



Case Study:

Clear, frameless, cantilevered glass balustrades at Europe's largest urban shopping mall

Open-edged laminated glass balustrades at Westfield London shopping center are subject to the highest category of British Standards and Building Regulations with regard to loadbearing capacity.

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Approximately 2,000 panels of laminated glass made with SentryGlas® ionoplast interlayer, are used to create clear balustrades at the new Westfield London shopping center, Europe's largest urban shopping mall.

Around 2,000 free-standing panels of laminated glass, containing SentryGlas® ionoplast interlayer, are used to form balustrades at the new Westfield London shopping center, Europe's largest urban shopping mall, which opened for business on 30 October 2008. 20 percent thinner than other glass laminate constructions of equivalent performance, the glass balustrades, manufactured by UK architectural glass supplier Kite Glass, provide a safe and secure shopping experience for all visitors to Westfield, while affording them unobstructed views of the more than 280 shops located there.

Europe's largest urban shopping mall

The Westfield London shopping center, a £1.7 billion development designed, constructed and operated by the Westfield Group, boasts 150,000 square meters (1.6 million square feet) of space over two floors - the equivalent of 30 soccer pitches. In addition to its retail units, Westfield London will contain a cinema (due to open in late 2009), nearly 50 restaurants, leisure space and a library - and is expected to attract over 20 million visitors per year.

Once inside the vast shopping complex, visitors will discover an atmosphere of spaciousness and calm, created in part by the influences of nature - water, light and earthy materials are recurrent themes in its architecture - and also by the integration of wide and expansive malls for a stress-

free shopping experience. It was as a reflection of the architectural vision for Westfield London, that CMF Ltd. of Feltham, Middlesex (UK), conceived the transparent glass balustrades and handrails for the first floor of the centre, its significantly reduced and, at the same time, the role of the glass balustrade as a barrier is maintained.

"During transportation and installation of the panels at Westfield London, one or two of them cracked as a result of inappropriate handling, yet remained rigid and with the glass intact - providing us, and the site's risk manager, with an impressive, first-hand demonstration of the interlayer's post breakage performance," confirmed Julian Clayton. "Overall, the end product has been first class. The glass balustrades and handrails, with their clean lines and simple design, conform perfectly with the light, spacious feel of Westfield London. At the same time they provide the many thousands of visitors to our centre with an unobstructed view of the exciting retail displays above and below them as well as a safe and secure shopping environment."

SentryGlas® was created to provide a superior solution in the use of glass in architecture and construction. Its superior strength and lasting clarity, even after years of service, has opened up a world of possibilities for both architects and structural engineers. Björn Sanden, development programs manager at Kuraray Glass Laminating Solutions, explains:

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“SentryGlas® represents an economically advantageous solution: because of the mechanical properties of the interlayers, it is possible to reduce the weight of the glass and consequently of the supporting structure, as in the case of the Westfield London shopping centre building.

As well as their high stiffness, SentryGlas® interlayers retain their original high transparency after years of usage and exposure to atmospheric conditions. Indeed, when used for external applications, as is the case for some of the balustrades at Westfield London, the resistance of laminated glass made with SentryGlas® to moisture and the effects of weather comes into its own in terms of its edge quality and clarity.”

SentryGlas® structural interlayer is used worldwide for architectural projects such as balustrades, flooring, stair treads, overhead glazing and innovative façade systems.

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.



Thinner than other glass laminates of equivalent performance, the balustrades manufactured by UK architectural glass supplier Kite Glass provide a safe and secure shopping experience for all visitors to Westfield, while offering unobstructed views of the shops located there.

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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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