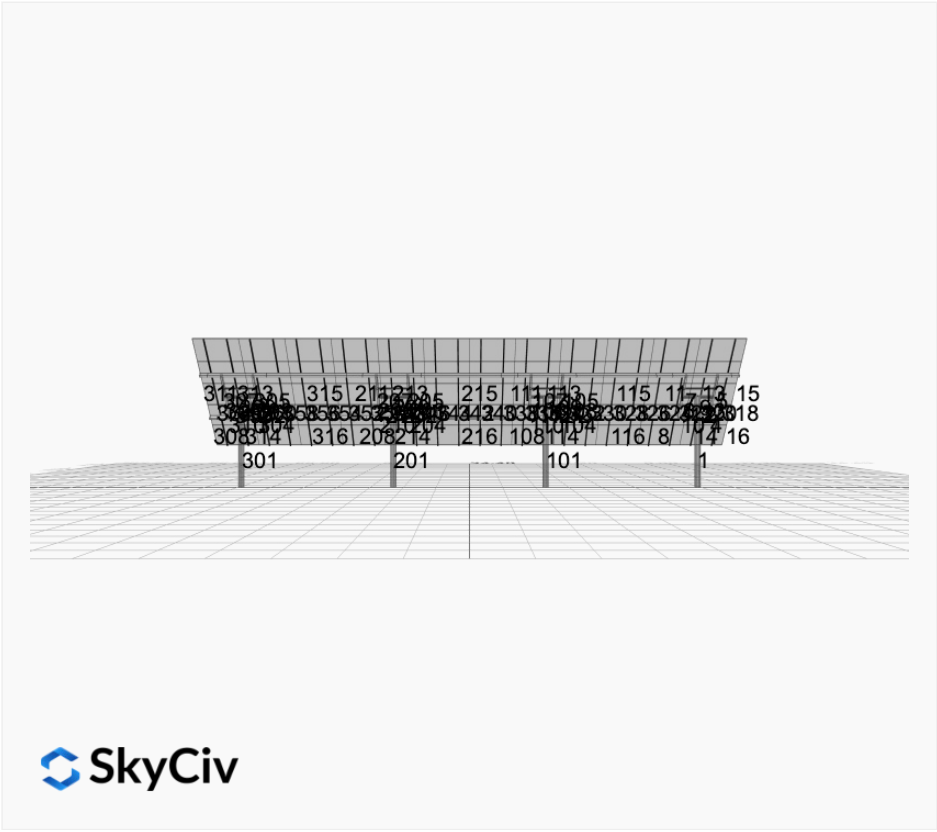
Project Details

Project Name: BROKEN H-CU5
Date: Thu Nov 20 2025
Location: 3500 N Fork Hwy, Cody, WY 82414, USA
Number of Modules: 60
Unique ID: 4P-19.75-8TOP-SD-12-L-5Hx12W-DCA7
Number of Poles: 4
Dealer: _____
Date Sold: _____



Array Dimensions N/S	18.79 ft
Array Dimensions E/W	68.80 ft
Winter Tilt Angle (Degrees)	46
Front Edge Clearance	5

MT Solar Bill of Materials (4P-19.75-8TOP-SD-12-L-5Hx12W-DCA7)

Part	Short Description	BOM Qty
MTS-PC-8	8IN Pole Cap Assembly	4
MTS-HF-SD	H-Frame Assembly-SD	4
MTS-SD-Wing-12	12IN SD Wing	4
MTS-SD-Splice-90	90IN SD Splice	6
MTS-SD-Splice-57	57IN SD Splice	6
MTS-CLAMP-ANGLE-4PK	Angle Clamp	12

Rail Bill of Materials

Part	Qty
Rails (226in Long)	24x
Rail Attachment	96x
Module Mid Clamp	96x
Module End Clamp	48x
Ground Lug	12x

Site Details:

Site Address: 3500 N Fork Hwy, Cody, WY 82414, USA

Array Specifications

Duty Classification:	SD
Module Width:	44.60 in
Module Length:	67.80 in
Number of Rows:	5
Number of Columns:	12
Total Number of Modules:	60
Winter Tilt Angle:	46
Front Edge Clearance:	5
Total Array Height at Tilt:	18.52 ft
Total Frame Length:	68.75 ft
Module Info/Notes:	
Array Dimensions N/S:	18.79 ft
Array Dimensions E/W:	68.80 ft
Rail Length:	225.50 in
Rail Spacing:	2.87 ft

Support Specifications

Pole Size:	8in Pipe Sch 80
Pole Length above Grade:	11.76 ft
Number of Poles:	4
Pole Spacing:	19.75 ft

Foundation Specifications

Foundation Type:	rectangular
Foundation Dimensions:	36x36 in
Foundation Depth (below grade):	6.8 ft
Foundation Volume:	60.75 ft^3

Site Info

Risk Category:	I
Exposure:	C
Soil Classification:	sand
Site Location:	3500 N Fork Hwy, Cody, WY 82414, USA
Wind Speed:	101 mph

Snow Load:	37 psf

Design Disclaimer

This software should be used for preliminary designs and should not be used as a final design unless reviewed, verified and designed by a qualified structural engineer.

AutoDesigner Input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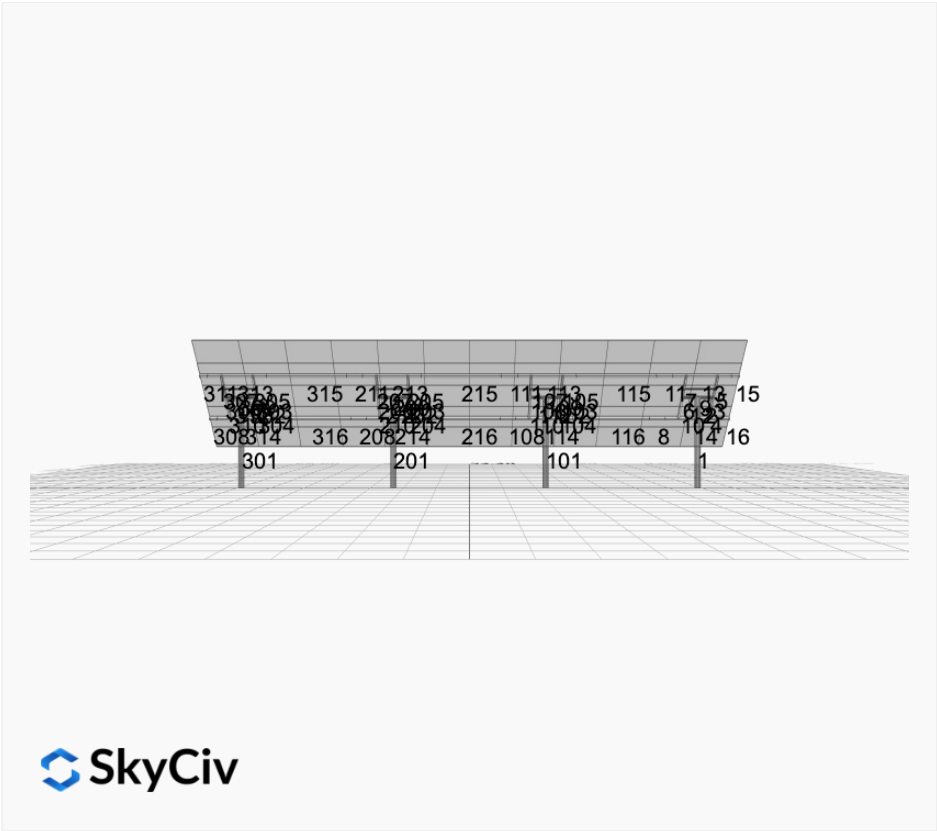
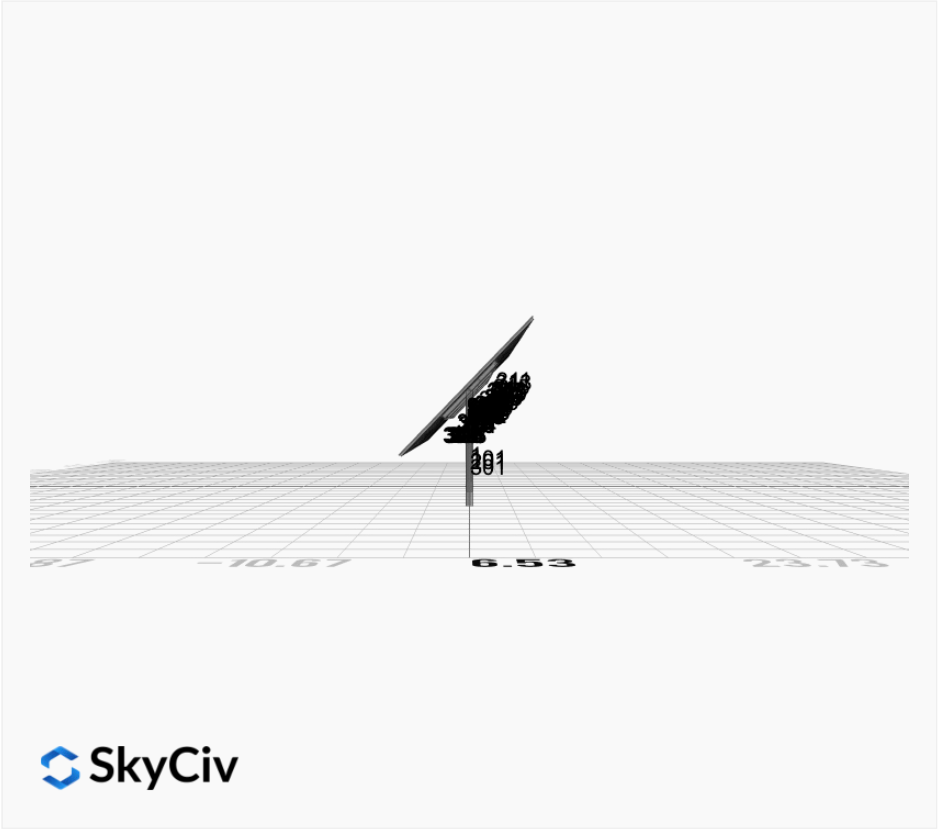
Design Notes:

- Deflection checks are set to L/1 due to manufacturer structural design intent
- Foundation Soil Parameters used in this Autodesign are all estimates, proper geotechnical reports are required to confirm soil profiles
- Wind speeds, snow loads and other site specific results are based on ASCE 7-16
- Steel frame design checks are based on AISC 360-16 LRFD
- Design / analysis of fixings and connections are not carried out by this module.
- Impacts of eccentrically applied, partial or pattern loading are not considered by this module.

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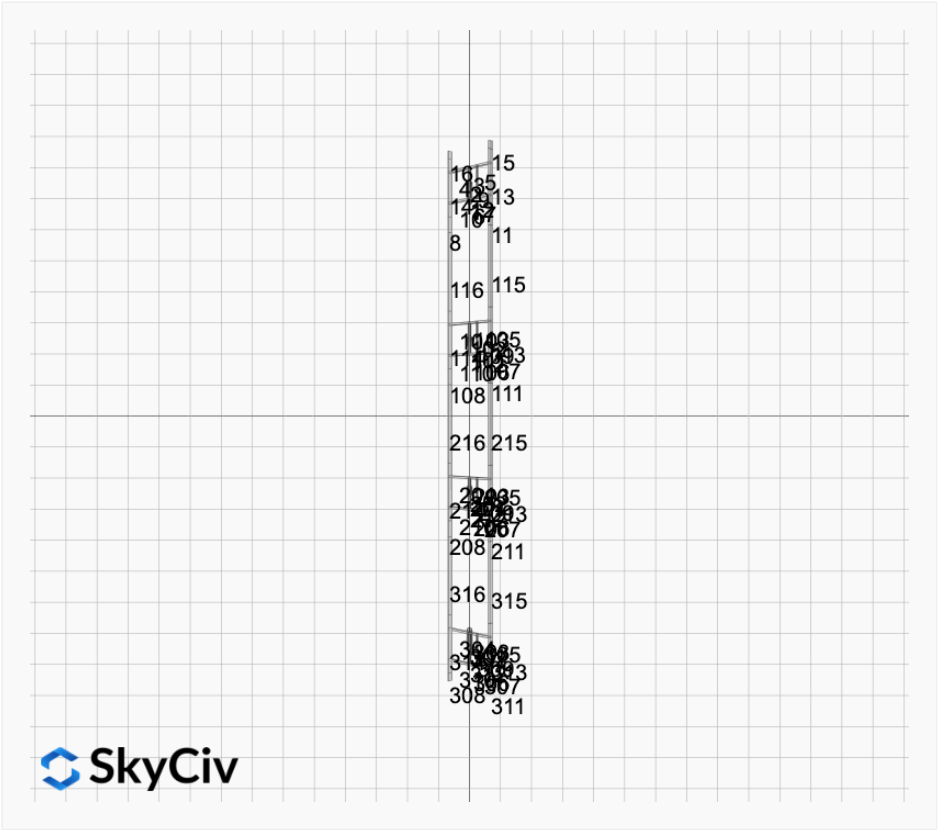
23.75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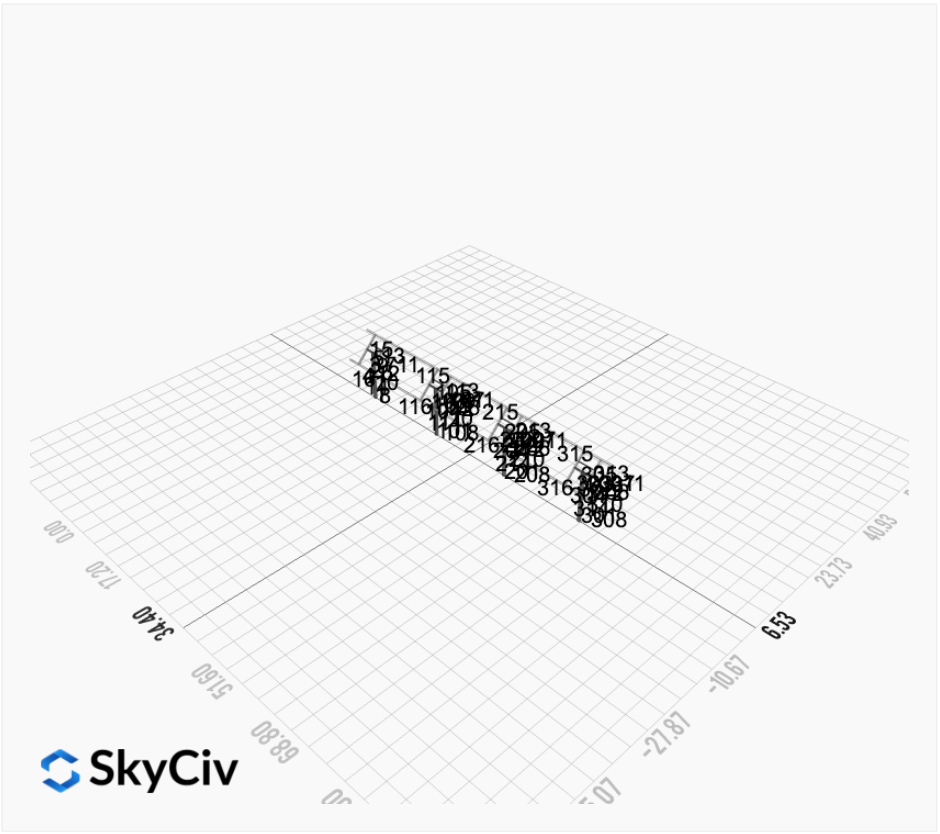
SkyCiv
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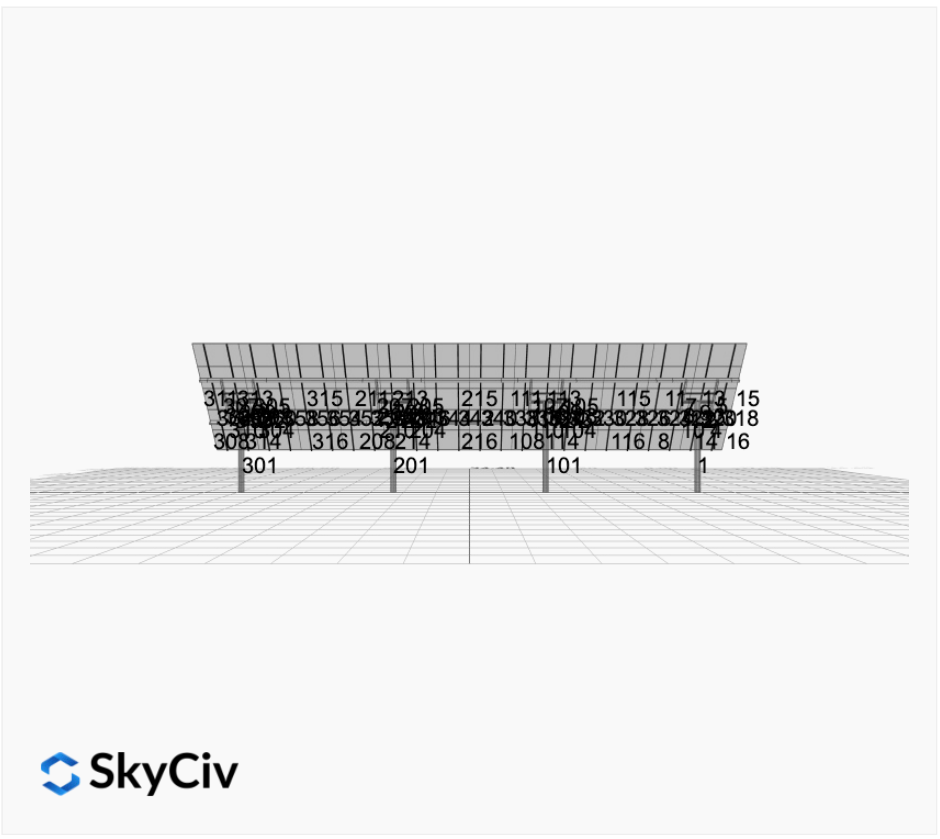
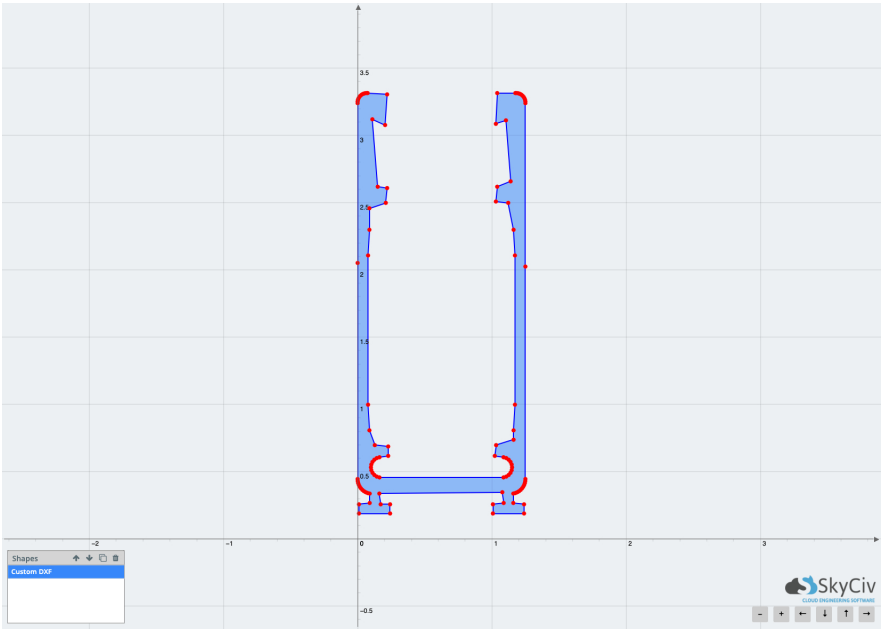
17.20
34.40
51.60
68.80
6.53
-10.67
-27.87
23.13
40.33


SkyCiv
301
201
101
1

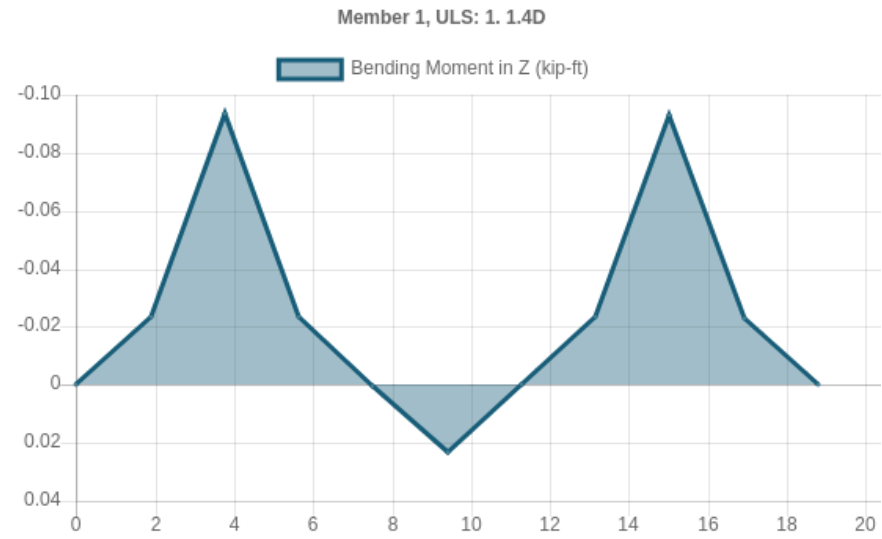
Rail Design Check

Rail Length: 18.79 ft
Additional Restraints Required: 4ft Spread Clamps
Tributary Width: 2.87 ft
Material: Aluminium
Density: 169.00 lb/ft^3
Elastic Modulus: 10000.00 ksi
Fy: 34.50 ksi
Fu: 37.00 ksi

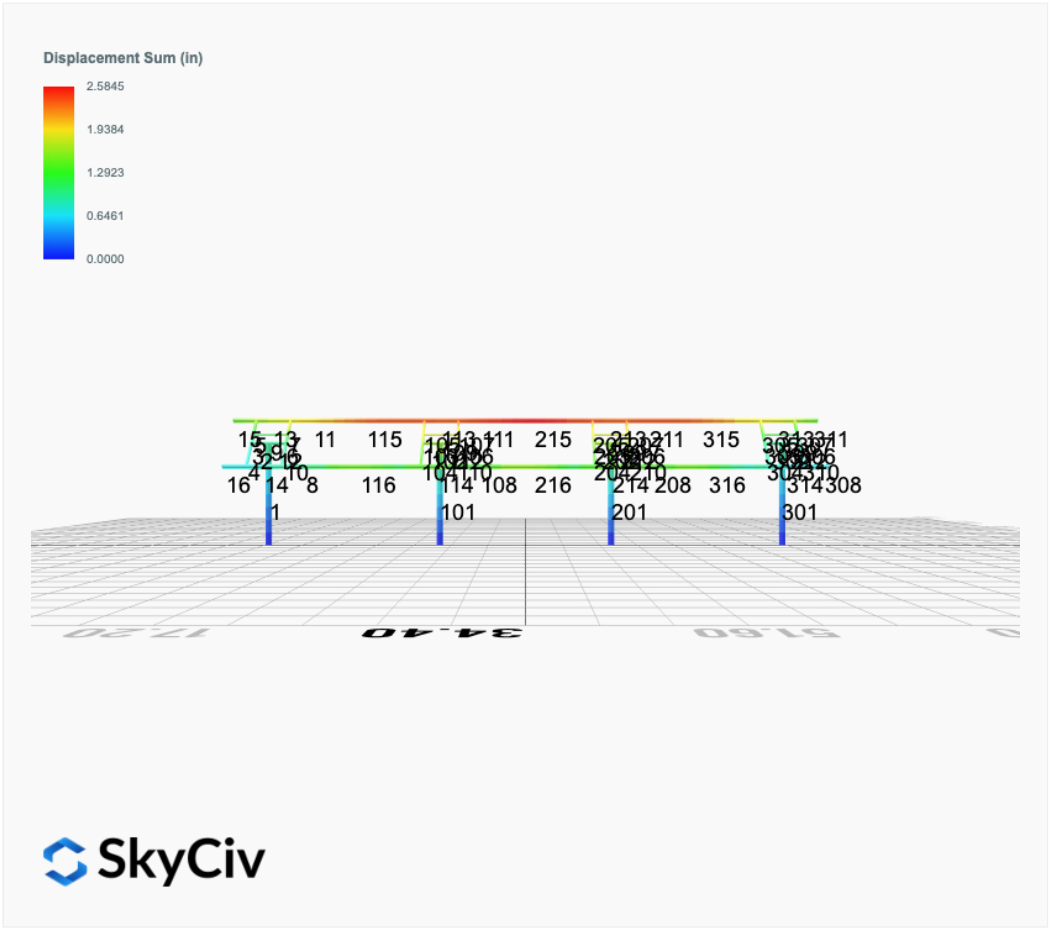
Rail Distributed Loading:
Note, gravity loading is resolved into member local X and Y axes.
Snow (X): 0.0194 kip/ft
Snow (Y): -0.0201 kip/ft
Wind uplift Case A (X): 0.0000 kip/ft
Wind uplift Case A (Y): 0.0490 kip/ft
Wind downforce Case A (X): 0.0000 kip/ft
Wind downforce Case A (Y): -0.0490 kip/ft
Dead (Panel load) (X): 0.0091 kip/ft
Dead (Panel load) (Y): -0.0094 kip/ft

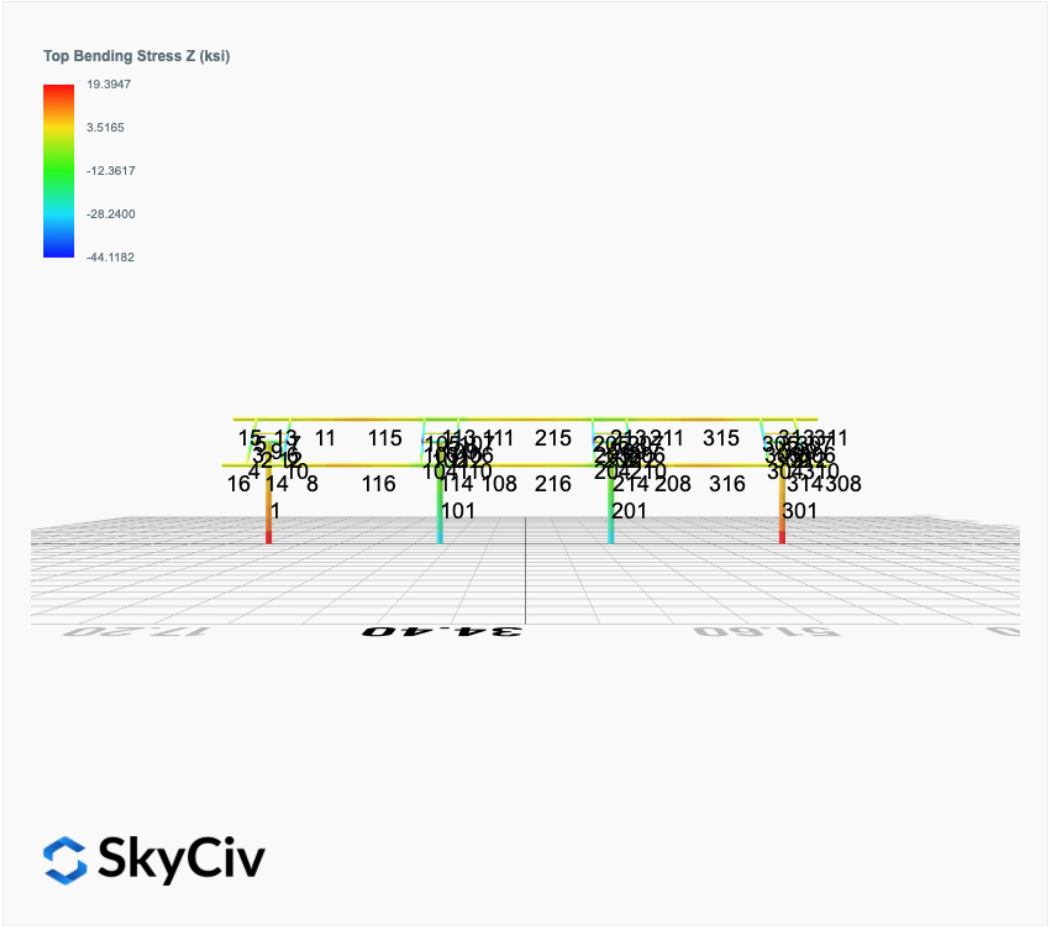


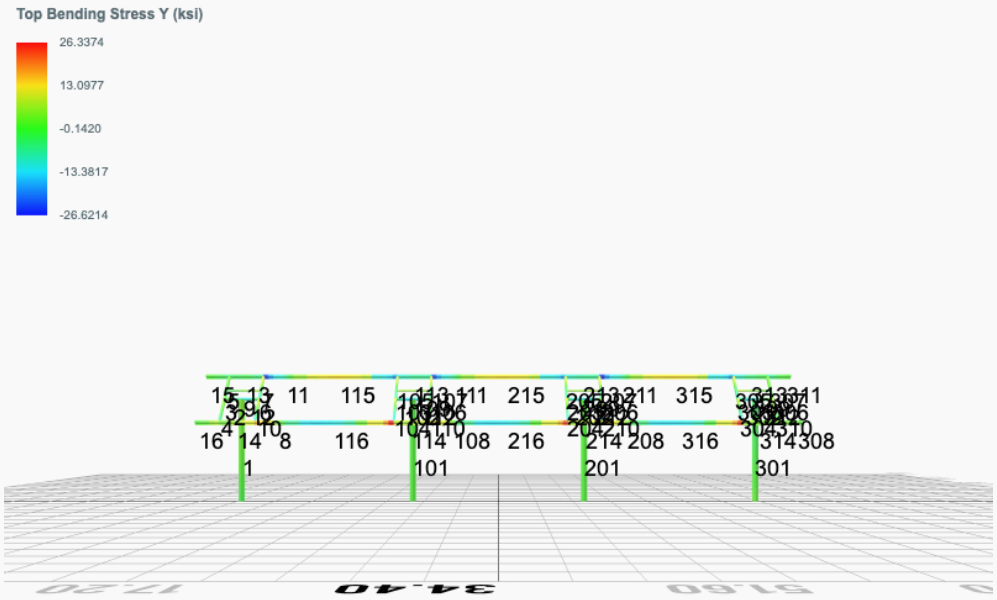
Result Check	Max Limit	Max Value	Utility	Status
Custom Stress Limit	34.50	10.83	0.314	PASS
Material Yield	34.50	10.83	0.314	PASS
Material Strength	37.00	10.83	0.293	PASS



FEM Results (Envelope Worst Case)







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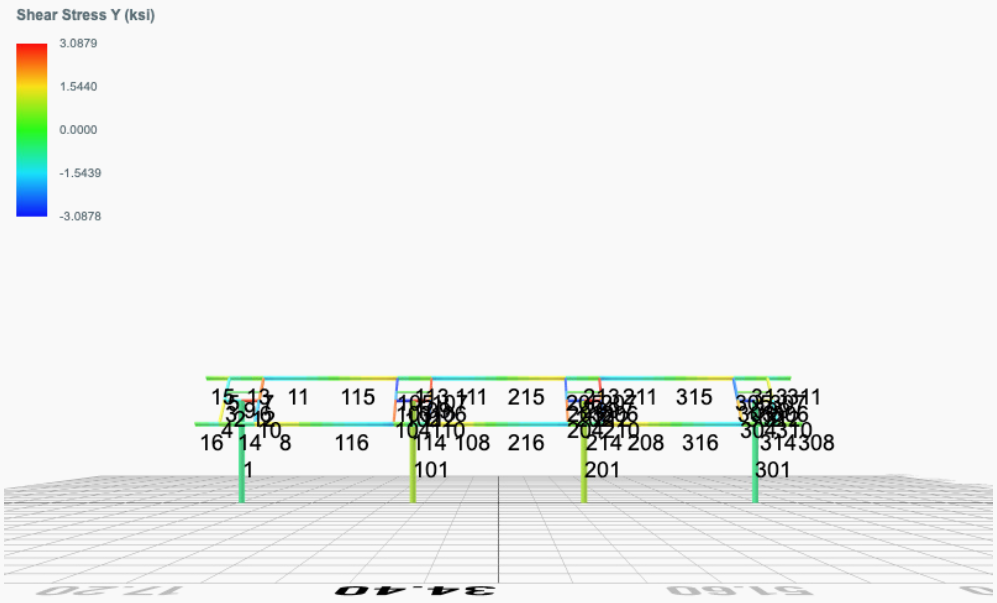

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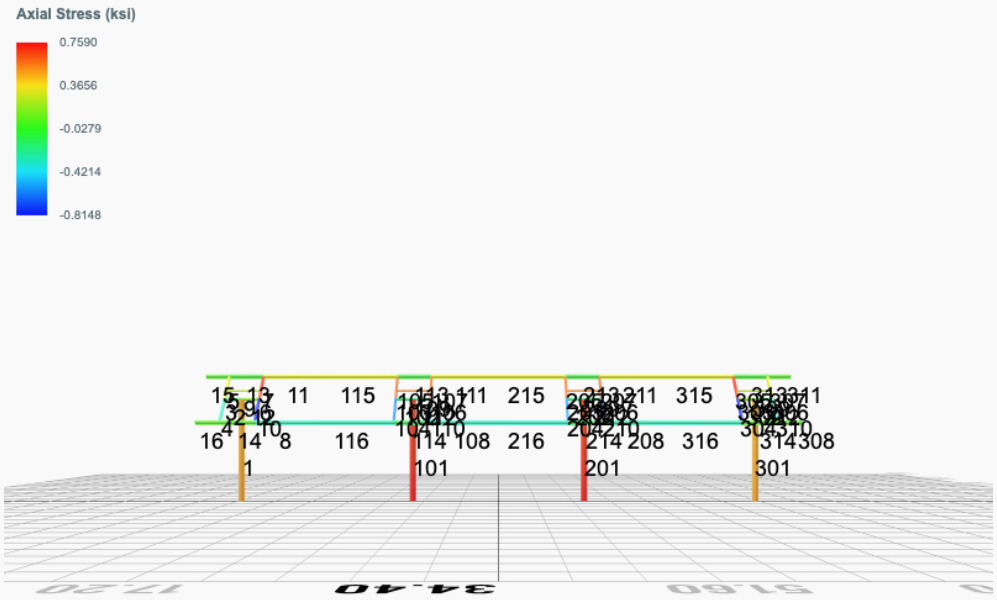

Axial Stress (ksi)
0.7590
0.3656
-0.0279
-0.4214
-0.8148
11
115
215
315
16
14
8
116
108
216
214
208
316
314
308
1
101
201
301

Reaction Forces for Foundation 1 (Node ID#1), (kip, kip-ft)

LRFD Load Combination Results

Name	Fx	Fy	Fz	Mx	My	Mz
ULS: 1. 1.4D	0.0492	2.9977	0.1616	0.5173	-0.2366	-0.5359
ULS: 2. 1.2D + 1.6L + 0.5(S or Lr or R)	0.0638	3.4792	0.2095	0.6712	-0.3070	-0.7006
ULS: 2. 1.2D + 1.6L + 0.5(S or Lr or R)	0.0422	2.5695	0.1384	0.4431	-0.2027	-0.4602
ULS: 3. 1.2D + 1.6(S or Lr or R) + L	0.1112	5.4805	0.3664	1.1759	-0.5372	-1.2198
ULS: 5. 1.2D + E + L + 0.2S	0.0508	2.9334	0.1668	0.5342	-0.2444	-0.5567
ULS: 7. 0.9D + 1.0E	0.0317	1.9271	0.1038	0.3320	-0.1519	-0.3461
ULS: 4. 1.2D + W + L + 0.5(S or Lr or R)_Wind downforce Case A only	-3.2248	6.5855	0.5921	1.7840	-2.5662	38.7923
ULS: 4. 1.2D + W + L + 0.5(S or Lr or R)_Wind downforce Case B only	0.0638	3.4792	0.2095	0.6712	-0.3070	-0.7006
ULS: 4. 1.2D + W + L + 0.5(S or Lr or R)_Wind uplift Case A only	3.3501	0.3740	-0.1687	-0.4287	1.9287	-39.6196
ULS: 4. 1.2D + W + L + 0.5(S or Lr or R)_Wind uplift Case B only	0.0638	3.4792	0.2095	0.6712	-0.3070	-0.7006
ULS: 4. 1.2D + W + L + 0.5(S or Lr or R)_Wind downforce Case A only	-3.2461	5.6759	0.5204	1.5542	-2.4590	38.9381
ULS: 4. 1.2D + W + L + 0.5(S or Lr or R)_Wind downforce Case B only	0.0422	2.5695	0.1384	0.4431	-0.2027	-0.4602
ULS: 4. 1.2D + W + L + 0.5(S or Lr or R)_Wind uplift Case A only	3.3283	-0.5357	-0.2392	-0.6551	2.0302	-39.2878
ULS: 4. 1.2D + W + L + 0.5(S or Lr or R)_Wind uplift Case B only	0.0422	2.5695	0.1384	0.4431	-0.2027	-0.4602
ULS: 3. 1.2D + 1.6(S or Lr or R) + 0.5W_Wind downforce Case A only	-1.5331	7.0335	0.5578	1.7325	-1.6670	18.5582
ULS: 3. 1.2D + 1.6(S or Lr or R) + 0.5W_Wind downforce Case B only	0.1112	5.4805	0.3664	1.1759	-0.5372	-1.2198
ULS: 3. 1.2D + 1.6(S or Lr or R) + 0.5W_Wind uplift Case A only	1.7549	3.9278	0.1761	0.6227	0.5867	-20.8524
ULS: 3. 1.2D + 1.6(S or Lr or R) + 0.5W_Wind uplift Case B only	0.1112	5.4805	0.3664	1.1759	-0.5372	-1.2198
ULS: 3. 1.2D + 1.6(S or Lr or R) + 0.5W_Wind downforce Case A only	-1.6017	4.1225	0.3289	0.9970	-1.3279	19.1666
ULS: 3. 1.2D + 1.6(S or Lr or R) + 0.5W_Wind downforce Case B only	0.0422	2.5695	0.1384	0.4431	-0.2027	-0.4602
ULS: 3. 1.2D + 1.6(S or Lr or R) + 0.5W_Wind uplift Case A only	1.6855	1.0167	-0.0509	-0.1076	0.9166	-19.9444
ULS: 3. 1.2D + 1.6(S or Lr or R) + 0.5W_Wind uplift Case B only	0.0422	2.5695	0.1384	0.4431	-0.2027	-0.4602
ULS: 6. 0.9D + 1.0W_Wind downforce Case A only	-3.2565	5.0335	0.4854	1.4422	-2.4066	38.9881
ULS: 6. 0.9D + 1.0W_Wind downforce Case B only	0.0317	1.9271	0.1038	0.3320	-0.1519	-0.3461
ULS: 6. 0.9D + 1.0W_Wind uplift Case A only	3.3175	-1.1781	-0.2736	-0.7653	2.0794	-39.1118
ULS: 6. 0.9D + 1.0W_Wind uplift Case B only	0.0317	1.9271	0.1038	0.3320	-0.1519	-0.3461

ASD Load Combination Results

Name	Fx	Fy	Fz	Mx	My	Mz
ULS: 1. D	0.0352	2.1412	0.1153	0.3690	-0.1688	-0.3842
ULS: 2. D + L	0.0352	2.1412	0.1153	0.3690	-0.1688	-0.3842
ULS: 3. D + (S or Lr or R)	0.0783	3.9606	0.2575	0.8254	-0.3774	-0.8640
ULS: 3. D + (S or Lr or R)	0.0352	2.1412	0.1153	0.3690	-0.1688	-0.3842
ULS: 4. D + 0.75L + 0.75(S or Lr or R)	0.0676	3.5058	0.2219	0.7110	-0.3252	-0.7451
ULS: 4. D + 0.75L + 0.75(S or Lr or R)	0.0352	2.1412	0.1153	0.3690	-0.1688	-0.3842
ULS: 5b. D + 0.7E	0.0352	2.1412	0.1153	0.3690	-0.1688	-0.3842
ULS: 6b. D + 0.75L + 0.75(0.7)E + 0.75S	0.0676	3.5058	0.2219	0.7110	-0.3252	-0.7451
ULS: 8. 0.6D + 0.7E	0.0211	1.2847	0.0691	0.2211	-0.1012	-0.2313
ULS: 5a. D + 0.6W_Wind downforce Case A only	-1.9375	4.0049	0.3438	1.0337	-1.5191	23.1598
ULS: 5a. D + 0.6W_Wind downforce Case B only	0.0352	2.1412	0.1153	0.3690	-0.1688	-0.3842
ULS: 5a. D + 0.6W_Wind uplift Case A only	2.0070	0.2780	-0.1117	-0.2911	1.1730	-23.7233
ULS: 5a. D + 0.6W_Wind uplift Case B only	0.0352	2.1412	0.1153	0.3690	-0.1688	-0.3842
ULS: 6a. D + 0.75L + 0.75(0.6)W + 0.75(S or Lr or R)_Wind downforce Case A only	-1.4120	4.9035	0.3936	1.2102	-1.3390	16.9567
ULS: 6a. D + 0.75L + 0.75(0.6)W + 0.75(S or Lr or R)_Wind downforce Case B only	0.0676	3.5058	0.2219	0.7110	-0.3252	-0.7451
ULS: 6a. D + 0.75L + 0.75(0.6)W + 0.75(S or Lr or R)_Wind uplift Case A only	1.5467	2.1083	0.0512	0.2144	0.6839	-18.3307
ULS: 6a. D + 0.75L + 0.75(0.6)W + 0.75(S or Lr or R)_Wind uplift Case B only	0.0676	3.5058	0.2219	0.7110	-0.3252	-0.7451

Name	Fx	Fy	Fz	Mx	My	Mz
ULS: 6a. D + 0.75L + 0.75(0.6)W + 0.75(S or Lr or R)_Wind downforce Case A only	-1.4442	3.5390	0.2866	0.8671	-1.1807	17.2544
ULS: 6a. D + 0.75L + 0.75(0.6)W + 0.75(S or Lr or R)_Wind downforce Case B only	0.0352	2.1412	0.1153	0.3690	-0.1688	-0.3842
ULS: 6a. D + 0.75L + 0.75(0.6)W + 0.75(S or Lr or R)_Wind uplift Case A only	1.5141	0.7438	-0.0551	-0.1265	0.8383	-17.9076
ULS: 6a. D + 0.75L + 0.75(0.6)W + 0.75(S or Lr or R)_Wind uplift Case B only	0.0352	2.1412	0.1153	0.3690	-0.1688	-0.3842
ULS: 7. 0.6D + 0.6W_Wind downforce Case A only	-1.9514	3.1484	0.2974	0.8851	-1.4502	23.2619
ULS: 7. 0.6D + 0.6W_Wind downforce Case B only	0.0211	1.2847	0.0691	0.2211	-0.1012	-0.2313
ULS: 7. 0.6D + 0.6W_Wind uplift Case A only	1.9928	-0.5785	-0.1576	-0.4383	1.2394	-23.5208
ULS: 7. 0.6D + 0.6W_Wind uplift Case B only	0.0211	1.2847	0.0691	0.2211	-0.1012	-0.2313

Worst Case Reactions (LRFD)

Note: Downforce / downwind wind load cases are assumed to govern.

Result	Value (kip, kip-ft)
Axial	7.0335
Shear X	-3.3501
Shear Z	0.5921
Moment X	1.7840
Moment Y (Twist)	2.5662
Moment Z	39.6196

Worst Case Reactions (ASD)

Note: Downforce / downwind wind load cases are assumed to govern.

Result	Value (kip, kip-ft)
Axial	4.9035
Shear X	-2.0070
Shear Z	0.3936
Moment X	1.2102
Moment Y (Twist)	1.5191
Moment Z	23.7233

Reaction Forces for Foundation 2 (Node ID#101), (kip, kip-ft)

LRFD Load Combination Results

Name	Fx	Fy	Fz	Mx	My	Mz
ULS: 1. 1.4D	-0.0492	3.8488	-0.0129	-0.0415	0.0679	0.6034
ULS: 2. 1.2D + 1.6L + 0.5(S or Lr or R)	-0.0638	4.5817	-0.0167	-0.0537	0.0879	0.7800
ULS: 2. 1.2D + 1.6L + 0.5(S or Lr or R)	-0.0422	3.2990	-0.0110	-0.0356	0.0582	0.5147
ULS: 3. 1.2D + 1.6(S or Lr or R) + L	-0.1112	7.4038	-0.0290	-0.0937	0.1529	1.3899
ULS: 5. 1.2D + E + L + 0.2S	-0.0508	3.8121	-0.0133	-0.0428	0.0701	0.6199
ULS: 7. 0.9D + 1.0E	-0.0317	2.4742	-0.0083	-0.0267	0.0437	0.3832
ULS: 4. 1.2D + W + L + 0.5(S or Lr or R)_Wind downforce Case A only	-4.7208	9.1484	-0.0273	-0.0977	0.0329	56.4991
ULS: 4. 1.2D + W + L + 0.5(S or Lr or R)_Wind downforce Case B only	-0.0638	4.5817	-0.0167	-0.0537	0.0879	0.7800
ULS: 4. 1.2D + W + L + 0.5(S or Lr or R)_Wind uplift Case A only	4.5956	0.0138	-0.0043	-0.0054	0.1302	-53.8720
ULS: 4. 1.2D + W + L + 0.5(S or Lr or R)_Wind uplift Case B only	-0.0638	4.5817	-0.0167	-0.0537	0.0879	0.7800
ULS: 4. 1.2D + W + L + 0.5(S or Lr or R)_Wind downforce Case A only	-4.6996	7.8656	-0.0220	-0.0801	0.0053	56.0541
ULS: 4. 1.2D + W + L + 0.5(S or Lr or R)_Wind downforce Case B only	-0.0422	3.2990	-0.0110	-0.0356	0.0582	0.5147
ULS: 4. 1.2D + W + L + 0.5(S or Lr or R)_Wind uplift Case A only	4.6174	-1.2689	0.0016	0.0133	0.0986	-53.9653
ULS: 4. 1.2D + W + L + 0.5(S or Lr or R)_Wind uplift Case B only	-0.0422	3.2990	-0.0110	-0.0356	0.0582	0.5147
ULS: 3. 1.2D + 1.6(S or Lr or R) + 0.5W_Wind downforce Case A only	-2.4397	9.6873	-0.0343	-0.1156	0.1248	29.3118
ULS: 3. 1.2D + 1.6(S or Lr or R) + 0.5W_Wind downforce Case B only	-0.1112	7.4038	-0.0290	-0.0937	0.1529	1.3899
ULS: 3. 1.2D + 1.6(S or Lr or R) + 0.5W_Wind uplift Case A only	2.2179	5.1200	-0.0233	-0.0706	0.1777	-26.2609
ULS: 3. 1.2D + 1.6(S or Lr or R) + 0.5W_Wind uplift Case B only	-0.1112	7.4038	-0.0290	-0.0937	0.1529	1.3899
ULS: 3. 1.2D + 1.6(S or Lr or R) + 0.5W_Wind downforce Case A only	-2.3712	5.5824	-0.0167	-0.0584	0.0333	28.1497
ULS: 3. 1.2D + 1.6(S or Lr or R) + 0.5W_Wind downforce Case B only	-0.0422	3.2990	-0.0110	-0.0356	0.0582	0.5147
ULS: 3. 1.2D + 1.6(S or Lr or R) + 0.5W_Wind uplift Case A only	2.2873	1.0152	-0.0049	-0.0116	0.0799	-26.8555
ULS: 3. 1.2D + 1.6(S or Lr or R) + 0.5W_Wind uplift Case B only	-0.0422	3.2990	-0.0110	-0.0356	0.0582	0.5147
ULS: 6. 0.9D + 1.0W_Wind downforce Case A only	-4.6892	7.0409	-0.0193	-0.0716	-0.0081	55.8114
ULS: 6. 0.9D + 1.0W_Wind downforce Case B only	-0.0317	2.4742	-0.0083	-0.0267	0.0437	0.3832
ULS: 6. 0.9D + 1.0W_Wind uplift Case A only	4.6281	-2.0936	0.0044	0.0225	0.0831	-53.9904
ULS: 6. 0.9D + 1.0W_Wind uplift Case B only	-0.0317	2.4742	-0.0083	-0.0267	0.0437	0.3832

ASD Load Combination Results

Name	Fx	Fy	Fz	Mx	My	Mz
ULS: 1. D	-0.0352	2.7491	-0.0092	-0.0296	0.0485	0.4268
ULS: 2. D + L	-0.0352	2.7491	-0.0092	-0.0296	0.0485	0.4268
ULS: 3. D + (S or Lr or R)	-0.0783	5.3147	-0.0205	-0.0660	0.1079	0.9598
ULS: 3. D + (S or Lr or R)	-0.0352	2.7491	-0.0092	-0.0296	0.0485	0.4268
ULS: 4. D + 0.75L + 0.75(S or Lr or R)	-0.0675	4.6733	-0.0176	-0.0569	0.0931	0.8238
ULS: 4. D + 0.75L + 0.75(S or Lr or R)	-0.0352	2.7491	-0.0092	-0.0296	0.0485	0.4268
ULS: 5b. D + 0.7E	-0.0352	2.7491	-0.0092	-0.0296	0.0485	0.4268
ULS: 6b. D + 0.75L + 0.75(0.7)E + 0.75S	-0.0675	4.6733	-0.0176	-0.0569	0.0931	0.8238
ULS: 8. 0.6D + 0.7E	-0.0211	1.6495	-0.0055	-0.0178	0.0291	0.2536
ULS: 5a. D + 0.6W_Wind downforce Case A only	-2.8299	5.4893	-0.0160	-0.0570	0.0187	33.5769
ULS: 5a. D + 0.6W_Wind downforce Case B only	-0.0352	2.7491	-0.0092	-0.0296	0.0485	0.4268
ULS: 5a. D + 0.6W_Wind uplift Case A only	2.7604	0.0086	-0.0018	-0.0007	0.0738	-32.3430
ULS: 5a. D + 0.6W_Wind uplift Case B only	-0.0352	2.7491	-0.0092	-0.0296	0.0485	0.4268
ULS: 6a. D + 0.75L + 0.75(0.6)W + 0.75(S or Lr or R)_Wind downforce Case A only	-2.1635	6.7284	-0.0227	-0.0772	0.0698	25.7699
ULS: 6a. D + 0.75L + 0.75(0.6)W + 0.75(S or Lr or R)_Wind downforce Case B only	-0.0675	4.6733	-0.0176	-0.0569	0.0931	0.8238
ULS: 6a. D + 0.75L + 0.75(0.6)W + 0.75(S or Lr or R)_Wind uplift Case A only	2.0289	2.6179	-0.0123	-0.0357	0.1137	-23.9061
ULS: 6a. D + 0.75L + 0.75(0.6)W + 0.75(S or Lr or R)_Wind uplift Case B only	-0.0675	4.6733	-0.0176	-0.0569	0.0931	0.8238
ULS: 6a. D + 0.75L + 0.75(0.6)W + 0.75(S or Lr or R)_Wind downforce Case A only	-2.1313	4.8043	-0.0144	-0.0503	0.0266	25.2533
ULS: 6a. D + 0.75L + 0.75(0.6)W + 0.75(S or Lr or R)_Wind downforce Case B only	-0.0352	2.7491	-0.0092	-0.0296	0.0485	0.4268
ULS: 6a. D + 0.75L + 0.75(0.6)W + 0.75(S or Lr or R)_Wind uplift Case A only	2.0614	0.6937	-0.0037	-0.0081	0.0679	-24.1858
ULS: 6a. D + 0.75L + 0.75(0.6)W + 0.75(S or Lr or R)_Wind uplift Case B only	-0.0352	2.7491	-0.0092	-0.0296	0.0485	0.4268
ULS: 7. 0.6D + 0.6W_Wind downforce Case A only	-2.8160	4.3896	-0.0124	-0.0455	0.0002	33.3158
ULS: 7. 0.6D + 0.6W_Wind downforce Case B only	-0.0211	1.6495	-0.0055	-0.0178	0.0291	0.2536
ULS: 7. 0.6D + 0.6W_Wind uplift Case A only	2.7746	-1.0911	0.0020	0.0114	0.0536	-32.4307
ULS: 7. 0.6D + 0.6W_Wind uplift Case B only	-0.0211	1.6495	-0.0055	-0.0178	0.0291	0.2536

Worst Case Reactions (LRFD)

Note: Downforce / downwind wind load cases are assumed to govern.

Result	Value (kip, kip-ft)
Axial	9.6873
Shear X	-4.7208
Shear Z	-0.0343
Moment X	-0.1156
Moment Y (Twist)	0.1777
Moment Z	56.4991

Worst Case Reactions (ASD)

Note: Downforce / downwind wind load cases are assumed to govern.

Result	Value (kip, kip-ft)
Axial	6.7284
Shear X	-2.8299
Shear Z	-0.0227
Moment X	-0.0772
Moment Y (Twist)	0.1137
Moment Z	33.5769

Reaction Forces for Foundation 3 (Node ID#201), (kip, kip-ft)

LRFD Load Combination Results

Name	Fx	Fy	Fz	Mx	My	Mz
ULS: 1. 1.4D	-0.0492	3.8488	0.0129	0.0415	-0.0677	0.6034
ULS: 2. 1.2D + 1.6L + 0.5(S or Lr or R)	-0.0638	4.5817	0.0167	0.0537	-0.0876	0.7800
ULS: 2. 1.2D + 1.6L + 0.5(S or Lr or R)	-0.0422	3.2990	0.0110	0.0356	-0.0581	0.5147
ULS: 3. 1.2D + 1.6(S or Lr or R) + L	-0.1112	7.4038	0.0290	0.0935	-0.1522	1.3899
ULS: 5. 1.2D + E + L + 0.2S	-0.0508	3.8121	0.0133	0.0428	-0.0699	0.6199
ULS: 7. 0.9D + 1.0E	-0.0317	2.4742	0.0083	0.0267	-0.0436	0.3832
ULS: 4. 1.2D + W + L + 0.5(S or Lr or R)_Wind downforce Case A only	-4.7209	9.1484	0.0273	0.0973	-0.0323	56.4991

Name	Fx	Fy	Fz	Mx	My	Mz
ULS: 4. 1.2D + W + L + 0.5(S or Lr or R)_Wind downforce Case B only	-0.0638	4.5817	0.0167	0.0537	-0.0876	0.7800
ULS: 4. 1.2D + W + L + 0.5(S or Lr or R)_Wind uplift Case A only	4.5956	0.0138	0.0043	0.0056	-0.1303	-53.8720
ULS: 4. 1.2D + W + L + 0.5(S or Lr or R)_Wind uplift Case B only	-0.0638	4.5817	0.0167	0.0537	-0.0876	0.7800
ULS: 4. 1.2D + W + L + 0.5(S or Lr or R)_Wind downforce Case A only	-4.6996	7.8656	0.0220	0.0799	-0.0048	56.0541
ULS: 4. 1.2D + W + L + 0.5(S or Lr or R)_Wind downforce Case B only	-0.0422	3.2990	0.0110	0.0356	-0.0581	0.5147
ULS: 4. 1.2D + W + L + 0.5(S or Lr or R)_Wind uplift Case A only	4.6174	-1.2689	-0.0015	-0.0132	-0.0988	-53.9653
ULS: 4. 1.2D + W + L + 0.5(S or Lr or R)_Wind uplift Case B only	-0.0422	3.2990	0.0110	0.0356	-0.0581	0.5147
ULS: 3. 1.2D + 1.6(S or Lr or R) + 0.5W_Wind downforce Case A only	-2.4397	9.6873	0.0343	0.1151	-0.1238	29.3118
ULS: 3. 1.2D + 1.6(S or Lr or R) + 0.5W_Wind downforce Case B only	-0.1112	7.4038	0.0290	0.0935	-0.1522	1.3899
ULS: 3. 1.2D + 1.6(S or Lr or R) + 0.5W_Wind uplift Case A only	2.2179	5.1200	0.0233	0.0707	-0.1773	-26.2610
ULS: 3. 1.2D + 1.6(S or Lr or R) + 0.5W_Wind uplift Case B only	-0.1112	7.4038	0.0290	0.0935	-0.1522	1.3899
ULS: 3. 1.2D + 1.6(S or Lr or R) + 0.5W_Wind downforce Case A only	-2.3712	5.5824	0.0167	0.0583	-0.0331	28.1497
ULS: 3. 1.2D + 1.6(S or Lr or R) + 0.5W_Wind downforce Case B only	-0.0422	3.2990	0.0110	0.0356	-0.0581	0.5147
ULS: 3. 1.2D + 1.6(S or Lr or R) + 0.5W_Wind uplift Case A only	2.2873	1.0152	0.0049	0.0117	-0.0799	-26.8555
ULS: 3. 1.2D + 1.6(S or Lr or R) + 0.5W_Wind uplift Case B only	-0.0422	3.2990	0.0110	0.0356	-0.0581	0.5147
ULS: 6. 0.9D + 1.0W_Wind downforce Case A only	-4.6892	7.0409	0.0193	0.0714	0.0084	55.8114
ULS: 6. 0.9D + 1.0W_Wind downforce Case B only	-0.0317	2.4742	0.0083	0.0267	-0.0436	0.3832
ULS: 6. 0.9D + 1.0W_Wind uplift Case A only	4.6281	-2.0936	-0.0044	-0.0224	-0.0832	-53.9904
ULS: 6. 0.9D + 1.0W_Wind uplift Case B only	-0.0317	2.4742	0.0083	0.0267	-0.0436	0.3832

ASD Load Combination Results

Name	Fx	Fy	Fz	Mx	My	Mz
ULS: 1. D	-0.0352	2.7491	0.0092	0.0296	-0.0484	0.4268
ULS: 2. D + L	-0.0352	2.7491	0.0092	0.0296	-0.0484	0.4268
ULS: 3. D + (S or Lr or R)	-0.0783	5.3147	0.0205	0.0659	-0.1075	0.9598
ULS: 3. D + (S or Lr or R)	-0.0352	2.7491	0.0092	0.0296	-0.0484	0.4268
ULS: 4. D + 0.75L + 0.75(S or Lr or R)	-0.0675	4.6733	0.0177	0.0569	-0.0928	0.8238
ULS: 4. D + 0.75L + 0.75(S or Lr or R)	-0.0352	2.7491	0.0092	0.0296	-0.0484	0.4268
ULS: 5b. D + 0.7E	-0.0352	2.7491	0.0092	0.0296	-0.0484	0.4268
ULS: 6b. D + 0.75L + 0.75(0.7)E + 0.75S	-0.0675	4.6733	0.0177	0.0569	-0.0928	0.8238
ULS: 8. 0.6D + 0.7E	-0.0211	1.6495	0.0055	0.0178	-0.0291	0.2536
ULS: 5a. D + 0.6W_Wind downforce Case A only	-2.8299	5.4893	0.0160	0.0569	-0.0185	33.5769
ULS: 5a. D + 0.6W_Wind downforce Case B only	-0.0352	2.7491	0.0092	0.0296	-0.0484	0.4268
ULS: 5a. D + 0.6W_Wind uplift Case A only	2.7604	0.0086	0.0018	0.0008	-0.0739	-32.3430
ULS: 5a. D + 0.6W_Wind uplift Case B only	-0.0352	2.7491	0.0092	0.0296	-0.0484	0.4268
ULS: 6a. D + 0.75L + 0.75(0.6)W + 0.75(S or Lr or R)_Wind downforce Case A only	-2.1635	6.7284	0.0227	0.0770	-0.0694	25.7699
ULS: 6a. D + 0.75L + 0.75(0.6)W + 0.75(S or Lr or R)_Wind downforce Case B only	-0.0675	4.6733	0.0177	0.0569	-0.0928	0.8238
ULS: 6a. D + 0.75L + 0.75(0.6)W + 0.75(S or Lr or R)_Wind uplift Case A only	2.0289	2.6179	0.0123	0.0358	-0.1136	-23.9062
ULS: 6a. D + 0.75L + 0.75(0.6)W + 0.75(S or Lr or R)_Wind uplift Case B only	-0.0675	4.6733	0.0177	0.0569	-0.0928	0.8238
ULS: 6a. D + 0.75L + 0.75(0.6)W + 0.75(S or Lr or R)_Wind downforce Case A only	-2.1313	4.8043	0.0144	0.0503	-0.0264	25.2533
ULS: 6a. D + 0.75L + 0.75(0.6)W + 0.75(S or Lr or R)_Wind downforce Case B only	-0.0352	2.7491	0.0092	0.0296	-0.0484	0.4268
ULS: 6a. D + 0.75L + 0.75(0.6)W + 0.75(S or Lr or R)_Wind uplift Case A only	2.0614	0.6937	0.0037	0.0081	-0.0679	-24.1858
ULS: 6a. D + 0.75L + 0.75(0.6)W + 0.75(S or Lr or R)_Wind uplift Case B only	-0.0352	2.7491	0.0092	0.0296	-0.0484	0.4268
ULS: 7. 0.6D + 0.6W_Wind downforce Case A only	-2.8160	4.3896	0.0124	0.0454	-0.0001	33.3158
ULS: 7. 0.6D + 0.6W_Wind downforce Case B only	-0.0211	1.6495	0.0055	0.0178	-0.0291	0.2536
ULS: 7. 0.6D + 0.6W_Wind uplift Case A only	2.7746	-1.0911	-0.0020	-0.0114	-0.0536	-32.4307
ULS: 7. 0.6D + 0.6W_Wind uplift Case B only	-0.0211	1.6495	0.0055	0.0178	-0.0291	0.2536

Worst Case Reactions (LRFD)

Worst Case Reactions (ASD)

Note: Downforce / downwind wind load cases are assumed to govern.

Result	Value (kip, kip-ft)
Axial	9.6873
Shear X	-4.7209
Shear Z	0.0343
Moment X	0.1151
Moment Y (Twist)	0.1773
Moment Z	56.4991

Note: Downforce / downwind wind load cases are assumed to govern.

Result	Value (kip, kip-ft)
Axial	6.7284
Shear X	-2.8299
Shear Z	0.0227
Moment X	0.0770
Moment Y (Twist)	0.1136
Moment Z	33.5769

Reaction Forces for Foundation 4 (Node ID#301), (kip, kip-ft)

LRFD Load Combination Results

Name	Fx	Fy	Fz	Mx	My	Mz
ULS: 1. 1.4D	0.0492	2.9977	-0.1616	-0.5173	0.2367	-0.5358
ULS: 2. 1.2D + 1.6L + 0.5(S or Lr or R)	0.0638	3.4792	-0.2095	-0.6713	0.3072	-0.7004
ULS: 2. 1.2D + 1.6L + 0.5(S or Lr or R)	0.0422	2.5695	-0.1384	-0.4431	0.2028	-0.4601
ULS: 3. 1.2D + 1.6(S or Lr or R) + L	0.1112	5.4804	-0.3665	-1.1766	0.5377	-1.2192
ULS: 5. 1.2D + E + L + 0.2S	0.0508	2.9334	-0.1668	-0.5343	0.2445	-0.5566
ULS: 7. 0.9D + 1.0E	0.0317	1.9271	-0.1038	-0.3320	0.1520	-0.3460
ULS: 4. 1.2D + W + L + 0.5(S or Lr or R)_Wind downforce Case A only	-3.2248	6.5855	-0.5921	-1.7843	2.5667	38.7930
ULS: 4. 1.2D + W + L + 0.5(S or Lr or R)_Wind downforce Case B only	0.0638	3.4792	-0.2095	-0.6713	0.3072	-0.7004
ULS: 4. 1.2D + W + L + 0.5(S or Lr or R)_Wind uplift Case A only	3.3501	0.3740	0.1687	0.4286	-1.9288	-39.6200
ULS: 4. 1.2D + W + L + 0.5(S or Lr or R)_Wind uplift Case B only	0.0638	3.4792	-0.2095	-0.6713	0.3072	-0.7004
ULS: 4. 1.2D + W + L + 0.5(S or Lr or R)_Wind downforce Case A only	-3.2461	5.6759	-0.5204	-1.5544	2.4593	38.9386
ULS: 4. 1.2D + W + L + 0.5(S or Lr or R)_Wind downforce Case B only	0.0422	2.5695	-0.1384	-0.4431	0.2028	-0.4601
ULS: 4. 1.2D + W + L + 0.5(S or Lr or R)_Wind uplift Case A only	3.3283	-0.5357	0.2392	0.6552	-2.0303	-39.2882
ULS: 4. 1.2D + W + L + 0.5(S or Lr or R)_Wind uplift Case B only	0.0422	2.5695	-0.1384	-0.4431	0.2028	-0.4601
ULS: 3. 1.2D + 1.6(S or Lr or R) + 0.5W_Wind downforce Case A only	-1.5332	7.0334	-0.5578	-1.7334	1.6678	18.5590
ULS: 3. 1.2D + 1.6(S or Lr or R) + 0.5W_Wind downforce Case B only	0.1112	5.4804	-0.3665	-1.1766	0.5377	-1.2192
ULS: 3. 1.2D + 1.6(S or Lr or R) + 0.5W_Wind uplift Case A only	1.7549	3.9278	-0.1762	-0.6231	-0.5864	-20.8523
ULS: 3. 1.2D + 1.6(S or Lr or R) + 0.5W_Wind uplift Case B only	0.1112	5.4804	-0.3665	-1.1766	0.5377	-1.2192
ULS: 3. 1.2D + 1.6(S or Lr or R) + 0.5W_Wind downforce Case A only	-1.6017	4.1225	-0.3289	-0.9971	1.3281	19.1670
ULS: 3. 1.2D + 1.6(S or Lr or R) + 0.5W_Wind downforce Case B only	0.0422	2.5695	-0.1384	-0.4431	0.2028	-0.4601
ULS: 3. 1.2D + 1.6(S or Lr or R) + 0.5W_Wind uplift Case A only	1.6855	1.0168	0.0509	0.1076	-0.9166	-19.9445
ULS: 3. 1.2D + 1.6(S or Lr or R) + 0.5W_Wind uplift Case B only	0.0422	2.5695	-0.1384	-0.4431	0.2028	-0.4601
ULS: 6. 0.9D + 1.0W_Wind downforce Case A only	-3.2565	5.0335	-0.4854	-1.4423	2.4068	38.9885
ULS: 6. 0.9D + 1.0W_Wind downforce Case B only	0.0317	1.9271	-0.1038	-0.3320	0.1520	-0.3460
ULS: 6. 0.9D + 1.0W_Wind uplift Case A only	3.3176	-1.1781	0.2736	0.7654	-2.0795	-39.1121
ULS: 6. 0.9D + 1.0W_Wind uplift Case B only	0.0317	1.9271	-0.1038	-0.3320	0.1520	-0.3460

ASD Load Combination Results

Name	Fx	Fy	Fz	Mx	My	Mz
ULS: 1. D	0.0352	2.1412	-0.1153	-0.3690	0.1689	-0.3841
ULS: 2. D + L	0.0352	2.1412	-0.1153	-0.3690	0.1689	-0.3841
ULS: 3. D + (S or Lr or R)	0.0783	3.9606	-0.2575	-0.8258	0.3777	-0.8637
ULS: 3. D + (S or Lr or R)	0.0352	2.1412	-0.1153	-0.3690	0.1689	-0.3841
ULS: 4. D + 0.75L + 0.75(S or Lr or R)	0.0675	3.5057	-0.2219	-0.7112	0.3254	-0.7449
ULS: 4. D + 0.75L + 0.75(S or Lr or R)	0.0352	2.1412	-0.1153	-0.3690	0.1689	-0.3841
ULS: 5b. D + 0.7E	0.0352	2.1412	-0.1153	-0.3690	0.1689	-0.3841
ULS: 6b. D + 0.75L + 0.75(0.7)E + 0.75S	0.0675	3.5057	-0.2219	-0.7112	0.3254	-0.7449

Name	Fx	Fy	Fz	Mx	My	Mz
ULS: 8. 0.6D + 0.7E	0.0211	1.2847	-0.0691	-0.2211	0.1012	-0.2313
ULS: 5a. D + 0.6W_Wind downforce Case A only	-1.9375	4.0049	-0.3438	-1.0338	1.5193	23.1601
ULS: 5a. D + 0.6W_Wind downforce Case B only	0.0352	2.1412	-0.1153	-0.3690	0.1689	-0.3841
ULS: 5a. D + 0.6W_Wind uplift Case A only	2.0070	0.2780	0.1116	0.2911	-1.1731	-23.7235
ULS: 5a. D + 0.6W_Wind uplift Case B only	0.0352	2.1412	-0.1153	-0.3690	0.1689	-0.3841
ULS: 6a. D + 0.75L + 0.75(0.6)W + 0.75(S or Lr or R)_Wind downforce Case A only	-1.4121	4.9034	-0.3936	-1.2106	1.3394	16.9572
ULS: 6a. D + 0.75L + 0.75(0.6)W + 0.75(S or Lr or R)_Wind downforce Case B only	0.0675	3.5057	-0.2219	-0.7112	0.3254	-0.7449
ULS: 6a. D + 0.75L + 0.75(0.6)W + 0.75(S or Lr or R)_Wind uplift Case A only	1.5467	2.1083	-0.0512	-0.2146	-0.6838	-18.3307
ULS: 6a. D + 0.75L + 0.75(0.6)W + 0.75(S or Lr or R)_Wind uplift Case B only	0.0675	3.5057	-0.2219	-0.7112	0.3254	-0.7449
ULS: 6a. D + 0.75L + 0.75(0.6)W + 0.75(S or Lr or R)_Wind downforce Case A only	-1.4442	3.5390	-0.2866	-0.8672	1.1809	17.2547
ULS: 6a. D + 0.75L + 0.75(0.6)W + 0.75(S or Lr or R)_Wind downforce Case B only	0.0352	2.1412	-0.1153	-0.3690	0.1689	-0.3841
ULS: 6a. D + 0.75L + 0.75(0.6)W + 0.75(S or Lr or R)_Wind uplift Case A only	1.5141	0.7438	0.0550	0.1265	-0.8383	-17.9077
ULS: 6a. D + 0.75L + 0.75(0.6)W + 0.75(S or Lr or R)_Wind uplift Case B only	0.0352	2.1412	-0.1153	-0.3690	0.1689	-0.3841
ULS: 7. 0.6D + 0.6W_Wind downforce Case A only	-1.9514	3.1484	-0.2974	-0.8852	1.4503	23.2621
ULS: 7. 0.6D + 0.6W_Wind downforce Case B only	0.0211	1.2847	-0.0691	-0.2211	0.1012	-0.2313
ULS: 7. 0.6D + 0.6W_Wind uplift Case A only	1.9928	-0.5785	0.1576	0.4383	-1.2394	-23.5209
ULS: 7. 0.6D + 0.6W_Wind uplift Case B only	0.0211	1.2847	-0.0691	-0.2211	0.1012	-0.2313

Worst Case Reactions (LRFD)

Note: Downforce / downwind wind load cases are assumed to govern.

Result	Value (kip, kip-ft)
Axial	7.0334
Shear X	-3.3501
Shear Z	-0.5921
Moment X	-1.7843
Moment Y (Twist)	2.5667
Moment Z	39.6200

Worst Case Reactions (ASD)

Note: Downforce / downwind wind load cases are assumed to govern.

Result	Value (kip, kip-ft)
Axial	4.9034
Shear X	-2.0070
Shear Z	-0.3936
Moment X	-1.2106
Moment Y (Twist)	1.5193
Moment Z	23.7235

Project Details

Design Code: AISC 360-16 LRFD
Provision: LRFD
Country: United States

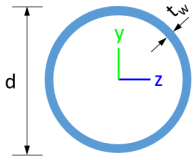
User Name: sales@mtsolar.us
Unit System: imperial

Design Input Information

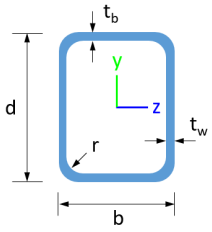
Design Factors			
Φ_t	Φ_c	Φ_b	Φ_v
0.9	0.9	0.9	0.9

Design Materials			
ID	E (ksi)	F_y (ksi)	F_u (ksi)
1	29000	50	65
2	29000	46	62
4	29000	50	62

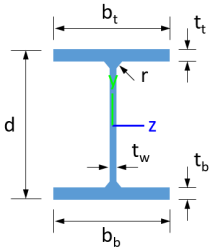
Section Dimensions



ID	Name	d (in)	t_w (in)					
1	2in Pipe Sch 40	2.38	0.15					
4	4in Pipe Sch 40	4.50	0.24					
10	8in Pipe Sch 80	8.63	0.50					



ID	Name	d (in)	b (in)	t_w (in)	t_b (in)	r (in)		
15	HSS5x3x1/8	5.00	3.00	0.12	0.12	0.12		



ID	Name	d (in)	t_w (in)	b_t (in)	b_b (in)	t_t (in)	t_b (in)	r (in)
18	W6x9	5.90	0.17	3.94	3.94	0.21	0.21	0.25

Section Properties

Section Properties

ID	Name	A (in^2)	J (in^4)	I_{yp} (in^4)	I_{zp} (in^4)	I_w (in^6)	S_{yp} (in^3)	S_{zp} (in^3)
1	2in Pipe Sch 40	1.07	1.33	0.67	0.67	0.00	0.76	0.76
4	4in Pipe Sch 40	3.17	14.47	7.23	7.23	0.00	4.31	4.31
10	8in Pipe Sch 80	12.76	211.43	105.72	105.72	0.00	33.05	33.05
15	HSS5x3x1/8	1.77	6.02	2.75	6.03	0.51	2.07	2.93
18	W6x9	2.68	0.04	2.20	16.40	17.70	1.72	6.23

Member Properties

Member ID	Section ID	K_z L (ft)	K_y L (ft)	L_b (ft)	C_b	LST	LSC	LD
1	10	7.64	7.64	11.76	-	300	200	250
2	4	1.30	1.30	2.00	-	300	200	250
3	15	0.92	0.92	1.42	1.17,1.17,1.17,1.17,1.17,1.17,1.16,1.17,1.15,1.17,1.16,1.17,1.16,1.17,1.16,1.17,1.18,1.17,1.17,1.17,1.14,1.17,1.16,1.17,1.16,1.17,1.17,1.17,1.17,1.17,1.17,1.17,1.17,1.17,1.17,1.16,1.17,1.15,1.17,1.17,1.17,2.13,1.17,1.17,1.17,1.14,1.17,1.16,1.17,1.16,1.17	300	200	250
4	15	2.44	2.44	3.75	1.69,1.68,1.69,1.67,1.68,1.69,1.67,1.68,1.66,1.68,1.67,1.69,1.66,1.69,1.67,1.67,1.69,1.67,1.67,1.69,1.64,1.69,1.67,1.69,1.66,1.69,1.69,1.69,1.68,1.69,1.68,1.69,1.69,1.68,1.69,1.67,1.69,1.65,1.69,1.67,1.68,1.13,1.68,1.67,1.69,1.64,1.69,1.67,1.69,1.66,1.69	300	200	250
5	15	1.52	1.52	2.33	1.68,1.67,1.68,1.67,1.68,1.68,1.67,1.67,1.66,1.67,1.67,1.68,1.66,1.68,1.67,1.67,1.68,1.67,1.67,1.68,1.65,1.68,1.67,1.68,1.66,1.68,1.68,1.68,1.67,1.68,1.67,1.68,1.68,1.67,1.68,1.67,1.68,1.66,1.68,1.67,1.67,1.10,1.67,1.67,1.68,1.65,1.68,1.67,1.68,1.66,1.68	300	200	250
6	15	0.92	0.92	1.42	1.19,1.19,1.19,1.19,1.19,1.19,1.19,1.19,1.18,1.19,1.19,1.19,1.18,1.19,1.19,1.19,1.19,1.19,1.19,1.19,1.18,1.19,1.19,1.19,1.19,1.19,1.19,1.19,1.19,1.19,1.19,1.19,1.19,1.19,1.19,1.19,1.19,1.18,1.19,1.19,1.19,1.16,1.19,1.19,1.19,1.18,1.19,1.19,1.19,1.19,1.19	300	200	250
7	15	1.52	1.52	2.33	1.67,1.67,1.67,1.67,1.67,1.67,1.67,1.67,1.66,1.67,1.67,1.67,1.66,1.67,1.67,1.67,1.68,1.67,1.67,1.67,1.66,1.67,1.67,1.67,1.67,1.67,1.67,1.67,1.67,1.67,1.67,1.67,1.67,1.67,1.67,1.67,1.67,1.66,1.67,1.67,1.67,1.63,1.67,1.67,1.67,1.66,1.67,1.67,1.67,1.67,1.67	300	200	250
8	18	1.33	1.33	2.05	1.29,1.29,1.29,1.29,1.29,1.29,1.29,1.29,1.29,1.29,1.29,1.29,1.29,1.29,1.29,1.29,1.31,1.29,1.29,1.29,1.29,1.29,1.29,1.29,1.29,1.29,1.29,1.29,1.29,1.29,1.29,1.29,1.29,1.29,1.29,1.29,1.29,1.29,1.29,1.29,1.29,1.22,1.29,1.29,1.29,1.29,1.29,1.29,1.29,1.29,1.29	300	200	250
9	1	2.60	2.60	4.00	-	300	200	250
10	15	2.44	2.44	3.75	1.68,1.68,1.68,1.67,1.68,1.68,1.67,1.68,1.66,1.68,1.67,1.68,1.66,1.68,1.67,1.67,1.68,1.67,1.67,1.68,1.65,1.68,1.67,1.68,1.66,1.68,1.68,1.68,1.67,1.68,1.67,1.68,1.68,1.67,1.68,1.67,1.68,1.66,1.68,1.67,1.67,1.56,1.67,1.67,1.68,1.66,1.68,1.67,1.68,1.66,1.68	300	200	250
11	18	1.33	1.33	2.05	1.32,1.32,1.32,1.32,1.32,1.32,1.35,1.32,1.41,1.32,1.36,1.32,1.39,1.32,1.34,1.32,1.22,1.32,1.35,1.32,1.44,1.32,1.36,1.32,1.38,1.32,1.32,1.32,1.32,1.32,1.32,1.32,1.32,1.32,1.32,1.35,1.32,1.40,1.32,1.34,1.32,1.71,1.32,1.35,1.32,1.43,1.32,1.36,1.32,1.38,1.32	300	200	250
12	4	1.30	1.30	2.00	-	300	200	250
13	18	4.88	4.00	7.50	1.16,1.16,1.16,1.16,1.16,1.16,1.20,1.16,1.27,1.16,1.20,1.16,1.25,1.16,1.17,1.16,1.64,1.16,1.19,1.16,1.30,1.16,1.21,1.16,1.24,1.16,1.16,1.16,1.16,1.16,1.16,1.16,1.16,1.16,1.16,1.20,1.16,1.26,1.16,1.18,1.16,1.66,1.16,1.19,1.16,1.29,1.16,1.20,1.16,1.24,1.16	300	200	250
14	18	4.88	4.00	7.50	1.16,1.16,1.16,1.16,1.16,1.16,1.14,1.16,1.13,1.16,1.14,1.16,1.13,1.16,1.15,1.16,1.19,1.16,1.15,1.16,1.13,1.16,1.14,1.16,1.13,1.16,1.16,1.16,1.16,1.16,1.16,1.16,1.16,1.16,1.16,1.14,1.16,1.13,1.16,1.15,1.16,2.44,1.16,1.15,1.16,1.12,1.16,1.14,1.16,1.13,1.16	300	200	250
15	18	2.10	2.10	1.00	2.33,2.33,2.33,2.33,2.33,2.32,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.32,2.33,2.32,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.33	300	200	250
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101	10	7.64	7.64	11.76	-	300	200	250
102	4	1.30	1.30	2.00	-	300	200	250
103	15	0.92	0.92	1.42	1.18,1.18,1.18,1.18,1.18,1.18,1.18,1.18,1.17,1.18,1.18,1.18,1.17,1.18,1.18,1.18,1.19,1.18,1.18,1.18,1.17,1.18,1.18,1.18,1.18,1.18,1.18,1.18,1.18,1.18,1.18,1.18,1.18,1.18,1.18,1.18,1.18,1.17,1.18,1.18,1.18,2.29,1.18,1.18,1.18,1.17,1.18,1.18,1.18,1.18,1.18	300	200	250
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104	15	4 4	4 4	75	66,1.68,1.68,1.68,1.67,1.68,1.67,1.68,1.68,1.67,1.68,1.67,1.68,1.66,1.68,1.67,1.67,1.47,1.67,1.67,1.68,1.66,1.68,1.67,1.6 8,1.66,1.68	0 0	0 0	5 0
105	15	1. 5 2	1. 5 2	2. 33	1.67,1.67,1.67,1.67,1.67,1.67,1.67,1.67,1.66,1.67,1.67,1.67,1.66,1.67,1.67,1.67,1.67,1.67,1.67,1.67,1.66,1.67,1.67,1.67,1. 67,1.67,1.67,1.67,1.67,1.67,1.67,1.67,1.67,1.67,1.67,1.67,1.67,1.66,1.67,1.67,1.67,1.12,1.67,1.67,1.67,1.66,1.67,1.67,1.6 7,1.66,1.67	3 0 0	2 0 0	2 5 0
106	15	0. 9 2	0. 9 2	1. 42	1.18,1.18,1.18,1.18,1.18,1.18,1.18,1.18,1.18,1.18,1.18,1.18,1.18,1.18,1.18,1.18,1.18,1.18,1.18,1.18,1.18,1.18,1.17,1.18,1.18,1.18,1. 18,1.18,1.18,1.18,1.18,1.18,1.18,1.18,1.18,1.18,1.18,1.18,1.18,1.18,1.18,1.18,1.18,1.14,1.18,1.18,1.18,1.17,1.18,1.18,1.1 8,1.18,1.18	3 0 0	2 0 0	2 5 0
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108	18	1. 3 3	1. 3 3	2. 05	2.23,2.23,2.23,2.24,2.23,2.23,2.12,2.23,2.11,2.23,2.12,2.23,2.11,2.23,2.17,2.24,2.35,2.24,2.13,2.23,2.10,2.23,2.12,2.23,2. 11,2.23,2.23,2.23,2.24,2.23,2.24,2.23,2.23,2.24,2.23,2.12,2.23,2.11,2.23,2.15,2.24,1.44,2.24,2.13,2.23,2.10,2.23,2.12,2.2 3,2.11,2.23	3 0 0	2 0 0	2 5 0
109	1	2. 6 0	2. 6 0	4. 00	-	3 0 0	2 0 0	2 5 0
110	15	2. 4 4	2. 4 4	3. 75	1.68,1.67,1.68,1.67,1.68,1.68,1.67,1.67,1.66,1.67,1.67,1.68,1.66,1.68,1.67,1.67,1.68,1.67,1.67,1.68,1.66,1.68,1.67,1.68,1. 66,1.68,1.68,1.68,1.67,1.68,1.67,1.68,1.68,1.67,1.68,1.67,1.68,1.66,1.68,1.67,1.67,1.57,1.67,1.67,1.68,1.66,1.68,1.67,1.6 8,1.66,1.68	3 0 0	2 0 0	2 5 0
111	18	1. 3 3	1. 3 3	2. 05	2.11,2.11,2.11,2.11,2.11,2.11,2.08,2.11,1.92,2.11,2.07,2.11,2.05,2.11,2.09,2.11,2.03,2.11,2.08,2.11,1.78,2.11,2.07,2.11,2. 06,2.11,2.11,2.11,2.11,2.11,2.11,2.11,2.11,2.11,2.11,2.11,2.08,2.11,1.95,2.11,2.09,2.11,1.10,2.11,2.08,2.11,1.82,2.11,2.07,2.1 1,2.06,2.11	3 0 0	2 0 0	2 5 0
112	4	1. 3 0	1. 3 0	2. 00	-	3 0 0	2 0 0	2 5 0
113	18	4. 8 8	4. 0 0	7. 50	1.05,1.05,1.05,1.05,1.05,1.05,1.06,1.05,1.08,1.05,1.06,1.05,1.08,1.05,1.06,1.05,1.05,1.05,1.06,1.05,1.10,1.05,1.06,1.05,1. 07,1.05,1.05,1.05,1.05,1.05,1.05,1.05,1.05,1.05,1.05,1.05,1.06,1.05,1.08,1.05,1.06,1.05,1.41,1.05,1.06,1.05,1.09,1.05,1.06,1.0 5,1.07,1.05	3 0 0	2 0 0	2 5 0
114	18	4. 8 8	4. 0 0	7. 50	1.05,1.05,1.05,1.05,1.05,1.05,1.05,1.05,1.07,1.05,1.06,1.05,1.06,1.05,1.05,1.05,1.05,1.05,1.05,1.05,1.07,1.05,1.06,1.05,1. 06,1.05,1.05,1.05,1.05,1.05,1.05,1.05,1.05,1.05,1.05,1.05,1.05,1.05,1.06,1.05,1.05,1.05,1.78,1.05,1.05,1.05,1.07,1.05,1.06,1.0 5,1.06,1.05	3 0 0	2 0 0	2 5 0
115	18	6. 6 3	6. 6 3	1 0. 20	1.16,1.16,1.16,1.16,1.16,1.16,1.14,1.16,1.12,1.16,1.14,1.16,1.12,1.16,1.15,1.16,1.26,1.16,1.14,1.16,1.11,1.16,1.14,1.16,1. 13,1.16,1.16,1.16,1.16,1.16,1.16,1.16,1.16,1.16,1.16,1.16,1.14,1.16,1.12,1.16,1.14,1.16,1.32,1.16,1.14,1.16,1.11,1.16,1.14,1.1 6,1.13,1.16	3 0 0	2 0 0	2 5 0
116	18	6. 6 3	6. 6 3	1 0. 20	1.16,1.16,1.16,1.16,1.16,1.16,1.16,1.16,1.16,1.15,1.16,1.16,1.16,1.16,1.16,1.16,1.16,1.18,1.16,1.16,1.16,1.15,1.16,1.16,1.16,1. 16,1.16,1.16,1.16,1.16,1.16,1.16,1.16,1.16,1.16,1.16,1.16,1.16,1.16,1.15,1.16,1.16,1.16,1.08,1.16,1.16,1.16,1.15,1.16,1.16,1.1 6,1.16,1.16	3 0 0	2 0 0	2 5 0
201	10	7. 6 4	7. 6 4	1 1. 76	-	3 0 0	2 0 0	2 5 0
202	4	1. 3 0	1. 3 0	2. 00	-	3 0 0	2 0 0	2 5 0
203	15	0. 9 2	0. 9 2	1. 42	1.18,1.18,1.18,1.18,1.18,1.18,1.18,1.18,1.18,1.18,1.18,1.18,1.18,1.18,1.18,1.18,1.18,1.18,1.18,1.18,1.18,1.18,1.17,1.18,1.18,1.18,1. 18,1.18,1.18,1.18,1.18,1.18,1.18,1.18,1.18,1.18,1.18,1.18,1.18,1.18,1.18,1.18,1.18,1.14,1.18,1.18,1.18,1.17,1.18,1.18,1.1 8,1.18,1.18	3 0 0	2 0 0	2 5 0
204	15	2. 4 4	2. 4 4	3. 75	1.68,1.67,1.68,1.67,1.68,1.68,1.67,1.67,1.66,1.67,1.67,1.68,1.66,1.68,1.67,1.67,1.68,1.67,1.67,1.68,1.66,1.68,1.67,1.68,1. 66,1.68,1.68,1.68,1.67,1.68,1.67,1.68,1.68,1.67,1.68,1.67,1.68,1.66,1.68,1.67,1.67,1.57,1.67,1.67,1.68,1.66,1.68,1.67,1.6 8,1.66,1.68	3 0 0	2 0 0	2 5 0
205	15	1. 5 2	1. 5 2	2. 33	1.67,1.67,1.67,1.67,1.67,1.67,1.67,1.67,1.66,1.67,1.67,1.67,1.66,1.67,1.67,1.67,1.67,1.67,1.67,1.67,1.66,1.67,1.67,1.67,1. 67,1.67,1.67,1.67,1.67,1.67,1.67,1.67,1.67,1.67,1.67,1.67,1.66,1.67,1.67,1.67,1.61,1.67,1.67,1.67,1.66,1.67,1.67,1.6 7,1.66,1.67	3 0 0	2 0 0	2 5 0
206	15	0. 9 2	0. 9 2	1. 42	1.18,1.18,1.18,1.18,1.18,1.18,1.18,1.18,1.17,1.18,1.18,1.18,1.17,1.18,1.18,1.18,1.19,1.18,1.18,1.18,1.17,1.18,1.18,1.18,1. 18,1.18,1.18,1.18,1.18,1.18,1.18,1.18,1.18,1.18,1.18,1.18,1.18,1.18,1.18,1.17,1.18,1.18,1.18,2.29,1.18,1.18,1.18,1.17,1.18,1.18,1.1 8,1.18,1.18	3 0 0	2 0 0	2 5 0
207	15	1. 5 2	1. 5 2	2. 33	1.67,1.67,1.67,1.67,1.67,1.67,1.67,1.67,1.66,1.67,1.67,1.67,1.66,1.67,1.67,1.67,1.67,1.67,1.67,1.67,1.66,1.67,1.67,1.67,1. 66,1.67,1.67,1.67,1.67,1.67,1.67,1.67,1.67,1.67,1.67,1.67,1.67,1.66,1.67,1.67,1.67,1.12,1.67,1.67,1.67,1.66,1.67,1.67,1.6 7,1.66,1.67	3 0 0	2 0 0	2 5 0
208	18	1. 3 3	1. 3 3	2. 05	2.08,2.08,2.08,2.08,2.08,2.08,2.07,2.08,2.03,2.08,2.07,2.08,2.07,2.08,2.08,2.08,2.11,2.08,2.07,2.08,1.98,2.08,2.07,2.08,2. 07,2.08,2.08,2.08,2.08,2.08,2.08,2.08,2.08,2.08,2.08,2.07,2.08,2.04,2.08,2.08,2.08,1.25,2.08,2.07,2.08,1.99,2.08,2.07,2.0 8,2.07,2.08	3 0 0	2 0 0	2 5 0
209	1	2. 6 0	2. 6 0	4. 00	-	3 0 0	2 0 0	2 5 0
210	15	2. 4 4	2. 4 4	3. 75	1.68,1.67,1.68,1.67,1.68,1.68,1.67,1.67,1.66,1.67,1.67,1.68,1.66,1.68,1.67,1.67,1.68,1.67,1.67,1.68,1.66,1.68,1.67,1.68,1. 66,1.68,1.68,1.68,1.67,1.68,1.67,1.68,1.68,1.67,1.68,1.67,1.68,1.66,1.68,1.67,1.67,1.47,1.67,1.67,1.68,1.66,1.68,1.67,1.6 8,1.66,1.68	3 0 0	2 0 0	2 5 0
211	18	1. 3 3	1. 3 3	2. 05	2.07,2.07,2.07,2.07,2.07,2.07,1.78,2.07,1.54,2.07,1.75,2.07,1.61,2.07,1.90,2.07,2.24,2.07,1.81,2.07,1.46,2.07,1.74,2.07,1. 64,2.07,2.07,2.07,2.07,2.07,2.07,2.07,2.07,2.07,2.07,2.07,1.78,2.07,1.56,2.07,1.86,2.07,1.01,2.07,1.80,2.07,1.49,2.07,1.75,2.0 7,1.63,2.07	3 0 0	2 0 0	2 5 0
212	4	1. 3 0	1. 3 0	2. 00	-	3 0 0	2 0 0	2 5 0
213	18	4. 8	4. 0	7.	1.05,1.05,1.05,1.05,1.05,1.05,1.06,1.05,1.08,1.05,1.06,1.05,1.08,1.05,1.06,1.05,1.05,1.05,1.06,1.05,1.10,1.05,1.06,1.05,1. 07,1.05,1.05,1.05,1.05,1.05,1.05,1.05,1.05,1.05,1.05,1.05,1.06,1.05,1.08,1.05,1.06,1.05,1.42,1.05,1.06,1.05,1.09,1.05,1.06,1.0	3 0	2 0	2 5

213	18	8	0	50	07,1.05,1.05,1.05,1.05,1.05,1.05,1.05,1.05,1.05,1.05,1.06,1.05,1.06,1.05,1.42,1.05,1.06,1.05,1.09,1.05,1.06,1.05,1.07,1.05	0	0	0
214	18	4.88	4.00	7.50	1.05,1.05,1.05,1.05,1.05,1.05,1.05,1.05,1.07,1.05,1.06,1.05,1.06,1.05,1.05,1.05,1.05,1.05,1.05,1.05,1.07,1.05,1.06,1.05,1.06,1.05,1.05,1.05,1.05,1.05,1.05,1.05,1.05,1.05,1.05,1.05,1.06,1.05,1.05,1.05,1.77,1.05,1.05,1.05,1.07,1.05,1.06,1.05,1.06,1.05	300	200	250
215	18	6.63	6.63	10.20	1.17,1.17,1.17,1.17,1.17,1.17,1.15,1.17,1.14,1.17,1.15,1.17,1.14,1.17,1.16,1.17,1.25,1.17,1.15,1.17,1.13,1.17,1.15,1.17,1.14,1.17,1.17,1.17,1.17,1.17,1.17,1.17,1.17,1.17,1.17,1.15,1.17,1.14,1.17,1.16,1.17,1.04,1.17,1.15,1.17,1.13,1.17,1.15,1.17,1.14,1.17	300	200	250
216	18	6.63	6.63	10.20	1.17,1.17,1.17,1.17,1.17,1.17,1.17,1.17,1.17,1.17,1.17,1.17,1.17,1.17,1.17,1.17,1.17,1.19,1.17,1.17,1.17,1.16,1.17,1.17,1.17,1.17,1.17,1.17,1.17,1.17,1.17,1.17,1.17,1.17,1.17,1.17,1.17,1.17,1.17,1.17,1.17,1.10,1.17,1.17,1.17,1.16,1.17,1.17,1.17,1.17,1.17	300	200	250
301	10	7.64	7.64	11.76	-	300	200	250
302	4	1.30	1.30	2.00	-	300	200	250
303	15	0.92	0.92	1.42	1.19,1.19,1.19,1.19,1.19,1.19,1.19,1.19,1.18,1.19,1.19,1.19,1.18,1.19,1.19,1.19,1.19,1.19,1.19,1.19,1.18,1.19,1.19,1.19,1.19,1.19,1.19,1.19,1.19,1.19,1.19,1.19,1.19,1.19,1.19,1.19,1.19,1.18,1.19,1.19,1.19,1.16,1.19,1.19,1.19,1.18,1.19,1.19,1.19	300	200	250
304	15	2.44	2.44	3.75	1.68,1.68,1.68,1.67,1.68,1.68,1.67,1.68,1.66,1.68,1.67,1.68,1.66,1.68,1.67,1.67,1.68,1.67,1.67,1.68,1.65,1.68,1.67,1.68,1.66,1.68,1.68,1.68,1.67,1.68,1.67,1.68,1.68,1.67,1.68,1.67,1.68,1.66,1.68,1.67,1.67,1.56,1.67,1.67,1.68,1.66,1.68,1.67,1.68,1.66,1.68	300	200	250
305	15	1.52	1.52	2.33	1.67,1.67,1.67,1.67,1.67,1.67,1.67,1.67,1.66,1.67,1.67,1.67,1.66,1.67,1.67,1.67,1.68,1.67,1.67,1.67,1.66,1.67,1.67,1.67,1.67,1.67,1.67,1.67,1.67,1.67,1.67,1.67,1.67,1.67,1.66,1.67,1.67,1.63,1.67,1.67,1.67,1.66,1.67,1.67,1.67,1.67	300	200	250
306	15	0.92	0.92	1.42	1.17,1.17,1.17,1.17,1.17,1.17,1.17,1.16,1.17,1.15,1.17,1.16,1.17,1.16,1.17,1.16,1.17,1.18,1.17,1.17,1.17,1.14,1.17,1.16,1.17,1.16,1.17,1.17,1.17,1.17,1.17,1.17,1.17,1.17,1.17,1.17,1.16,1.17,1.15,1.17,1.17,1.17,2.13,1.17,1.17,1.17,1.14,1.17,1.16,1.17	300	200	250
307	15	1.52	1.52	2.33	1.68,1.67,1.68,1.67,1.68,1.68,1.67,1.67,1.66,1.67,1.67,1.68,1.66,1.68,1.67,1.67,1.68,1.67,1.67,1.68,1.65,1.68,1.67,1.68,1.66,1.68,1.68,1.68,1.67,1.68,1.67,1.68,1.68,1.67,1.68,1.67,1.68,1.66,1.68,1.67,1.67,1.10,1.67,1.67,1.68,1.65,1.68,1.67,1.68,1.66,1.68	300	200	250
308	18	2.10	2.10	1.00	2.33,2.33,2.33,2.33,2.33,2.32,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.32,2.33,2.32,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.33	300	200	250
309	1	2.60	2.60	4.00	-	300	200	250
310	15	2.44	2.44	3.75	1.69,1.68,1.69,1.67,1.68,1.69,1.67,1.68,1.66,1.68,1.67,1.69,1.66,1.69,1.67,1.67,1.69,1.67,1.67,1.69,1.64,1.69,1.67,1.69,1.66,1.69,1.69,1.69,1.68,1.69,1.68,1.69,1.69,1.68,1.69,1.67,1.69,1.65,1.69,1.67,1.68,1.13,1.68,1.67,1.69,1.64,1.69,1.67,1.69,1.66,1.69	300	200	250
311	18	2.10	2.10	1.00	2.33,2.33,2.33,2.33,2.33,2.32,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.32,2.33,2.32,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.33,2.33	300	200	250
312	4	1.30	1.30	2.00	-	300	200	250
313	18	4.88	4.00	7.50	1.16,1.16,1.16,1.16,1.16,1.16,1.16,1.20,1.16,1.27,1.16,1.20,1.16,1.25,1.16,1.17,1.16,1.64,1.16,1.19,1.16,1.30,1.16,1.21,1.16,1.24,1.16,1.16,1.16,1.16,1.16,1.16,1.16,1.16,1.16,1.16,1.20,1.16,1.26,1.16,1.18,1.16,1.66,1.16,1.19,1.16,1.29,1.16,1.20,1.16,1.16,1.24,1.16	300	200	250
314	18	4.88	4.00	7.50	1.16,1.16,1.16,1.16,1.16,1.16,1.14,1.16,1.13,1.16,1.14,1.16,1.13,1.16,1.15,1.16,1.19,1.16,1.15,1.16,1.13,1.16,1.14,1.16,1.14,1.16,1.16,1.16,1.16,1.16,1.16,1.16,1.16,1.16,1.16,1.14,1.16,1.13,1.16,1.15,1.16,2.46,1.16,1.15,1.16,1.12,1.16,1.14,1.16,1.13,1.16	300	200	250
315	18	6.63	6.63	10.20	1.09,1.09,1.09,1.09,1.09,1.09,1.09,1.09,1.10,1.09,1.09,1.09,1.09,1.09,1.09,1.09,1.09,1.09,1.09,1.10,1.09,1.09,1.09,1.09,1.09,1.09,1.09,1.09,1.09,1.09,1.09,1.09,1.10,1.09,1.09,1.09,1.09,1.09,1.09,1.09,1.09,1.09,1.09,1.09,1.09,1.09,1.09	300	200	250
316	18	6.63	6.63	10.20	1.09,1.09,1.09,1.09,1.09,1.09,1.09,1.09,1.08,1.09,1.09,1.09,1.08,1.09,1.09,1.09,1.09,1.09,1.09,1.09,1.08,1.09,1.09,1.09,1.08,1.09,1.09,1.09,1.09,1.09,1.09,1.09,1.09,1.09,1.09,1.09,1.08,1.09,1.09,1.09,1.07,1.09,1.09,1.09,1.08,1.09,1.09,1.09,1.08	300	200	250

Member Design Capacity

Member ID	$\Phi_t P_n$ (kip)	$\Phi_c P_n$ (kip)	$\Phi_b M_{zn}$ (k-ft)	$\Phi_b M_{yn}$ (k-ft)	$\Phi_v V_{yn}$ (kip)	$\Phi_v V_{zn}$ (kip)
1	528.38	493.49	114.02	114.02	158.51	158.51
2	131.41	130.46	14.87	14.87	39.42	39.42
3	79.65	74.89	10.99	6.26	29.14	16.61
4	79.65	72.84	10.99	6.26	29.14	16.61
5	79.65	74.30	10.99	6.26	29.14	16.61
6	79.65	74.89	10.99	6.26	29.14	16.61
7	79.65	74.30	10.99	6.26	29.14	16.61

8	120.60	115.40	23.36	6.45	30.09	45.74
9	44.49	40.02	2.63	2.63	13.35	13.35
10	79.65	72.84	10.99	6.26	29.14	16.61
11	120.60	115.40	23.36	6.45	30.09	45.74
12	131.41	130.46	14.87	14.87	39.42	39.42
13	120.60	84.03	20.44	6.45	30.09	45.74
14	120.60	84.03	19.74	6.45	30.09	45.74
15	120.60	113.97	23.36	6.45	30.09	45.74
16	120.60	113.97	23.36	6.45	30.09	45.74
101	528.38	493.49	114.02	114.02	158.51	158.51
102	131.41	130.46	14.87	14.87	39.42	39.42
103	79.65	74.89	10.99	6.26	29.14	16.61
104	79.65	72.84	10.99	6.26	29.14	16.61
105	79.65	74.30	10.99	6.26	29.14	16.61
106	79.65	74.89	10.99	6.26	29.14	16.61
107	79.65	74.30	10.99	6.26	29.14	16.61
108	120.60	115.40	23.36	6.45	30.09	45.74
109	44.49	40.02	2.63	2.63	13.35	13.35
110	79.65	72.84	10.99	6.26	29.14	16.61
111	120.60	115.40	23.36	6.45	30.09	45.74
112	131.41	130.46	14.87	14.87	39.42	39.42
113	120.60	84.03	18.42	6.45	30.09	45.74
114	120.60	84.03	18.41	6.45	30.09	45.74
115	120.60	68.63	15.12	6.45	30.09	45.74
116	120.60	68.63	14.75	6.45	30.09	45.74
201	528.38	493.49	114.02	114.02	158.51	158.51
202	131.41	130.46	14.87	14.87	39.42	39.42
203	79.65	74.89	10.99	6.26	29.14	16.61
204	79.65	72.84	10.99	6.26	29.14	16.61
205	79.65	74.30	10.99	6.26	29.14	16.61
206	79.65	74.89	10.99	6.26	29.14	16.61
207	79.65	74.30	10.99	6.26	29.14	16.61
208	120.60	115.40	23.36	6.45	30.09	45.74
209	44.49	40.02	2.63	2.63	13.35	13.35
210	79.65	72.84	10.99	6.26	29.14	16.61
211	120.60	115.40	23.36	6.45	30.09	45.74
212	131.41	130.46	14.87	14.87	39.42	39.42
213	120.60	84.03	18.42	6.45	30.09	45.74
214	120.60	84.03	18.41	6.45	30.09	45.74
215	120.60	68.63	14.19	6.45	30.09	45.74
216	120.60	68.63	15.07	6.45	30.09	45.74
301	528.38	493.49	114.02	114.02	158.51	158.51
302	131.41	130.46	14.87	14.87	39.42	39.42
303	79.65	74.89	10.99	6.26	29.14	16.61
304	79.65	72.84	10.99	6.26	29.14	16.61
305	79.65	74.30	10.99	6.26	29.14	16.61
306	79.65	74.89	10.99	6.26	29.14	16.61
307	79.65	74.30	10.99	6.26	29.14	16.61
308	120.60	113.97	23.36	6.45	30.09	45.74
309	44.49	40.02	2.63	2.63	13.35	13.35
310	79.65	72.84	10.99	6.26	29.14	16.61

311	120.60	113.97	23.36	6.45	30.09	45.74
312	131.41	130.46	14.87	14.87	39.42	39.42
313	120.60	84.03	20.44	6.45	30.09	45.74
314	120.60	84.03	19.74	6.45	30.09	45.74
315	120.60	68.63	14.84	6.45	30.09	45.74
316	120.60	68.63	14.61	6.45	30.09	45.74

Design Ratio

Member ID	P	M_z	M_y	V_y	V_z	(P,M_z,M_y)	Worst LC	KL/r	δ	Status
1	0.014	0.347	0.045	0.021	0.004	0.363	#13	0.159	Not Required	Pass
2	0.003	0.173	0.129	0.049	0.031	0.284	#13	0.052	Not Required	Pass
3	0.008	0.377	0.032	0.035	0.003	0.381	#13	0.044	Not Required	Pass
4	0.005	0.378	0.103	0.038	0.020	0.475	#13	0.117	Not Required	Pass
5	0.006	0.234	0.042	0.038	0.008	0.246	#13	0.073	Not Required	Pass
6	0.017	0.731	0.190	0.077	0.043	0.855	#13	0.044	Not Required	Pass
7	0.018	0.453	0.274	0.073	0.053	0.492	#13	0.073	Not Required	Pass
8	0.005	0.138	0.141	0.040	0.016	0.192	#13	0.088	Not Required	Pass
9	0.005	0.070	0.123	0.006	0.008	0.176	#13	0.198	Not Required	Pass
10	0.018	0.702	0.255	0.071	0.044	0.732	#13	0.078	Not Required	Pass
11	0.007	0.128	0.145	0.043	0.016	0.180	#21	0.088	Not Required	Pass
12	0.002	0.501	0.302	0.113	0.059	0.804	#13	0.052	Not Required	Pass
13	0.009	0.084	0.373	0.056	0.021	0.419	#21	0.265	Not Required	Pass
14	0.005	0.072	0.367	0.054	0.021	0.390	#21	0.177	Not Required	Pass
15	0.000	0.005	0.009	0.008	0.003	0.013	#21	Not Required	Not Required	Pass
16	0.000	0.005	0.009	0.008	0.003	0.013	#21	Not Required	Not Required	Pass
101	0.020	0.496	0.003	0.030	0.000	0.506	#13	0.159	Not Required	Pass
102	0.004	0.492	0.327	0.117	0.059	0.813	#13	0.034	Not Required	Pass
103	0.016	0.790	0.120	0.079	0.017	0.869	#13	0.044	Not Required	Pass
104	0.015	0.807	0.271	0.081	0.046	0.926	#13	0.078	Not Required	Pass
105	0.016	0.490	0.289	0.079	0.057	0.536	#13	0.073	Not Required	Pass
106	0.016	0.788	0.117	0.079	0.017	0.852	#13	0.044	Not Required	Pass
107	0.016	0.490	0.274	0.079	0.054	0.532	#13	0.073	Not Required	Pass
108	0.005	0.051	0.133	0.046	0.016	0.178	#21	0.088	Not Required	Pass
109	0.017	0.062	0.076	0.001	0.000	0.136	#13	0.198	Not Required	Pass
110	0.015	0.784	0.263	0.079	0.045	0.895	#13	0.078	Not Required	Pass
111	0.007	0.063	0.137	0.046	0.016	0.177	#21	0.088	Not Required	Pass
112	0.004	0.472	0.325	0.113	0.060	0.796	#13	0.034	Not Required	Pass
113	0.009	0.209	0.384	0.063	0.021	0.553	#21	0.265	Not Required	Pass
114	0.008	0.236	0.380	0.065	0.021	0.564	#21	0.265	Not Required	Pass
115	0.011	0.288	0.210	0.049	0.016	0.460	#21	0.439	Not Required	Pass
116	0.005	0.282	0.210	0.052	0.016	0.451	#21	0.439	Not Required	Pass
201	0.020	0.496	0.003	0.030	0.000	0.506	#13	0.159	Not Required	Pass
202	0.004	0.472	0.325	0.113	0.060	0.796	#13	0.034	Not Required	Pass
203	0.016	0.788	0.117	0.079	0.017	0.852	#13	0.044	Not Required	Pass
204	0.015	0.784	0.263	0.079	0.045	0.895	#13	0.078	Not Required	Pass
205	0.016	0.490	0.274	0.079	0.054	0.532	#13	0.073	Not Required	Pass
206	0.016	0.790	0.120	0.079	0.017	0.869	#13	0.044	Not Required	Pass
207	0.016	0.490	0.289	0.079	0.057	0.536	#13	0.073	Not Required	Pass
208	0.005	0.080	0.151	0.052	0.016	0.184	#21	0.088	Not Required	Pass
209	0.017	0.061	0.076	0.001	0.000	0.136	#13	0.198	Not Required	Pass

210	0.015	0.807	0.271	0.081	0.046	0.926	#13	0.078	Not Required	Pass
211	0.007	0.093	0.154	0.049	0.016	0.179	#21	0.088	Not Required	Pass
212	0.004	0.492	0.327	0.117	0.059	0.813	#13	0.034	Not Required	Pass
213	0.009	0.209	0.384	0.063	0.021	0.554	#21	0.265	Not Required	Pass
214	0.008	0.236	0.380	0.065	0.021	0.564	#21	0.265	Not Required	Pass
215	0.011	0.213	0.211	0.046	0.016	0.392	#21	0.439	Not Required	Pass
216	0.005	0.191	0.209	0.046	0.016	0.373	#21	0.439	Not Required	Pass
301	0.014	0.347	0.045	0.021	0.004	0.363	#13	0.159	Not Required	Pass
302	0.002	0.501	0.302	0.113	0.059	0.804	#13	0.052	Not Required	Pass
303	0.017	0.731	0.190	0.077	0.043	0.855	#13	0.044	Not Required	Pass
304	0.018	0.702	0.255	0.071	0.044	0.732	#13	0.078	Not Required	Pass
305	0.018	0.453	0.274	0.073	0.053	0.492	#13	0.073	Not Required	Pass
306	0.008	0.377	0.032	0.035	0.003	0.381	#13	0.044	Not Required	Pass
307	0.006	0.235	0.042	0.038	0.008	0.246	#13	0.073	Not Required	Pass
308	0.000	0.005	0.009	0.008	0.003	0.013	#21	Not Required	Not Required	Pass
309	0.005	0.070	0.123	0.006	0.008	0.176	#13	0.198	Not Required	Pass
310	0.005	0.378	0.103	0.038	0.020	0.475	#13	0.117	Not Required	Pass
311	0.000	0.005	0.009	0.008	0.003	0.013	#21	Not Required	Not Required	Pass
312	0.003	0.173	0.129	0.049	0.031	0.284	#13	0.052	Not Required	Pass
313	0.009	0.084	0.373	0.056	0.021	0.419	#21	0.177	Not Required	Pass
314	0.005	0.072	0.367	0.054	0.021	0.390	#21	0.265	Not Required	Pass
315	0.011	0.300	0.211	0.043	0.016	0.468	#21	0.439	Not Required	Pass
316	0.005	0.302	0.208	0.040	0.016	0.462	#21	0.439	Not Required	Pass

Definitions

Φ_t	Safety factor for tensile
Φ_c	Safety factor for compression
Φ_b	Safety factor for flexure
Φ_v	Safety factor for shear
E	Modulus of elasticity
F_y	Specified minimum yield stress
F_u	Specified minimum tensile strength
A	Cross-sectional area
J	Torsional constant
I_{yp}	Moment of inertia about the Y axes
I_{zp}	Moment of inertia about the Z axes
I_w	Warping constant
S_{yp}	Plastic section modulus about the Y axis
S_{zp}	Plastic section modulus about the Z axis
KL	Effective length
C_b	Buckling modification factor (from all load combinations)
L_b	Length between braced points
LST	Limited slenderness for tension
LSC	Limited slenderness for compression
LD	Limited deflection
P_n	Nominal axial strength (tension/comression)
M_n	Nominal flexural strength (about Z/Y axis)
V_n	Nominal shear strength (along Z/Y axis)
P	Design ratio in case of axial force
M_z	Design ratio in case of bending about Z axis
M_y	Design ratio in case of bending about Y axis
V_y	Design ratio in case of shear along Y axis
V_z	Design ratio in case of shear along Z axis
(P,M_z,M_y)	Design ratio in case of axial force and bending action
KL/r	Design ratio in case of section slenderness
δ	Design ratio in case of member deflection
OK	Capacity is provided
NG	Capacity is not provided

IBC 2018 Pile Design

Powered by SkyCiv

Input	Description
Region	American Standard
Concrete design code	American Concrete Institute (ACI 318:2019)

Cross-section

Input	Description	Value
Shape	Cross-sectional shape	Square
b	Section width	36 in
D	Section deph	36 in

Material Properties

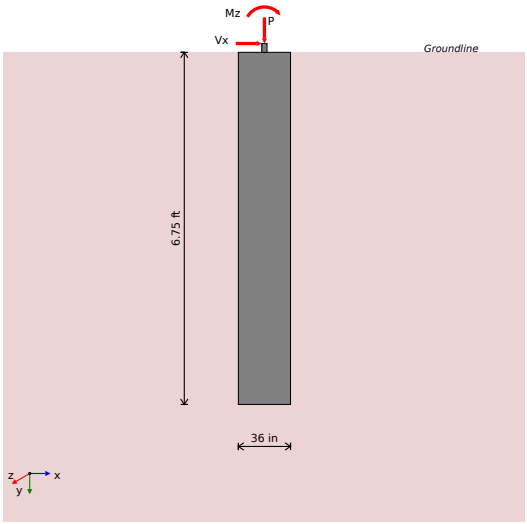
Input	Description	Value
f'_{ck}	Concrete compressive strength	2.5 ksi
f_{yk}	Yield strength of steel	60 ksi
d_b	Rebar diameter	#5 (0.625) in
cover	Concrete cover	3 in

Soil Parameters (IBC 1806)

Input	Description	Value
Soil type	Sand, silty sand, clayey sand, silty gravel & clayey gravel	
q_a	Allowable bearing pressure	2000 psf
R	Allowable lateral pressure	150 psf/ft

Loading

Load	ASD	LRFD
P	4.903 kip	7.033 kip
Vx	-2.007 kip	-3.35 kip
Vz	-0.394 kip	-0.592 kip
Mx	-1.211 kip-ft	-1.784 kip-ft
Mz	23.72 kip-ft	39.62 kip-ft



REFERENCES CALCULATIONS RESULTS

Required depth to resist lateral loads (ASD)

Allowable lateral pressure $R =$ 150 psf/ft

Point of application of lateral load:

$$H = h_1 + h_2 + h_e = 0 + 0 + 0 = 0\ ft$$

Considering x-direction:

Lateral force per section length

$$H_o = \frac{V_x}{1.57 \times D} = \frac{-2.007}{1.57 \times 36} = -0.426\ \frac{kip}{ft}$$

Moment per section length

$$M_o = \frac{M_z + (V_x \times H)}{1.57 \times D} = \frac{23.72 + (-2.007 \times 0)}{1.57 \times 36} = 5.037 \ \frac{kip - ft}{ft}$$

Required depth of embedment in earth:

$$L_x^3 - \left(9 \times \frac{H_o \times L_x}{R}\right) - \left(12 \times \frac{M_o}{R}\right) = 0$$

Solving the cubic equation:

$$L_{e,x} = 6.243 \ ft$$

Considering z-direction:

Lateral force per section length

$$H_o = \frac{V_z}{1.57 \times b} = \frac{-0.394}{1.57 \times 36} = -0.084 \ \frac{kip}{ft}$$

Moment per section length

$$M_o = \frac{M_x + (V_z \times H)}{1.57 \times b} = \frac{-1.211 + (-0.394 \times 0)}{1.57 \times 36} = -0.257 \ \frac{kip - ft}{ft}$$

Required depth of embedment in earth:

$$L_z^3 - \left(9 \times \frac{H_o \times L_z}{R}\right) - \left(12 \times \frac{M_o}{R}\right) = 0$$

Solving the cubic equation:

$$L_{e,z} = -2.142 \ ft$$

Minimum embedded depth

Depth of pile required

$$L_{e,req} = MAX[L_{e,x}, L_{e,z}] = MAX[6.243, -2.142] = 6.243 \ ft$$

Actual embedded length

$$L_e = L - h_2 - h_e = 6.75 - 0 - 0 = 6.75 \ ft$$

Utilisation

$$Ratio = \frac{L_{e,req}}{L_e} = \frac{6.243}{6.75} = 0.925$$

UTILITY: 0.92

REFERENCES	CALCULATIONS	RESULTS

End-bearing Capacity (ASD)

Allowable bearing pressure	$q_a =$	2000 psf
Unit weight of concrete	$w_c =$	0.15 kip/ft^3

Cross-sectional area:

$$A = b \times D = 36 \times 36 = 9 \ ft^2$$

End-bearing pressure:

$$q = \frac{P}{A} = \frac{4.903}{9} = 544.8 \ psf$$

Utilisation

$$Ratio = \frac{q}{q_a} = \frac{544.8}{2000} = 0.272$$

UTILITY: 0.27

Lateral Soil Pressure (ASD)

Allowable lateral pressure	$R =$	150 psf/ft

Length to least lateral dimension ratio:

$$\frac{L}{MIN[b, D]} = \frac{6.75}{MIN[3, 3]} = 2.25$$

L/D ratio ≤ 10. This pile is classified as a short pile.

Considering x-direction:

Distance from resting surface to pivot point:

$$a = \frac{(4 \times M_o \times L_e) + (3 \times H_o \times L_e^2)}{}$$

$$(6 \times M_o) + (4 \times H_o \times L_e)$$

$$a = \frac{(4 \times 5.037 \times 6.75) + (3 \times 0.426 \times 6.75^2)}{(6 \times 5.037) + (4 \times 0.426 \times 6.75)} = 4.655\ ft$$

Earth pressure against the pile at a distance a/2 from the resting surface:

$$p = \frac{0.75 \times [(4 \times M_o) + (3 \times H_o \times L_e)]^2}{L_e^2 \times [(3 \times M_o) + (2 \times H_o \times L_e)]}$$

$$p = \frac{0.75 \times [(4 \times 5.037) + (3 \times -0.426 \times 6.75)]^2}{6.75^2 \times [(3 \times 5.037) + (2 \times -0.426 \times 6.75)]} = 0.233\ \frac{kip}{ft^2}$$

Allowable lateral soil pressure at a depth of a/2:

$$p_a = R \times \frac{a}{2} = 0.15 \times \frac{4.655}{2} = 0.349\ \frac{kip}{ft^2}$$

Utilisation - pressure at a depth of a/2

$$Ratio = \frac{p}{p_a} = \frac{0.233}{0.349} = 0.668$$

UTILITY: 0.67

Earth pressure against the pile at distance L_e:

$$s = \frac{6 \times [(2 \times M_o) + (H_o \times L_e)]}{L_e^2} = \frac{6 \times [(2 \times 5.037) + (-0.426 \times 6.75)]}{6.75^2} = 0.948\ \frac{kip}{ft^2}$$

Allowable lateral soil pressure at a depth of L_e:

$$p_s = R \times L_e = 0.15 \times 6.75 = 1.012\ \frac{kip}{ft^2}$$

Utilisation - pressure at a depth of L_e

$$Ratio = \frac{s}{p_s} = \frac{0.948}{1.012} = 0.936$$

UTILITY: 0.94

Considering z-direction:

Distance from resting surface to pivot point:

$$a = \frac{(4 \times M_o \times L_e) + (3 \times H_o \times L_e^2)}{(6 \times M_o) + (4 \times H_o \times L_e)}$$

$$a = \frac{(4 \times 0.257 \times 6.75) + (3 \times 0.084 \times 6.75^2)}{(6 \times 0.257) + (4 \times 0.084 \times 6.75)} = 4.834\ ft$$

Earth pressure against the pile at a distance a/2 from the resting surface:

$$p = \frac{0.75 \times [(4 \times M_o) + (3 \times H_o \times L_e)]^2}{L_e^2 \times [(3 \times M_o) + (2 \times H_o \times L_e)]}$$

$$p = \frac{0.75 \times [(4 \times -0.257) + (3 \times -0.084 \times 6.75)]^2}{6.75^2 \times [(3 \times -0.257) + (2 \times -0.084 \times 6.75)]} = -0.064\ \frac{kip}{ft^2}$$

Allowable lateral soil pressure at a depth of a/2:

$$p_a = R \times \frac{a}{2} = 0.15 \times \frac{4.834}{2} = 0.363\ \frac{kip}{ft^2}$$

Utilisation - pressure at a depth of a/2

$$Ratio = \frac{p}{p_a} = \frac{-0.064}{0.363} = -0.177$$

UTILITY: 0.18

Earth pressure against the pile at distance L_e:

$$s = \frac{6 \times [(2 \times M_o) + (H_o \times L_e)]}{L_e^2} = \frac{6 \times [(2 \times -0.257) + (-0.084 \times 6.75)]}{6.75^2} = -0.142\ \frac{kip}{ft^2}$$

Allowable lateral soil pressure at a depth of L_e:

$$p_s = R \times L_e = 0.15 \times 6.75 = 1.012\ \frac{kip}{ft^2}$$

Utilisation - pressure at a depth of L_e

$$Ratio = \frac{s}{p_s} = \frac{-0.142}{1.012} = -0.14$$

UTILITY: 0.14

REFERENCES	CALCULATIONS	RESULTS

Shear force and bending moment (LRFD)

Considering x-direction:

Lateral force per section length

$$H_o = \frac{V_x}{1.57 \times D} = \frac{-3.35}{1.57 \times 36} = -0.711 \frac{kip}{ft}$$

Moment per section length

$$M_o = \frac{M_z + (V_x \times H)}{1.57 \times D} = \frac{39.62 + (-3.35 \times 0)}{1.57 \times 36} = 8.412 \frac{kip - ft}{ft}$$

Distance from resting surface to pivot point:

$$a = \frac{(4 \times M_o \times L_e) + (3 \times H_o \times L_e^2)}{(6 \times M_o) + (4 \times H_o \times L_e)}$$

$$a = \frac{(4 \times 8.412 \times 6.75) + (3 \times 0.711 \times 6.75^2)}{(6 \times 8.412) + (4 \times 0.711 \times 6.75)} = 4.655\ ft$$

Max shear force located at depth a:

$$E = \frac{M_o}{H_o} = \frac{8.412}{-0.711} = 11.83\ ft$$

$$V_{max,x} = (H_o \times D) \times [1 - [3 \times \left(\frac{4 \times E}{L_e} + 3\right) \times \left(\frac{a}{L_e}\right)^2] + [4 \times \left(\frac{3 \times E}{L_e} + 2\right) \times \left(\frac{a}{L_e}\right)^3]]$$

$$V_{max,x} = (-0.711 \times 36) \times [1 - [3 \times \left(\frac{4 \times 11.83}{6.75} + 3\right) \times \left(\frac{4.655}{6.75}\right)^2] + [4 \times \left(\frac{3 \times 11.83}{6.75} + 2\right) \times \left(\frac{4.655}{6.75}\right)^3]]$$

$$V_{max,x} = 8.023\ kip$$

Max bending moment located at a depth of a/2:

$$M_{max,x} = (H_o \times D \times L_e) \times [\left(\frac{E}{L_e} + \frac{a}{2 \times L_e}\right) - [\left(\frac{4 \times E}{L_e} + 3\right) \times \left(\frac{a}{2 \times L_e}\right)^3] + [\left(\frac{3 \times E}{L_e} + 2\right) \times \left(\frac{a}{2 \times L_e}\right)^4]]$$

$$M_{max,x} = (-0.711 \times 36 \times 6.75) \times [\left(\frac{11.83}{6.75} + \frac{4.655}{2 \times 6.75}\right) - [\left(\frac{4 \times 11.83}{6.75} + 3\right) \times \left(\frac{4.655}{2 \times 6.75}\right)^3] + [\left(\frac{3 \times 11.83}{6.75} + 2\right) \times \left(\frac{4.655}{2 \times 6.75}\right)^4]]$$

$$M_{max,x} = 25.77\ kip - ft$$

Considering z-direction:

Lateral force per section length

$$H_o = \frac{V_z}{1.57 \times b} = \frac{-0.592}{1.57 \times 36} = -0.126 \frac{kip}{ft}$$

Moment per section length

$$M_o = \frac{M_x + (V_z \times H)}{1.57 \times b} = \frac{-1.784 + (-0.592 \times 0)}{1.57 \times 36} = -0.379 \frac{kip - ft}{ft}$$

Distance from resting surface to pivot point:

$$a = \frac{(4 \times M_o \times L_e) + (3 \times H_o \times L_e^2)}{(6 \times M_o) + (4 \times H_o \times L_e)}$$

$$a = \frac{(4 \times 0.379 \times 6.75) + (3 \times 0.126 \times 6.75^2)}{(6 \times 0.379) + (4 \times 0.126 \times 6.75)} = 4.837\ ft$$

Max shear force located at depth a:

$$E = \frac{M_o}{H_o} = \frac{-0.379}{-0.126} = 3.014\ ft$$

$$V_{max,z} = (H_o \times b) \times [1 - [3 \times \left(\frac{4 \times E}{L_e} + 3\right) \times \left(\frac{a}{L_e}\right)^2] + [4 \times \left(\frac{3 \times E}{L_e} + 2\right) \times \left(\frac{a}{L_e}\right)^3]]$$

$$V_{max,z} = (-0.126 \times 36) \times [1 - [3 \times \left(\frac{4 \times 3.014}{6.75} + 3\right) \times \left(\frac{4.837}{6.75}\right)] + [4 \times \left(\frac{3 \times 3.014}{6.75} + 2\right) \times \left(\frac{4.837}{6.75}\right)^{3}]]$$

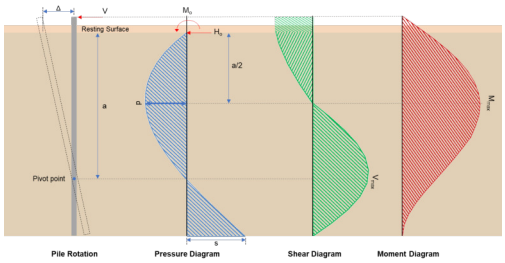
$$V_{max,z} = 0.55\ kip$$

Max bending moment located at a depth of a/2:

$$M_{max,z} = (H_o \times b \times L_e) \times [\left(\frac{E}{L_e} + \frac{a}{2 \times L_e}\right) - [\left(\frac{4 \times E}{L_e} + 3\right) \times \left(\frac{a}{2 \times L_e}\right)^{3}] + [\left(\frac{3 \times E}{L_e} + 2\right) \times \left(\frac{a}{2 \times L_e}\right)^{4}]]$$

$$M_{max,z} = (-0.126 \times 36 \times 6.75) \times [\left(\frac{3.014}{6.75} + \frac{4.837}{2 \times 6.75}\right) - [\left(\frac{4 \times 3.014}{6.75} + 3\right) \times \left(\frac{4.837}{2 \times 6.75}\right)^{3}] + [\left(\frac{3 \times 3.014}{6.75} + 2\right) \times \left(\frac{4.837}{2 \times 6.75}\right)^{4}]]$$

$$M_{max,z} = 1.628\ kip - ft$$



Minimum Reinforcement Check (LRFD)

Gross area of concrete:

$$A_g = b \times D = 36 \times 36 = 1296\ in^2$$

Main Reinforcement

22.4.2.2 Required reinforcement:

$$A_{st,req} = \frac{P - (0.85 \times f'_{ck} \times A_g)}{f_{yk} - (0.85 \times f'_{ck})} = \frac{7.033 - (0.85 \times 2.5 \times 1296)}{60 - (0.85 \times 2.5)} = -47.46\ in^2$$

10.6.1.1 Maximum reinforcement:

$$A_{st,max} = 0.08 \times A_g = 0.08 \times 1296 = 103.7 in^2$$

7.6.1.1 Minimum reinforcement:

$$A_{st,min} = 0.0018 \times A_g = 0.0018 \times 1296 = 2.333 in^2$$

Governing minimum reinforcement area:

$$(0.0018 \times A_g) \leq A_{st,req} \leq (0.08 \times A_g)$$

$$A_{min} = 2.333\ in^2$$

Minimum number of reinforcements:

$$A_{bar} = 0.307\ in^2$$

$$n_{min} = \frac{A_{min}}{A_{bar}} = \frac{2.333}{0.307} = 8$$

25.2.3 Minimum spacing:

$$s_{rebar} = MAX[1.5, 1.5 \times d_b] = MAX[1.5, (1.5 \times 0.625)] = 1.5\ in$$

Use: $n = 8$pcs at 1.5 in minimum spacing

Total reinforcement area:

$$A_{st} = 8 \times 0.307 = 2.454\ in^2$$

Shear Reinforcement

25.7.2.2 For main reinforcement $\leq$ 1.41 in: Use #3(0.375 in)

Maximum spacing of shear Reinforcements:

$$s = MIN[16 \times d_b, 48 \times d_{b,tics}, MIN(b, D)] = MIN[(16 \times 0.625), (48 \times 0.375), MIN(36, 36)] = 10\ in$$

Detailing Summary	
Main reinforcement	#5 (0.625 in) - 8pcs at 1.5 in min. spacing

Shear reinforcement	#3 (0.375 in) at 10 in max. spacing

Axial Compression Strength (LRFD)

22.4.2.2 Allowable axial compressive strength:

$$\phi P_N = \phi \times 0.8 \times [(0.85 \times f'_{ck} \times [A_g - A_{st}) + (f_{yk} \times A_{st})]$$

$$\phi P_N = 0.65 \times 0.8 \times [(0.85 \times 2.5 \times [1296 - 2.454]) + (60 \times 2.454)] = 1506\ kip$$

Utilisation

$$Ratio = \frac{P}{\phi P_N} = \frac{7.033}{1506} = 0.005$$

UTILITY: 0.00

Shear Strength LRFD)

Effective shear width	$b_w =$	36 in
Effective shear depth	$d =$	32.31 in
Shear reinforcement area	$A_v =$	0.221 in^2
Shear reinforcement spacing	$s =$	10 in
Concrete type factor (Normal concrete)	$\lambda =$	1
Strength reduction factor for shear	$\phi =$	0.75
Maximum shear in the x-direction	$V_{max,x} =$	8.023 kip
Maximum shear in the z-direction	$V_{max,z} =$	0.55 kip

22.5.5.1.1 Max shear strength of concrete:

$$V_{c,max} = 5 \times \lambda \times \sqrt{f'_{ck}} \times b_w \times d = 5 \times 1 \times \sqrt{2.5} \times 36 \times 32.31 = 290.8\ kip$$

Table 22.5.5.1 Shear strength of concrete:

$$V_{c,a} = \left(2 \times \lambda \times \sqrt{f'_{ck}} + MIN[\frac{P}{6 \times A_g}, (0.05 \times f'_{ck})]\right) \times (b_w \times d)$$

$$V_{c,a} = \left(2 \times 1 \times \sqrt{2.5} + MIN[\frac{7.033}{6 \times 1296}, (0.05 \times 2.5)]\right) \times (36 \times 32.31) = 117.4\ kip$$

Governing shear strength of concrete:

$$V_c = MIN[V_{c,max}, V_{c,a}] = MIN[290.8, 117.4] = 117.4\ kip$$

22.5.1.2 Shear strength of steel (a):

$$V_{s,a} = 8 \times \sqrt{f'_{ck}} \times b_w \times d = 8 \times \sqrt{2.5} \times 36 \times 32.31 = 465.3\ kip$$

22.5.8.5.3 Shear strength of steel (b):

$$V_{s,b} = \frac{A_v \times f_{yk} \times d}{s} = \frac{0.221 \times 60 \times 32.31}{10} = 42.83\ kip$$

Governing shear strength of steel:

$$V_s = MIN[V_{s,a}, V_{s,b}] = MIN[465.3, 42.83] = 42.83\ kip$$

22.5.1.1 Allowable shear strength:

$$\phi V_n = \phi \times (V_c + V_s) = 0.75 \times (117.4 + 42.83) = 120.2\ kip$$

$$V_{max} = MAX[8.023, 0.55] = 8.023\ kip$$

Utilisation

$$Ratio = \frac{V_{max}}{\phi V_n} = \frac{8.023}{120.2} = 0.067$$

UTILITY: 0.07

Flexural Strength (LRFD)

Concrete type factor (Normal concrete)	$\lambda =$	1
Strength reduction factor for flexure	$\phi =$	0.65
Modulus of steel reinforcement	$E_s =$	200e3 ksi
Maximum concrete strain	$\varepsilon_c =$	0.0030
Yield strain of steel f_y/E_s	$\varepsilon_y =$	0.0003
Section width	$b =$	36 in
Distance to the compression rebar	$d_s =$	3.688 in
Distance to the tension rebar	$d =$	32.31 in
Total bar area	$A_s =$	2.454 in^2
Maximum applied axial load	$P =$	7.033 kip
Maximum moment in the x-direction	$M_{max,x} =$	25.77 kip-ft
Maximum moment in the z-direction	$M_{max,z} =$	1.628 kip-ft

Compressive force due to concrete:

$$\beta_1 = 0.85$$

$$C_{rc} = 0.85 \times \beta_1 \times f'_c \times b \times c$$

Compressive force due to bars in compression:

$$C_{rs} = f_1 \times A_{sc}$$

$$\varepsilon_1 = (c - d_s) \times \frac{\varepsilon_c}{c}$$

$$f_1 = E_s \times \varepsilon_1 \ (\varepsilon_1 < \varepsilon_{sy}),\ f_1 = f_y \ (\varepsilon_1 \geq \varepsilon_{sy})$$

Tensile force due to bars in tension:

$$T_{rs} = f_2 \times A_{st}$$

$$\varepsilon_2 = (d - c) \times \frac{\varepsilon_{cu}}{c}$$

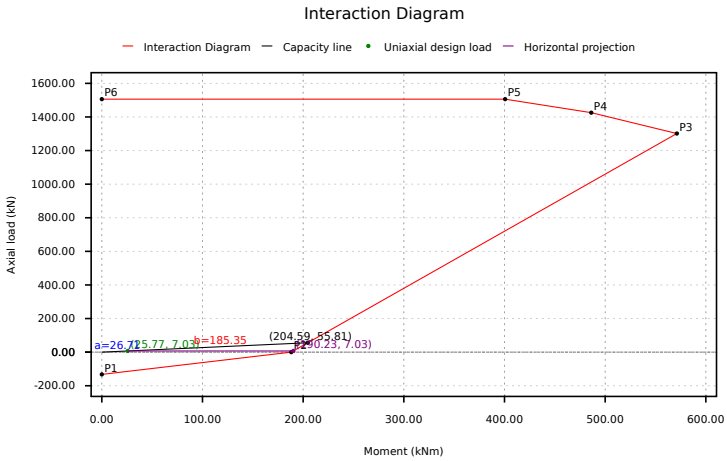
$$f_2 = E_s \times \varepsilon_2 \ (\varepsilon_2 < \varepsilon_{sy}),\ f_2 = \phi_s \times f_y \ (\varepsilon_2 \geq \varepsilon_{sy})$$

Interaction Diagram Summary

Point	Case	M_r	P_r
P1	Pure Tension	0	-132.5
P2	Pure Bending	188.2	0
P3	Balanced Failure	571.2	1301
P4	Decompression	486.2	1426
P5	Compression Limit	400.6	1506
P6	Pure Compression	0	1506

Uniaxial Bending Check

$$M_f = MAX[25.77, 1.628] = 25.77\ kip - ft$$



Segment	Signed Distance
P1 - P2	99.27
P2 - P3	157.8
P3 - P4	1181
P4 - P5	1349
P5 - P6	1499
Status	PASS: Point lies inside the curve

Utilisation

$$Ratio = \frac{a}{a+b} = \frac{26.71}{26.71 + 185.3} = 0.126$$

UTILITY: 0.13

Biaxial Bending Check

Maximum moment in the x-direction	$M_{max,x} =$ 25.77 kip-ft
Maximum moment in the z-direction	$M_{max,z} =$ 1.628 kip-ft
Nominal uniaxial moment strength about the x-axis	$M_{nox} =$ 190.2 kip-ft
Nominal uniaxial moment strength about the z-axis	$M_{noz} =$ 190.2 kip-ft
Interaction exponent	$\alpha =$ 1

Bresler (1960)	According to Bresler (method B): $$\left(\frac{M_{max,x}}{M_{nox}}\right)^{\alpha}+\left(\frac{M_{max,z}}{M_{noz}}\right)^{\alpha}=1.0$$ $$\left(\frac{25.77}{190.2}\right)^{1}+\left(\frac{1.628}{190.2}\right)^{1}=0.144$$	**UTILITY: 0.14**

REFERENCES	CALCULATIONS	RESULTS

Results Summary

Result Name	Results
PILE DETAILS	
Length of the pile	6.75 ft
Dimensions	36 x 36 in
Main bar reinforcement	#5-8pcs at 1.5 in min.
Shear reinforcement	#3 at 10 in max.
UTILISATIONS	
Required depth	0.92
End-bearing capacity	0.27
p_a	0.67
p_s	0.94
Axial compression strength	0.00
Shear strength	0.07
Uniaxial bending strength	0.13
Biaxial bending strength	0.14