Location: Homebush Bay, Sydney, NSW

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Owner/Trustee: Royal Agricultural Society

Architect: Anchor, Mortlock and Wooley

Engineer: Ove Arup

Builder: Theiss Constructions

Constuction Date: 1997-98

written by: Susan Ferguson | **with:** Greg Nolan | **design:** Peter Walker

Olympic Exhibition Centre

Homebush Bay, Sydney - New South Wales

One of the largest structures built at Homebush Bay for the Royal Agricultural Society and the 2000 Olympic Games is the timber dome and hall of the Exhibition Building. The dome is the largest clear span timber structure in Australia, far exceeding the 53 metre span World War 2 hangers built at Archerfield in Queensland, which had been Australia's largest clear span buildings.

For Sydney's "Green" Games, the Olympic Coordination Authority actively pursued ecologically sustainable development principles. In particular, they sought the conservation of species and natural resources, and the control of pollution.

The Olympic Exhibition Centre, designed as part of the new Sydney Showground redevelopment within the Homebush site, is one of the buildings in which at concept design stage, it was decided that timber would be used as a structural element and finish. The Exhibition Hall was designed and constructed using **glulam**, specified by the architects, Anchor, Mortlock and Wooley for its unique aesthetics, cost effectiveness and environmental credentials. Timber is a renewable building material with low embodied energy when compared to other comparable materials.

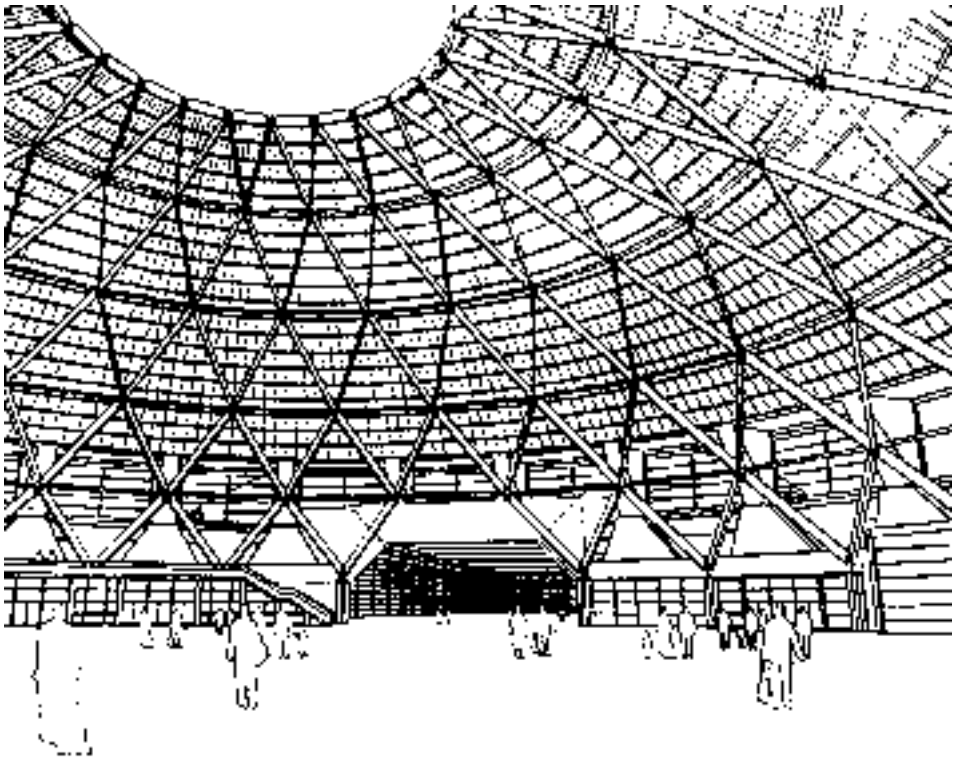
main image
the exposed timber structure in the interior of the Olympic dome

•**Description** - Constricted by the surrounding urban fabric on its existing Moore Park site, the Royal Agricultural Society (RAS) decided to relocate the Showground to the Homebush site, with a continuing long term link with the Olympic infrastructure in hand, rather than upgrade and retrofit its existing facilities.

The relocation to Homebush Bay offered the RAS 140,000m^2 of purpose built facilities and exhibition space, its own rail link and shuttle bus services, 10,000 parking spaces and an additional two hectares of land.

Located adjacent to the Olympic Park railway, at the southern edge of the Showground precinct, the Olympic Exhibition Centre has two main sections, a 97m span dome and hall. The design for the building has a simple parti - the dome provides the arena and the hall, the venue for exhibitions, concerts, banquets, displays, conventions or staged events. Operable walls may subdivide the hall space to create six bays. If used as one space the hall is the size of three football fields.

isometric



dome interior

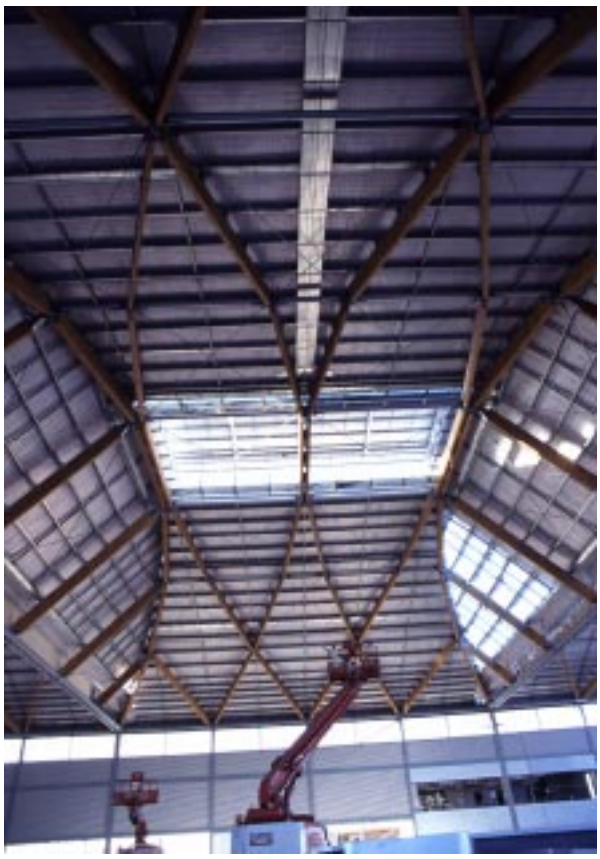
hall interior

top right
the main volume of the dome taken from the mezzanine level

bottom right
interior perspective of the exhibition hall

top left
internal perspective of the interior of the dome

bottom
isometric of the Olympic exhibition centre
drawings - courtesy of the architects



• **Structural Description** - The dome is a conventional **geodesic** structure, with glue laminated Radiata Pine used in the compression members and steel used in the struts. As architectural expression, the timber elements are detailed to establish pattern, provide colour and a layering of structure. All of the other elements are then scaled to complement the use of timber. The elements meet at complex fabricated steel connection nodes. To fix to these nodes, each end of the timber beams has eight **couplers** and threaded anchor rod set into the laminated timber with epoxy resin. To resist the increased loads towards the base, the timber section progressively increases from 800 x 130mm in the top circle of the dome to 800 x 230mm at its base.

The hall has been designed so that it can be divided into six separate pavilions by operable walls. The hall's roof form derives from the need to give each of these pavilions some distinction while supporting the moving walls and retaining a roof structure in sympathy to that of the dome. Again, glue laminated timber beams are combined with steel struts to arch down from the peak of the roof to the steel support columns. Here at the perimeter, the steel and timber elements form a truss in the plane of the roof. This takes the horizontal thrust from the arched form and resolves it through the major transverse tension ties of the operable wall support lines.

F11 Radiata Pine was specified for the beams and the material for the dome was sourced from South Australian **plantations**. To ensure quality and consistency for such a large and public project, a rigorous quality assurance program was put in place. Each laminate and each finger joint in the beams was individually proof tested before the beams were assembled and a length was cut from each beam and subjected to a **cleavage test**.

Further, a sample of every batch of epoxy used in setting the bolting couplers was retained and tested.

top left
connection detail

bottom left
the dome under construction

top right
structure and lining of the dome

middle right
steel connection node of hall roof

bottom right
the ribbed bays for the exhibition hall

left + middle left
detail of steel connection joint

middle right
coupler and template

far right
the exhibition hall under construction

•**The use of plantation pine** - The architects of the Olympic Exhibition Centre selected timber because it was a sustainable building material. They specified Radiata Pine because it was a plantation material. Radiata pine is not a native Australian species but is now grown throughout Australia as part of broad forestry practice. Pine increasingly is used as source stock for basic and engineered timber products.




•**Sustainability and Greenhouse** - As a building material, timber has many environmental benefits. Growing trees as plantations or reintroduced native forests can rehabilitate land subjected to poor farming practices. Timber production is reasonably labour intensive and can promote regional development. Trees, particularly native trees, provide ecosystems for native fauna.

The debate that surrounds the relative environmental merit of timber or other building materials is still in its infancy. Some simple comparisons are striking. Timber is an organic material. It is drawn from the trunks of trees that use solar energy to grow. While other energy sources are used in transforming the trees to timber, the end product has relatively low embodied energy. Primarily composed of carbon based compounds, timber sequesters carbon from the atmosphere into buildings for as long as it remains in service. By comparison, steel is produced in a coal-based process that is energy intensive in manufacture and finishing. Two tonnes of carbon dioxide are released into the atmosphere for every tonne of steel produced. Every tonne of timber used in building sequesters 500kg of carbon from the atmosphere while every tonne of steel used in building puts 700kg of carbon from fossil fuels into the atmosphere. Growing trees in a sustainable manner to provide the raw material for a building product has environmental benefits. It can be argued therefore, that timber is a reasonably good building material if it is grown sustainably and in a way that does not reduce **biodiversity**.

Still, issues of sustainability and forest management are complex and emotion charged. For example, there is an unconscious aesthetic debate about timber and forestry practice. What is a beautiful pastoral scene? Is it an agricultural landscape containing **monocultural** European grasses, Middle Eastern animals, such as sheep and cows, and European and North American Willow trees growing along watercourses? Such a description defines much of the Australian landscape. However, this imported construct of the Picturesque conflicts with the native landscape of Australia and has produced significant problems of salinity and erosion through poor agricultural practices. To remedy this, degraded farmland is being turned into plantations of pine and native hardwood species. Both can lower the watertable and reduce salinity levels. Yet plantation pine currently holds favour with some timber users as environmentally preferable even though native species can encourage a higher degree of biodiversity.

As these plantations develop, the distinction between native forests and plantation will blur. A stand of native trees might be and look like a plantation, that is, all the trees in rows. It might look like native forest but actually be a plantation or it could be native forest. Trees take a relatively long time to grow and their arrangement is influenced by natural selection, storms and human intervention. Whichever way the trees are grown, the question remains; what is the most benefit we can derive from growing and using trees on a continuing and sustainable basis?

•**references**

Forest and Wood Products Research and Development Corporation 1997, Environmental Properties of Timber, FWPRDC , Melbourne

Keating N. 1997, "The shape of timber structures", Australian Timber Design, September, Timber Research and Development Advisory Council of Queensland, p4-5

•**glossary**

biodiversity: a concept that encompasses the diversity of species and communities occurring in a given region

cleavage test: test measuring the resistance of timber to splitting longitudinally along the radial and tangential planes

coupler: a metal sleeve threaded internally and used to connect threaded rods or bolts

geodesic: a structure consisting of a space-frame like grid in the shape of a dome

glulam (glue laminated): laminated timber where laminations are joined with adhesive

monoculture: an environment that has a single species of animal or plant dominant. Usually associated with the artificial environments created by intensive agriculture

plantation: an intensively managed stand of trees of either native or introduced species, created by the regular placement of seedlings or seed

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