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Business Domain
Energy & Utilities

Project Type
3D CAD Modeling for Electrical Infrastructure

3D CAD Modeling of a 110 kV Electrical Substation — Enabling Safe Upgrades & Smart Operations

Client

A Romanian engineering and geospatial services provider specializing in energy infrastructure projects. The client focuses on delivering advanced technical solutions for substations, transmission networks, and digital modernization initiatives across Romania and Central Europe.

Project

The project aimed to create a detailed 3D CAD model of a 110 kV electrical substation using terrestrial LiDAR scans, and DSLR imagery. The model was intended to support design validation, visualization, and future BIM integration.

Objective

To transform raw LiDAR and photographic data into an accurate, high-detail 3D CAD model of a 110 kV substation, aligned with the Client's technical standards and suitable for visualization, planning, and future BIM workflows.

Team Reinforcement

Faced with tight deadlines and limited internal capacity, the client engaged Intetics as an external modeling partner. Our team quickly delivered a high-quality 3D model, helping reduce the workload on the Client's engineers and ensuring on-time delivery.

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Challenge

To meet tight project timelines and ensure technical accuracy, the Client needed to convert field data into a detailed 3D CAD model of a substation. However, the complexity of the task required not only domain-specific expertise, but also immediate access to qualified modeling resources.

The Client lacked internal capacity and needed a trusted partner.

Limited in-house resources made it critical to find an external partner who could guarantee consistent modeling quality and meet urgent delivery deadlines.

Quick Facts

- 3 functional blocks (110 kV, 20 kV, and control)
- 2.5 ha substation site
- 100 hours of modeling at a partial LOD 350–400
- Core equipment and structures including transformers, breakers, CTs/VTs, busbars, trenches, grounding, control building, and foundations modeled

Technologies

AutoCAD / ReCap Pro / Microstation / Global Mapper / Navisworks

Solution

★ 01

Laser Scanning & Panoramic Imagery Integration

High-resolution laser scans and panoramic photos were captured onsite to provide accurate spatial and visual context. These were unified into a single, georeferenced point cloud to serve as the basis for 3D modeling.

★ 02

Optimized Point Cloud Processing

The raw point cloud data was cleaned, classified, and thinned to reduce file size and enhance performance in CAD environments without compromising critical geometry, ensuring efficient navigation and modeling.

★ 03

Modeling from Reality Capture

Using the processed point cloud, key substation equipment was modeled in 3D by snapping to the laser data. A simplified component library (e.g., breakers, disconnectors, transformers) was used in this initial phase to speed up modeling and ensure geometry standardization.

★ 04

Hybrid Modeling Workflow

Combined manual modeling with automated placement of basic equipment templates based on scan references. This hybrid approach allowed quick development of a visually and dimensionally accurate model anchored in real-world conditions.

★ 05

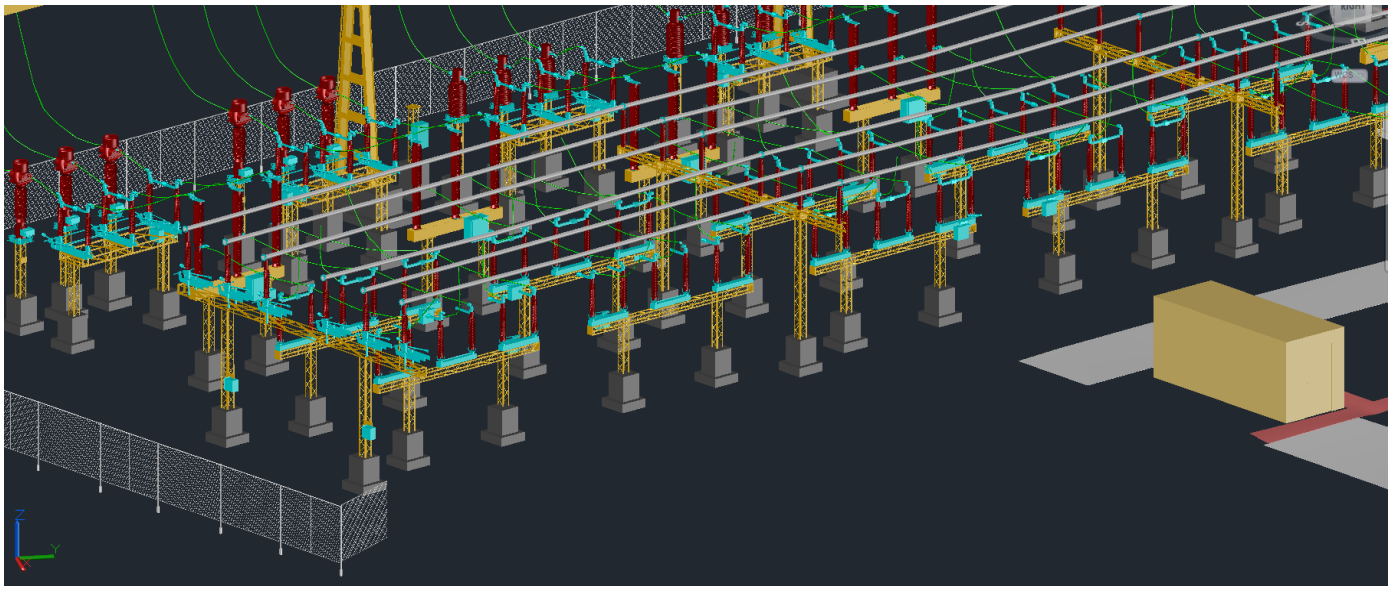
Accuracy Validation Using Visual Context

The panoramic imagery overlaid with the point cloud allowed for cross-verification of element orientation, dimensions, and spatial relationships - reducing modeling errors and minimizing rework.

★ 06

Scalable Foundation for Detailed Modeling

The use of a basic components library over the scan provided a scalable foundation for later LOD upgrades. Detailed modeling (e.g., fittings, conduit paths, grounding mesh) was deferred to a second phase once major assets were positioned and validated.



Client Reference

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Thank you for your prompt help and the high-quality model delivered right on schedule. We truly appreciate your attention to detail and professional approach throughout the project.

Head of LiDAR

Benefits and Results

- **Delivered a high-quality, optimized 3D CAD model** that included relay buildings, roads, fence, and existing cable ducts — all aligned with the site plan and ready for planning and BIM workflows.
- **Accelerated project delivery and reduced client workload** by quickly providing skilled resources, allowing the client’s team to focus on core engineering tasks.
- **Enabled the Client to secure more similar projects,** leveraging the completed model as a showcase of their capabilities.
- **Established a trusted partnership** for future substation and grid modeling projects.

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Techstack:

AutoCAD, ReCap Pro, Microstation, Global Mapper, Navisworks

Team: 3+

3 3D Modelers (CAD), Point Cloud Specialist, BIM/CAD Coordinator