Structural Desktop Newsletter

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Case Study: "Tilt Wall Construction"

Tilt-wall projects can be made easy by incorporating Structural Desktop. Our engineering team recently completed a new theater complex, in which we designed the tilt-wall concrete panels and all the embedded pre-cast connections. Structural Desktop was used to speed up the flow of design, bid, and creation of contract documents.

We started the process with Structural Desktop by building a 3D model of the facility from the architect's and engineer-of-record's drawings. The model included the foundation, tilt walls, connections and attached beams, joists, and columns. To see pictures of this model click here. The foundation, beams, joists, columns, and connection plates were modeled using Structural Desktop members and the tilt walls were made using Structural Desktop plate-elements.

The connections were given a high level of detail in the model showing the connection plates, erection angles, and shear plates connecting the beams. The bolts connecting the shear plates to the beams were not shown. These connections were given a preliminarily size by the engineer. The model was checked for conflicts between tilt wall panel joints and connections. This allowed us to optimize the tilt wall panel joint locations as well as satisfy the architectural requirements. Click here for an example.

Our senior engineer created the model and shared the Structural Desktop file with two other individuals: the draftsman-designer and a junior engineer. The draftsman-designer created a 3D drawing from the model using the appropriate Structural Desktop function. The resulting plain AutoCAD drawing was composed of AutoCAD solid objects. He then subtracted all the doors using simple solid-editing functions native to AutoCAD. By copying each resulting panel to a 2D plane he was able to dimension the wall panels. The wall panels had all the correct dimensions, opening cut-outs, and connection plates in their proper locations. Click here to see the 3D model with the cutouts.

Demonstration

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At the same time the junior engineer was working on the connections. He extracted plain AutoCAD 2D elevation drawings from the model as a starting point for his connection details. Plate sizes and thicknesses will change, but the model gave him a good place to start his details by using the appropriate Structural Desktop function. Each connection was shown clearly in the model as defined by the senior engineer. This allowed the junior engineer to view each connection and make the necessary calculations. Worst-case parameters for the calculations could be readily noted in the model and this reduced the time spent by other team members in examining the drawings for conflicts or finding worst case scenarios. Click here for an example of a connection detail started in Structural Desktop.

Meanwhile, the senior engineer used the model to design the wall panels. He saved a 2D drawing of each unique panel configuration, then used the drawings as a guide to create a Structural Desktop finite element model of each panel. He created a finite-element-mesh structured so that all loads could be applied at correct locations via the element nodes. The panels made of Structural Desktop elements were exported into an analytical program and the boundary conditions and loads were applied in order to determine the moment values. The Enercalc program was used to establish the capacity of several reinforcement layouts in the pre-cast tilt-up walls. The capacities were checked against the values given by an analysis using the RISA 3D program. This process permitted a quick path to an efficient design. Click here to see the three step process: saved AutoCAD drawing from Structural Desktop, Structural Desktop element model, and RISA analysis model.

This article should give you a better insight into some to the possibilities of Structural Desktop. It lays out a the work flow that worked well on this project for this team. Each engineering office is different, with each member of the team having different strengths and weaknesses, but the strength of Structural Desktop is the flexibility designed into the program. We hope you can use some of the ideas presented to build your own model, your own work flow, and your own business.

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