



OpenTower™ Designer

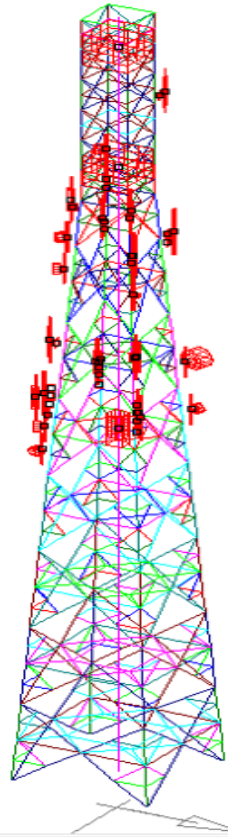


OpenTower Designer and MStower: A Comparative Study

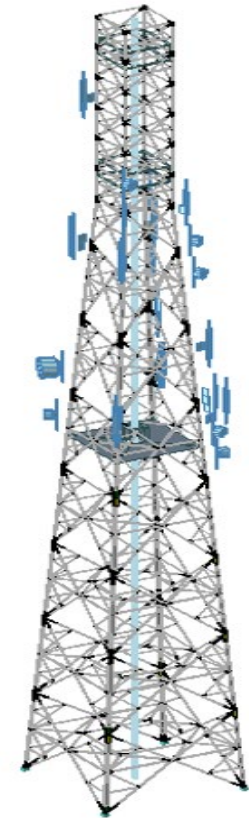
Bentley®

Tower Profile

A 50 mt 4-legged lattice tower designed according to TIA-222-G code with wind speed of 33.5 m/sec having Tower Bearing of 90.

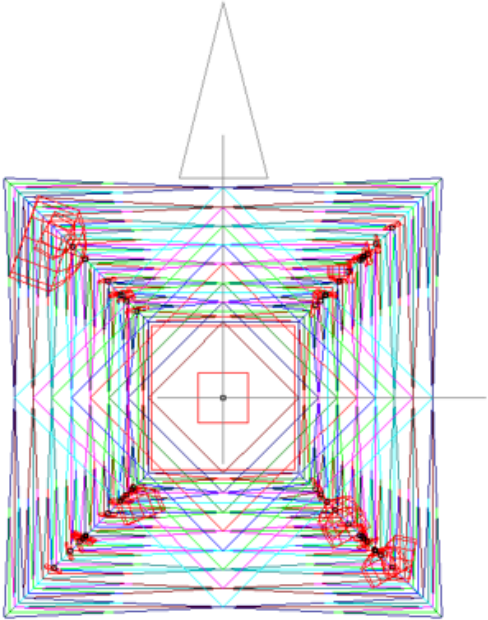


MStower

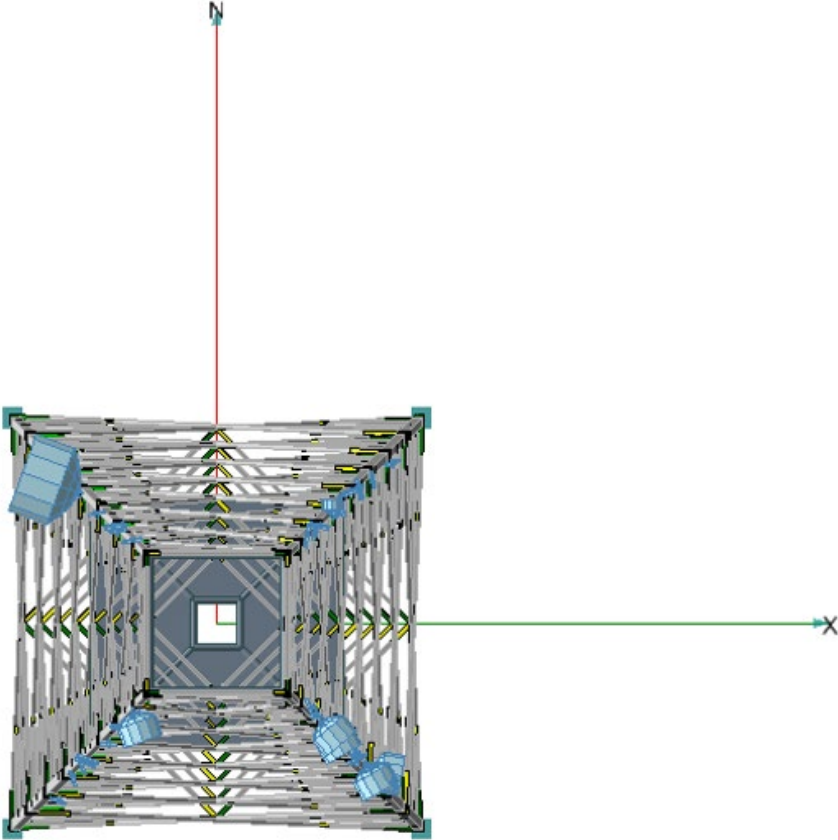


OpenTower Designer

Plan View Showing the Bearing

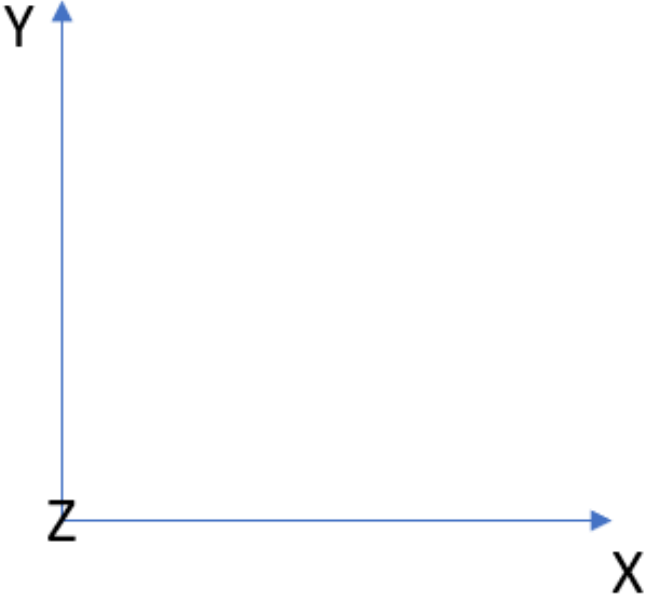


MStower



OpenTower Designer

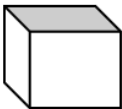
Global Axis Sign Convention



MStower



OpenTower Designer



View from Top

Dead Load Checking

The total dead load reported by two software are as follows:

	Structure	Large	Linear	Total (KN)
MStower	78.78	22.3	14.08	115.2
OpenTower Designer	78.74	22.29	14.6	115.6

Wind Pressure for Wind 0 Direction

MStower	
z (m)	qz (N/m2)
2.25	1095
7.89	1070.7
12.4	1071.8
16.91	1053.8
22.54	1025.7
27.05	1004.5
32.69	982.1
36.07	971.1
39.45	961.9
41.7	956.7
43.96	952.3
45.08	950.3
47.34	946.9
49.59	944.1

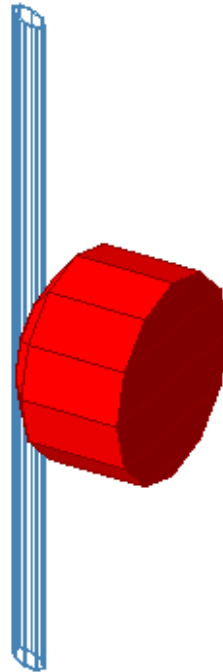
OpenTower Designer	
z (m)	qz (N/m2)
2.5	1088.7
7.5	1069
12.5	1071.9
17.5	1051.3
22.5	1026.3
27.5	1002.9
32.5	983.1
36.5	970.1
39	963.4
41	958.6
43	954.4
45	950.8
47	947.7
49	945.1

Forces Per Panel - Wind in 0 Direction

Panel	MStower		OpenTower Designer	
	EPA-(m2)	Force (kN)	EPA-(m2)	Force (kN)
1	2.53	2.03	2.52	2.03
2	2.58	2.08	2.57	2.07
3	2.29	1.85	2.29	1.85
4	2.29	1.86	2.29	1.85
5	2.29	1.87	2.29	1.86
6	2.58	2.11	2.57	2.1
7	3.7	3.05	3.68	3.04
8	6.84	5.72	6.82	5.7
9	7.85	6.69	7.83	6.68
10	8.34	7.28	8.33	7.26
11	8.97	8.01	8.95	8
12	9.86	8.98	9.85	8.98
13	10.65	9.67	10.64	9.66
14	11.17	10.33	11.16	10.33

Sample Large Antenna Wind Load for Wind 0 Direction

****** While comparing the force, keep in mind the global sign convention as shown in the figure above.



	MStower	OpenTower Designer
Ancillary ID	Tower: DISH006(0.6M)	121
Identifier	DISH006(0.6M)	Dish006(0.6m)
Wind Direction	0	0
Wind Angle (EofN)	90	90
Wind Pattern	WindWithNolce	WindWithNolce
Libr	0.6DISH	0.6DISH
Drag Table	SHIELDED	SHIELDED
Ref Area(m2)	0.32	0.318
Bearing	150	150
Factor	1	1
Shade	1	1
Sheff	1	1
Cd_Fx	0.9629	0.96285
Cd_Fy	0.3733	0
Cd_Fz	0	0.37335
Cd_Mx	0	0
Cd_My	0	0.00786
Cd_Mz	0.0079	0
V(m/sec)	39.962	39.9685
Fx_Tower-Axis(kN)	-0.21	-0.213
Fy_Tower-Axis(kN)	0.17	0
Fz_Tower-Axis(kN)	0	-0.1713
Mx_Tower-Axis(kNm)	0	0
My_Tower-Axis(kNm)	0	0.0009
Mz_Tower-Axis(kNm)	0	0

Sample Linear Antenna Load for Wind 0 Direction

****** While comparing the force, keep in mind the global sign convention as shown in the figure above.

	MStower	OpenTower Designer
ip	1	1
Identifier	Tower: LADDER02	LADDER02
Wind Direction	0	0
Wind Angle-EofN	90	90
Wind Pattern	WindWithNolce	WindWithNolce
Libr	H-LADDER	H-LADDER
Drag Table	NONE	NONE
iShape	0	0
WindAngle-AncAxis	0	0
Sin-Psi	1	1
RefWidth(m)	0.198	0.198
Shade	0.6	0.6
Sheff	1	1
SegmentId	NA	1
hanc(m)	2	2
V(m/sec)	39.259	39.265
Fxo(kN)	-0.229	-0.229
Fzo(kN)	0	0
ka	1	1

Total Discrete Wind Load (Wind 0 Degree) for 74 Antennas

	FX (KN)	FY (kN)	FZ
MStower - Discrete	-22.79	0.84	0
OpenTower Designer – Total Discrete (Mount + Ancillary)	-22.8013	0	-0.83

Total Linear Wind Load (Wind 0 Degree)

	FX (KN)	FY (kN)	FZ
MStower - Linear	-6.326	0	0
OpenTower Designer – Linear	-6.328	0	0

****** While comparing the force, keep in mind the global sign convention as shown in the figure above.

Strength Checking Value

Leg Member Class (Compressive Strength Check)

Load Combination: 1.2 DL + 1.6 Wind

Panel ID	Member Description (Leg Members)	MStower			OpenTower Designer		
		Pu (Comp)(kN)	ϕ_c Pn(kN)	Ratio	Pu (Comp)(kN)	ϕ_c Pn(kN)	Ratio (%)
1	EA80X80X8	1	210	0.004	0.9229	210.2439	0.44
2	EA80X80X8	5	210	0.026	5.5983	210.2439	2.66
3	EA80X80X8	12	210	0.059	12.8516	210.2439	6.11
4	EA80X80X9	23	235	0.1	23.7258	234.701	10.11
5	EA80X80X9	36	235	0.153	36.2315	234.701	15.44
6	EA80X80X9	49	235	0.21	49.3484	234.701	21.03
7	EA100X100X10	76	288	0.264	77.6578	287.7347	26.99
8	EA100X100X10	107	315	0.341	107.8456	314.7164	34.27
9	EA120X120X10	162	413	0.392	162.9372	413.1511	39.44
10	EA120X120X10	221	415	0.533	222.068	414.59	53.56
11	EA120X120X12	289	494	0.586	290.3512	493.7689	58.8
12	EA130X130X12	350	551	0.635	350.9773	551.0725	63.69
13	EA130X130X14	417	638	0.653	417.3451	637.9773	65.42
14	EA130X130X14	479	639	0.75	479.9288	638.6962	75.14

** The values are taken from Summary Design Table (MStower) and Leg Summary table for OpenTower Designer.

Strength Checking Value

Leg Member Class (Tensile Strength Check)

Load Combination: 1.2 DL + 1.6 Wind

Panel ID	Member Description	MStower			OpenTower Designer		
		Pu (Tens)(kN)	ϕ_t Pn(kN)	Ratio	Pu (Tens)(kN)	ϕ_t Pn(kN)	Ratio (%)
1	EA80X80X8	0	257	0.001	0.191	257.184	0.07%
2	EA80X80X8	2	257	0.008	2.0045	257.184	0.78%
3	EA80X80X8	7	257	0.027	7.1234	257.184	2.77%
4	EA80X80X9	17	287	0.058	16.7592	287.4285	5.83%
5	EA80X80X9	28	287	0.097	27.9368	287.4285	9.72%
6	EA80X80X9	39	287	0.137	39.4842	287.4285	13.74%
7	EA100X100X10	62	363	0.17	62.3284	362.85	17.18%
8	EA100X100X10	89	363	0.245	88.9355	362.85	24.51%
9	EA120X120X10	137	486	0.282	137.1203	485.85	28.22%
10	EA120X120X10	187	486	0.384	187.0693	485.85	38.50%
11	EA120X120X12	248	576	0.432	248.4564	575.64	43.16%
12	EA130X130X12	302	629	0.48	302.443	629.424	48.05%
13	EA130X130X14	361	728	0.496	361.2806	728.406	49.60%
14	EA130X130X14	415	728	0.57	414.793	728.406	56.95%

** The values are taken from Summary Design Table (MStower) and Leg Summary table for OpenTower Designer. OpenTower Capacity ratios are shown as percentage.

Strength Checking Value

Diagonal Member Class (XBR / BR1)(Compressive Strength Check)

Load Combination: 1.2 DL + 1.6 Wind

Panel ID	Member Description	MStower			OpenTower Designer		
		Pu (Comp)(kN)	$\phi\tau$ Pn(kN)	Ratio	Pu (Comp)(kN)	ϕ_c Pn(kN)	Ratio (%)
1	EA50X50X4	1	28	0.035	1.0121	27.7841	3.64
2	EA50X50X4	3	28	0.091	2.5214	27.7841	9.07
3	EA50X50X4	5	28	0.176	4.5896	27.7841	16.52
4	EA50X50X4	6	28	0.221	6.1509	27.7841	22.14
5	EA50X50X4	7	28	0.255	7.6084	27.7841	27.38
6	EA50X50X4	10	28	0.365	10.3421	27.7841	37.22
7	EA50X50X5	12	22	0.544	12.2227	21.745	56.21
8	EA60X60X4	23	26	0.873	22.8017	26.1337	87.25
9	EA60X60X4	25	25	1.032	26.2441	24.5598	106.86
10	EA60X60X5	33	28	1.177	32.9203	27.7559	118.61
11	EA60X60X5	32	25	1.258	32.1777	25.4672	126.35
12	EA60X60X5	33	23	1.433	33.359	23.2366	143.56
13	EA65X65X5	34	27	1.267	34.427	27.1224	126.93
14	EA65X65X5	34	25	1.381	34.3288	24.641	139.32

** The values are taken from Summary Design Table (MStower) and Leg Summary table for OpenTower Designer. OpenTower capacity ratios are shown as percentage.

Strength Checking Value

Diagonal Member Class (XBR / BR1)(Tensile Strength Check)

Load Combination: 1.2 DL + 1.6 Wind

Panel ID	Member Description	MStower			OpenTower Designer		
		Pu (Tens)(kN)	$\phi_t P_n$ (kN)	Ratio	Pu (Tens)(kN)	$\phi_t P_n$ (kN)	Ratio (%)
1	EA50X50X4	1	72	0.012	0.7867	71.955	1.09%
2	EA50X50X4	2	72	0.034	2.3965	71.955	3.33%
3	EA50X50X4	5	72	0.065	4.3794	71.955	6.09%
4	EA50X50X4	6	72	0.084	6.0245	71.955	8.37%
5	EA50X50X4	7	72	0.101	7.3296	71.955	10.19%
6	EA50X50X4	9	72	0.12	9.0344	71.955	12.56%
7	EA50X50X5	12	89	0.13	11.9456	88.7906	13.45%
8	EA60X60X4	22	90	0.239	21.4107	90.405	23.68%
9	EA60X60X4	24	90	0.27	25.298	90.405	27.98%
10	EA60X60X5	31	112	0.276	31.161	111.8531	27.86%
11	EA60X60X5	31	112	0.278	31.2528	111.8531	27.94%
12	EA60X60X5	31	112	0.28	31.4291	111.8531	28.10%
13	EA65X65X5	33	123	0.268	33.1547	123.3844	26.87%
14	EA65X65X5	32	123	0.259	32.1745	123.3844	26.08%

** The values are taken from Summary Design Table (MStower) and Leg Summary table for OpenTower Designer. OpenTower capacity ratios are shown as percentage.



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