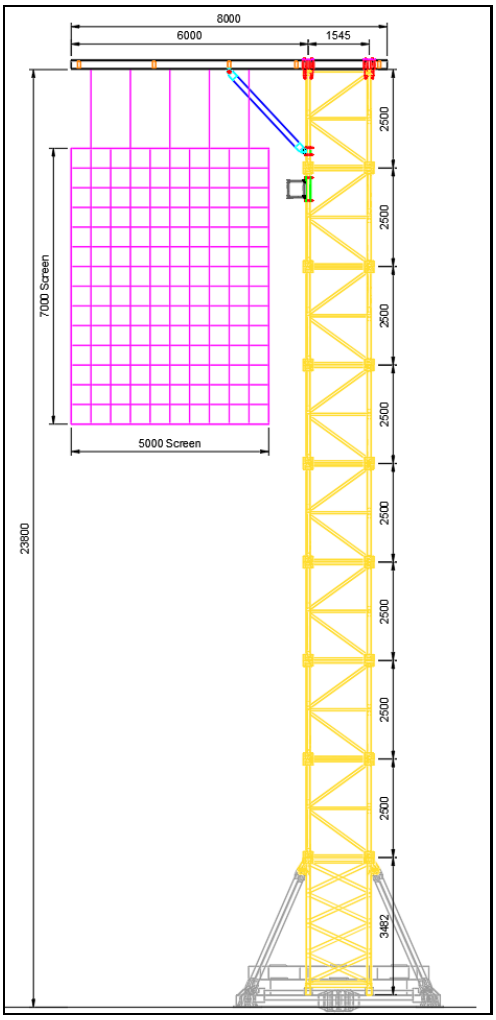
Proposed Elevation of Ed sheeran stage



Proposed Tower structure (3D view)



Proposed Plan layout of Tower structure



Proposed Elevation layout of Tower structure

2. MATERIALS

2.1. Material for Center stage structure

Sr. No.	Member	Remarks	Grade (N/mm^2)
1	I-Beam section :IPEA 180	Beam for hanging Circular LED light	S355
2	CHS 88.9x4	Top Purlins	S355
3	SHS 60x4	Column truss Horizontal elements	S355
4	SHS 60x4	Column Truss Main cord members	S355
5	CHS 42.4x3.2	Column Truss diagonal bracing	S355
6	CHS 42.2x4	Space truss top bottom parallel members	5275
7	SHS 70x5	Primary truss main cord	S355
8	SHS 60x3	Primary truss Side diagonal	S275
9	SHS 60x3	Primary truss vertical & Horizontal members	S275
10	CHS 60.3x5	Space truss main cord	S355
11	CHS 48.3x4	Space truss Side diagonal	S355
12	CHS 42.4x3.2	Space truss Top & bottom diagonal	S275
13	16 mm dia. Cable	Guy wire	S355
14	CHS 33.7X3.2	Space truss internal bracing	S275
15	I-beam section : IPE 200	Beam for hanging PA speaker	S355
16	RHS 80x40x3.2	Bracing for base supporting unit	S275
17	SHS 80x3.2	Horizontal member for base supporting structure	S275
18	SHS 60x5	Vertical members for base supporting unit	S275
19	SHS 40x3.2	Bracing for base supporting unit	S355
20	UAP100	Horizontal member for base supporting unit	S355

2.2. Material for Tower structure

Sr. No.	Member	Remarks	Grade (N/mm^2)
1	RHS 160x80x5	Tie member for Main beam	S355
2	SHS 100x5	Knee brace	S355
3	SHS 50x5	Horizontal truss members	S355
4	SHS 100x50x5	Horizontal truss members	S355
5	SHS 60x6.3	Diagonal brace members	S355
6	SHS 60x5	Diagonal brace members	S355
7	CHS 88.9x5	Pipe member at base	S355
8	IPEO 240	Base member	S355
9	EA 120x120x14	Brace members	S355
10	UPN 240	Base members	S355
11	CHS 48.3x2.6	Truss main cord members	S275
12	CHS 26.9x2.3	Truss diagonal members	S275
13	Built-up I section : Web : 225 x 10 Flange : 250 x 10	Main beam member	S355
14	SHS 90X16.2	Vertical Main Chord Members	S355

3. CODES CONSIDERED

Following codes are referred for analysis and design of Ed Sheeran stage structure

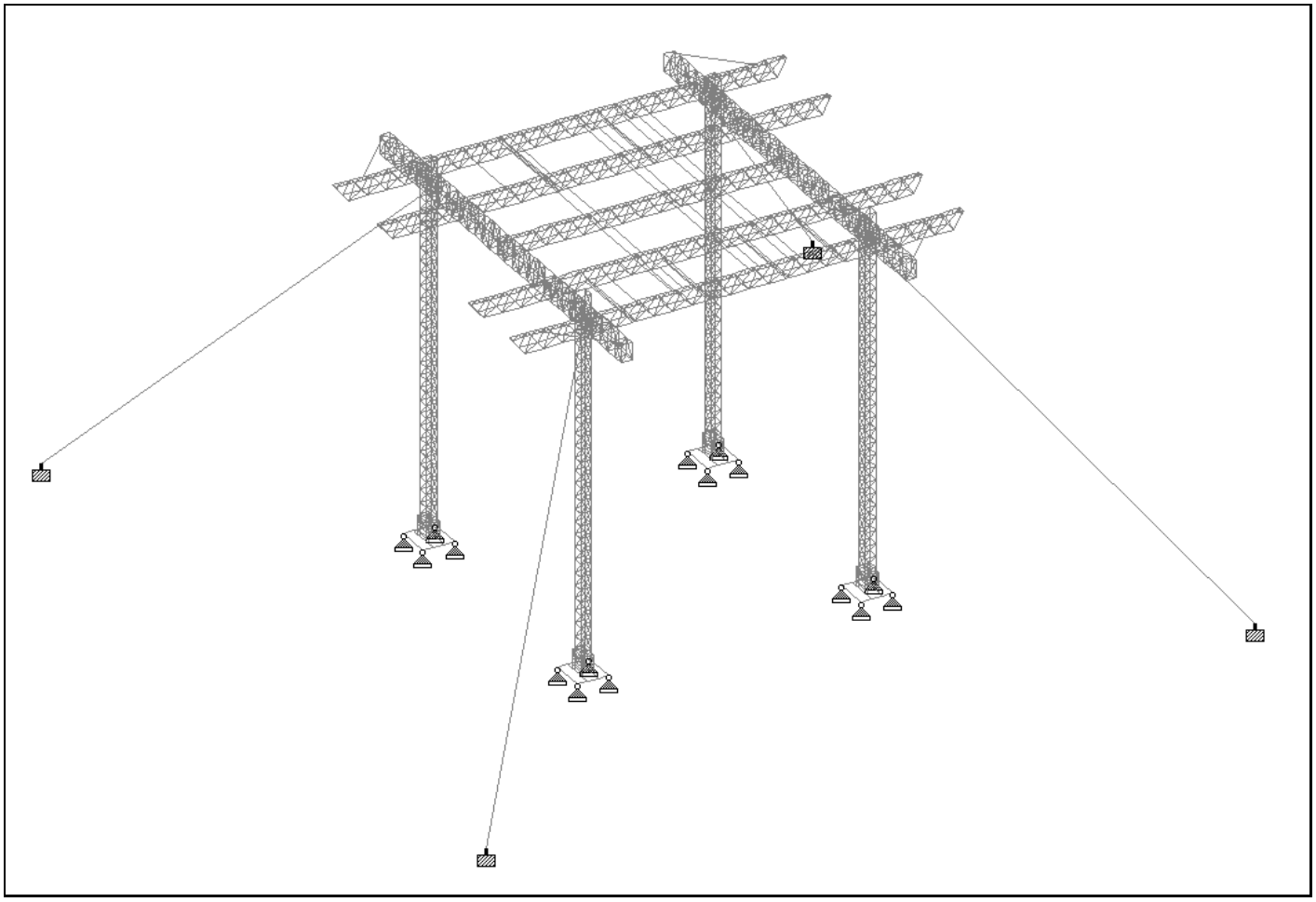
- BS EN 1990 Euro code Basis of Structural Design
- BS EN 1991 Euro code 1: Actions on Structures
- BS EN 1993 Euro code 3: Design of Steel Structures
- BS EN 12811-1:2003 Temporary works equipment - Part 1: Scaffolds Performance Requirements and general design
- BS 5950-1:2000, Structural use of steelwork in building
- Temporary Demountable Structures, Guidance on procurement, design & use
- TG20:13 – Technical guide for BS EN 12811-1

4. STAAD MODELING OF CENTER STAGE & TOWER STRUCTURE

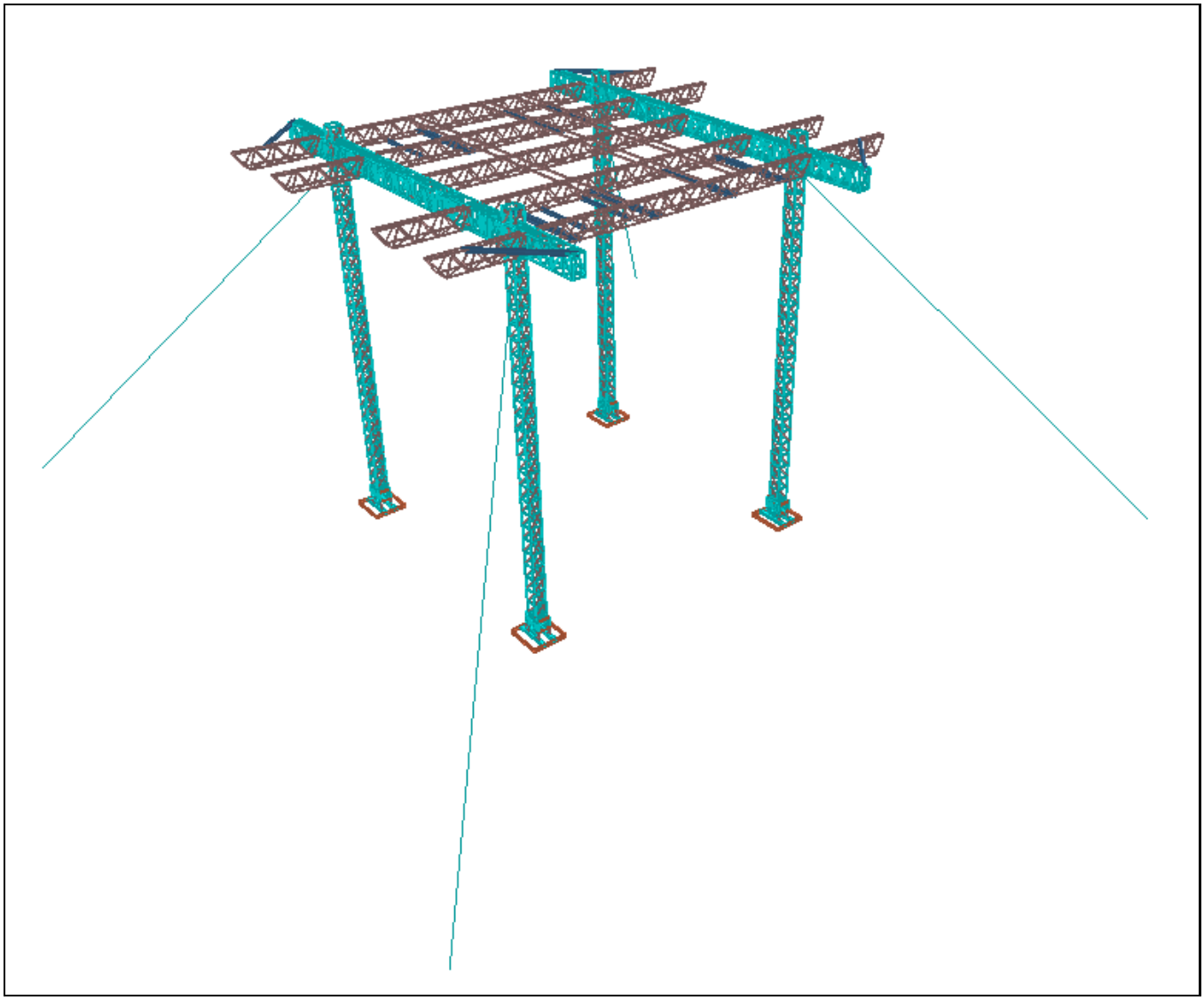
4.1. Geometry & dimensions

4.1.1. Center stage structure

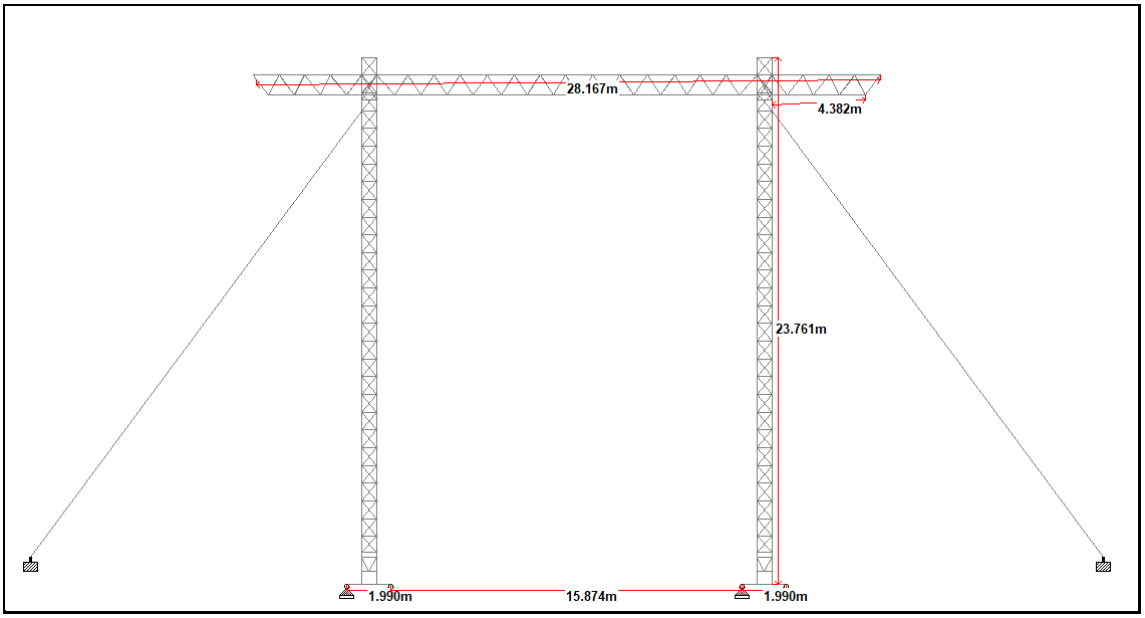
Refer below images showing normal & render 3D view of stage structure structure modeled in STAAD Pro software.

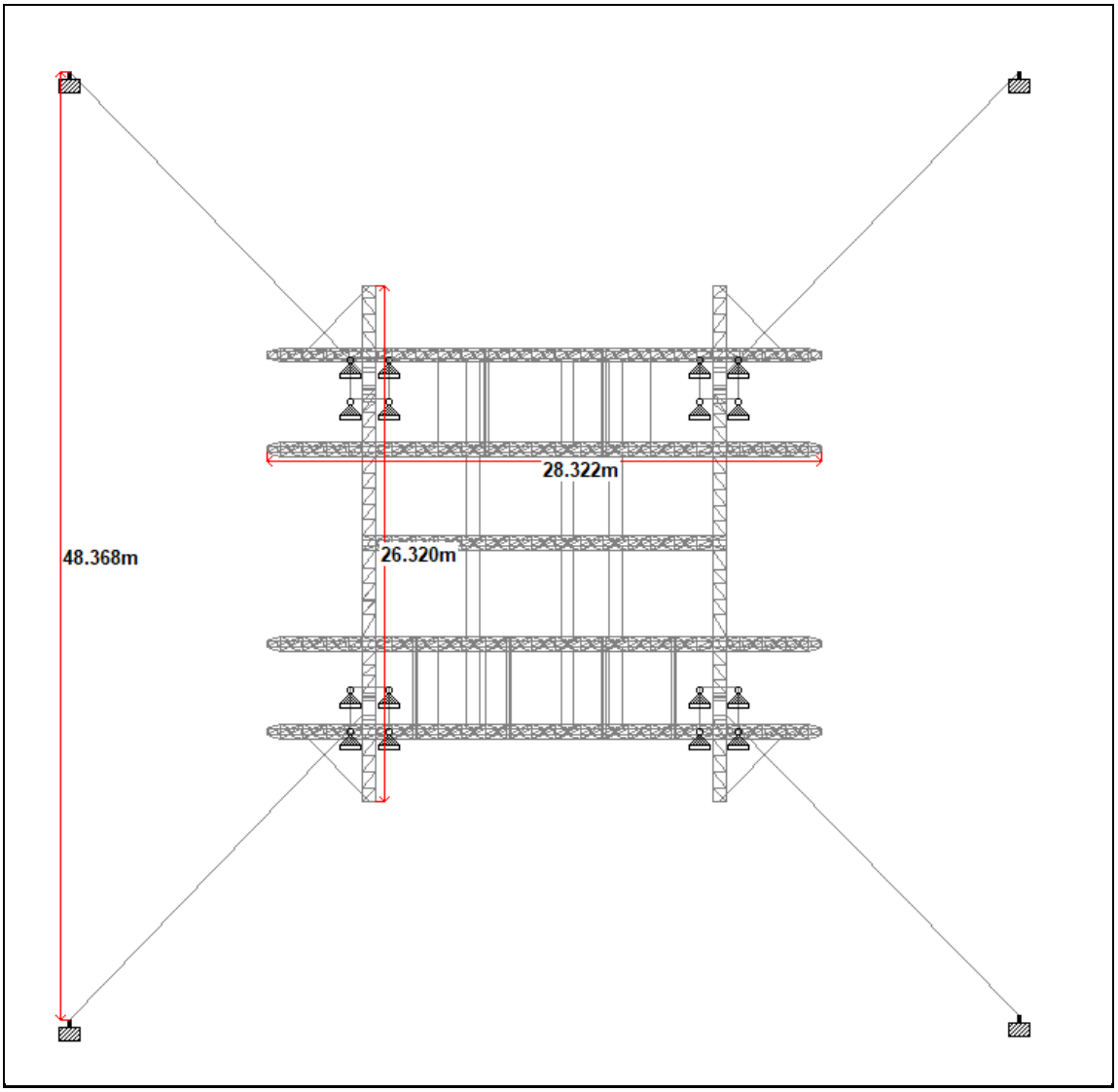


3D view of stage structure STAAD Pro model



3D render view of center stage structure STAAD Pro model

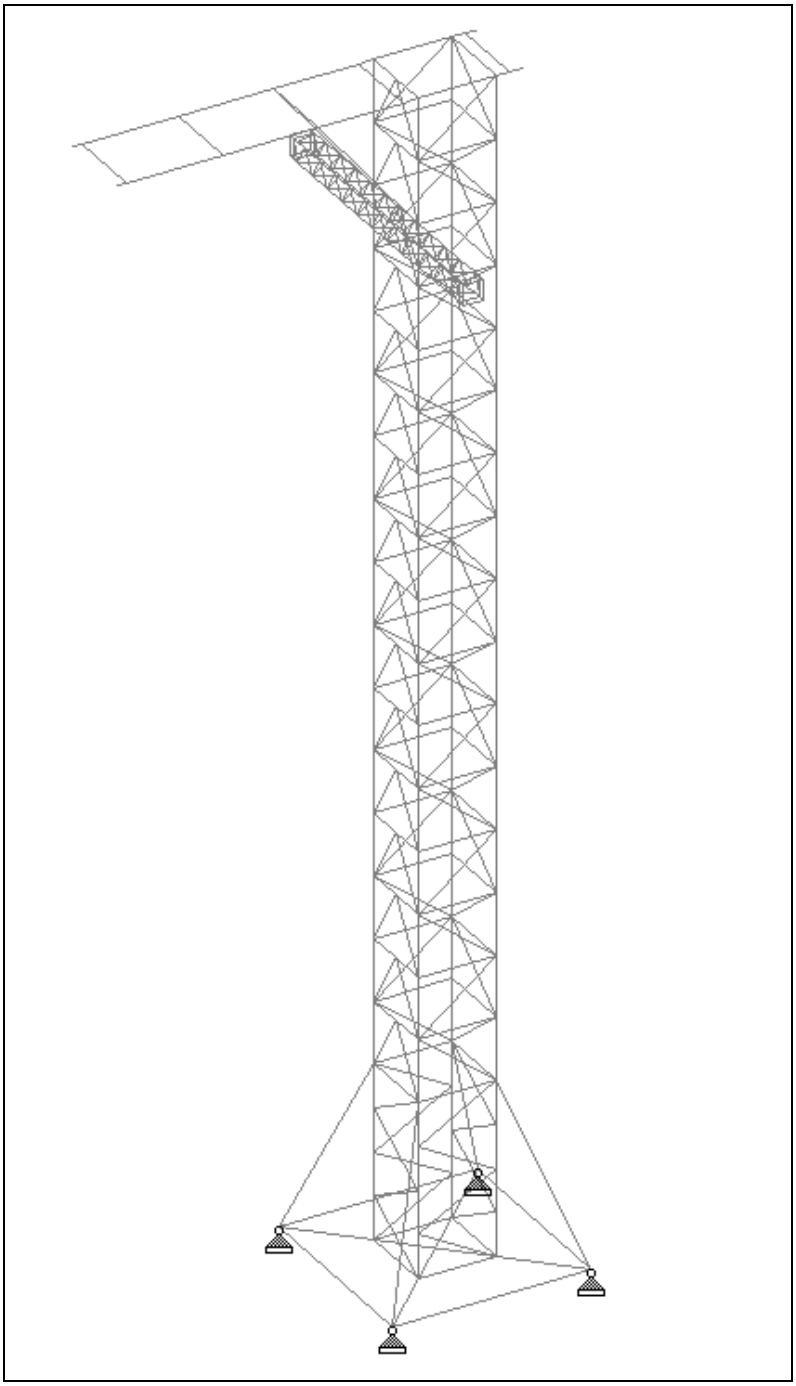




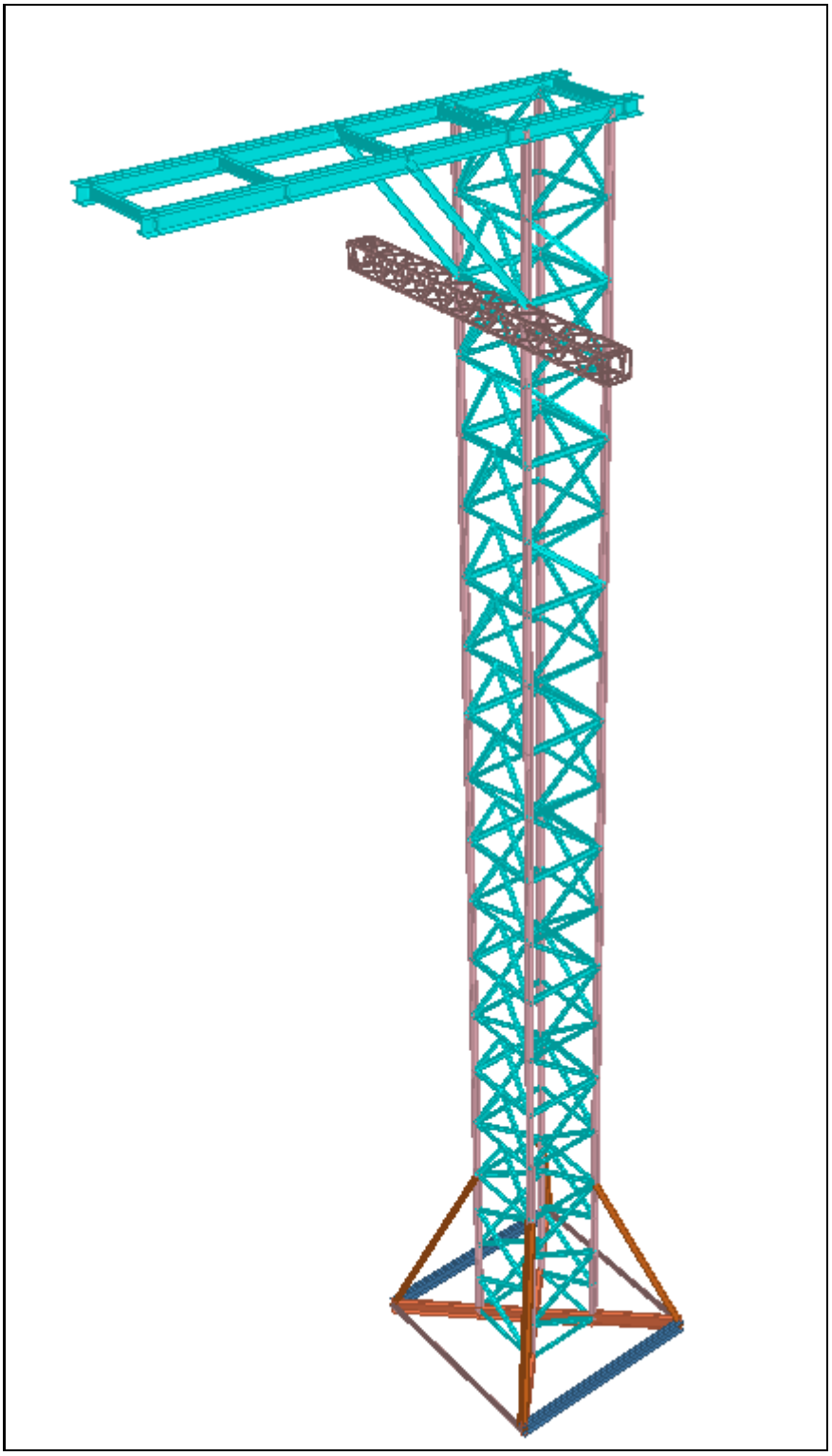
Dimensions of Center stage structure

4.1.2. Tower structure

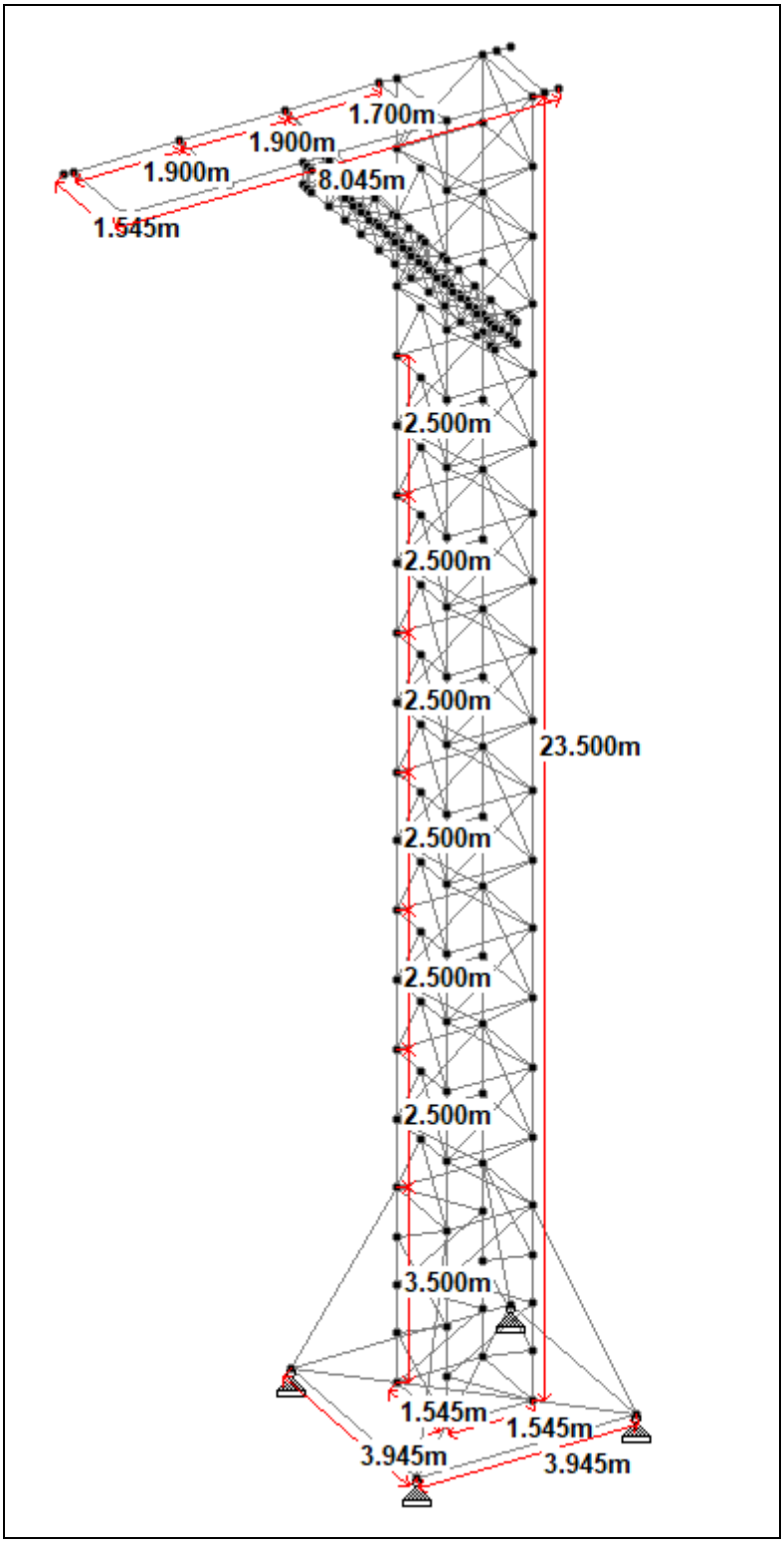
Refer below images showing normal & render 3D view of tower structure structure modeled in STAAD Pro software.



3D view of Tower structure STAAD Pro model



3D render view of Tower structure STAAD Pro model

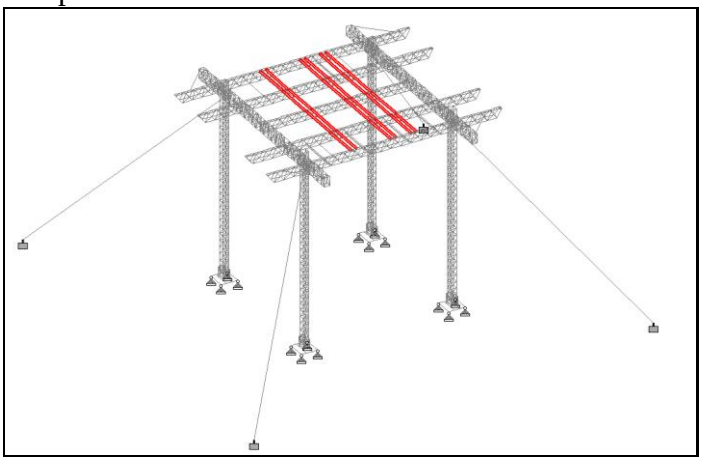


Dimensions of Tower Structure

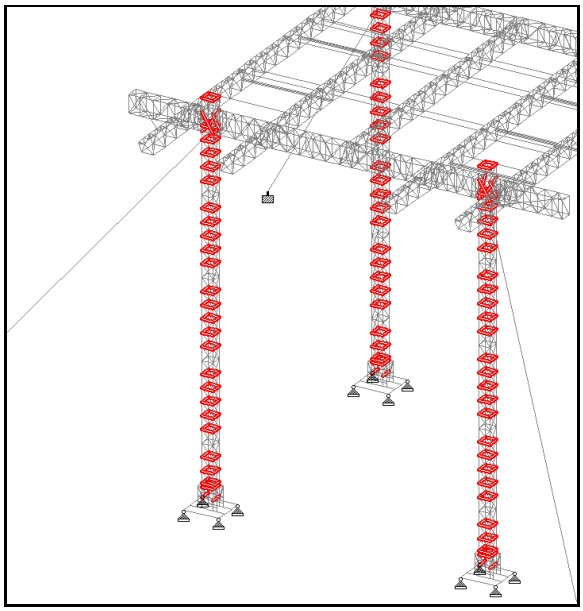
4.2. Member Properties

4.2.1. Member Properties for Center stage structure

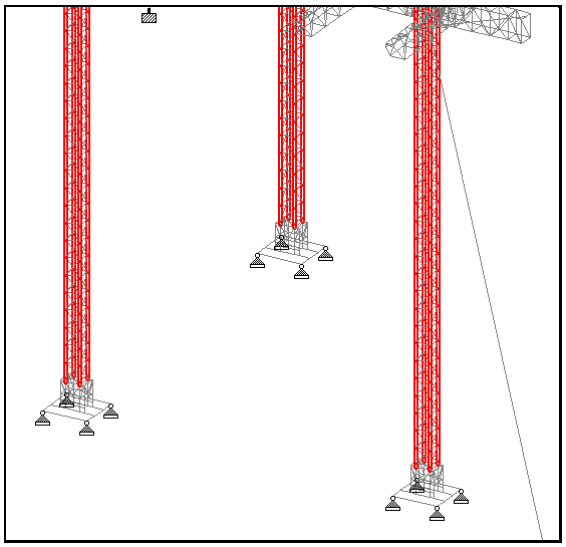
1. CHS 88.9x4 –Top Purlins



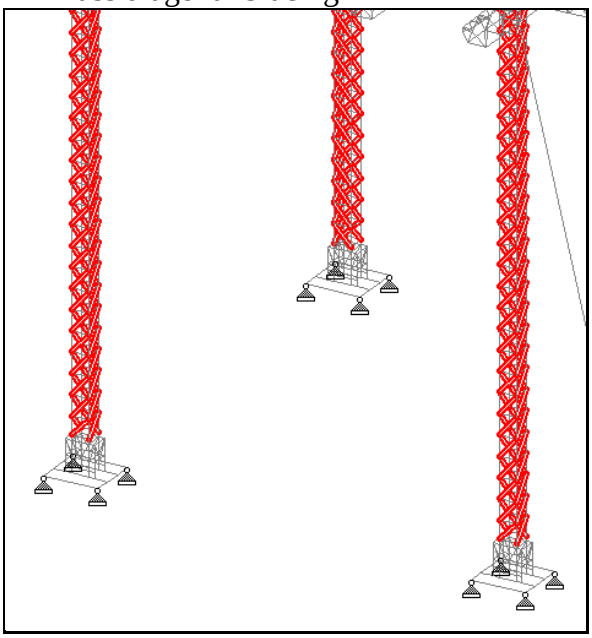
2. SHS 60x4–Column truss Horizontal elements



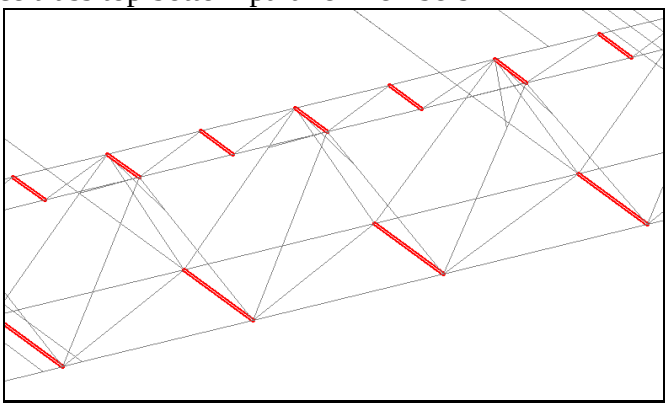
3. SHS 60x4 –Column Truss Main cord members



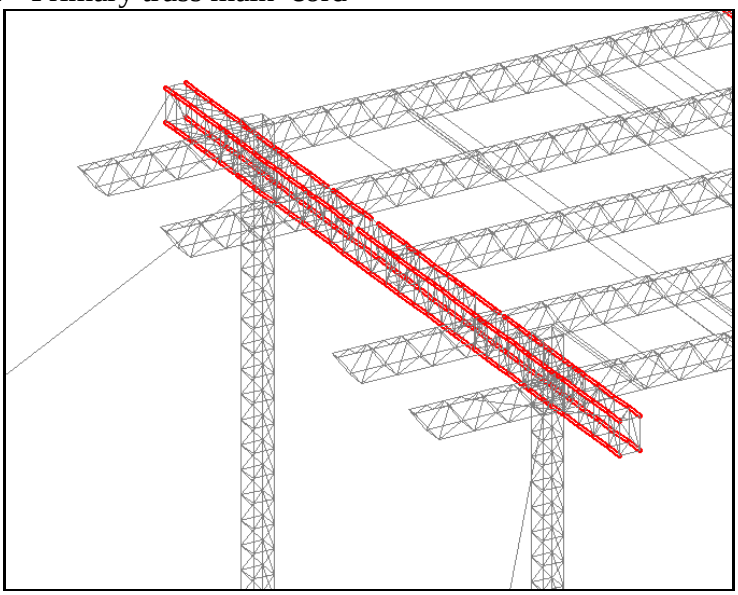
4. CHS 42.4x3.2 –Column Truss diagonal bracing



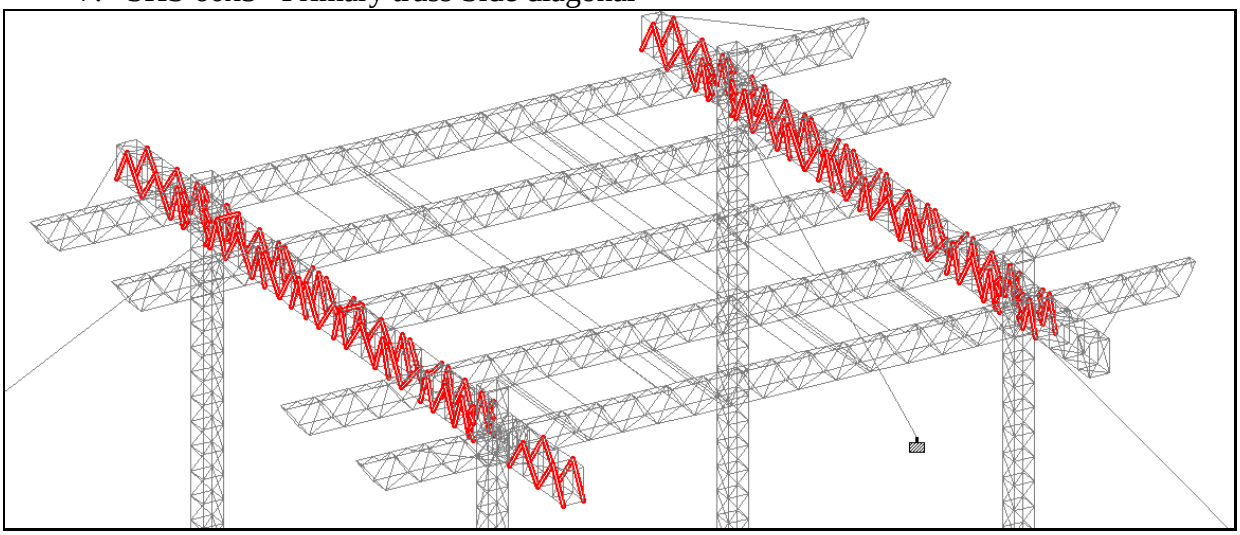
5. CHS 42.2x4 –Space truss top bottom parallel members



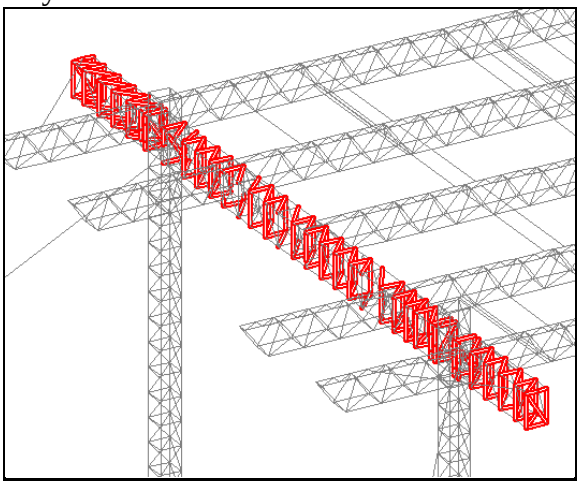
6. SHS 88.9x4 - Primary truss main cord



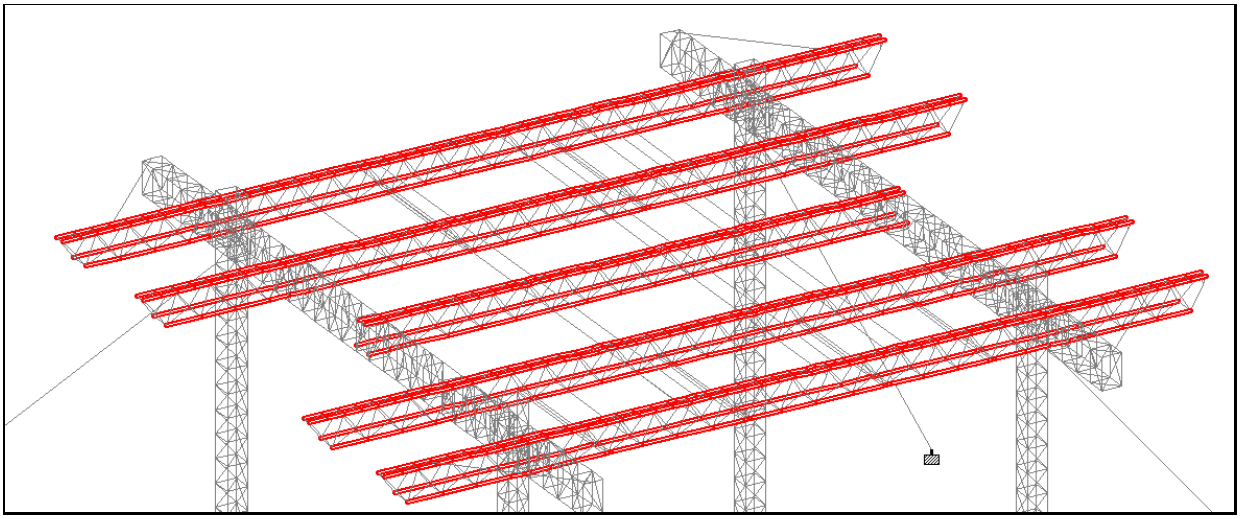
7. SHS 60x3 –Primary truss Side diagonal



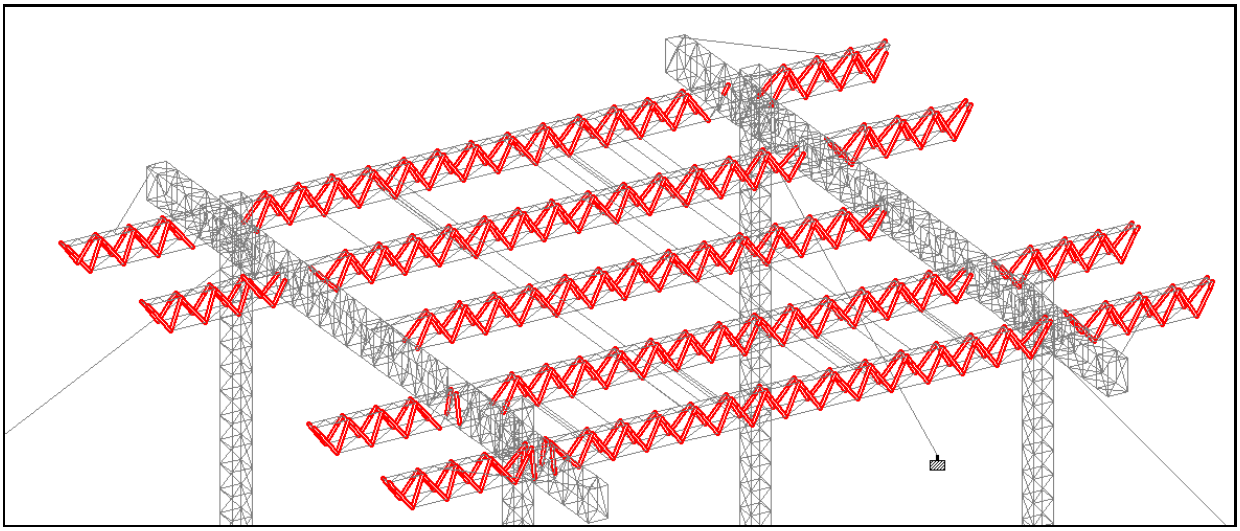
8. SHS 60x3 –Primary truss vertical & Horizontal members



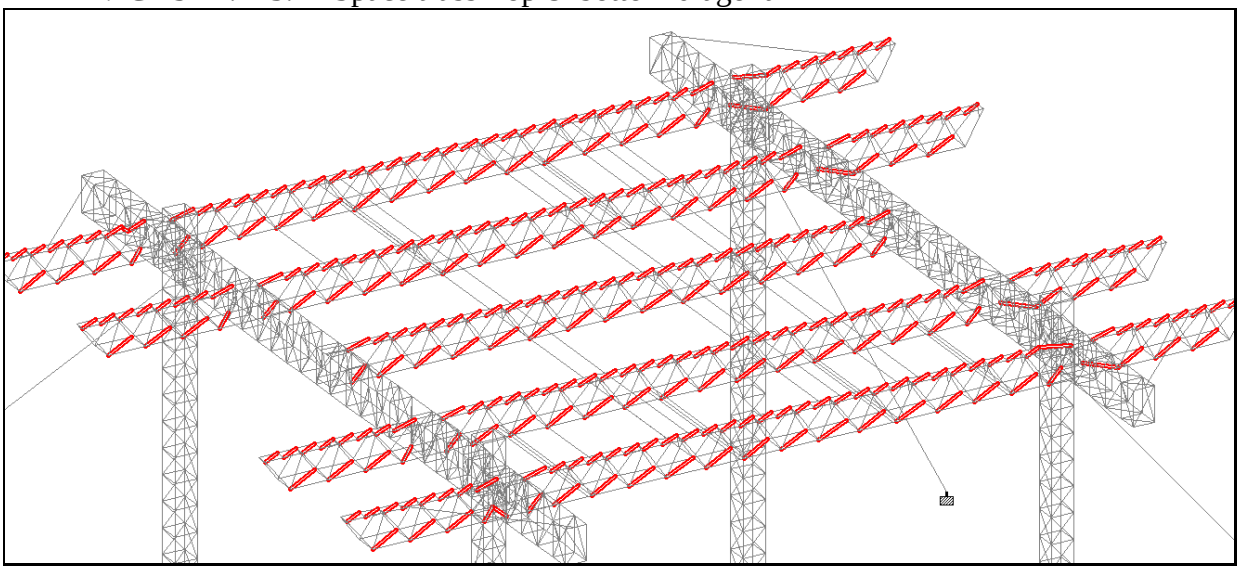
9. CHS 60.3x5 –Space truss main cord



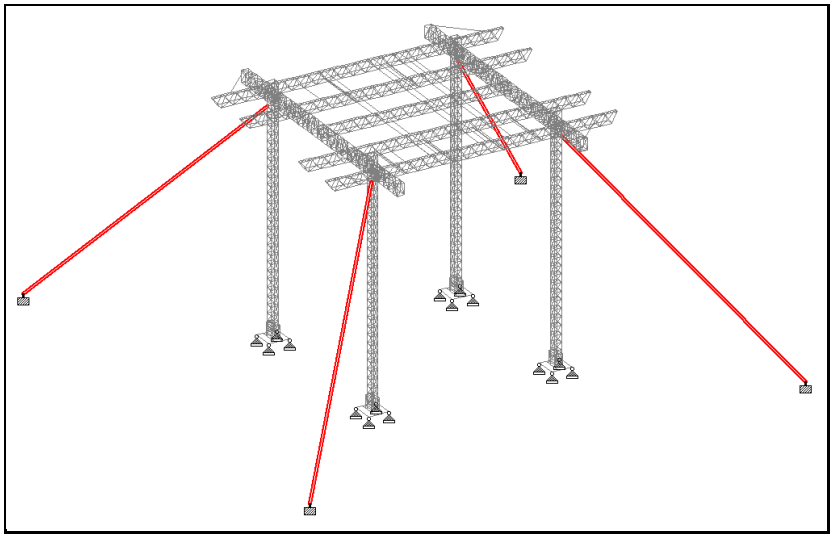
10. CHS 48.3x4 –Space truss Side diagonal



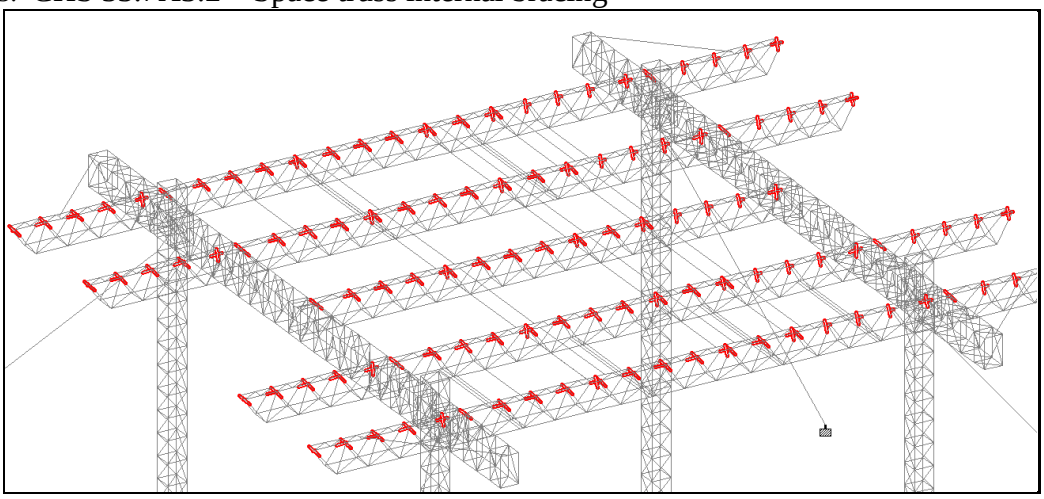
11. CHS 42.4x3.2 –Space truss Top & bottom diagonal



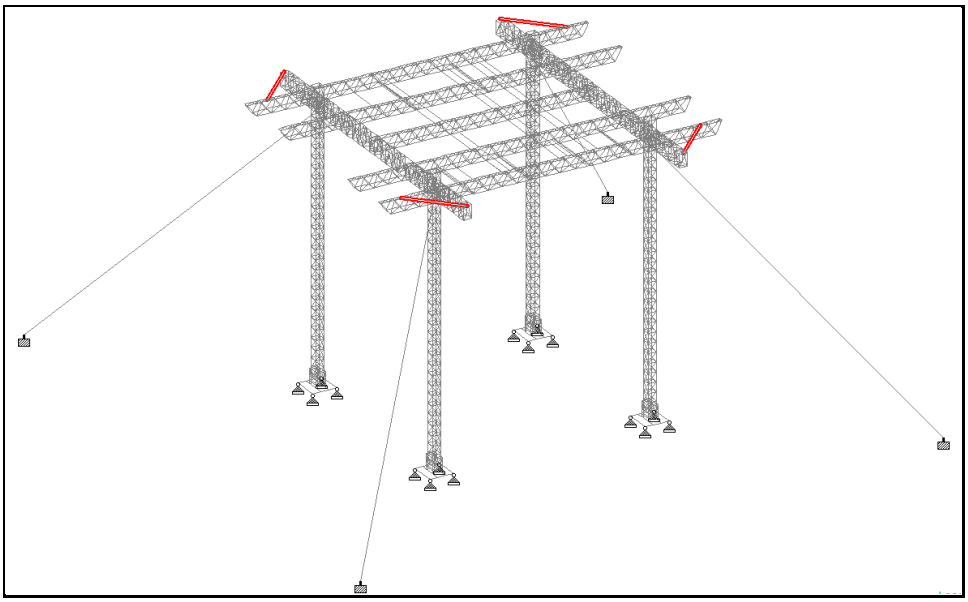
12. 16mm DIA cable



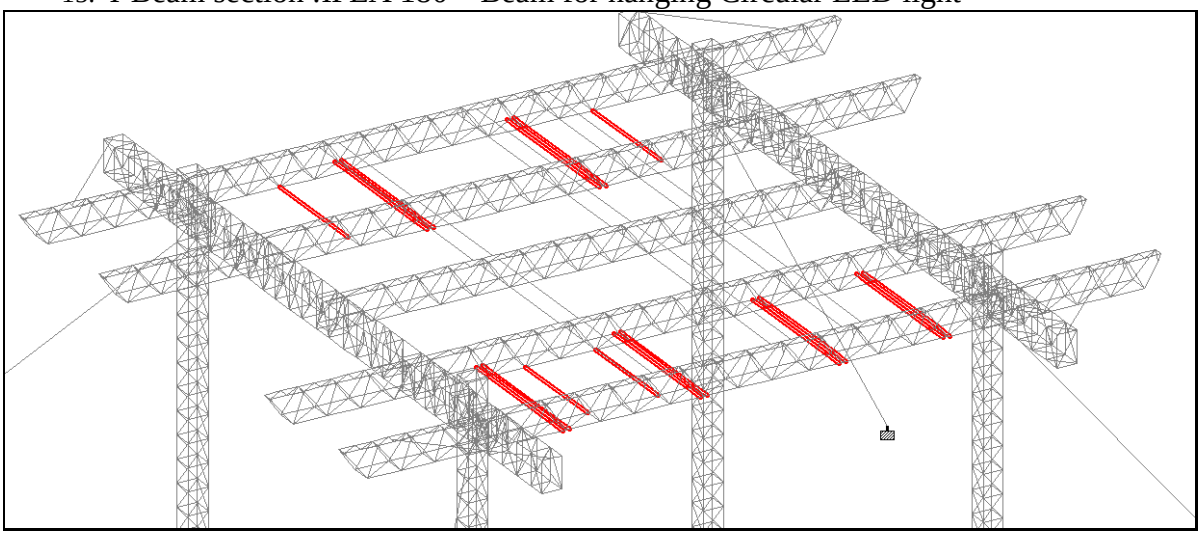
13. CHS 33.7X3.2 – Space truss internal bracing



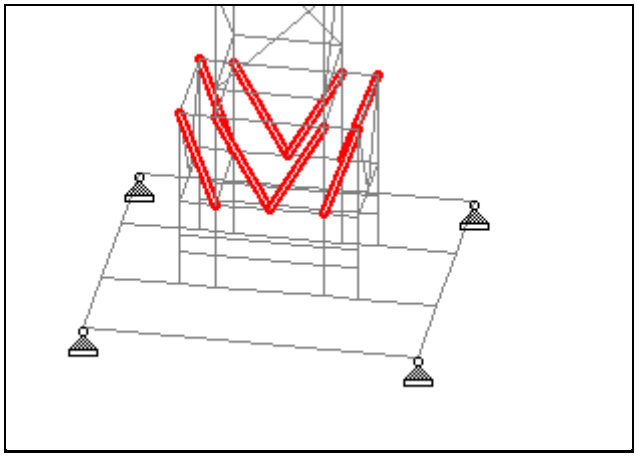
14. I section Beam IPE 200 – Beam for hanging PA speaker



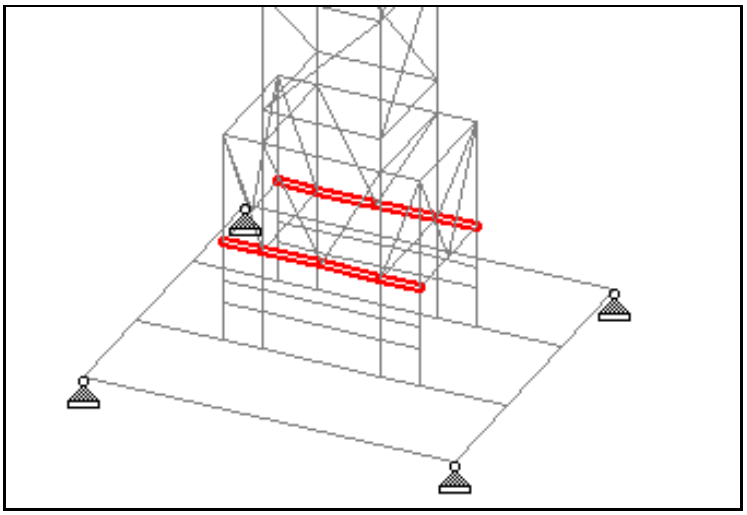
15. I-Beam section :IPEA 180 – Beam for hanging Circular LED light



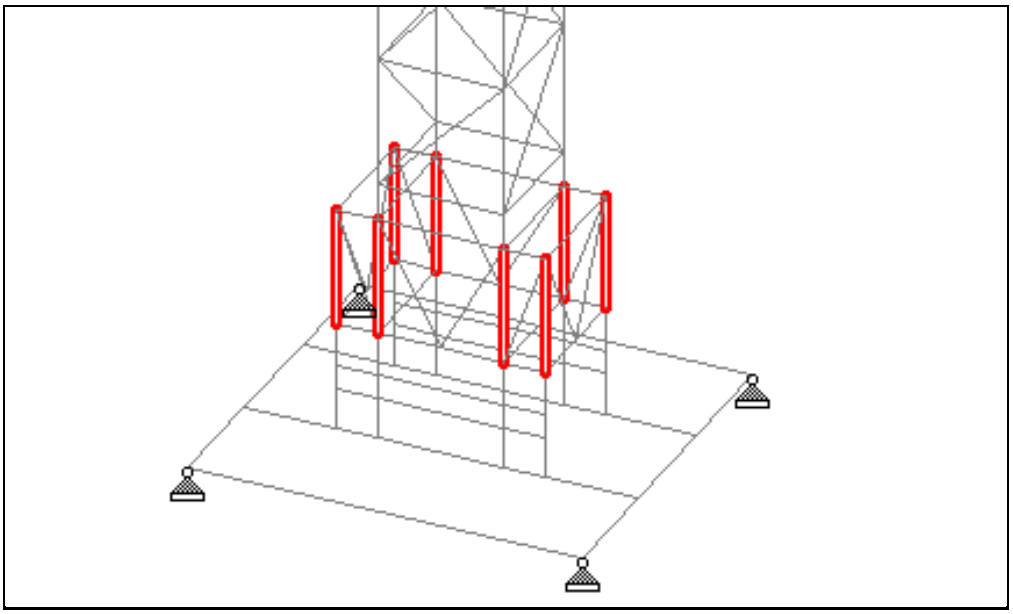
16. RHS 80x40x3.2 – Bracing for base supporting unit



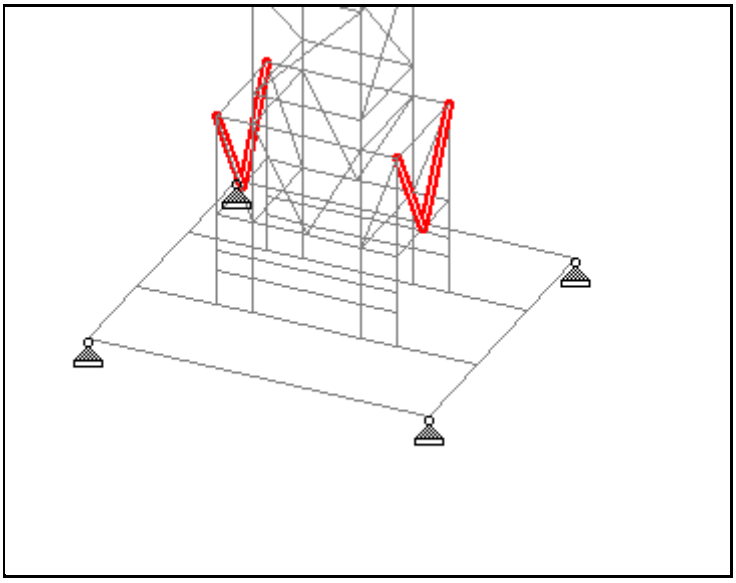
17. SHS 80x3.2 – Horizontal member for base supporting structure



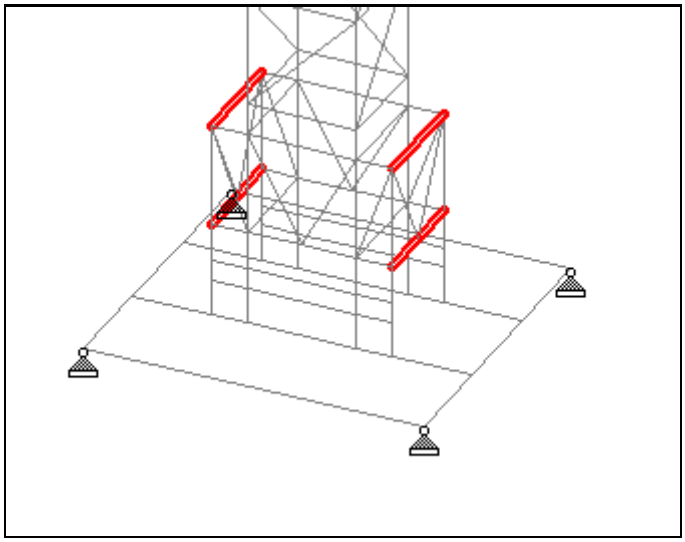
18. SHS 60x5 – Vertical members for base supporting unit



19. SHS 40x3.2 – Bracing for base supporting unit

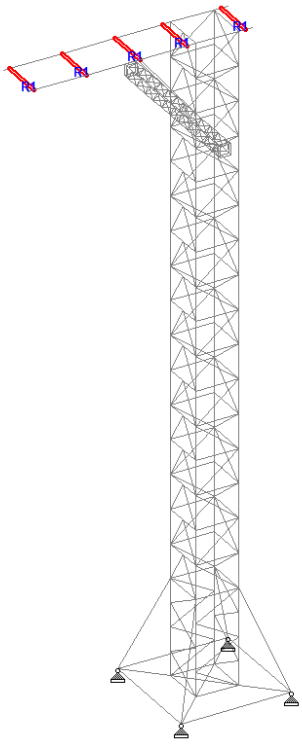


20. UAP100 Channel section – Horizontal member for base supporting unit

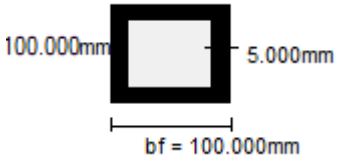


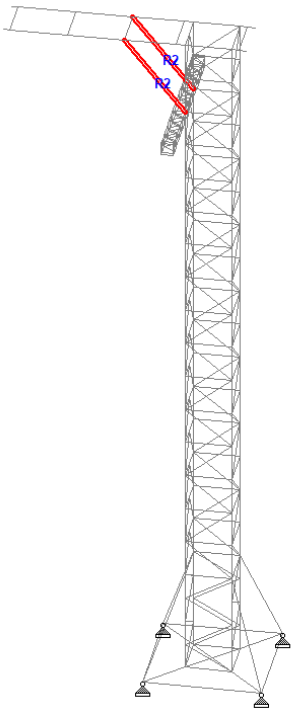
4.2.2. Member Properties for Tower structure

21. RHS 160x80x5 – Tie member for Main beam

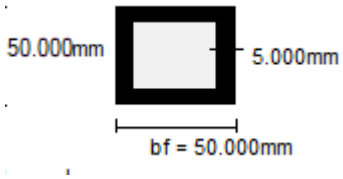


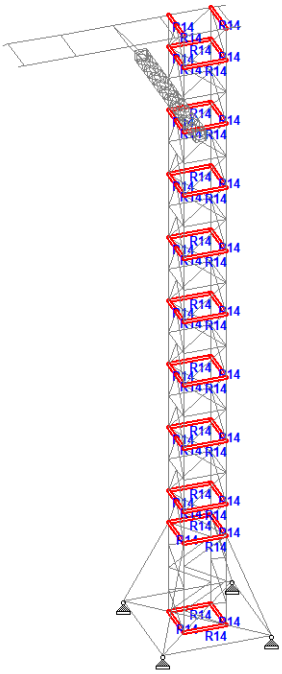
22. SHS 100x5 – Knee brace



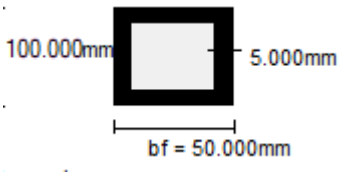


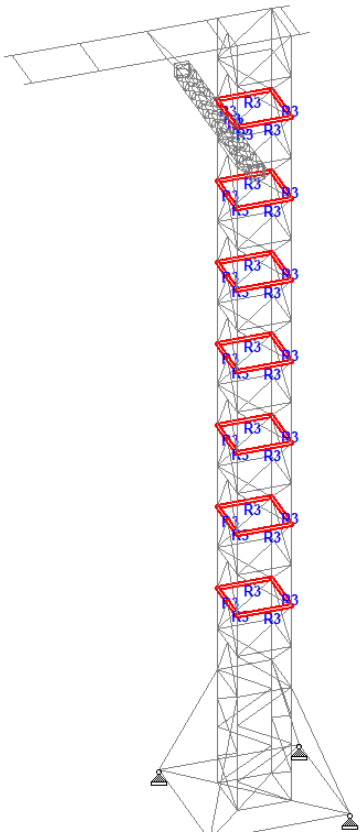
23. SHS 50x5 – Horizontal truss members



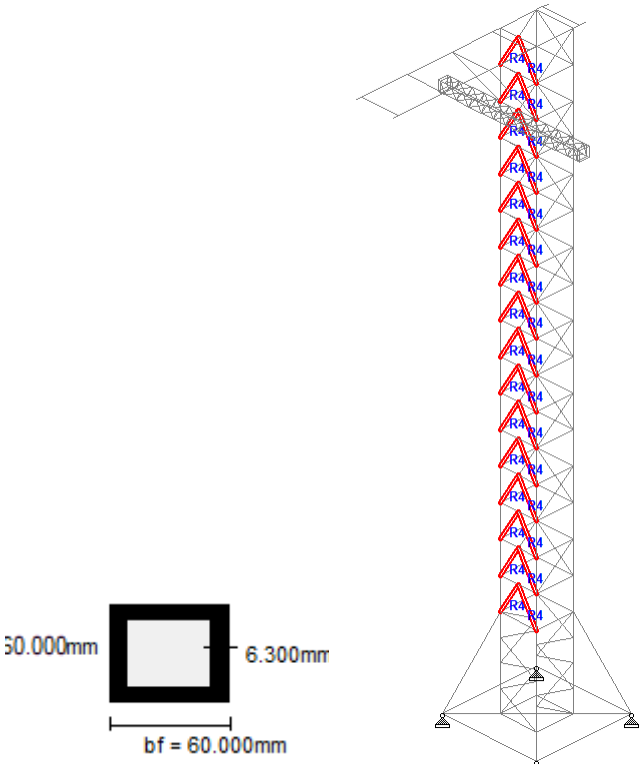


24. SHS 2-50x50x5 – Horizontal truss members

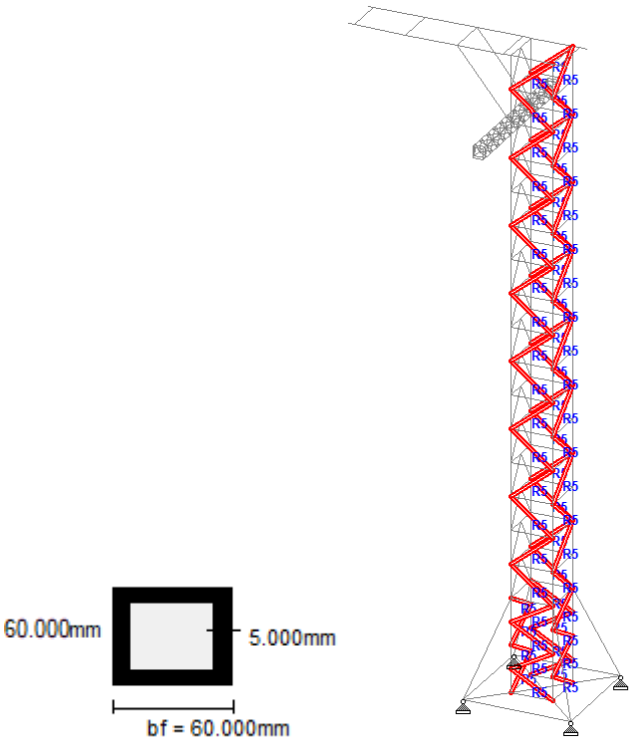




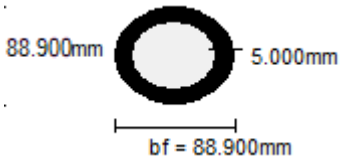
25. SHS 60x6.3 – Diagonal brace members

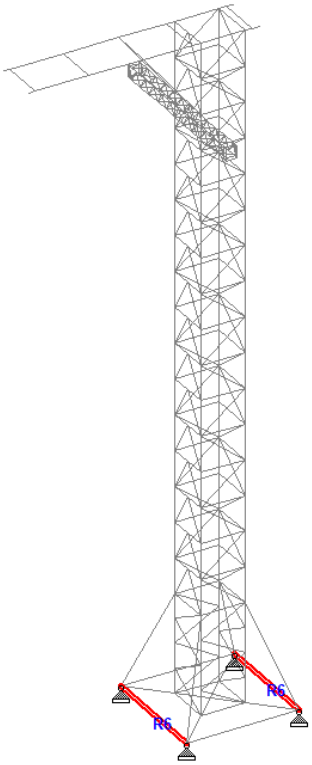


26. SHS 60x5 – Diagonal brace members

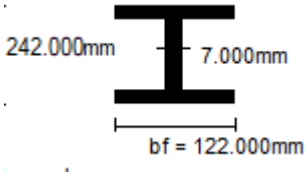


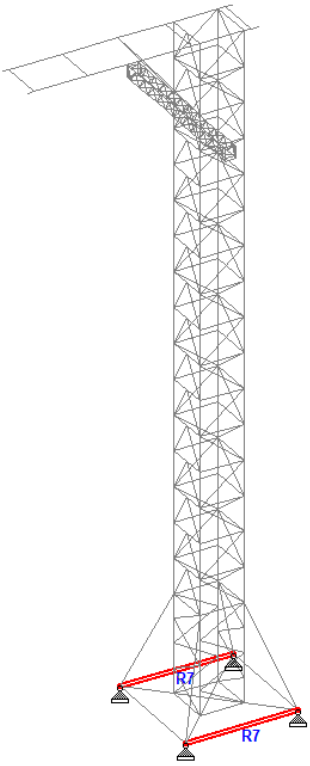
27. CHS 88.9x5 – Pipe member at base



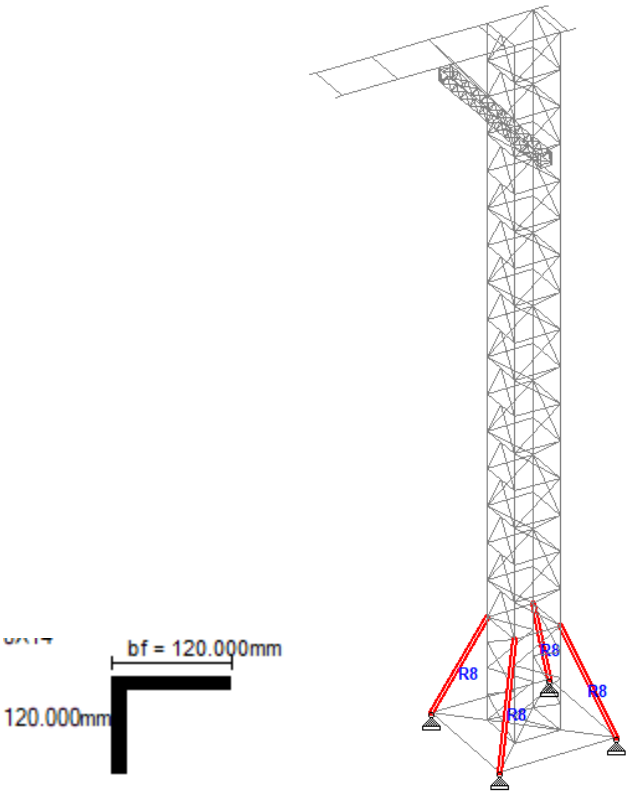


28. IPE 240 O – Base member

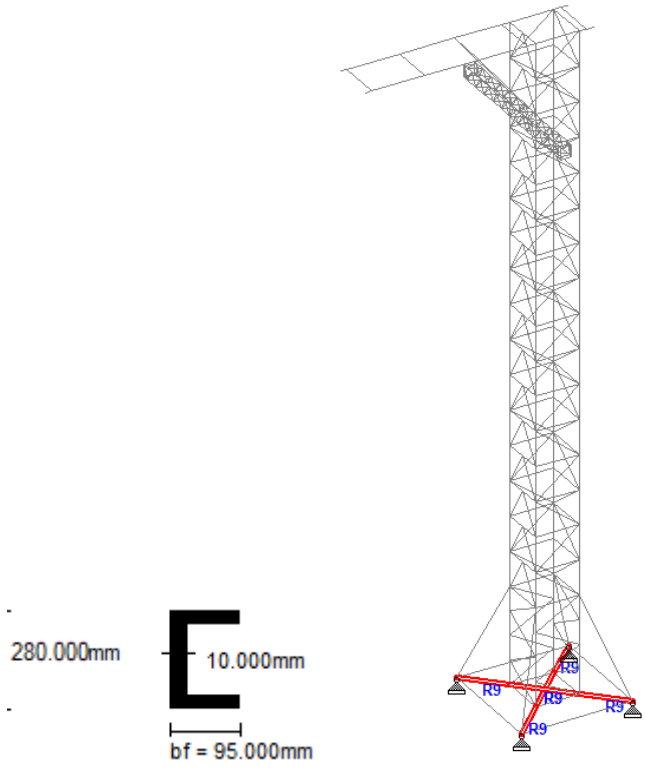




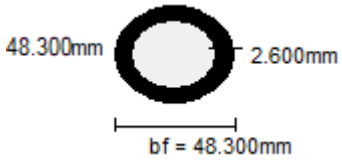
29. EA 120x120x14 – brace members

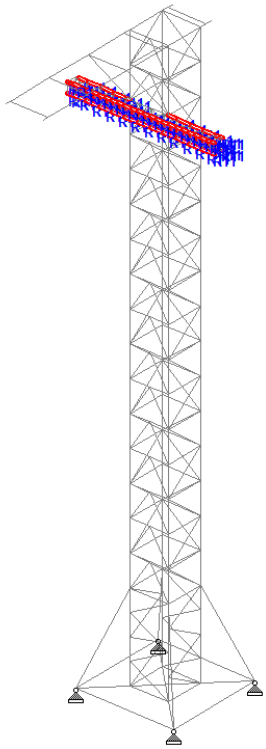


30. UPN 240 – Base members

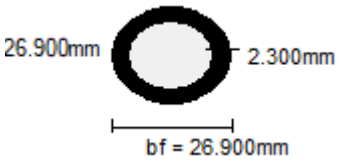


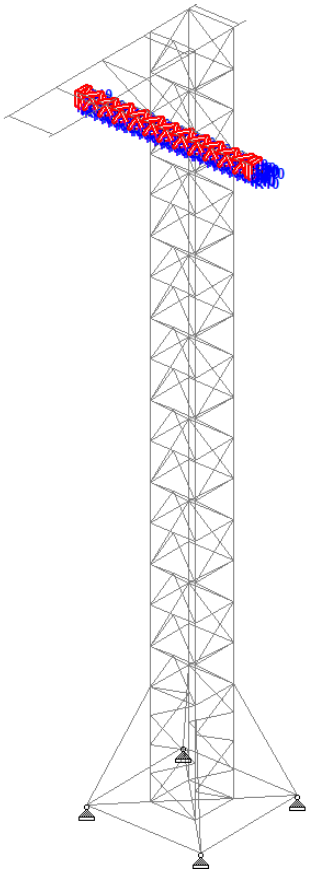
31. CHS 48.3x2.6 – Truss main cord members



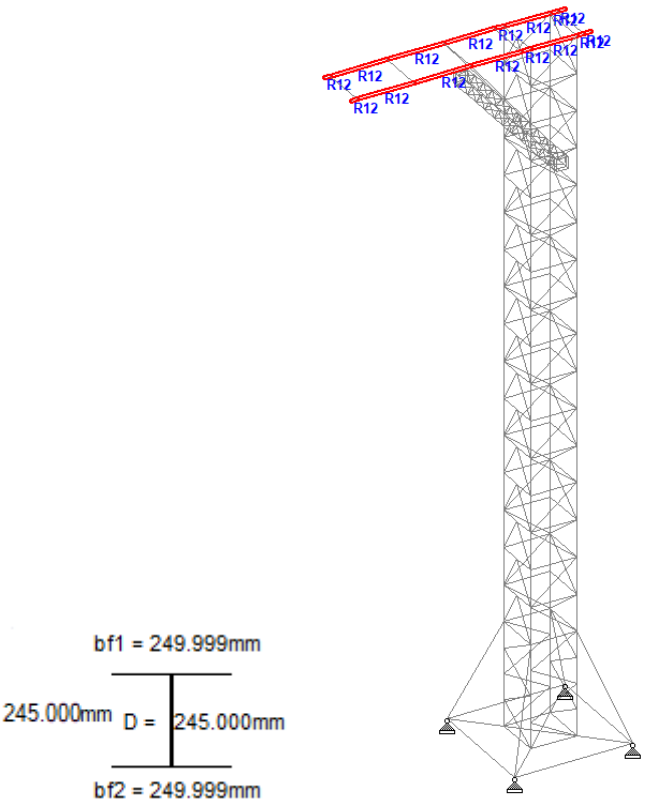


32. CHS 26.9x2.3 – Truss diagonal members

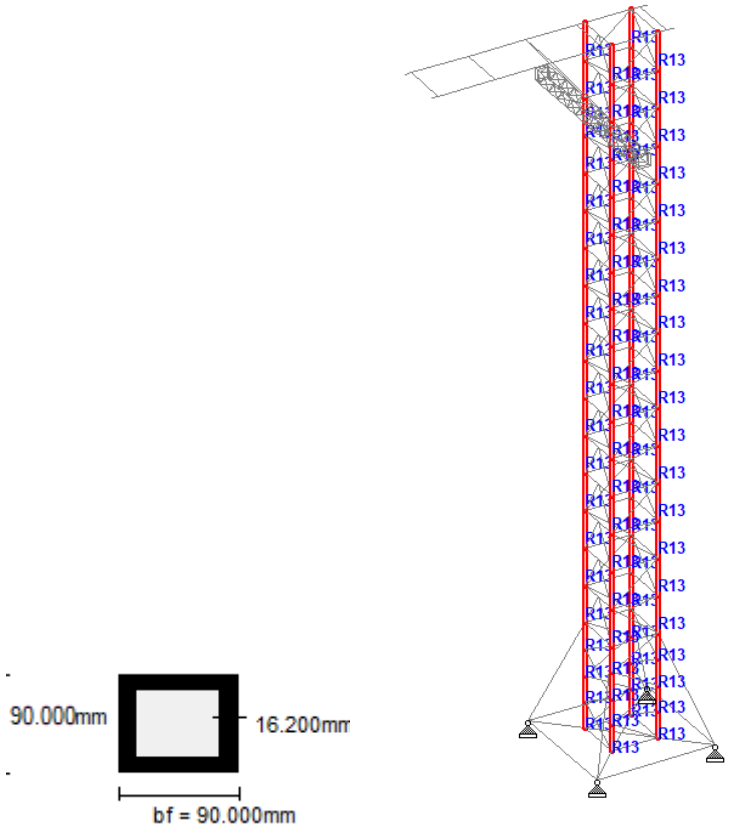




33. Built-up I section : Web : 225 x 10 Flange : 250 x 10 – Main beam member

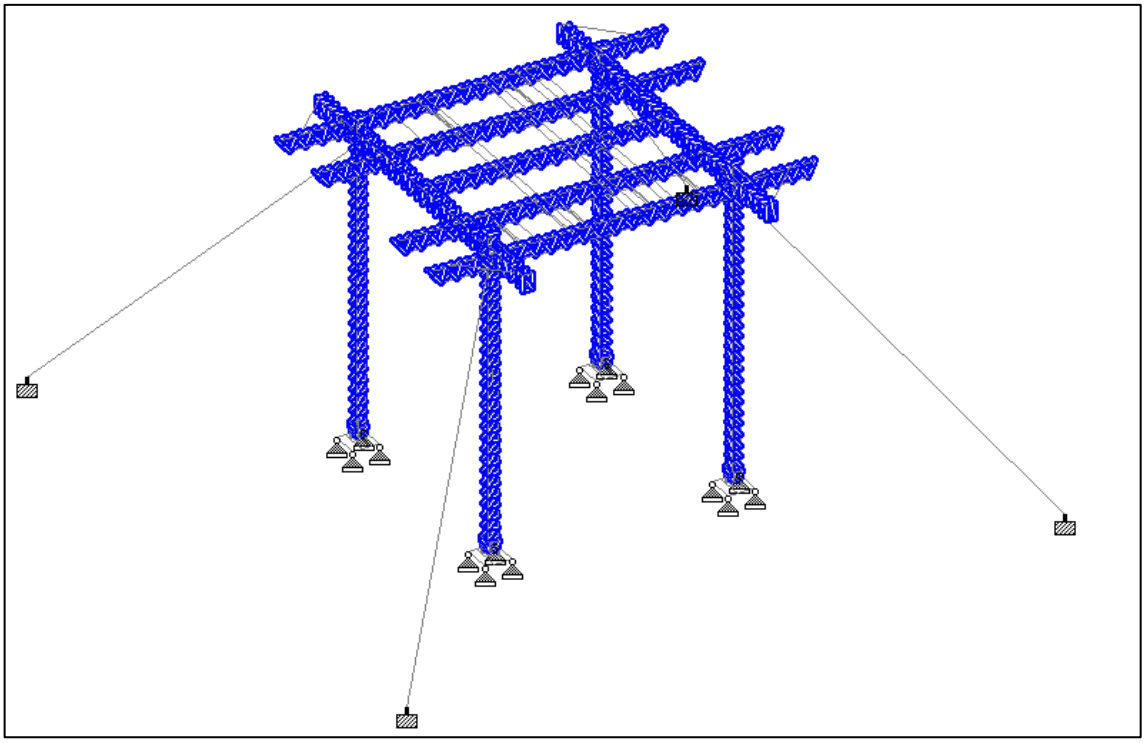


34. SHS 90X16.2 – Vertical Main Chord Members

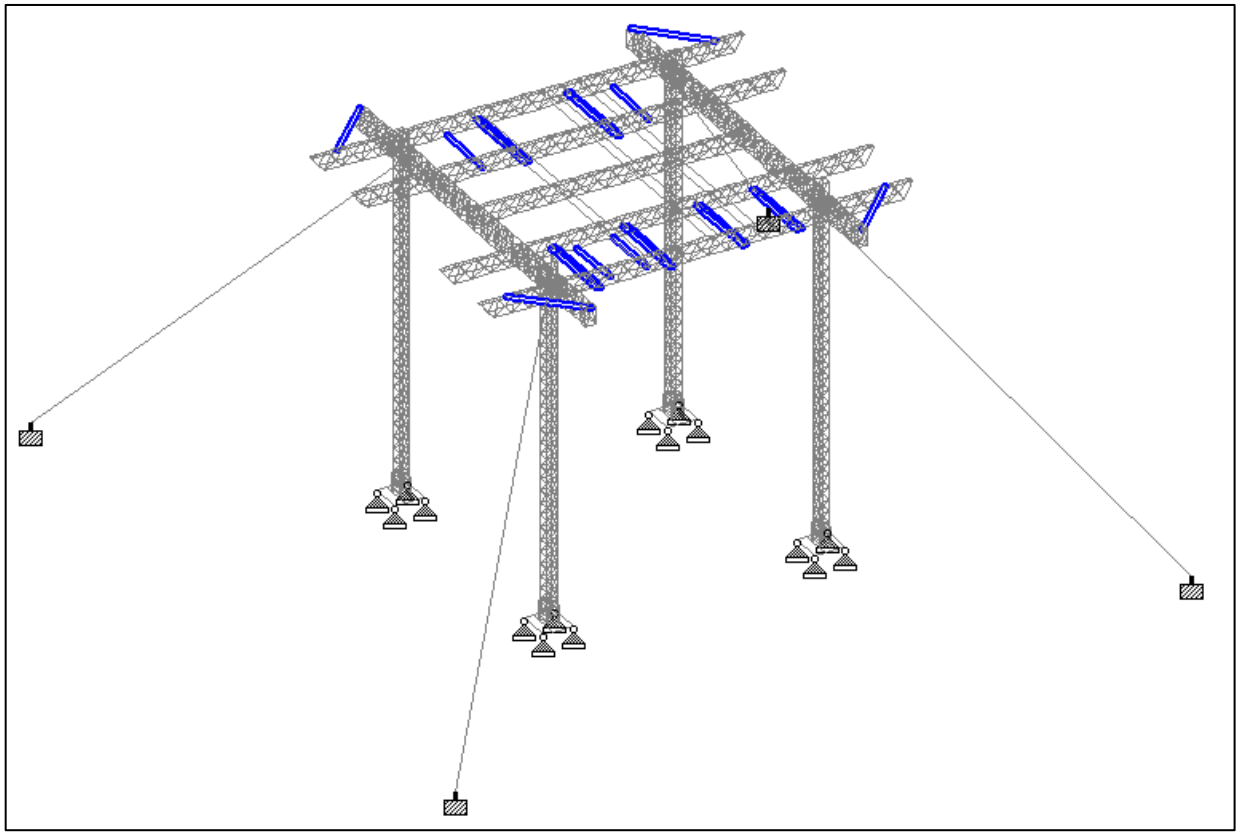


4.3. Member Specifications

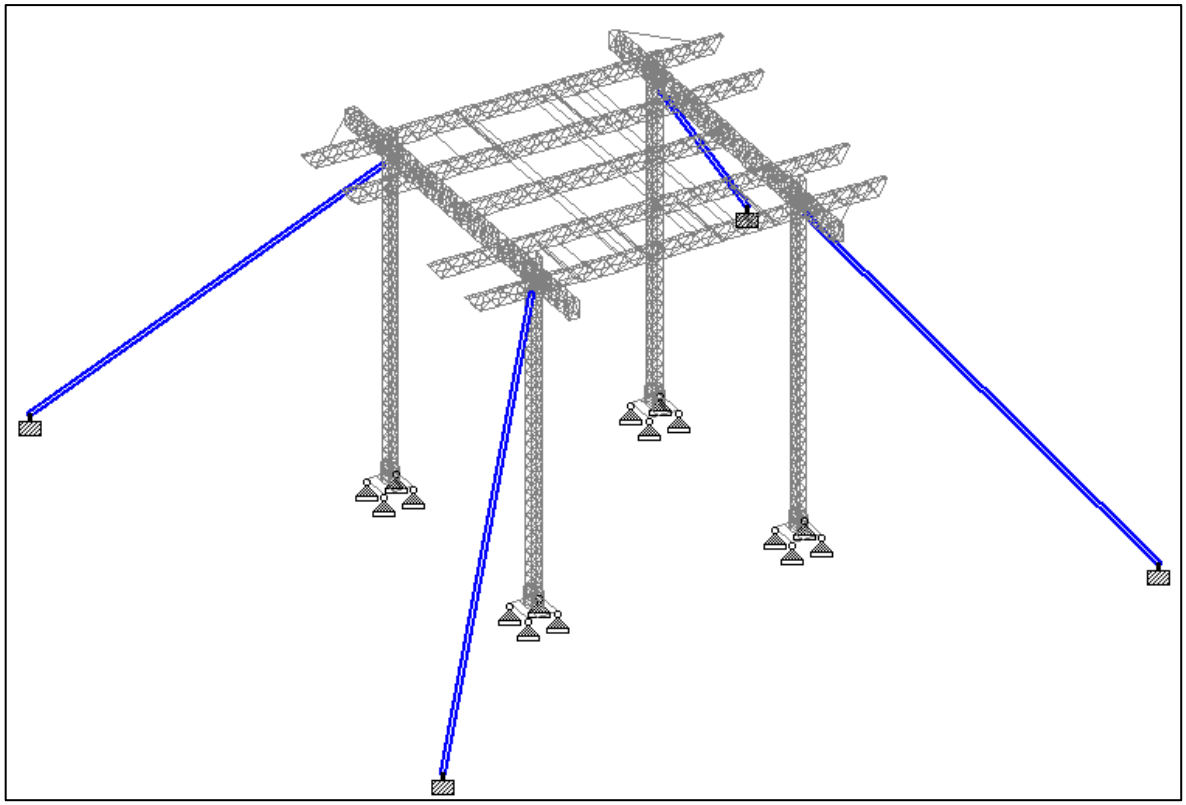
Refer below image shows member specification applied to steel members.



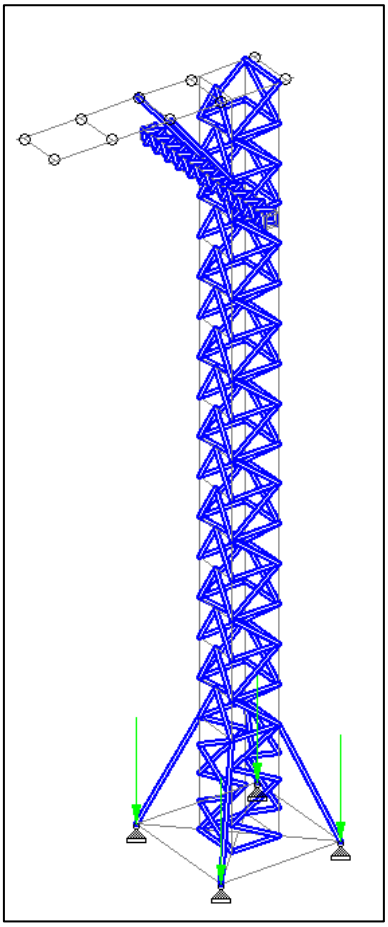
Member Truss



Member moment release at end



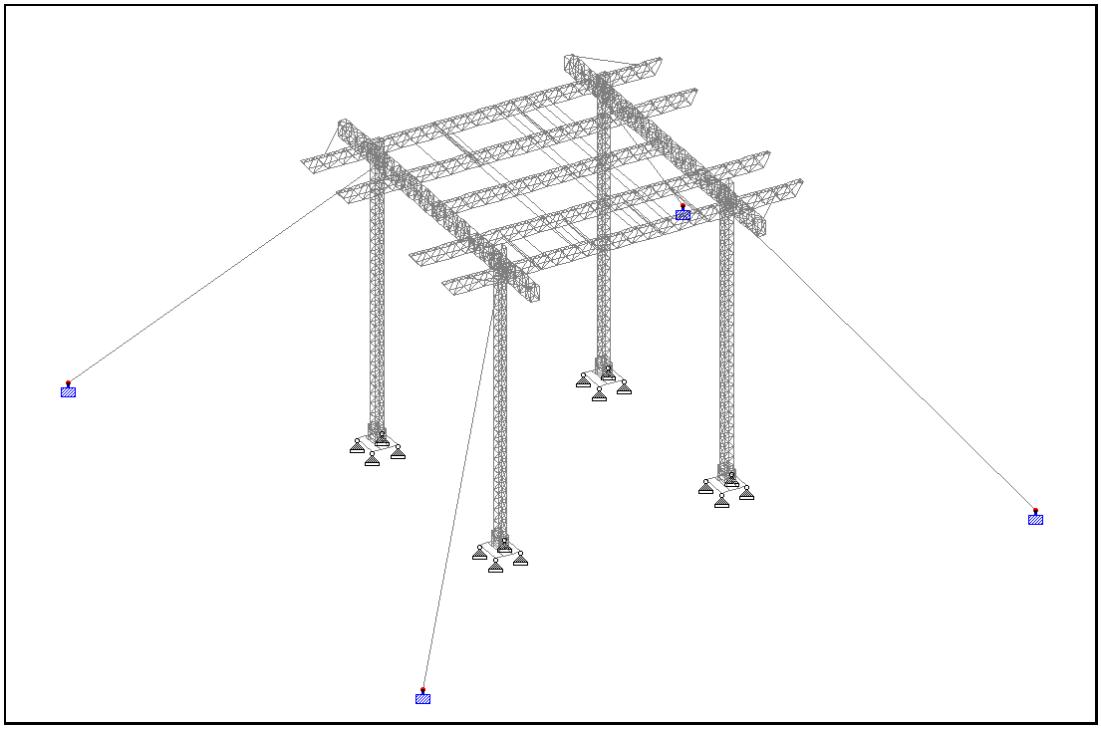
Member Tension only



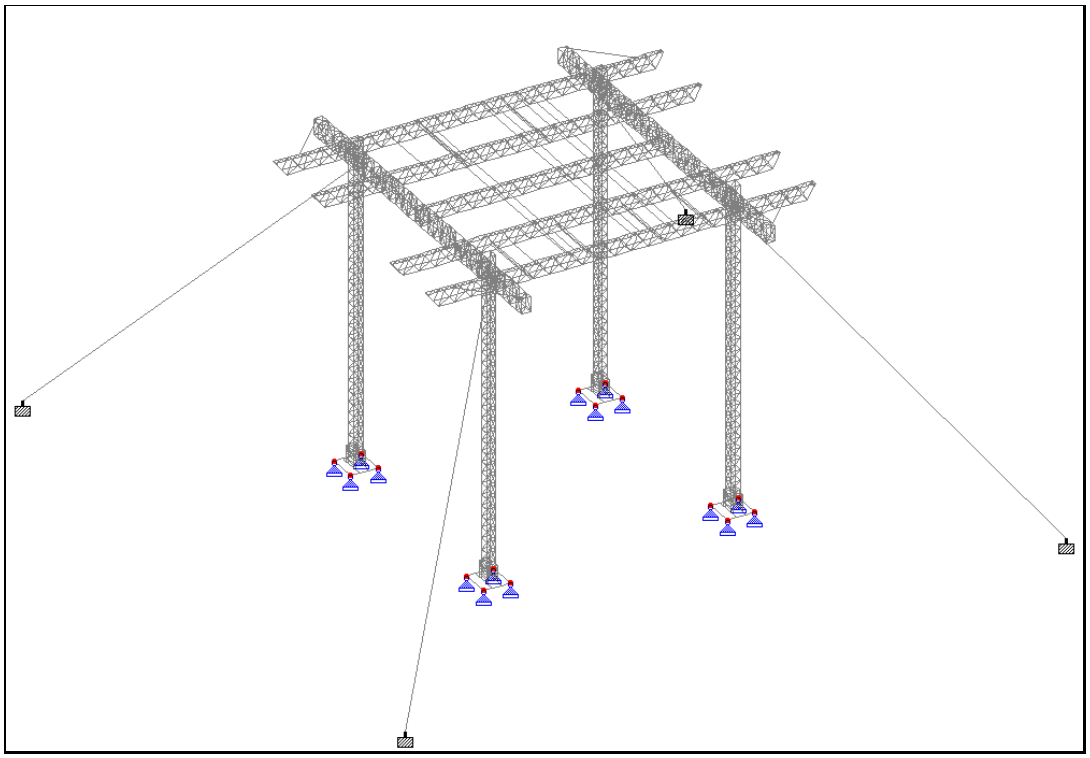
Member Truss

4.4. Support Condition

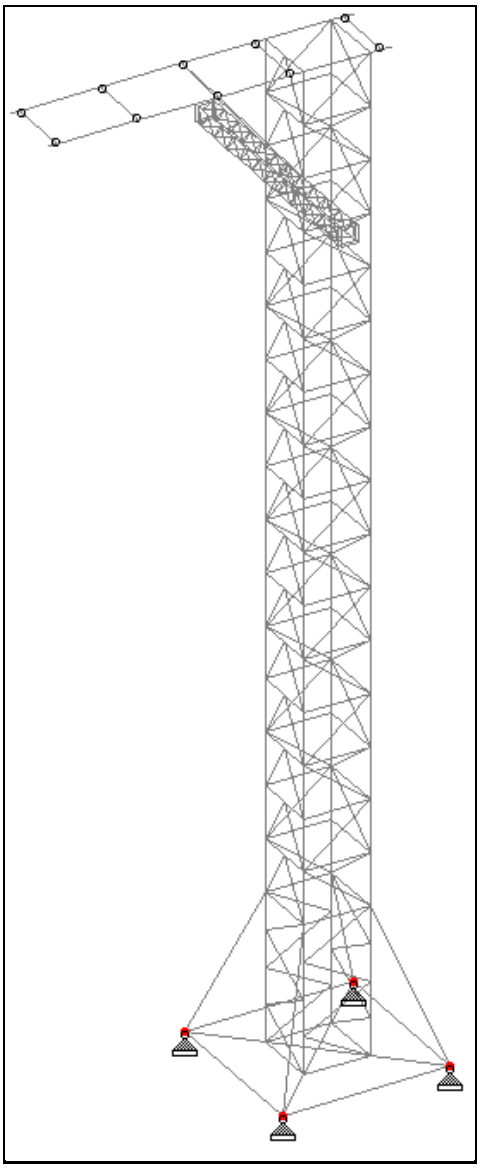
Below image shows support assigned to center stage structure and Tower structure. Guy wire reactions of center stage structure applied as uplift forces in Tower structure.



Fixed Supports



Pinned Supports



Pinned Supports

5. LOADING

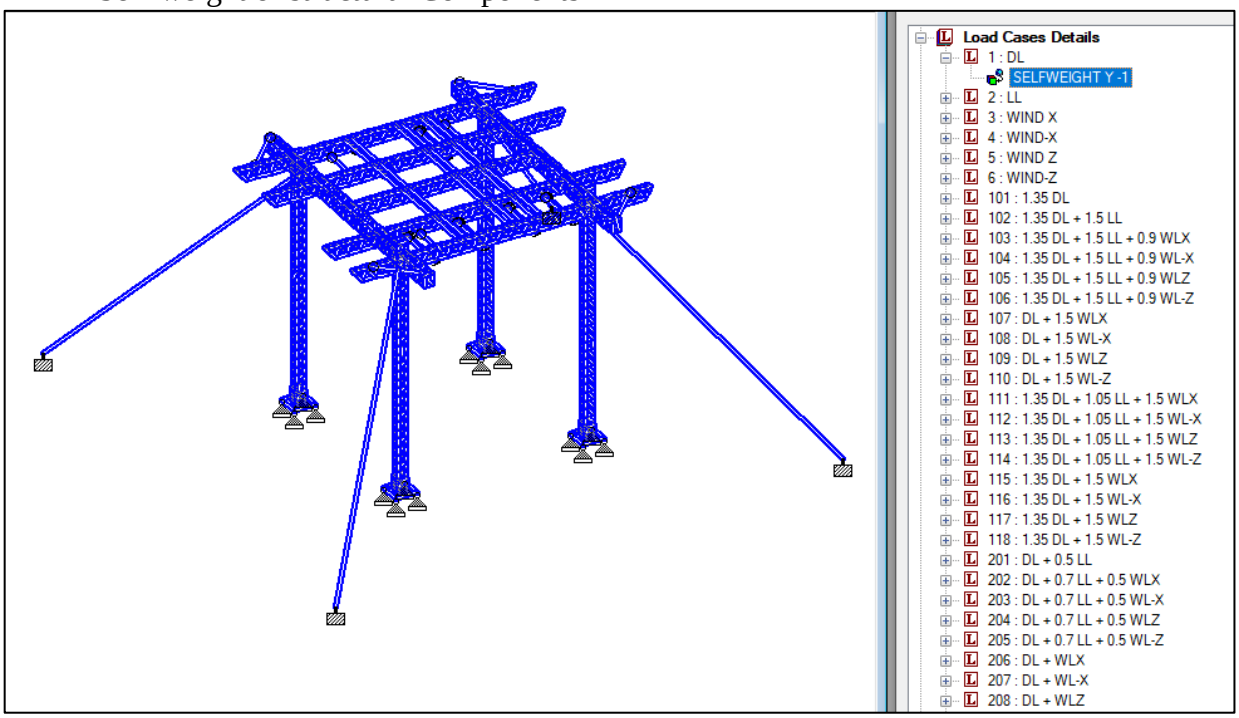
Load cases:

1. DL: Dead Load
2. LL: Live load
3. Wind X: Wind in (Positive) X-direction @ 25 m/s
4. Wind-X: Wind in (Negative) X-direction @ 25 m/s
5. Wind Z: Wind in (Positive) Z-direction @ 25 m/s
6. Wind-Z: Wind in (Negative) Z-direction @ 25 m/s

5.1. Loading on Center Stage structure

DL: Dead Load

- Self-weight of structural Components

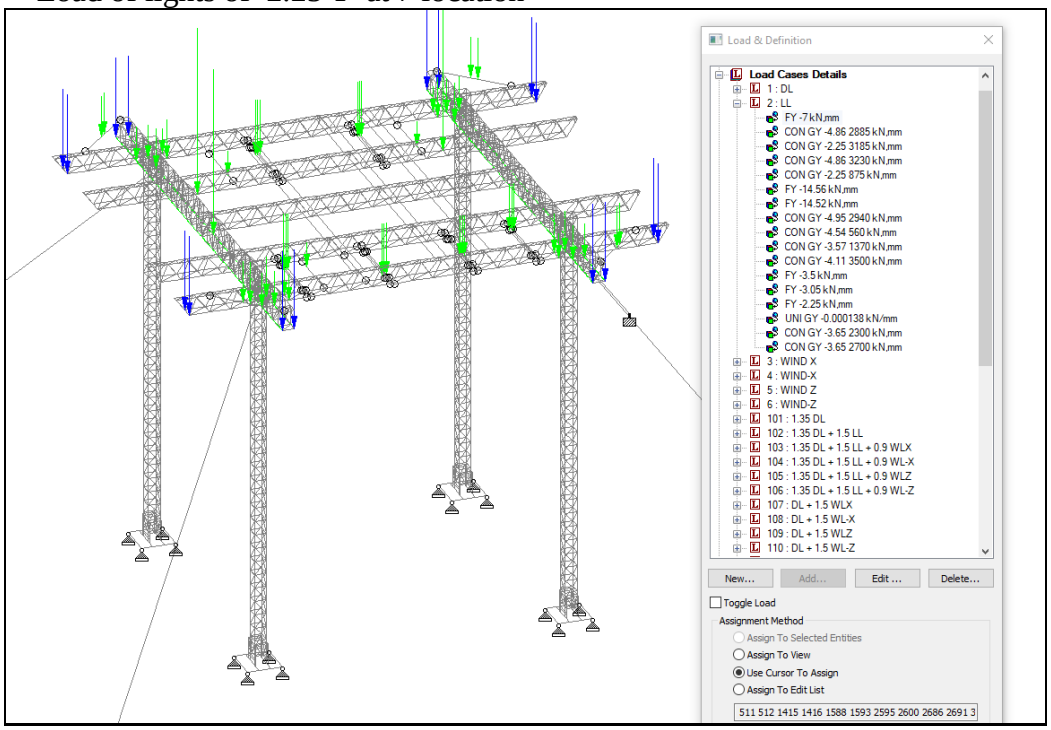


Self-weight of structural member

LL: Live Load

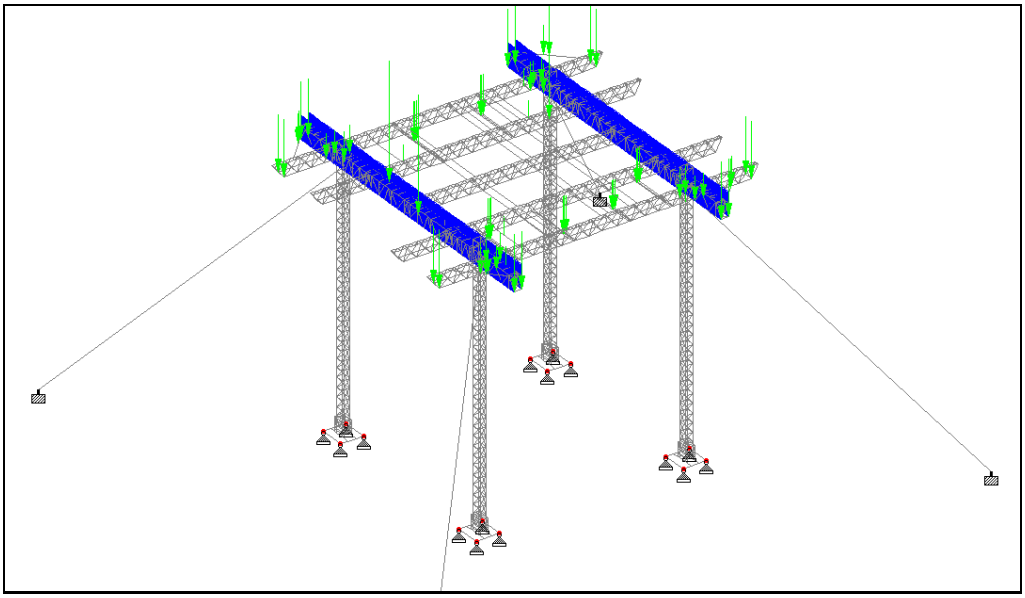
Loading of Lighting & speakers is considered as per ES rigging layout applied as Live load.

- Loading of Clair Main PA speaker (as shown) = Total 8 no. of speaker to be provided at corner of the primary truss and space truss with load of 14 kN each. Each speaker load has been devided in two point load of 7kN
- Loading of Clair Main Subs speaker = 7.3 T (2 x 3.65T) at center of diagonal beam at each corner (At 4 Locations)
- Load of circular LED screen = Total load of approx. 15T uniformly distributed in 10 locations as1.5 T at each location
- Load of lights of 3.5 T at 8 location
- Load of lights of 3.05 T at 8 location
- Load of lights of 2.25 T at 7 location



- As per BS EN 1991-1-1:2002 , Table 6.10 - Imposed loads on roofs of as per category H (Roofs not accessible except for normal maintenance and repair)

  Live load considered for repair & maintenance = 0.4 kN/m^2



WL: Wind Load

Wind loading for 25m/s acting to on structure has been considered with following calculations:-

Effective Wind speed = 25 m/s

As per "BS EN 12811-1(2003) section 6.2.7 Wind loads",

Wind loads shall be calculated by assuming that there is a velocity pressure on a reference area of the working structure, which is in general the projected area in the wind direction. The resultant wind force, F,

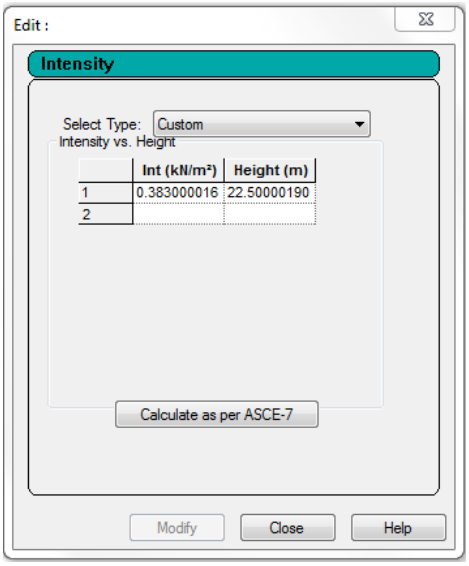
Wind Force $F = Cs \times (C_{fi} \times A_i \times q_p)$

Wind Pressure intensity $= Cs \times (C_{fi} \times q_p)$

$C_{f,i}$ = Aerodynamic force coefficient = 1.3 (As per BS EN 12811-1 :2003, Clause A.2)
C_s = Site coefficient = 1 (As per BS EN 12811-1 :2003, Clause A.4)
A_i = Reference area of the scaffold component
q_p = Peak velocity pressure

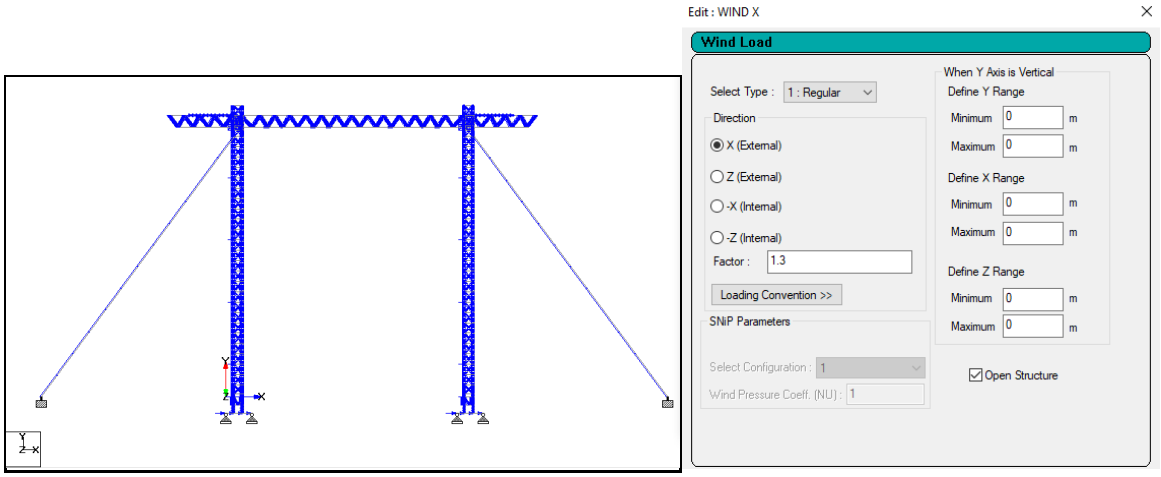
Peak Velocity Pressure $q_p = 0.5 \times \rho \times V_e^2$
$= 0.5 \times 1.226 \times V_e^2$ (ρ = Average air density 1.226)
$= 0.613 \times V_e^2$ N/m^2
$= (0.613 \times Ve^2) / 1000$ kN/m^2
$= (0.613*25\text{^}2)/1000$ kN/m^2
$= 0.383$ kN/m^2

Wind Pressure intensity $= 0.383 \times 1 \times 1.3 = 0.383 \times 1.3 = 0.4979$ kN/m^2

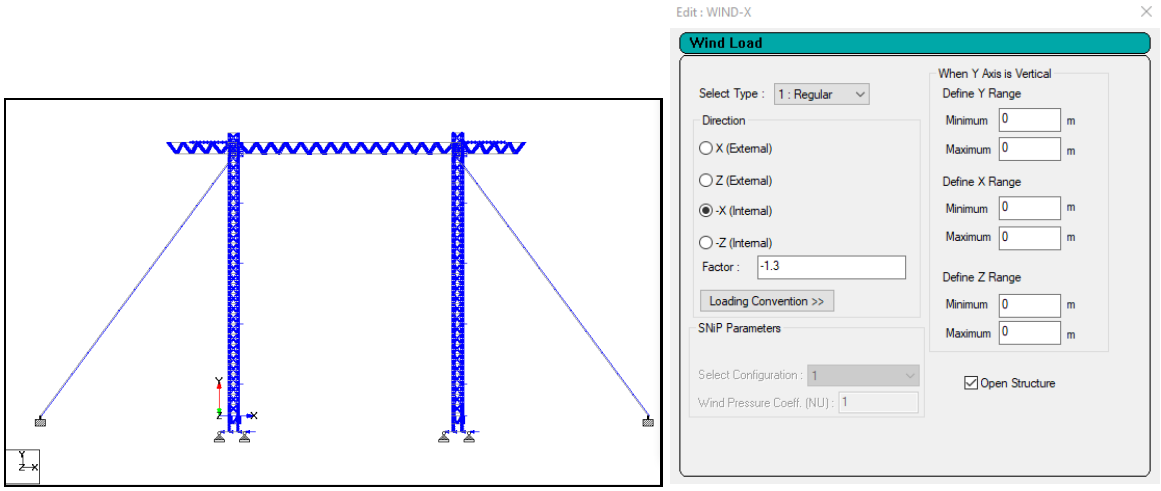


Wind load intensity

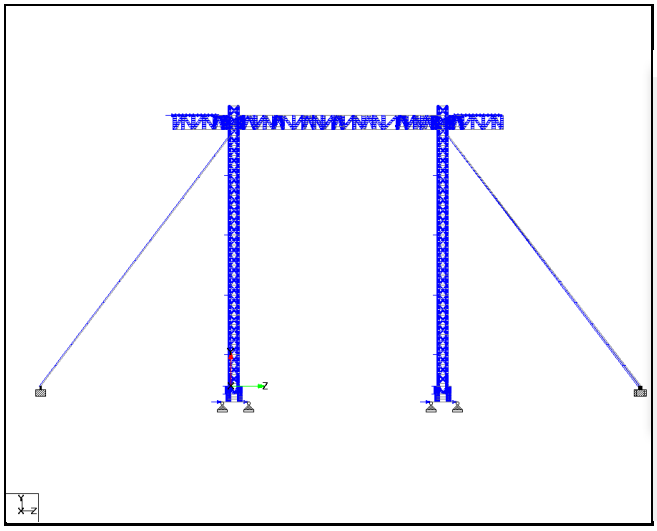
Wind load in (Positive) X-direction

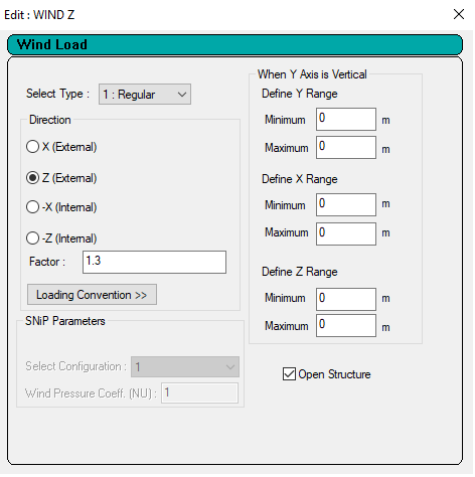


Wind load in (Negative) X-direction

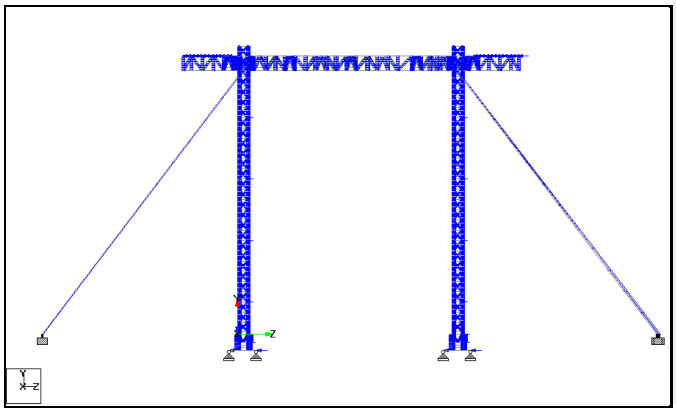


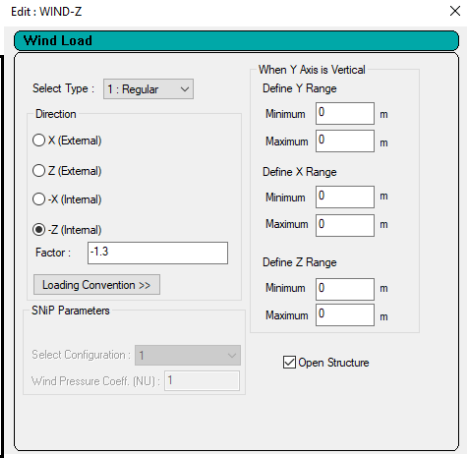
Wind load in (Positive) Z-direction





Wind load in (Negative) Z-direction





5.2. Loading on Tower structure

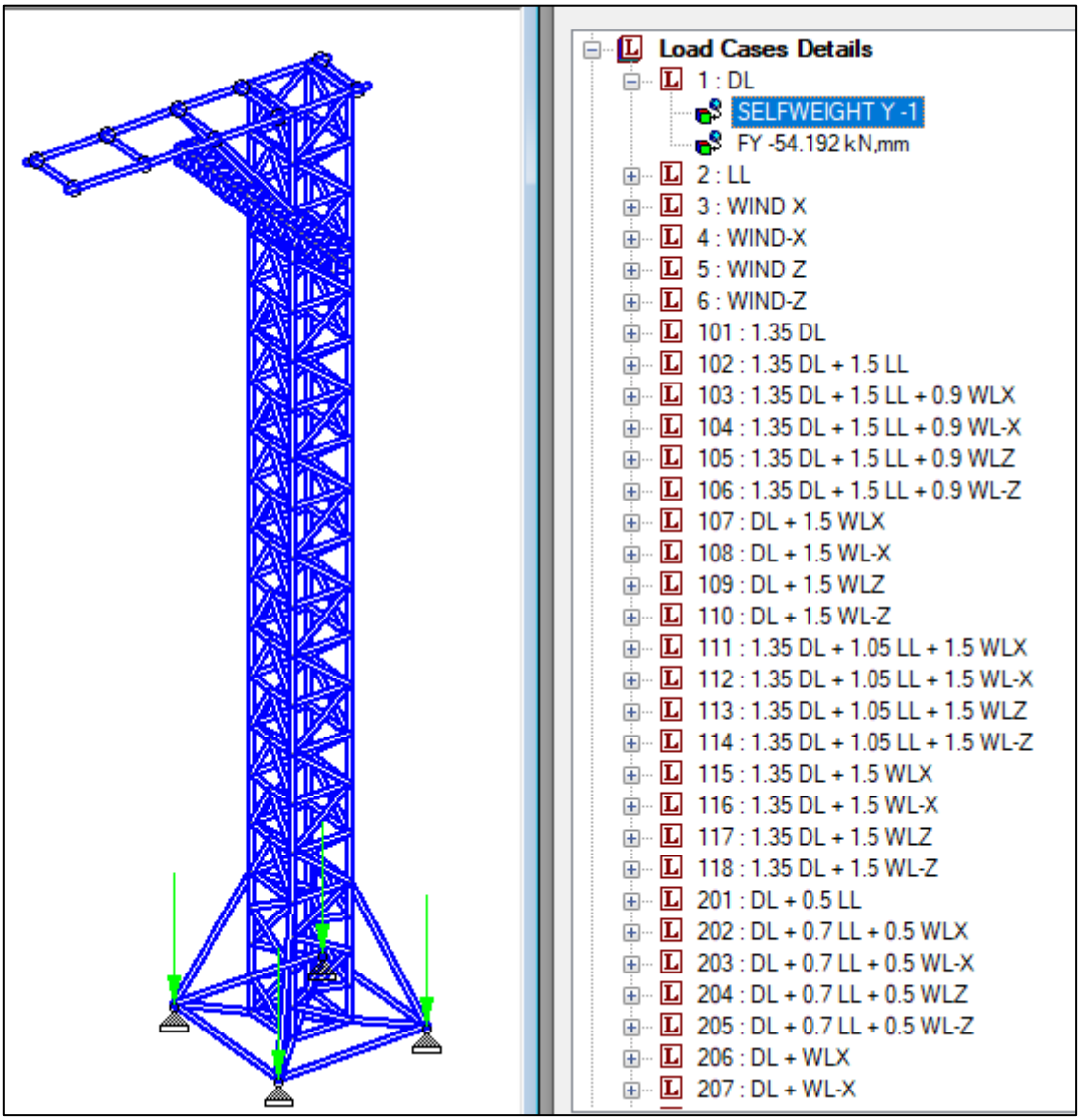
Load cases:

7. DL: Dead Load
8. LL: Live load
9. Wind X: Wind in (Positive) X-direction @ 25 m/s
10. Wind-X: Wind in (Negative) X-direction @ 25 m/s
11. Wind Z: Wind in (Positive) Z-direction @ 25 m/s
12. Wind-Z: Wind in (Negative) Z-direction @ 25 m/s

DL: Dead Load

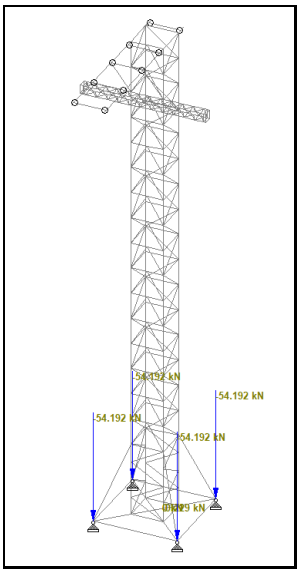
1. Self weight

Self weight of center stage structure including Vertical members, Horizontal members & trusses unit.



2. Load of concrete block as ballast at base = 21.6 T total load distributed at 4 supports

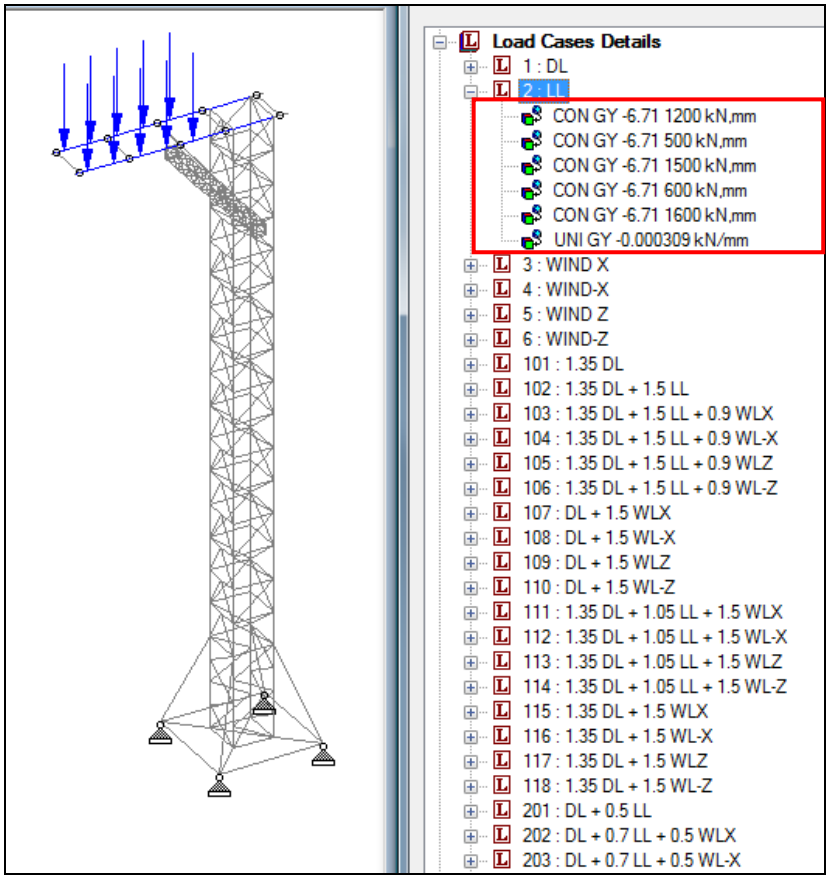
= 5.41 T = 54.19 kN



LL: Live Load

1. Live load applied on member

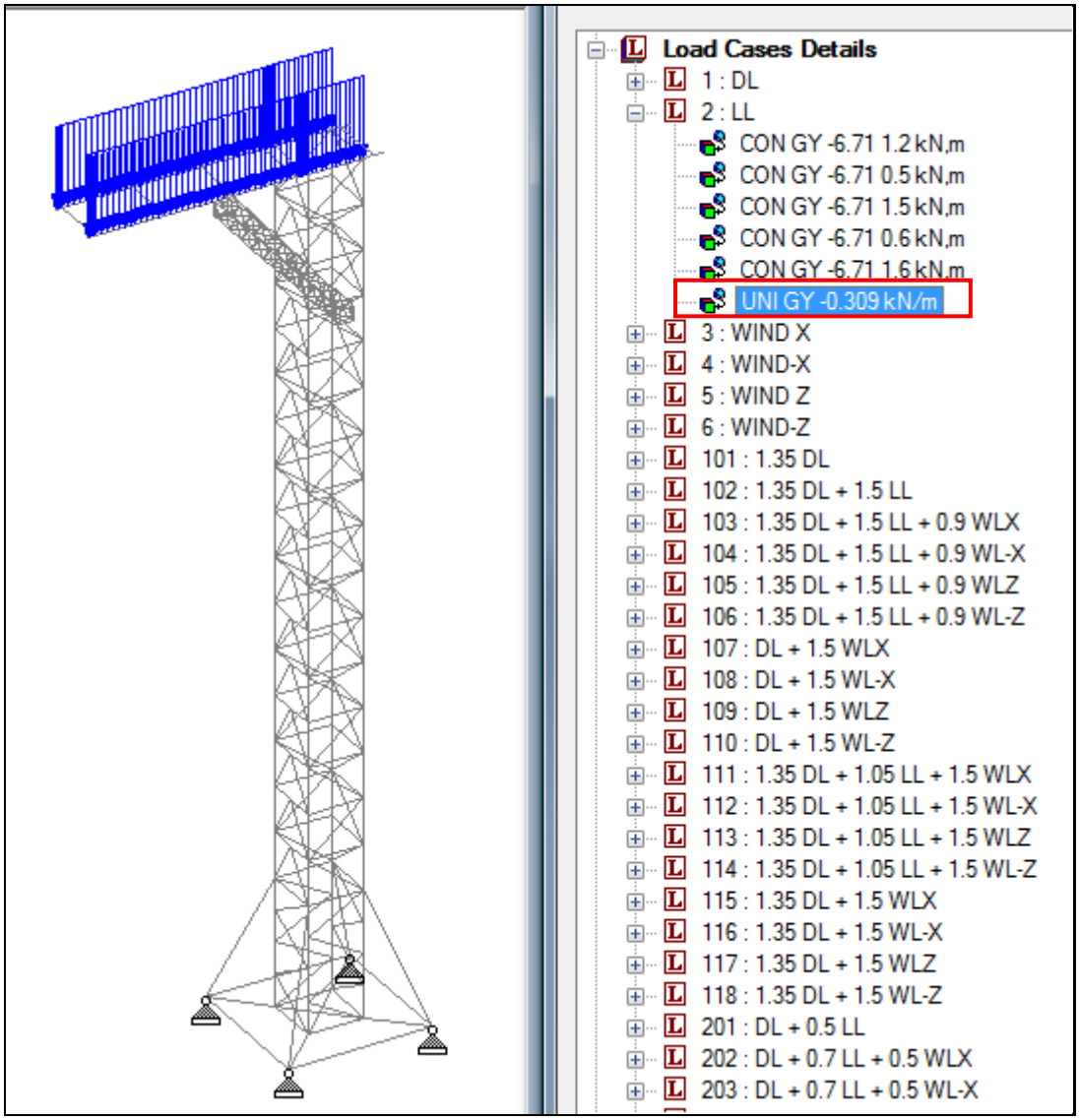
Live load on beam member due to hanging Screen = 6.71 kN/m



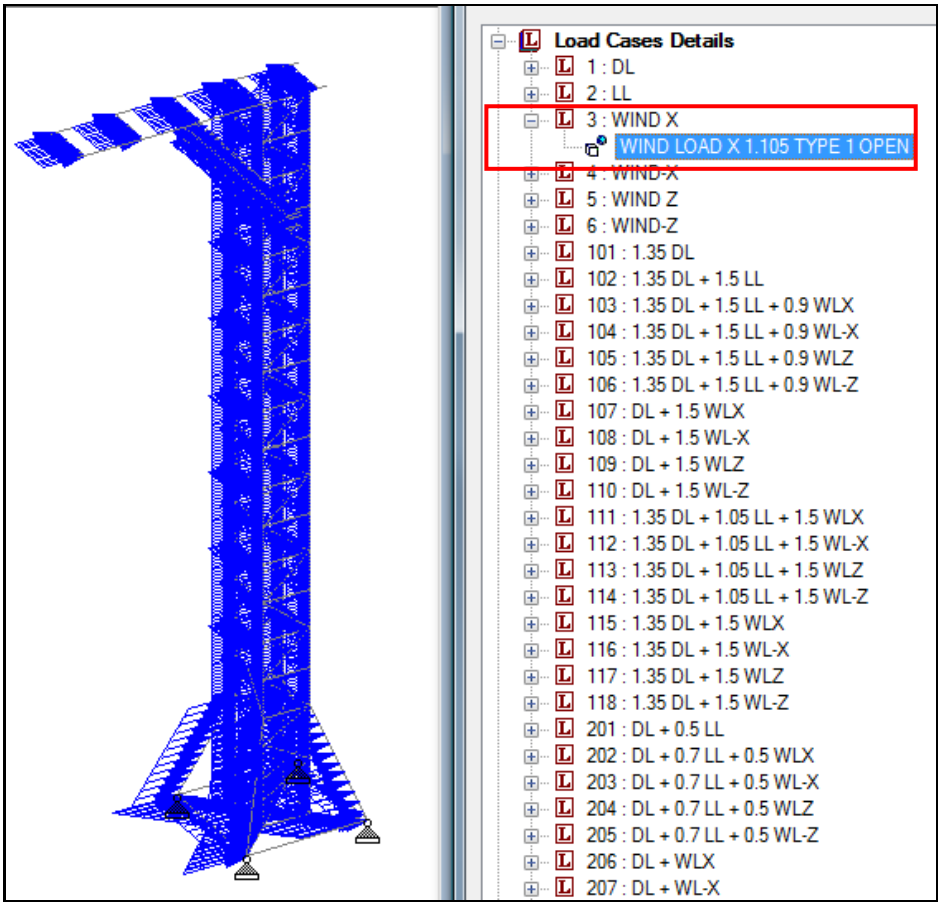
Live load considered for repair & maintenance = 0.4 kN/m^2

= 0.4 x Tributary span/2

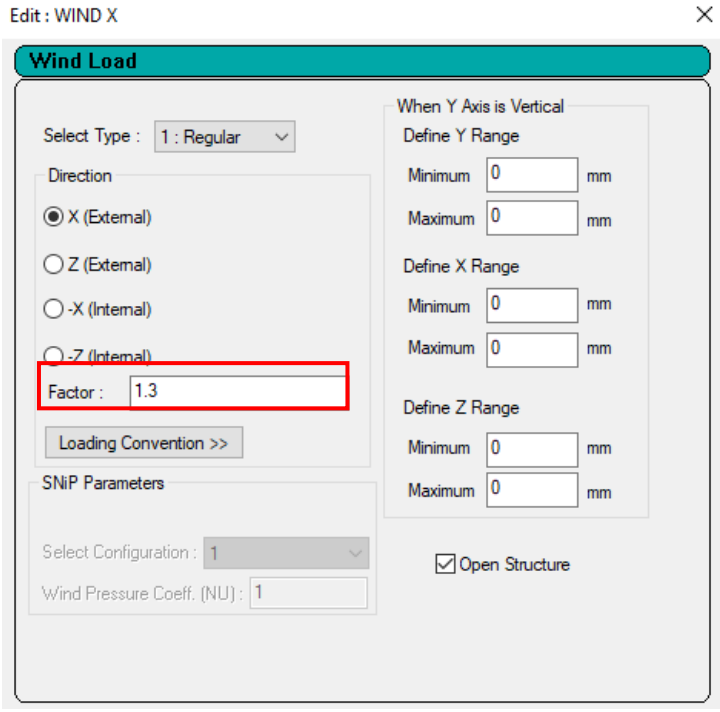
= 0.4 x 1.545/2 = 0.309 kN/m as a UDL



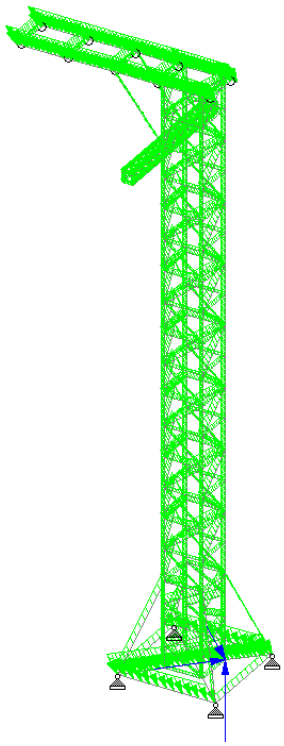
Wind load in (Positive) X-direction



Wind load in (positive) X-Direction

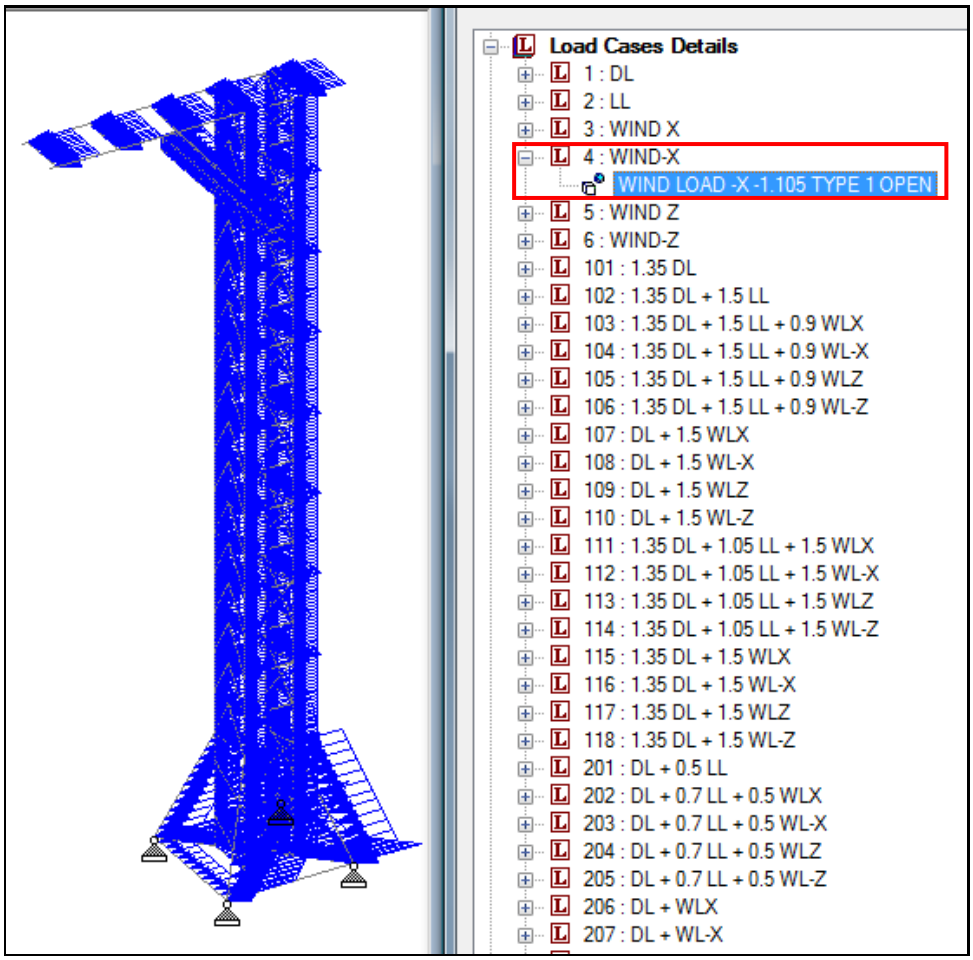


Factor of Wind load applied in (positive) X-Direction

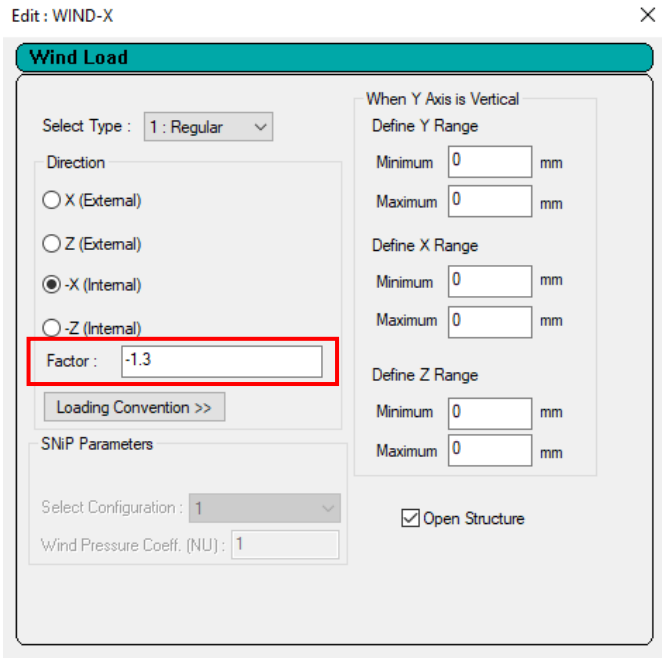


Reaction of Guy wire support

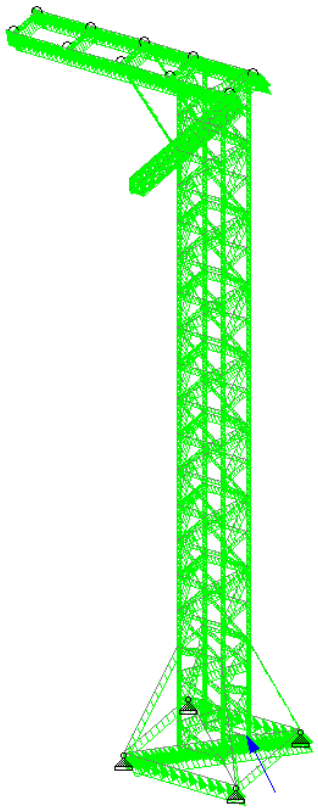
Wind load in (Negative) X-direction



Wind load in (negative) X-Direction

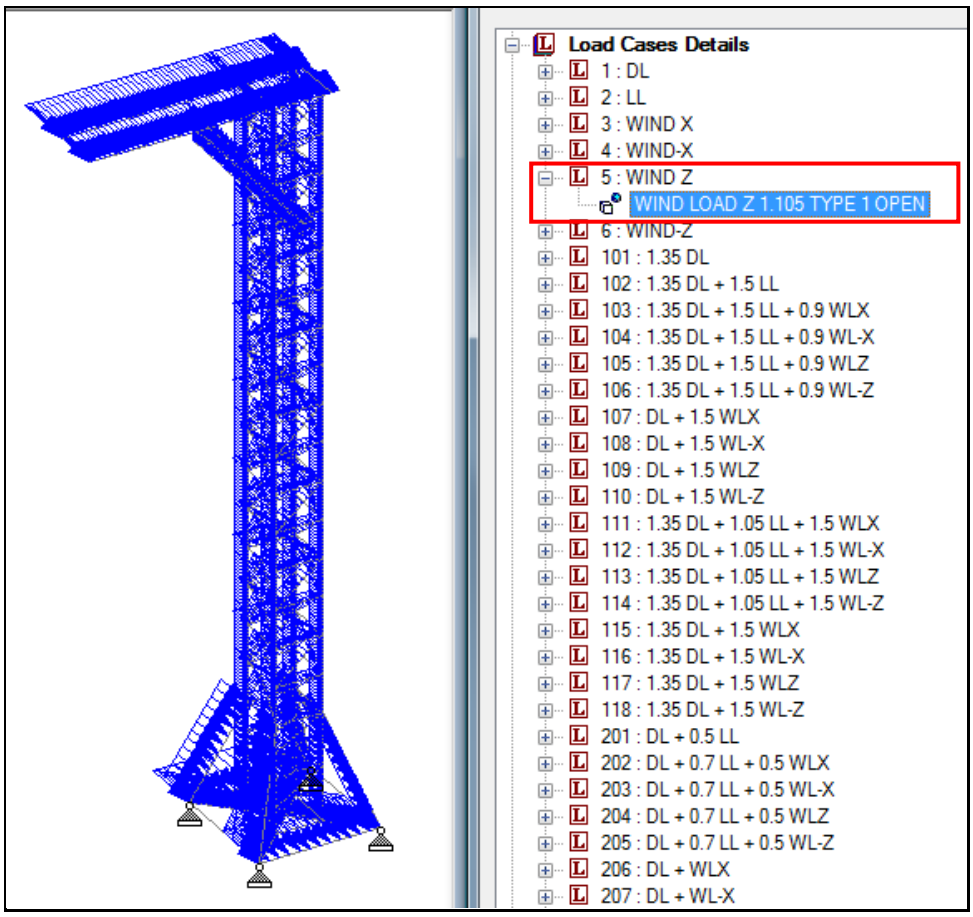


Factor of Wind load applied in (negative) X-Direction

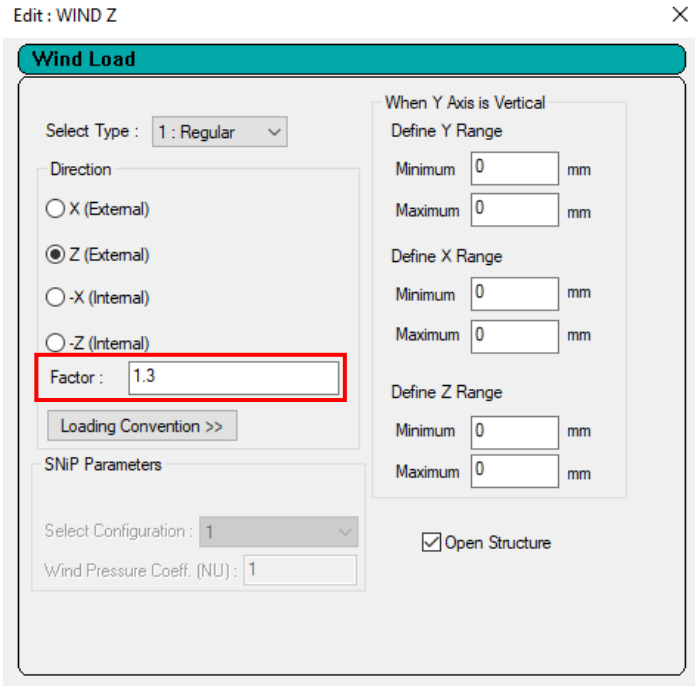


Reaction of Guy wire support

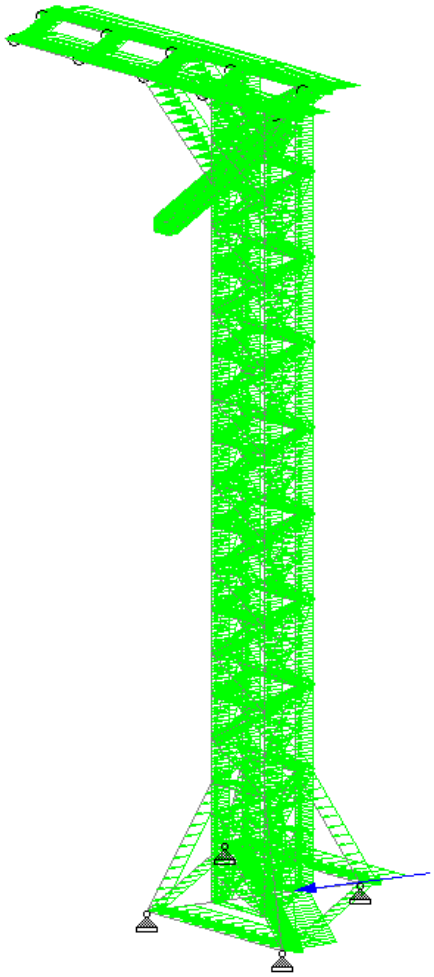
Wind load in (Positive) Z-direction



Wind load in (positive) Z-Direction

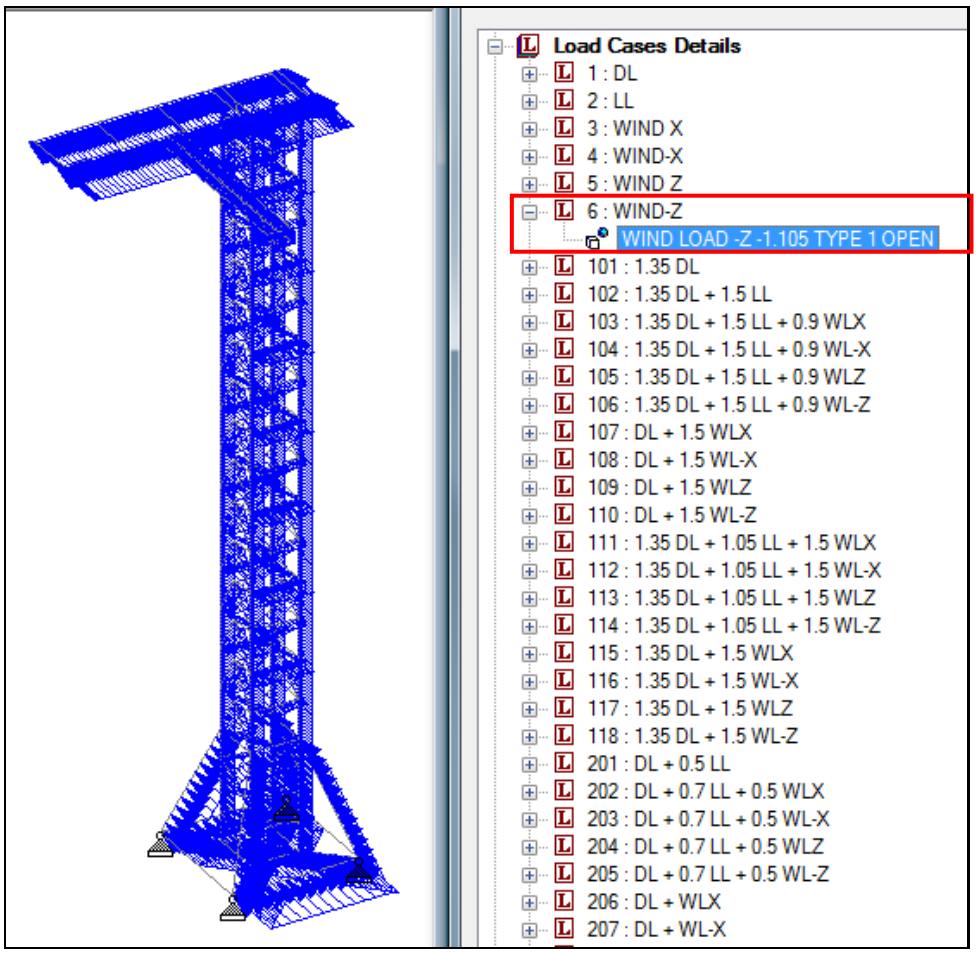


Factor of Wind load applied in (positive) Z-Direction

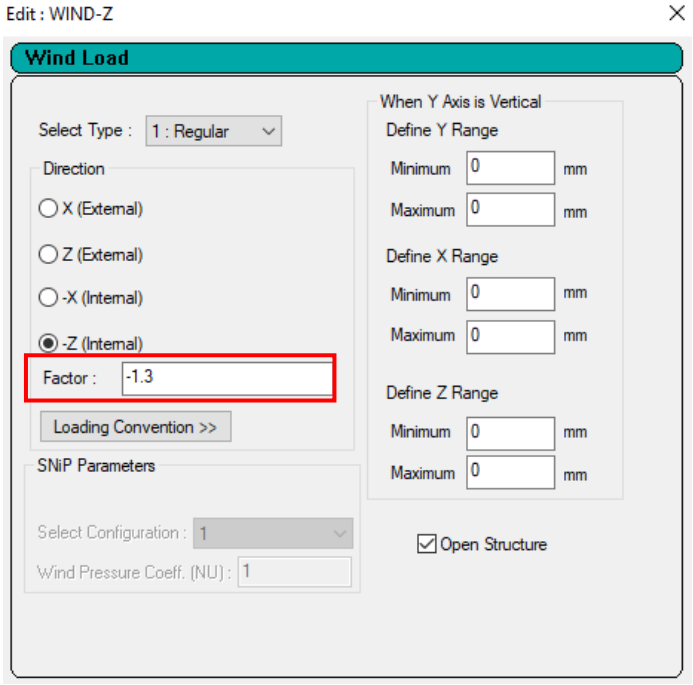


Reaction of Guy wire support

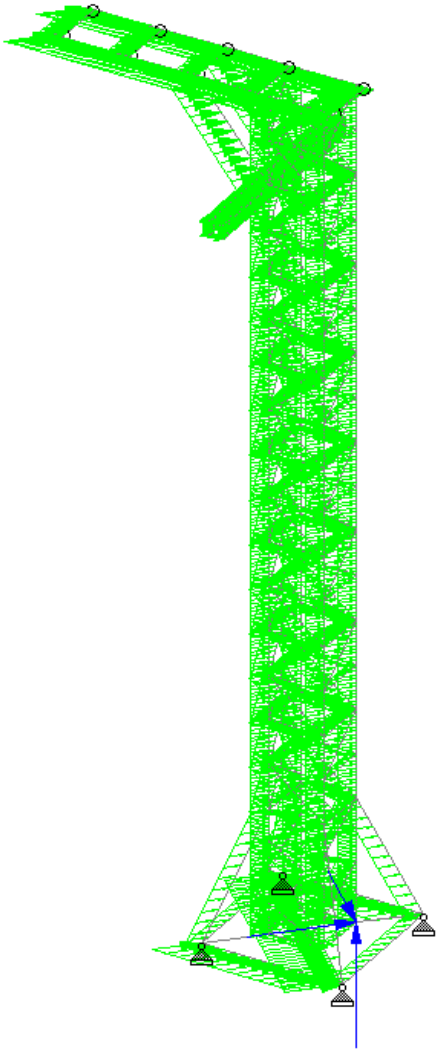
Wind load in (Negative) Z-direction



Wind load in (negative) Z-Direction



Factor of Wind load applied in (negative) Z-Direction



Reaction of Guy wire support

6. LOAD COMBINATIONS

Design load combinations:

Design load combinations (ULS: Ultimate limit state):

- 101 : 1.35 DL
- 102 : 1.35 DL + 1.5 LL
- 103 : 1.35 DL + 1.5 LL + 0.9 WLX
- 104 : 1.35 DL + 1.5 LL + 0.9 WL-X
- 105 : 1.35 DL + 1.5 LL + 0.9 WLZ
- 106 : 1.35 DL + 1.5 LL + 0.9 WL-Z
- 107 : DL + 1.5 WLX
- 108 : DL + 1.5 WL-X
- 109 : DL + 1.5 WLZ
- 110 : DL + 1.5 WL-Z
- 111 : 1.35 DL + 1.05 LL + 1.5 WLX
- 112 : 1.35 DL + 1.05 LL + 1.5 WL-X
- 113 : 1.35 DL + 1.05 LL + 1.5 WLZ
- 114 : 1.35 DL + 1.05 LL + 1.5 WL-Z
- 115 : 1.35 DL + 1.5 WLX
- 116 : 1.35 DL + 1.5 WL-X
- 117 : 1.35 DL + 1.5 WLZ
- 118 : 1.35 DL + 1.5 WL-Z

Serviceability load combinations (SLS: Serviceability Limit State):

- 201 : DL + 0.5 LL
- 202 : DL + 0.7 LL + 0.5 WLX
- 203 : DL + 0.7 LL + 0.5 WL-X
- 204 : DL + 0.7 LL + 0.5 WLZ
- 205 : DL + 0.7 LL + 0.5 WL-Z
- 206 : DL + WLX
- 207 : DL + WL-X
- 208 : DL + WLZ
- 209 : DL + WL-Z
- 210 : DL + LL + 0.5 WLX
- 211 : DL + LL + 0.5 WL-X
- 212 : DL + LL + 0.5 WLZ
- 213 : DL + LL + 0.5 WL-Z

7. ANALYSIS RESULTS

7.1. Deflection Check

7.1.1. Deflection Check for Center stage structure

			Horizontal	Vertical	Horizontal	Resultant	Rotational		
	Node	L/C	X mm	Y mm	Z mm	mm	rX rad	rY rad	rZ rad
Max X	387	206 DL + WL	**111.120**	-6.001	6.317	111.461	-0.001	-0.001	-0.003
Min X	1297	207 DL + WL-	**-109.484**	-6.008	5.166	109.770	-0.001	0.001	0.003
Max Y	2439	213 DL + LL +	-1.486	**8.823**	-43.047	43.967	0.005	0.000	0.003
Min Y	2522	212 DL + LL +	0.332	**-27.577**	46.547	54.104	-0.002	-0.000	0.000
Max Z	2261	208 DL + WL	0.999	-17.493	**80.847**	82.724	-0.002	-0.000	-0.000
Min Z	2259	209 DL + WL-	0.901	-17.860	**-80.733**	82.690	0.002	0.000	-0.000
Max rX	1610	211 DL + LL +	-57.203	-16.643	1.986	59.609	**0.012**	-0.001	-0.001
Min rX	1677	210 DL + LL +	60.224	-16.821	4.361	62.681	**-0.011**	0.001	0.000
Max rY	2059	209 DL + WL-	0.612	-9.572	-74.299	74.916	0.002	**0.005**	-0.001
Min rY	138	207 DL + WL-	-92.018	-2.740	-5.711	92.235	0.001	**-0.004**	0.001
Max rZ	308	207 DL + WL-	-44.613	-0.064	0.923	44.623	-0.000	-0.000	**0.006**
Min rZ	1218	206 DL + WL	44.564	-0.022	0.981	44.575	-0.000	0.000	**-0.006**
Max Rst	387	206 DL + WL	111.120	-6.001	6.317	**111.461**	-0.001	-0.001	-0.003

Horizontal Deflection:-

X-Direction:

From above displacement summary, Deflection for DL+ WLX

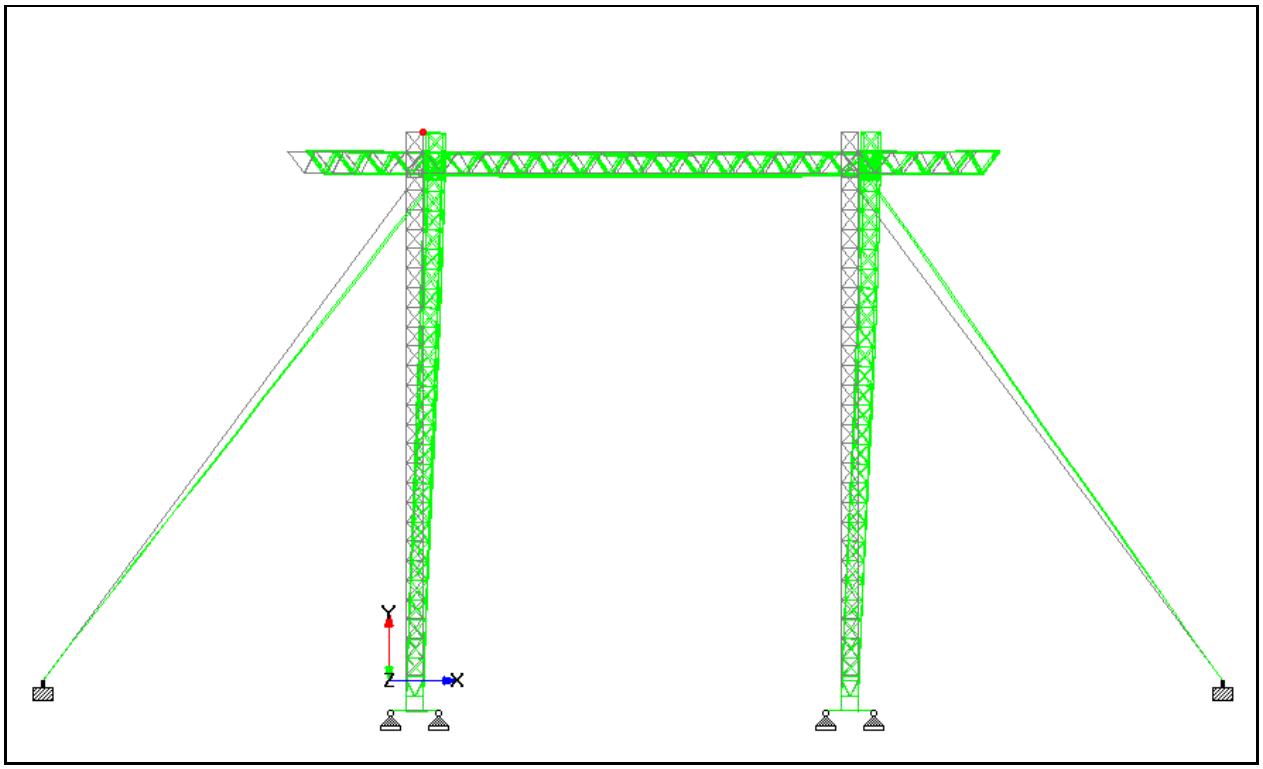
Maximum horizontal displacement of structure in X direction = 111.12 mm

Permissible horizontal deflection in X direction = height / 100

= 23800 / 100

= 238 mm

Actual maximum horizontal deflection in X direction = 111.12 mm ≤ 238 mm (**Hence, OK**)



Z-Direction:

From above displacement summary, Deflection for DL+ WLZ

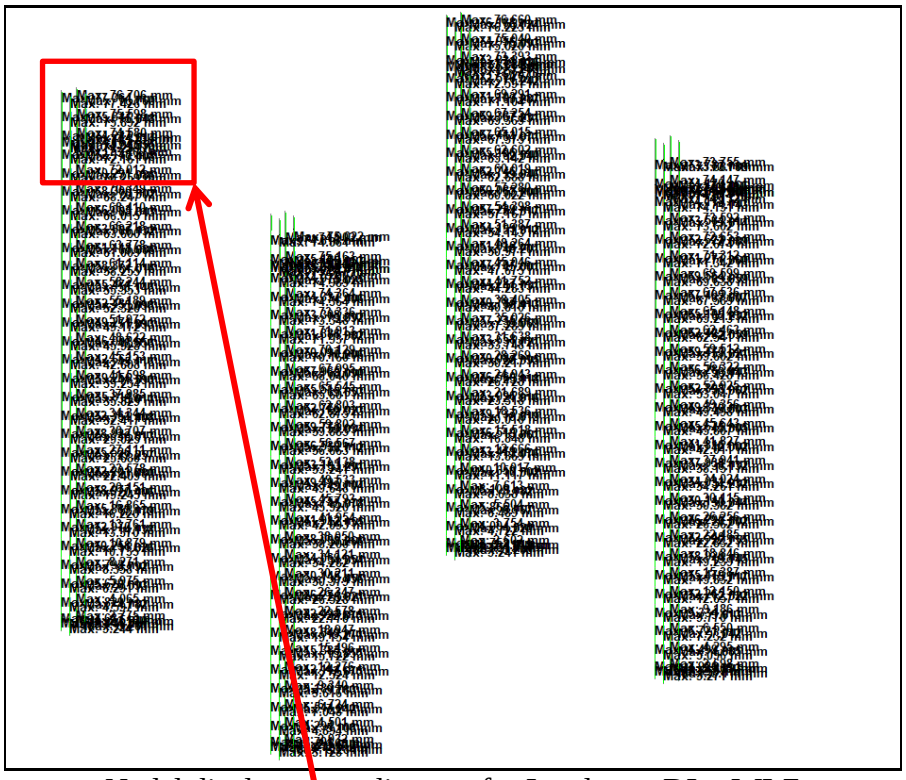
Maximum horizontal displacement of structure in Z direction = 77.426 mm

Permissible horizontal deflection in X direction = height / 100

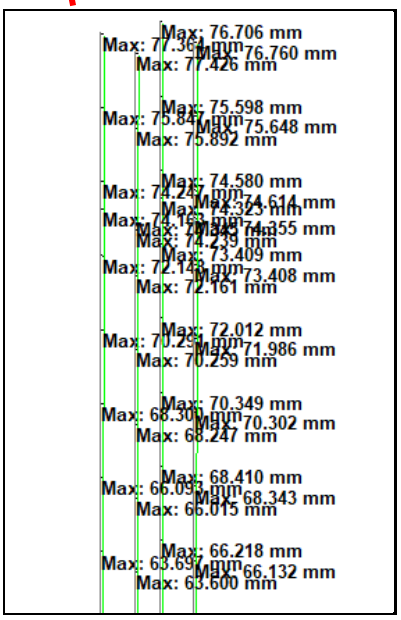
= 23800 / 100

= 238 mm

Actual maximum horizontal deflection in X direction = 77.426 mm ≤ 238 mm (**Hence, OK**)



Nodal displacement diagram for Load case DL+ WLZ



Zoom view

Vertical Deflection:-

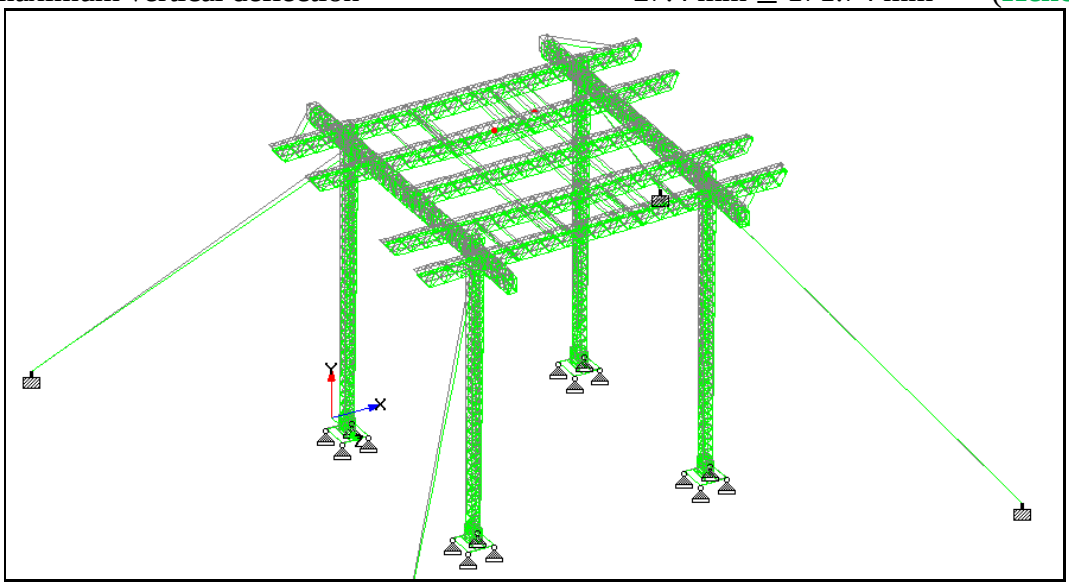
Y-Direction:

From above displacement summary, Deflection diagram for DL+LL+0.5 WLZ

Maximum vertical displacement of structure in Y direction = 27.4 mm

Permissible vertical deflection in Y = Span / 100
= 17174 / 100
= 171.74 mm

Actual maximum vertical deflection = 27.4 mm ≤ 171.74 mm (**Hence, OK**)



7.1.2. Deflection Check for Tower structure

Horizontal Deflection:-

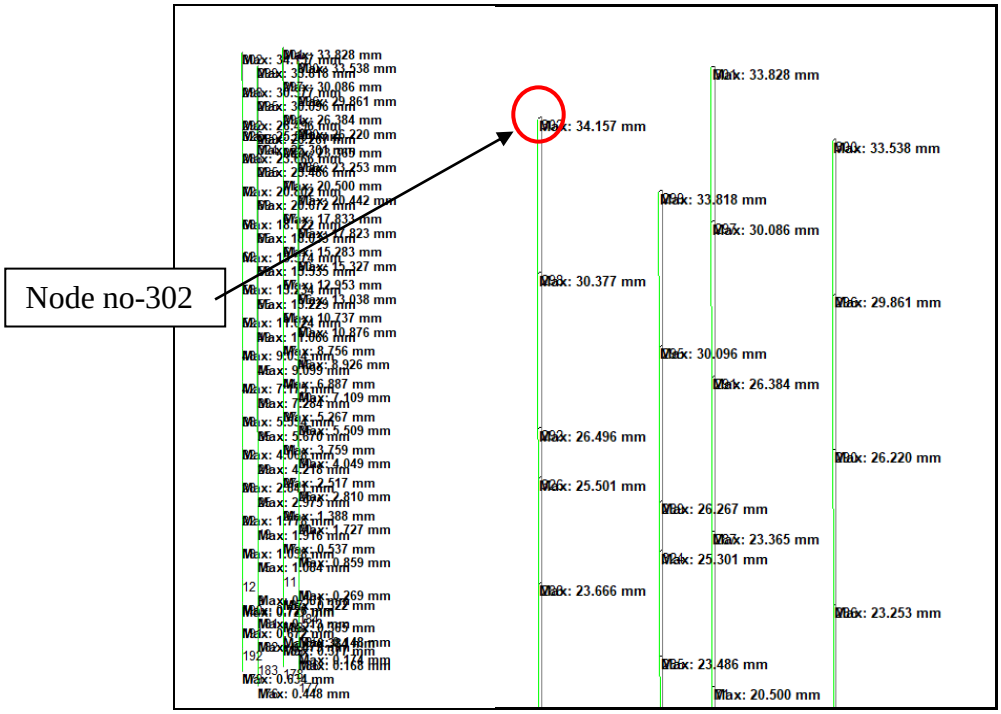
X-Direction:

			Horizontal	Vertical	Horizontal	Resultant	Rotational		
	Node	L/C	X mm	Y mm	Z mm	mm	rX rad	rY rad	rZ rad
Max X	325	206 DL + WL	**14.588**	1.229	-3.387	15.027	0.002	-0.003	0.002
Min X	309	211 DL + LL +	**-39.892**	-56.796	22.576	72.986	0.008	-0.001	0.009
Max Y	433	212 DL + LL +	-28.345	**3.656**	33.565	44.084	0.003	0.001	0.002
Min Y	309	211 DL + LL +	-39.892	**-56.796**	22.576	72.986	0.008	-0.001	0.009
Max Z	310	212 DL + LL +	-22.151	-56.780	**40.250**	73.039	0.009	0.001	0.008
Min Z	309	209 DL + WL-	-20.515	-1.946	**-30.457**	36.773	-0.000	-0.004	0.001
Max rX	310	212 DL + LL +	-22.151	-56.780	40.250	73.039	**0.009**	0.001	0.008
Min rX	285	209 DL + WL-	-4.137	0.423	-9.695	10.550	**-0.001**	-0.002	0.000
Max rY	309	208 DL + WL	8.089	-8.523	27.659	30.051	0.002	**0.003**	0.001
Min rY	309	209 DL + WL-	-20.515	-1.946	-30.457	36.773	-0.000	**-0.004**	0.001
Max rZ	309	211 DL + LL +	-39.892	-56.796	22.576	72.986	0.008	-0.001	**0.009**
Min rZ	288	206 DL + WL	9.892	0.450	0.400	9.910	0.000	-0.002	**-0.001**
Max Rst	310	212 DL + LL +	-22.151	-56.780	40.250	**73.039**	0.009	0.001	0.008

From above displacement summary, Deflection for DL + LL + 0.5 WL-X
Maximum horizontal displacement of structure in X direction = 34.157 mm

Permissible horizontal deflection in X direction = height / 100
= 23500 / 100
= 235 mm

Actual maximum horizontal deflection in X direction= 34.157 mm ≤ 235 mm
(**Hence, OK**)

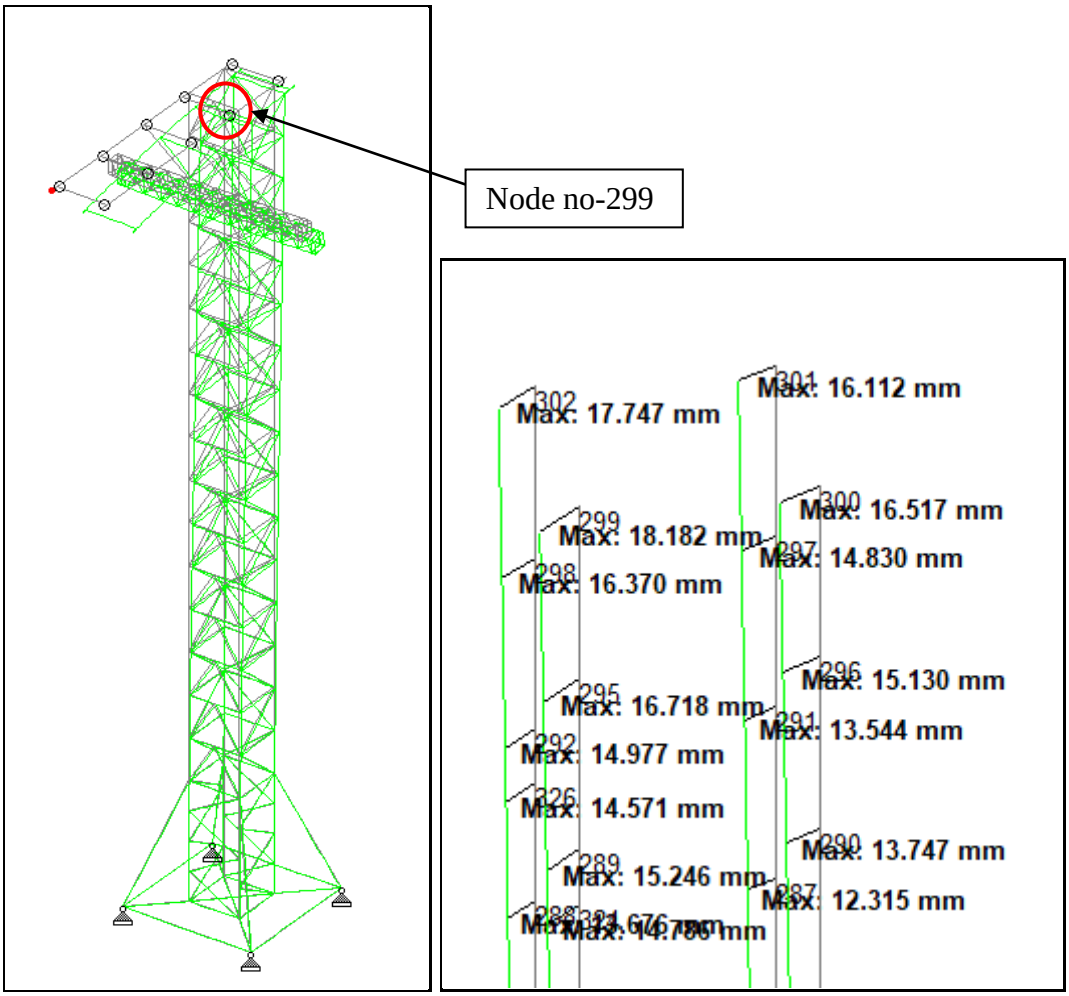


Nodal displacement diagram for Load case DL+LL+0.5 WL-X & Zoom view

Z-Direction:

From above displacement summary, Deflection diagram for DL+ WLZ
Maximum horizontal displacement of structure in Z direction = 18.182 mm

Permissible horizontal deflection in Z = height / 100
= 23500 / 100
= 235 mm
Actual maximum horizontal deflection = 18.182 mm ≤ 235 mm (**Hence, OK**)



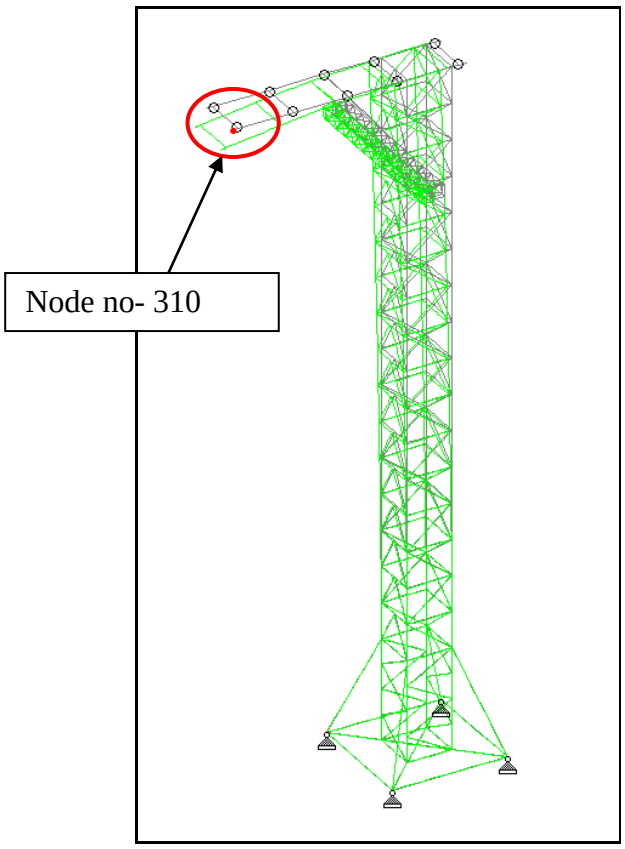
Horizontal deflection (Z-Direction)

Vertical Deflection:-

Y-Direction:

From above displacement summary, Deflection diagram for DL+LL+0.5 WL-X
Maximum vertical displacement of structure in Y direction = 56.796 mm

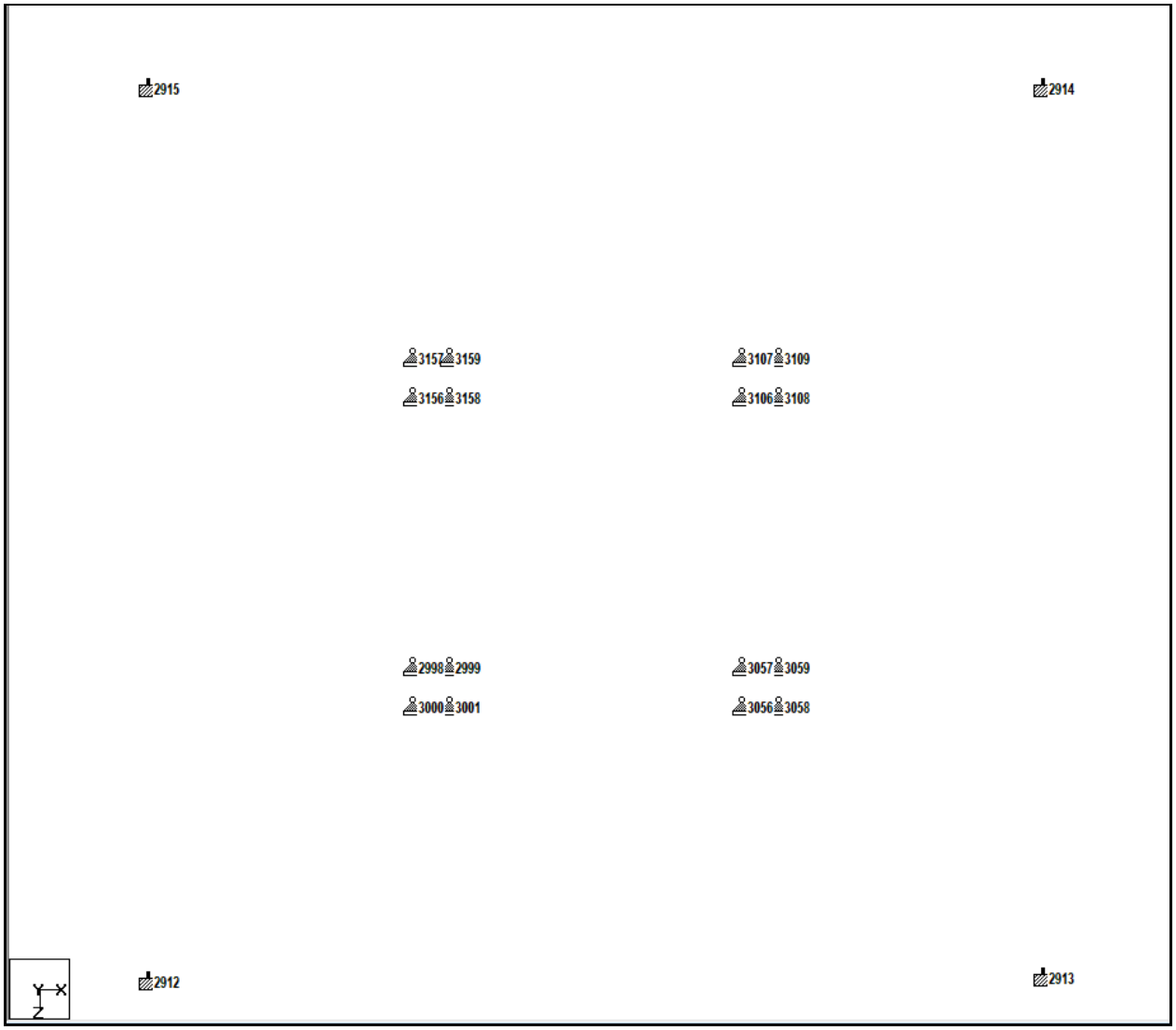
Permissible vertical deflection in Y	= Span / 100	
	= 6000 / 100	
	= 60 mm	
Actual maximum vertical deflection	= 56.796 mm ≤ 60 mm	(**Hence, OK**)



Vertical deflection (Y-Direction)

7.2. Support Reaction

7.2.1. Support Reactions of Center stage structure:



		Horizontal	Vertical	Horizontal
Node	L/C	Fx kN	Fy kN	Fz kN
2912	101 1.35 DL	0	0.309	0
	102 1.35 DL + 1.5 LL	0	0.309	0
	103 1.35 DL + 1.5 LL + 0.9 WLX	-27.787	-36.901	28.738
	104 1.35 DL + 1.5 LL + 0.9 WL-X	0.143	0.309	0
	105 1.35 DL + 1.5 LL + 0.9 WLZ	0	0.309	-0.143
	106 1.35 DL + 1.5 LL + 0.9 WL-Z	-20.857	-27.767	21.826
	107 DL + 1.5 WLX	-47.433	-63.299	49.063
	108 DL + 1.5 WL-X	0.239	0.229	0
	109 DL + 1.5 WLZ	0	0.229	-0.238
	110 DL + 1.5 WL-Z	-36.431	-48.811	38.113
	111 1.35 DL + 1.05 LL + 1.5 WLX	-47.002	-62.638	48.615
	112 1.35 DL + 1.05 LL + 1.5 WL-X	0.239	0.309	0

	113 1.35 DL + 1.05 LL + 1.5 WLZ	0	0.309	-0.238
	114 1.35 DL + 1.05 LL + 1.5 WL-Z	-35.793	-47.871	37.449
	115 1.35 DL + 1.5 WLX	-47.353	-63.111	48.98
	116 1.35 DL + 1.5 WL-X	0.239	0.309	0
	117 1.35 DL + 1.5 WLZ	0	0.309	-0.238
	118 1.35 DL + 1.5 WL-Z	-36.306	-48.563	37.983
	201 DL + 0.5 LL	0	0.229	0
	202 DL + 0.7 LL + 0.5 WLX	-15.424	-20.426	15.952
	203 DL + 0.7 LL + 0.5 WL-X	0.08	0.229	0
	204 DL + 0.7 LL + 0.5 WLZ	0	0.229	-0.079
	205 DL + 0.7 LL + 0.5 WL-Z	-11.563	-15.336	12.101
	206 DL + WLX	-31.546	-42.02	32.63
	207 DL + WL-X	0.159	0.229	0
	208 DL + WLZ	0	0.229	-0.159
	209 DL + WL-Z	-24.169	-32.304	25.285
	210 DL + LL + 0.5 WLX	-15.324	-20.291	15.848
	211 DL + LL + 0.5 WL-X	0.08	0.229	0
	212 DL + LL + 0.5 WLZ	0	0.229	-0.079
	213 DL + LL + 0.5 WL-Z	-11.416	-15.139	11.948
2913	101 1.35 DL	0	0.308	0
	102 1.35 DL + 1.5 LL	0	0.308	0
	103 1.35 DL + 1.5 LL + 0.9 WLX	-0.143	0.308	0
	104 1.35 DL + 1.5 LL + 0.9 WL-X	28.061	-37.272	28.65
	105 1.35 DL + 1.5 LL + 0.9 WLZ	0	0.308	-0.143
	106 1.35 DL + 1.5 LL + 0.9 WL-Z	20.955	-27.899	21.647
	107 DL + 1.5 WLX	-0.238	0.228	0
	108 DL + 1.5 WL-X	47.74	-63.714	48.748
	109 DL + 1.5 WLZ	0	0.228	-0.238
	110 DL + 1.5 WL-Z	36.45	-48.837	37.644
	111 1.35 DL + 1.05 LL + 1.5 WLX	-0.238	0.308	0
	112 1.35 DL + 1.05 LL + 1.5 WL-X	47.376	-63.143	48.374
	113 1.35 DL + 1.05 LL + 1.5 WLZ	0	0.308	-0.238
	114 1.35 DL + 1.05 LL + 1.5 WL-Z	35.877	-47.985	37.055
	115 1.35 DL + 1.5 WLX	-0.238	0.308	0
	116 1.35 DL + 1.5 WL-X	47.653	-63.517	48.658
	117 1.35 DL + 1.5 WLZ	0	0.308	-0.238
	118 1.35 DL + 1.5 WL-Z	36.316	-48.576	37.506
	201 DL + 0.5 LL	0	0.228	0
	202 DL + 0.7 LL + 0.5 WLX	-0.079	0.228	0
	203 DL + 0.7 LL + 0.5 WL-X	15.562	-20.613	15.889
	204 DL + 0.7 LL + 0.5 WLZ	0	0.228	-0.079
	205 DL + 0.7 LL + 0.5 WL-Z	11.601	-15.388	11.985
	206 DL + WLX	-0.159	0.228	0
	207 DL + WL-X	31.744	-42.288	32.413
	208 DL + WLZ	0	0.228	-0.159

	209 DL + WL-Z	24.172	-32.31	24.964
	210 DL + LL + 0.5 WLX	-0.079	0.228	0
	211 DL + LL + 0.5 WL-X	15.483	-20.507	15.808
	212 DL + LL + 0.5 WLZ	0	0.228	-0.079
	213 DL + LL + 0.5 WL-Z	11.476	-15.219	11.856
2914	101 1.35 DL	0	0.308	0
	102 1.35 DL + 1.5 LL	0	0.308	0
	103 1.35 DL + 1.5 LL + 0.9 WLX	-0.143	0.308	0
	104 1.35 DL + 1.5 LL + 0.9 WL-X	27.766	-36.876	-28.348
	105 1.35 DL + 1.5 LL + 0.9 WLZ	20.864	-27.776	-21.553
	106 1.35 DL + 1.5 LL + 0.9 WL-Z	0	0.308	0.143
	107 DL + 1.5 WLX	-0.238	0.228	0
	108 DL + 1.5 WL-X	47.224	-63.018	-48.218
	109 DL + 1.5 WLZ	36.328	-48.673	-37.518
	110 DL + 1.5 WL-Z	0	0.228	0.238
	111 1.35 DL + 1.05 LL + 1.5 WLX	-0.238	0.308	0
	112 1.35 DL + 1.05 LL + 1.5 WL-X	46.886	-62.484	-47.871
	113 1.35 DL + 1.05 LL + 1.5 WLZ	35.758	-47.826	-36.934
	114 1.35 DL + 1.05 LL + 1.5 WL-Z	0	0.308	0.238
	115 1.35 DL + 1.5 WLX	-0.238	0.308	0
	116 1.35 DL + 1.5 WL-X	47.104	-62.777	-48.095
	117 1.35 DL + 1.5 WLZ	36.161	-48.368	-37.347
	118 1.35 DL + 1.5 WL-Z	0	0.308	0.238
	201 DL + 0.5 LL	0	0.228	0
	202 DL + 0.7 LL + 0.5 WLX	-0.079	0.228	0
	203 DL + 0.7 LL + 0.5 WL-X	15.368	-20.352	-15.689
	204 DL + 0.7 LL + 0.5 WLZ	11.522	-15.282	-11.904
	205 DL + 0.7 LL + 0.5 WL-Z	0	0.228	0.079
	206 DL + WLX	-0.159	0.228	0
	207 DL + WL-X	31.368	-41.783	-32.028
	208 DL + WLZ	24.059	-32.158	-24.849
	209 DL + WL-Z	0	0.228	0.159
	210 DL + LL + 0.5 WLX	-0.079	0.228	0
	211 DL + LL + 0.5 WL-X	15.306	-20.268	-15.625
	212 DL + LL + 0.5 WLZ	11.408	-15.128	-11.786
	213 DL + LL + 0.5 WL-Z	0	0.228	0.079
2915	101 1.35 DL	0	0.308	0
	102 1.35 DL + 1.5 LL	0	0.308	0
	103 1.35 DL + 1.5 LL + 0.9 WLX	-27.746	-36.848	-28.326
	104 1.35 DL + 1.5 LL + 0.9 WL-X	0.143	0.308	0
	105 1.35 DL + 1.5 LL + 0.9 WLZ	-20.772	-27.654	-21.46
	106 1.35 DL + 1.5 LL + 0.9 WL-Z	0	0.308	0.143
	107 DL + 1.5 WLX	-47.527	-63.427	-48.529
	108 DL + 1.5 WL-X	0.238	0.228	0
	109 DL + 1.5 WLZ	-36.454	-48.842	-37.648

	110 DL + 1.5 WL-Z	0	0.228	0.238
	111 1.35 DL + 1.05 LL + 1.5 WLX	-47.029	-62.677	-48.018
	112 1.35 DL + 1.05 LL + 1.5 WL-X	0.238	0.308	0
	113 1.35 DL + 1.05 LL + 1.5 WLZ	-35.753	-47.819	-36.928
	114 1.35 DL + 1.05 LL + 1.5 WL-Z	0	0.308	0.238
	115 1.35 DL + 1.5 WLX	-47.444	-63.235	-48.444
	116 1.35 DL + 1.5 WL-X	0.238	0.308	0
	117 1.35 DL + 1.5 WLZ	-36.316	-48.577	-37.506
	118 1.35 DL + 1.5 WL-Z	0	0.308	0.238
	201 DL + 0.5 LL	0	0.228	0
	202 DL + 0.7 LL + 0.5 WLX	-15.407	-20.404	-15.73
	203 DL + 0.7 LL + 0.5 WL-X	0.079	0.228	0
	204 DL + 0.7 LL + 0.5 WLZ	-11.513	-15.27	-11.895
	205 DL + 0.7 LL + 0.5 WL-Z	0	0.228	0.079
	206 DL + WLX	-31.605	-42.102	-32.271
	207 DL + WL-X	0.159	0.228	0
	208 DL + WLZ	-24.171	-32.309	-24.964
	209 DL + WL-Z	0	0.228	0.159
	210 DL + LL + 0.5 WLX	-15.289	-20.245	-15.608
	211 DL + LL + 0.5 WL-X	0.079	0.228	0
	212 DL + LL + 0.5 WLZ	-11.352	-15.053	-11.729
	213 DL + LL + 0.5 WL-Z	0	0.228	0.079
2998	101 1.35 DL	-0.062	20.163	0.113
	102 1.35 DL + 1.5 LL	-0.219	57.115	1.091
	103 1.35 DL + 1.5 LL + 0.9 WLX	-2.284	51.253	0.821
	104 1.35 DL + 1.5 LL + 0.9 WL-X	1.836	71.394	1.404
	105 1.35 DL + 1.5 LL + 0.9 WLZ	-1.028	41.881	-1.074
	106 1.35 DL + 1.5 LL + 0.9 WL-Z	0.586	78.76	3.292
	107 DL + 1.5 WLX	-3.334	7.424	-0.337
	108 DL + 1.5 WL-X	3.259	37.293	0.59
	109 DL + 1.5 WLZ	-1.297	-8.16	-3.312
	110 DL + 1.5 WL-Z	1.229	49.69	3.557
	111 1.35 DL + 1.05 LL + 1.5 WLX	-3.52	37.644	0.366
	112 1.35 DL + 1.05 LL + 1.5 WL-X	3.177	68.924	1.31
	113 1.35 DL + 1.05 LL + 1.5 WLZ	-1.461	22.051	-2.678
	114 1.35 DL + 1.05 LL + 1.5 WL-Z	1.128	81.276	4.345
	115 1.35 DL + 1.5 WLX	-3.361	12.502	-0.309
	116 1.35 DL + 1.5 WL-X	3.255	42.657	0.618
	117 1.35 DL + 1.5 WLZ	-1.319	-3.095	-3.301
	118 1.35 DL + 1.5 WL-Z	1.22	55.042	3.602
	201 DL + 0.5 LL	-0.098	27.253	0.41
	202 DL + 0.7 LL + 0.5 WLX	-1.268	28.908	0.39
	203 DL + 0.7 LL + 0.5 WL-X	1.027	40.159	0.713
	204 DL + 0.7 LL + 0.5 WLZ	-0.568	23.692	-0.668
	205 DL + 0.7 LL + 0.5 WL-Z	0.331	44.247	1.767

	206 DL + WLX	-2.248	9.786	-0.198
	207 DL + WL-X	2.169	29.97	0.42
	208 DL + WLZ	-0.885	-0.616	-2.198
	209 DL + WL-Z	0.81	38.224	2.414
	210 DL + LL + 0.5 WLX	-1.313	36.092	0.583
	211 DL + LL + 0.5 WL-X	1.005	47.664	0.91
	212 DL + LL + 0.5 WLZ	-0.609	30.876	-0.49
	213 DL + LL + 0.5 WL-Z	0.304	51.743	1.979
2999	101 1.35 DL	-0.543	19.242	-0.372
	102 1.35 DL + 1.5 LL	-2.021	55.492	-0.302
	103 1.35 DL + 1.5 LL + 0.9 WLX	-4.198	74.861	-0.353
	104 1.35 DL + 1.5 LL + 0.9 WL-X	-0.037	43.992	-0.495
	105 1.35 DL + 1.5 LL + 0.9 WLZ	-1.315	41.272	-2.506
	106 1.35 DL + 1.5 LL + 0.9 WL-Z	-2.871	75.645	1.719
	107 DL + 1.5 WLX	-3.896	45.425	-0.378
	108 DL + 1.5 WL-X	2.787	-3.689	-0.583
	109 DL + 1.5 WLZ	0.719	-7.599	-3.729
	110 DL + 1.5 WL-Z	-1.754	46.331	2.871
	111 1.35 DL + 1.05 LL + 1.5 WLX	-5.123	76.215	-0.419
	112 1.35 DL + 1.05 LL + 1.5 WL-X	1.654	26.235	-0.635
	113 1.35 DL + 1.05 LL + 1.5 WLZ	-0.437	22.085	-3.859
	114 1.35 DL + 1.05 LL + 1.5 WL-Z	-2.955	77.275	2.908
	115 1.35 DL + 1.5 WLX	-4.046	50.494	-0.473
	116 1.35 DL + 1.5 WL-X	2.659	1.153	-0.683
	117 1.35 DL + 1.5 WLZ	0.586	-2.803	-3.845
	118 1.35 DL + 1.5 WL-Z	-1.899	51.429	2.792
	201 DL + 0.5 LL	-0.895	26.337	-0.252
	202 DL + 0.7 LL + 0.5 WLX	-2.303	41.944	-0.271
	203 DL + 0.7 LL + 0.5 WL-X	0.016	24.713	-0.353
	204 DL + 0.7 LL + 0.5 WLZ	-0.695	23.194	-1.473
	205 DL + 0.7 LL + 0.5 WL-Z	-1.564	42.384	0.884
	206 DL + WLX	-2.74	35.111	-0.342
	207 DL + WL-X	1.736	2.152	-0.484
	208 DL + WLZ	0.353	-0.499	-2.597
	209 DL + WL-Z	-1.307	35.743	1.839
	210 DL + LL + 0.5 WLX	-2.61	49.293	-0.255
	211 DL + LL + 0.5 WL-X	-0.272	31.88	-0.339
	212 DL + LL + 0.5 WLZ	-0.988	30.305	-1.477
	213 DL + LL + 0.5 WL-Z	-1.866	49.769	0.917
3000	101 1.35 DL	0.943	23.278	-0.127
	102 1.35 DL + 1.5 LL	2.227	55.739	0.488
	103 1.35 DL + 1.5 LL + 0.9 WLX	0.746	53.153	0.621
	104 1.35 DL + 1.5 LL + 0.9 WL-X	4.217	69.474	0.28
	105 1.35 DL + 1.5 LL + 0.9 WLZ	3.061	73.252	-1.691
	106 1.35 DL + 1.5 LL + 0.9 WL-Z	1.78	46.639	2.613

	107 DL + 1.5 WLX	-1.599	15.173	0.119
	108 DL + 1.5 WL-X	3.89	38.608	-0.429
	109 DL + 1.5 WLZ	2.01	44.086	-3.512
	110 DL + 1.5 WL-Z	0.082	5.271	3.241
	111 1.35 DL + 1.05 LL + 1.5 WLX	-0.522	43.07	0.52
	112 1.35 DL + 1.05 LL + 1.5 WL-X	5.079	67.914	-0.035
	113 1.35 DL + 1.05 LL + 1.5 WLZ	3.181	73.706	-3.195
	114 1.35 DL + 1.05 LL + 1.5 WL-Z	1.176	32.804	3.717
	115 1.35 DL + 1.5 WLX	-1.367	21.047	0.087
	116 1.35 DL + 1.5 WL-X	4.149	44.828	-0.465
	117 1.35 DL + 1.5 WLZ	2.264	50.367	-3.564
	118 1.35 DL + 1.5 WL-Z	0.318	11.072	3.224
	201 DL + 0.5 LL	1.127	28.063	0.111
	202 DL + 0.7 LL + 0.5 WLX	0.473	30.929	0.267
	203 DL + 0.7 LL + 0.5 WL-X	2.409	40.108	0.075
	204 DL + 0.7 LL + 0.5 WLZ	1.766	42.218	-1.024
	205 DL + 0.7 LL + 0.5 WL-Z	1.048	27.294	1.377
	206 DL + WLX	-0.845	15.71	0.049
	207 DL + WL-X	2.84	31.662	-0.32
	208 DL + WLZ	1.582	35.372	-2.391
	209 DL + WL-Z	0.279	9.039	2.145
	210 DL + LL + 0.5 WLX	0.715	37.221	0.391
	211 DL + LL + 0.5 WL-X	2.675	46.704	0.198
	212 DL + LL + 0.5 WLZ	2.028	48.887	-0.918
	213 DL + LL + 0.5 WL-Z	1.293	33.503	1.518
3001	101 1.35 DL	0.122	22.362	-0.566
	102 1.35 DL + 1.5 LL	0.577	54.602	-0.849
	103 1.35 DL + 1.5 LL + 0.9 WLX	-1.31	76.815	-1.476
	104 1.35 DL + 1.5 LL + 0.9 WL-X	2.571	42.38	-0.544
	105 1.35 DL + 1.5 LL + 0.9 WLZ	-0.208	73.142	-3.074
	106 1.35 DL + 1.5 LL + 0.9 WL-Z	1.447	43.537	1.135
	107 DL + 1.5 WLX	-2.898	52.396	-1.454
	108 DL + 1.5 WL-X	3.295	-2.642	0.08
	109 DL + 1.5 WLZ	-1.126	44.665	-3.902
	110 DL + 1.5 WL-Z	1.487	1.088	2.661
	111 1.35 DL + 1.05 LL + 1.5 WLX	-2.608	81.225	-1.803
	112 1.35 DL + 1.05 LL + 1.5 WL-X	3.689	25.286	-0.261
	113 1.35 DL + 1.05 LL + 1.5 WLZ	-0.812	74.099	-4.332
	114 1.35 DL + 1.05 LL + 1.5 WL-Z	1.857	28.332	2.402
	115 1.35 DL + 1.5 WLX	-2.877	58.266	-1.601
	116 1.35 DL + 1.5 WL-X	3.339	3.054	-0.068
	117 1.35 DL + 1.5 WLZ	-1.1	50.677	-4.068
	118 1.35 DL + 1.5 WL-Z	1.524	6.637	2.533
	201 DL + 0.5 LL	0.242	27.311	-0.514
	202 DL + 0.7 LL + 0.5 WLX	-0.747	43.953	-0.899

	203 DL + 0.7 LL + 0.5 WL-X	1.415	24.79	-0.383
	204 DL + 0.7 LL + 0.5 WLZ	-0.133	41.955	-1.793
	205 DL + 0.7 LL + 0.5 WL-Z	0.788	25.396	0.555
	206 DL + WLX	-1.912	40.521	-1.109
	207 DL + WL-X	2.238	3.664	-0.087
	208 DL + WLZ	-0.726	35.502	-2.76
	209 DL + WL-Z	1.027	6.011	1.652
	210 DL + LL + 0.5 WLX	-0.67	50.512	-0.957
	211 DL + LL + 0.5 WL-X	1.515	31.142	-0.439
	212 DL + LL + 0.5 WLZ	-0.051	48.647	-1.868
	213 DL + LL + 0.5 WL-Z	0.883	31.595	0.518
3056	101 1.35 DL	-0.09	22.191	-0.585
	102 1.35 DL + 1.5 LL	-0.624	48.595	-0.562
	103 1.35 DL + 1.5 LL + 0.9 WLX	-2.633	36.304	-0.282
	104 1.35 DL + 1.5 LL + 0.9 WL-X	1.188	70.107	-1.143
	105 1.35 DL + 1.5 LL + 0.9 WLZ	0.138	66.821	-2.775
	106 1.35 DL + 1.5 LL + 0.9 WL-Z	-1.532	37.234	1.432
	107 DL + 1.5 WLX	-3.273	-2.741	0.034
	108 DL + 1.5 WL-X	2.832	51.502	-1.408
	109 DL + 1.5 WLZ	1.144	44.393	-3.906
	110 DL + 1.5 WL-Z	-1.51	0.536	2.668
	111 1.35 DL + 1.05 LL + 1.5 WLX	-3.725	20.993	-0.102
	112 1.35 DL + 1.05 LL + 1.5 WL-X	2.479	76.009	-1.54
	113 1.35 DL + 1.05 LL + 1.5 WLZ	0.767	69.519	-4.122
	114 1.35 DL + 1.05 LL + 1.5 WL-Z	-1.935	23.618	2.616
	115 1.35 DL + 1.5 WLX	-3.306	2.918	-0.118
	116 1.35 DL + 1.5 WL-X	2.823	57.377	-1.562
	117 1.35 DL + 1.5 WLZ	1.129	50.401	-4.078
	118 1.35 DL + 1.5 WL-Z	-1.538	6.05	2.534
	201 DL + 0.5 LL	-0.245	25.239	-0.425
	202 DL + 0.7 LL + 0.5 WLX	-1.433	21.916	-0.267
	203 DL + 0.7 LL + 0.5 WL-X	0.697	40.779	-0.748
	204 DL + 0.7 LL + 0.5 WLZ	0.112	38.987	-1.659
	205 DL + 0.7 LL + 0.5 WL-Z	-0.821	22.394	0.69
	206 DL + WLX	-2.214	3.562	-0.122
	207 DL + WL-X	1.879	39.93	-1.085
	208 DL + WLZ	0.748	35.318	-2.767
	209 DL + WL-Z	-1.033	5.609	1.651
	210 DL + LL + 0.5 WLX	-1.553	27.08	-0.262
	211 DL + LL + 0.5 WL-X	0.599	46.102	-0.742
	212 DL + LL + 0.5 WLZ	0.009	44.449	-1.671
	213 DL + LL + 0.5 WL-Z	-0.934	27.413	0.713
3057	101 1.35 DL	0.521	18.837	-0.392
	102 1.35 DL + 1.5 LL	1.939	52.375	-0.06
	103 1.35 DL + 1.5 LL + 0.9 WLX	-0.03	40.679	-0.278

	104 1.35 DL + 1.5 LL + 0.9 WL-X	4.074	71.671	-0.077
	105 1.35 DL + 1.5 LL + 0.9 WLZ	1.226	38.09	-2.255
	106 1.35 DL + 1.5 LL + 0.9 WL-Z	2.781	72.457	1.966
	107 DL + 1.5 WLX	-2.752	-3.939	-0.625
	108 DL + 1.5 WL-X	3.837	45.157	-0.346
	109 DL + 1.5 WLZ	-0.717	-7.737	-3.733
	110 DL + 1.5 WL-Z	1.742	46.106	2.872
	111 1.35 DL + 1.05 LL + 1.5 WLX	-1.68	23.802	-0.506
	112 1.35 DL + 1.05 LL + 1.5 WL-X	5.004	73.878	-0.204
	113 1.35 DL + 1.05 LL + 1.5 WLZ	0.377	19.815	-3.683
	114 1.35 DL + 1.05 LL + 1.5 WL-Z	2.887	74.959	3.084
	115 1.35 DL + 1.5 WLX	-2.627	0.839	-0.729
	116 1.35 DL + 1.5 WL-X	3.983	50.123	-0.447
	117 1.35 DL + 1.5 WLZ	-0.587	-3.018	-3.854
	118 1.35 DL + 1.5 WL-Z	1.883	51.111	2.789
	201 DL + 0.5 LL	0.859	25.133	-0.18
	202 DL + 0.7 LL + 0.5 WLX	-0.047	23.097	-0.257
	203 DL + 0.7 LL + 0.5 WL-X	2.238	40.348	-0.147
	204 DL + 0.7 LL + 0.5 WLZ	0.652	21.633	-1.361
	205 DL + 0.7 LL + 0.5 WL-Z	1.518	40.8	0.995
	206 DL + WLX	-1.715	1.925	-0.515
	207 DL + WL-X	2.697	34.834	-0.327
	208 DL + WLZ	-0.354	-0.663	-2.604
	209 DL + WL-Z	1.295	35.504	1.835
	210 DL + LL + 0.5 WLX	0.223	29.658	-0.193
	211 DL + LL + 0.5 WL-X	2.53	47.135	-0.077
	212 DL + LL + 0.5 WLZ	0.927	28.156	-1.312
	213 DL + LL + 0.5 WL-Z	1.805	47.614	1.079
3058	101 1.35 DL	-0.922	23.149	-0.161
	102 1.35 DL + 1.5 LL	-1.985	50.005	0.669
	103 1.35 DL + 1.5 LL + 0.9 WLX	-4	63.963	0.457
	104 1.35 DL + 1.5 LL + 0.9 WL-X	-0.552	47.669	0.836
	105 1.35 DL + 1.5 LL + 0.9 WLZ	-2.833	67.597	-1.498
	106 1.35 DL + 1.5 LL + 0.9 WL-Z	-1.567	41.022	2.81
	107 DL + 1.5 WLX	-3.884	38.402	-0.447
	108 DL + 1.5 WL-X	1.563	15.187	0.142
	109 DL + 1.5 WLZ	-1.989	43.77	-3.52
	110 DL + 1.5 WL-Z	-0.093	5.022	3.248
	111 1.35 DL + 1.05 LL + 1.5 WLX	-4.928	63.98	0.082
	112 1.35 DL + 1.05 LL + 1.5 WL-X	0.633	39.261	0.689
	113 1.35 DL + 1.05 LL + 1.5 WLZ	-3.014	69.599	-3.06
	114 1.35 DL + 1.05 LL + 1.5 WL-Z	-1.037	28.755	3.864
	115 1.35 DL + 1.5 WLX	-4.134	44.536	-0.49
	116 1.35 DL + 1.5 WL-X	1.338	21.02	0.1
	117 1.35 DL + 1.5 WLZ	-2.235	49.98	-3.581

	118 1.35 DL + 1.5 WL-Z	-0.321	10.767	3.223
	201 DL + 0.5 LL	-1.037	26.1	0.157
	202 DL + 0.7 LL + 0.5 WLX	-2.299	37.447	0.151
	203 DL + 0.7 LL + 0.5 WL-X	-0.378	28.332	0.359
	204 DL + 0.7 LL + 0.5 WLZ	-1.651	39.499	-0.942
	205 DL + 0.7 LL + 0.5 WL-Z	-0.943	24.61	1.462
	206 DL + WLX	-2.827	31.443	-0.339
	207 DL + WL-X	0.827	15.68	0.054
	208 DL + WLZ	-1.56	35.094	-2.405
	209 DL + WL-Z	-0.28	8.82	2.142
	210 DL + LL + 0.5 WLX	-2.526	43.002	0.314
	211 DL + LL + 0.5 WL-X	-0.58	33.544	0.528
	212 DL + LL + 0.5 WLZ	-1.873	45.104	-0.793
	213 DL + LL + 0.5 WL-Z	-1.148	29.749	1.645
3059	101 1.35 DL	0.069	19.778	0.074
	102 1.35 DL + 1.5 LL	0.123	54.332	1.226
	103 1.35 DL + 1.5 LL + 0.9 WLX	-1.909	68.696	1.535
	104 1.35 DL + 1.5 LL + 0.9 WL-X	2.114	49.349	1.004
	105 1.35 DL + 1.5 LL + 0.9 WLZ	0.916	39.423	-0.924
	106 1.35 DL + 1.5 LL + 0.9 WL-Z	-0.701	76.316	3.448
	107 DL + 1.5 WLX	-3.194	36.911	0.563
	108 DL + 1.5 WL-X	3.254	8.063	-0.303
	109 DL + 1.5 WLZ	1.31	-8.353	-3.324
	110 DL + 1.5 WL-Z	-1.239	49.757	3.565
	111 1.35 DL + 1.05 LL + 1.5 WLX	-3.192	66.872	1.391
	112 1.35 DL + 1.05 LL + 1.5 WL-X	3.352	36.758	0.519
	113 1.35 DL + 1.05 LL + 1.5 WLZ	1.387	20.293	-2.575
	114 1.35 DL + 1.05 LL + 1.5 WL-Z	-1.215	79.663	4.464
	115 1.35 DL + 1.5 WLX	-3.185	42.157	0.583
	116 1.35 DL + 1.5 WL-X	3.285	12.987	-0.287
	117 1.35 DL + 1.5 WLZ	1.337	-3.435	-3.324
	118 1.35 DL + 1.5 WL-Z	-1.226	54.991	3.6
	201 DL + 0.5 LL	0.069	26.168	0.439
	202 DL + 0.7 LL + 0.5 WLX	-1.054	38.773	0.765
	203 DL + 0.7 LL + 0.5 WL-X	1.188	27.915	0.466
	204 DL + 0.7 LL + 0.5 WLZ	0.522	22.401	-0.609
	205 DL + 0.7 LL + 0.5 WL-Z	-0.382	43.004	1.83
	206 DL + WLX	-2.121	29.604	0.394
	207 DL + WL-X	2.199	10.065	-0.187
	208 DL + WLZ	0.899	-0.885	-2.216
	209 DL + WL-Z	-0.814	38.156	2.41
	210 DL + LL + 0.5 WLX	-1.056	45.834	0.996
	211 DL + LL + 0.5 WL-X	1.207	34.706	0.696
	212 DL + LL + 0.5 WLZ	0.536	29.181	-0.395
	213 DL + LL + 0.5 WL-Z	-0.379	50.053	2.077

3106	101 1.35 DL	-0.302	18.01	-0.031
	102 1.35 DL + 1.5 LL	-0.321	53.743	-1.199
	103 1.35 DL + 1.5 LL + 0.9 WLX	-2.357	42.781	-0.974
	104 1.35 DL + 1.5 LL + 0.9 WL-X	1.443	72.825	-1.504
	105 1.35 DL + 1.5 LL + 0.9 WLZ	0.26	74.708	-3.389
	106 1.35 DL + 1.5 LL + 0.9 WL-Z	-1.109	38.856	0.938
	107 DL + 1.5 WLX	-3.472	-3.568	0.346
	108 DL + 1.5 WL-X	2.591	44.296	-0.526
	109 DL + 1.5 WLZ	0.67	46.883	-3.473
	110 DL + 1.5 WL-Z	-1.453	-9.462	3.341
	111 1.35 DL + 1.05 LL + 1.5 WLX	-3.62	25.591	-0.477
	112 1.35 DL + 1.05 LL + 1.5 WL-X	2.544	74.278	-1.352
	113 1.35 DL + 1.05 LL + 1.5 WLZ	0.605	77.074	-4.373
	114 1.35 DL + 1.05 LL + 1.5 WL-Z	-1.577	19.453	2.59
	115 1.35 DL + 1.5 WLX	-3.56	1.005	0.339
	116 1.35 DL + 1.5 WL-X	2.527	49.078	-0.538
	117 1.35 DL + 1.5 WLZ	0.602	51.711	-3.5
	118 1.35 DL + 1.5 WL-Z	-1.537	-4.947	3.349
	201 DL + 0.5 LL	-0.23	25.252	-0.412
	202 DL + 0.7 LL + 0.5 WLX	-1.365	23.912	-0.443
	203 DL + 0.7 LL + 0.5 WL-X	0.754	40.674	-0.74
	204 DL + 0.7 LL + 0.5 WLZ	0.096	41.733	-1.791
	205 DL + 0.7 LL + 0.5 WL-Z	-0.671	21.714	0.623
	206 DL + WLX	-2.399	1.977	0.224
	207 DL + WL-X	1.667	34.085	-0.362
	208 DL + WLZ	0.382	35.853	-2.341
	209 DL + WL-Z	-1.049	-2.008	2.235
	210 DL + LL + 0.5 WLX	-1.382	30.936	-0.676
	211 DL + LL + 0.5 WL-X	0.759	47.874	-0.973
	212 DL + LL + 0.5 WLZ	0.097	48.979	-2.041
	213 DL + LL + 0.5 WL-Z	-0.682	28.685	0.406
3107	101 1.35 DL	0.676	21.429	0.152
	102 1.35 DL + 1.5 LL	1.763	49.877	-0.678
	103 1.35 DL + 1.5 LL + 0.9 WLX	0.091	39.828	-0.923
	104 1.35 DL + 1.5 LL + 0.9 WL-X	3.658	68.3	-0.451
	105 1.35 DL + 1.5 LL + 0.9 WLZ	1.088	38.817	-2.838
	106 1.35 DL + 1.5 LL + 0.9 WL-Z	2.611	67.355	1.475
	107 DL + 1.5 WLX	-2.141	0.78	-0.272
	108 DL + 1.5 WL-X	3.557	45.628	0.476
	109 DL + 1.5 WLZ	-0.502	0.608	-3.276
	110 DL + 1.5 WL-Z	1.835	42.736	3.504
	111 1.35 DL + 1.05 LL + 1.5 WLX	-1.26	25.608	-0.823
	112 1.35 DL + 1.05 LL + 1.5 WL-X	4.531	71.462	-0.059
	113 1.35 DL + 1.05 LL + 1.5 WLZ	0.387	24.878	-3.897
	114 1.35 DL + 1.05 LL + 1.5 WL-Z	2.8	69.058	3.037

	115 1.35 DL + 1.5 WLX	-1.975	6.228	-0.234
	116 1.35 DL + 1.5 WL-X	3.742	51.252	0.514
	117 1.35 DL + 1.5 WLZ	-0.334	5.901	-3.256
	118 1.35 DL + 1.5 WL-Z	2.018	48.491	3.56
	201 DL + 0.5 LL	0.863	25.356	-0.164
	202 DL + 0.7 LL + 0.5 WLX	0.078	23.558	-0.411
	203 DL + 0.7 LL + 0.5 WL-X	2.065	39.395	-0.15
	204 DL + 0.7 LL + 0.5 WLZ	0.632	22.936	-1.481
	205 DL + 0.7 LL + 0.5 WL-Z	1.482	38.918	0.926
	206 DL + WLX	-1.269	5.709	-0.145
	207 DL + WL-X	2.548	35.775	0.354
	208 DL + WLZ	-0.175	5.446	-2.165
	209 DL + WL-Z	1.398	33.972	2.389
	210 DL + LL + 0.5 WLX	0.283	29.095	-0.579
	211 DL + LL + 0.5 WL-X	2.29	45.169	-0.314
	212 DL + LL + 0.5 WLZ	0.838	28.358	-1.664
	213 DL + LL + 0.5 WL-Z	1.705	44.795	0.777
3108	101 1.35 DL	-0.733	19.545	0.372
	102 1.35 DL + 1.5 LL	-2.15	54.244	0.054
	103 1.35 DL + 1.5 LL + 0.9 WLX	-4.17	66.438	-0.038
	104 1.35 DL + 1.5 LL + 0.9 WL-X	-0.653	51.908	0.242
	105 1.35 DL + 1.5 LL + 0.9 WLZ	-3.251	75.793	-2.053
	106 1.35 DL + 1.5 LL + 0.9 WL-Z	-1.44	40.059	2.24
	107 DL + 1.5 WLX	-3.751	32.84	0.146
	108 DL + 1.5 WL-X	1.812	12.42	0.579
	109 DL + 1.5 WLZ	-2.317	48.754	-3.013
	110 DL + 1.5 WL-Z	0.584	-7.427	3.716
	111 1.35 DL + 1.05 LL + 1.5 WLX	-4.994	62.956	0.01
	112 1.35 DL + 1.05 LL + 1.5 WL-X	0.682	41.097	0.458
	113 1.35 DL + 1.05 LL + 1.5 WLZ	-3.524	78.749	-3.222
	114 1.35 DL + 1.05 LL + 1.5 WL-Z	-0.577	21.279	3.667
	115 1.35 DL + 1.5 WLX	-3.952	38.036	0.241
	116 1.35 DL + 1.5 WL-X	1.637	17.306	0.674
	117 1.35 DL + 1.5 WLZ	-2.509	53.92	-2.937
	118 1.35 DL + 1.5 WL-Z	0.4	-2.518	3.829
	201 DL + 0.5 LL	-1.015	26.044	0.17
	202 DL + 0.7 LL + 0.5 WLX	-2.327	37.458	0.076
	203 DL + 0.7 LL + 0.5 WL-X	-0.367	29.307	0.23
	204 DL + 0.7 LL + 0.5 WLZ	-1.814	42.644	-1.05
	205 DL + 0.7 LL + 0.5 WL-Z	-0.807	22.739	1.346
	206 DL + WLX	-2.692	26.842	0.188
	207 DL + WL-X	1.041	12.933	0.476
	208 DL + WLZ	-1.727	37.422	-1.936
	209 DL + WL-Z	0.214	-0.277	2.585
	210 DL + LL + 0.5 WLX	-2.625	44.578	0.01

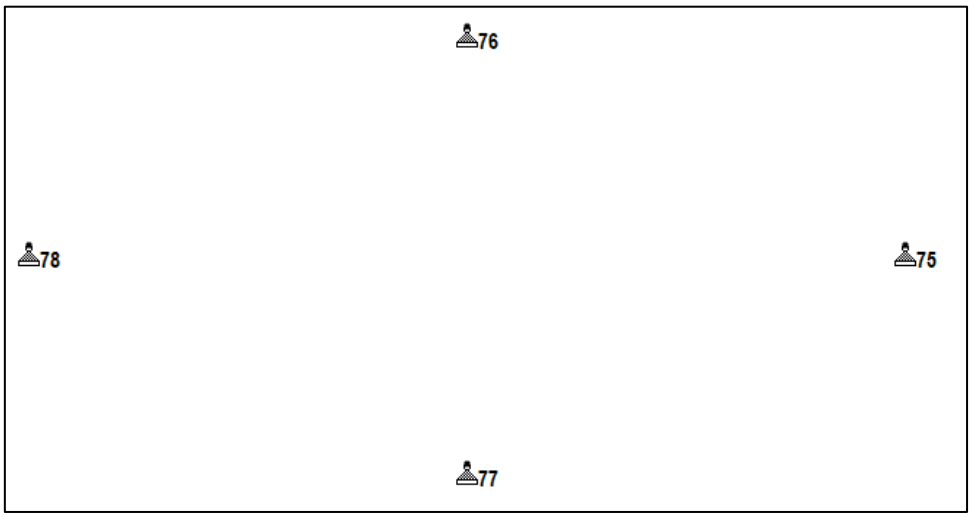
	211 DL + LL + 0.5 WL-X	-0.64	36.104	0.168
	212 DL + LL + 0.5 WLZ	-2.104	49.738	-1.131
	213 DL + LL + 0.5 WL-Z	-1.086	29.539	1.299
3109	101 1.35 DL	-0.147	23.03	0.607
	102 1.35 DL + 1.5 LL	0.367	50.444	0.608
	103 1.35 DL + 1.5 LL + 0.9 WLX	-1.39	63.695	1.009
	104 1.35 DL + 1.5 LL + 0.9 WL-X	2.02	47.966	0.434
	105 1.35 DL + 1.5 LL + 0.9 WLZ	1.039	40.493	-1.417
	106 1.35 DL + 1.5 LL + 0.9 WL-Z	-0.385	68.598	2.811
	107 DL + 1.5 WLX	-2.896	37.434	1.108
	108 DL + 1.5 WL-X	2.528	14.715	0.179
	109 DL + 1.5 WLZ	0.949	3.431	-2.698
	110 DL + 1.5 WL-Z	-1.285	44.777	3.914
	111 1.35 DL + 1.05 LL + 1.5 WLX	-2.629	63.253	1.27
	112 1.35 DL + 1.05 LL + 1.5 WL-X	2.892	39.242	0.331
	113 1.35 DL + 1.05 LL + 1.5 WLZ	1.292	27.513	-2.625
	114 1.35 DL + 1.05 LL + 1.5 WL-Z	-0.994	70.907	4.15
	115 1.35 DL + 1.5 WLX	-2.943	43.525	1.267
	116 1.35 DL + 1.5 WL-X	2.504	20.453	0.331
	117 1.35 DL + 1.5 WLZ	0.921	9.074	-2.562
	118 1.35 DL + 1.5 WL-Z	-1.329	50.941	4.088
	201 DL + 0.5 LL	0.062	26.197	0.45
	202 DL + 0.7 LL + 0.5 WLX	-0.846	37.232	0.673
	203 DL + 0.7 LL + 0.5 WL-X	1.055	28.36	0.35
	204 DL + 0.7 LL + 0.5 WLZ	0.51	24.186	-0.683
	205 DL + 0.7 LL + 0.5 WL-Z	-0.288	39.978	1.678
	206 DL + WLX	-1.976	30.757	0.89
	207 DL + WL-X	1.662	15.274	0.264
	208 DL + WLZ	0.606	7.662	-1.67
	209 DL + WL-Z	-0.898	35.722	2.775
	210 DL + LL + 0.5 WLX	-0.756	42.869	0.674
	211 DL + LL + 0.5 WL-X	1.166	33.728	0.35
	212 DL + LL + 0.5 WLZ	0.616	29.454	-0.7
	213 DL + LL + 0.5 WL-Z	-0.192	45.682	1.696
3156	101 1.35 DL	0.718	19.494	0.319
	102 1.35 DL + 1.5 LL	2.145	55.78	0.24
	103 1.35 DL + 1.5 LL + 0.9 WLX	0.632	53.359	0.431
	104 1.35 DL + 1.5 LL + 0.9 WL-X	4.161	67.994	0.125
	105 1.35 DL + 1.5 LL + 0.9 WLZ	3.241	77.292	-1.879
	106 1.35 DL + 1.5 LL + 0.9 WL-Z	1.428	41.63	2.418
	107 DL + 1.5 WLX	-1.816	12.639	0.555
	108 DL + 1.5 WL-X	3.768	33.311	0.057
	109 DL + 1.5 WLZ	2.337	49.151	-3.068
	110 DL + 1.5 WL-Z	-0.586	-7.138	3.659
	111 1.35 DL + 1.05 LL + 1.5 WLX	-0.698	42.233	0.582

	112 1.35 DL + 1.05 LL + 1.5 WL-X	4.998	64.3	0.08
	113 1.35 DL + 1.05 LL + 1.5 WLZ	3.529	80.009	-3.126
	114 1.35 DL + 1.05 LL + 1.5 WL-Z	0.569	22.546	3.765
	115 1.35 DL + 1.5 WLX	-1.642	17.538	0.639
	116 1.35 DL + 1.5 WL-X	3.968	38.545	0.136
	117 1.35 DL + 1.5 WLZ	2.529	54.357	-3.005
	118 1.35 DL + 1.5 WL-Z	-0.405	-2.229	3.759
	201 DL + 0.5 LL	1.007	26.536	0.21
	202 DL + 0.7 LL + 0.5 WLX	0.355	30.007	0.306
	203 DL + 0.7 LL + 0.5 WL-X	2.324	38.242	0.133
	204 DL + 0.7 LL + 0.5 WLZ	1.811	43.401	-0.984
	205 DL + 0.7 LL + 0.5 WL-Z	0.799	23.488	1.414
	206 DL + WLX	-1.045	13.091	0.449
	207 DL + WL-X	2.703	27.192	0.114
	208 DL + WLZ	1.741	37.725	-1.986
	209 DL + WL-Z	-0.218	-0.084	2.534
	210 DL + LL + 0.5 WLX	0.625	37.062	0.29
	211 DL + LL + 0.5 WL-X	2.618	45.601	0.117
	212 DL + LL + 0.5 WLZ	2.096	50.731	-1.018
	213 DL + LL + 0.5 WL-Z	1.077	30.567	1.416
3157	101 1.35 DL	0.137	22.333	0.549
	102 1.35 DL + 1.5 LL	-0.296	54.069	0.818
	103 1.35 DL + 1.5 LL + 0.9 WLX	-1.949	51.396	0.645
	104 1.35 DL + 1.5 LL + 0.9 WL-X	1.451	67.053	1.194
	105 1.35 DL + 1.5 LL + 0.9 WLZ	-0.98	43.841	-1.221
	106 1.35 DL + 1.5 LL + 0.9 WL-Z	0.46	72.108	3.013
	107 DL + 1.5 WLX	-2.499	14.537	0.157
	108 DL + 1.5 WL-X	2.899	36.739	1.02
	109 DL + 1.5 WLZ	-0.936	3.08	-2.75
	110 DL + 1.5 WL-Z	1.298	44.226	3.856
	111 1.35 DL + 1.05 LL + 1.5 WLX	-2.826	41.592	0.472
	112 1.35 DL + 1.05 LL + 1.5 WL-X	2.673	65.284	1.356
	113 1.35 DL + 1.05 LL + 1.5 WLZ	-1.244	29.711	-2.511
	114 1.35 DL + 1.05 LL + 1.5 WL-Z	1.054	73.129	4.266
	115 1.35 DL + 1.5 WLX	-2.474	20.169	0.297
	116 1.35 DL + 1.5 WL-X	2.946	42.664	1.162
	117 1.35 DL + 1.5 WLZ	-0.905	8.609	-2.629
	118 1.35 DL + 1.5 WL-Z	1.34	50.221	4.015
	201 DL + 0.5 LL	-0.043	27.121	0.496
	202 DL + 0.7 LL + 0.5 WLX	-1.02	29.856	0.436
	203 DL + 0.7 LL + 0.5 WL-X	0.875	38.611	0.74
	204 DL + 0.7 LL + 0.5 WLZ	-0.48	25.625	-0.606
	205 DL + 0.7 LL + 0.5 WL-Z	0.321	41.434	1.756
	206 DL + WLX	-1.642	15.055	0.238
	207 DL + WL-X	1.978	30.135	0.815

	208 DL + WLZ	-0.595	7.319	-1.718
	209 DL + WL-Z	0.905	35.194	2.723
	210 DL + LL + 0.5 WLX	-1.121	35.977	0.486
	211 DL + LL + 0.5 WL-X	0.797	45.074	0.796
	212 DL + LL + 0.5 WLZ	-0.576	31.654	-0.572
	213 DL + LL + 0.5 WL-Z	0.24	47.979	1.827
3158	101 1.35 DL	0.261	18.25	-0.067
	102 1.35 DL + 1.5 LL	0.371	54.875	-1.046
	103 1.35 DL + 1.5 LL + 0.9 WLX	-1.404	74.038	-1.342
	104 1.35 DL + 1.5 LL + 0.9 WL-X	2.389	44.108	-0.841
	105 1.35 DL + 1.5 LL + 0.9 WLZ	-0.223	76.031	-3.248
	106 1.35 DL + 1.5 LL + 0.9 WL-Z	1.15	39.998	1.089
	107 DL + 1.5 WLX	-2.6	44.285	-0.524
	108 DL + 1.5 WL-X	3.439	-3.282	0.282
	109 DL + 1.5 WLZ	-0.68	47.036	-3.508
	110 DL + 1.5 WL-Z	1.425	-9.387	3.309
	111 1.35 DL + 1.05 LL + 1.5 WLX	-2.519	75.109	-1.234
	112 1.35 DL + 1.05 LL + 1.5 WL-X	3.627	26.66	-0.416
	113 1.35 DL + 1.05 LL + 1.5 WLZ	-0.581	78.075	-4.29
	114 1.35 DL + 1.05 LL + 1.5 WL-Z	1.595	20.27	2.683
	115 1.35 DL + 1.5 WLX	-2.543	49.092	-0.542
	116 1.35 DL + 1.5 WL-X	3.519	1.342	0.264
	117 1.35 DL + 1.5 WLZ	-0.619	51.892	-3.544
	118 1.35 DL + 1.5 WL-Z	1.5	-4.818	3.308
	201 DL + 0.5 LL	0.23	25.727	-0.376
	202 DL + 0.7 LL + 0.5 WLX	-0.743	41.262	-0.671
	203 DL + 0.7 LL + 0.5 WL-X	1.37	24.592	-0.394
	204 DL + 0.7 LL + 0.5 WLZ	-0.085	42.383	-1.735
	205 DL + 0.7 LL + 0.5 WL-Z	0.68	22.299	0.684
	206 DL + WLX	-1.679	34.101	-0.367
	207 DL + WL-X	2.369	2.216	0.171
	208 DL + WLZ	-0.395	35.982	-2.373
	209 DL + WL-Z	1.021	-1.907	2.205
	210 DL + LL + 0.5 WLX	-0.736	48.695	-0.869
	211 DL + LL + 0.5 WL-X	1.401	31.826	-0.588
	212 DL + LL + 0.5 WLZ	-0.074	49.864	-1.948
	213 DL + LL + 0.5 WL-Z	0.707	29.467	0.505
3159	101 1.35 DL	-0.647	21.054	0.116
	102 1.35 DL + 1.5 LL	-1.895	53.144	-0.5
	103 1.35 DL + 1.5 LL + 0.9 WLX	-3.793	71.536	-0.263
	104 1.35 DL + 1.5 LL + 0.9 WL-X	-0.218	43.004	-0.764
	105 1.35 DL + 1.5 LL + 0.9 WLZ	-1.222	42.021	-2.67
	106 1.35 DL + 1.5 LL + 0.9 WL-Z	-2.735	70.498	1.652
	107 DL + 1.5 WLX	-3.516	45.22	0.474
	108 DL + 1.5 WL-X	2.206	-0.085	-0.34

	109 DL + 1.5 WLZ	0.552	-0.003	-3.316
	110 DL + 1.5 WL-Z	-1.782	42.014	3.468
	111 1.35 DL + 1.05 LL + 1.5 WLX	-4.606	73.535	0.075
	112 1.35 DL + 1.05 LL + 1.5 WL-X	1.204	27.402	-0.745
	113 1.35 DL + 1.05 LL + 1.5 WLZ	-0.457	26.827	-3.798
	114 1.35 DL + 1.05 LL + 1.5 WL-Z	-2.861	70.894	3.145
	115 1.35 DL + 1.5 WLX	-3.693	50.756	0.506
	116 1.35 DL + 1.5 WL-X	2.051	5.218	-0.314
	117 1.35 DL + 1.5 WLZ	0.395	5.169	-3.305
	118 1.35 DL + 1.5 WL-Z	-1.957	47.661	3.515
	201 DL + 0.5 LL	-0.895	26.292	-0.119
	202 DL + 0.7 LL + 0.5 WLX	-2.117	40.804	-0.069
	203 DL + 0.7 LL + 0.5 WL-X	-0.124	24.862	-0.35
	204 DL + 0.7 LL + 0.5 WLZ	-0.682	24.288	-1.413
	205 DL + 0.7 LL + 0.5 WL-Z	-1.529	40.249	0.998
	206 DL + WLX	-2.512	35.419	0.346
	207 DL + WL-X	1.323	4.994	-0.201
	208 DL + WLZ	0.219	4.923	-2.2
	209 DL + WL-Z	-1.354	33.387	2.356
	210 DL + LL + 0.5 WLX	-2.378	47.312	-0.192
	211 DL + LL + 0.5 WL-X	-0.366	31.2	-0.474
	212 DL + LL + 0.5 WLZ	-0.926	30.477	-1.554
	213 DL + LL + 0.5 WL-Z	-1.787	46.887	0.892

7.2.2. Support Reactions of Tower structure:



		Horizontal	Vertical	Horizontal
Node	L/C	Fx kN	Fy kN	Fz kN
75	101 1.35 DL	-12.333	95.462	0.009
	102 1.35 DL + 1.5 LL	-25.125	65.244	0.104

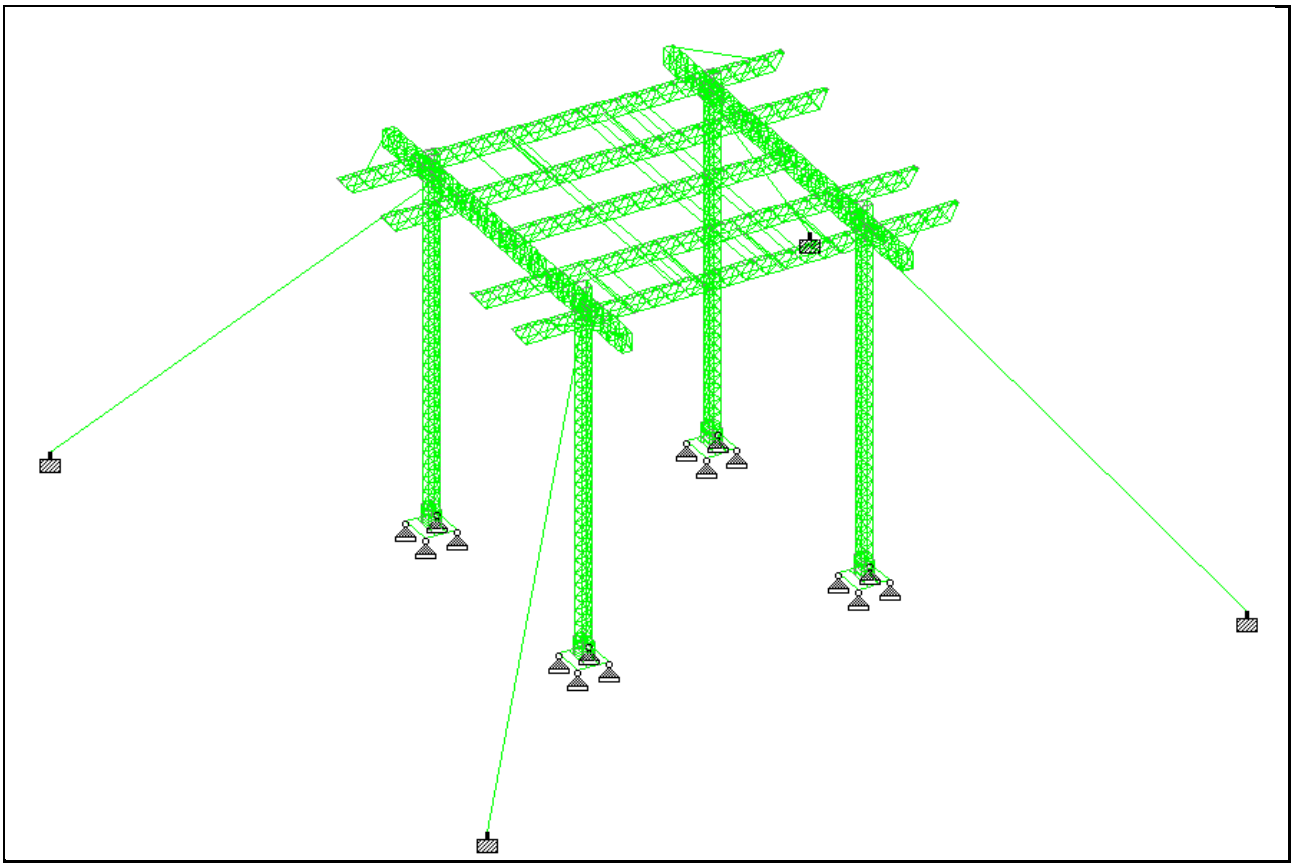
	103 1.35 DL + 1.5 LL + 0.9 WLX	-41.597	95.954	-1.843
	104 1.35 DL + 1.5 LL + 0.9 WL-X	-16.88	28.338	-0.324
	105 1.35 DL + 1.5 LL + 0.9 WLZ	-25.048	63.766	0.353
	106 1.35 DL + 1.5 LL + 0.9 WL-Z	-31.584	61.915	-1.987
	107 DL + 1.5 WLX	-36.59	121.895	-3.24
	108 DL + 1.5 WL-X	4.607	9.201	-0.707
	109 DL + 1.5 WLZ	-9.008	68.249	0.42
	110 DL + 1.5 WL-Z	-19.9	65.164	-3.479
	111 1.35 DL + 1.05 LL + 1.5 WLX	-48.742	125.492	-3.17
	112 1.35 DL + 1.05 LL + 1.5 WL-X	-7.545	12.798	-0.638
	113 1.35 DL + 1.05 LL + 1.5 WLZ	-21.16	71.846	0.49
	114 1.35 DL + 1.05 LL + 1.5 WL-Z	-32.052	68.761	-3.41
	115 1.35 DL + 1.5 WLX	-39.787	146.645	-3.237
	116 1.35 DL + 1.5 WL-X	1.409	33.951	-0.705
	117 1.35 DL + 1.5 WLZ	-12.206	92.998	0.423
	118 1.35 DL + 1.5 WL-Z	-23.098	89.913	-3.477
	201 DL + 0.5 LL	-13.399	60.64	0.038
	202 DL + 0.7 LL + 0.5 WLX	-24.256	73.672	-1.031
	203 DL + 0.7 LL + 0.5 WL-X	-10.524	36.107	-0.187
	204 DL + 0.7 LL + 0.5 WLZ	-15.063	55.79	0.189
	205 DL + 0.7 LL + 0.5 WL-Z	-18.693	54.761	-1.111
	206 DL + WLX	-27.438	104.834	-2.158
	207 DL + WL-X	0.026	29.705	-0.469
	208 DL + WLZ	-9.051	69.07	0.282
	209 DL + WL-Z	-16.312	67.013	-2.317
	210 DL + LL + 0.5 WLX	-26.815	67.628	-1.012
	211 DL + LL + 0.5 WL-X	-13.083	30.064	-0.168
	212 DL + LL + 0.5 WLZ	-17.621	49.746	0.208
	213 DL + LL + 0.5 WL-Z	-21.252	48.718	-1.092
76	101 1.35 DL	-0.002	95.493	12.338
	102 1.35 DL + 1.5 LL	-0.012	65.208	25.032
	103 1.35 DL + 1.5 LL + 0.9 WLX	-2.255	50.282	38.924
	104 1.35 DL + 1.5 LL + 0.9 WL-X	-0.239	63.678	24.218
	105 1.35 DL + 1.5 LL + 0.9 WLZ	0.457	28.225	17.427
	106 1.35 DL + 1.5 LL + 0.9 WL-Z	-2.397	89.425	42.782
	107 DL + 1.5 WLX	-3.741	45.858	32.292
	108 DL + 1.5 WL-X	-0.381	68.185	7.783
	109 DL + 1.5 WLZ	0.779	9.097	-3.536
	110 DL + 1.5 WL-Z	-3.977	111.096	38.723
	111 1.35 DL + 1.05 LL + 1.5 WLX	-3.748	49.417	44.377
	112 1.35 DL + 1.05 LL + 1.5 WL-X	-0.388	71.743	19.867
	113 1.35 DL + 1.05 LL + 1.5 WLZ	0.772	12.656	8.549
	114 1.35 DL + 1.05 LL + 1.5 WL-Z	-3.984	114.655	50.807
	115 1.35 DL + 1.5 WLX	-3.741	70.616	35.491
	116 1.35 DL + 1.5 WL-X	-0.381	92.942	10.981

	117 1.35 DL + 1.5 WLZ	0.779	33.855	-0.337
	118 1.35 DL + 1.5 WL-Z	-3.977	135.854	41.921
	201 DL + 0.5 LL	-0.005	60.641	13.37
	202 DL + 0.7 LL + 0.5 WLX	-1.252	48.31	22.781
	203 DL + 0.7 LL + 0.5 WL-X	-0.132	55.752	14.611
	204 DL + 0.7 LL + 0.5 WLZ	0.254	36.057	10.838
	205 DL + 0.7 LL + 0.5 WL-Z	-1.331	70.056	24.924
	206 DL + WLX	-2.494	54.151	24.574
	207 DL + WL-X	-0.254	69.035	8.235
	208 DL + WLZ	0.519	29.643	0.689
	209 DL + WL-Z	-2.652	97.643	28.862
	210 DL + LL + 0.5 WLX	-1.254	42.253	25.319
	211 DL + LL + 0.5 WL-X	-0.134	49.695	17.15
	212 DL + LL + 0.5 WLZ	0.252	30	13.377
	213 DL + LL + 0.5 WL-Z	-1.333	63.999	27.463
77	101 1.35 DL	-0.002	106.799	-12.355
	102 1.35 DL + 1.5 LL	-0.012	190.839	-25.24
	103 1.35 DL + 1.5 LL + 0.9 WLX	1.719	188.663	-13.965
	104 1.35 DL + 1.5 LL + 0.9 WL-X	0.567	189.308	-24.39
	105 1.35 DL + 1.5 LL + 0.9 WLZ	-0.38	230.778	-34.414
	106 1.35 DL + 1.5 LL + 0.9 WL-Z	2.148	148.024	-6.66
	107 DL + 1.5 WLX	2.883	75.484	9.641
	108 DL + 1.5 WL-X	0.964	76.56	-7.735
	109 DL + 1.5 WLZ	-0.615	145.676	-24.44
	110 DL + 1.5 WL-Z	3.599	7.753	21.815
	111 1.35 DL + 1.05 LL + 1.5 WLX	2.876	162	-2.582
	112 1.35 DL + 1.05 LL + 1.5 WL-X	0.956	163.076	-19.958
	113 1.35 DL + 1.05 LL + 1.5 WLZ	-0.622	232.192	-36.663
	114 1.35 DL + 1.05 LL + 1.5 WL-Z	3.591	94.269	9.592
	115 1.35 DL + 1.5 WLX	2.882	103.173	6.438
	116 1.35 DL + 1.5 WL-X	0.963	104.248	-10.938
	117 1.35 DL + 1.5 WLZ	-0.616	173.364	-27.644
	118 1.35 DL + 1.5 WL-Z	3.598	35.442	18.612
	201 DL + 0.5 LL	-0.005	107.124	-13.447
	202 DL + 0.7 LL + 0.5 WLX	0.956	117.12	-8.901
	203 DL + 0.7 LL + 0.5 WL-X	0.316	117.479	-14.693
	204 DL + 0.7 LL + 0.5 WLZ	-0.21	140.517	-20.261
	205 DL + 0.7 LL + 0.5 WL-Z	1.194	94.543	-4.843
	206 DL + WLX	1.922	76.693	3.377
	207 DL + WL-X	0.642	77.41	-8.207
	208 DL + WLZ	-0.411	123.487	-19.344
	209 DL + WL-Z	2.399	31.539	11.493
	210 DL + LL + 0.5 WLX	0.954	133.928	-11.478
	211 DL + LL + 0.5 WL-X	0.314	134.287	-17.27
	212 DL + LL + 0.5 WLZ	-0.212	157.325	-22.838

	213 DL + LL + 0.5 WL-Z	1.192	111.351	-7.42
78	101 1.35 DL	12.336	106.775	0.009
	102 1.35 DL + 1.5 LL	25.148	190.882	0.104
	103 1.35 DL + 1.5 LL + 0.9 WLX	0.829	144.718	2.028
	104 1.35 DL + 1.5 LL + 0.9 WL-X	33.67	230.85	0.496
	105 1.35 DL + 1.5 LL + 0.9 WLZ	24.972	189.404	-0.49
	106 1.35 DL + 1.5 LL + 0.9 WL-Z	13.07	187.553	2.495
	107 DL + 1.5 WLX	-31.393	2.152	3.213
	108 DL + 1.5 WL-X	23.342	145.705	0.659
	109 DL + 1.5 WLZ	8.844	76.629	-0.984
	110 DL + 1.5 WL-Z	-10.992	73.544	3.991
	111 1.35 DL + 1.05 LL + 1.5 WLX	-19.227	88.709	3.282
	112 1.35 DL + 1.05 LL + 1.5 WL-X	35.508	232.263	0.728
	113 1.35 DL + 1.05 LL + 1.5 WLZ	21.011	163.186	-0.915
	114 1.35 DL + 1.05 LL + 1.5 WL-Z	1.175	160.102	4.06
	115 1.35 DL + 1.5 WLX	-28.195	29.835	3.215
	116 1.35 DL + 1.5 WL-X	26.54	173.388	0.661
	117 1.35 DL + 1.5 WLZ	12.043	104.312	-0.982
	118 1.35 DL + 1.5 WL-Z	-7.794	101.227	3.993
	201 DL + 0.5 LL	13.408	107.128	0.038
	202 DL + 0.7 LL + 0.5 WLX	1.606	92.696	1.12
	203 DL + 0.7 LL + 0.5 WL-X	19.851	140.547	0.269
	204 DL + 0.7 LL + 0.5 WLZ	15.019	117.521	-0.279
	205 DL + 0.7 LL + 0.5 WL-Z	8.407	116.493	1.379
	206 DL + WLX	-17.883	27.799	2.144
	207 DL + WL-X	18.607	123.501	0.441
	208 DL + WLZ	8.942	77.45	-0.654
	209 DL + WL-Z	-4.282	75.394	2.663
	210 DL + LL + 0.5 WLX	4.169	109.517	1.139
	211 DL + LL + 0.5 WL-X	22.414	157.368	0.288
	212 DL + LL + 0.5 WLZ	17.581	134.343	-0.26
	213 DL + LL + 0.5 WL-Z	10.969	133.314	1.398

8. DESIGN RESULTS

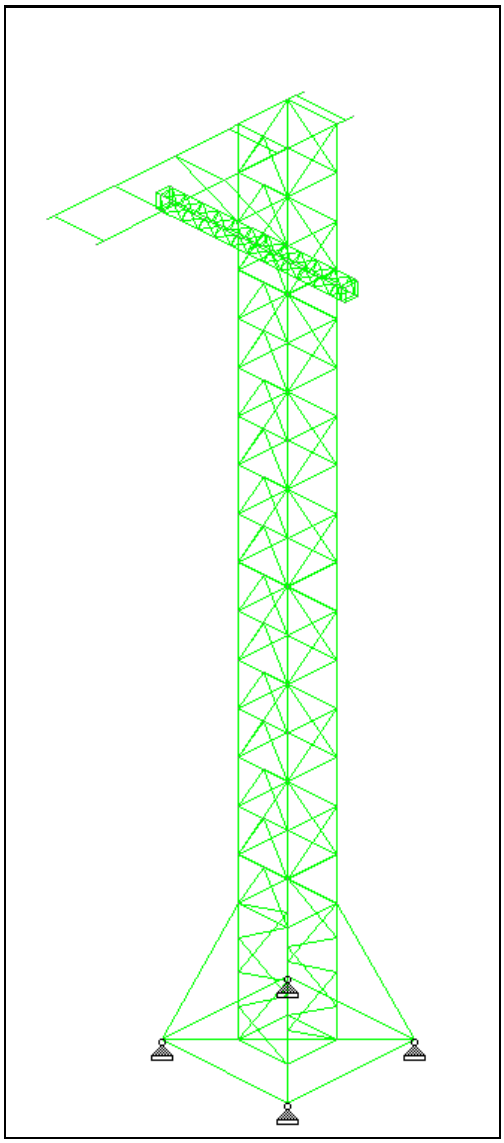
8.1. Utility Check for Center stage structure



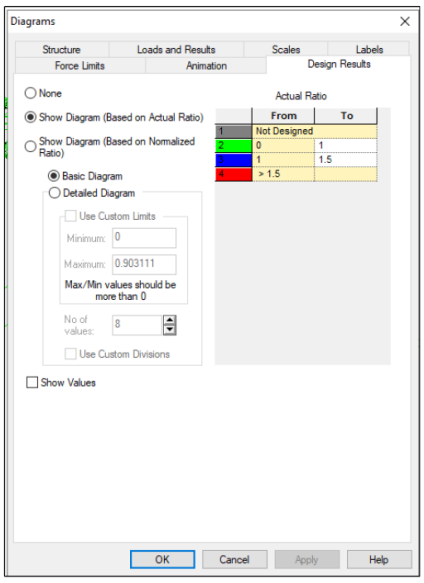
Utility ratio of Center stage structure

In StaadPro members with design capacity Ratio < 1 highlighted as green members & with design capacity ratio > 1 (overstressed) are highlighted in red. As shown above, all members are highlighted as green marked. Hence all members are passing in strength design.

8.2. Utility Check for Tower structure

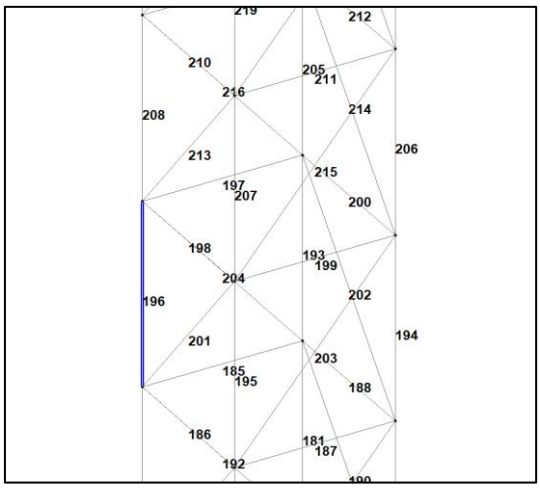


Utility ratio of Tower structure



8.3. STAAD Pro design calculation

- STAAD Output for Highlighted member of main cord of Column truss unit



Beam 196

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=========================================================================

   193 ST   60X4SHS     (EUROPEAN SECTIONS)
                         PASS     EC-6.3.3-662       0.139       212
                      40.02 C         -7.85           2.70      200.00
=========================================================================
  MATERIAL DATA
     Grade of steel           =  S 355
     Modulus of elasticity    =  205 kN/mm2
     Design Strength  (py)    =  355  N/mm2

  SECTION PROPERTIES (units - cm)
     Member Length =     80.00
     Gross Area =    8.79          Net Area =    8.79

                                    z-axis          y-axis
     Moment of inertia        :       45.400          45.400
     Plastic modulus          :       18.300          18.300
     Elastic modulus          :       15.133          15.133
     Shear Area               :        4.395           4.395
     Radius of gyration       :        2.273           2.273
     Effective Length         :       80.000          80.000

  DESIGN DATA (units - kN,m)   EUROCODE NO.3 /2005
     Section Class            :   CLASS 1
     Squash Load              :    312.05
     Axial force/Squash load  :     0.128
    DXF IMPORT OF ALS-EV-4500-07-REV03 MAIN STAGE RIGHT WING -- PAGE NO.

     GM0 :  1.00          GM1 :  1.00          GM2 :  1.25
```

	z-axis	y-axis
Slenderness ratio (KL/r) :	35.2	35.2
Compression Capacity :	292.1	292.1
Tension Capacity :	310.1	310.1
Moment Capacity :	6.5	6.5
Reduced Moment Capacity :	6.5	6.5
Shear Capacity :	90.1	90.1

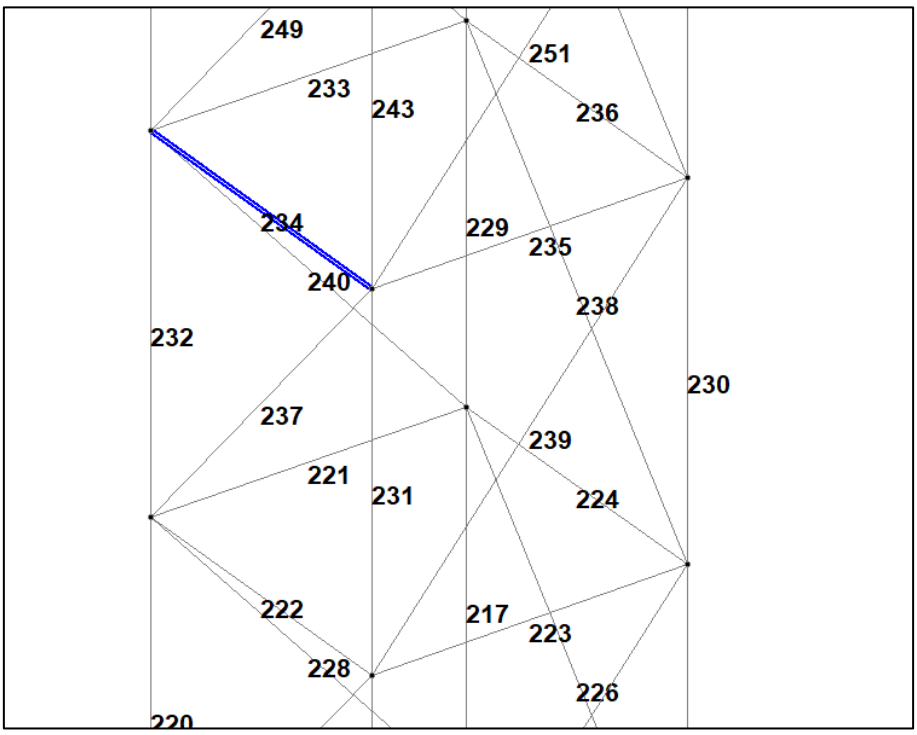
BUCKLING CALCULATIONS (units - kN,m)
Lateral Torsional Buckling Moment MB = 6.5
co-efficients C1 & K : C1 =1.132 K =1.0, Effective Length= 0.800
Lateral Torsional Buckling Curve : CURVE d
Elastic Critical Moment for LTB, Mcr = 305.8
Compression buckling curves: z-z: Curve a y-y: Curve a

CRITICAL LOADS FOR EACH CLAUSE CHECK (units- kN,m):

CLAUSE	RATIO	LOAD	FX	VY	VZ	MZ	MY
EC-6.3.1.1	0.137	212	40.0	0.0	-0.0	0.0	-0.0
EC-6.2.9.1	0.003	207	19.5	-0.0	0.0	0.0	0.0
EC-6.3.3-661	0.138	212	40.0	0.0	-0.0	0.0	-0.0
EC-6.3.3-662	0.139	212	40.0	0.0	-0.0	0.0	-0.0
EC-6.2.5	0.003	207	19.5	-0.0	0.0	0.0	0.0

Torsion has not been considered in the design.

- STAAD Output for Highlighted member of diagonal brace truss member of Column truss unit



Beam 234

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=========================================================================

   234 ST   60X4SHS     (EUROPEAN SECTIONS)
                         PASS     EC-6.2.3 (T)       0.016       213
                      5.03 T          0.00           0.00        0.00
=========================================================================
  MATERIAL DATA
     Grade of steel           =  S 355
     Modulus of elasticity    =  205 kN/mm2
     Design Strength  (py)    =  355  N/mm2

  SECTION PROPERTIES (units - cm)
     Member Length =     69.00
     Gross Area =    8.79          Net Area =    8.79

                                    z-axis          y-axis
     Moment of inertia          :     45.400          45.400
     Plastic modulus            :     18.300          18.300
     Elastic modulus            :     15.133          15.133
     Shear Area                 :      4.395           4.395
     Radius of gyration         :      2.273           2.273
     Effective Length           :     69.000          69.000

  DESIGN DATA (units - kN,m)   EUROCODE NO.3 /2005
     Section Class              :   CLASS 1
     Squash Load                :    312.05
     Axial force/Squash load    :     0.016
     GM0 :  1.00          GM1 :  1.00          GM2 :  1.25

                                    z-axis          y-axis
     Slenderness ratio (KL/r) :       30.4            30.4
     Compression Capacity       :     297.5           297.5
     Tension Capacity           :     310.1           310.1
     Moment Capacity            :       6.5             6.5
     Reduced Moment Capacity    :       6.5             6.5
     Shear Capacity             :      90.1            90.1

  BUCKLING CALCULATIONS (units - kN,m)
     Lateral Torsional Buckling Moment       MB =    6.5
     co-efficients C1 & K : C1 =1.132 K =1.0, Effective Length= 0.690
     Lateral Torsional Buckling Curve : CURVE d
     Elastic Critical Moment for LTB,               Mcr   =   352.0
     Compression buckling curves:     z-z:  Curve a   y-y:  Curve a
  CRITICAL LOADS FOR EACH CLAUSE CHECK (units- kN,m):
   CLAUSE        RATIO  LOAD     FX       VY      VZ      MZ      MY
  EC-6.2.3 (T)   0.016   213    -5.0      0.0     0.0     0.0     0.0
    DXF IMPORT OF ALS-EV-4500-07-REV03 MAIN STAGE RIGHT WING -- PAGE NO.

   Torsion has not been considered in the design.
```
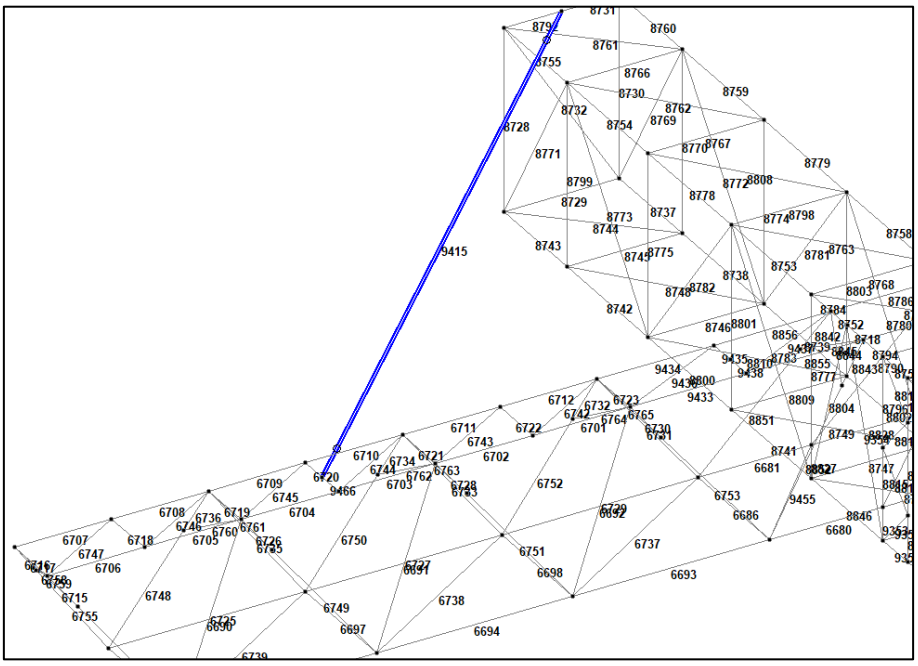

- STAAD Output for Highlighted member of Beam

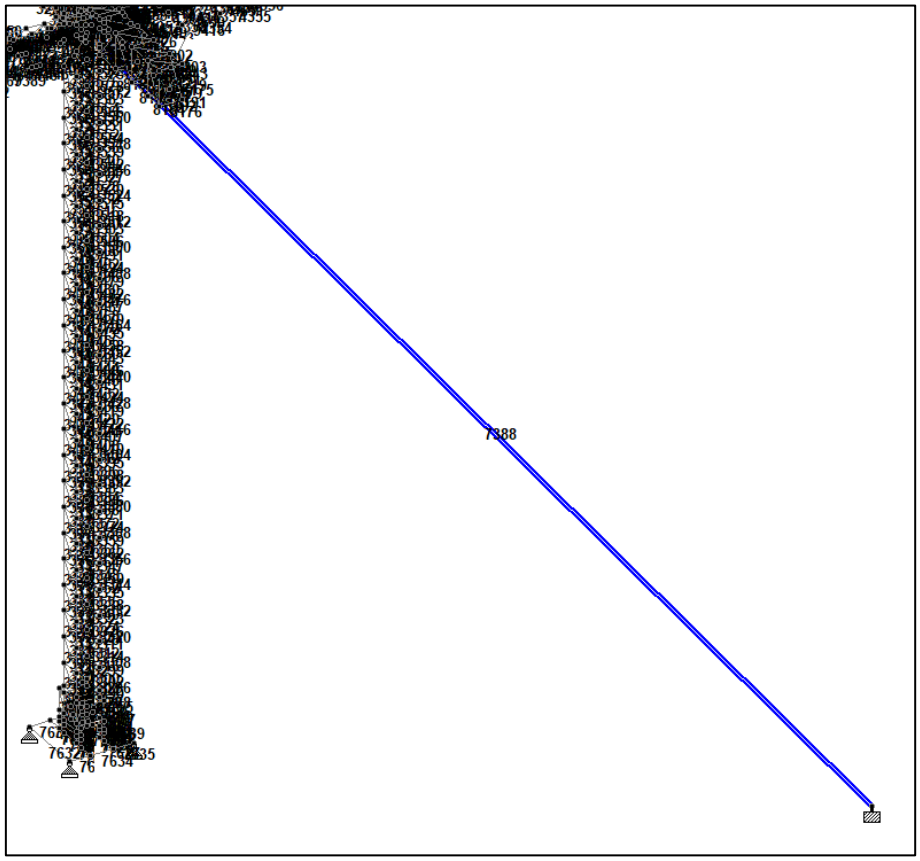


Beam 9415

```
MEMBER     TABLE       RESULT/    CRITICAL COND/     RATIO/     LOADING/
                         FX             MY              MZ       LOCATION
=========================================================================


   9415 ST   IPE200      (EUROPEAN SECTIONS)
                          PASS      EC-6.3.3-662       0.370       210
                       0.38 C         -78.88        -9044.15     2491.27
    DXF IMPORT OF ALS-EV-4500-07-REV03 MAIN STAGE RIGHT WING -- PAGE NO.

=========================================================================
  MATERIAL DATA
     Grade of steel           =  S 275
     Modulus of elasticity    =  205 kN/mm2
     Design Strength  (py)    =  275  N/mm2

  SECTION PROPERTIES (units - cm)
     Member Length =    498.25
     Gross Area =   28.50          Net Area =   28.50

                                     z-axis          y-axis
     Moment of inertia         :     1943.000         142.000
     Plastic modulus           :      221.000          45.000
     Elastic modulus           :      194.300          28.400
     Shear Area                :       14.484          14.016
     Radius of gyration        :        8.257           2.232
     Effective Length          :      498.255         498.255

  DESIGN DATA (units - kN,m)   EUROCODE NO.3 /2005
     Section Class             :   CLASS 1
     Squash Load               :    783.75
     Axial force/Squash load   :     0.000
     GM0 :  1.00          GM1 :  1.00          GM2 :  1.25
```

```
BUCKLING CALCULATIONS (units - kN,m)
   Lateral Torsional Buckling Moment       MB =   25.1
   co-efficients C1 & K : C1 =1.132 K =1.0, Effective Length= 4.983
   Lateral Torsional Buckling Curve : CURVE b
   Elastic Critical Moment for LTB,              Mcr   =    25.8
   Compression buckling curves:     z-z:  Curve a   y-y:  Curve b
   Critical Load For Torsional Buckling,         NcrT  =   899.5
   Critical Load For Torsional-Flexural Buckling, NcrTF =   899.5

CRITICAL LOADS FOR EACH CLAUSE CHECK (units- kN,m):
 CLAUSE         RATIO  LOAD     FX       VY      VZ      MZ      MY
EC-6.2.3 (T)   0.002   207    -1.5      0.5     0.1     0.0     0.0
EC-6.3.1.1     0.012   206     1.2      0.5    -0.1     0.0     0.0
EC-6.2.9.1     0.149   210     0.4     -0.0     0.0    -9.0    -0.1
EC-6.3.3-661   0.347   210     0.4     -0.0     0.0    -9.0    -0.1
EC-6.3.3-662   0.370   210     0.4     -0.0     0.0    -9.0    -0.1
EC-6.2.5       0.149   210     0.4     -0.0     0.0    -9.0    -0.1
EC-6.2.6-(Y)   0.019   210     0.4      4.2    -0.1     0.0     0.0
EC-6.3.2 LTB   0.361   210     0.4     -0.0     0.0    -9.0    -0.1
  DXF IMPORT OF ALS-EV-4500-07-REV03 MAIN STAGE RIGHT WING -- PAGE NO.

 Torsion has not been considered in the design.
```

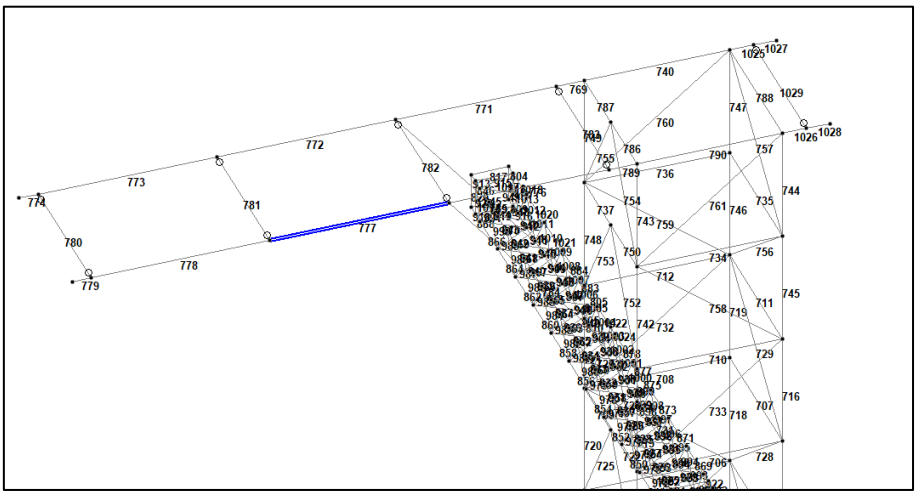
- STAAD Output for Highlighted member of Guy cable as a tension member



Beam 7388

```
======================================================================

   7388 ST   16DIACABLE  (UPT: DESIGNED AS I-SECTION)
                         PASS     EC-6.2.3 (T)       0.872       207
                     62.17 T          0.00           0.00        0.00
======================================================================
  MATERIAL DATA
     Grade of steel           =  S 355
     Modulus of elasticity    =  205 kN/mm2
     Design Strength  (py)    =  355  N/mm2

  SECTION PROPERTIES (units - cm)
     Member Length =   2938.56
     Gross Area =    2.02          Net Area =    2.02

                                    z-axis          y-axis
     Moment of inertia        :       0.325           0.325
     Plastic modulus          :       0.688           0.688
     Elastic modulus          :       0.406           0.406
     Shear Area               :       1.719           1.719
     Radius of gyration       :       0.401           0.401
     Effective Length         :    2938.558        2938.558

  DESIGN DATA (units - kN,m)   EUROCODE NO.3 /2005
     Section Class            :   CLASS 1
     Squash Load              :     71.72
     Axial force/Squash load  :     0.867
     GM0 :  1.00          GM1 :  1.00          GM2 :  1.25

                                    z-axis          y-axis
     Slenderness ratio (KL/r) :      7328.8          7328.8
     Compression Capacity     :         0.0             0.0
     Tension Capacity         :        71.3            71.3
     Moment Capacity          :         0.2             0.2
     Reduced Moment Capacity  :         0.0             0.1
     Shear Capacity           :        35.2            35.2

  BUCKLING CALCULATIONS (units - kN,m)
     Lateral Torsional Buckling Moment       MB =    0.1
     co-efficients C1 & K : C1 =1.132 K =1.0, Effective Length=29.386
     Lateral Torsional Buckling Curve : CURVE b
     Elastic Critical Moment for LTB,               Mcr   =     0.1
     Compression buckling curves:     z-z:  Curve b   y-y:  Curve c
     Critical Load For Torsional Buckling,          NcrT  = 15928.6
     Critical Load For Torsional-Flexural Buckling, NcrTF = 15928.6

  CRITICAL LOADS FOR EACH CLAUSE CHECK (units- kN,m):
   CLAUSE        RATIO  LOAD     FX       VY       VZ       MZ       MY
  EC-6.2.3 (T)   0.872   207   -62.2      0.0      0.0      0.0      0.0
    DXF IMPORT OF ALS-EV-4500-07-REV03 MAIN STAGE RIGHT WING -- PAGE NO.

   Torsion has not been considered in the design.
```

- STAAD Output for Highlighted member of Main beam

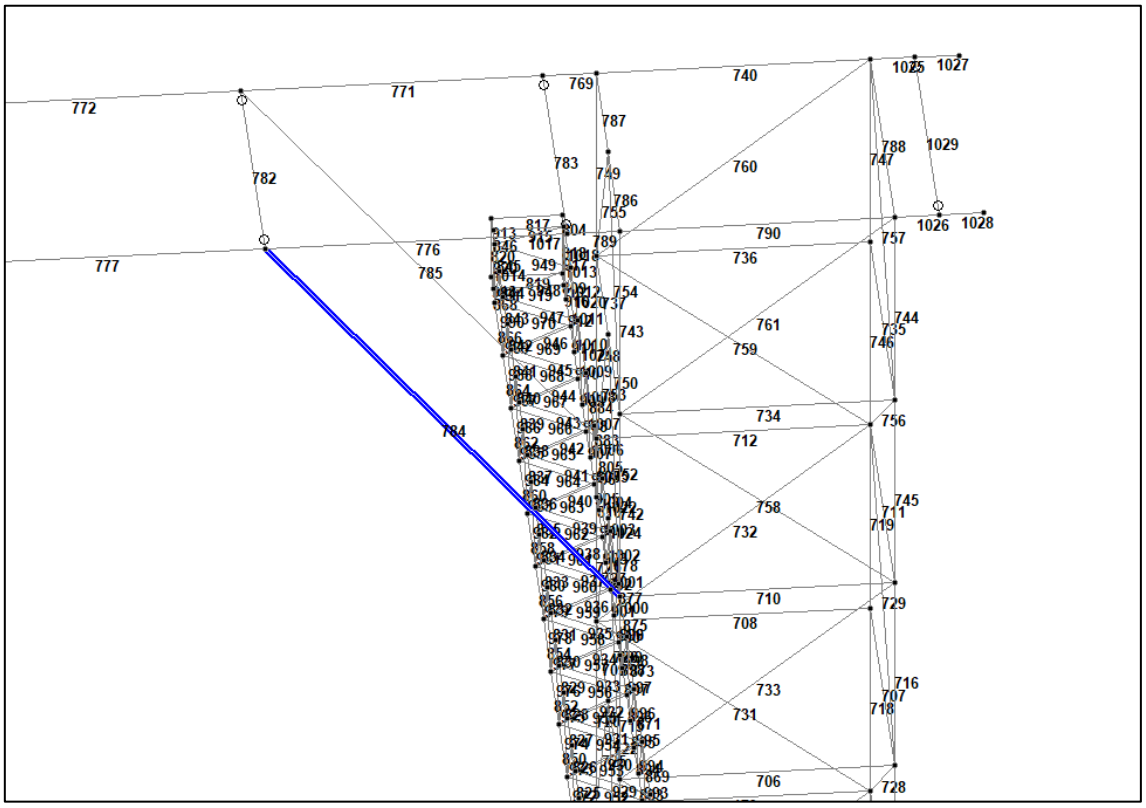


Beam 777

```
   777      TAPERED     (I)
                         PASS      EC-BB 3.2.1         0.920        206
                       0.31 C       -663.66         5187.23         0.00
=========================================================================
  MATERIAL DATA
     Grade of steel           =  S 355
     Modulus of elasticity    =  205 kN/mm2
     Design Strength  (py)    =  355  N/mm2

  SECTION PROPERTIES (units - cm)
     Member Length =    190.00
     Gross Area =   72.50          Net Area =   72.50

                                    z-axis          y-axis
     Moment of inertia        :     7856.511        2606.042
     Plastic modulus          :      714.062         318.125
     Elastic modulus          :      641.348         208.483
     Shear Area               :       44.200          28.300
     Radius of gyration       :       10.410           5.995
     Effective Length         :      400.000         190.001

  DESIGN DATA (units - kN,m)   EUROCODE NO.3 /2005
     Section Class            :   CLASS 3
     Squash Load              :   2573.75
     Axial force/Squash load  :     0.000
     GM0 :  1.00          GM1 :  1.00          GM2 :  1.25

                                    z-axis          y-axis
     Slenderness ratio (KL/r) :        38.4            31.7
     Compression Capacity     :      2573.8          2573.8
     Tension Capacity         :      2557.8          2557.8
     Moment Capacity          :       227.7            74.0
     Reduced Moment Capacity  :       227.7            74.0
     Shear Capacity           :       905.9           580.0
```

```
BUCKLING CALCULATIONS (units - kN,m)
   Critical Length b/w Lateral Restraint (Lm)                    =   2.065
   Co-efficients: C1 =1.000 K =1.0,Distance b/w Lateral restraints =   1.900
   Critical Length b/w Plastic Hinge & Torsional Restraint (Ls)  =   3.743
   Modification Factor Cn =   1.00          Taper Factor (c)     =   1.000
   Distance b/w Torsional restraints                             =   1.900

CRITICAL LOADS FOR EACH CLAUSE CHECK (units- kN,m):
 CLAUSE        RATIO  LOAD     FX       VY       VZ       MZ       MY
EC-6.2.9.1     0.077   210     0.2     30.6      0.2     61.4     -0.3
  STAAD SPACE                                              -- PAGE NO.  460

EC-6.2.5       0.270   211    -0.2     30.6     -0.2     61.4      0.3
EC-6.2.6-(Y)   0.053   210     0.2     30.6      0.2     61.4     -0.3
EC-6.2.9.2/3   0.274   211    -0.2     30.6     -0.2     61.4      0.3
EC-BB 3.2.1    0.920   206     0.3      2.5      0.3      5.2     -0.7
EC-BB 3.2.2    0.508   201     0.0     -8.5     -0.0     -9.2     -0.0
 Torsion has not been considered in the design.
```

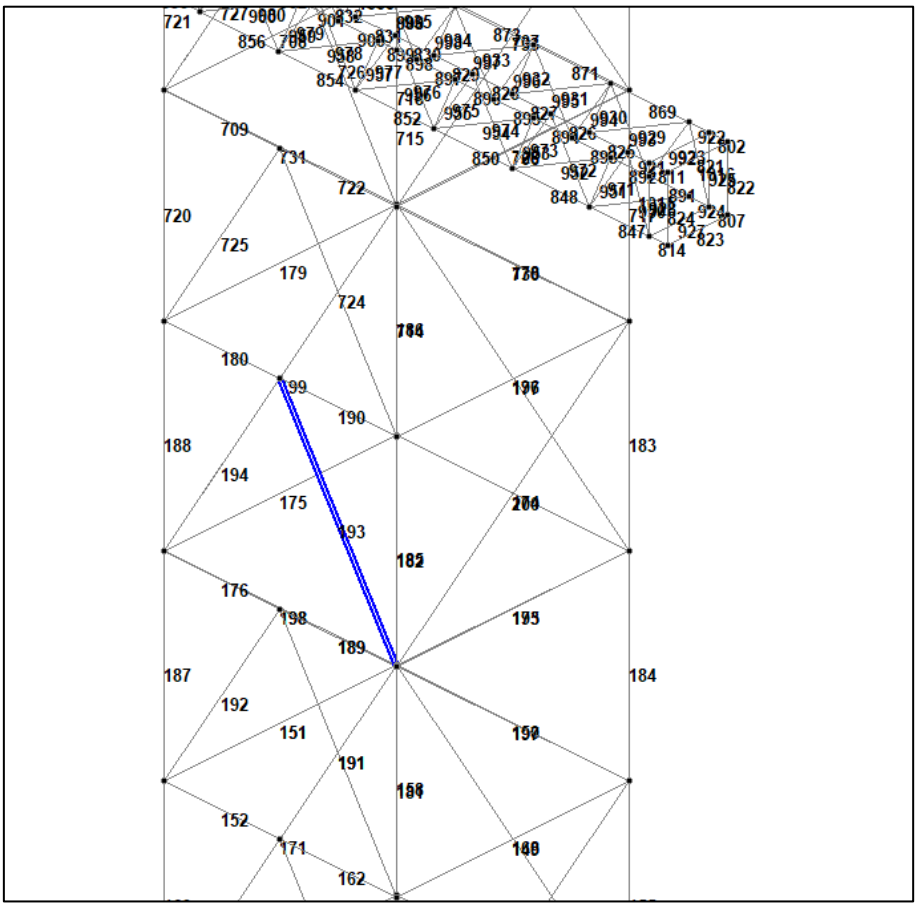
- STAAD Output for Highlighted Knee brace truss member



Beam 784

```
    784 ST   100X5SHS    (EUROPEAN SECTIONS)
                          PASS     EC-6.3.1.1         0.213       210
                       85.57 C          0.00           0.00      3201.56
     STAAD SPACE                                                -- PAGE NO.

=======================================================================
  MATERIAL DATA
     Grade of steel           =  S 355
     Modulus of elasticity    =  205 kN/mm2
     Design Strength  (py)    =  355  N/mm2

  SECTION PROPERTIES (units - cm)
     Member Length =    320.16
     Gross Area =   18.70          Net Area =   18.70

                                      z-axis          y-axis
     Moment of inertia          :      279.000         279.000
     Plastic modulus            :       66.400          66.400
     Elastic modulus            :       55.800          55.800
     Shear Area                 :        9.350           9.350
     Radius of gyration         :        3.863           3.863
     Effective Length           :      320.156         320.156

  DESIGN DATA (units - kN,m)   EUROCODE NO.3 /2005
     Section Class              :   CLASS 1
     Squash Load                :    663.85
     Axial force/Squash load    :     0.129
     GM0 :  1.00          GM1 :  1.00          GM2 :  1.25

                                      z-axis          y-axis
     Slenderness ratio (KL/r) :          82.9            82.9
     Compression Capacity       :       402.5           402.5
     Tension Capacity           :       659.7           659.7
     Moment Capacity            :        23.6            23.6
     Reduced Moment Capacity    :        23.6            23.6
     Shear Capacity             :       191.6           191.6

  BUCKLING CALCULATIONS (units - kN,m)
     Lateral Torsional Buckling Moment       MB =   23.6
     co-efficients C1 & K : C1 =1.132 K =1.0, Effective Length= 3.202
     Lateral Torsional Buckling Curve : CURVE d
     Elastic Critical Moment for LTB,               Mcr   =   481.0
     Compression buckling curves:     z-z:  Curve a   y-y:  Curve a
  CRITICAL LOADS FOR EACH CLAUSE CHECK (units- kN,m):
   CLAUSE        RATIO  LOAD     FX       VY      VZ      MZ      MY
  EC-6.3.1.1     0.213   210    85.6      0.0     0.0     0.0     0.0
    STAAD SPACE                                              -- PAGE NO.

   Torsion has not been considered in the design.
```

- STAAD Output for Highlighted brace truss member of tower structure

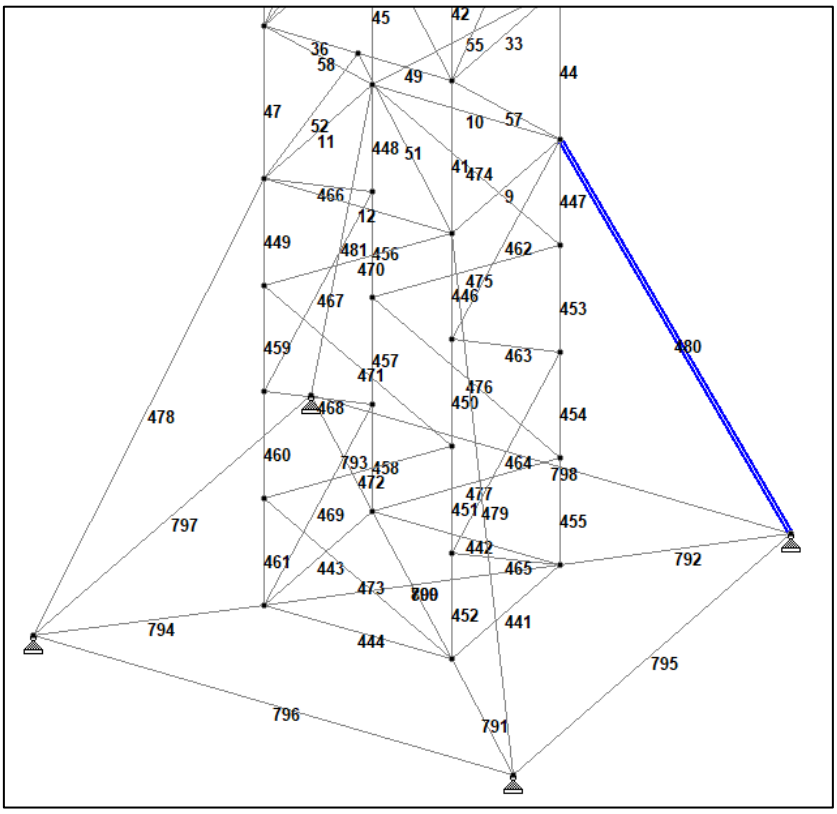


Beam 193

```
=====================================================================

   193 ST   60X6.3SHS   (EUROPEAN SECTIONS)
                         PASS     EC-6.3.1.1         0.012       208
                      4.24 C          0.00           0.00        0.00
    STAAD SPACE                                              -- PAGE NO.

=====================================================================
  MATERIAL DATA
     Grade of steel           =  S 355
     Modulus of elasticity    =  205 kN/mm2
     Design Strength  (py)    =  355  N/mm2

  SECTION PROPERTIES (units - cm)
     Member Length =    146.94
     Gross Area =   13.10          Net Area =   13.10

                                    z-axis          y-axis
     Moment of inertia        :       61.600          61.600
     Plastic modulus          :       26.000          26.000
     Elastic modulus          :       20.533          20.533
     Shear Area               :        6.550           6.550
     Radius of gyration       :        2.168           2.168
     Effective Length         :      146.944         146.944

  DESIGN DATA (units - kN,m)   EUROCODE NO.3 /2005
     Section Class            :   CLASS 1
     Squash Load              :    465.05
     Axial force/Squash load  :     0.009
     GM0 :  1.00          GM1 :  1.00          GM2 :  1.25

                                    z-axis          y-axis
     Slenderness ratio (KL/r) :        67.8            67.8
     Compression Capacity     :       345.3           345.3
     Tension Capacity         :       462.2           462.2
     Moment Capacity          :         9.2             9.2
     Reduced Moment Capacity  :         9.2             9.2
     Shear Capacity           :       134.2           134.2
```

```
BUCKLING CALCULATIONS (units - kN,m)
   Lateral Torsional Buckling Moment       MB =    9.2
   co-efficients C1 & K : C1 =1.132 K =1.0, Effective Length= 1.469
   Lateral Torsional Buckling Curve : CURVE d
   Elastic Critical Moment for LTB,               Mcr   =   235.7
   Compression buckling curves:     z-z:  Curve a   y-y:  Curve a
CRITICAL LOADS FOR EACH CLAUSE CHECK (units- kN,m):
 CLAUSE        RATIO  LOAD     FX       VY      VZ      MZ      MY
EC-6.2.3 (T)   0.008   209    -3.6      0.0     0.0     0.0     0.0
EC-6.3.1.1     0.012   208     4.2      0.0     0.0     0.0     0.0
  STAAD SPACE                                              -- PAGE NO.

 Torsion has not been considered in the design.
```

- STAAD Output for Highlighted brace truss member of tower structure

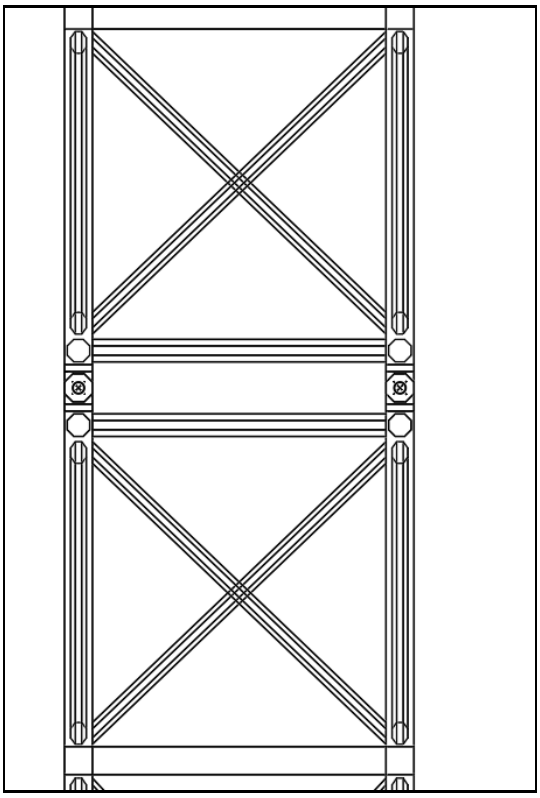


Beam 480

```
    480 ST   L120X120X14 (EUROPEAN SECTIONS)
                          PASS     EC-6.3.1.1         0.262       206
                       52.93 C          0.00           0.00      0.00
 ========================================================================
  MATERIAL DATA
     Grade of steel           =  S 355
     Modulus of elasticity    =  205 kN/mm2
     Design Strength  (py)    =  355  N/mm2

  SECTION PROPERTIES (units - cm)
     Member Length =    388.97
     Gross Area =   31.80          Net Area =   31.80

                                     z-axis          y-axis
     Moment of inertia          :     172.639         678.107
     Plastic modulus            :      62.844         143.848
     Elastic modulus            :      34.913          79.916
     Shear Area                 :      11.200          11.200
     Radius of gyration         :       2.330           4.618
     Effective Length           :     388.973         388.973

  DESIGN DATA (units - kN,m)   EUROCODE NO.3 /2005
     Section Class              :   CLASS 3
     Squash Load                :   1128.90
     Axial force/Squash load    :     0.047
     GM0 :  1.00          GM1 :  1.00          GM2 :  1.25

                                     z-axis          y-axis
     Slenderness ratio (KL/r)   :       166.9           107.4
     Compression Capacity       :       201.7           427.9
     Tension Capacity           :      1121.9          1121.9
     Moment Capacity            :        12.4            28.4
     Reduced Moment Capacity    :        12.4            28.4
     Shear Capacity             :       229.6           229.6

  BUCKLING CALCULATIONS (units - kN,m)
     Lateral Torsional Buckling Moment       MB =   25.8
     co-efficients C1 & K : C1 =1.132 K =1.0, Effective Length= 3.890
     Lateral Torsional Buckling Curve : CURVE d
     Elastic Critical Moment for LTB,              Mcr   =   122.7
     Compression buckling curves:     z-z:  Curve b   y-y:  Curve b
]    STAAD SPACE                                              -- PAGE NO.

  CRITICAL LOADS FOR EACH CLAUSE CHECK (units- kN,m):
   CLAUSE        RATIO  LOAD     FX       VY      VZ      MZ      MY
  EC-6.2.3 (T)   0.024   207   -27.3      0.0     0.0     0.0     0.0
  EC-6.3.1.1     0.262   206    52.9      0.0     0.0     0.0     0.0
   Torsion has not been considered in the design.
```

9. CONNECTION DESIGN

9.1.1. Connection check between Vertical Column trusses of Center stage structure:



Elevation view

From design load combinations, Maximum forces at joint locations are:
(For load combination: 114):

L/C	Node	Axial Force kN	Shear-Y kN	Shear-Z kN	Torsion kN-m	Moment-Y kN-m	Moment-Z kN-m
114	1184	106.652	0.4	-0.259	0.001	0.071	0.241
114	1181	104.392	0.418	0.306	0.001	-0.269	0.253
114	1183	-15.958	-0.221	-0.04	0.005	-0.064	-0.127
114	1182	-22.621	-0.199	0.457	0.005	-0.359	-0.112

Axial Force (Fx) = 106.65 kN (Act as Shear in pins)
Shear force (Fy) = 0.476 kN (Act as Tension in pins)
Moment = 0.241+0.253-0.127-0.112 = 0.254 kNm (Act as equivalent shear by pull-push action)

Check for bolt:
Form main cord of truss member, force considered to be transferred by **1-M24 bolts**.

Tension Check:

Total axial force in one bolt = 0.476/1 = 0.476 kN

Design tension resistance of bolt = $F_{t,Rd} = \frac{k_2 \times f_{ub} \times A_s}{\gamma_{M2}}$ *(As per EN 1993-1-8:2005, table 3.4)*

Where,

k_2 = 0.9 *(As per EN 1993-1-8:2005, table 3.4, for other than countersunk bolt)*

f_{ub} = 800 N/mm^2 *(Considering 8.8 grade bolts)*

A_s = 452.39 mm^2

γ_{M2} = 1.25 *(As per EN 1993-1-8:2005, NOTE below table 2.1)*

$F_{t,Rd} = \frac{0.9 \times 800 \times 452.39}{1.25}$

∴ Design tension resistance of bolt = 260.57 kN ≥ 0.476 kN (Hence, OK)

Shear Check:

Equivalent Shear force (pull-push force) generated in bolts due to moment with bolt arranged 690 mm apart, axial at main cord member

= Moment/ Lever arm = 0.254 kNm / (0.69 m x 2) = 0.184 KN

Total axial force in member acting as shear (per bolts) = (106.65 + 0.184) = 106.83 kN

Total shear force per bolt = Fy/1 = 106.83 /1 = 106.83 kN

Design shear resistance of bolt = $F_{v,Rd} = \frac{\alpha_v \times f_{ub} \times A}{\gamma_{M2}}$ *(As per EN 1993-1-8:2005, table 3.4)*

Where,

α_v = 0.6 *(As per EN 1993-1-8:2005, table 3.4, considering 8.8 grade bolt)*

f_{ub} = 800 N/mm^2 *(As per EN 1993-1-8:2005, table 3.1, considering 8.8 grade bolt)*

A = A_s = 452.39 mm^2

γ_{M2} = 1.25 *(As per EN 1993-1-8:2005, NOTE below table 2.1)*

$F_{v,Rd} = \frac{0.6 \times 800 \times 452.39}{1.25}$

$F_{v,Rd}$= 173.71 kN

As pins act in double shear,

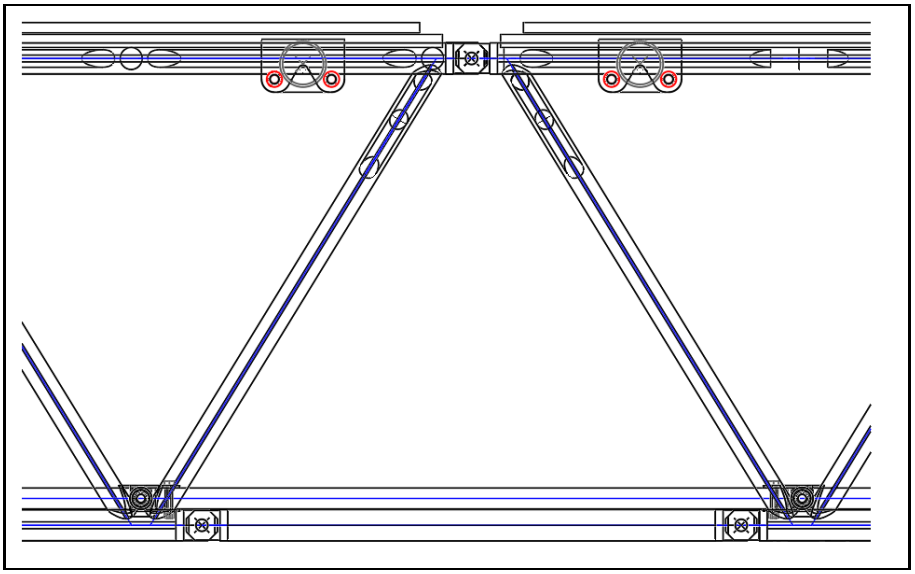
Shear capacity = 2 x $F_{v,Rd}$ = 2 x 173.71= 347.42 kN ≥ 106.83 kN (Hence, OK)

Combined shear & tension check:

$\frac{F_{v,Ed}}{F_{v,Rd}} + \frac{F_{t,Ed}}{1.4\,F_{t,Rd}} \leq 1$ *(As per EN 1993-1-8:2005, table 3.4)*

$\frac{F_{v,Ed}}{F_{v,Rd}} + \frac{F_{t,Ed}}{1.4F_{t,Rd}} = \frac{106.83}{347.42} + \frac{0.476}{1.4 \text{ X } 260.57} = 0.308 \leq 1$ (Hence, OK)

9.1.2. Connection between Horizontal Space trusses of Center stage structure :



Elevation view

From design load combination, Maximum value of axial load on bolts in member is given below:

L/C	Node	Axial Force kN	Shear-Y kN	Shear-Z kN	Torsion kN-m	Moment-Y kN-m	Moment-Z kN-m
103	1583	76.468	-1.33	0.018	-0.067	0.026	-0.134
103	1582	66.502	-0.07	0.247	0	-0.07	0.046
103	1625	-43.44	-0.049	0.384	-0.124	-0.163	0.045
103	1626	-60.344	-0.182	0.904	-0.137	-0.277	0.073

Axial Force (Fx) = 76.468 kN (Act as Shear)
Shear force (Fy) = 1.33 kN (Act as Shear)
Shear force (Fz) = 0.904 kN (Act as Tension)
Moment = -0.134+0.046+0.045+0.073= 0.03 kNm (Act as equivalent shear by pull-push action)

Check for bolt:
Form main cord of truss member, force considered to be transferred by **1 - 7/8" (22.2 mm) diameter pin**.

Shear Check:
Equivalent shear force (pull-push force) generated in bolts due to moment with bolt arranged 900 mm apart, Shear force at main cord member due to corresponding moment
= Moment / Lever arm = 0.03 kNm / 0.9 m = 0.138 KN

Axial force per bolts acting as shear = (76.468+0.138+1.33)/1 = 77.936 kN

Design shear resistance of bolt = $F_{v,Rd} = \frac{\alpha_v \times f_{ub} \times A}{\gamma_{M2}}$ *(As per EN 1993-1-8:2005, table 3.4)*
Where,

α_v = 0.6 *(As per EN 1993-1-8:2005, table 3.4, considering 8.8 grade bolt)*
f_{ub} = 800 N/mm^2 *(As per EN 1993-1-8:2005, table 3.1, considering 8.8 grade bolt)*
A = A_s = 387.07 mm^2
γ_{M2} = 1.25 *(As per EN 1993-1-8:2005, NOTE below table 2.1)*
$F_{v,Rd} = \frac{0.6 \times 800 \times 387.07}{1.25}$

$F_{v,Rd}$= 148.63 kN

As pins act in double shear,
Shear capacity = 2 x $F_{v,Rd}$ = 2 x 148.63 = 297.27 kN ≥ 77.936 kN (Hence, OK)

Tension Check:

Total tension force in one bolt = 0.904/1 = 0.904 kN

Design tension resistance of bolt = $F_{t,Rd} = \frac{k_2 \times f_{ub} \times A_s}{\gamma_{M2}}$ *(As per EN 1993-1-8:2005, table 3.4)*
Where,

k_2 = 0.9 *(As per EN 1993-1-8:2005, table 3.4, for other than countersunk bolt)*

f_{ub} = 800 N/mm^2 *(Considering 8.8 grade bolts)*

A_s = 387.07 mm^2

γ_{M2} = 1.25 *(As per EN 1993-1-8:2005, NOTE below table 2.1)*

$F_{t,Rd} = \frac{0.9 \times 800 \times 387.07}{1.25}$

∴ Design tension resistance of bolt = 222.95 kN ≥ 0.904 kN (Hence, OK)

Combined shear & tension check:

$\frac{F_{v,Ed}}{F_{v,Rd}} + \frac{F_{t,Ed}}{1.4\,F_{t,Rd}} \leq 1$ *(As per EN 1993-1-8:2005, table 3.4)*

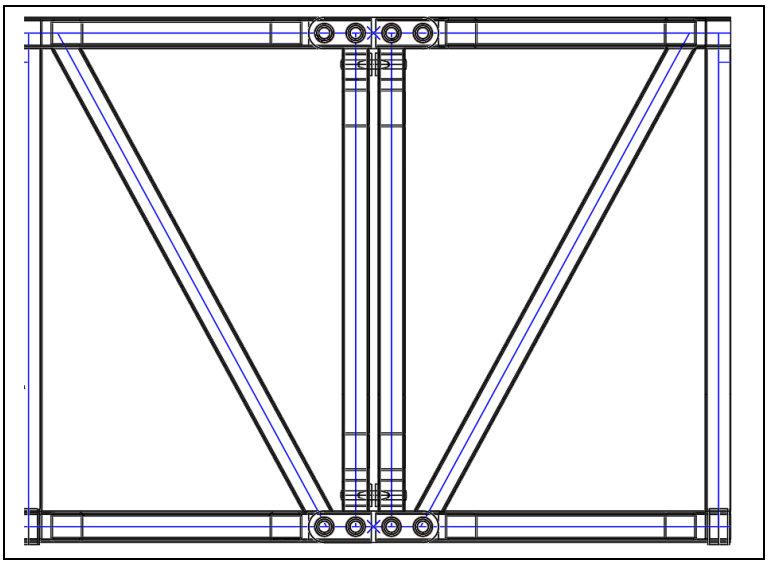
$\frac{F_{v,Ed}}{F_{v,Rd}} + \frac{F_{t,Ed}}{1.4F_{t,Rd}} = \frac{77.936}{297.27} + \frac{0.904}{1.4 \text{ X } 222.95} = 0.26 \leq 1$ (Hence, OK)

9.1.3. Connection between Main Horizontal Truss of Center stage structure :

From design load combinations, Maximum value of axial force, shear force and corresponding Moment to be transferred through main cord member is given below:

L/C	Node	Axial Force kN	Shear-Y kN	Shear-Z kN	Torsion kN-m	Moment-Y kN-m	Moment-Z kN-m
106	135	-149.23	-22.992	1.593	0.124	-0.002	-1.992
106	136	-75.575	-8.203	2.153	0.111	-0.045	-0.779
106	146	97.582	13.709	-2.382	0.079	0.784	1.607
106	145	120.856	32.912	-3.164	0.075	0.881	3.663

Axial Force in horizontal framing member at end (Fx) = 149.23 kN (Act as a Shear)
Shear force in horizontal framing member at end (Fy) = 32.912 kN (Act as a Shear)
Shear force in horizontal framing member at end (Fy) = 3.164 kN (Act as a Tension)
Moment in horizontal framing member at end (Mz) = -0.192-0.779+1.607+3.663= 2.499 kNm (Act as a equivalent Shear)



Elevation view

Check for bolt:
Form Horizontal main cord member, Axial force, shear forces and corresponding moments are considered to be transferred by **2-M24 bolts each side** to the adjoining truss component.

Shear Check:
Equivalent axial force (pull-push force) generated in bolts due to moment with bolt arranged 1100 mm apart, axial at main cord member, Shear force at main cord member due to corresponding moment

= Moment / Lever arm = 2.499 kNm / 1.1 m = 2.27 KN

Resultant shear force per bolt $=\sqrt{(Fx)^2 + (Fy)^2}$

$=\sqrt{(149.23)^2 + (32.912)^2} =$ 152.81 kN

Total shear force per bolt = (152.81+2.27)/2 = 77.54 kN

Design shear resistance of bolt = $F_{v,Rd} = \frac{\alpha_v \times f_{ub} \times A}{\gamma_{M2}}$ *(As per EN 1993-1-8:2005, table 3.4)*

Where,

α_v = 0.6 *(As per EN 1993-1-8:2005, table 3.4, considering 8.8 grade bolt)*

f_{ub} = 800 N/mm^2 *(As per EN 1993-1-8:2005, table 3.1, considering 8.8 grade bolt)*

A = A_s = 452.34 mm^2

γ_{M2} = 1.25 *(As per EN 1993-1-8:2005, NOTE below table 2.1)*

$F_{v,Rd} = \frac{0.6 \times 800 \times 452.34}{1.25}$

$F_{v,Rd}$= 173.69 kN

As bolts act in double shear,

Shear capacity = 2 x $F_{v,Rd}$ = 2 x 173.69 = 347.38 kN ≥ 77.54 kN (Hence, OK)

Tension Check:

Total tension force in one bolt = 3.164/2 = 1.582 kN

Design tension resistance of bolt = $F_{t,Rd} = \frac{k_2 \times f_{ub} \times A_s}{\gamma_{M2}}$ *(As per EN 1993-1-8:2005, table 3.4)*

Where,

k_2 = 0.9 *(As per EN 1993-1-8:2005, table 3.4, for other than countersunk bolt)*

f_{ub} = 800 N/mm^2 *(Considering 8.8 grade bolts)*

A_s = 452.38 mm^2

γ_{M2} = 1.25 *(As per EN 1993-1-8:2005, NOTE below table 2.1)*

$F_{t,Rd} = \frac{0.9 \times 800 \times 452.38}{1.25}$

∴ Design tension resistance of bolt = 260.57 kN ≥ 1.582 kN (Hence, OK)

Combined shear & tension check:

$\frac{F_{v,Ed}}{F_{v,Rd}} + \frac{F_{t,Ed}}{1.4\,F_{t,Rd}} \leq 1$ *(As per EN 1993-1-8:2005, table 3.4)*

$\frac{F_{v,Ed}}{F_{v,Rd}} + \frac{F_{t,Ed}}{1.4F_{t,Rd}} = \frac{77.54}{347.38} + \frac{1.582}{1.4 \text{ X } 260.57} = 0.22 \leq 1$ (Hence, OK)

9.1.4. Connection check between Vertical Column trusses of Tower structure:

Plan

Elevation

L/C	Node	Axial Force kN	Shear-Y kN	Shear-Z kN	Torsion kN-m	Moment-Y kN-m	Moment-Z kN-m
104	15	-205.338	1.18	1.574	-0.014	0.512	-0.151
104	16	177.111	1.183	-0.494	-0.029	-0.506	-0.333
104	17	117.321	1.161	0.341	-0.033	-0.154	-0.343
104	18	-280.151	1.533	-0.366	-0.042	-0.241	-0.376

From design load combination, Maximum value of load on bolts in member is given below:
Axial Force (Fx) = 280.15 kN (Act as Tension)
Shear force (Fy) = 1.5 kN (Act as Shear)
Moment = -0.151-0.333-0.343-0.376 = 1.203 kNm (Act as equivalent tension)

Check for bolt:
Form main cord of truss member, force considered to be transferred by **2-M24 bolts**.

Tension Check:

Equivalent axial force (pull-push force) generated in bolts due to moment with bolt arranged 1545 mm apart, axial at main cord member
= Moment/ Lever arm = 1.203 kNm / 1.545 m = 0.77 KN

Axial force in member acting as tension (per bolts) = (280.15 + 0.77) = 280.92 kN
Total axial force in one bolt = (280.15 + 0.97)/2 = 140.46 kN

Design tension resistance of bolt = $F_{t,Rd} = \frac{k_2 \times f_{ub} \times A_s}{\gamma_{M2}}$ *(As per EN 1993-1-8:2005, table 3.4)*

Where,

k_2 = 0.9 *(As per EN 1993-1-8:2005, table 3.4, for other than countersunk bolt)*

f_{ub} = 800 N/mm^2 *(Considering 8.8 grade bolts)*

A_s = 452.39 mm^2

γ_{M2} = 1.25 *(As per EN 1993-1-8:2005, NOTE below table 2.1)*

$F_{t,Rd} = \frac{0.9 \times 800 \times 452.39}{1.25}$

∴ Design tension resistance of bolt = 260.57 kN ≥ 140.46 kN (Hence, OK)

Shear Check:

Total shear force per bolt = Fy/2 = 1.5/2 = 0.75kN

Design shear resistance of bolt = $F_{v,Rd} = \frac{\alpha_v \times f_{ub} \times A}{\gamma_{M2}}$ *(As per EN 1993-1-8:2005, table 3.4)*

Where,

α_v = 0.6 *(As per EN 1993-1-8:2005, table 3.4, considering 8.8 grade bolt)*

f_{ub} = 800 N/mm^2 *(As per EN 1993-1-8:2005, table 3.1, considering 8.8 grade bolt)*

A = A_s = 452.39 mm^2

γ_{M2} = 1.25 *(As per EN 1993-1-8:2005, NOTE below table 2.1)*

$F_{v,Rd} = \frac{0.6 \times 800 \times 201}{1.25}$

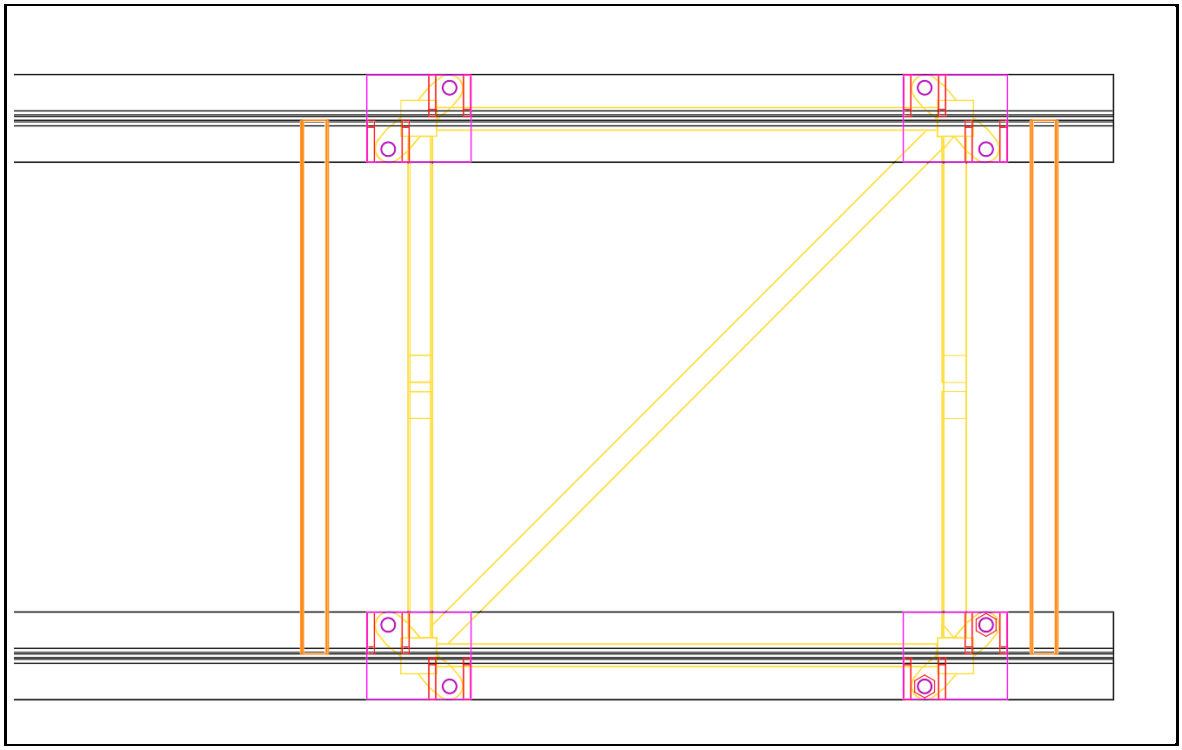
$F_{v,Rd}$= 173.71 kN ≥ 0.75kN (Hence, OK)

Combined shear & tension check:

$\frac{F_{v,Ed}}{F_{v,Rd}} + \frac{F_{t,Ed}}{1.4\,F_{t,Rd}} \leq 1$ *(As per EN 1993-1-8:2005, table 3.4)*

$\frac{F_{v,Ed}}{F_{v,Rd}} + \frac{F_{t,Ed}}{1.4F_{t,Rd}} = \frac{0.75}{173.71} + \frac{140.46}{1.4 \text{ X } 260.57} = 0.38 \leq 1$ (Hence, OK)

9.1.5. Connection check between Beam to vertical main cord of Tower structure:



From design load combination, Maximum value of load on bolts in member is given below:

L/C	Node	Axial Force kN	Shear-Y kN	Shear-Z kN	Torsion kN-m	Moment-Y kN-m	Moment-Z kN-m
104	299	34.88	0.803	0.969	-0.44	1.325	-1.287
104	300	65.25	1.32	1.532	-0.029	1.559	-1.556
104	301	64.12	1.305	1.514	-0.033	1.54	-1.536
104	302	35.07	0.929	0.816	-0.439	1.266	-1.319

Axial Force (Fx) = 65.25 kN (Act as tension)
Shear force (Fy) = 2.02 kN (Act as Shear)
Moment = -1.287-1.556-1.536-1.319 = 5.698 kNm (Act as equivalent tension)
Check for bolt:
Form beam to truss member, force considered to be transferred by **2-M24 bolts**.

Tension Check:

Equivalent axial force (pull-push force) generated in bolts due to moment with bolt arranged 1545 mm apart, axial at main cord member
= Moment/ Lever arm = 5.698 kNm / (1.545 m /2) = 1.84 kN

Axial force in member acting as tension (per bolts) = (65.25 + 1.84) = 67.09 kN
Total axial force in one bolt = (67.09)/2 = 33.54 kN

Design tension resistance of bolt = $F_{t,Rd} = \frac{k_2 \times f_{ub} \times A_s}{\gamma_{M2}}$ *(As per EN 1993-1-8:2005, table 3.4)*

Where,

k_2 = 0.9 *(As per EN 1993-1-8:2005, table 3.4, for other than countersunk bolt)*

f_{ub} = 800 N/mm^2 *(Considering 8.8 grade bolts)*

A_s = 452.39 mm^2

γ_{M2} = 1.25 *(As per EN 1993-1-8:2005, NOTE below table 2.1)*

$F_{t,Rd} = \frac{0.9 \times 800 \times 452.39}{1.25}$

∴ Design tension resistance of bolt = 260.57 kN ≥ 33.54 kN (Hence, OK)

Shear Check:

Total shear force per bolt = Fy/2 = 2.02/2 = 1.01 kN

Design shear resistance of bolt = $F_{v,Rd} = \frac{\alpha_v \times f_{ub} \times A}{\gamma_{M2}}$ *(As per EN 1993-1-8:2005, table 3.4)*

Where,

α_v = 0.6 *(As per EN 1993-1-8:2005, table 3.4, considering 8.8 grade bolt)*

f_{ub} = 800 N/mm^2 *(As per EN 1993-1-8:2005, table 3.1, considering 8.8 grade bolt)*

A = A_s = 452.39 mm^2

γ_{M2} = 1.25 *(As per EN 1993-1-8:2005, NOTE below table 2.1)*

$F_{v,Rd} = \frac{0.6 \times 800 \times 201}{1.25}$

$F_{v,Rd}$= 173.71 kN ≥ 1 kN (Hence, OK)

Combined shear & tension check:

$\frac{F_{v,Ed}}{F_{v,Rd}} + \frac{F_{t,Ed}}{1.4\,F_{t,Rd}} \leq 1$ *(As per EN 1993-1-8:2005, table 3.4)*

$\frac{F_{v,Ed}}{F_{v,Rd}} + \frac{F_{t,Ed}}{1.4F_{t,Rd}} = \frac{1.01}{173.71} + \frac{33.54}{1.4 \text{ X } 260.57} = 0.097 \leq 1$ (Hence, OK)

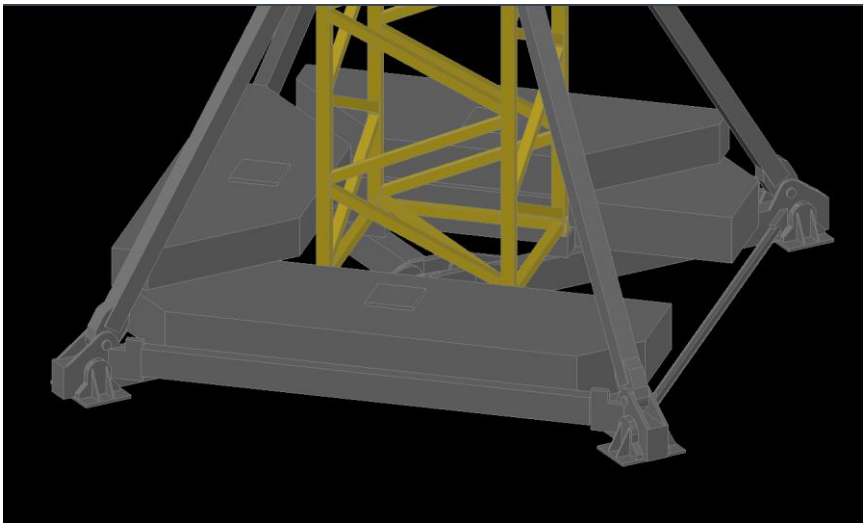
10. STABILITY CHECK & CONCLUSION

10.1. Uplift/Overturning check

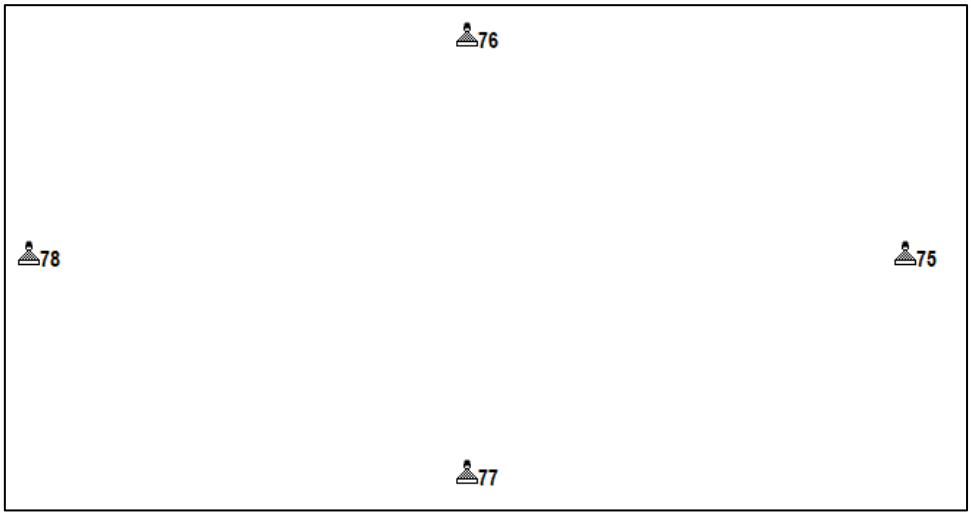
Guy cable from Main Center structure has been tied with each Tower structure. Along with Tower structure loading, Guy cable also creates uplift action in Tower structure.

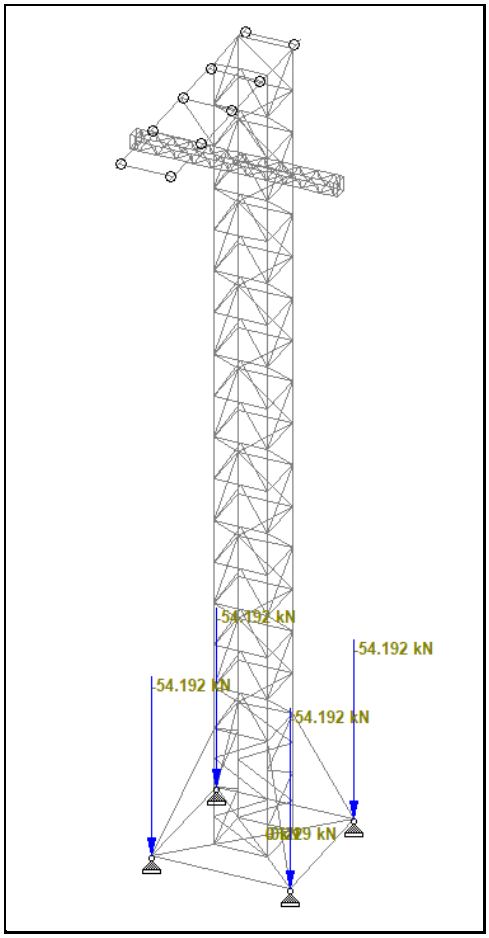
As shown in the image, to account for total uplift forces, Additional load of ballast in form of Concrete block is provided at base of tower structure.

Approximate 21.6 T (5.4T at each support node) of total ballast weight of concrete block is applied in Tower structure support.



Concrete block at base





Ballast load applied at support

As per support reaction results of the tower structure, there is no uplift force found.

Hence the provided ballast load of is sufficient for the structure.

		Horizontal	Vertical	Horizontal
Node	L/C	Fx kN	Fy kN	Fz kN
75	201 DL + 0.5 LL	-13.399	**60.64**	0.038
	202 DL + 0.7 LL + 0.5 WLX	-24.256	**73.672**	-1.031
	203 DL + 0.7 LL + 0.5 WL-X	-10.524	**36.107**	-0.187
	204 DL + 0.7 LL + 0.5 WLZ	-15.063	**55.79**	0.189
	205 DL + 0.7 LL + 0.5 WL-Z	-18.693	**54.761**	-1.111
	206 DL + WLX	-27.438	**104.834**	-2.158
	207 DL + WL-X	0.026	**29.705**	-0.469
	208 DL + WLZ	-9.051	**69.07**	0.282
	209 DL + WL-Z	-16.312	**67.013**	-2.317
	210 DL + LL + 0.5 WLX	-26.815	**67.628**	-1.012
	211 DL + LL + 0.5 WL-X	-13.083	**30.064**	-0.168
	212 DL + LL + 0.5 WLZ	-17.621	**49.746**	0.208
	213 DL + LL + 0.5 WL-Z	-21.252	**48.718**	-1.092
76	201 DL + 0.5 LL	-0.005	**60.641**	13.37
	202 DL + 0.7 LL + 0.5 WLX	-1.252	**48.31**	22.781

	203 DL + 0.7 LL + 0.5 WL-X	-0.132	**55.752**	14.611
	204 DL + 0.7 LL + 0.5 WLZ	0.254	**36.057**	10.838
	205 DL + 0.7 LL + 0.5 WL-Z	-1.331	**70.056**	24.924
	206 DL + WLX	-2.494	**54.151**	24.574
	207 DL + WL-X	-0.254	**69.035**	8.235
	208 DL + WLZ	0.519	**29.643**	0.689
	209 DL + WL-Z	-2.652	**97.643**	28.862
	210 DL + LL + 0.5 WLX	-1.254	**42.253**	25.319
	211 DL + LL + 0.5 WL-X	-0.134	**49.695**	17.15
	212 DL + LL + 0.5 WLZ	0.252	**30**	13.377
	213 DL + LL + 0.5 WL-Z	-1.333	**63.999**	27.463
77	201 DL + 0.5 LL	-0.005	**107.124**	-13.447
	202 DL + 0.7 LL + 0.5 WLX	0.956	**117.12**	-8.901
	203 DL + 0.7 LL + 0.5 WL-X	0.316	**117.479**	-14.693
	204 DL + 0.7 LL + 0.5 WLZ	-0.21	**140.517**	-20.261
	205 DL + 0.7 LL + 0.5 WL-Z	1.194	**94.543**	-4.843
	206 DL + WLX	1.922	**76.693**	3.377
	207 DL + WL-X	0.642	**77.41**	-8.207
	208 DL + WLZ	-0.411	**123.487**	-19.344
	209 DL + WL-Z	2.399	**31.539**	11.493
	210 DL + LL + 0.5 WLX	0.954	**133.928**	-11.478
	211 DL + LL + 0.5 WL-X	0.314	**134.287**	-17.27
	212 DL + LL + 0.5 WLZ	-0.212	**157.325**	-22.838
	213 DL + LL + 0.5 WL-Z	1.192	**111.351**	-7.42
78	201 DL + 0.5 LL	13.408	**107.128**	0.038
	202 DL + 0.7 LL + 0.5 WLX	1.606	**92.696**	1.12
	203 DL + 0.7 LL + 0.5 WL-X	19.851	**140.547**	0.269
	204 DL + 0.7 LL + 0.5 WLZ	15.019	**117.521**	-0.279
	205 DL + 0.7 LL + 0.5 WL-Z	8.407	**116.493**	1.379
	206 DL + WLX	-17.883	**27.799**	2.144
	207 DL + WL-X	18.607	**123.501**	0.441
	208 DL + WLZ	8.942	**77.45**	-0.654
	209 DL + WL-Z	-4.282	**75.394**	2.663
	210 DL + LL + 0.5 WLX	4.169	**109.517**	1.139
	211 DL + LL + 0.5 WL-X	22.414	**157.368**	0.288
	212 DL + LL + 0.5 WLZ	17.581	**134.343**	-0.26
	213 DL + LL + 0.5 WL-Z	10.969	**133.314**	1.398

10.2. Sliding check

Support reactions at base of Tower structure after applying Guy cable loading and concrete ballast loading are as below.

		Horizontal	Vertical	Horizontal
Node	L/C	Fx kN	Fy kN	Fz kN
75	201 DL + 0.5 LL	-13.399	60.64	0.038
	202 DL + 0.7 LL + 0.5 WLX	-24.256	73.672	-1.031
	203 DL + 0.7 LL + 0.5 WL-X	-10.524	36.107	-0.187
	204 DL + 0.7 LL + 0.5 WLZ	-15.063	55.79	0.189
	205 DL + 0.7 LL + 0.5 WL-Z	-18.693	54.761	-1.111
	206 DL + WLX	-27.438	104.834	-2.158
	207 DL + WL-X	0.026	29.705	-0.469
	208 DL + WLZ	-9.051	69.07	0.282
	209 DL + WL-Z	-16.312	67.013	-2.317
	210 DL + LL + 0.5 WLX	-26.815	67.628	-1.012
	211 DL + LL + 0.5 WL-X	-13.083	30.064	-0.168
	212 DL + LL + 0.5 WLZ	-17.621	49.746	0.208
	213 DL + LL + 0.5 WL-Z	-21.252	48.718	-1.092
76	201 DL + 0.5 LL	-0.005	60.641	13.37
	202 DL + 0.7 LL + 0.5 WLX	-1.252	48.31	22.781
	203 DL + 0.7 LL + 0.5 WL-X	-0.132	55.752	14.611
	204 DL + 0.7 LL + 0.5 WLZ	0.254	36.057	10.838
	205 DL + 0.7 LL + 0.5 WL-Z	-1.331	70.056	24.924
	206 DL + WLX	-2.494	54.151	24.574
	207 DL + WL-X	-0.254	69.035	8.235
	208 DL + WLZ	0.519	29.643	0.689
	209 DL + WL-Z	-2.652	97.643	28.862
	210 DL + LL + 0.5 WLX	-1.254	42.253	25.319
	211 DL + LL + 0.5 WL-X	-0.134	49.695	17.15
	212 DL + LL + 0.5 WLZ	0.252	30	13.377
	213 DL + LL + 0.5 WL-Z	-1.333	63.999	27.463
77	201 DL + 0.5 LL	-0.005	107.124	-13.447
	202 DL + 0.7 LL + 0.5 WLX	0.956	117.12	-8.901
	203 DL + 0.7 LL + 0.5 WL-X	0.316	117.479	-14.693
	204 DL + 0.7 LL + 0.5 WLZ	-0.21	140.517	-20.261
	205 DL + 0.7 LL + 0.5 WL-Z	1.194	94.543	-4.843
	206 DL + WLX	1.922	76.693	3.377
	207 DL + WL-X	0.642	77.41	-8.207
	208 DL + WLZ	-0.411	123.487	-19.344
	209 DL + WL-Z	2.399	31.539	11.493
	210 DL + LL + 0.5 WLX	0.954	133.928	-11.478
	211 DL + LL + 0.5 WL-X	0.314	134.287	-17.27
	212 DL + LL + 0.5 WLZ	-0.212	157.325	-22.838
	213 DL + LL + 0.5 WL-Z	1.192	111.351	-7.42
78	201 DL + 0.5 LL	13.408	107.128	0.038
	202 DL + 0.7 LL + 0.5 WLX	1.606	92.696	1.12
	203 DL + 0.7 LL + 0.5 WL-X	19.851	140.547	0.269

	204 DL + 0.7 LL + 0.5 WLZ	15.019	117.521	-0.279
	205 DL + 0.7 LL + 0.5 WL-Z	8.407	116.493	1.379
	206 DL + WLX	-17.883	27.799	2.144
	207 DL + WL-X	18.607	123.501	0.441
	208 DL + WLZ	8.942	77.45	-0.654
	209 DL + WL-Z	-4.282	75.394	2.663
	210 DL + LL + 0.5 WLX	4.169	109.517	1.139
	211 DL + LL + 0.5 WL-X	22.414	157.368	0.288
	212 DL + LL + 0.5 WLZ	17.581	134.343	-0.26
	213 DL + LL + 0.5 WL-Z	10.969	133.314	1.398

Max. Horizontal sliding force Fx = 45.893 kN (For 206 DL + WLX Load combination)
Max. Horizontal sliding force Fz = 27.937 kN (For 206 DL + WLX Load combination)

Resultant sliding force $= \sqrt{[(45.893)^2 + (27.937)^2]}$

$= 53.73$ kN

Total Vertical downward reactions for 206 DL + WLX load combination = 263.47 kN

Available Horizontal resistance for sliding = Vertical forces x Factor of safety against sliding
= 263.47 x 0.5
= 131.73 kN

Factor of safety for Sliding = Available Horizontal resistance for sliding /Resultant sliding force
= 131.73/53.73 = 2.45 > 1.5 (Hence OK)