The patterns on the west and east facades, formed from 337,500 small tabs set at angles, are derived from landscape photographs. The double-skin facade contributes to the building's Net Zero energy plan.

Emma and Georgina Bloomberg Center at Cornell Tech

The first academic building to open on Cornell Tech's Roosevelt Island campus aims for net-zero energy performance, a mission that drives its advanced aesthetics. Its facade of pixelated perforated aluminum and curved glass provides both thermal protection and inspiration.

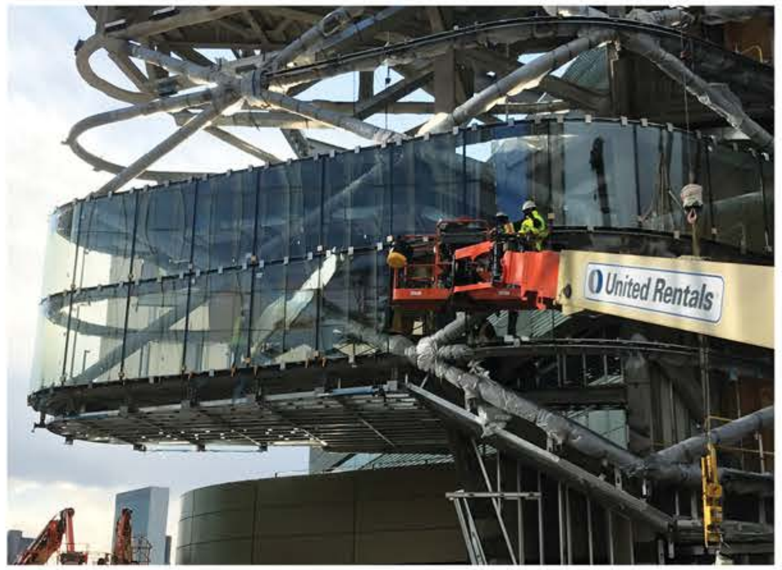
A STROLL THROUGH CORNELL TECH'S new campus, which opened in the fall of 2017, reveals surprises practically everywhere the eye lands. One is a ping-pong table. Beside a walkway near The House (the residential tower by Handel Architects) and The Bridge (the Weiss/Manfredi academic/corporate co-location building, now renamed the Tata Innovation Center; see *Metals in Construction* Winter 2018, p. 14), with a direct view of the Bloomberg Center, stands a futuristic German outdoor table with a metal net. It's not just sturdier than fabric nets; it's a hint that this campus values quality-of-life details and puts materials to unexpected uses.

The Bloomberg Center, the four-story, 160,000-square-foot academic and research facility named for the former Mayor's daughters and designed by Morphosis, is the most visually adventurous of Cornell Tech's buildings, thanks largely to an aluminum-and-glass facade that combines complex digital patterns with distinctive, ever-changing coloration. Like all buildings erected here to date, Bloomberg meets rigorous standards for energy performance (not just LEED Platinum here but Net Zero, generating as much power as it uses). "We were given not so much of a cost budget," says Ung-Joo Scott Lee, Morphosis's project principal, as "an energy budget, so we kind of have to work backwards from a restrictive amount of energy consumption."

Beginning with that core mission, the design and construction team devised strategies that went beyond the familiar. Photovoltaics were always part of the sustainability plan, Lee recalls (along with an 80-well closed-loop geothermal system providing all heating and most cooling, a rainwater harvesting system to reduce potable-water usage, low-energy workstations and LED lighting, a facade designed to minimize solar heat gain, and an all-electric power system avoiding fossil fuels altogether)—yet the architects, he says, rejected "the original concept, which was to put all of these solar panels down on the field and cover the greenscape of the campus. We wanted to do a little bit better than that, and we actually wanted everything that talks about sustainability to be integrated into the identity of the building." The PVs form a roof canopy instead; "it's a building that actually begins from the top down," Lee comments. Observers may read its profile, at first glance, as a building wearing a scholar's mortarboard; the 1,465-panel PV canopy, a companion to the one topping the Tata, proudly proclaims both the Bloomberg's cerebrality and its commitment to renewables.

With exceptional coordination among the architects, engineers, fabricators, general contractor, and others to align decisions with energy goals, Lee says, the Bloomberg Center embodies a broad definition of resilience. Along with the rigorous metrics, he observes, "there's a lot of hype about the Net Zero thing," but "we wanted to prove that a Net Zero building is actually a healthier building": better-lit, more livable, and more productive than ordinary facilities. "If you have a building that is wonderful, it spends no energy, but it's awful to be [in] because it's dark, there's no lights, or it's just kind of unpleasant, there is really no point." Intangibles like views, artwork, program-tailored rooms, elegant structural members, and smoothly curved volumes all contribute to its performance. The Bloomberg is sustainable not in an eat-your-vegetables sense of constraints, but in the heady atmosphere of a clean green future.

The facade, 60 percent opaque and 40 percent transparent, controls energy demand through shading and achieves a form of dynamism without



Above Installation of the curved glass and aluminum panels over the building's feature stair.
Above right A detail of the louvered perforation patterns on color-shift iridescent painted aluminum panels.

moving parts. On a gateless campus that emphasizes "porosity and access and public space," Lee says, circular perforations in the aluminum panels made conceptual sense; the facade simultaneously breathes, functions as a rainscreen, and suggests streaming bits of information. It also shimmers: iridescent PPG polymer coating on the aluminum shifts color along a green/brown/copper continuum as lighting conditions and viewing angles vary.

The aluminum came pre-finished in huge rolls resembling paper products, Lee recalls. The design team had the idea of "imprinting the facade with some kind of pixelation ... we wanted to perforate it, but keep the remains of the hole [as] a little tab." Though the multi-angled tab patterns were created robotically with fabricator A. Zahner's Louvered ZIRA (Zahner Interpretive Relational Algorithm) system, Lee likes to "debunk the myth a little bit." Zahner had "a very old welding arm that wasn't even being used in their shop ... collecting dust in the corner, and one of the fabricator guys said ... 'we could probably program it ... and we can 3-D print a little nozzle that we could attach to the arm,'" turning it gently to shape the tabs. Staffers with Cornell and MIT tech backgrounds connected the device to an old laptop and wrote some quick scripts.

Voila: a repurposed welding robot. "All the advancement was only on this programming and scripting command," Lee recalls; "the infrastructure to execute the fabrication was all there." The patterns on the west and east facades, respectively, are derived from landscape photographs of the Manhattan elevation as viewed from the site, "a reflection of the exterior imprinted back to the building," and, facing Tech Walk on the campus interior, an image of an Ithaca gorge near Cornell's main campus. Overall, the facade has 337,500 tabs: pores in the skin of an organism, pixels composing images that hover between familiarity and abstraction.

Opening: Matthew Carbone/Morphosis; top right: Bill Millard; left column: courtesy W&W Glass

This page: Bill Millard; following pages: Matthew Carbone/Morphosis

The feature stair cantilevers over the pedestrian path between Bloomberg Center and the neighboring Tata Innovation Center.

Another distinct feature is an arrestingly cantilevered curved-steel staircase hovering to the southeast, using the most complex of the building's three categories of Guardian low-emissivity, low-iron glass fabricated by Cristacurva, a specialist in glass bending. The strip windows, curtain walls, and skylights are SNX 62/27 insulating glass units (IGUs) with argon fill and warm-edge spacers (double SentryGuard Plus [SGP] laminated makeup on inboard and outboard lites for strip windows and curtain walls; SGP laminated makeup on inboard lites for skylights). "The Stair 5 structure was treated almost as its own job by itself," notes Corey Weakley, project manager for W&W Glass; that area used custom-bent SN 68 IGUs.

The shapes involved compound bends, Weakley says, with a regular radius at the nose of the stair and "trapezoidal shapes that are also curved" at its bottom skirt. "We had a very challenging time engineering the substructure to that glass, and then actually the thickness of the glass and the strengthening process to be able to withstand the loads to be imposed" by Roosevelt Island's winds. "I've never seen a building like that. It's almost shaped like the Millennium Falcon from 'Star Wars.'"

"When they engineered the building," Weakley continues, "it's like a gigantic truss, and it's designed so that when there's six stories of glass hanging on it, it'll drop ... two inches here, an inch and a half here." The team installed the panels out of level, anticipating the drop when all panels were stacked. The steel diagrid structure at the second and fourth levels "cantilevered as it came up to the nose of the structure; we had to pre-tension that" to 725 pounds per cable, the engineered weight of the glass, using tension cables and Jersey barriers on the ground as dead weight, slowly releasing tension as glass was set. "If we didn't simulate the weight of the glass, the tabs would have been off. I mean, those things moved over ¾ inch from the weight of the glass." Further complications included the lack of a floor carrying through the structure, as in a conventional stairwell (Weakley and his surveyor devised a waterjet-cut template attached to the parapet wall to hold control lines) and keeping intumescent paint on custom steel members watertight before installing the glass.

Every aspect of the project, Lee reports, involved high awareness of sustainability and constructibility in all their forms. At the schematic-design stage, he recalls, Superstorm Sandy struck. The architects re-evaluated program/space relations, moving most mission-critical equipment to the penthouse, elevating pumps and other basement gear onto pads, and specifying some items as submersible. Other measures tailored to the conditions of Roosevelt Island included offsite construction of "unitized or modulized" facade systems to be transported via temporary barge—

Every aspect of the project involved high awareness of sustainability and constructibility in all their forms.

not trucked, since the island has only one access road. These measures offered other advantages: "You can quality-control, you can build them inside a heated warehouse, you're not trying to stick-build this thing over the wintertime. You load it up as efficiently as you can, and then you start just clipping the thing: once they start clipping the facade, it goes very quickly." The facade's support system is "a unitized stud panel with continuous insulation outboard of the studs, so we could get a really good continuous-envelope perimeter insulating line," with a Fabreeka pad providing a thermal break at the tricky transition point where a structural column emerges through the roof to support the PV canopy.

Cornell Tech prioritizes collaborative project work over disciplinary boundaries and top-down information delivery, Lee says, hailing Dean Daniel Huttenlocher as the architect of this curriculum. The interiors correspondingly downplay "sage on the stage" unidirectional lecture halls for "guide on the side" communal spaces, scaled and proportioned appropriately. Public amenities on the ground floor include a lecture hall, a "galleria" running the length of the building for impromptu meetings, and a large café offering wide views to Manhattan and Queens. Embracing the quirks and vulnerabilities of its midriver site, the Bloomberg Center expresses openness on multiple levels, with an edgy design that fuses today's technology with tomorrow's purpose.

Above The center's lobby and circulating staircase.
Right The Bloomberg Center was the first academic building to open on Cornell Tech's new Roosevelt Island.

EMMA AND GEORGINA BLOOMBERG CENTER AT CORNELL TECH

Location: **2 W. Loop Road, Roosevelt Island, New York, NY**
Owner: **Cornell University**, *New York, NY*
Architect: **Morphosis Architects**, *Culver City, CA, and New York, NY*
Structural Engineer: **Arup**, *New York, NY*
Mechanical Engineer: **Arup**, *New York, NY*
Construction Manager/General Contractor: **Barr & Barr**, *New York, NY*
Preconstruction Construction Manager: **Tishman Construction**, *New York, NY*
Curtain Wall Consultant: **Arup**, *New York, NY*
Structural Steel Erector: **Stonebridge Steel Erection**, *South Plainfield, NJ*
Curtain Wall Fabricators: **A. Zahner**, *Kansas City, MO;* **Island International Exterior Fabricators**, *Calverton, NY*
Curtain Wall Erectors: **W&W Glass**, *Nanuet, NY;* **Island International Exterior Fabricators**, *Calverton, NY*