BE Award Finalist

Courting Success

BIM marshals multiple disciplines for federal courthouse design synchronicity

The design directives for the new United States Courthouse in Rockford, Illinois, called for multiple, sometimes seemingly contradictory objectives. For instance, because the U.S. General Services Administration (GSA) foresees a building life of up to 100 years, provisions for future expansion had to be extremely flexible to accommodate changing space needs. Also, the building design needed to meet stringent security requirements while simultaneously being open and inviting to the public. To meet these challenges, GSA retained the design team of Koetter, Kim & Associates and PSA-Dewberry in November 2002.

Forming the centerpiece of a new urban district within Rockford, the two urban blocks selected as the courthouse site lie in an underutilized section of the city. The plan focused on further developing Rockford's Main Street as an urban street interspersed with public green spaces. The courthouse location forms a park-like square that connects to Rockford's riverfront park system, with the main entrance to the courthouse marked by a pavilion located in park space. The primary security checkpoint occupies the connector between the pavilion and the building itself.

The building is designed to project a stable and dignified image appropriate to the judiciary while being visually engaged with the city's character. It will house five courtrooms: two District Courts, one Magistrate Court, and two Bankruptcy Courts. Space is also provided for District and Bankruptcy Clerk of the Court, U.S. Marshals Services, U.S. Attorneys, and Pre-trial/Probation Services.

The organization of the building produces a long narrow form that defines the western edge of the newly created park. The scale of the courthouse relates well to surrounding buildings, but the courthouse is tall enough to establish an urban presence and provide views in all directions from the upper floors.

Upon entering the courthouse, visitors receive an immediate sense of how the building is organized. The entrance lobby cuts through five of the building's six floors to orient visitors to the publicly accessible areas. The departments that will generate the most traffic are located on the first and second floors, adjacent to the lobby, which also introduces as much natural light as possible into the interior office spaces. Clerks' offices on the first and second

▲ PSA-Dewberry designed a courthouse that projects a dignified image while visually reflecting the city's character

PROJECT OVERVIEW

United States Courthouse

Organization
PSA-Dewberry

BE Awards Category
BIM for Visualization and Simulation

Project Objective
Adopt 3D BIM to design a new courthouse that meets requirements for security, public access, expandability, and integration with surrounding area

floors benefit from borrowed light from both the atrium and the public corridor to the east.

The 193,000-square-foot courthouse complies with GSA's Design Excellence Criteria and GSA/ISC Design Criteria for Courthouses and Federal Facilities. The selection of exterior material was critical in the design of the building because of the need to meet ISC blast requirements.

The design team specified a combination of natural and cast stone, and the exterior glazing system uses standard curtain wall elements that are used as infill panels for the grid of cast stone elements. Clear, translucent fitted glass panels, as well as metal panels, are glazed into the curtain wall to create a dynamic layering of materials and transparencies. Environmental considerations also factored into the building design, since the new courthouse will seek to earn LEED Silver certification from the U.S. Green Building Council.

The role of BIM

GSA turned to PSA-Dewberry to construct a 3D model of the project prior to the project being bid. Before the building information modeling (BIM) took place, PSA-Dewberry held team meetings to discuss client expectations, work distribution, file and model breakdowns, and project deadlines. Because most of the team was not familiar with BIM, PSA-Dewberry incorporated a review of the actual 3D model into its team meetings. A workstation with a projector was used to display the 3D model.

In addition to cost savings on paper and staff time, this process allowed the team to discuss the reasons for the placement of particular elements and to explore alternatives. This method effectively forced each discipline to review how its data worked together with the other disciplines.

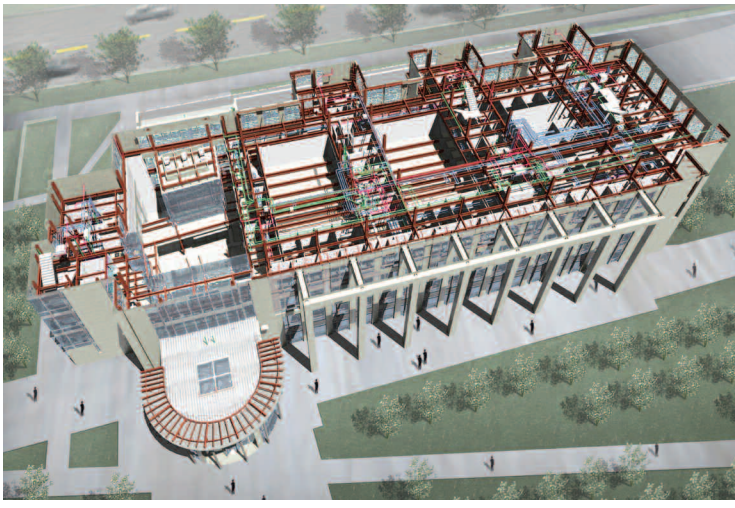
"BIM is a great visual communication tool, but it does not replace the dialog that needs to occur among team members within a given discipline. While the communication does not always happen as it should, there is no disputing the value of seeing the actual elements in the 3D building space," said Kirk Stuaan, IT operations manager at PSA-Dewberry.

Michelle M. Wehrle, GSA project manager, added, "BIM technology enables closer collaboration. The Rockford Courthouse was a perfect opportunity to work with the project team to use that technology and strategically position GSA to achieve our design and development objectives."

PSA-Dewberry used an assortment of Bentley products. While MicroStation handled 2D work, the 3D modeling took place in several applications: Bentley Architecture, Bentley Electric, Bentley Mechanical, Bentley Structural, and GEOPAK. Using the same basic tools and file format across all disciplines greatly reduced staff time needed to set up and manage the project.

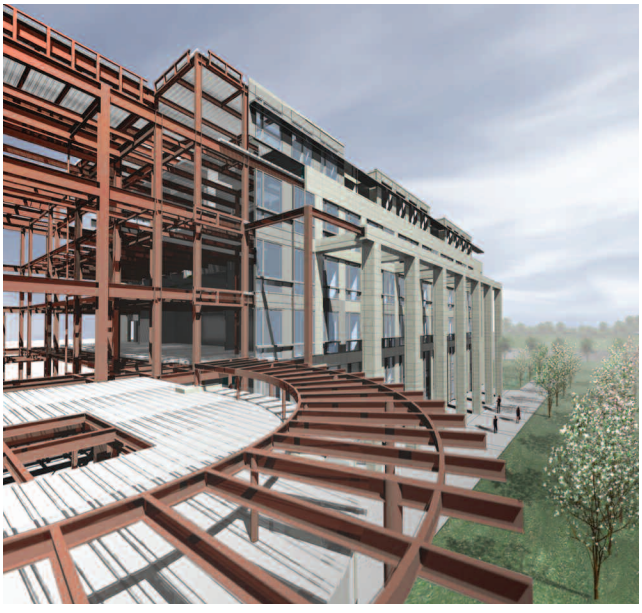
The 3D model helped team members—consisting of Brandon Buchner, Jason Coffman, Nate England, Blake Gleason, Rob Herrick, Sam Hudson, Mike Justice, Mike McTavish, Ed Page, Evan Spirrison, Matt Wilner, and Luke Wirtz—move past their own discipline's viewpoint to see the complete building. The ability to view all elements in 3D revealed issues that were overlooked in 2D reviews. The design team used the building model to evaluate various materials to see how they connected and interacted in light of security requirements.

For instance, controlling floor-to-floor heights as well as maintaining high ceilings in the courtrooms and open spaces were two goals that were in direct conflict. PSA-Dewberry designers used 3D models to optimize the placement of the mechanical system in the limited space available. The ability to quickly modify the 3D model allowed the team to explore routing options, duct forms, and various delivery methods.



▲ The 197,000-square-foot courthouse complies with GSA's Design Excellence Criteria and GSA/ISC Design Criteria for Courthouses and Federal Facilities

BIM enabled PSA-Dewberry to create a proof-of-concept model for GSA to validate the systems and components for each discipline. Gerry Guerrero, project manager for PSA-Dewberry, estimates that using BIM on the project may potentially decrease the percentage of construction-related change orders by 60 percent, which translates to a potential construction cost savings of 0.25 to 0.5 percent. PSA-Dewberry also anticipates the possibility of cutting



▲ BIM enabled PSA-Dewberry to create a proof-of-concept model to validate the systems and components for each discipline

a month or two from the project's construction time line, as well as saving about 250 to 400 hours of staff time needed to process such construction-related requests.

In adopting BIM, PSA-Dewberry incurred costs for training. However, the firm believes that those costs have been recouped through overall project efficiencies. PSA-Dewberry's BIM experience will also position it to meet yet another GSA requirement on projects—the use of BIM software in the building design phase.

BE Award Winner

Remodeling an Icon

Sydney Opera House adopts BIM to guide renovations, manage facilities

Distinguished by its soaring roof shells, the Sydney Opera House has earned both National and World Heritage status as one of the world's greatest buildings. To meet the dual goals of preserving the Sydney Opera House for future generations and ensuring its continuing utility as a performing arts center, the Sydney Opera House Trust has adopted building information modeling (BIM) as the core for its strategic building and asset maintenance plans.

Utzon Architects and Johnson Pilton Walker, in collaboration with a consulting team including Arup, conducted a review and study of the Opera Theatre interior as part of the strategic building plan. The design team included 10 engineers, two 3D technicians (architectural and structural), and specialists in acoustics, fire, and theater planning. The team's assignment was to create a base as-built model for the structural, architectural, and selected MEP components of the building.

The 1,547-seat Opera Theatre is used for opera, ballet, and other dance performances. The record information maintained by the partner firms proved invaluable in creating the Opera Theatre existing-conditions model. However, it took considerable time to sort through the large amount of historical and recent construction documentation to find the relevant information for the as-built model.

BIM forms the foundation for further internal building studies and scheme documentation, ensuring confidence in the redistribution of internal space and existing structural constraints. At the start of the project, the architect and structural engineers used a single software platform—Bentley Architecture and Bentley Structural—to ensure interoperability between their models. Later, MEP consulting engineers Steensen Varming joined the project, using the same software platform.

"Early experiments in using other software packages demonstrated severe difficulties in creating the geometry, with less-than-desirable results when creating section files," said Stuart Bull, Arup BIM coordinator. "When the rib/shell structure model was converted into another software package, the file size increased tenfold, making it virtually impossible to manipulate the model."

Because of the complexity of the acoustic paneling throughout the auditorium, the team engaged a building surveyor to conduct a 3D laser-scanning survey. The resulting point cloud, accurate to ±20 millimeters, was converted to a surface model, which became the base model for an acoustic panel model to be used in acoustic analysis software.

Working concurrently, the structural engineer created a structural model of the auditorium bowl. The 2D and 3D survey data was constantly reviewed to identify instances where as-built information might give misleading results and require reinterpretation. Engineers also modeled the existing primary mechanical duct runs in and around the Opera Theatre auditorium to help determine where new plant rooms and duct runs could be located.

PROJECT OVERVIEW

Review and Study, Sydney Opera House Interior, and New Works, Sydney Opera House

Organization
Arup—Utzon Architects/Johnson Pilton Walker

BE Awards Category
BIM for Multiple Disciplines

Project Objective
Create an as-built 3D building model for the structural, architectural, and MEP components of the Sydney Opera House