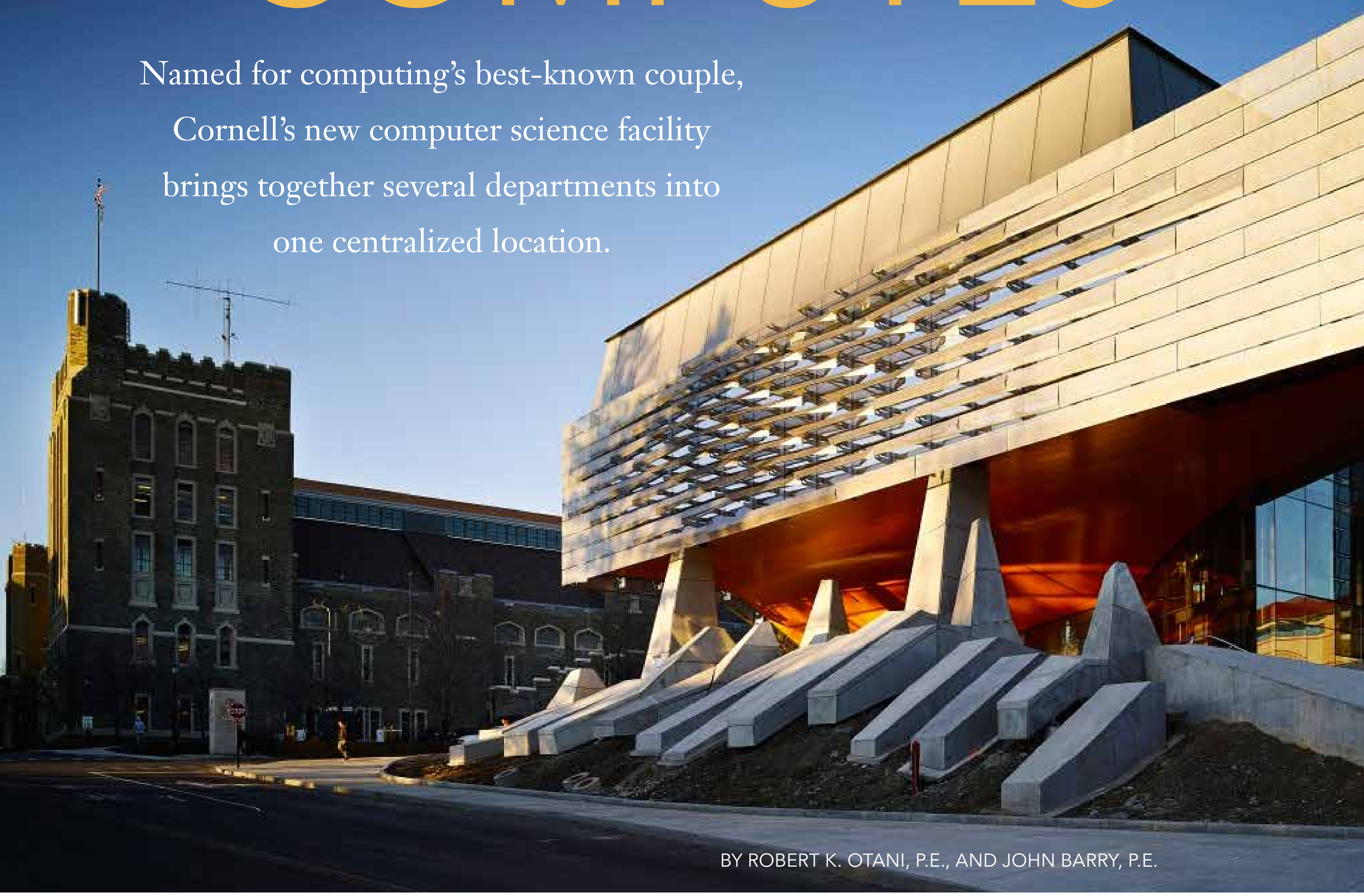
Collaboration COMPUTES

Named for computing's best-known couple, Cornell's new computer science facility brings together several departments into one centralized location.



BY ROBERT K. OTANI, P.E., AND JOHN BARRY, P.E.

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THE C IN CIS typically stands for "computing," but in the case of Cornell University's new Bill and Melinda Gates Hall, it could also stand for "centralized" or "collaborative."

The new 100,000-sq.-ft building sits in the middle of the renowned Ithaca, N.Y., campus and was designed to foster collaboration between the academic departments of the university's computing and information science (CIS) unit, home to the computer science, information science and statistics departments. Cornell's goal was to create an innovative academic structure for its world-class CIS faculty and students, who have ties to departments across the university.

The new four-story building houses classrooms, collaborative spaces, faculty offices and an auditorium. Circulation starts at the voluminous and curved atrium at the entrance, which extends up to a linear skylight. The fully glazed atrium, through its transparency, creates a visual connection between the collabora-

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The building's curtain wall consists of sloped and vertical glazing with integrated thermally broken brackets that support perforated, folded stainless steel shading panels.

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tive spaces, interconnecting stairs and the 60-ft-long cantilever extending to the south at the upper floor levels.

Hanging Out

Gates Hall's structural system consists of composite steel floor framing with concentrically braced steel cores for the lateral system and drilled shaft foundations and footings bearing on rock. It uses a total of 759 tons of structural steel in the form of 1,703 members. Concentrically braced frames with HSS members were used to simplify the enclosure wall details that needed to be built around the diagonal bracing. The bracing connections were field bolted, and the gusset plates were welded at fabricator Schenectady Steel's shop.

The site grade on the transverse (north-south) section of the building has a substantial elevation differential, which required intermittent shear walls in the lower mechanical levels to resist the net earth pressures acting on the structure's north side. The challenges from an erection/logistics standpoint were largely based on the limited space available for the crane and delivery of large truss sections. Shoring was required for the large cantilever truss to the south, and the entire second floor cantilevers 10 ft to the north and south, providing both an open east/west pedestrian passageway at the ground level and shading for offices and the auditorium at the lower level.

The high-performance building is accentuated by the south-facing cantilevered truss, which allows the third-floor collaborative lounge and work spaces to extend far beyond the building base while acting as a visual gateway to the south campus. The truss consisted of W24 members, which also supported the floors. Since the diagonals were exposed, architect Morphosis called for HSS members without gusset plates, so welded connections were employed for the bracing.

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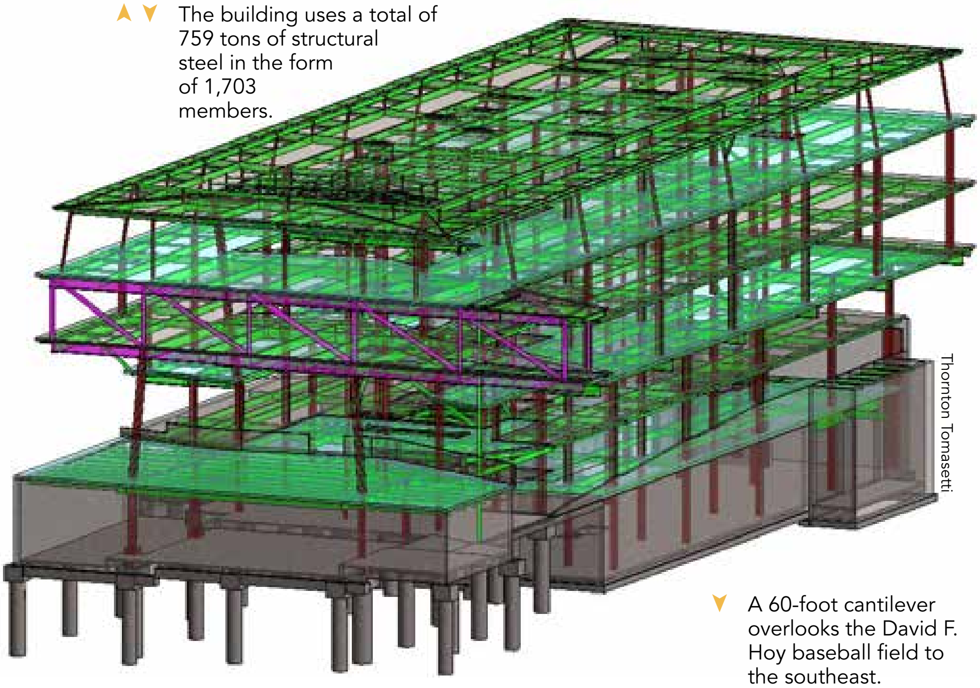

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A 60-foot cantilever overlooks the David F. Hoy baseball field to the southeast.

Morphosis Architects

On the west, a perforated metal scrim provides shading and partially shields the views of the full-height truss, and the 60-foot cantilever overlooks the David F. Hoy baseball field to the southeast. In plan, the cantilevered floor tapers south, framing a view of that part of the campus and the engineering quad. At the floor level of the cantilever is a glass floor that provides an overhead view of the pedestrian activity at the entrance. To accomplish the open views to the southeast, the eastern portion of the cantilever was only framed with large girders at the third and fourth floors. The imbalance of vertical stiffness necessitated careful façade glazing detailing to accommodate the inherent rotation of the cantilevered slabs, as well as a rigorous diaphragm analysis (using SAP2000) to account for the in-plane shear forces from gravity, wind and seismic forces acting on the cantilevered portal.

Crucial Cladding

Knowing that the façade design was one of the most important elements of the project, both architecturally and for environmental performance, structural engineer Thornton Tomasetti's structural and façade teams worked very closely with Morphosis and the design assist façade contractors (W&W Glass and Erie Architectural Products USA) to ensure that building movements and tolerances were fully coordinated. The building's curtain wall consists of sloped and vertical glazing with integrated thermally broken brackets that support perforated, folded stainless steel shading panels. The entire façade system is supported by the cantilevered structural system, which required differential movements and glass-to-metal façade interfaces to be carefully detailed and designed.

The original design required a thermally broken shroud around the metal bracket that supported the shading panels at the aluminum mullion interface, as well as a specified U-value (heat transfer rate) for the assembly. The façade contractor, Zahner, performed a thermal analysis and chose stainless steel, which has lower conductivity than aluminum or carbon steel, for the support bracket. The thermal break also included a stainless steel insert to the mullion, which allowed the mullion assembly to exceed the performance criteria of the specified U-value.

In some instances, the structural design was modified specifically to adhere to the stringent tolerances of the façade systems and interfaces of single-span glaz-

Steel framing allowed for a lightweight building that minimized foundation loads.

ing elements with multi-span glazing elements. The design team collaborated with Zahner in 3D building information models (BIM) to coordinate the various façade systems and structural interfaces. At both the exterior and interior atrium spandrel conditions, extensive detailing and system coordination was undertaken to integrate the glazing systems, curtain wall and brise soleil perforated skin.

The building's envelope has many interfaces of both façade materials and systems in elevation and section, re-entrant corners and the many cantilevered conditions. To facilitate the building movements with the tight façade detailing tolerances, the structural design team created specific movement

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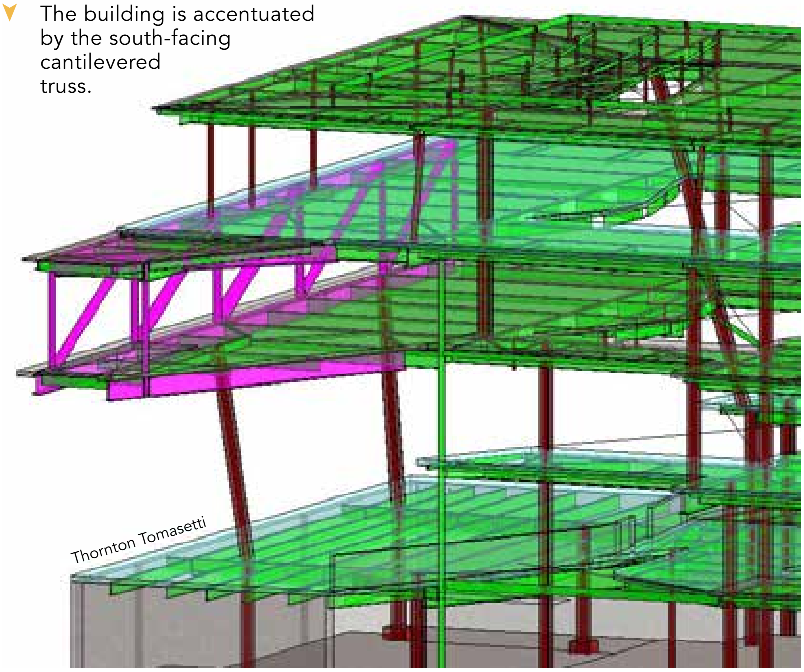
The building is accentuated by the south-facing cantilevered truss.



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Green Space

The sustainable features at Gates Hall demonstrate Cornell University's commitment to environmentally conscious policies. As the structural engineer and façade consultants, Thornton Tomasetti used high-efficiency glass façades and skylights throughout the building to allow for maximum daylight, as well as occupancy sensors and high-efficiency lighting. The perforated solar shading panels on the façade reduce glare and cooling loads during the summer. The university uses lake source cooling to run its central chilled water system on campus. This method, in addition to other efficient mechanical systems such as radiant flooring and active and passive chilled beams, is expected to lead to a 30% reduction in energy usage at Gates Hall compared to a comparable typical academic building. In addition, the use of structural steel and composite steel framing allowed for a lightweight building, minimizing the foundation loads (Thornton Tomasetti estimates that a concrete-framed building with the same column grid would have been at least 50% heavier than the steel building given the complexity of the building superstructure) and overall embodied energy, which was tracked and implemented using the firm's custom embodied energy/carbon parametric analyzer called GreenSpace.

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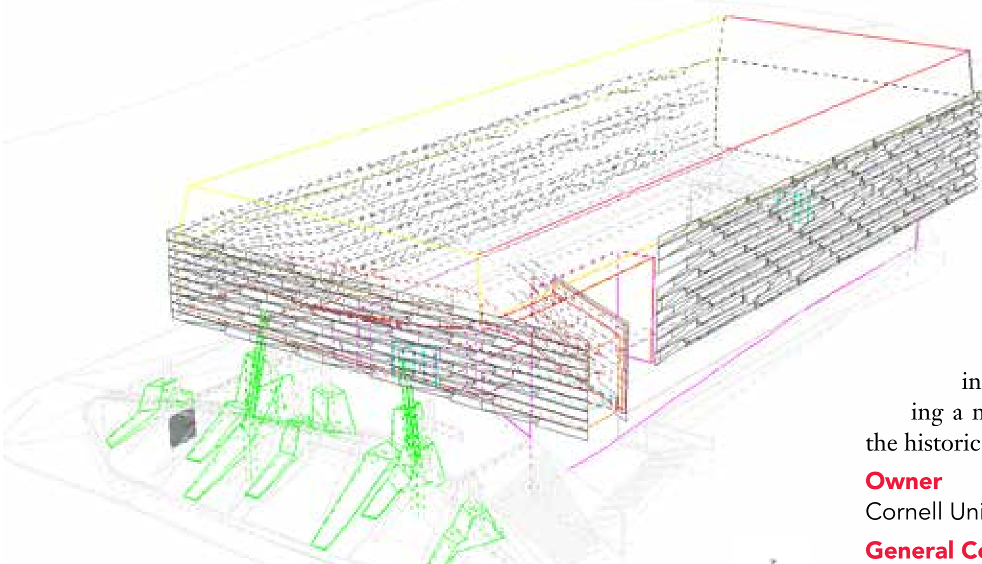
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A model of the scrim system.

drawings in plan, section and elevation of the dead load, live load, wind and seismic movements to convey our understanding of the façade system's gravity loading points and wind-only connection points. These macro-scale views of the behavior of the structural system allowed the façade team to fine-tune and optimize the façade details both in terms of constructability and overall economy. This iterative and collaborative effort ensured that the façade cost and long-term performance met or exceeded the estimated façade budget and project design criteria and goals, respectively.

The integrated engineering approach of both façade and structural design allowed the project team to address any proposed changes quickly and efficiently, and the project schedule was reduced by nearly a year from the original schedule established in the RFP. The building opened last year, adding a new component of modern, high-tech flare to the historic campus. ■

Owner
Cornell University

General Contractor
Welliver

Architect
Morphosis Architects

Structural Engineer
Thornton Tomasetti, Inc.

Steel Team

Steel Fabricator and Erector
Schenectady Steel Co., Inc.

Steel Detailer
Lehigh Valley Technical Associates, Inc.