



PROJECT : LIGHTING POLE
POLE TYPE : PADO -80/0
DATE : 07/11/2013

POLYGONAL STEEL POLE DESIGN

DESIGN



CUSTOMER

PADO 80/0 8m LIGHTING POLE DESIGN CALCULATIONS



DESIGN

	PREPARED BY	CHECKED BY	DATE
LOAD CALCULATION	M.H.SAHIN(CE)	K.CANBALOGLU(CE)	07/11/2013
STATIC ANALYSIS	M.H.SAHIN(CE)	K.CANBALOGLU(CE)	07/11/2013
DRAWINGS	M.H.SAHIN(CE)	K.CANBALOGLU(CE)	07/11/2013
PRESENTATION	M.H.SAHIN(CE)	K.CANBALOGLU(CE)	07/11/2013
APPROVED		K.CANBALOGLU(CE)	07/11/2013

REVISIONS

NO	REVISION	DONE BY	CHECKED BY	DATE	APPROVED BY
0	Rev 0	M.H.SAHIN(CE)	K.CANBALOGLU(CE)	07/11/2013	
1					
2					
3					
4					



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CONTENT

1. TECHNICAL DATA

2. STATIC ANALYSIS



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TECHNICAL DATA

MATERIAL	S235JR
IN ACCORDANCE WITH EN 10025	
MATERIAL YIELD STRESS	235 N/mm²
ALLOWABLE YIELD STRESS	141 N/mm²
DESIGN STANDARD:	ASCE Manual No 72
POLE DIMENSIONS:	
TOP DIAMETER:	70mm
BOTTOM DIAMETER:	209mm
POLYGONAL SECTION:	8-SIDED
LENGTH & THICKNESS OF POLE SHAFTS	8000mm / 3mm
LOADS & WIND AREA :	
DESIGN WIND SPEED - V_u:	130 km/h
LUMINAIRE WINDAGE AREA :	0.2 m²



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STATIC ANALYSIS

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*
*                               PLS-POLE                               *
*                               POLE AND FRAME ANALYSIS AND DESIGN      *
*                               Copyright Power Line Systems, Inc. 1999-2011 *
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Project Name : PADO 80/0
 Project Notes:
 Project File : D:\
 Date run : 16:31:29 Thursday, November 07, 2013
 by : PLS-POLE Version 12.50
 Licensed to : MITAS Engineering - Turkey

Successfully performed nonlinear analysis

The model has 0 warnings.



Modeling options:

- Offset Arms from Pole/Mast: Yes
- Offset Braces from Pole/Mast: Yes
- Offset Guys from Pole/Mast: Yes
- Offset Posts from Pole/Mast: Yes
- Offset Strains from Pole/Mast: Yes
- Use Alternate Convergence Process: No
- Steel poles checked with RTE/ASCE Manual 72

Default Modulus of Elasticity for Steel = 199947.60 (MPa)
 Default Weight Density for Steel = 76972.84 (N/m^3)

Steel Pole Properties:

Steel Pole Property Label	Stock Length (m)	Default Embedded Length (m)	Base Plate	Shape	Tip Diameter (mm)	Base Diameter (mm)	Taper (mm/m)	Default Drag Coef.	Tubes	Modulus of Elasticity (MPa)	Weight Density (N/m^3)	Shape At Base	Strength Check Type	Distance From Tip (m)	Ultimate Trans. Load (kN)	Ultimate Long. Load (kN)
PADO 80/0	8.00	0	No	8F	70	209	0	1	1 tube	0	0		Calculated	0.000	0.0000	0.0000

Steel Tubes Properties:

Pole Property No.	Tube Length (m)	Thickness (cm)	Lap Length (m)	Lap Factor	Lap Gap (mm)	Yield Stress (MPa)	Moment Cap. (kN-m)	Tube Weight (N)	Center of Gravity (m)	Calculated Taper (mm/m)	Tube Top Diameter (cm)	Tube Bot. Diameter (cm)	1.5x Diam. Lap (m)	Actual Length Overlap (m)	
PADO 80/0	1	8	0.3	0.000	0.000	0.000	141.000	0.000	857	4.79	20.75000	6.00	22.60	0.000	0.000

Steel Pole Connectivity:

Pole Label	Tip Joint	Base X of Base (m)	Y of Base (m)	Z of Base (m)	Inclin. About X (deg)	Inclin. About Y (deg)	Property Set	Attach. Labels	Base Connect	Embed % Override	Embed C. Override (m)
Pole		0	0	0	0	0	PADO 80/0	8 labels		0.00	0

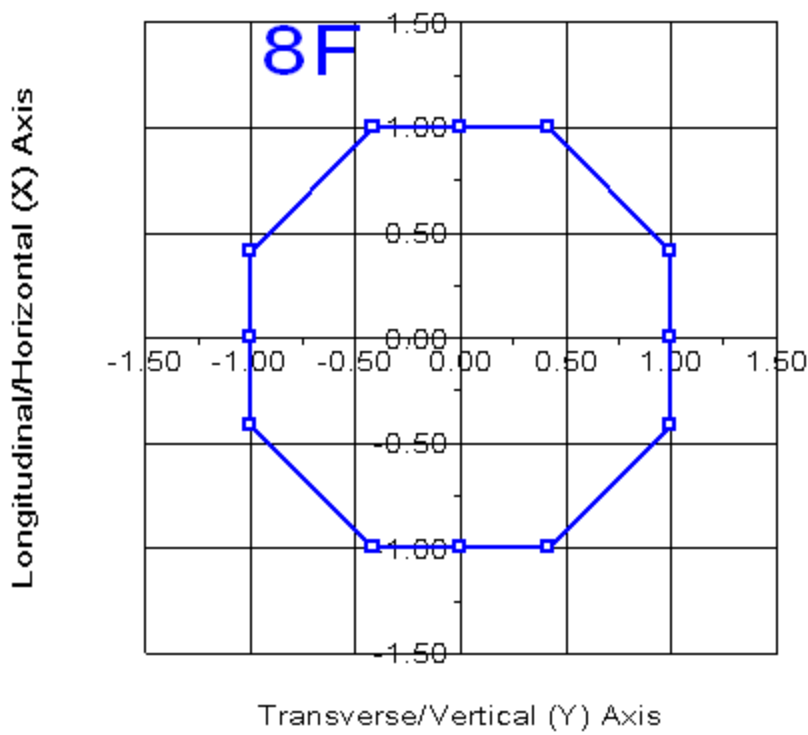


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STATIC ANALYSIS

Relative Attachment Labels for Steel Pole "Pole":

Joint Label	Distance From Origin/Top Joint (m)	Global Z of Attach (m)
Pole:8	7.50	0.00
Pole:7	6.50	0.00
Pole:6	5.50	0.00
Pole:5	4.37	0.00
Pole:4	3.37	0.00
Pole:3	2.50	0.00
Pole:2	1.50	0.00
Pole:1	0.50	0.00



Pole Steel Properties:

Element Label	Joint Label	Joint Position	Rel. Dist. (m)	Outer Diam. (cm)	Area (cm ²)	T-Moment Inertia (cm ⁴)	L-Moment Inertia (cm ⁴)	D/t	W/t Max.	Fy (MPa)	Fa Min. (MPa)	T-Moment Capacity (kN-m)	L-Moment Capacity (kN-m)
Pole	Pole:t	Pole:t Ori	0.00	6.00	5.67	24.40	24.40	0.00	4.1	141.00	141.00	1.15	1.15
Pole	Pole:1	Pole:1 End	0.50	7.04	6.70	40.26	40.26	0.00	5.6	141.00	141.00	1.61	1.61
Pole	Pole:1	Pole:1 Ori	0.50	7.04	6.70	40.26	40.26	0.00	5.6	141.00	141.00	1.61	1.61
Pole	Pole:2	Pole:2 End	1.50	9.11	8.76	90.01	90.01	0.00	8.4	141.00	141.00	2.79	2.79
Pole	Pole:2	Pole:2 Ori	1.50	9.11	8.76	90.01	90.01	0.00	8.4	141.00	141.00	2.79	2.79
Pole	Pole:3	Pole:3 End	2.50	11.19	10.82	169.67	169.67	0.00	11.3	141.00	141.00	4.28	4.28
Pole	Pole:3	Pole:3 Ori	2.50	11.19	10.82	169.67	169.67	0.00	11.3	141.00	141.00	4.28	4.28
Pole	Pole:4	Pole:4 End	3.37	12.98	12.61	268.13	268.13	0.00	13.8	141.00	141.00	5.82	5.82
Pole	Pole:4	Pole:4 Ori	3.37	12.98	12.61	268.13	268.13	0.00	13.8	141.00	141.00	5.82	5.82
Pole	Pole:5	Pole:5 End	4.37	15.06	14.67	422.38	422.38	0.00	16.6	141.00	141.00	7.91	7.91
Pole	Pole:5	Pole:5 Ori	4.37	15.06	14.67	422.38	422.38	0.00	16.6	141.00	141.00	7.91	7.91
Pole	#Pole:0	Tube 1 End	4.93	16.23	15.84	531.74	531.74	0.00	18.3	141.00	141.00	9.24	9.24
Pole	#Pole:0	Tube 1 Ori	4.93	16.23	15.84	531.74	531.74	0.00	18.3	141.00	141.00	9.24	9.24
Pole	Pole:6	Pole:6 End	5.50	17.41	17.01	658.52	658.52	0.00	19.9	141.00	141.00	10.66	10.66
Pole	Pole:6	Pole:6 Ori	5.50	17.41	17.01	658.52	658.52	0.00	19.9	141.00	141.00	10.66	10.66
Pole	Pole:7	Pole:7 End	6.50	19.49	19.07	928.24	928.24	0.00	22.8	141.00	141.00	13.43	13.43
Pole	Pole:7	Pole:7 Ori	6.50	19.49	19.07	928.24	928.24	0.00	22.8	141.00	141.00	13.43	13.43
Pole	Pole:8	Pole:8 End	7.50	21.56	21.14	1263.07	1263.07	0.00	25.6	141.00	141.00	16.52	16.52
Pole	Pole:8	Pole:8 Ori	7.50	21.56	21.14	1263.07	1263.07	0.00	25.6	141.00	141.00	16.52	16.52
Pole	Pole:g	Pole:g End	8.00	22.60	22.17	1457.10	1457.10	0.00	27.1	141.00	141.00	18.18	18.18

*** Insulator Data

Clamp Properties:

Label	Stock Number	Holding Capacity (N)
clamp		1e+012



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STATIC ANALYSIS

*** Loads Data

Insulator dead and wind loads are already included in the point loads printed below.

Loading Method Parameters:

Structure Height Summary (used for calculating wind/ice adjust with height):

Z of ground for wind height adjust 0.00 (m) and structure Z coordinate that will be put on the centerline ground profile in PLS-CADD.
 Ground elevation shift 0.00 (m)
 Z of ground with shift 0.00 (m)
 Z of structure top (highest joint) 8.00 (m)
 Structure height 8.00 (m)
 Structure height above ground 8.00 (m)

Vector Load Cases:

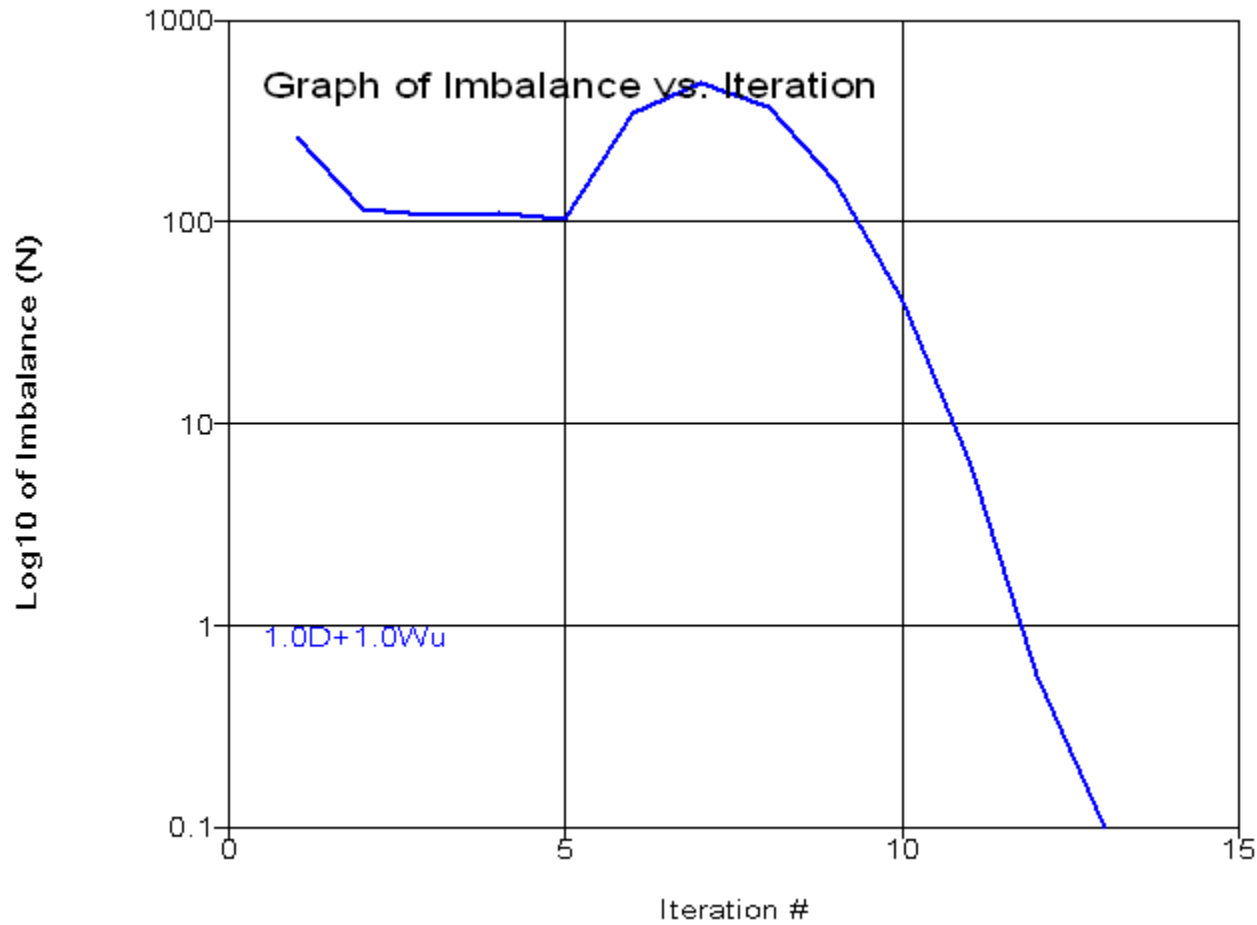
Load Case Description	Dead Load Factor	Wind Area Factor	SF for Steel Poles and Towers	SF for Wood Poles	SF for Conc. Ult.	SF for Conc. First Crack	SF for Conc. Zero Tens.	SF for Guys and Cables	SF for Non Braces	SF for Insuls.	SF For Found.	Point Loads	Wind/Ice Model	Trans. Wind Pressure (Pa)	Longit. Wind Pressure (Pa)	Ice Wind Thick. (cm)	Ice Density (N/m ³)	Ice Temperature (deg C)	Pole Deflection Check	Pole Deflection Limit % or (m)
1.0D+1.0Wu	1.0000	1.0000	1.00000	1.0000	1.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	1 load	Wind on All	800	0	0.000	0.000	0.0	No Limit	0

Point Loads for Load Case "1.0D+1.0Wu":

Joint Label	Vertical Load (N)	Transverse Load (N)	Longitudinal Load (N)	Load Comment
Pole:t	250	160	0	

*** Analysis Results:

Maximum element usage is 23.86% for Steel Pole "Pole" in load case "1.0D+1.0Wu"
 Maximum insulator usage is 0.00% for Clamp "Lum" in load case "1.0D+1.0Wu"





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STATIC ANALYSIS

*** Analysis Results for Load Case No. 1 "1.0D+1.0Wu" - Number of iterations in SAPS 13

Equilibrium Joint Positions and Rotations for Load Case "1.0D+1.0Wu":

Joint Label	X-Displ (m)	Y-Displ (m)	Z-Displ (m)	X-Rot (deg)	Y-Rot (deg)	Z-Rot (deg)	X-Pos (m)	Y-Pos (m)	Z-Pos (m)
Pole:g	0	0	0	0.0000	0.0000	0.0000	0	0	0
Pole:t	0.0001733	0.05126	-0.0002383	-0.7148	0.0020	0.0000	0.0001733	0.05126	8
Pole:1	0.0001557	0.04508	-0.000199	-0.6953	0.0020	0.0000	0.0001557	0.04508	7.5
Pole:2	0.0001214	0.03356	-0.0001308	-0.6077	0.0019	0.0000	0.0001214	0.03356	6.5
Pole:3	8.949e-005	0.02374	-8.063e-005	-0.5068	0.0017	0.0000	8.949e-005	0.02374	5.5
Pole:4	6.494e-005	0.01669	-5.028e-005	-0.4199	0.0015	0.0000	6.494e-005	0.01669	4.635
Pole:5	4.077e-005	0.01015	-2.689e-005	-0.3229	0.0012	0.0000	4.077e-005	0.01015	3.635
Pole:6	1.98e-005	0.004782	-1.171e-005	-0.2174	0.0009	0.0000	1.98e-005	0.004782	2.5
Pole:7	7.291e-006	0.00172	-4.802e-006	-0.1283	0.0005	0.0000	7.291e-006	0.00172	1.5
Pole:8	8.288e-007	0.0001911	-1.272e-006	-0.0422	0.0002	0.0000	8.288e-007	0.0001911	0.5

Joint Support Reactions for Load Case "1.0D+1.0Wu":

Joint Label	X Force (kN)	X Usage %	Y Force (kN)	Y Usage %	H-Shear Usage %	Z Comp. Force (kN)	Z Usage %	Uplift Usage %	Result. Force (kN)	Result. Usage %	X Moment (kN-m)	X-M. Usage %	Y Moment (kN-m)	Y-M. Usage %	H-Bend-M Usage %	Z Moment (kN-m)	Z-M. Usage %	Max. Usage %
Pole:g	-0.01	0.0	-1.07	0.0	0.0	-1.11	0.0	0.0	1.55	0.0	4.26	0.0	-0.0	0.0	0.0	0.00	0.0	0.0

Detailed Steel Pole Usages for Load Case "1.0D+1.0Wu":

Element Label	Joint Label	Joint Position	Rel. Dist. (m)	Trans. Defl. (cm)	Long. Defl. (cm)	Vert. Defl. (cm)	Trans. Mom. (Local Mx) (kN-m)	Long. Mom. (Local My) (kN-m)	Tors. Mom. (kN-m)	Axial Force (kN)	Tran. Shear (kN)	Long. Shear (kN)	P/A (MPa)	M/S. (MPa)	V/Q. (MPa)	T/R. (MPa)	Res. (MPa)	Max. Usage %	At Usage Pt.
Pole	Pole:t	Origin	0.00	5.13	0.02	-0.02	-0.00	0.00	-0.0	-0.26	0.18	-0.00	-0.46	0.00	0.62	0.00	1.17	0.8	2
Pole	Pole:1	End	0.50	4.51	0.02	-0.02	0.09	-0.00	-0.0	-0.26	0.18	-0.00	-0.39	7.70	0.53	0.00	8.14	5.8	2
Pole	Pole:1	Origin	0.50	4.51	0.02	-0.02	0.09	-0.00	0.0	-0.30	0.22	-0.00	-0.45	7.70	0.66	0.00	8.23	5.8	2
Pole	Pole:2	End	1.50	3.36	0.01	-0.01	0.31	-0.00	0.0	-0.30	0.22	-0.00	-0.34	15.69	0.51	0.00	16.06	11.4	2
Pole	Pole:2	Origin	1.50	3.36	0.01	-0.01	0.31	-0.00	0.0	-0.37	0.29	-0.00	-0.42	15.69	0.67	0.00	16.16	11.5	2
Pole	Pole:3	End	2.50	2.37	0.01	-0.01	0.60	-0.00	0.0	-0.37	0.29	-0.00	-0.34	19.95	0.54	0.00	20.31	14.4	2
Pole	Pole:3	Origin	2.50	2.37	0.01	-0.01	0.60	-0.00	0.0	-0.45	0.38	-0.00	-0.41	19.95	0.70	0.00	20.40	14.5	2
Pole	Pole:4	End	3.37	1.67	0.01	-0.01	0.93	-0.00	0.0	-0.45	0.38	-0.00	-0.35	22.56	0.60	0.00	22.94	16.3	2
Pole	Pole:4	Origin	3.37	1.67	0.01	-0.01	0.93	-0.00	0.0	-0.54	0.47	-0.00	-0.43	22.56	0.75	0.00	23.02	16.3	2
Pole	Pole:5	End	4.37	1.02	0.00	-0.00	1.41	-0.00	0.0	-0.54	0.47	-0.00	-0.37	25.09	0.65	0.00	25.48	18.1	2
Pole	Pole:5	Origin	4.37	1.02	0.00	-0.00	1.41	-0.00	0.0	-0.63	0.57	-0.00	-0.43	25.09	0.77	0.00	25.55	18.1	2
Pole	Tube 1	End	4.93	0.72	0.00	-0.00	1.73	-0.01	0.0	-0.63	0.57	-0.00	-0.39	26.40	0.71	0.00	26.82	19.0	2
Pole	Tube 1	Origin	4.93	0.72	0.00	-0.00	1.73	-0.01	0.0	-0.70	0.64	-0.00	-0.44	26.40	0.81	0.00	26.88	19.1	2
Pole	Pole:6	End	5.50	0.48	0.00	-0.00	2.09	-0.01	0.0	-0.70	0.64	-0.00	-0.41	27.67	0.75	0.00	28.11	19.9	2
Pole	Pole:6	Origin	5.50	0.48	0.00	-0.00	2.09	-0.01	0.0	-0.80	0.75	-0.00	-0.47	27.67	0.88	0.00	28.19	20.0	2
Pole	Pole:7	End	6.50	0.17	0.00	-0.00	2.84	-0.01	0.0	-0.80	0.75	-0.00	-0.42	29.87	0.79	0.00	30.32	21.5	2
Pole	Pole:7	Origin	6.50	0.17	0.00	-0.00	2.84	-0.01	0.0	-0.95	0.91	-0.00	-0.50	29.87	0.95	0.00	30.41	21.6	2
Pole	Pole:8	End	7.50	0.02	0.00	-0.00	3.75	-0.02	0.0	-0.95	0.91	-0.00	-0.45	32.04	0.86	0.00	32.52	23.1	2
Pole	Pole:8	Origin	7.50	0.02	0.00	-0.00	3.75	-0.02	0.0	-1.07	1.03	-0.01	-0.51	32.04	0.98	0.00	32.59	23.1	2
Pole	Pole:g	End	8.00	0.00	0.00	0.00	4.26	-0.02	0.0	-1.07	1.03	-0.01	-0.48	33.12	0.93	0.00	33.64	23.9	2

Summary of Clamp Capacities and Usages for Load Case "1.0D+1.0Wu":

Clamp Label	Clamp Force (kN)	Input Holding Capacity (kN)	Factored Holding Capacity (kN)	Usage %
Lum	0.297	1000000000.00	1000000000.00	0.00
1	0.000	1000000000.00	1000000000.00	0.00
2	0.000	1000000000.00	1000000000.00	0.00
3	0.000	1000000000.00	1000000000.00	0.00
4	0.000	1000000000.00	1000000000.00	0.00
5	0.000	1000000000.00	1000000000.00	0.00
6	0.000	1000000000.00	1000000000.00	0.00
7	0.000	1000000000.00	1000000000.00	0.00
8	0.000	1000000000.00	1000000000.00	0.00



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STATIC ANALYSIS

*** Overall summary for all load cases - Usage = Maximum Stress / Allowable Stress

Summary of Steel Pole Usages:

Steel Pole Label	Maximum Usage %	Load Case	Segment Number	Weight (N)
Pole	23.86	1.0D+1.0Wu	10	857.0

*** Maximum Stress Summary for Each Load Case

Summary of Maximum Usages by Load Case:

Load Case	Maximum Usage %	Element Label	Element Type
1.0D+1.0Wu	23.86	Pole	Steel Pole

Summary of Steel Pole Usages by Load Case:

Load Case	Maximum Usage %	Steel Pole Label	Segment Number
1.0D+1.0Wu	23.86	Pole	10

Summary of Insulator Usages:

Insulator Label	Insulator Type	Maximum Usage %	Load Case	Weight (N)
Lum	Clamp	0.00	1.0D+1.0Wu	0.0
1	Clamp	0.00	1.0D+1.0Wu	0.0
2	Clamp	0.00	1.0D+1.0Wu	0.0
3	Clamp	0.00	1.0D+1.0Wu	0.0
4	Clamp	0.00	1.0D+1.0Wu	0.0
5	Clamp	0.00	1.0D+1.0Wu	0.0
6	Clamp	0.00	1.0D+1.0Wu	0.0
7	Clamp	0.00	1.0D+1.0Wu	0.0
8	Clamp	0.00	1.0D+1.0Wu	0.0

Loads At Insulator Attachments For All Load Cases:

Load Case	Insulator Label	Insulator Type	Structure Attach Label	Structure Attach Load X (kN)	Structure Attach Load Y (kN)	Structure Attach Load Z (kN)	Structure Attach Load Res. (kN)
1.0D+1.0Wu	Lum	Clamp	Pole:t	0.000	0.160	0.250	0.297
1.0D+1.0Wu	1	Clamp	Pole:1	0.000	0.000	-0.000	0.000
1.0D+1.0Wu	2	Clamp	Pole:2	0.000	0.000	-0.000	0.000
1.0D+1.0Wu	3	Clamp	Pole:3	0.000	0.000	-0.000	0.000
1.0D+1.0Wu	4	Clamp	Pole:4	0.000	0.000	-0.000	0.000
1.0D+1.0Wu	5	Clamp	Pole:5	0.000	0.000	-0.000	0.000
1.0D+1.0Wu	6	Clamp	Pole:6	0.000	0.000	-0.000	0.000
1.0D+1.0Wu	7	Clamp	Pole:7	0.000	0.000	-0.000	0.000
1.0D+1.0Wu	8	Clamp	Pole:8	0.000	0.000	-0.000	0.000

Overturning Moments For User Input Concentrated Loads:

Moments are static equivalents based on central axis of 0,0 (i.e. a single pole).

Load Case	Total Tran. Load (kN)	Total Long. Load (kN)	Total Vert. Load (kN)	Transverse Overturning Moment (kN-m)	Longitudinal Overturning Moment (kN-m)	Torsional Moment (kN-m)
1.0D+1.0Wu	0.160	0.000	0.250	1.280	0.000	0.000

*** Weight of structure (N):
 Weight of Steel Poles: 857.0
 Total: 857.0

*** End of Report