Integrating Terrestrial LiDAR into Substation Operations: A Case Study

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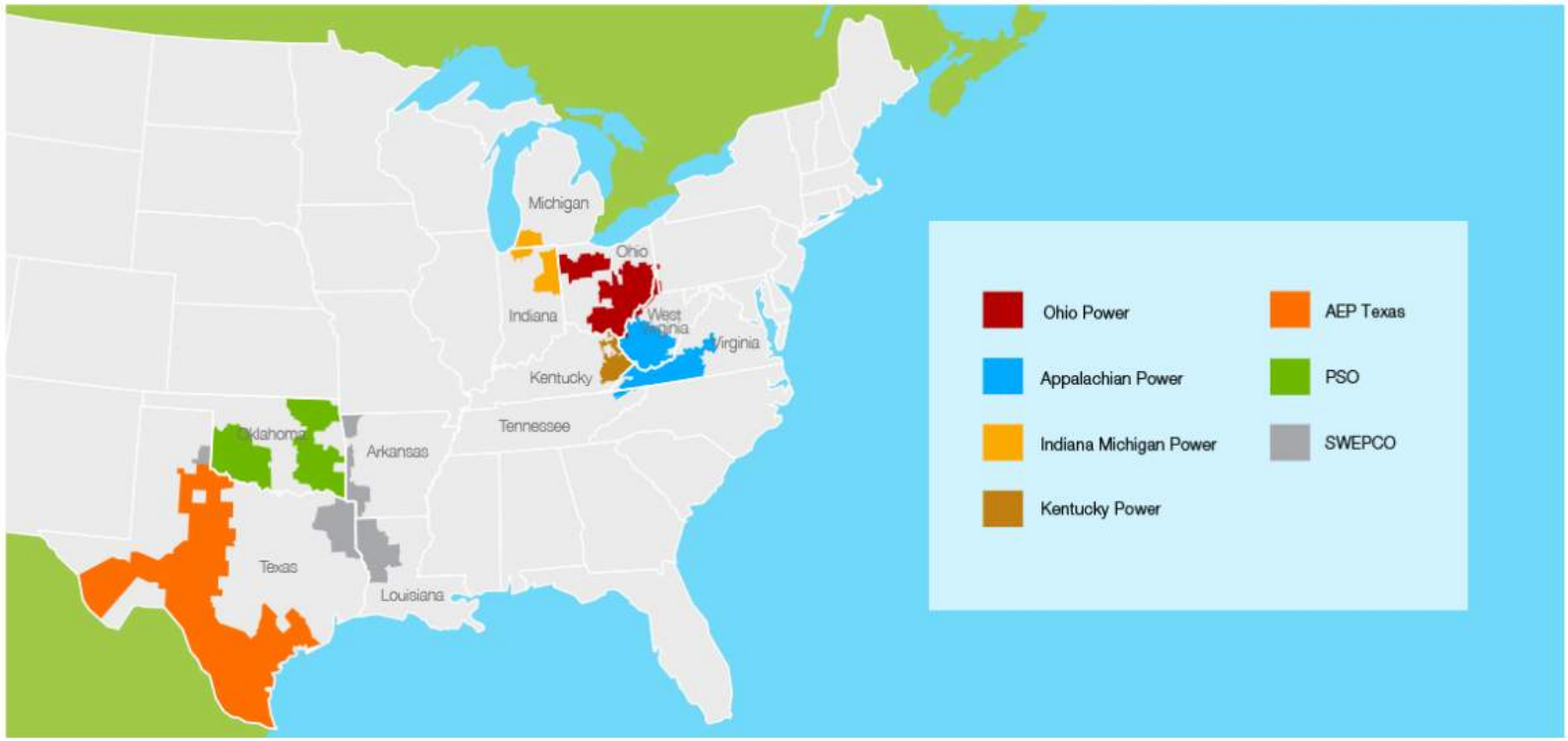
- Hardware agno
- Survey history
- Extensive expe with LiDAR acq approaches:
  - Terrestrial
  - Mobile
  - Aerial
- Extensive expe with LiDAR typ
  - Linear
  - Gieger Mod Photon
  - Bathymetric
- Funded by the evaluate LiDAR technologies

AMERICAN ELECTRIC POWER℠

BOUNDLESS ENERGY℠

- 5.4M Customers in 11 states
- 40K+ mi electricity transmission network - largest in the nation
- 26K megawatts of generating capacity



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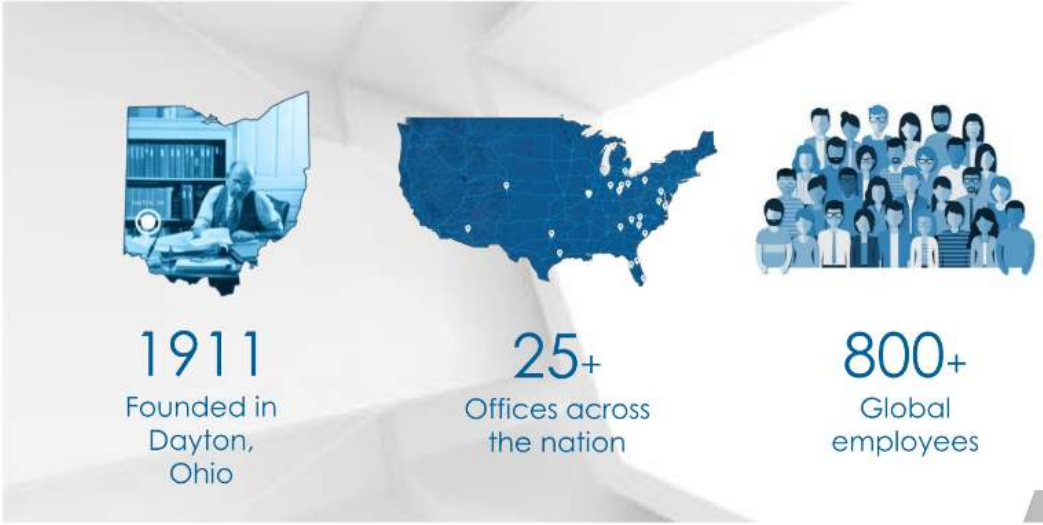
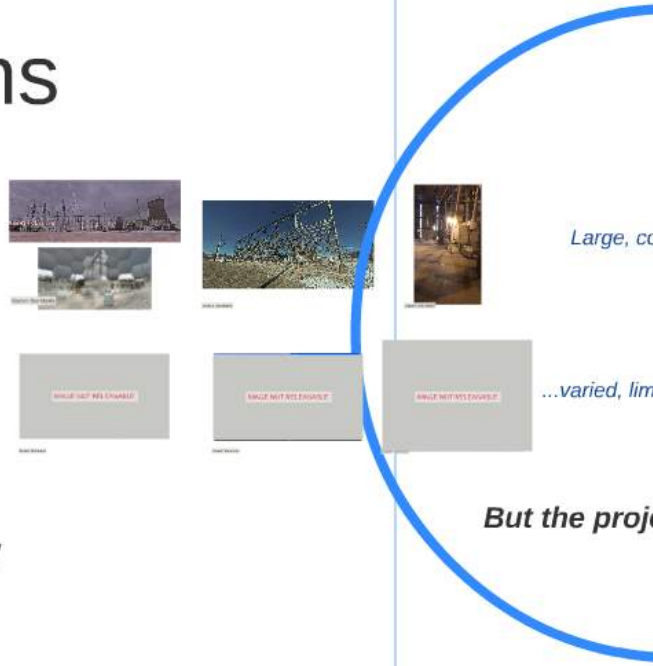
ARCHITECTURE | ENGINEERING | GEOSPATIAL

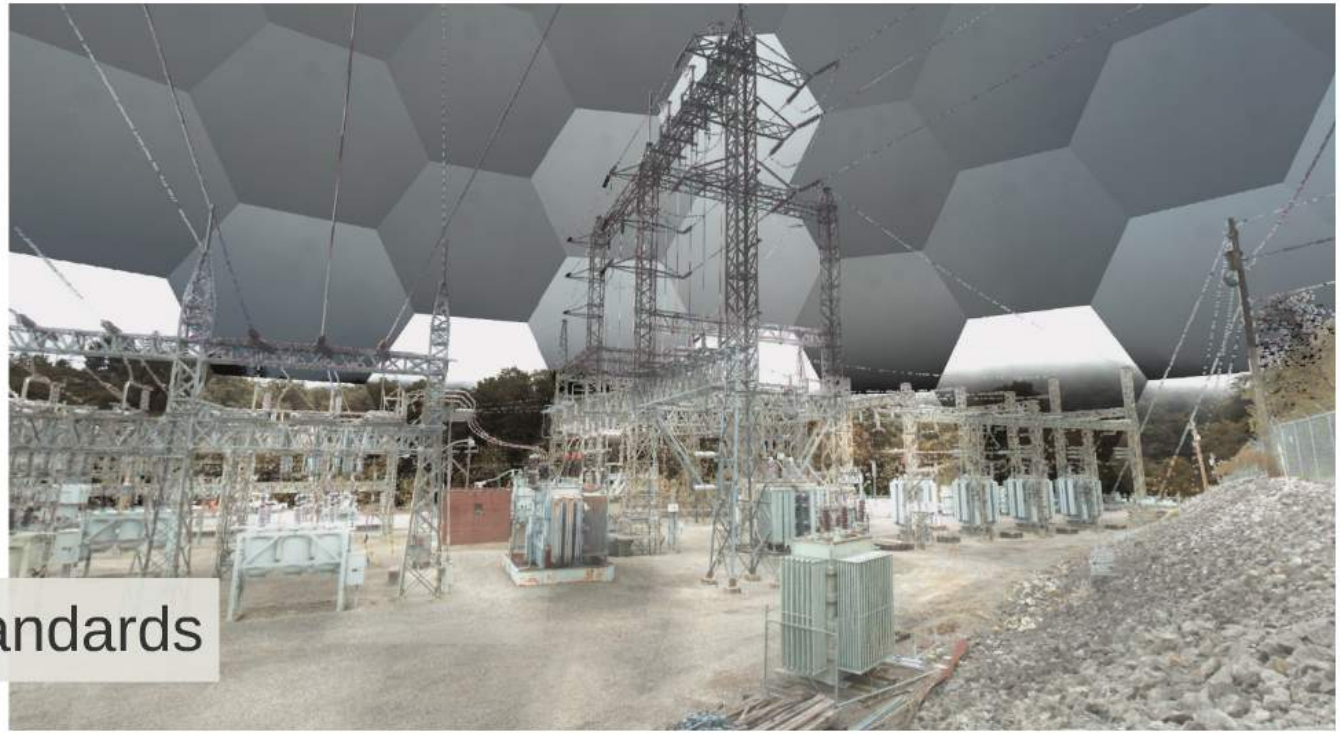
- Hardware agnostic
- Survey history
- Extensive experience with LiDAR acquisition approaches:
  - Terrestrial
  - Mobile
  - Aerial
- Extensive experience with LiDAR types:
  - Linear
  - Gieger Mode / Single Photon
  - Bathymetric
- Funded by the USGS to evaluate LiDAR technologies



Overview

- Station Standards' concerns
  - Site complexity
  - Safety
  - Outage / uptime
  - Budget / schedule
- Terrestrial LiDAR overview
  - Technology review
  - Approach
- Datasets
- Applicability to Electric operations
- Lessons learned
- Data demonstration
- Q&A

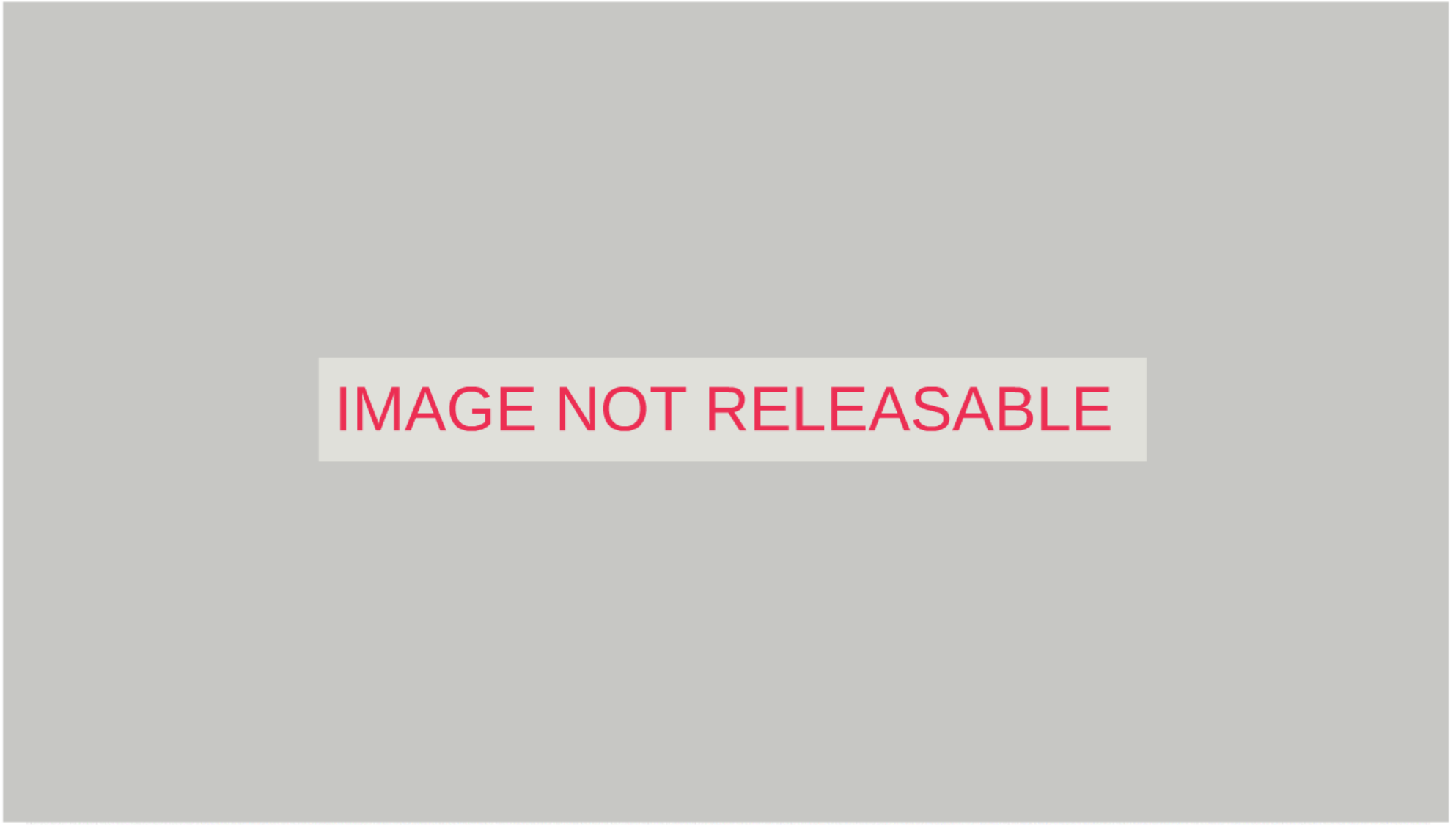




Station Standards

Inspection Standards

Station Standards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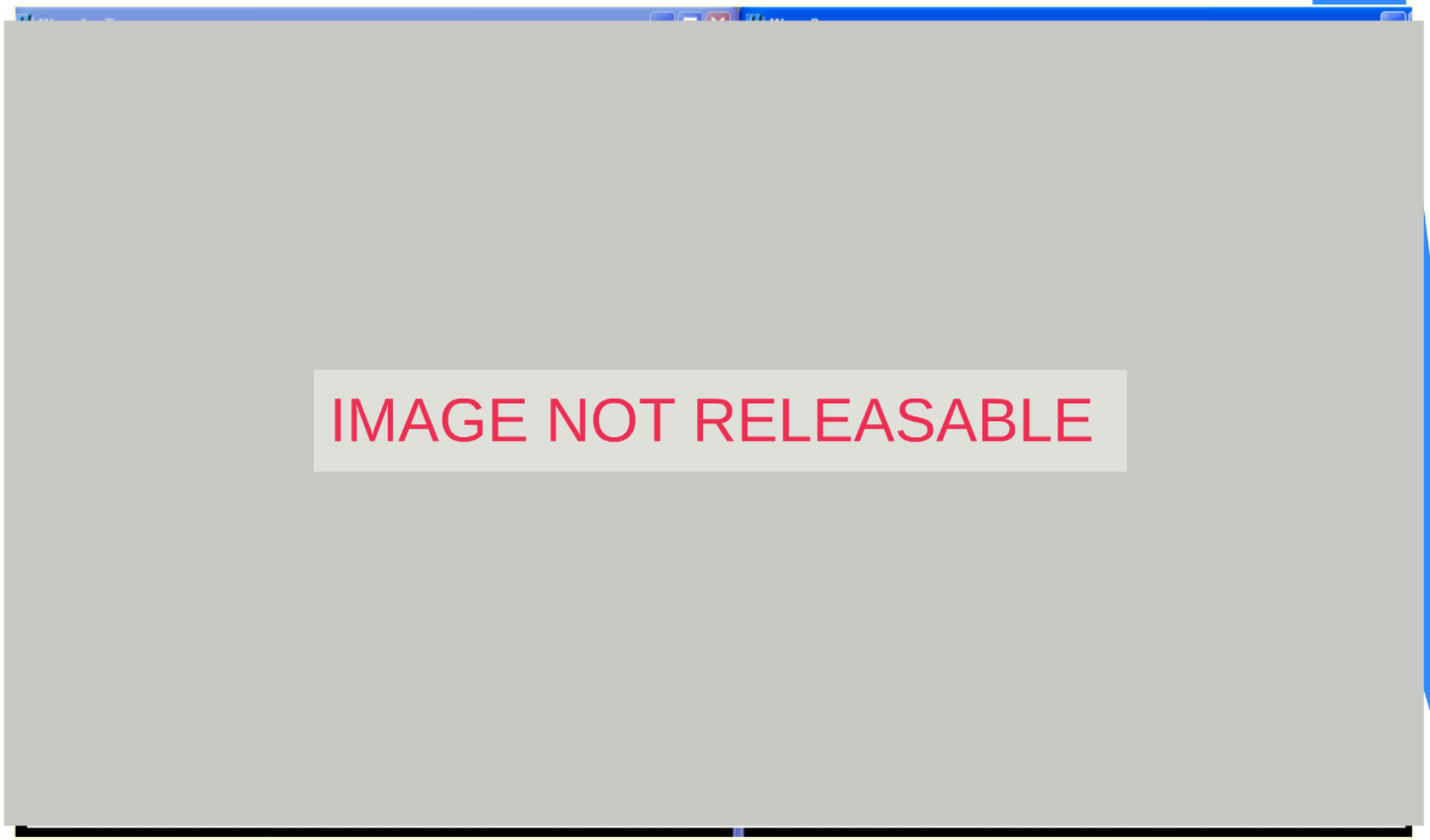
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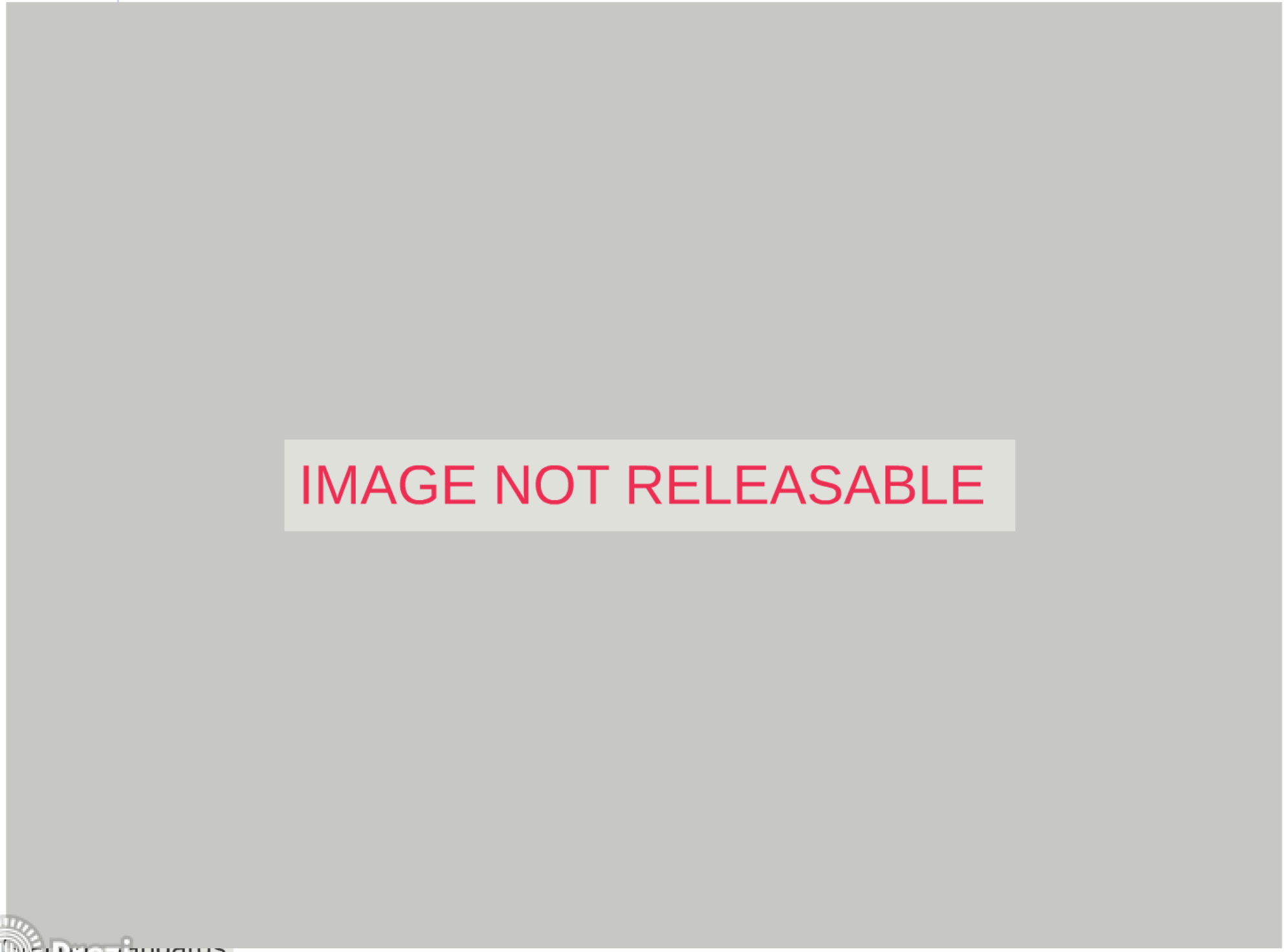
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Large, complex, and hazardous sites...

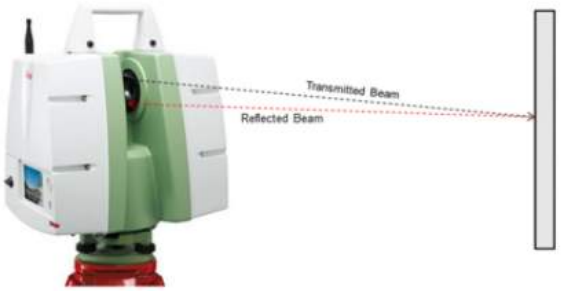
...varied, limited datasets of unknown accuracy

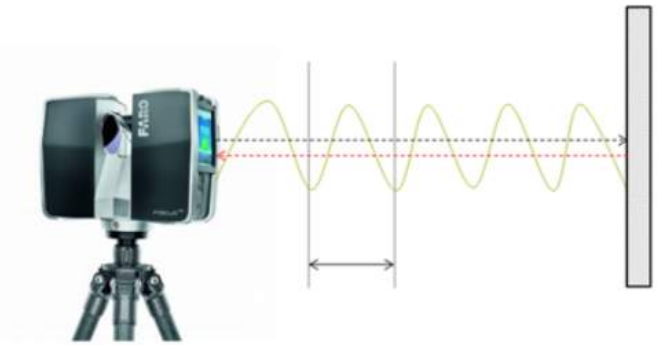
But the project must go on...

Terrestrial LiDAR:

Terrestrial LiDAR: Overview

- Developed in the 1960s, major introduction into the AEC market in the late 1990s and early 2000s
- Light Detection & Ranging (LiDAR)
- Time-of-flight, phase-shift, Hybrid
- In short, 3D data is determined via laser travel time, laser phase change, or signal/wave-form processing
- Considerations:
  - Indoor vs. Outdoor
  - Point density
  - Accuracy
  - Image quality
  - Speed
- Certain scanners excel at certain tasks
- Data collected by scanners:
  - LiDAR, 3D point cloud
  - “Dome” Imagery, Imagery spheres
  - Thermal signature



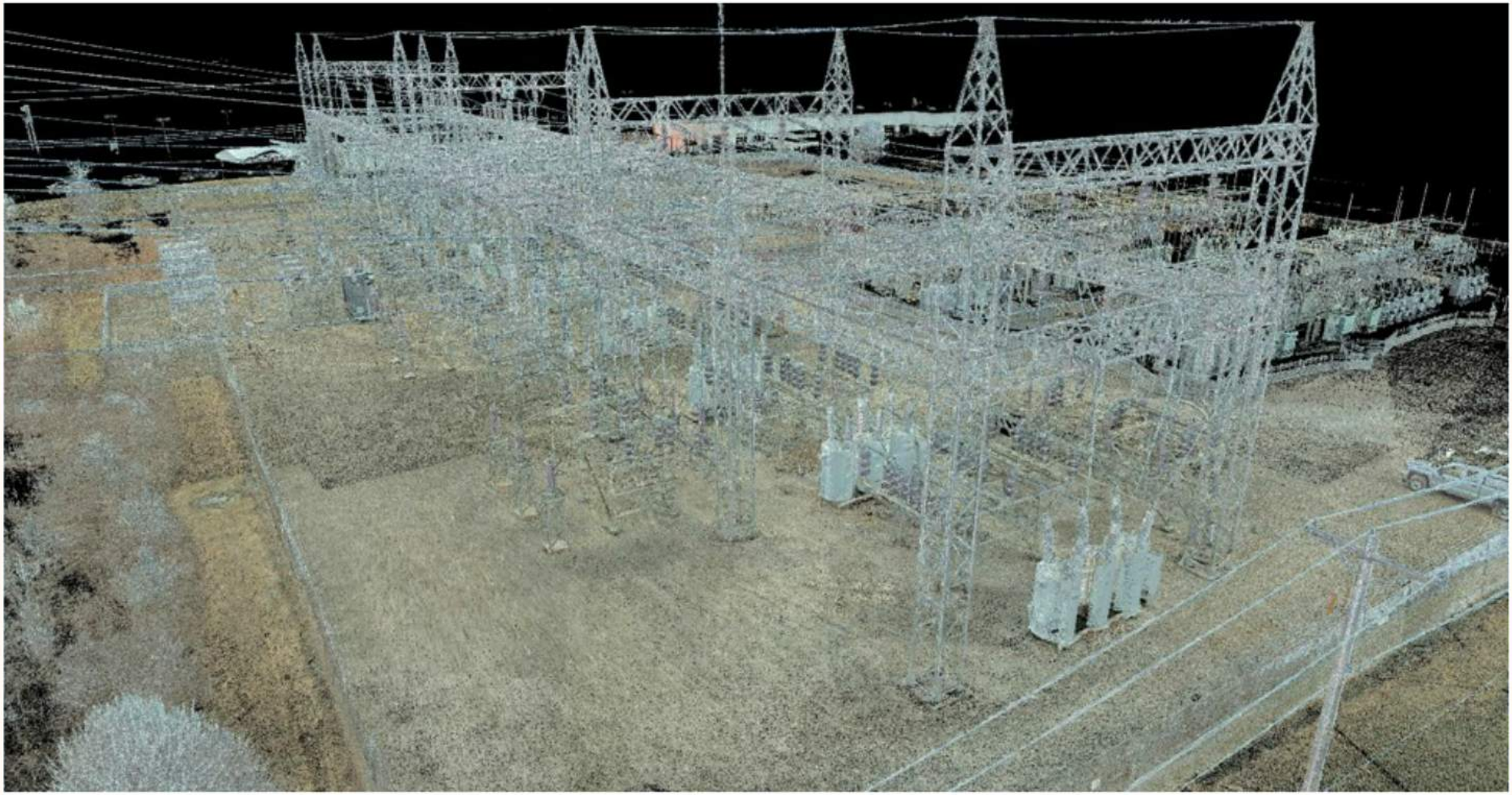


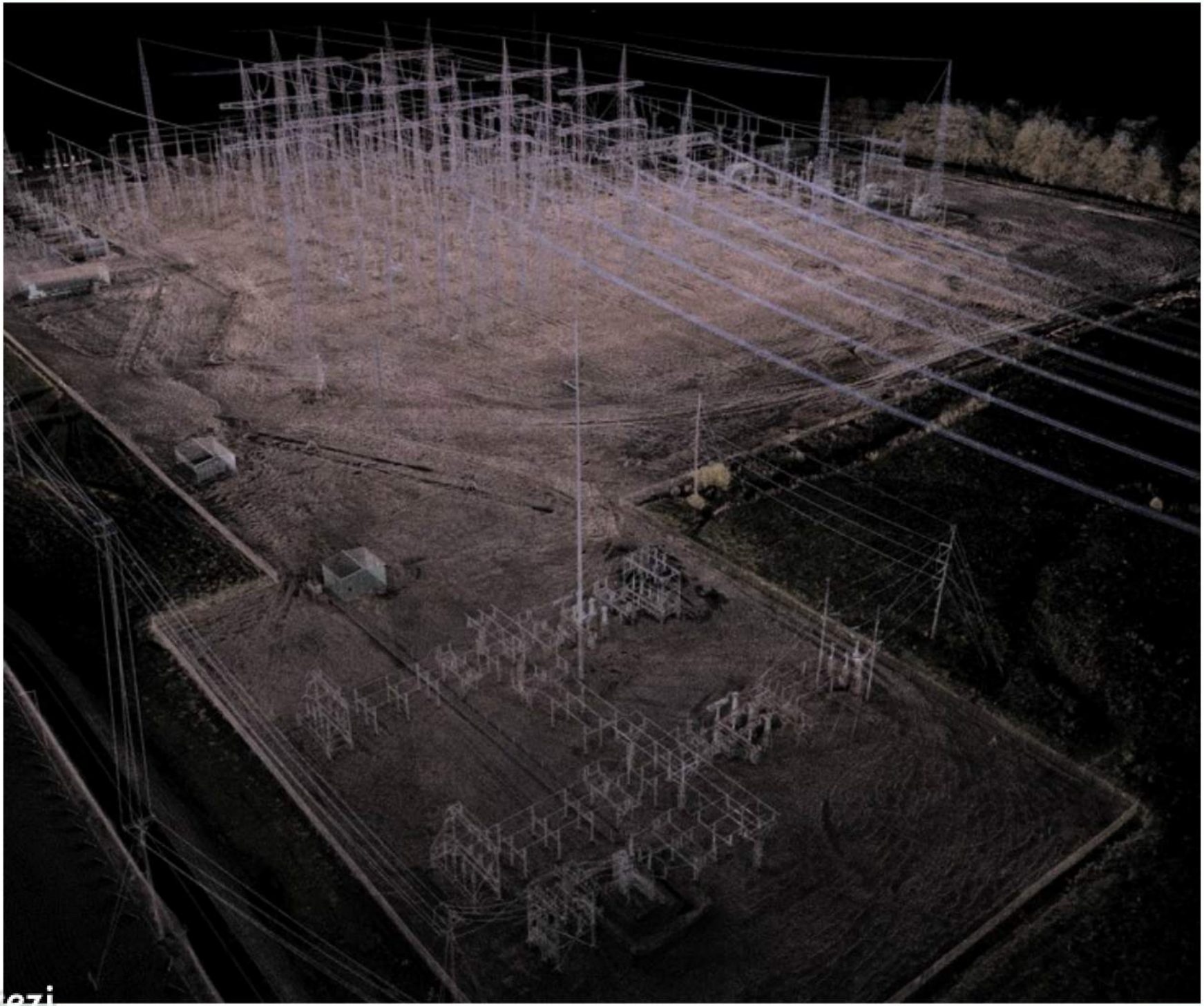
Terrestrial LiDAR: Approach

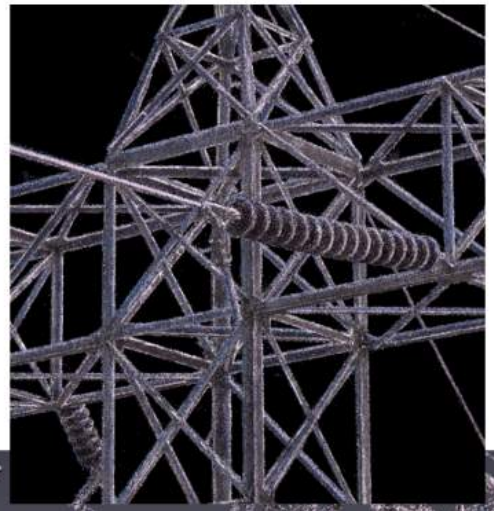
- Pre-mobilization considerations:
  - Accuracy
  - “Resolution” of data
  - Data deliverables
  - Site conditions
- Mobilize
  - Survey
  - Scanner setups / data collection
- Post-processing
  - QA/QC
  - Registration
  - Deliverable creation
    - 3D point cloud
    - 3D CAD file
    - 3D model
    - Surface
    - Imagery

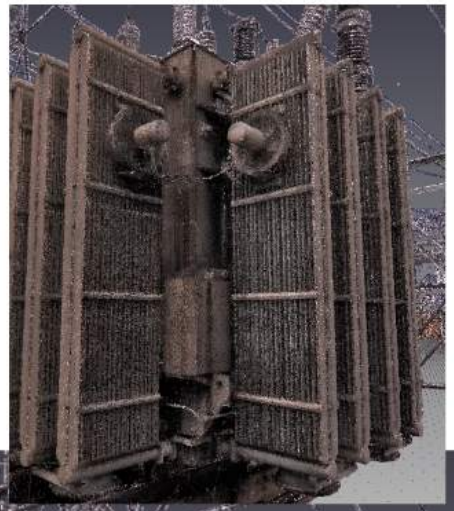
Terrestrial LiDAR: Data Deliverables

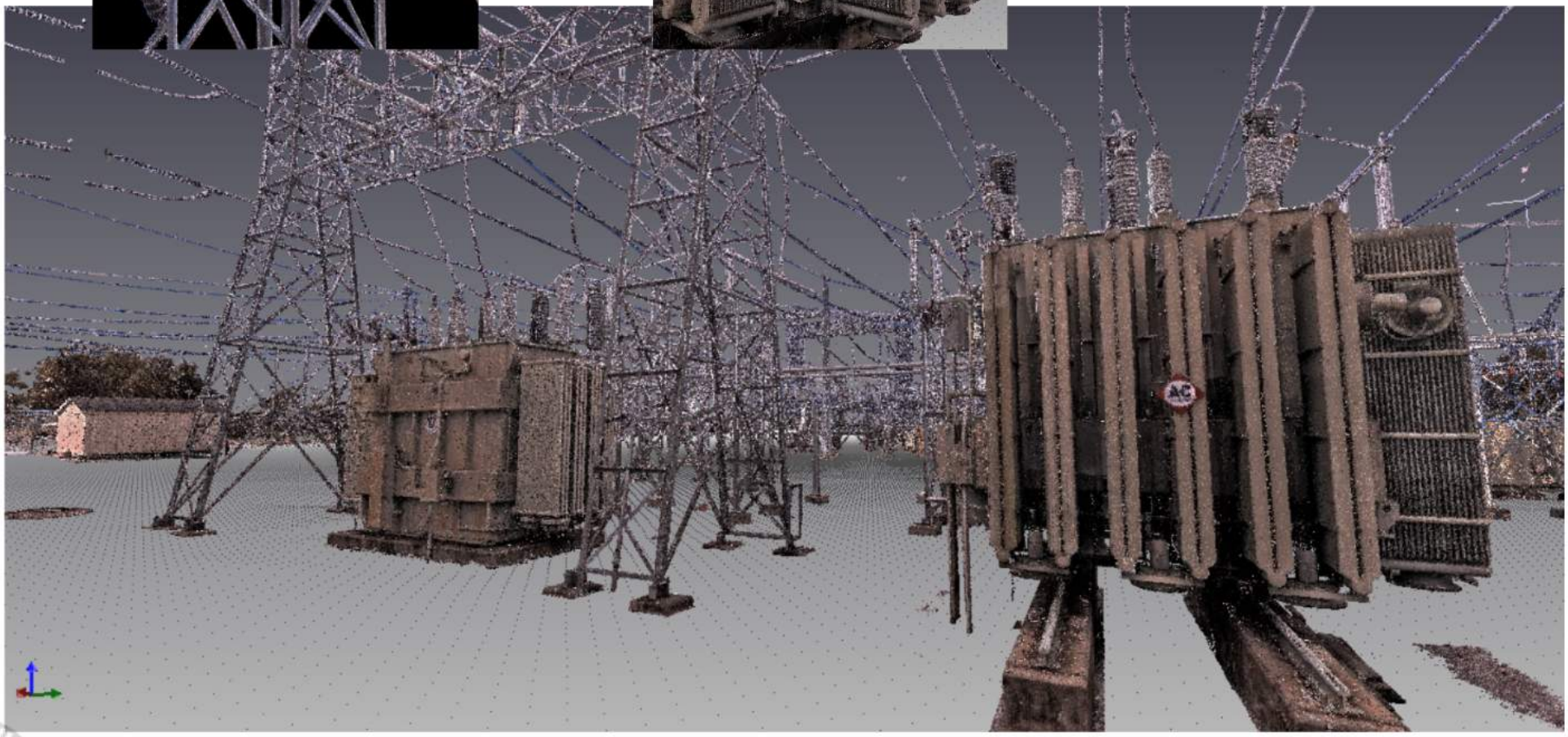
- One mobilization can create a variety of 2D and 3D datasets
  - 3D colorized point cloud (.las, .laz)
  - 3D solid model (.dwg)
  - 3D CAD file (.dwg)
  - 3D GIS (geodb, enterprise database)
  - Surface (.xml)
  - Image sphere

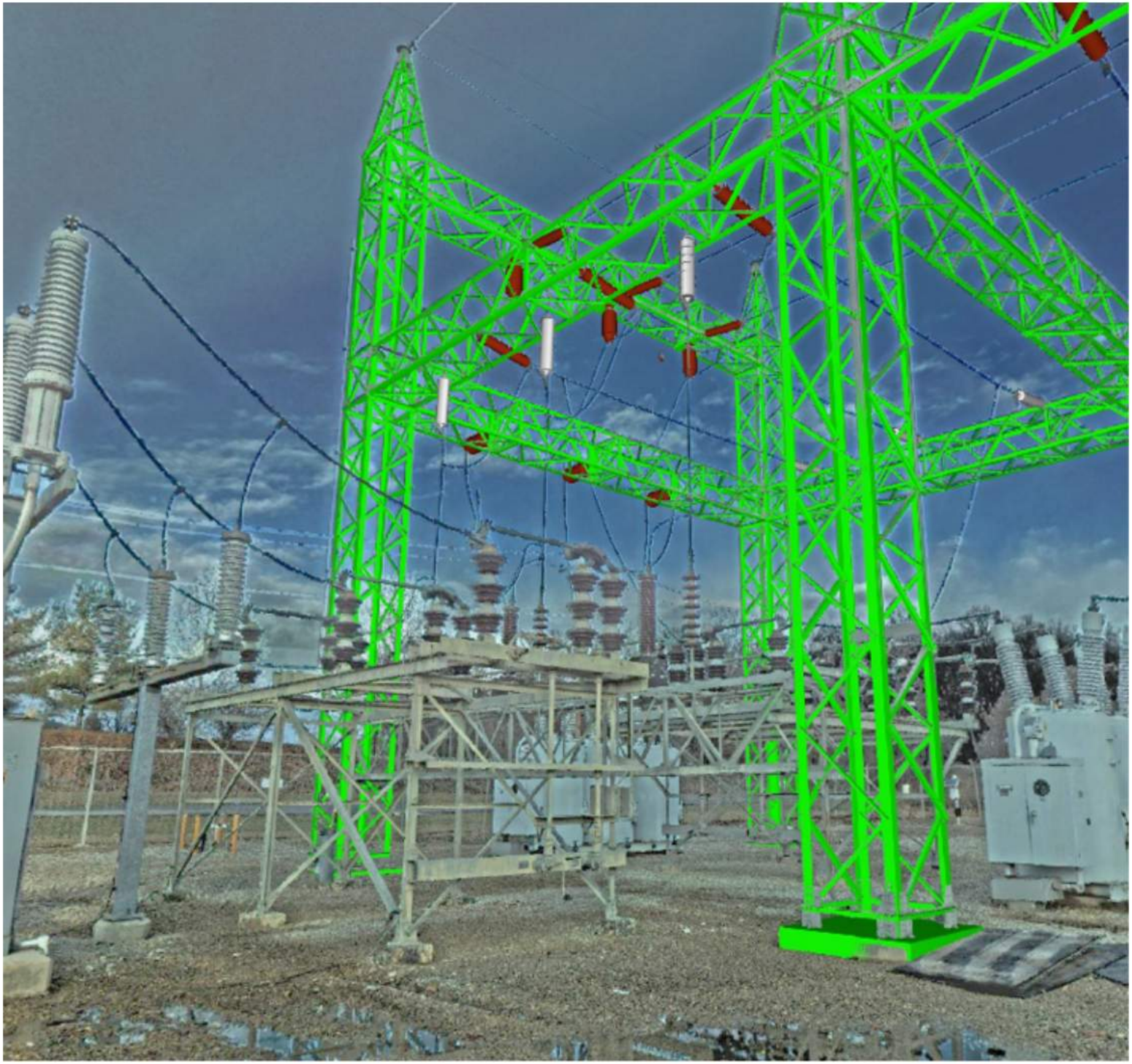


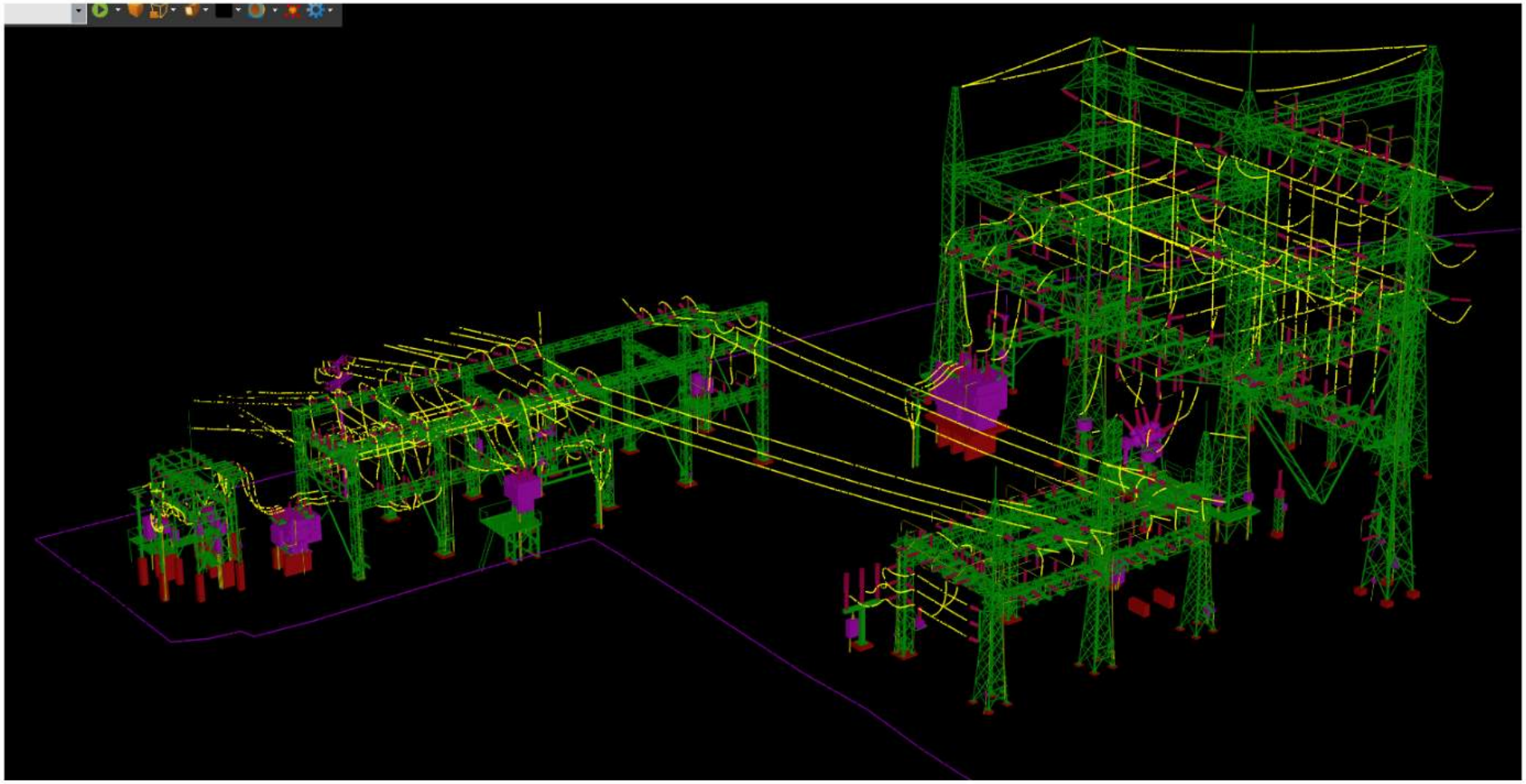


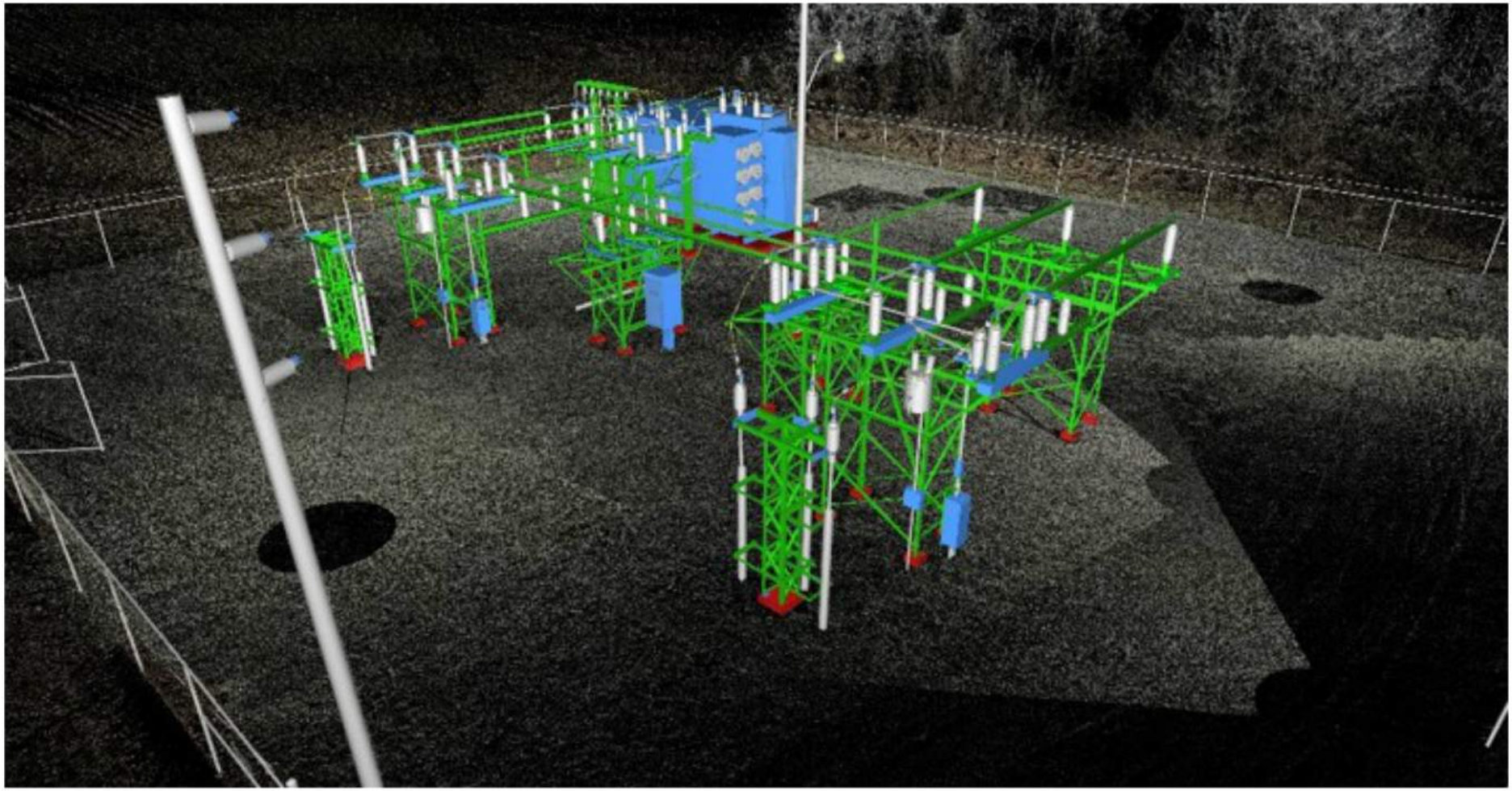


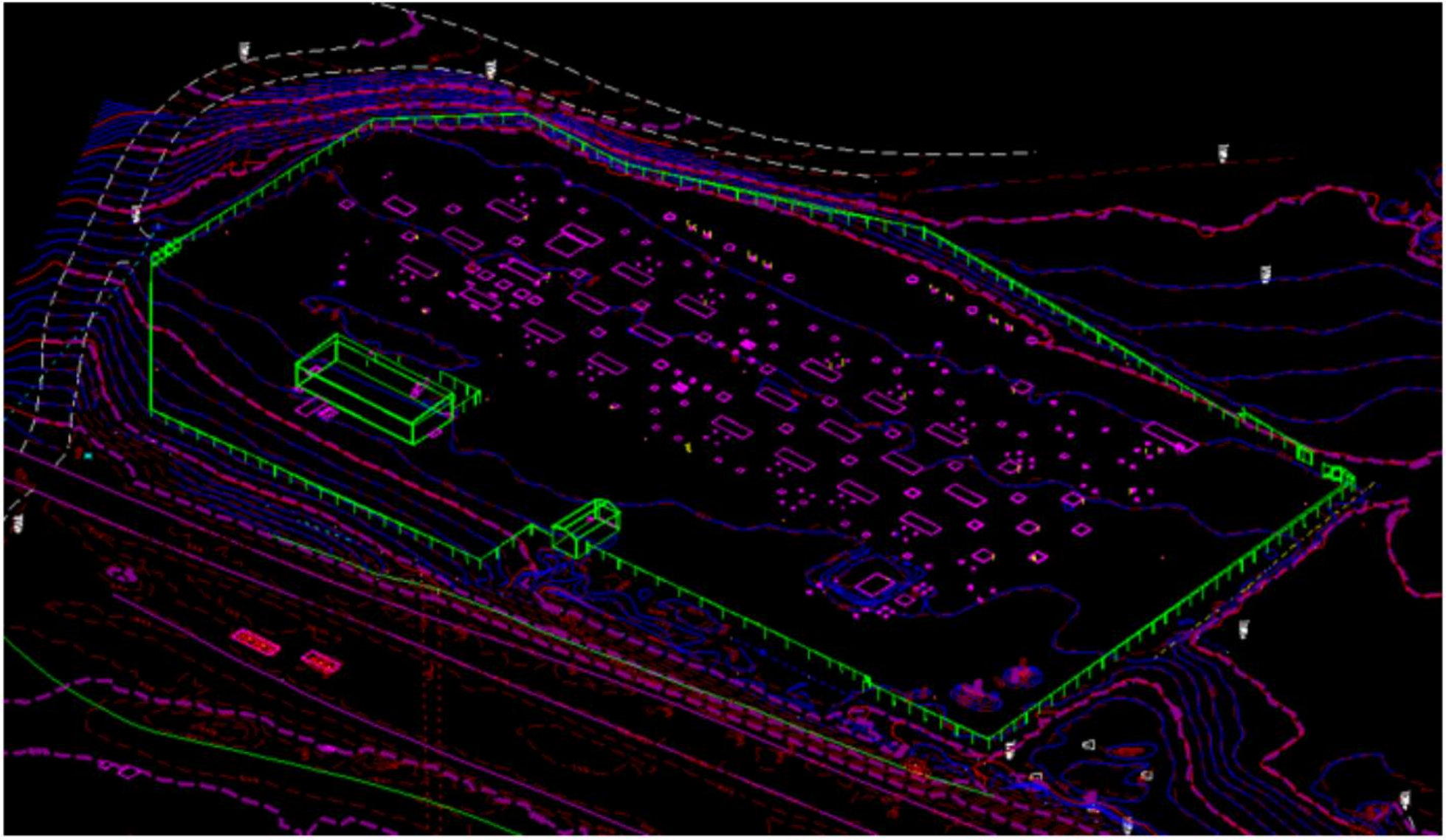


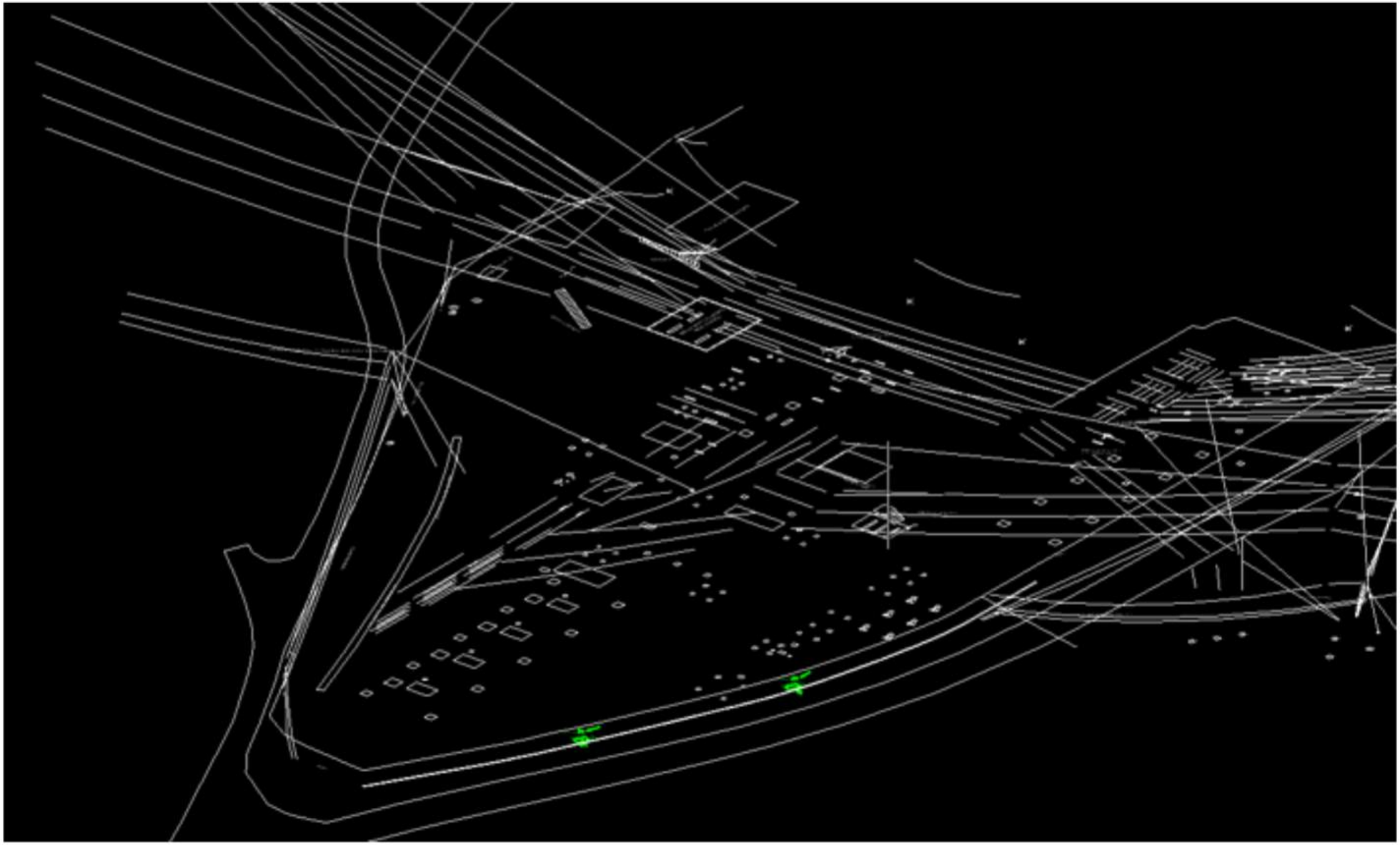












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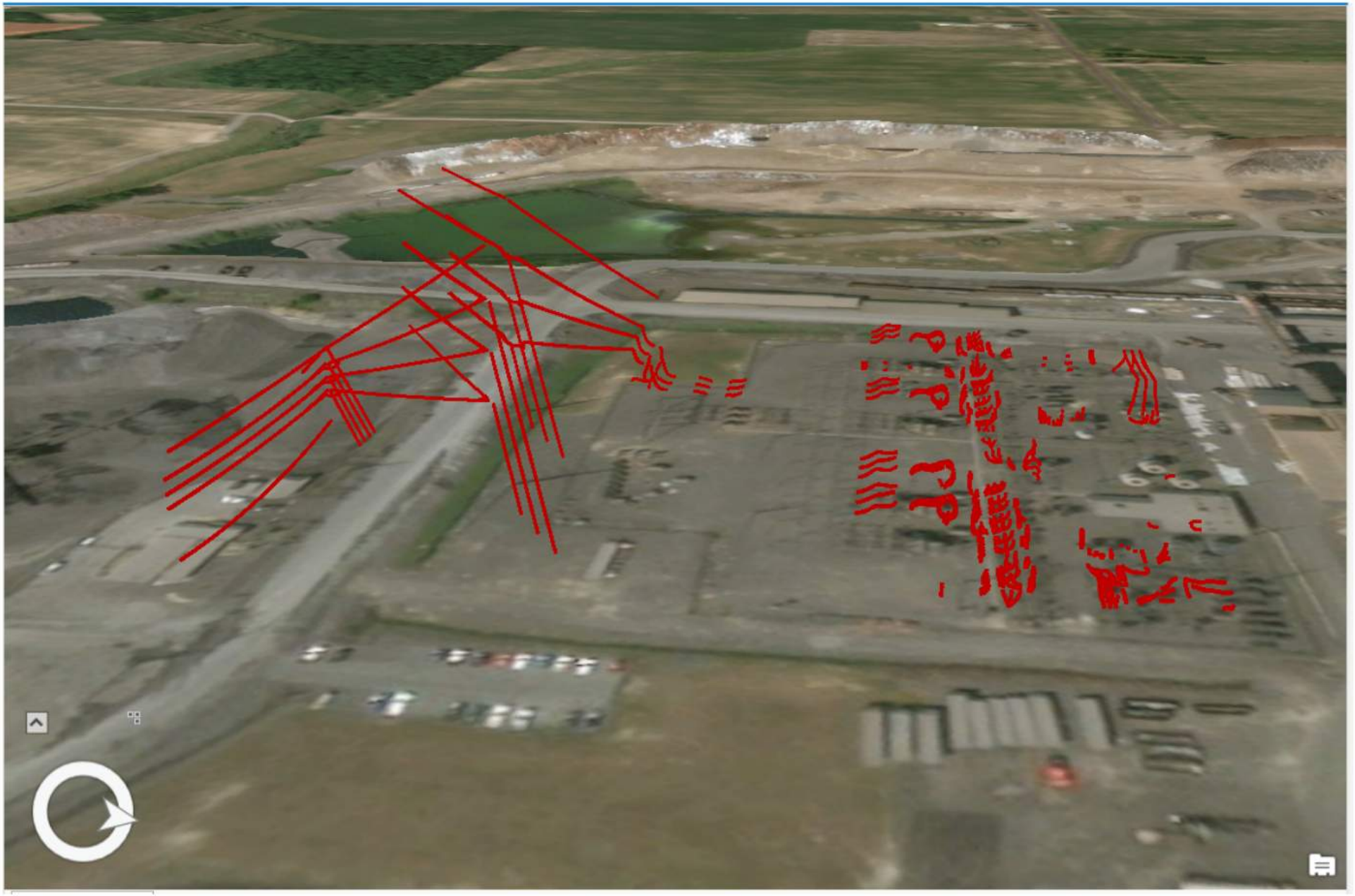


Catalog
Scene


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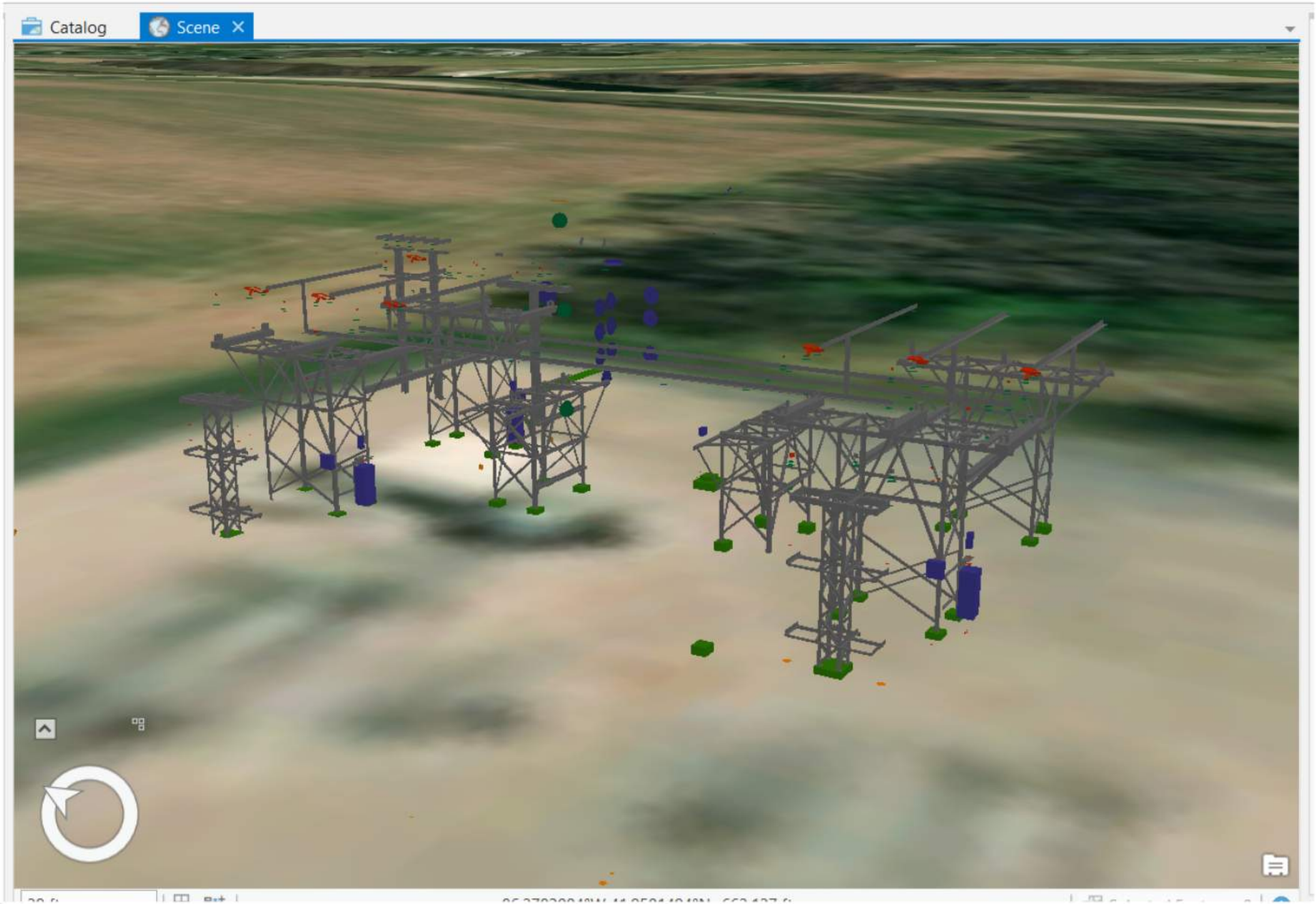
Scene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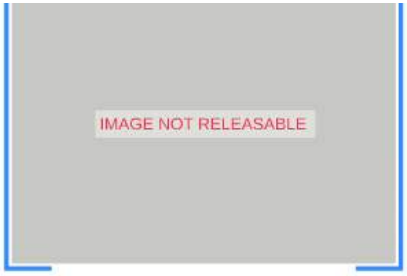
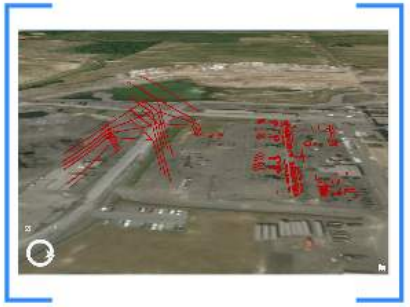
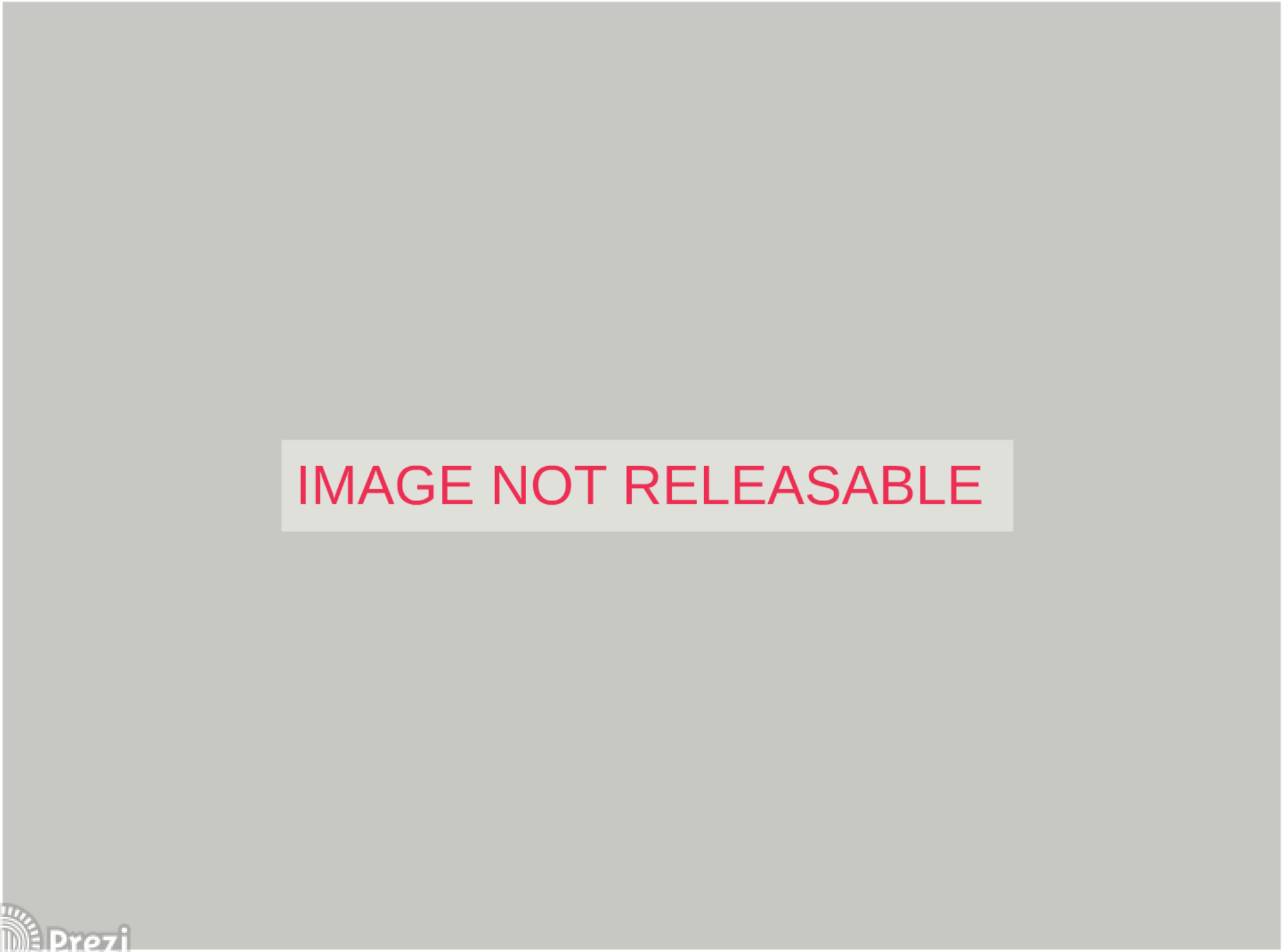




Inclusion of control and accurate approach...

...3D, geospatially accurate representation of critical facilities.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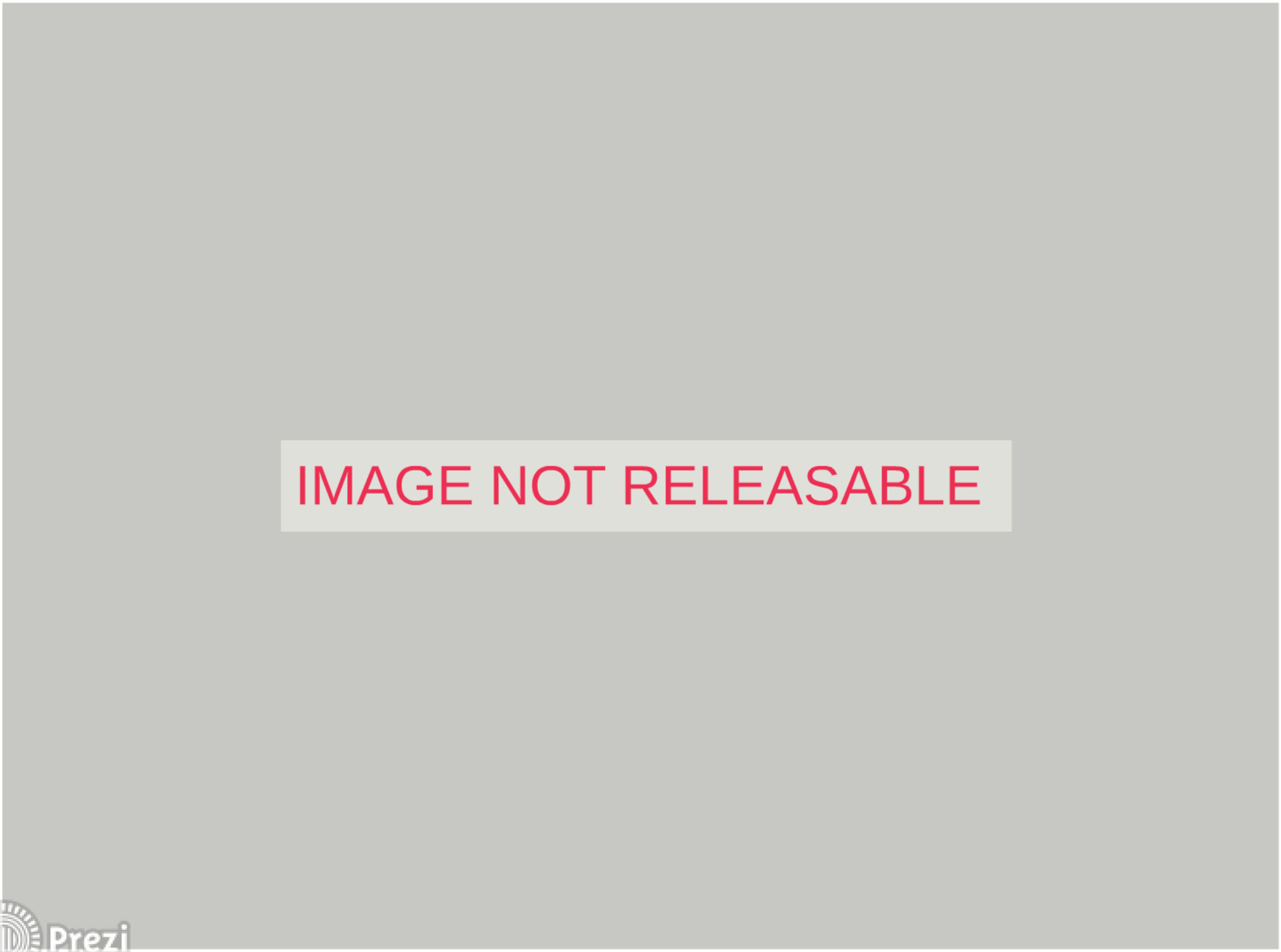

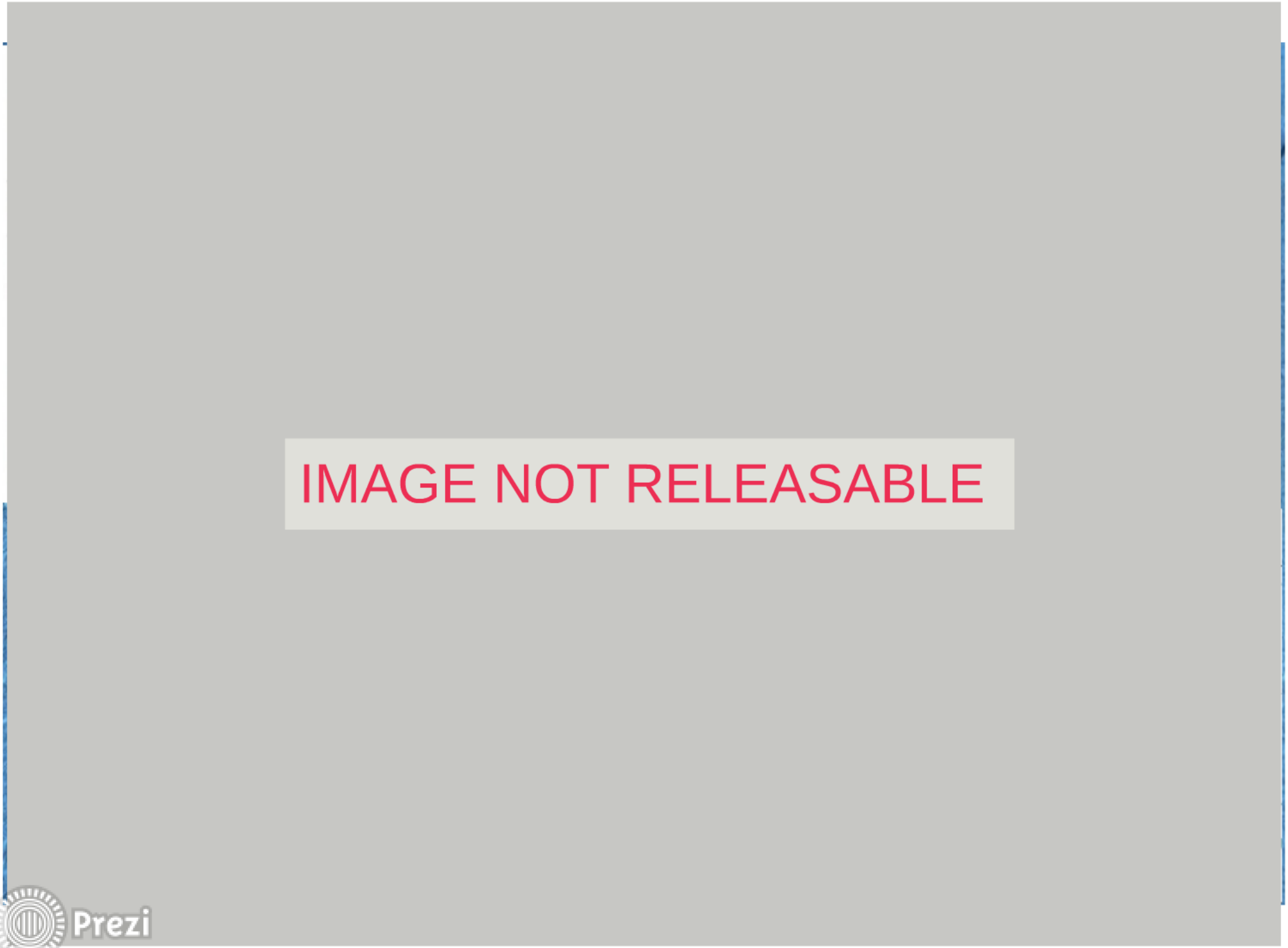
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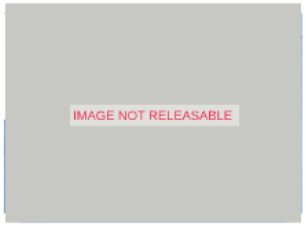
Lessons Learned

- Determination of what's needed? A lot is possible
- Multiple data acquisitions in a single mobilization - spans workflows and business processes
- Data is LARGE / HEAVY
  - Software
  - Hardware
  - Storage
- Integration into contractor workflows
- Internal learning curve
- Visualization issues
  - 3D linework
  - "raw" LiDAR visualization
- **For every scan project completed, legacy data differed from as-constructed**



Data Demonstration!!!

http://arcg.is/09q5ym

Questions?

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Thanks!

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