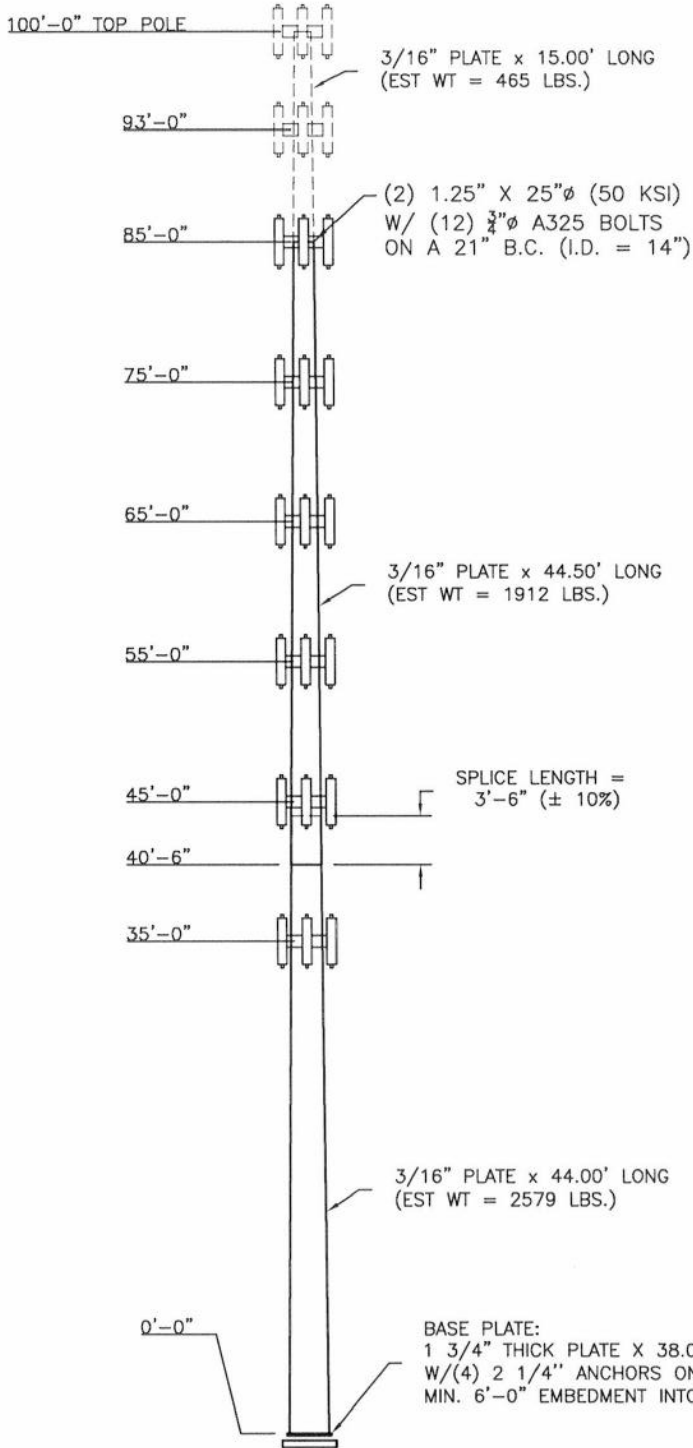


# DaVinci Engineering, Inc.

PO Box 66, Unionville Center, OH 43077  
 PH: 614-937-4922 / FX: 614-413-2887

## LANDA MONOPOLES



### DESIGN CRITERIA PER ANSI/TIA-222-G-2

STRUCTURE CLASS	EXPOSURE CATEGORY	TOPOGRAPHIC CATEGORY	CREST HEIGHT
II	C	1	

DESIGN SPECIFICATIONS:

DESIGNED ACCORDING TO: ANSI/TIA-222-G-2

COMPLIES WITH: 2006 INTERNATIONAL BUILDING CODE

Wind Speed Load Cases: (According to the ANSI/TIA-222-G-2)

LOAD CASE 1: 90 MPH DESIGN WIND SPEED

LOAD CASE 2: 50 MPH OPERATIONAL WIND SPEED

### Pole Steel Specifications:

POLE SHAFT SHAPE: 18-Sided Tapered Polygon  
 POLE SHAFT TAPER: 0.19875 inches/ft.  
 POLE SHAFT STEEL: ASTM A572 GR. 65 (Fy= 65 KSI)  
 BASE PLATE STEEL: ASTM A572 GR. 60 (Fy= 60 KSI)  
 ANCHOR RODS: 2 1/4"Ø 2.25 in. A615 GR. 75 X 7'-0" LONG

### Monopole Base Reactions: (Base Reactions For Foundation Design)

MOMENT:	800 ft-kips
SHEAR:	14.0 kips
AXIAL:	13.0 kips

### Pole Shaft Sections Dimensions:

Bottom ↑ Top	SECTION LENGTH (FT)	WALL THK. (INCHES)	SPLICE LENGTH (FT)	TOP DIA. (INCHES)	BOT. DIA. (INCHES)
	15.00	0.1875	0.00	14.000	16.981
44.50	0.1875	3.50	16.981	25.826	
44.00	0.1875	0.00	24.755	33.500	

ELEVATION	90 MPH WIND SPEED		50 MPH WIND SPEED	
	DEFLECTION	ROTATION	DEFLECTION	ROTATION
100'-0"	74.6"	5.8"	18.5"	1.4"

### Appurtenance List:

Elev.(FT)	Equipment Description:
TOP	LIGHTNING ROD (OPTIONAL)
100.0	(6) 72" X 6" X 3" PANEL
100.0	FLUSH MOUNTS
93.0	(6) 72" X 6" X 3" PANEL
93.0	FLUSH MOUNTS
85.0	(6) 72" X 6" X 3" PANEL
85.0	FLUSH MOUNTS
75.0	(6) 72" X 6" X 3" PANEL
75.0	FLUSH MOUNTS
65.0	(6) 72" X 6" X 3" PANEL
65.0	FLUSH MOUNTS
55.0	(6) 72" X 6" X 3" PANEL
55.0	FLUSH MOUNTS
45.0	(6) 72" X 6" X 3" PANEL
45.0	FLUSH MOUNTS
35.0	(6) 72" X 6" X 3" PANEL
35.0	FLUSH MOUNTS



©Copyright 2010 by DaVinci Engineering, Inc. All Rights Reserved

POLE: 85-FT POLE (FUT. 100-FT)	DATE: 5/17/10
OWNER: USED TOWERS	
SITE NAME: CORRALES	SITE #: ABQ-085
LOCATION: SANDOVAL CO., NM	
CLIENT: TAPP	DESIGN #: TP-8772
REV. #:	REV. DATE:
REV. COMMENT:	
DESIGNED BY: MFP	CHECKED BY:
DAVINCI JOB#: 10235-1244	PAGE 1 OF 2

## POLE ELEVATION

SCALE: NTS

NOTES: STEP BOLTS TO FULL HEIGHT  
 ANTENNA COAX INSIDE POLE SHAFT

# DAVINCI Engineering, Inc.

PO Box 66, Unionville Center, OH 43077  
 PH: 614-937-4922 / FX: 614-413-2887

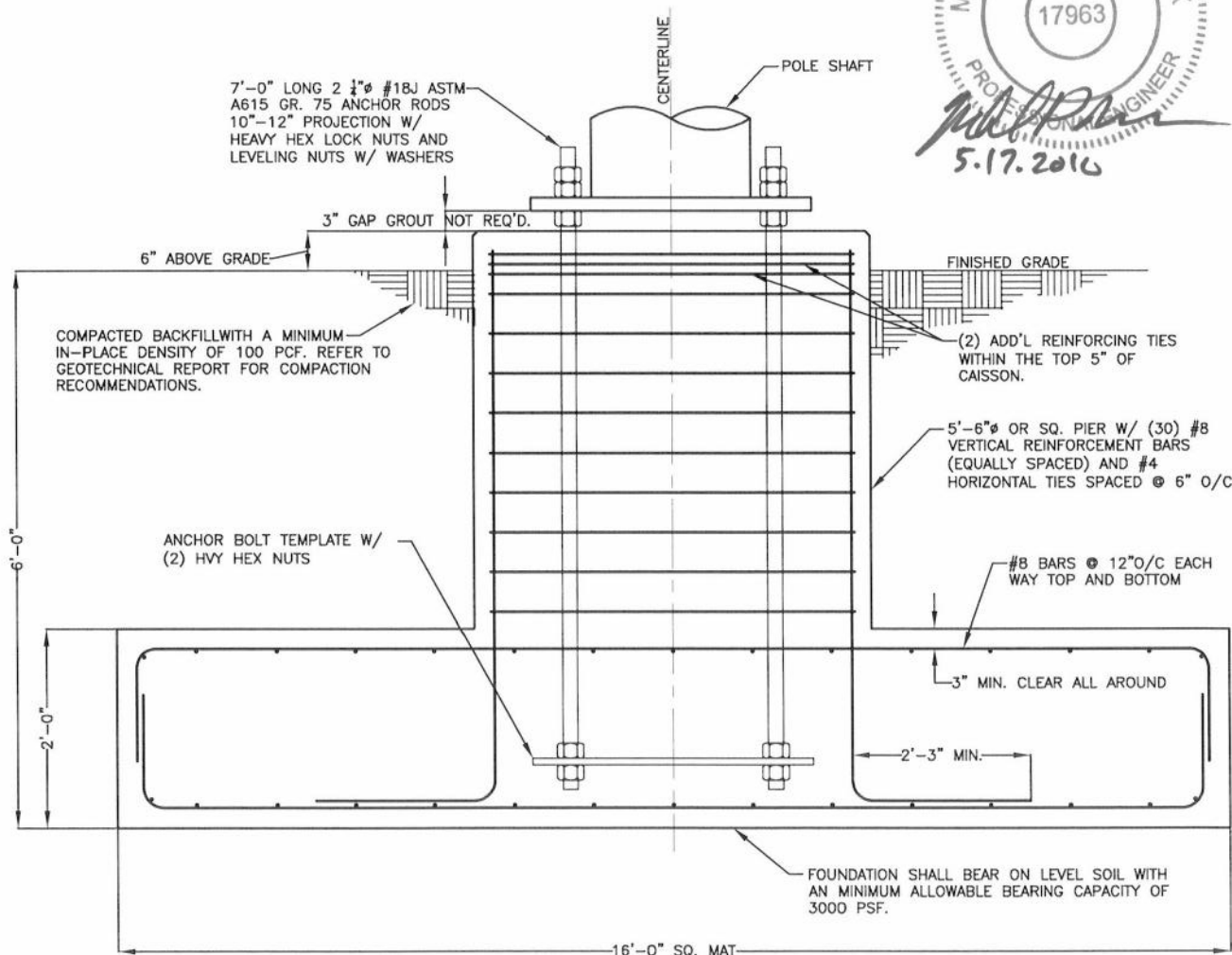
## LANDA MONOPOLES

### FOUNDATION NOTES:

1. THE GEOTECHNICAL ENGINEER (OR THE APPROPRIATE INSPECTOR) SHALL INSPECT THE EXCAVATION PRIOR TO PLACING REINFORCING STEEL OR FORMS. THE GEOTECHNICAL ENGINEER (OR INSPECTOR) SHALL PROVIDE A NOTICE OF INSPECTION FOR THE BUILDING INSPECTOR FOR REVIEW AND RECORDS PURPOSE.
2. THE CONTRACTOR SHALL READ THE GEOTECHNICAL REPORT AND SHALL CONSULT THE GEOTECHNICAL ENGINEER AS NECESSARY PRIOR TO CONSTRUCTION.
3. FOUNDATION DESIGN IS BASED ON GEOTECHNICAL REPORT:  
 BY: VINYARD & ASSOCIATES  
 REPORT NO: 10-1-062  
 DATED: 5-12-2010

### FOUNDATION NOTES (CONT.):

4. ALL FOUNDATION CONCRETE SHALL USE TYPE II CEMENT AND ATTAIN A MINIMUM COMPRESSIVE STRENGTH OF 4000 PSI AT 28 DAYS. CONCRETE SHALL HAVE A MAXIMUM WATER/CEMENT RATIO OF 0.46 AND SHALL BE AIR ENTRAINED 6% ( $\pm 1.5\%$ ). ALL CONCRETE CONSTRUCTION SHALL BE IN ACCORDANCE WITH ACI 318, "THE BUILDING CODE REQUIREMENTS FOR REINFORCED CONCRETE", LATEST EDITION.
5. ALL REINFORCING STEEL SHALL CONFORM TO ASTM A615 VERTICAL BARS SHALL BE GRADE 60, AND TIES OR STIRRUPS SHALL BE A MINIMUM OF GRADE 40. THE PLACEMENT OF ALL REINFORCEMENT SHALL CONFORM TO ACI 315, "MANUAL OF STANDARD PRACTICE FOR DETAILING REINFORCED CONCRETE STRUCTURES", LATEST EDITION, UNLESS OTHERWISE DETAILED ON THIS SHEET.
6. ESTIMATED CONCRETE VOLUME = 24 CUBIC YARDS.
7. THE FOUNDATION HAS BEEN DESIGNED TO RESIST THE FOLLOWING FACTORED LOADS:  
 MOMENT: 800 FT\*KIPS  
 SHEAR: 14 KIPS  
 AXIAL: 13 KIPS



### PAD & PIER FOUNDATION

SCALE: NTS

#### NOTE:

THE GEOTECHNICAL REPORT INDICATES THAT THE SITE MAY BE SUSCEPTIBLE TO LIQUEFACTION DURING A SEISMIC EVENT. WE RECOMMEND THE OWNER AND THE GEOTECHNICAL ENGINEER EVALUATE POTENTIAL RISK OF DIFFERENTIAL SETTLEMENT AS A RESULT OF LIQUEFACTION.

POLE: 85-FT POLE (FUT. 100-FT)	DATE: 5/17/10
OWNER: USED TOWERS	
SITE NAME: CORRALES	SITE #: ABQ-085
LOCATION: SANDOVAL CO., NM	
CLIENT: TAPP	DESIGN #: TP-8772
REV. #:	REV. DATE:
REV. COMMENT:	
DESIGNED BY: MFP	CHECKED BY:
DAVINCI JOB#: 10235-1244	PAGE 2 OF 2

<b>RISATower</b>  <b>DaVinci Engineering, Inc.</b> P.O. Box 66 Unionville Center, OH 43077 Phone: 614-937-4922 FAX:	<b>Job</b> 85-ft Pole (Fut. 100-ft) - DaVinci #10235-1244	<b>Page</b> 1 of 6
	<b>Project</b> Corrales	<b>Date</b> 07:28:42 05/17/10
	<b>Client</b> TAPP (TP-8772)	<b>Designed by</b> Mike P

## Tower Input Data

There is a pole section.

This tower is designed using the TIA-222-G standard.

The following design criteria apply:

Tower is located in Sandoval County, New Mexico.

Basic wind speed of 90 mph.

Structure Class II.

Exposure Category C.

Topographic Category 1.

Crest Height 0.00 ft.

Deflections calculated using a wind speed of 60 mph.

A non-linear (P-delta) analysis was used.

Pressures are calculated at each section.

Stress ratio used in pole design is 1.

Local bending stresses due to climbing loads, feedline supports, and appurtenance mounts are not considered.

## Tapered Pole Section Geometry

Section	Elevation ft	Section Length ft	Splice Length ft	Number of Sides	Top Diameter in	Bottom Diameter in	Wall Thickness in	Bend Radius in	Pole Grade
L1	100.00-85.00	15.00	0.00	18	14.0000	16.9800	0.1875	0.7500	A572-65 (65 ksi)
L2	85.00-40.50	44.50	3.50	18	16.9800	25.8300	0.1875	0.7500	A572-65 (65 ksi)
L3	40.50-0.00	44.00		18	24.7589	33.5000	0.1875	0.7500	A572-65 (65 ksi)

## Tapered Pole Properties

Section	Tip Dia. in	Area in <sup>2</sup>	I in <sup>4</sup>	r in	C in	I/C in <sup>3</sup>	J in <sup>4</sup>	I/Q in <sup>2</sup>	w in	w/t
L1	14.2160	8.2202	198.1356	4.9034	7.1120	27.8593	396.5319	4.1109	2.1340	11.381
	17.2419	9.9936	356.0342	5.9613	8.6258	41.2753	712.5369	4.9978	2.6585	14.179
L2	17.2419	9.9936	356.0342	5.9613	8.6258	41.2753	712.5369	4.9978	2.6585	14.179
	26.2285	15.2605	1267.7299	9.1031	13.1216	96.6137	2537.1279	7.6317	4.2161	22.486
L3	25.8469	14.6231	1115.4166	8.7229	12.5775	88.6832	2232.3009	7.3129	4.0276	21.48
	34.0168	19.8251	2779.5041	11.8259	17.0180	163.3273	5562.6656	9.9144	5.5660	29.685

## Feed Line/Linear Appurtenances - Entered As Area

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Total Number	C <sub>A</sub> A <sub>1</sub> ft <sup>2</sup> /ft	Weight plf
7/8"	C	No	Inside Pole	85.00 - 0.00	12	No Ice	0.33
7/8"	C	No	Inside Pole	75.00 - 0.00	12	No Ice	0.33
7/8"	C	No	Inside Pole	65.00 - 0.00	12	No Ice	0.33
7/8"	C	No	Inside Pole	55.00 - 0.00	12	No Ice	0.33
7/8"	C	No	Inside Pole	45.00 - 0.00	12	No Ice	0.33
7/8"	C	No	Inside Pole	35.00 - 0.00	12	No Ice	0.33
***							
7/8"	C	No	Inside Pole	100.00 - 0.00	12	No Ice	0.33
7/8"	C	No	Inside Pole	93.00 - 0.00	12	No Ice	0.33

<b>RISATower</b>  <b>DaVinci Engineering, Inc.</b> P.O. Box 66 Unionville Center, OH 43077 Phone: 614-937-4922 FAX:	<b>Job</b> 85-ft Pole (Fut. 100-ft) - DaVinci #10235-1244	<b>Page</b> 2 of 6
	<b>Project</b> Corrales	<b>Date</b> 07:28:42 05/17/10
	<b>Client</b> TAPP (TP-8772)	<b>Designed by</b> Mike P

## Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C <sub>A</sub> A <sub>A</sub> Front ft <sup>2</sup>	C <sub>A</sub> A <sub>A</sub> Side ft <sup>2</sup>	Weight K
(2) 72" x 6" x 3" Panel w/ mount pipe	A	From Face	1.00 0.00 0.00	0.0000	85.00	No Ice	4.70	4.38	0.05
(2) 72" x 6" x 3" Panel w/ mount pipe	B	From Face	1.00 0.00 0.00	0.0000	85.00	No Ice	4.70	4.38	0.05
(2) 72" x 6" x 3" Panel w/ mount pipe	C	From Face	1.00 0.00 0.00	0.0000	85.00	No Ice	4.70	4.38	0.05
Flush Mounts ***	C	None		0.0000	85.00	No Ice	2.50	2.50	0.07
(2) 72" x 6" x 3" Panel w/ mount pipe	A	From Face	1.00 0.00 0.00	0.0000	75.00	No Ice	4.70	4.38	0.05
(2) 72" x 6" x 3" Panel w/ mount pipe	B	From Face	1.00 0.00 0.00	0.0000	75.00	No Ice	4.70	4.38	0.05
(2) 72" x 6" x 3" Panel w/ mount pipe	C	From Face	1.00 0.00 0.00	0.0000	75.00	No Ice	4.70	4.38	0.05
Flush Mounts ***	C	None		0.0000	75.00	No Ice	2.50	2.50	0.07
(2) 72" x 6" x 3" Panel w/ mount pipe	A	From Face	1.00 0.00 0.00	0.0000	65.00	No Ice	4.70	4.38	0.05
(2) 72" x 6" x 3" Panel w/ mount pipe	B	From Face	1.00 0.00 0.00	0.0000	65.00	No Ice	4.70	4.38	0.05
(2) 72" x 6" x 3" Panel w/ mount pipe	C	From Face	1.00 0.00 0.00	0.0000	65.00	No Ice	4.70	4.38	0.05
Flush Mounts ***	C	None		0.0000	65.00	No Ice	2.50	2.50	0.07
(2) 72" x 6" x 3" Panel w/ mount pipe	A	From Face	1.00 0.00 0.00	0.0000	55.00	No Ice	4.70	4.38	0.05
(2) 72" x 6" x 3" Panel w/ mount pipe	B	From Face	1.00 0.00 0.00	0.0000	55.00	No Ice	4.70	4.38	0.05
(2) 72" x 6" x 3" Panel w/ mount pipe	C	From Face	1.00 0.00 0.00	0.0000	55.00	No Ice	4.70	4.38	0.05
Flush Mounts ***	C	None		0.0000	55.00	No Ice	2.50	2.50	0.07
(2) 72" x 6" x 3" Panel w/ mount pipe	A	From Face	1.00 0.00 0.00	0.0000	45.00	No Ice	4.70	4.38	0.05
(2) 72" x 6" x 3" Panel w/ mount pipe	B	From Face	1.00 0.00 0.00	0.0000	45.00	No Ice	4.70	4.38	0.05
(2) 72" x 6" x 3" Panel w/ mount pipe	C	From Face	1.00 0.00 0.00	0.0000	45.00	No Ice	4.70	4.38	0.05
Flush Mounts	C	None		0.0000	45.00	No Ice	2.50	2.50	0.07

<b>RISATower</b>  <b>DaVinci Engineering, Inc.</b> P.O. Box 66 Unionville Center, OH 43077 Phone: 614-937-4922 FAX:	<b>Job</b> 85-ft Pole (Fut. 100-ft) - DaVinci #10235-1244	<b>Page</b> 3 of 6
	<b>Project</b> Corrales	<b>Date</b> 07:28:42 05/17/10
	<b>Client</b> TAPP (TP-8772)	<b>Designed by</b> Mike P

Description	Face or Leg	Offset Type	Offsets:			Azimuth Adjustment °	Placement ft	C <sub>A</sub> A <sub>1</sub> Front ft <sup>2</sup>	C <sub>A</sub> A <sub>2</sub> Side ft <sup>2</sup>	Weight K
			Horz Lateral ft	Vert ft	ft					
***										
(2) 72" x 6" x 3" Panel w/ mount pipe	A	From Face	1.00 0.00 0.00		0.0000	35.00	No Ice	4.70	4.38	0.05
(2) 72" x 6" x 3" Panel w/ mount pipe	B	From Face	1.00 0.00 0.00		0.0000	35.00	No Ice	4.70	4.38	0.05
(2) 72" x 6" x 3" Panel w/ mount pipe	C	From Face	1.00 0.00 0.00		0.0000	35.00	No Ice	4.70	4.38	0.05
Flush Mounts	C	None			0.0000	35.00	No Ice	2.50	2.50	0.07
***										
(2) 72" x 6" x 3" Panel w/ mount pipe	A	From Face	1.00 0.00 0.00		0.0000	100.00	No Ice	4.70	4.38	0.05
(2) 72" x 6" x 3" Panel w/ mount pipe	B	From Face	1.00 0.00 0.00		0.0000	100.00	No Ice	4.70	4.38	0.05
(2) 72" x 6" x 3" Panel w/ mount pipe	C	From Face	1.00 0.00 0.00		0.0000	100.00	No Ice	4.70	4.38	0.05
Flush Mounts	C	None			0.0000	100.00	No Ice	2.50	2.50	0.07
***										
(2) 72" x 6" x 3" Panel w/ mount pipe	A	From Face	1.00 0.00 0.00		0.0000	93.00	No Ice	4.70	4.38	0.05
(2) 72" x 6" x 3" Panel w/ mount pipe	B	From Face	1.00 0.00 0.00		0.0000	93.00	No Ice	4.70	4.38	0.05
(2) 72" x 6" x 3" Panel w/ mount pipe	C	From Face	1.00 0.00 0.00		0.0000	93.00	No Ice	4.70	4.38	0.05
Flush Mounts	C	None			0.0000	93.00	No Ice	2.50	2.50	0.07

### Load Combinations

Comb. No.	Description
1	Dead Only
2	1.2 Dead+1.6 Wind 0 deg - No Ice
3	0.9 Dead+1.6 Wind 0 deg - No Ice
4	1.2 Dead+1.6 Wind 90 deg - No Ice
5	0.9 Dead+1.6 Wind 90 deg - No Ice
6	1.2 Dead+1.6 Wind 180 deg - No Ice
7	0.9 Dead+1.6 Wind 180 deg - No Ice
8	Dead+Wind 0 deg - Service
9	Dead+Wind 90 deg - Service
10	Dead+Wind 180 deg - Service

<b>RISATower</b>  <b>DaVinci Engineering, Inc.</b> P.O. Box 66 Unionville Center, OH 43077 Phone: 614-937-4922 FAX:	<b>Job</b> 85-ft Pole (Fut. 100-ft) - DaVinci #10235-1244	<b>Page</b> 4 of 6
	<b>Project</b> Corrales	<b>Date</b> 07:28:42 05/17/10
	<b>Client</b> TAPP (TP-8772)	<b>Designed by</b> Mike P

### Maximum Member Forces

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Axial K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
L1	100 - 85	Pole	Max Tension	6	0.00	0.00	0.00
			Max. Compression	1	-1.31	0.00	0.00
			Max. Mx	4	-1.30	-29.74	0.00
			Max. My	2	-1.30	0.00	29.74
			Max. Vy	4	2.81	-29.74	0.00
			Max. Vx	2	-2.81	0.00	29.74
L2	85 - 40.5	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	4	-6.23	-293.20	0.00
			Max. Mx	4	-6.23	-293.20	0.00
			Max. My	2	-6.23	0.00	293.20
			Max. Vy	4	9.79	-293.20	0.00
			Max. Vx	2	-9.79	0.00	293.20
L3	40.5 - 0	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	4	-12.16	-797.69	0.00
			Max. Mx	4	-12.16	-797.69	0.00
			Max. My	2	-12.16	0.00	797.69
			Max. Vy	4	12.53	-797.69	0.00
			Max. Vx	2	-12.53	0.00	797.69

### Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	100 - 85	18.467	10	1.4236	0.0000
L2	85 - 40.5	14.038	10	1.3810	0.0000
L3	44 - 0	4.117	10	0.8509	0.0000

### Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
100.00	(2) 72" x 6" x 3" Panel w/ mount pipe	10	18.467	1.4236	0.0000	35071
93.00	(2) 72" x 6" x 3" Panel w/ mount pipe	10	16.386	1.4106	0.0000	25051
85.00	(2) 72" x 6" x 3" Panel w/ mount pipe	10	14.038	1.3810	0.0000	11429
75.00	(2) 72" x 6" x 3" Panel w/ mount pipe	10	11.205	1.3041	0.0000	6023
65.00	(2) 72" x 6" x 3" Panel w/ mount pipe	10	8.570	1.1865	0.0000	4056
55.00	(2) 72" x 6" x 3" Panel w/ mount pipe	10	6.232	1.0381	0.0000	3058
45.00	(2) 72" x 6" x 3" Panel w/ mount pipe	10	4.287	0.8686	0.0000	2499
35.00	(2) 72" x 6" x 3" Panel w/ mount pipe	10	2.805	0.6867	0.0000	3024

<b>RISATower</b>  <b>DaVinci Engineering, Inc.</b> P.O. Box 66 Unionville Center, OH 43077 Phone: 614-937-4922 FAX:	<b>Job</b> 85-ft Pole (Fut. 100-ft) - DaVinci #10235-1244	<b>Page</b> 5 of 6
	<b>Project</b> Corrales	<b>Date</b> 07:28:42 05/17/10
	<b>Client</b> TAPP (TP-8772)	<b>Designed by</b> Mike P

### Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	100 - 85	74.617	2	5.7579	0.0000
L2	85 - 40.5	56.731	2	5.5861	0.0000
L3	44 - 0	16.646	2	3.4416	0.0000

### Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
100.00	(2) 72" x 6" x 3" Panel w/ mount pipe	2	74.617	5.7579	0.0000	8874
93.00	(2) 72" x 6" x 3" Panel w/ mount pipe	2	66.214	5.7055	0.0000	6338
85.00	(2) 72" x 6" x 3" Panel w/ mount pipe	2	56.731	5.5861	0.0000	2888
75.00	(2) 72" x 6" x 3" Panel w/ mount pipe	2	45.285	5.2748	0.0000	1513
65.00	(2) 72" x 6" x 3" Panel w/ mount pipe	2	34.642	4.7994	0.0000	1015
55.00	(2) 72" x 6" x 3" Panel w/ mount pipe	2	25.193	4.1992	0.0000	763
45.00	(2) 72" x 6" x 3" Panel w/ mount pipe	2	17.330	3.5134	0.0000	621
35.00	(2) 72" x 6" x 3" Panel w/ mount pipe	2	11.340	2.7776	0.0000	750

### Pole Design Data

Section No.	Elevation ft	Size	L ft	L <sub>u</sub> ft	KI/r	A in <sup>2</sup>	P <sub>u</sub> K	φP <sub>n</sub> K	Ratio P <sub>u</sub> / φP <sub>n</sub>
L1	100 - 85 (1)	TP16.98x14x0.1875	15.00	0.00	0.0	9.9936	-1.30	742.48	0.002
L2	85 - 40.5 (2)	TP25.83x16.98x0.1875	44.50	0.00	0.0	14.8462	-6.23	1011.77	0.006
L3	40.5 - 0 (3)	TP33.5x24.7589x0.1875	44.00	0.00	0.0	19.8251	-12.16	1186.28	0.010

### Pole Bending Design Data

Section No.	Elevation ft	Size	M <sub>ux</sub> kip-ft	φM <sub>ux</sub> kip-ft	Ratio M <sub>ux</sub> / φM <sub>ux</sub>	M <sub>uy</sub> kip-ft	φM <sub>uy</sub> kip-ft	Ratio M <sub>uy</sub> / φM <sub>uy</sub>
L1	100 - 85 (1)	TP16.98x14x0.1875	29.74	255.55	0.116	0.00	255.55	0.000
L2	85 - 40.5 (2)	TP25.83x16.98x0.1875	293.20	519.19	0.565	0.00	519.19	0.000
L3	40.5 - 0 (3)	TP33.5x24.7589x0.1875	797.69	814.42	0.979	0.00	814.42	0.000

<b>RISATower</b>  <b>DaVinci Engineering, Inc.</b> P.O. Box 66 Unionville Center, OH 43077 Phone: 614-937-4922 FAX:	<b>Job</b> 85-ft Pole (Fut. 100-ft) - DaVinci #10235-1244	<b>Page</b> 6 of 6
	<b>Project</b> Corrales	<b>Date</b> 07:28:42 05/17/10
	<b>Client</b> TAPP (TP-8772)	<b>Designed by</b> Mike P

**Pole Shear Design Data**

Section No.	Elevation ft	Size	Actual $V_u$ K	$\phi V_n$ K	Ratio $\frac{V_u}{\phi V_n}$	Actual $T_u$ kip-ft	$\phi T_n$ kip-ft	Ratio $\frac{T_u}{\phi T_n}$
L1	100 - 85 (1)	TP16.98x14x0.1875	2.81	371.24	0.008	0.00	511.72	0.000
L2	85 - 40.5 (2)	TP25.83x16.98x0.1875	9.79	505.88	0.019	0.00	1039.66	0.000
L3	40.5 - 0 (3)	TP33.5x24.7589x0.1875	12.53	593.14	0.021	0.00	1630.83	0.000

**Pole Interaction Design Data**

Section No.	Elevation ft	Ratio $\frac{P_u}{\phi P_n}$	Ratio $\frac{M_{ux}}{\phi M_{nx}}$	Ratio $\frac{M_{uy}}{\phi M_{ny}}$	Ratio $\frac{V_u}{\phi V_n}$	Ratio $\frac{T_u}{\phi T_n}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
L1	100 - 85 (1)	0.002	0.116	0.000	0.008	0.000	0.118	1.000	4.8.2 ✓
L2	85 - 40.5 (2)	0.006	0.565	0.000	0.019	0.000	0.571	1.000	4.8.2 ✓
L3	40.5 - 0 (3)	0.010	0.979	0.000	0.021	0.000	0.990	1.000	4.8.2 ✓

**Section Capacity Table**

Section No.	Elevation ft	Component Type	Size	Critical Element	P K	$\phi P_{allow}$ K	% Capacity	Pass Fail
L1	100 - 85	Pole	TP16.98x14x0.1875	1	-1.30	742.48	11.8	Pass
L2	85 - 40.5	Pole	TP25.83x16.98x0.1875	2	-6.23	1011.77	57.1	Pass
L3	40.5 - 0	Pole	TP33.5x24.7589x0.1875	3	-12.16	1186.28	99.0	Pass ✓
Summary								
Pole (L3)							99.0	Pass
<b>RATING =</b>							<b>99.0</b>	<b>Pass</b>

# Monopole Flange Connection Calculation

ANSI/ TIA-222-G 2005

Factored Connection Reactions:		Pole Shape:	Bolts:	Flange Plate:
Moment:	30 ft-kips	18-Sided	(12) 0.75 dia. A325 Bolts	1.25 in. x 25 in. Round
Shear:	3 kips	Pole Dia. ( $D_p$ ):	On a 21 in Bolt Circle	$f_u = 50$ ksi
Axial:	2 kips	16.98 in		Inner Dia = 14 in

Bolt Calculation TIA 4.9.6.4 (Combined Shear and Tension)

The following Interaction Equation Shall Be Satisfied:

$$\begin{aligned} \phi &= 0.75 \text{ TIA 4.9.9} \\ I_{bolts} &= 661.50 \text{ in}^2 \text{ Moments of Inertia} \\ T_u &= 5.71 \text{ kips Tension Force} \\ P_u &= 5.88 \text{ kips Compressive Force} \\ V_u &= 0.25 \text{ kips Shear Force} \\ \phi R_{nv} &= 15.90 \text{ kips From AISC 7-1} \\ \phi R_{nt} &= 29.80 \text{ kips From AISC 7-2} \end{aligned}$$

$$\left( \frac{V_{ub}}{\phi R_{nv}} \right)^2 + \left( \frac{T_{ub}}{\phi R_{nt}} \right)^2 \leq 1.0$$

$$0.037 < 1.0 \rightarrow \text{OK}$$

Base Plate Calculation According to TIA-222-G

$$\begin{aligned} \phi &= 0.90 \text{ TIA 4.7} \\ M_{pL} &= 11.82 \text{ in-kip Plate Moment} \\ L &= 4.45 \text{ in Section Length} \\ Z &= 1.74 \text{ Plastic Section Modulus} \\ M_p &= 86.83 \text{ in-kip Plastic Moment} \\ \phi M_n &= 78.15 \text{ in-kip Factored Resistance} \end{aligned}$$

Calculated Moment vs Factored Resistance

$$11.82 \text{ in-kip} \leq 78 \text{ in-kip}$$

Anchor Rods Are Adequate	3.7%
Base Plate Is Adequate	15.1%

# Monopole Anchor Rod and Base Plate Calculation

ANSI/ TIA-222-G 2005

## Factored Base Reactions:

Moment: 798 ft-kips  
 Shear: 13 kips  
 Axial: 13 kips

## Pole Shape:

18-Sided  
 Pole Dia. ( $D_f$ ): 33.50 in

## Anchor Rods:

(4) 2.25 in. A615 GR. 75  
 Anchor Rods in Quadrants  
 On a 40.5 in Bolt Circle

## Base Plate:

1.75 in. x 38 in. Square  
 $f_y = 60$  ksi

## Anchor Rod Calculation According to TIA-222-G section 4.9.9

$\phi = 0.80$  TIA 4.9.9  
 $I_{bolts} = 820.13$  in<sup>2</sup> Moment of Inertia  
 $P_u = 236$  kips Tension Force  
 $V_u = 3$  kips Shear Force  
 $R_{nt} = 325.00$  kips Nominal Tensile Strength  
 $\eta = 0.50$  for detail type (a)

The following Interaction Equation Shall Be Satisfied:

$$\left( \frac{P_u + \frac{V_u}{\eta}}{\phi R_{nt}} \right) \leq 1.0$$

$$0.934 \leq 1$$

## Base Plate Calculation According to TIA-222-G

$\phi = 0.90$  TIA 4.7  
 $M_{pL} = 569.27$  in-kip Plate Moment  
 $L = 20.24$  in Section Length  
 $Z = 15,496$  Plastic Section Modulus  
 $M_p = 929.78$  in-kip Plastic Moment  
 $\phi M_n = 836.8$  in-kip Factored Resistance

Calculated Moment vs Factored Resistance

$$569.3 \text{ in-kip} \leq 837 \text{ in-kip}$$

Anchor Rods Are Adequate	93.4%
Base Plate Is Adequate	68.0%

# Monopole Spread Footing Calculation

ANSI/TIA-222-G 2005

Factored Base Reactions:	Footing Dimensions:	Concrete:
Moment: 800 ft-kips *	16 ft x 16 ft *	$f'_c = 4000$ psi
Shear: 14 kips *	x 2 ft thick *	Steel $f_y = 60$ ksi
Axial: 13 kips *	Bearing 6 ft B.G. *	$\phi = 0.75$
Soil Backfill: 100 pcf *	Ultimate Bearing: 3000 psf ( $SF=2.0$ )	Water Table: 6.0

## Foundation Weight

Weight of Pole	13.0 kips
Weight of Concrete	97.219 kips
Weight of Soil	90.3 kips
Buoyancy of Water	0.0 kips
<b>Total</b>	<b>200.5 kips</b>

## Overturning Resistance:

Overturning Moment ( $M_u$ )	891 ft-kips	$800 \text{ ft-kips} + (14 \text{ kips} \times 6.5 \text{ ft})$
Resisting Moment ( $R_s$ )	1604.2 ft-kips	$200.51875 \text{ kips} \times 16 \text{ ft} / 2$
$\phi \times R_s > M_u$	$M_{\text{overturning}} / \phi M_{\text{resist}}$	74.1% OK ✓

## Soil Bearing Pressure:

Eccentricity ( $e$ )	4.44 ft	$891 \text{ ft-kips} / 200.51875 \text{ kips}$
$6(e)$	26.7 ft >	16.0 ft $6e > 16 \text{ ft}$ , the soil pressure will distribution will be triangular
Maximum Soil Bearing	2656.4 psf	Calculated across corners
Soil Overburden	-600 psf	Overburden - Buoyancy
Net Soil Bearing	2056.4 psf	
Resisting Soil Bearing ( $R_s$ )	3000 psf	
Net Soil Bearing < $\phi \times R_s$	Net Bearing / $\phi R_s$	91.4% OK ✓

## Bending Moment in Pier:

Bending Moment	863 ft-kips	$800 \text{ ft-kips} + (14 \text{ kips} \times 4.5 \text{ ft})$
Pier Steel Req'd (Loads)	12.96 in <sup>2</sup>	
Min. Pier Steel	21.78 in <sup>2</sup>	1/2% (Based on Square Pier) → 23.4 in <sup>2</sup> PROVIDED ✓

## Bending Moment in Footing:

Max Bending Moment	433.04 ft-kips	$\Sigma$ Moments about pier face
Footing Steel Req'd (Loads)	0.66 in <sup>2</sup> /ft	→ 0.78 in <sup>2</sup> /ft PROVIDED ✓
Min. Footing Steel	0.52 in <sup>2</sup> /ft	0.18%

Overturning Moment	74.1%
Soil Bearing Pressure	91.4%