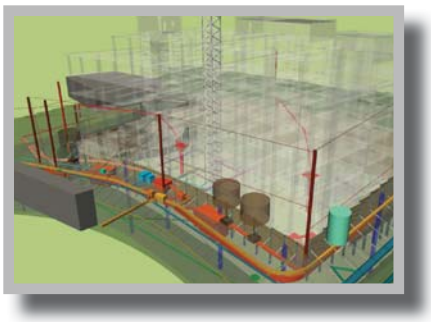
Case**Study**

Virtual Design & Construction: Innovative Project Solutions



Benjamin D. Hall Interdisciplinary Research Building – University of Washington
Seattle, Washington

The project is a 151,000-sq-ft structure to be used primarily as a laboratory/office facility which can accommodate tenants of practically any size (from 500 to 50,000-sq-ft). Nearly any research need, from dry labs or wet labs to vivariums and vibration-sensitive research can be managed. All building systems were designed to allow tenants the flexibility of choosing research spaces that fit their needs.

CHALLENGES AND SOLUTIONS

Challenge: The University of Washington needed to design and build a lab facility to accommodate numerous science initiatives that didn't fit into the traditional university environment. They wanted to deliver the building more quickly and cost effectively than usual, with a 30-year fixed cost of operations.

Solution: A close-knit, collaborative and interdisciplinary team that used BIM to its full advantage (most importantly, by fostering communication). The BIM model allowed for design, planning and construction of the following elements: general conditions; civil/site; landscape; structural; architectural; HVAC/sheet metal; MEP; fire protection; telecom; fixtures and equipment.

Challenge: A 3D model is great for coordination in the office, but translating it into actionable, real-life steps in the field is another thing.

Solution: With a fully coordinated BIM model, the team developed techniques to communicate it to the craftworkers in the field. These techniques included extracting shop drawings from the model, developing "concrete lift drawings" to provide field crews with clear instructions for concrete formwork and layout of decks, and translating model coordinates directly to survey equipment (translating X, Y, and Z coordinates from the BIM to northing, easting, and elevation points) enabled direct, paperless use of 3D BIM data in the field to layout sleeves and embeds in the concrete.

Challenge: The DBOM team was tasked with building a facility that would be cost-effective to operate and maintain for 30 years – and incorporate sustainable practices.

Project Type:

Education / Research Facility

Delivery method:

Design-Build-Operate-Maintain

Key Participants:

Design Builder:

Mortenson Construction

Architect/Engineer:

CollinsWoerman

Solution: Utilizing the latest research, the team was able to incorporate the following features into the structure: 1) energy savings alone are predicted to be $220,000 the first year as compared with standard buildings of this size and use; 2) During construction, 93 percent of construction waste was diverted from the landfill; 3) About 23 percent of the total construction cost was spent on recycled materials; 4) Underground parking eliminates the "heat island" effect cause by surface parking. The parking area gives preference to carpools; 5) To encourage bicycle commuting, the building has secure bicycle storage and shower/changing facilities; 6) The selection of low-water-use and native plants will reduce landscape watering by 43 percent; 9) Energy-efficient plumbing will reduce interior water use by 38 percent; 10) Heat-energy recovery of general exhaust air, energy-efficient lighting systems and light controls, and variable-frequency drives and fans should result in a 30 percent reduction in energy costs.

Challenge: Budget, schedule and quality considerations drove the team to attempt to have as many systems as possible prefabricated in subcontractor shops.

Solution: With a fully coordinated model, the team was able to isolate and analyze any scope or area of the building in detail. They then refined the design to allow for prefabrication and assembly of complex building systems and components offsite. Prefabricated components included rooftop mechanical equipment, multi-trade corridor pipe racks, plumbing carriers, framed wet-walls between toilet rooms, and entire electrical closets. This level of prefabrication would not have been possible without BIM – and it had the side benefits of reducing field labor and construction time.

Challenge: Given the operate-maintain portion of the delivery method, a high degree of importance was placed on making those elements as efficient as possible over the course of the 30-year contract.

Solution: During construction, all revisions to the work were documented in real time in the model, developing a 3D as-built record of the project (both core and shell). The team continued to use and update this as-built model when inserting new tenant improvement work into the facility. With an accurate model supporting 30 years of operations and maintenance, BIM was a valuable factor in the total cost of ownership of the facility, which is 26% below the owner's proforma.

Results:

- The project received the following recognition: Design-Build Institute of America (DBIA) National Design-Build Award; Northwest Construction Consumer Council Distinguished Project Award; the AIA award for "Design / Delivery Process Innovation Using BIM"; and became the first Design-Build-Operate-Maintain laboratory facility in the U.S.
- The building earned Gold LEED® CS Pilot Certification by the USGBC – becoming the first building on the West Coast, the second in higher education, and the 11th in the U.S. to receive this level of certification.
- The DBOM team proposed a project with a tight floor-to-floor height (allowing for an extra floor in the building) – this provided 14% more leasable floor area than was requested – made possible only by the use of BIM.
- With the help of 4D simulation, the project was completed 40% faster than the owner's traditional delivery schedule.
- Using BIM, over 1,500 systems conflicts were discovered/resolved before they became problems in the field. This collaborative effort resulted in an 80 percent reduction in RFIs per dollar of construction compared to non-BIM projects.
- The project was delivered on time and on schedule.