TIM BRADLEY IMAGING

PHOTO SIM LOCATIONS

MORRISON HERSHFIELD

verizon

POR STINGER

29421 E. WOODARD RD., TROUTDALE, OR

MORRISON HERSHFIELD

verizon

POR STINGER

29421 E. WOODARD RD., TROUTDALE, OR

CURRENT

VIEW #1 LOOKING NORTH
AT 29421 E. WOODARD RD.

PROPOSED

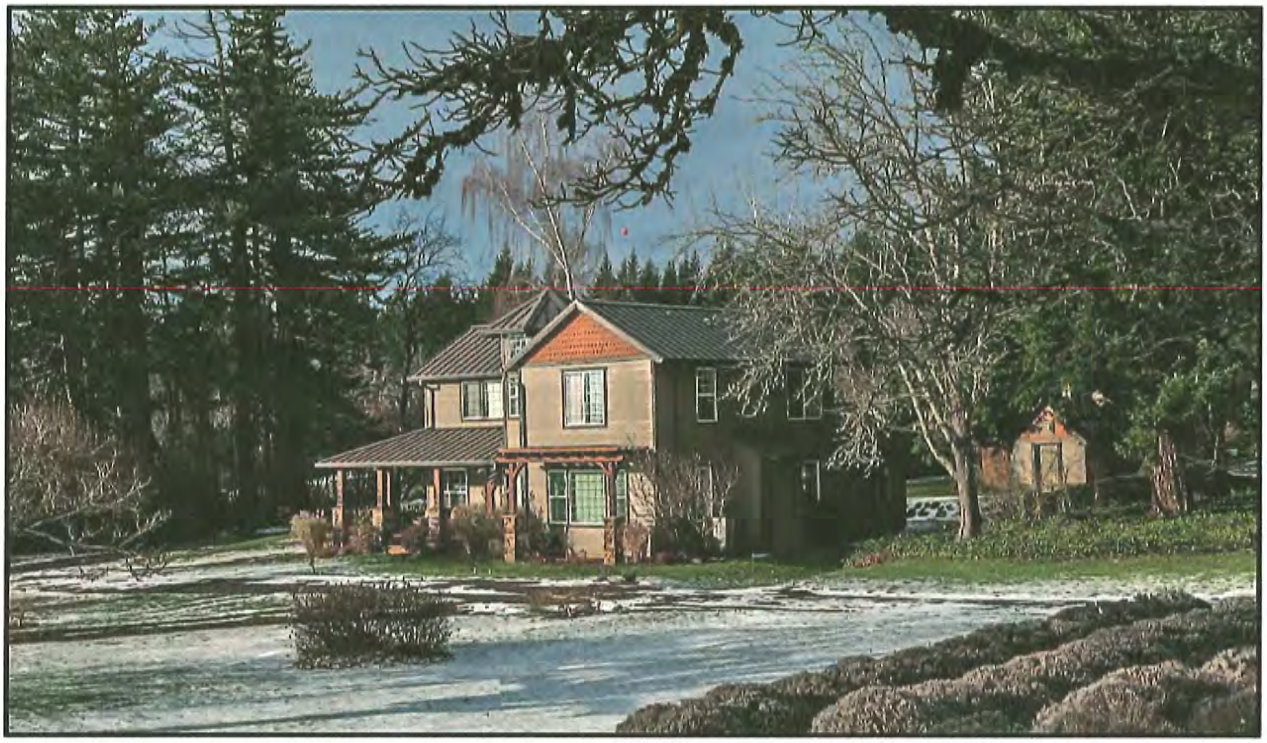
TIM BRADLEY IMAGING

MORRISON HERSHFIELD

verizon

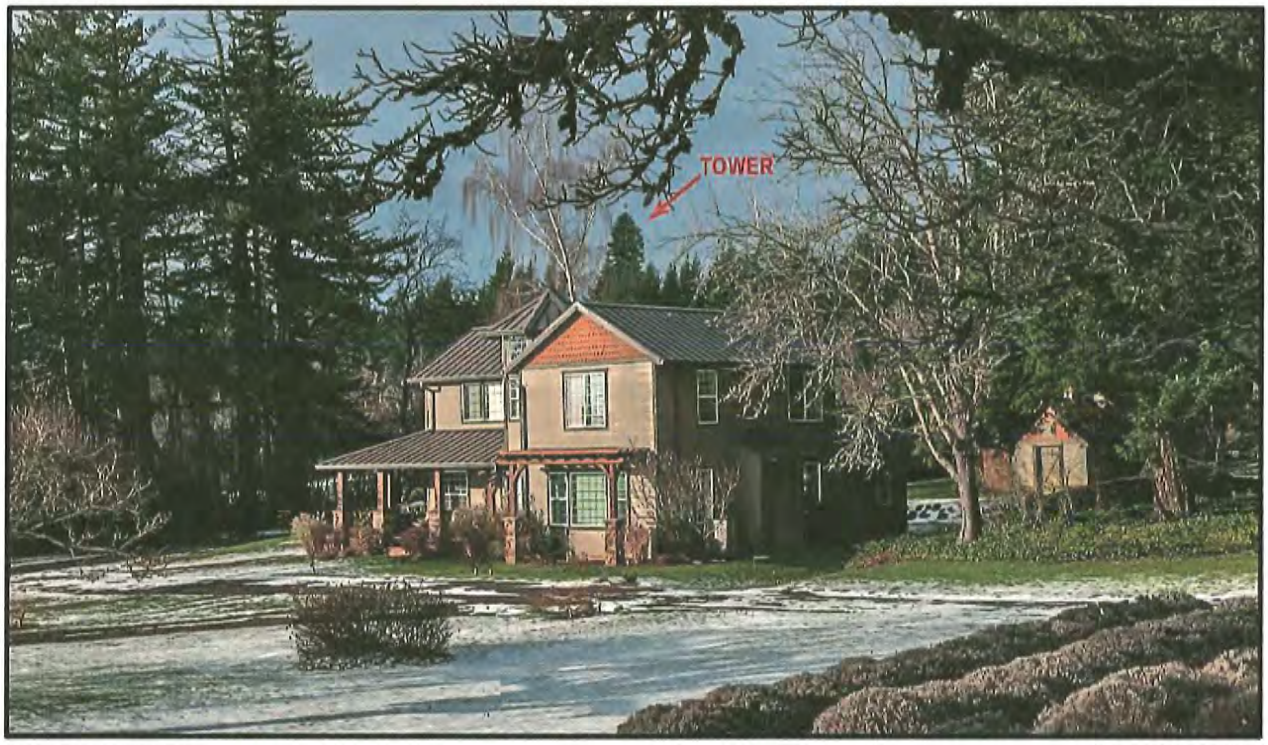
POR STINGER

29421 E. WOODARD RD., TROUTDALE, OR



CURRENT

VIEW #2 LOOKING NORTHWEST
AT 29853 E. WOODARD RD.



PROPOSED

TIM BRADLEY IMAGING

MORRISON HERSHFIELD

verizon

POR STINGER

20421 E. WOODARD RD., TROUTDALE, OR

CURRENT

VIEW #3 LOOKING NORTHEAST
AT E. WOODARD RD. AND NE SEIDL RD.

PROPOSED

TIM BRADLEY IMAGING

MORRISON HERSHFIELD

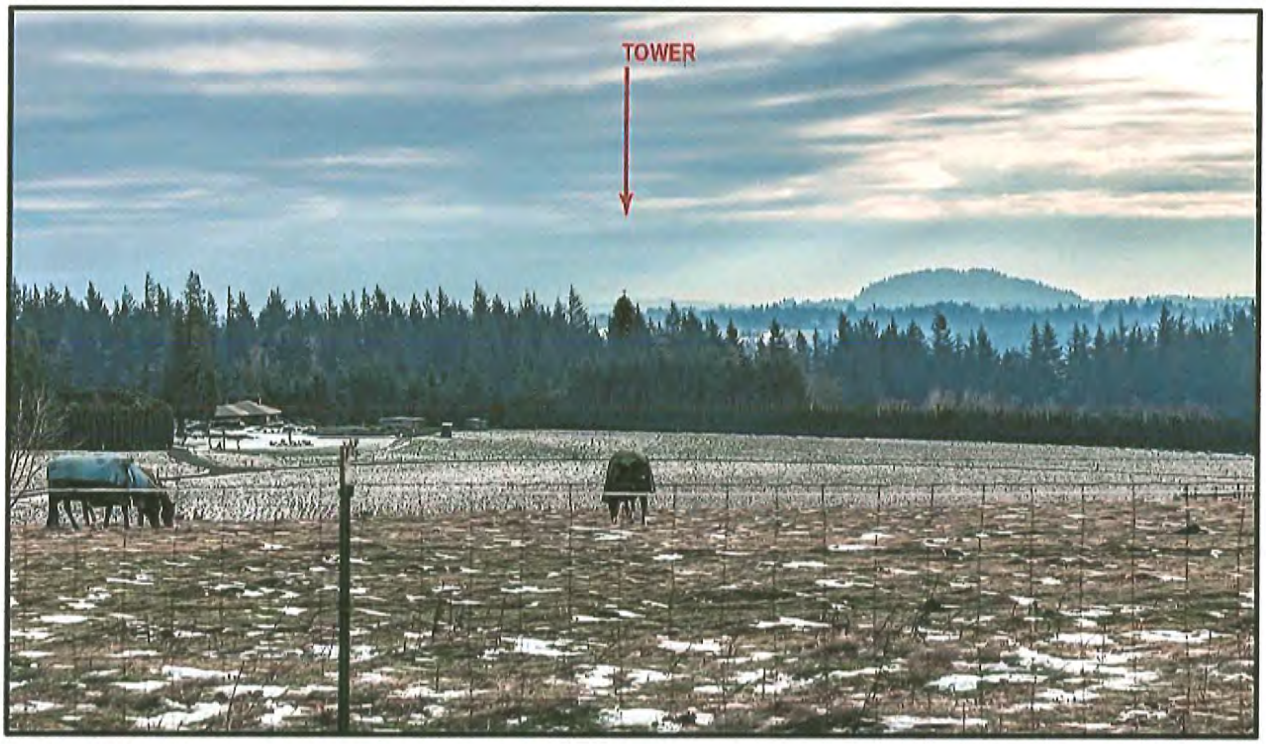
verizon

POR STINGER

29421 E. WOODARD RD., TROUTDALE, OR

CURRENT

VIEW #4 LOOKING SOUTH
ON NE LAMPERT ROAD



PROPOSED

TIM BRADLEY IMAGING

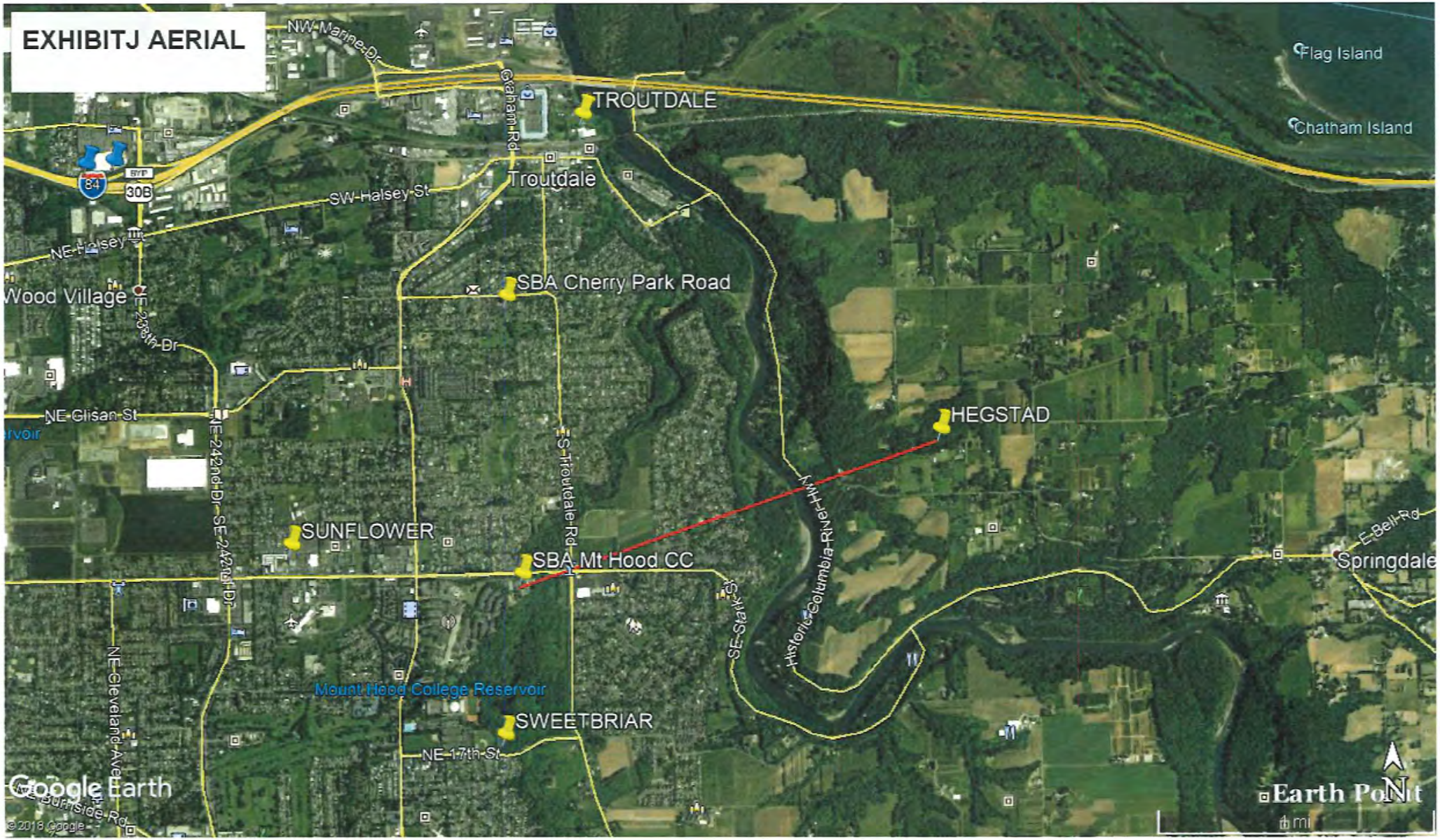

EXHIBITJ AERIAL
NW Marine Dr
Graham Rd
TROUTDALE
Troutdale
Flag Island
Chatham Island
84
BYP
30B
SW Halsey St
NE Halsey St
Wood Village
NE 238th Dr
SBA Cherry Park Road
NE Glisan St
NE 242nd Dr
SE 242nd Dr
HEGSTAD
S Troutdale Rd
SUNFLOWER
SBA Mt Hood CC
Historic Columbia River Hwy
SE Stark St
E Bell Rd
Springdale
NE Cleveland Ave
Mount Hood College Reservoir
SWEETBRIAR
NE 17th St
Google Earth
© 2018 Google
Earth Point
N
mi

EXHIBIT K

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DAVID J. PINION, PE
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THOMAS S. GORTON, PE
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MAURY L. HATFIELD, PE
(1942 – 2009)
PAUL W. LEONARD, PE
(1925 – 2011)

April 6, 2018

To Whom It May Concern
Land Use Planning Division
Multnomah County Oregon
1600 SE 190th Avenue
Portland, Oregon 97233

Re: RF Engineering Review of proposed Verizon Wireless communications facility "POR STINGER".

PROJECT DESCRIPTION AND RF USAGE AND FACILITY JUSTIFICATION
In accordance with Multnomah County Code (MCC), sections 35.6182 (B)(4)(a-c), I have reviewed construction drawings, dated October 12, 2017, the Exhibit E "Search Ring Map," the Exhibit F "RF Usage and Facility Justification with Propagation Maps" presentation, dated February 20, 2018, by Verizon RF Specialist Jeff Culley, and a narrative and other material provided by Mr. Konrad Hyle of Black Rock LLC.

The construction drawings indicate that the proposed Verizon Wireless (VAW) LLC (d/b/a Verizon Wireless) personal Wireless Communications Facility (WCF) "POR STINGER" will support Verizon panel and microwave antennas atop a new 150 foot monopole support tower on the proposed project site at 29421 E Woodward Rd, Troutdale, Oregon 97060. According to the drawings the project tower will accommodate two levels of additional antennas for future co-location.

(a). The reasons why the WCF must be located at the proposed site (service demands, topography, dropped coverage, etc.)

Verizon is in the business of providing personal wireless communications services in Multnomah County and other areas of the United States. In order to more effectively provide such services, Verizon must construct wireless facilities and choose appropriate antenna support structures. These support structures must provide a minimum antenna height to meet coverage and service objectives. Intervening obstructions such as hills, trees and nearby buildings must be avoided.

In his narrative Mr. Hyle states that the extent of the coverage objective areas for the proposed POR STINGER WCF are generally north to SW Cherry Park Road, east to SE Lucas Road, south to SE Sweetbriar Road, and west to 257th Avenue. The primary service objective for the proposed WCF is to close a significant gap in existing network coverage to persons inside buildings and inside vehicles, and to enhance voice and data wireless services to the residents of Troutdale, persons traveling on the Historic Columbia River Highway, and nearby portions of Multnomah County as depicted on page 4 of Exhibit F.

All of the Verizon service coverage maps in Exhibit F show Reference Signal Received Power (RSRP) levels in four intervals: white areas have low capacity for data services and unreliable signal coverage less than -95 dBm, blue areas correspond to poor received signal levels between -95 and -85 dBm which provide marginal in-vehicle coverage but are inadequate for serving indoor users, green areas correspond to stronger received signal levels between -85 and -75 dBm which may be adequate for users inside vehicles but provide unreliable coverage and data capacity inside buildings, and the red areas have the strongest received signal levels of greater than -75 dBm which are capable of providing reliable service inside buildings and vehicles.

Page 4 of Exhibit F shows the location of the proposed project site with respect to the existing Verizon WCFs located to the northwest and to the southwest of the proposed site, labeled as TROUTDALE and SWEETBRIAR respectively on the maps. This page also shows the present Verizon network coverage area provided by the combined signals from the existing Verizon WCFs closest to the project site. The two existing WCFs TROUTDALE and SWEETBRIAR are not adequate to fill the coverage and service gaps. The proposed WCF will offload data burdens from TROUTDALE and SWEETBRIAR, and it will provide more service capacity for users. The proposed WCF will be advantageously located to provide service capacity relief to these two existing Verizon WCFs since it will be approximately equidistant from both.

It is clear from the existing coverage map on page 4 that there is a lack of adequate existing service coverage and data capacity by the Verizon network to vehicular and indoor users in the coverage objective areas described by Mr. Hyle. The coverage gap is graphically portrayed as the white and blue colored areas shown on page 4. In order to remain competitive, Verizon must improve services in those coverage gap areas where consumers are increasingly using their phones and data services, and where existing service is inadequate. The extensive white and blue areas indicate very unreliable signal coverage and an especially low capacity for data services.

The coverage map on page 5 of Exhibit F shows the future projected "post-construction" Verizon service coverage after the proposed WCF is activated with antennas atop the proposed 150-foot monopole. This exhibit shows significant improvements in service coverage of the areas surrounding the proposed project site, the areas between the existing TROUTDALE and SWEETBRIAR WCFs, and in the low-lying areas along the Columbia River including the Historic Columbia River Highway. A comparison of the coverage maps on pages 4 and 5 shows the dramatic increase in reliable service coverage and data capacity within the coverage objective areas with the Verizon antennas at the proposed 150-foot elevation.

The proposed POR STINGER WCF is both a service coverage and a service capacity site. Mr. Culley describes the service capacity issues on pages 2 and 3, and graphically on page 9 of Exhibit F. The proposed WCF will offload data burdens from the existing Verizon WCFs TROUTDALE and SWEETBRIAR, and it will provide more service capacity for users. Users in neighborhoods surrounding those WCFs may already be experiencing sluggish data speeds or interruptions of data-based services.

The Exhibit E "Search Ring Map" shows two areas highlighted in yellow where a proposed Verizon WCF could fulfill the coverage objective areas. When contemplating how to provide coverage to the identified service area, Verizon representatives considered every feasible existing WCF option available within the search ring area. The representatives determined that there are no existing towers within, or anywhere near, the search areas. As a result, Verizon was not able to consider co-locating the proposed WCF on an existing tower structure.

According to Mr. Hyle the western search area in the Troutdale "Sunrise City Park" was not suitable for use because of its likely adverse impacts on neighboring residences, and the fact that the park was built on a landfill "... and may have environmental impacts for tower construction." The proposed project site in the eastern search area along NE Seidl Road just north of E. Woodard Road was chosen after due diligence and negotiations, and after a lease agreement was executed between the parties.

The two existing towers nearest to the search ring areas are shown and discussed on Exhibit F – the SBA tower at the Mount Hood Community College (MHCC) on page 7, and the SBA tower at the Cherry Park Presbyterian Church on page 8. As demonstrated in Exhibit F neither of these collocation sites would fulfill the coverage objectives and close the existing coverage gap.

Furthermore the two existing alternative sites are not acceptable for collocation because they are too close to the existing Verizon WCFs. A new Verizon WCF with antennas on the SBA tower at the MHCC would unnecessarily duplicate the wireless services provided by SWEETBRIAR, and would cause interference to the Verizon network. Likewise, a new Verizon WCF with antennas at the Cherry Park site would unnecessarily duplicate the wireless services provided by TROUTDALE, and would also cause interference to the Verizon network.

The coverage maps in Exhibit 5 show that the proposed project site is ideally suited to meet coverage objectives because of favorable topography which places it well above the residential areas to the west of the site, and well above the nearby low-lying coverage objectives along the Columbia River which includes the Historic Columbia River Highway.

b). The reason why the WCF must be constructed at the proposed height;

Verizon operates in the 700MHz, cellular, PCS and AWS base-station frequency ranges for receive and transmit functions. In order to provide effective wireless service at these frequencies, the RF signal path to the primary coverage area must be primarily line-of-sight from the Verizon antennas. Intervening obstructions such as hills, trees and nearby buildings must be avoided. Therefore the antennas must be high enough to overcome intervening obstructions.

The proposed location at 29421 E Woodward Rd was chosen because it will overcome topographic obstacles to best provide wireless communication services to new and existing Verizon customers in areas where these services are currently lacking. Page 5 of Exhibit F shows the vastly improved network coverage resulting from a new Verizon WCF with a 150-foot monopole at the proposed project site.

Page 6 of Exhibit F shows that coverage from a reduced tower height of 120 feet would not adequately meet coverage objectives, especially for the in-building coverage shown in red, and the in-vehicle coverage shown in green, because of intervening obstructions including the tall trees surrounding the proposed project site. Those obstructions would attenuate the Verizon signals, and prevent the WCF from providing line-of-sight coverage, especially to the west and southwest of the site.

There are no available existing tall structures in or near the search areas that would allow Verizon to meet the coverage and service objectives. A new 150-foot tall support structure which will support all of the antennas at a minimum height above grade is required to meet the objectives.

c). Verification of good faith efforts made to locate or design the proposed WCF to qualify for an expedited review process. To this end, if an existing structure approved for co-location is within the area recommended by the engineer's report, the reason for not co-locating shall be provided;

The Verizon Real Estate Group, with the help of outside consultant Mr. Hyle of Black Rock, has evaluated the search areas for co-location opportunities, but ultimately found none suitable. The findings of this good faith effort, as described in Mr. Hyle's narrative, resulted in the proposal for a new WCF at the proposed project site.

According to Mr. Hyle the real estate search was supplemented by a driving tour of the search ring and coverage area. During that tour "... the Applicant quickly discovered that co-locating the required facility on an existing or approved tower, building or other suitable structure within the identified search ring was simply not available. The majority of the buildings in the search area are 2 stories maximum height or 25-30' height. There are a few short power utility poles (about 30' height) in the vicinity on Woodard Road, however these are too short to provide the service required. A tall tower height of 150' is minimum required to provide the coverage. There are no tall structures in or near the search area available to meet the coverage objective."

The author has searched the FCC Antenna Structure Registration (ASR) database, and the "Antenna Search" website at AntennaSearch.com in order to confirm that there are no existing towers suitable for collocation within or anywhere near the search areas.

CONCLUSION

I have reviewed the narratives and coverage exhibits provided by Verizon personnel and representatives. The information provided is internally consistent, and reasonable from an RF engineering perspective. The supplied material, taken as a whole, appears to present an accurate and complete depiction of the existing and proposed Verizon network service coverage and service capacity in the areas near the proposed WCF. Verizon has provided sufficient evidence justifying the need for the proposed WCF at the proposed location and height. In my opinion the narrative and exhibits provide a plausible justification for the requested placement and height of the proposed

Verizon WCF. The proposed project site is well situated to provide capacity relief for the existing WCFs, and to improve Verizon network service to the coverage objective areas while avoiding conflicts with, and duplication of, existing Verizon wireless services.

Furthermore I concur with the conclusion that none of the identified alternative support towers, including the SBA towers at the Mount Hood Community College and at the Cherry Park Presbyterian Church, are feasible co-location alternatives. There does not appear to be any existing towers or structures within the planned service coverage area which are suitable for co-location.

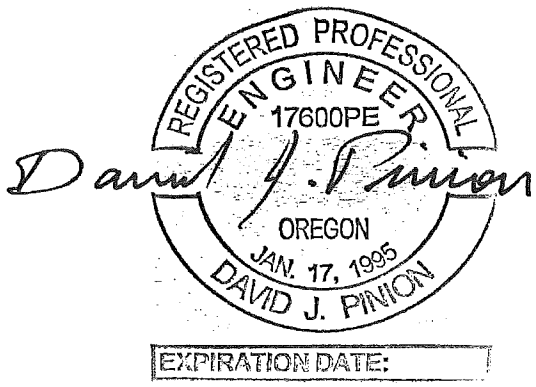
The proposed Verizon "POR STINGER" WCF will help to fill a significant gap in existing Verizon network service coverage, it will provide service capacity relief to the existing Verizon WCFs TROUTDALE and SWEETBRIAR, and it will improve the user's experience in terms of voice, video and data services, as well as critical 911 services necessary for public safety.

QUALIFICATIONS

I am a Senior Member of the IEEE. As a partner in the firm of Hatfield & Dawson Consulting Engineers I am registered as a Professional Engineer in the States of Oregon, Washington, California and Hawaii. I am an experienced radio engineer and RF Specialist with over 35 years of professional engineering experience whose qualifications are a matter of record with the Federal Communications Commission, and I hold an FCC General Radiotelephone Operator License PG-12-21740.

All representations contained herein are true to the best of my knowledge.

April 6, 2018



David J. Pinion, P.E. PE Expiration Date 12/31/2018

EXHIBIT L

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(1942 – 2009)
PAUL W. LEONARD, PE
(1925 – 2011)

NON-IONIZING ELECTROMAGNETIC EXPOSURE ANALYSIS AND ENGINEERING CERTIFICATION

PREPARED FOR

Verizon Wireless

"POR STINGER"

PROPOSED WIRELESS FACILITY

29421 E WOODWARD RD

TROUTDALE

MULTNOMAH COUNTY, OREGON

MARCH 2018

INTRODUCTION

Hatfield & Dawson Consulting Engineers has been retained to evaluate the proposed Verizon Wireless personal wireless telecommunications facility "POR STINGER" for compliance with current Federal Communications Commission (FCC) and local guidelines regarding public exposure to radio frequency (RF) electromagnetic fields (EMFs).

BACKGROUND

Construction drawings and other information provided by Verizon representatives indicate that the Verizon Wireless facility will have panel antennas installed atop a new 150-foot monopole tower at 29421 E Woodward Rd, Troutdale, in Multnomah County, Oregon 97060.

The drawings show that all of the Verizon panel antennas will be mounted and centered approximately 145 feet above grade. Microwave dish antennas and two levels of future colocated antennas are shown centered at, and above, the 110 foot level. Therefore all of the Verizon and future colocated antennas will be mounted well above head height for persons at the project site or on adjacent properties. The tower compound will be surrounded by a 6-foot tall chain link fence topped with barbed wire. Therefore it is unlikely that anyone other than authorized and RF cognizant workers could approach near enough to any of the Verizon or colocated antennas to cause that person's RF exposure to exceed FCC limits.

Personal wireless panel and microwave antennas are highly directional; these antennas project the majority of the transmitted RF energy horizontally and well above all nearby accessible areas. It is expected that RF exposure conditions at the project site and on adjacent properties, due to the contributions from all of the Verizon wireless operations, in combination with any future colocated wireless facilities, will be well below FCC and local public exposure limits.

The operation of the Verizon facility, in combination with the future colocated wireless facilities, will NOT create significant RF exposure conditions at any occupancy, habitable area or publicly accessible area.

EMISSION CHARACTERISTICS

The Verizon facility may operate within the 700 MHz LTE band, the 850 MHz cellular band, the 1.9 GHz Personal Communications Service (PCS) bands, the 2.1 GHz Advanced Wireless Service (AWS) frequency bands, and the point-to-point microwave frequency bands.

RF EXPOSURE CONDITIONS DUE TO VERIZON FACILITY

It is expected that RF exposure conditions at the project site, within nearby buildings, and on all adjacent properties, due to the contributions from all of the Verizon and colocated antennas, will be a fraction of the 100% FCC Public MPE (Maximum Permissible Exposure) limit. ***Installation of the new Verizon facility will not cause any occupancy or public area to exceed the FCC limits for human exposure to radio frequency electromagnetic fields.***

Therefore Verizon wireless operations at the project site will not have a significant environmental impact as defined by the FCC Public MPE limits. Furthermore, the Verizon facility will not cause any existing wireless facilities to exceed non-ionizing electromagnetic radiation (NIER) exposure standards.

FCC COMPLIANCE

The FCC has determined through calculations and technical analysis that personal wireless and microwave facilities, such as those operated by Verizon, are highly unlikely to cause human RF exposures in excess of FCC guideline limits. In particular, personal wireless facilities with non-building-mounted antennas greater than 10 meters (about 33 feet) above ground level are considered to have such a low impact on overall exposure conditions that they are "categorically excluded" (i.e., exempt) from the requirement for routine environmental assessment regarding RF exposure hazards.

Thus according to FCC rules, the Verizon facility, and future collocated wireless facilities, with all antennas centered above the 33 foot level, will be exempt from further RF safety environmental assessment because they are presumed to be in compliance with the FCC RF exposure rules and guidelines. The Verizon facility is expected to be compliant with FCC rules regarding public RF exposure provided that direct access to the Verizon antennas is positively restricted.

COMPLIANCE WITH FCC REGULATIONS FOR RF EMISSIONS AND RF INTERFERENCE

It is expected that the RF interaction between all of the wireless operations at the project site will be low enough to preclude the likelihood of localized interference caused by the Verizon Wireless facility to the reception of any other communications signals. All of the wireless antennas will be sufficiently high enough, and far enough removed from all occupancies, that they are unlikely to cause interference with nearby consumer receivers or other consumer electronic devices.

Transmission equipment for the Verizon wireless facility is certified by the FCC under the equipment authorization procedures set forth in the FCC rules. This assures that the wireless facility will transmit within the desired base-station frequency bands at authorized power levels.

The Verizon Wireless facility will operate in accordance with all FCC rules regarding power, signal bandwidth, interference mitigation, and good RF engineering practices. ***The Verizon facility will comply with all FCC standards for radio frequency emissions.***

Predicted RF exposure conditions at the project site and on adjacent properties, within any nearby buildings, and on all adjacent properties, due to the contributions from all of the Verizon wireless operations, in combination with future colocated wireless facilities, will be well below the 100% FCC Public MPE limit. In fact the Verizon facility will likely contribute less than 1% of the FCC MPE limit to the ground level exposure environment at the project site, or on any adjacent property. This conclusion is based on information supplied by Verizon representatives, and estimates of future RF exposure conditions due to the Verizon facility in specific areas with the corresponding safe exposure guidelines set forth in the FCC rules and guidelines.

The FCC exposure limits are based on recommendations by federal and private entities with the appropriate expertise in human safety issues. Under the Commission's rules and guidelines, licensees are required to ensure compliance with the limits for maximum permissible exposure (MPE) established by the FCC. These limits have been developed based on guidelines provided by the Institute of Electrical and Electronics Engineers, Inc. (IEEE) and the National Council on Radiation Protection and Measurements (NCRP). Both the NCRP and IEEE guidelines were developed by scientists and engineers with a great deal of experience and knowledge in the area of RF biological effects and related issues.

To ensure full compliance with FCC rules and guidelines regarding human exposure to radio frequency electromagnetic fields, the Verizon transmitters should be turned off whenever maintenance personnel are required to work in the immediate vicinity of the Verizon antenna apertures. This safety procedure should apply to all future wireless transmission facilities at the project site. All instances of antenna-related work require deactivation of the subject antennas.

CONCLUSIONS BASED ON LOCAL AND FCC REGULATIONS

The Verizon facility "POR STINGER" will be in compliance with current local and FCC rules and standards regarding radio frequency emissions including radio frequency interference, and public exposure to radio frequency electromagnetic fields. The proposed facility will be in compliance with NIER emissions standards as set forth by the FCC, particularly with respect to any habitable areas near the project site, provided that direct access to the Verizon antennas is positively restricted to authorized and RF cognizant workers accessing the project tower.

The Verizon facility will comply with all FCC RF emissions safety standards.

Sabre Industries™
Towers and Poles

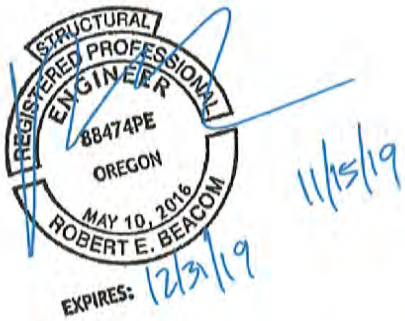
Structural Design Report

150' Monopine
Site: POR Stinger, OR

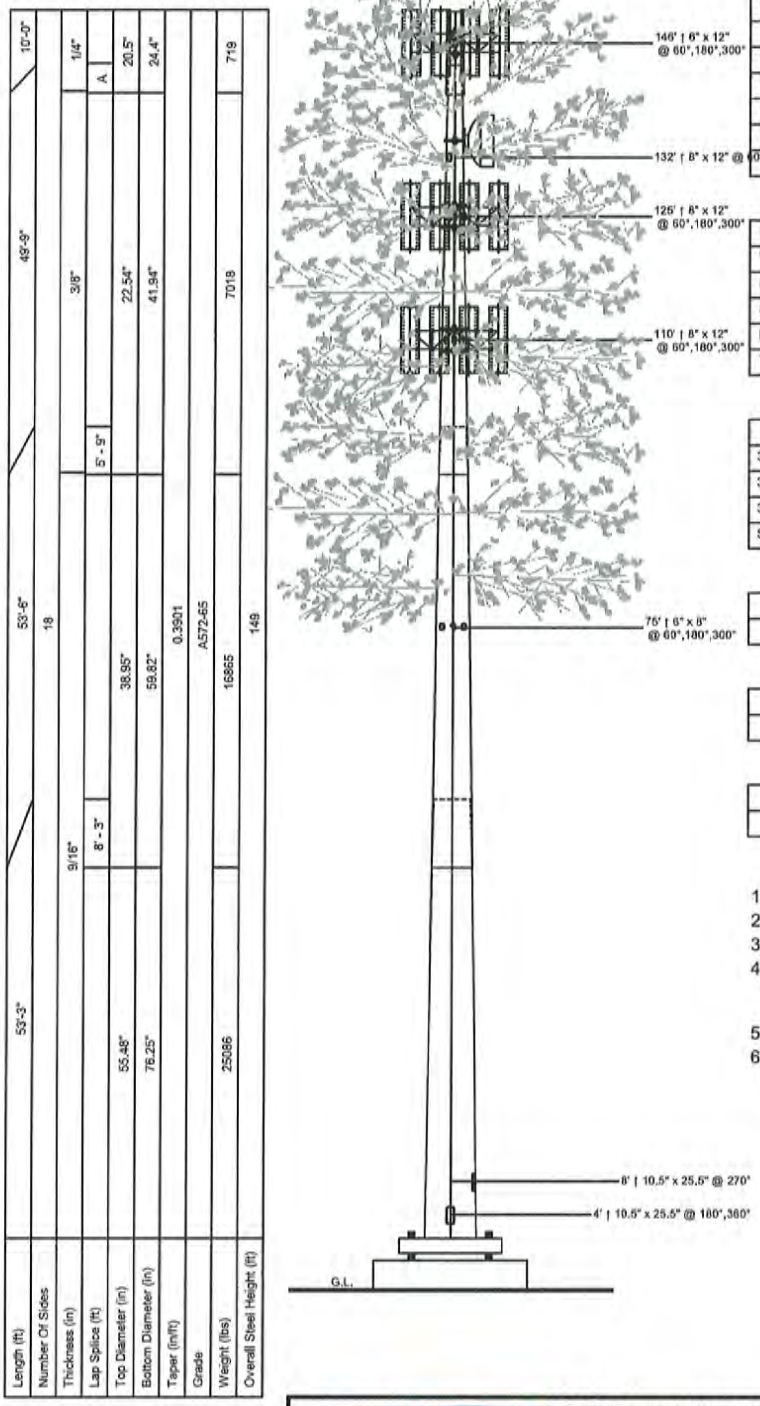
Prepared for: VERIZON WIRELESS
by: Sabre Towers & Poles ™

Job Number: 446974
Revision C

November 15, 2019



11/15/19



Designed Appurtenance Loading

Elev	Description	Tx-Line
150	(1) Beacon + 6' Extension	
146	3V-Boom - 10ft Face - 3ft Standoff	
146	(12) 8' x 2' x 6in	
146	(9) RRUS 12	(3) DC/Fiber Trunks
146	(3) RCMDC-3315-PF-48	
134	(1) Dish Mount (Monopole Only) - Pipe Mount (up to 6' Dish)	
134	(1) 6' H.P. Dish	(1) EW63
125	3V-Boom - 10ft Face - 3ft Standoff	
125	(12) 8' x 2' x 6in	(12) 1 5/8"
125	(12) RRH (18.86" x 20.38" x 5.83")	(3) DC/Fiber Trunks
125	(3) RCMDC-3315-PF-48	
110	3V-Boom - 10ft Face - 3ft Standoff	
110	(12) 8' x 2' x 6in	(12) 1 5/8"
110	(12) RRH (18.86" x 20.38" x 5.83")	(3) DC/Fiber Trunks
110	(3) RCMDC-3315-PF-48	
75	(3) Side Light	

Design Criteria - ANSI/TIA-222-G

Nominal Wind Speed (No Ice)	120 mph
Wind Speed (Ice)	120 mph
Design Ice Thickness	0.50 in
Structure Class	II
Exposure Category	C
Topographic Category	1

Load Case Reactions

Description	Axial (kips)	Shear (kips)	Moment (ft-k)	Deflection (ft)	Sway (deg)
3s Gusted Wind	77.89	127.97	14082.85	9.92	7.43
3s Gusted Wind 0.9 Dead	56.56	127.83	13996.12	9.84	7.37
3s Gusted Wind&Ice	101.75	112.98	12111.04	8.46	6.31
Service Loads	64.93	17.89	1969.76	1.4	1.04

Base Plate Dimensions

Shape	Diameter	Thickness	Bolt Circle	Bolt Qty	Bolt Diameter
Round	89.75"	2.75"	84"	34	2.25"

Anchor Bolt Dimensions

Length	Diameter	Hole Diameter	Weight	Type	Finish
84"	2.25"	2.625"	4117.4	A615-75	Galv

Material List

Display	Value
A	3' - 6"

Notes

1) Antenna Feed Lines Run Inside Pole
2) All dimensions are above ground level, unless otherwise specified.
3) Weights shown are estimates. Final weights may vary.
4) This tower design and, if applicable, the foundation design(s) shown on the following page(s) also meet or exceed the requirements of the 2019 Oregon Structural Specialty Code.
5) Tower Rating: 99.6%
6) This structure has been designed to support pine tree branches starting at the 80' elevation to an overall height of 155'.

Sabre Industries
Towers and Poles

Sabre Communications Corporation
7101 Southbridge Drive
P.O. Box 658
Sioux City, IA 51102-0658
Phone: (712) 258-6690
Fax: (712) 279-0614

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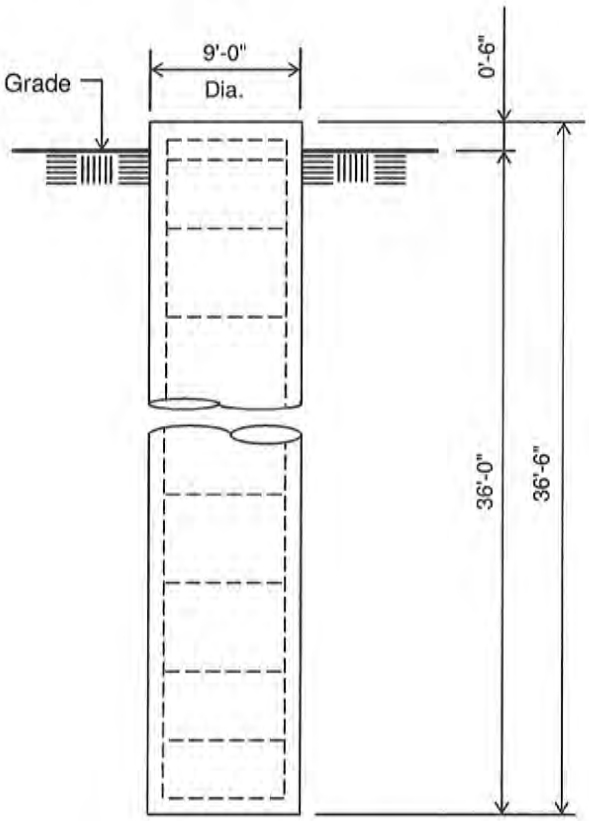
Job:	446974C
Customer:	VERIZON WIRELESS
Site Name:	POR Stinger, OR
Description:	150' Monopine
Date:	11/15/2019 By: REB

Sabre Industries™
Towers and Poles

No.: 446974

Date: 11/15/19
By: REB
Revision B

Customer: VERIZON WIRELESS
Site: POR Stinger, OR
150' Monopole



ELEVATION VIEW
(86. Cu. Yds.)
(1 REQUIRED; NOT TO SCALE)

Notes:

1) Concrete shall have a minimum 28-day compressive strength of 4,500 psi, in accordance with ACI 318-11.

2) Rebar to conform to ASTM specification A615 Grade 60.

3) All rebar to have a minimum of 3" concrete cover.

4) All exposed concrete corners to be chamfered 3/4".

5) The foundation design is based on the geotechnical report by Adapt Engineering project no. OR17-20807-GEO, dated: 5/4/17.

6) See the geotechnical report for drilled pier installation requirements, if specified.

7) The foundation is based on the following factored loads:
   Moment = 14,082.85 k-ft
   Axial = 77.89 k
   Shear = 127.97 k

Rebar Schedule for Pier	
Pier	(62) #11 vertical rebar w/ #5 ties, (2) within top 5" of pier, then 6" C/C

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7101 Southbridge Drive - P.O. Box 658 - Sioux City, IA 51102-0658 - Phone 712.258.6690 - Fax 712.279.0814

(USA 222-G) - Monopole Spatial Analysis (c)2015 Guymast Inc.

Tel:(416)736-7453 Fax:(416)736-4372 Web:www.guymast.com

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Sabre Towers and Poles on: 15 nov 2019 at: 13:14:58

150' Monopine / POR Stinger, OR

* All pole diameters shown on the following pages are across corners.
See profile drawing for widths across flats.

POLE GEOMETRY

ELEV ft	SECTION NAME	No. SIDE	OUTSIDE DIAM in	THICK -NESS in	RESISTANCES ϕ*Pn kip	RESISTANCES ϕ*Mn ft-kip	SPLICE TYPE	OVERLAP... LENGTH ft	OVERLAP... RATIO	w/t
149.0										
			20.82	0.250	1193.8	495.1				
	A	18								12.7
			23.38	0.250	1342.8	627.2				
142.5										
			23.38	0.250	1342.8	627.2				
	A/B	18					SLIP	3.50	1.76	
			24.28	0.375	2081.0	999.5				
139.0										
			24.28	0.375	2081.0	999.5				
	B	18								9.5
			40.30	0.375	3433.3	2771.8				
98.5										
			40.30	0.375	3433.3	2771.8				
	B/C	18					SLIP	5.75	1.67	
			41.84	0.562	5390.9	4480.6				
92.7										
			41.84	0.562	5390.9	4480.6				
	C	18								11.2
			57.46	0.562	7431.0	8544.9				
53.2										
			57.46	0.562	7431.0	8544.9				
	C/D	18					SLIP	8.25	1.69	
			59.62	0.562	7645.6	9128.7				
45.0										
			59.62	0.562	7645.6	9128.7				
	D	18								16.6
			77.43	0.562	9165.1	14274.3				
0.0										

POLE ASSEMBLY

SECTION NAME	BASE ELEV ft	BOLTS AT BASE OF SECTION... NUMBER	TYPE	DIAM in	STRENGTH ksi	THREADS IN SHEAR PLANE	CALC BASE ELEV ft
A	139.000	0	A325	0.00	92.0	0	139.000
B	92.750	0	A325	0.00	92.0	0	92.750
C	45.000	0	A325	0.00	92.0	0	45.000
D	0.000	0	A325	0.00	92.0	0	0.000

POLE SECTIONS

SECTION NAME	No.of SIDES	LENGTH ft	OUTSIDE.DIAMETER BOT * in	OUTSIDE.DIAMETER TOP * in	BEND RAD in	MAT-ERIAL ID	FLANGE.ID BOT	FLANGE.ID TOP	FLANGE.WELD ..GROUP.ID.. BOT	FLANGE.WELD ..GROUP.ID.. TOP
A	18	10.00	24.78	20.82	0.000	1	0	0	0	0
B	18	49.75	42.59	22.88	0.000	2	0	0	0	0
C	18	53.50	60.74	39.55	0.000	3	0	0	0	0
D	18	53.25	77.43	56.33	0.000	4	0	0	0	0

* - Diameter of circumscribed circle

MATERIAL TYPES

TYPE OF SHAPE	TYPE NO	NO OF ELEM.	ORIENT & deg	HEIGHT in	WIDTH in	.THICKNESS. WEB in	FLANGE in	IRREGULARITY .PROJECTION. % OF AREA	ORIENT deg
PL	1	1	0.0	24.78	0.25	0.250	0.250	0.00	0.0
PL	2	1	0.0	42.59	0.38	0.375	0.375	0.00	0.0
PL	3	1	0.0	60.74	0.56	0.562	0.562	0.00	0.0
PL	4	1	0.0	77.43	0.56	0.562	0.562	0.00	0.0

& - With respect to vertical

MATERIAL PROPERTIES

MATERIAL TYPE NO.	ELASTIC MODULUS ksi	UNIT WEIGHT pcf	.. STRENGTH .. Fu ksi	Fy ksi	THERMAL COEFFICIENT /deg
1	29000.0	490.0	80.0	65.0	0.00001170
2	29000.0	490.0	80.0	65.0	0.00001170
3	29000.0	490.0	80.0	65.0	0.00001170
4	29000.0	490.0	80.0	65.0	0.00001170

* Only 3 condition(s) shown in full
* RRUs/TMAs were assumed to be behind antennas

* Some concentrated wind loads may have been derived from full-scale wind tunnel testing

LOADING CONDITION A

120 mph Nominal wind with no ice. Wind Azimuth: 0♦

LOADS ON POLE

LOAD TYPE	ELEV ft	APPLY..LOAD..AT RADIUS ft	AZI	LOAD AZI	.....FORCES..... HORIZ kip	DOWN kip	.....MOMENTS..... VERTICAL ft-kip	TORSNAL ft-kip
C	151.500	0.00	0.0	0.0	2.1314	0.3000	0.0000	0.0000
C	149.000	0.00	0.0	0.0	0.4863	0.1536	0.0000	0.0000
C	146.500	0.00	0.0	0.0	2.1165	0.3000	0.0000	0.0000
C	145.000	0.00	0.0	0.0	0.0000	0.0522	0.0000	0.0000
C	145.000	0.00	0.0	0.0	13.5526	4.0645	0.0000	0.0000
C	141.500	0.00	0.0	0.0	4.2024	0.6000	0.0000	0.0000
C	136.500	0.00	0.0	0.0	4.1709	0.6000	0.0000	0.0000
C	133.000	0.00	0.0	0.0	0.0000	0.0814	0.0000	0.0000
C	131.500	0.00	0.0	0.0	4.1385	0.6000	0.0000	0.0000
C	126.500	0.00	0.0	0.0	4.1051	0.6000	0.0000	0.0000
C	124.000	0.00	0.0	0.0	0.0000	1.9017	0.0000	0.0000
C	124.000	0.00	0.0	0.0	13.1123	4.1581	0.0000	0.0000
C	121.500	0.00	0.0	0.0	4.0707	0.6000	0.0000	0.0000
C	116.500	0.00	0.0	0.0	4.0351	0.6000	0.0000	0.0000
C	111.500	0.00	0.0	0.0	3.9983	0.6000	0.0000	0.0000
C	109.000	0.00	0.0	0.0	0.0000	1.6716	0.0000	0.0000
C	109.000	0.00	0.0	0.0	12.7641	4.1581	0.0000	0.0000
C	106.500	0.00	0.0	0.0	3.9603	0.6000	0.0000	0.0000
C	101.500	0.00	0.0	0.0	3.9208	0.6000	0.0000	0.0000
C	96.500	0.00	0.0	0.0	4.3111	0.6000	0.0000	0.0000
C	91.500	0.00	0.0	0.0	4.2636	0.6000	0.0000	0.0000
C	86.500	0.00	0.0	0.0	4.2140	0.6000	0.0000	0.0000
C	81.500	0.00	0.0	0.0	4.1621	0.6000	0.0000	0.0000
C	74.000	0.00	0.0	0.0	0.2127	0.1159	0.0000	0.0000

D	149.000	0.00	180.0	0.0	0.1013	0.0698	0.0000	0.0000
D	142.500	0.00	180.0	0.0	0.1013	0.0698	0.0000	0.0000
D	142.500	0.00	180.0	0.0	0.1095	0.1876	0.0000	0.0000
D	139.000	0.00	180.0	0.0	0.1095	0.1876	0.0000	0.0000
D	139.000	0.00	180.0	0.0	0.1209	0.1275	0.0000	0.0000
D	125.500	0.00	180.0	0.0	0.1209	0.1275	0.0000	0.0000
D	125.500	0.00	180.0	0.0	0.1417	0.1528	0.0000	0.0000
D	112.000	0.00	180.0	0.0	0.1417	0.1528	0.0000	0.0000
D	112.000	0.00	180.0	0.0	0.1611	0.1781	0.0000	0.0000
D	98.500	0.00	180.0	0.0	0.1611	0.1781	0.0000	0.0000
D	98.500	0.00	180.0	0.0	0.1739	0.4850	0.0000	0.0000
D	92.750	0.00	180.0	0.0	0.1739	0.4850	0.0000	0.0000
D	92.750	0.00	180.0	0.0	0.1824	0.3154	0.0000	0.0000
D	79.583	0.00	180.0	0.0	0.1824	0.3154	0.0000	0.0000
D	79.583	0.00	180.0	0.0	0.1969	0.3525	0.0000	0.0000
D	66.417	0.00	180.0	0.0	0.1969	0.3525	0.0000	0.0000
D	66.417	0.00	180.0	0.0	0.2088	0.3895	0.0000	0.0000
D	53.250	0.00	180.0	0.0	0.2088	0.3895	0.0000	0.0000
D	53.250	0.00	180.0	0.0	0.2160	0.8323	0.0000	0.0000
D	45.000	0.00	180.0	0.0	0.2160	0.8323	0.0000	0.0000
D	45.000	0.00	180.0	0.0	0.2158	0.4402	0.0000	0.0000
D	33.750	0.00	180.0	0.0	0.2158	0.4402	0.0000	0.0000
D	33.750	0.00	180.0	0.0	0.2160	0.4719	0.0000	0.0000
D	22.500	0.00	180.0	0.0	0.2160	0.4719	0.0000	0.0000
D	22.500	0.00	180.0	0.0	0.2080	0.5036	0.0000	0.0000
D	11.250	0.00	180.0	0.0	0.2080	0.5036	0.0000	0.0000
D	11.250	0.00	180.0	0.0	0.2134	0.5353	0.0000	0.0000
D	0.000	0.00	180.0	0.0	0.2134	0.5353	0.0000	0.0000

ANTENNA LOADING

.....ANTENNA.....			ATTACHMENT		.....ANTENNA FORCES.....			
TYPE	ELEV ft	AZI	RAD ft	AZI	AXIAL kip	SHEAR kip	GRAVITY kip	TORSION ft-kip
HP	133.0	0.0	1.8	0.0	2.96	0.00	0.34	0.00

LOADING CONDITION M

120 mph Nominal wind with no ice. Wind Azimuth: 0◆

LOADS ON POLE

LOAD TYPE	ELEV ft	APPLY..LOAD..AT RADIUS ft	AZI	LOAD AZI	.....FORCES..... HORIZ kip	DOWN kip	.....MOMENTS..... VERTICAL ft-kip	TORSNAL ft-kip
C	151.500	0.00	0.0	0.0	2.1314	0.2250	0.0000	0.0000
C	149.000	0.00	0.0	0.0	0.4863	0.1152	0.0000	0.0000
C	146.500	0.00	0.0	0.0	2.1165	0.2250	0.0000	0.0000
C	145.000	0.00	0.0	0.0	0.0000	0.0391	0.0000	0.0000
C	145.000	0.00	0.0	0.0	13.5526	3.0484	0.0000	0.0000
C	141.500	0.00	0.0	0.0	4.2024	0.4500	0.0000	0.0000
C	136.500	0.00	0.0	0.0	4.1709	0.4500	0.0000	0.0000
C	133.000	0.00	0.0	0.0	0.0000	0.0610	0.0000	0.0000
C	131.500	0.00	0.0	0.0	4.1385	0.4500	0.0000	0.0000
C	126.500	0.00	0.0	0.0	4.1051	0.4500	0.0000	0.0000
C	124.000	0.00	0.0	0.0	0.0000	1.4262	0.0000	0.0000
C	124.000	0.00	0.0	0.0	13.1123	3.1186	0.0000	0.0000
C	121.500	0.00	0.0	0.0	4.0707	0.4500	0.0000	0.0000
C	116.500	0.00	0.0	0.0	4.0351	0.4500	0.0000	0.0000
C	111.500	0.00	0.0	0.0	3.9983	0.4500	0.0000	0.0000
C	109.000	0.00	0.0	0.0	0.0000	1.2537	0.0000	0.0000
C	109.000	0.00	0.0	0.0	12.7641	3.1186	0.0000	0.0000
C	106.500	0.00	0.0	0.0	3.9603	0.4500	0.0000	0.0000
C	101.500	0.00	0.0	0.0	3.9208	0.4500	0.0000	0.0000
C	96.500	0.00	0.0	0.0	4.3111	0.4500	0.0000	0.0000
C	91.500	0.00	0.0	0.0	4.2636	0.4500	0.0000	0.0000
C	86.500	0.00	0.0	0.0	4.2140	0.4500	0.0000	0.0000
C	81.500	0.00	0.0	0.0	4.1621	0.4500	0.0000	0.0000
C	74.000	0.00	0.0	0.0	0.2127	0.0869	0.0000	0.0000
D	149.000	0.00	180.0	0.0	0.1013	0.0523	0.0000	0.0000
D	142.500	0.00	180.0	0.0	0.1013	0.0523	0.0000	0.0000

D	142.500	0.00	180.0	0.0	0.1095	0.1407	0.0000	0.0000
D	139.000	0.00	180.0	0.0	0.1095	0.1407	0.0000	0.0000
D	139.000	0.00	180.0	0.0	0.1209	0.0956	0.0000	0.0000
D	125.500	0.00	180.0	0.0	0.1209	0.0956	0.0000	0.0000
D	125.500	0.00	180.0	0.0	0.1417	0.1146	0.0000	0.0000
D	112.000	0.00	180.0	0.0	0.1417	0.1146	0.0000	0.0000
D	112.000	0.00	180.0	0.0	0.1611	0.1336	0.0000	0.0000
D	98.500	0.00	180.0	0.0	0.1611	0.1336	0.0000	0.0000
D	98.500	0.00	180.0	0.0	0.1739	0.3637	0.0000	0.0000
D	92.750	0.00	180.0	0.0	0.1739	0.3637	0.0000	0.0000
D	92.750	0.00	180.0	0.0	0.1824	0.2366	0.0000	0.0000
D	79.583	0.00	180.0	0.0	0.1824	0.2366	0.0000	0.0000
D	79.583	0.00	180.0	0.0	0.1969	0.2643	0.0000	0.0000
D	66.417	0.00	180.0	0.0	0.1969	0.2643	0.0000	0.0000
D	66.417	0.00	180.0	0.0	0.2088	0.2921	0.0000	0.0000
D	53.250	0.00	180.0	0.0	0.2088	0.2921	0.0000	0.0000
D	53.250	0.00	180.0	0.0	0.2160	0.6242	0.0000	0.0000
D	45.000	0.00	180.0	0.0	0.2160	0.6242	0.0000	0.0000
D	45.000	0.00	180.0	0.0	0.2158	0.3301	0.0000	0.0000
D	33.750	0.00	180.0	0.0	0.2158	0.3301	0.0000	0.0000
D	33.750	0.00	180.0	0.0	0.2160	0.3539	0.0000	0.0000
D	22.500	0.00	180.0	0.0	0.2160	0.3539	0.0000	0.0000
D	22.500	0.00	180.0	0.0	0.2080	0.3777	0.0000	0.0000
D	11.250	0.00	180.0	0.0	0.2080	0.3777	0.0000	0.0000
D	11.250	0.00	180.0	0.0	0.2134	0.4015	0.0000	0.0000
D	0.000	0.00	180.0	0.0	0.2134	0.4015	0.0000	0.0000

ANTENNA LOADING

.....ANTENNA..... TYPE	ELEV ft	AZI	ATTACHMENT RAD ft	AZI	.....ANTENNA FORCES..... AXIAL kip	SHEAR kip	GRAVITY kip	TORSION ft-kip
HP	133.0	0.0	1.8	0.0	2.96	0.00	0.25	0.00

LOADING CONDITION Y

120 mph wind with 0.5 ice. Wind Azimuth: 0♦

LOADS ON POLE

LOAD TYPE	ELEV ft	APPLY..LOAD..AT RADIUS ft	AZI	LOAD AZI	.....FORCES..... HORIZ kip	DOWN kip	.....MOMENTS..... VERTICAL ft-kip	TORSNAL ft-kip
C	151.500	0.00	0.0	0.0	1.5805	0.7662	0.0000	0.0000
C	149.000	0.00	0.0	0.0	0.5830	0.2467	0.0000	0.0000
C	146.500	0.00	0.0	0.0	1.5686	0.7646	0.0000	0.0000
C	145.000	0.00	0.0	0.0	0.0000	0.0522	0.0000	0.0000
C	145.000	0.00	0.0	0.0	11.1442	6.3359	0.0000	0.0000
C	141.500	0.00	0.0	0.0	3.3561	1.0630	0.0000	0.0000
C	136.500	0.00	0.0	0.0	3.3284	1.0614	0.0000	0.0000
C	133.000	0.00	0.0	0.0	0.0000	0.0814	0.0000	0.0000
C	131.500	0.00	0.0	0.0	3.2999	1.0597	0.0000	0.0000
C	126.500	0.00	0.0	0.0	3.2706	1.0579	0.0000	0.0000
C	124.000	0.00	0.0	0.0	0.0000	1.9017	0.0000	0.0000
C	124.000	0.00	0.0	0.0	10.7777	6.5453	0.0000	0.0000
C	121.500	0.00	0.0	0.0	3.2404	1.0561	0.0000	0.0000
C	116.500	0.00	0.0	0.0	3.2092	1.0542	0.0000	0.0000
C	111.500	0.00	0.0	0.0	3.1770	1.0522	0.0000	0.0000
C	109.000	0.00	0.0	0.0	0.0000	1.6716	0.0000	0.0000
C	109.000	0.00	0.0	0.0	10.4595	6.5150	0.0000	0.0000
C	106.500	0.00	0.0	0.0	3.1437	1.0501	0.0000	0.0000
C	101.500	0.00	0.0	0.0	3.1092	1.0480	0.0000	0.0000
C	96.500	0.00	0.0	0.0	3.3430	1.0458	0.0000	0.0000
C	91.500	0.00	0.0	0.0	3.3028	1.0434	0.0000	0.0000
C	86.500	0.00	0.0	0.0	3.2609	1.0410	0.0000	0.0000
C	81.500	0.00	0.0	0.0	3.2171	1.0384	0.0000	0.0000
C	74.000	0.00	0.0	0.0	0.2584	0.1159	0.0000	0.0000
D	149.000	0.00	180.0	0.0	0.1291	0.1028	0.0000	0.0000
D	142.500	0.00	180.0	0.0	0.1291	0.1028	0.0000	0.0000
D	142.500	0.00	180.0	0.0	0.1385	0.2232	0.0000	0.0000
D	139.000	0.00	180.0	0.0	0.1385	0.2232	0.0000	0.0000

D	139.000	0.00	180.0	0.0	0.1515	0.1669	0.0000	0.0000
D	125.500	0.00	180.0	0.0	0.1515	0.1669	0.0000	0.0000
D	125.500	0.00	180.0	0.0	0.1750	0.1992	0.0000	0.0000
D	112.000	0.00	180.0	0.0	0.1750	0.1992	0.0000	0.0000
D	112.000	0.00	180.0	0.0	0.1970	0.2313	0.0000	0.0000
D	98.500	0.00	180.0	0.0	0.1970	0.2313	0.0000	0.0000
D	98.500	0.00	180.0	0.0	0.2114	0.5429	0.0000	0.0000
D	92.750	0.00	180.0	0.0	0.2114	0.5429	0.0000	0.0000
D	92.750	0.00	180.0	0.0	0.2209	0.3768	0.0000	0.0000
D	79.583	0.00	180.0	0.0	0.2209	0.3768	0.0000	0.0000
D	79.583	0.00	180.0	0.0	0.2371	0.4197	0.0000	0.0000
D	66.417	0.00	180.0	0.0	0.2371	0.4197	0.0000	0.0000
D	66.417	0.00	180.0	0.0	0.2503	0.4621	0.0000	0.0000
D	53.250	0.00	180.0	0.0	0.2503	0.4621	0.0000	0.0000
D	53.250	0.00	180.0	0.0	0.2580	0.9089	0.0000	0.0000
D	45.000	0.00	180.0	0.0	0.2580	0.9089	0.0000	0.0000
D	45.000	0.00	180.0	0.0	0.2573	0.5185	0.0000	0.0000
D	33.750	0.00	180.0	0.0	0.2573	0.5185	0.0000	0.0000
D	33.750	0.00	180.0	0.0	0.2567	0.5530	0.0000	0.0000
D	22.500	0.00	180.0	0.0	0.2567	0.5530	0.0000	0.0000
D	22.500	0.00	180.0	0.0	0.2464	0.5860	0.0000	0.0000
D	0.000	0.00	180.0	0.0	0.2518	0.6145	0.0000	0.0000

ANTENNA LOADING

.....ANTENNA.....			ATTACHMENT		.....ANTENNA FORCES.....			
TYPE	ELEV ft	AZI	RAD ft	AZI	AXIAL kip	SHEAR kip	GRAVITY kip	TORSION ft-kip
HP	133.0	0.0	1.8	0.0	1.97	0.00	0.84	0.00

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150' Monopine / POR Stinger, OR

MAXIMUM POLE DEFORMATIONS CALCULATED(w.r.t. wind direction)

MAST ELEV ft	.....DEFLECTIONS (ft)..... HORIZONTAL ALONG	ACROSS	DOWN	.....ROTATIONS (deg)..... TILT ALONG	ACROSS	TWIST
149.0	9.92A	0.18O	0.91A	7.43A	0.14O	-0.01J
142.5	9.09A	0.17O	0.81A	7.39A	0.14O	-0.01J
139.0	8.65A	0.16O	0.75A	7.34A	0.14O	-0.01J
125.5	6.99A	0.13O	0.54A	6.87A	0.14O	-0.01J
112.0	5.48A	0.10O	0.37A	6.11A	0.12O	-0.01J
98.5	4.16A	0.07O	0.24A	5.13A	0.09O	0.00J
92.7	3.67A	0.06O	0.20A	4.83A	0.09O	0.00J
79.6	2.65A	0.04O	0.12A	4.06A	0.07O	0.00J
66.4	1.81A	0.03O	0.07A	3.30A	0.06O	0.00J
53.2	1.14A	0.02O	0.03A	2.57A	0.04O	0.00J
45.0	0.80A	0.01O	0.02A	2.14A	0.04O	0.00J
33.7	0.44A	0.01O	0.01A	1.54A	0.03O	0.00J

446974C

22.5	0.19A	0.000	0.00A	0.99A	0.020	0.00J
11.2	0.05A	0.000	0.00Y	0.48A	0.010	0.00J
0.0	0.00A	0.00A	0.00A	0.00A	0.00A	0.00A

MAXIMUM ANTENNA AND REFLECTOR ROTATIONS

ELEV ft	ANT AZI deg	ANT TYPE	.... BEAM DEFLECTIONS (deg) .... ROLL	YAW	PITCH	TOTAL
133.0	0.0	HP	6.999 D	0.387 K	7.129 A	7.129 A

MAXIMUM POLE FORCES CALCULATED(w.r.t. to wind direction)

MAST ELEV ft	TOTAL AXIAL kip	SHEAR.w.r.t.WIND.DIR ALONG kip	ACROSS kip	MOMENT.w.r.t.WIND.DIR ALONG ft-kip	ACROSS ft-kip	TORSION ft-kip
149.0	1.02 AJ	2.63 N	0.01 X	-5.37 J	0.03 N	0.00 X
	8.84 AJ	18.95 N	0.01 X	-67.85 K	-0.05 O	0.14 W
142.5	8.84 Z	19.07 B	0.09 B	-68.02 I	-0.17 AA	0.15 W
	10.68 Z	23.65 B	0.09 B	-146.97 B	0.28 R	0.32 W
139.0	10.71 AB	23.68 E	0.23 U	-147.03 A	-0.29 B	-0.33 C
	17.06 AB	40.67 A	-1.64 W	-581.55 A	12.87 W	-3.98 J
125.5	17.06 Z	40.72 A	-1.67 W	-581.56 A	12.87 W	-3.98 J
	30.29 Z	63.84 A	-1.67 W	-1374.86 A	35.54 W	-3.86 J
112.0	30.32 AB	63.80 A	1.63 O	-1374.83 A	35.52 W	-3.86 J
	44.77 AB	90.61 A	1.63 O	-2504.50 A	-57.63 O	-3.85 J
98.5	44.76 AB	90.64 A	1.61 O	-2504.58 A	-57.67 O	-3.85 J
	48.92 AB	95.94 A	1.61 O	-3056.17 A	-67.06 O	-3.85 J
92.7	48.91 Z	96.00 A	-1.72 K	-3055.97 A	-67.21 O	-3.85 J
	56.99 Z	111.03 A	-1.72 K	-4452.19 A	-88.87 O	-3.89 J
79.6	56.98 AB	111.04 A	1.71 O	-4452.13 A	-88.86 O	-3.89 J
	62.61 AB	113.84 A	1.71 O	-5961.56 A	-111.63 O	-3.93 J
66.4	62.62 AB	113.85 A	1.71 O	-5961.57 A	-111.67 O	-3.93 J
	68.70 AB	116.59 A	1.71 O	-7505.74 A	-134.46 O	-3.97 J
53.2	68.70 AB	116.60 A	-1.73 K	-7505.73 A	-134.47 O	-3.97 J
	76.19 AB	118.38 A	-1.73 K	-8491.00 A	-148.51 O	-3.99 J
45.0	76.19 AB	118.40 A	-1.70 K	-8490.96 A	-148.56 O	-3.99 J
	82.02 AB	120.82 A	-1.70 K	-9856.14 A	-167.69 O	-4.01 J
33.7	82.02 AB	120.81 A	-1.70 K	-9856.11 A	-167.69 O	-4.01 J
	88.24 AB	123.24 A	-1.70 K	-11243.93 A	-186.76 O	-4.02 J
22.5	88.24 AB	123.25 A	-1.71 K	-11243.91 A	-186.76 O	-4.02 J
	94.92 AB	125.59 A	-1.71 K	-12653.24 A	-205.67 O	-4.03 J
11.2						

	94.92 AB	125.57 A	-1.71 K	-12653.24 A	-205.68 O	-4.03 J
	101.75 AB	127.97 A	-1.71 K	-14082.85 A	-224.55 O	-4.03 J
base reaction	101.75 AB	-127.97 A	1.71 K	14082.85 A	224.55 O	4.03 J

COMPLIANCE WITH 4.8.2 & 4.5.4

ELEV ft	AXIAL	BENDING	SHEAR + TORSIONAL	TOTAL	SATISFIED	D/t(w/t)	MAX ALLOWED
149.00							
	0.00AJ	0.01J	0.00N	0.01J	YES	12.70A	45.2
	0.01AJ	0.11K	0.03N	0.11K	YES	14.48A	45.2
142.50							
	0.00Z	0.07I	0.02B	0.08I	YES	9.07A	45.2
	0.01Z	0.14B	0.02B	0.14B	YES	9.71A	45.2
139.00							
	0.01AB	0.15A	0.02E	0.15A	YES	9.48A	45.2
	0.01AB	0.39A	0.03A	0.39A	YES	11.95A	45.2
125.50							
	0.01Z	0.39A	0.03A	0.39A	YES	11.95A	45.2
	0.01Z	0.65A	0.04A	0.66A	YES	14.43A	45.2
112.00							
	0.01AB	0.65A	0.04A	0.66A	YES	14.43A	45.2
	0.01AB	0.90A	0.05A	0.91A	YES	16.90A	45.2
98.50							
	0.01AB	0.60A	0.03A	0.61A	YES	10.68A	45.2
	0.01AB	0.66A	0.03A	0.67A	YES	11.38A	45.2
92.75							
	0.01Z	0.68A	0.04A	0.69A	YES	11.15A	45.2
	0.01Z	0.78A	0.04A	0.79A	YES	12.76A	45.2
79.58							
	0.01AB	0.78A	0.04A	0.79A	YES	12.76A	45.2
	0.01AB	0.85A	0.03A	0.85A	YES	14.37A	45.2
66.42							
	0.01AB	0.85A	0.03A	0.85A	YES	14.37A	45.2
	0.01AB	0.88A	0.03A	0.89A	YES	15.98A	45.2
53.25							
	0.01AB	0.88A	0.03A	0.89A	YES	15.98A	45.2
	0.01AB	0.90A	0.03A	0.91A	YES	16.99A	45.2
45.00							
	0.01AB	0.93A	0.03A	0.94A	YES	16.64A	45.2
	0.01AB	0.95A	0.03A	0.96A	YES	18.01A	45.2
33.75							
	0.01AB	0.95A	0.03A	0.96A	YES	18.01A	45.2
	0.01AB	0.97A	0.03A	0.98A	YES	19.39A	45.2
22.50							
	0.01AB	0.97A	0.03A	0.98A	YES	19.39A	45.2
	0.01AB	0.98A	0.03B	0.99A	YES	20.76A	45.2
11.25							
	0.01AB	0.98A	0.03B	0.99A	YES	20.76A	45.2
	0.01AB	0.99A	0.03B	1.00A	YES	22.14A	45.2
0.00							

MAXIMUM LOADS ONTO FOUNDATION(w.r.t. wind direction)

DOWN	SHEAR.w.r.t.WIND.DIR ALONG	ACROSS	MOMENT.w.r.t.WIND.DIR ALONG	ACROSS	TORSION
kip	kip	kip	ft-kip	ft-kip	ft-kip

101.75	127.97	-1.71	-14082.85	-224.55	-4.03
AB	A	K	A	O	J

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150' Monopine / POR Stinger, OR

****
********** Service Load Condition **********
****

* Only 1 condition(s) shown in full
* RRUs/TMAs were assumed to be behind antennas

* Some concentrated wind loads may have been derived from full-scale wind tunnel testing

LOADING CONDITION A ==========

60 mph wind with no ice. Wind Azimuth: 0♦

LOADS ON POLE
==========

LOAD TYPE	ELEV ft	APPLY..LOAD..AT RADIUS ft	AZI	LOAD AZI	.....FORCES..... HORIZ kip	DOWN kip	.....MOMENTS..... VERTICAL ft-kip	TORSNAL ft-kip
C	151.500	0.00	0.0	0.0	0.2980	0.2500	0.0000	0.0000
C	149.000	0.00	0.0	0.0	0.0717	0.1280	0.0000	0.0000
C	146.500	0.00	0.0	0.0	0.2959	0.2500	0.0000	0.0000
C	145.000	0.00	0.0	0.0	0.0000	0.0435	0.0000	0.0000
C	145.000	0.00	0.0	0.0	1.8947	3.3871	0.0000	0.0000
C	141.500	0.00	0.0	0.0	0.5875	0.5000	0.0000	0.0000
C	136.500	0.00	0.0	0.0	0.5831	0.5000	0.0000	0.0000
C	133.000	0.00	0.0	0.0	0.0000	0.0678	0.0000	0.0000
C	131.500	0.00	0.0	0.0	0.5786	0.5000	0.0000	0.0000
C	126.500	0.00	0.0	0.0	0.5739	0.5000	0.0000	0.0000
C	124.000	0.00	0.0	0.0	0.0000	1.5847	0.0000	0.0000
C	124.000	0.00	0.0	0.0	1.8331	3.4651	0.0000	0.0000
C	121.500	0.00	0.0	0.0	0.5691	0.5000	0.0000	0.0000
C	116.500	0.00	0.0	0.0	0.5641	0.5000	0.0000	0.0000
C	111.500	0.00	0.0	0.0	0.5590	0.5000	0.0000	0.0000
C	109.000	0.00	0.0	0.0	0.0000	1.3930	0.0000	0.0000
C	109.000	0.00	0.0	0.0	1.7845	3.4651	0.0000	0.0000
C	106.500	0.00	0.0	0.0	0.5537	0.5000	0.0000	0.0000
C	101.500	0.00	0.0	0.0	0.5481	0.5000	0.0000	0.0000
C	96.500	0.00	0.0	0.0	0.6027	0.5000	0.0000	0.0000
C	91.500	0.00	0.0	0.0	0.5961	0.5000	0.0000	0.0000
C	86.500	0.00	0.0	0.0	0.5891	0.5000	0.0000	0.0000
C	81.500	0.00	0.0	0.0	0.5819	0.5000	0.0000	0.0000
C	74.000	0.00	0.0	0.0	0.0297	0.0966	0.0000	0.0000
D	149.000	0.00	180.0	0.0	0.0142	0.0581	0.0000	0.0000
D	142.500	0.00	180.0	0.0	0.0142	0.0581	0.0000	0.0000
D	142.500	0.00	180.0	0.0	0.0153	0.1563	0.0000	0.0000
D	139.000	0.00	180.0	0.0	0.0153	0.1563	0.0000	0.0000
D	139.000	0.00	180.0	0.0	0.0169	0.1062	0.0000	0.0000
D	125.500	0.00	180.0	0.0	0.0169	0.1062	0.0000	0.0000
D	125.500	0.00	180.0	0.0	0.0198	0.1273	0.0000	0.0000
D	112.000	0.00	180.0	0.0	0.0198	0.1273	0.0000	0.0000
D	112.000	0.00	180.0	0.0	0.0225	0.1484	0.0000	0.0000

D	98.500	0.00	180.0	0.0	0.0225	0.1484	0.0000	0.0000
D	98.500	0.00	180.0	0.0	0.0243	0.4041	0.0000	0.0000
D	92.750	0.00	180.0	0.0	0.0243	0.4041	0.0000	0.0000
D	92.750	0.00	180.0	0.0	0.0255	0.2629	0.0000	0.0000
D	79.583	0.00	180.0	0.0	0.0255	0.2629	0.0000	0.0000
D	79.583	0.00	180.0	0.0	0.0275	0.2937	0.0000	0.0000
D	66.417	0.00	180.0	0.0	0.0275	0.2937	0.0000	0.0000
D	66.417	0.00	180.0	0.0	0.0292	0.3246	0.0000	0.0000
D	53.250	0.00	180.0	0.0	0.0292	0.3246	0.0000	0.0000
D	53.250	0.00	180.0	0.0	0.0302	0.6936	0.0000	0.0000
D	45.000	0.00	180.0	0.0	0.0302	0.6936	0.0000	0.0000
D	45.000	0.00	180.0	0.0	0.0302	0.3668	0.0000	0.0000
D	33.750	0.00	180.0	0.0	0.0302	0.3668	0.0000	0.0000
D	33.750	0.00	180.0	0.0	0.0302	0.3932	0.0000	0.0000
D	22.500	0.00	180.0	0.0	0.0302	0.3932	0.0000	0.0000
D	22.500	0.00	180.0	0.0	0.0291	0.4197	0.0000	0.0000
D	11.250	0.00	180.0	0.0	0.0291	0.4197	0.0000	0.0000
D	11.250	0.00	180.0	0.0	0.0298	0.4461	0.0000	0.0000
D	0.000	0.00	180.0	0.0	0.0298	0.4461	0.0000	0.0000

ANTENNA LOADING
==========

.....ANTENNA.....			ATTACHMENT		.....ANTENNA FORCES.....			
TYPE	ELEV ft	AZI	RAD ft	AZI	AXIAL kip	SHEAR kip	GRAVITY kip	TORSION ft-kip
HP	133.0	0.0	1.8	0.0	0.41	0.00	0.28	0.00

MAXIMUM POLE DEFORMATIONS CALCULATED(w.r.t. wind direction)
==========

MAST ELEV ft	.....DEFLECTIONS (ft)..... HORIZONTAL ALONG	HORIZONTAL ACROSS	DOWN	.....ROTATIONS (deg)..... TILT ALONG	TILT ACROSS	TWIST
149.0	1.40A	-0.02K	0.02A	1.04A	-0.02K	0.00J
142.5	1.29A	-0.02K	0.02A	1.04A	-0.02K	0.00J
139.0	1.22A	-0.02K	0.02A	1.03A	-0.02K	0.00J
125.5	0.99A	-0.02K	0.01A	0.97A	-0.02K	0.00J
112.0	0.77A	-0.01K	0.01A	0.86A	-0.01K	0.00J
98.5	0.59A	-0.01K	0.01A	0.72A	-0.01K	0.00J
92.7	0.52A	-0.01K	0.01A	0.68A	-0.01K	0.00J
79.6	0.37A	-0.01K	0.00A	0.57A	-0.01K	0.00J
66.4	0.25A	0.00K	0.00A	0.46A	-0.01K	0.00J
53.2	0.16A	0.00K	0.00A	0.36A	-0.01K	0.00J
45.0	0.11A	0.00K	0.00A	0.30A	0.00K	0.00J
33.7	0.06A	0.00K	0.00A	0.22A	0.00K	0.00J
22.5	0.03A	0.00K	0.00A	0.14A	0.00K	0.00J
11.2	0.01A	0.00K	0.00A	0.07A	0.00K	0.00J
0.0	0.00A	0.00A	0.00A	0.00A	0.00A	0.00A

MAXIMUM ANTENNA AND REFLECTOR ROTATIONS
==========

ELEV ft	ANT AZI deg	ANT TYPE	.... BEAM DEFLECTIONS (deg) .... ROLL	YAW	PITCH	TOTAL
133.0	0.0	HP	-0.986 J	0.008 C	1.002 A	1.002 A

MAXIMUM POLE FORCES CALCULATED(w.r.t. to wind direction)

MAST ELEV ft	TOTAL AXIAL kip	SHEAR.w.r.t.WIND.DIR ALONG kip	ACROSS kip	MOMENT.w.r.t.WIND.DIR ALONG ft-kip	ACROSS ft-kip	TORSION ft-kip
149.0	0.38 C	0.37 F	0.00 H	-0.75 I	0.00 H	0.00 H
	4.44 C	2.65 F	0.00 H	-9.61 A	-0.01 H	0.00 K
142.5	4.44 H	2.67 F	-0.01 F	-9.65 L	0.03 E	0.00 K
	5.49 H	3.31 F	-0.01 F	-20.79 F	-0.03 H	0.01 K
139.0	5.49 H	3.31 C	-0.01 B	-20.81 E	0.05 K	0.01 K
	8.77 H	5.68 A	-0.21 K	-81.69 G	-1.53 I	-0.56 J
125.5	8.77 H	5.68 A	-0.21 K	-81.69 G	-1.53 I	-0.56 J
	16.54 H	8.91 A	-0.21 K	-193.11 A	4.14 K	-0.56 J
112.0	16.54 H	8.91 A	-0.21 K	-193.11 A	4.14 K	-0.56 J
	24.90 H	12.66 A	-0.21 K	-351.61 A	7.10 K	-0.56 J
98.5	24.90 H	12.67 A	0.22 C	-351.58 A	7.10 K	-0.56 J
	27.72 H	13.42 A	0.22 C	-428.94 A	8.32 K	-0.56 J
92.7	27.72 H	13.43 A	-0.22 K	-428.91 A	8.33 K	-0.56 J
	32.68 H	15.53 A	-0.22 K	-624.52 A	11.26 K	-0.56 J
79.6	32.68 H	15.52 A	-0.22 K	-624.53 A	11.26 K	-0.56 J
	36.65 H	15.91 A	-0.22 K	-835.51 A	14.23 K	-0.57 J
66.4	36.65 H	15.91 A	-0.22 K	-835.52 A	14.22 K	-0.57 J
	40.92 H	16.30 A	-0.22 K	-1051.21 A	17.20 K	-0.57 J
53.2	40.92 H	16.30 A	-0.22 K	-1051.23 A	17.19 K	-0.57 J
	46.64 H	16.55 A	-0.22 K	-1188.80 A	19.04 K	-0.57 J
45.0	46.64 H	16.56 A	-0.22 K	-1188.81 A	19.04 K	-0.57 J
	50.77 H	16.90 A	-0.22 K	-1379.41 A	21.56 K	-0.57 J
33.7	50.77 H	16.89 A	-0.22 K	-1379.42 A	21.56 K	-0.57 J
	55.19 H	17.23 A	-0.22 K	-1573.17 A	24.06 K	-0.57 J
22.5	55.19 H	17.23 A	-0.22 K	-1573.17 A	24.06 K	-0.57 J
	59.91 H	17.56 A	-0.22 K	-1769.98 A	26.56 K	-0.57 J
11.2	59.91 H	17.55 A	-0.22 K	-1769.99 A	26.56 K	-0.57 J
	64.93 H	17.89 A	-0.22 K	-1969.76 A	29.05 K	-0.57 J
base reaction	64.93 H	-17.89 A	0.22 K	1969.76 A	-29.05 K	0.57 J

COMPLIANCE WITH 4.8.2 & 4.5.4

ELEV ft	AXIAL	BENDING	SHEAR + TORSIONAL	TOTAL	SATISFIED	D/t(w/t)	MAX ALLOWED
149.00							

	0.00C	0.00I	0.00F	0.00I	YES	12.70A	45.2
	0.00C	0.02A	0.00F	0.02A	YES	14.48A	45.2
142.50							
	0.00H	0.01L	0.00F	0.01L	YES	9.07A	45.2
	0.00H	0.02F	0.00F	0.02F	YES	9.71A	45.2
139.00							
	0.00H	0.02E	0.00C	0.02E	YES	9.48A	45.2
	0.00H	0.05G	0.00A	0.06G	YES	11.95A	45.2
125.50							
	0.00H	0.05G	0.00A	0.06G	YES	11.95A	45.2
	0.01H	0.09A	0.01A	0.10A	YES	14.43A	45.2
112.00							
	0.01H	0.09A	0.01A	0.10A	YES	14.43A	45.2
	0.01H	0.13A	0.01A	0.13A	YES	16.90A	45.2
98.50							
	0.00H	0.08A	0.00A	0.09A	YES	10.68A	45.2
	0.01H	0.09A	0.00A	0.10A	YES	11.38A	45.2
92.75							
	0.01H	0.10A	0.00A	0.10A	YES	11.15A	45.2
	0.01H	0.11A	0.01A	0.12A	YES	12.76A	45.2
79.58							
	0.01H	0.11A	0.01A	0.12A	YES	12.76A	45.2
	0.01H	0.12A	0.00A	0.12A	YES	14.37A	45.2
66.42							
	0.01H	0.12A	0.00A	0.12A	YES	14.37A	45.2
	0.01H	0.12A	0.00A	0.13A	YES	15.98A	45.2
53.25							
	0.01H	0.12A	0.00A	0.13A	YES	15.98A	45.2
	0.01H	0.13A	0.00A	0.13A	YES	16.99A	45.2
45.00							
	0.01H	0.13A	0.00A	0.14A	YES	16.64A	45.2
	0.01H	0.13A	0.00A	0.14A	YES	18.01A	45.2
33.75							
	0.01H	0.13A	0.00A	0.14A	YES	18.01A	45.2
	0.01H	0.14A	0.00A	0.14A	YES	19.39A	45.2
22.50							
	0.01H	0.14A	0.00A	0.14A	YES	19.39A	45.2
	0.01H	0.14A	0.00A	0.14A	YES	20.76A	45.2
11.25							
	0.01H	0.14A	0.00A	0.14A	YES	20.76A	45.2
	0.01H	0.14A	0.00J	0.15A	YES	22.14A	45.2
0.00							

MAXIMUM LOADS ONTO FOUNDATION(w.r.t. wind direction)

DOWN	SHEAR.w.r.t.WIND.DIR ALONG	ACROSS	MOMENT.w.r.t.WIND.DIR ALONG	ACROSS	TORSION
kip	kip	kip	ft-kip	ft-kip	ft-kip
64.93	17.89	-0.22	-1969.76	29.05	-0.57
H	A	K	A	K	J

Sabre Industries™
Towers and Poles

SO#: 446974C
Site Name: POR Stinger, OR
Date: 11/15/2019

Round Base Plate and Anchor Rods, per ANSI/TIA 222-G

Pole Data

Diameter:	76.250	in (flat to flat)
Thickness:	0.5625	in
Yield (Fy):	65	ksi
# of Sides:	18	"0" IF Round
Strength (Fu):	80	ksi

Reactions

Moment, Mu:	14082.85	ft-kips
Axial, Pu:	77.89	kips
Shear, Vu:	127.97	kips

Anchor Rod Data

Quantity:	34		
Diameter:	2.25	in	
Rod Material:	A615		
Strength (Fu):	100	ksi	
Yield (Fy):	75	ksi	
BC Diam. (in):	84	BC Override:	

Anchor Rod Results

Maximum Rod (Pu+ Vu/η):	246.5 Kips	
Allowable Φ*Rnt:	260.0 Kips	(per 4.9.9)
Anchor Rod Interaction Ratio:	**94.8%** **Pass**	

Plate Data

Diameter (in):	89.75	Dia. Override:	
Thickness:	2.75	in	
Yield (Fy):	50	ksi	
Eff Width/Rod:	7.12	in	
Drain Hole:	2.625	in. diameter	
Drain Location:	36	in. center of pole to center of drain hole	
Center Hole:	64	in. diameter	

Base Plate Results

Base Plate (Mu/Z):	43.1 ksi	
Allowable Φ*Fy:	45.0 ksi	(per AISC)
Base Plate Interaction Ratio:	**95.9%** **Pass**	

LPile for Windows(Beta), Version 2018-10.009

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method
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Files Used for Analysis

Path to file locations:
\Program Files (x86)\Ensoft\Lpile2018\files\

Name of input data file:
446974B.lp10

Name of output report file:
446974B.lp10

Name of plot output file:
446974B.lp10

Name of runtime message file:
446974B.lp10

Date and Time of Analysis

Date: November 15, 2019 Time: 8:36:19

Problem Title

Site : POR Stinger, OR

Tower : 150' Monopole

Prepared for : VERIZON WIRELESS

Job Number : 446974 Revision B

Engineer : REB

Program Options and Settings

Computational Options:
 - Use unfactored loads in computations (conventional analysis)
Engineering Units Used for Data Input and Computations:
 - US Customary System Units (pounds, feet, inches)

Analysis Control Options:

- Maximum number of iterations allowed	=	999
- Deflection tolerance for convergence	=	1.0000E-05 in
- Maximum allowable deflection	=	100.0000 in
- Number of pile increments	=	100

Loading Type and Number of Cycles of Loading:
 - Static loading specified

 - Use of p-y modification factors for p-y curves not selected
 - Analysis uses layering correction (Method of Georgiadis)
 - No distributed lateral loads are entered
 - Loading by lateral soil movements acting on pile not selected
 - Input of shear resistance at the pile tip not selected
 - Input of moment resistance at the pile tip not selected
 - Computation of pile-head foundation stiffness matrix not selected
 - Push-over analysis of pile not selected
 - Buckling analysis of pile not selected

Output Options:
 - Output files use decimal points to denote decimal symbols.
 - Report only summary tables of pile-head deflection, maximum bending moment, and maximum shear force in output report file.
 - No p-y curves to be computed and reported for user-specified depths
 - Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined	=	1
Total length of pile	=	36.500 ft
Depth of ground surface below top of pile	=	0.5000 ft

Pile diameters used for p-y curve computations are defined using 2 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	108.0000
2	36.500	108.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

Section 1 is a round drilled shaft, bored pile, or CIDH pile

Length of section	=	36.500000 ft
Shaft Diameter	=	108.000000 in
Shear capacity of section	=	0.0000 lbs

Ground Slope and Pile Batter Angles

Ground Slope Angle	=	0.000 degrees
	=	0.000 radians
Pile Batter Angle	=	0.000 degrees
	=	0.000 radians

Soil and Rock Layering Information

The soil profile is modelled using 5 layers

Layer 1 is soft clay, p-y criteria by Matlock, 1970

Distance from top of pile to top of layer	=	0.500000	ft
Distance from top of pile to bottom of layer	=	2.500000	ft
Effective unit weight at top of layer	=	110.000000	pcf
Effective unit weight at bottom of layer	=	110.000000	pcf
Undrained cohesion at top of layer	=	14.400000	psf
Undrained cohesion at bottom of layer	=	14.400000	psf
Epsilon-50 at top of layer	=	0.100000	
Epsilon-50 at bottom of layer	=	0.100000	

Layer 2 is stiff clay without free water

Distance from top of pile to top of layer	=	2.500000	ft
Distance from top of pile to bottom of layer	=	5.500000	ft
Effective unit weight at top of layer	=	110.000000	pcf
Effective unit weight at bottom of layer	=	110.000000	pcf
Undrained cohesion at top of layer	=	500.000000	psf
Undrained cohesion at bottom of layer	=	500.000000	psf
Epsilon-50 at top of layer	=	0.020000	
Epsilon-50 at bottom of layer	=	0.020000	

Layer 3 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	5.500000	ft
Distance from top of pile to bottom of layer	=	15.500000	ft
Effective unit weight at top of layer	=	110.000000	pcf
Effective unit weight at bottom of layer	=	110.000000	pcf
Friction angle at top of layer	=	29.000000	deg.
Friction angle at bottom of layer	=	29.000000	deg.
Subgrade k at top of layer	=	25.000000	pci
Subgrade k at bottom of layer	=	25.000000	pci

Layer 4 is stiff clay without free water

Distance from top of pile to top of layer	=	15.500000	ft
Distance from top of pile to bottom of layer	=	20.500000	ft
Effective unit weight at top of layer	=	110.000000	pcf
Effective unit weight at bottom of layer	=	110.000000	pcf
Undrained cohesion at top of layer	=	1429.	psf
Undrained cohesion at bottom of layer	=	1429.	psf
Epsilon-50 at top of layer	=	0.007000	
Epsilon-50 at bottom of layer	=	0.007000	

Layer 5 is stiff clay without free water

Distance from top of pile to top of layer	=	20.500000	ft
Distance from top of pile to bottom of layer	=	36.500000	ft
Effective unit weight at top of layer	=	110.000000	pcf
Effective unit weight at bottom of layer	=	110.000000	pcf
Undrained cohesion at top of layer	=	5160.	psf
Undrained cohesion at bottom of layer	=	5160.	psf
Epsilon-50 at top of layer	=	0.004000	
Epsilon-50 at bottom of layer	=	0.004000	

(Depth of the lowest soil layer extends 0.000 ft below the pile tip)

Summary of Input Soil Properties

Layer Num.	Soil Type Name (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Undrained Cohesion psf	Angle of Friction deg.	E50 or krm	kpy pci

1	Soft	0.5000	110.0000	14.4000	--	0.10000	--
	Clay	2.5000	110.0000	14.4000	--	0.10000	--
2	Stiff Clay	2.5000	110.0000	500.0000	--	0.02000	--
	w/o Free Water	5.5000	110.0000	500.0000	--	0.02000	--
3	Sand	5.5000	110.0000	--	29.0000	--	25.0000
	(Reese, et al.)	15.5000	110.0000	--	29.0000	--	25.0000
4	Stiff Clay	15.5000	110.0000	1429.	--	0.00700	--
	w/o Free Water	20.5000	110.0000	1429.	--	0.00700	--
5	Stiff Clay	20.5000	110.0000	5160.	--	0.00400	--
	w/o Free Water	36.5000	110.0000	5160.	--	0.00400	--

Static Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 2

Load No.	Load Type	Condition 1		Condition 2		Axial Thrust Force, lbs	Compute Top y vs. Pile Length
1	1	V =	170627. lbs	M =	225325600. in-lbs	103853.	No
2	1	V =	17840. lbs	M =	23568960. in-lbs	64830.	No

V = shear force applied normal to pile axis
M = bending moment applied to pile head
y = lateral deflection normal to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applied to pile head
Values of top y vs. pile lengths can be computed only for load types with specified shear loading (Load Types 1, 2, and 3).
Thrust force is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

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Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 1

Pile Section No. 1:

Dimensions and Properties of Drilled Shaft (Bored Pile):

Length of Section	=	36.500000 ft
Shaft Diameter	=	108.000000 in
Concrete Cover Thickness (to edge of long. rebar)	=	3.625000 in
Number of Reinforcing Bars	=	62 bars
Yield Stress of Reinforcing Bars	=	60000. psi
Modulus of Elasticity of Reinforcing Bars	=	29000000. psi
Gross Area of Shaft	=	9161. sq. in.
Total Area of Reinforcing Steel	=	96.809905 sq. in.
Area Ratio of Steel Reinforcement	=	1.06 percent
Edge-to-Edge Bar Spacing	=	3.621488 in
Maximum Concrete Aggregate Size	=	0.750000 in
Ratio of Bar Spacing to Aggregate Size	=	4.83

Offset of Center of Rebar Cage from Center of Pile = 0.0000 in

Axial Structural Capacities:

Nom. Axial Structural Capacity = 0.85 Fc Ac + Fy As = 40478.678 kips
Tensile Load for Cracking of Concrete = -4314.393 kips
Nominal Axial Tensile Capacity = -5808.594 kips

Reinforcing Bar Dimensions and Positions Used in Computations:

Bar Number	Bar Diam. inches	Bar Area sq. in.	X inches	Y inches
1	1.410000	1.561450	49.670000	0.00000
2	1.410000	1.561450	49.415159	5.025031
3	1.410000	1.561450	48.653252	9.998497
4	1.410000	1.561450	47.392097	14.869366
5	1.410000	1.561450	45.644635	19.587655
6	1.410000	1.561450	43.428796	24.104948
7	1.410000	1.561450	40.767320	28.374892
8	1.410000	1.561450	37.687516	32.353671
9	1.410000	1.561450	34.220987	36.000458
10	1.410000	1.561450	30.403304	39.277831
11	1.410000	1.561450	26.273642	42.152160
12	1.410000	1.561450	21.874378	44.593951
13	1.410000	1.561450	17.250652	46.578148
14	1.410000	1.561450	12.449911	48.084390
15	1.410000	1.561450	7.521418	49.097222
16	1.410000	1.561450	2.515744	49.606249
17	1.410000	1.561450	-2.515744	49.606249
18	1.410000	1.561450	-7.521418	49.097222
19	1.410000	1.561450	-12.449911	48.084390
20	1.410000	1.561450	-17.250652	46.578148
21	1.410000	1.561450	-21.874378	44.593951
22	1.410000	1.561450	-26.273642	42.152160
23	1.410000	1.561450	-30.403304	39.277831
24	1.410000	1.561450	-34.220987	36.000458
25	1.410000	1.561450	-37.687516	32.353671
26	1.410000	1.561450	-40.767320	28.374892
27	1.410000	1.561450	-43.428796	24.104948
28	1.410000	1.561450	-45.644635	19.587655
29	1.410000	1.561450	-47.392097	14.869366
30	1.410000	1.561450	-48.653252	9.998497
31	1.410000	1.561450	-49.415159	5.025031
32	1.410000	1.561450	-49.670000	0.00000
33	1.410000	1.561450	-49.415159	-5.025031
34	1.410000	1.561450	-48.653252	-9.998497
35	1.410000	1.561450	-47.392097	-14.869366
36	1.410000	1.561450	-45.644635	-19.587655
37	1.410000	1.561450	-43.428796	-24.104948
38	1.410000	1.561450	-40.767320	-28.374892
39	1.410000	1.561450	-37.687516	-32.353671
40	1.410000	1.561450	-34.220987	-36.000458
41	1.410000	1.561450	-30.403304	-39.277831
42	1.410000	1.561450	-26.273642	-42.152160
43	1.410000	1.561450	-21.874378	-44.593951
44	1.410000	1.561450	-17.250652	-46.578148
45	1.410000	1.561450	-12.449911	-48.084390
46	1.410000	1.561450	-7.521418	-49.097222
47	1.410000	1.561450	-2.515744	-49.606249
48	1.410000	1.561450	2.515744	-49.606249
49	1.410000	1.561450	7.521418	-49.097222
50	1.410000	1.561450	12.449911	-48.084390
51	1.410000	1.561450	17.250652	-46.578148
52	1.410000	1.561450	21.874378	-44.593951
53	1.410000	1.561450	26.273642	-42.152160
54	1.410000	1.561450	30.403304	-39.277831
55	1.410000	1.561450	34.220987	-36.000458
56	1.410000	1.561450	37.687516	-32.353671
57	1.410000	1.561450	40.767320	-28.374892
58	1.410000	1.561450	43.428796	-24.104948
59	1.410000	1.561450	45.644635	-19.587655
60	1.410000	1.561450	47.392097	-14.869366
61	1.410000	1.561450	48.653252	-9.998497
62	1.410000	1.561450	49.415159	-5.025031

NOTE: The positions of the above rebars were computed by LPile

Minimum spacing between any two bars not equal to zero = 3.621 inches
between bars 41 and 42.

Ratio of bar spacing to maximum aggregate size = 4.83

Concrete Properties:

Compressive Strength of Concrete	=	4500. psi
Modulus of Elasticity of Concrete	=	3823676. psi
Modulus of Rupture of Concrete	=	-503.115295 psi
Compression Strain at Peak Stress	=	0.002001
Tensile Strain at Fracture of Concrete	=	-0.0001152
Maximum Coarse Aggregate Size	=	0.750000 in

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 2

Number	Axial Thrust Force kips
1	64.830
2	103.853

Summary of Results for Nominal (Unfactored) Moment Capacity for Section 1

Moment values interpolated at maximum compressive strain = 0.003
or maximum developed moment if pile fails at smaller strains.

Load No.	Axial Thrust kips	Nominal Mom. Cap. in-kip	Max. Comp. Strain
1	64.830	261712.114	0.00300000
2	103.853	263167.368	0.00300000

Note that the values of moment capacity in the table above are not
factored by a strength reduction factor (phi-factor).

In ACI 318, the value of the strength reduction factor depends on whether
the transverse reinforcing steel bars are tied hoops (0.65) or spirals (0.70).

The above values should be multiplied by the appropriate strength reduction
factor to compute ultimate moment capacity according to ACI 318, Section
9.3.2.2 or the value required by the design standard being followed.

The following table presents factored moment capacities and corresponding
bending stiffnesses computed for common resistance factor values used for
reinforced concrete sections.

Axial Load No.	Resist. Factor for Moment	Nominal Moment Cap in-kips	Ult. (Fac) Ax. Thrust kips	Ult. (Fac) Moment Cap in-kips	Bend. Stiff. at Ult Mom kip-in^2
1	0.65	261712.	42.139500	170113.	6.7830E+09
2	0.65	263167.	67.504667	171059.	6.8242E+09
1	0.70	261712.	45.381000	183198.	6.7607E+09
2	0.70	263167.	72.697333	184217.	6.8001E+09
1	0.75	261712.	48.622500	196284.	6.5378E+09
2	0.75	263167.	77.890000	197376.	6.5800E+09

Layering Correction Equivalent Depths of Soil & Rock Layers

Layer No.	Top of Layer Below Pile Head ft	Equivalent Top Depth Below Grnd Surf ft	Same Layer Type As Layer Above	Layer is Rock or is Below Rock Layer	F0 Integral for Layer lbs	F1 Integral for Layer lbs
1	0.5000	0.00	N.A.	No	0.00	2083.

2	2.5000	0.1532	No	No	2083.	46584.
3	5.5000	3.5289	No	No	48667.	746157.
4	15.5000	15.3773	No	No	794824.	346430.
5	20.5000	7.4756	Yes	No	1141254.	N.A.

Notes: The F0 integral of Layer n+1 equals the sum of the F0 and F1 integrals for Layer n. Layering correction equivalent depths are computed only for soil types with both shallow-depth and deep-depth expressions for peak lateral load transfer. These soil types are soft and stiff clays, non-liquefied sands, and cemented c-phi soil.

Summary of Pile-head Responses for Conventional Analyses

Definitions of Pile-head Loading Conditions:

Load Type 1: Load 1 = Shear, V, lbs, and Load 2 = Moment, M, in-lbs
Load Type 2: Load 1 = Shear, V, lbs, and Load 2 = Slope, S, radians
Load Type 3: Load 1 = Shear, V, lbs, and Load 2 = Rot. Stiffness, R, in-lbs/rad.
Load Type 4: Load 1 = Top Deflection, y, inches, and Load 2 = Moment, M, in-lbs
Load Type 5: Load 1 = Top Deflection, y, inches, and Load 2 = Slope, S, radians

Load Case No.	Load Type 1	Pile-head Load 1	Load Type 2	Pile-head Load 2	Axial Loading lbs	Pile-head Deflection inches	Pile-head Rotation radians	Max Shear in Pile lbs	Max Moment in Pile in-lbs
1	V, lb	170627.	M, in-lb	2.25E+08	103853.	20.6455	-0.07317	-1382170.	2.40E+08
2	V, lb	17840.	M, in-lb	2.36E+07	64830.	0.06435	-3.16E-04	-191498.	2.52E+07

Maximum pile-head deflection = 20.6455032029 inches
Maximum pile-head rotation = -0.0731697072 radians = -4.192315 deg.

The analysis ended normally.

1807.3.2.1 (2009 IBC, 2012 IBC, & 2015 IBC)

Moment (ft·k)	14,082.85	
Shear (k)	127.97	
Caisson diameter (ft)	9	
Caisson height above ground (ft)	0.5	
Caisson height below ground (ft)	36	
Lateral soil pressure (lb/ft^2)	340.00	
Ground to application of force, h (ft)	110.55	
Applied lateral force, P (lb)	127,970	
Lateral soil bearing pressure, S_1 (lb/ft)	4,080.00	
Diameter, b (ft)	9	
A	8.15	$= (2.34P)/(S_1 b)$
Minimum depth of embedment, d (ft)	35.69	$= 0.5A[\,1 + (\,1 + (\,4.36h / A\,)\,)^{1/2}\,]$