

## Ove Arup: avant-garde architectural engineering with laminated glass

Ove Arup & Partners, founded in 1947 and based in London, is today one of the world's largest and most prestigious consultant engineering firms. With more than 60 permanent offices in over 50 countries and over 5,000 employees – including more than 1,500 structural engineers – it has won a plethora of architectural awards including several DuPont Benedictus Awards for innovation in laminated glass. Founded in 1947, Ove Arup today is at the front rank of architectural technology. Maintaining a close connection with avant-garde architects, the firm has pioneered a host of advanced structural solutions for projects the world over.

For this article, Laminated Glass News interviewed leading specialist from Ove Arup's façade Engineering Group in London, Sydney and New York.



**Graham Dodd,**  
**Associate,**  
**Façade**  
**Engineering**  
**Group, Ove**  
**Arup**  
**Partnership**  
**(UK)**

“Ove Arup was a pioneer in the use of architectural laminated glass when we worked on the Sydney Opera House 30 years ago. Until fairly recently, the only choice of interlayer was PVB – but these days there is a wider range of interlayers that give you various properties and which perform differently under load”.

### **BEYELER ART GALLERY, BASEL, SWITZERLAND**

“On this project, we worked with Renzo Piano as the architect and selected a multi-layered glass roof to control and diffuse the daylight and get the right ‘feel’ of diffused light in the gallery spaces”.

“The glass ceiling is of laminated glass and above that is a double-glazed, waterproof and weathering section of the roof that is also of laminated glass. This consists of a series of canopies, flat panes of white glass that overhang the building in the form of cantilevered panels strong

enough to withstand wind and snow. The glass panels are bent upwards on a gentle slope and bend downwards in other areas to deal with snowfall”.

“People need to be able to walk over the roof to maintain it – and there are a lot of people walking under the roof also. So safety was a primary consideration. This was difficult to achieve in the four corner panels since the glass cantilevers go out at the ends – the actual support position is not ideal. We therefore had to design a very strong panel which, if it broke, would not collapse catastrophically”.

“We achieved this by a combination of toughened glass doing the structural work

and heat strengthened glass laminated onto it to maintain the integrity of the panel in the case of breakage. The construction is particularly unusual since the toughened glass is bolted and clamped from underneath. Using the heat strengthened laminated glass on top, in the direction of the loading, ensured that the construction was safe from fallout and had maximum strength”. “The glass processor, Vegla/St. Gobain, was able to achieve this laminated construction using PVB. They incorporated white stripes for sunshading and to achieve a diffused lighting effect. Normally, these stripes are printed on the outside of the glass but in this case they were printed directly onto the interlayer.”

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*Beyeler Art Gallery, Basel, Switzerland*

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