

## **The New Saint Joseph Hospital** *Submitted by Mortenson Construction*

Building an 831,000 square foot hospital in a dense urban location presents numerous challenges on its own, yet the daunting challenge on the new Saint Joseph Hospital – build this very large and complex project in 30 months – created additional pressures for the design and construction team. Driven by regulatory deadlines, the new hospital had to be open and operational by January 1<sup>st</sup>, 2015.

The project had to go “beyond fast-track” to “psycho track”, according to Rob Davidson, principal for H+L Architecture, one of three architecture firms on the design team.

The first private hospital established in Denver, the original Saint Joseph Hospital was founded by the Sisters of Charity of Leavenworth. It had undergone various modernizations and expansions over the years, but the hospital was aging and could no longer meet current, let alone new codes. “When I got here in January of 2010, the clock was ticking,” says Bain Ferris, CEO of Saint Joseph Hospital, owned by SCL Health Systems. The new hospital needs included 365 beds, 1100 parking stalls, a stand-alone central utility plant, 21 operating rooms, including two hybrids, and 40 emergency department rooms.

The new hospital also presented an opportunity to create a new image and identity for one of Denver’s oldest and most respected health care institutions. It is a model for the new era of hospitals with increased outpatient focus and the efficiency to help lower escalating costs of health care and better results in patient care.

### **Getting it Done in 30 Months**

But how to speed up one of the most complicated project types to build at this scale and get it done in less than three years? First and foremost, it required a truly collaborative and integrated project team. Mortenson Construction, builder of the project, the architectural design team, comprised of H+L Architecture, Davis Partnership, and ZGF, along with MEP engineer Cator Ruma & Associates and civil/structural engineer Martin/Martin came together to set the parameters and expectations of how the team would work together. While design and construction contracts were separate, the entire team created and signed a written collaboration

agreement to ensure all parties bought in to the project's guiding principles and customer success factors.

Mass excavation started on the project in mid-December 2011. A process was set to issue more than 25 separate bid packages to keep construction progressing at the pace required to meet the schedule. For example, foundation and superstructure packages were complete and issued while design progressed on floor layouts and exterior skin evolved.

Yet one of the most impactful solutions to the schedule demand was the implementation of prefabrication on a grand scale.

Advancements in prefabrication have been enabled by the continued progression of detailed building information modeling and virtual design and construction expertise, as well as collaborative software tools such as those provided by Bluebeam software. The team realized the impact that prefabrication would have on this size of a project and wanted more than anecdotal evidence for the evaluation of that impact. With that goal in mind, Mortenson established a process and resources for conducting a study of the impact of the prefabricated elements on the New Saint Joseph Hospital by leveraging the resources of a professor and student from The University of Colorado. ***Overall, the study concluded that for every dollar spent on prefab, approximately 13% of the investment is expected to be returned as a quantifiable benefit to the project.***

The best opportunities for repetitive prefabrication strategies on the new Saint Joseph hospital included: exterior panel systems, multi-trade racks (MTRs), patient room head walls, bathroom pods, doors and hardware and other miscellaneous “kitted” and preassembled components.

Early design coordination and decisions were required to ensure the prefabricated components met the design intent. The design team worked with Mortenson and its major trade partners to construct mockups virtually, and then physically to ensure the prefabricated components were just right.

This was particularly important when it came to the 440 prefabricated bathrooms on the project, which are often one of the more challenging building components to perfect in a hospital. “Once

the decision was made to go with prefabricated bathrooms, numerous selections from tile, to bath accessories, and fixtures had to be made well before completion of design development drawings. While out of sequence in the traditional progression of design documents, making these selections early really brought home how quickly decisions would have to be made on this project to meet the owner's goals," said Rob Galvin, architect at H+L.

Virtual and physical mockups allowed every component to be tested and agreed upon – all while the foundations for the new hospital were being excavated. The final pod design was then implemented into the overall design, allowing for production to begin as soon as possible. *The mock-ups helped all stakeholders review and revise the product to ensure final design decisions met owner needs and eliminated any surprises.*

### **Outside/In: Prefab Exterior Panels Enable Faster Interior Progression**

The new hospital includes 346 prefabricated enclosure panels with an average size of 30' x 15'. These panels are complete with interior spray insulation, exterior sheathing and moisture membrane, as well as exterior cavity insulation and brick ties. This prefabrication allowed the building enclosure to advance very quickly, enabling interior work to begin in a protected environment, which could not have happened with traditional methods of construction. Panel mock-up production began at a very early stage to allow for a trial assembly and test of the process. The team received valuable feedback to inform the balance of the fabrication and installation process, ensuring success during final installation. These adjustments included:

- Integrated a lifting apparatus into the panels
- Trucking more panels in at a time
- Connection details to the slab/structure
- As-built slabs to ensure proper dimensions.

### **Above the Ceiling and Behind the Bed from the Floor of a Warehouse**

At a leased warehouse about five miles away from the jobsite, before the structure reached its fourth story, work began on the assembly of 166, 25-foot, multi-trade racks (MTRs). The units included mechanical, piping, HVAC systems that were insulated and labeled, electrical, cable

tray, and pneumatic tube systems, which allowed a plug and play installation of connecting the racks along patient tower corridors. The MTRs were able to be built as soon as coordination was complete, and their production schedule was not dependent on the building structure being ready to receive, as racks were stored at the warehouse and delivered and installed on demand. This work was conducted in a controlled environment at standing level and resulted in a safer and higher quality assembly, with reduced overhead work. A MTR mock-up was produced very early on for everyone to evaluate from a design, assembly, quality, and installation point of view, and proved to be very valuable in informing the final design and construction on all MTRs.

For the owner and for the Authorities Having Jurisdiction, there was a great benefit to being able to see and inspect the work at “bench height” in the warehouse before the MTR was installed. For the craft workers, prefabrication of the MTRs became a project perk to work in the controlled environment of the warehouse as the majority of the assembly occurred in the winter.

Patient head walls were also assembled at the off-site warehouse. Again, mockups, BIM and software collaboration tools help ensure these critical patient safety elements came together flawlessly in the field. This led to significant schedule savings by resolving coordination issues such as the medical gas hookups, ahead of time. The finished head walls arrived at the site pre-tested and ready for operation once installed. Due to the way the team assembled and installed the head walls, the project was able to achieve very high levels of sound reduction on the patient room demising walls – in most cases they tested out to be Sound Transfer Class 55 or greater- which is typically very difficult to achieve in a hospital wall full of pipes, conduits and back boxes. Prefabrication in the controlled warehouse site also led to enhanced cleanliness and infection control, and an overall healthier, better-quality, building.

The safety benefits from assembling some of the most complicated and critical elements in an off-site controlled environment warehouse and the reduced congestion of both personnel and materials at the site add to the logic of prefabrication.

### **A New Era for Patient Care in the Denver Metro Area Begins 12-13-14.**

The demand on the construction industry as a whole is to “build it better, build it faster, build it smarter”, and the project teams leveraging manufacturing-based innovation such as

prefabrication and collaborative thinking are helping meet that goal. The new Saint Joseph Hospital saw its first patient on December 13, 2014. Throughout its construction, architects, healthcare professionals, and community members ensured that every design element and building feature would help create the best possible patient experience.









