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Looming Large: Big Sizes Mean Big Focus on Structural Engineering

The architectural community is pushing the limits of what can be done with glass, as applications grow beyond what many thought was possible even a few years ago.

The glass and glazing industry is happy to accommodate, having made monumental strides in fabrication capabilities. German fabricator sedak, for example, has introduced to the United States lites of glass spanning 49 feet by 10½ feet in size. Other North American fabricators are also investing in larger product offerings.

With the ever-increasing dimensions of architectural glass comes a responsibility in the building community to ensure that it doesn't overextend the material.

"As a supplier, we provide the glass that the client requests," says sedak North America vice president Maic Pannwitz. "… The responsibility for the structural concept work is with the facade contractor." He says a special glass engineer should be involved as soon as building development begins.

"They have to check story drifts, deadloads and building movements," he says. "Glass can accommodate a lot, but it's still glass, and if it gets overloaded, it breaks. Designing the correct interfaces between the building structure and the glass is the key."

This attention to detail is particularly important when dealing with structural glazing and point-supported glass.

"Building codes determine how much glass can handle. The engineer's job is to protect architects and glazing contractors from unknowingly exceeding those boundaries," says Stewart Jeske, president of JEI Structural Engineering Glazing Systems. "Engineers need to be involved in the beginning design phase of projects. If the engineers are not involved in the architectural design stage, it's very important for the glazing contractors to have an experienced engineer on their team as early as possible."

Architectural demands for maintaining minimum sightlines while using larger structural glazing applications have also opened up opportunities for innovations in sealants and adhesives.

Jon Kimberlain, senior application specialist at Dow Corning Corp., says his company has been increasingly involved in the early design phases of projects, as architects seek engineering data. He says Dow Corning has a potential patent on how to use finite element analysis (FEA) to reduce the sightline for bigger glass lites and "super-high windloads."

"Through this process, it has taught us more than we ever knew about how our sealant performs under these unique design situations," he says. "It's driving the industry to think about what we can do beyond the convention."

Jeske points out that, for point-supported glazing, the stress limits around the holes in the glass are key.

"This requires finite element analysis, and special programs are used to make sure we stay within code-allowed stress limits," he says. "Larger glass sizes need more support fittings to limit deflection and stress, which requires more rigorous engineering analysis. Providing FEA with glass is very specialized because of the unique material of glass and its limiting properties. It is very different than steel, concrete or wood taught in engineering curriculums."

Pannwitz says "there are more elegant concepts on the market" to fix point-supported glass if spider fittings aren't in the architectural design.

"You can fix the glass with patch fittings, you can glue the glass to the substructure with structural silicon… sedak laminates titanium embeds with thread into the glass as a structural point for connection with fins or other parts of the building," he says.

Kimberlain says he's seen more inquiries regarding the use of high

sedak featured its oversized glass at the most recent glasstec event in Germany. As these large lites make their way into structural and point-supported applications, a bigger focus is being placed on engineering.

strength adhesives in point-supported.

"That's another avenue in innovation," he says. "If you think about the cost of this huge piece of glass in a point-supported application… and then drilling through the glass, is that going to create some potential for breakage? I don't know, but these are the things we're starting to think about."

These larger glass installations across a variety of applications have pointed to a need for specialized engineering in the architectural community. Jeske has seen an uptick in requests from architects for engineering support in the design phase regarding the capacity of large glass lites.

"We're pushing the limits of the older empirical test-based load capacities that have typically defined maximum glass sizes in the past," he says. "… Our engineers are more in demand because we focus solely on glazing systems' structural engineering. This focus keeps us sharp on all of the latest code requirements, methods and construction trends so our clients save time and money. Because of the demand and the specialized engineering for glass, more training time is needed to bring new hires up to speed. This is something not taught in school."

His company has developed proprietary software specialized toward the glazing industry for fast and accurate engineering solutions. It also uses new FEA software specific to glass. That technology combined with fabrication developments, such as strong interlayers, will continue to drive things forward, he says.

"We anticipate more and more innovative technology in every area of the glass industry as architects, manufactures, glazing contractors and engineers continue to push the boundaries in glass use," says Jeske.

—Nick St. Denis ■