Unlocking Infrastructure Intelligence from Generation and Past the Meter

Digital Twins from Generation, Transmission, Substations and Distribution Designs

Joe Travis, Sr. Director – Bentley Systems

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Global Top 100 Software Company

FOCUSED ON INFRASTRUCTURE

> 1.8 million users

> 34,000 accounts

38 years operation

> 5,000 colleagues

> 1,500 Engineering degrees (in addition to computer sciences)

> 180 countries

> $1B annual revenue 2021

$590M in R&D past 4 years

BSY Publicly traded company

93% ENR Top 250 Engineering Firms

72% Bentley Infrastructure Top 500 Owners

Advancing sustainable infrastructure

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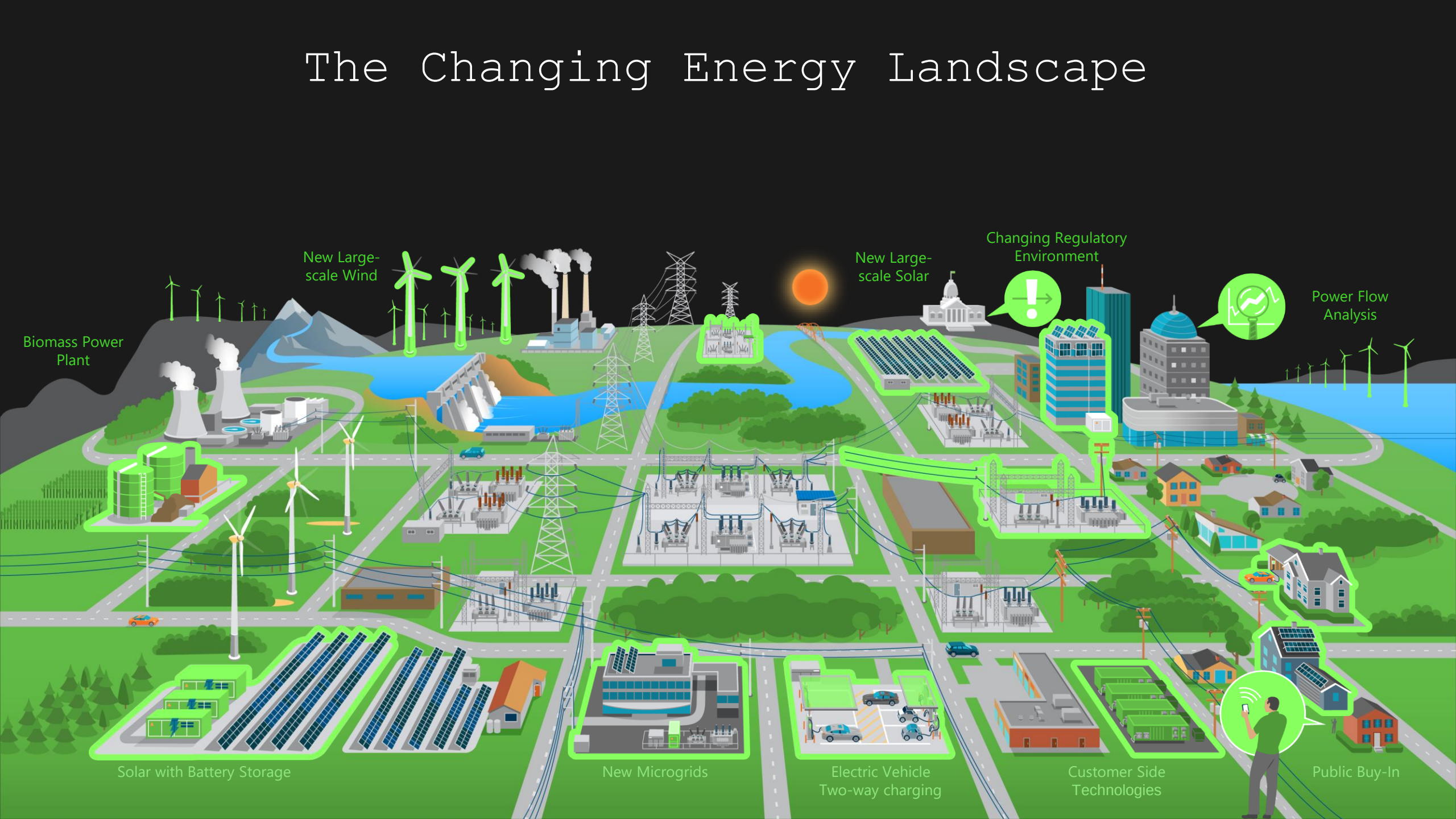
The Changing Energy Landscape



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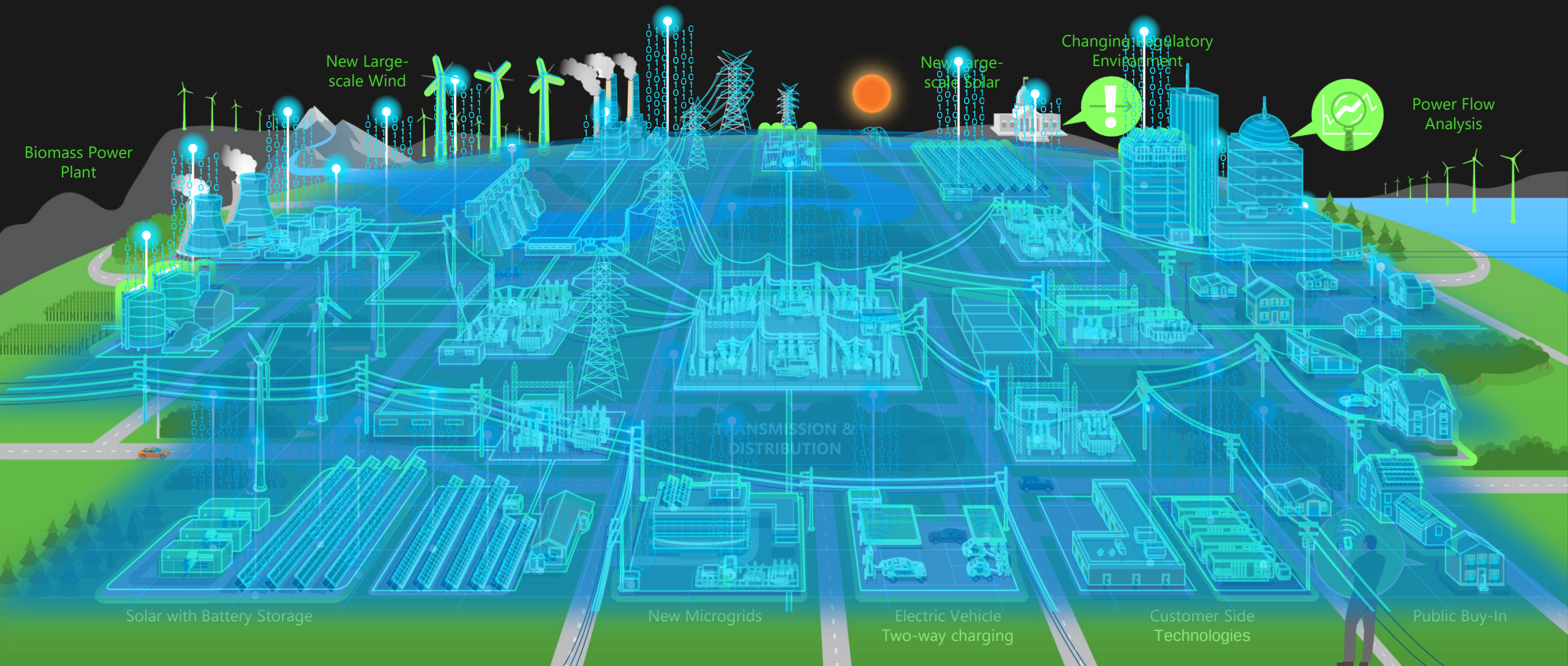
ACCELERATING

The Energy Transition Through

Unlocking Infrastructure Intelligence

Engineering Data In a Digital Twin Environment



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OPTIMIZING

Every Stage of the Energy Lifecycle

Energy Production

Plant Design | Geotechnical Engineering | Pipe Stress & Vessel Analysis | Project Delivery

Energy Delivery

Structural Analysis | Distribution Design | Substation Design | Transmission Design | Reality Modeling

Energy Consumption

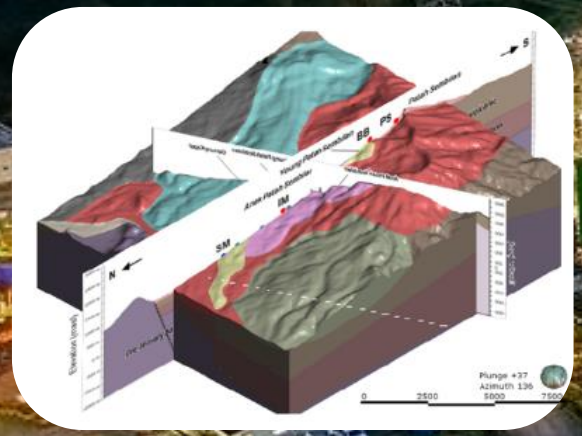
Power Systems Analysis | Plant Design

SEEQUENT

Geothermal at Supreme Energy

Indonesia

- Subsurface digital twin of an 85 MW geothermal plant
- Dynamically updates thermal model during directional drilling
- Manages and visualizes data for better decision making



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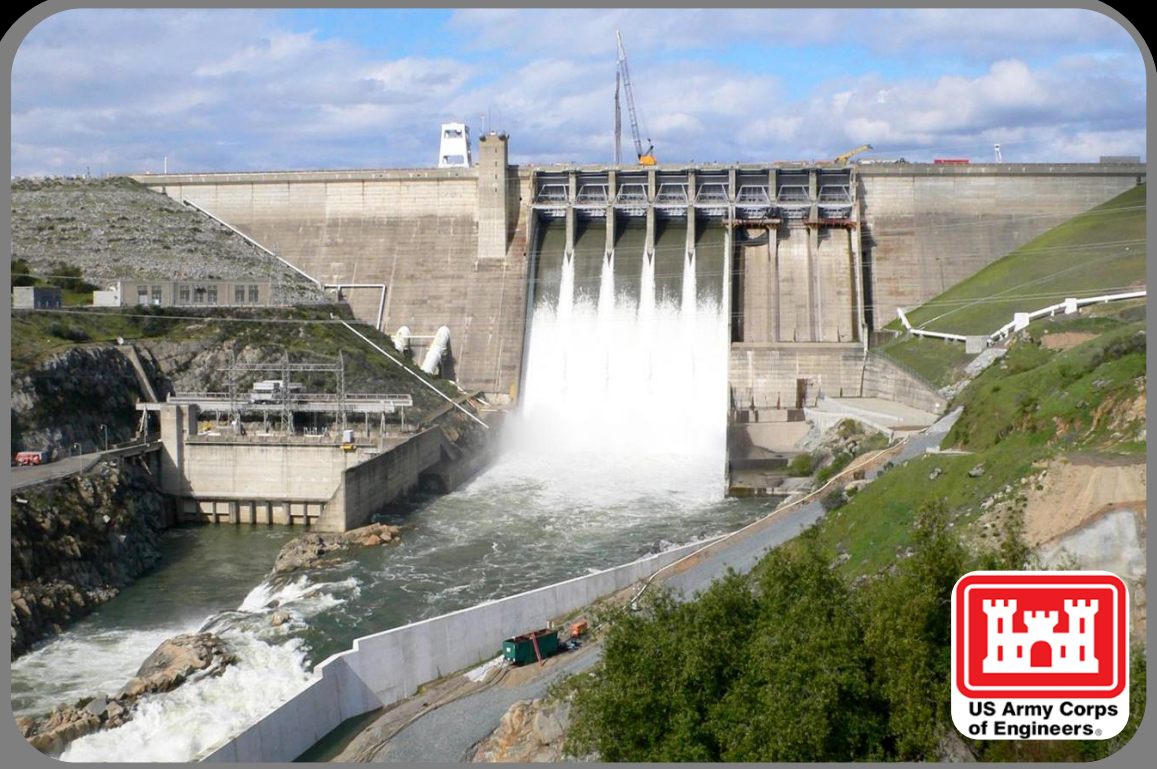
Power Generation and Hydro Monitorin

Pardee Dam

Largest geodetic & geotechnical dam monitoring system in the US.



Folsom Dam

Geotechnical spillway construction monitoring throughout six new auxiliary spillway gates

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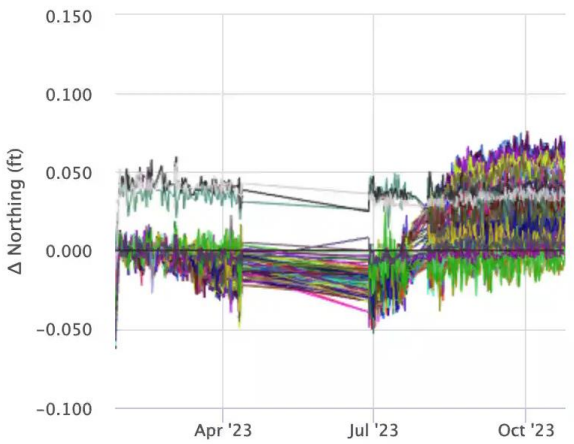
iTwin® IoT | Yuba Water Agency Default Project 13°C Oct 24, 2023

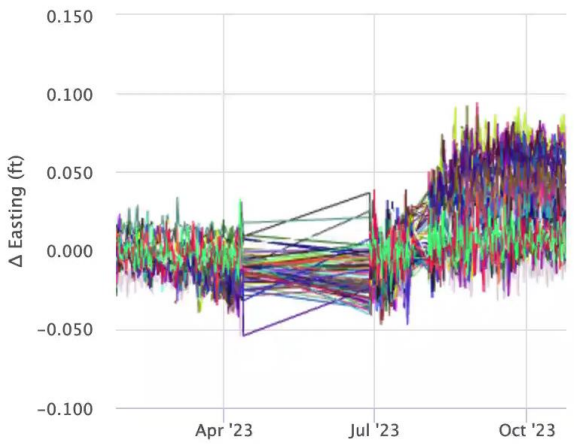
Correlation Dashboard

1h 12h 1d 1w 2w 1m 1y

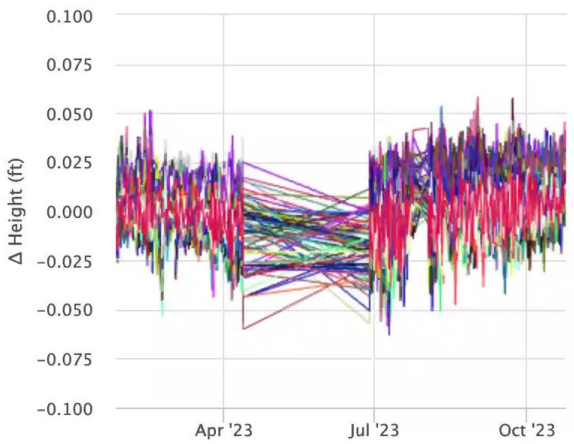
Delta Northing



Delta Easting

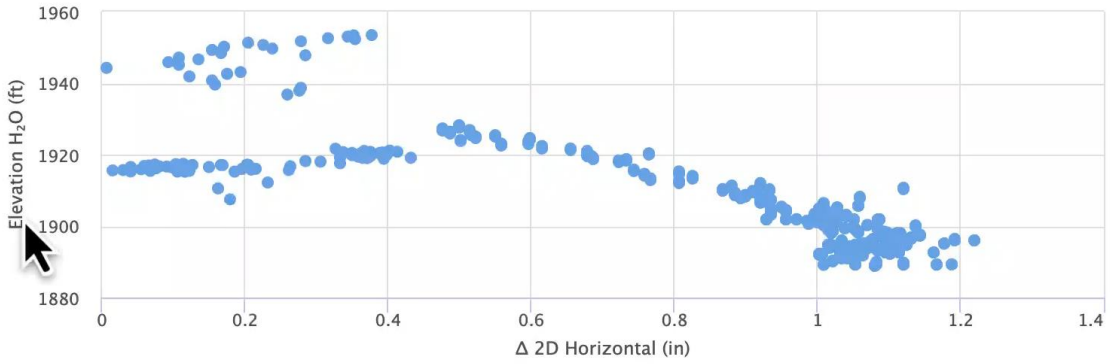


Delta Height



Reservoir Elevation

Reservoir Elevation vs Horizontal Deflection



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Doosan - Offshore Wind Reality Modeling

Maximizing Turbine Performanc

Doosan Heavy Industries & Construction
Seoul, Korea

Doosan worked with Microsoft and Bentley Systems to develop a digital twin of one of its wind farms, creating a 3D model for operators to use.

The digital twin links IoT sensor data, ML and models to accurately predict production output to maximize energy production and minimize operations and maintenance costs.

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Zhuanghe III Offshore Wind Farm

中国三峡 China Three Gorges Corporation

SIDRI 上海勘测设计研究院有限公司 Shanghai Investigation Design & Research Institute Co., Ltd.

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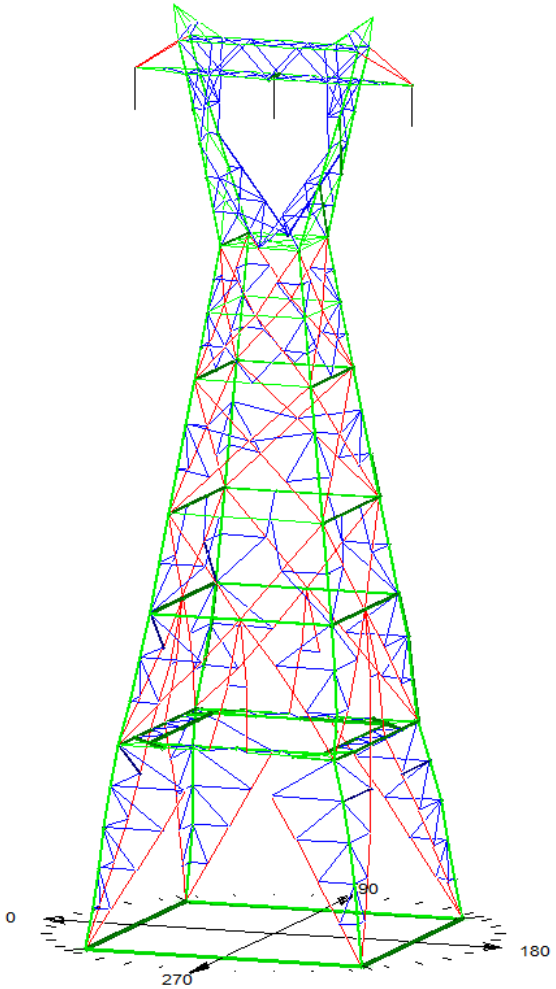
Structural Design and Improvements



EXO

Ensuring Structural Integrity

- Lattice tower model assessment and stabilization
- Data inspection acquisition using 3D photogrammetry

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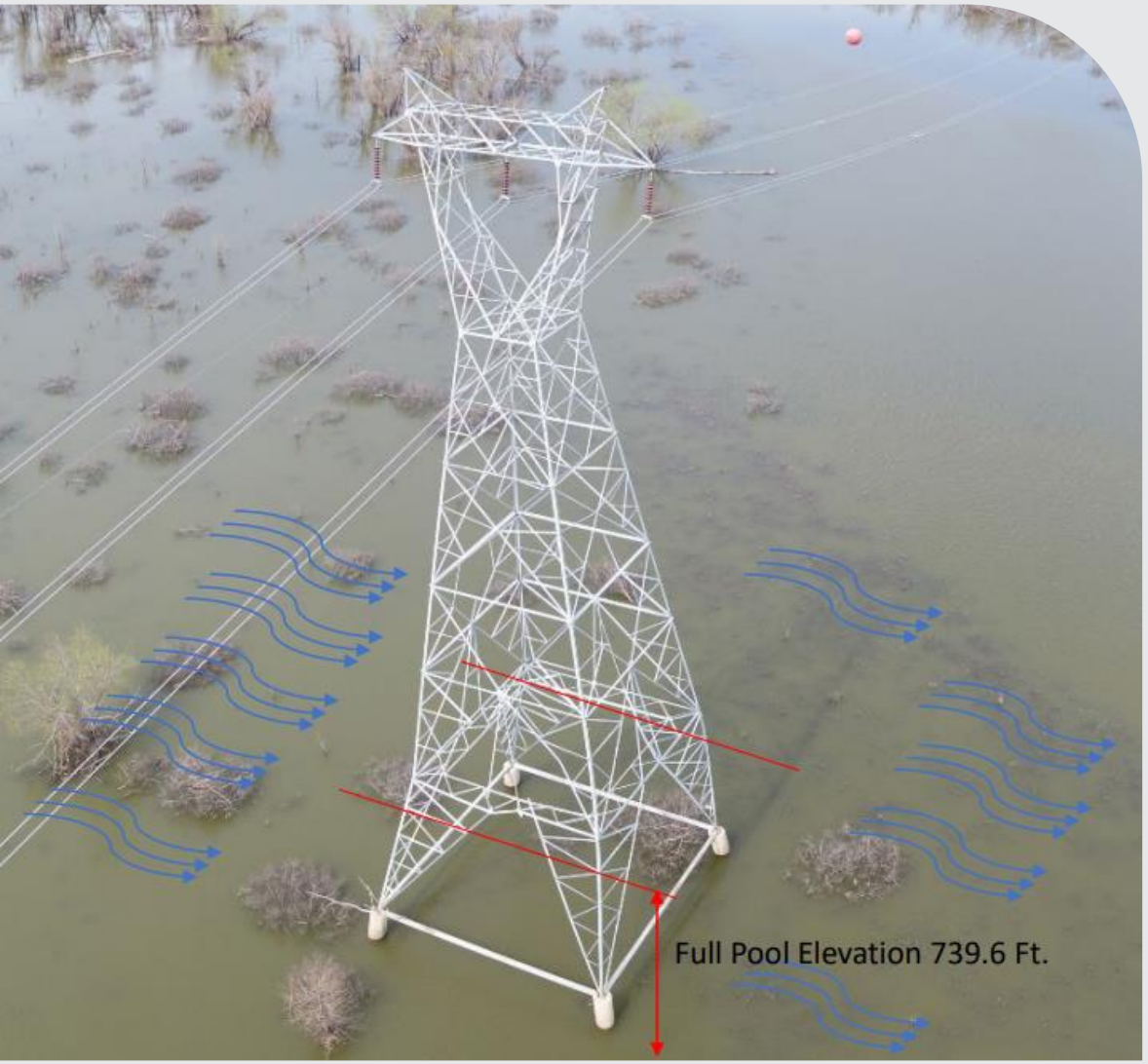

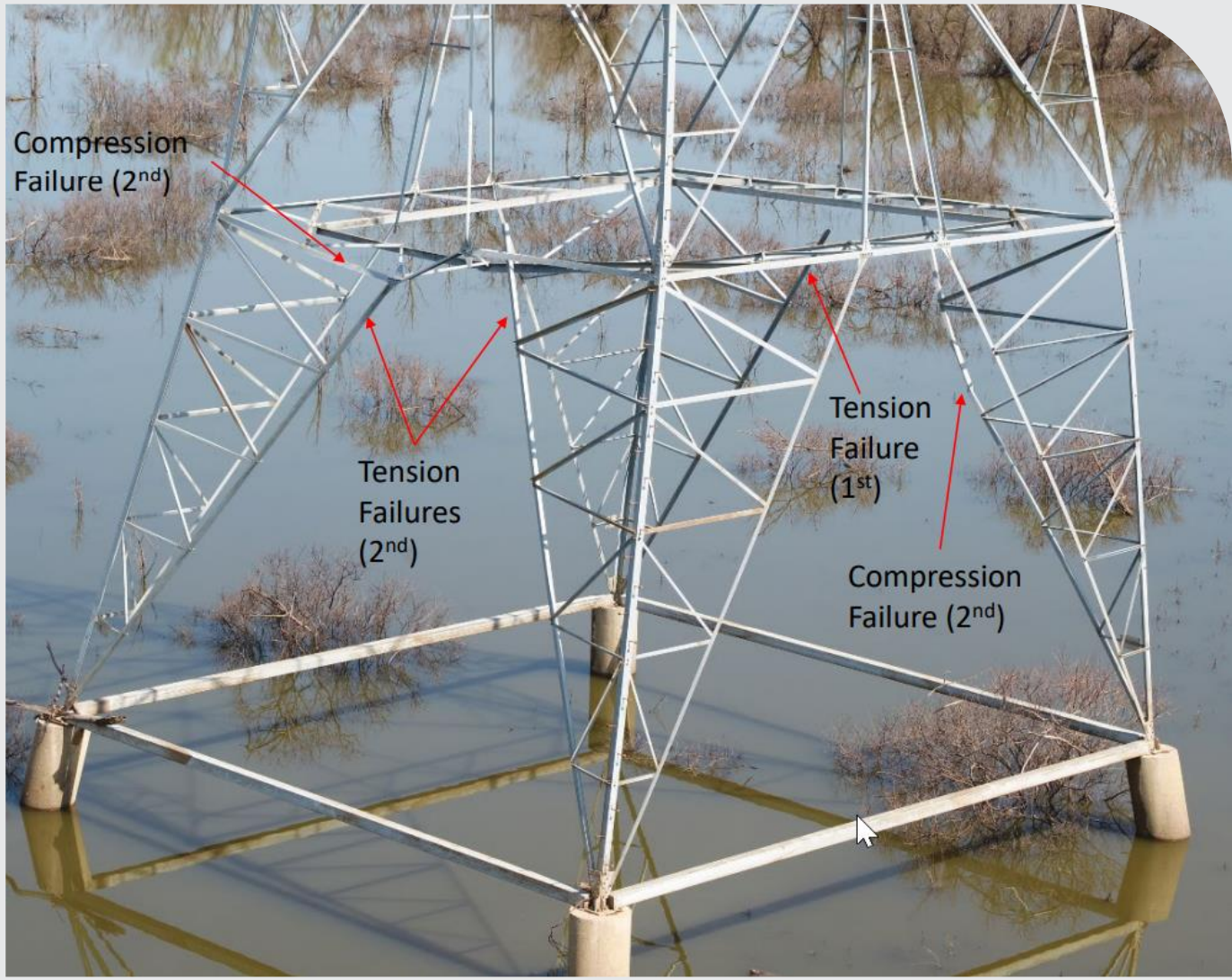

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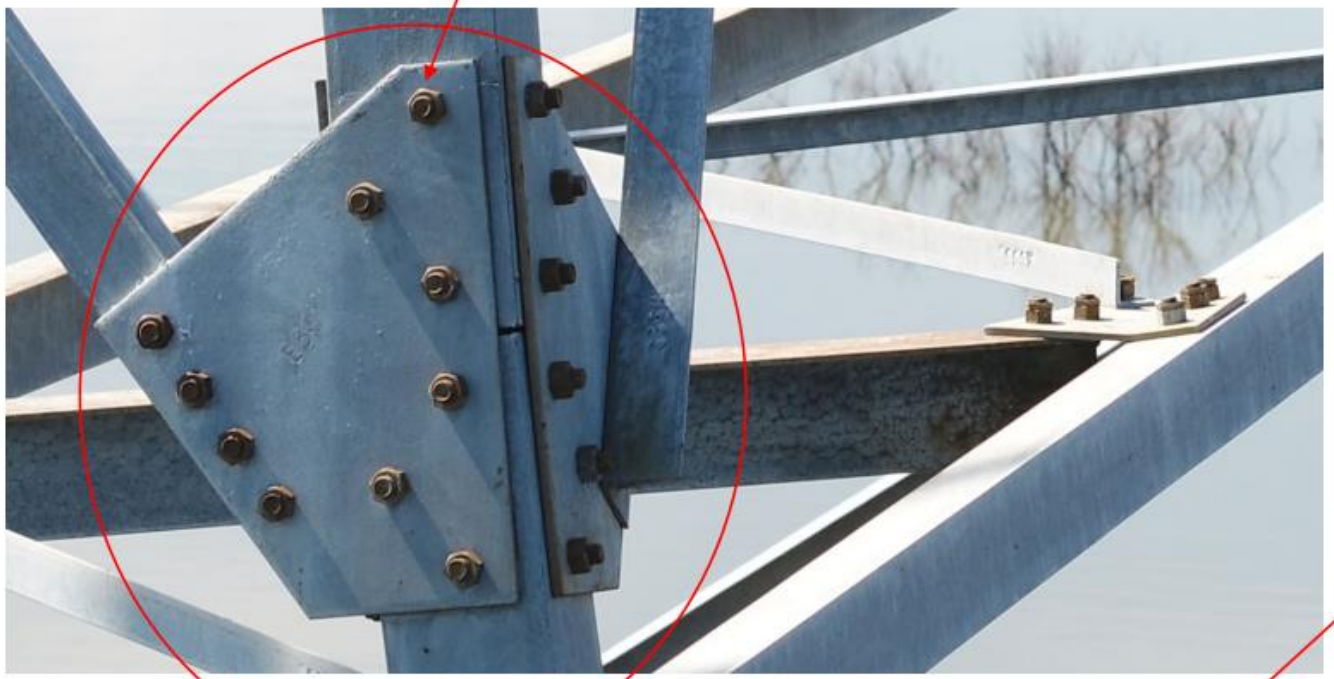
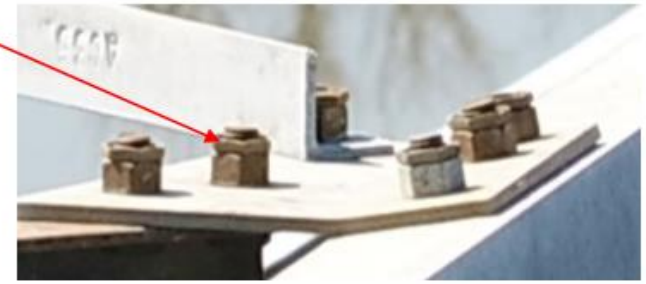
Twr 58:L Missing Locknuts

Tower 58

Locknuts





Missing Bolt

The Clues

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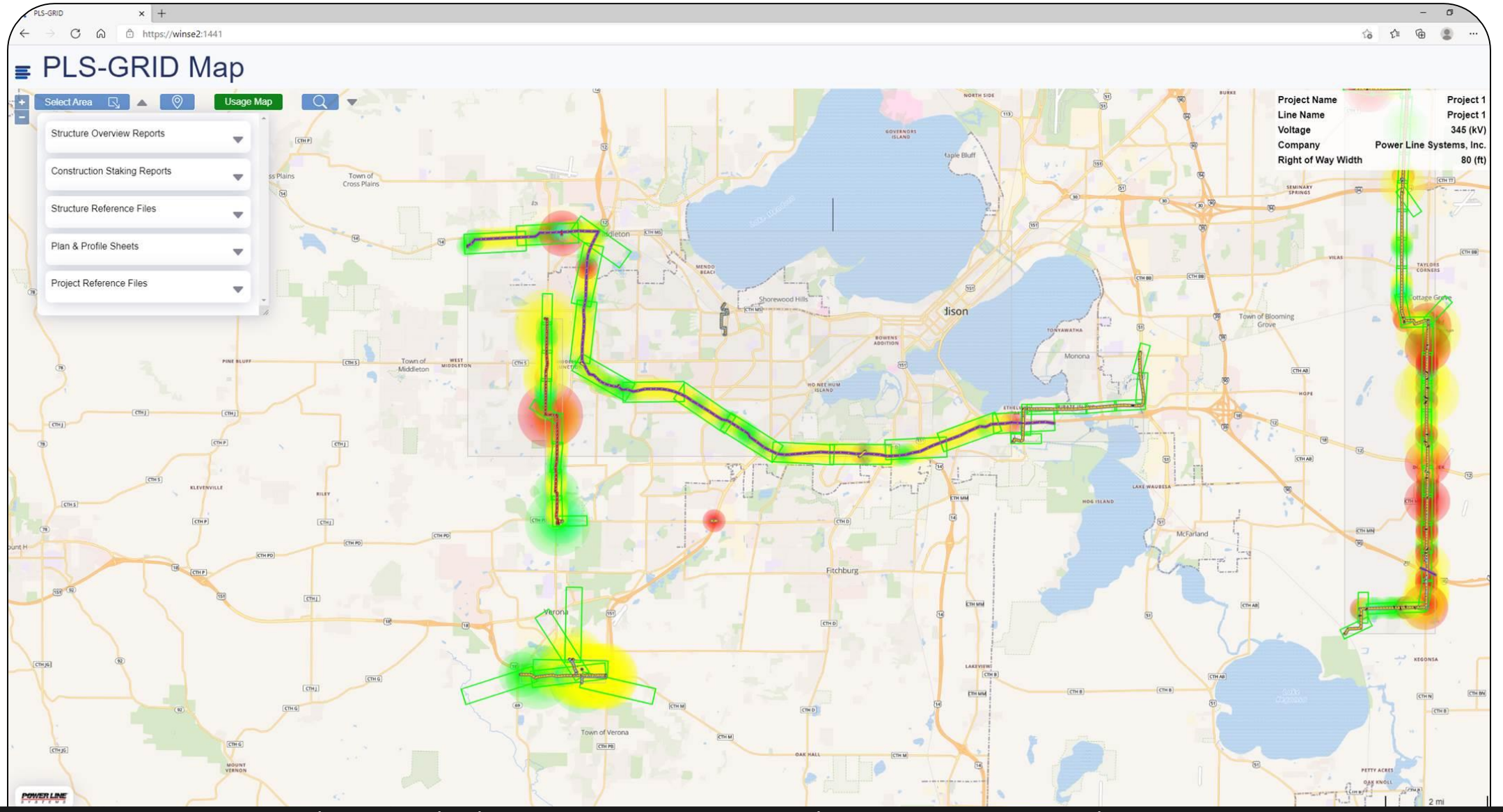

Heat Map Showing Critical Structure Failures for Projected Storm Event

Transmission Digital Twin info with PLSCAD / PLSGRID

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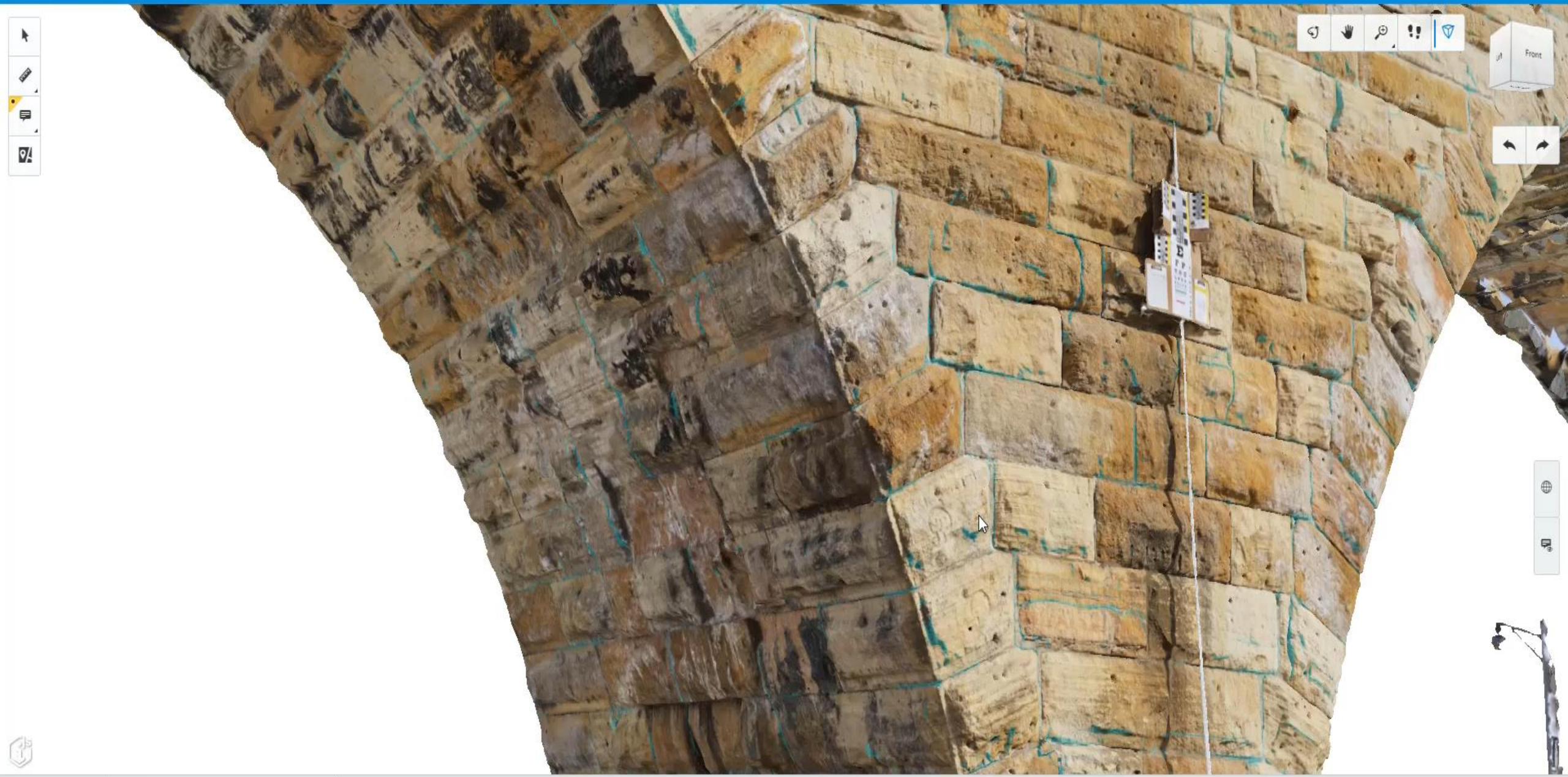
Front

3D Design and BIM Models for Improved Substation

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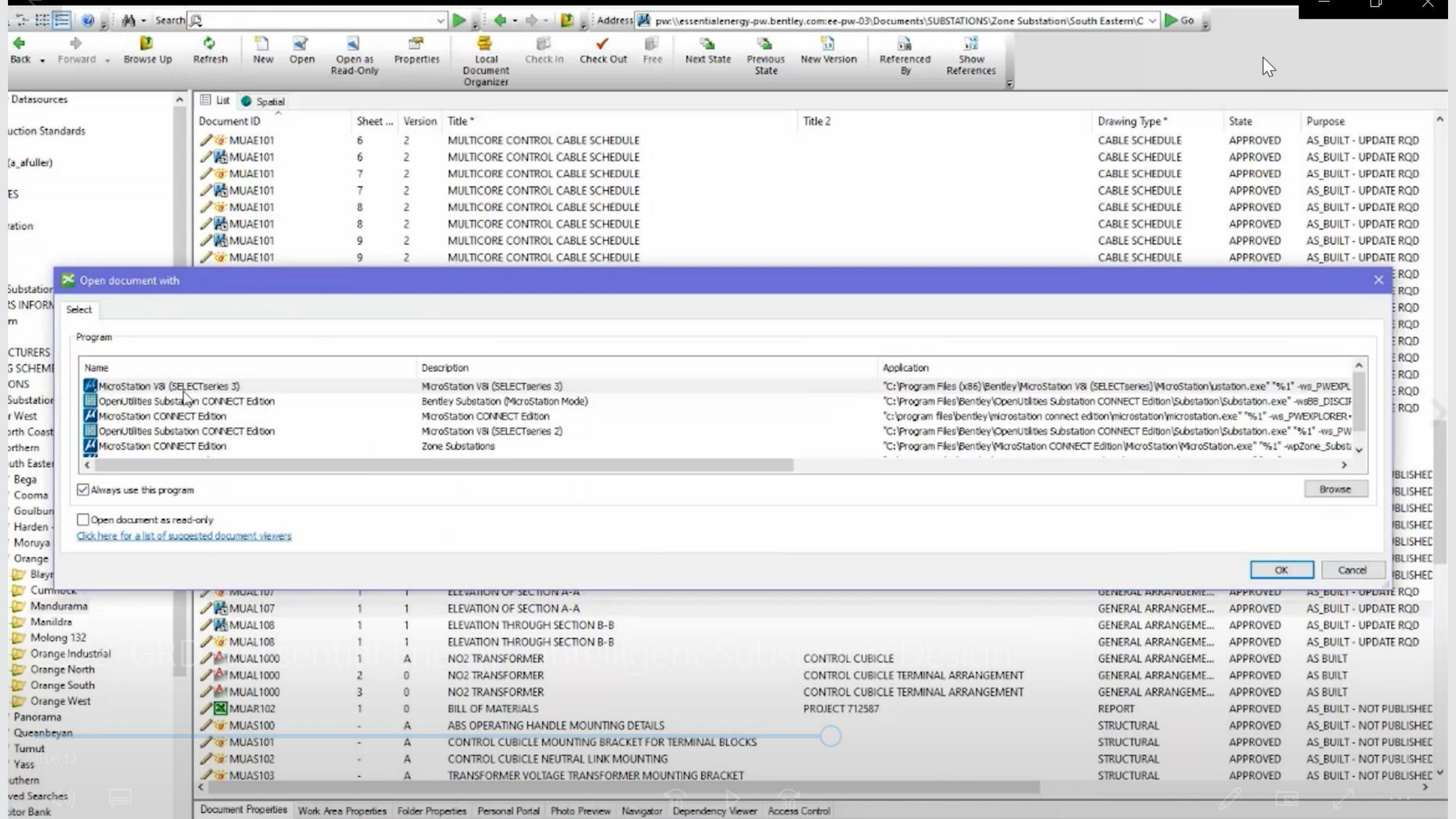
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MUAE101 | 6 | 2 | MULTICORE CONTROL CABLE SCHEDULE | CABLE SCHEDULE | APPROVED | AS_BUILT - UPDATE RQD
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OpenUtilities Substation CONNECT Edition | Bentley Substation (MicroStation Mode) | "C:\Program Files\Bentley\OpenUtilities Substation CONNECT Edition\Substation\Substation.exe" -ws8B_DISCI
MicroStation CONNECT Edition | MicroStation CONNECT Edition | "c:\program files\bentley\microstation connect edition\microstation\microstation.exe" "%1" -ws_PWEXPLORER
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MUAL108 | 1 | 1 | ELEVATION THROUGH SECTION B-B | GENERAL ARRANGEME... | APPROVED | AS_BUILT - UPDATE RQD
MUAL108 | 1 | 1 | ELEVATION THROUGH SECTION B-B | GENERAL ARRANGEME... | APPROVED | AS_BUILT - UPDATE RQD
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MUAL1000 | 2 | 0 | NO2 TRANSFORMER | CONTROL CUBICLE TERMINAL ARRANGEMENT | GENERAL ARRANGEME... | APPROVED | AS BUILT
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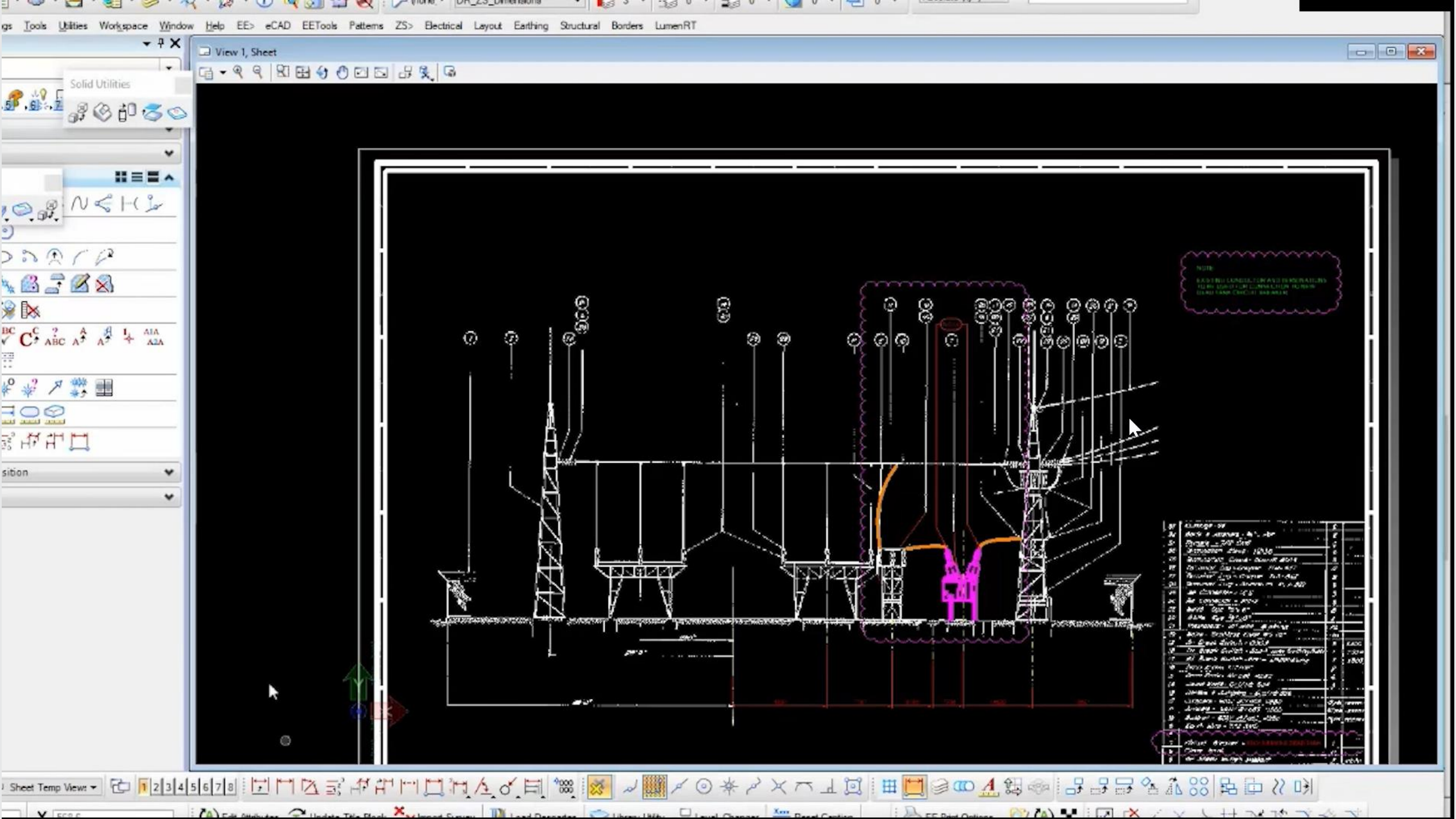
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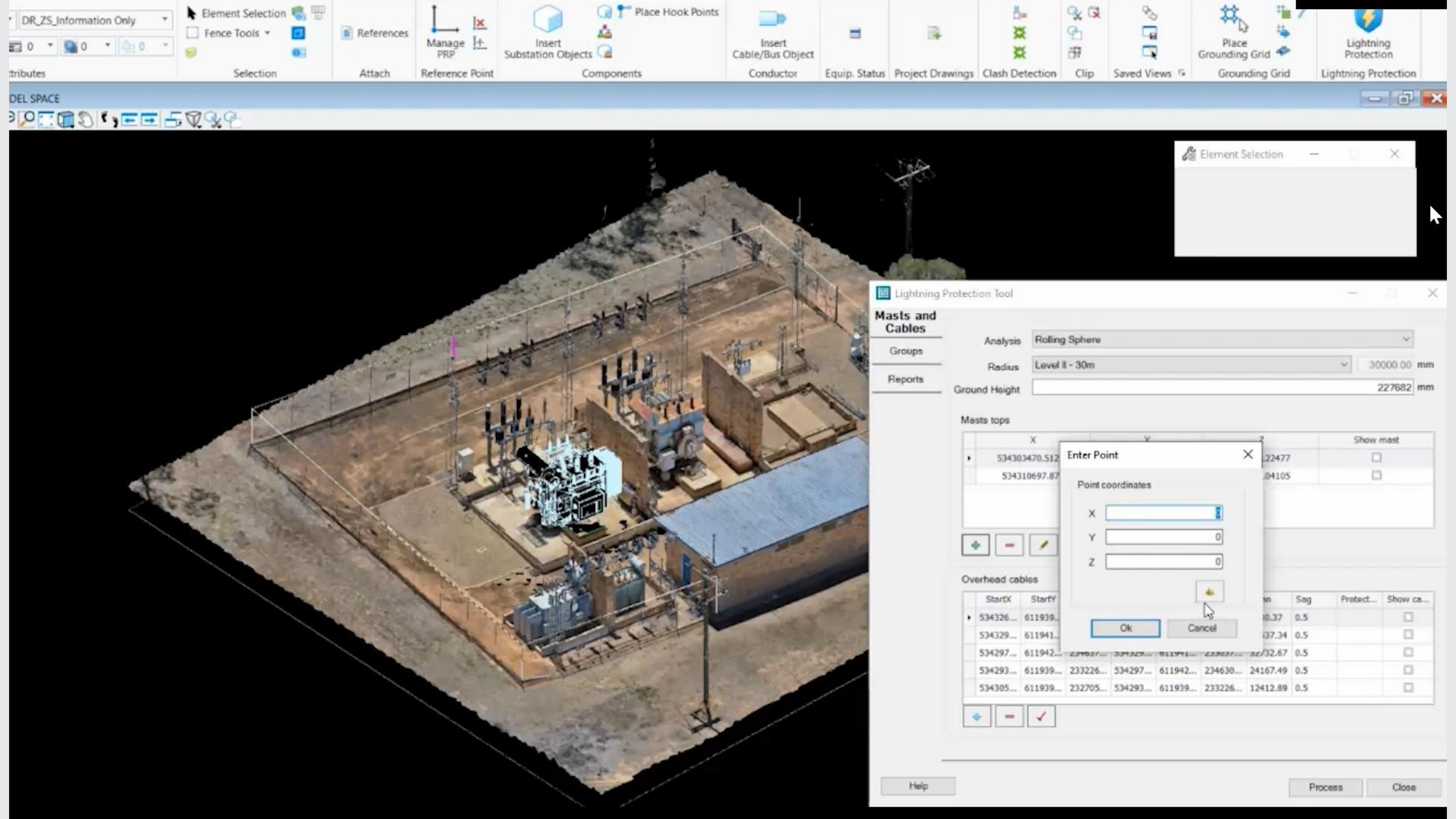
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Lightning Protection Tool
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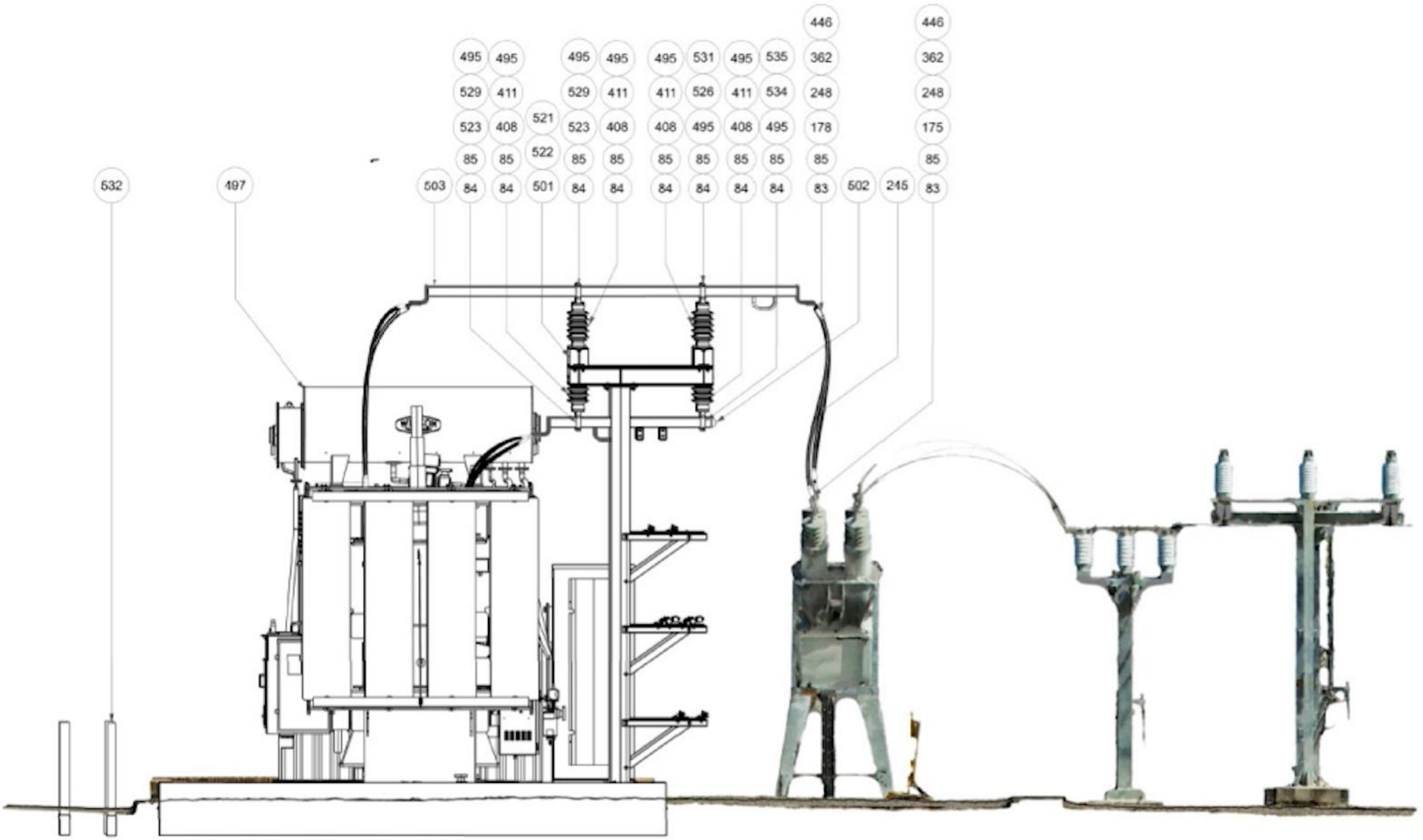
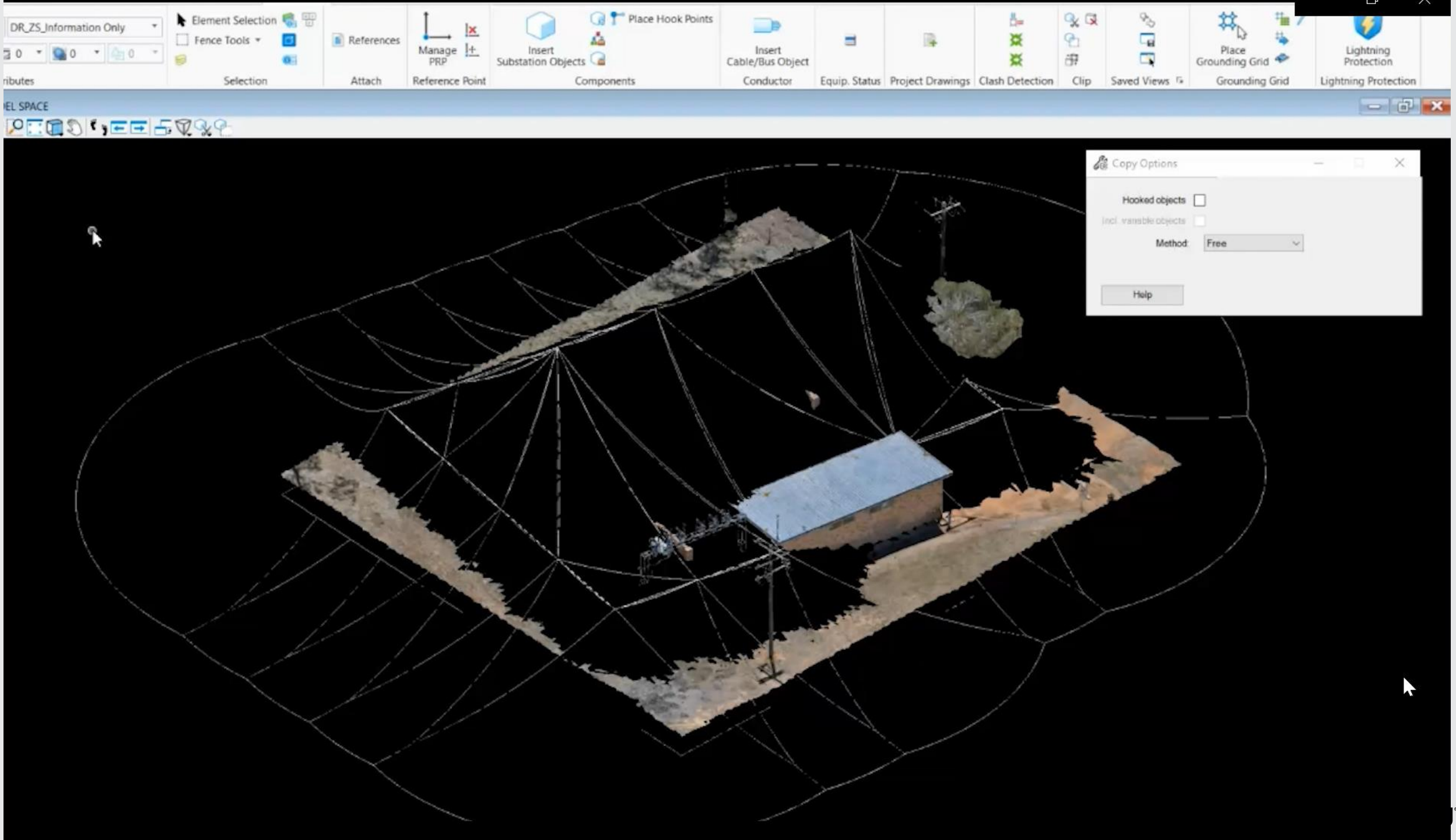


ALL DIMENSIONS ARE IN mm U.N.O. DO NOT SCALE	PROJECT No. 764210	COMMENTS	DESIGNED S. Rodgers	NORTH STREET 33/11kV ZONE SUBSTATION ELECTRICAL EQUIPMENT TX2 BAY - ELEVATION	© 2013 Essential Energy
DATE OF ISSUE 02/07/2020	NEW TX2, OIL SPLASH GUARD & TX BUS SUPPORT INSTALLATION		DRAWN A.Faller		essential
			REVIEWED J.Doyle		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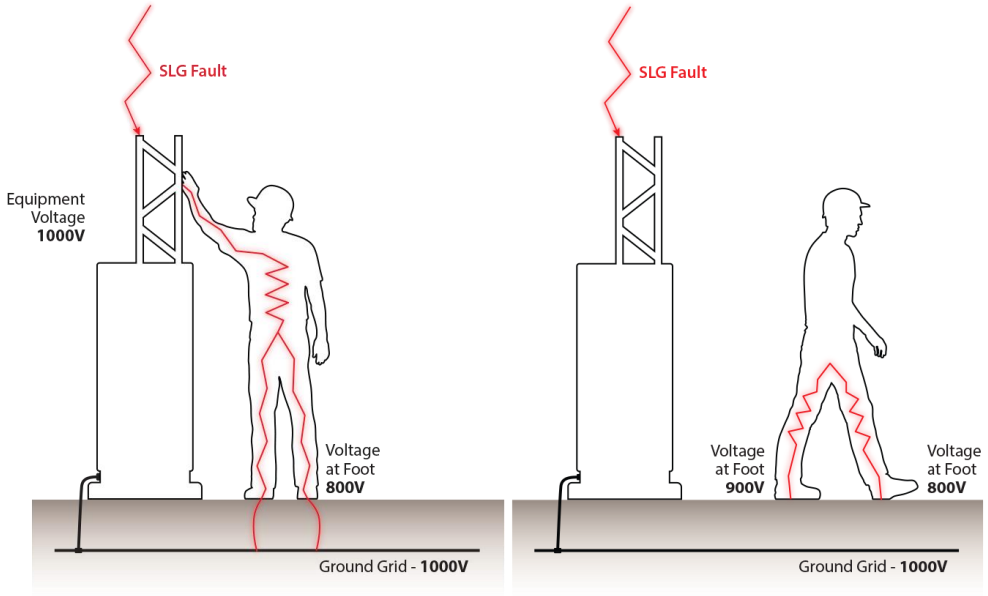
Project Drawings
Clash Detection
Clip
Saved Views
Place Grounding Grid
Grounding Grid
Lightning Protection
Lightning Protection
Copy Options
Hooked objects
Method:
Free
Help

Grounding Touch & Step Voltage

- Yellow regions require mitigation



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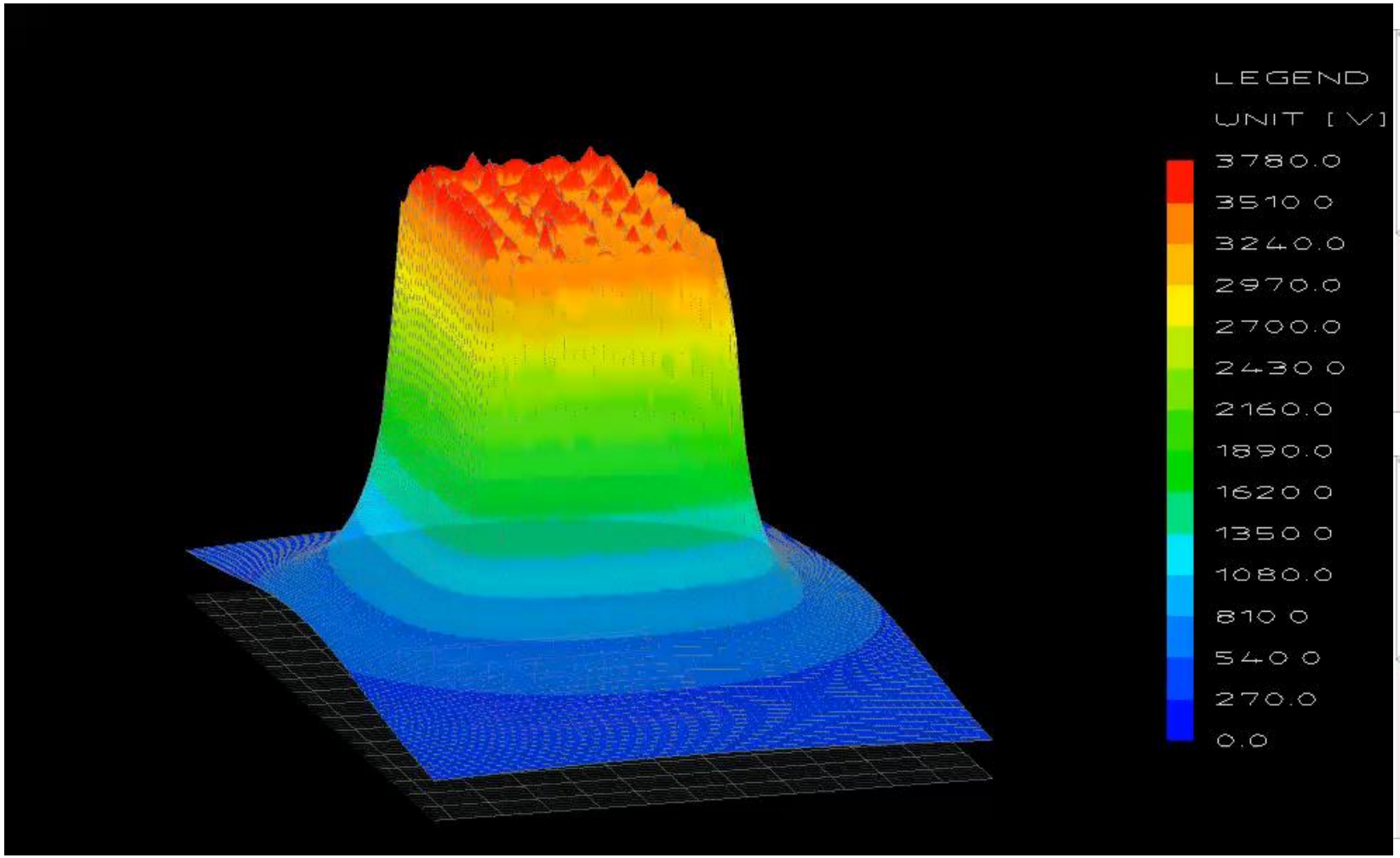
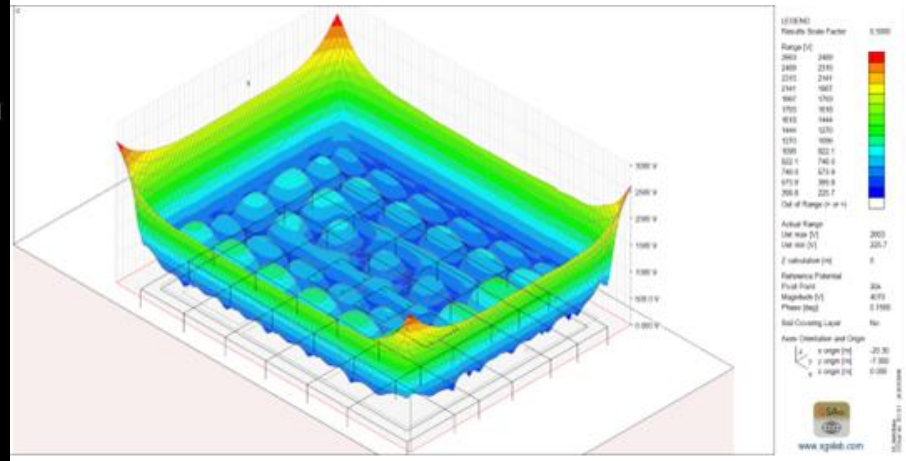
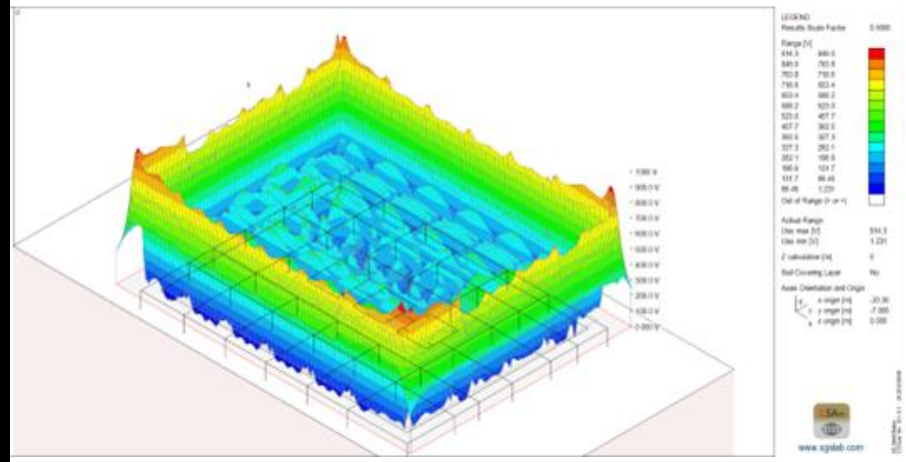
Earthing – Analyze Touch & Step Voltages







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iTwin IoT
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Anem1
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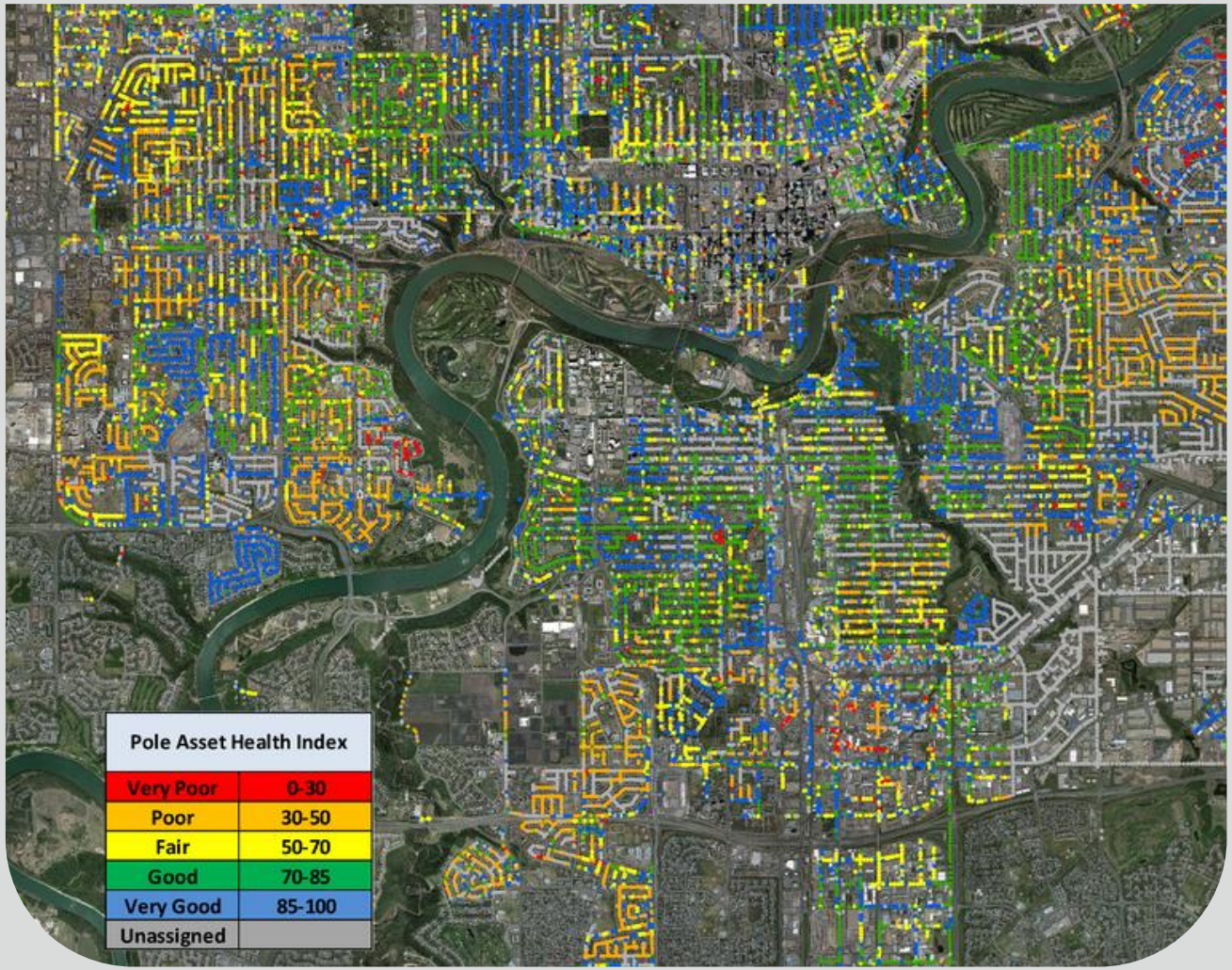
Distribution Vulnerability Assessment



- Ingest SCADA data to determine electrical loading information in near real-time
- Quantify asset health
- Prioritize assets for lifecycle replacement

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Project Location Design Tools Preferences Help Dev

Pole loading for CSA Heavy -

Search

Detailed Analysis Results - (2165481, As Is)

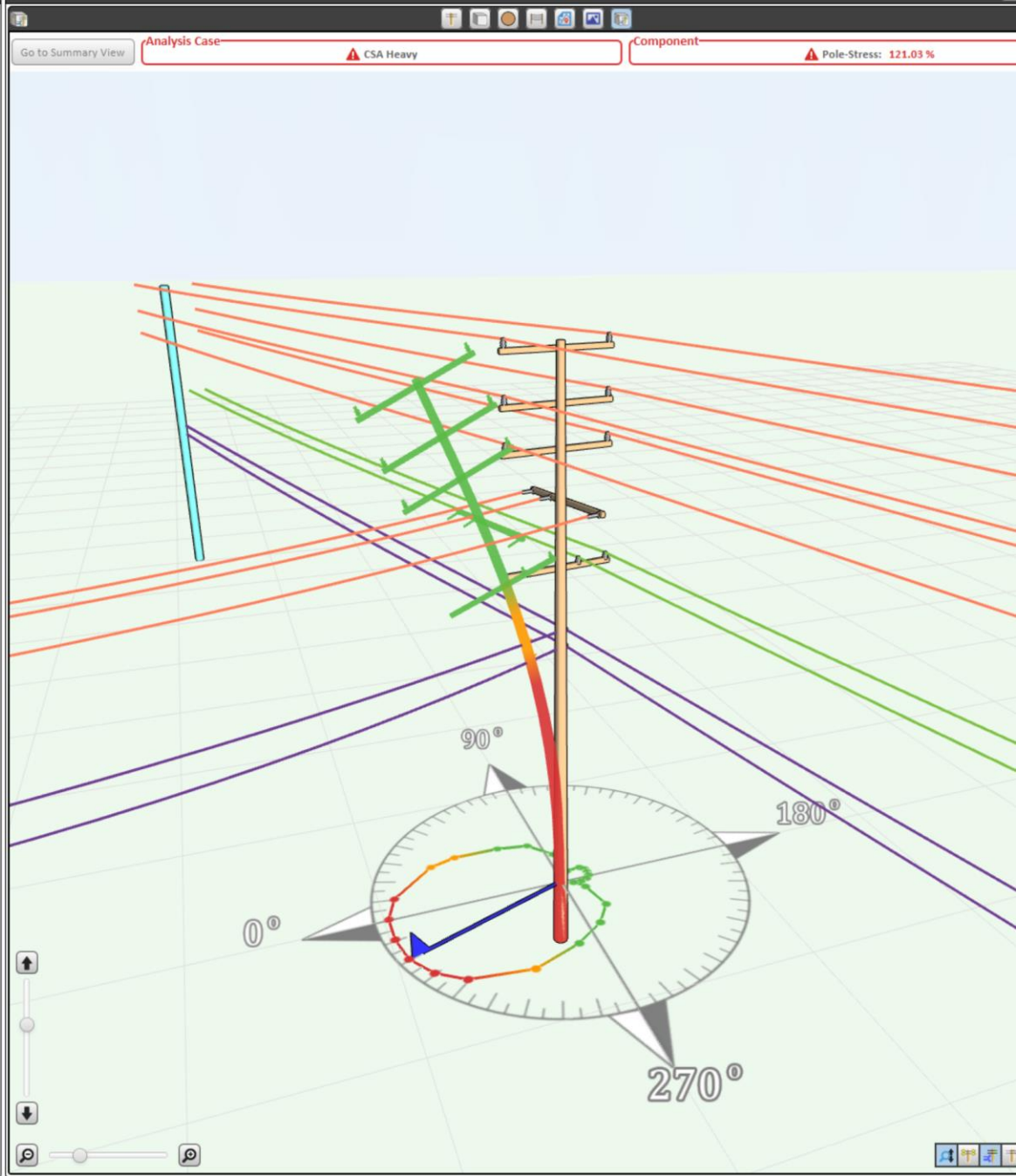
Analysis Results Summary

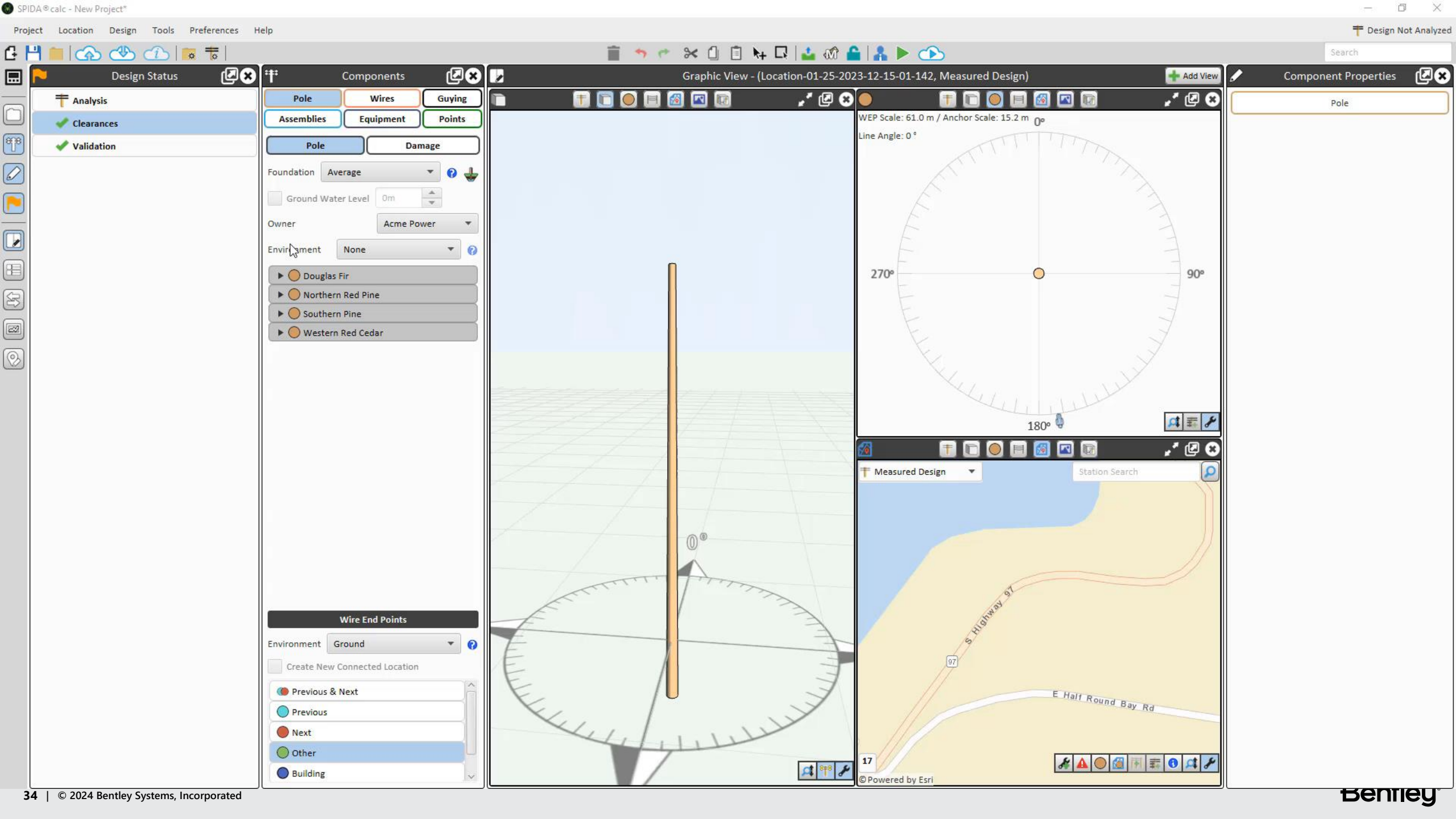
Double-click any table cell for more details.

Details

Component	CSA Heavy	GO95 Light	NESC Light
Pole - Stress 55'-3 Western Red Cedar	121.03%	1.99 S.F.	99.52%
Wood 10 Ft 3-1/2 x 4-1/2 (SYP) - Stress [48' 0"], Acme Power, CrossArm#1	21.58%	17.32 S.F.	12.91%
Wood 10 Ft 3-1/2 x 4-1/2 (SYP) - Stress [43' 10"], Acme Power, CrossArm#2	21.90%	17.32 S.F.	12.91%
Wood 10 Ft 3-1/2 x 4-1/2 (SYP) - Stress [40' 2"], Acme Power, CrossArm#3	26.44%	17.32 S.F.	12.91%
Wood 10 Ft 3-1/2 x 4-1/2 (SYP) - Stress [36' 0"], Acme Power, CrossArm#4	67.53%	5.23 S.F.	35.20%
Wood 10 Ft 3-1/2 x 4-1/2 (SYP) - Stress [30' 4"], Acme Power, CrossArm#5	24.77%	19.18 S.F.	11.25%
13.2 kV POST Insulator (Crossarm) - Force [0' 4"], Acme Power, Insulator#10	11.23%	24.20 S.F.	7.05%
13.2 kV POST Insulator (Crossarm) - Force [9' 8"], Acme Power, Insulator#2	10.27%	24.20 S.F.	7.05%
13.2 kV POST Insulator (Crossarm) - Force [0' 4"], Acme Power, Insulator#8	11.10%	24.20 S.F.	7.05%
13.2 kV POST Insulator (Crossarm) - Force [9' 8"], Acme Power, Insulator#9	10.20%	24.20 S.F.	7.05%
13.2 kV POST Insulator (Crossarm) - Force [0' 4"], Acme Power, Insulator#1	11.18%	24.20 S.F.	7.05%
13.2 kV POST Insulator (Crossarm) - Force [9' 8"], Acme Power, Insulator#3	10.42%	24.20 S.F.	7.05%
15 kV Dead End Insulator - Force [0' 4"], Acme Power, Insulator#11	7.46%	48.24 S.F.	3.24%
15 kV Dead End Insulator - Force [7' 0"], Acme Power, Insulator#6	9.62%	48.46 S.F.	3.23%
15 kV Dead End Insulator - Force [9' 8"], Acme Power, Insulator#5	6.46%	48.46 S.F.	3.23%
13.2 kV Pin Type Insulator (Crossarm) - Force [0' 4"], Acme Power, Insulator#13	6.92%	50.90 S.F.	3.91%
13.2 kV Pin Type Insulator (Crossarm) - Force [3' 0"], Acme Power, Insulator#4	8.77%	50.90 S.F.	3.91%
3 Bolt Clamp - Force [25' 0"], Phil's Telco, Insulator#12	7.30%	26.39 S.F.	5.95%
3 Bolt Clamp - Force [23' 6"], Phil's Telco, Insulator#7	13.65%	12.52 S.F.	12.80%
4/0 ACSR (6/1) - Tension [48' 11"], Acme Power, Wire#13	N/A	N/A	32.94%
C11.2M2000 (7/0) - Tension [23' 6"], Phil's Telco, Wire#4	N/A	N/A	25.04%

Graphic View - (2165481, As Is)

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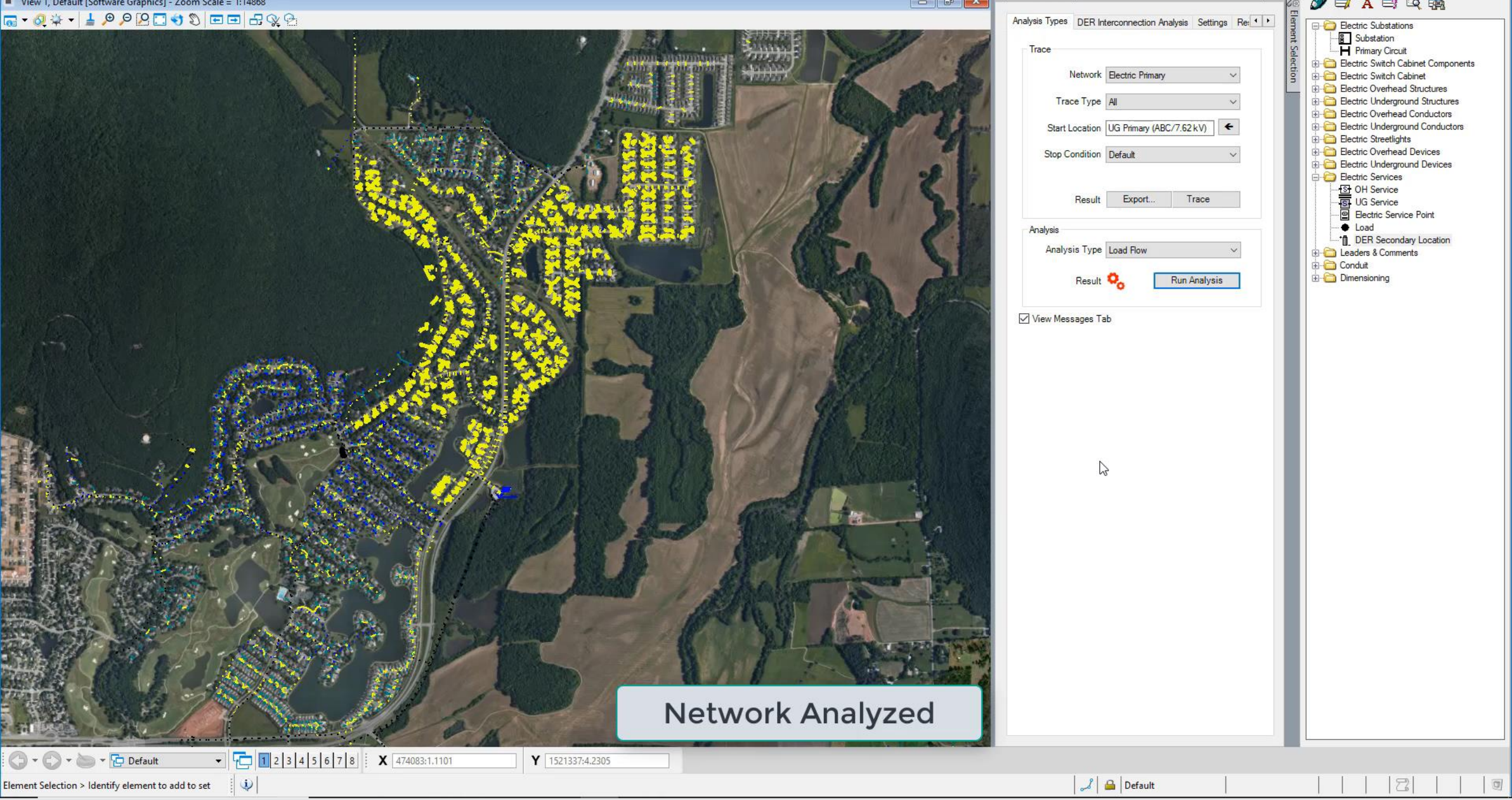
Acme Power
Environment
None
Douglas Fir
Northern Red Pine
Southern Pine
Western Red Cedar
Wire End Points
Environment
Ground
Create New Connected Location
Previous & Next
Previous
Next
Other
Building
Graphic View - (Location-01-25-2023-12-15-01-142, Measured Design)
Add View
0°
WEP Scale: 61.0 m / Anchor Scale: 15.2 m
Line Angle: 0 °
270°
90°
180°
Measured Design
Station Search
S Highway 97
97
E Half Round Bay Rd
17
© Powered by Esri
Component Properties
Pole



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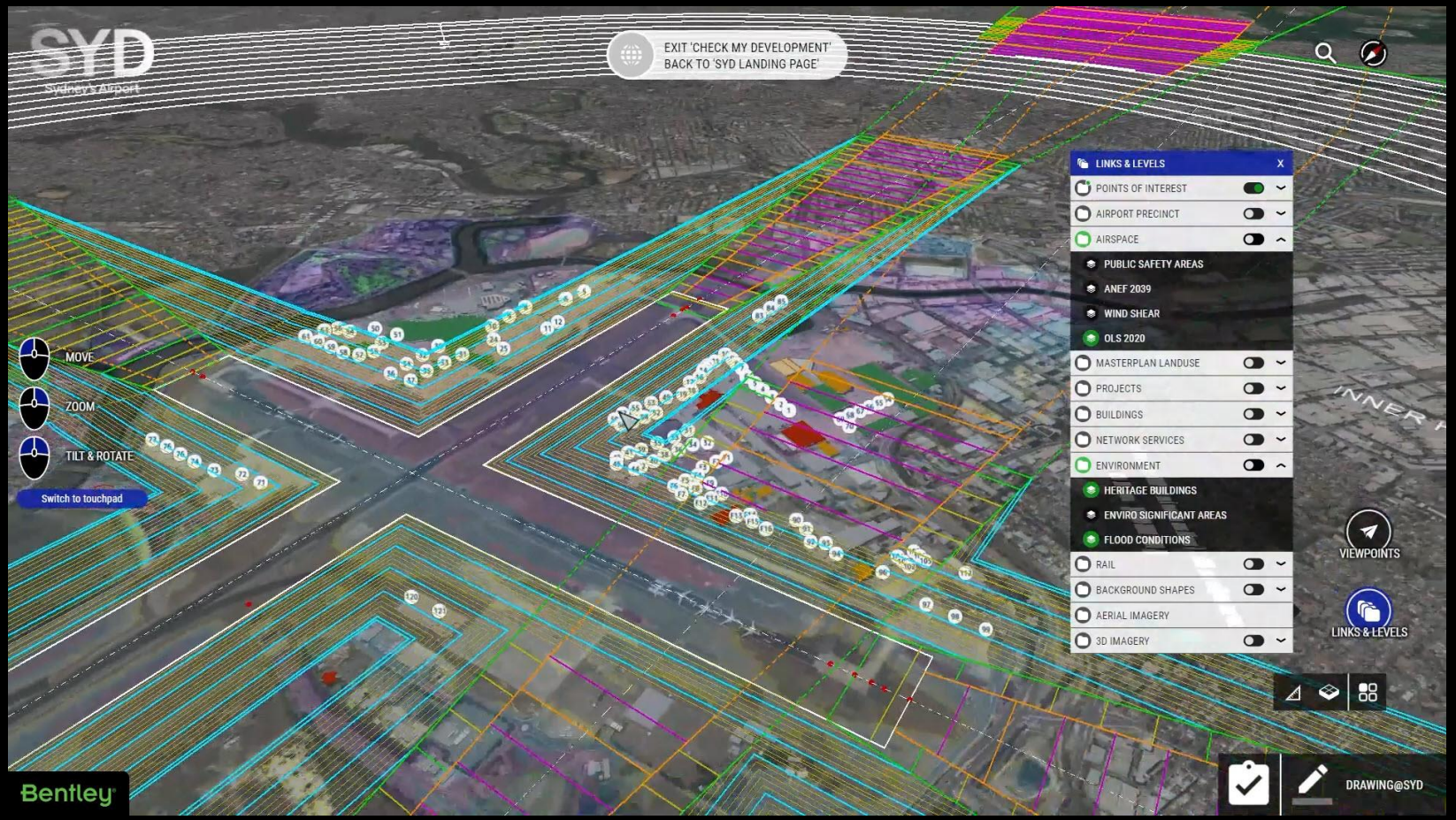
Digitize, Integrate and Analyze



- Self-serve critical project and asset information
- Visualize key data in an immersive environment
- Leverage digital twins to scale from the micro to the macro

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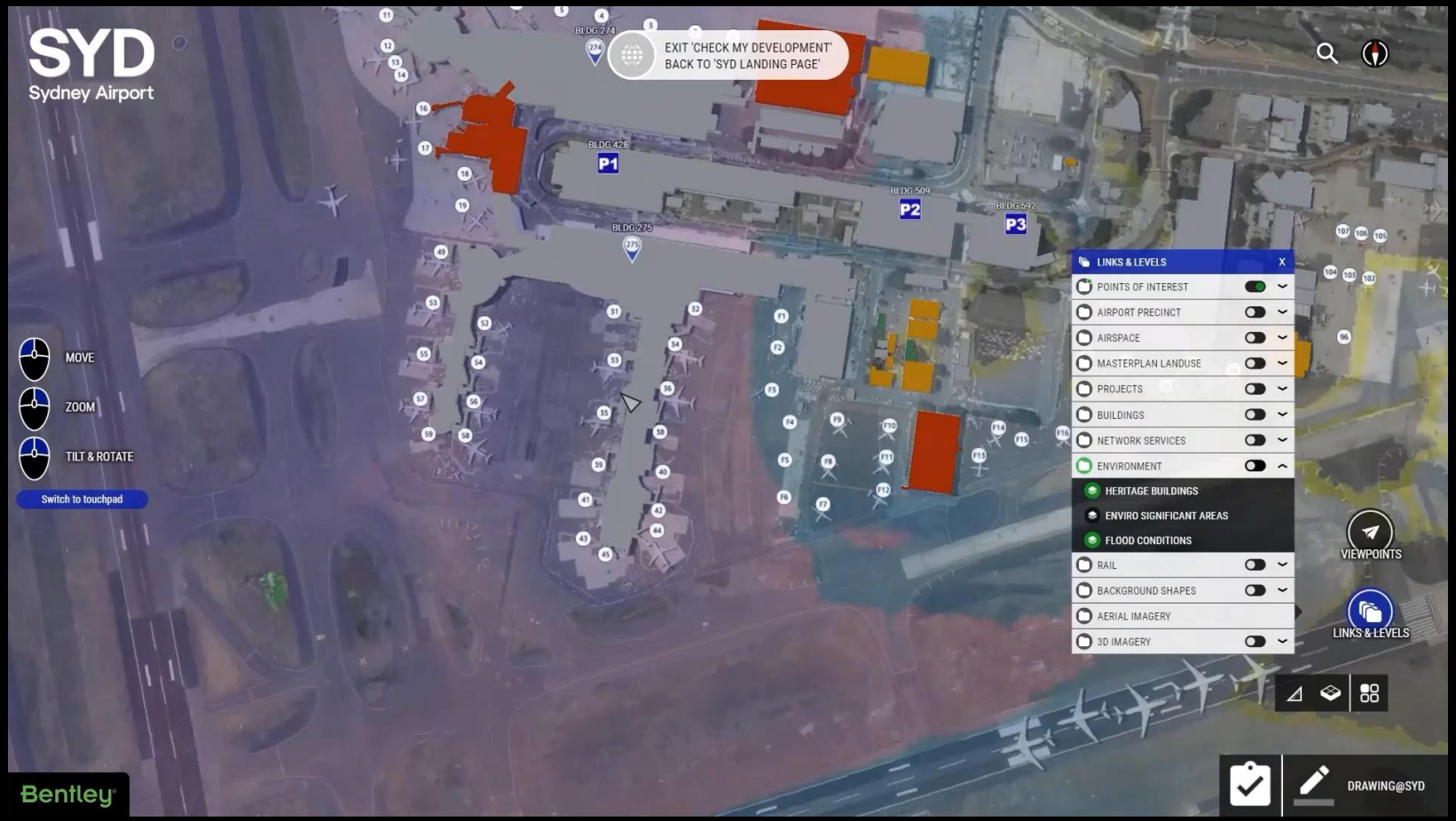
Assess and Implement



- Consolidate GIS data, Reality Capture, CAD files, BIM models and more
- Use a single solution for more structured, accessible data and faster decision-making
- Identify assets that require maintenance and prevent critical failures

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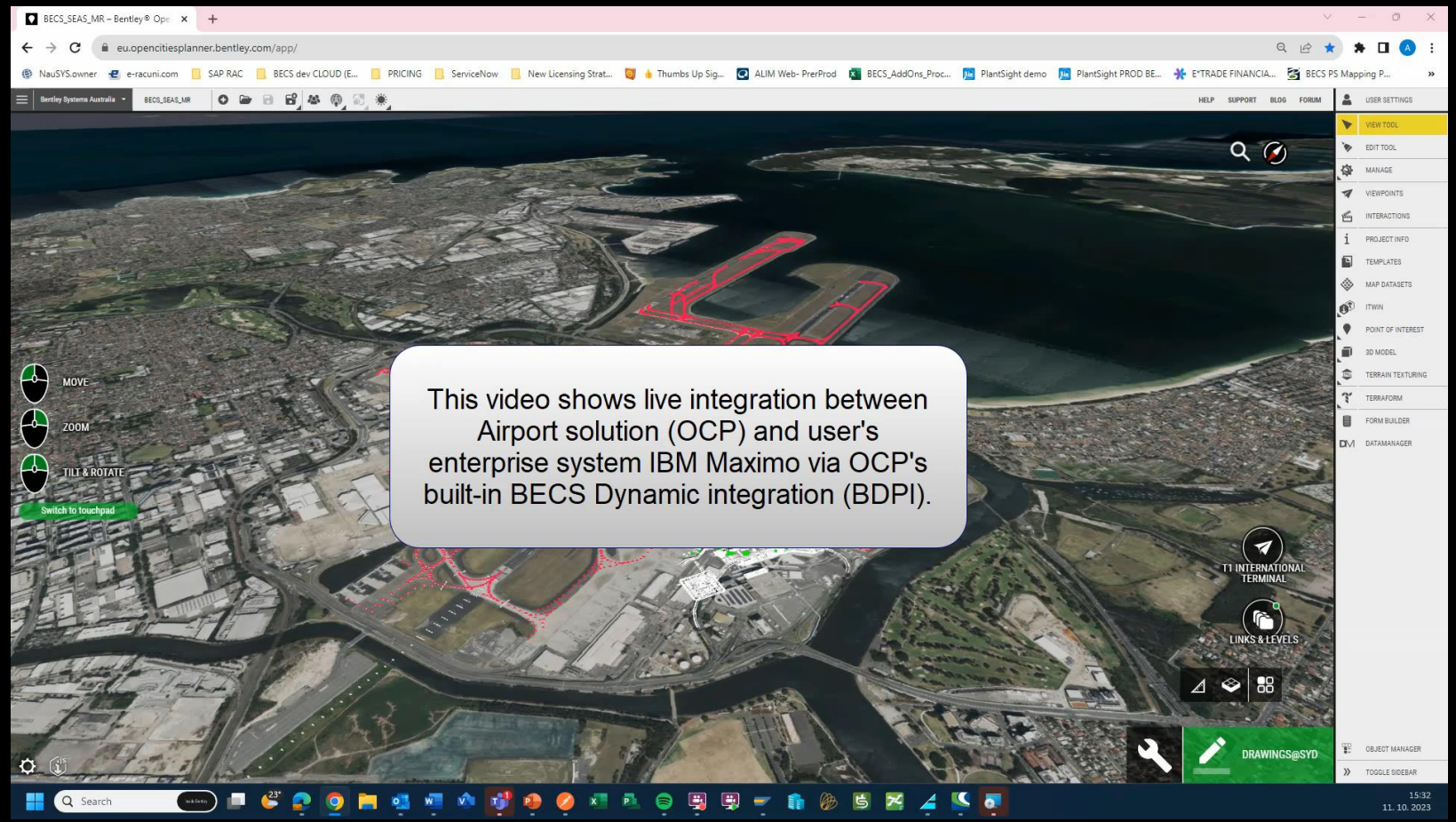
Integrate



- Connect your spatial, engineering and enterprise data to an easy-to-use platform
- Leverage the data from your other systems to sustain a living database for all your operations
- Compile data on your lease and rental management for easier access and use

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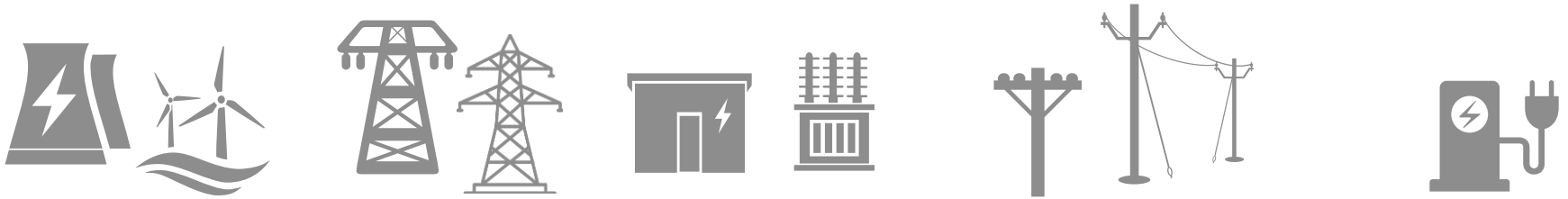
INFRASTRUCTURE VALUE CHAIN



CAD, Drafting

Engineering Data Collaboration

Planning/Design Modeling and Integrated Analysis

Asset Performance

Asset Management

Digital Twins

Bentley Advancing Infrastructure

SEEQUENT

POWER LINE SYSTEMS

SPIDA SOFTWARE

Cohesive

SIEMENS Ingenuity for life

sensemetrics

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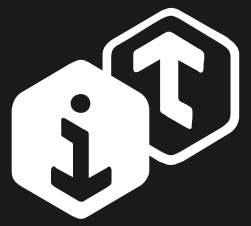
Open Applications



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iTwin Platform

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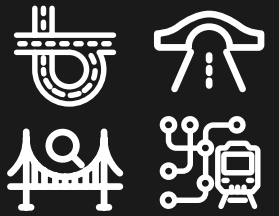
Infrastructure Cloud



Industry
Solutions

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