2019 PLS-CADD Advanced Training and User Group

PLS-CADD & PLS-POLE Integration with ikeGPS

by

Ali Khavari

Power Line Reporting

https://powerlinereporting.com/ike

Meet the IKE

https://youtu.be/dwPhreVE5LU

How Accurate Is It?

Attachment Heights

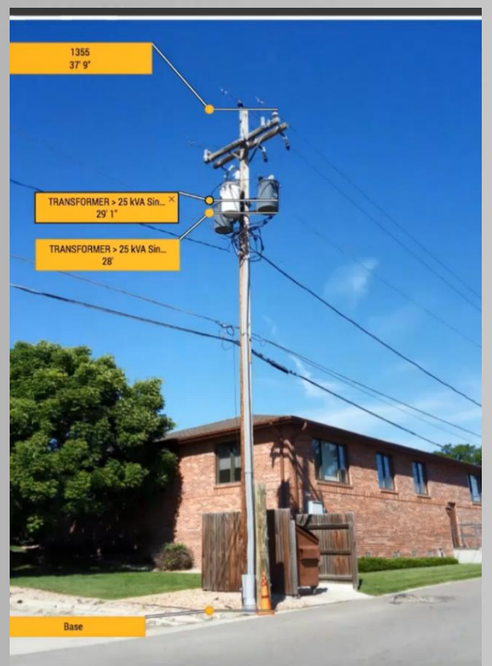
- **1 in on a 40 ft Pole**

Spans, Anchors, Poles, Wire Sag

- **1% of Target Distance**

GPS

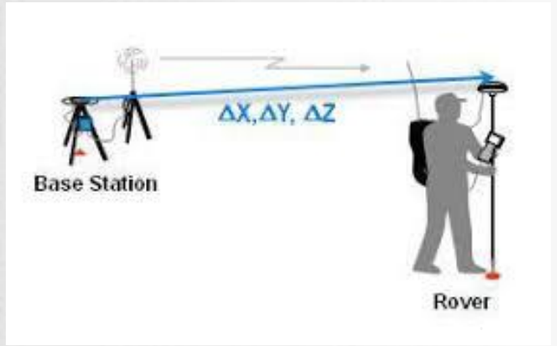
- Horizontal Accuracy: **1-4 m**
- Vertical Accuracy: **3-12 m**



IKE 4+ (RTK Enabled)

- **GPS** - Structure Base, Survey Points
  - Horizontal Accuracy: **2-4 cm**
  - Vertical Accuracy: **10 cm**

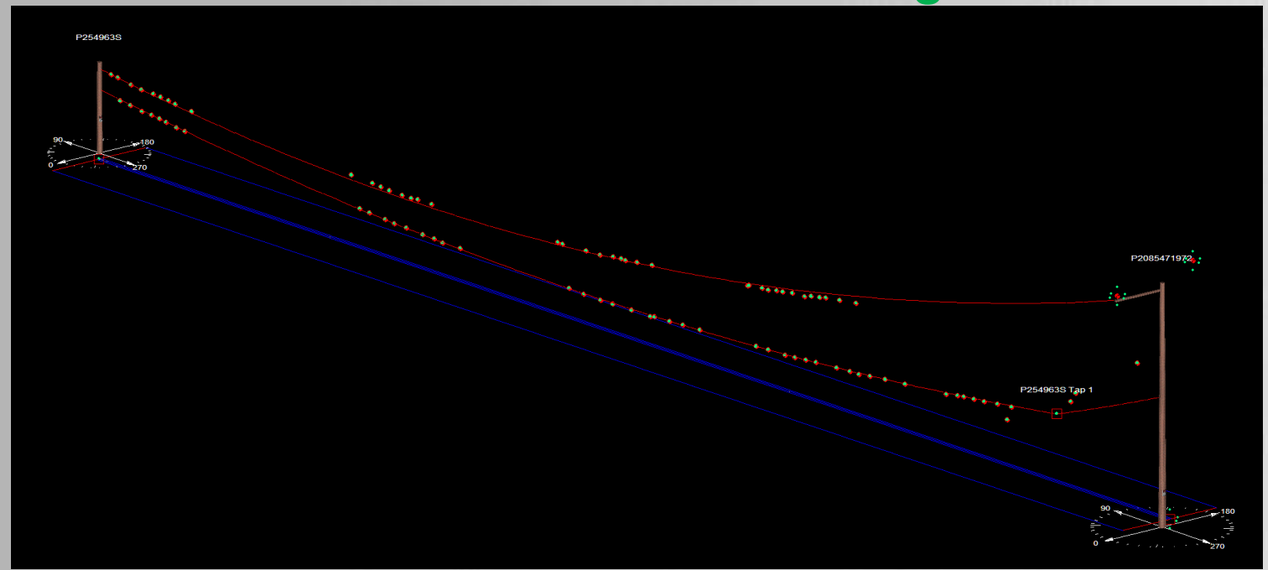
- **'Point and Shoot' Survey Points**
  - Vertical Accuracy: **0.5% Target Distance**
  - Horizontal Accuracy: **0.5-20% Target Distance**

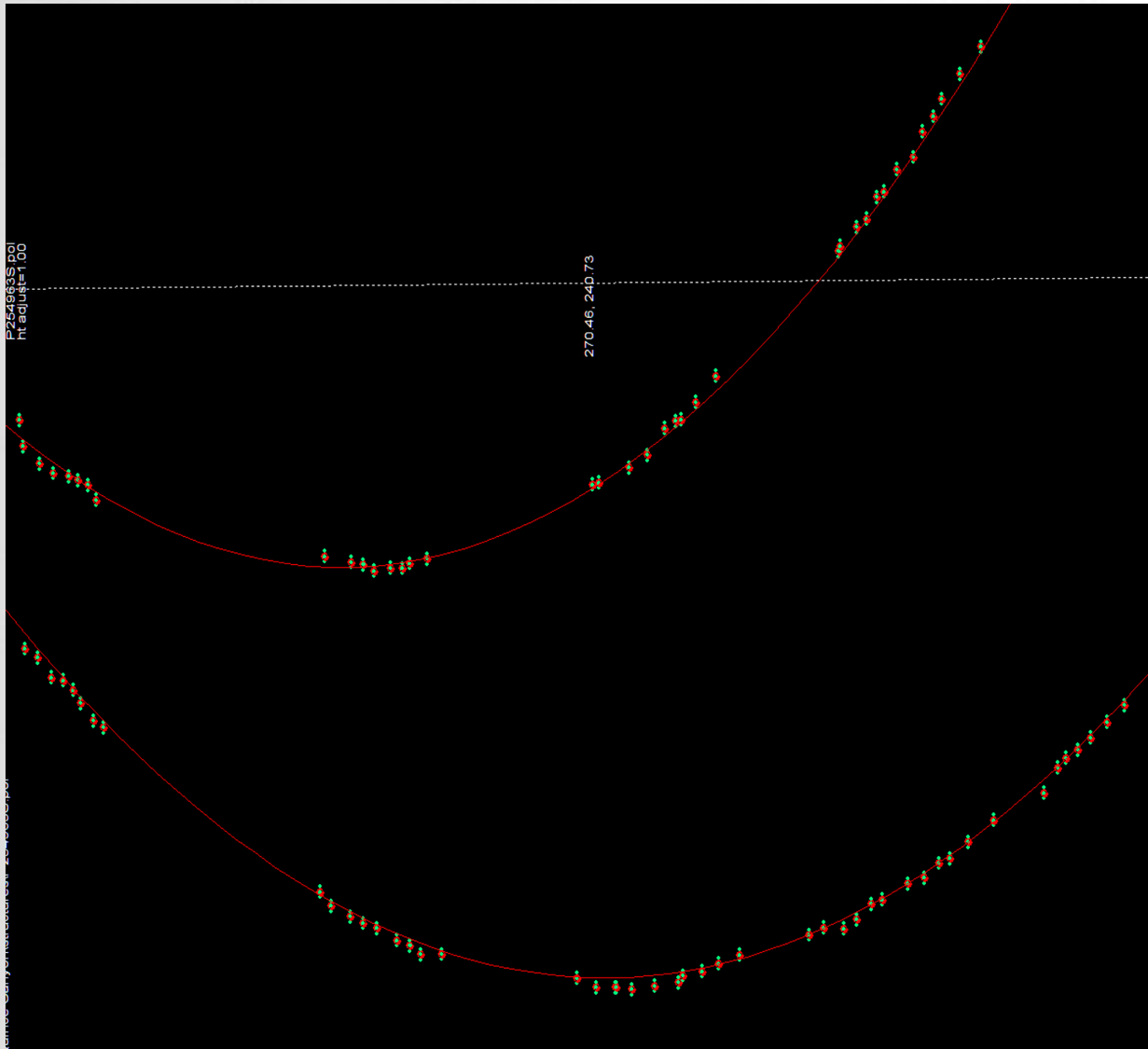


‘Point and Shoot’ Vertical Accuracy

Span Length	270 ft
Target Distance	30 ft
Sample Size	85 Points
Average Distance to Wire	**1.38 in**
Max Distance to Wire	**3.96 in**
Standard Deviation	**0.95 in**
Accuracy = 1.38 in / 30 ft	**0.5%**

Target Distance

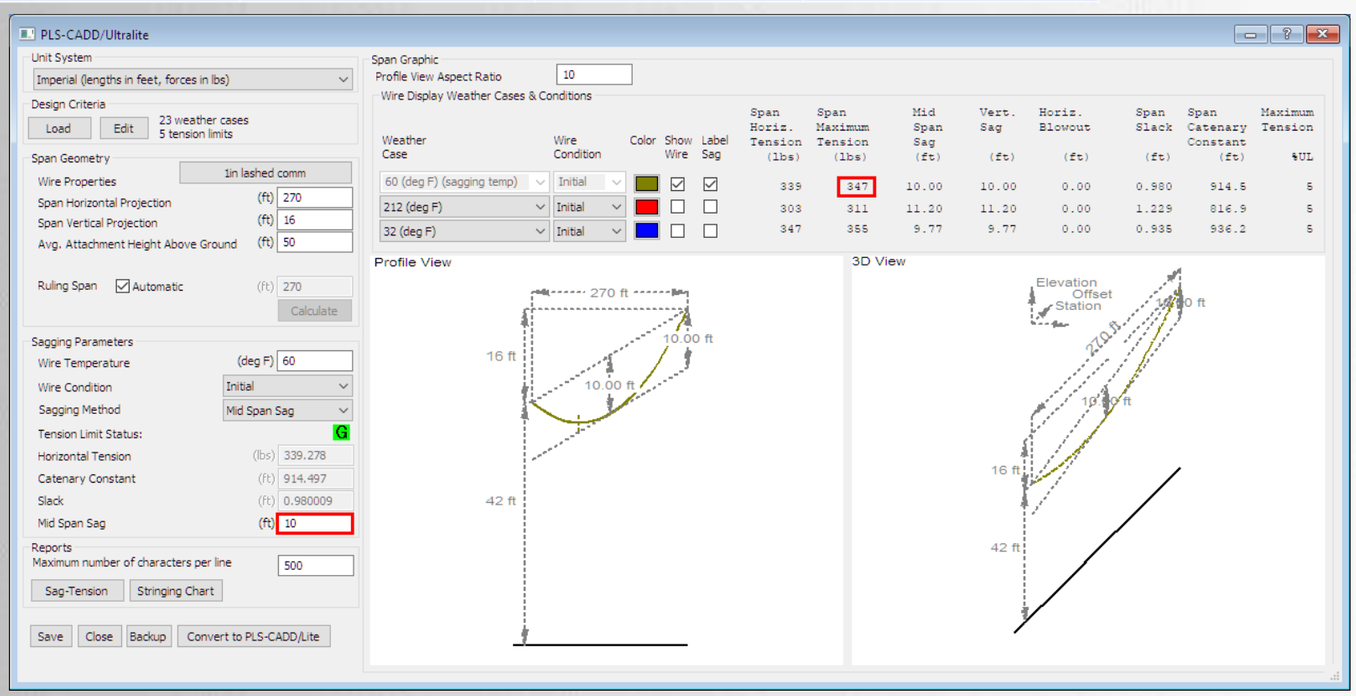




‘Point and Shoot’ Vertical Accuracy

Sag Tension Comparison

Sag Fit	Mid Span Sag (ft)	Tension (lbs)	% Difference
Best Fit	10	347	
Best Fit +/- Average Distance to Wire	10 +/- 0.12	347 +/- 3	1
Best Fit +/- Max Distance to Wire	10 +/- 0.33	347 +/- 11	3

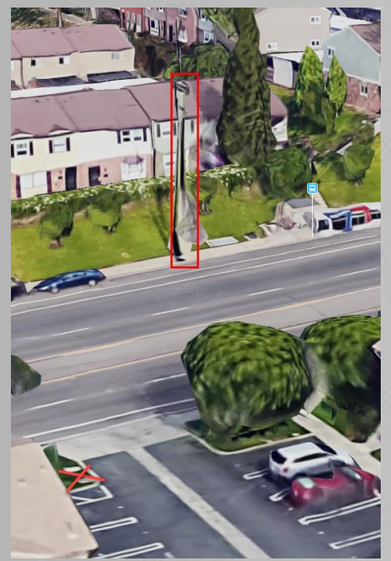


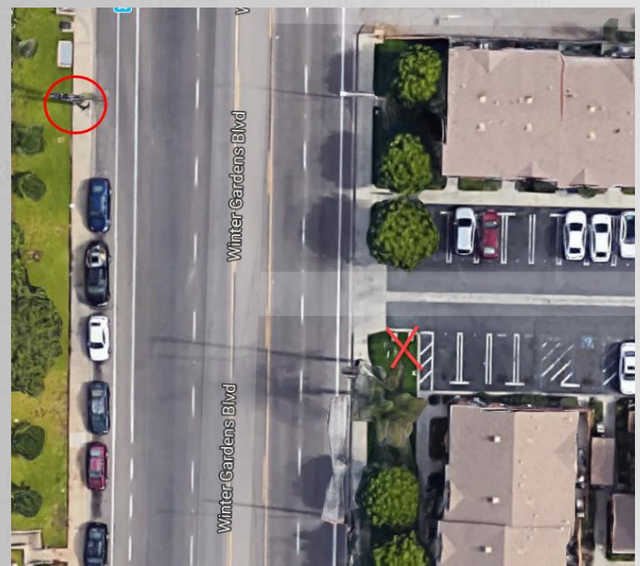
‘Point and Shoot’ Horizontal Accuracy

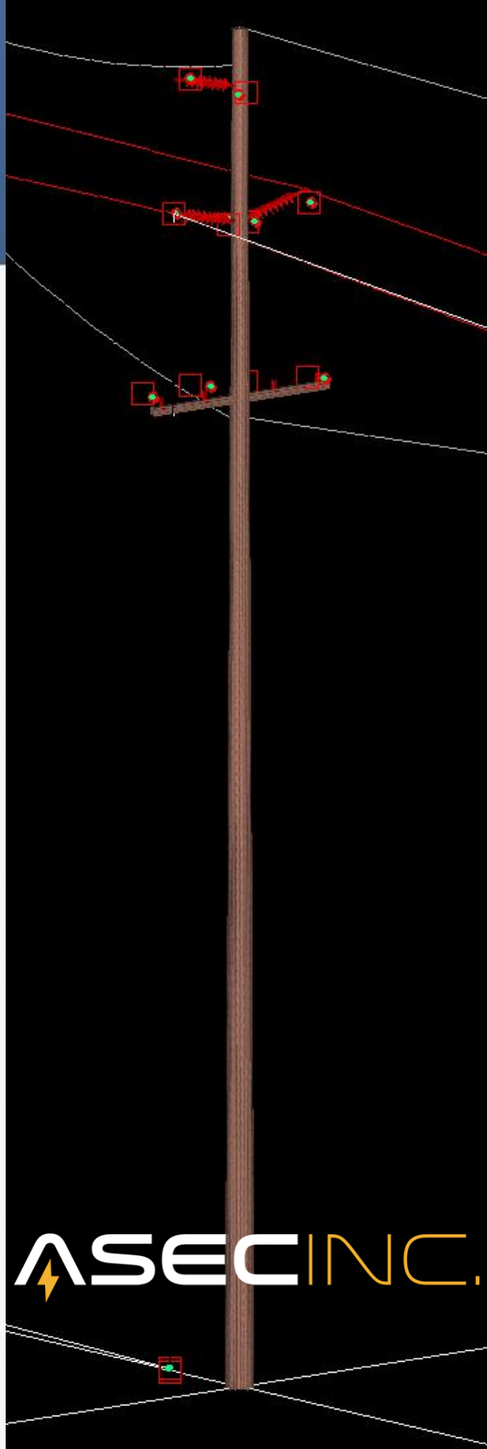
IKE+ vs Professional Survey: Structure 1

- No overhead power line, clear open position

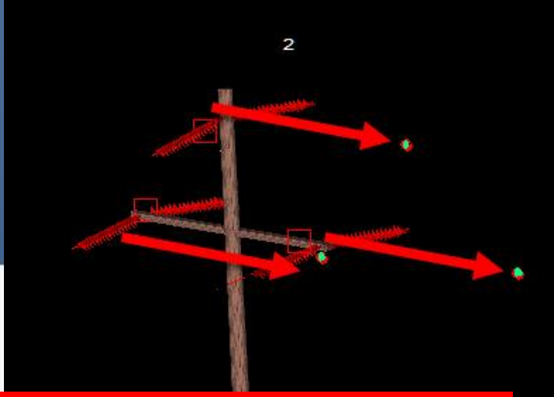
- Base Difference: 2 in
- Target Distance: 80 ft
- Average Horizontal & Vertical Difference: **4 in**
- Horizontal & Vertical Accuracy = 4 in / 80 ft ~ **0.5% of Target Distance**







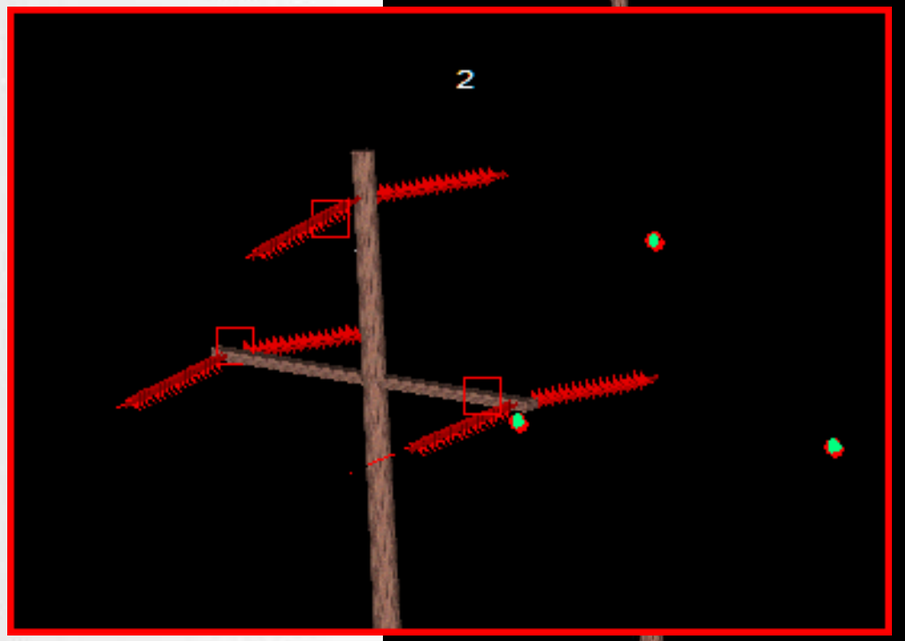
‘Point and Shoot’ Horizontal Accuracy

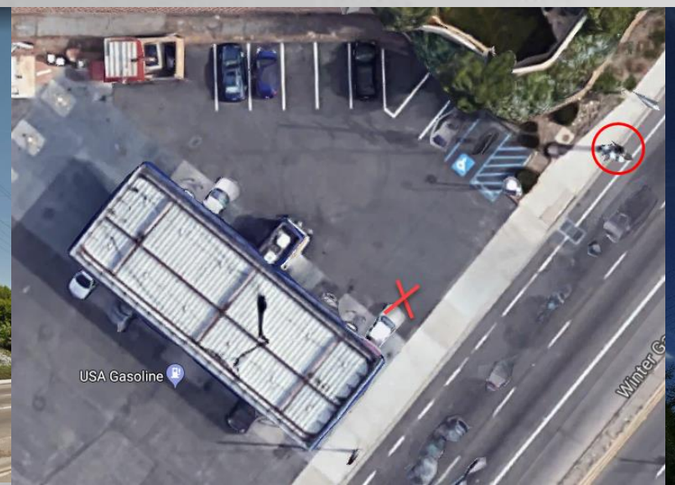


IKE+ vs Professional Survey: Structure 2

- Directly under power line, in Gas Station, large metal overhang

- Base Difference: 3 in
- Target Distance: 50 ft
- Average Horizontal Difference: **10 ft**
- Average Vertical Difference: **9 in**
- Horizontal Accuracy = 10 ft / 50 ft **20% of Target Distance**
- Vertical Accuracy = 9 in / 50 ft **1.5% of Target Distance**





IKE Use Case for PLS-CADD Users

Distribution

- System Hardening
- Joint Use Requests
- Pole Replacements

Transmission

- Emergency Projects
- Pole Replacements
- As-Built Validation

IKE to PLS Integration Overview

IKE

1. IKE Form
2. IKE Field
3. IKE Office

Power Line Reporting

4. IKE to PLS-POLE Automation
5. Project Directory Standardization

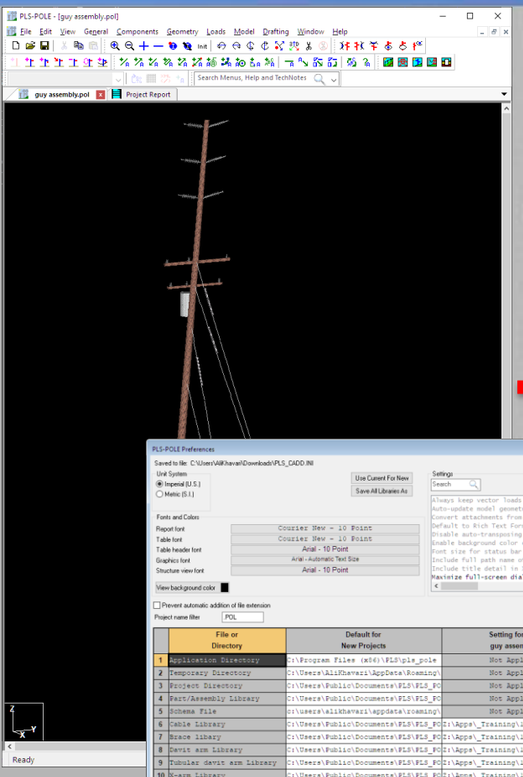
PLS

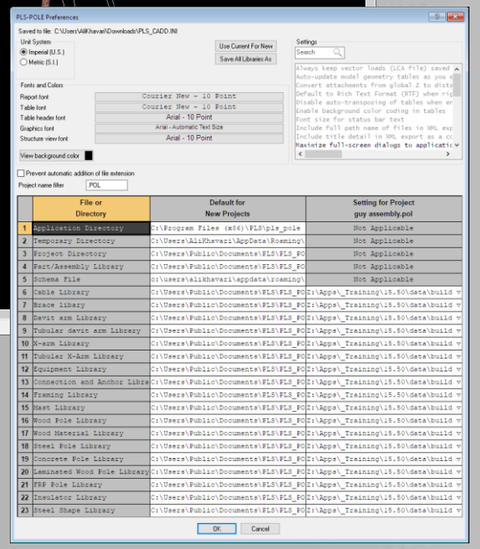
8. Structure Spotting
9. Automatic Stringing
10. Batch Thermal Calculation
11. Model Finalization
    - Wire Sagging
    - Structure Adjustments
    - Load Case Assignment
12. Analysis & Reporting

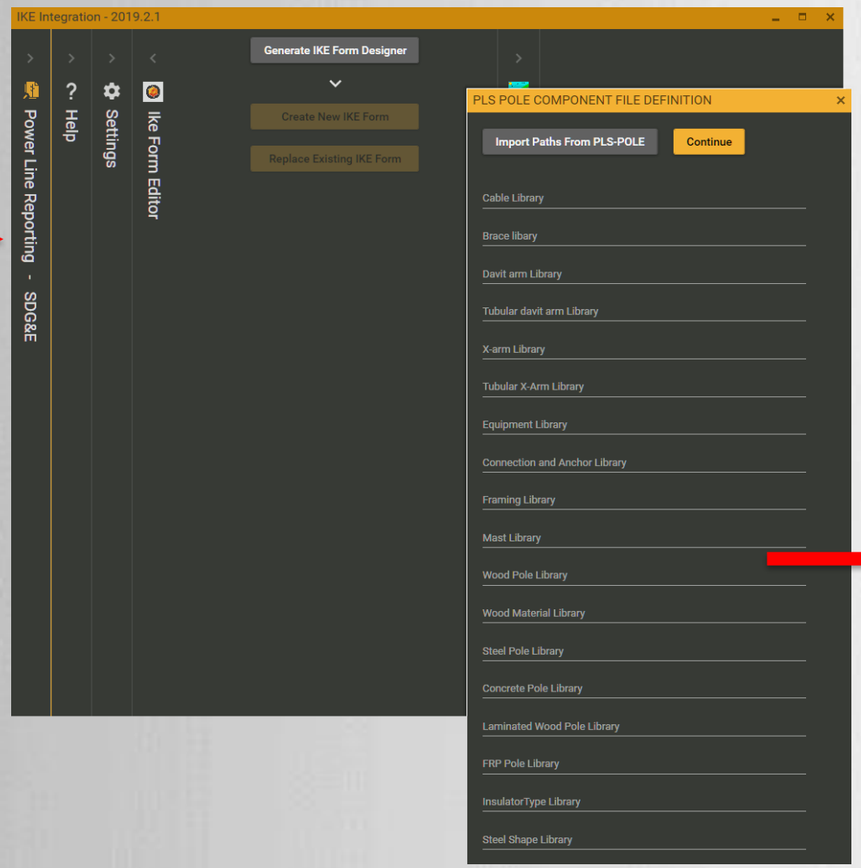
Power Line Reporting

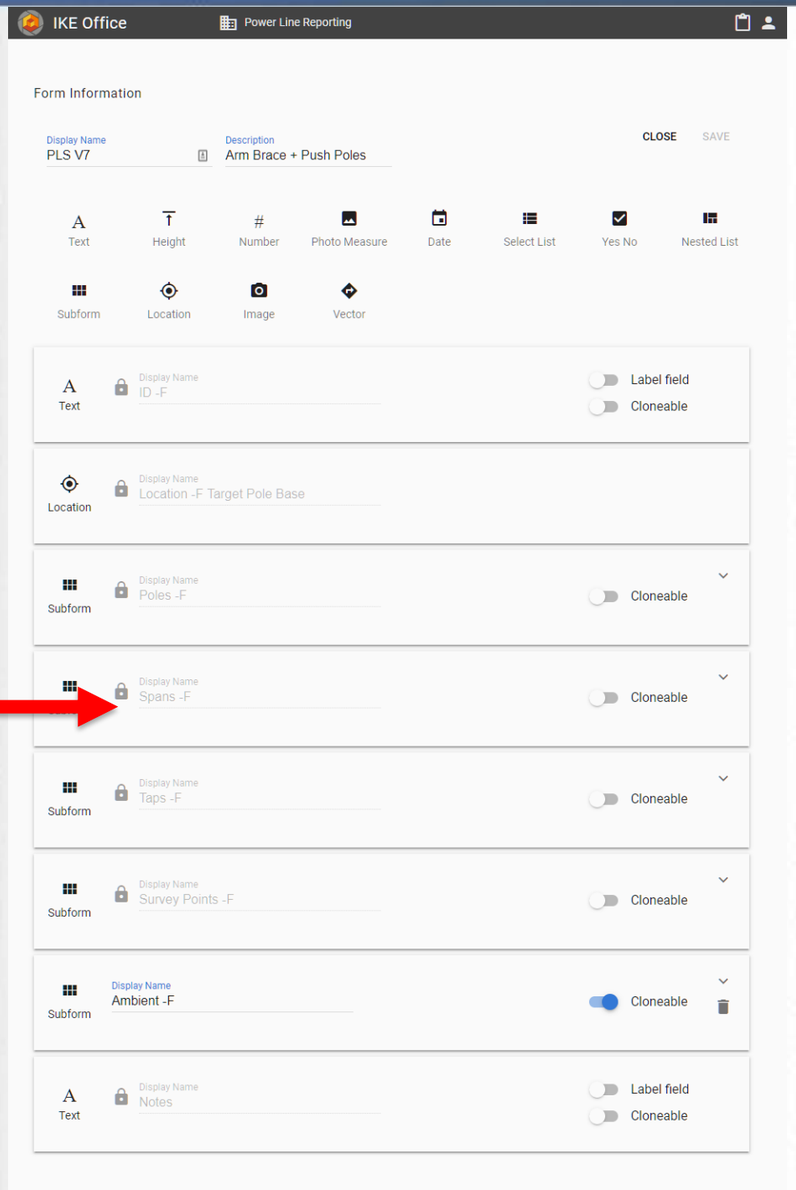
13. Custom XML Processing

IKE Form

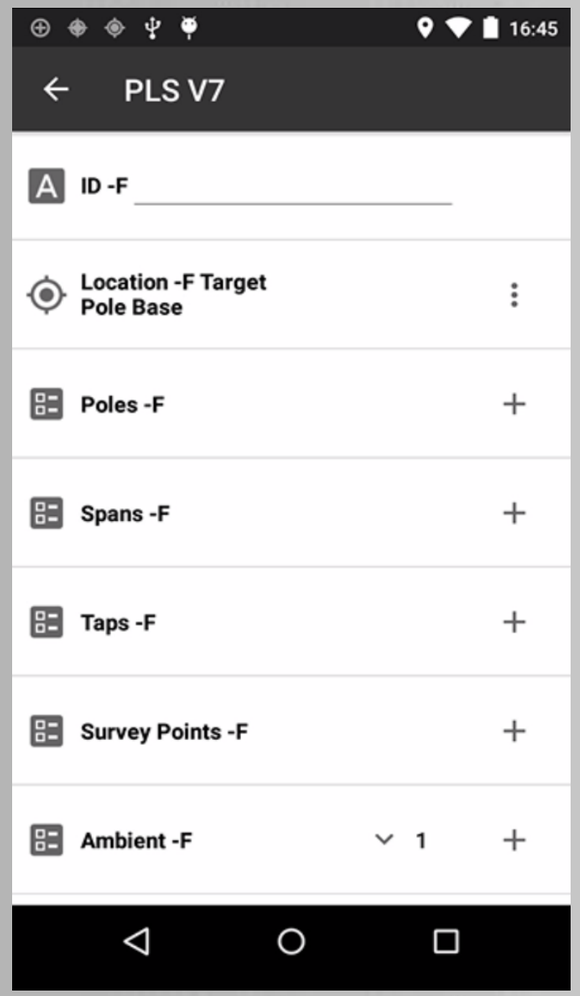


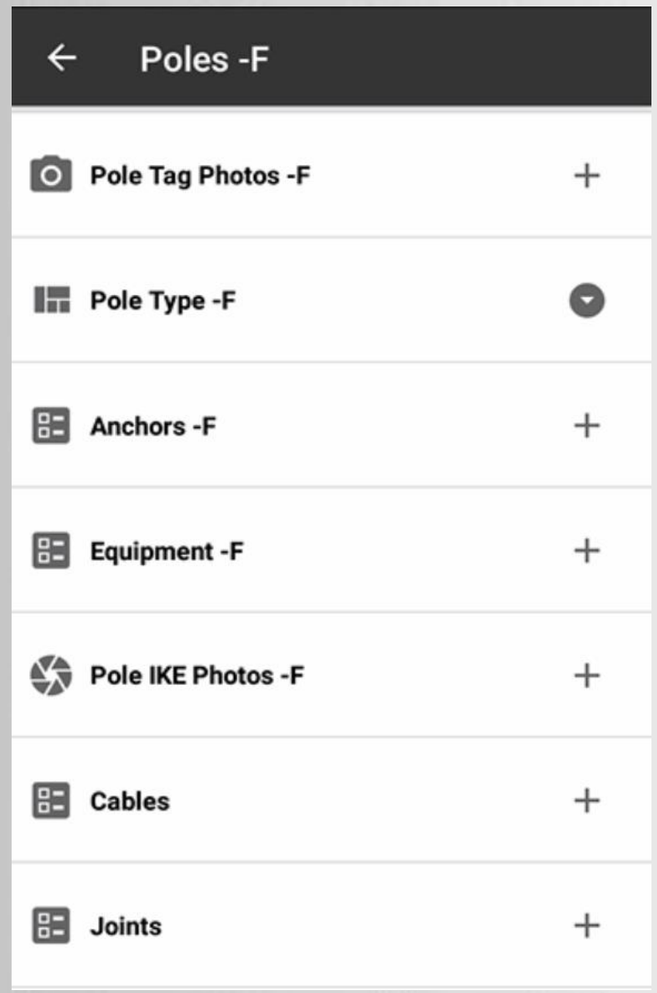


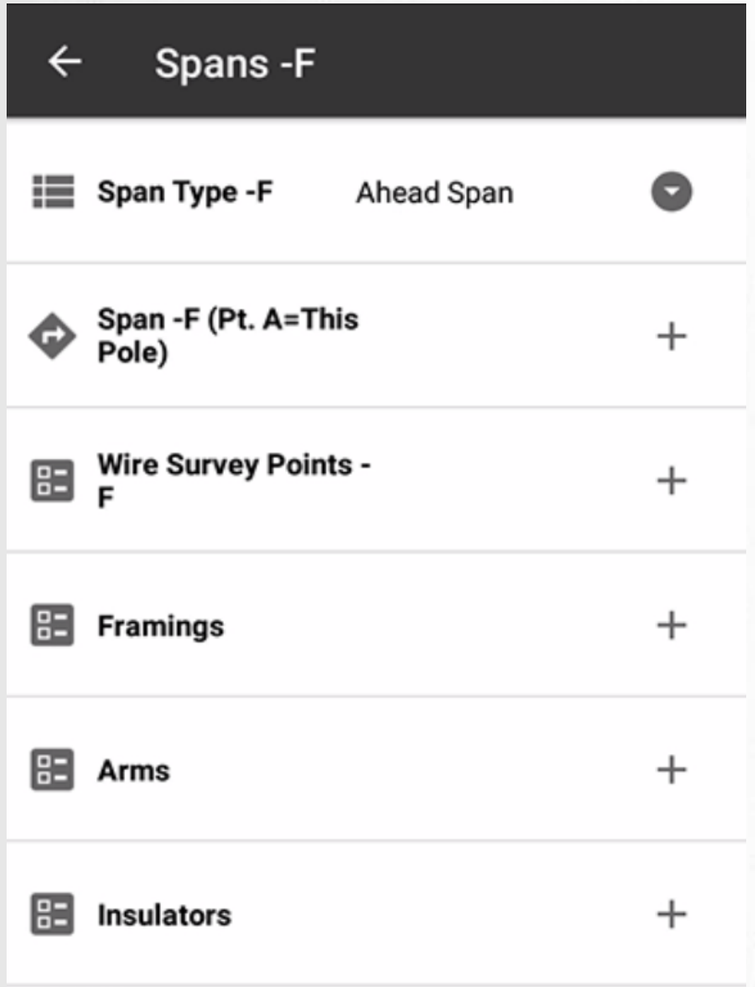

IKE Integration - 2019.2.1
Power Line Reporting - SDG&E
Help
Settings
Ike Form Editor
Generate IKE Form Designer
Create New IKE Form
Replace Existing IKE Form
PLS POLE COMPONENT FILE DEFINITION
Import Paths From PLS-POLE
Continue
Cable Library
Brace libary
Davit arm Library
Tubular davit arm Library
X-arm Library
Tubular X-Arm Library
Equipment Library
Connection and Anchor Library
Framing Library
Mast Library
Wood Pole Library
Wood Material Library
Steel Pole Library
Concrete Pole Library
Laminated Wood Pole Library
FRP Pole Library
InsulatorType Library
Steel Shape Library


IKE Office
Power Line Reporting
Form Information
Display Name
PLS V7
Description
Arm Brace + Push Poles
CLOSE
SAVE
Text
Height
Number
Photo Measure
Date
Select List
Yes No
Nested List
Subform
Location
Image
Vector
Display Name
ID -F
Label field
Cloneable
Location -F Target Pole Base
Poles -F
Spans -F
Taps -F
Survey Points -F
Ambient -F
Notes

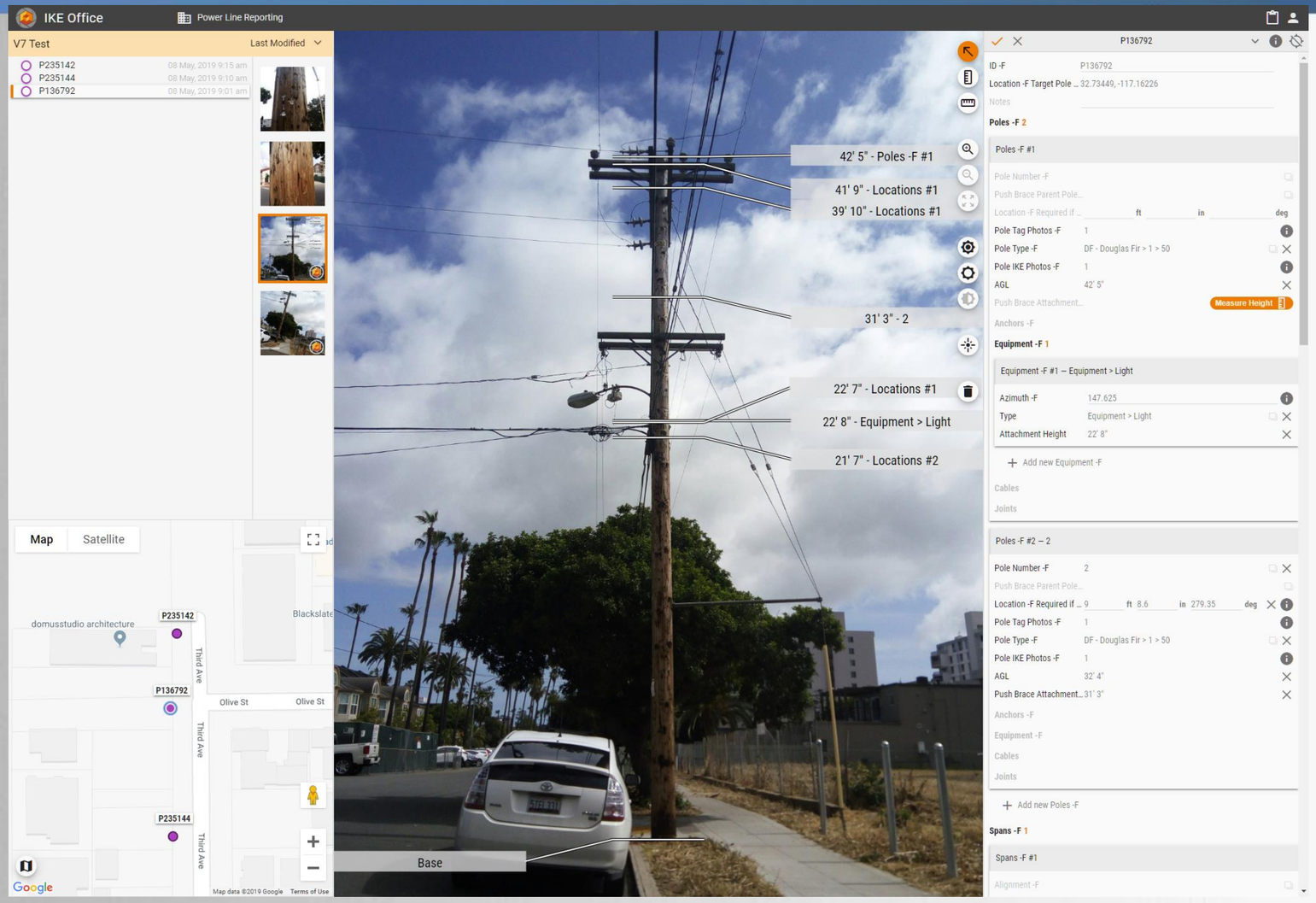
IKE Field


16:45
PLS V7
ID -F
Location -F Target Pole Base
Poles -F
Spans -F
Taps -F
Survey Points -F
Ambient -F
1

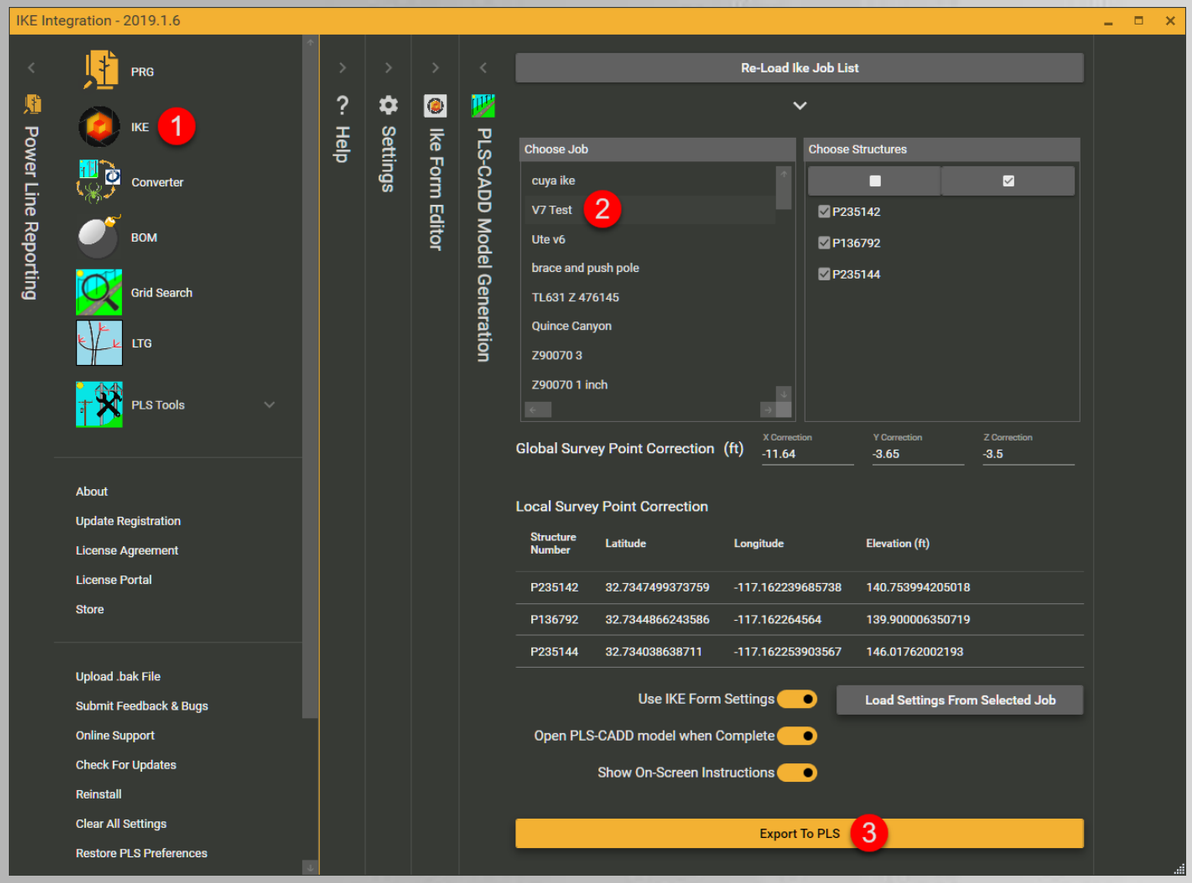

Poles -F
Pole Tag Photos -F
Pole Type -F
Anchors -F
Equipment -F
Pole IKE Photos -F
Cables
Joints

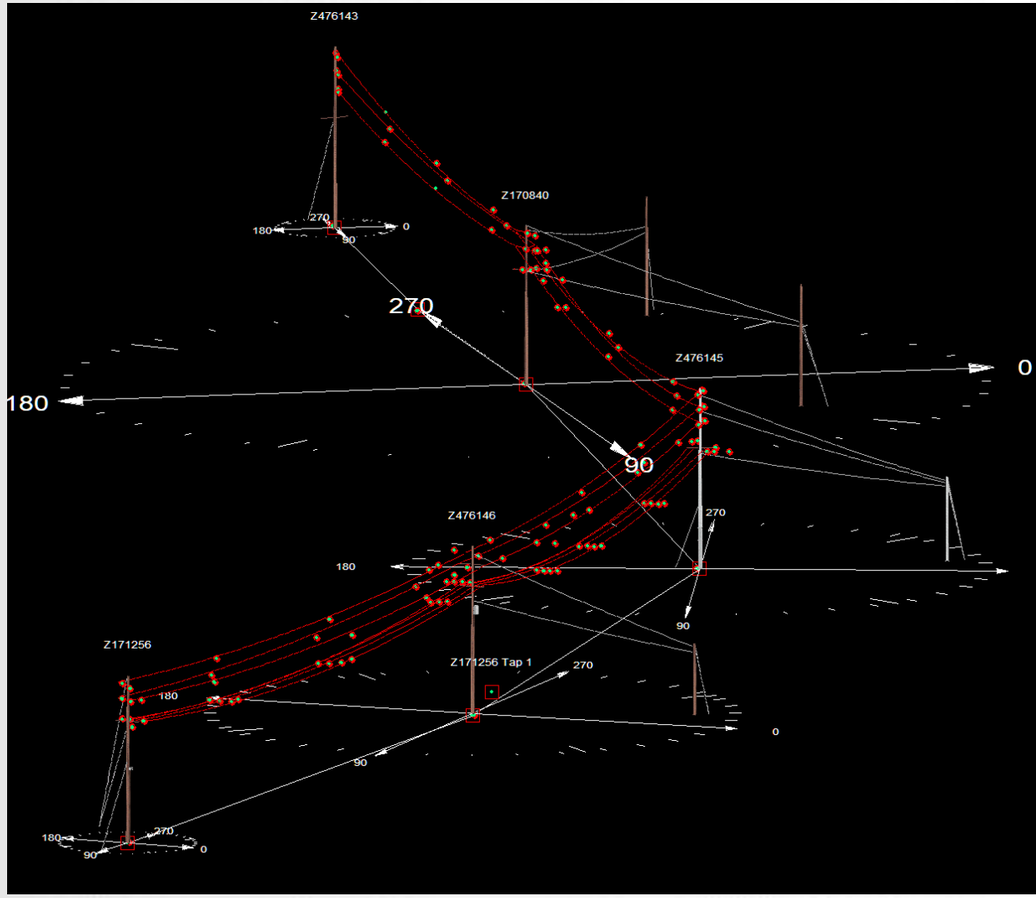

Spans -F
Span Type -F
Ahead Span
Span -F (Pt. A=This Pole)
Wire Survey Points - F
Framings
Arms
Insulators

IKE Office

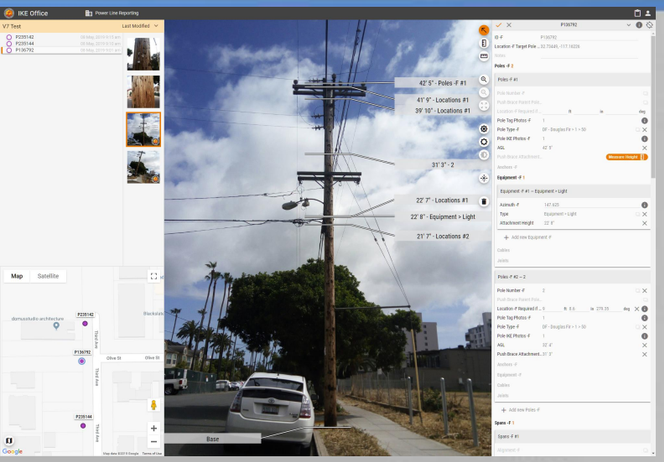

IKE Office
Power Line Reporting
V7 Test
Last Modified
P235142 08 May, 2019 9:15 am
P235144 08 May, 2019 9:10 am
P136792 08 May, 2019 9:01 am
Map
Satellite
domusstudio architecture
P235142
P136792
P235144
Third Ave
Olive St
Blackslate
Google
42' 5" - Poles -F #1
41' 9" - Locations #1
39' 10" - Locations #1
31' 3" - 2
22' 7" - Locations #1
22' 8" - Equipment > Light
21' 7" - Locations #2
Base
P136792
ID -F P136792
Location -F Target Pole ... 32.73449,-117.16226
Notes
Poles -F 2
Poles -F #1
Pole Number -F
Push Brace Parent Pole...
Location -F Required if ...
Pole Tag Photos -F 1
Pole Type -F DF - Douglas Fir > 1 > 50
Pole IKE Photos -F 1
AGL 42' 5"
Push Brace Attachment...
Measure Height
Anchors -F
Equipment -F 1
Equipment -F #1 – Equipment > Light
Azimuth -F 147.625
Type Equipment > Light
Attachment Height 22' 8"
Add new Equipment -F
Cables
Joints
Poles -F #2 – 2
Pole Number -F 2
Location -F Required if ... 9 ft 8.6 in 279.35 deg
Pole Tag Photos -F 1
Pole Type -F DF - Douglas Fir > 1 > 50
Pole IKE Photos -F 1
AGL 32' 4"
Push Brace Attachment... 31' 3"
Anchors -F
Equipment -F
Cables
Joints
Add new Poles -F
Spans -F 1
Spans -F #1
Alignment -F

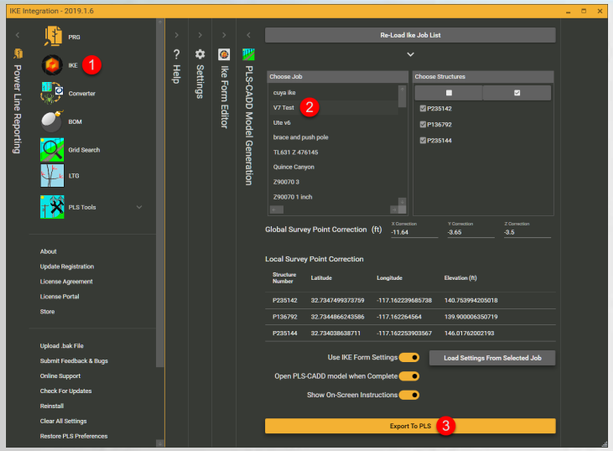
Power Line Reporting Application

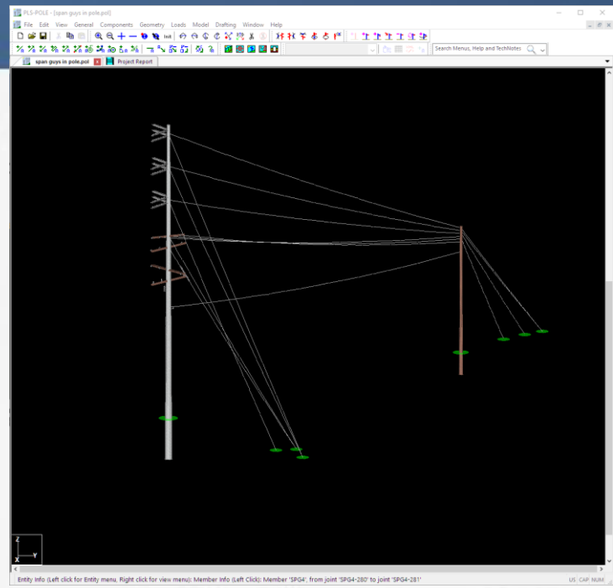




IKE to PLS-POLE Automation







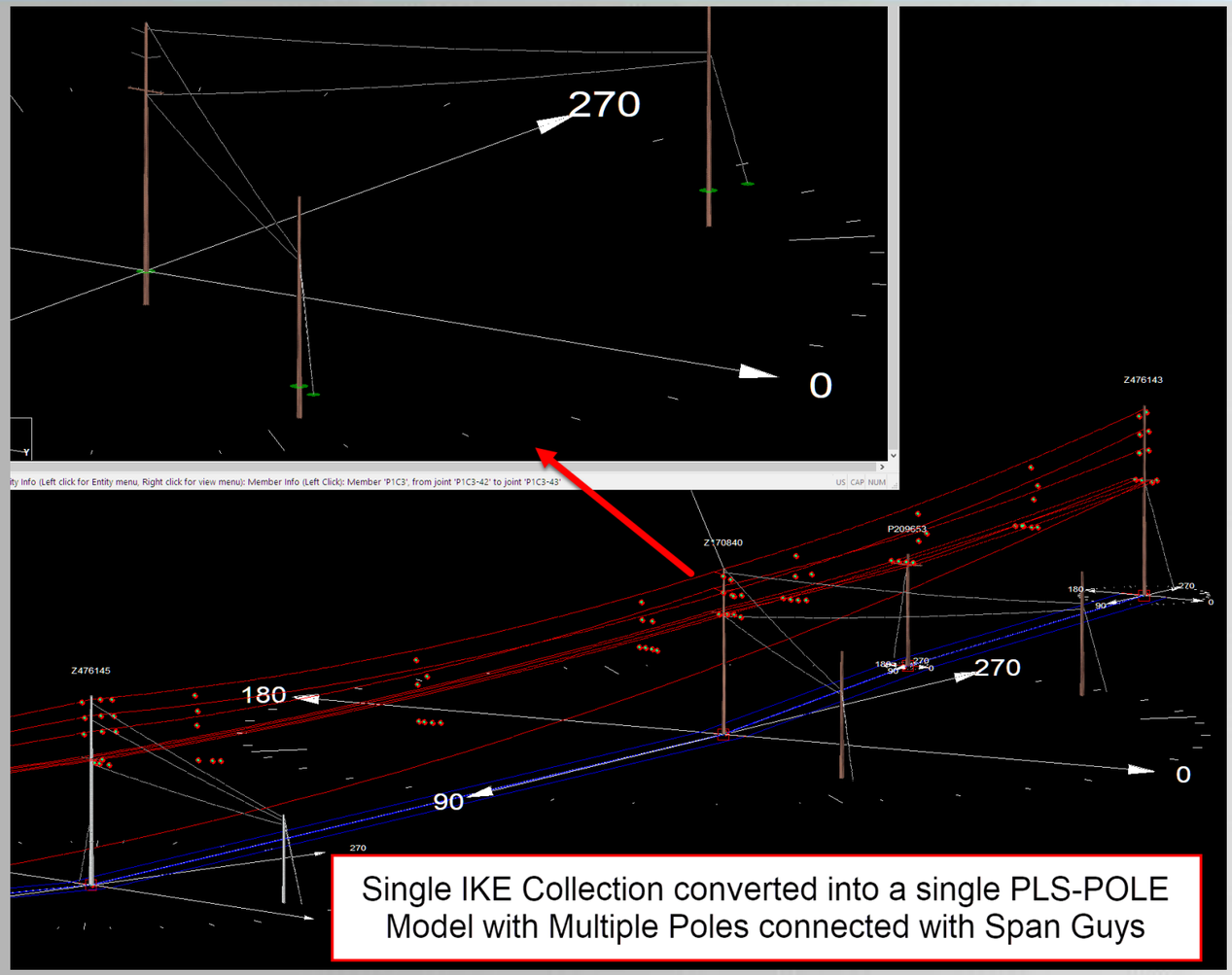
IKE Office API

- JSON Structure Data
- Photo File Store

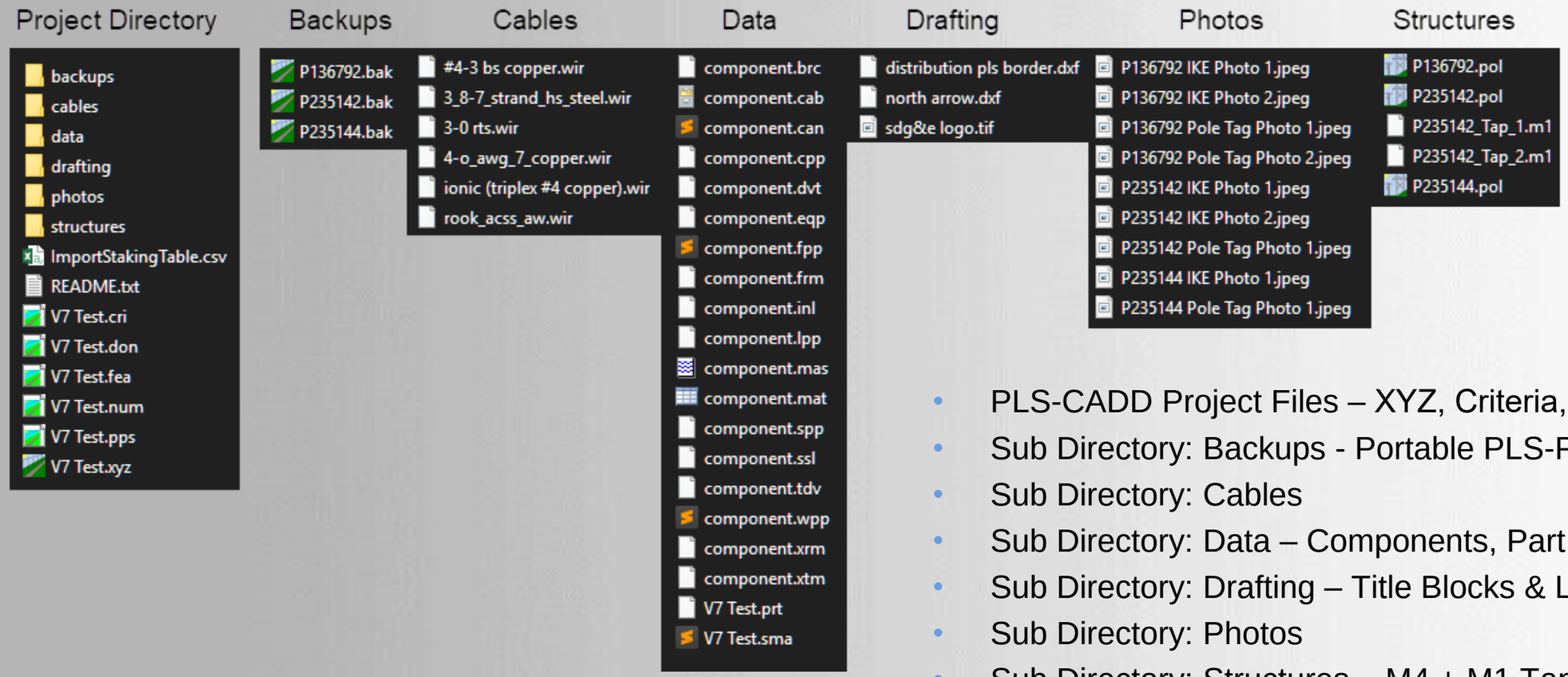
PLS API

- **Poles**: All Materials, Multi-Pole Arrangements, Push Brace
- **Arms**: All PLS-POLE Arm Types
- **Insulators**: ALL PLS-POLE Insulator Types
- **Equipment**: PLS-POLE Equipment / Framings
- **Guys:** Down / Span + Guy Strain Insulators
- **Framings:** Inserted at Attachment Height

IKE to PLS-POLE Samples



Project Directory Standardization



- PLS-CADD Project Files – XYZ, Criteria, Feature Code, …
- Sub Directory: Backups - Portable PLS-POLE BAK Files
- Sub Directory: Cables
- Sub Directory: Data – Components, Part, Schema
- Sub Directory: Drafting – Title Blocks & Logos
- Sub Directory: Photos
- Sub Directory: Structures – M4 + M1 Taps
- Import Staking Table + Readme

Project Directory Standardization: XYZ File

```
TYPE='XYZ FILE' VERSION='4' UNITS='US' SOURCE='PLS-CADD Version 14.40' USER='PLR' FILENAME='C:\Users\AliKhavari\Downloads\V7 Test\V7 Test.xyz'
'P235142' 1590549.37150078 11882852.3550424 137.253994205018 120 0.000 'C:\Users\AliKhavari\Downloads\V7 Test\structures\P235142.pol' ''
'P235142_Tap_1' 1590541.15731391 11882807.2937559 156.526918206833 120 0.000 'C:\Users\AliKhavari\Downloads\V7 Test\structures\P235142_Tap_1.m1' ''
'P235142_Tap_2' 1590643.4520664 11882811.8534273 139.043593721789 120 0.000 'C:\Users\AliKhavari\Downloads\V7 Test\structures\P235142_Tap_2.m1' ''
'P136792' 1590541.57734515 11882756.5999715 136.400006350719 120 0.000 'C:\Users\AliKhavari\Downloads\V7 Test\structures\P136792.pol' ''
'P235144' 1590544.60483582 11882593.6628594 142.51762002193 120 0.000 'C:\Users\AliKhavari\Downloads\V7 Test\structures\P235144.pol' ''
'' 1590545.28206365 11882690.3564227 155.437412433897 75 0.000 '' ''
'' 1590548.78183307 11882688.3921564 177.472860513444 75 0.000 '' ''
'' 1590543.03245379 11882689.9745729 177.78778600004 75 0.000 '' ''
'' 1590545.63766697 11882689.5214638 155.74807286933 75 0.000 '' ''
'' 1590546.33386443 11882689.0881753 156.951676345849 75 0.000 '' ''
```

PLS-CADD Manual Appendix D

D.1 XYZ File Format

PLS-CADD can save XYZ files in either binary or ASCII format. The default format is binary and this results in much smaller files and faster file/open and file/save operations. The disadvantage of binary is that it is not human readable nor is it readable by programs other than **PLS-CADD**. To save in ASCII format use **File/Save As** and change the **Save as type** to "*ASCII XYZ Files*".

The ASCII format for an XYZ file consists of one record per line formatted as shown below. A record of that file, designated as R.* below, includes one or more data which must be separated by blanks.

Records

R.0 Header which includes:
TYPE= ' XYZ FILE ', VERSION= ' 4 ' or other, UNITS= ' US ' or ' SI '
SOURCE= ' **PLS-CADD** Version *** ', USER= ' Username ', FILENAME= ' '

Then for each terrain point a record that includes:

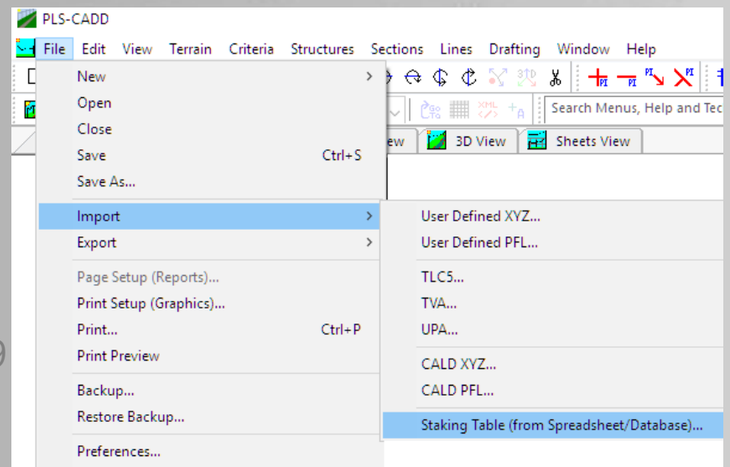
R.i Description of terrain point (text string limited to 256 characters included within single quotation marks)
x-coordinate (m or ft), y-coordinate (m or ft), z-coordinate (m or ft)
Feature code (Integer)
Obstacle height, h (m or ft) - must input zero value if there is no obstacle
Optional surveyor note to appear on all profile views (this is a text string limited to 256 characters that must be included within single quotation marks, for example ' poor soil ')
Optional surveyor note to appear on all plan views (this is a text string limited to 256 characters that must be included within single quotation marks)

For example, the record { '12345' 1000. 500. 100. 200 0 ' ' ' Hydrant ' } will cause the word "Hydrant" to be drawn on all plan views at the location of ground point 12345.

Structure Spotting Options

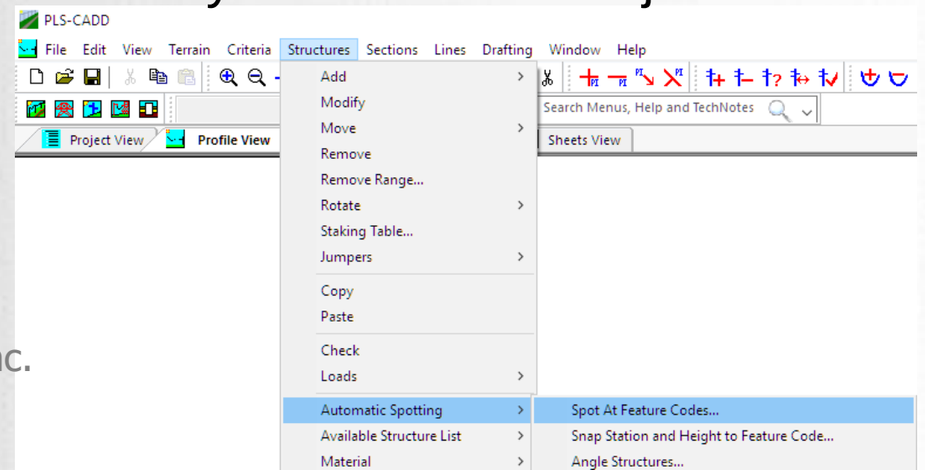
Import Staking Table

- Pros
  - Most Configurable Option
    - Alignment & XY Based Structures
    - Automatic structure orientation
    - Structure Comment Definition
- Cons
  - Requires more pre-processing to setup Staking Table



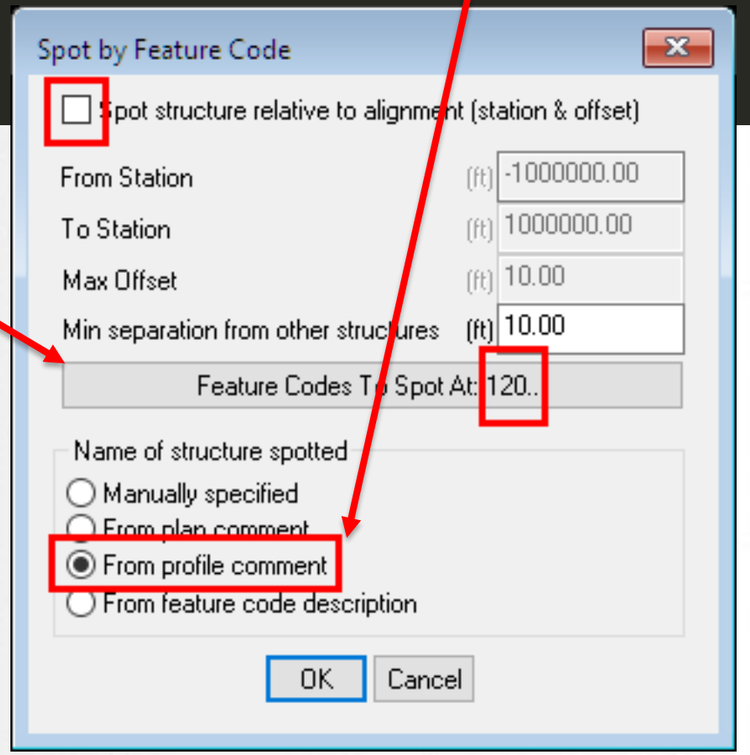
Feature Code Spotting

- Pros
  - Simple, easy to use
- Cons
  - XY Structures Only
  - Limited configurability
  - No alignment definition
  - Structures orientations must be manually reviewed and adjusted



Feature Code Spotting

```
1  TYPE='XYZ FILE' VERSION='4' UNITS='US' SOURCE='PLS-CADD Version 14.40' USER='PLR' FILENAME='C:\Users\AliKhavari\Downloads\V7 Test\V7 Test.xyz'
2  'P235142' 1590549.37150078 11882852.3550424 137.253994205018 120 0.000 'C:\Users\AliKhavari\Downloads\V7 Test\structures\P235142.pol' ''
3  'P235142_Tap_1' 1590541.15731391 11882807.2937559 156.526918206833 120 0.000 'C:\Users\AliKhavari\Downloads\V7 Test\structures\P235142_Tap_1.m1' ''
4  'P235142_Tap_2' 1590643.4520664 11882811.8534273 139.043593721789 120 0.000 'C:\Users\AliKhavari\Downloads\V7 Test\structures\P235142_Tap_2.m1' ''
5  'P136792' 1590541.57734515 11882756.5999715 136.400006350719 120 0.000 'C:\Users\AliKhavari\Downloads\V7 Test\structures\P136792.pol' ''
6  'P235144' 1590544.60483582 11882593.6628594 142.51762002193 120 0.000 'C:\Users\AliKhavari\Downloads\V7 Test\structures\P235144.pol' ''
7  '' 1590545.28206365 11882690.3564227 155.437412433897 75 0.000 '' ''
8  '' 1590548.78183307 11882688.3921564 177.472860513444 75 0.000 '' ''
9  '' 1590543.03245379 11882689.9745729 177.78778600004 75 0.000 '' ''
10 '' 1590545.63766697 11882689.5214638 155.74807286933 75 0.000 '' ''
11 '' 1590546.33386443 11882689.0881753 156.951676345849 75 0.000 '' ''
```



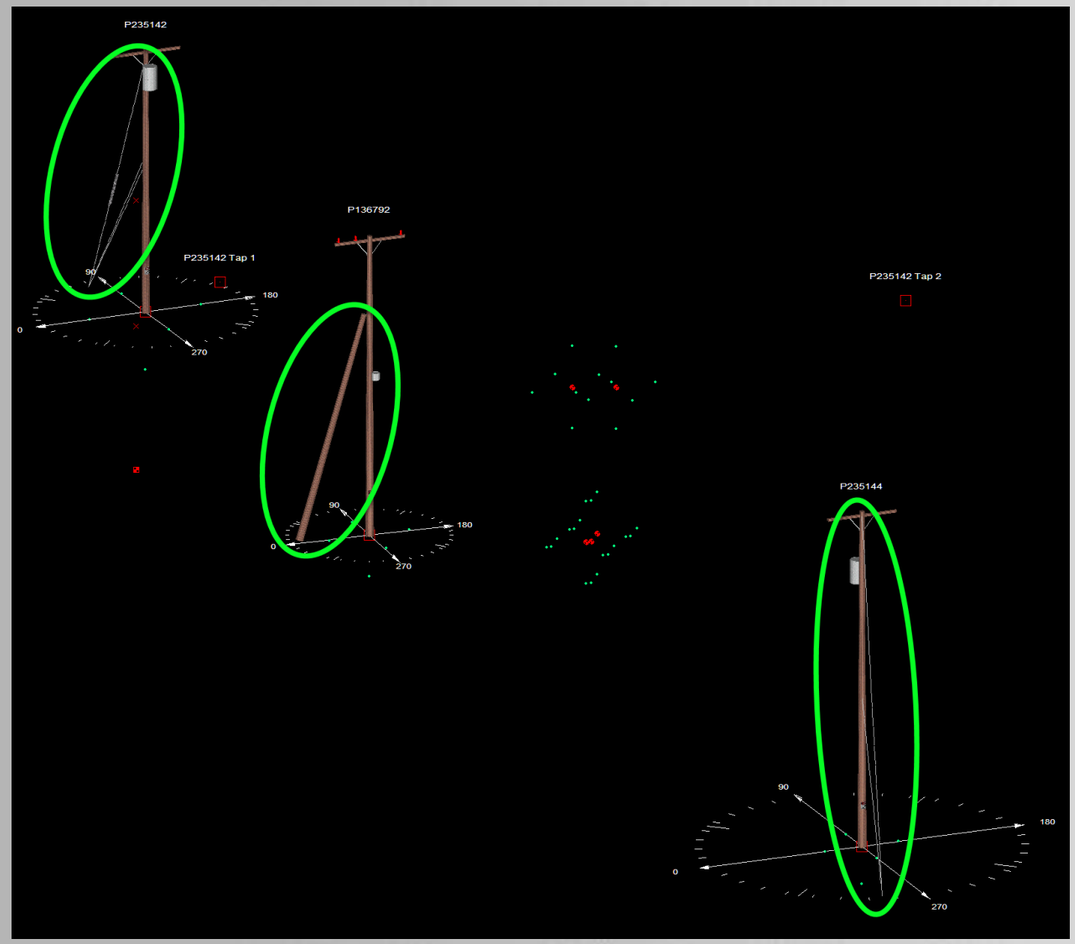
Structures > Automatic Spotting > Spot at Feature Codes

1. Uncheck ‘Spot Structures Relative to Alignment’
2. Define Feature Code
3. Choose Correct Comment

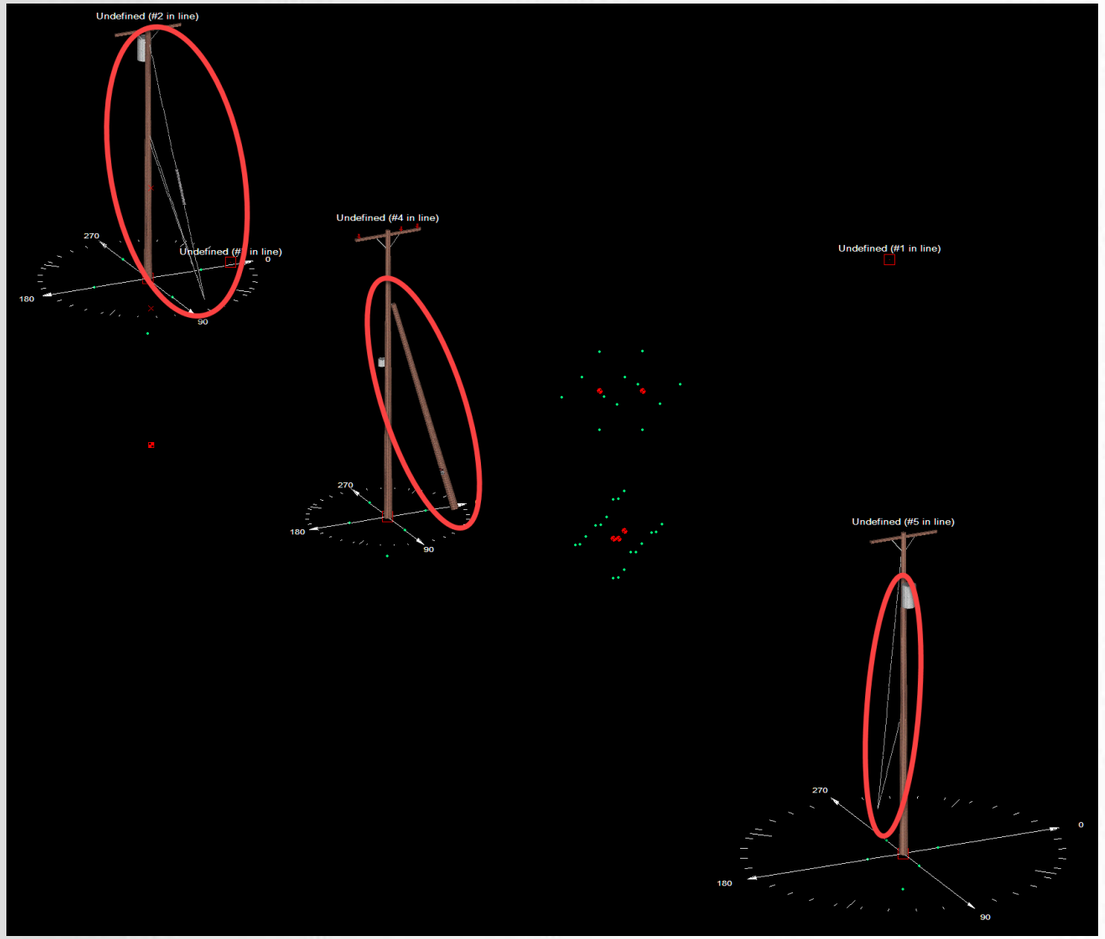
   Profile Comment is **First** Comment in XYZ File

Structure Spotting Options

Import Staking Table

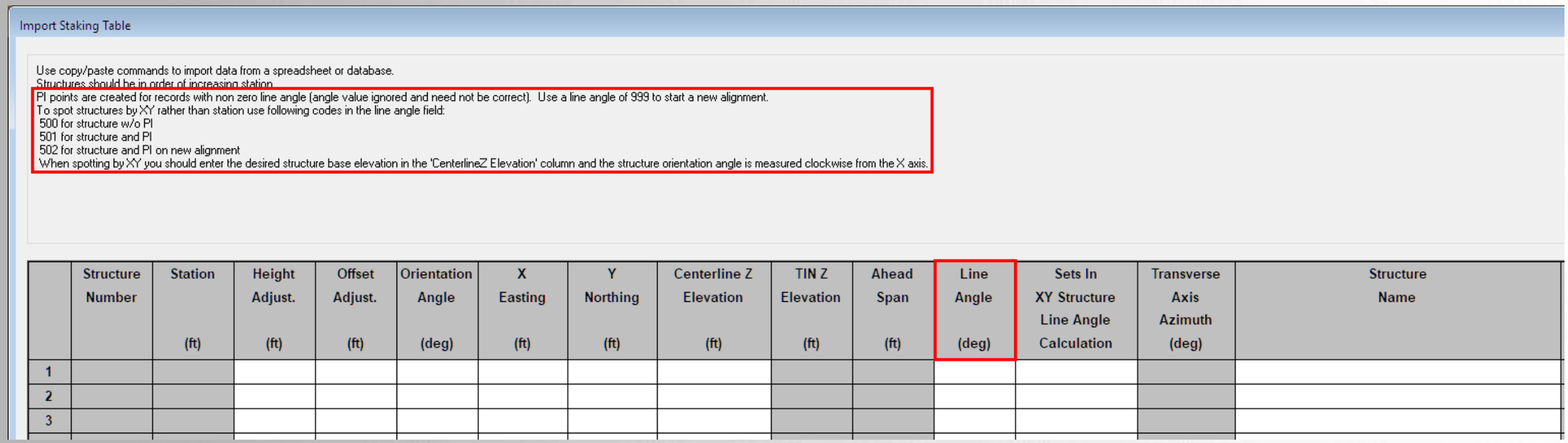


Feature Code Spotting



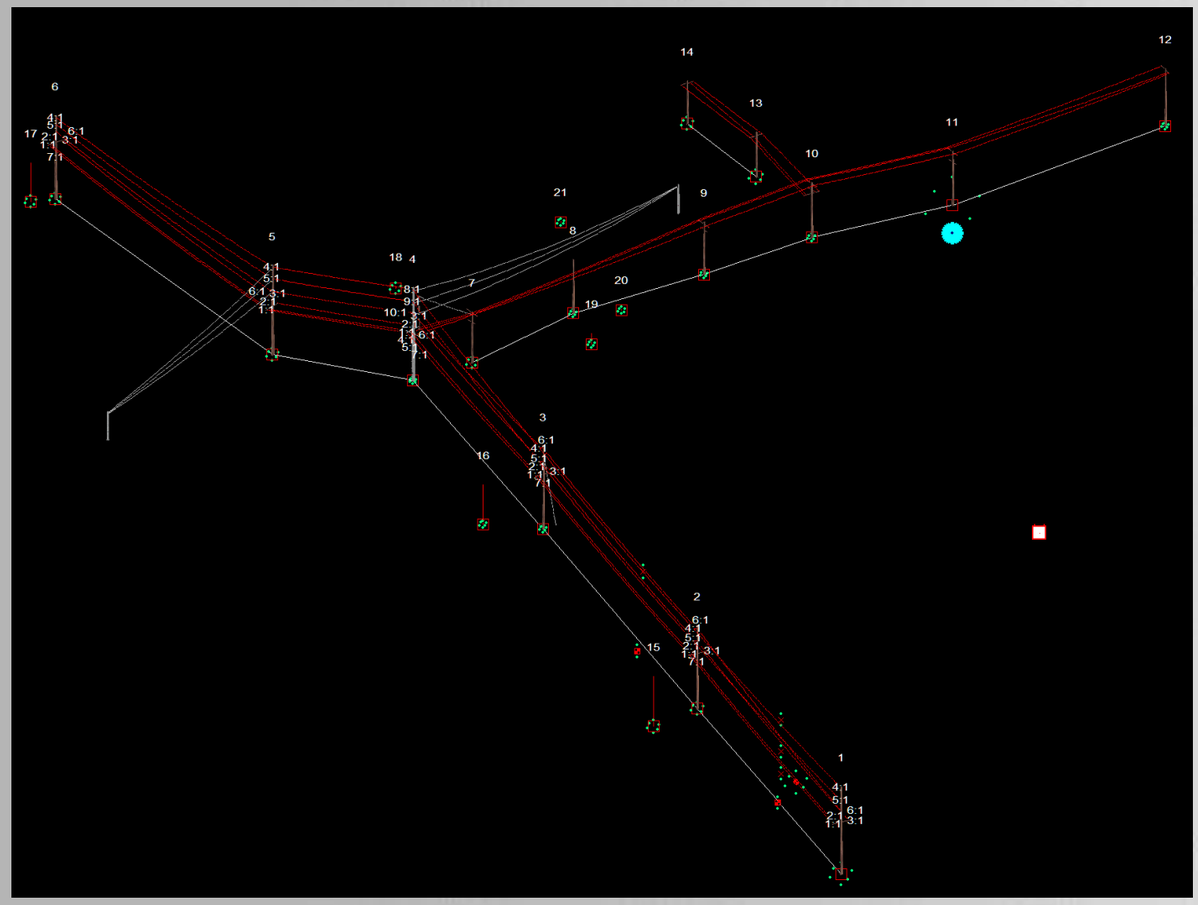
Import Staking Table & Line Angle "Cheat Codes"

PLS-CADD > File > Import > Staking Table (from Spreadsheet/Database)

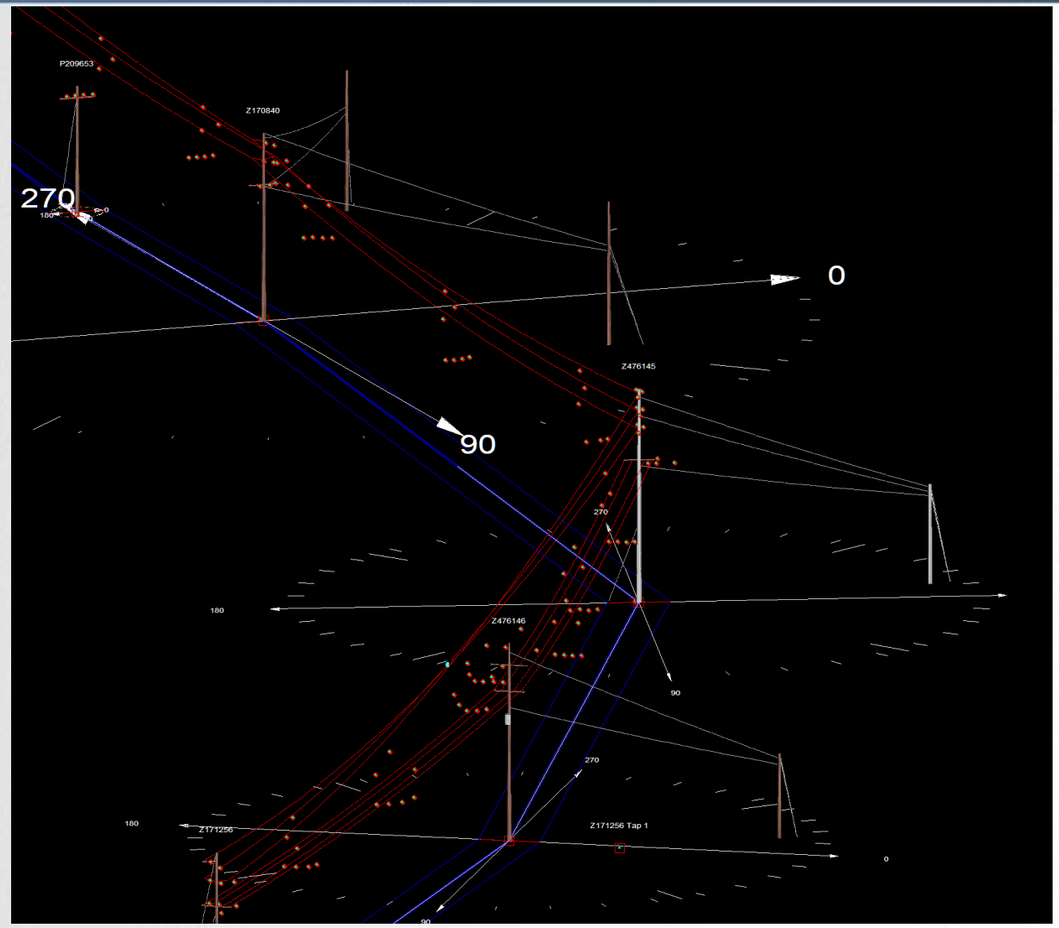


PI points are created for records with non zero line angle (angle value ignored and need not be correct). Use a line angle of 999 to start a new alignment.
To spot structures by XY rather than station use following codes in the line angle field:
500 for structure w/o PI
501 for structure and PI
502 for structure and PI on new alignment

IKE to PLS-CADD Samples: XY vs Alignment

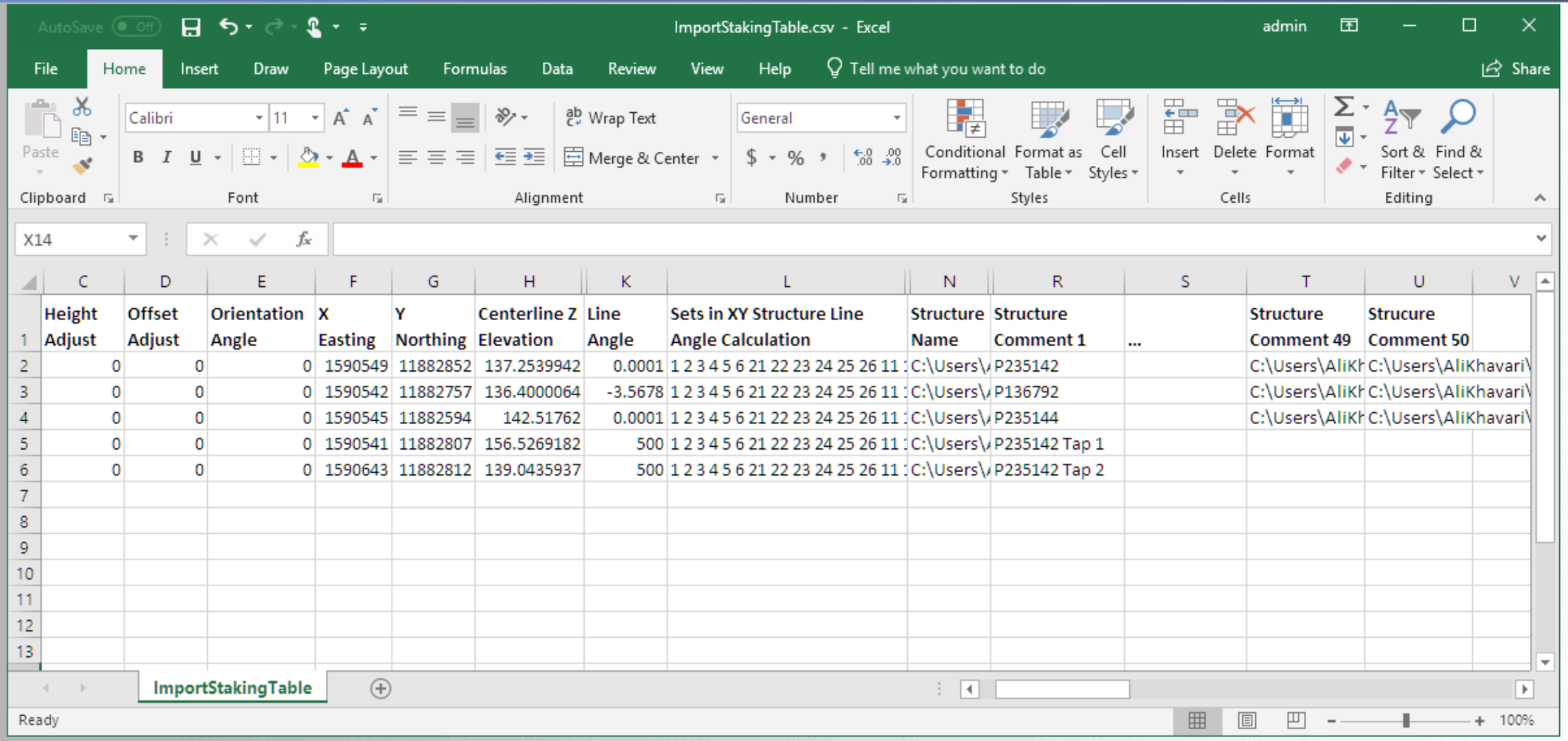


XY with PI Points, 3 Alignments



Alignment Based

Import Staking Table Automation

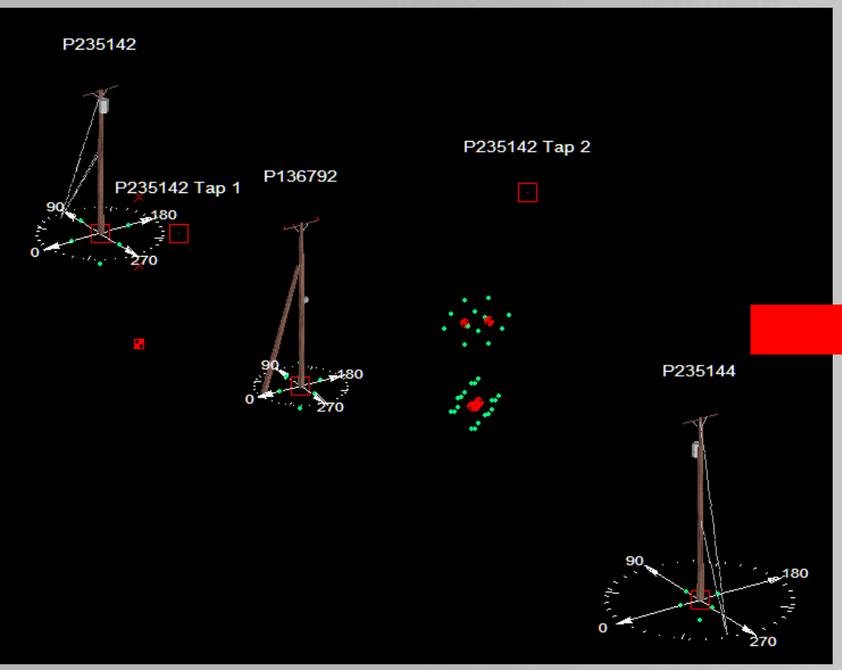


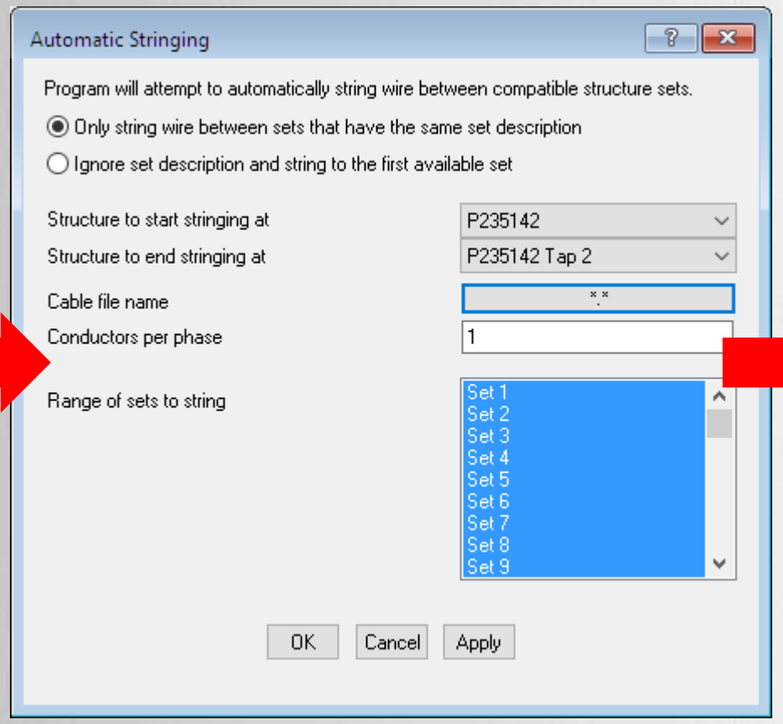
	C	D	E	F	G	H	K	L	N	R	S	T	U	V
1	Height Adjust	Offset Adjust	Orientation Angle	X Easting	Y Northing	Centerline Z Elevation	Line Angle	Sets in XY Structure Line Angle Calculation	Structure Name	Structure Comment 1	...	Structure Comment 49	Strucure Comment 50	
2	0	0	0	1590549	11882852	137.2539942	0.0001	1 2 3 4 5 6 21 22 23 24 25 26 11 :	C:\Users\	P235142		C:\Users\AliKh	C:\Users\AliKhavari\	
3	0	0	0	1590542	11882757	136.4000064	-3.5678	1 2 3 4 5 6 21 22 23 24 25 26 11 :	C:\Users\	P136792		C:\Users\AliKh	C:\Users\AliKhavari\	
4	0	0	0	1590545	11882594	142.51762	0.0001	1 2 3 4 5 6 21 22 23 24 25 26 11 :	C:\Users\	P235144		C:\Users\AliKh	C:\Users\AliKhavari\	
5	0	0	0	1590541	11882807	156.5269182	500	1 2 3 4 5 6 21 22 23 24 25 26 11 :	C:\Users\	P235142 Tap 1				
6	0	0	0	1590643	11882812	139.0435937	500	1 2 3 4 5 6 21 22 23 24 25 26 11 :	C:\Users\	P235142 Tap 2				
7														
8														
9														
10														
11														
12														
13														

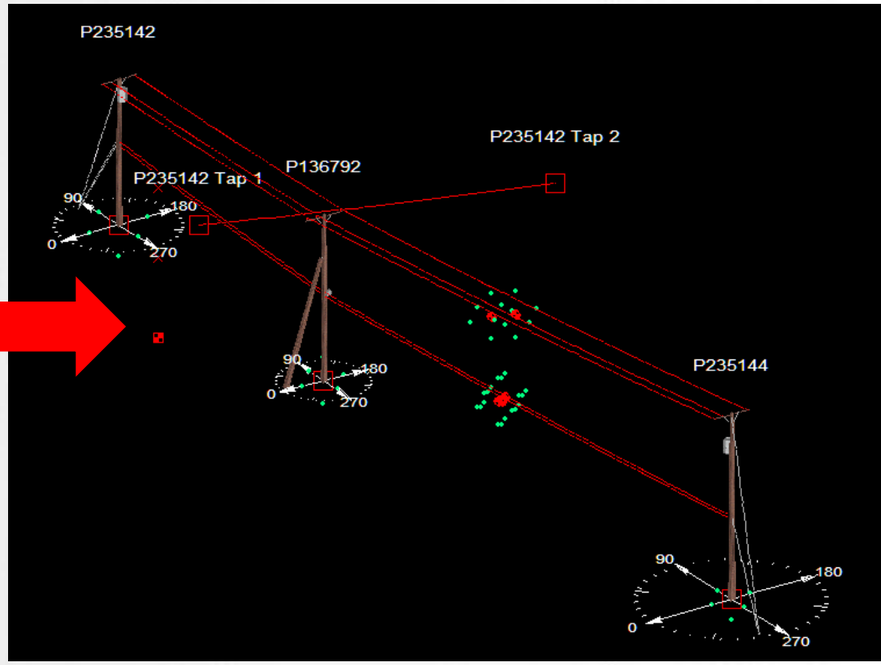
Automatic Stringing

Automatically Presented after Import Staking Table

Manually Performed using ‘PLS-CADD > Sections > Automatic Stringing’



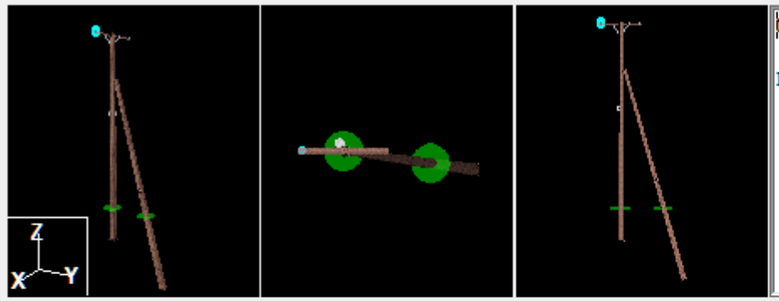




Automatic Stringing Optimization

Optimize Automatic Stringing by Defining Set, Phase, and Set Description

PLS-CADD Link Cable Sets

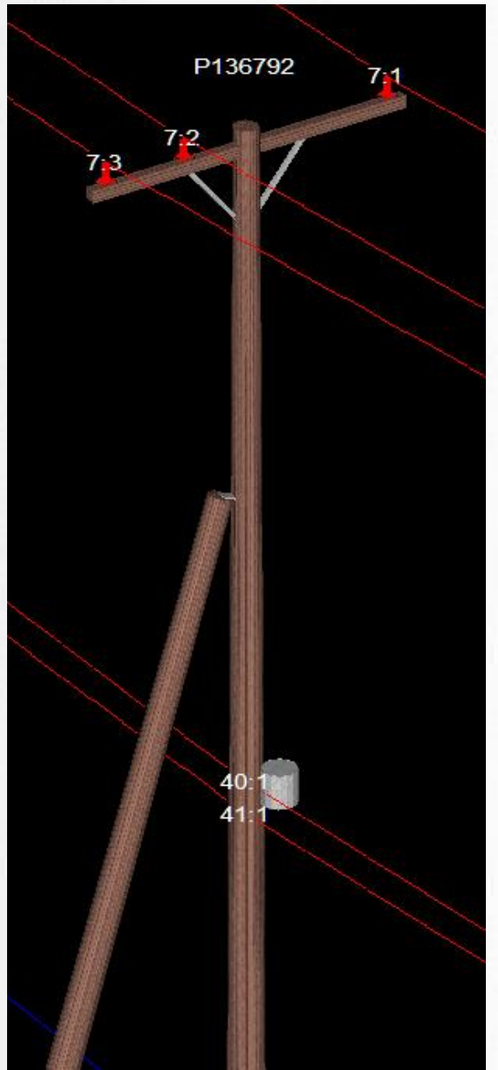


Model Check Report

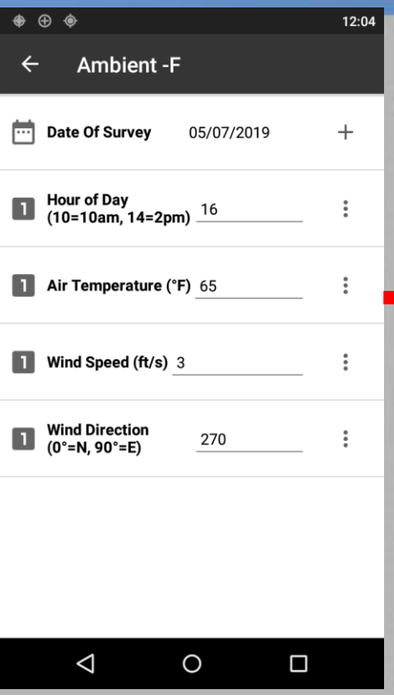
No errors or relevant warnings detected.

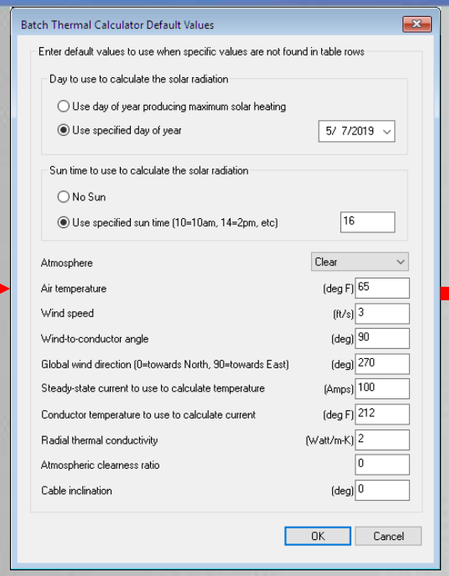
	Insulator Label	Conductor Attach Label	Insulator Type	Set Number	Phase Number	Set Description	Dead End	Framing Source
1	S1A1L1I1	S1A1L1I1	Post	7	1	Distribution A1	No	
2	S1A1L1I2	S1A1L1I2	Post	7	2	Distribution A1	No	
3	S1A1L1I3	S1A1L1I3	Post	7	3	Distribution A1	No	
4	S1I1L1	A1:S1I1L1	Clamp	40	1	Comms A1	No	
5	S1I1L2	A1:S1I1L2	Clamp	41	1	Comms A1	No	

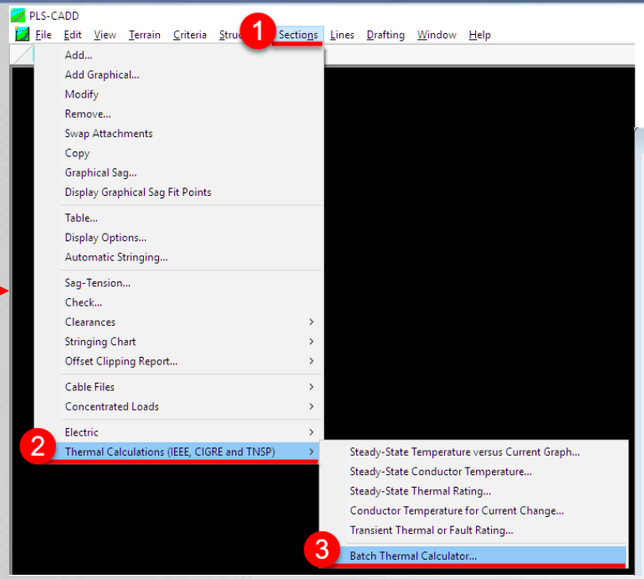
OK Cancel

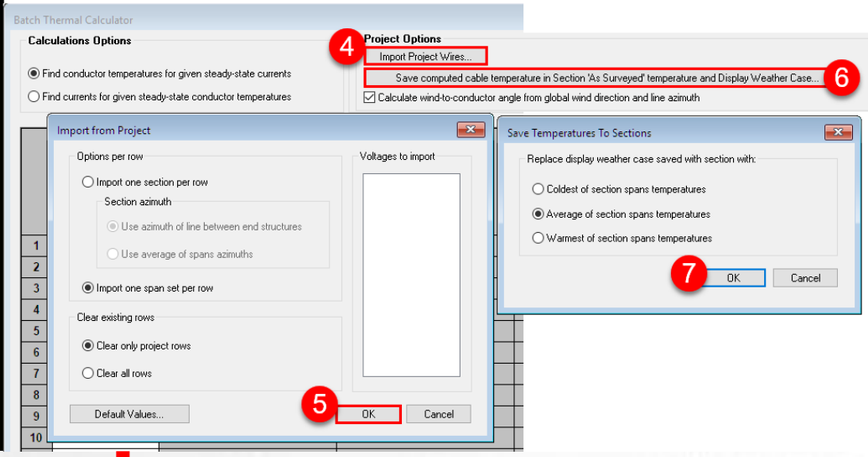


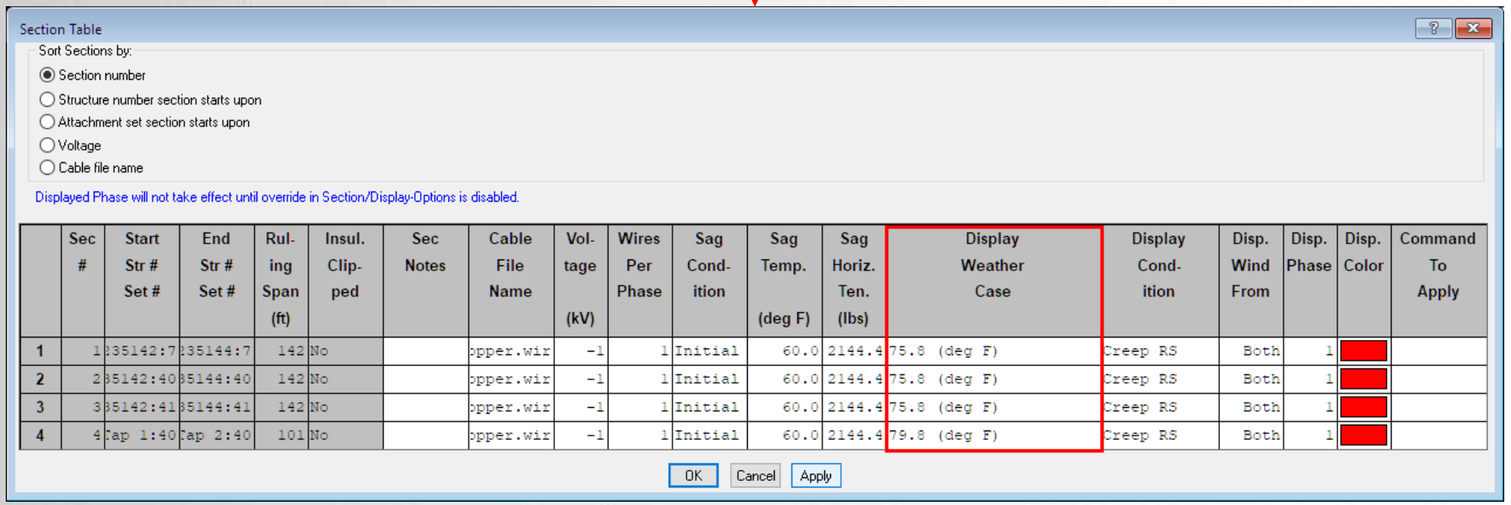
Batch Thermal Calculator







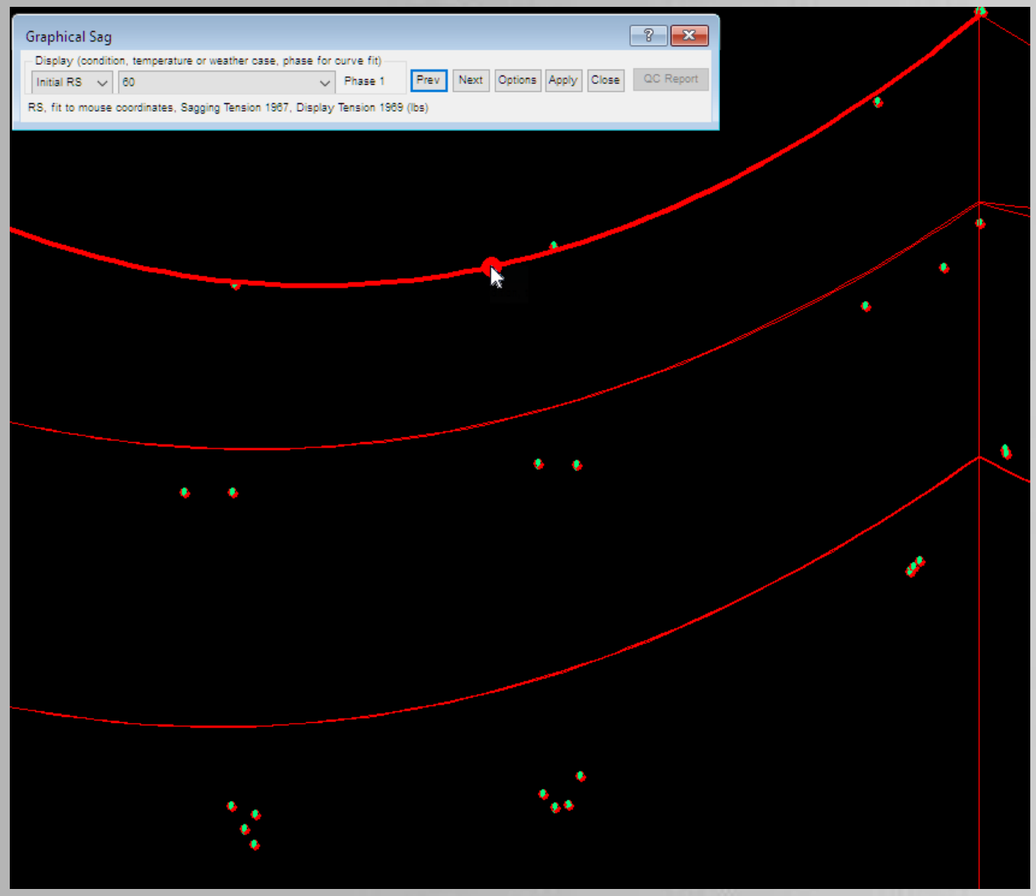




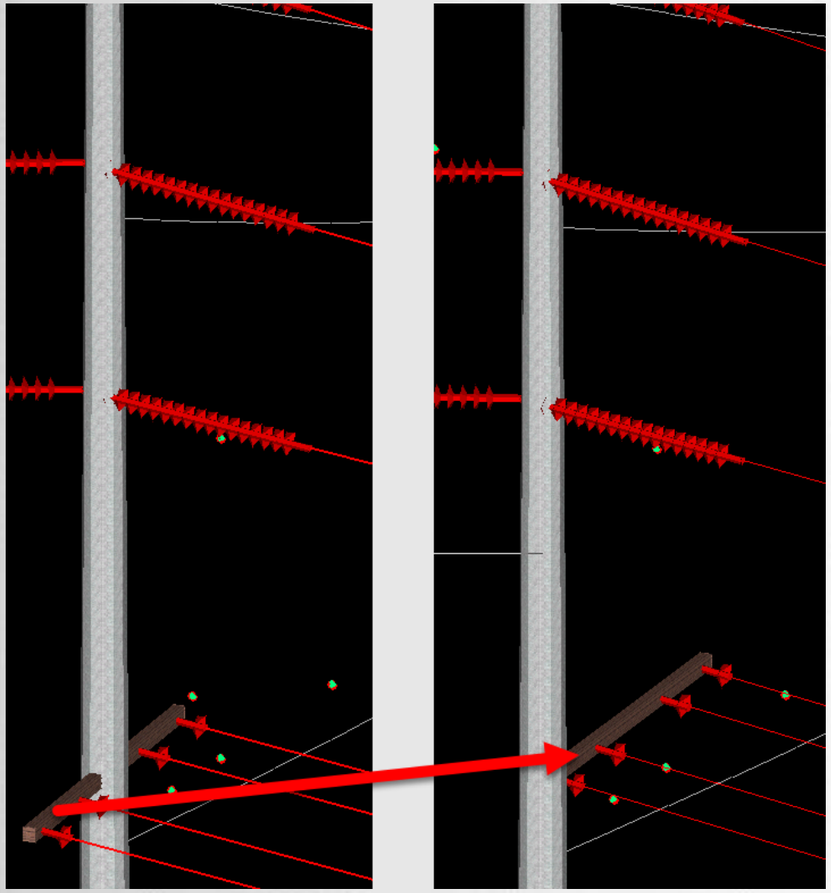
	Sec #	Start Str # Set #	End Str # Set #	Ruling Span (ft)	Insul. Clipped	Sec Notes	Cable File Name	Voltage (kV)	Wires Per Phase	Sag Condition	Sag Temp. (deg F)	Sag Horiz. Ten. (lbs)	Display Weather Case	Display Condition	Disp. Wind From	Disp. Phase	Disp. Color	Command To Apply
1	1	335142:7	335144:7	142	No		opper.wir	-1	1	Initial	60.0	2144.4	75.8 (deg F)	Creep RS	Both	1		
2	2	35142:40	35144:40	142	No		opper.wir	-1	1	Initial	60.0	2144.4	75.8 (deg F)	Creep RS	Both	1		
3	3	35142:41	35144:41	142	No		opper.wir	-1	1	Initial	60.0	2144.4	75.8 (deg F)	Creep RS	Both	1		
4	4	Tap 1:40	Tap 2:40	101	No		opper.wir	-1	1	Initial	60.0	2144.4	79.8 (deg F)	Creep RS	Both	1		

Model Finalization

Sag Wires to IKE Survey



True Up Structures



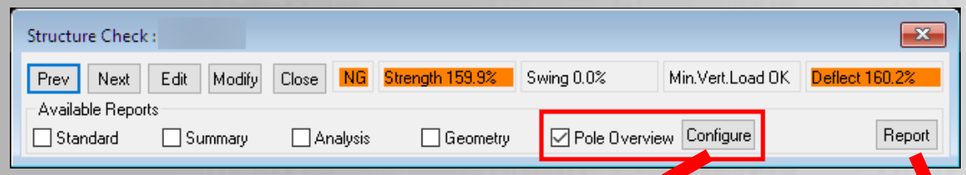
Apply Loads

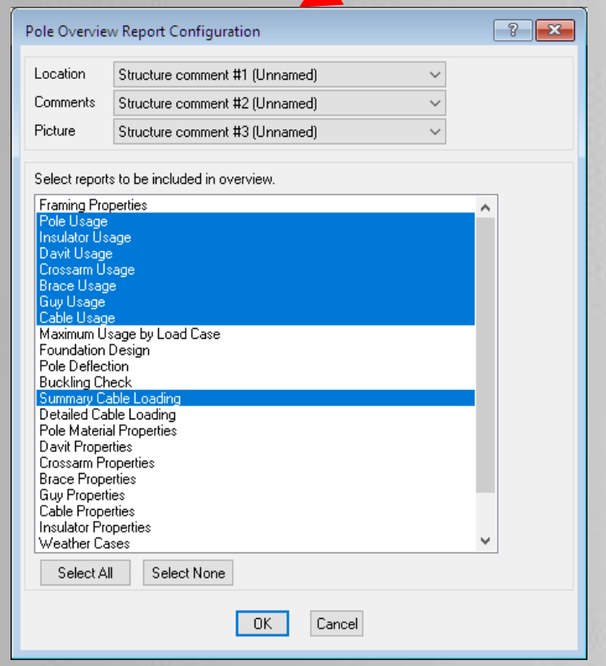
Staking Table

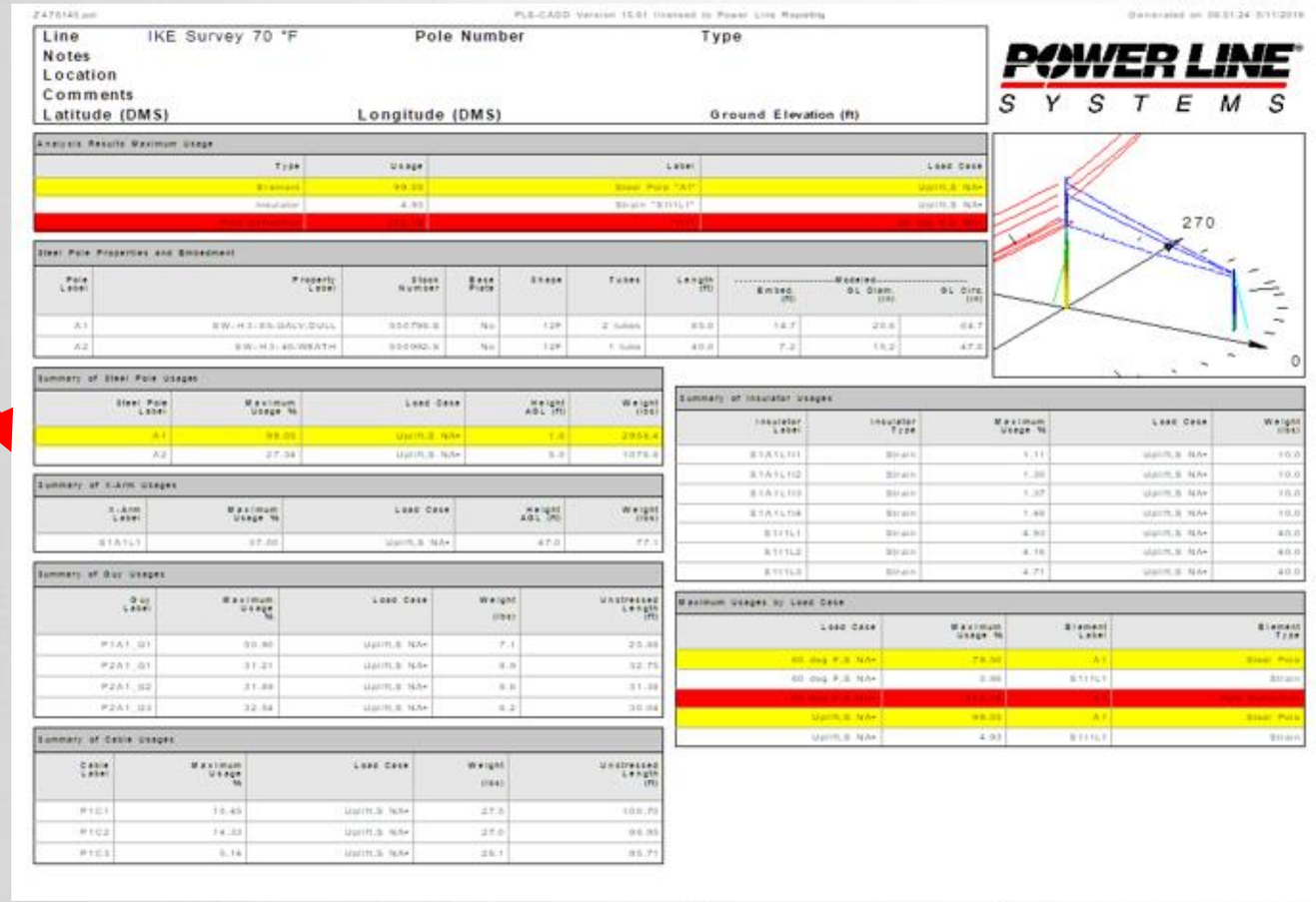
	Automatic Structure Group Membership	Manual Structure Group Membership	S C
1	'All', 'Has DE'	'GO95LT_A_REP'	Z1712
2	'All', 'Has DE'	'GO95LT_A_REP'	Z4761
3	'All', 'Has DE'	'GO95LT_A_REP'	Z4761
4	'All', 'No DE',	'GO95LT_A_REP'	Z1708
5	'All', 'No DE',	'GO95LT_A_REP'	P2096
6	'All', 'Has DE'	'GO95LT_A_REP'	Z4761
7	'All', 'Has DE'	'GO95LT_A_REP'	Z1712

Analysis & Reporting

New ‘Pole Overview’ Report – Coming in PLS 16!

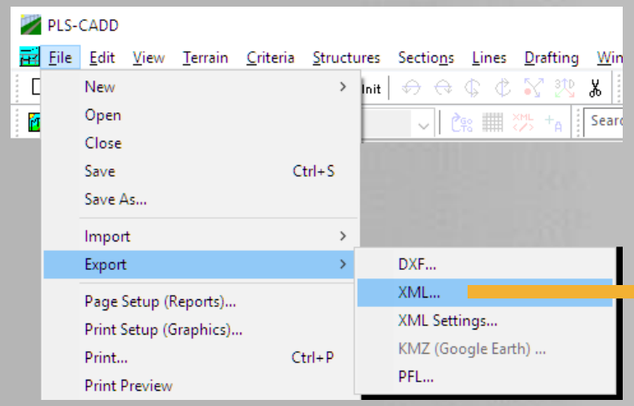


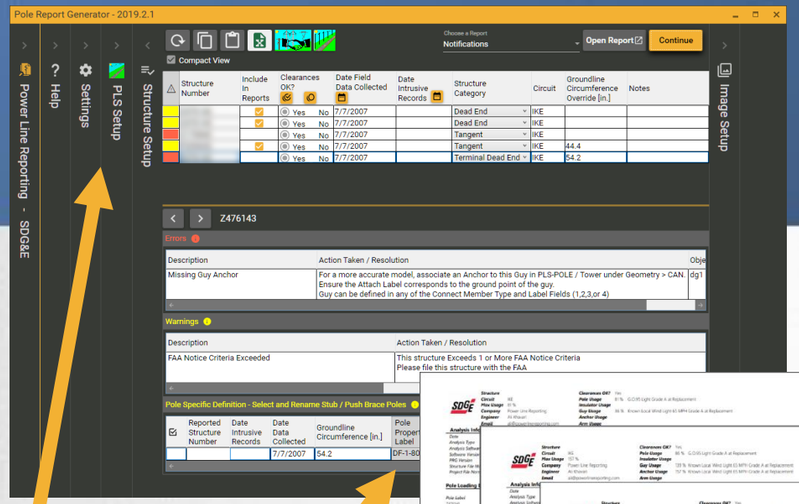


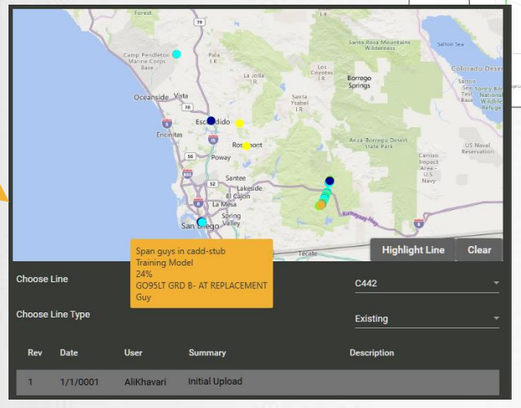


Custom XML Processing

- PLS-CADD QC Automation
- Customized Reports
- Database Integrations







Takeaways

- **Demo**
  - https://youtu.be/Wyst3QZxzxs

- The **Import Staking Table** Is the Most Complete way to Integrate Third Party Data into PLS-CADD
  - Multiple Alignments
  - XY Spotting: Set Line Angle = 500
  - Correct Structure Orientation
  - Automated Stringing
  - Structure Comments

- **Pole Overview Report** in PLS Version 16

- IKE+ Accuracy
  - **2-4 cm** Accurate Structure Base Spotting
  - IKE+ can be used to collect generic survey points in budget or time constrained PLS-CADD Modeling applications.

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