



Tower Engineering Solutions

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**REVIEWED
FOR
CODE
COMPLIANCE**
09/03/2021

Structural Analysis Report

Existing 140 ft Valmont Self Supporting Tower

Customer Name: SBA Communications Corp

Customer Site Number: CO09874-A

Customer Site Name: Hayden 2, CO

Carrier Name: Harris Corp (App#: 133635, V2)

Carrier Site ID / Name: SV383-05 / Hayden-2

Site Location: 6985 Homesteader Lane

Hayden, Colorado

Routt County

Latitude: 40.520863

Longitude: -107.297072



Analysis Result:

Max Structural Usage: 90.8% [Pass]

Max Foundation Usage: 66.6% [Pass]

Additional Usage Caused by New Mount/Mount Modification: N/A

9/30/2020

Report Prepared By: Nasib Pandey

Introduction

The purpose of this report is to summarize the analysis results on the 140 ft Valmont Self Supporting Tower to support the proposed antennas and transmission lines in addition to those currently installed. Any modification listed under Sources of Information was assumed completed and was included in this analysis.

Sources of Information

Tower Drawings	Valmont, Job # 18286-05, dated 6/24/05
Foundation Drawing	Not Available
Geotechnical Report	NWCC, Job # 99-4132, dated 9/15/99
Modification Drawings	N/A
Mount Analysis	N/A

Analysis Criteria

The feasibility analysis was performed in accordance with the requirements and stipulations of the TIA-222-G-2. In accordance with this standard, the structure was analyzed using **TESTowers**, a proprietary analysis software. The program considers the structure as an elastic 3-D model with second-order effects and temperature effects incorporated in the analysis. The analysis was performed using multiple wind directions.

Wind Speed Used in the Analysis:	Ultimate Design Wind Speed $V_{ult} = 115.0$ mph (3-Sec. Gust)/ Nominal Design Wind Speed $V_{asd} = 89.0$ mph (3-Sec. Gust)
Wind Speed with Ice:	N/A
Operational Wind Speed:	60 mph + 0" Radial ice
Standard/Codes:	TIA-222-G-2 / 2015 IBC
Exposure Category:	C
Structure Class:	II
Topographic Category:	1
Crest Height:	0 ft
Seismic Parameters:	$S_s = 0.27$, $S_1 = 0.075$

This structural analysis is based upon the tower being classified as a Structure Class II; however, if a different classification is required subsequent to the date hereof, the tower classification will be changed to meet such requirement and a new structural analysis will be run.

Existing Antennas, Mounts and Transmission Lines

The table below summarizes the antennas, mounts and transmission lines that were considered in the analysis as existing on the tower.

Items	Elevation (ft)	Qty.	Antenna Descriptions	Mount Type & Qty.	Transmissio n Lines	Owner
2	80' to 137'	1	6-Bay FM	Side Arm	(2) 3"	Always Mountain Time
3		1	6-Bay FM			
4	85.0	1	6 ft Dish w/Radome	Pipe	(1) EW63	UBET Wireless
5	70.0	2	42"x8.5"x7.5" Panel	Sector Frame	(2) 1 5/8"	NC Telecom, Inc
6	62.0	1	Electric Supply 22" x 20" x 8" Junction Box	Leg	-	Zirkel Wireless
7	61.0	1	Motorola 9000APF - Panel	(3) Sector Frame	(3) 2" Conduit (Each conduit housing (13) CAT5 cables)	
8	60.0	2	Cambium Networks 5GHZ PMP 450			
9		1	Cambium Networks 3GHz PMP 450			
10	60.0	2	72" x 12" Panel	Leg	-	UBET Wireless
11	57.0	2	800 10634 - Panel	Leg	(2) 7/8"	Union Telephone
12	56.0	2	800 10634 - Panel	Leg	(2) 7/8"	
13	53.0	2	800 10634 - Panel	Leg	(2) 7/8"	
14	42.0	1	6 ft Dish w/Radome - Dish	Pipe	(1) EW63	UBET Wireless
15	37.0	1	2 Bay FM	Leg	(1) 1/2"	Always Mountain Time
16	34.0	1	4 ft Dish	Pipe	(1) 1/2"	Fones West Digital
17	30.0	1	4 ft Dish	Pipe	(1) 1/2"	
18	30.0	1	6 ft Grid Dish		(1) 7/8"	Always Mountain Time
19	28.0	1	Radiowave SPR-5-8NS - Dish	Pipe	(1) 1 1/4"	Union Telephone
20	25.0	1	3 ft Dish	Pipe	(1) 1/2"	Fones West Digital
21	23.0	1	3 ft Dish	Pipe	(1) 1/2"	
22	23.0	1	Dragonwave A-ANT-11G-4-C - Dish	Pipe	-	Zirkel Wireless
23		1	Dragonwave A-ANT-11G-3-C - Dish			
24	22.0	1	Cambium Networks 11 GHZ PTP820S	Valmont R5 Universal	-	
25	21.0	1	Saf Tehnika 11 GHz Integra-S	Leg	-	
26	19.0	1	Dragonwave 23 GHz Horizon Compact	Leg	-	
27		1	WB Manufacuring OSF-R2-23C - Dish	Leg	-	
28	17.0	3	Motorola 2450AP - Panel	Pipe	-	
29		8	Cambium Networks 5GHZ PMP 450	(3) McCown Technology M-TOW-3P-38 (Sector Mount)	-	
30		1	Cambium Networks 3GHz PMP 450		-	
31		1	Electric Supply 22" x 20" x 8" Junction Box		-	
32	13.0	1	HPX8-65-P6A - Dish	Pipe	(2) EW63	Union Telephone
33	12.0	1	HP6-107-PGA - Dish	Pipe	(1) EW90	
34	10.0	1	1' Yagi	Leg	(1) 1/2"	Always Mountain Time
35	10.0	2	Cambium Networks GPS	Leg	-	Zirkel Wireless

Proposed Carrier's Final Configuration of Antennas, Mounts and Transmission Lines

Information pertaining to the proposed carrier's final configuration of antennas and transmission lines was provided by SBA Communications Corp. The proposed antennas and lines are listed below.

Items	Elevation (ft)	Qty.	Antenna Descriptions	Mount Type & Qty.	Transmission Lines	Owner
1	145.0	2	Db System Inc 5100A Antenna	(2) Connect- it HS6 Mount @ 138' elevation	(2) 1-5/8" Coax	Harris Corp

See the attached coax layout for the line placement considered in the analysis.

Analysis Results

The results of the structural analysis, performed for the wind and ice loading and antenna equipment as defined above, are summarized as the following:

Tower Component	Legs	Diagonals	Horizontals
Max. Usage:	48.1%	90.8%	4.4%
Pass/Fail	Pass	Pass	Pass

Foundations

	Compression (Kips)	Uplift (Kips)	Shear (Kips)
Original Design Reactions	176.4	164.1	20.3
Analysis Reactions	131.9	113.6	18.3
Factored Reactions*	238.1	221.5	27.4
% of Design Reactions	55.4%	51.3%	66.6%

* Per section 15.5.1 of the TIA-222-G standard, factored reactions were obtained by multiplying a 1.35 factor to the original design reactions.

No foundation drawing is available for the analysis of the existing foundation. Since the reactions calculated from the current analysis are less than those indicated on the original structural design drawing, the foundations are assumed to be adequate to resist the reactions from the current analysis.

Operational Condition (Rigidity):

The maximum twist and sway of the microwave dishes under the operational wind speed as specified in the Analysis Criteria are listed in the table below:

Elevation (ft)	Antenna / Dish	Carrier	Twist (deg)	Sway (deg)
85.0	6 ft Dish w/Radome - Dish	UBET Wireless	0.021	0.098
42.0	6 ft Dish w/Radome - Dish	UBET Wireless	0.007	0.054
34.0	4 ft Std Dish - Dish	Fones West Digital	0.007	0.055
30.0	4 ft Std Dish - Dish	Fones West Digital	0.003	0.036
30.0	6 ft Grid Dish - Dish	Always Mountain Time	0.003	0.036
28.0	Radiowave SPR-5-8NS - Dish	Union Telephone	0.003	0.036
25.0	3 ft Std Dish - Dish	Fones West Digital	0.003	0.036
23.0	3 ft Std Dish - Dish	Fones West Digital	0.003	0.036
23.0	A-ANT-11G-4-C - Dish	Zirkel Wireless	0.003	0.036
23.0	A-ANT-11G-3-C - Dish	Zirkel Wireless	0.003	0.036
19.0	OSF-R2-23C - Dish	Zirkel Wireless	0.002	0.036
13.0	HPX8-65-P6A - Dish	Union Telephone	0.002	0.036
12.0	HP6-107-PGA - Dish	Union Telephone	0.002	0.036

It is recommended that the carriers review the twist and sway values of the microwave dishes.

Conclusions

Based on the analysis results, the existing structure and its foundation were found to be adequate to safely support the existing and proposed equipment and meet the minimum requirements per the TIA-222 Standard under the design basic wind speed as specified in the Analysis Criteria.

Standard Conditions

1. This analysis was performed based on the information supplied to **(TES) Tower Engineering Solutions, LLC**. Verification of the information provided was not included in the Scope of Work for **TES**. The accuracy of the analysis is dependent on the accuracy of the information provided.
2. The structural analysis was performance based upon the evidence available at the time of this report. All information provided by the client is considered to be accurate.
3. The analyses will be performed based on the codes as specified by the client or based on the best knowledge of the engineering staff of **TES**. In the absence of information to the contrary, all work will be performed in accordance with the latest relevant revision of ANSI/TIA-222. If wind speed and/or ice loads are different from the minimum values recommended by the EIA/TIA-222 standard or other codes, **TES** should be notified in writing and the applicable minimum values provided by the client.
4. The configuration of the existing mounts, antennas, coax and other appurtenances were supplied by the customer for the current structural analysis. **TES** has not visited the tower site to verify the adequacy of the information provided. If there is any discrepancy found in the report regarding the existing conditions, **TES** should be notified immediately to evaluate the effect of the discrepancy on the analysis results.
5. The client will assume responsibility for rework associated with the differences in initially provided information, including tower and foundation information, existing and/or proposed equipment and transmission lines.
6. If a feasibility analysis was performed, final acceptance of changed conditions shall be based upon a rigorous structural analysis.

Structure: CO09874-A-SBA

Site Name: Hayden 2, CO

Code: EIA/TIA-222-G

9/30/2020

Type: Self Support

Base Shape: Triangle

Basic WS: 89.00

Height: 140.00 (ft)

Base Width: 17.00

Basic Ice WS: 0.00

Base Elev: 0.00 (ft)

Top Width: 5.00

Operational WS: 60.00

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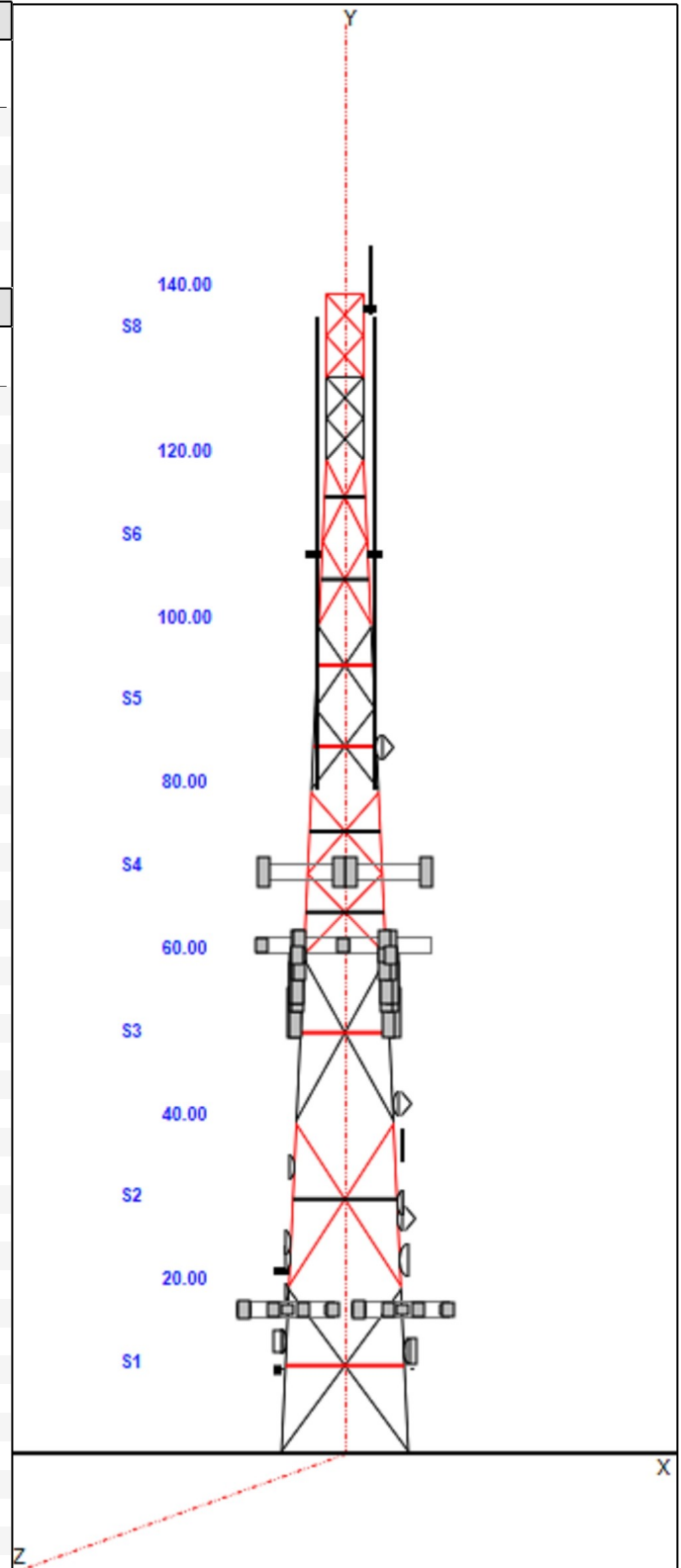


Section Properties

Sect	Leg Members	Diagonal Members	Horizontal Members
1	PST 8" DIA PIPE	PST 2-1/2" DIA PIPE	
2-3	PST 6" DIA PIPE	PST 2-1/2" DIA PIPE	
4	PST 5" DIA PIPE	PST 1-1/2" DIA PIPE	
5	PST 4" DIA PIPE	PST 1-1/2" DIA PIPE	
6	PST 3-1/2" DIA PIPE	PST 1-1/2" DIA PIPE	
7-8	PST 2-1/2" DIA PIPE	SAE 1.75X1.75X0.1875	SAE 2X2X0.1875

Discrete Appurtenances

Attach Elev (ft)	Force Elev (ft)	Qty	Description
138.00	141.30	2	5100A
138.00	138.00	2	Side Arm (L. Heavy)
108.50	108.50	1	6-Bay FM
108.50	108.50	1	6-Bay FM
108.50	108.50	2	Side Arm
85.00	85.00	1	6 ft Dish w/Radome
85.00	85.00	1	Pipe Mount
70.00	70.00	1	Sector Frame
70.00	70.00	2	42"x8.5"x7.5" Panel
62.00	62.00	1	22" x 20" x 8" Junction Box
61.00	61.00	1	24" x 20" x 8" Pipe Mount
61.00	61.00	3	Sector Frame
61.00	61.00	1	9000APF
60.00	60.00	2	5GHZ PMP 450
60.00	60.00	2	72" x 12" Panel
60.00	60.00	1	3GHz PMP 450
57.00	57.00	2	800 10634
56.00	56.00	2	800 10634
53.00	53.00	2	800 10634
42.00	42.00	1	6 ft Dish w/Radome
42.00	42.00	1	Pipe Mount
37.00	37.00	1	2 Bay FM
34.00	34.00	1	Pipe Mount
34.00	34.00	1	4 ft Std Dish
30.00	30.00	1	4 ft Std Dish
30.00	30.00	1	6 ft Grid Dish
30.00	30.00	2	Pipe Mount
28.00	28.00	1	Radiowave SPR-5-8NS
28.00	28.00	1	Pipe Mount
25.00	25.00	1	Pipe Mount
25.00	25.00	1	3 ft Std Dish
23.00	23.00	1	3 ft Std Dish
23.00	23.00	1	Pipe Mount
23.00	23.00	1	A-ANT-11G-4-C
23.00	23.00	1	Pipe Mount
23.00	23.00	1	A-ANT-11G-3-C
22.00	22.00	1	11 GHZ PTP820S
22.00	22.00	1	Valmont R5 Universal Stand-Off
21.00	21.00	1	11 GHZ Integra-S
19.00	19.00	1	OSF-R2-23C
19.00	19.00	1	23 GHz Horizon Compact
17.00	17.00	3	2450AP
17.00	17.00	1	22" x 20" x 8" Junction Box



Structure: CO09874-A-SBA

Site Name: Hayden 2, CO	Code: EIA/TIA-222-G	9/30/2020
Type: Self Support	Base Shape: Triangle	Basic WS: 89.00
Height: 140.00 (ft)	Base Width: 17.00	Basic Ice WS: 0.00
Base Elev: 0.00 (ft)	Top Width: 5.00	Operational WS: 60.00



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17.00	17.00	3	McCown Technology M-TOW-3P-38
17.00	17.00	1	3GHz PMP 450
17.00	17.00	8	5GHZ PMP 450
13.00	13.00	1	Pipe Mount
13.00	13.00	1	HPX8-65-P6A
12.00	12.00	1	HP6-107-PGA
12.00	12.00	1	Pipe Mount
10.00	10.00	1	1' Yagi
10.00	10.00	2	Cambium Networks GPS

Linear Appurtenances

Elev From (ft)	Elev To (ft)	Qty	Description
0.00	140.00	1	Climbing Ladder
0.00	140.00	1	Safety Cable
0.00	138.00	2	1 5/8" Coax
0.00	138.00	1	W/G Ladder
0.00	108.50	2	3" Coax
0.00	90.00	1	W/G Ladder
0.00	85.00	1	EW63
0.00	70.00	2	1 5/8" Coax
0.00	61.00	3	2" Conduit
0.00	57.00	2	7/8" Coax
0.00	56.00	2	7/8" Coax
0.00	53.00	2	7/8" Coax
0.00	42.00	1	EW63
0.00	37.00	1	1/2" Coax
0.00	34.00	1	1/2" Coax
0.00	30.00	1	1/2" Coax
0.00	30.00	1	7/8" Coax
0.00	28.00	1	1 1/4" Coax
0.00	25.00	1	1/2" Coax
0.00	23.00	1	1/2" Coax
0.00	13.00	2	EW63
0.00	12.00	1	EW90
0.00	10.00	1	1/2" Coax

Base Reactions

Leg	Overtopping
Max Uplift: -113.58 (kips)	Moment: 1807.80 (ft-kips)
Max Down: 131.91 (kips)	Total Down: 27.37 (kips)
Max Shear: 18.25 (kips)	Total Shear: 29.12 (kips)

Structure: CO09874-A-SBA

Site Name: Hayden 2, CO

Type: Self Support

Height: 140.00 (ft)

Base Elev: 0.00 (ft)

Base Shape: Triangle

Base Width: 17.00

Top Width: 5.00

Code: EIA/TIA-222-G

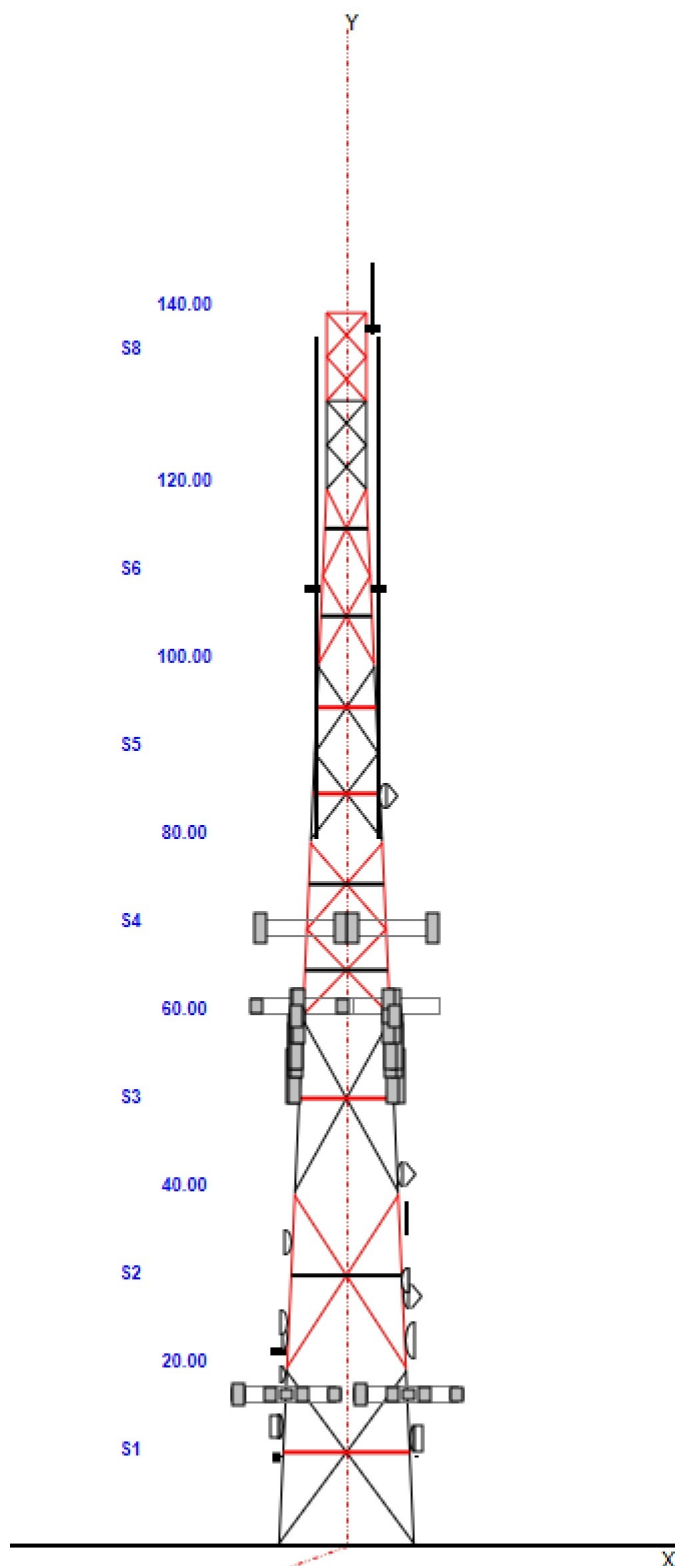
Basic WS: 89.00

Basic Ice WS: 0.00

Operational WS: 60.00

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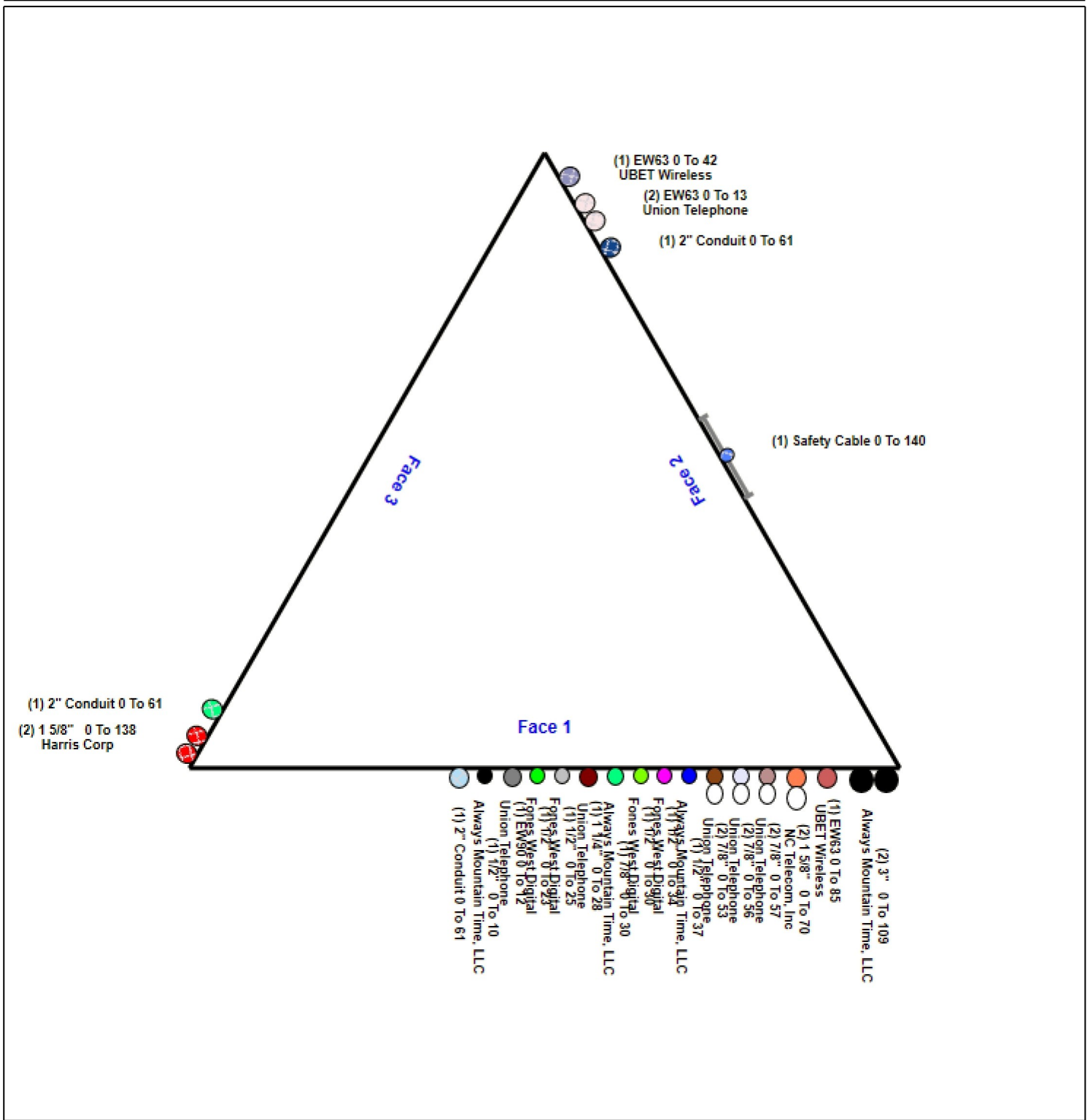


Structure: CO09874-A-SBA - Coax Line Placement

Type: Self Support
Site Name: Hayden 2, CO
Height: 140.00 (ft)

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Loading Summary

Structure: CO09874-A-SBA	Code: EIA/TIA-222-G	9/30/2020
Site Name: Hayden 2, CO	Exposure: C	
Height: 140.00 (ft)	Crest Height: 0.00	
Base Elev: 0.000 (ft)	Site Class: D - Stiff Soil	
Gh: 0.85	Topography: 1	Struct Class: II
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Discrete Appurtenances Properties

Attach Elev (ft)	Description	Qty	No Ice		Ice		Len (in)	Width (in)	Depth (in)	Ka	Orientation Factor	Vert Ecc (ft)
			Weight (lb)	CaAa (sf)	Weight (lb)	CaAa (sf)						
138.00	5100A	2	22.00	2.590	0.00	0.000	100.000	3.660	3.660	1.00	1.00	3.300
138.00	Side Arm (L. Heavy)	2	120.00	4.500	150.00	6.000	0.000	0.000	0.000	1.00	1.00	0.000
108.50	6-Bay FM	1	928.00	44.810	1299.80	56.990	384.000	0.000	0.000	1.00	1.00	0.000
108.50	6-Bay FM	1	928.00	44.810	1299.80	56.990	384.000	0.000	0.000	1.00	1.00	0.000
108.50	Side Arm	2	160.00	6.000	200.00	8.000	0.000	0.000	0.000	1.00	1.00	0.000
85.00	6 ft Dish w/Radome	1	162.00	24.410	321.00	25.090	0.000	0.000	0.000	1.00	1.00	0.000
85.00	Pipe Mount	1	50.00	2.000	450.00	6.000	0.000	0.000	0.000	1.00	1.00	0.000
70.00	Sector Frame	1	300.00	10.000	550.00	16.000	0.000	0.000	0.000	1.00	1.00	0.000
70.00	42"x8.5"x7.5" Panel	2	15.00	3.300	0.00	0.000	42.000	8.500	7.500	1.00	1.00	0.000
62.00	22" x 20" x 8" Junction Box	1	15.00	4.270	0.00	0.000	8.000	20.000	22.000	1.00	1.00	0.000
61.00	24" x 20" x 8" Pipe Mount	1	49.00	4.000	150.00	6.000	0.000	0.000	0.000	1.00	1.00	0.000
61.00	Sector Frame	3	450.00	14.000	550.00	16.000	0.000	0.000	0.000	0.75	0.75	0.000
61.00	9000APF	1	12.50	1.950	0.00	0.000	19.500	12.000	4.800	0.80	1.00	0.000
60.00	5GHZ PMP 450	2	11.00	1.030	0.00	0.000	20.000	6.000	5.000	1.00	1.00	0.000
60.00	72" x 12" Panel	2	45.00	8.160	0.00	0.000	72.000	12.000	6.000	1.00	1.00	0.000
60.00	3GHz PMP 450	1	11.00	1.300	0.00	0.000	28.000	5.000	2.700	1.00	1.00	0.000
57.00	800 10634	2	23.10	7.400	0.00	0.000	74.100	10.200	3.900	1.00	1.00	0.000
56.00	800 10634	2	23.10	7.400	0.00	0.000	74.100	10.200	3.900	1.00	1.00	0.000
53.00	800 10634	2	23.10	7.400	0.00	0.000	74.100	10.200	3.900	1.00	1.00	0.000
42.00	6 ft Dish w/Radome	1	162.00	24.410	321.00	25.090	0.000	0.000	0.000	1.00	1.00	0.000
42.00	Pipe Mount	1	50.00	2.000	450.00	6.000	0.000	0.000	0.000	1.00	1.00	0.000
37.00	2 Bay FM	1	30.00	10.500	84.50	6.110	48.000	43.000	0.000	0.00	0.00	0.000
34.00	Pipe Mount	1	50.00	2.000	200.00	8.000	0.000	0.000	0.000	1.00	1.00	0.000
34.00	4 ft Std Dish	1	188.00	20.910	277.00	21.790	0.000	0.000	0.000	1.00	1.00	0.000
30.00	4 ft Std Dish	1	188.00	20.910	277.00	21.790	0.000	0.000	0.000	1.00	1.00	0.000
30.00	6 ft Grid Dish	1	198.00	16.790	396.00	48.370	0.000	0.000	0.000	1.00	1.00	0.000
30.00	Pipe Mount	2	50.00	2.000	200.00	8.000	0.000	0.000	0.000	1.00	1.00	0.000
28.00	Radiowave SPR-5-8NS	1	170.00	15.860	280.00	16.520	0.000	0.000	0.000	1.00	1.00	0.000
28.00	Pipe Mount	1	50.00	2.000	200.00	8.000	0.000	0.000	0.000	1.00	1.00	0.000
25.00	Pipe Mount	1	50.00	2.000	200.00	8.000	0.000	0.000	0.000	1.00	1.00	0.000
25.00	3 ft Std Dish	1	100.00	11.760	150.00	12.430	0.000	0.000	0.000	1.00	1.00	0.000
23.00	3 ft Std Dish	1	100.00	11.760	150.00	12.430	0.000	0.000	0.000	1.00	1.00	0.000
23.00	Pipe Mount	1	50.00	2.000	200.00	8.000	0.000	0.000	0.000	1.00	1.00	0.000
23.00	A-ANT-11G-4-C	1	121.00	17.760	223.40	18.460	50.800	50.800	26.100	1.00	1.00	0.000
23.00	Pipe Mount	1	50.00	2.000	200.00	8.000	0.000	0.000	0.000	1.00	1.00	0.000
23.00	A-ANT-11G-3-C	1	49.60	8.920	101.80	9.420	35.000	35.000	0.000	1.00	1.00	0.000
22.00	11 GHZ PTP820S	1	5.50	0.730	0.00	0.000	10.600	8.300	2.800	1.00	1.00	0.000
22.00	Valmont R5 Universal Stand-Off	1	35.00	2.000	150.00	6.000	0.000	0.000	0.000	1.00	1.00	0.000
21.00	11 GHZ Integra-S	1	18.00	2.150	0.00	0.000	17.000	11.000	4.000	1.00	1.00	0.000
19.00	OSF-R2-23C	1	27.00	4.690	55.10	5.050	26.100	26.100	0.000	1.00	1.00	0.000
19.00	23 GHz Horizon Compact	1	14.00	1.010	0.00	0.000	11.000	11.000	8.000	1.00	1.00	0.000
17.00	2450AP	3	1.00	0.340	0.00	0.000	11.700	3.400	3.400	1.00	1.00	0.000
17.00	22" x 20" x 8" Junction Box	1	15.00	4.270	0.00	0.000	8.000	20.000	22.000	1.00	1.00	0.000
17.00	McCown Technology M-TOW-3P-38	3	49.00	4.000	700.00	21.500	0.000	0.000	0.000	0.75	0.75	0.000
17.00	3GHz PMP 450	1	11.00	1.300	0.00	0.000	28.000	5.000	2.700	1.00	1.00	0.000
17.00	5GHZ PMP 450	8	11.00	1.030	0.00	0.000	20.000	6.000	5.000	1.00	1.00	0.000
13.00	Pipe Mount	1	50.00	2.000	200.00	8.000	0.000	0.000	0.000	1.00	1.00	0.000
13.00	HPX8-65-P6A	1	470.00	63.420	1010.00	64.750	0.000	0.000	0.000	1.00	1.00	0.000

Loading Summary

Structure: CO09874-A-SBA	Code: EIA/TIA-222-G	9/30/2020
Site Name: Hayden 2, CO	Exposure: C	
Height: 140.00 (ft)	Crest Height: 0.00	
Base Elev: 0.000 (ft)	Site Class: D - Stiff Soil	
Gh: 0.85	Topography: 1	Struct Class: II



Page: 6

12.00	HP6-107-PGA	1	281.00	35.670	501.00	36.670	0.000	0.000	0.000	1.00	1.00	0.000
12.00	Pipe Mount	1	50.00	2.000	200.00	8.000	0.000	0.000	0.000	1.00	1.00	0.000
10.00	1' Yagi	1	1.80	0.770	10.10	1.320	12.000	30.000	0.000	1.00	1.00	0.000
10.00	Cambium Networks GPS	2	0.50	0.090	2.50	0.140	4.000	4.000	4.000	1.00	1.00	0.000
Totals:		76	7,614.00		14,762.50					Number of Appurtenances : 52		

Loading Summary

Structure: CO09874-A-SBA	Code: EIA/TIA-222-G	9/30/2020
Site Name: Hayden 2, CO	Exposure: C	
Height: 140.00 (ft)	Crest Height: 0.00	
Base Elev: 0.000 (ft)	Site Class: D - Stiff Soil	
Gh: 0.85	Topography: 1	Page: 7
	Struct Class: II	



Linear Appurtenances Properties

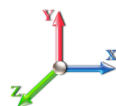
Elev. From (ft)	Elev. To (ft)	Description	Qty	Width (in)	Weight (lb/ft)	Pct In Block	Spread On Faces	Bundling Arrangement	Cluster Dia (in)	Out of Zone	Spacing (in)	Orientation Factor	Ka Override
0.00	140.00	Climbing Ladder	1	2.50	6.90	100.00	2	Individual NR		N	1.00	1.00	
0.00	140.00	Safety Cable	1	0.38	0.27	100.00	2	Individual NR		N	1.00	1.00	
0.00	138.00	1 5/8" Coax	2	1.98	1.04	100.00	3	Individual IR		N	1.00	1.00	
0.00	138.00	W/G Ladder	1	3.00	6.00	100.00	3	Individual NR		N	1.00	1.00	
0.00	108.50	3" Coax	2	3.02	1.78	100.00	1	Individual NR		N	1.00	1.00	
0.00	90.00	W/G Ladder	1	2.50	6.00	100.00	1	Individual NR		N	1.00	1.00	
0.00	85.00	EW63	1	2.01	0.51	100.00	1	Individual NR		N	1.00	1.00	
0.00	70.00	1 5/8" Coax	2	1.98	1.04	50.00	1	Block		N	1.00	1.00	
0.00	61.00	2" Conduit	3	2.00	1.61	100.00	1,2,3	Individual NR		N	1.00	1.00	
0.00	57.00	7/8" Coax	2	1.11	0.52	50.00	1	Block		N	1.00	1.00	
0.00	56.00	7/8" Coax	2	1.11	0.52	50.00	1	Block		N	1.00	1.00	
0.00	53.00	7/8" Coax	2	1.11	0.52	50.00	1	Block		N	1.00	1.00	
0.00	42.00	EW63	1	2.01	0.51	100.00	2	Individual NR		N	1.00	1.00	
0.00	37.00	1/2" Coax	1	0.65	0.16	100.00	1	Individual NR		N	1.00	1.00	
0.00	34.00	1/2" Coax	1	0.65	0.16	100.00	1	Individual NR		N	1.00	1.00	
0.00	30.00	1/2" Coax	1	0.65	0.16	100.00	1	Individual NR		N	1.00	1.00	
0.00	30.00	7/8" Coax	1	1.11	0.52	100.00	1	Individual NR		N	1.00	1.00	
0.00	28.00	1 1/4" Coax	1	1.55	0.66	100.00	1	Individual NR		N	1.00	1.00	
0.00	25.00	1/2" Coax	1	0.65	0.16	100.00	1	Individual NR		N	1.00	1.00	
0.00	23.00	1/2" Coax	1	0.65	0.16	100.00	1	Individual NR		N	1.00	1.00	
0.00	13.00	EW63	2	2.01	0.51	100.00	2	Individual NR		N	1.00	1.00	
0.00	12.00	EW90	1	1.32	0.32	100.00	1	Individual NR		N	1.00	1.00	
0.00	10.00	1/2" Coax	1	0.65	0.16	100.00	1	Individual NR		N	1.00	1.00	

Section Forces

Structure: CO09874-A-SBA
Site Name: Hayden 2, CO
Height: 140.00 (ft)
Base Elev: 0.000 (ft)
Gh: 0.85

Topography: 1

Code: EIA/TIA-222-G
Exposure: C
Crest Height: 0.00
Site Class: D - Stiff Soil
Struct Class: II

9/30/2020

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Load Case: 1.2D + 1.6W Normal Wind

1.2D + 1.6W 89 mph Wind at Normal To Face

Wind Load Factor: 1.60

Wind Importance Factor: 1.00

Dead Load Factor: 1.20

Ice Dead Load Factor: 0.00

Ice Importance Factor: 1.00

Sect Seq	Wind Height (ft)	qz (psf)	Total Flat Area (sqft)	Total Round Area (sqft)	Ice Round Area (sqft)	Sol Ratio	Cf	Df	Dr	Ice Thick (in)	Eff Area (sqft)	Linear Area (sqft)	Ice Linear Area (sqft)	Total Weight (lb)	Weight Ice (lb)	Struct Force (lb)	Linear Force (lb)	Total Force (lb)
1	10.0	14.65	2.657	40.54	0.00	0.13	2.85	1.00	1.00	0.00	21.97	72.24	0.00	4,311.5	0.0	1247.35	1195.64	2,442.99
2	30.0	16.93	2.322	33.36	0.00	0.12	2.87	1.00	1.00	0.00	19.48	60.79	0.00	3,451.0	0.0	1289.74	1191.78	2,481.52
3	50.0	18.85	1.987	32.83	0.00	0.14	2.81	1.00	1.00	0.00	18.68	51.86	0.00	3,319.0	0.0	1347.38	1156.40	2,503.78
4	70.0	20.24	2.910	27.13	0.00	0.14	2.80	1.00	1.00	0.00	17.34	36.13	0.00	2,401.5	0.0	1334.00	900.14	2,234.14
5	90.0	21.34	2.325	22.78	0.00	0.15	2.77	1.00	1.00	0.00	15.03	29.38	0.00	1,918.7	0.0	1208.84	770.48	1,979.32
6	110.0	22.26	1.734	20.47	0.00	0.18	2.68	1.00	1.00	0.00	13.43	20.67	0.00	1,589.9	0.0	1089.99	583.65	1,673.65
7	125.0	22.86	4.765	4.79	0.00	0.18	2.66	1.00	1.00	0.00	7.50	8.20	0.00	628.5	0.0	619.68	251.90	871.58
8	135.0	23.24	4.778	4.79	0.00	0.18	2.65	1.00	1.00	0.00	7.52	7.04	0.00	609.1	0.0	630.75	222.03	852.79
														18,229.1	0.0			15,039.76

Load Case: 1.2D + 1.6W 60° Wind

1.2D + 1.6W 89 mph Wind at 60° From Face

Wind Load Factor: 1.60

Wind Importance Factor: 1.00

Dead Load Factor: 1.20

Ice Dead Load Factor: 0.00

Ice Importance Factor: 1.00

Sect Seq	Wind Height (ft)	qz (psf)	Total Flat Area (sqft)	Total Round Area (sqft)	Ice Round Area (sqft)	Sol Ratio	Cf	Df	Dr	Ice Thick (in)	Eff Area (sqft)	Linear Area (sqft)	Ice Linear Area (sqft)	Total Weight (lb)	Weight Ice (lb)	Struct Force (lb)	Linear Force (lb)	Total Force (lb)
1	10.0	14.65	2.657	40.54	0.00	0.13	2.85	0.80	1.00	0.00	21.44	72.24	0.00	4,311.5	0.0	1217.18	1195.64	2,412.82
2	30.0	16.93	2.322	33.36	0.00	0.12	2.87	0.80	1.00	0.00	19.02	60.79	0.00	3,451.0	0.0	1259.00	1191.78	2,450.78
3	50.0	18.85	1.987	32.83	0.00	0.14	2.81	0.80	1.00	0.00	18.28	51.86	0.00	3,319.0	0.0	1318.72	1156.40	2,475.12
4	70.0	20.24	2.910	27.13	0.00	0.14	2.80	0.80	1.00	0.00	16.76	36.13	0.00	2,401.5	0.0	1289.23	900.14	2,189.37
5	90.0	21.34	2.325	22.78	0.00	0.15	2.77	0.80	1.00	0.00	14.56	29.38	0.00	1,918.7	0.0	1171.44	770.48	1,941.92
6	110.0	22.26	1.734	20.47	0.00	0.18	2.68	0.80	1.00	0.00	13.09	20.67	0.00	1,589.9	0.0	1061.85	583.65	1,645.50
7	125.0	22.86	4.765	4.79	0.00	0.18	2.66	0.80	1.00	0.00	6.55	8.20	0.00	628.5	0.0	540.99	251.90	792.88
8	135.0	23.24	4.778	4.79	0.00	0.18	2.65	0.80	1.00	0.00	6.56	7.04	0.00	609.1	0.0	550.57	222.03	772.60
														18,229.1	0.0			14,680.99

Section Forces

Structure: CO09874-A-SBA

Code: EIA/TIA-222-G

9/30/2020

Site Name: Hayden 2, CO

Exposure: C

Height: 140.00 (ft)

Crest Height: 0.00

Base Elev: 0.000 (ft)

Site Class: D - Stiff Soil

Gh: 0.85

Topography: 1

Struct Class: II



Page: 9

Load Case: 1.2D + 1.6W 90° Wind

1.2D + 1.6W 89 mph Wind at 90° From Face

Wind Load Factor: 1.60

Wind Importance Factor: 1.00

Dead Load Factor: 1.20

Ice Dead Load Factor: 0.00

Ice Importance Factor: 1.00

Sect Seq	Wind Height (ft)	qz (psf)	Total Flat Area (sqft)	Total Round Area (sqft)	Ice Round Area (sqft)	Sol Ratio	Cf	Df	Dr	Ice Thick (in)	Eff Area (sqft)	Linear Area (sqft)	Linear Area (sqft)	Total Weight (lb)	Weight Ice (lb)	Struct Force (lb)	Linear Force (lb)	Total Force (lb)
1	10.0	14.65	2.657	40.54	0.00	0.13	2.85	0.85	1.00	0.00	21.57	72.24	0.00	4,311.5	0.0	1224.72	1195.64	2,420.36
2	30.0	16.93	2.322	33.36	0.00	0.12	2.87	0.85	1.00	0.00	19.14	60.79	0.00	3,451.0	0.0	1266.69	1191.78	2,458.47
3	50.0	18.85	1.987	32.83	0.00	0.14	2.81	0.85	1.00	0.00	18.38	51.86	0.00	3,319.0	0.0	1325.88	1156.40	2,482.29
4	70.0	20.24	2.910	27.13	0.00	0.14	2.80	0.85	1.00	0.00	16.90	36.13	0.00	2,401.5	0.0	1300.42	900.14	2,200.56
5	90.0	21.34	2.325	22.78	0.00	0.15	2.77	0.85	1.00	0.00	14.68	29.38	0.00	1,918.7	0.0	1180.79	770.48	1,951.27
6	110.0	22.26	1.734	20.47	0.00	0.18	2.68	0.85	1.00	0.00	13.17	20.67	0.00	1,589.9	0.0	1068.88	583.65	1,652.54
7	125.0	22.86	4.765	4.79	0.00	0.18	2.66	0.85	1.00	0.00	6.79	8.20	0.00	628.5	0.0	560.66	251.90	812.56
8	135.0	23.24	4.778	4.79	0.00	0.18	2.65	0.85	1.00	0.00	6.80	7.04	0.00	609.1	0.0	570.62	222.03	792.65
														18,229.1	0.0	14,770.68		

Load Case: 0.9D + 1.6W Normal Wind

0.9D + 1.6W 89 mph Wind at Normal To Face

Wind Load Factor: 1.60

Wind Importance Factor: 1.00

Dead Load Factor: 0.90

Ice Dead Load Factor: 0.00

Ice Importance Factor: 1.00

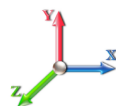
Sect Seq	Wind Height (ft)	qz (psf)	Total Flat Area (sqft)	Total Round Area (sqft)	Ice Round Area (sqft)	Sol Ratio	Cf	Df	Dr	Ice Thick (in)	Eff Area (sqft)	Linear Area (sqft)	Linear Area (sqft)	Total Weight (lb)	Weight Ice (lb)	Struct Force (lb)	Linear Force (lb)	Total Force (lb)
1	10.0	14.65	2.657	40.54	0.00	0.13	2.85	1.00	1.00	0.00	21.97	72.24	0.00	3,233.6	0.0	1247.35	1195.64	2,442.99
2	30.0	16.93	2.322	33.36	0.00	0.12	2.87	1.00	1.00	0.00	19.48	60.79	0.00	2,588.2	0.0	1289.74	1191.78	2,481.52
3	50.0	18.85	1.987	32.83	0.00	0.14	2.81	1.00	1.00	0.00	18.68	51.86	0.00	2,489.2	0.0	1347.38	1156.40	2,503.78
4	70.0	20.24	2.910	27.13	0.00	0.14	2.80	1.00	1.00	0.00	17.34	36.13	0.00	1,801.1	0.0	1334.00	900.14	2,234.14
5	90.0	21.34	2.325	22.78	0.00	0.15	2.77	1.00	1.00	0.00	15.03	29.38	0.00	1,439.1	0.0	1208.84	770.48	1,979.32
6	110.0	22.26	1.734	20.47	0.00	0.18	2.68	1.00	1.00	0.00	13.43	20.67	0.00	1,192.4	0.0	1089.99	583.65	1,673.65
7	125.0	22.86	4.765	4.79	0.00	0.18	2.66	1.00	1.00	0.00	7.50	8.20	0.00	471.3	0.0	619.68	251.90	871.58
8	135.0	23.24	4.778	4.79	0.00	0.18	2.65	1.00	1.00	0.00	7.52	7.04	0.00	456.8	0.0	630.75	222.03	852.79
														13,671.8	0.0	15,039.76		

Section Forces

Structure: CO09874-A-SBA
Site Name: Hayden 2, CO
Height: 140.00 (ft)
Base Elev: 0.000 (ft)
Gh: 0.85

Topography: 1

Code: EIA/TIA-222-G
Exposure: C
Crest Height: 0.00
Site Class: D - Stiff Soil
Struct Class: II

9/30/2020

 Page: 10



Load Case: 0.9D + 1.6W 60° Wind

0.9D + 1.6W 89 mph Wind at 60° From Face

Wind Load Factor: 1.60

Wind Importance Factor: 1.00

Dead Load Factor: 0.90

Ice Importance Factor: 1.00

Ice Dead Load Factor: 0.00

Sect Seq	Wind Height (ft)	qz (psf)	Total Flat Area (sqft)	Total Round Area (sqft)	Ice Round Area (sqft)						Ice		Total Weight (lb)	Weight Ice (lb)	Struct Force (lb)	Linear Force (lb)	Total Force (lb)		
						Sol Ratio	Cf	Df	Dr	Ice Thick (in)	Eff Area (sqft)	Linear Area (sqft)						Linear Area (sqft)	
1	10.0	14.65	2.657	40.54	0.00	0.13	2.85	0.80	1.00	0.00	21.44	72.24	0.00	3,233.6	0.0	1217.18	1195.64	2,412.82	
2	30.0	16.93	2.322	33.36	0.00	0.12	2.87	0.80	1.00	0.00	19.02	60.79	0.00	2,588.2	0.0	1259.00	1191.78	2,450.78	
3	50.0	18.85	1.987	32.83	0.00	0.14	2.81	0.80	1.00	0.00	18.28	51.86	0.00	2,489.2	0.0	1318.72	1156.40	2,475.12	
4	70.0	20.24	2.910	27.13	0.00	0.14	2.80	0.80	1.00	0.00	16.76	36.13	0.00	1,801.1	0.0	1289.23	900.14	2,189.37	
5	90.0	21.34	2.325	22.78	0.00	0.15	2.77	0.80	1.00	0.00	14.56	29.38	0.00	1,439.1	0.0	1171.44	770.48	1,941.92	
6	110.0	22.26	1.734	20.47	0.00	0.18	2.68	0.80	1.00	0.00	13.09	20.67	0.00	1,192.4	0.0	1061.85	583.65	1,645.50	
7	125.0	22.86	4.765	4.79	0.00	0.18	2.66	0.80	1.00	0.00	6.55	8.20	0.00	471.3	0.0	540.99	251.90	792.88	
8	135.0	23.24	4.778	4.79	0.00	0.18	2.65	0.80	1.00	0.00	6.56	7.04	0.00	456.8	0.0	550.57	222.03	772.60	
														13,671.8	0.0				14,680.99

Load Case: 0.9D + 1.6W 90° Wind

0.9D + 1.6W 89 mph Wind at 90° From Face

Wind Load Factor: 1.60

Wind Importance Factor: 1.00

Dead Load Factor: 0.90

Ice Importance Factor: 1.00

Ice Dead Load Factor: 0.00

Sect Seq	Wind Height (ft)	qz (psf)	Total Flat Area (sqft)	Total Round Area (sqft)	Ice Round Area (sqft)	Sol Ratio	Cf	Df	Dr	Ice Thick (in)	Eff Area (sqft)	Ice			Struct Force (lb)	Linear Force (lb)	Total Force (lb)	
												Linear Area (sqft)	Linear Area (sqft)	Total Weight (lb)				
1	10.0	14.65	2.657	40.54	0.00	0.13	2.85	0.85	1.00	0.00	21.57	72.24	0.00	3,233.6	0.0	1224.72	1195.64	2,420.36
2	30.0	16.93	2.322	33.36	0.00	0.12	2.87	0.85	1.00	0.00	19.14	60.79	0.00	2,588.2	0.0	1266.69	1191.78	2,458.47
3	50.0	18.85	1.987	32.83	0.00	0.14	2.81	0.85	1.00	0.00	18.38	51.86	0.00	2,489.2	0.0	1325.88	1156.40	2,482.29
4	70.0	20.24	2.910	27.13	0.00	0.14	2.80	0.85	1.00	0.00	16.90	36.13	0.00	1,801.1	0.0	1300.42	900.14	2,200.56
5	90.0	21.34	2.325	22.78	0.00	0.15	2.77	0.85	1.00	0.00	14.68	29.38	0.00	1,439.1	0.0	1180.79	770.48	1,951.27
6	110.0	22.26	1.734	20.47	0.00	0.18	2.68	0.85	1.00	0.00	13.17	20.67	0.00	1,192.4	0.0	1068.88	583.65	1,652.54
7	125.0	22.86	4.765	4.79	0.00	0.18	2.66	0.85	1.00	0.00	6.79	8.20	0.00	471.3	0.0	560.66	251.90	812.56
8	135.0	23.24	4.778	4.79	0.00	0.18	2.65	0.85	1.00	0.00	6.80	7.04	0.00	456.8	0.0	570.62	222.03	792.65
													13,671.8	0.0				14,770.68

Section Forces

Structure: CO09874-A-SBA

Code: EIA/TIA-222-G

9/30/2020

Site Name: Hayden 2, CO

Exposure: C

Height: 140.00 (ft)

Crest Height: 0.00

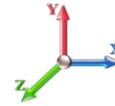
Base Elev: 0.000 (ft)

Site Class: D - Stiff Soil

Gh: 0.85

Topography: 1

Struct Class: II



Page: 11

Load Case: 1.0D + 1.0W Normal Wind

1.0D + 1.0W 60 mph Wind at Normal To Face

Wind Load Factor: 1.00

Wind Importance Factor: 1.00

Dead Load Factor: 1.00

Ice Dead Load Factor: 0.00

Ice Importance Factor: 1.00

Sect Seq	Wind Height (ft)	qz (psf)	Total Flat Area (sqft)	Total Round Area (sqft)	Ice Round Area (sqft)	Sol Ratio	Cf	Df	Dr	Ice Thick (in)	Eff Area (sqft)	Linear Area (sqft)	Linear Area (sqft)	Total Weight (lb)	Weight Ice (lb)	Struct Force (lb)	Linear Force (lb)	Total Force (lb)
1	10.0	6.66	2.657	40.54	0.00	0.13	2.85	1.00	1.00	0.00	24.69	72.24	0.00	3,592.9	0.0	398.20	339.63	737.82
2	30.0	7.69	2.322	33.36	0.00	0.12	2.87	1.00	1.00	0.00	21.24	60.79	0.00	2,875.8	0.0	399.36	338.53	737.89
3	50.0	8.57	1.987	32.83	0.00	0.14	2.81	1.00	1.00	0.00	20.45	51.86	0.00	2,765.8	0.0	419.12	328.48	747.61
4	70.0	9.20	2.910	27.13	0.00	0.14	2.80	1.00	1.00	0.00	18.46	36.13	0.00	2,001.2	0.0	403.34	255.69	659.03
5	90.0	9.70	2.325	22.78	0.00	0.15	2.77	1.00	1.00	0.00	15.39	29.38	0.00	1,599.0	0.0	351.57	218.86	570.43
6	110.0	10.12	1.734	20.47	0.00	0.18	2.68	1.00	1.00	0.00	13.53	20.67	0.00	1,324.9	0.0	311.90	165.79	477.69
7	125.0	10.39	4.765	4.79	0.00	0.18	2.66	1.00	1.00	0.00	7.50	8.20	0.00	523.7	0.0	176.02	71.55	247.58
8	135.0	10.56	4.778	4.79	0.00	0.18	2.65	1.00	1.00	0.00	7.52	7.04	0.00	507.6	0.0	179.17	63.07	242.24
														15,190.9	0.0	4,420.29		

Load Case: 1.0D + 1.0W 60° Wind

1.0D + 1.0W 60 mph Wind at 60° From Face

Wind Load Factor: 1.00

Wind Importance Factor: 1.00

Dead Load Factor: 1.00

Ice Dead Load Factor: 0.00

Ice Importance Factor: 1.00

Sect Seq	Wind Height (ft)	qz (psf)	Total Flat Area (sqft)	Total Round Area (sqft)	Ice Round Area (sqft)	Sol Ratio	Cf	Df	Dr	Ice Thick (in)	Eff Area (sqft)	Linear Area (sqft)	Linear Area (sqft)	Total Weight (lb)	Weight Ice (lb)	Struct Force (lb)	Linear Force (lb)	Total Force (lb)
1	10.0	6.66	2.657	40.54	0.00	0.13	2.85	0.80	1.00	0.00	24.16	72.24	0.00	3,592.9	0.0	389.63	339.63	729.25
2	30.0	7.69	2.322	33.36	0.00	0.12	2.87	0.80	1.00	0.00	20.78	60.79	0.00	2,875.8	0.0	390.63	338.53	729.16
3	50.0	8.57	1.987	32.83	0.00	0.14	2.81	0.80	1.00	0.00	20.06	51.86	0.00	2,765.8	0.0	410.98	328.48	739.46
4	70.0	9.20	2.910	27.13	0.00	0.14	2.80	0.80	1.00	0.00	17.87	36.13	0.00	2,001.2	0.0	390.62	255.69	646.31
5	90.0	9.70	2.325	22.78	0.00	0.15	2.77	0.80	1.00	0.00	14.92	29.38	0.00	1,599.0	0.0	340.95	218.86	559.81
6	110.0	10.12	1.734	20.47	0.00	0.18	2.68	0.80	1.00	0.00	13.19	20.67	0.00	1,324.9	0.0	303.91	165.79	469.70
7	125.0	10.39	4.765	4.79	0.00	0.18	2.66	0.80	1.00	0.00	6.55	8.20	0.00	523.7	0.0	153.67	71.55	225.22
8	135.0	10.56	4.778	4.79	0.00	0.18	2.65	0.80	1.00	0.00	6.56	7.04	0.00	507.6	0.0	156.39	63.07	219.46
														15,190.9	0.0	4,318.38		

Section Forces

Structure: CO09874-A-SBA

Code: EIA/TIA-222-G

9/30/2020

Site Name: Hayden 2, CO

Exposure: C

Height: 140.00 (ft)

Crest Height: 0.00

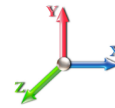
Base Elev: 0.000 (ft)

Site Class: D - Stiff Soil

Gh: 0.85

Topography: 1

Struct Class: II



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Load Case: 1.0D + 1.0W 90° Wind

1.0D + 1.0W 60 mph Wind at 90° From Face

Wind Load Factor: 1.00

Wind Importance Factor: 1.00

Dead Load Factor: 1.00

Ice Dead Load Factor: 0.00

Ice Importance Factor: 1.00

Sect Seq	Wind Height (ft)	qz (psf)	Total Flat Area (sqft)	Total Round Area (sqft)	Ice Round Area (sqft)	Sol Ratio	Cf	Df	Dr	Ice Thick (in)	Eff Area (sqft)	Linear Area (sqft)	Linear Area (sqft)	Total Weight (lb)	Weight Ice (lb)	Struct Force (lb)	Linear Force (lb)	Total Force (lb)
1	10.0	6.66	2.657	40.54	0.00	0.13	2.85	0.85	1.00	0.00	24.29	72.24	0.00	3,592.9	0.0	391.77	339.63	731.40
2	30.0	7.69	2.322	33.36	0.00	0.12	2.87	0.85	1.00	0.00	20.89	60.79	0.00	2,875.8	0.0	392.81	338.53	731.34
3	50.0	8.57	1.987	32.83	0.00	0.14	2.81	0.85	1.00	0.00	20.16	51.86	0.00	2,765.8	0.0	413.02	328.48	741.50
4	70.0	9.20	2.910	27.13	0.00	0.14	2.80	0.85	1.00	0.00	18.02	36.13	0.00	2,001.2	0.0	393.80	255.69	649.49
5	90.0	9.70	2.325	22.78	0.00	0.15	2.77	0.85	1.00	0.00	15.04	29.38	0.00	1,599.0	0.0	343.61	218.86	562.47
6	110.0	10.12	1.734	20.47	0.00	0.18	2.68	0.85	1.00	0.00	13.27	20.67	0.00	1,324.9	0.0	305.90	165.79	471.69
7	125.0	10.39	4.765	4.79	0.00	0.18	2.66	0.85	1.00	0.00	6.79	8.20	0.00	523.7	0.0	159.26	71.55	230.81
8	135.0	10.56	4.778	4.79	0.00	0.18	2.65	0.85	1.00	0.00	6.80	7.04	0.00	507.6	0.0	162.09	63.07	225.16
														15,190.9	0.0	4,343.86		

Force/Stress Compression Summary

Structure: CO09874-A-SBA

Code: EIA/TIA-222-G

9/30/2020

Site Name: Hayden 2, CO

Exposure: C

Height: 140.00 (ft)

Crest Height: 0.00

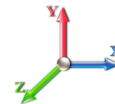
Base Elev: 0.000 (ft)

Site Class: D - Stiff Soil

Gh: 0.85

Topography: 1

Struct Class: II



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LEG MEMBERS

Top Sect	Elev	Member	Force (kips)	Load Case	Len (ft)	Bracing %			KL/R	Fy (ksi)	Mem Cap (kips)	Leg Use %	Controls
						X	Y	Z					
1	20	PST - 8" DIA PIPE	-132.38	1.2D + 1.6W Normal Wind	0.25	50	50	50	0.51	46.00	347.75	38.1	Member X
2	40	PST - 6" DIA PIPE	-92.61	1.2D + 1.6W Normal Wind	19.53	50	50	50	52.09	46.00	192.48	48.1	Member X
3	60	PST - 6" DIA PIPE	-67.74	1.2D + 1.6W Normal Wind	19.53	50	50	50	52.09	46.00	192.48	35.2	Member X
4	80	PST - 5" DIA PIPE	-58.35	1.2D + 1.6W Normal Wind	0.25	50	50	50	0.80	46.00	178.01	32.8	Member X
5	100	PST - 4" DIA PIPE	-39.71	1.2D + 1.6W Normal Wind	0.25	50	50	50	1.00	46.00	131.23	30.3	Member X
6	120	PST - 3-1/2" DIA PIPE	-22.62	1.2D + 1.6W Normal Wind	0.25	50	50	50	1.12	46.00	110.94	20.4	Member X
7	130	PST - 2-1/2" DIA PIPE	-6.12	1.2D + 1.6W Normal Wind	5.00	100	100	100	63.36	46.00	53.85	11.4	Member X
8	140	PST - 2-1/2" DIA PIPE	-2.08	1.2D + 1.6W Normal Wind	5.00	100	100	100	63.36	46.00	53.85	3.9	Member X

HORIZONTAL MEMBERS

Top Sect	Elev	Member	Force (kips)	Load Case	Len (ft)	Bracing %			KL/R	Fy (ksi)	Mem Cap (kips)	Num Bolts	Num Holes	Shear Cap (kips)	Bear Cap (kips)	Use %	Controls
						X	Y	Z									
1	20										0.00	0	0				
2	40										0.00	0	0				
3	60										0.00	0	0				
4	80										0.00	0	0				
5	100										0.00	0	0				
6	120										0.00	0	0				
7	130	SAE - 2X2X0.1875	-0.31	0.9D + 1.6W 60° Wind	5.00	100	100	100	152.28	36.00	6.92	1	1	12.43	9.79	4	Member Z
8	140	SAE - 2X2X0.1875	-0.23	1.2D + 1.6W Normal Wind	5.00	100	100	100	152.28	36.00	6.92	1	1	12.43	9.79	3	Member Z

DIAGONAL MEMBERS

Top Sect	Elev	Member	Force (kips)	Load Case	Len (ft)	Bracing %			KL/R	Fy (ksi)	Mem Cap (kips)	Num Bolts	Num Holes	Shear Cap (kips)	Bear Cap (kips)	Use %	Controls
						X	Y	Z									
1	20	PST - 2-1/2" DIA PIPE	-11.2	1.2D + 1.6W 90° Wind	25.23	50	50	50	159.85	46.00	15.06	1	1	12.43		91	Bolt Shear
2	40	PST - 2-1/2" DIA PIPE	-7.20	0.9D + 1.6W 90° Wind	24.01	50	50	50	152.13	46.00	16.63	1	1	12.43		58	Bolt Shear
3	60	PST - 2-1/2" DIA PIPE	-7.45	1.2D + 1.6W 90° Wind	22.90	50	50	50	145.11	46.00	18.28	1	1	12.43		60	Bolt Shear
4	80	PST - 1-1/2" DIA PIPE	-3.89	1.2D + 1.6W 90° Wind	13.62	50	50	50	131.22	46.00	10.48	1	1	12.43		37	Member X
5	100	PST - 1-1/2" DIA PIPE	-3.35	1.2D + 1.6W Normal Wind	12.31	50	50	50	118.93	46.00	12.76	1	1	12.43		27	Bolt Shear
6	120	PST - 1-1/2" DIA PIPE	-3.97	1.2D + 1.6W Normal Wind	11.82	50	50	50	115.34	46.00	13.52	1	1	12.43		32	Bolt Shear
7	130	SAE - 1.75X1.75X0.1875	-1.61	1.2D + 1.6W 90° Wind	7.07	50	50	50	123.69	36.00	8.98	1	1	12.43	9.79	18	Member Z
8	140	SAE - 1.75X1.75X0.1875	-0.75	1.2D + 1.6W 90° Wind	7.07	50	50	50	123.69	36.00	8.98	1	1	12.43	9.79	8	Member Z

Force/Stress Tension Summary

Structure: CO09874-A-SBA

Code: EIA/TIA-222-G

9/30/2020

Site Name: Hayden 2, CO

Exposure: C

Height: 140.00 (ft)

Crest Height: 0.00

Base Elev: 0.000 (ft)

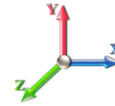
Site Class: D - Stiff Soil

Gh: 0.85

Topography: 1

Struct Class: II

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LEG MEMBERS

Sect	Top Elev	Member	Force (kips)	Load Case	Fy (ksi)	Mem Cap (kips)	Leg Use %	Controls
1	20	PST - 8" DIA PIPE	114.56	0.9D + 1.6W 60° Wind	46	347.76	32.9	Member
2	40	PST - 6" DIA PIPE	89.78	0.9D + 1.6W 60° Wind	46	231.01	38.9	Member
3	60	PST - 6" DIA PIPE	69.77	0.9D + 1.6W 60° Wind	46	231.01	30.2	Member
4	80	PST - 5" DIA PIPE	49.57	0.9D + 1.6W 60° Wind	46	178.02	27.8	Member
5	100	PST - 4" DIA PIPE	33.85	0.9D + 1.6W 60° Wind	46	131.24	25.8	Member
6	120	PST - 3-1/2" DIA PIPE	18.44	0.9D + 1.6W 60° Wind	46	110.95	16.6	Member
7	130	PST - 2-1/2" DIA PIPE	5.62	0.9D + 1.6W 60° Wind	46	70.55	8.0	Member
8	140	PST - 2-1/2" DIA PIPE	1.31	0.9D + 1.6W 60° Wind	46	70.55	1.9	Member

HORIZONTAL MEMBERS

Sect	Top Elev	Member	Force (kips)	Load Case	Fy (ksi)	Mem Cap (kips)	Num Bolts	Num Holes	Shear Cap (kips)	Bear Cap (kips)	B.S. Cap (kips)	Use %	Controls
1	20	-			46	0.00	0	0					
2	40	-			46	0.00	0	0					
3	60	-			46	0.00	0	0					
4	80	-			46	0.00	0	0					
5	100	-			46	0.00	0	0					
6	120	-			46	0.00	0	0					
7	130	SAE - 2X2X0.1875	0.15	1.2D + 1.6W 60° Wind	36	18.58	1	1	12.43	9.79	8.51	1.8	Blck Shear
8	140	SAE - 2X2X0.1875	0.25	0.9D + 1.6W Normal Wi	36	18.58	1	1	12.43	9.79	8.51	2.9	Blck Shear

DIAGONAL MEMBERS

Sect	Top Elev	Member	Force (kips)	Load Case	Fy (ksi)	Mem Cap (kips)	Num Bolts	Num Holes	Shear Cap (kips)	Bear Cap (kips)	B.S. Cap (kips)	Use %	Controls
1	20	PST - 2-1/2" DIA PIPE	8.55	0.9D + 1.6W 90° Wind	46	70.55	1	1	12.43			68.8	Bolt Shear
2	40	PST - 2-1/2" DIA PIPE	7.87	1.2D + 1.6W 90° Wind	46	70.55	1	1	12.43			63.3	Bolt Shear
3	60	PST - 2-1/2" DIA PIPE	6.70	0.9D + 1.6W 90° Wind	46	70.55	1	1	12.43			53.9	Bolt Shear
4	80	PST - 1-1/2" DIA PIPE	3.61	1.2D + 1.6W 90° Wind	46	33.08	1	1	12.43			29.0	Bolt Shear
5	100	PST - 1-1/2" DIA PIPE	3.47	1.2D + 1.6W Normal Wi	46	33.08	1	1	12.43			27.9	Bolt Shear
6	120	PST - 1-1/2" DIA PIPE	3.42	0.9D + 1.6W 60° Wind	46	33.08	1	1	12.43			27.5	Bolt Shear
7	130	SAE - 1.75X1.75X0.1875	1.34	1.2D + 1.6W 90° Wind	36	15.64	1	1	12.43	9.79	6.48	20.7	Blck Shear
8	140	SAE - 1.75X1.75X0.1875	0.68	0.9D + 1.6W 90° Wind	36	15.64	1	1	12.43	9.79	6.48	10.4	Blck Shear

Seismic Section Forces

Structure: CO09874-A-SBA

Code: EIA/TIA-222-G

9/30/2020

Site Name: Hayden 2, CO

Exposure: C

Height: 140.00 (ft)

Crest Height: 0.00

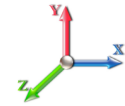
Base Elev: 0.000 (ft)

Site Class: D - Stiff Soil

Gh: 0.85

Topography: 1

Struct Class: II



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Load Case: 1.2D + 1.0E

Dead Load Factor 1.20 **Sds** 0.285 **Ss** 0.2700 **Fa** 1.5840 **Ke** 0.0000

Seismic Load Factor 1.00 **Sd1** 0.120 **S1** 0.0750 **Fv** 2.4000 **Kg** 0.0000

Seismic Importance Factor 1.00 **SA** 0.275 **R** 3.0000 **Vs** 2.5106 **f1** 2.2926

Sect #	Elev (ft)	Wz (lb)	Lateral			Fsz (lb)
			a	b	c	
1	10.00	4751.7	0.01	0.05	0.03	29.16
2	30.00	4428.9	0.09	0.07	0.04	65.10
3	50.00	3239.4	0.24	0.06	0.02	88.93
4	70.00	3757.7	0.47	-0.01	0.01	160.06
5	90.00	1810.9	0.78	-0.11	0.05	107.71
6	110.00	3500.8	1.17	-0.02	0.23	327.99
7	125.00	523.72	1.51	0.52	0.55	78.57
8	135.00	791.56	1.76	1.35	0.91	165.96

Load Case: 0.9D + 1.0E

Dead Load Factor 0.90 **Sds** 0.285 **Ss** 0.2700 **Fa** 1.5840 **Ke** 0.0000

Seismic Load Factor 1.00 **Sd1** 0.120 **S1** 0.0750 **Fv** 2.4000 **Kg** 0.0000

Seismic Importance Factor 1.00 **SA** 0.275 **R** 3.0000 **Vs** 2.5106 **f1** 2.2926

Sect #	Elev (ft)	Wz (lb)	Lateral			Fsz (lb)
			a	b	c	
1	10.00	4751.7	0.01	0.05	0.03	29.16
2	30.00	4428.9	0.09	0.07	0.04	65.10
3	50.00	3239.4	0.24	0.06	0.02	88.93
4	70.00	3757.7	0.47	-0.01	0.01	160.06
5	90.00	1810.9	0.78	-0.11	0.05	107.71
6	110.00	3500.8	1.17	-0.02	0.23	327.99
7	125.00	523.72	1.51	0.52	0.55	78.57
8	135.00	791.56	1.76	1.35	0.91	165.96

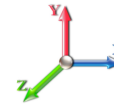
Support Forces Summary

Structure: CO09874-A-SBA
Site Name: Hayden 2, CO
Height: 140.00 (ft)
Base Elev: 0.000 (ft)
Gh: 0.85

Topography: 1

Code: EIA/TIA-222-G
Exposure: C
Crest Height: 0.00
Site Class: D - Stiff Soil
Struct Class: II

9/30/2020



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Load Case	Node	FX (kips)	FY (kips)	FZ (kips)	(-) = Uplift (+) = Down
1.2D + 1.6W Normal Wind	1	-0.57	131.91	-18.24	
	1a	6.25	-52.25	-5.61	
	1b	-5.68	-52.30	-5.27	
1.2D + 1.6W 60° Wind	1	-2.17	69.37	-9.40	
	1a	-9.29	69.36	2.83	
	1b	-13.45	-111.37	-7.82	
1.2D + 1.6W 90° Wind	1	-2.21	9.11	-0.71	
	1a	-14.56	114.01	6.60	
	1b	-12.09	-95.76	-5.90	
0.9D + 1.6W Normal Wind	1	-0.57	129.57	-18.08	
	1a	6.39	-54.50	-5.69	
	1b	-5.82	-54.55	-5.35	
0.9D + 1.6W 60° Wind	1	-2.17	67.06	-9.24	
	1a	-9.15	67.04	2.75	
	1b	-13.59	-113.58	-7.90	
0.9D + 1.6W 90° Wind	1	-2.20	6.84	-0.55	
	1a	-14.42	111.66	6.52	
	1b	-12.24	-97.98	-5.98	
1.2D + 1.0E	1	0.00	15.59	-0.66	
	1a	0.21	5.89	-0.16	
	1b	-0.21	5.89	-0.16	
0.9D + 1.0E	1	0.00	13.31	-0.51	
	1a	0.34	3.61	-0.24	
	1b	-0.34	3.61	-0.24	
1.0D + 1.0W Normal Wind	1	-0.16	42.74	-5.62	
	1a	1.48	-9.96	-1.44	
	1b	-1.32	-9.98	-1.34	
1.0D + 1.0W 60° Wind	1	-0.64	24.84	-3.07	
	1a	-3.00	24.87	0.99	
	1b	-3.55	-26.91	-2.07	
1.0D + 1.0W 90° Wind	1	-0.65	7.58	-0.56	
	1a	-4.51	37.64	2.08	
	1b	-3.17	-22.42	-1.51	

Max Reactions

Leg			Overturning		
Max Uplift:	-113.58	(kips)	Moment:	1807.80	(ft-kips)
Max Down:	131.91	(kips)	Total Down:	27.37	(kips)
Max Shear:	18.25	(kips)	Total Shear:	29.12	(kips)

Analysis Summary

Structure: CO09874-A-SBA	Code: EIA/TIA-222-G	9/30/2020
Site Name: Hayden 2, CO	Exposure: C	
Height: 140.00 (ft)	Crest Height: 0.00	
Base Elev: 0.000 (ft)	Site Class: D - Stiff Soil	
Gh: 0.85	Topography: 1	Struct Class: II
		Page: 17



Max Reactions

Leg		Overturning	
Max Uplift:	-113.58 (kips)	Moment:	1807.80 (ft-kips)
Max Down:	131.91 (kips)	Total Down:	27.37 (kips)
Max Shear:	18.25 (kips)	Total Shear:	29.12 (kips)

Anchor Bolts

Bolt Size (in.): 1.25	Number Bolts: 4
Yield Strength (Ksi): 55.00	Tensile Strength (Ksi): 75.00
Detail Type: A	
Interaction Ratio: 0.58	

Max Usages

Max Leg: 48.1% (1.2D + 1.6W Normal Wind - Sect 2)
 Max Diag: 90.8% (1.2D + 1.6W 90° Wind - Sect 1)
 Max Horiz: 4.4% (0.9D + 1.6W 60° Wind - Sect 7)

Max Deflection, Twist and Sway

Load Case	Elevation (ft)	Deflection (ft)	Twist (deg)	Sway (deg)
0.9D + 1.0E - Normal To Face	0.25	0.0000	0.0000	0.0011
	19.75	0.0062	-0.0001	0.0143
	20.25	0.0063	-0.0001	0.0120
	39.75	0.0027	-0.0004	0.0125
	40.25	0.0028	0.0004	0.0096
	59.75	0.0087	0.0007	0.0173
	60.00	0.0088	0.0007	0.0184
	60.25	0.0088	0.0007	0.0198
	70.00	0.0098	0.0007	0.0168
	80.25	0.0137	-0.0009	0.0230
	110.13	0.0251	0.0010	0.0283
	140.00	0.0413	0.0000	0.0323
0.9D + 1.6W 89 mph Wind at 60° From Face	0.25	0.0000	0.0001	0.0018
	19.75	0.0184	0.0084	0.1267
	20.25	0.0196	0.0088	0.1270
	39.75	0.0531	0.0197	0.1809
	40.25	0.0515	0.0256	0.1708
	59.75	0.1134	0.0340	0.2361
	60.00	0.1145	0.0342	0.2383
	60.25	0.1155	0.0345	0.2371
	70.00	0.1516	0.0225	0.2218
	80.25	0.1984	0.0618	0.3431
	110.13	0.3661	-0.0079	0.3581
	140.00	0.5605	-0.0199	0.3621

0.9D + 1.6W 89 mph Wind at 90° From Face	0.25	0.0000	0.0001	0.0018
	19.75	0.0171	0.0082	0.1175
	20.25	0.0182	0.0085	0.1179
	39.75	0.0513	0.0254	0.1740
	40.25	0.0560	0.0242	0.1874
	59.75	0.1133	0.0428	0.2341
	60.00	0.1144	0.0430	0.2374
	60.25	0.1154	0.0433	0.2394
	70.00	0.1528	0.0227	0.2265
	80.25	0.1988	0.0744	0.3323
	110.13	0.3678	0.0131	0.3604
	140.00	0.5628	0.0113	0.3281
0.9D + 1.6W 89 mph Wind at Normal To Face	0.25	0.0000	0.0001	0.0021
	19.75	0.0184	0.0082	0.1215
	20.25	0.0195	0.0085	0.1220
	39.75	0.0562	0.0106	0.1894
	40.25	0.0506	0.0247	0.1745
	59.75	0.1140	0.0240	0.2377
	60.00	0.1150	0.0240	0.2408
	60.25	0.1161	0.0239	0.2419
	70.00	0.1544	0.0199	0.2265
	80.25	0.2001	0.0422	0.3151
	110.13	0.3739	-0.0184	0.3587
	140.00	0.5767	-0.0537	0.4753
1.0D + 1.0W 60 mph Wind at 60° From Face	0.25	0.0000	0.0000	0.0004
	19.75	0.0048	0.0024	0.0359
	20.25	0.0052	0.0025	0.0362
	39.75	0.0149	0.0055	0.0516
	40.25	0.0150	0.0073	0.0493
	59.75	0.0323	0.0095	0.0700
	60.00	0.0326	0.0096	0.0706
	60.25	0.0329	0.0097	0.0703
	70.00	0.0435	0.0064	0.0638
	80.25	0.0568	0.0173	0.0982
	110.13	0.1055	-0.0025	0.1042
	140.00	0.1620	-0.0057	0.1055
1.0D + 1.0W 60 mph Wind at 90° From Face	0.25	0.0000	0.0000	0.0006
	19.75	0.0051	0.0023	0.0333
	20.25	0.0054	0.0024	0.0335
	39.75	0.0144	0.0071	0.0496
	40.25	0.0164	0.0069	0.0541
	59.75	0.0323	0.0120	0.0688
	60.00	0.0326	0.0120	0.0694
	60.25	0.0329	0.0121	0.0690
	70.00	0.0439	0.0064	0.0651
	80.25	0.0569	0.0209	0.0951
	110.13	0.1058	0.0039	0.1050
	140.00	0.1625	0.0031	0.0960
1.0D + 1.0W 60 mph Wind at Normal To Face	0.25	0.0000	0.0000	0.0007
	19.75	0.0058	0.0023	0.0356
	20.25	0.0061	0.0024	0.0356
	39.75	0.0165	0.0029	0.0547
	40.25	0.0143	0.0071	0.0499
	59.75	0.0329	0.0069	0.0690
	60.00	0.0332	0.0069	0.0696
	60.25	0.0335	0.0069	0.0698
	70.00	0.0443	0.0057	0.0648
	80.25	0.0573	0.0118	0.0900
	110.13	0.1071	-0.0054	0.1037
	140.00	0.1652	-0.0154	0.1355

1.2D + 1.0E - Normal To Face	0.25	0.0000	0.0000	0.0011
	19.75	0.0060	-0.0001	0.0139
	20.25	0.0061	-0.0001	0.0117
	39.75	0.0027	-0.0004	0.0126
	40.25	0.0027	0.0004	0.0095
	59.75	0.0087	0.0007	0.0165
	60.00	0.0087	0.0007	0.0176
	60.25	0.0088	0.0007	0.0190
	70.00	0.0098	0.0007	0.0168
	80.25	0.0137	-0.0009	0.0230
	110.13	0.0251	0.0010	0.0283
	140.00	0.0414	0.0000	0.0324

1.2D + 1.6W 89 mph Wind at 60° From Face	0.25	0.0000	0.0001	0.0018
	19.75	0.0182	0.0084	0.1265
	20.25	0.0194	0.0088	0.1269
	39.75	0.0530	0.0197	0.1809
	40.25	0.0516	0.0256	0.1711
	59.75	0.1134	0.0340	0.2373
	60.00	0.1145	0.0342	0.2395
	60.25	0.1156	0.0345	0.2383
	70.00	0.1518	0.0225	0.2223
	80.25	0.1986	0.0618	0.3436
	110.13	0.3670	-0.0079	0.3595
	140.00	0.5621	-0.0200	0.3636

1.2D + 1.6W 89 mph Wind at 90° From Face	0.25	0.0000	0.0001	0.0019
	19.75	0.0169	0.0082	0.1173
	20.25	0.0180	0.0085	0.1178
	39.75	0.0512	0.0254	0.1740
	40.25	0.0562	0.0242	0.1877
	59.75	0.1134	0.0428	0.2343
	60.00	0.1144	0.0430	0.2369
	60.25	0.1155	0.0433	0.2389
	70.00	0.1530	0.0227	0.2269
	80.25	0.1990	0.0744	0.3328
	110.13	0.3686	0.0131	0.3619
	140.00	0.5643	0.0114	0.3298

1.2D + 1.6W 89 mph Wind at Normal To Face	0.25	0.0000	0.0001	0.0021
	19.75	0.0186	0.0082	0.1218
	20.25	0.0197	0.0085	0.1223
	39.75	0.0563	0.0106	0.1898
	40.25	0.0506	0.0247	0.1746
	59.75	0.1142	0.0240	0.2376
	60.00	0.1152	0.0240	0.2402
	60.25	0.1163	0.0239	0.2412
	70.00	0.1546	0.0199	0.2268
	80.25	0.2003	0.0422	0.3155
	110.13	0.3745	-0.0185	0.3599
	140.00	0.5776	-0.0539	0.4759
