Case Study

TRANSPORT

Jewel Changi Singapore Airport

SINGAPORE, MALAYSIA

Owner
Jewel Changi Airport Development Corp.

Architects
Safdie Architects
XRSP Architects, Planners and Engineers

Vitro Glass Products
Solarban® 70 Glass (Dome)
Solarban® 72 *Starphire Ultra-Clear*® Glass (Linking Bridges)

Glazing Fabricators
GnT Glass Company, Ltd. (Dome)
Wujiang Golden Glass Technologies (Linking Bridges)
Da Di Glass (Interior Glass)

Glazing Contractor
Mero Asia Pacific

Solarban® 72 *Starphire Ultra-Clear*® glass, which features a triple-silver low-e coating over the industry's most transparent architectural glass, distinguishes the linking bridges that connect the airport terminals to Jewel.

PROJECT BACKGROUND

Jewel Changi International Airport is more than a thriving international transportation center. With an indoor waterfall, rainforest, mirrored maze, topiary walk, interactive gardens, glass-bottomed bridge, and play and imagination stations sprawling beneath 550,000 square-feet of *Solarban*® 70 glass, the structure is also one of the world's most innovative showcases of biophilic design.

City in a garden

Located on the site of a former parking lot and designed to handle more than 65 million passengers a year, Jewel functions as Changi's main hub, connecting visitors to three of the airport's four terminals and a host of attractions including an upscale shopping mall, entertainment complex and luxury hotel.

Envisioned by architect Moshe Safdie as a "paradise garden," serving the "city in a garden," the center was constructed not just to attract more air travelers to Singapore, but to be a destination for people who live throughout the island-city.

Vitro® Architectural Glass

Jewel Changi Singapore Airport | Singapore, Malaysia

The dome-shaped façade, which stretches more than 650 feet across its longest span, is a continuous grid supported by a ring of 14 tree-like columns and ring beam at the roof's edge. *Solarban*® 70 glass was specified collectively by the project team for its ability to meet the building's extraordinary range of demands.

Among the most critical was the ability to transmit high levels of sunlight into the dome while mitigating heat gain. With visible light transmittance (VLT) of 64% and a solar heat gain coefficient (SHGC) of 0.27 in a standard one-inch insulating glass unit (IGU), *Solarban*® 70 glass helps Jewel sustain more than 200 species of trees, shrubs and flora collected from subtropical climates throughout the world.

These same characteristics also enable Jewel to reduce energy use without sacrificing occupant comfort, an achievement that earned it Green Mark certification at the Gold level from Singapore's Building and Construction Authority (BCA).

The exterior reflectivity of *Solarban*® 70 glass was heavily scrutinized during the specification process as well. Extensive research and testing were conducted to ensure that glare emitted from the dome would not blind views from the air-traffic control tower or pilots approaching the two runways.

Finally, the glass also had to meet radar-absorbing material requirements established by airport authorities. These mandates stated that no glass materials or metal cladding with high reflectivity of radar signals between 1GHz and 3GHz could be used. Due to its triple-silver coating, *Solarban*® 70 glass was determined to provide the best combination of radio frequency (RF) attenuation and daylighting to sustain plant life.

Photography by thirtysixshots phorography

Beauty and complexity

The fabrication of Jewel's glass dome was incredibly complex, which provided a range of logistical challenges, not just for the architect, but for the building engineers, general contractor, glazing contractor, fabricator and other members of the project team.

Much of this was due to the placement of the giant waterfall, which drops more than seven stories from an oculus that spans 33 feet. Because the oculus and waterfall had to be placed slightly off-center, the glass dome had to be constructed in a slightly irregular shape. This lack of symmetry dictated the fabrication of more than 9,000 double-glazed triangular glass panels, including many with frit patterns, with no more than two panels being exactly alike.

Each glass panel also had to incorporate a 16-millimenter air gap to insulate against aircraft noise. In addition, many were restricted to a maximum width of 2,500 millimeters (8-plus feet) to accommodate SentryGlas™ Plus laminating material.

Quality and logistics

To manage these intricate logistics, Safdie Architects developed a sophisticated design-to-construction program. More than 50,000 glass panels, steel members and custom-shaped solid steel nodes were fabricated by CNC robots directly from the design team's computer models. Once the components were made, they were labeled with barcodes indicating where they should be installed on the dome; then placed in containers and shipped to Singapore.

Vitro Glass products were held to rigorous quality standards as well. In addition to meeting the specific performance requirements of acoustical, climate-control, radar and other consultants, Vitro Glass supplied samples from each production run for performance data verification by an independent lab.

The result of these efforts is a stunning biophilic landmark that simply would not have been possible without use of glass – and perhaps even more specifically, the use of *Solarban*® 70 glass.

To learn more about *Solarban*® 70 glass, *Starphire Ultra-Clear*® glass and the entire line of high-performance Vitro Architectural Glass products, visit **www.vitroglazings.com** or call **1-855-VTRO-GLS (887-6457)**.

Vitro® Architectural Glass

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