

Case Study:

Laminated glass strength and clarity reach new heights at Skydeck Chicago

In July 2009, the Skydeck Chicago at the Willis Tower opened a new visitor attraction called “The Ledge” offering birds-eye views and heart-pounding thrills from an earth-defying glass cube 103 stories up in the air.

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Extra-clear glass flooring uses tempered, low-iron glass and SentryGlas® ionoplast interlayers

At 442 m (1450 ft) tall, the Willis Tower (formerly Sears Tower) in Chicago is the tallest building in the Western Hemisphere. Now it gets a further distinction as host of a 103-story-high, all-glass visitor attraction called “The Ledge” where adventurers can step out into the sky for a heart-pounding view of an ant-like streetscape nearly a quarter mile below.

The Ledge is part of the already well-visited Skydeck at the Willis Tower. Since The Ledge opened in July, thousands of people have enjoyed the thrill-seeking experience each day. Visitors can enjoy the experience safely because it was constructed to bear five tons of weight.

The Ledge consists of two separate boxes jutting a little more than 1,2 m (4 ft) out past the edge of the Skydeck façade, creating a gravity-defying view that’s sure to thrill those who dare step out onto the glass floor. Strength of the all-glass construction comes from laminated glass, a multilayered sandwich of glass and clear adhesive interlayer sheet material that holds the layers of glass together. The laminated glass is assembled using minimally obtrusive framing, with bolts through the glass holding it to a retractable structural rail.

Stiff, tough, clear interlayer adds to glass floor safety and strength

The crystal-clear, see-through floors for The Ledge are made with 1,52 mm (60 mil) SentryGlas® interlayers sandwiched between three half-inch plates of fully

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tempered low-iron glass, a combination that's unmatched for strength and clarity. Compared with traditional interlayers, SentryGlas® is five times tougher and up to 100 times stiffer, making it an ideal choice for improved structural performance in applications such as flooring, balustrades, building façades and security glazing.

Original Sears Tower architectural firm Skidmore, Owings and Merrill (SOM) designed The Ledge so that the fully enclosed glass boxes retract into the building, allowing easy access for cleaning and maintenance. Experts in international structural glass design, Halcrow Yolles, fully designed and detailed all the glass and steel components. Beginning with the architect's original concept, the engineers took the design one step further by eliminating all perimeter structural steel at the sides and along the floor of the glass enclosures and creating a nearly invisible support system. Lamination of The Ledge floor was done by Prelco in Montreal, Canada.

Lighter façade panels enable more subtle supporting structures

For decades, interlayers made of polyvinyl butyral (PVB) have been the industry standard when producing laminated safety glass. Architects are well aware of the possibilities and limitations of such glass when used extensively in façade engineering, for roofing and window panels. In contrast, SentryGlas® enables an entirely new approach because the interlayer is over 100 times stiffer and five times stronger than PVB. As a consequence, there is an almost perfect transmission of load between two laminated sheets of glass, even at high temperatures, leading to the excellent flexural behavior of the glass when under load - also under direct sunlight in high summer. Accordingly, laminates with SentryGlas® show less than half the rate of deflection when compared to laminates with PVB, when under the same load, and thus almost the same behavior as monolithic glass of the same thickness.



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As well as improved strength and stiffness, other benefits of SentryGlas® include:

- **Safety:** In the event of breakage, glass fragments remain firmly bonded to the interlayer, reducing the chance for injury
- **Security:** SentryGlas® can be used in glazing that withstands bullets, hurricane-force winds and even bomb blasts
- **Durability:** SentryGlas® is extremely durable and resistant to clouding, even after years of exposure
- **Design Versatility:** SentryGlas® can be used in glass manufactured flat or curved, including annealed, toughened, heat-strengthened, spandrel, wired, patterned and color tinted glass
- **UV control:** SentryGlas® is available with or without UV transmittance

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