



The Amazon Waterlily Pavilion – Project Details



- \$4.3m Public Glasshouse
- Located in Adelaide's Botanic Gardens
- Houses exotic Amazon Waterlily flower
- Structural Glass load-bearing beams, columns and walls
- \$3m was spent on glass, only \$0.5m on structural steelwork



The Amazon Waterlily Pavilion - The Brief



- Publicly funded structure – tight budget
- Replace dilapidated 1950s aluminium superstructure
- Preserve original 1867 pond
- Must be modern showpiece structure for Gardens 150 Celebrations
- Should not detract from adjacent Heritage-listed buildings



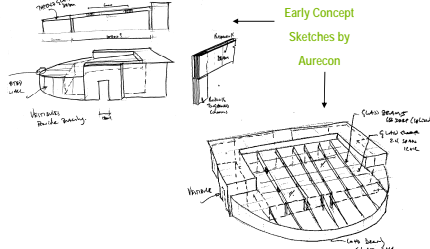
The Amazon Waterlily Pavilion – The Team

- **Great Team + Close Collaboration = Outstanding Result!**
- **Conceptual Engineering Design –**
Connell Wagner Sydney (Damian Murphy and David Kennedy)
- **Detailed Engineering Design –**
Connell Wagner Adelaide (Niko Tsoukalas and Jennifer Macdonald)
- **Specialist Glass Contractor (and Client) –**
Construction Glazing (Marc Kovacic)
- **Architecture –** Flightpath Architects
- **Builder –** Built Environs




Engineering Solution – The Concept

A Structural Glass Pavilion – provides transparent showcase structure, doesn't detract from surroundings



Early Concept Sketches by Aurecon



Presentation to Client




An Inspiring Plant!

- Amazon Waterlily collected by Dr Richard Schomburgk (early Director of Gardens) in 1860s
- Had inspired Paxton's Crystal Palace of 1851: a groundbreaking glass structure of its time
- Flower changes from white to pink during pollination, hence pink accents used in structure of Pavilion



Glass as a structural material



- **Pros:**
 - High compression strength
 - Perfectly transparent
- **Cons:**
 - Non-ductile, brittle material (but is flexible within its elastic zone)
 - Tensile strength is low (c.f. metals)
 - Micro scratches are a problem
 - Cannot ignore lack of fit or stress concentrations



Engineering Solution – Safety & Redundancy

Issues:

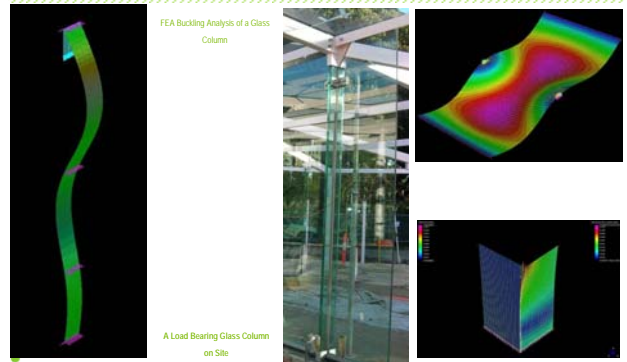
- Glass is inherently strong in compression, but can fail in sudden brittle manner
- Bolt holes cause stress concentrations in plates

Solution:

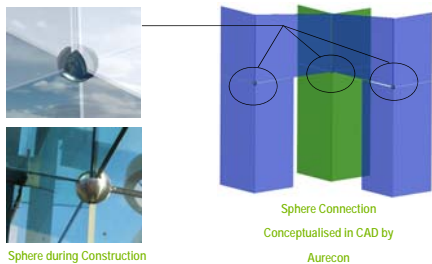
- Design for redundancy
- All planar elements laminated, all critical elements triple laminated
- Lateral/Tensile loads taken out by small amount of steelwork



Advanced Finite Element Analyses



Innovative Fail-Safe Connections

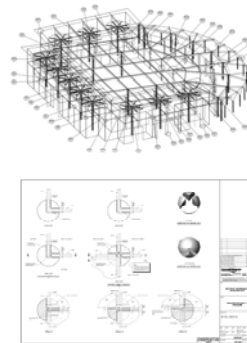


Sphere during Construction

Sphere Connection
Conceptualised in CAD by
Aurecon



High level of Detail



- 400 separate glass panels covering 500m2 area
- 1000+ design hours invested
- 3D shop model utilised
- Details drawn at 1:2 scale
- 3,700 Part Drawings Produced
- Custom stainless steel fittings designed by Aurecon



Budget and Timeframe

- 400 separate panels were rationalised and engineering design was scheduled to suit Contractor's requirements
- FEA analysis assisted us in reducing roof thickness by 4mm; allowed "Pilkington Activ" Self Cleaning glass to be procured

Code	Description	Unit	Quantity	Rate	Amount
100	CONSTRUCTION				
101	Site Preparation				
102	Excavation				
103	Foundation				
104	Structural Steel				
105	Roofing				
106	Glazing				
107	Interior Fitout				
108	External Works				
109	Other				
110	Contingency				
111	Professional Fees				
112	Other				
113	Other				
114	Other				
115	Other				
116	Other				
117	Other				
118	Other				
119	Other				
120	Other				



Contribution to the Local Economy



- The Gardens have been a focal point in the City for 150 years; attract 1.3m+ visitors per year
- They are only Gardens in Australia to showcase the Amazon Waterlily
- Pavilion was designed, engineered and constructed by locally-based companies
- Students at the Adelaide TAFE helped cultivate the plants
- It is hoped the Pavilion will help to increase visitor numbers to the City



AWP: An Icon of Australian Engineering

- Continues the proud tradition of innovative structures inspired by the Amazon Waterlily
- Stretches the application of glass technology in Australia to its limits
- First Australian public building to use structural glass as its main supporting material
- First Australian building to use load-bearing structural glass columns
- Highlights the value of engineers working closely with suppliers to achieve an outstanding result



Images from Apple – New York



Slide Title

"The all-glass structure... is expected to further cement the Adelaide Botanic Gardens' international reputation. This is an impressive architectural inclusion to our Gardens that will help build on the 1.3 million visitors that visit them each year... Adelaide Botanic Gardens was one of the first in the world to cultivate this amazing flower and it remains the only botanic garden in Australia to showcase its impressive display... Its completion during the Gardens' 150th year marks a stunning job by local designers and builders"

SA Premier Mike Rann



Question Time!

