



Revit Resolution:

A Case Study Discussing the Benefits of **Building Information Modeling** on the Design and Construction of a Physician-Owned Surgery Hospital Impacted by **Federal Health Care Reform**

CLIENTS

Methodist Health System
Private Physician Consortium
SRP Medical
Medica Development

PROJECT SIZE

108,500 SF
7 Operating Rooms
32 Patient Beds (including 4 ICU)
Diagnostic Imaging Suite



Building Information Modeling (BIM) has changed the way architects and contractors deliver a building from beginning to end. As technology has advanced, the possibilities in terms of complexity and sophistication using computer-aided, three-dimensional design have become endless.

For many firms, BIM is a new tool. The resources required, including advanced hardware and software technology coupled with specialized training for architectural staff, can be daunting for small to mid-size firms who are considering designing projects in BIM. But the payoff can be substantial for all involved, especially on particularly complicated projects like health care facilities.

When Dallas-based BOKA Powell and Rogers-O'Brien Construction were awarded the physician-owned Methodist Hospital for Surgery project, located in Addison, Texas, the team resolved from the outset to draw the project in BIM.

"Increasingly, hospital owners recognize that as complex as a hospital is, it requires a higher level of coordination than a traditional office building," said John Carver, senior vice-president for Rogers-O'Brien. "The investment of human resources and capital are required to allow decisions to be made more quickly, and right the first time." The ability to share BIM data with all team members makes it inherently collaborative.

"Clients rely upon architects to provide the latest in technology," said Tom Dwyer, principal in charge of BOKA Powell's healthcare practice. "BIM requires more of the architect's up front time and effort, but pays back during the construction administration phase by reducing the time associated with shop drawing reviews and fewer RFIs."

While BIM was a new technology for BOKA Powell, the level of coordination integral to the Revit software and the confidence of his designers convinced Don Powell, a principal at BOKA Powell, that doing the Methodist hospital in BIM would be an appropriate challenge for his team.

"Revit became a corporate priority due to grassroots interest among young professionals in our organization," Powell said.

Nic Jung and Jeff Rennells were among the first to recognize the potential benefits of BIM, and were drafted to serve on the Methodist project after they started a pilot program within the firm.

"BIM is an assembly-based process, not just lines on paper," Rennells said. "There is better accuracy to track changes in plan view, elevation and RCP all at once."

According to BOKA Powell Project Manager Michael Crowe, the architect prepared the structural Revit model and shared it with the structural engineer who completed his structural frame model in roughly two months. The civil engineer also finished work quickly and seamlessly. But four months into documentation, it became clear that unfamiliarity with Revit was causing the MEP engineer to struggle. After consultation with Rogers-O'Brien, a decision was reached to shift the responsibility for 3D modeling to the subcontractor, Brandt Engineering, to complete the construction documents. An agreement was reached for the engineer of record to provide review and performance verification for the turnkey systems. That move allowed the team to proceed with construction.

Carson Coleman, project manager for Rogers-O'Brien, said it became clear that Revit (BIM software) was not vital for detailed MEP coordination, except to avoid structural conflicts. "The subs have to re-draw everything for fabrication and automation. Duct work, roof drain piping and critical overhead items need to be coordinated to ensure that the plenum is sufficiently sized," Coleman said.

Construction began in the fall of 2009 with BIM yielding immediate time savings in the fabrication and installation of all site utility work and under floor plumbing rough-ins.

"We were able to save 25 to 30 days on underground work thanks to 95 percent accuracy with the subcontractors' off-site prefabrication of pipe and fittings and use of GPS technology to locate MEP slab penetrations into partitions," said Rogers- O'Brien Construction Superintendent Donnie Tidwell.

In March 2010, federal health care reform became a reality, including a permanent moratorium on new physician-owned hospitals. A deadline of Dec. 31, 2010 was set for CMS certification. If the Methodist Hospital for Surgery did not receive its certification before that date, it would be ineligible to receive payment for Medicare and Medicaid patients.

"Failure was not an option," said Michael Schaefer, CFO of Methodist Health System. "We didn't say, what can we do about this, but tell us what has to happen in order for this to get done."

Immediately, the client sat down with BOKA Powell, Rogers-O'Brien and the subcontractors and the team collectively worked out details to achieve an accelerated construction schedule. Rogers-O'Brien and the subcontractors noted that additional shifts could be added to accelerate MEP, drywall and the exterior envelope. Gate Precast suggested adding a second crew could reduce the precast erection time by 50 percent.

With such high stakes, accuracy was key. The level of detail in the BIM models became a huge asset. "There was no time in the schedule for redos. Work had to be done right the first time," Coleman said.

Numerous examples of BIM's contribution surfaced, including using GPS technology coupled with the Revit model. A field engineer verified precast embed placement in the structural frame to 1/16 of an inch accuracy. Of more than 600 embeds, only two were misaligned, and human error was to blame. Armed with the actual embed locations, Gate Precast was able to reposition corresponding embeds in the affected panel prior to casting.

While BIM was accelerating the construction process, BOKA Powell needed to move BIM documentation staff on site to reduce response time.

"Failure was not an option," said Crowe. "Immediately, a critical mass of on-site talent was essential. We quadrupled the CA staff commitment to make this happen.

Crowe, lead BIM modelers Rennells and Jung, and BOKA Powell construction administrator Dave Walls moved themselves and their BIM equipment to a jobsite trailer and began handling accelerated CA services on site.

“On-site services turned the general contractor’s RFIs into responses in minutes rather than days,” Crowe said. “Models were being updated continuously and we were able to track the domino effect of changes and adapt accordingly.”

Coleman said the level of coordination and the trust the team had developed with the BIM model allowed them to stick to the accelerated schedule.

“We were able to double the crew because of how well we were coordinated,” Coleman said. “We weren’t afraid to have two precast erection crews working two cranes and two crews in opposite directions around the building. Everything worked,” he said.

The hospital’s certificate of occupancy was issued Sept. 30, 2010, four months ahead of the original scheduled completion. Staff occupied the building on October 11, 2010, and patients began arriving Nov. 1, 2010. By Nov. 3, 2010 the hospital had seen the required 15 inpatient and 5 outpatient cases to be eligible to be surveyed for Medicare/Medicaid provider certification. Methodist Hospital for Surgery received its provider number on Dec. 29, 2010. It was the last physician-owned hospital in Texas to receive CMS certification.

Reflecting upon the finished facility, team members said there were many lessons learned. The BIM process and collaboration were invaluable tools, said John Carver.

“BIM makes the general contractor’s job easier, the project goes more smoothly and it can be completed more quickly with far fewer field issues,” Carver said. “Concerns are addressed in the office ahead of time.”

Crowe said BIM had proven itself to be an invaluable throughout the process. “I believe we would not have been able to achieve this accelerated schedule without BIM and the commitment from our team,” said Crowe.