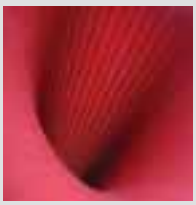
HIGHTEX



The World of Membranes

Hightex

Introduction


Munich Airport, Germany

Hightex is one of the foremost International Companies in the field of tensile fabric engineering, still a young and vibrant industry. Exploiting modern fabric technology and associated structural engineering techniques, they are at the cutting edge, designing and creating tensile membrane structures with stunning architectural elegance and impact. Fabric engineering is an unrivalled solution for construction.

Our team has a holistic and creative approach to projects which, when combined with extensive, state of the art production facilities, promises to tackle the complex areas involved in specialised architectural fabric contracting, with the knowledge required to ensure clients get the full service they are paying for.

The Hightex Team has completed hundreds of outstanding projects worldwide the highest standards.

Content

Hightex

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Hightex

Philosophy


Olympic Stadium Berlin, Germany

DECADES OF MEMBRANE KNOWLEDGE IN EVERY DEPARTMENT GUARANTEES SUCCESS

Financial success is not the goal, but the result of our daily work. Our success allows us to continuously serve our clients during and after warranty periods and to continue investing in our lead role as pioneers and innovators.

After many years of doing business in the field of tensile structures, we recognise that the key to our success is a happy and satisfied client. A well treated client will invariably come back with more work and also refer us to others. With this philosophy in mind, you can rest assured that you will receive both a first class project and a real return on investment.

Cultural, economical and technical skills are indispensable factors which contribute to the make-up, integrity and business etiquette of any “healthy” company. Our motivation and satisfaction is achieved through our long-lasting relations with clients, architects, engineers, suppliers and with our own team members.

The following additional factors illustrate the primary principles of our service:

CORE TERMINOLOGY

Company philosophy:

Internally - independent from national borders, we at Hightex believe in the strength of individuality. Each individual employed by the company is able to develop to their full potential, position and satisfaction within the boundary conditions of our network. Externally – in addition to its relationship with its clients, Hightex is proud of its community and encourages social engagement, which is actively supported by all members of our team.

National and international etiquette:

It is understood that to be active in an international market, only the highest performance and customer satisfaction is to be expected. This is achieved through our ability to respect and achieve the varying cultural idiosyncrasies, technological standards and expectations of the respective stakeholder.

Attitude:

A project should not be linked primarily to financial aspects, but rather aimed at realising benefits for all involved parties. This alone leads to sound financial principles.

Products:

Our market is made up of a wide range of materials and fabrics, each with differing properties and uses. Hightex possesses not only a comprehensive knowledge of these materials and fabrics, but through it's long association with numerous innovative companies, research institutes and specialists, is permanently involved in the further development of these products.

Quality at Hightex (Design and material):

Hightex operate completely independent from suppliers. Our maxim is to achieve the optimal balance between technical performance and economical aspects when procuring components in the international marketplace. Through our decades old tradition as a pioneer in Membrane Engineering, we have been intimately involved in the improvement of processing techniques and research and development. As a result of this, Hightex is continually present to influence and assist in the development of the products and technologies of tomorrow. Standards such as ISO based quality management, which are essential elements in the demanding world of membrane technology, are of course our every-day tools of the trade.

Simultaneous Planning:

We are conscious that certain procedures, especially international public tenders, are often not developed with adequate flexibility so that the special (not the general know-how) requirements can be integrated. The quality of the details, project execution and long time behaviour can only be achieved through the clear and accurate interpretation described in the Tender Documents. The Tender documents provide the foundation for the development of the unique final product. Through its complete engagement and competency, Hightex ensure that the complete and relevant documents are adapted and taken into account.
Hightex regards membranes not as „the solution", but rather as an complement to the most common and regularly utilised building materials and as an expansion to the construction and function in regards to shape, light, energy, acoustics and environment.

Hightex

What do we offer?

Pavilion 2006 Serpentine Gallery, London, UK Picture: John Offenbach

HIGHTEX FOR YOUR BUSINESS

Hightex offers a wide range of services to the construction industry. Aim is to always enable a contractor/ client to place one contract for the membrane element of a project and to include within this contract all the ancillary items of structure to minimise coordination requirements for the contractor.

Among the services typically offered by Hightex are the following, although other services may be added depending on the individual project.

- Budgeting support
- Concept design advice on fabric selection and feasibility
- Early stage design input
- Full design service
- Project Management
- Structural design
- Foundation design
- Membrane analysis
- Form finding
- Load analysis
- Pattern making
- Turnkey design/fabrication/installation service
- Membrane fabrication
- Structural fabrication
- Full installation
- Extensive warranties
- Maintenance services

Hightex

Team

A TEAM OF SPECIALISTS FOR YOUR CHALLENGE

Hightex is proud to have established a creative, highly experienced and efficient team over the years. Currently, our reference list consists of more than 800 membrane structure projects around the world – of all sizes and degrees of difficulty.

Renowned international architects and engineers have utilised Hightex´s experience to successfully complete their prestigious projects around the world.

The Hightex team is comprised of architects, civil and mechanical engineers, sail makers and roof and membrane specialists and unites all their skills and abilities for a professional and efficient implementation of your project. Each individual team member possesses an impressive level of education, experience, dedication and team spirit.

Based on your unique requirements, Hightex will form a project team that ensures a smooth perfect transition from design to fabrication to the construction phase. From project start to its execution, the team will ensure that the project progresses in a seamless and structured manner.

Hightex

Fabrication Facilities

HIGHTEX FABRICATES IN SEVERAL LOCATIONS WORLDWIDE

Highly qualified fabrication teams of up to 250 people, many with more than 15 years experience, give Hightex the fabrication capacity and flexibility to produce even the largest projects with the highest quality and at a competitive price. The fabrication teams operate under the close control of our in-house fabrication engineers.

Equipment includes PVC high frequency welding machines, PTFE/Glass welding machines and also special ETFE welding machines.

Hightex offers a wide range of services: any size, any complexity, custom, individual or serial production. Decades of experience has allowed Hightex to develop all the necessary know-how and design skills to ensure that the fabrication details will give a finished product not only of the highest quality but detailed for the longest life – tailor made for your project.

In addition, Hightex has its own in-house test laboratory which continuous quality control during all fabrication stages of a project. Our quality control systems cover all phases of pro production: from initial material delivery; cutting and welding; through the complete fabrication process to the final dispatch.

Hightex

Quality Control

Computer- controlled biaxial testing machine University Duisburg - Essen

PROJECT QUALITY MANAGEMENT

Hightex operates a quality control system in accordance with ISO 9002 and is constantly seeking ways to improve its level of quality control. All of Hightex´s principal suppliers also operate similar ISO 9002 systems, and those suppliers on whom we are particularly dependent (sub-contract fabricators, installers, etc) have developed systems in conjunction with us to ensure full integration and traceability.

Major areas covered by our Quality Control System include:

- Document Control
- Design
- Purchasing
- Material Quality
- Traceability
- Manufacturing Control
- Test Equipment
- Packing & Delivery
- Installation
- Training

All stages of purchasing, manufacture and installation are fully documented, and samples of quality control documentation follow.

Hightex

Safety Management

SAFETY FIRST

No member of Hightex staff has ever been involved in a fatal accident – and we intend that they never will be. Therefore, in order to reduce the possibility of this to an absolute minimum, we have developed safety procedures which we will always follow in all work places irrespective of where in the world we are working.

It is not only fatal accidents that concern us. The number of injuries – no matter how small – must be minimised.

To achieve this goal it is important that the rules set out in this document and any additional requirements set up for individual projects, are followed to the letter by all Hightex staff.

It is emphasised that this document is part of the Company‘s general policy. It is not intended to replace any other documents concerning safety, health or welfare which have been issued by the Company.

Further documents concerning these subjects will be continually updated and supplemented by the Company.

This document, as a statement of general Company Policy, is not intended to be specific to any one Project. As the requirements of each Project are different, a Project Specific Policy will be developed in co-ordination with the Management / Main Contractor at the start of the Project, and such policy will draw on both this document and the Management / Main Contractors requirements, together with current statutory guidelines in force.

HIGHTEX



Selected Projects

Suvarnabhumi Airport Bangkok, Thailand

Passenger Concourse Building

Year:	2003 - 2005
Material:	PTFE-coated glass fabric
Dimension:	108,000 m^2 (per layer) 3-layers
Client:	Royal Thai Government, Thailand
Contractor:	ITO Joint Venture, Thailand
Architect:	Murphy/Jahn, Chicago, USA
Structural Engineer:	Werner Sobek Engineers, Stuttgart

TECHNOLOGY TAKES OFF

The Murphy/Jahn planning team from Chicago, together with Werner Sobek Engineers and Transsolar from Stuttgart, was responsible for designing the new international airport in Bangkok. The technical optimisation, material development and detailed planning of the membrane roof system were undertaken by Hightex.

The passenger Concourse buildings are characterised by wide span arched trusses which are covered by glass and membrane elements in alternative bays. An ingenious stratified climate-control ensures comfortable internal temperatures. The 108 membrane bays were designed as a three-layered system to meet the high technical requirements with respect to daylight, acoustics, energy balance and building physics.

The three-layer membrane roof structure consists of an outer skin of PTFE-coated glass fabric, a highly transparent sound-insulating middle layer of thermoplastic elements, and a sound absorbing low-E coated inner layer with a defined light transmission. The low-E coating of this newly developed textile material greatly reduces the internal level of infrared radiation. This fluoropolymer-coated, metallised glass fabric has a noise reduction coefficient (NRC) of approximately 70 percent. New membrane production technology allows the development of bespoke products for multifunctional building skins.

The diagrammatic representation of the membrane geometry and structural system shows various loading situations in the pre-stress state and under conditions of wind suction. The indoor climate-control concept, with its stratified air layers, was designed on the basis of calculations and practical trials. The assembly sequences were also visualised graphically during the planning stage. The 1000 sq/m membrane elements were cut to form and processed close to the site in a purpose built fabrication plant.

Royal Ascot Racecourse
Ascot, UK

Year:	2006
Material:	PTFE-coated glass fabric
Dimension:	approx. 7,000 m²
Client:	Ascot Racecourse Estates
Architect:	HOK Sport, UK
Structural Engineer:	BURO Happold, UK

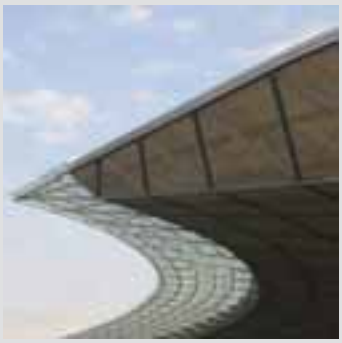
PROTECTING THE ROYAL HATS

The Royal venue for horseracing, which exists since 1711, has undergone a dramatic £200m renovation. Royal Ascot, an internationally renowned sporting and social occasion, where tradition, pageantry and style all meet in a glorious setting, now has a magnificent grandstand to compliment their grand showpiece.

70,000 spectators benefit from the vast facilities provided within the grandstand complex which offers a spectacular 300 metre long, light filled atrium made possible by the inspiring new membrane roof.

54 individual translucent hyperbolic parabolic panels form the 7,000 sq/m main membrane roof providing protection to both parade ring viewers on the entrance side of the structure and to the horseracing audience on the track side. In addition, 136 mesh membrane awnings in the distinctive Royal Ascot blue are additional protection for the spectators below, terracing to upper levels.

Membrane technology contributed to completing the vast construction within a short 20 month period, allowing business as usual for the 2006 Royal Ascot festival.



Olympic Stadium Berlin

Berlin, Germany

Year:	2002-2004
Material:	PTFE-coated glass fabric
Dimension:	approx. 62,000 m²
Client:	City of Berlin
Contractor:	Walter Bau AG, Berlin, Germany
Architect:	gmp architects, Berlin, Germany
Structural Engineer:	Krebs & Kiefer, Berlin, Germany Schlaich Bergermann & Partners, Stuttgart, Germany

NEW LIFE TO A HISTORIC VENUE

The new roof is intentionally a contrast to the solid structure of this historical stadium. A white translucent PTFE/glass membrane is stretched over a finely articulated steel and cable structure.

The textile membrane drawn over the underside of this structure masks the stadium lighting and public address system without impairing their function. Visual obstacles such as floodlight masts and loudspeaker towers are items of the past.

On completion of this refurbishment in 2004, the stadium was able to accommodate 76,000 spectators. An additional challenge with this modernisation work was that it had to be executed while the stadium was still in use for several events.

Hightex has been honoured with an Outstanding Achievement Award by the Industrial Fabrics Association International for the outstanding execution of this project.

Busan Stadium, South Korea

World Cup Winner

Year:	2001
Material:	PTFE-coated glass fabric
Dimension:	approx. 55,000 m²
Client:	City of Busan
Contractor:	Hyundai Eng. & Constr. Co. Ltd., Pusan
Architect:	Space Group
Structural Engineer:	Schlaich Bergermann and Partner W. S. Atkins Consults

A WHITE LANDMARK

Busan, the second-largest city in South Korea, was the venue of the World Cup football championships and the Asian Games in 2002.

The new stadium built for these events can accommodate up to 55,500 spectators, protecting them from the sun, wind and rain with a 55,000sq/m membrane roof.

Raised slightly on a platform, the stadium forms a landmark in the ring of developments around the city. The 96 individual membrane elements of the roof, each with an area of 570sq/m, are tensioned by the use of a slender cable network. Loads are carried to the ground by a system that resembles the spokes of a wheel.

The translucent membrane material helps to provide the appropriate lighting conditions within the stadium. Good acoustics also ensure a relaxed atmosphere during a wide range of events.

Rothenbaum Centre Court,
Hamburg, Germany

Year:	1997
Material:	PVC-coated polyester fabric
Dimension:	total: 8,500 m²
	Outer Ring: 5,300 m²
	Inner Ring: 3,200 m²
Client:	DTB, German Tennis Federation
Architect:	Schweger & Partner, Hamburg
Structural Engineer:	Sobek & Rieger, Stuttgart

RAISING THE ROOF FOR ANY OCCASION

The Rothenbaum Tennis Stadium consists of an oval formed sport centre with an area of 8.500 square metres. The stadium was covered by a permanent roof for the stand, by a retractable roof and also by a transparent outer canopy as a shelter for the entrances and areas on the periphery of the stadium.

For the exterior ring, a single layered Fluorpolymer membrane was chosen. For the retractable part and for the 5.300 square metres high point stand roof, a single layered PVC/PES membrane was used.

The concept is based on the idea of an open air stadium which you can weatherproof by closing it in a few minutes without interrupting or disturbing the match.
The retractable roof is suspended off a filigrane cable and steel structure and has an area of 3.200 square meters to cover the centre court. It can be closed or opened within five minutes.

It was decided to use a PVC/PES membrane because the translucent membrane has a light transmittance of 10% and can be easily folded when being retracted, without any problem, even in these dimensions.

Special belt reinforcements along the ridges and suspension areas allow for very smooth folding and minimum volume when being folded.

Josefsburg Kufstein
Kufstein, Austria

Year:	2006
Material:	PTFE fabric
Dimension:	approx. 1,900 m²
Client:	Stadtwerke Kufstein GmbH, Austria
Architect:	Nikolai Kugel Architects, Stuttgart
Structural Engineer:	Alfred Rein Engineers, Stuttgart

RETRACTABLE ROOF

For many years the city of Kufstein wanted to use this beautiful castle more often and in particular, more independent of the weather. The inner ward is suited wonderfully for theatre performance, music concerts, and other events. To reduce the weather risk the consultants Kugel und Rein was assigned to design a retractable roof, which can be opened like an umbrella.

A radial cable stayed system is the primary structural system for this retractable membrane roof that can be closed at the push of a button. In the opened position the membrane is folded and parked in the centre of the roof.

The membrane material is a PTFE coated fabric. The determining factors for the choice of this very new and high grade material were the requirements for durability and quality with very high light translucency.

The membrane is connected at intervals along the radial seams to trolleys of the drive system. Along the perimeter, scallop cables together with tangential webbing belts are connected to the tension trolleys, which are pulled into the final position with hydraulic actuators and provide the pre-stress in the fabric. Rainwater is collected along the perimeter in flexible rain gutters.
The retractable roof of the “Josefsburg” was completed in time and to the fullest satisfaction of the client. Several events that have been scheduled for quite some time have already taken place in spite of summer thunderstorms with rain showers.

Pabellón de Estado, Airport Madrid Barajas

Madrid, Spain

Year:	2005
Material:	PTFE-coated glass fabric, Glass Mesh, ETFE
Dimension:	4,400 m²
Client:	Aeroportos Espanoles y Navegacion Aerea
Contractor:	Dragados S.A., Madrid, Spain
Architect:	R. Rogers London & Studio Lamela, Madrid
Structural Engineers:	Schlaich Bergermann & Part., Germany

RECEPTION OF ROYAL AND POLITICAL DIGNITARIES

The architects from Richard Rogers Partnership, London and Studio Lamela, Madrid and the structural engineers from Schlaich Bergermann Partner, Stuttgart were contracted by AENA to design and plan the “Pabellón de Estado”. The directive was to design an independent terminal building of the Airport Madrid Barajas with an appealing and elegant architecture at the highest quality standards for the reception of royal and political dignitaries.

The central element of this building is the entrance hall with a hanging glass roof and vertical glazing along the entrance areas. The double layered membrane above the transparent entrance hall roof presents itself as a prominent design feature and also serves as weather protection. The primary structure of the membrane roof consists of ten double arched vertical steel trusses and the two visor beams cantilevering out at each end. The upper and the lower membrane in conjunction with the valley cables in the centre of each bay and layer stabilise the structure. The visor beams are held in place only by the upper and lower membrane, but there are safety cables below the upper membrane to prevent any catastrophic failure.

The upper membrane and the actual weather protection skin is a PTFE coated glass fabric. Due to fabrication and handling restrictions the membrane was divided into 5 pieces and delivered to site. The connections on top of the arched trusses are standard clamping details. The scalloped edges between the trusses are detailed with double clamping plates attached to the edge cables with stainless steel straps. The membranes were essentially prestressed by tensioning the valley cables.

The lower membrane is an open weave glass fabric with PTFE coating. The open weave fabric has a semi translucent effect, which makes the structural system fairly visible and gives the roof a certain ease. The lower membrane was fabricated in 11 separate pieces and is connected to the steel trusses with keder extrusion profiles. The scalloped edges of the lower membrane between the trusses are detailed identical to the upper membrane and the fabric is also prestressed by tensioning the valley cables. The gap between the upper and lower membrane along the perimeter was closed with an ETFE mesh.

Overall the membrane roof of the “Pabellón de Estado” has a very winning and compelling design and was realised with a very professional co-operation of all participants of this project. It was completed within 4 months and was in operation just after 8 months.

Alnwick Garden, UK

Pavilion and Visitor Centre

Year:	2005
Material:	ETFE, PTFE-coated glass fabric, Flexible thermal insulation
Dimension:	2,700 m² (344 cushions 2.8 x 2.8m)
Client:	The Alnwick Garden Trust Ltd
Architect:	Hopkins Architects, UK
Structural Engineer:	BURO Happold Engineers, UK

A GARDEN ENTRANCE

The Visitor Centre and Pavilion provide a theatrical entry point to the gardens which front the world famous ‘Harry Potter’ castle. The buildings, designed by the London architectural firm Hopkins Architects, are built against the backdrop of an 18th century historical wall and on the site of the original 19th century pavilion. The pavilion reflects the original pavilion glass house though with a modern design utilising the latest materials and environmentally advanced services and installations.

More than 340 multi layer pneumatically inflated cushions measuring 2.8 by 2.8 m, made from ETFE, PTFE and thermal insulation cover the two roofs as a homogenous structure. Due to the unique lighting and thermal conditions of the various areas of the building, the cushions were designed with different combination of layers to meet the performance requirements of each area.

The project is one of the first to be completed world-wide which incorporates multi-layer cushions comprising of differing material types installed into a roof.

Federal Environment Foundation

Osnabrück, Germany

Year:	2002
Material:	ETFE
Dimension:	1,950 m²
Client:	German Environment Foundation
Architect:	Herzog and Partner, Germany
Structural Engineer:	Barthel & Maus, Munich

ENVIRONMENTALLY FRIENDLY

The brief called for a "sustainable" building of great architectural quality and cost-effective implementation of the design. The multi-functional roof structure extends over areas used for quite different purposes.

This largely single-storey building has a timber skeleton-frame. It is covered by an outer ventilated, weatherproof membrane roof that forms part of a variable, multi-layer construction.

The durable skin consists of a single-layer of transparent ETFE film, a material that has been used for over 25 years. It is fully recyclable and thus imposes no burden on the environment. Its anti-adhesive properties also mean that surface dirt is simply washed off by rain.

Through the combination of layers over each bay, the roof can be adapted to the specific needs of the spaces beneath them.

Hightex has been honoured with an Outstanding Achievement Award by the Industrial Fabrics Association International for the excellent design and execution of this project.

Clarke Quay, Singapore
Shopping under ETFE

Year:	2005/2006
Material:	ETFE foil cushion
Dimension:	10,630 m²
Client:	Clarke Quay Pte Ltd.
Architect:	ALSOP Architects, Singapore
Structural Engineers:	RSP Architects & Engineers (PTE) Ltd., Singapore

CLEAR AND PATTERNED IMPRESSIONS

Near the mouth of the Singapore River, the site of Clarke Quay was the centre of commerce during the late 19th century. Clarke Quay is still buzzing with life and activity today.

In an attempt to save the five blocks of abandoned godowns, the Singapore Government launched a massive conservation project. After significant financial investment and careful restoration, the former port was transformed into a vibrant riverside festival village.

The waterfront godowns now play host to a colourful kaleidoscope of restaurants, wine bars, entertainment spots and retail shops. The bustling market atmosphere of a bygone era comes alive amidst rows of charming shop houses, pushcarts, and five-foot-way merchants.

A new ETFE cushion roof is supported by a series of 18 new environmental ‘angle’ structures between the shop houses. The promenade Main Canopy Roof covers the main streets, which quarter the site and the new food court at the centre. The ETFE cushions are printed with various degrees of fritting. Shading and cooling, both passive and mechanical, are introduced and encouraged as environmental and cooling systems within the Main Canopy Roof areas.

At night the cushions are lit from below in various shades of colour to give a lively impression to the bustling night life below and add to the festival spirit of Clark Quay.

Centre for Gerontology
Bad Tölz, Germany

Year:	2003
Material:	ETFE foil
Dimension:	1,550 m²
Contractor:	Wörsching GmbH & Co. KG, Starnberg, Germany
Architect:	Architect Siegert, Bad Tölz, Germany

WALKWAYS PROTECTED BY MEMBRANE FACADE

The project is a snail type multi storey building which includes offices in the upper levels and shops in the lower level. Special about the building is the very demanding geometry with changing radii in the entire facade area reflecting the building's geometry. The concept was to have a membrane facade protecting the walkways between the facade and the actual office areas and shops. The architect's intention was to provide a highly transparent facade with a minimised structure to offer the users free view from the gangways to the outside world. The project was built in the town of Bad Tölz, Upper Bavaria.

For the first time, a single layered ETFE project of this scale was built as a facade. Therefore the ETFE membrane had to be patterned for pre-stressing and special attachment systems were developed to ensure achieving an even pre-stress and adjustment during installation on one hand and a minimised clamping detail on the other hand. The achievement was to build the world wide first single layered ETFE facade.

The client's needs were achieved by a geometry allowing a maximum span of ETFE film and using the strongest ETFE film available on the market. The solution supplies natural UV-light to the inside of the building and at the same time minimises the maintenance costs due to the antiadhesive properties of the ETFE film so rainwater washes away any dirt. Therefore this project opened a wide range of new applications for membranes on facades.

Burj Al Arab, Dubai

The worlds first seven star hotel

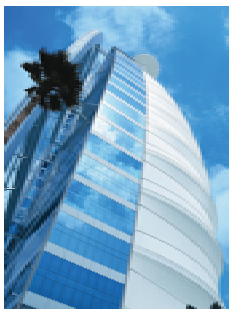
Year:	1999
Material:	PTFE-coated glass fabric
Dimension:	15,000 m²
Client:	Jumeirah Beach Resort LLC
Architect:	W. S. Atkins, Overseas/UK
Engineers:	Al Habtoor Eng., Abu Dhabi, UAE Fletcher Construction, Auckland Murray & Roberts, Bedfordview S. Africa

THE ARABIAN TOWER – ONE OF THE WORLDS BEST HOTELS

The Burj Al Arab ("Tower of the Arabs"), a luxury hotel in Dubai, UAE, is the world's tallest structure incorporating a membrane facade. It was built to resemble the sail of a dhow (a type of Arabian vessel) and intentionally placed in such a way that its shadow does not cover the beach.

The open side of the V-shaped floor plan is encased with a white translucent membrane facade with a height of 200m and an area of 15.000 m^2. The north facing two layer membrane facade is formed from 12 individual tensioned membrane panels, which enclose the vast 18 storey atrium. In the evening the facade which is a coated PTFE glass fibre is used as a projection screen.

The membrane material with a weight of 1550g/m^2 and a suction load of 7500N/5cm (warp) has excellent resistance against the extremes of UV radiation, large temperature variation, sandstorms and fire.



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