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Hospital Additions + Renovations: 14 Lessons from Expert Building Teams

Four Building Teams offer their hard-earned wisdom on negotiating the many obstacles associated with expanding and renovating occupied hospitals.

By Jay W. Schneider, Senior Editor -- Building Design & Construction, February 1, 2010

An atrium with a three-story “forest” is part of a $63 million expansion to Community Hospital and Wellness Center in Bryan, Ohio.

Two additions to a community hospital in Ohio that will double its square footage. A 12-story addition on top of an existing 12-story tower at Houston's M.D. Anderson Cancer Center. A $54 million renovation and addition at the University of Virginia Medical Center. A 67-bed, $70 million addition/renovation to a community hospital that is only five years old.

These four projects chart the direction in which healthcare construction is headed. With insufficient hospital beds to accommodate our aging population and with facilities becoming outdated even faster these days due to lightning-quick advances in technology, hospital renovations, additions, and expansions are going to pay the bills at many AEC firms in the coming years.

Consider these facts: In 2009, 13.6 million square feet of hospital renovations and additions accounted for $4.65 billion in construction starts, according to Reed Construction Data. Total healthcare projects are expected to increase 1.2% over 2009 levels, according to ZweigWhite's 2010 AEC Industry Outlook, and hospital renovations and additions should account for a healthy dose of that work.

Sounds great, right? But think twice before you sign up to take on this enticing sector of the construction market.

The Community Hospital and Wellness Center showing how old (red) and new (green) fi t together. Note the vegetated roof over the cafeteria.

Working on occupied, fully operational hospitals is no picnic. You've got to plan for infection control, noise and vibration problems, disruptions to patients, staff, and visitors, emergencies, staging, parking—the list goes on and on. Building Teams involved in the four projects mentioned above offer their advice on how to navigate around the many—and very significant—obstacles involved with expanding and renovating hospitals.

Community Hospital and Wellness Center, Bryan, Ohio

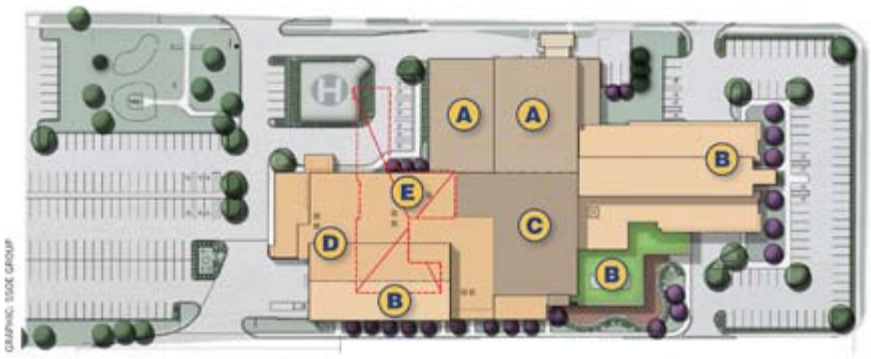
Serving a growing but still rural area of northwest Ohio, Community Hospital and Wellness Center in Bryan was a patchwork of buildings dating to as far back as the 1930s. “The overall condition of the hospital was okay, but the physical plant was tapped out,” says Bob Siebenaller, AIA, NCARB, ACHE, a senior associate and healthcare division manager at SSOE Group, Toledo. “Mechanically, the hospital couldn't expand anymore and actually was on the verge of losing some systems,” he says.

Hospital administrators floated the idea of building a replacement hospital on a 140-acre site outside Bryan and hired SSOE to do the master plan. Vacating the hospital, however, alarmed the community of around 8,300, many of whom viewed the hospital as a community center. Some residents even used the cafeteria for after-church Sunday brunch.

Eventually administrators decided to stay put and tasked SSOE and Weigand Construction, Fort Wayne, Ind. (as GC), with designing and constructing two additions to the four-story, 80-bed facility, expanding it by 120,000 sf and significantly upgrading its patient spaces and infrastructure. The $63 million project broke ground in June 2008 and is currently about 30% complete, even as the existing hospital remains open.

Lessons from the Building Team

1. Get the heck out of the way. “Plan out exactly when and where you're going to be performing work and make sure the hospital knows all those details,” says SSOE's Seibenaller. The team planned the four-phase program with precision so as to minimize disruptions to hospital functions. “It's like a game of checkers,” adds Eric Murrell, CCS, CSA, senior associate with SSOE Group. The strategy has the Building Team in and out of the hospital, and staff always knows their next 10 moves.



The Community Hospital and Wellness Center's expansion and renovation is a four-phase project involving: A. renovation to the existing hospital (phase 3); B. new construction (phase 1); C. renovation to the existing hospital (phase 4); D. new construction (phase 2); and E. demolition (phase 1).

2. Assume there will be emergencies and plan for them. "Establish protocols and points of contact upfront so hospital staff know whom they can call," says Murrell. "With everything working as it should, stoppage should be within minutes." On this project, demolition and construction work near the hospital's MRI interfered with its use, so the team had to interrupt its work a few times as a result of emergencies.

3. Be prepared for the unknown inside the building. As is often the case in older buildings, the Building Team is finding that the existing hospital's mechanicals and utilities simply are not located where they're supposed to be. "We're playing cat and mouse with the utilities," says Murrell. Pipes and wires were reworked during previous additions and renovations. "Not everything is the way we expected it to be, but that's to be expected," he says.

4. Use BIM, but don't assume it's a cure-all. "Revit was critical to the success of this project and allowed us to compress the schedule," says Siebenaller. But BIM is not a panacea. Siebenaller says Revit's MEP tools were not up to the level of its architectural tools at the time. Moreover, he acknowledges that not enough people on the team were trained in the MEP tools. The Building Team restricted the use of BIM to the additions, not to any work on the existing hospital, whose construction predated BIM.

University of Texas M.D. Anderson Cancer Center, Houston

The M.D. Anderson Cancer Center is one of the nation's highest-rated hospitals for cancer care, which is the main reason why this world-class facility was in desperate need of more patient beds. "We're beyond 100% occupancy," says Susan Lipka, the hospital's associate VP for capital planning and management services.

Fortunately, the existing 12-story Alkek Hospital Tower, completed in 1998, had been designed by Dallas A/E firm HKS to accommodate a 10-story vertical expansion. In 2007 the hospital opted to put a massive 500,000-sf addition atop the tower, thereby adding 208 new patient rooms (each 40 sf larger than those in the existing hospital) and providing shell space for another 200 or so patient rooms.

Corners on the M.D. Anderson expansion are filled in, making the floors slightly larger than those below and adding four extra rooms per floor.

A Building Team consisting of HKS, structural engineer Walter P Moore, and contractor McCarthy Building Companies was hired under a design-build contract to complete the $220 million project. There was just one hitch. The hospital decided that if a 10-story addition was good, a 12-story one would be even better. That meant adding two extra floors, at 45,000 sf each, while the existing facility was not only occupied, but operating at more than 100% capacity.

The plans were turned into a BIM model, starting in AutoCAD and finishing in Revit. Extensive wind-load testing was conducted at CPP Wind in Fort Collins, Colo. Walter P Moore modified the wind-resisting system to redistribute loads on the mat foundation, eliminated shear walls from the upper floors to reinforce existing shear walls, utilized high-strength concrete for the addition's floors and columns (to reduce the load), and relocated the new mechanical level from an upper floor to the floor just above the hospital's existing roof level. Glass fiber reinforced concrete cladding matching the original building's precast concrete façade (but at about one-quarter the weight) was specified. The three-year project is expected to open this June.

Lessons from the Building Team

5. Know how much noise you're going to make well before you make it. “We didn't want to start the process and find out there's too much noise, vibration, and interference, so we conducted a pre-investigation before we even decided to go ahead with any of the work,” says Lipka. Jackhammer tests showed that noise penetrated down as far as the ninth floor, and vibrations went down even farther. Lipka says the hospital officials were shocked. “We assumed that closing the top floor (the 12th) would be required but we didn't anticipate that noise levels on the 11th and 10th floors would be just as loud.”

To avoid closing three floors during construction, Lipka and her team put strict requirements into the RFQ: drilling, jackhammering, and other intrusive work would be limited to 15-minute increments in any one area to minimize patient and staff disruption. The lesson, says Lipka, is that it's better to know what to expect than be in for a nasty surprise.

6. Communicate, communicate, communicate. It may sound trite, but letting the hospital staff, patients, and patients' families know what's going on in the project is crucial, says Lipka. The nursing staff was involved in the logistics plan and were alerted—pretty much on a daily basis—as to what work to expect. The hospital reworked wayfinding. They printed weekly news bulletins and placed them on patients' food trays. “We spelled everything out,” says Lipka. “Because nurses and patients were kept in the loop to such a significant degree, their tolerance levels were higher.”

The tower crane rises above the top fl oor of the M.D. Anderson expansion. This uppermost level is an observation lounge offering city views.

7. Negotiate for any parking spaces and staging areas you can get. Because the existing tower was surrounded on all sides by buildings and a busy road, staging on site was impossible. That meant the team had to use just-in-time delivery of materials. (Subcontractors stored their materials at their own facilities.) Nor was there parking near the site. McCarthy's jobsite office was a half mile from the site. Soon after the project started, however, McCarthy was able to find parking for subcontractors in a garage not far from the site; as a result, they were able to negotiate lower bids from subcontractors.

8. Minimize exposure to harmful elements. “Something I've never encountered before was working on the roof with 25 fans releasing harmful, or possibly harmful, exhaust because they were connected to fume hoods inside the hospital,” says Ben Johanneman, project director for McCarthy. Since the fans had to be removed to accommodate the 12-story addition, the Building Team installed temporary fans with vertical ductwork; they kept adding on to this ductwork as work progressed, so that the exhaust was always expelled at least 20 feet above where any crews were working.

University of Virginia Medical Center, Charlottesville, Va.

Before and after images of the University of Virginia Medical Center illustrate how a thin, 34-foot-deep addition with glass curtain wall is being "laminated" over a portion of the hospital's existing façade.

The University of Virginia Medical Center is adding 50,000 sf and 72 universal patient beds to its 500-bed, 20-year-old hospital. Another 50,000 sf of space will be renovated during the $54 million project. The overall $150 million expansion of the medical center campus also includes construction of a new cancer center and a parking garage. The Building Team consists of a Mid-Atlantic-based group from Gilbane Building (CM, not at risk) and a design team from SmithGroup's Washington, D.C., office.

To say the site was tight would be an understatement; there was no available land adjacent to the hospital on which an addition could be built, so the team devised a skinny, eight-story, 34-foot-deep addition that's being more or less "laminated" onto the front elevation of the hospital, over the existing lobby and main entrance, with a two-foot-eight-inch gap between the new construction and the old exterior wall. This will remain intact until the addition is closed up and the gap built out. Once that façade comes off, the area where old hospital meets new (mostly corridors and staff support spaces) is slated for renovation.

Construction started in October 2008 and is expected to wrap up in August 2011.

Lessons from the Building Team

9. Understand that no phasing plan is perfect. "Our vision was to build the new structure first and then when we got to the

top, capture the renovation piece and work our way down, completing two floors at a time," says Michael Holdren, project executive at Gilbane. "It hasn't worked out that way." That's because the hospital hasn't been able to vacate the floors for the Building Team—a pitfall of working on an occupied hospital—so the team has had to rework its plan and avoid occupied spaces. "We accomplish what we can where we can," says Holdren.

10. Expect your work to bother someone, and adjust accordingly. "When we were working on the seventh floor, it wasn't unexpected to have an impact on sensitive medical equipment on the third floor," says Holdren. "We just had to adjust our schedule and sometimes work an hour, stop for an hour, and then start up again for an hour."

11. Minimize inconveniences. With the new addition being built above the lobby, the Building Team wanted to close the main entrance, an impossible request with as many as 2,000 people a day using that entry. A compromise was reached whereby the lobby was closed from 9 p.m. to 5 a.m., and all steel erection had to be done during these hours. (Fortunately, most patient rooms are located at the rear of the hospital, away from the construction.) To minimize inconvenience for nighttime visitors or patients, Gilbane trained its crew to direct people around the closure. In fact, Holdren says the hospital stated that patient satisfaction scores actually increased during construction, a fact he attributes at least in part to beefed-up wayfinding.

Baptist Medical Center South, Jacksonville, Fla.

When Baptist Medical Center opened in 2005, it was a state-of-the-art, 92-bed, 257,000-sf hospital that served southern Duval and northern St. Johns Counties. A scant five years later the hospital is a nine-story, 479,000-sf, 159-bed facility as the result of a $70.7 million expansion designed by Gresham, Smith and Partners.

"Almost from the time the [existing] hospital opened, it was filled," says Rick McManus, director of construction at the Haskell Commercial Group and the senior project manager on this project. The campus had been master planned for future expansion, but the expansion came much sooner than anticipated. "They thought this tower would be built as part of a 10-year-plan, but it turned out to be a three-year plan," says McManus.

The patient tower addition started in spring 2007 and the first parts of the tower were occupied in February 2009, in time to help the hospital mop up the flu season.

Lessons from the Building Team

12. Make infection control training a top priority. With ICRA (infection control risk assessment) requirements a part of the package, Building Teams are faced with difficult standards that aren't part of a typical construction project. "There's lots of liability because any and all work you do can affect patients," says Paul Tyler, president of Haskell Commercial Group. Working on an occupied healthcare facility requires more than just erecting and maintaining sanitary enclosures between the existing space and the new work. Everyone on the job has to understand what infection control means. "Everyone on our construction staff who went into the existing hospital had to have infection control training," says Tyler. "If they didn't understand what it took to work within the sanitary enclosure, they didn't work on that part of the project."

13. Utilities can't be shut off, so have a backup plan. Have backup equipment ready to go because utilities can't be shut down. When new equipment is being connected to existing equipment, you need to have a backup system at the ready to handle the loads in the interim. In the event of accidental power cutoff at a hospital, warns McManus, "It's not an inconvenience, it's life and death."

14. Anticipate surprises. "It's inevitable something unexpected will happen," says Tyler. The hospital could ask for construction to be halted immediately despite weeks of planning. You might not be able to find oxygen lines, med-gas lines, or water lines where they should be. You might have to redesign the foundation four times to minimize disruption to hospital operations (as was the case with the Baptist Medical project). "Plan everything in detail and then create a detailed Plan B, Plan C, and Plan D," says McManus.

A Royal Crane in the Neck

A Royal Crane in the Neck

The Alkek Hospital Tower site at M.D. Anderson Cancer Center is tight. Surrounded on three sides by medical buildings and a busy street on the fourth, there was absolutely no land on which to stage a tower crane needed for construction of the 12-story rooftop addition. The only solution was to drop a crane down an existing elevator shaft, one section at a time, then bolt it to the floor and build up 12 stories around the crane. “The crane was the biggest controlling factor of the entire project,” says Ben Johanneman, project director for general contractor McCarthy Building Companies.

Once the crane was operational, it ran almost nonstop for 20 months. As the only crane on site, it had to tackle everything—concrete, steel, façade panels. “Hook time was a limiting factor,” says Johanneman. “We could have gone a lot faster with another crane on site, but that just wasn't possible.”

What goes up must come down, so removing the crane from inside the 24-story hospital tower turned into a complicated three-week project. Last October, the street next to the tower was closed for one weekend as a huge second crane was brought in and partially assembled, then moved to a side street for storage. The next weekend, the rest of the crane and

the 282-foot boom were assembled, and the tower crane was disassembled. On the third weekend the second crane was disassembled; by Monday morning both cranes were history.

Wireless BAS Systems Can Trim Hospital Reconstruction Costs

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Hospitals planning for expansion have begun looking to technologies that employ innovative temperature and lighting management to help cut installation costs and environmental impact. Rather than extending cable-based climate control systems to new patient wings or operating rooms, hospitals now have another option: going wireless.

Healthcare facilities like the Montreal (Que.) Heart Institute, the Müritz (Germany) MediClin, and the VA Medical Center in Dayton, Ohio, have gone the wireless route to gain three benefits:

Simple installation and maintenance - Wireless control can be set up and serviced without shutting down hospital sections or knocking down walls.

Energy independence—Self-powered sensors and light switches do not tap into hospital electricity.

Optimized temperature management – Heating and lighting are customized for each patient or room purpose.

Here's how it works: Each room is equipped with ultra-low-voltage temperature sensors, occupancy sensors, and light switches that “sip” energy, rather than drain it. Instead of relying on batteries or hospital electricity, these modules scavenge for energy from movement, light, or temperature changes. They then use the harvested power to wirelessly transmit the room's condition and light-switch positions to a nearby controller.

For example, an occupancy sensor detects when a patient enters the room and sends that data to the room controller, which automatically activates lights and heating while also adjusting window blinds. Sensors that detect daylight intensity, window position, and air quality provide similar functions.

Existing hospitals can typically save 70% in installation costs by retrofitting their climate system with a wireless system rather than going with a traditional cable-based solution, says Graham Martin, chair of the EnOcean Alliance, a consortium of companies that develop products and standards for wireless and sustainable building automation.

After installation, the wireless system's ability to automatically optimize temperature and lighting for different rooms, combined with the power-harvesting nature of the sensors, can help slash energy and operating costs by up to 40%, according to the EnOcean Alliance.—*Andrew Baltazar, Associate Editor*

Expert Advice on Infection Control

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Mark Howell, a VP in Skanska Building USA's Seattle office, offers these words of advice on infection control planning and procedures:

Hire an independent outside air sampling consultant to assess air quality.

When turning soil to prepare a staging area, get asphalt or ATB down quickly to avoid releasing fungus into the air around the project.

Create a negative air separation between new construction and the existing, occupied hospital to prevent the spread of contaminants.

Put temporary filters on all air intakes.

Monitor the operations of the air intake units after setting a baseline to make sure they're still functioning.

Confirm the static pressure is where it should be.

Make sure filter banks aren't requiring maintenance more often than before. When a project is immediately adjacent to another clinical facility, regular inspections are recommended, as is regularly scheduled air monitoring. During demolition, regular filter changes may also be required.

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