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focus

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Tornado Safe Rooms

As spring approaches and midwestern states begin to recognize severe weather awareness weeks, memories of recent devastating tornadoes come to mind. School superintendents, public officials and building owners are more closely evaluating the benefits of incorporating tornado safe rooms into existing and new construction. These safe rooms can greatly aid local communities without drastically impacting the construction budget thanks to efficient design techniques.

In the past, tornado safe rooms often did not receive sufficient consideration because of the false perception that they require a "bunker" appearance due to the protection restrictions that dictate design. Schools and other public facilities were not specifically designed to protect occupants from tornadoes. Designated shelter areas in these facilities were generally hallways or areas not designed to withstand high winds and wind-borne debris. However, numerous safe rooms have been successfully constructed as gymnasiums, higher-education classroom buildings, performing-arts centers and community centers.

Precast concrete is inherently resilient and provides excellent protection against high winds, storm surge, and flying debris, among many other high-performance attributes. It is often used in FEMA shelters, residential, institutional, public, government, and other structures providing protection and resiliency. Impact testing of precast insulated sandwich wall panels show that

precast concrete provides excellent resistance against flying debris, which often become projectiles or missiles during a tornado or hurricane.

For additional information regarding the design of precast tornado safe rooms, please contact PCI Midwest's Executive Director, Mike Johnsrud, PhD, PE via email at mike@pcimidwest.org.



St. Mary's Catholic Church and School

Everything changed for St. Mary's parish church and school on the afternoon of May 22, 2011, when a catastrophic EF-5 tornado swept through the Midwestern community and destroyed the entire parish facilities. It was officially ranked the deadliest tornado in the United States since 1947, and the town was devastated.

The one structure that remained standing was St. Mary's iconic church cross, which the community embraced as a symbol of hope and courage, says Randy Milbrath of RDG Planning & Design. "It left Father Monaghan and the members of St. Mary's determined to rebuild a place of safety and peace of mind."

Local fundraising efforts supported the rebuilding. Once funds were raised, the church was eager to get the project done as quickly as possible to be ready for returning students and parish members in the

fall. Along with driving an accelerated schedule, the owners wanted a high-performance, durable structure that could be a safe haven for community members, as well as a dramatic design that would make a distinct visual statement to all who saw it.

These goals led designers to choose a precast concrete design, featuring architectural precast concrete panels embedded with thin brick in a modern interpretation of Romanesque architecture. "Architectural precast wall panels on the exterior allowed the new structure of the church and school to be erected quickly, which was a powerful message of hope in a city trying to rebuild much of its retail and institutional buildings all at once," Milbrath says.

The decision to go with precast concrete for the building's facade provided durability to the entire building enclosure, which was particularly important to a community rebuilding itself in the wake of disaster. As part of the project, actual Federal Emergency Management Agency (FEMA) storm shelters were

incorporated throughout the interior core of the school. "Spaces normally used as corridors and interior rooms of the school have become safe rooms, meeting FEMA standards for the entire school population and church simultaneously," Milbrath says. The walls of the school were finished smooth and painted, but left exposed in all of the corridors—a request from the school principal for durable wall surfaces as well as a visual reminder of their second purpose.

To achieve the aesthetic goals, the designers included intricate precast concrete detailing on the facades of both buildings, including protruding brick features and areas of exposed precast concrete that simulate what cast stone would look like on a traditional, masonry project. Formliners were used at the base of the school panels to emulate natural split-faced stone.

Working directly with the precast concrete producer early on allowed design, review, and production to proceed on a greatly accelerated schedule to meet the goal of re-opening the school in August of 2014, and the church and parish hall and offices before Christmas of the same year, says Dirk McClure of Enterprise Precast.

"When that iconic cross remained standing, it served as a symbol of determination and hope, not just for the religious community, but for all of Joplin as a whole." McClure says, "Now St. Mary's has reestablished itself with a brand new parish and adjacent private school designed to strengthen the Community. Due (largely) to the effective use of precast concrete, the tight schedule and all of the project's unique needs were met. Today it's the new church and school that stand as a symbol of fortitude for Joplin."



Owner: **St Mary's Catholic Church and School** • Architect: **RDG Planning & Design (Omaha, NE)** • Engineer: **Thompson, Dreesen & Dorner Inc. (Omaha, NE)** • Contractor: **Crossland Construction (Kansas City, NE)** • Photo Credit: **Jacia Phillips Photography & Enterprise Precast Concrete, Inc.** • Location: **Joplin, MO**



www.enterpriseprecast.com

Built to Meet Strict FEMA Specifications, Precast Offers Protection and Peace of Mind

Most areas of the country experience nasty weather from time to time, but where there is high wind, there is greater need for protection. According to the National Weather Service Storm Prediction Center, there have been 56 confirmed tornadoes this year in the United States from January 1st to March 5th.

Precast concrete inherently possesses the vital characteristics, such as strength, penetration resistance and durability, required to withstand the hazards of violent weather. As a result, the Bobcat Company turned to precast for a recent addition to its operations in Gwinner, North Dakota.

The Bobcat North Assembly Addition is a 210 ft. x 50.ft. addition to an existing



structure that was completed in early 2016. The addition is a storm shelter that serves as locker rooms and a lunch/cafeteria space adjacent to the existing assembly building. Since the addition is a storm shelter, it was designed to resist a 200 mph wind load per the design codes provisions stipulated in FEMA 361 and ICC 500 for that geographic location. (Buildings, shelters or spaces designed to the ICC-500 standard are termed “shelters,”

so all precast concrete safe rooms designed to the FEMA criteria meet or exceed the ICC-500 requirements.)

The new building being adjacent to an existing structure presented a minor design challenge from an accessibility perspective, but was overcome by bearing the roof double tees on an 8” solid wall and cantilevering the double-tee to meet the existing building.

The precast components on the job consisted of 10DT26 roof members (a 10DT24 with a 4” Flange), 14” IWPs (8/3/3) and 8” solid panels. The double-tee size was dictated by load demands, but the insulated wall panels were made thicker to help with global uplift on the structure since they were only 17’ tall.

As with any storm shelter, the challenges with this job were ensuring the load demands during a tornadic event were correctly resolved so that load path existed to the foundation elements. Aside from these typical design challenges the job went very well and went together quickly and efficiently.



Project Name: **Bobcat North Assembly Addition** • Architect of Record: **Shultz + Associates Architects** • Engineer of Record: **Sandman Structural Engineers** • Contractor: **Comstock Construction** • Photo credit: **Doosan Bobcat No. America** • Location: **Gwinner, ND**

Gage
Brothers

www.gagebrothers.com

University of Nebraska Medical Center- Sterile Processing Facility

This 39,000 square foot Sterile Processing Facility follows European design models of sterile processing that produce more predictable outcomes to serve all the medical suites in the University of Nebraska system. The building incorporates state of the art decontamination and tracking processes and also houses automated Getinge equipment that is utilized throughout the facility. As one of the only facilities of its kind in the country, the University of Nebraska is leading the nation in the future of sterile processing.

Precast concrete encompasses a vast majority of the building's exterior and

also a common cladding material on the university's campus. The solid wall panels have a buff color with a light sandblast finish. Reveals were also incorporated as an architectural feature. Precast concrete was specified due to cost savings and its accelerated schedule capabilities. Not

only was the project fast track, it also needed to be constructed during the typically harsh midwest winter.



www.coreslab.com



Architect and Structural Engineer: **Cromwell, Little Rock, AR** • Contractor: **MCL Construction, Omaha, NE** • Owner: **Landlease Healthcare Development** • Location: **Omaha, NE**

Carroll CSD - Fairview Elementary

The \$3 million construction expansion project at Fairview Elementary in Carroll, IA included a new entryway and offices, a new competition-size 500-seat gymnasium, a new playground area and renovating classrooms to a more "open model." The inner vestibule doors inside the new entryway lock while school is in session, leaving all visitors to pass through the front office to enter the building.

The expansion needed to have a storm resistance component to it, so the volume was designed to resist storm winds that are achieved at the top end of an EF -3 tornado (167 mph). Wells Concrete incorporated an additional 2" of flange thickness into a standard 42" x 8' wide double tee, which allowed for resistance against the significant

uplift forces that would be created in a significant wind event. The 44" double-tees were able to clear a 73' span and still handle all service roof loads as well as a potential significant storm event. The gymnasium is also a great central location for all students,

teachers, and staff to gather in case of a storm event while still having two options for safe egress after an event.



www.wells.concrete.com



Architect of Record: **FRK Architects & Engineers (Tom Wollan)** • Engineer of Record: **FRK Architects & Engineers (Brian Bartlett)** • Contractor: **Badding Construction** • Installer: **US Erectors** • Location: **Carroll, IA**

Mercy Joplin Hospital

On May 22, 2011, an EF-5 tornado tore through Joplin, Mo., demolishing dozens of buildings. The town's multilevel hospital actually stood through the storm but sustained significant damages, necessitating its replacement. Less than four years later, a brand-new, state-of-the-art \$345 million hospital has opened its doors, setting a new standard for tornado readiness.

After the storm, an assessment of the original hospital showed that while the precast concrete architectural cladding exterior on the building held, many brick and block walls failed as well as most of the glass. When the design

team began creating plans for the new hospital, they started with the part of the original structure that worked—precast concrete—then they looked for ways to improve it. To achieve a storm-hardening design, the new structure included a durable exterior cladding of precast concrete, concrete roofs with hurricane-grade penthouses and fastened equipment, and high-impact glass secured by the precast concrete to increase wind loads.

In addition to durability and resiliency, precast concrete also helped with the schedule and aesthetic goals. The owners needed the hospital to be replaced as soon as possible so they could once again serve this vibrant community. And they wanted a solution that made a strong visual statement. Using

precast concrete enabled them to achieve all of these goals.

The designers were pleased with the way the necessary level of storm resistance was delivered through the use of a precast concrete. More-durable high-performance facades are just the beginning of an era of large-scale structures that are built to be more impact-resistant as devastating tornadoes become more common. The lessons learned from rebuilding this hospital will likely have an impact on how owners look at designing and building hospitals for many years to come.



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Owner: **Mercy Health Systems (Joplin, MO)** • Architect: **HKS Inc. (Dallas, TX)** • Engineer: **SSE Inc. (St. Louis, MO)** • General Contractor: **McCarthy Building Cos. Inc. (St. Louis, MO)** • Photo Credit: **Jacia Phillips Photography & Enterprise Precast Concrete, Inc.** • Location: **Joplin, MO**

Learn & Earn Box Lunches

PCI Midwest provides continuing education programs on a variety of topics. These programs are easily tailored to conference room or classroom lunch programs. Architects and engineers can learn about precast concrete hollow-core floors and walls, architectural precast concrete, precast parking structures, glass fiber reinforced concrete, high performance precast concrete and much, much more. Contact mike@pcimidwest.org to request a program for you or your company.

The following programs are prepared and ready for presentation. Please allow a minimum of two- to three-weeks from the date of your submission to the date of your requested presentation.



C&E Flats

Prestressed construction using hollowcore plank made possible the bold construction of a five-story complex in the middle of an existing structure for the C&E Flats complex in St. Paul, MN. This redevelopment project transformed a 90-year-old garage into a five-story apartment complex with 119 living units.

The single-story, warehouse-style building was not an ideal layout for constructing apartments. Because the building itself had no historic designation, complete demolition was an option. However, renovations or changes still needed approval from the Saint Paul Historic Preservation Commission and it was doubtful that complete demolition would be allowed.

Exeter Group worked with BKV Group to develop a bold plan to construct a five-story complex in the middle of the existing structure, while keeping the exterior and several other existing walls intact. This plan created several challenges. First, the building's interior would have to be demolished while the outer shell was kept in place. Keeping the façade in place also would limit access to the construction site because the new



Owner: **Steven Scott Management, Inc.** • Architect/Engineer: **BKV Group** • General Contractor: **Frana Companies** • Hollowcore Erection: **Zachman Precast Inc.** • Location: **St. Paul, MN**

structure would be built within the existing footprint. Lastly, the first floor needed to have large open spaces to house several amenities, including the parking garage, which itself required a fire-resistant material.

Construction began with the demolition of the building's interior. During this phase, the exterior façade was supported by metal beams to prevent any damage or collapse of the walls. After the demolition, the walls were surveyed to determine lengths for each hollowcore plank. After the survey, it was apparent that the erection process would take careful planning because of the building's unique shape, including a 120-degree corner.

Each piece of hollowcore plank was custom formed to fit the layout of the existing building. The precaster sub-

contracted Zachman Precast Inc. of St. Michael, MN to erect the hollowcore. A single crane was deployed to the site to erect columns, beams, and hollowcore for the building's first level. This phase included more than 380 planks of hollowcore and solid slabs, 50 of which were precisely cut with an angled end to fit the building's shape. Extra deep beams and specially designed planks provided a sturdy system on which to install a roof-top swimming pool. The designers used the large open area under the pool for additional parking spots. After this phase, a tower crane sat on top of the just-erected hollowcore structure in order to erect the additional five stories of residential living space. In total, the precaster provided 113 deliveries of hollowcore plank.

The hollowcore erection took place late fall 2016 and was completed in an impressive two and a half weeks. Frana Construction continued construction for the next year. C&E Flats opened its doors to residents in August 2017.



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