Trimble MEP
CASE STUDY

BIM: More Than Modeling to F.E. Moran

Finding a way to seamlessly transfer our 3D modeling content from the office to the field and vice versa has helped increase our field productivity, in some cases, by a factor of 10. Now we're beginning to realize the true BIM edge!

F.E. Moran (FEM) is a leader in the design and installation of large, medium and small mechanical heating, ventilating and air conditioning (HVAC) systems in Northern Illinois. As a full-service mechanical contractor, the firm has been involved in nearly every major HVAC project in the Chicago area for over 50 years.

More recently, the firm has expanded its use of building information modeling (BIM) data to the field to achieve impressive improvements in productivity, accuracy and quality.

A field disconnect

About four years ago, the FEM's HVAC design and engineering team, led by its chief engineer, Jason Smith, transitioned to 3D and building information modeling (BIM) in an effort to improve coordination, collaboration and precision of its piping fabrication and sheet metal operations.

Besides AutoCAD, FEM implemented QuickPen DuctDesigner 3D and QuickPen PipeDesigner 3D AutoCAD-based 3D CAD solutions to support the design and detailing of HVAC and general piping systems. In addition to CAD, FEM has been using QuickPen's AutoBid estimating software for over twenty years and Quicken's Vulcan fabrication software in the sheet metal shop.

Yet, Smith and his team noticed a disconnect between concepts modeled in the office and produced in the shop as compared to what occurred in the field.

Smith says,"We are coordinating components down to the nearest inch, sometimes less. Because of jobsite conditions, time allowed and the understandable margin of error on large jobsites, the precision was difficult to carry out in the field."

"Whether pipes or metal products, HVAC components are fabricated per the 3D designed and coordinated models – and must be placed in the field with the same accuracy. Turns out, we needed more than 3D modeling capabilities; we needed a way to seamlessly transfer that data from the office to the field, and vice versa", explains Smith.

Soon after, Smith selected the Trimble® MEP Layout Solution to connect 3D data, such as sleeves and hanger positions, designed within 'QuickPen's CAD products to the field. QuickPen's PipeDesigner 3D and DuctDesigner 3D database maintains the parametric model characteristics while allowing the model to store data by size, geometry and material; schedule for piping, and pressure class for sheet metal.

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- Jason Smith, Chief Engineer - F.E. Moran

The 3D parametric data is then imported into the firm's estimating software for material ordering and tracking.

Smith says, "Working together, these tools tie our people and processes together into a seamless digital working environment that minimizes chance of error and helps us produce a better product – an edge clearly evident on the Palos Community Hospital expansion project."

Palos possibilities

Palos Community Hospital's 300,000-sq-ft, 7-story hospital expansion includes a new $48.9-million central utility and power distribution system. The new plant includes four steam boilers totaling 2,400 boiler horsepower, 5 chillers totaling 5,100 tons of cooling and a set of plate and frame heat exchangers to provide 1,100 tons of free cooling. The 3000 kW emergency generating system provides back-up power to the campus. A redundant 15 KV distribution system and 3 new double-ended substations serve the new central plant and campus.

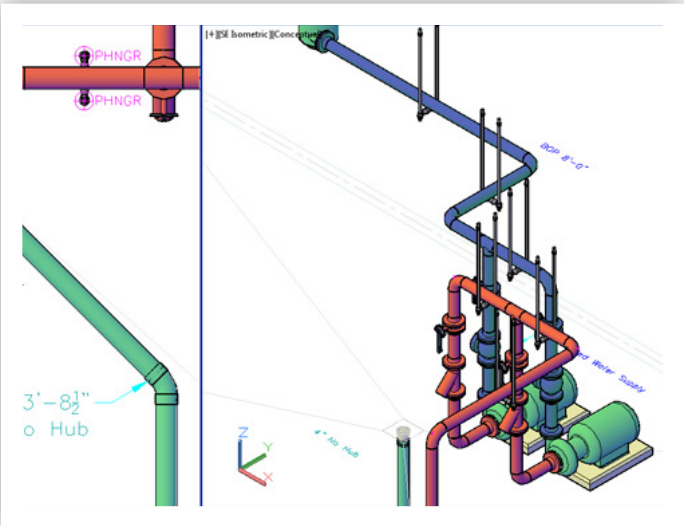
The new central plant connects to the existing distribution system via a complex system of below grade utility tunnels, which contain the steam, water, chilled water, medical gas, fire protection and other piping systems.

Engineers needed to keep HVAC in that tunnel to manage the steam condensate flow. The tunnel slopes up while the steam piping was required to slope down. We needed our model and the as-built conditions to match as closely as possible or we'd end up with discontinuities that would cost time and money.

The challenge for FEM was to connect a complex network of new and old mechanical systems together through an underground tunnel, Smith explains.

As-built modeling

In support of 3D coordination amongst the entire project team, FEM created a structural model of the central plant and distribution system within the QuickPen CAD software. The structural model created by FEM included the tunnel structure, utility plant structure along with footing and grade beams to accommodate underground coordination.



The field and control points were exported from the QuickPen PipeDesigner 3D® solution to the Trimble® Nomad handheld computer. Site engineers then placed the Trimble MEP Robotic Total Station on the approximately 17,500 square foot deck. The FEM team performed calibration onsite by referencing the control points...

FEM used the Trimble MEP Layout solution to bring the as-built conditions into the structural model within the QuickPen CAD database. Then they located field points, such as hanger inserts, equipment pads or equipment objects, in the model.

The field and control points were exported from the QuickPen PipeDesigner 3D® solution to the Trimble® Nomad handheld computer. Site engineers then placed the Trimble MEP Robotic Total Station on the approximately 17,500 square foot deck. The FEM team performed calibration onsite by referencing the control points provided by the surveyor with the points input into the CAD model.

Smith recalls, "Using the Trimble robotic total station, we set approximately 500 individual field points in one day with one person. Comparable conventional methods using a tape measure would have taken several days. When it comes to concrete deck insert layouts, we have increased our productivity by a factor of 10."

During the concrete deck layout, FEM is usually working alongside other MEP trades as well as the concrete re-bar steel installation crews.

"It would have been cumbersome to have our two-person crews working in this area using a traditional tape measure and paper drawings. The Trimble MEP Layout Solution allows one person to work more efficiently around the clutter," says Smith.

Full steam ahead

Soon after, FEM utilized the Trimble MEP Layout Solution to layout steam piping within the sloping utility tunnel.

Due to the ADA requirements, the tunnel incorporates several landings. There are approximately four vertical risers with a drip leg to raise the main back up to the highest possible location, which accommodates the pitching of the steam main. Because these drip legs and the landings did not match up dimensionally, the elevation of the pipe through the entire tunnel varied.

Similar to the concrete deck, FEM imported survey control points provided by the civil contractor into the CAD software, and then designed the piping system in the QuickPen PipeDesigner 3D® application, adding field points with elevation. Once the components were fabricated, FEM exported the points to the Trimble MEP Total Station via the Trimble Nomad handheld computer, calibrated the instrument onsite using the defined control points, and then placed the points in the field.

Once the pipe components were delivered to the site, construction crews could install the complex network of pipes quickly and accurately.

Smith says, "We were able to exactly coordinate the support positions between the model and the field thanks to the Trimble MEP Layout Solution. Much like the concrete deck layout, we were able to take data directly from the 3D model and transfer it to the field, which enables us to set this prefabricated piping in a complex layout right the first time."

FEM is using BIM solutions on all of its projects, including Lurie Children's Memorial Hospital, BP Bright Lights, Kraft Foods, WMS Gaming, and Walsh Construction Headquarters.

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