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LIDAR CAPTURES ACCURATE AS-BUILT CONDITION OF COMBINED SEWER OVERFLOW PIPES IN CITY OF MILWAUKEE

IMPROVING THE BURLINGTON BRIDGE

STREAMLINING THE WETLAND DELINEATION PROCESSES

ENVIRONMENTALLY-CONSCIOUS TOLLWAY CONSTRUCTION IN AUSTIN

SPARK BUILDING INSULATES HEATED SLABS FROM FRIGID BALCONIES WITH STRUCTURAL THERMAL BREAKS

SPARK IS A STATE-OF-THE-ART BUILDING near Madison's Capitol — owned by American Family Insurance. The 158,000 sq ft (14,694 sq m) Spark is home to several hundred of American Family's 8,100 employees. It also houses DreamBank, a community space dedicated to the pursuit of dreams, and StartingBlock Madison, an entrepreneurial hub fostering Madison's start-up community, along with the new American Family Insurance Institute for Corporate and Social Impact.

Located in Madison's revitalized Capitol East District, where January lows average 8ºF (-13ºC), it features a sustainable, LEED certified design expected to yield dramatic reductions in heat energy consumption and carbon emissions.

Among the innovative energy-saving measures are a 10,000 gallon (38,000 liter) rooftop rainwater collection system, a dedicated outdoor air mechanical system (DOAS) coupled with a geo-exchange bore field, sun shades that raise and lower automatically based on sunlight intensity, and structural thermal breaks that isolate cold exterior balconies from the warm interior floor slabs.

Balconies: an office building anomaly

"This is the first time I've done balconies for an office building," said Joe Lopera, Senior Project Specialist at Milwaukee's Eppstein Uhen Architects (EUA). "The idea was to give tenants stunning views of the Madison skyline, and encourage them to work on the balconies with their laptops in warm weather."

During frigid Madison winters, however, EUA wanted to minimize the heat loss through the balconies to improve the overall efficiency of the building envelope, a problem solved by installing structural thermal breaks at the line of insulation.

In typical balcony construction, thermal bridging occurs where a monolithic slab penetrates the insulated building envelope, allowing heat energy to easily escape through concrete and rebar into the cantilevered balcony, which acts as a cooling fin during low-temperature conditions.

In addition to wasting energy, uninsulated balconies allow for significant cold penetration into the building, chilling adjacent interior surfaces. If these adjacent surfaces fall below the dew point condensation occurs, greatly elevating the risk of degradation of materials and potential mold growth in wall and ceiling cavities.

Often the risk of condensation alone at the slab-to-wall interface drives the decision to incorporate a structural thermal break.

Thermal breaks prevent condensation, improve thermal comfort, reduce energy demand

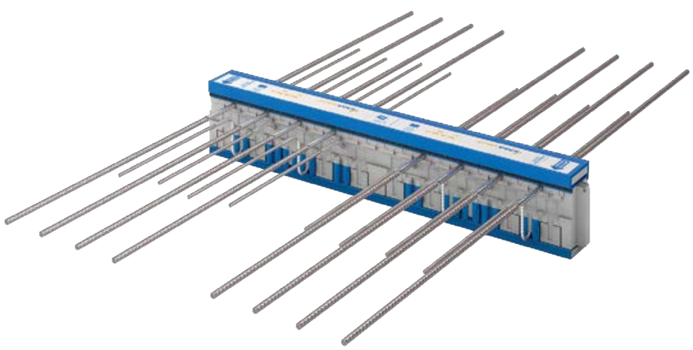
The design team averted thermal bridging issues at the balconies by installing Schöck Isokorb® Structural Thermal Breaks. Positioned within the building envelope between the interior floor slab and cantilevered balcony slab, they act as continuation of the wall insulation through the concrete floor slab. Most of the cross sectional area typically consisting of concrete and carbon steel is now comprised of a high-performing graphite-enhanced expanded polystyrene block that is less than 2 percent as conductive as concrete. Additional energy savings are derived from the module's stainless steel rebar, which is one-third as conductive as its carbon steel equivalent. Projecting from both sides of the structural thermal break, the rebar is engineered to fully develop into the adjacent concrete components without the need for lapping onto adjacent steel.

The assembly provides the necessary strength and stiffness to support the anticipated loads on the exterior cantilevered slab, while raising the temperature of the adjacent interior slab by up to 34ºF (19ºC), with three results: 1) prevention of condensation and mold growth on adjacent interior surfaces, 2) improved occupant comfort, and 3) energy savings up to 90 percent at the connection.

The Spark's five balconies contain a total of 148 linear feet (44 linear meters) of structural thermal breaks. Joe

The Spark Building with balconies visible

Underside of slabs reveal The Spark's post-tension concrete construction supporting 10 ft (3 m) cantilevered balconies.



Stainless steel tension and shear rebar of Isokorb® structural thermal break ties into carbon steel rebar of interior and exterior slabs prior to casting.

Lopera says the thermal breaks worked well with the post-tensioned concrete structure, allowing for the 10 ft (3 m) long and 12 in. (305 mm) thick balcony slabs to freely cantilever, for a more elegant building. "Structural thermal breaks gave me more freedom as a designer," he adds.

Early planning led to success

The architect, structural engineer, contractor and structural thermal break supplier conducted early planning and design meetings to determine the best way to install and integrate the structural thermal breaks with the post-tensioning layout.

Eric Lewis, project manager with J.H. Findorff & Son Inc. Construction, of Madison and Milwaukee, said, "This was a first-time experience with Schöck's structural thermal break technology. But the modules became easy to install after the pre-planning and design meetings with Schöck as well as their site visits and instructions and guidance to our crews at first install."

Lewis added that the structural thermal breaks "allowed us to pour the deck and the balcony in the same day, improving the overall schedule. The thermal breaks eliminated the need for the usual edge forms that create the joint where the deck joins the balcony slab, saving time and materials to prep the balcony slab after pouring the main deck and letting it set up enough to strip the form, which is the typical sequence."

Structural thermal breaks are installed at right angles to the post-tension tendons.

Eric Feile of Pierce Engineers, a consulting structural engineering firm based in Milwaukee, said, "There's always the danger of elements like structural thermal breaks being 'value engineered' out of the project. But we fought for them and they stayed a part of the project."

Building codes require tighter building envelopes

ASHRAE building codes are requiring continuous insulation of building envelopes to conserve energy. The organization requires separate modeling of uninsulated assemblies, such as balconies, for energy efficiency.

Whereas in the past "uninsulated assemblies" could be ignored if these assemblies comprised less than 2.5 percent of the total envelope surface area, the latest ASHRAE code requires remedying uninsulated assemblies with thermal-bridging resistant elements like structural thermal breaks. Further, the state of Wisconsin as of October 2017 has mandated continuous building envelope insulation.

Better insulation, better design, better building

Nate Lambrecht, Midwest and Western U.S. regional manager of Schöck North America, pointed out that while The Spark is among the first applications of concrete-to-concrete thermal breaks in Wisconsin, Isokorb® installations within the U.S. are becoming more commonplace. With global applications exceeding 10 million, North America will surely catch up," he said. "As municipalities and states increasingly adopt energy codes requiring continuous insulation, and owners look for practical solutions to limit liability and durability concerns, the inclusion of structural thermal breaks as 'best design practice' will become more prevalent."

"The Spark application has planted the seed for future use of structural thermal breaks," Feile concludes.