Jakarta ETFE Canopy

FABRITECTURE
WHERE DREAMS TAKE SHAPE

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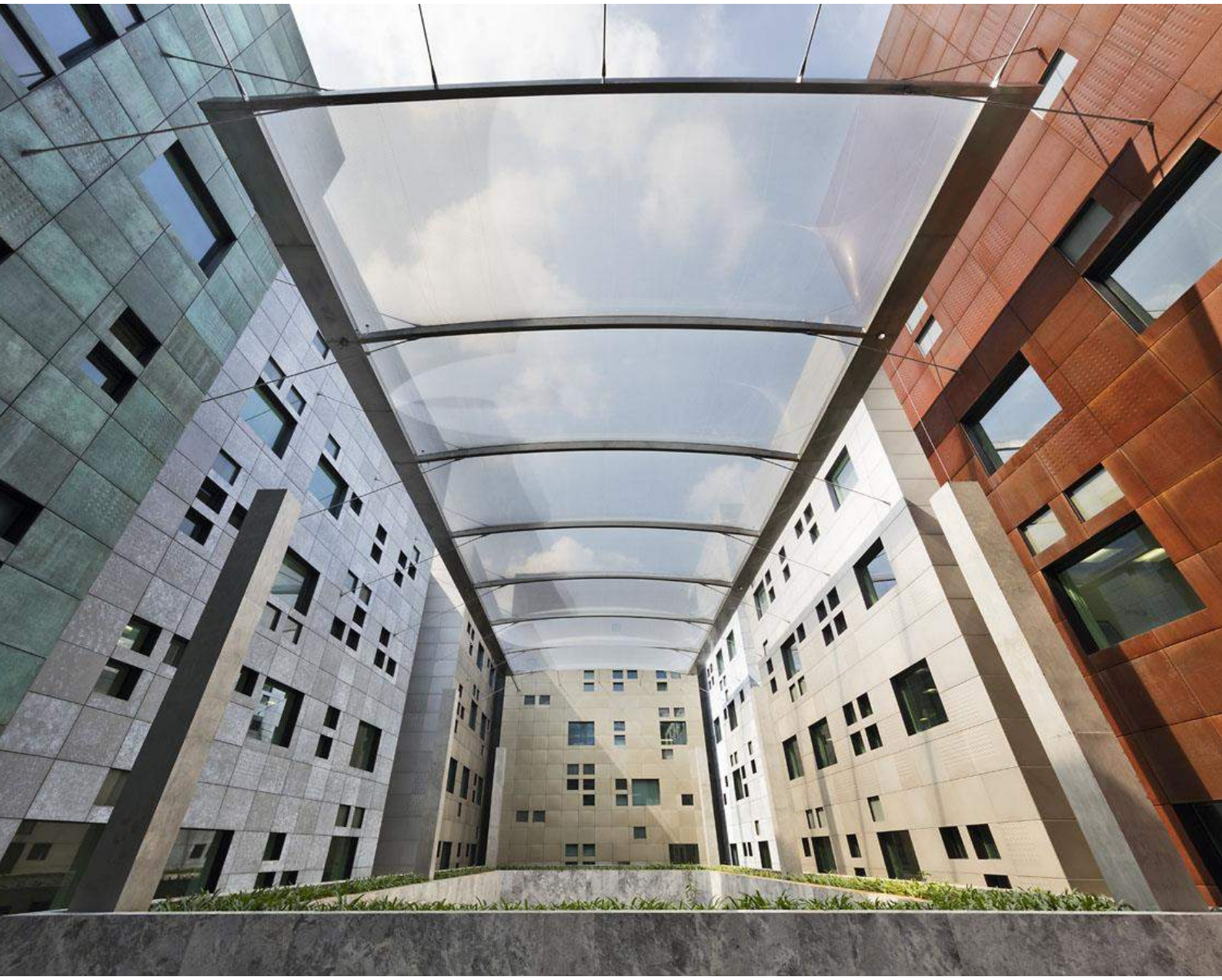
In 2015, Australia's largest embassy complex in the world was built in Jakarta, Indonesia, to provide an official residence for Australia's permanent mission to Indonesia. The embassy was created to deliver accommodation and recreational facilities to Australian-based officers and their families.

Fabritecture was contracted for the design & construction of a 2-layer ETFE pneumatic cushion canopy suspended over the chancellery courtyard at the Embassy. The structure was designed to create an architectural piece that resembled a cloud 'floating' in the sky, but also to provide functional weather protection to the people in the courtyard below.

Location	Jakarta, Indonesia	**Completed**	2015
Scope	Design & Construct	**Size**	437m^2
Fabric	Top layer: *AGC Fluon 250µm ETFE with 16mm silver dot frit pattern (46% cover rate);* Bottom layer: *AGC Fluon 250 µm clear ETFE*	**Framing**	Bespoke stainless steel



Design Brief

The client's design brief for the Australian Embassy project required a canopy that offered complete protection from the elements to patrons in the courtyard area below. The specification for the design also required longevity from the structure – with a design life of at least 30 years. The material selected for the canopy also needed to be shatter-proof (in the case of a blast or earthquake) and fire resistant. There would also be plants growing underneath the canopy, so the material needed to transmit full spectrum light to support plant growth.

The canopy is supported by stainless steel tie rods that are fixed to the concrete substructure of the main chancellery buildings to create the aesthetic "cloud-like" effect.

Material Selection

The beautiful and light weight ETFE canopy ultimately designed and constructed by the Fabritecture team comprises a rare combination of stainless structural steel and ETFE material.

Stainless steel was selected for the structural component of the project, comprising a stainless-steel support frame, along with stainless steel tie rods that fix to the concrete substructure of the existing chancellery buildings on either side of the canopy. The use of stainless steel provided the durability required for the project, as well as satisfying the architectural intent of a light-weight "floating" cloud-like structure.

ETFE (*Ethylene Tetra Fluro Ethylene*), a high strength fluoro-polymer was selected for the canopy material. The material was used in a 2-layer pneumatic (air-filled) configuration. A silver dot frit pattern is printed on the top layer to manage solar transmission (reducing solar transmission by approximately 50%). An integrated plenum system provides air supply to the cushions.

ETFE was selected over glass for the canopy for various reasons:

- ETFE does not degrade under UV light, weather, or pollution and has an anticipated life of around 50 years;
- It is light weight, weighing approximately 1% the weight of glass;
- It has very high translucency and transmits UV light, therefore promoting plant growth;
- ETFE does not support combustion;
- The pneumatic cushion system provided the floating 'cloud' shape required for the canopy.

Unlike glass, ETFE is a forgiving form of construction and therefore shatterproof.

ETFE was also selected over glass due to public safety reasons. ETFE is a forgiving form of construction: as support elements deflect or sway, the ETFE panels move to compensate. If the structural integrity of the foil is compromised (e.g. due to fire or impact), the ETFE panels in this canopy are designed to simply float away, with nothing falling into the courtyard below.

Fabrication & Installation

The project involved unique parameters which provided challenges that the Fabritecture team worked diligently to effectively mitigate throughout the course of the project.

The use of 316 grade stainless structural steel was the most complex element of this project, as the material can be very challenging to work with and cannot be modified on site. It also has very tight tolerances. This meant that all stainless steel components had to fit together perfectly when shipped from the fabrication plant. A 100% trial assembly in the factory was completed prior to installation, in order to eliminate any issues occurring during on-site assembly.

Fabrication of the ETFE canopy material was carried out in an ETFE specialist fabrication facility then shipped to site for installation.

To mitigate risks, a 100% trial assembly was completed in the factory prior to delivery and installation on site.

Sustainable Construction

This project utilises materials and processes that make a significant contribution to sustainable construction.

- Due to its extreme chemical stability, ETFE has a life expectancy of 50+ years;
- ETFE is 100% recyclable. At the end of its life, it can be melted down and re-extruded for use in new ETFE materials and products;
- Due to its light weight, ETFE requires far less structural support and less energy transport and installation than other rigid transparent building systems such as glass. The carbon footprint of ETFE is approximately 80 times lower than that of comparable systems;
- With its high translucency, the use of ETFE reduces the need for artificial indoor lighting during the day, thus contributing to reduced energy consumption.

Due to the minimalist structural support and use of ETFE, this canopy is a true lightweight structure and has received multiple industry awards in recognition of this.

Drainage and Guttering

The canopy is not flush up against the building and therefore is technically an open canopy. To manage water run-off, a gutter system on each side has been designed into the canopy to not only catch rain water but also to hide the ducting for the air supply system that inflates the cushions.

Spigots have been designed at locations along the gutters with chains which direct the captured rain water into architecturally designed downpipes that sit below the canopy. This allows movement in the canopy while still catching water. Consequently, rain and other elements don't impact people below on the ground level, but instead are captured to feed the planter boxes underneath, adding a further sustainable element to the design.

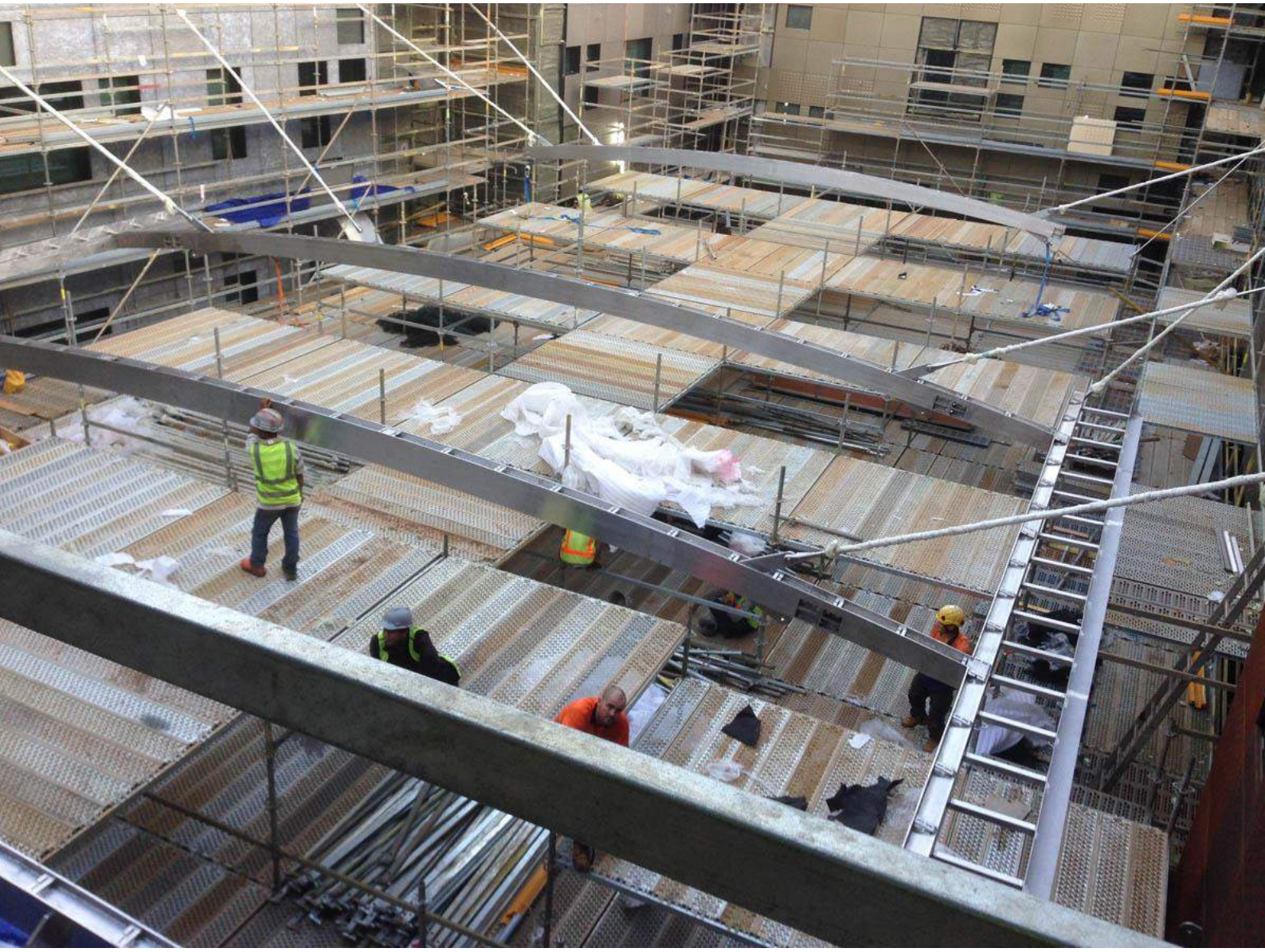
Architecturally designed down pipes sit below the canopy, catching water which feeds plants below — adding a sustainable element to the design.

Installation Methodology

The installation of this canopy was a challenge to undertake – the risks of which needed to be mitigated by our expert project team and construction management.

The project took 1,210 man hours to complete and required intensive collaboration and cooperation amongst all parties involved in the development. Fabritecture sent specialist ETFE technical supervisors to oversee construction and used skilled local labour to complete the installation.

The install took place within a courtyard; therefore, the space didn't allow for any access equipment. The entire installation was completed using scaffolding, which had to be built up to the 10th storey. A tower crane was used to drop the frame components into place from above.

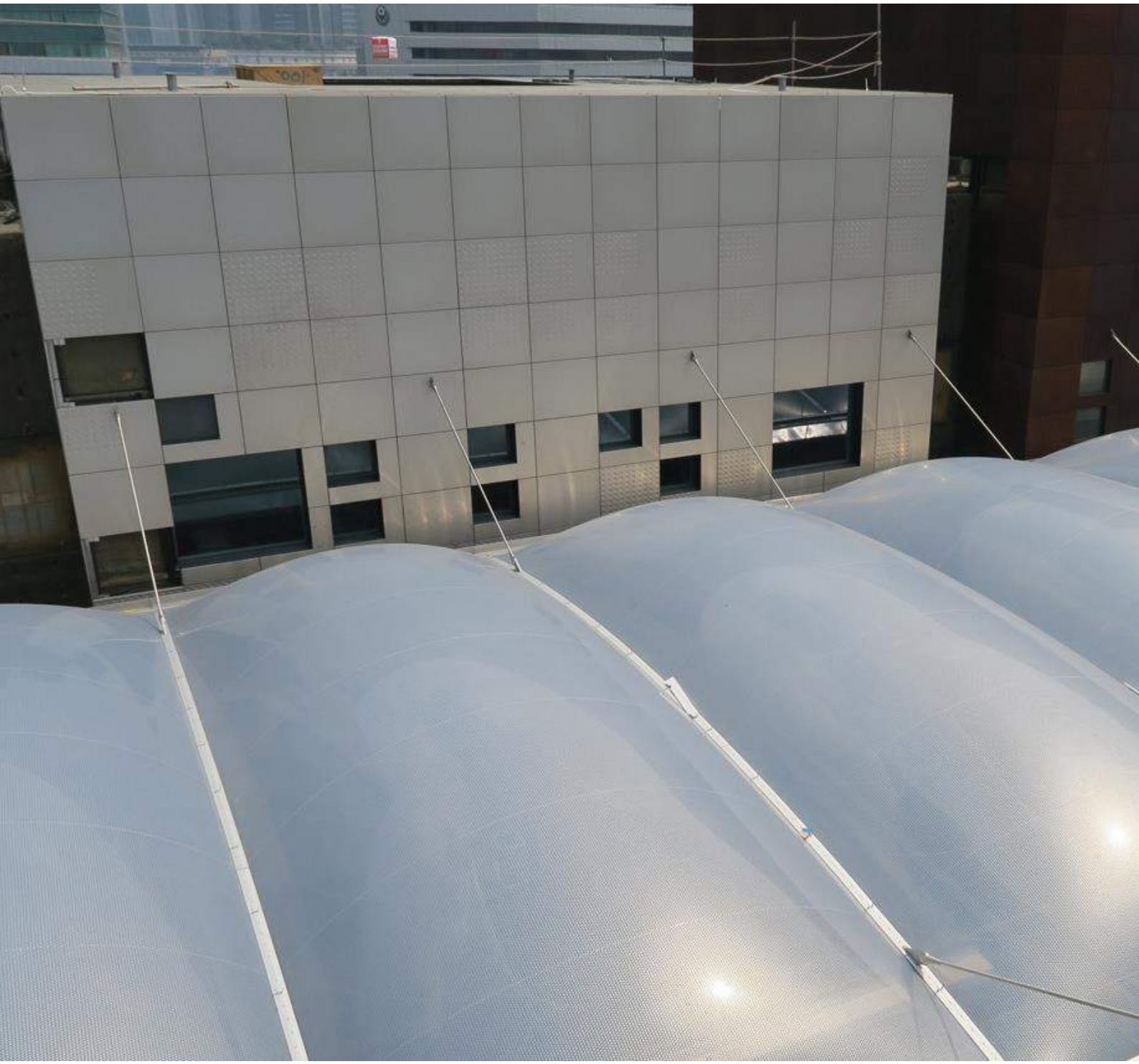


The entire installation was completed by scaffold, which had to be built up to the 10th storey.

Collaboration, Construction & Maintenance

Collaboration with wall plates behind the cladding was necessary prior to the wall plates being installed. The plenum and ducting system is disguised, coming from the main building towards the canopy, and within the structural system of the canopy.

The ability to overcome project-specific obstacles & remain on schedule were, and always are, of the utmost importance. Our team remained flexible and worked through various challenges that were encountered throughout the project, such as language barriers, working with local contractors, customs issues with delivery of materials & equipment, and collaboration with the Indonesian Government.



Conclusion

The innovatively designed ETFE canopy structure was a highly successful project, which has been recognised on national and international platforms.

Industry Recognition

2016 LSAA Award of Excellence: Jakarta ETFE Canopy

2016 STA Award for Excellence (Category 11): Jakarta ETFE Canopy

About Fabritecture

Fabritecture Australia Pty Ltd (ABN 66 104 929 071) is an Australian-headquartered designer, manufacturer, supplier and installer of custom designed “bespoke” and modular tensile fabric structures for private and public clients in Australia, South East Asia, the Middle East, and the USA.

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