AMERICAN INSTITUTE OF ARCHITECTS 2015 TAP INNOVATION AWARD

OHSU/PSU/OSU COLLABORATIVE LIFE SCIENCES BUILDING and OHSU SKOURTES TOWER

PORTLAND, OR

GREAT PROJECTS ARE EXECUTED BEST WHEN THE OWNER-ARCHITECT-CONTRACTOR TEAM DEVELOPS A HIGH LEVEL OF TRUST AND COLLABORATION BETWEEN ALL PARTIES, AND LEVERAGES THE EXTENSIVE USE OF KEY TECHNOLOGIES.

THIS IS OUR STORY.

PROJECT SUMMARY

Great projects start with great partners. Oregon Health & Science University (OHSU), Portland State University (PSU) and Oregon State University (OSU) created a tenancy in common agreement to expand their academic and research programs. Through this alliance, the new OHSU/ PSU/OSU COLLABORATIVE LIFE SCIENCES BUILDING (CLSB) and OHSU SKOURTES TOWER (SKT) were conceived. The Owners selected the Architect and Contractor teams simultaneously, helping to ensure a highly collaborative project delivery. The technological compatibility of the Architect and Contractor was excellent, with both parties interested in leveraging technology to the fullest extent possible to deliver a large, complicated project in record time.

The 2.4 acre site is located near the banks of the spectacular Willamette River near downtown Portland, Oregon. This location is part of the new 18-acre OHSU Schnitzer campus, only a sky tram ride down from the main Marquam Hill campus of OSHU and a streetcar ride from the downtown campus of PSU and adjacent to the new Tilikum Crossing light rail bridge (for light rail, buses, streetcar, pedestrians and bicyclists- opening in fall 2015).

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Project Information

- OWNER
  - Oregon Health & Science University
  - Portland State University
  - Oregon State University
- 2.4 acre brown-field site
- Project awarded in April 2011
- Occupancy July 2014
- LEED Platinum Certified
- District System ready

Program
- Medical research laboratories
- PSU science teaching laboratories
- Specialty microscope imaging suite
- Medical school- simulation
- Medical school- clinical / patient skills
- Nursing school components
- OHSU School of Dentistry
- OSU College of Pharmacy
- Lecture halls
- Flexible classrooms
- Parking garage
- Student support
- Building support

Partners and Teammates

Architects
- Executive Architect
- Design Architect
- Laboratory Planner
- Dental School Planner
- Landscape Architect

Building Engineers
- Structural Engineer
- Mechanical Engineer
- Electrical Engineer
- Plumbing Engineer
- Civil
- AV / D / IT

Owner's team
- Owner's Representative
- Geotechnical Engineer
- Environmental Engineer
- Equipment Coordinator
- Commissioning Agent

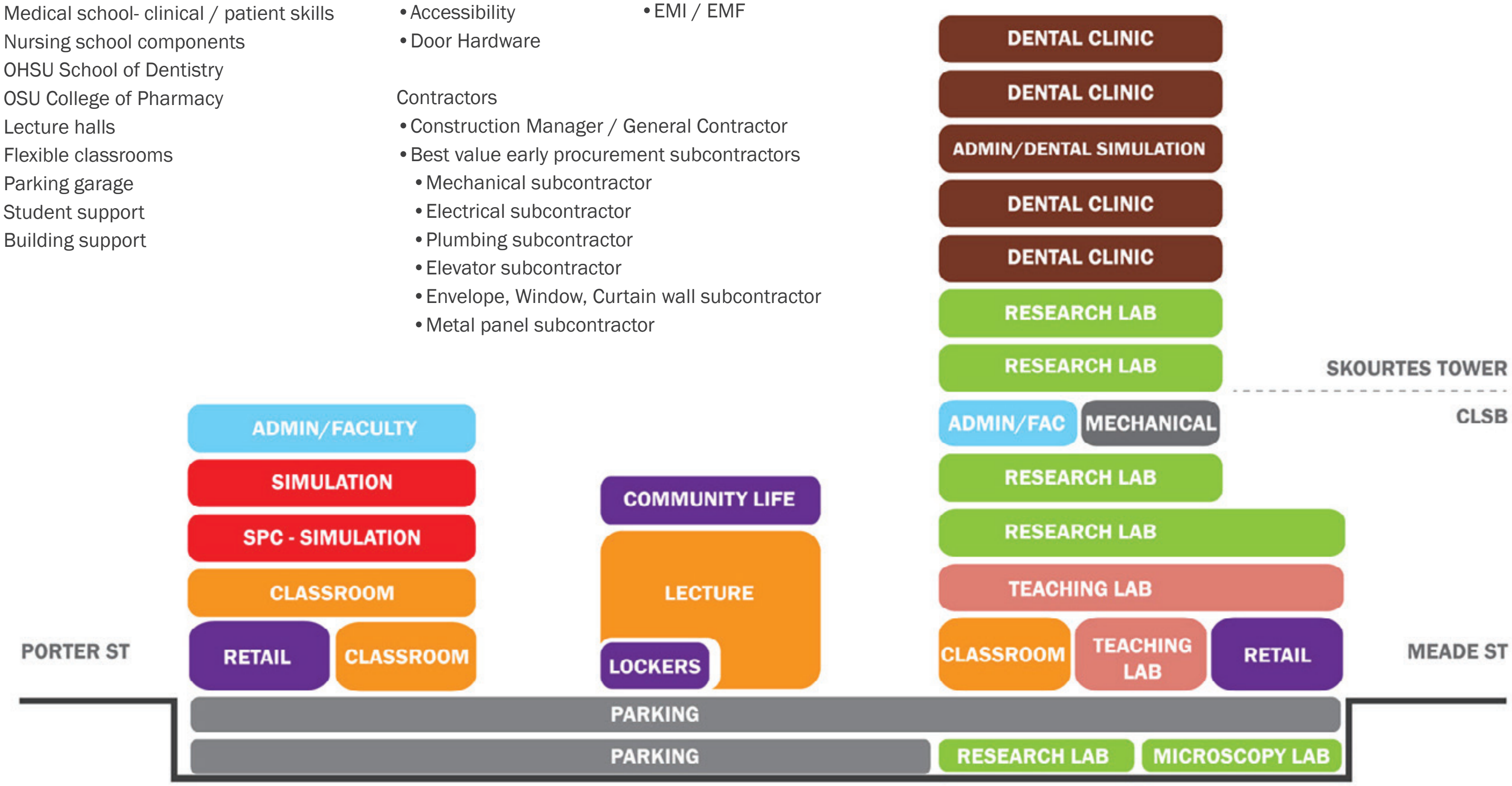
Consultants
- Envelope / Window
- Roofing
- Signage
- Cost Estimating
- Acoustics
- Building Code
- Accessibility
- Door Hardware

Specialty Engineers
- Vibration Isolation
- Atrium Fire CFD Modeling
- Wind CFD Modeling
- Traffic
- Corrosion
- Power / Empacity
- EMI / EMF

Contractors
- Construction Manager / General Contractor
- Best value early procurement subcontractors
  - Mechanical subcontractor
  - Electrical subcontractor
  - Plumbing subcontractor
  - Elevator subcontractor
  - Envelope, Window, Curtain wall subcontractor
  - Metal panel subcontractor

Building Information

- $230,000,000 GMP construction budget
- 650,000 gross square feet
- 12 story north tower
- 5 story south tower
- 4 story central atrium
- 421 space 2 story below grade parking
- 400 seat tiered lecture hall
- 200 seat dividable tiered lecture hall
- 150 seat tiered lecture hall
- 360 seat dividable flat learning studio
- 60 seat flat learning studio
- Specialty microscope imaging suite

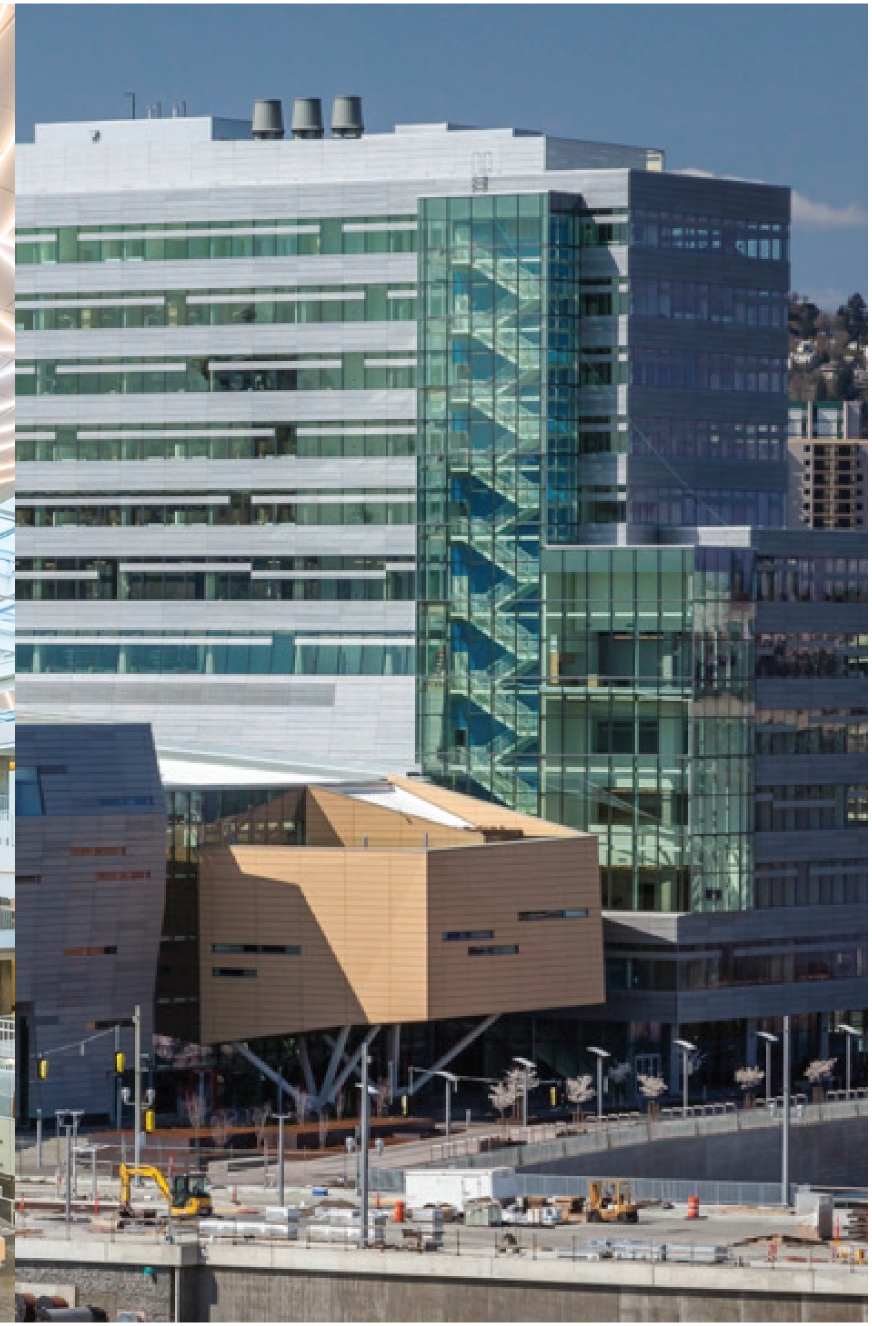


Building program organization.

DESIGN SUMMARY

CLSB/SKT, as the project is known, consists of a 12-story north tower, a five story south tower and an atrium circulation area containing a total of 650,000 square feet of medical research laboratories, academic teaching laboratories, state of the art medical simulation education spaces, multi-use/ multi-functioning classrooms, conference rooms and lecture halls, retail spaces, a two level below grade parking garage and academic support amenities. The upper five stories of the north tower contain the relocated OHSU School of Dentistry that includes patient clinic spaces, specialty dentistry operatories, professional dentistry continuing education spaces and academic faculty offices. The south tower houses the relocated OSU College of Pharmacy, complete with a multimedia lecture hall, classroom spaces, conference rooms and academic faculty offices. Also located in the south tower is a clinical healthcare simulation program that includes fully fit-out exam and procedure rooms.

The design focuses on setting the state for the new OHSU campus on the south waterfront. The dynamic architecture speaks to the vibrant student and research population, focusing on creating common spaces for informal collaboration and cross-pollination across populations and fields of study/research. The design places and emphasis on daylighting and views from public spaces that allow for “teaching and research on display.”



The project is one of only two new constructions larger than 500,000 gross square feet to achieve LEED Platinum.

FAST-TRACKED PROJECT SCHEDULE

With funding coming from private sources and public bonds with a ‘use it or lose it’ expiration date, CLSB/SKT was awarded, conceived, entitled, constructed and delivered in only 38 months.

The contractor began driving foundation piles 5 months after the design team was awarded its contract by the Owners. For this extremely fast-tracked project, multiple pieces of the whole were simultaneously in design, permitting and construction. There were seven distinct permit packages with revisions for each that needed to go to the contractor and to the City for permitting.

The schedule shown at right shows the actual project schedule, comparing it to traditional project delivery. The savings of 19 months would not have been possible without the team’s reliance on technology for project delivery, as is outlined in this submission.

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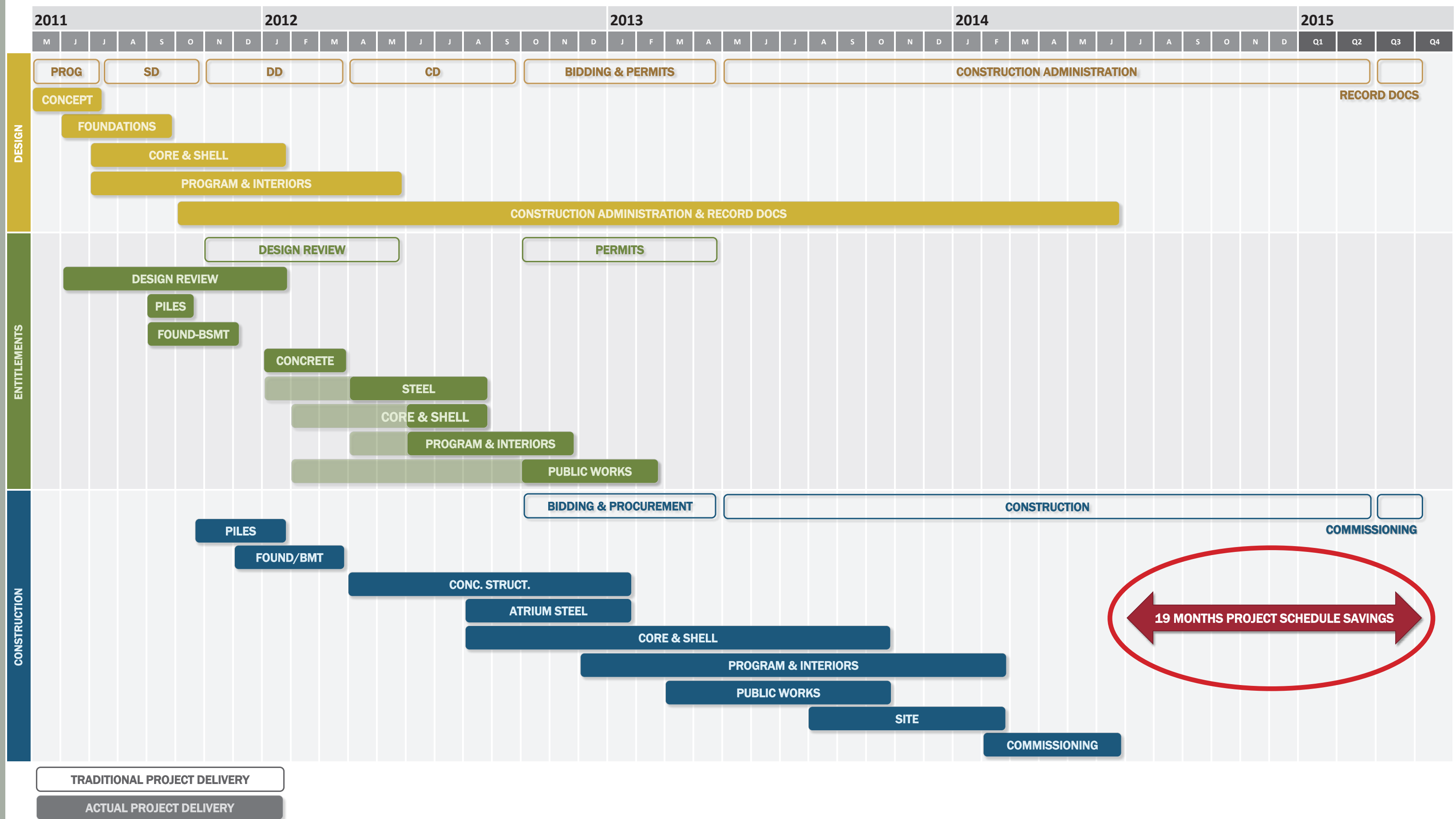

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TEAMING & TECHNOLOGY SUMMARY

The design and construction team chose to colocate throughout the project. During design, as many as 30 Architect, Owner, Contractor and Engineering team members were colocated in the architect's offices. During construction, this same team was colocated at the construction site in job trailers. This colocation, including the robust internet and server connections to allow interaction with out-of-area consultants, was key to the success of the project.

In the marketplace, there is an overwhelming selection of technical tools. The trick is to select the proper tool for each use and circumstance, achieve buy-in from stakeholders and implement it across the entire project team. For CLSB/SKT, many tools were selected, each with their specific use. A few of those tools had deep and profound impacts, enabling the team to use real-time document and decision-making updates to successfully deliver the aggressive project on schedule and on budget. With 28 design team firms in ten states throughout twelve different cities, the use of modeling software, file exchange software, cloud-based collaboration technology and document management tools were critical to the project's workflow.

An Owner/Architect meeting within the colocation big room at the Architect's office during design.

Design collaboration and technology software.

The field superintendent discusses a coordination item with the architect team in the colocation space during construction.

Construction collaboration and technology software.

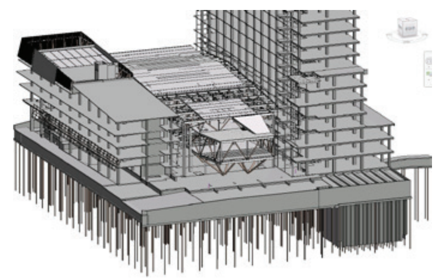
3D DESIGN MODELING

Building Information Modeling (BIM) was a key component for team member and stakeholder understanding and buy-in. With the compressed design schedule, ways to show potential designs, layouts and information for cost modeling were achieved through modeling design options. Once the client group approved a concept, that particular option could be accepted with little to no rework; the selected option could be built upon toward the final design. The 3D model was a valuable tool to show user groups and stakeholders unfamiliar with reading drawings the progression of the design. With dynamic building geometry, communicating the design of the building any other way would have been a challenge.

Twenty-three individual models were developed for the various design disciplines, linked together to form a confederated model. A robust BIM management plan was developed to ensure modeling expectations for the various design and construction team members were clearly understood and carried out.

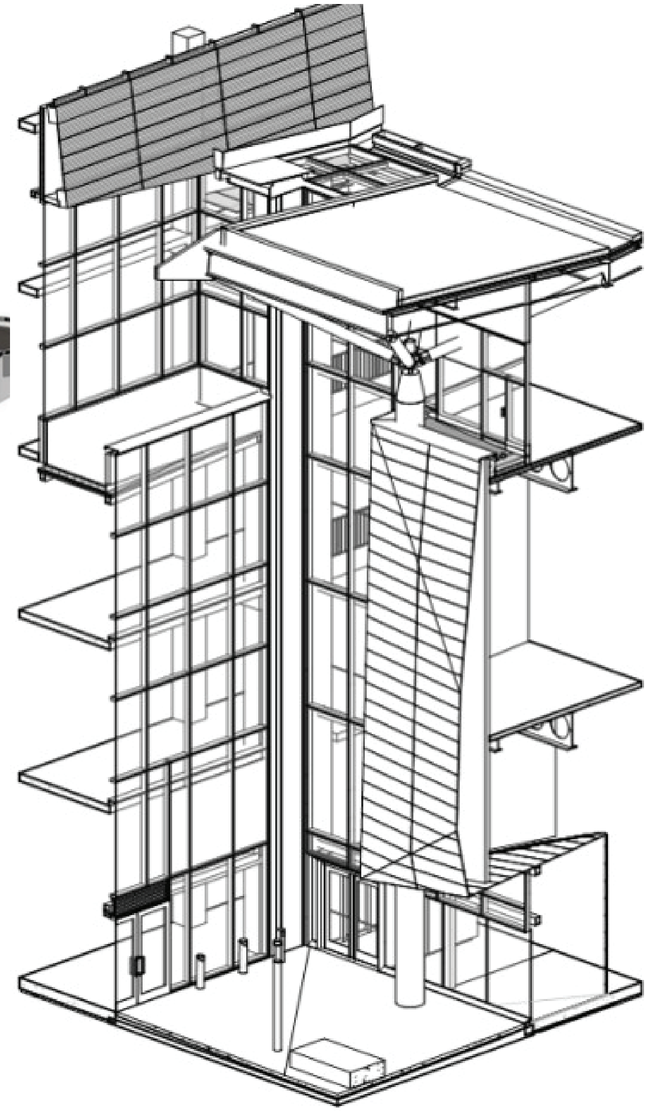
Design concept rendering of an atrium bridge.

3D model showing color coded program boxes.



3D model showing components of a system. In this example, the structural model.

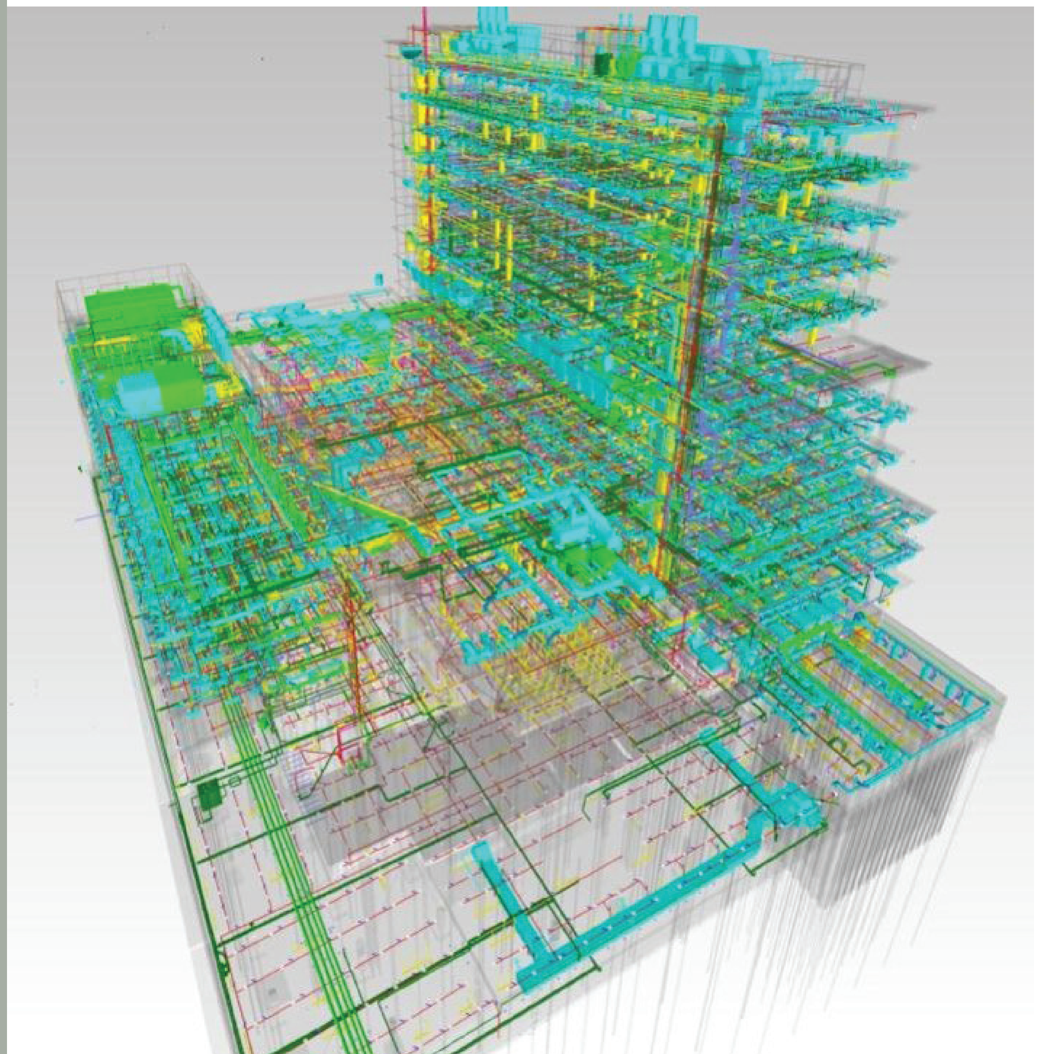
Revit was used to convey many design ideas from renderings, program layout to constructability studies.



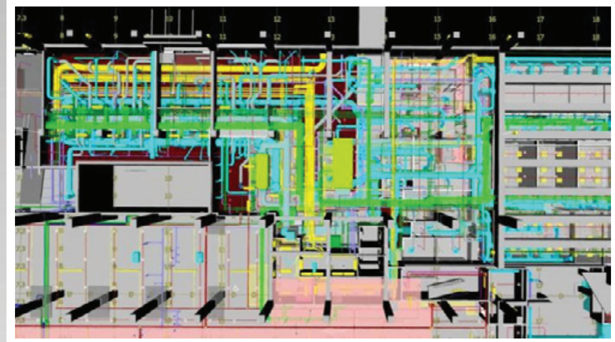
Constructability study showing the confluence of several complex building components.

SYSTEMS INTEGRATION AND CLASH DETECTION

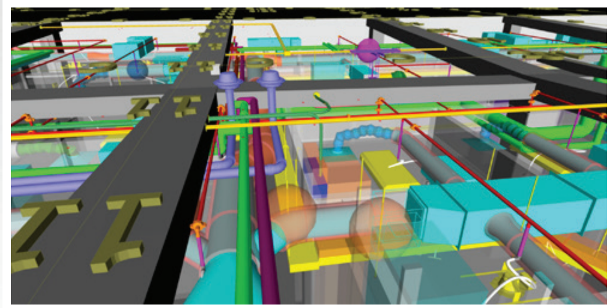
During the latter stages of design, the architect, engineers, contractor, and best-value subcontractors met in thrice-weekly clash-detection meetings, resolving systems conflicts during design and easing the 3D model transition to the subcontractors. Similarly, during construction, 3D models from the subcontractors were combined in Navisworks and weekly clash detection meetings allowed the contractor, subcontractors, architect and engineers to further coordinate systems at a finer level. These clash-detection sessions were held via remote desktop, with the meeting host moving the team live through the 3D model. By remoting in, subcontractors were able to make changes to their respective 3D models in real-time during the meetings as clashes were highlighted on their screens.



Integrated design model highlighting the building MEP systems within the structural model.



One floor during a Navisworks clashing exercise.



The contractor developed a unique add-on to Navisworks that added highly visible spheres to the model at all clash locations.

CLOUD-BASED INFORMATION CONTROL

Over the course of any project, how decisions are documented and the information retained is often an afterthought. For this project, the use of Smartsheet as a cloud-based collaboration tool helped organize and archive the process. Everything from the actual decision made and direction given, supporting documentation, meeting date and attendees could be viewed by all team members wherever they had an internet connection. The ability to simultaneously have multiple people in the same document from several different meeting locations reduced the number of meetings people had to attend, the hours required for consolidating the information post-meeting and time spent tracking down lost documents. This cloud-based tracking solution was used to log the feedback of dozens of user-groups and track the design team response to each item.

For CLSB/SKT, there were over 50 different Smartsheets. These were used for design issues, tracking and constructability reviews to jurisdiction checksheet comments and document issuance tracking during construction.

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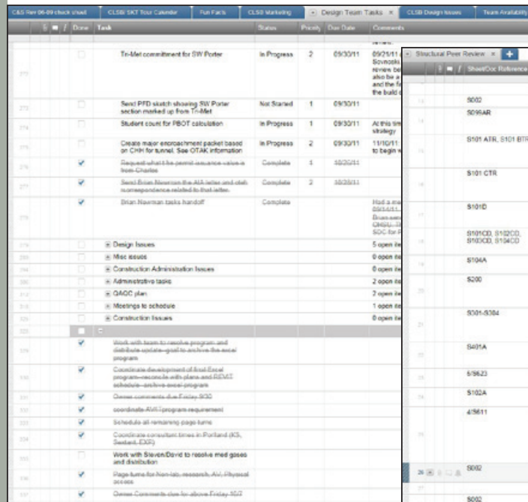
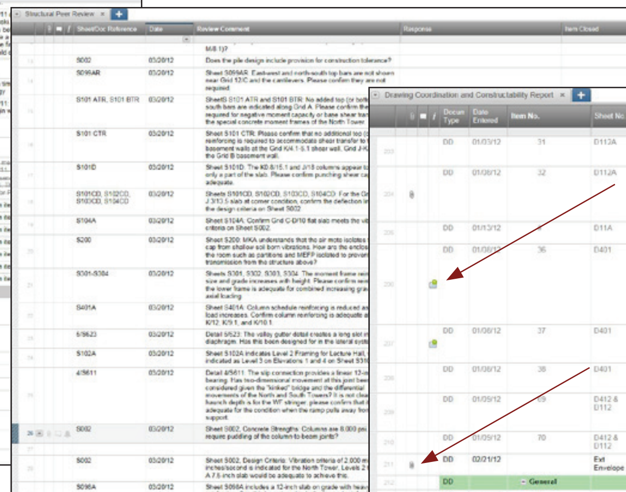
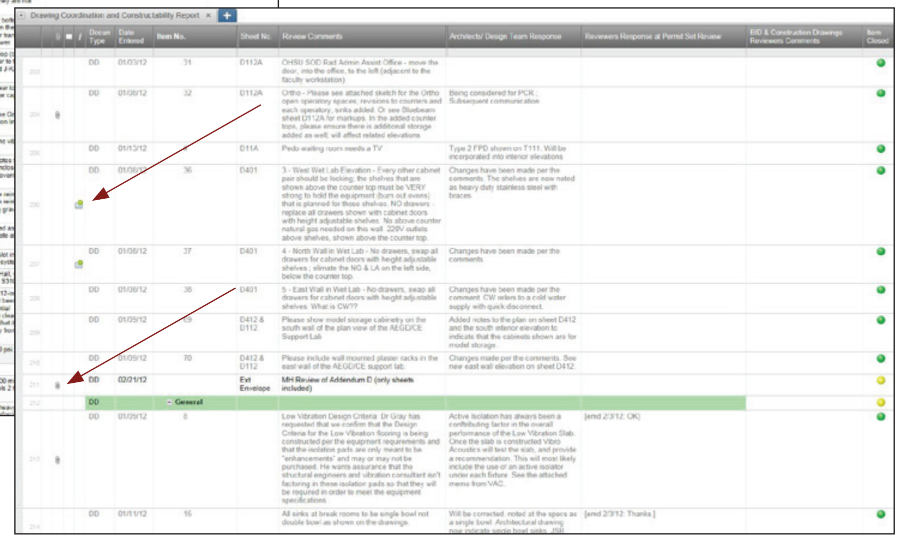
Smartsheet utilized during design.



Design team task tracking.

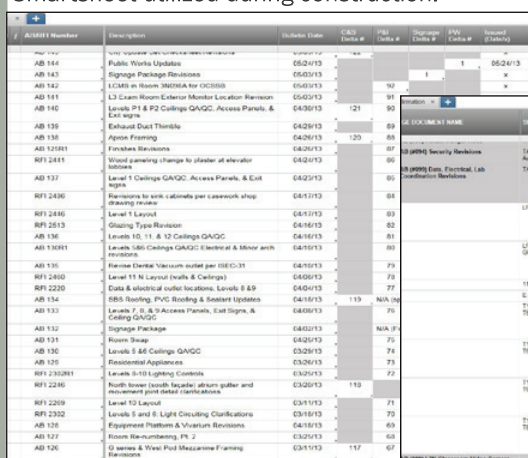


Constructability review comment tracking.

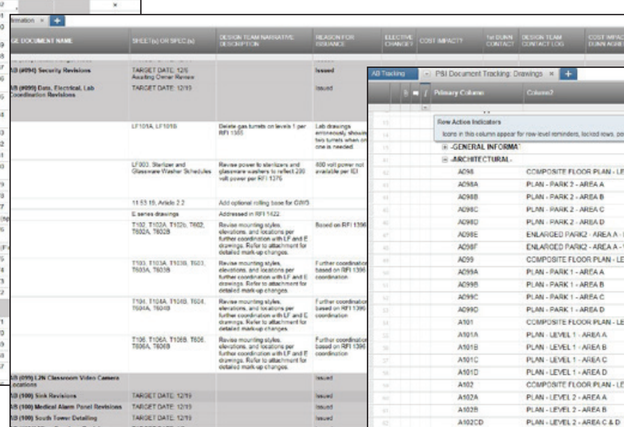


Owner comments showing documents and emails attached for tracking.

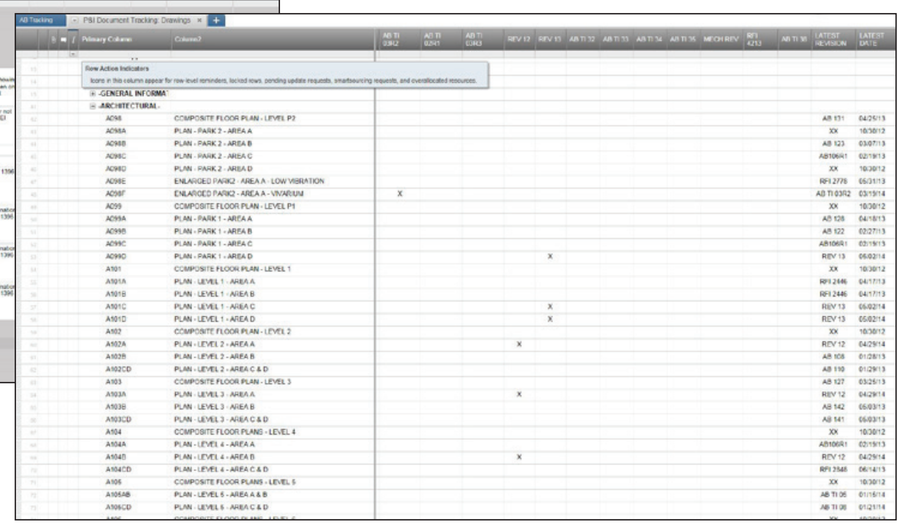
Smartsheet utilized during construction.



Date and delta revision master tracking list.



Revision document verification sheet.



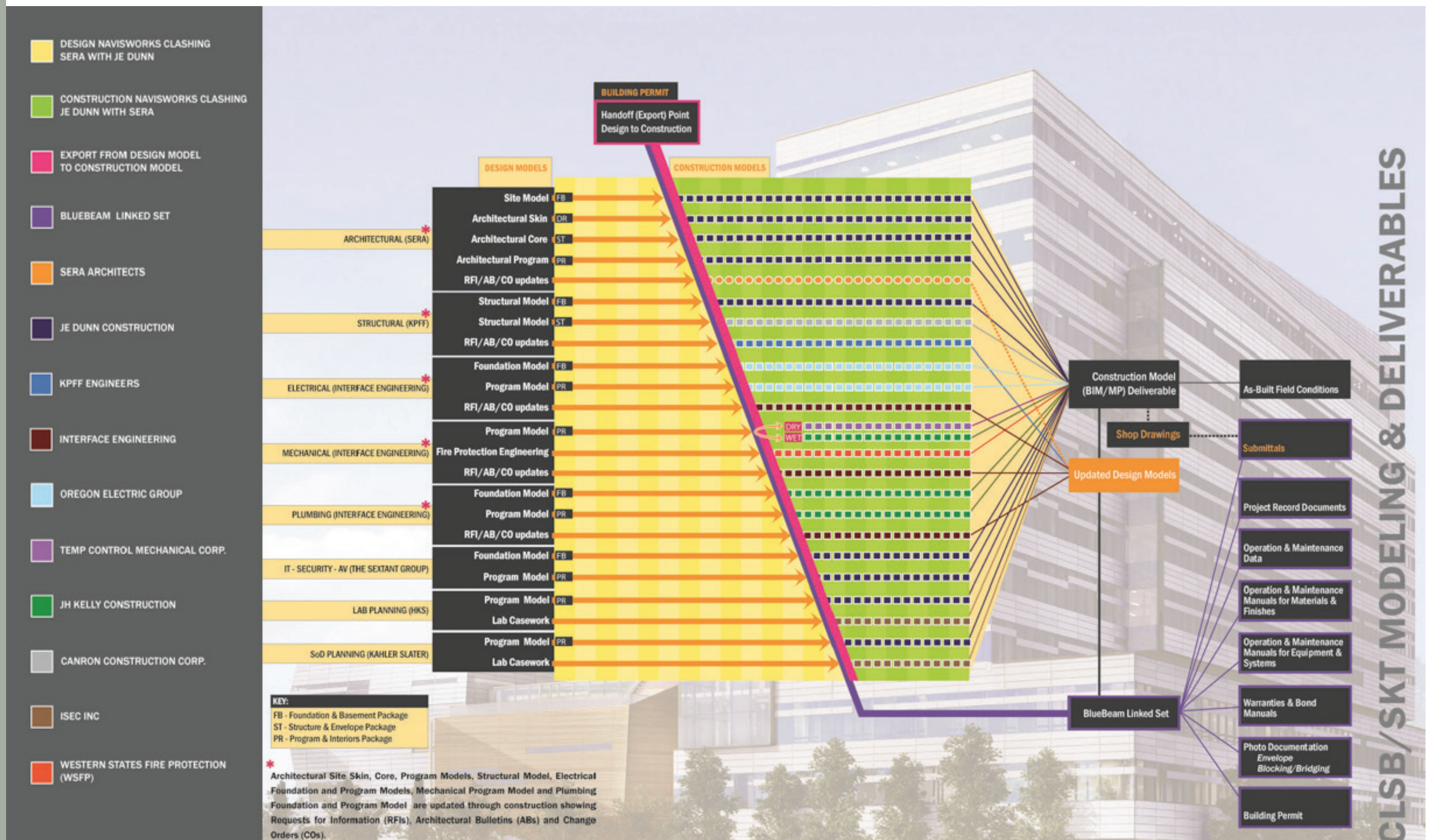
Document issuance tracking master list.

CONSTRUCTION TECHNOLOGY SUMMARY

At each transition point from design to construction, the 3D models were turned over to the general contractor and their subcontractors. Since key subcontractors had been involved heavily during the design process in a design-assist capacity, there was a deep understanding and familiarity with the project. And since they had each been intimately involved early, the technical tools were very familiar to them.

Several subcontractors were contracted during the design phase as best value:

- Mechanical subcontractor
- Electrical subcontractor
- Plumbing subcontractor
- Elevator subcontractor
- Envelope, Window, Curtain Wall subcontractor
- Metal panel subcontractor



3D model hand-off schedule.

SYSTEMS FABRICATION

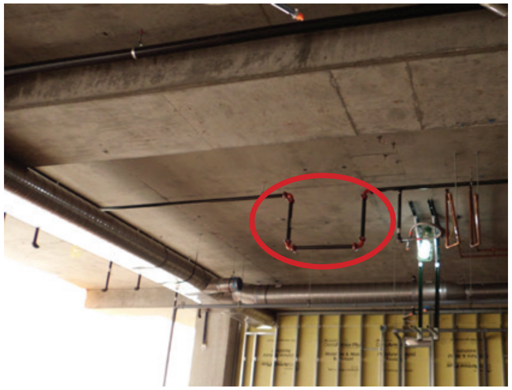
As each subcontractor prepared their layout, coordination, submittals and shop drawings, the team once again assembled for weekly meetings to resolve modeling conflicts. Each anchor point, bolt, rod, pipe assembly, connection point, material and object was scrutinized against other subcontractor information. Since the team could see all of the pieces at once, they could develop ways in which to work and integrate with their trade neighbor. Subcontractors had the confidence that installed work was accounted for and coordinated with their subsequent work.

This process of checking and then verifying building component integration led to several innovations that benefited the owner and therefore the project. Plumbing systems could be unitized and fabricated off-site in factory controlled settings and then delivered to the site and installed. Duct work could also be pre-fabricated off-site, delivered and installed with minimum rework. Each piece had a specific location including straight runs, bends and elbows, offsets and ‘tight squeeze’ locations adjacent to other building elements. The team achieved record installation rates while increasing quality, safety and generating approximately 15% cost savings.

The use of specific technologies (Revit and then Navisworks) made this process possible.

Planning for later trades prevented rework in the field.

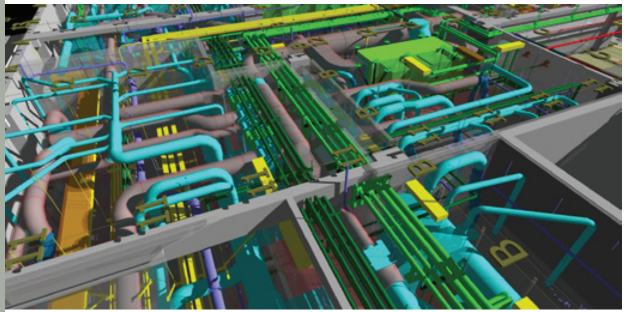
Navisworks model showing building components.



Sprinkler pipe installed.

Duct work integrated.

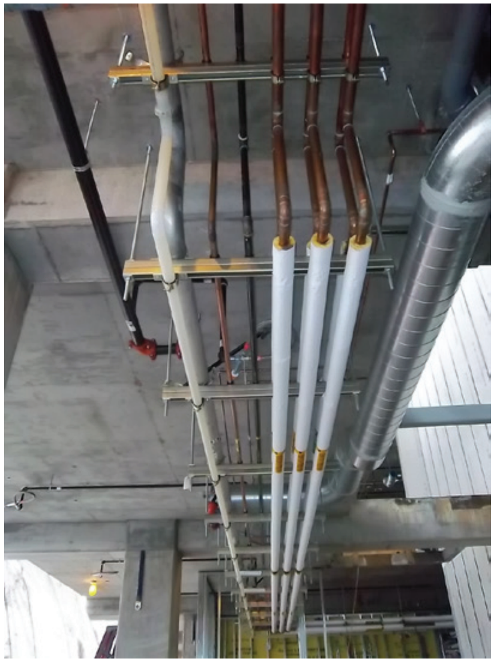
Pre-fabrication allowed for both time and cost savings.



Navisworks model showing pipe and duct work layout.

Pre-fabricated duct work sections ready for installation.

Pre-fabricated pipe rack sections ready for installation.



Installed duct work and pipe racks with connection to other pipe rack sections.

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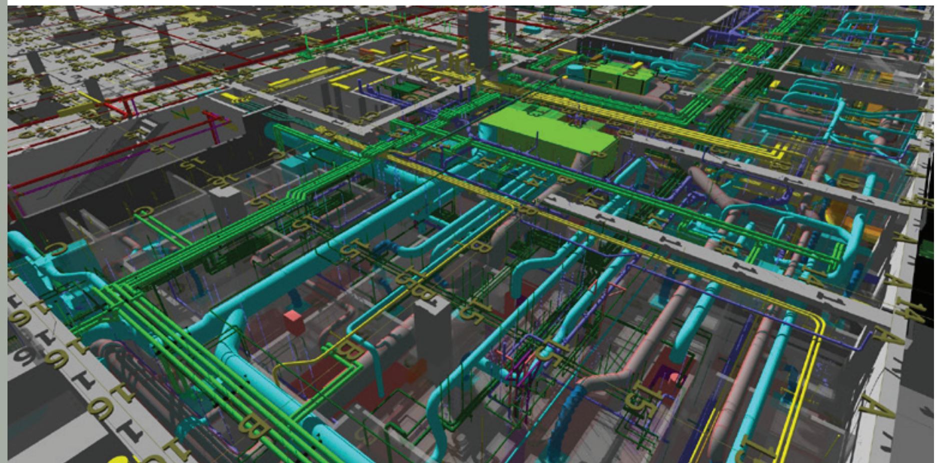
CONSTRUCTION LAYOUT

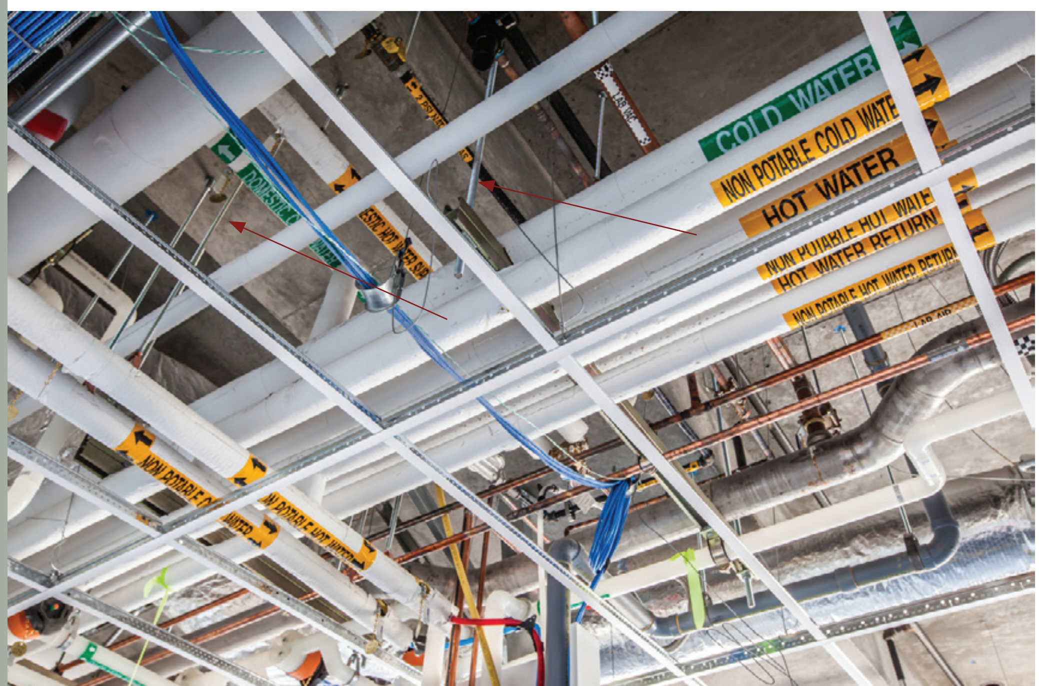
Five months before the program and interiors documents were due to be issued, the Contractor approached the design team with an opportunity to save the Owners money. If the anchors for the Mechanical, Electrical, Plumbing and Fire Protection overhead work could be cast top-side into the concrete slabs rather than drilled in via lifts later, it would save the project nearly $1,000,000. In order to do this, the team would need to lock-down the locations of the interior partitions and design the routing of the MEP systems, then hand off the 3D electronic model to the Contractor and Subcontractors for hanger location determination and field surveying/placement. The design team agreed to a “lock-down” schedule, working closely with the Owners and Users to verify then model final partition locations and MEP layouts, starting at the bottom floor of the 14-story building and working progressively upwards in two-week increments that stayed just ahead of the concrete pour schedule. No 2D drawings were issued; this was all done via the 3D model.

This innovative and highly collaborative “just-in-time-delivery” approach highlighted how trust-based teams that leverage technology can drive real cost savings to Owners.



Full MEP Navisworks model. The anchor rods and mounting racks were modeled. This information was then exported to a survey program.

Anchors installed from the top of the forms. These were installed with information from the model and input into a survey program.



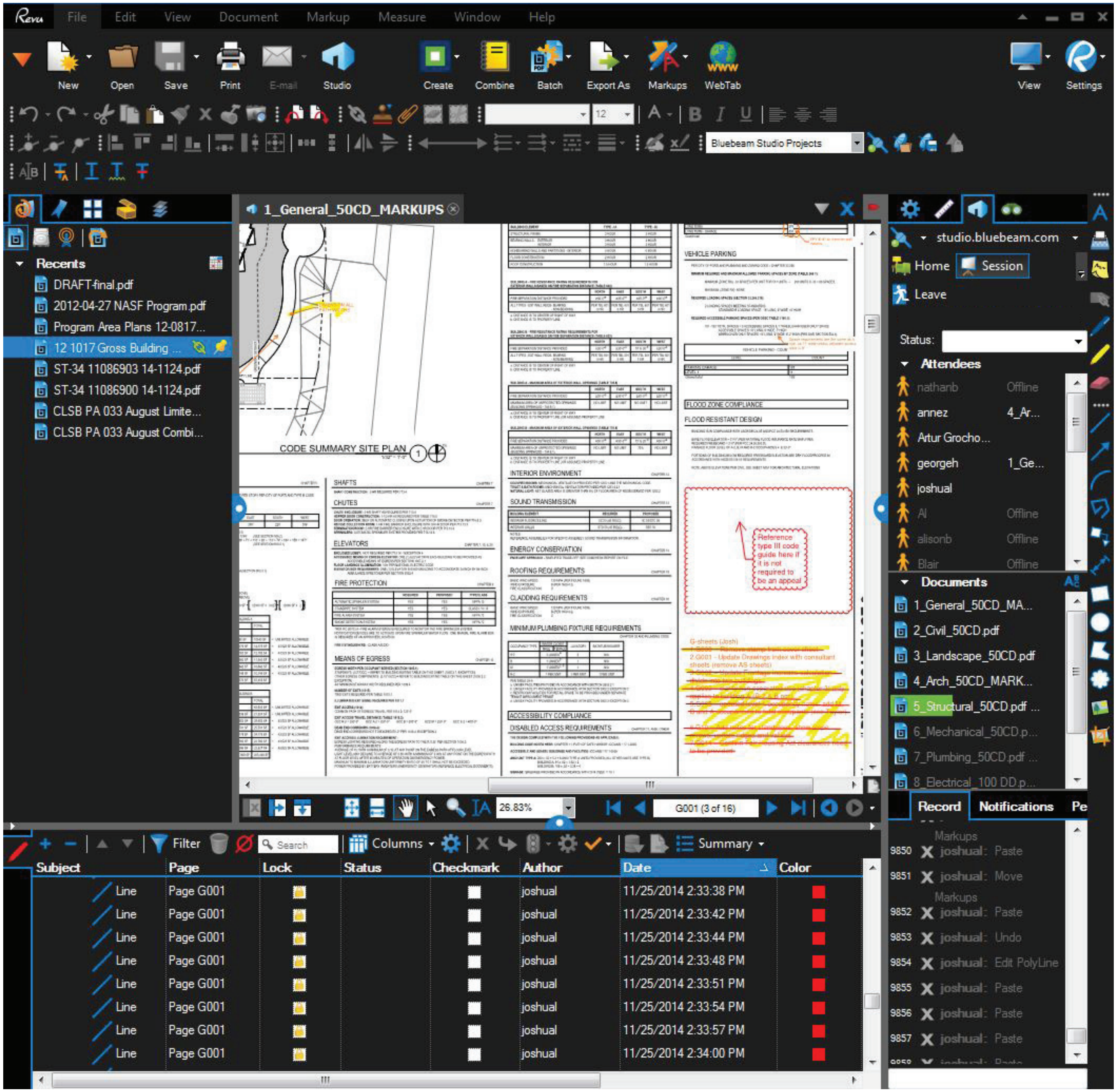
Installed systems using pre-installed anchors. Subcontractors had confidence that the cast-in anchors would be where they needed them to be weeks or months later.

Installation of the MEP system anchors from the top of the form was a tremendous cost benefit for the owner.

ELECTRONIC CONTRACT DOCUMENTS

The team used an all-electronic construction administration process. All RFIs and Submittals were submitted and reviewed electronically. In order to avoid the need to consolidate comments or forward documents in a chain of custody, the team used BlueBeam Studio to create online worksessions that reviewers and responders could log into to make comments. The software tracked which comments were made by who, and when they were made. This allowed for an extremely efficient review and response process by the architects, consultants, and owner coordinators.

This collaborative cloud-based solution resulted in RFI turn-around times of 4.3 days, and Submittal turn-around times of 8.8 days, remarkable for a project of this scale and complexity.



Cloud-based submittal review software allowed simultaneous review and comments, logging activity by all participants.

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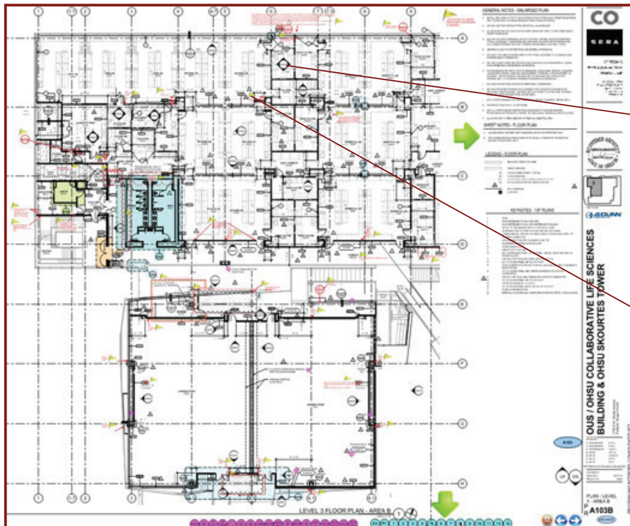
ELECTRONIC CONTRACT DOCUMENTS AND VERSION CONTROL

The contractor assembled and maintained a PDF-based “hyperlinked set” using Bluebeam for all team members to use. The hyperlinked set included issued addenda, architectural bulletins (ASIs, PR and CCDs), RFIs, submittals, O&M information and photo documentation. A script file automatically copied the digital files to team members’ servers each day to ensure the entire design and construction team continuously had the most up-to-date construction documents in an easy-to-use format.

The total savings to the owner for this all-digital process was just under $10,000,000 when accounting for print costs and labor hours for all sets issued to all team members (design team, contractor, subcontractors and owners) and deducting for a technologist to digitally post all documents issued.

In the field, display kiosks were provided by the contractor for all to use that allowed access to the hyperlinked set. This eliminated the need for field crew subcontractors to travel back and forth to their office or trailer to review documents.

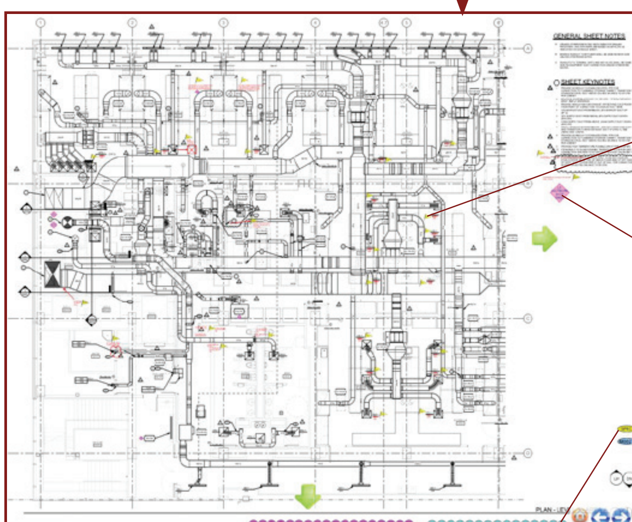
The arrows at the right represent a mouse click on a hyperlinked icon in the 2D electronic contract documents, and point to the document that would open on screen when the hyperlink is clicked.



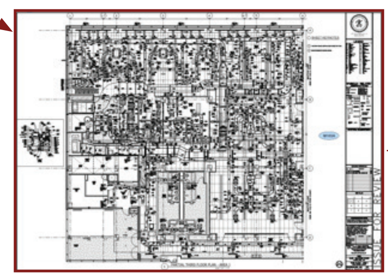
Architectural floor plan with navigation hotspots to project documents.


Enlarged drawing.

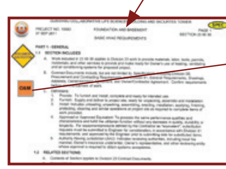

Contractor Request For Information.

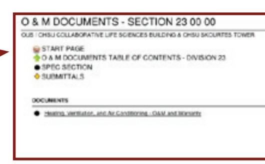

Engineer’s drawings accessed from floor plans.


Contractor Request For Information.


Shop drawings.


Information can be accessed quickly in the field through the use of kiosks.


Specifications.



Operations & Maintenance information.

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VISION TO REALITY

Without a strong teaming attitude and proactive management of communication and information, combined with leveraging technology and cloud-based software tools, the project schedule would not have been achieved. In the end, the combination of industry modeling technology (Revit and Navisworks), cloud-based task-management and documentation tools (Smartsheet) and document management and mark-up software (Bluebeam) allowed the project team to achieve a large, highly complex, mixed-program, multi-owner project on an extremely fast-track schedule.

Process and collaboration were everything. Choosing the right technology tools for the right process was equally critical.