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Laminated Glass News

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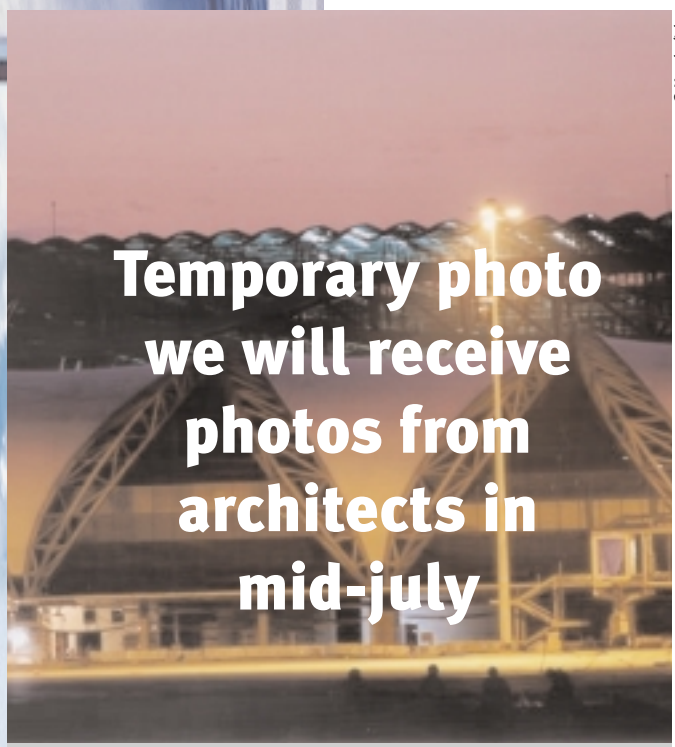
New Bangkok Airport: the largest laminated glass structure in the world!



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New Bangkok Airport's Thai name, 'Suvarnabhumi', means 'the golden land' and was the old name for the area that is now Thailand. Now, thanks to the Thai Government, architects Murphy/Jahn, all the subcontractors that worked for them, and architectural laminated glass, the golden land has a jewel of an airport.

More than 200,000 m² of laminated glass is used in the airport. For example, 34,000 m² of laminated glass with Butacite® is used in the façade of the main terminal alone. A further 45,000 m² is used in the skylight roof of the main terminal, making this the most extensive use of laminated glass for a skylight roof in the world. At least 40,000 m² of the same material is used in other applications throughout the airport such as passenger loading bridges, bus gate canopies, an Automated People Mover (APM) station, elevator shafts and signage. Roughly another 100,000 m² of laminated glass is used in the glazing of the airport's five concourses.

Murphy/Jahn Principal Architect Tom Chambers said: "We used laminated glass throughout New Bangkok Airport's main terminal primarily because we wanted to achieve a great deal of transparency, both from the exterior and the interior, which could only be achieved with laminated glass. This is consistent with Murphy/Jahn's architectural design philosophy, which emphasizes an integration of architecture and engineering, and an economic use of materials. The unique attributes of laminated glass, particularly with regard to its safety and acoustic qualities, make it essential to the nature of this building.

"Murphy/Jahn has been designing airports for many years and we have come to realize that laminated glass is the most appropriate material for the building enclosure in the airport environment. Unlike painted metal, for example, glass is impervious to airborne pollutants and is easily maintained. The use of laminated glass allows even greater benefits by virtue of its strength and adaptability. Laminated glass also helps acoustically in reducing the airport noise passing into the interior.

"For the roof, we used laminated glass with varying patterns of white and black ceramic frit and a Low-E coating on the overhead glazing is used throughout the terminal to help control the solar heat gain and glare, although the frit is barely perceptible to the naked eye."

The façade laminated glass was supplied by Thai German Specialty Glass (TGSG) of Thailand. The laminated glass for the skylight roof of the main terminal was supplied by PMK-Central Glass Co. Ltd. and Shenzhen King Glass of Shenzhen, China. Another laminator, China Southern Glass, also of Shenzhen, China supplied laminated glass, also with Butacite®, for the host of applications within the airport complex.

Bruce Wymond of Meinhardt Façade Technolgy (MFT) Australia said: "Butacite® PVB interlayer was used to enhance acoustic performance and provide safe resistance to fallout in the event of glass breakage. Laminated glass with Butacite® also provides safe breakage characteristics in the event of a bomb blast."

Continued on page 2

Toulouse Natural History Museum: large elliptical façades of laminated glass

When Paris-based architect Jean-Paul Viguier undertook the renovation and extension of Toulouse's Natural History Museum for the City of Toulouse he needed to take account of two major design challenges. First, sections of the museum comprised two classified buildings: an eighteenth-century Carmelite convent and a sixteenth-century Renaissance church. Second, the museum Curator wanted a continuous visual and conceptual link between an interior, open-air botanical garden, and the 'mineral' and 'animal' displays – including impressive dinosaur and whale skeletons - within the museum.

Architect Vigiuer solved these challenges by designing a breathtaking, 9 m-high, 120 m-long interior, elliptical façade of transparent laminated glass with DuPont™ Butacite® PVB interlayer, circling the interior garden. (The laminated glass façade forms the 'outer skin' of a double glass façade; a 16 cm exhibition space divides the two facades.) By way of its full transparency, the laminated glass façade allows full view of the listed monuments - as an added plus they are also reflected beautifully in the laminated glass – and visually links the museum's botany, mineral and animal displays, meeting the Curator's wishes.

Viguier said: "This invisible 'wall that is not a wall' could only have been built of laminated glass; considering the façade's huge dimensions it is the only type of glass that meets the safety codes. Also, the penetration-resistance of laminated glass was needed as a passive security measure to prevent break-ins or vandalism. The laminated glass construction we selected prevents heat build-up in the interior of the museum, necessary in the very warm, southwestern area of France where Toulouse is situated. Lastly, the Butacite® PVB contains a barrier to UV rays from the strong sunshine which could harm the museum's precious exhibits."

The laminator for this project was V2S Vitrages of Narbonne, France and the façade installer was Coprover of Castres, France. The laminated glass construction designed by these two companies allowed it to meet the EU standard P5A/ EN 356 for anti-intrusion, an important testament to the ability of the laminated glass façade to contribute to the passive security measures installed at the museum.

©Coprover

Paris-based architect Jean-Paul Viguier used an elliptical, fully-transparent laminated glass inner façade to draw attention to a 16th- and 18th-century edifices that form part of the Toulouse Natural History Musuem's original architecture while providing links between inside and outside – and state-of-the-art anti-intrusion resistance.

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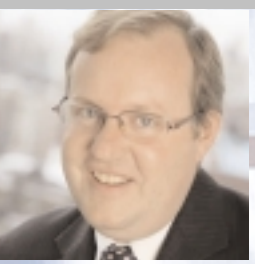
editorial



SentryGlas® Plus – a wealth of innovative applications

By Neil McClelland, Associate Principal, ARUP, New York

Long gone are the days when glass was used by architects only in windows. Now, architects often come to us wanting to build whole structures from glass because of the transparency and beauty of the material – at the same time asking Arup to provide 'engineering solutions for the impossible'. As engineers, we have to ensure the soundness and safety of architectural structures and the obvious problem with glass is that it can break. In some instances it can break for no apparent reason – for example the 'spontaneous' breakage sometimes experienced with tempered glass due to nickel sulphide inclusions.

Laminated glass gives the post-breakage strength needed for a range of architectural applications, particularly laminated glass with DuPont™ SentryGlas® Plus structural interlayer. For structural glass assemblies, laminated glass with its post-breakage strength is essential to minimize the risk of progressive collapse. The improved post-breakage behavior of SentryGlas® Plus over other interlayer materials is ideally suited for these applications.

SentryGlas® Plus was originally developed by DuPont for hurricane glass applications but it is now used by architects and structural engineers for a wealth of applications beyond the large and small missile impact resistance needed for hurricane glass.

First, laminated glass with SentryGlas® Plus provides better clarity than traditional laminated glass; stunning transparency can be achieved by architects, particularly if the interlayer is used in conjunction with low iron glass.

Second, from an engineering point of view, laminated glass with SentryGlas® Plus provides a step-change over PVB; it bears as much as twice the mechanical stress of traditional laminated glass and provides about four times the stiffness, depending on the details of the loading and support conditions. This results in better composite action of the overall laminate, a desirable engineering feature.

Third, traditional laminated glass positioned off the vertical can sag or creep if exposed for long periods to the moderate-to-high temperatures typically generated by solar radiation. While this is not usually a structural problem, it is often an aesthetic or serviceability problem. SentryGlas® Plus has a much lower loss of stiffness at temperatures likely to be experienced by architectural glass, so creep and sag are reduced or even effectively eliminated in many applications. This benefit is of particular relevance to architects wanting to use large expanses of horizontal glass, for example in extensive flat overhead glazing, sloped overhead glazing or glass walkways. As structural engineers, we would advise architects that laminated glass with SentryGlas® Plus is a better choice than traditional laminated glass for such applications. Laminated glass with SentryGlas® Plus would be an elegant and structurally sound solution for a long-span flat glass bridge, for example.

Fourth, Arup has recommended laminated glass with SentryGlas® Plus in "wet" applications such as around water features and in yachts because of the interlayer's outstanding moisture resistance and edge stability. We would not recommend continuous water immersion. However, in the context of architecture, the moisture resistance of the interlayer means that architects can design in polished, exposed edges to their laminated glass applications with more confidence.

Fifth, SentryGlas® Plus flows during the lamination process. This allows architects and engineers to cast metal inserts directly into the laminated glass. For structural glass applications, this allows an alternative connection method to end-bearing or bolted patch fitting connections. The increased strength, stiffness and temperature performance of SentryGlas® Plus, as well as its good adhesion to many metals, allows higher load capacities than most of the more traditional bolted patch fitting connections – an essential feature in larger structural glass applications. These metal fixings can either be positioned at the edges of the laminated glass, or at the face of the glass. Examples of where these fixings can be used include on the edge of stair treads or glass bridges, or into the face of laminated glass for retail store fittings. This is a much more advanced and elegant way of securing attachments to laminated glass than the traditional way of introducing fixings by patch fittings, which are bolted through the glass, or countersunk, fittings.These give a flush finish at the back but still show the metal fitting.

Architects come to Arup with their design dreams. Working with research/science companies like DuPont we are able to provide a fundamental understanding of the material (in this case, laminated glass) and suggest new structural engineering solutions to help the architect's dream become reality. For me, discovering the many properties of SentryGlas® Plus structural interlayer has involved blending the knowledge base of a cutting-edge science company (DuPont) and a cutting-edge engineering firm (Arup), working often in 'triplicate' with an outstanding laminator. This is how architectural dreams can become reality.

Neil McClelland, Associate Principal, ARUP New York

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Architects Michele Bonan of Florence, Italy and Louis Rivuelta of Miami worked on Grovenor House's canopy and balustrade respectively.

Canopy and balustrade in Miami private residence use outstanding adhesion of SentryGlas® Plus to metal for 'invisible' fixings

A 350 m² laminated glass entrance canopy that is elegant, frameless, "weightless" and completely free of fixings to the eye, and an 'invisible', tightly curved, laminated glass balustrade have both been built for Grovenor House, a high-end residential building located in Miami's exclusive Coconut Grove area. The canopy and balustrade were achieved thanks to the outstanding adhesion of DuPont™ SentryGlas® Plus structural interlayer to metal, meaning that "invisible fixings" could be achieved.

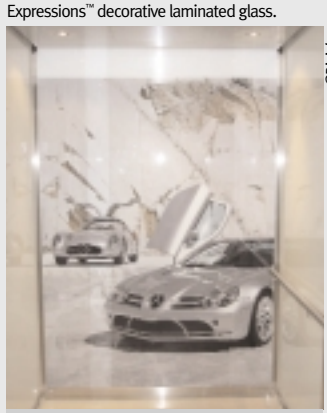
Project architect with Vetreria Longianese of Gambettola, Italy Claudia Guastadini, said: "We originally selected SentryGlas® Plus as the interlayer for the laminated glass canopy in order to meet Miami-Dade County hurricane codes. Yet working closely with DuPont, and as we came to understand more about the properties of this structural interlayer, we realized that we would be able to meet the client's desire for a total absence of visible clutter in terms of the holes, bolts and metal attachments usually needed to support a large, laminated glass canopy by casting the SentryGlas® Plus interlayer itself around the metal fixings, thus rendering them invisible to the eye.

"We were able to do this because of the interlayer's outstanding adhesion to metal. We attached the laminated glass panels of 2 m x 1.60 m using a point-fixed system whereby at the four edges of the glass, metal inserts are fixed or molded directly into the SentryGlas® Plus structural interlayer. The metal fixings are therefore completely invisible to inhabitants of the building, looking down onto the canopy.

The tightly-curved (1.25 m) laminated glass balustrade with SentryGlas® Plus is situated in the building's lobby. Architect Guastadini said: "For the balustrade, we incorporated the same method of 'invisible fixings' as for the canopy; the SentryGlas® Plus interlayer adheres directly to metal inserts and as a result there are no visible fixings or obstructions, making the balustrade seem almost

DaimlerChrysler Australia/Pacific uses SentryGlas® Expressions™ for elevator mural

DaimlerChrysler's Australia/Pacific's Mercedes-Benz of Melbourne (Australia) showroom greets visitors with a stunning elevator mural photograph that juxtaposes the classic Gull Wing car with the latest Mercedes-Benz SRL McLaren. The mural is made of DuPont™ SentryGlas® Expressions™ decorative laminated glass.



©Digiglass

Woods Bagot project architect Frank Rog said: "The elevator doors are made of totally transparent laminated glass so there is a very strong and immediate visual impact."

Architects Woods Bagot of Melbourne designed the showroom, including the elevator concept, in partnership with Digiglass of Australasia and DaimlerChrysler Australia/Pacific's senior project manager for dealer development, Richard Tan, who said: "This was a great opportunity to showcase Mercedes-Benz history and technology within our flagship 'Autohaus' dealership in Melbourne. The solution we arrived at encourages customers to think about DaimlerChrysler's long history of design excellence. The reaction from customers to the SentryGlas® Expressions™ mural has been fantastic! We are considering using a similar concept in other elevators as we refurbish DaimlerChrysler showrooms throughout Australia, starting with Mercedes-Benz of Sydney."

The elevator was made by Independent Lifting Services of Melbourne. Managing Director John Sanderson said: "We had never worked with SentryGlas® Expressions™ before but we intend to use the technology in as many elevator applications as possible in the future. It offers our clients great creative freedom for branding – the possibility to use photography or other types of digital images for great aesthetics and brand reinforcement is literally infinite!" The laminator for this project was DMS Glass of Melbourne.

Custom screen-print and one-way vision products broaden decorative interlayer offerings from DuPont

DuPont Glass Laminating Solutions is broadening its offering to the laminated glass market with the addition of two new decorative interlayer product lines to its portfolio.

The first addition to the DuPont SentryGlas® Expressions™ family of products involves customized decorative interlayers utilizing screen-print technology. Almost any artistic form is possible, including sandblast appearance, logos, customized colors, geometric designs, textures, and even metallic looks. Besides customization of the desired image or pattern, other parameters such as shading and light transmission can all be controlled from opaque through varying degrees of translucency in the decorative interlayer to create truly unique visual effects. When this decorative interlayer is laminated between two lites of glass, the resulting laminated glass construction can be designed to comply with all major building codes and key industry standards.

The second innovative product line involves customized decorative interlayers utilizing Contra Vision® one-way vision technology, which DuPont has licensed from Contra Vision Supplies Ltd., a company with leading technology in the one-way viewable glazing arena. Sometimes called 'privacy glass', laminated glass panels using one-way viewable interlayers enable a design to be visible from one side of the glass but not the other side. This technology can transform windows and doors into spectacular advertisements, signs or decorative designs, while maintaining the essential properties of the vision area – a clear view out and daylight in. Typical applications for one-way viewable decorative interlayers include commercial windows and doors, balustrades, bus shelters and even entire building façades.

Both product lines are now available through a supply agreement established between DuPont and Imaging Sciences of Willoughby, Ohio (USA), a leading graphic design and imaging company. Said Jeffrey D. Granato, Global Marketing Manager of DuPont Building Innovations: "The addition of these two innovative decorative families will give new meaning to personalization of one's environment – if you can dream it, you can do it!"

New Bangkok Airport, continued from page 1

MFT Australia, a highly-regarding independent façade consultant, was employed to test and approve the façade, ensuring that it meets the highest standards of aesthetics and functionality. Wymond, continued: "Added to its safety benefits, laminated heat strengthened glass was used instead of toughened glass to alleviate the risk of spontaneous breakage due to nickel sulphide inclusions.

"It's a fantastic achievement. The façade of New Bankok Airport's main terminal comprises what we believe to be the largest application of bolted point-fixed heat strengthened laminated glass in the world!"

Zaha Hadid: "An unswerving commitment to modernism"

©Steve Double

The London-based, Iraqi-born architect Zaha Hadid has won widespread international acclaim for her work; among these is the 2004 Pritzker Architecture Prize (Hadid is the first female architect to win the Award). Pritzker Prize jury chairman, Lord Rothschild, commented: "At the same time as her theoretical and academic work, as a practicing architect, Zaha Hadid has been unswerving in her commitment to modernism. Always inventive, she's moved away from existing typology, from high tech, and has shifted the geometry of buildings." Another Pritzker juror, the journalist Karen Stein, said: "Over the past 25 years, Zaha Hadid has built a career on defying convention – conventional ideas of architectural space, of practice, of representation and of construction." And juror and architecture critic Ada Louise Huxtable added: "Zaha Hadid's fragmented geometry and fluid mobility do more than create an abstract, dynamic beauty; this is a body of work that explores and expresses the world we live in."

Laminated Glass News: *: Zaha Hadid, please tell us about how materials such as laminated glass inspire you.*

Zaha Hadid: In a design environment that is dominated by new software that enables us to rethink form and space radically, there is an urgent need for 'high tech' materials, which match our computer-generated complex shapes and special conditions. After simulating demanding geometries on the computer's screen, the search for materials - such as laminated glass with the latest structural interlayers - with matching properties, starts. Glass properties might be explored in this research process that had not been thought of previously. At best there might be a new application or construction method, using architectural laminated glass for example, as a consequence of our research. We aim for an expansion of the material's performance and try not to think of the traditional limits given to materials such as glass by conventional applications.

LGN: *How important are innovative new materials –such as state-of-the-art laminated glass – and new processes in your work?*

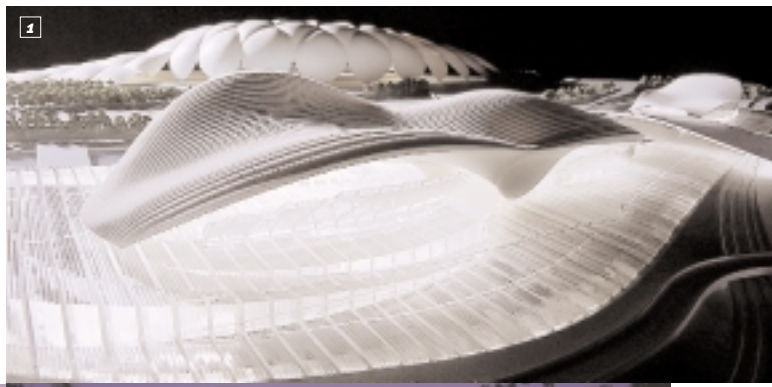
ZH: Techniques that enable us to 'stretch' a material such as glass, like thermoforming, techniques which allow us to achieve highly complex, double-curved surfaces, are currently being explored in our practice for applications like glass façade claddings. In the case of external applications these new techniques allow us to produce a completely new formal expression; glass buildings might appear like huge masses of melting ice, which can add a strong poetic quality to an urban space.

The combination of new materials and process can therefore play an important role in the creation of 'liquid glass spaces'.

Potentially, materials like architectural laminated glass, with multiple properties, will become even more interesting in the future. Architectural laminated glass with structural interlayers has the potential to perform very well, with minimal weight. At the same time, structures made with this material have very good insulation properties.

LGN: *What would be your dream material?*

ZH: With regard to the discussion of a sophisticated architectural skin, this would be a material that can be twisted, stretched, bent and wrapped around in whichever imaginable way and which, at the same time, can be completely transparent, translucent or opaque, structurally self-supporting and take any surface quality, color or decoration one could think of. This material would have multiple properties all compressed in a single layer. Laminated glass with the latest interlayers would fulfill many of these criteria.



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1. *London Aquatic Center, London, UK (2005-2008)*
2. *BMW Central Building, Leipzig, Germany (2002-2006).*
3. *Ordrupgaard Museum Extension, Copenhagen, Denmark (2001-2005).*

LGN: *Lars Teichmann, you were Zaha Hadid Architects' project manager for the BMW Central Building in Leipzig, which has won enormous critical acclaim and many awards. Please tell us about the use of laminated glass in this project.*

Lars Teichmann: Laminated glass contributed greatly to the high degree of porosity and true transparency that we wanted within the building; even the deepest spaces of the building are opened up. An office building is a sensitive space, psychologically. The flows and connections within the building that we had designed, made up of a series of interlocking bundles of curvilinear volumes and dynamic shapes, enable workers in the production line and office workers in the company headquarters to be in constant visual contact, encouraging interaction between the various groups. This interaction is achieved through extensive, floor-to-ceiling internal partitions of laminated safety glass in the interior spaces, often using large panels of 3 m tall x 2.5 m wide. Functionally, the use of laminated glass for these partitions also provided an acoustic barrier, despite the transparency.

Externally, laminated glass is used for two curtain walls, one at the main entrance and another at the back of the building, to introduce maximum daylight.

LGN: *Thomas Vietzke, you are the project manager for the Nordpark Cable Railway in Innsbruck, Austria. Please tell us how laminated glass will be used here.*

Thomas Vietzke: The project comprises four stations situated on the steep mountains of Austria, replacing stations that were 80 years old. The new stations have very sculptural yet lightweight roof shells made of laminated glass, floating on top of concrete plinths. Laminated glass is to be used for a transparent aesthetic and because of the way we want the stations to unobtrusively blend into the landscape. Looking at the roof shell's fluid shapes and soft contours, one might be reminded of natural phenomena such as glacier movements.

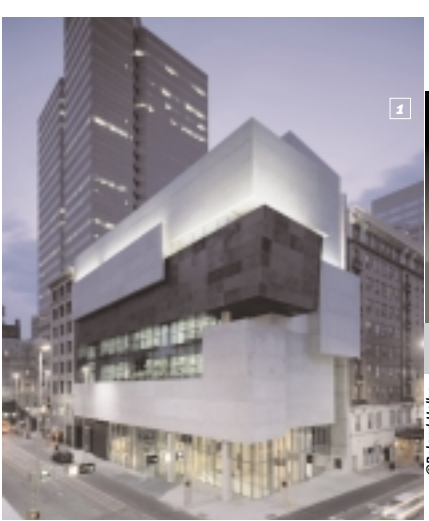
LGN: *Ken Bostock, you were the project manager for the Ordrupgaard Museum Extension in Copenhagen, Denmark. Please tell us how laminated glass is used in this Extension.*

Ken Bostock Physically, the extension space is small, therefore we used laminated glass extensively to open up the available space as much as possible and introduce as much transparency as we could. Aesthetically, transparent façades were important because we wanted to create a landscape within a landscape; the Museum extension is located in the extensive gardens of a large historic estate. In addition, Tambest of Finland supplied large panels of conical, curved laminated glass for small, sharply curved façades deep within the building. These conical aesthetics are in line with the contemporary vision of our firm; we like to use unusual geometric forms and abstract contours for soft shapes and this design choice can be fulfilled by using laminated glass.

LGN: *Zaha Hadid Architects has used architectural laminated glass in many other projects, notably a translucent ground-floor façade at the Rosenthal Center for Contemporary Art in Cincinnati, USA. From the exterior, the upstairs galleries are expressed as though they had been carved from a single block of concrete. They appear to 'float' over the lobby space downstairs, with its extensive façades in laminated glass, which are illuminated at night.*

Thomas Vietzke, do you believe that Zaha Hadid Architects will use laminated glass in the London Aquatics Centre, built for the 2012 Summer Olympic Games?

TV: Yes, definitely! Although we are obviously still in the early planning stages for this exciting project, we know that the large sculptural roof of the Aquatics Centre will be offset by some pretty amazing and impressive, enormous and undulating, laminated glass facades. This is in line with our firm's philosophy of openness and transparency, of linking the inside and the outside. Laminated glass will also be used for overhead glazing above the swimming pool level in order to get vertical daylight into that area.



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©Zaha Hadid Architects

1. *The Rosenthal Center for Contemporary Art, Cincinnati, USA (1997-2003).*
2. *Nordpark Cable Railway, Innsbruck, Austria (2005-7).*

Museums worldwide use laminated glass for a range of innovative effects

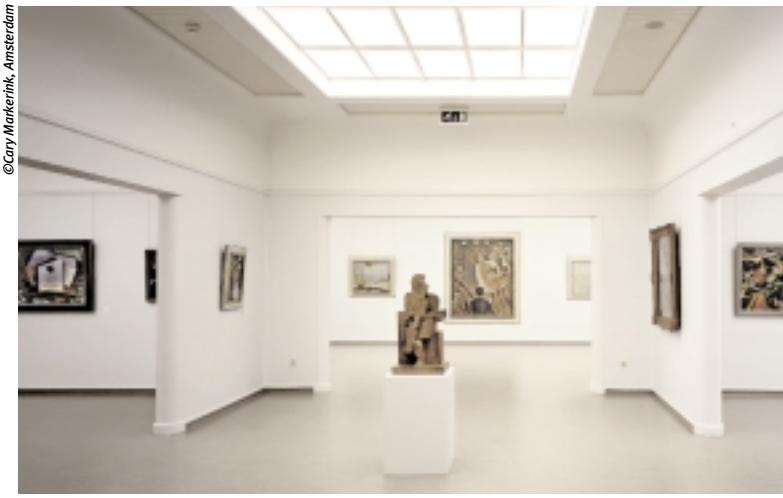
Kröller-Müller Museum in Holland: skylights of Soft White™ Butacite® and SentryGlas® Plus

Quist Wintermans Architekten of Rotterdam recently completed the renovation of the Van de Velde wing of the Kröller-Müller Museum in Otterlo, Holland, famous for its collection of Van Gogh paintings. Key goals of the renovation, completed in April 2006, were to make the building safer and to improve the quality of light thrown down into the galleries.

DGMR Engineers of Arnhem worked with the architects to specify a series of 44 inner skylights made of laminated glass with DuPont™ Soft White™ Butacite® interlayer for the museum's 28 galleries. These skylights combine with an outer skylight of laminated safety glass with DuPont™ SentryGlas® Plus structural interlayer (designed to provide security and thermal insulation), built into the outer, copper roof of the museum, to give the precise quality of soft light architects wanted inside the galleries.

DGMR's Johan Koudijs said: "Our primary concerns for the roof skylight were thermal insulation and security. Although we had originally considered using PVB, SentryGlas® Plus is a much stiffer interlayer. The museum is of course equipped with 'active' security measures such as alarms and guards. However, the roof skylight's laminated glass provides an invaluable 'passive' security device, essential to protect the museum's priceless collection of Van Gogh paintings. The glass supplier, Westland-Glaverbel of Maasland, near Rotterdam, recommended SentryGlas® Plus for the outer skylight because this interlayer is clear and transparent; therefore the light thrown down through this roof skylight to the ceiling skylights using Soft White™ Butacite® PVB would be absolutely neutral in color. As the museum is located in a forest, the quest to light the galleries appropriately was particularly challenging. The overall result is a beautiful, soft translucent light that permeates the galleries and meets the architects' specifications to their entire satisfaction. The Van Gogh paintings are thus now displayed in the exact tone of light that the architects and museum owners required.

"During extensive mock-up testing of the laminated glass skylight with SentryGlas® Plus, our readings showed total blockage of UV rays due to the interlayer. Combined with the second set of ceiling skylights with Soft White™ Butacite® PVB interlayer this means that the Van Gogh paintings themselves are absolutely protected from potentially-damaging UV rays."



©Cary Markerink, Amsterdam

Beijing Capital Museum: transparent street-facing façade of laminated glass with Butacite® invites people into city's "huge new living room".

Beijing Capital Museum, located at the centre of the city near Tiananmen Square and the Forbidden City, was completed in February 2006 by AREP of France and the Architecture & Design Institute of the Chinese Ministry of Construction (architect in charge: Cui Kai). Transparent laminated glass containing DuPont™ Butacite® was used for the museum's street-facing façade to create a feeling of openness and for reasons of safety, security, acoustics and energy efficiency.

Architect Cui Kai said: "This was a very important project for the City of Beijing. It's as though a huge new 'living room' has been created for the people of Beijing. Everyone is invited to come in, to explore the historic treasures inside the museum, which trace the history of the city. This is why it was very important to have such a large (40 m high x 60 m wide), fully transparent and open laminated glass façade facing the street. The transparency of the façade also means that when you're inside, you have clear views of the streetscape, where a non-stop 'live' performance of Beijing's contemporary history is being played out." Project architect at AREP, Daniel Claris, agreed: "Laminated glass is used for the east façade, facing onto Fu Xing Men Street so that there is no visual barrier between the museum and the city outside. The architectural intent for the façade was definitely to invite the citizens of Beijing to explore the museum's voluminous and mysterious interior."

Both Daniel Claris and Cui Kai confirmed that they selected laminated glass for reasons of safety, security, acoustics and energy efficiency. Also, since October 2005 laminated safety glass has been specified by the Chinese building codes for large façades such as this one. The laminator for this project was Shenzhen Sanxin Special Glass Technology Co. Ltd. of China.

© AREP

Skeleton leaf pattern decorates overhead glass canopies for Schomburgk Pavilion in Adelaide

Flightpath Architects of Adelaide, Australia used DuPont™ SentryGlas® Expressions™ decorative laminated glass for canopies totaling 400 m² for the Schomburgk Pavilion, a new atrium space completed in early 2006 as part of the Adelaide Botanical Gardens' 150 th anniversary celebrations.

Two central canopies, one wave-like in shape and one rectangular, incorporate a black ink, 'skeleton leaf' motif on a clear background, leaving areas of fully-transparent, clear glass. In contrast, the eastern and western, spiral-shaped canopies are printed on DuPont™ Soft White™ Butacite® interlayer, using greens and pinks from the SentryGlas® Expressions™ color palette.

Architect Steve Duddy of Flightpath Architects said: "The glass canopies using the black-on-clear design throw a subtle, dappled shade over the terrace. One has the feeling of walking through a forest; the canopy glass reflects and refracts the light, heightening visitors' appreciation of the quality of daylight as it changes throughout the days and seasons – a relevant message for a botanical garden, where plants need light to survive. The canopy glass is weatherproof for visitors but definitely does not exclude the beauty of changing weather conditions from the visitor's view.

"The pattern printed onto the SentryGlas® Expressions™ laminate is a highly magnified impression of the skeleton of a leaf and, in addition to having its own unique aesthetic qualities and providing shade, acts to camouflage dust build-up. The colored section of the canopies, using the same leaf skeleton design, provides a more solid shade and glows beautifully like a stained glass ceiling from the interior when the sun shines on it." Flightpath worked with SentryGlas® Expressions™ specialists Digiglass Australasia to create the canopies, which were laminated by DMS Glass of Melbourne. Duddy continued: "SentryGlas® Expressions™ works well in these new buildings because it is a contemporary application of the age-old material – glass – used in botanical gardens dating back to Joseph Paxton's glasshouses and his Crystal Palace of 1851, and because it has the lightness and transparency suitable to its setting."

© Digiglass

Atrium of laminated glass for Nasher Museum of Art

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The Nasher Musuem of Art at Duke University in Durham, North Carolina (USA) opened its USD 24 million new building designed by Rafael Vinoly Architects of New York in October 2005. Stepping into the sunlight-filled atrium of the new building, one is struck that the laminated glass skylight is seemingly free from any supporting columns. Five interlocking beams alone give the structure its stability. In the words of Rafael Vinoly: "The beams are based on a rotational structure, allowing for an enormous span, with no structure being perceived." The eccentric aesthetic of the laminated glass that covers the piazza is related to two functional elements: the drainage of rainwater and the different heights of the Museum's pavilions. The laminated glass for the atrium skylight was supplied by global glass fabricator Viracon.

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