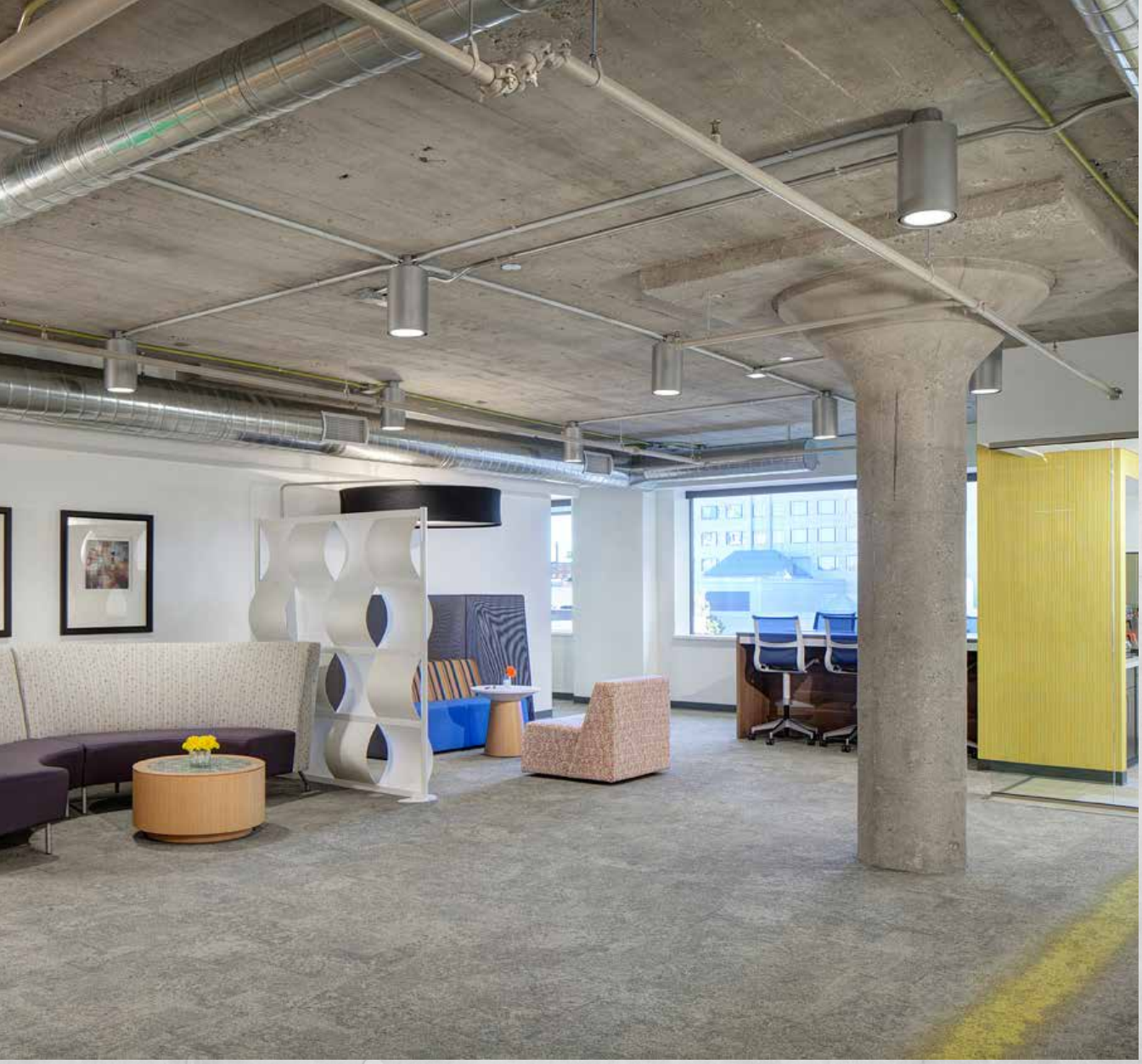


AIA TECHNOLOGY IN ARCHITECTURAL PRACTICE
2014 BIM AWARDS: CATEGORY B
NORTHWESTERN MUTUAL VAN BUREN OFFICE BUILDING

Technology Transforms Existing Building Into 21st Century Workspace

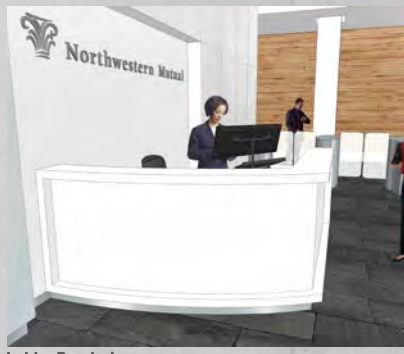
The Northwestern Mutual - Van Buren Office Building project included the complete remodel of a seven-story, 162,087-square-foot existing office building. The interior of the building was completely demolished to keep only the structure and enclosure. New mechanical, electrical, and plumbing systems, windows, insulation, and interiors were constructed.

The new office includes 650 work stations designed for the 21st century work environment. Private offices, open collaborative spaces, enclaves and conference rooms, copy/mail room, amenities room, and modernized restrooms are located on each floor. In addition, the building houses the Mutual Health Center with seven exam rooms, a procedure room, physical therapy, and a themed children's health care exam room. The project is seeking LEED Certification.

As a challenging project, the team utilized Building Information Modeling (BIM) technologies to add value to the project and ensure success. Specifically, BIM identified existing conditions, allowed the owner to visualize design components for decision making, streamlined prefabrication and installation efforts, and created opportunities for long-term building maintenance. BIM also contributed to improvements in quality, safety, schedule, and budget.

The transformation began in October 2012 and was substantially complete in August 2013, nearly **a month ahead of schedule**. The project was also nearly **$1.0 million under budget.**

Building Demolition



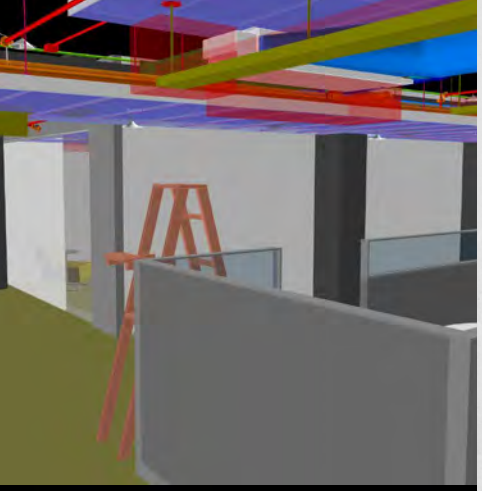
Lobby Rendering

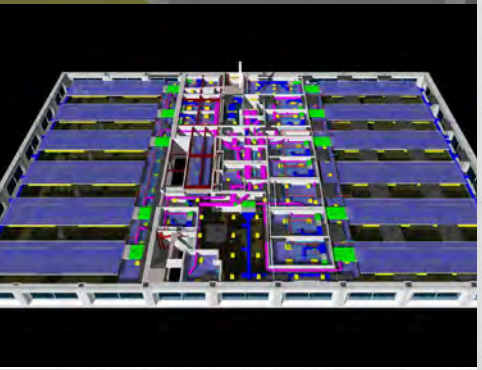
Exterior Rendering

Van Buren Building Exterior

Building Demolition

Office Space Rendering



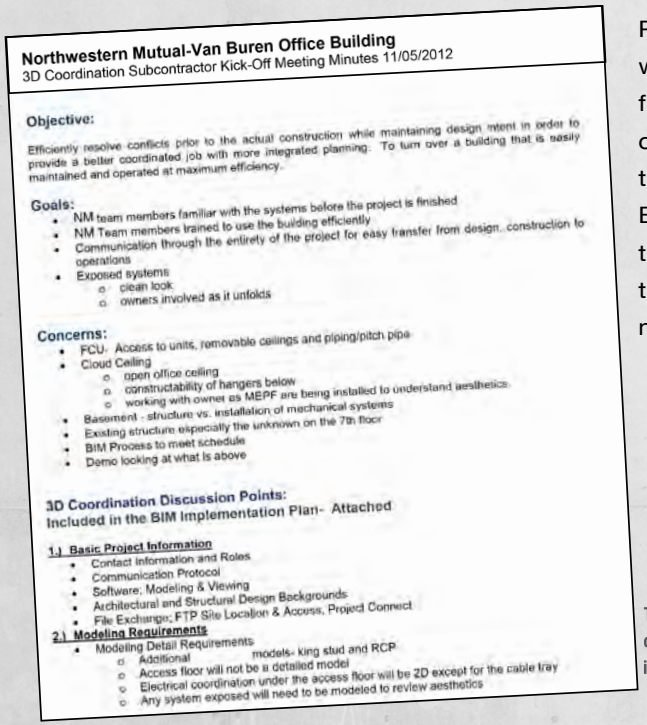


BIM WAS A FANTASTIC TOOL FOR OUR TEAM; IT ALLOWED US TO VISUALLY SEE OUR NEW OFFICE SPACE PRIOR TO CONSTRUCTION STARTING. THE ORIGINAL 1920'S CONCRETE CONSTRUCTION WAS RENOVATED MANY TIMES OVER THE YEARS AND FEW AREAS WERE SQUARE AND PLUMB. WITHOUT LASER SCANS AND BIM MODELS, OUR RISK OF COST CHANGES WOULD HAVE DRAMATICALLY INCREASED. THE VIRTUAL MOCK-UPS PROVED VALUABLE AS WE WERE MAKING FINAL DESIGN DECISIONS AND ENSURED THE END RESULT WOULD FIT OUR NEEDS, WOULD BE EASILY MAINTAINED, AND MEET OUR EXPECTATIONS AS A 21ST CENTURY WORKSPACE. WE WERE ALSO ABLE TO POST VIRTUAL FLY-THROUGHS TO THE INTERNET TO SHARE WITH OUR EMPLOYEES AND IT PROVED TO BE A GREAT WAY TO ENGAGE 6000+ PEOPLE INTO THE CONSTRUCTION PROCESS. BIM TRULY IMPACTED THE SUCCESS OF OUR PROJECT. – NORTHWESTERN MUTUAL

AS THE DESIGN TEAM, WE COLLABORATED WITH NORTHWESTERN MUTUAL'S FACILITIES TEAM TO ACHIEVE THE DESIRED 21ST CENTURY AESTHETIC AND WORKPLACE ENVIRONMENT. THE USE OF BIM WAS INTEGRAL TO THE PROJECT'S SUCCESS BY ALLOWING US TO QUICKLY AND ACCURATELY VISUALIZE HOW OUR DESIGN SOLUTIONS INTEGRATED WITH THE EXISTING BUILDING CONDITIONS AND OUR TRADE PARTNERS' SOLUTIONS. RAISED ACCESS FLOOR, PARTIALLY EXPOSED CEILINGS AND THE INTEGRATION OF MECHANICAL SYSTEMS RESULTED IN VERY CONSTRAINED CLEARANCES, AND THE BENEFIT OF BIM ALLOWED US TO ANTICIPATE AREAS WHERE WE COULD GAIN THAT NECESSARY INCH. – ARCHITECT

BIM IS A NON-NEGOTIABLE TOOL FOR US, IT'S HOW WE BUILD. IT PROVIDES US THE OPPORTUNITY TO BUILD FASTER AND MORE EFFICIENTLY. OUR TEAM COORDINATED THE BUILDING SYSTEMS, PREFABRICATED WORK OFF-SITE SAVING TIME AND MONEY, INSTALLED HIGH-QUALITY WORK, KEPT EVERYONE SAFE, AND PROVIDED THE OWNER WITH A COMPREHENSIVE MODEL FOR FUTURE MAINTENANCE. – CONSTRUCTION MANAGER

A Cohesive Team: Sharing BIM Responsibilities



Northwestern Mutual-Van Buren Office Building
3D Coordination Subcontractor Kick-Off Meeting Minutes 11/05/2012

Objective:

Efficiently resolve conflicts prior to the actual construction while maintaining design intent in order to provide a better coordinated job with more integrated planning. To turn over a building that is easily maintained and operated at maximum efficiency.

Goals:

- NM team members familiar with the systems before the project is finished
- NM Team members trained to use the building efficiently
- Communication through the entirety of the project for easy transfer from design, construction to operations
- Exposed systems
  - clean look
  - owners involved as it unfolds

Concerns:

- FCU- Access to units, removable ceilings and piping/pitch pipe
- Cloud Ceiling
  - open office ceiling
  - constructability of hangers below
  - working with owner as MEPF are being installed to understand aesthetics
- Basement - structure vs. installation of mechanical systems
- Existing structure especially the unknown on the 7th floor
- BIM Process to meet schedule
- Demo looking at what is above

3D Coordination Discussion Points:
Included in the BIM Implementation Plan- Attached

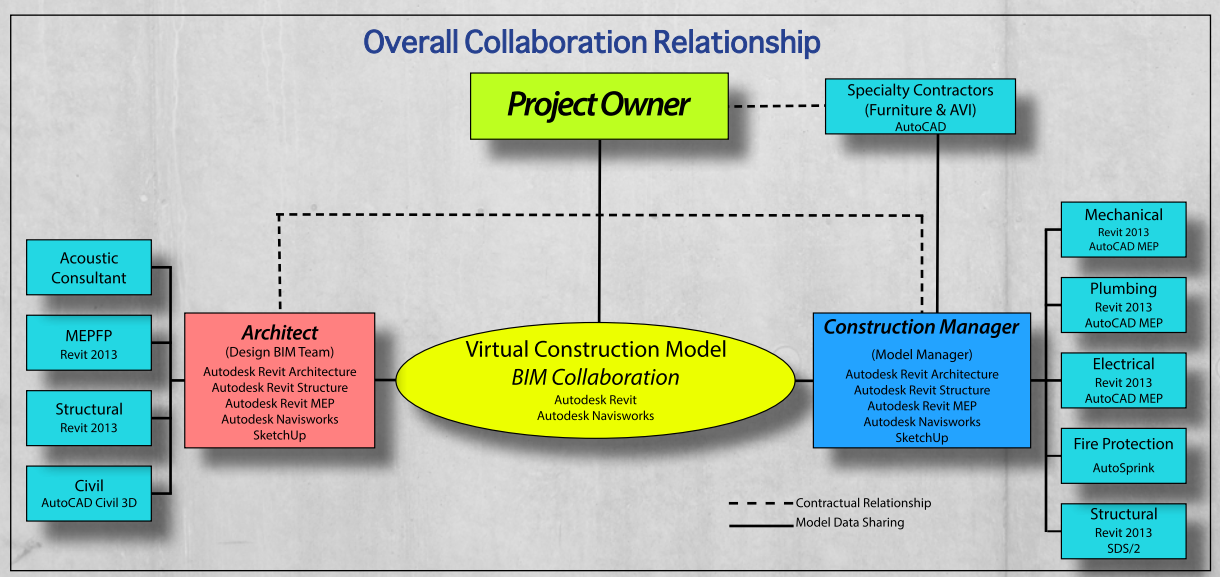
1.) **Basic Project Information**
- Contact Information and Roles
- Communication Protocol
- Software: Modeling & Viewing
- Architectural and Structural Design Backgrounds
- File Exchange; FTP Site Location & Access, Project Connect

2.) **Modeling Requirements**
- Modeling Detail Requirements
  - Additional models- king stud and RCP
  - Access floor will not be a detailed model
  - Electrical coordination under the access floor will be 2D except for the cable tray
  - Any system exposed will need to be modeled to review aesthetics

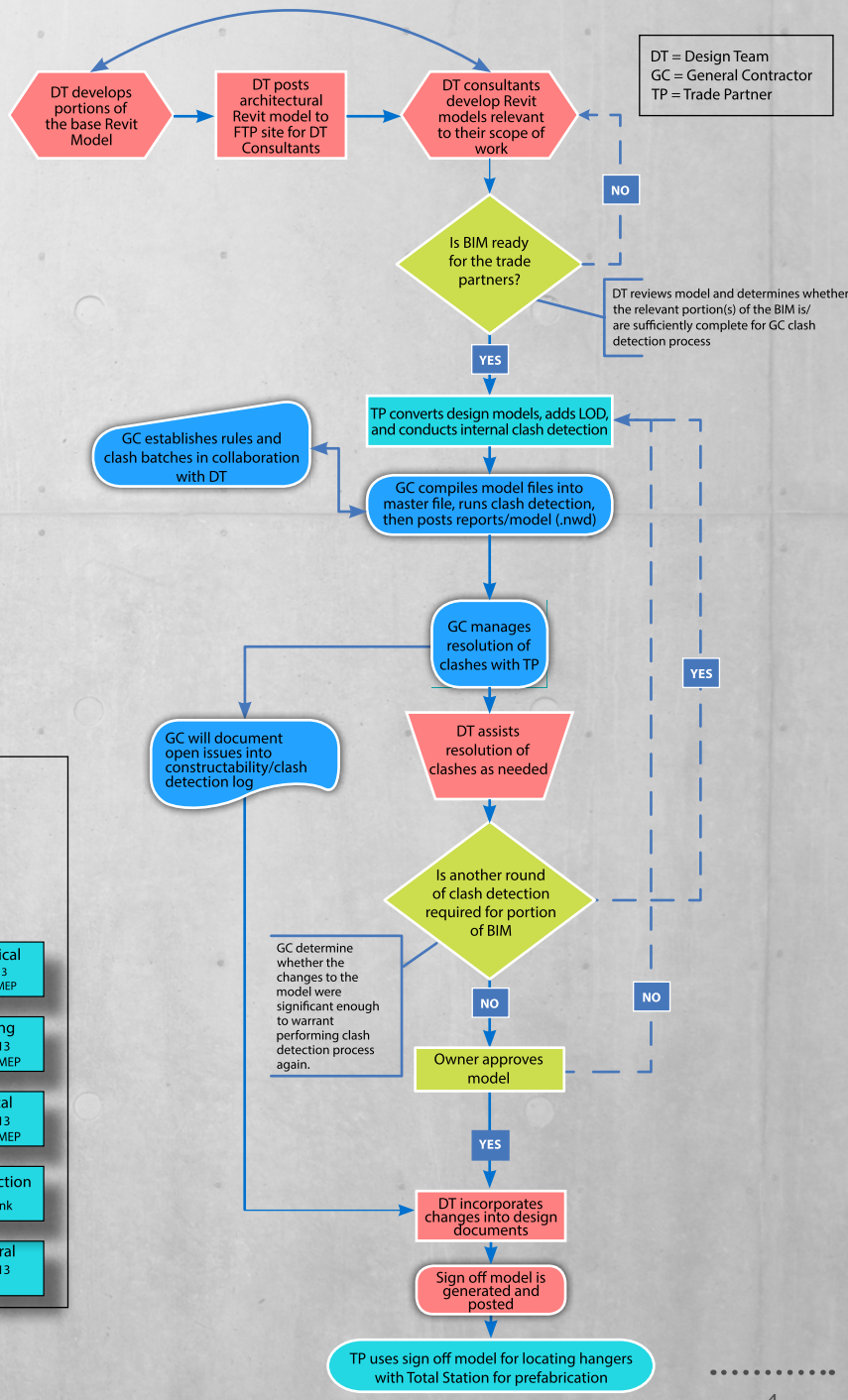
Paramount to the success of this project was the cohesive team that collaborated from day one. The team openly communicated and shared information through a variety of mediums, including BIM. BIM was a shared responsibility that tied all project stakeholders together – from the architect to engineer and construction manager to trade partners.

The team identified concerns, objectives, and goals for the project's BIM coordination process. All stakeholders were involved in this process including the owner, architect, construction manager, and sub contractors.

Overall Collaboration Relationship



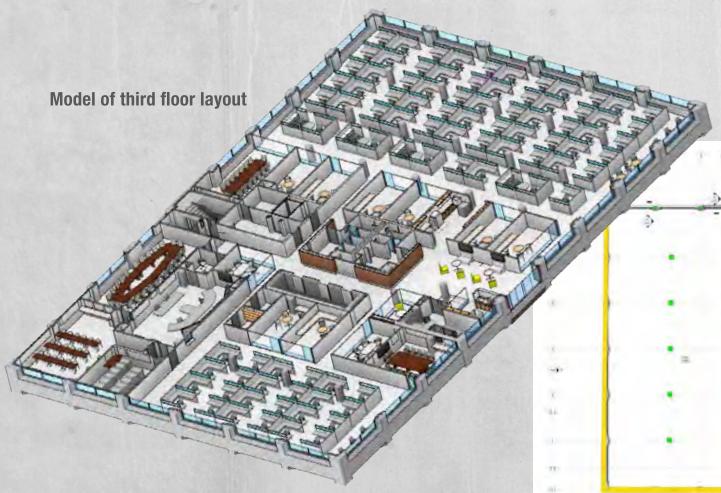
Building Coordination Approval Process



Quantifiable Results - BIM's Impact on the Van Buren Project

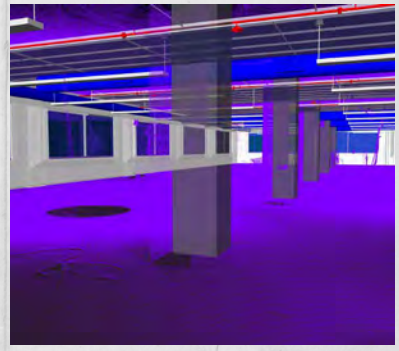
Expectations on this project were high and the challenge at hand was unique — transform an existing building on a tight downtown site into a 21st century workspace. The existing 1920's building had undergone an addition and numerous renovations. BIM and the use of new technologies contributed significantly to the project's success. Four major technology success stories included:

1. **Point Cloud Mapping:** Identified existing conditions and ensured the architectural drawings and new Mechanical, Electrical, Plumbing, Fire Protection (MEPFP) systems fit.
2. **Design Finalization Through Virtual Mock-Ups:** Used to finalize design specifically for a conference room and the 7th floor.
3. **Prefabricated Components:** Multiple systems of the building were prefabricated using BIM; this improved efficiency, quality, and saved time and money.
4. **Model for Facility Management Team:** Model will help the facility team access systems and maintain the building.

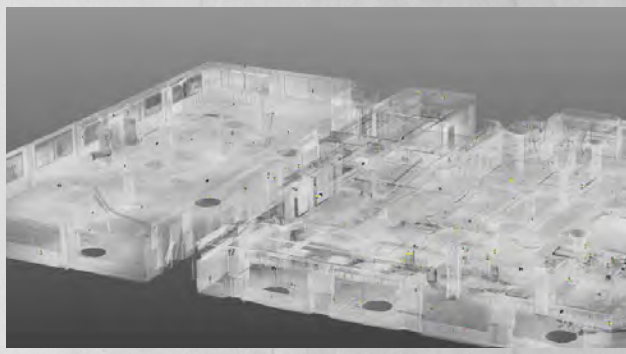


Model of third floor layout

New plans accommodated the building's skew



Navisworks image showing point cloud vs. architectural model; Note the differences in column locations



Point cloud view of stitched floor

Point Cloud Mapping: Saving Time, Adding Value

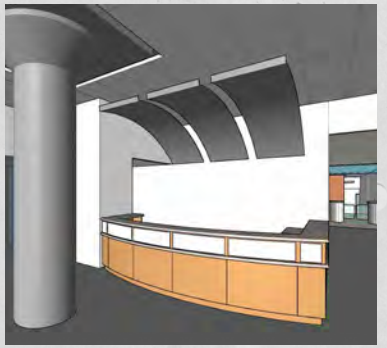
Point cloud mapping identifies a set of data points in a coordinate system. For this project, a 3D scanner was used to identify accurate measurements of certain areas of the existing building (i.e. walls, ceilings, floors, beams, columns, etc). The device measured a large number of points on the surface and output a point cloud data file that was cross referenced to the previous architectural drawings. This data was then input into a Revit model and used to ensure the design and MEPFP systems would fit. During the process, the team discovered **the width of the building was 14 inches trapezoidally out of square. In identifying this during design, the team saved countless hours of redesign and rework with potential conflicts of MEPFP systems and furniture layout.**

VALUE ADDED RESULTS:

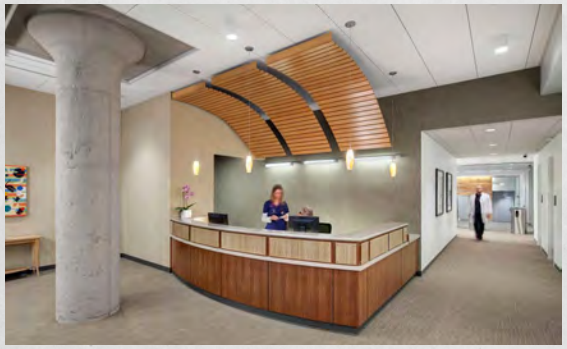
- Scan of basement, second, and seventh floor verified existing structure
- Identified structural anomalies
- Expedited design of interior spaces and MEPFP systems preventing rework
- Crucial to have the existing structure scan of the basement to assist with pre-planning
- Scan allowed team members to go back and review the structure even after the walls went up – reducing time spent in field verification.

Design Finalization Through Virtual Mock-Ups

To meet the expectations of the owner, virtual mock-ups were used to visualize design decisions and their impact to the final building.

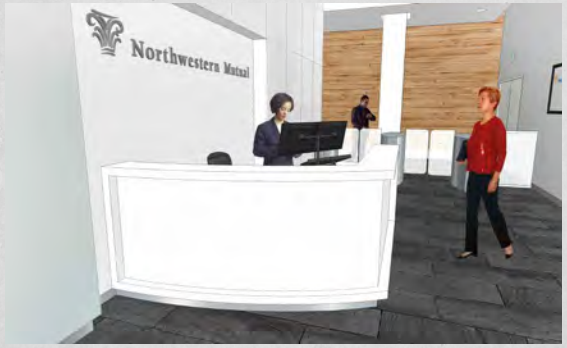


Mutual Health: Virtual Mock-Up



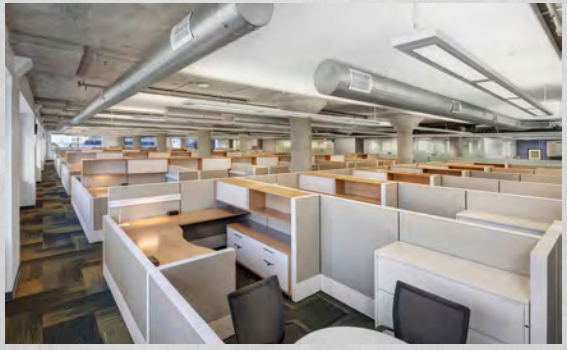
Mutual Health: Final Photograph

Main Entrance: Final Photograph



Main Entrance: Virtual Mock-Up

Office Area: Virtual Mock-Up



Office Area: Final Photograph

Upon demolition, the concrete beams were found to be undesirable

Mock-up of the seventh floor with proposed new ceiling

Example: 7th Floor

Initially the design of the 7th floor included an exposed ceiling. Upon demolition, the concrete beams were determined to be undesirable if left exposed. The design team decided the addition of a ceiling was necessary. Using BIM, the team explored various ceiling options to ensure it was visually appealing, would fit the MEPFP systems, and would be cost effective.

VALUE ADDED RESULTS:

- Assisted owner in visualization of ceiling
- Ensured MEPFP systems fit
- Identified cost implications

Original design mock-up of conference room

Final conference room mock-up with streamlined design

Example: Conference Room

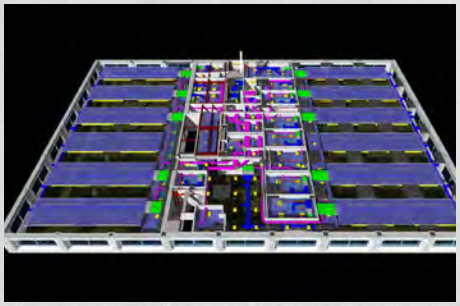
BIM significantly helped streamline the look of the exposed ceilings to ensure the owner's expectations were met. An example included a conference room where a difference in structure occurred. The team modeled various options of MEPFP systems and ceiling configurations to meet owner expectations.

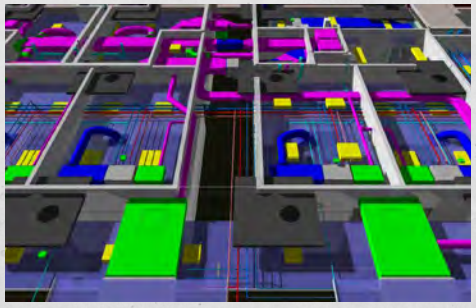
VALUE ADDED RESULTS:

- Owner finalized design
- No rework after installation

BIM & Prefabricated Components

BIM allowed the team to see the entire scope and complete design changes virtually – and confidently prefabricate much of the work, moving labor into the shops (instead of on-site) to minimize risk. On-site work carries a higher risk due to the possibility of weather, safety hazards, and lower productivity. Prefabricated systems included: mechanical piping, ductwork, fire protection, and plumbing carriers.

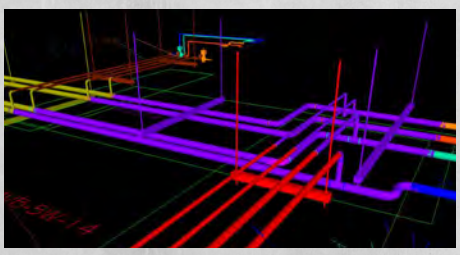




3D Coordination: The mechanical and electrical systems in the building were coordinated virtually via the 3D Model. Coordination meetings allowed the location and design of systems to be finalized before procurement, allowed for prefabrication, and also eliminated any conflicts in the field preventing work stoppages and unforeseen change requests.

Prefabrication sequence drawing

Prefabricated pipes prior to installation

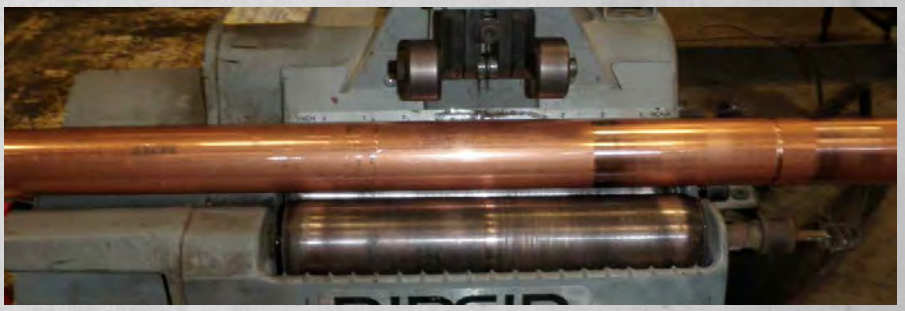


Model of the piping system for prefabrication

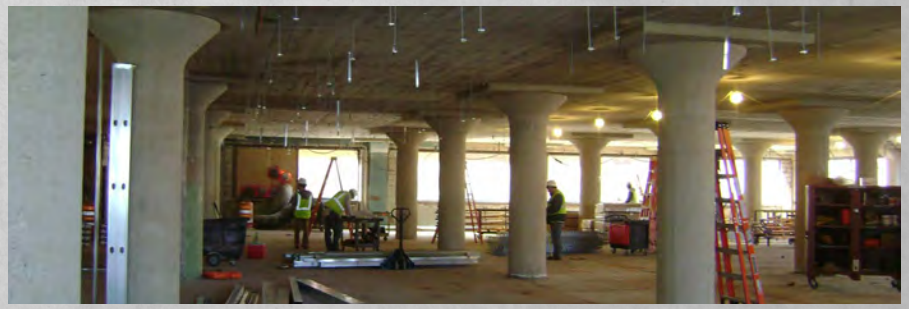
Prefabricated copper piping ready for just-in-time delivery and installation

Mechanical Piping. A major advantage of the copper rack fabrication is that mechanical contractor could start right away. Whether the site was ready or not (due to demolition, abatement, shoring, etc.), off-site fabrication allowed the team to move forward.

Material Optimization. Since piping, duct, and plumbing systems were accurately detailed in the model, the team optimized all materials and minimize scrap.



Labor Efficiency & Quality Control. Higher quality control measurements were available in the shop. All of the copper racks on this project were fabricated by the same three people, ensuring quality control and a quicker pace.



GPS Total Station. A Total Station with the model uploaded was used to efficiently and effectively identify exact locations for MEPFP hangers, clearances, and devices.

BIM & Prefabricated Components

VALUE ADDED RESULTS:

1. Prefabrication labor transferred to the shops from the field for both plumbing and piping

2,500 hours saved or approx. 20%

2. Prefabrication drastically reduced installation time for Fitters.

640 hours vs 3,140 hours

3. Quicker transition of trades to complete work.

Insulators and drywall contractors came in earlier, which contributed to the success of the fast-track schedule.

4. Eliminated excess material and shipping waste

1% Material waste from pipe cutting as low as 1%

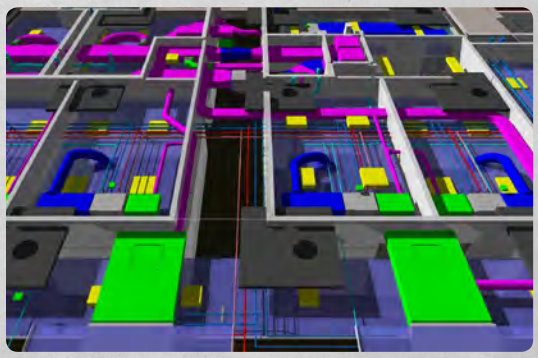
5. Reduced field corrections and change orders

20' sections in the shop vs. 10' sections in the field reduce couplings, reducing possibility of future leaks

6. Overall prefabrication in the shop savings

10% schedule savings or $20k savings vs

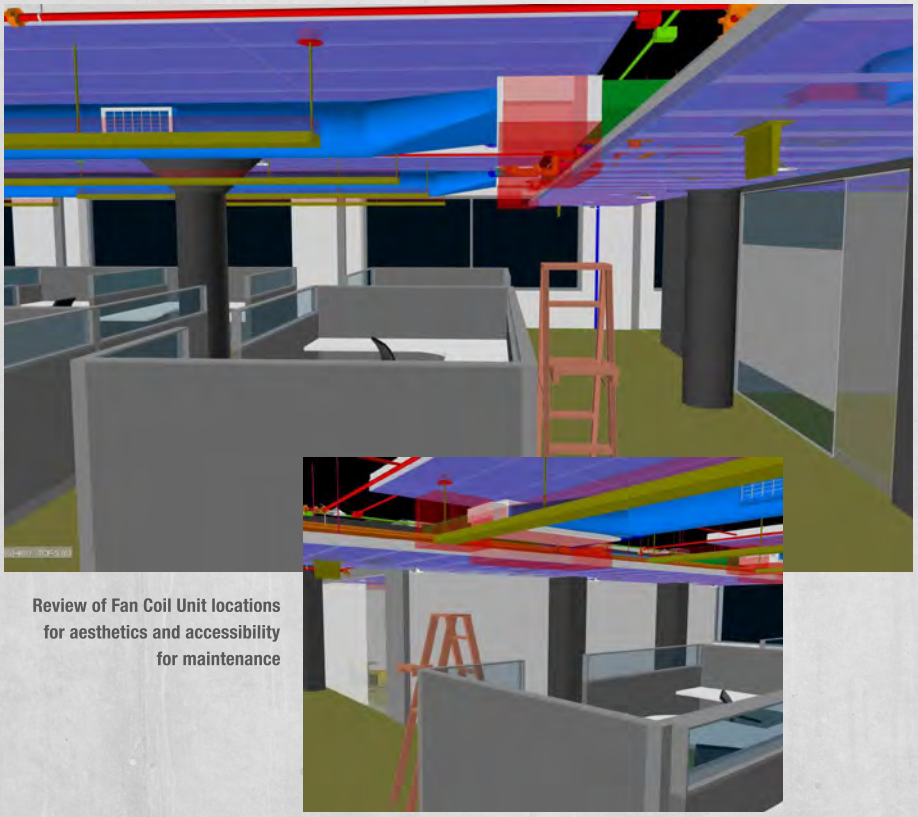
7. Prefabrication in the shop utilized more rigid construction techniques (to withstand shipping) – ultimately benefiting the end user



8. Created accurate as-built models for use by the Facilities Team

Collaboration with Facilities Team

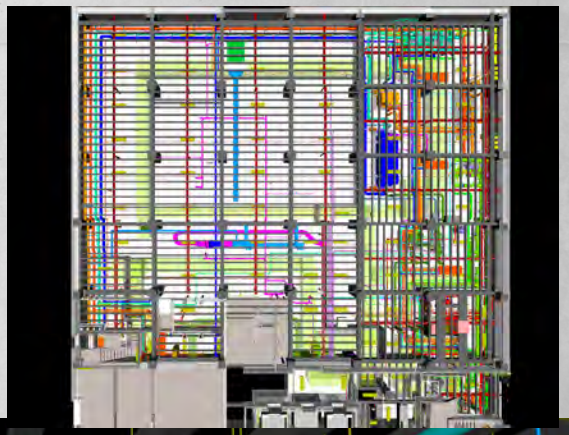
The team reviewed the BIM and MEPFP models with the architect and facilities team to look at aesthetics in the space, ceilings, and access to the mechanical units for future maintenance.



Review of Fan Coil Unit locations for aesthetics and accessibility for maintenance

3D MODEL OF THE BASEMENT

During the initial review of the basement, the team established facility maintenance goals including placement, accessibility to equipment, and ensuring proper paths to replace equipment if needed. Additionally, it was requested that the team maintain pathways at 6'6". Challenges were low ceiling heights in the basement and coordinating all the mechanical systems of the building. The team worked through these challenges with several meetings with the owner's engineers, electricians, technicians, and trade partners. The group reviewed the space and answered any questions regarding the design. Walk throughs were held once a month to show progress and help everyone get a better understanding of the building before they need to service it.



Tight spaces in the mechanical room were precisely modeled to ensure systems fit into the space and that they were accessible and safe for future maintenance.