

Electric Substation Structural Design

ProSteel, STAAD.Pro and STAAD.foundation

Structural Analysis for Substations

The layout and design of electrical substations and switchyards is critical to the entire power delivery system. A well planned facility ensures that the electrical equipment is properly supported by steel structures and foundations, resulting in outstanding system reliability and performance.

Substation and switchyard structures are used to support the above grade components and electrical equipment such as cable bus, rigid bus, and strain bus conductors; switches; surge arresters; insulators; and other equipment. These structures must be designed such that applicable steel design codes and standards are incorporated into the final build. Additionally, structures must be designed to withstand various static and dynamic loads such as dead weight of conductors and electrical components, wind, snow/ice, and seismic loads. Bentley's STAAD.Pro® is well suited to perform structural analysis and design of these types of structures.

Structural Detailing for Equipment Fabrication

Structural detailing is also important when designing new support equipment within a substation or switchyard. Detailing information can be provided to structural steel fabricators to manufacture, assemble, and deliver the parts necessary to support electrical equipment within a facility. Bentley's ProSteel allows detailers to produce structural fabrication or shop drawings as well as placement of all connections with minimal human intervention.

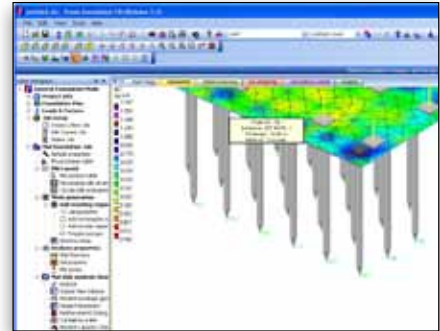
Bentley's STAAD.Pro and ProSteel® are integrated using StrucLink, which allows substation structure models to be imported or exported between the two applications.

Foundation Design and Analysis

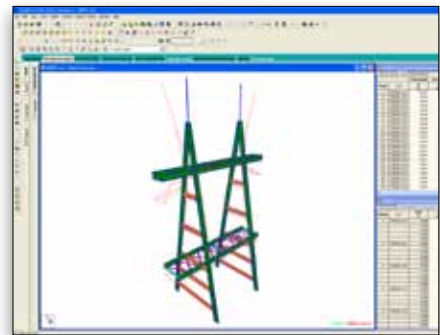
Foundation design is also essential when planning electrical substations and switchyards. Designs can include a wide range of foundations such as slab-on-grade, isolated, combined, pile cap, drilled-pier, and mat. STAAD®.foundation is a foundation design management system that can design a wide range of foundations based on support reactions obtained from STAAD.Pro structural analysis models.

Bentley's structural design, analysis, and detailing products complement the Bentley substation solution:

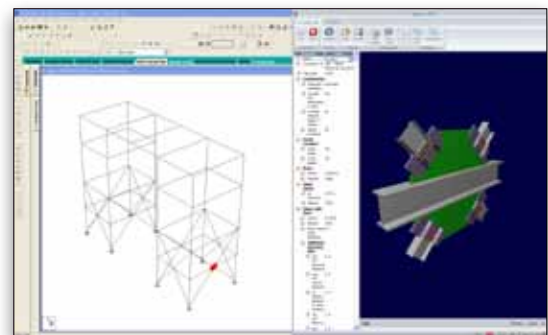
- **STAAD.Pro** – Structural analysis and design
- **STAAD.foundation** – Foundation analysis and design
- **ProSteel** – 3D structural steel detailing and drawing production



The above figure illustrates a slab-on-pile foundation in STAAD.foundation and associated moment contour plots due to loads imported from STAAD.Pro.



A-Frame substation structures can be easily modeled, analyzed and designed using the STAAD.Pro user interface. The above figure illustrates exaggerated deflections and the tabular representation of nodal and section displacements.



STAAD.Pro can be integrated with other products to design steel connections based upon AISC code. The above figure illustrates a connection joint in the structure and the corresponding connection design on the right hand side.