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A brief history of tension fabric and shade structures in Australia



Dr Peter Kneen Exec Officer, LSAA

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The Modern Tents attributed mainly to Frei Otto

Frei Otto started into Lightweight structures in 1947.

He later was interested in **equilibrium formfinding** and in ideas taken from nature and technic. The "soap film" concepts were used as a model for many years.


His first tent structures were tents for the garden shows in 1955 and 1957.

Many early structures used canvas and a "sewing pattern" to avoid cutting the selvedge of the canvas.



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Frei Otto and Australia
MSAA Founded 1980-81



Vinzenz Sedlak (left and right) worked in Frei Otto's (centre) Institute in Stuttgart but came to UNSW in 1975 and set up the LSRU and taught membrane structures and lightweight structures at the Faculty of the Built Environment.

The Frei Otto connection was important for the MSAA (later to become the LSAA) to mount some significant International Conferences in 1986 and 1998.




WALTER BIRD
RYOTARO NOHMURA
FREI OTTO

Bob Anderson – Pickers
Bernie Davis – McWilliams
Bert Billsborough
Les Thorogood - Chemfab

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Dean Park Sound Shell 1978



Early 1:100 scale model – Later a 1:10 (?) "model" was made

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Queen Street Mall 1980
 Formfinding, edge cable fittings, wind loads

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The NSW Demountable Stage Structure.

An initial 1:100 scale model was constructed from which the coordinates of key points were measured.

A soap film membrane computer model was constructed using elastic cables and masts. From this cutting patterns were generated and a more refined 1:25 (maybe 1:20) model was made by sewing the patterns together and adding details such as edge pockets for the cables etc.

The first structure was fabricated by Bert Billsborough and used sewn and welded seams. Bert was a pioneer in adopting the new forms and was very supportive of the MSAA / LSAA

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Air Supported Structures

Many pools covered with pneumatic structures. (Hobart, Melbourne etc) Some other travelling domes.

Chemfab did the only cable restrained inflatable structure at Burswood in Perth.

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Preston markets redevelopment – VIC

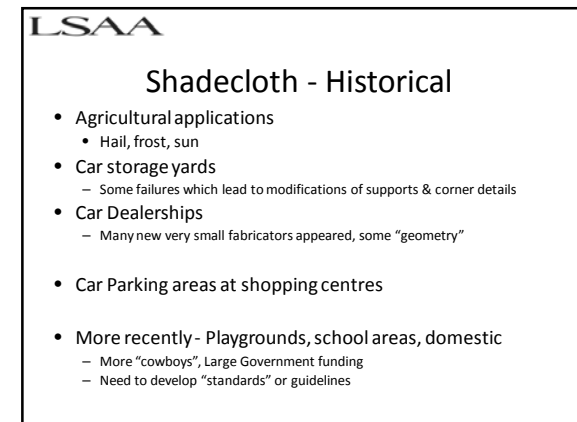
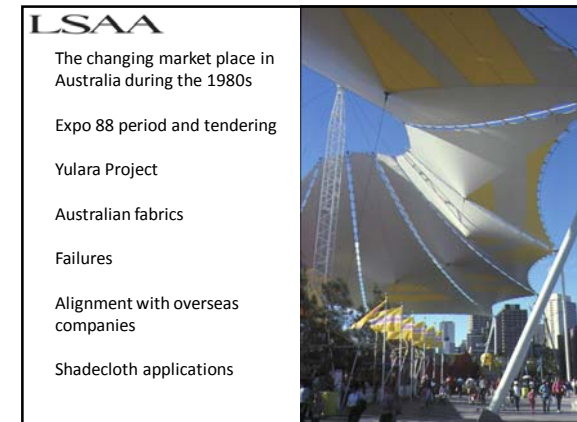
Maroochydore shopping mall

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Wind Loads

Cones seemed to be popular in the early days.

The MSAA Technical Committee organized some wind tunnel tests of cones.

Determination of suitable wind loads on 3D forms is still a problem today.



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Agricultural Applications

- Many nurseries used woven shadecloth nailed to timber rafters up to the early 1980s (Australia)
- Some very large areas destroyed by high winds
- Lead to a development where 2 factors addressed:
 - Fixed (concentrated) attachment points
 - Inherent weakness to distortion & tearing of woven shadecloth

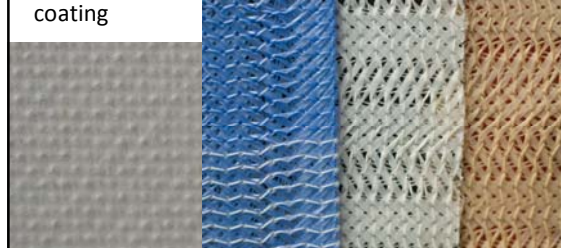


Superspan
Prototype 1982

4x2 Panels (14.3m square)
With / without wall panels
Observed under winds for 4 months
Uplift forces and deflections recorded.
70% shade factor, knitted, webbings

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- Knitted construction permits in plane shearing
- Distortions of cloth larger due to lack of coating



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Shadecloth Structures – Early 1980s



The first commercial application of the new system – approx 1 hectare

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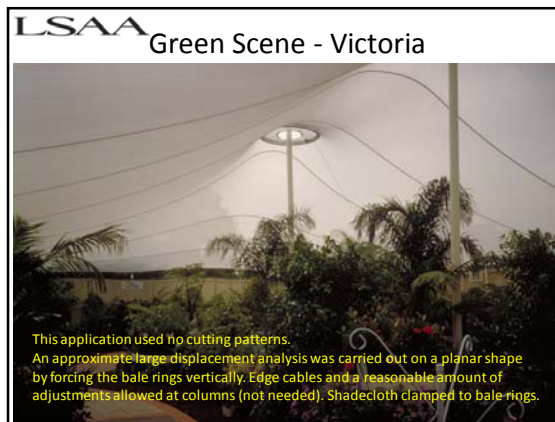
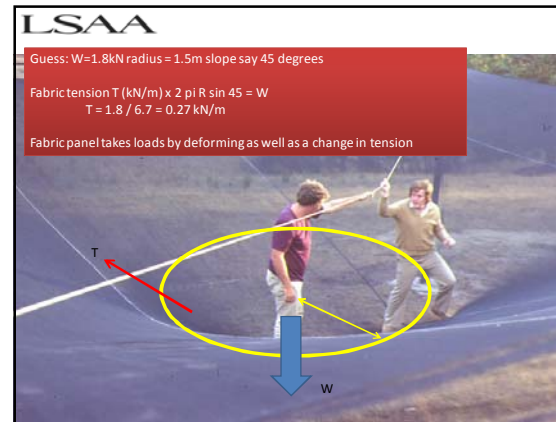


Agricultural shade houses used shade factors of between 70 to 80 percent

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Structures built in many regions in Australia, USA





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Playgrounds, Schools

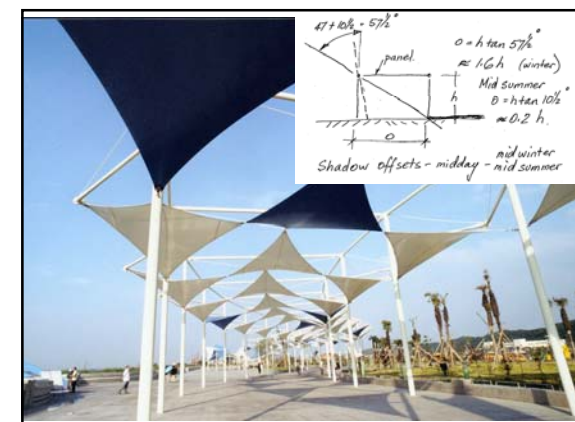
- Australia has extremely high incidence of skin cancers
- Cancer Council – SunSmart has active programs to educate the public about the dangers of exposure to sun
- SunSmart has produced some guidelines
- Government funding (“stimulus package”) for COLAs, but many “cowboys” have come out of the woodwork!

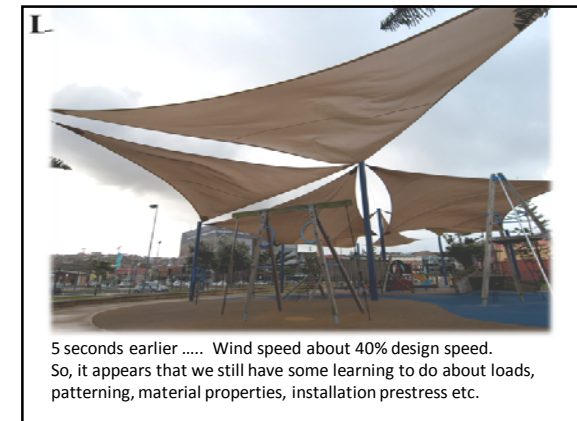
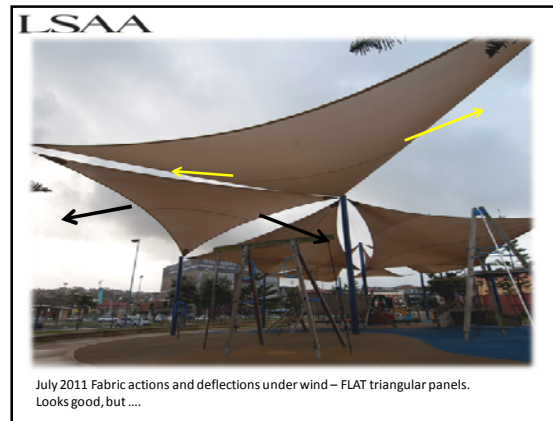


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Current Situation

- Large variation in quality of installed shade structures – often driven by perceived cost
- Large deflections, many sagging panels, degradation, failures of foundations, poles
- Do not provide adequate shade – shade cover often not determined
- There are no standards – and some imposed conditions





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Basic Considerations to be Covered

- Understanding materials – Bob Cahill
- Understanding Shade – John Greenwood
- Learning from existing – Joseph Dean
- It is all in the details - Joseph
- How to predict – Trevor Scott, Alan Stewart
- How to make it – Alan Stewart
- Rules, guidelines – Peter Kneen & Panel

