Schöck Isokorb®

World's Tallest Passive House Pushes Environmental Envelope

With the Help of Structural Thermal Breaks

Roosevelt Island, New York City

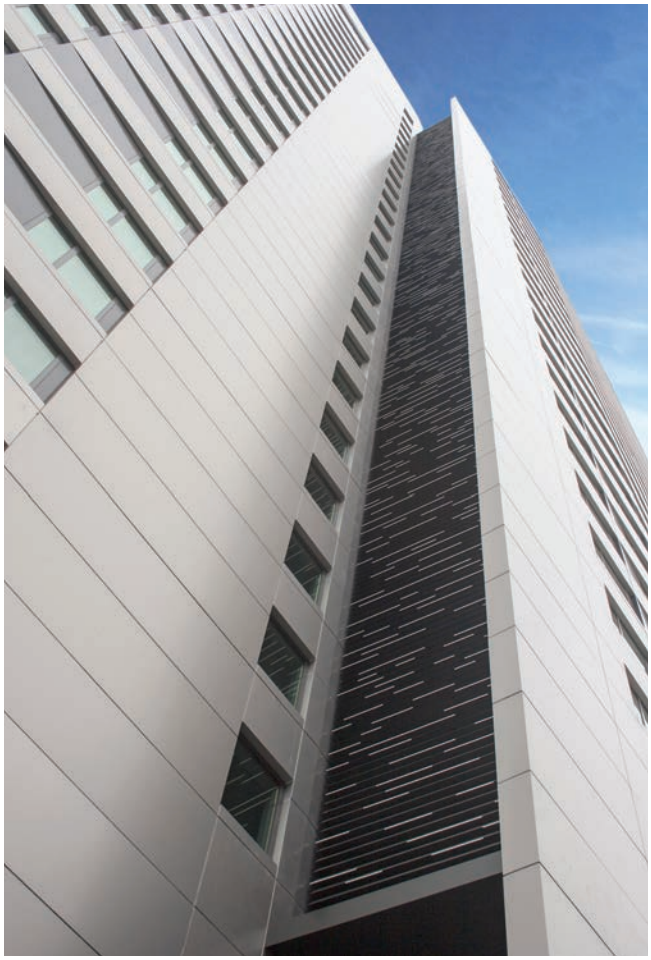
Breaking new Passive House ground

The success of an innovative project often comes down to the collective sum of its details. Such was the case when structural thermal breaks were specified in the new Cornell Tech high-rise dormitory to minimize heat loss at balcony slabs and canopy connections, contributing to the building's Passive House performance.

Roosevelt Island, New York City – At 26 stories, The House at Cornell Tech is the tallest high-rise Passive House building in the world. The ground-breaking residential tower at Cornell Tech on Roosevelt Island was developed in partnership with The Hudson Companies and Related Companies.

Speaking for Buro Happold, which provided structural and MEP engineering services for the project, Associate Principal Julie Janiski says the firm expressed confidence about meeting Passive House standards during initial meetings with Handel Architects, The Hudson Companies and Cornell.

This decision to pursue Passive House principles is revolutionary in this high-rise application because Passive House is the strictest energy efficiency standard for buildings in the world. Developed in Darmstadt, Germany in the 1990s, the standard cuts energy consumption by 60 to 80 percent compared to buildings built to traditional codes. For the Cornell Tech dormitory, Passive House construction translates to a projected savings of 882 tons of CO_2 per year. The reduced energy consumption is critical in an era where the building industry accounts for 39 percent of all greenhouse gas emissions in the United States.



Louvered exterior balcony enclosures at the corner of each floor house an electric HVAC unit. Structural thermal breaks cast between exterior balcony slabs and interior floor slabs minimize thermal bridging, while supporting loads equivalent to conventional monolithic balcony castings.

Passive House standards push for reduced thermal bridging and optimal energy conservation

How does the dormitory meet Passive House criteria? “The façade is one big thermal wrapper,” Janiski said. “The building is well insulated and leak proof, so that energy needed for heating, cooling and lighting is calibrated to optimize energy use.”

Building orientation for solar management and façade detailing for thermal management are integral to the building’s energy conservation. The tower is a long rectangle, oriented so that the long sides are facing north/south to allow the façade to optimize available solar energy. This orientation and use of triple-glazed windows are key elements of the Passive House standard.

Passive House construction also aims to avoid thermal bridging, which is typically unaddressed in traditional designs in the US.

Thermal bridging occurs when heat is conducted through the insulated building envelope by structural penetrations. During winter, heat from interior slabs or steel supports is conducted through the envelope into exterior balconies, canopies, parapets or other penetrations that dissipate heat into the environment like cooling fins.

A louvered balcony enclosure at the corner of each floor houses an HVAC unit. Structural thermal breaks insulate exterior balcony slabs from interior floor slabs while supporting loads equivalent to conventional monolithic balcony castings.

sion modules. These components are efficiently sized to maximize the thermal performance of the assembly. Extruded insulation provides the body of the unit, with top and bottom fire-plates for a two hour fire-rating. The STB tension bars are tied into the standard steel reinforcement of the interior slab and balcony.

STBs for steel construction include stainless steel threaded rods and an internal HSS stub to ensure the rigidity of the unit. Extruded insulation surrounds the body of the unit. When two or more modules are used in a connection to resist moment loading, insulation spacers can be packed between the structural elements. This minimizes the thermal conductivity through the beam.

The Cornell Tower has thermal bridge risk areas at the mechanical equipment balcony on typical floors and the steel entrance canopy. Concrete-to-concrete STBs are used to treat the balconies, and steel-to-steel STBs are used at its cantilevered entrance canopy.

The STBs were supplied by Schöck USA, a division of The Schöck Group of Germany. The design was patented in 1983 by the company's founder, Eberhard Schöck, and is now utilized in more than 10 million installations in 34 countries.

Where structural thermal breaks were installed

Structural thermal breaks (STBs) were specified at the Cornell residential tower to preclude thermal bridging in vulnerable areas in the façade, roof line and main entrance.

The dormitory's façade, made of a prefabricated metal panel system, acts as a thermally insulated blanket. This thermal wrapping requires sealing at several places including the entrance steel "eyebrow" canopy, the roof line where the concrete curves weave in and out, and the southwest façade that opens out to reveal a louver system extending to the entire height of the building.

According to Handel Architects, "This reveal is designed to be the 'gills' of the building, literally providing a louvered exterior space where the heating and cooling equipment live, allowing the building system to breathe. Purified fresh air will be ducted into each bedroom and living room, providing superior indoor air quality."

Structural thermal breaks within the building envelope (left wall) insulate interior floor slabs from exterior balcony slabs (area shown here) at the corner of each floor where electrical HVAC units are located.

Instead of locating mechanical systems on the roof, which is typical for high-rise construction, they are installed on enclosed balcony slabs in a corner of every floor to facilitate efficient heating and cooling of that floor. Since these enclosures lack AC or heating, and are vented to the exterior through louvers, structural thermal breaks were installed to insulate the exterior balcony slab from the interior floor slab, while providing load bearing performance equivalent to that of traditional balcony extensions.

The integrative approach to building systems and architectural expression does not limit design flexibility, but it does require technologies and attention to detail that contribute to achieving a design that complies with LEED® requirements and the more stringent Passive House standards.

In the case of Cornell Tech tower, the use of structural thermal breaks made it possible to meet the requirement for continuous insulation, reducing energy loss by 80 to 90 percent compared with conventional steel and monolithic concrete penetrations.

Upfront communication required for acceptance and successful execution

Mark Paskus, associate at Buro Happold Engineering says, "because the balconies are structurally complex, Schöck certified the model and placement of structural thermal breaks based on our dimensions and capacity requirements."

He explained that the steel canopy required more coordination among teams because the engineers needed information from the supplier to put in their drawings while meeting the architect's requirements for maintaining the thinnest canopy possible. "We provided the loads and moments so the supplier could design the system and deliver a fully-engineered product constructed to the specifics of the design at hand.

"The challenge of using STBs is not the technology itself, but rather, getting people to understand and trust it," Paskus said, adding, "The contractors were unfamiliar with the system and apprehensive until the shoring was removed, the mechanical units were installed and the STBs performed as specified."

Upfront coordination among the trades, proper notation of construction documents, and supplier participation were essential to the successful outcome of this project.

Cornell Tech proudly conveys their efforts toward advancement.

Isokorb® structural thermal breaks for steel-to-steel construction insulate the steel building canopy from interior structural steel supporting it. In addition to supporting loads and reducing heat loss, STBs prevent the formation of condensation and mold adjacent to cold structures on the interior side of the envelope.

Advances in building design and components make Passive House possible

By adhering to Passive House principles and employing innovative technologies, The House at Cornell Tech is leading the charge in high performance, eco-friendly urban construction that significantly reduces energy consumption and carbon emissions without impacting design freedom or structural performance.

Details	
Project	House At Cornell Tech
Start of construction	June 2015
End of construction	August 2017
Location	Roosevelt Island, NYC
Architect	Handel Architects
Engineer	Buro Happold
Products	Schöck Isokorb® Type CM Schöck Isokorb® Type S

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