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This project sought to dramatically change the closed-door corporate layout of the existing facility into a dynamic free flowing work space that fosters collaboration, fitting with the cutting edge research and collaborative working culture of the client’s organization. The main design intent was to create open office and lab areas, highlight the lab support and core labs functions, and create inviting collaborative zones.

The use of BIM allowed the design team to rapidly adapt to the changing program needs of the client while maintaining the design intent. Renderings, axonometric floor plans, and diagrams produced from the model were utilized for design visualization and communication throughout the design of the project. Custom families developed for this project aided in the coordination of complex building components such as lab equipment and a complex decorative light layout.

To accomplish this major transformation, meet aggressive sustainability goals, and adapt the design to the evolving program needs required a highly collaborative team. The design team was an important part of the overall project team that achieved the vision for the tenant improvement. The knowledge and innovative thinking the design team brought to the project complemented the client’s knowledge and expertise centered on science and technology.
CONTRACTOR’S STATEMENT

By using BIM for the planning, design, construction, and operations of this project, the entire team enjoyed increased communication, understanding, and confidence.

We have a strong, collaborative relationship with both the designer and owner. Moreover, leveraging BIM in nearly every aspect of the project empowered us to effectively and broadly partner with all project stakeholders and suppliers, enabling sharing of information and ideas rapidly and extensively. At the heart of this enhanced collaboration with BIM was the free exchange of model source data between parties to ensure the most accurate, reliable documentation of design intent. This enabled us to deliver the project on budget while preserving design intent, and meet an accelerated delivery date in an already aggressive project schedule.

The collaborative nature of the team also fostered innovation throughout the project. We leveraged the team’s BIM standards, and evolved them to support new processes and introduce new tools to deliver the project. By integrating BIM with our site-specific safety plan, using Augmented Reality on the project site, calculating quantities to support LEED documentation, and handing over an as-built model to support facility operations and maintenance, the team readily embraced innovative processes and tools across the entire project life cycle.
One of our major goals was to leverage BIM to generate and manage building life cycle data from design, through construction, and into facilities management. With a collaborative project team, we made innovative use of BIM to mitigate problems, increase efficiency, and ultimately deliver a successful and higher quality facility for less cost.

During design, the team developed the model to provide a real-time, 3-D walkthrough of the project, which was presented to over 300 staff at a company retreat. Although the design was well into development, this walkthrough provided the project team with additional information needed to make construction more efficient and eliminate uncertainties before starting the construction process.

During construction, we needed to accelerate the completion of the facility by a month in order to start up the vivarium on time. The contractor detailed the architect’s design model to develop a virtual mockup of the cage rack washer and surrounding assemblies, resolving and eliminating ambiguity in the details. BIM enabled us to make decisions rapidly, accurately, and confidently.

The contractor developed a hand-over model, currently used by our field engineers to support ongoing operations and maintenance, and we are working towards integrating it with a facilities management system.

BIM ENABLED US TO MAKE DECISIONS RAPIDLY, ACCURATELY, AND CONFIDENTLY
THE TEAM READILY EMBRACED INNOVATIVE PROCESSES AND TOOLS ACROSS THE ENTIRE PROJECT LIFE CYCLE

INFORMATION EXCHANGES

THROUGHOUT THE ENTIRE PROJECT THE BIM WAS UPDATED CONTINUOUSLY BY THE PROJECT TEAM
THROUGH THE USE OF BIM, THE DESIGN TEAM WAS ABLE TO QUICKLY GENERATE DESIGN OPTIONS FOR THE CLIENT, WHICH SAVED TIME AND MINIMIZED DELAYS TO THE SCHEDULE.
2 SYSTEM COORDINATION

It was important to coordinate the MEP systems before and during construction to better manage the complex nature of the lab TI project. Further complicating the process, existing mechanical and electrical systems had to be shared with another tenant during demolition and construction.

The project team was able to detect and resolve nearly 2000 model clashes before construction started. Subcontractors and the design team met on-site for a series of intense and thorough coordination meetings, which translated into a direct reduction in the total number of RFI’s issued during construction, saving the project both time and money.

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During the middle of an aggressive schedule, the stained concrete scope had yet to be finalized by the owner. The contractor utilized the design model to quickly and accurately quantify and estimate the scope of work during successive design iterations. With the use of material schedules and custom floor plan views, we were able to turn over estimate options to the client in half the time it would have taken to do this traditionally.

The team has pursued (and anticipates achieving) LEED Platinum, an unusual and ambitious certification for a laboratory TI project. As such, every LEED credit was critical, including the “Building Reuse – Maintain Interior Nonstructural Components” credit. It required significant reuse of existing non-shell, non-structural components, and entailed intensive backup documentation accounting for the surface area of all wall partitions, casework, floors, and ceilings.

The contractor used phases and filters to develop custom 3-D views of the design model corresponding to the LEED phase categories, and generated custom schedules from those views. These schedules were exported to a spreadsheet, where the surface areas were calculated and summarized for LEED backup documentation. Screen-shots of the 3-D views were also used as documentation.

By relying on BIM to quantify the materials reused, the team accurately accomplished the LEED documentation in two hours, what would have otherwise taken days or weeks to measure and document manually.

### LEED DOCUMENTATION

The team used phases and filters to develop custom 3-D views of the design model corresponding to the LEED phase categories, and generated custom schedules from those views. These schedules were exported to a spreadsheet, where the surface areas were calculated and summarized for LEED backup documentation. Screen-shots of the 3-D views were also used as documentation.

By relying on BIM to quantify the materials reused, the team accurately accomplished the LEED documentation in two hours, what would have otherwise taken days or weeks to measure and document manually.
Many of the subcontractors’ shop drawings were drawn and reviewed in 3-D, enabling the design team to review models to efficiently make comments and redlines. In the case of the millwork shop drawings, modeling the details helped cut the review process time by as much as 50%.

The steel fabricators used a detailing program which offered the highest level of automation available in 3-D steel detailing with unparalleled connection design intelligence and high-quality drawing production abilities. The details, submaterial, and erection drawings were automatically generated from the 3-D model, saving time on shop drawings.

MODELING THE DETAILS HELPED CUT THE REVIEW PROCESS TIME BY AS MUCH AS 50%
Based on 2-D details from the architect, the contractor used 3-D modeling tools to recreate the clean and soiled cage rack washer rooms. This model was used as a collaboration tool to help clarify design intent. The 3-D visualization of the model was deemed to be an effective way to communicate with the architect and end user. We were able to finalize unresolved material transitions that occurred within the design and develop construction details, which accelerated decision-making and kept construction moving forward.
The architect developed a parametric family that allowed special “light-saber” fixtures to be individually oriented in plan and elevation, and set at different heights. This model was used for analysis to ensure fixtures would not collide with one another during a seismic event. Various colored diagrams were developed to coordinate with the entire project team on the placement of this complex light layout. These layout drawings were used as a precise field communication tool for the electricians.

During the construction phase, the owner decided the vivarium needed to be turned over one month sooner than originally planned. To achieve this accelerated schedule, the contractor utilized BIM for generating custom wall, ceiling, and lighting layout drawings. The layout time was cut by 75% because information went directly from the model to the field. Without this capability, the team could not have met the clients required completion date.
The project team used 4-D visualization during construction to help determine trade sequencing and maintain quality control of a complex set of architectural feature stairs. We coordinated the detailing of the stairs by integrating models from the subcontractors and detailers with the background design model. The complex nature of the stairs and its immediate context required unorthodox sequencing, in which field welds had to take place directly adjacent to already-installed feature glass.

This led to an intense study of the means and methods to solve the problem. We used 4-D visualization to study, optimize, and communicate the sequencing of the work with the detailers and labor crews. By relying on 4-D, the project team performed the necessary layout and installation flawlessly and on schedule.
WE MITIGATED THE RISK AND EXECUTED FLAWLESSLY USING AR AS A TOOL TO GET THE RICHEST SET OF BIM DATA IN THE HANDS OF THE PEOPLE WHO NEEDED IT MOST.
QUALITY CONTROL

Field management software was utilized at the job site to increase the efficiency of quality control, safety audits, completion lists, and punch lists. This on-line software application was taken into the field by crews with tablet computers loaded with corresponding models and drawings. We coordinated with key subcontractors to ensure foremen managed issues using the online project server. In addition, the project architect partnered with the contractor to electronically manage the punch list using the same tools. The implementation of BIM and field management software on tablet computers allowed us to identify more quality issues than ever before on a project, and resolve them faster.

SAFETY

BIM assisted the team in understanding and communicating safety issues as well. The contractor used the design background model to plan and emphasize areas of concern in the site-specific safety plan. Illustrations generated from the safety model were used at safety orientations for all project team members to more effectively communicate site-specific hazards. This innovative use of BIM in construction proved valuable to the team to safely plan potentially hazardous work on the roof of the building, and contributed to a project free from injuries.
Throughout the entire project the BIM was updated continuously by the project team. In addition, all subcontractors submitted finalized as-built models of their respective scopes. This provided us a great opportunity to compile an accurate and complete model for the end user. This visual aid assisted the owners’ facility management team in being able to quickly and effectively understand their building inside and out.
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