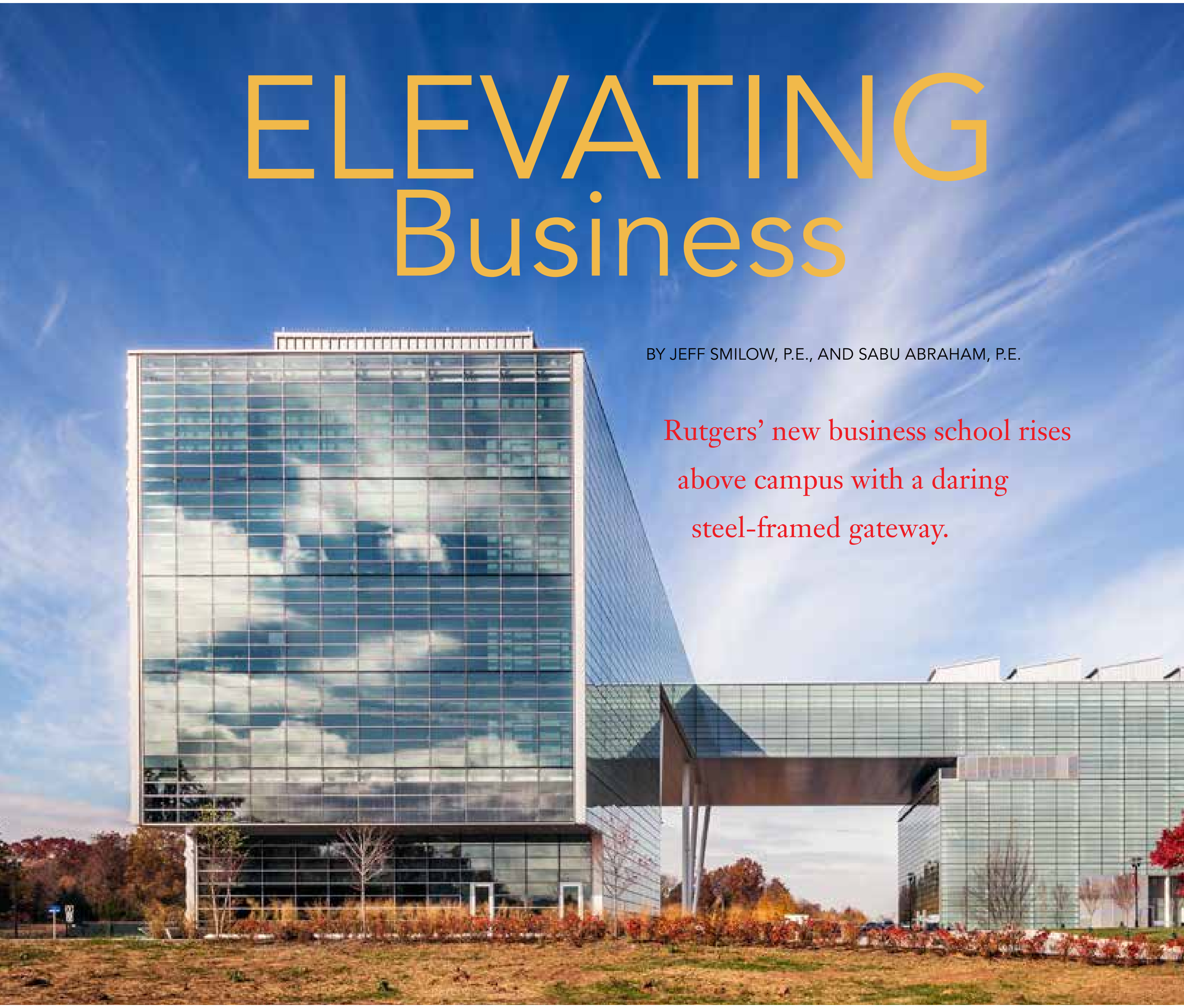
ELEVATING Business



BY JEFF SMILOW, P.E., AND SABU ABRAHAM, P.E.

Rutgers' new business school rises above campus with a daring steel-framed gateway.

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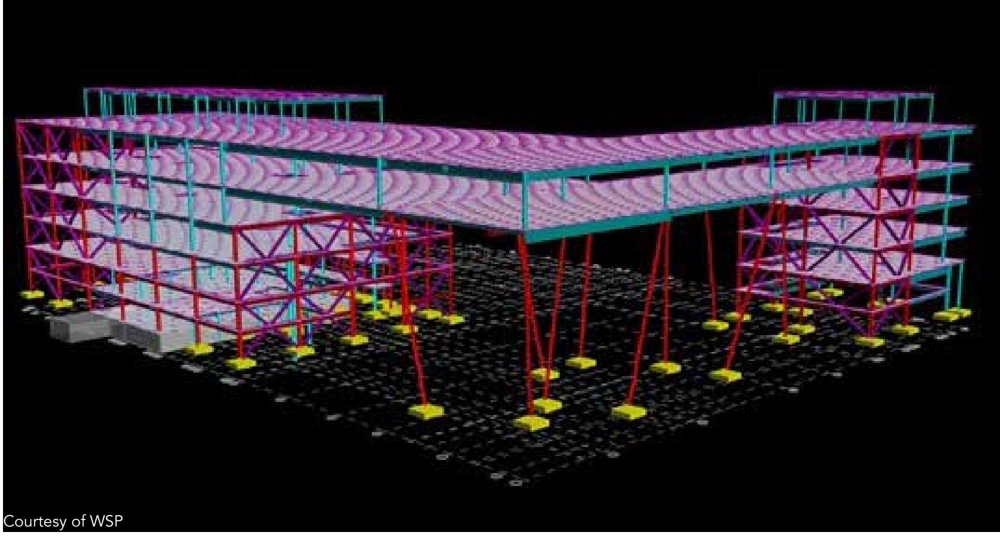
RUTGERS UNIVERSITY is relying on its new business school for more than simply educational purposes.

The new 150,000-sq.-ft building also serves as the gateway to the school's new Livingston Campus in Piscataway, N.J. The L-shaped form of the building appears to float 60 ft above Rockefeller Road, and most campus traffic passes under and through the building. The design keeps within the goals of the master plan of creating a high-density academic development complete with urban facilities, shared amenities and a walkable campus. In addition, it reflects the ongoing shift in higher education that supports collaboration and moves away from a focus on simply classroom-oriented organization, which in turn prepares students for contemporary business models where cross-collaborative ideas, cultures and concepts help create market innovation.

TEN Arquitectos



Courtesy of WSP

▲ A 3D model of the building.

◀ The 150,000-sq.-ft building serves as the gateway to the school's new Livingston Campus in Piscataway, N.J.

▼ Twelve 65-ft-long, 36-in.-diameter round sloping columns support the "floating" L-shaped building form above.

TEN Arquitectos

Not-so-Slippery Slope

The building is organized into three programmatic "bands": classrooms, offices and public spaces. Architect TEN Arquitectos connected the bands vertically with an atrium and horizontally with communal spaces of different sizes. Structurally, there are twelve 65-ft-long, 36-in.-diameter round sloping columns that support the L-shaped building form above. These exposed exterior columns feature an intumescent coating for fire resistance. In order to achieve the necessary strength, they were filled with self-consolidating concrete after the steel was erected but before the fifth-floor slab above was poured; the concrete was poured through two 6-in.-diameter holes in the cap plates of the columns.

Tapered details were used at column bases. Instead of creating the tapered ends with castings, the fabricator made each one by scribing out a piece of the pipe section and welding a plate into the scribed area. The plate was then welded to the tip of the column to receive the 5-in. pin, a more economical solution than using custom casting due to the particularly large tube diameter required.

The floating L-shaped feature connects the two sections of the building at the fifth floor and includes a 92-ft, column-free span. To achieve this long span, 60-in.-deep built-up plate girders were used are supported by the sloping columns at one end and "regular" building columns at the other. The plate girders were subcontracted to a specialty highway girder manufacturer and delivered full-length directly to the site.

As one can imagine, erecting sloping columns supporting 92-ft-long girders posed a significant erection challenges. The steel erector answered this with optimized sequencing to hold up the sloping columns while connecting beams and girders,

Courtesy of WSP

The columns were filled with self-consolidating concrete after the steel was erected but before the fifth-floor slab above was placed.

The design team created a finite-element model to study human-induced vibration for the floating portion of the building.

Courtesy of WSP

TEN Arquitectos

Exposed bracing inside the building became an architectural feature.

and sufficient columns, beams and girders had to be connected together before a section became stable.

Addressing Vibration

In order to assure there would not be a vibration issue with the floating portion of the building, the design team at WSP Structures created a finite-element model to study human-induced vibration for this area as well as performed a time history analysis following the AISC Design Guide 11 *Floor Vibrations Due To Human Activity* recommendations. Based on the analysis, it was determined that the human-induced vibrations would be considerably less than the acceptable vibration levels defined by the ISO chart in Chapter 2 of the guide.

Dr. Thomas Murray, the guide's author, visited the site before the building fit-out and façade erection to study the vibrations on the floating L-shape. With an accelerometer placed on the floor and attached to a smart phone, a volunteer walked the floor at different frequencies with a metronome in hand. Based on the data collected, the floor performed exactly as predicted by the time history analysis.

Enhanced Exposure

Structural steel members also created other architectural features within the building. Exposed bracing was one example, and ensuring that the lateral forces induced from wind and seismic events could get to these bracing systems turned out to be a challenge as well. Because of the open nature of the building, numerous openings in the floor diaphragms were required. These openings, in conjuncture with the L-shaped building mass connecting the two parts of the building, required the design team to carefully follow the load paths of the wind- and seismic-induced loads into the bracing systems.

In the end, the architect's vision created numerous structural challenges for

➤ The building is organized into three programmatic "bands": classrooms, offices and public spaces.

Allen Thompson courtesy of WSP

the design team, but those challenges were overcome using the same collaborative, problem-solving techniques that the new business school promotes. ■

Owner
Rutgers University

General Contractor
Century 21 Construction

Construction Manager
Structure Tone

Architect
TEN Arquitectos

Structural Engineer
WSP USA Corp.

➤ The exposed exterior columns are coated with white intumescent paint.

TEN Arquitectos