



# Building Information Modeling Optimizes Building Services in Tight Spaces

FaberMaunsell put Bentley's building information modeling (BIM) solution of architectural design applications to the test when it performed 3D prototyping on building services for its 30 Gresham Street project, located in the heart of London's financial district. Using MicroStation® TriForma®, Bentley® HVAC™, Bentley® Structural™, Bentley® PlantSpace® Piping™, Bentley® Navigator™, and Bentley® Interference Manager®, FaberMaunsell optimized the number of floors accommodated and provided floor-to-ceiling heights acceptable to the marketplace while meeting height restraints placed on buildings within the sight line of St. Paul's Cathedral.

## SUMMARY

### Organization

FaberMaunsell

### Vertical Market

Building

### Location

London, England

### Project Objectives

- Maximize available space, while respecting the height constraints on this historic building.
- Optimize the number of floors that could be occupied, while allowing for a generous IT distribution.
- Use 3D prototyping, enhanced by Bentley BIM technologies.

### Fast Facts

- 30 Gresham Street is located in the heart of London's financial district, where it is subject to height restraints placed on buildings within sight of St. Paul's Cathedral.
- FaberMaunsell produced all the materials needed for the project in Bentley software, including the 3D model and 2D plans, elevations, and sections, as well as the AVIs.
- Bentley Interference Manager allowed the team to quickly clash-detect any potential problems.
- Bentley Navigator enables the firm to show clients around inside a virtual environment, where a simple click on a pipe brings up all associated information about that pipe.

### Bentley Products Used

- MicroStation Triforma
- Bentley HVAC
- Bentley Structural
- Bentley PlantSpace Piping
- Bentley Navigator
- Bentley Interference Manager

Surrounded by some of the world's leading financial institutions in the heart of London's financial district, 30 Gresham Street will provide world-class office space for financial institutions when completed. The building is located close to the Bank of England and St. Paul's Cathedral, overlooking historic Guildhall.

The project was restricted by height constraints, because it is located within a protected sight corridor from one of several strategic viewpoints towards St. Paul's Cathedral. The developer, Land Securities, wanted to maximize the available space for its future tenants. That meant optimizing the number of floors that could be occupied and providing floor-to-ceiling heights acceptable to the marketplace.

This presented international multidisciplinary consulting firm FaberMaunsell with a challenge. The IT-intensive building needed highly complex building services distribution. But it had to fit into the tight spaces that were allocated to the ceiling voids on each floor and in the basement plant areas.

### Solving worst-case scenarios with 3D prototyping

While FaberMaunsell has been performing prototyping for several years, only recently has the company actually been able to do it more efficiently. This new efficiency is due to the advent of BIM tools from software vendors such as Bentley and to more affordable processing power,

according to FaberMaunsell's Chris Hindle, associate director of building services. The design team used Bentley HVAC, Bentley PlantSpace Piping, and Bentley Structural to determine what would fit in the limited ceiling void space.



"Instead of creating dumb 2D drawings, we can now create a 3D prototype of the environment, because Bentley has

developed more robust solutions we can actually use," he explains. "If there was a beam, we'd draw a beam using Bentley Structural. If we were drawing ductwork, we'd use Bentley HVAC, which gives us a new capability to draw in 3D with real components—as opposed to having to build individual

components ourselves, which is also a tremendous time-saving benefit for us."

"For example," Hindle continues, "because we were in a 3D environment, we could physically see the depth of a beam, so we'd know what space we had left to work with to run the ductwork, piping and massive bundles of electrical cables. If we needed a hole in the beam to pass services through, we'd then relay that information back to the structural engineer to see if that's possible. In some cases it is, in some cases it isn't, in which case we'd have to rethink the area. It's an ongoing cycle. Having Bentley's integrated suite

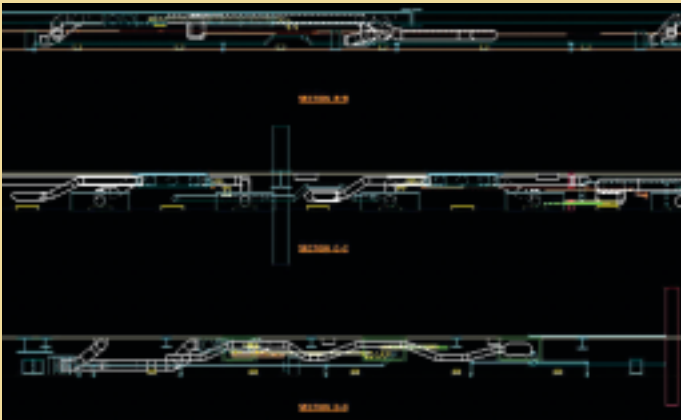
of software with 3D capabilities made it whole lot easier to solve such problems."

FaberMaunsell had to coordinate several systems within a prototype model of the fifth-floor ceiling void—the worst-case ceiling void they faced, which provided a mere 700mm of space.

Systems included the air conditioning system and fan coil units, heating and

chilled water pipework, lighting and lighting control modules, cable distribution—including trunking, trays and ladders—sprinkler pipework, structural elements, and cavity barriers.





“On the 30 Gresham Street project, we created a services model using Bentley HVAC to prove we could fit our design intent information within a very small space and show our client that it was possible,” says Hindle.

### Modeling real life-sized services with Bentley PlantSpace Piping

FaberMaunsell was able to solve the fifth-floor worst-case scenario, as the prototype successfully proved. The project manager then decided to prototype the basement plant area, where a lot of systems would also be coordinated in a small space. The basement plant rooms allow only 4.9 meters of headroom, from slab level to the underside of the slab above. Some corridor areas have a reduced headroom of 2.3 meters above slab level. Here, the team needed to include the boiler plant, ventilation plant supply/extract, smoke extract, central refrigeration plant, electricity generation plant, HV supply and distribution and LV distribution.

Bentley PlantSpace Piping was used to route all the piped systems, including all valve arrangements.

“We found we could coordinate the systems initially using simple linestrings to lay out the basic routes,” says Brian Evans, coordination draftsman on the project. “These could then be turned directly into intelligent pipe runs. This saves

## Making the most of MicroStation

FaberMaunsell has been a Bentley user since 1988 and a strong proponent of Bentley software capabilities. Says Hindle, “When we first began using MicroStation, the only other product out in the marketplace was AutoCAD® 2.3, and we couldn’t do anything with it at all. It didn’t handle external files and things like that. Whereas MicroStation could handle external files extremely well, even back then.”

The software’s flexibility has been another advantage for the firm. According to Hindle, “Being able to read and write DWG and DXF files with Bentley software gives us greater flexibility in being able to work with other CAD applications and firms who don’t use Bentley products. If we go to tender or try to win a project that requires the final deliverables be DWG AutoCAD format, it’s not a problem.”

And, since the advent of MicroStation TriForma, FaberMaunsell is exploring how the firm can take full advantage of the application moving forward, according to Hindle.

us time with the initial routing and coordination. If we had to place pipe as is first, it would take us much longer to modify.

“Due to the inherently constricted space we had to fit the basement plant into, we needed a set of tools that would enable us to appreciate all aspects of the structure and available space simultaneously whilst giving us the ability to model real life sized services,” Evans continued. “Bentley PlantSpace Piping

“Instead of creating dumb 2D drawings, we can now create a 3D prototype of the environment, because Bentley has developed more robust solutions we can actually use.”

gave us this ability to model the space as we built into it. And with the Bentley Interference Manager and Bentley Navigator software, we were quickly able to clash-detect any problems with the structure and other services or the escape zones.

The time required to provide this level of confidence with a manually coordinated services scheme of this size would have been a very costly exercise."

### Closing the gaps with 3D

Another benefit of building information modeling is creating "as is" information.

Evans explains that when creating a 2D plan using traditional drafting methods, then creating the section or elevation, there's no link between the plan and the section or elevation; they're disparate pieces of information.

Someone who updates the plan needs to remember to update the section or elevation that relates to it as well which leads to a large potential margin of error.

"Because of that margin of error, you tend not to produce many sections or elevations, since each one you produce takes an additional resource on the project," he explains.

"However, we can create as many sections and elevations as we want using the 3D model, because it doesn't take much

more effort or additional resources to do so. This is where the cost savings come in. With 3D, we can provide a lot more information that's much more highly detailed than we could previously, in a short amount of time. For example, we can

take a section of a ceiling void, and that section would then show the beams and the services distribution as a point in space."

### Reducing risk with Bentley Interference Manager

Bentley Interference Manager, an application for the detection, review and management of component interferences in 3D models, served as a QA back-stop on the project, according to Hindle, whose design team used the application to determine if their proposals were feasible.

"Our quality assurance process dictates that we have to certify that our information is correct," explains Hindle. "Traditionally, someone would have to go through all the drawings with a fine-toothed comb to make sure, for example, that someone interpreted the beam depth correctly to allow a duct to pass under that beam. Now, with Bentley Interference Manager, we no longer have to worry about human error. It will perform that QA process for us and highlight those clashes in an instant. Bentley Interference Manager is truly a great product—saving us a lot of time and reducing risk."

### Communicating design intent with Bentley animation and virtual navigation tools

FaberMaunsell presented its systems distribution design solutions on the project to the developer in an AVI movie taken from the model that was generated with MicroStation TriForma. A live walk-through of the 3D model was made

## FABER MAUNSELL

FaberMaunsell is an international multidisciplinary consultancy that offers a comprehensive range of services in the engineering, transportation, infrastructure, and environmental sectors through a network of 34 offices and 2,100 employees across the UK and Europe. FaberMaunsell is part of AECOM Technology Corporation, one of the world's largest providers of professional technical services, with 10 principal operating companies and over 15,000 employees worldwide. AECOM Technology uses more than 600 seats of MicroStation and approximately 200 seats of other Bentley applications across its operating companies.



using Bentley Navigator, which helped with visualizing and navigating graphical and non-graphical facility information.

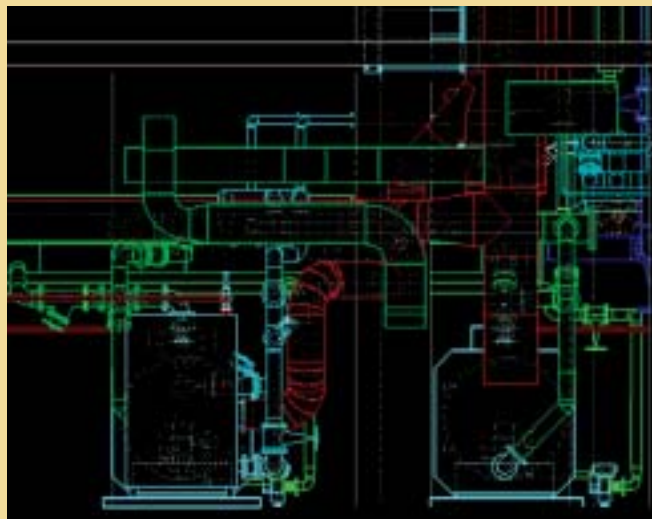
“Bentley Navigator gives us the ability to walk around in a virtual environment and show our clients exactly what they’re going to get,” says Hindle. “We can click on a pipe, and it will tell us the correct material, size, and content of the pipe—that there is going to be cold water in there, for example.”

### *Innovative tools for visionary organizations*

Using BIM tools enables forward-thinking firms such as FaberMaunsel to exceed client expectations and forge ahead in the marketplace.

“Everything we produced on this project—from the 3D model and 2D plans, elevations and sections to AVIs—to show the client, we did using Bentley software. It’s amazing that we can do all this using a single platform and the tools that come with standard MicroStation, standard MicroStation TriForma, or any of the other architectural design applications—it affords us tremendous cost-saving and time-saving benefits,” says Hindle.

30 Gresham Street is due for completion by late 2003.



For more information on Bentley, please visit [www.bentley.com](http://www.bentley.com) or call 1-800-BENTLEY.



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