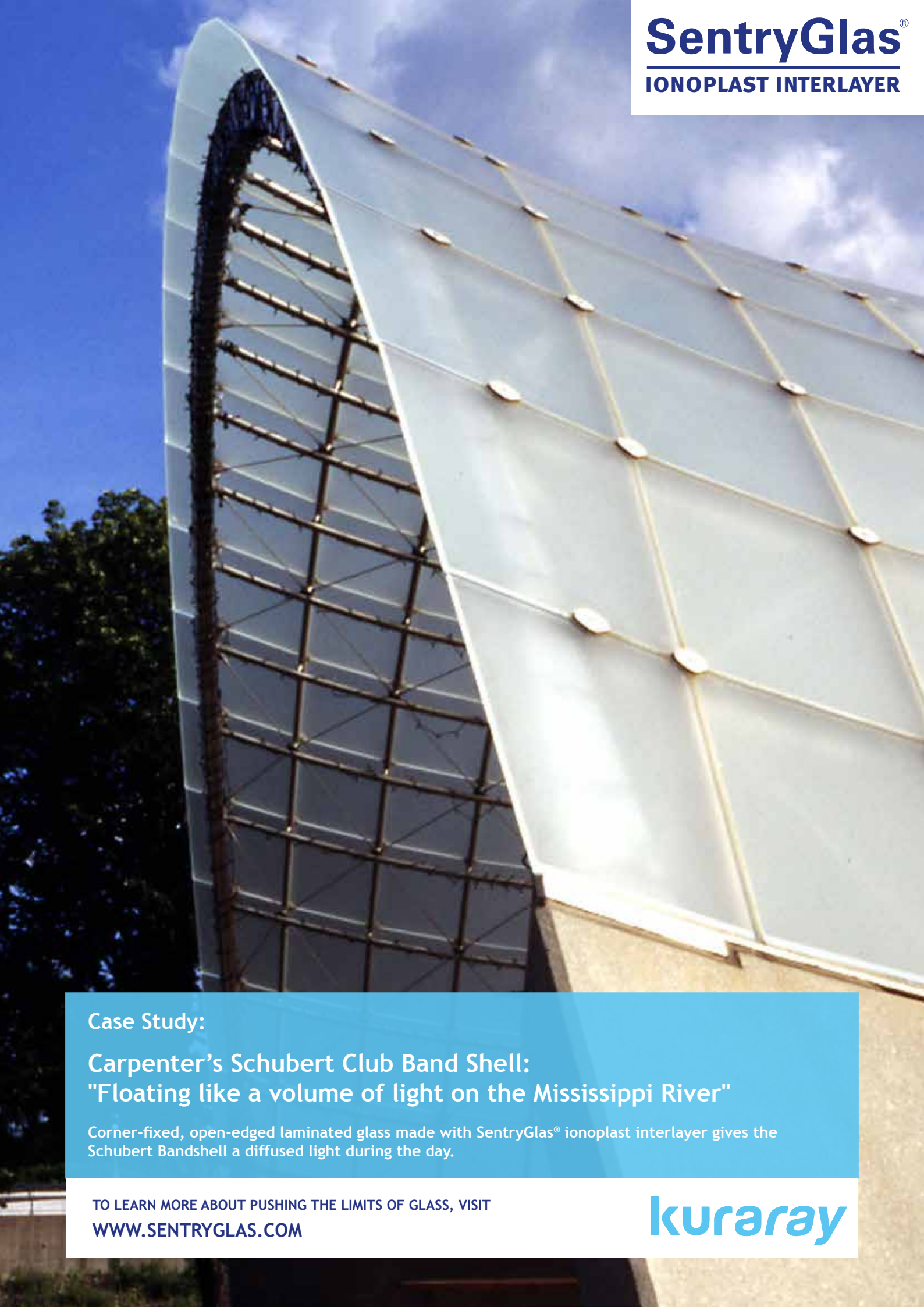

SentryGlas®
IONOPLAST INTERLAYER

Case Study:

Carpenter's Schubert Club Band Shell: "Floating like a volume of light on the Mississippi River"

Corner-fixed, open-edged laminated glass made with SentryGlas® ionoplast interlayer gives the Schubert Bandshell a diffused light during the day.

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Carpenter's Schubert Club Band Shell:'
'Floating like a volume of light on the Mississippi River''

The sculpted shape of the bandshell is designed to let the mighty Mississippi River flow right through during flood stages.

The Schubert Club Band Shell is a tough yet delicate, selfsupporting and free standing sculptural structure of laminated glass incorporating SentryGlas® ionoplast interlayer. It is located at tiny Raspberry Island on the Mississippi River at St Paul, Minnesota. Cultural events ranging from chamber music to poetry readings are now being hosted there.

James Carpenter Design Associates (JCDA) of New York used SentryGlas® ionoplast interlayers for the Band Shell because the interlayer empowered the firm to design an ethereal-looking laminated glass structure that can be beautifully illuminated at night. According to James Carpenter: "Use of the interlayer allowed us to design a lightweight and delicate structure that floats like a volume of light on the Mississippi River." At the same time, the tough ionoplast means that the glass Band Shell is strong enough to withstand snow loads and Mississippi River flood-borne debris.
"The use of SentryGlas® meant that we could design with laminated glass as freely and safely as we could with a fully composite material such as concrete.

" Prior to completion of the Schubert Club Band Shell in September 2002, the island had been long neglected. The vision of the client, The Schubert Club of St Paul (the oldest chamber music society in the USA's Mid-West) and the island owner, the City of St Paul Division of Parks and Recreation, was to re-awaken recreational activity along the river front.

Carpenter told LGN: "The river valley, once a major industrial transportation corridor for the city was previously a dark silent void at night. Now, instead, the double-curved form of the luminous glass band shell acts as a light-diffusing canopy during the day and a luminous, glowing lantern at night. It draws people down to the island and river front, initiating the process of transforming the river into a recreational corridor of parks. "The challenge was to design a delicate structure that could survive the long cold winters and high snow loads as well as occasional floods. The solution we designed consists of a sinuous, translucent, low-iron faceted laminated glass form that will not impede the flow of the river during flood season and also acts as a two-sided performance space.

"The detail refinement of the Band Shell brings together concrete, wood, stainless steel and laminated safety glass into a space of intimate scale and functionality.

"The low-iron laminated glass with a 1.52 mm (60 mil) interlayer of SentryGlas® and an acid-etched surface has impressive optical and structural properties. The lattice

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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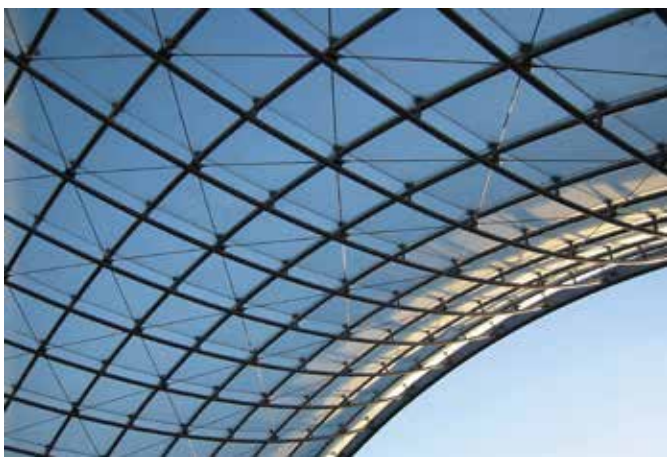
geometry allows a high degree of repetition in glass sizes and detailing and enables the glass panels to be planar, avoiding the need for warped or triangular-shaped panels. In other words, the surface of the sculpture appears smooth and not multifaceted. The panes of glass used are approximately 1m^2 (10,8 sq ft) and at the exterior edges the panels cantilever over the edge beams by as much as 20 cm (7.9 in). This self-supporting structural strength could only be achieved by using SentryGlas®." All the glass panes are laminated, with infill panels composed of two 6 mm (¼ in) an-nealed plies and cantilever panels of one 6 mm annealed and one 6 mm tempered ply. The tempered plies are located at the top due to their impact resistance and higher tensile capacity. Each panel is laminated with SentryGlas®.

Carpenter explained: "Physical glass testing was conducted by our firm, together with the structural engineers for the project, Shane McCormick and Bill Baker of SOM Structural. Dr Hans Schober of Schlaich, Bergermann & Partner of Stuttgart, Germany and consulting engineer André Chaszer confirmed that the ionoplast interlayer is an unbelievable 100 times stiffer than PVB. The results of the testing meant that we could design with laminated glass as freely and safely as we could with a fully composite material such as concrete."

JCDA's project architect, Richard Kress, said: "The significantly greater composite strength of laminated glass with SentryGlas® means that the band shell could be as thin and delicate as possible while fulfilling stringent safety requirements in both broken and unbroken conditions.

In addition, the shape of the curved laminated glass structure with the ionoplast interlayer benefits the acoustic performance of the band shell by dampening the glass surface. Maintenance and cleaning is also made easy since workers can safety walk on the band shell roof."

The architect of record for this project is Peter Kramer of St Paul. The glass fabricator is Depp Glass of Long Island City, New York. Wesley Depp commented: "For this particular design, when testing a full size mock up at our facility with the engineers it was discovered that when the glass was purposely broken and PVB was used the glass sagged significantly and slipped out of the holding clips. However, when we used laminated glass with the ionoplast interlayer in the same testing method the glass supported itself substantially longer and did not slip out of the holding clips."



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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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