UT's New Hackerman Experimental Science Building Inspires Teamwork

By Michael Brack, P.E.

The $115M Norman Hackerman Experimental Science Building sets a new standard for design on the UT Austin campus. Courtesy of Tom Bonner, 2011.

The University of Texas first opened its doors in 1883, having been granted 40 acres of land just north of the state capitol in what was then the tiny town of Austin. Since then, the main campus has expanded to over 400 acres, but Austin has grown up around it. As a result, this campus of 50,000+ students is landlocked.

With space at a premium, UT has had to make tough choices about how to handle aging and obsolete facilities. As a result, Datum Gojer Engineers had the rare opportunity to design a new building to replace the old Experimental Science Building originally designed by Datum's founder in the 1950s.

The structural bones of the old Experimental Science Building (ESB), where many current Datum employees had classes when in school at UT, were in good shape. But the mechanical systems had largely failed, causing large portions of the building to be abandoned in its final years, and the 12-foot floor-to-floor heights would not accommodate new systems. On top of this, the 20- by 27-foot bays were very inefficient for modern laboratory layout, making reuse of the 200,000 square foot building on this land-starved campus a non-starter.

The owner selected Los Angeles-based CO Architects, along with the Austin firm Taniguchi Architects, to lead the design team. The Austin office of The Beck Group was selected as the Construction Manager at the outset of the project. Together, with Datum Gojer Engineers (structural), this team would tackle a myriad of challenges along the road to completing the project.

The end result is the eight-story, 294,000-square-foot, $115 million Norman Hackerman Building, home to organic chemistry research labs, neuroscience research labs, teaching labs, an auditorium, the Imaging Resource Center, a Nuclear Magnetic Resonance suite, and a vivarium for keeping and raising animals or plants for observation or research.

The old Experimental Science Building, while handsome, had become obsolete, inefficient, and expensive to retrofit.

The building is 500 feet long and 88 feet wide, filling the site of the old ESB and then some. To keep the interior from feeling like a long tunnel, the architects organized the facility into thirds, with atrium/mixing spaces at the third points.

The 88-foot width allows for a 31-foot lab bay, a 33-foot lab prep bay, and a 22-foot office/corridor bay. In the long direction, an 11-foot lab module is carried the entire length of the building.

Structural System Selection

Vibration performance of this building would be critically important, and UT Austin has had struggles with the performance of some of its

The story-height penthouse trusses cantilever up to 33 feet to overhang the expansion joint.

The setback at the west entry afforded an opportunity to conceal the expansion joint in a re-entrant corner.

buildings over the last decade. At the outset of the project, Datum Gojer engineers met with the owner, the users, and other consultants to establish the criteria for the building design. Labs had typically been limited to 2000 micro-inches per second (VC-A) in the past, although some buildings were not performing up to this level. Based on research and input from consultants, UT decided to design this building to a 300 micro-inch peak-to-peak total vibratory motion criterion. Based on apples-to-apples comparisons, this results in about a 40% decrease in velocity.

The engineers worked through several structural framing options with the design team and settled on a wide-pan joist system with 20-inch deep pans, a 5-inch thick slab, and joists spaced at 5 feet 6 inches on center to correlate with the lab module. A distribution rib at midspan of the long bays helps individual joists redistribute isolated footfalls to adjacent joists. This simple addition to the design further improved the system's vibration performance for sensitive lab equipment. Concrete was more economical than steel because of the ability to use a deeper system for much greater stiffness, with very little premium in formwork and material costs.

Datum Gojer performed an analysis of the structural system to confirm its compliance with the vibration criteria, and the Guelph, Ontario, office of RWDI performed an independent analysis to verify the design. Just before the project opened for the spring semester of 2011, RWDI measured the performance of the actual building structure and confirmed that it was acceptable in accordance with the design criteria.

The design team decided to locate a critically vibration-sensitive imaging suite in the basement so that it would sit on a thickened slab-on-grade over the limestone substrata, rather than trying to create a super-stiff suspended slab on an elevated level. The design team also made the decision to stagger the joists from the lab module, centering the pans on the column grids rather than centering the joists on the column grids. This allowed plumbing, gas, and electrical services for the lab benches to feed through sleeved or cored holes in the slab, rather than through joists, which sped the construction process as it made getting all the sleeves in place less critical. It also allows any future services that come up in partitions or lab benches to be cored through the slab, rather than the joists. The coordination of the structural framing system with the very regular architectural layout and lab planning module created a versatile, flexible building for an owner with a long planning horizon.

Datum Gojer indicated to the architects that it would be most efficient to locate the exterior masonry shelf angles within the depth of the flush-bottom perimeter beams to save forming or miscellaneous metal costs. CO Architects was able to do this, resulting in simple loose lintels above the punched window openings.

Due to the structure's length of 500 feet, a horizontal expansion joint was required. Datum Gojer and CO worked together to find a location that would be as simple as possible for the construction, while minimizing the visual impact on the exterior. The team decided to locate the joint in a setback in the building at the west entry, at about the ⅓ point of the building. Locating it in the setback enabled the joint to be detailed inconspicuously in the re-entrant corner.

The tradeoff for this expansion joint location was the need to cantilever 33 feet of the penthouse floor and roof over the joint. To accomplish this, story-height steel-framed cantilever trusses were used in the exterior walls of the penthouse. The trusses were designed to accommodate a future 22-foot extension of a shade canopy over a potential green roof area on the west wing. Because of the appearance-critical nature of the canopy as an extension of the initial canopy, deflection control was critical. The trusses, which cantilever in two directions, were designed to limit the total deflection to less than 1.5 inches at the tip of the future canopy addition.

The UT Hackerman Building Team assembled in front of the completed building for an evening celebration to dedicate the building and honor its namesake.

Schedule Challenges

Due to funding and budget delays during the design process, Datum Gojer had less than 60 days to produce a foundation and basement wall package from the time of authorization to move ahead at the end of the Design Development phase. With material prices soaring in a super-heated economy at the time, The Beck Group needed a concrete package a month later in order to avoid huge increases in concrete and rebar prices; this was no small matter for a large concrete building. Shortly after that, Beck would need to start building the first elevated framing levels.

These challenges required a high level of trust and teamwork among the construction manager, architect, owner, structural engineer, and subcontractors. The stakeholders held regular meetings to discuss the progress of design versus construction, and made plans for an orderly delivery of phased, fast-tracked structural packages to meet the project needs.

Datum Gojer focused design efforts first on completing the basement and foundation design. Next, a concrete scope package was issued so that The Beck Group could lock in their concrete and rebar subs at certain unit pricing for the duration of the project. Then design efforts focused on completing the documentation for the lower levels of the building, saving the upper levels for last to keep in sequence with the construction schedule. As a result, the owner realized material cost savings and an accelerated design schedule kept construction moving to meet the opening date of January 2011.▪

Michael Brack, P.E. is President of Datum Engineers, Inc., a Texas-based structural engineering firm. Credit for this fantastic project is rightfully shared with his in-house team of Jeremy Klahorst, P.E., Igor Teplitskiy, P.E., Emily Cleland, Kelly Thibodeaux, and Jesse Paster, as well as the good people of CO Architects, Taniguchi Architects, The Beck Group, and The University of Texas. Michael can be reached at ***michaelb@datumengineers.com****.*

Part 2 of this article, in a future issue of STRUCTURE, will describe some of the additional challenges posed by this project and the innovative solutions that the design and construction team developed.