LSAA 2013 Lightweight Structures Design Awards

Souk Okaz Public Theatre, Taif City, Saudi Arabia

MakMax Australia

AWARD OF EXCELLENCE

Entrant: **MakMax Australia**

- Category: 6 ID Number: 4303
- Location: Taif City, Saudi Arabia
- Client: Taif City
- Completion Date: March 2013

Credits:

Architect: Diyar Consultants
Structural Engineer: MakMax Australia
Specialists: MakMax (Designer)
Builder: Abdullah Hassan Al Shihry
Fabricator: Shanghai Taiyo Kogyo,
Taiyo Middle East

The purpose of Souk Okaz Public Theatre was to deliver both a functional public space for cultural activities and evocative ambience reminiscent of the ancient pre-Islamic era of a bustling Bedouin market place. It provides both modern facilities and an austere tribute to the proud cultural history of the Taif City.

The artistic element of this project is its greatest achievement. The unique shapes and textures it depicts are uniquely Arabic; this is of the highest importance to the client and the end users. MakMax designers took great care in creating this aesthetic as it makes up the character of the project. The Souk Okaz was a famous bazaar in the Arabian Peninsula dating back to the pre-Islam era.

The public theatre has a capacity of seating 3,000 people, and serves as a venue for cultural activities such as theatrical plays, poetry competitions and annual poetry festival.

The structure needed to be water tight roof structure, including a porte-cochere, and made from a material that would protect from and withstand both the extremely high UV environment and an abrasive sandstorm prone area. The client's ambition for this large imposing public space required an extremely large internal clear span area measuring approximately 60m x 65m with a minimum under canopy clearance of 12m, full integration of the structure with the main seating, stage and tower constructions and an embodiment of traditional Arabic design.

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Listen Out Festival Temporary Canopy, Melbourne

Tensys Engineers Pty Ltd

AWARD OF EXCELLENCE

Entrant: Tensys Engineers Pty Ltd
Category: 6 ID Number: 6512
Location: Royal Botanical Gardens, Melb.
Client: Listen Out Festival, Melb 2013
Credits:
Architect: Tim Schork MADA, Monash Uni.
Structural Engineer: Tensys Engineers
Others: Callum Morton (MAP)
Builder & Fabricator: Monash Art Design & Architecture (MADA)

This structure is an end result of conceptual and digital studies carried out by MADA students of a cloud. The functional brief was to provide a temporary shading structure for the patrons of the festival covering a 5m x 5m footprint.

In response to these instructions, a decision was made to construct a lightweight pavilion from fibreglass rods coupled with a fabric membrane that would not only address the need for shelter but also accommodate individuals who wish to unwind and collect themselves.

Through prototyping, it was evident that the individual rods themselves would not provide the rigidity required for the stresses of a music festival. This led to creation of pre-fabricated trichord truss modules.

The pavilion required five connection components to be fabricated prior to its construction. A stainless steel splice join was required to connect the fibreglass rods to the appropriate length. Stainless steel strapping then formed the basis of the structural connections, used with a rubber lining to fix two rods to each other and with a plywood spacer to connect three and six rods together.

The nylon lycra fabric panels were lashed to structure using nylon cord, threaded through eyelets in the hem of each panel.

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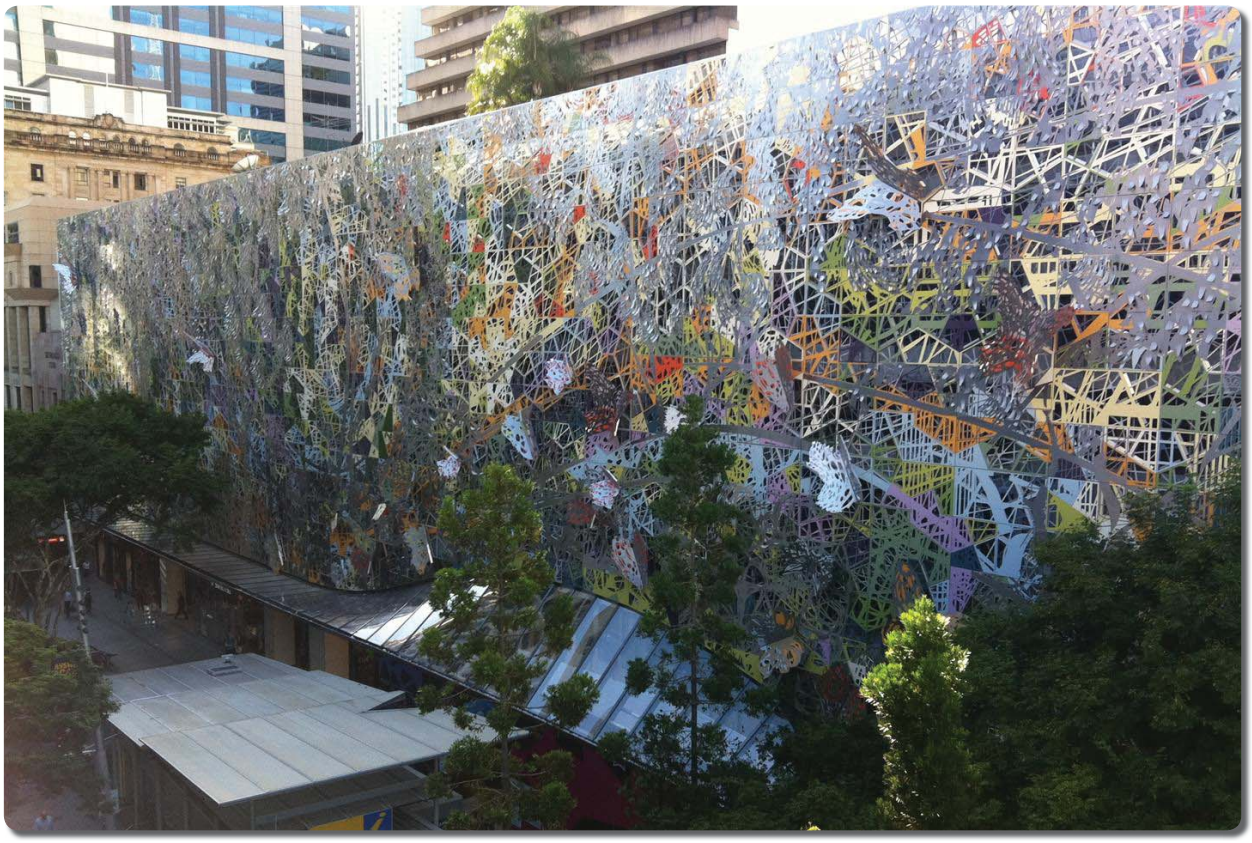
Wintergarden Art Facade, Queen St. Mall, Brisbane

Tensys Engineers Pty Ltd

AWARD OF EXCELLENCE



Entrant: **Tensys Engineers Pty Ltd**

- Category: 5 ID Number: 6513
- Location: Queen Street Mall, Brisbane
- Client: Industry Super Property Trust P/L
- Completion Date: April 2012

Credits:

- Architect: Studio 505
- Structural Engineer: Tensys
- Builder: Brookfield Multiplex
- Fabricator: UAP

The architectural intent of the façade is to create a three dimensional depiction of a winter garden painting To achieve this, the façade consists of multi layers of rigid cladding supported by a modular structural steel grillage frame. In addition to the cladding panels, the façade consists of a number of steel frame, stainless steel cald butterflies which cantilever from the grillage.

The structure was designed as a modular grillage frame of 2.4m x 10m (weighing approximately 3 tonnes each – fully cladded) to enable the economics of scale to produce this abstract painting using a modular system. Hidden bolted connections are used extensively to enable ease of construction and ensuring uniformity of the winter garden painting.Limited connections to both the existing 26 storey Harry Seidler's Hilton Hotel and the 5 storey carpark structure were a challenging design parameter through the project.

The structural system consists of lightweight closed section SHS steel members. The cladding system consists of a combination of lasercut aluminium and laser cut stainless steel solid panels.
CAD CAM technology was used extensively to create cutting patterns of the various aluminium and stainless steel cladding panels. The steel grillage frames were fabricated into 2.4 x 10m modules (for each of transportation in containers). The cladding panels were fixed onto the steel grillage frames in the factory. Special lifting lugs and trolleys were developed to ensure ease of site assembly.

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Cloud City: Casula Powerhouse, NSW

LAVA

HIGH COMMENDATION

Entrant: **LAVA**
Category: 1 ID Number: 1567
Location: Casula Powerhouse, Casula NSW
Client: Object Gallery
Completion Date: July 2013

Credits:
Architect: Chris Bosse
Structural Engineer: Büro für Leichtbau (Germany)
Fabricator: Fabric Shelters Workshop
Steelwork: GKR Interiors

Cloud City: An urban ecosystem is a sculptural rendition of Chris Bosse's vision of a future city - a soaring, stretched membrane cloud anchored to the 'city' on the gallery floor by high-rise towers that have been re-skinned and revitalised. A series of large circular forms, doubly curved, is made of stretchy lycra. The installation is part of a nation-wide exhibition by 12 Australian designers that explores the potential of design in our lives and generates ideas that could 'change the way we inhabit the world'.

This small-scale prototype provides invaluable insight into possible applications of smart membranes in the augmentation of the inner intelligence of buildings, and thus the city of the future. Membranes are the future and this is demonstrated as a sculpture in the CUSP exhibition. It continues LAVA's work in combining digital workflow, nature's structural principles and the latest digital fabrication technologies with the aim of achieving MORE WITH LESS: more (architecture) with less (material/ energy/time/cost).

The installation demonstrates how lightweight structures are relocatable, reusable, recyclable and sustainable. The shape of the structure was determined through an optimisation process that involved parametric control and physics simulation of the geometry and its environmental variables since the very first steps of the design process. This continuous feedback between final geometry and boundary conditions [in this case the various venues, the light conditions etc] allowed LAVA to produce a single design successfully adaptable to many different situations.

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Glen Eira Aquatic Centre, East Bentleigh, Vic

Oasis Tension Structures

HIGH COMMENDATION

Entrant: Oasis Tension Structures
Category: 2 ID Number: 2926
Location: East Bentleigh
Client: Glen Eira City Council
Completion Date: December 2011
Credits:
Architect: Mantric Architecture
Structural Engineer: Cardno Victoria P/L
Specialists: Tensys Engineers
Builder: Hansen Yuncken Pty Ltd
Fabricator: Atkins Fabrication Pty Ltd
Installer: Oasis Tension Structures

This is an insulated conic tension structure. A truncated, highly curved eccentric cone on an inclined elliptical ring beam, best describes the geometric definition of this structure. The architectural intent was to create a temperature controlled environment within a chlorinated water activity space and thereby satisfy ecologically sustainable development guidelines.

The site was previously an antiquated, outdoor public swimming pool. After years of public consultation and indecision the City of Glen Eira embarked upon a major redevelopment of the site. This included an array of playful water features. Two waterslides dominate the northern precinct. Entry to both is via a platform 12m above the pool level. A 25m x 15m elliptical ring beam forms the base of the conic. A 6m x 8m upper ring beam, covered with Danpalon polycarbonate sheeting and angled at 15deg, sits 15m above the pool level. A “horse” fitted to the stairway structure is braced to secure the upper ring.

Mantric Architecture, in association with Cardno Victoria and Tensys Engineers, developed a hyperplasic fabric surface aimed to nullify internal noise by using an acoustic inner liner. A PTFE outer membrane, combined with an internal layer of thermal insulation blanket beneath, completed the fabric composite.

LSAA 2013 Lightweight Structures Design Awards

South Hedland Town Centre, South Hedland, WA

MakMax Australia

HIGH COMMENDATION

Entrant: **MakMax Australia**
Category: 5 ID Number: 4304
Location: Colebatch Way, South Hedland
Client: UDLA and Landcorp
Completion Date: October 2011
Credits:
Architect: Advance Timber Concept & University of WA
Structural Engineer: Scott Smally Partnership
Builder: Ertech Pty Ltd
Fabricator: MakMax Australia

The opportunity to use a timber frame to support tensile membrane does not present its self often. The striking visual effect this combination creates is often associated with nautical themes and the presence of water. Far from the sea in Western Australia, our client requested a timber framed saddle shaped structure erected to provide shade to an outdoor stage.

The PTFE mesh fabric provides a high level of light transmission and tensile strength. Fabric patterns were created based on the reactions of the wooden structure, with some variation found that is not normally present in a traditional steel frame.

Our engineers faced some challenges in tailoring fabric to suit a wooden frame., the variances in structural support means design and engineering reactions can vary in places a steel structure would remain consistent. This issue was overcome though the development of a special cleat system to allow uniform distribution of point loads on the timber frame.

Benefits of using wood far outweigh any inconvenience in installation or maintenance, the sheer beauty and elegance these two materials create is something to behold. All parties are extremely happy with the result.

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Westlake Girls High School Sports Facility

Structurflex Limited

HIGH COMMENDATION

Entrant: **Structurflex Limited**

- Category: 4 ID Number: 4101
- Location: Auckland
- Client: Westlake Girls High School
- Completion Date: May 2012

Credits:

- Architect:Creative Spaces (Harry Street)
- Structural Engineer: Fabspan
- Others: OCTA Associates (PM)
- Builder: ASPEC Construction
- Fabricator: Structurflex Limited
- Installer: Structurflex Limited
- Steelwork: Grayson Engineering

The Tension Membrane Structure covers 4 Netball Courts and 6 Tennis Courts. The School wanted to enable increased use of their Netball and Tennis Courts by adding an all weather Canopy.

The vision called for full light between each netball court with more shade for on-court players. The project was also challenged by unusually bad weather and the discovery of inconsistent ground conditions. Combining 2 different fabric types added a large degree of complexity as well as the scale of the clearspan required over the courts (84m x 36m).

We advised the Architect on the design and were responsible for all structural engineering, as well as the supply, fabrication and installation of all components. Working with the architect, we developed the fabric connection details that satisfied the architect's vision and also the custom guttering system.

The architects vision for conveying intense natural light between the courts was effectively achieved by combining PVC coated membrane with ETFE foil. The contrast between the translucency characteristics of the materials ensures a pattern of comfortable shading and full natural light.

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Mooloolaba Bowls Club, Mooloolaba

Light Weight Structures

HIGH COMMENDATION

Entrant: **Light Weight Structures**

- Category: 4 ID Number: 4351
- Location: Mooloolaba
- Client: Mooloolaba Bowls Club
- Completion Date: November 2011

Credits:

- Structural Engineer: Jeremy Hunter
- Specialists: Trevor Scott Building Designer
- Builder: Light Weight Structures
- Fabricator: Stanfast
- Installer: Light Weight Structures

The project covered two bowling greens each measuring 1240 sqmts for a total undercover area of the tensile structure 3253 sqmts. Fabric roofing was the superior choice of roofing material over metal roofing, as fabric offers translucency of natural light during daylight hours and with the use of energy efficient up lights an aesthetically favorable backlit effect at night with the added benefit of shadow free reflected lighting to the bowling arena. The structural design features leaning arches and valley cables spanning the width of the structure forming a Ridge and Valley canopy. The ends of structure are curved/closed encapsulating artificial nighttime light within the roof canopy minimizing the nighttime light spillage and annoyance to neighboring properties.

Rather than using trussed steel rafters, large diameter high strength pipe sections in a leaning arch configuration would create the required strength to span the 42.8 mt distance. These pipe sections maintain strength but are cost effective as they require minimal labor during fabrication. Valley cables over the top of the fabric canopy deliver both strength and stability to the fabric. In addition, the Valley cables allow for tensioning of the canopy if required after a severe storm event.

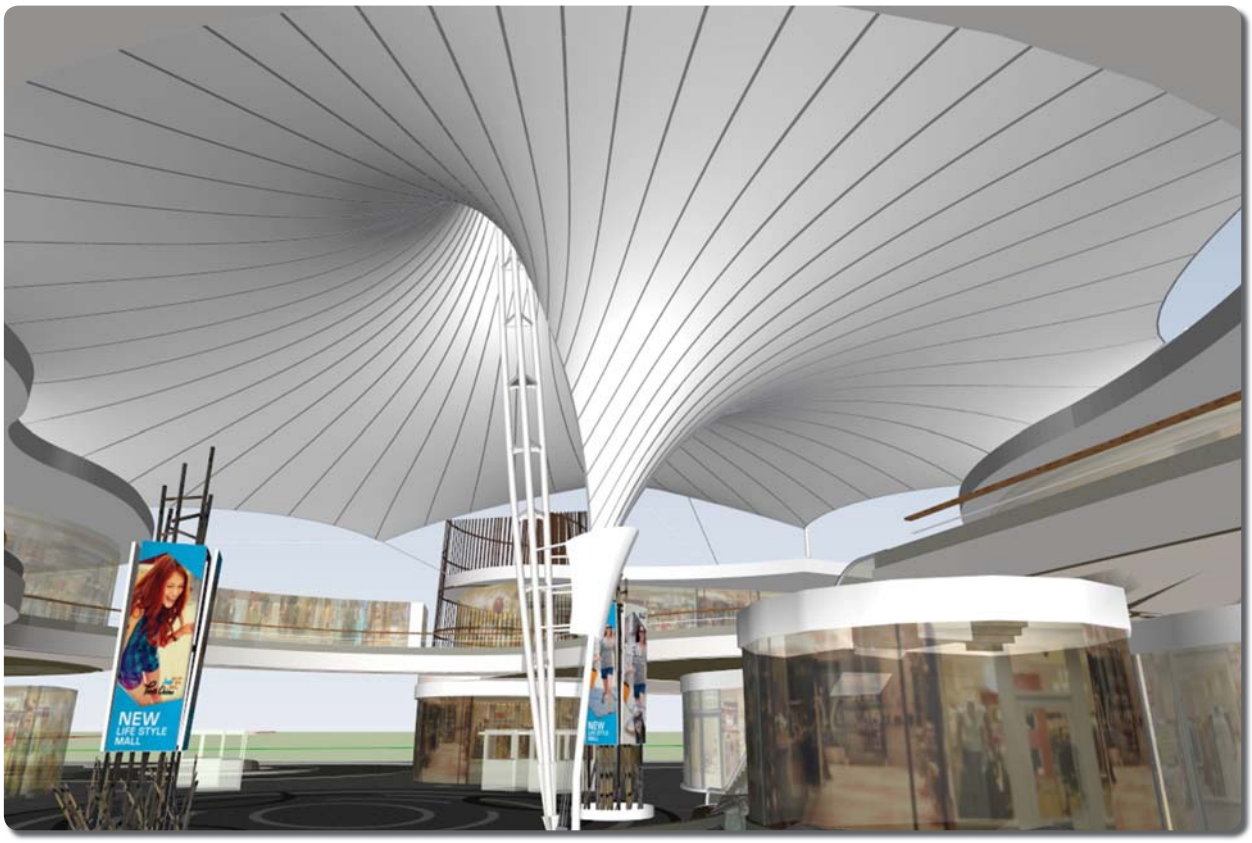
The combination of leaning arches and valley cables resulted in less structural surface for dust, dirt and birds nesting birds to accumulate. Consequently less cleaning maintenance is required to keep the structure looking in optimum condition.

LSAA 2013 Lightweight Structures Design Awards

Porto Chino, Samut Sakhon, Thailand

Geometal Limited

HIGH COMMENDATION



Entrant: **Geometal Limited**

- Category: 4 ID Number: 4166
- Location: Samut Sakhon, Thailand
- Client: D Land Group Co., Ltd
- Completion Date: July 2012

Credits:

- Architect: Contour Co., Ltd
- Structural Engineer: EDMA Co., Ltd
- Specialists: Enplus Co., Ltd
- Builder: Cho Rungrot Co., Ltd
- Fabricator: Fastech Co., Ltd

Our company was taking roles as design and engineer being a reason that the architect for the project came up only concept with an idea to cover void in center of life style shopping using fabric structure.

First concept was single conical, however, this was changed to one high point and one low point later to create new shape and allow wind to flow downward to space below.

The project comprises of 2 main buildings, Left and Right, leaving the center as a void for outdoor area as promotional activities. The fabric structural system are single center mast and using building's roof floor as support to maximize usage of fabric's property and minimize cost of steel work.

By having one higher point and one lower point at center of fabric creates double curvature to be able to take wind load for this large span as well as using as opening to allow wind flow to space underneath. Center mast is built-up section using 3 pipes and having stay cables on top to hold them in place.