



Project Summary

Organization:

Stopford Projects Ltd.

Solution:

Buildings

Location:

Northwich, Cheshire,
United Kingdom

Project Objective:

- Perform a structural inspection survey of Tata Chemicals' 6,000-square-meter wet-side soda ash plant
- Produce a color-coded inspection model indicating areas with no defects, minor defects, major defects, and severe defects
- Deliver an intelligent 3D model for future asset management and maintenance

Products used:

ProSteel
AutoPLANT Piping
Bentley Navigator

Fast Facts

- A demonstration of ProSteel persuaded Tata Chemicals to choose an intelligent 3D model as the deliverable
- The survey team inspected and documented approximately 5,750 individual structural elements
- Stopford modeled more than 10,000 structural elements in ProSteel and 2,500 metric tons of iron pipe in AutoPLANT Piping

ROI

- Stopford's bid on the Tata Chemicals project was one-third that of competitors, based on expected time savings
- ProSteel's model production speed helped Stopford to complete the project in just five months
- Subsequent to the successful survey project, Stopford was awarded five follow-on projects using the intelligent 3D model

Stopford Projects Uses ProSteel to Model Corrosion at Victorian-era Soda Ash Plant

Leverages Century-old Pen-and-ink Drawings to Create Intelligent 3D Model of Structural Inspection Survey Results

Full Structural Inspection Survey Performed

Built by Brunner Mond & Company in 1873, the Winnington Works at Northwich, Cheshire, United Kingdom, was acquired in 2006 by Tata Chemicals Limited, the second largest producer of soda ash in the world. Tata Chemicals, based in Mumbai, India, commissioned Stopford Projects Ltd. to perform a full structural inspection survey of the 6,000-square-meter wet-side soda ash plant as part of an ongoing asset management and maintenance strategy. Within just five months time, Stopford delivered an intelligent 3D model created in Bentley's ProSteel® to map corroded components throughout the plant.

Stopford is a world-class consultancy that provides multidisciplinary engineering design, project management, and construction services to both U.K. and international clients in a variety of industrial sectors. The firm started the \$1.5 million Tata Chemicals project in April 2011, completed the survey by September 2011, and was subsequently awarded follow-on remediation works.

Using ProSteel, Bentley's structural steel detailing and fabrication software, was critical to success because Stopford based its winning bid on completing the project quickly. Although Tata Chemicals did not initially specify an intelligent 3D model as the required deliverable, Stopford persuaded the client to reconsider by demonstrating ProSteel's features – including model production speed, automatic updating, and model exporting to AutoCAD.

Thousands of Components to Survey

Given the go-ahead to use state-of-the-art modeling software, the survey team had to start from scratch at Winnington Works. The wet-side soda ash plant is a 10-story steel-framed building that occupies a T-shaped area with

overall dimensions of 90 x 75 meters. The structure is comprised of a mix of 19th-century timber, early 20th-century columns, beams, and bracing, and 1950s-era steelwork.

The supporting structure is now a structural steel shell clad in corrugated steel panels. Structural connections are mainly riveting, with sections riveted to form composite members.

The building has remained virtually unchanged since its last major expansion in 1950.

Over time, the constant wet, alkaline atmosphere has degraded the building materials.

Stopford's job was to perform the structural inspection as well as review the major equipment and pipework that impinges on the structure. The survey team had to inspect approximately 5,750 individual structural elements and prepare comprehensive documentation, with every

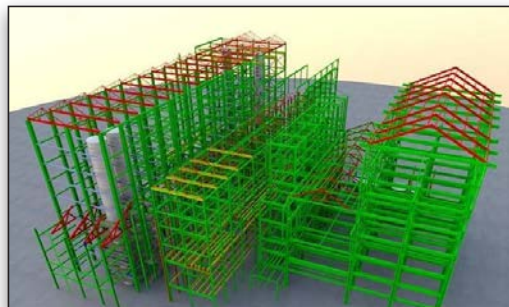
element photographed, assessed, numbered, and recorded on drawings. All secondary steelwork also had to be inspected, including platforms, walkways, concrete floors, and other load-bearing elements.

The results of the survey were to be evaluated for corrosion levels on individual components, so that Tata Chemicals could plan remediation works.

From Archival Drawings to a 3D Model

Stopford began building a basic model based on 671 archived drawings, including as-builts dating back to 1908. The earliest drawings reflected the British Standards of 1906. These original plans yielded enough data for 95 percent of the 3D model. The few 2D drawings of subsequent plant modifications comprised the remaining 5 percent. Also, a fairly recent model of a large vessel was incorporated.

The first step was to create a custom library of obsolete steel and wood member sections in ProSteel, as well as a catalog of obsolete iron pipe standards in AutoPLANT® Piping™,



During weekly client meetings, progress was monitored by reviewing the latest model using Bentley Navigator, an i-model, and progressive PDF views.

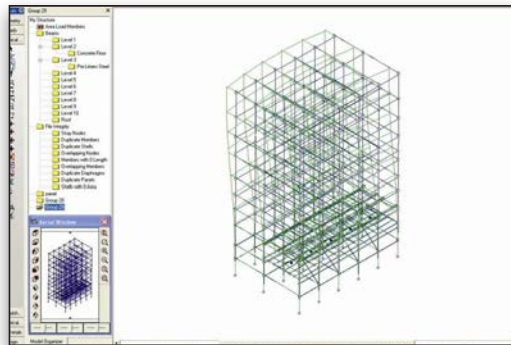
"Bentley software provided the advantage of speed of modeling. Our price for the job was a third that of some other bidders. This was the main reason Stopford was awarded the project."

— David Coupe,
piping department manager,
Stopford Projects

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Model geometry was directly exported to STAAD and SFRAME for structural analysis.

which is Bentley's piping design and modeling software. Structural elements were easily produced using the ProSteel shape files. Custom pipe specifications were produced using modified ductile iron catalogs. General arrangement drawings were generated directly from the model, using ProSteel workframes clipping planes to produce plans and elevations. Column and beam annotations are read directly from the model database.

Color-coded Model for Inspection

The general arrangement drawings had numerous sectional views of each floor, and each structural element was given a unique tag number. The 3D model included 13 primary structural steel models, 15 secondary structure models, 13 piping and equipment models, and all 102 staircases in the complex. In total, more than 10,000 structural elements were modeled in ProSteel, and 2,500 metric tons of iron pipe were modeled in AutoPLANT Piping.

Stopford took the completed general arrangement drawings to the site and used the tag numbers on the reports and photographs to inspect the as-built structure. The degraded sections were mapped to create a visual representation for use in the development of maintenance plans. An up-to-date, color-coded inspection model was produced, and 3D PDFs were generated for client review. Various colors indicated areas with no defects, minor defects, major defects, and severe defects.

Capturing Inspection Results

During the on-site inspection, ProSteel made it easy to keep the 3D model up to date. A change in the size of a structural section, for example, automatically adjusted all the connecting elements to the modified size, and the respective general arrangement drawings were simultaneously updated as well.

At the weekly progress meetings, Stopford used Bentley Navigator, Bentley i-models, and progressive PDF views for dynamic project review and analysis. Being able to easily view the 3D model helped the client monitor progress, as well as visualize how the model would aid in maintenance planning. At the conclusion of the project, Stopford delivered a 12-volume survey report, the 3D model in AutoCAD, general arrangement drawings, and as-builts.

When remediation commenced, the 3D model was easily modified to reflect current as-built conditions. The color-coding facilitated prioritization of projects, with safety issues such as spurious loads, restricted access areas, and unsafe stairways getting prompt attention.

Delivering Value for Maintenance and Safety

Stopford produced an adaptable tool for Tata Chemicals to use not only in maintenance planning but also in training personnel. The model revealed places that were not readily visible in photographs or drawings, such as areas encased in scaffolding. In addition, plant safety was improved through an awareness of highlighted escape routes. All stairways were brought up to modern standards as a result of the inspections.

Tata Chemicals can maintain the 3D model in ProSteel or convert it to AutoCAD solids and/or ACIS bodies. In addition, the ability to interface with other software such as STAAD.Pro® and Bentley AutoPIPE will help to jumpstart future projects that require data for structural analysis, isometric generation, and other functions. Estimating the cost to duplicate or expand facilities is made easier with access to an intelligent 3D model. For example, the 3D model of the Winnington Works wet-side soda ash plant could be used to estimate the cost of future steelwork by extracting the data for the steel components and calculating the total weight.



Redundant pipework was color coded in the model and helped reduce the overall load on the building.

One-third the Cost

For Stopford, using Bentley software allowed the project team to achieve their schedule for modeling the plant. The firm had priced the job at one-third less than some of the other bidders based on the anticipated ease and speed to model. This was the main reason Stopford was awarded the project, according to David Coupe, piping department manager.

Subsequent to the successful survey project, Stopford was awarded five follow-on projects in the wet-side building and used the intelligent 3D model extensively. These projects included a lateral load study associated with re-cladding the building, stairway replacements to bring stairs up to current standards, removal of a concrete floor and replacement with steelwork, and inspection of the utilities building using the same methodology. Stopford's proven approach using Bentley software continues to provide value-added results.