ACE Awards 2017

Category 10. Best Building Project – General Contractor ($40-$70mil)

General Contractor – GH Phipps Construction Company

Project Name – University of Denver Engineering & Computer Science Building

Old-School Building Type Meets Today's Innovation

For more than a decade, the University of Denver (DU) has commissioned buildings that are decidedly "old school." These structures rely on masonry, limestone, copper, cast-in-place concrete, and other traditional materials that allow the school to predict with certainty that these buildings will stand for centuries.

The new 130,000-square-foot, 5-story Engineering and Computer Science Building is no exception. But what goes on inside this formidable building is all about today: The Engineering and Computer Science Building houses the *Daniel Felix Ritchie School of Engineering and Computer Science and the Knoebel Institute for Healthy Aging*. The project is part of the university's Science, Technology, Engineering and Mathematics (STEM) initiative. Even the building's waterscape/landscape, called STEM Green, serves as a graceful front yard for the building, while offering pathways that form connections to the rest of the campus. The new building features two wings with a central atrium topped by a silver-hued copper dome with skylights, and a rooftop terrace. Common spaces, break-out areas, laboratories (including a vivarium), and classrooms were designed to foster collaboration and integrate science, engineering and social sciences. A café is located on the first floor, along with an Innovation Lab and Maker Space.

Numerous elements make this an ACE worthy project: the projects old-school structure, unique spiral steel dome, center of campus location, tight site, custom highly efficient mechanical system, aggressive schedule complicated by additional donor dollars/scope added late in construction and deep excavation shored against buildings 15' away.

Project Execution and Teamwork

The challenges on this project involved disparate concerns, all of them met by dedicated teamwork.

Method of construction: Though innovations are woven through this project, the main construction methods used were "old school." Exterior structural brick walls are the final interior surface. A significant portion of the wiring runs as well as rebar had to be installed within the voids of individual structural brick. The coordination effort between masons and electricians to meet this task was monumental. As masons constructed the brick walls (including rebar), electricians threaded conduit and wiring into the brick voids. This tedious process demanded strict coordination and cooperation between trades as the walls went up to accommodate devices such as outlets, lighting fixtures, switches and telecom connections. The brick wall had to remain clean – no notes jotted on these walls – and undamaged during construction.

Concrete work: Concrete is an element throughout the building, but required special precision when it reached the support system for the dome at the very top. The building was constructed layer-by-layer with load-bearing masonry supporting concrete structural decks.

The slabs had over 3,000 pans utilized for the joist and beam structure system, with 1,500 embeds and openings placed with precision by utilizing BIM modeling and placement. There were zero miscalculations in the forming of the structure. Additionally, as a sole source of support for the massive dome ring-beam, the architectural columns required 5,000 psi and associated embeds throughout the rotunda. Placement and pours were completed on a cold December morning to enable a crane to position the dome exactly on the ring beam.

Innovations

The dome structural support and design: The dome demonstrates a twist of a classic with "function follows form." While traditional dome structures have segmented steel that meet uniformly at the crown, this dome takes each steel member and twists it off-center. The elegant crown becomes a skylight with layout and complexity unparalleled: some 600 unique custom-cut beams, plus wood strips, all covered with copper shingles. These beams were formed into spirals that spread across the roof, forming an aesthetically pleasing pattern inside the dome while supporting the entire structure. Each steel beam was slowly bent and twisted, over and over again, to achieve the correct curve/angle for it to fit in its place. The placement of the linear wood ceiling proved efficient in insulating the dome and in creating superior acoustics.

Concrete rose to the top: The concrete columns throughout are exposed, and the precision of layout for their orientation was critical to hold the 60,000lb steel dome structure. The massive dome sits on top of the 5th-story ring beam to support the dome. Fluting was added to the top of the columns for aesthetic quality. To facilitate the aggressive schedule and promote safety, the dome was constructed on grade and lifted, by crane, into place.

A total of 7,900cy of concrete were poured during the construction; 400cy was dedicated to the project's ring beam and architectural columns. Over 3,500cy were poured for the 4 levels of structural decks.

Budget and schedule: The delivery method was hard bid, setting a firm price. However, during construction, the owner elected to finish previously shelled areas into the final building. This decision was made late in the project and required extensive adjustments to complete as planned for the fall semester occupancy. In the end, the quality exceeded expectations. The project ended on-time and on-budget – with more space completed.

Environmental/Safety

The project included many green sustainable features. The highlight is a pioneering high-efficiency (95%) heat recovery system. Here's where "new school" comes in. The project included an energy-efficient Konvekta heat recovery system in the lower level, which required an opening larger than was provided by the design plans and which had a lead time of 7-8 months from order to delivery. The ability to get the enormous equipment into its space required substantial planning that included structural modifications for access. But the extra cost of the system will save money over time – especially important for a building housing energy-hungry labs. The heat recovery system uniquely recovers both heat and cool air concurrently, providing a more stable atmosphere as setting changes are managed automatically. Although the client did not apply for LEED certification, the building was designed to LEED standards. The heat recovery system contributed to that status.

Safety awareness is heightened at DU's densely occupied year-round campus. Although the site of the Engineering and Computer Sciences Building claimed 2 acres of land, there was little open space around the structure and STEM garden, in terms of lay down areas, trailers and facilities for workers.

GH Phipps develops site-specific safety plans for all projects, and the one for this project is especially detailed. On the inside front cover is a drawing of the job site so all workers (including subcontractors, suppliers and vendors) were aware of the detailed site boundaries; at the end of the booklet, is a list of I DU's Construction Rules of Conduct, which cover everything from the requirement to stay within the job site limits, to designated parking areas.

On the pages in between, the information contains basic rules to keep everyone safe. Specific precautions were put in place. For example, during the muddy winter/spring season, it was decided not to use gravel to avoid slipping on work paths. Instead, strips of landscape weed barrier were laid down to keep the mud under control; easily washable from day to day, the material helped prevent slips and falls.

As well as protecting workers and others on campus, it was necessary to work around historic oak trees in an adjacent arboretum area and nearby occupied apartments; noise ordinances also were enforced.

After 60,000 hours by GH Phipps personnel there were no lost time accidents.

Excellence in Client Service and/or Contribution to Community

The building's design is clear in its architectural – and practical -- intent: collaboration, clearly understood organization, and connections, as expressed by AndersonMasonDale Architects.

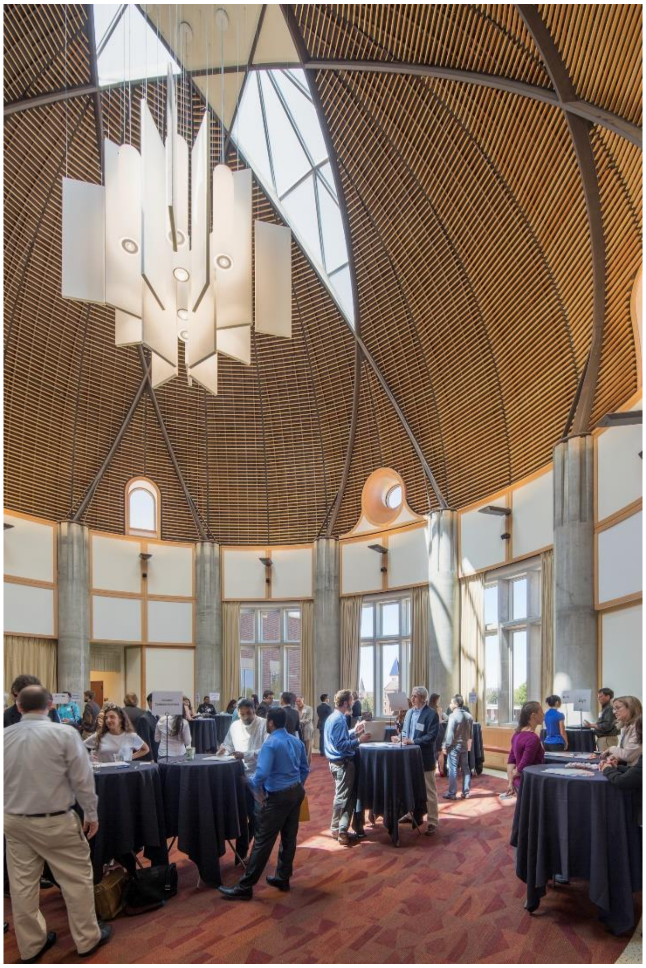
Gateway: The building is the threshold between the predominantly undergraduate and graduate precincts of campus, acting as a gateway. Visitors to the building and those simply passing through have views into labs and shop spaces so the excitement of the work in the building is palpable to all. A new café acts as a magnet, encouraging students to use the building to cross from one portion of the campus to another.

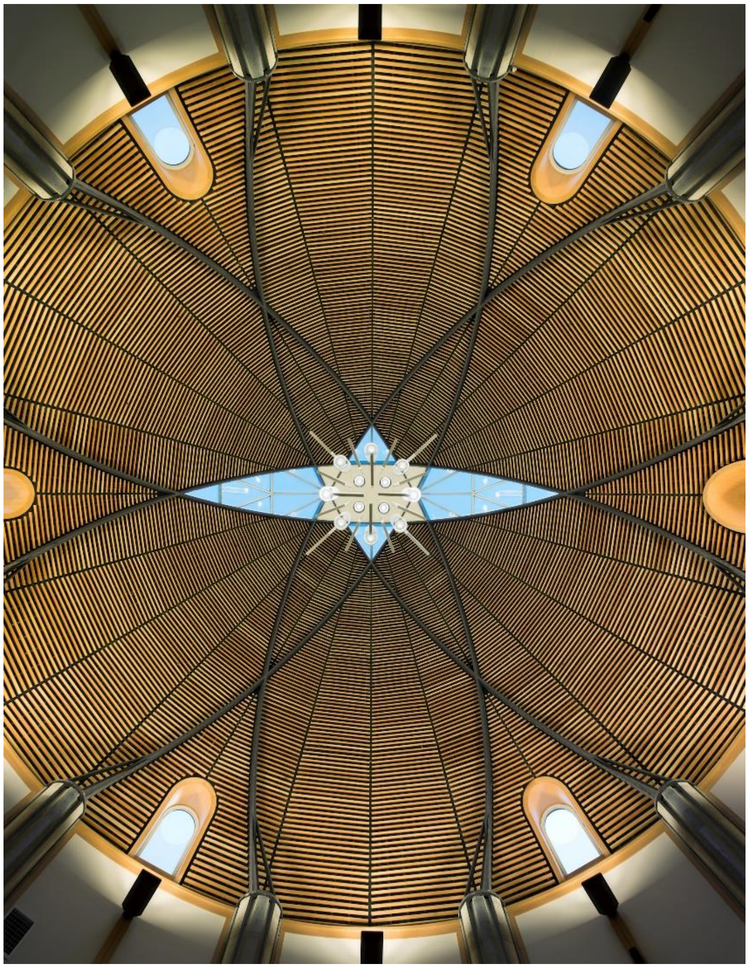
Building Organization / Enhanced Collaboration: The project is organized roughly as an H-shape, with offices in one bar, labs in a parallel bar and a link between the two. This organization is optimal from an energy-efficiency standpoint, since the mechanically intensive lab spaces are consolidated.

The facility consolidates related disciplines formerly housed in five scattered buildings, maximizing the potential for collaboration and cross-pollination between disciplines. In the "link" area of the building, connecting stairs, floor openings with connecting views, and group work rooms amplify the opportunities for the building's inhabitants to work together.

Campus Meeting Place: Located under a dome, the top floor is a meeting room for the campus community. It provides the university with an impactful yet flexible space that is typically set up as a study lounge, but can be configured for high-profile campus events, from symposia to banquets.

The building's old school heft and power will certainly last centuries while the ACE-worthy techniques to deliver the transformative building met the test and lifts the DU Campus to new heights of instruction and collaboration.



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