EDITH GREEN-WENDELL WYATT
FEDERAL BUILDING MODERNIZATION

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PORTLAND, OR

AMERICAN INSTITUTE OF ARCHITECTS 2012 TAP/BIM AWARDS

PROJECT SUMMARY

The existing Edith Green Wendell Wyatt (EGWW) Federal Building is an 18 story office tower built in downtown Portland, Oregon in 1974.
By 1996, the General Services Administration (GSA) was already studying the building's deficiencies and in 2003 contracted design work to begin for repairs and alterations to the aging facility. That effort was put on hold in 2006 due to lack of funding. In 2009, the project was brought back to life by the American Recovery and Reinvestment Act (ARRA).

PROJECT INFORMATION

- Renovation of 35 year old federal building
- 18 story, 512,474 sf building
- Major building system renovation
- LEED Platinum Target US Green Building Council
- Coordination of swing space with phased construction
- Aggressive energy and water conservation goals
- Building Information Modeling (BIM)
- Innovative workplace design

INVOLVED TEAM MEMBERS IN BIM PROCESS

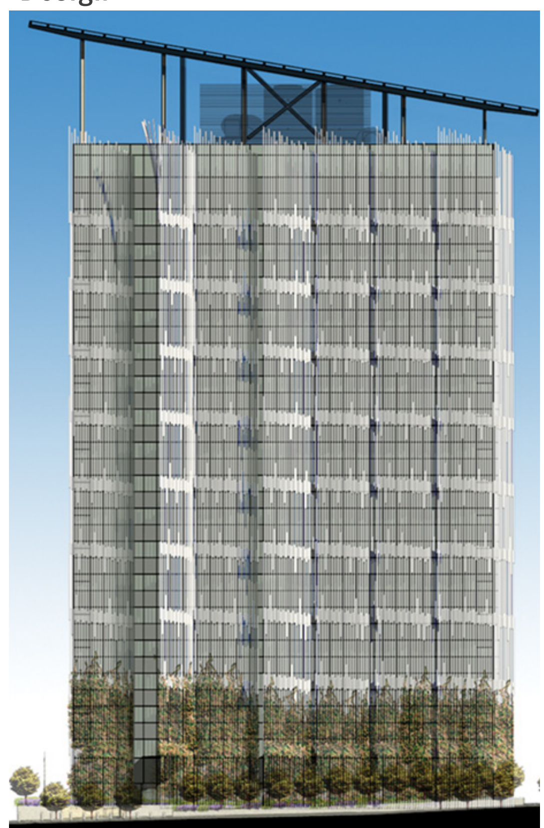
Owner: General Services Administration
Executive Architect
Design Excellence Architect
Structural Engineer
Mechanical Engineer
Plumbing Engineer
Electrical Engineer
CMc – Construction Manager as Constructor
Envelope Design Build Subcontractor
Mechanical Subcontractor
Electrical Subcontractor
Demolition Subcontractor

BUILDING INFORMATION

Size	525,421 SQ.FT. 18 Levels and 2 Basements
Project Cost	$141.5 M
location	Portland, OR
Tenants	24 Agencies
Built	1974

1974 Building

Design



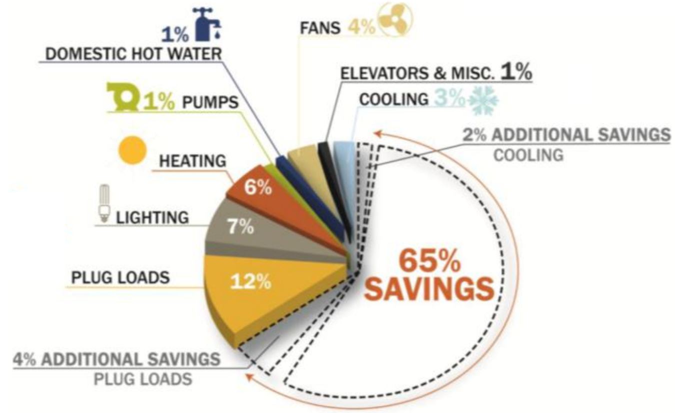
Current Construction

EGWW GOALS & REQUIREMENTS

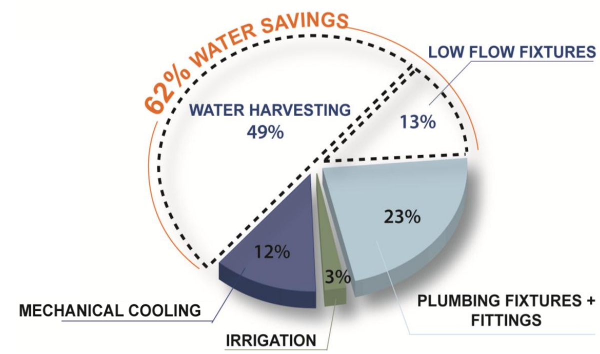
On the EGWW project, the team was tasked by the GSA to achieve significant reduction in the project schedule. Under normal conventions for GSA, this $141,500,000 project, with design and required approvals to reach a Guaranteed Maximum Price, would have taken 27 months. Working with the Owner on-site every other week and the builder on site full time, construction started 14 months after project restart with over 60% of the construction contracts awarded and shop drawings submitted or in process, removing over a year from the schedule.

The final building will be exceptionally energy efficient, modeled to save 65% of the energy used by a conventional office building and reduce the water used by the facility up to 65% versus a conventional building, far exceeding the requirements of the Energy Independence Security Act (EISA).

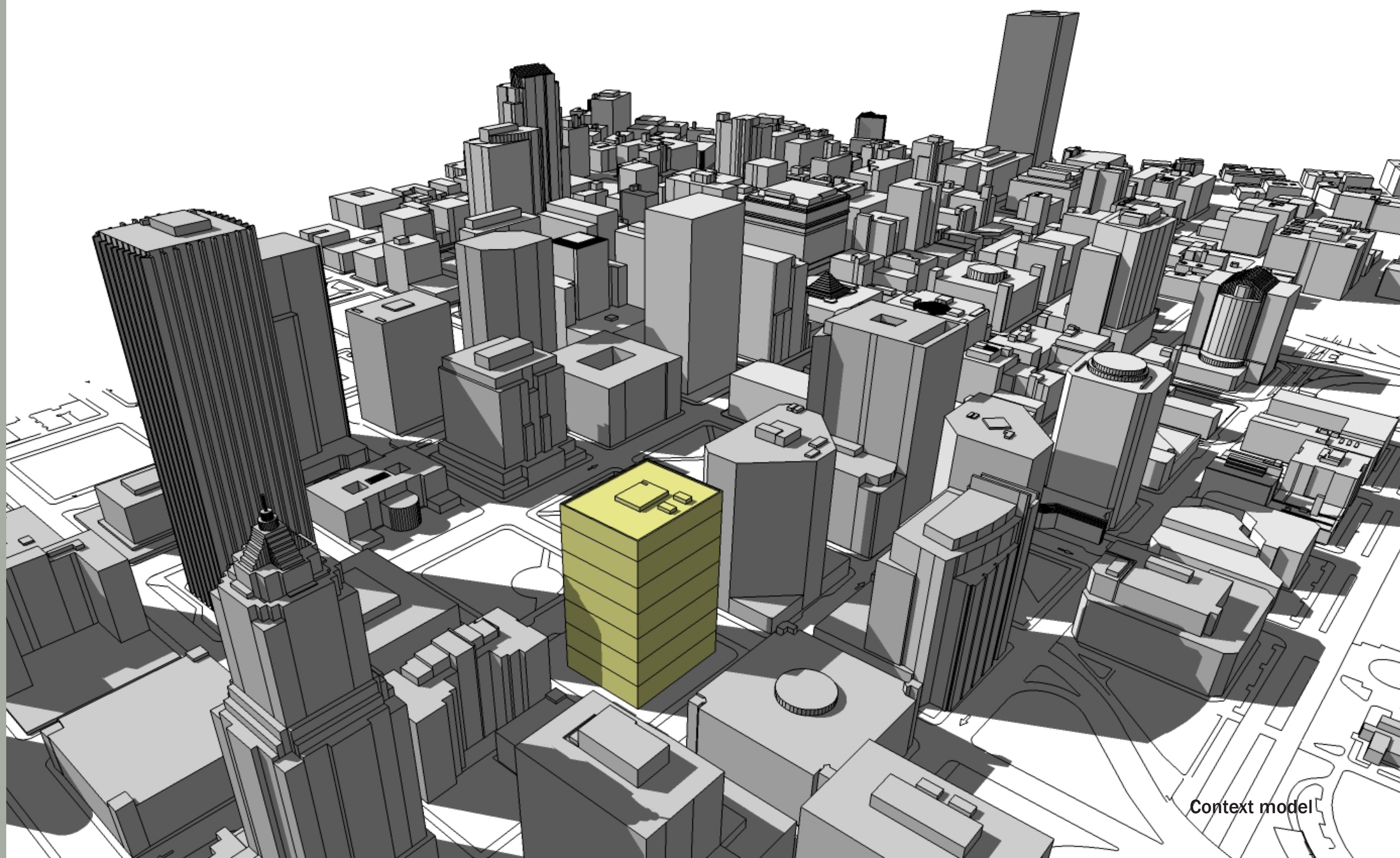
The EGWW Federal Building will be one of the premier environmentally-friendly buildings in the nation and will establish GSA as a green proving ground for innovative green building techniques.



DESIGN ENERGY USE REDUCTIONS



DESIGN WATER USE REDUCTIONS



Context model

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WORKFLOW

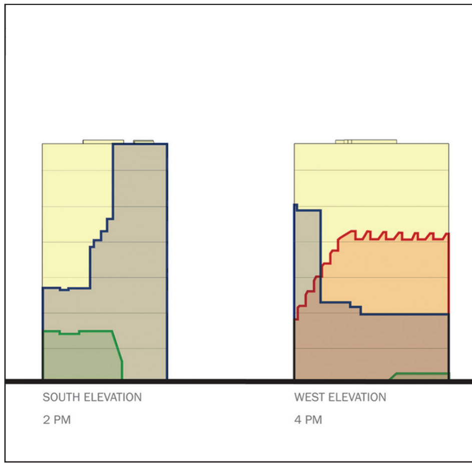
EGWW DESIGN PROCESS

Turning the architecture lead design process on its head, the EGWW project team spent five months after the project restart focused on determining the optimal engineering for the project before engaging the Design Excellence Architect in the re-design effort. Based on the results and recommendations of this building analysis, the Design Excellence Architect started his work, giving shape to a medley of high performance engineered components, synthesizing them into a visually poetic public building.

BIM TOOLS

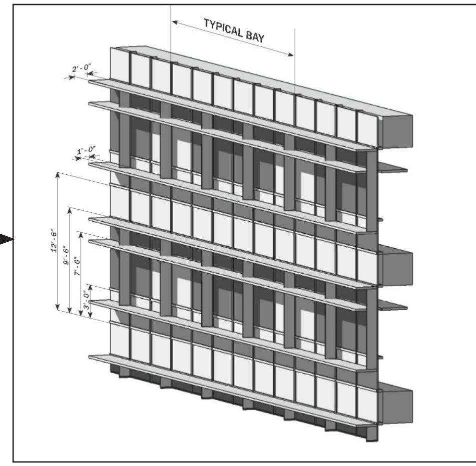
Since the project timeline was significantly compressed, numerous BIM tools were employed to study small sections of the building and determine their impact on the overall buildings energy and water use.
The true innovation for EGWW during this phase was not in the individual studies or analyses, many of which have been used before, but in the sequence in which they were done. Since most engineering is done to support a design vision, the integrated nature of how these studies carried out and the use of BIM tools allowed the design to meet High Performance Building criteria without adversely impacting the project schedule or budget.

SITE STUDY



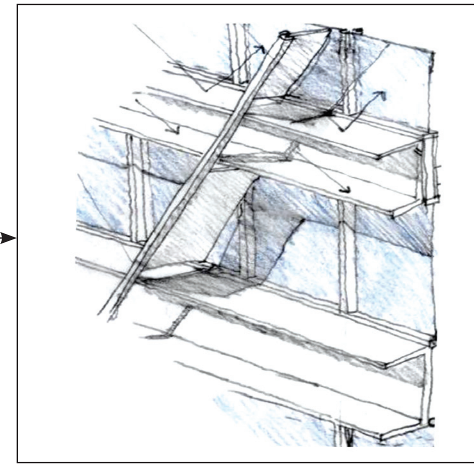
1. NUMEROUS DAYLIGHT STUDIES WERE CONDUCTED TO DETERMINE THE LIMITATIONS AND OPPORTUNITIES AVAILABLE FOR THE PROJECT

ANALYSIS



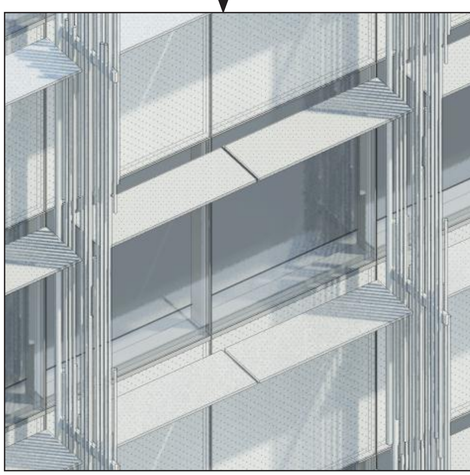
2. DAYLIGHT OPTIMIZATION STUDY FIRST ESTABLISHED THE SIZE AND POSITION OF THE SHADING DEVICES AND LIGHT REFLECTORS. THIS ENGINEERING ANALYSIS OCCURRED PRIOR TO DESIGN ARCHITECT COMMENCING WORK

DESIGN



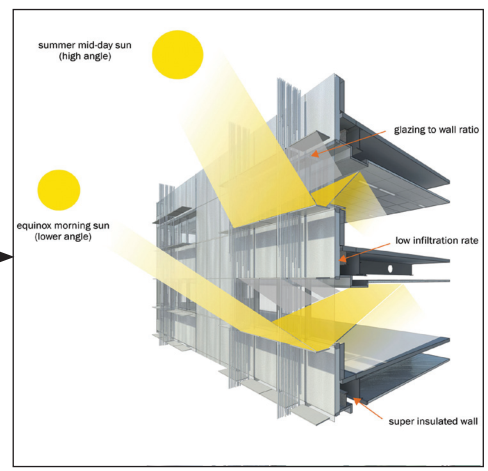
3. THE DESIGN ARCHITECT BEGAN WORK, TRANSLATING THE ENGINEERING CRITERIA TO ARCHITECTURAL FORM

DETAIL MODELING



4. BUDGET CONSTRAINS FURTHER REFINED THE FORM, SUBSTITUTING VERTICAL REEDS FOR THE SOLID VERTICAL SHADES

VALIDATION



5. THE FINAL DESIGN WAS THEN REFINED TO VERIFY ALL CRITERIA ARE MET

CONSTRUCTION

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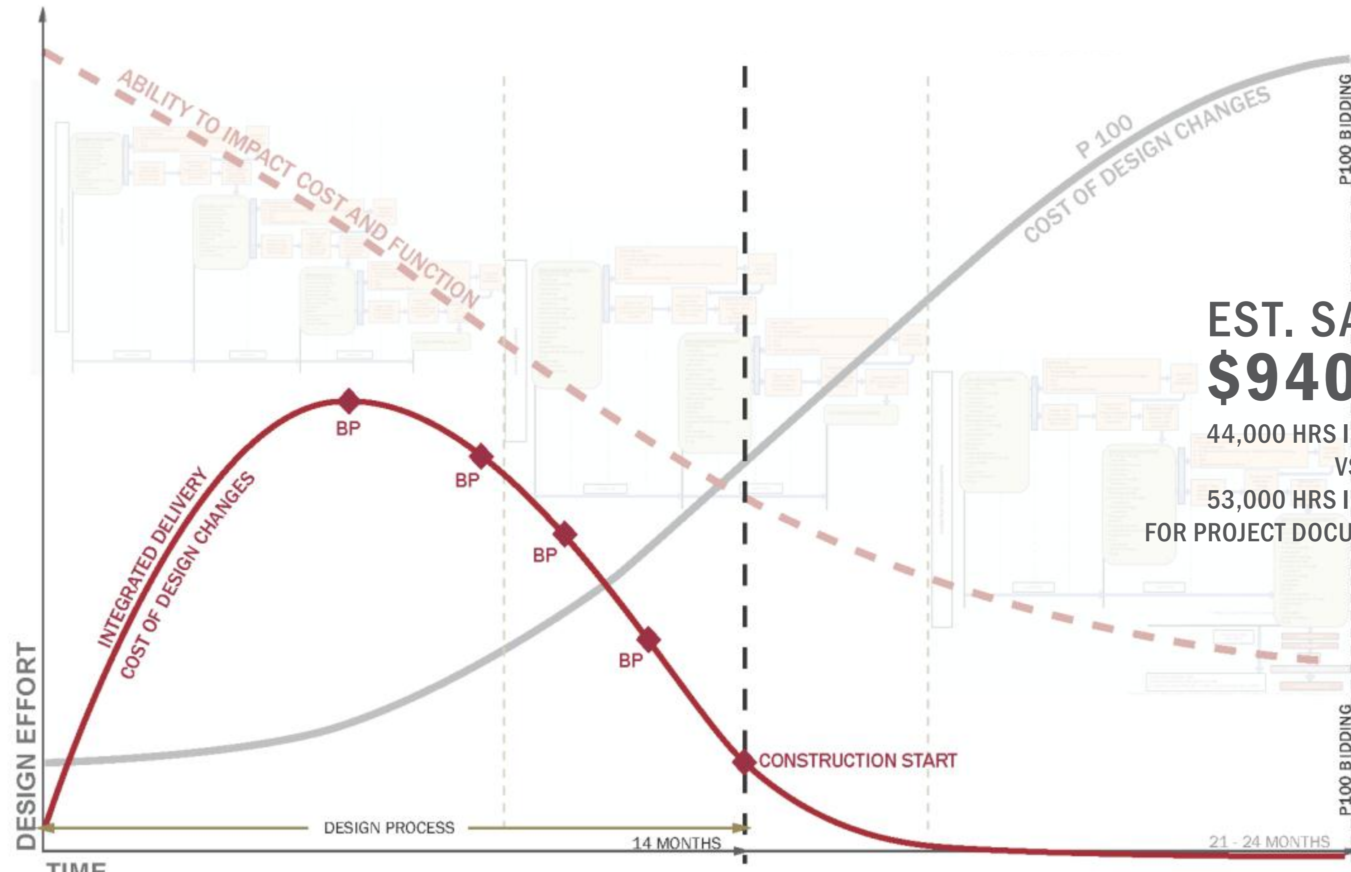
TEAM INTEGRATION

Throughout the design process, team members had access to each disciplines design via co-located models on a shared server in the Information Room (iRoom). Each Revit model was available at any time and allowed for on the fly coordination and problem resolution to occur. Engineering consultants were required to work in Revit and were linked to the primary architectural design model. System coordination efforts were started early in the design process and the results of the efforts informed the progression of the various disciplines' designs and helped accelerate the production delivery schedule. In addition to the engineering disciplines, the first tier subcontractors were also co-located in the iRoom, helping them become familiar with the design, the design expectations, and allowed them to provide constructability reviews in real time to the design team and continuous cost feedback.

In addition to their constructability reviews, the first tier subcontractors were able to get an early start on their detailing models, participate in the Navisworks coordination and do early project planning. The result of this closely collaborative work environment and ready access to design information was a highly coordinated building design that has resulted in fewer RFI's*and change orders than would normally have been obtained.

*As of January 16, 2012, 222 RFI's have been issued at 60% construction complete.



EGWW DELIVERY FLOWCHART

EST. SAVINGS
$940,000
44,000 HRS IN 15 MONTHS
VS.
53,000 HRS IN 24 MONTHS
FOR PROJECT DOCUMENT PRODUCTION

EGWW SAVED AN ESTIMATED **$82,000** IN TRAVEL TIME TO MEETINGS FOR CONSULTANTS WHO WERE CO-LOCATED

iRoom-Design

iRoom-Construction

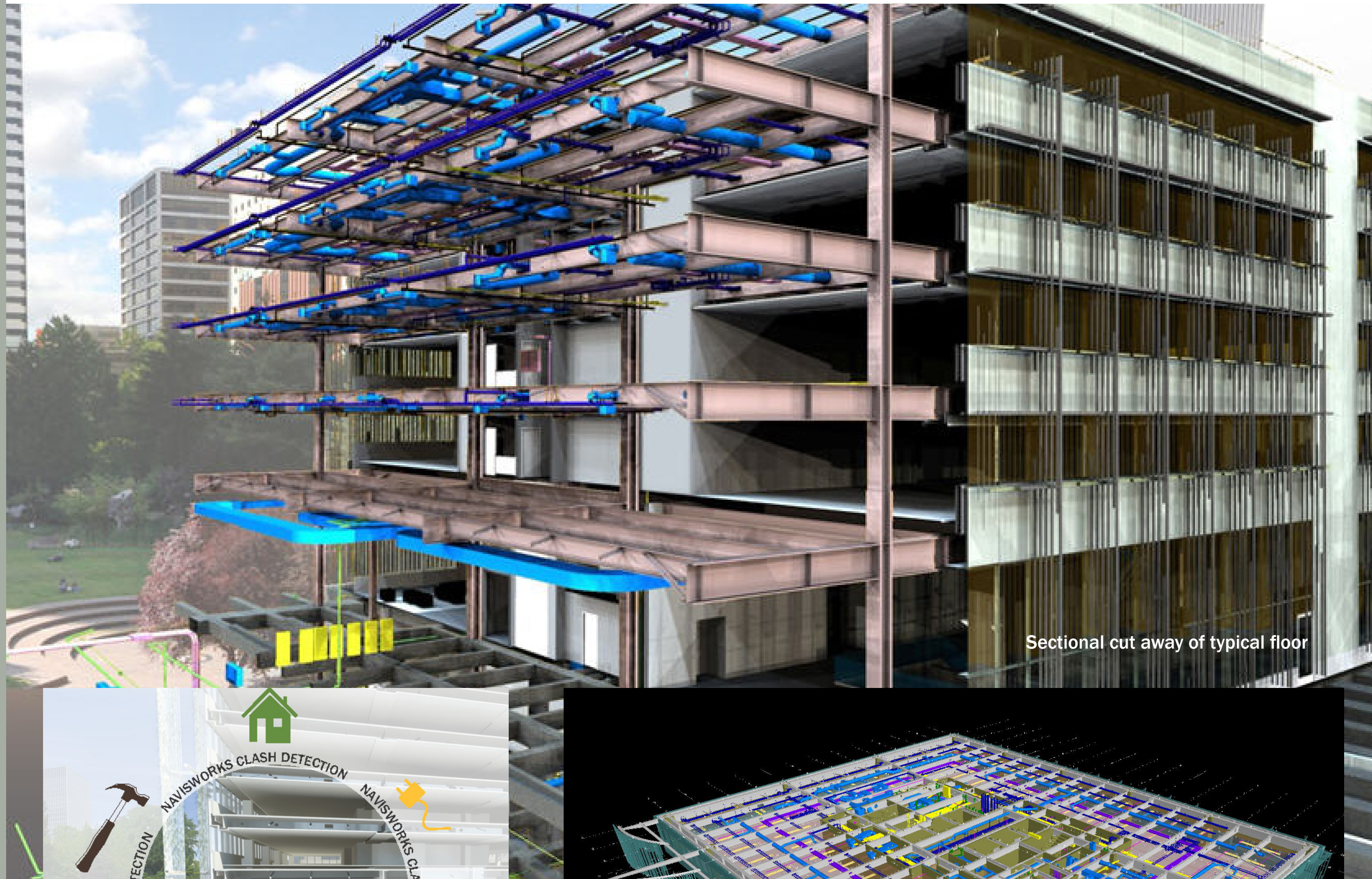
DESIGN SUPPORT AND BIM BENEFITS

In soliciting the design contract, GSA made it clear they expected the investment in BIM tools to provide significant benefits to the project. Initial goals included developing:

- A design with lower overall costs than estimated
- Better sharing and collaboration of information
- Enhanced quality control
- Validation of contractor take-offs
- More and clearer information for use with tenant agencies and project stakeholders
- Reduction in redundancy in modeled information
- Models as collaborative tools used for problem solving.
- Accelerated learning by junior and new team members as the team size adjusted to meet the project needs

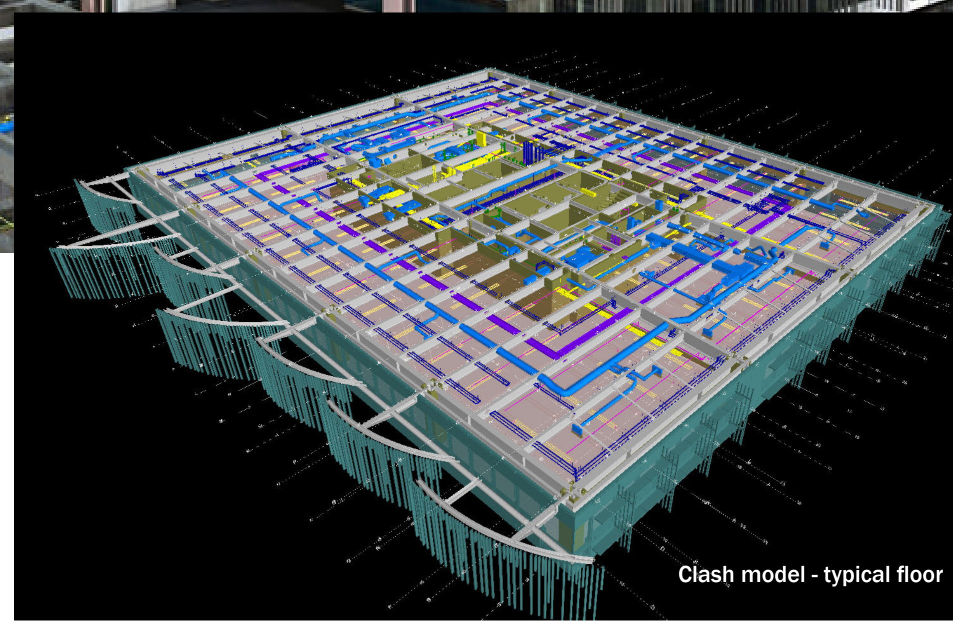
The project team has been able to meet the goals outlined by GSA while maintaining the project schedule, project budget and making adjustments to meet the challenges posed by working with an existing structure.

By using an integrated project delivery process, co-location and an optimized and integrated BIM delivery, the design and construction teams were able to not only able to start construction early, but get systems designs developed for the project to be on track to achieve LEED Platinum.



Sectional cut away of typical floor

6 REVIT MODELS, 2 CAD DISCIPLINES
OVER 30 SOFTWARE PROGRAMS
28 ARCHITECTS, ENGINEERS AND MODELERS



Clash model - typical floor

CLASHING EFFICACY

Tracking the efficacy of clashing was an important process used by the design team to evaluate the software package and its impact on the design of each system and the associated coordination efforts.

The model complexity increased continually over the course of the project, as indicated in the gray line in the graph. The orange line indicates the clash rate, denominated as the number of clashes discovered per object in the model. This number was initially high, as the systems were initially uncoordinated. The clash rate dropped over the first five weeks as the preliminary coordination issues were resolved.

The rate rose again at this point as the major subcontractors' designs were developed and incorporated into the coordination effort. This continued to rise as the system designs became larger and more complex, peaking around Week 15, about halfway through the design process.

As the various systems' designs matured, the clash rate once again began to decrease, dropping to almost negligible levels by the end of the design cycle.

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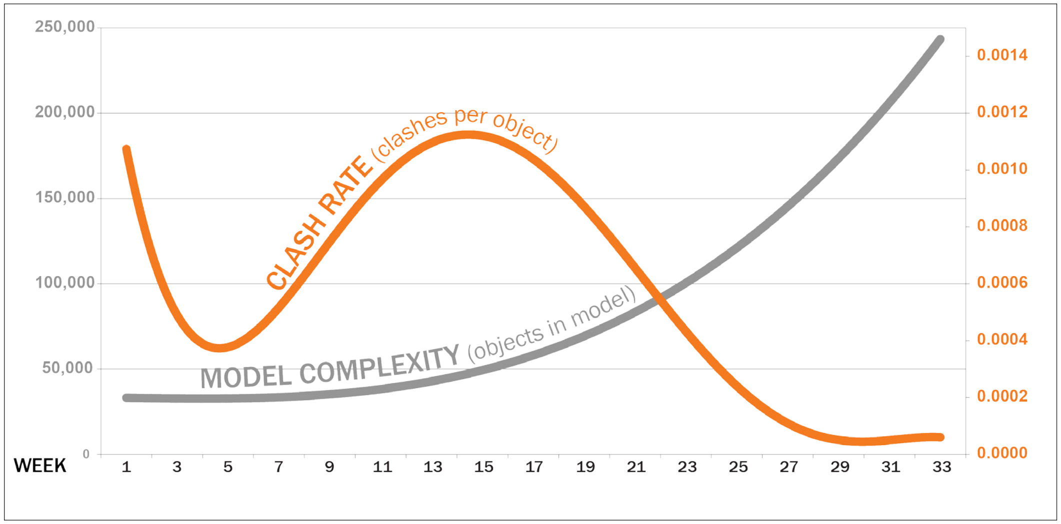
DESIGN-SIDE CLASH ANALYSIS

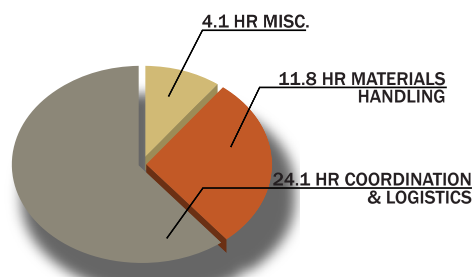
CONTINUOUS IMPROVEMENT: As Model Complexity Increases, Number of Clashes Decreases



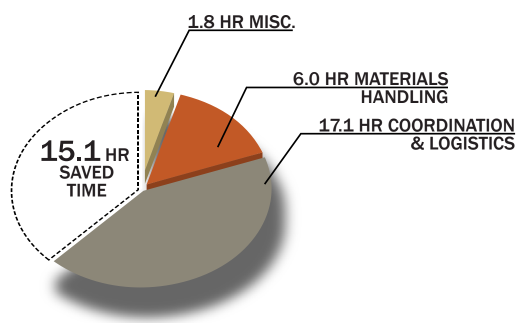

Model of plumbing wall

TIME & COST SAVINGS THROUGH PREFABRICATION

MECHANICAL SYSTEMS "MODULAR SKIDS" PREFAB METHOD



ON-SITE FAB. HOURS IN 40-HR WEEK



EQUIVALENT USING PRE-FAB METHODS

38% REDUCTION IN FABRICATION TIME


Fixture skid lift to floor


Fixture skid installed

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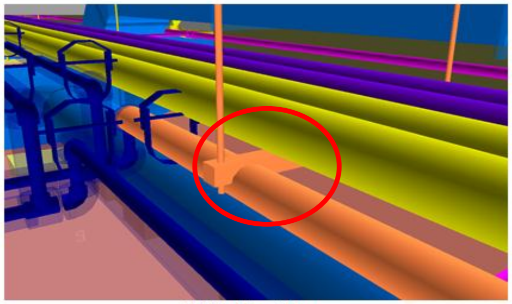
CLASH PROCESS

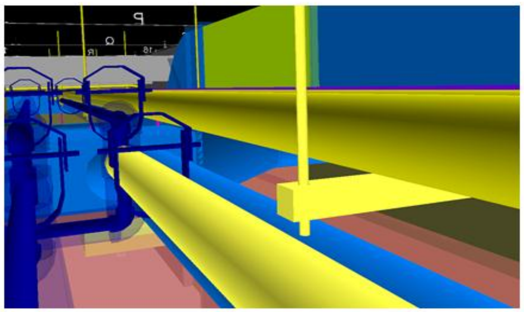
Clashing has been a central effort to the project delivery and has influenced every decision on the EGWW Modernization Project from schedule to sequence.

At this point in the project, there has been zero rework required due to issues with clashing model elements that were not coordinated. Changes have been limited to issues related to differences in the existing structure that were unforeseeable or scope revisions. In order to get an estimation of how the process was influencing the budget of the project and understand the benefits of clashing, numerous examples of 'typical' clashes common on non-BIM projects have been estimated to see the potential problems avoided.

When compared to the costs associated with rework, material changes and project delays, the savings are significant relative to the minimal cost of the software and the computers needed to run it. These metrics have allowed the owner to more fully understand the potential for BIM in project execution.



Original Condition



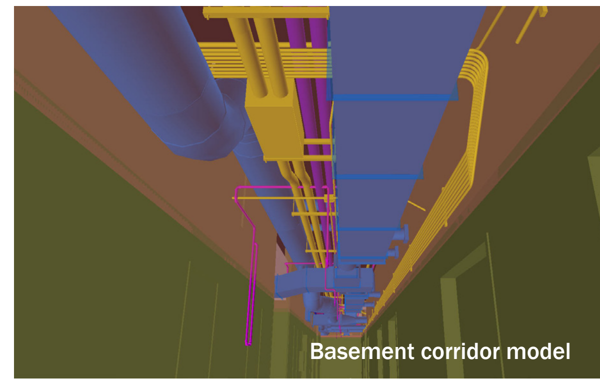
Resolved Condition

Clash Date:	11/9/2010
Design Phase:	90% CDs
Building Level:	B1
Clash Batch:	Elec vs Mech
Clash Number:	300
Resolution Date:	11/16/2010
ADMINISTRATIVE COST:	$750
ARCH DESIGN COST:	$0
GC COST:	$0
TRADE COSTS	
MECH:	$560
ELEC:	$7400
PLUMBING:	$0
FIRE PROT	$0
STRUCTURE:	$0
DELAY COSTS:	$0
TOTAL COSTS:	**$8710**
Design resolution time:	1 days
Construction resolution time:	6 days

PERFORMING SYSTEMS
COORDINATION WITH CLASH SOFTWARE PROVIDED

~300%

RETURN ON INVESTMENT



Basement corridor model

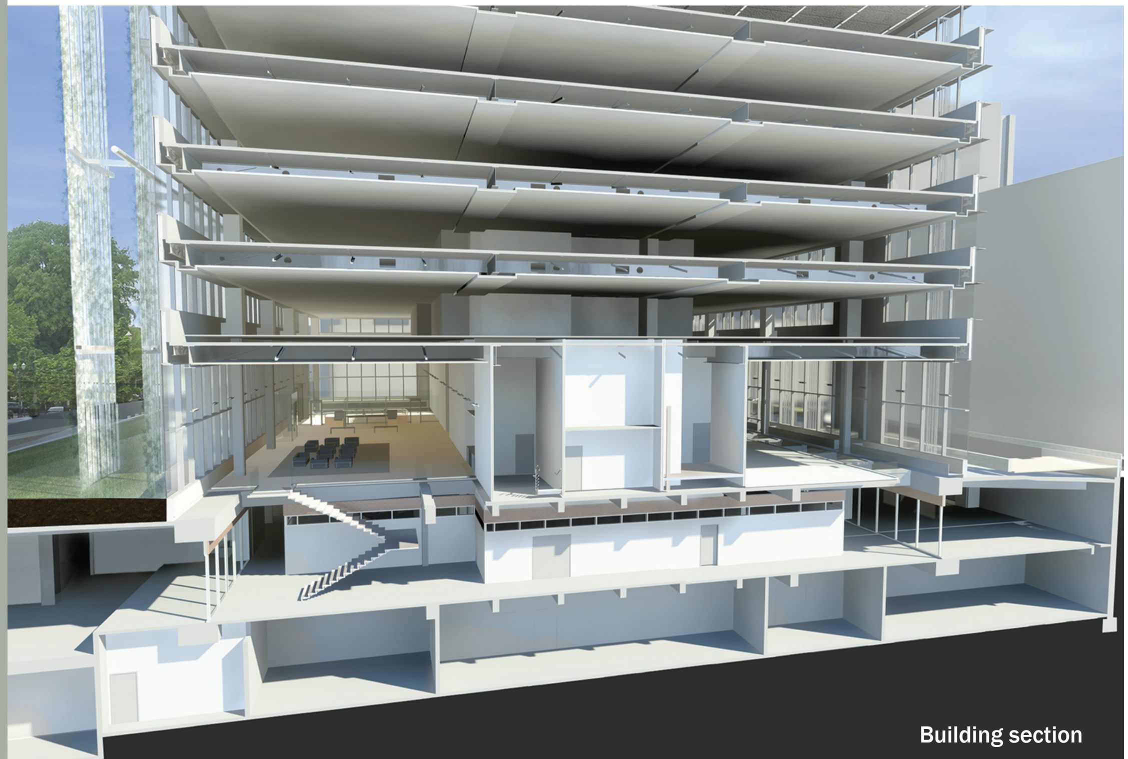
Penthouse level ductwork installation and material staging

Basement corridor installed

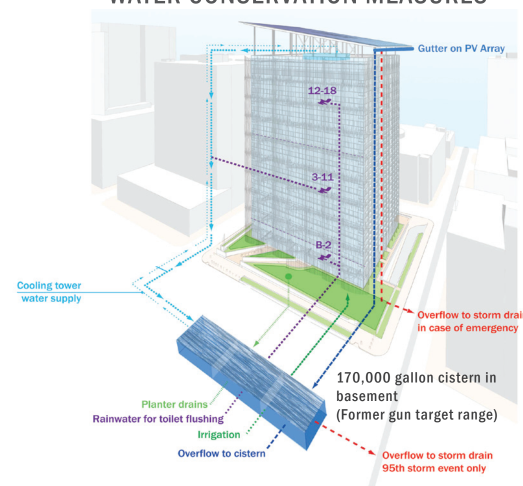
BIM VISUALIZATION

For the EGWW Modernization Project, the number of stakeholders is significant and the design full of nuance. Finding a common platform for conveying information, a typical problem for any projects, has been a minimal challenge for the EGWW team.

With the use of clash software to find and resolve coordination issues, quick renderings for impromptu design discussions, or manipulation of the live model during meetings, BIM expressions have been an incredible tool for conveying information quickly and allowing unique instances of collaboration to occur which are not provided with other design tools.


Building section

RAINWATER REUSE SYSTEM
WATER CONSERVATION MEASURES



Design coordination with design architect


Ground level tenant space

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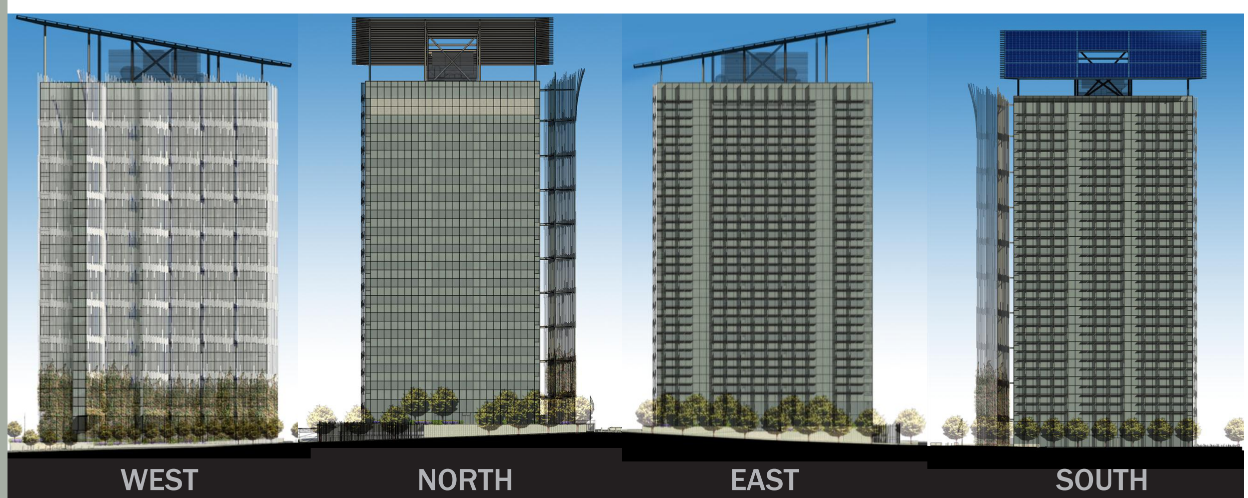
ENVELOPE

In a collaborative environment utilizing BIM tools, a different methodology for partnering has developed for the EGWW project team. Great ideas have the ability to be quickly implemented, revisions expedited, and a level of trust not found in many projects is earned between team members.

While one of many examples, the development of the envelope design exemplifies the power of how using a BIM tool can gain the trust of a major manufacturer and influence the way they deliver a project. With each facade tuned to its solar orientation, the BIM models allowed the architect and contractor to minimize the number of design questions and resolve technical issues quickly, efficiently, and with dramatic results.

Prior to EGWW, the curtain wall subcontractor did not use any BIM software for their project delivery. With the assistance of the Executive Architect firm for EGWW, this contractor is now working with BIM software to do their first generation shop drawings and is exploring the expanding use of other modeling software in their work process.


View from below the West reeds



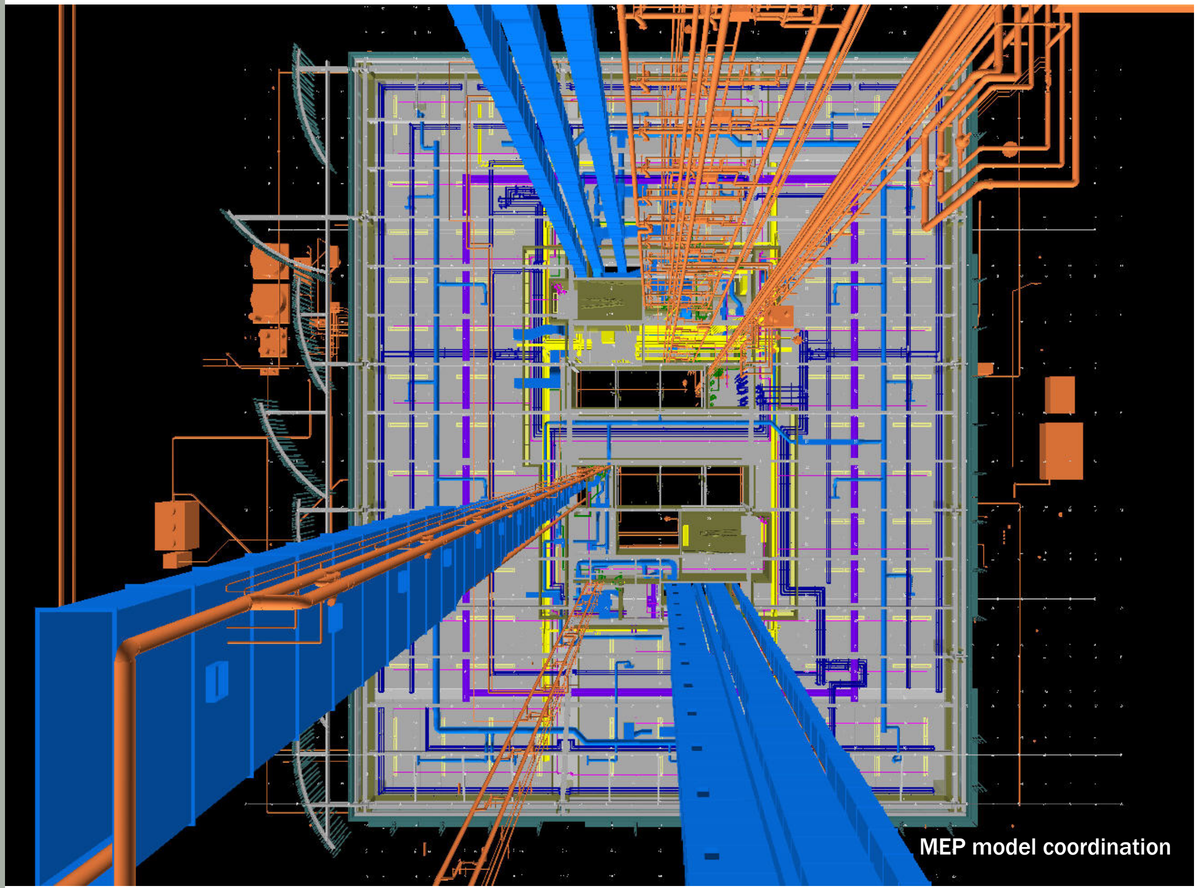

Reed installation

CONSTRUCTION COMPLETION AND THE EGWW FUTURE

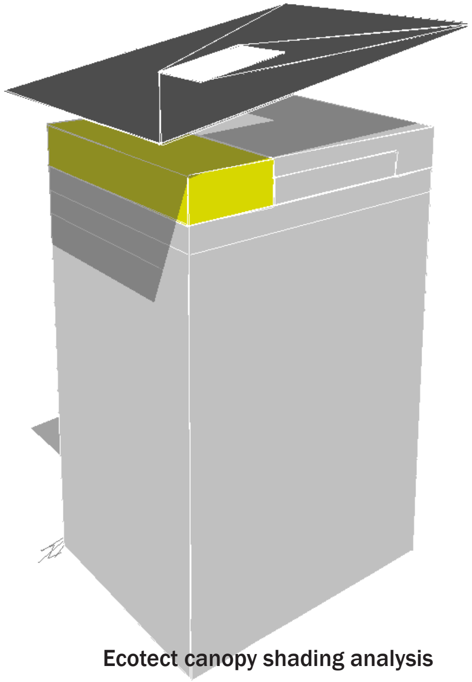
As the EGWW project continues construction, final installation of the building's infrastructure continues with several major design elements, most notably the solar canopy and lower level lobby remaining to be completed.

In addition, the tenant space build-outs must be completed before the building is occupied. It is at this juncture that many members on the project team are transitioning from utilizing the BIM model as a construction tool to finding ways to use the models, and the wealth of information imbedded in them, as operations and maintenance tools.

It is in this transition from construction to operations that the team expects to see the expectations for a high performance green building realized and further efficiencies and process improvements developed for the next chapter in the story of the Edith Green Wendell Wyatt Federal Building.



MEP model coordination



Ecotect canopy shading analysis

Ground level lobby

Plaza level building entry