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MONTHLY ARCHIVES

- December 2010
- November 2010
- October 2010
- September 2010

CATEGORIES

- Articles
- BIMForum News

UPCOMING EVENTS

02.07 An Introduction to Building Information Modeling
San Diego, CA 92101

02.08 BIM Technology
San Diego, CA 92101

02.08 BIM Contract Negotiation and Risk Allocation
San Diego, CA 92101

02.09 BIM Process, Adoption, and Integration
San Diego, CA 92101

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San Diego, CA 92101

CPMC Cathedral Hill

Lean principles + Integrated Delivery = Project Savings

By Jeff Yoders

California Healthcare provider Sutter Health knew it would need a new replacement hospital for its San Francisco market when state regulations demanded it update its facilities for seismic compliance early in the decade. After looking at expansion options in its existing affiliated California Pacific Medical Center campuses, a site in the Cathedral Hill neighborhood at the corner of Geary Boulevard and Van Ness Avenue was chosen for the new hospital.

After going through a traditional design process, Sutter found itself with a 1.2 million-sf replacement hospital that was already significantly over budget before construction even began. They decided to step back, pull the plug and reevaluate the entire process of design and delivery of CPMC Cathedral Hill.

“From our perspective we were faced with a project in the realm of wants rather than needs,” said David Long, program manager for the Cathedral Hill Project and senior program manager at Sutter Health. “It was 400,000 sf too big and the finishes were out of step with the needs. We had a recognition that we had to do something different. We needed an approach that streamlines the entire planning and design process by applying lean management techniques and focusing on drastically reducing waste while increasing value.”

Sutter Health, architect SmithGroup and general contractor HerreroBoldt agreed to use Integrated Project Delivery, a process that allows owners, designers, contractors, and trade partners to collaborate under one roof from project inception to completion, as opposed to traditional delivery where each project team member has a separate agreement with the owner. The 40-firm IPD team's initial validation study resulted in a smaller, 914,000-sf design that takes better advantage of the site and unites two of CPMC's existing campuses in one city block. The new patient tower and medical office building will house 555 beds when it's completed in 2015. The new design delivers 90% of the original's program in 70% of the space, is targeting a LEED-Gold rating from the U.S. Green Building Council, and is projected to cost $960 million, about $200 million less than its original price tag.

Incentive and risk

The integrated team sought to follow lean principles, as defined by Dr. Glenn Ballard and the Lean Construction Institute at UC Berkeley, during both design and construction of the project. The team is also using myriad BIM software packages including Autodesk Revit, Tekla Structures, and Autodesk Navisworks Manage for clash detection. But beyond process and technology, ownership still needed to give the massive team a way to work together so closely from start to finish. The integrated contract for CPMC Cathedral Hill, for that reason, has two main parts: incentives and risk-sharing.

If the team achieves 100% of its initial target value design (of its production goal) of $88 million, the estimated incentive pool to be distributed proportionately among each architect, construction company, structural engineer, MEP specialist and other partner is approximately $20 million (roughly 1% of the project budget). The integrated team, though, is essentially tethered together in meeting target value design goals. If one fails, the entire collective suffers. Only when the team delivers the project at a certain specified level, within a certain targeted cost does the team earn 100% of their profits. If the project goes over budget and targets are not met, that profit is gradually lost. All of the firms in the unified team are guaranteed to at least break even on the project, but the entire team is putting profit at risk.

"We knew that we at SmithGroup had the capability to design this as efficiently as possible, but to deliver it we need compatibility between designers and subcontractors at a level of detail and complexity where everyone needed to be in that room from the start," said David King, FAIA, Chairman of SmithGroup, lead designer for the Cathedral Hill project. "Traditional project delivery does not incentivize reduction of the cost of construction."

On the incentive side, there is a contract proviso designed to drive the cost below target. The target value design agreed to represents the level of building, finish, and value desired for the project. Once that target value is achieved the team will begin working on getting below the project's target cost of $960 million. The further the project is delivered under cost, the more the team begins to share in the savings the owner reaps below the budgeted cost. After the first $15 million below target is achieved the unified project team gets 10% of that savings. By shaving a second $15 million below the target cost, the team unlocks 20% of those savings. The third $15 million below cost allows them to share 30% and the 4th $15 million and below gives the integrated team 40% of those savings

"It begs the question? Why as an owner do you do that," Long said. "The answer is that previously we weren't finishing these projects on time and have not had the opportunity to deliver them below cost, anyway. Not all of them, but many of them have been over budget. If in the end if we're getting back 60 cents on the dollar in project savings we're very satisfied."

The core group of the IPD team includes Long, King, other representatives of Sutter Health and

SmithGroup, executives from HerreroBoldt and executives from CPMC. Beyond that decision-making group, the entire team is split into discipline-specific cluster groups who all have their own target value design goals to meet that are each a part of the overall target value design.

CPMC Cathedral Hill

The IPD team for the Cathedral Hill Hospital project has been together for the entire design process.

New technology

Sutter also wants to leverage lessons learned using lean construction and IPD on the Cathedral Hill project for use on its other CPMC retrofits and renovations. The integrated team is having the 550 bathrooms for each patient room pre-assembled off-site and each will be ready to be connected and installed into the building when they arrive on-site. Another 80 bathroom units are being fabricated for installation at the nearby St. Luke's hospital site, another CPMC hospital that will undergo a renovation shortly after Cathedral Hill is completed.

Much of the projected savings in the second design came from planning ahead from the co-located mechanical, electrical, plumbing and structural engineers. Simple concepts such as shared overhead utility racks and displacement ventilation added up. Planning and scheduling for the building's structural steel frame accounted for 8% of the $200 million savings.

"We were looking for two categories when it came to innovation from lean processes and IPD," said Paul Reiser, executive vice president of HerreroBoldt and project executive for Cathedral Hill Hospital. "Small, incremental savings from lean alone and, this is the trickier one, a push for innovation to look at other projects all over the world and incorporate technologies that aren't commonly used."

One of the biggest innovations is using viscous wall dampers that use less than 20lbs/ft of steel to brace Cathedral Hill's outer walls for seismic compliance. Viscous wall dampers are hydraulic devices that dissipate energy when a fluid is forced to pass through an orifice. The "damping" is the process by which vibration steadily decreases its amplitude as it passes through the hydraulic devices in the viscous walls. Their use was pioneered as shock absorbers in long-range military weapons but they've been used to dampen earthquake shocks in hundreds of buildings in Japan since 1990.

Cathedral Hill is the first hospital project in California to use viscous wall dampers for seismic and one of less around 60 buildings in the US to use viscous wall dampers, period.

"It's a dampening system, so in a seismic event you're not getting the accelerations of a normal tremor," said Steve Peppler, a Smithgroup vice president and project director on Cathedral Hill Hospital. "Typically, in a tall building the further you get from the ground the more movement you get. With a dampening system you get lower acceleration on upper floors than you do on lower

floors. The impact is that everything you have to do to anchor equipment on the upper floors, then, is less costly. Hospitals not only have to withstand an earthquake but continue to function during the event. Because of this dampening innovation we expect to take great advantage of reducing the amount of anchorage necessary in those upper floors."

From design to production

One of the biggest hurdles for the integrated team is getting approval from California's Office of Statewide Health Planning and Development. The mechanics of actually getting the documents to OSHPD for review and issuance of permits are complicated simply because of the size of the project and its level of detail. There are 6 increments that are portions of the building that need approved: site preparation, structural system (both gravity and seismic), exterior, architecture and MEP, equipment anchorage and finishes. Because the level of detail is much further along in the planning stage than what OSHPD has been used to seeing in documents, matters of interpretation that are usually confronted on the site are now being confronted in preconstruction.

The structural and architecture/MEP increments have already been submitted to OSHPD and the team is expecting them to be approved in 6 months, a process that would normally take close to two years.

"We have 12 volumes for increment four (arch/MEP) only and they have a limit that you can't deliver anything over 40 lbs., so we have 12 packages of 40 lbs each," Peppler said. "We're also trying to encourage them to look at things electronically and get away from paper, but they're a government agency and a bit slower about these things. All of that being said, the process of splitting these increments into smaller bite-sized pieces and sitting down with OSHPD in Sacramento to explain these concepts has created a much better working relationship."

Because of California's underfunded state government situation most OSHPD employees are on three-day-a-month furloughs, and many have had their salaries reduced. However, Reiser said not only has the integrated team compensated for that lack of access, they are actually further along in the approval process than they had planned and if approval goes through and ground is broken in ~~January~~ early 2011 it will be the fastest approval ever for a Sutter Health project.

As the integrated team transitions from design to production, many of its cluster groups are re-forming with an emphasis on construction rather than design. 4D sequencing and scheduling is being planned using the Revit and Tekla models its documents are based on. The team's production cluster group is working on the design of a site-specific safety plan, the project-labor agreement, and workforce development plans. The same degree of innovation and collaboration is being put into transitioning the project that went into its design, this includes applying lean principles such as prefabrication, modularization and just-in-time delivery.

Yet, because the team has been together for more than two years the challenge ahead is less daunting. Target value design has delivered even more camaraderie and project buy-in than the team's monetary incentives.

"Without that target we would not be in the position we are in today with a complete trusting and collaborative relationship," King said. "However, we're finding that the money is not the driving force. The entire body of work that this represents is really a collective rallying around the idea of everybody being an advocate of the project."

Jeff Yoders is a Chicago-based freelance writer who covers technology in design and construction. Read his blog at bimboysblog@blogspot.com