07

Location: John XXIII College, Mt. Claremont, WA

Owner: The Archdiocese of Perth

Architects: Brand Deykin & Hay

Engineer: Bruechle Gilchrist and Evans Pty Ltd

Builder: Clough Engineering

Constuction Date: 1986

written by: Bernard Toogood | **design:** Peter Walker

John XXIII - Chapel

Mount Claremont - Western Australia

Religious buildings have a tradition of expressing their structure in a dramatic way, dating back to Gothic times. In Australian religious buildings, this was most often in the form of finely crafted timber roof structures. John XXIII Chapel, part of a primary and secondary college campus in the Perth suburb of Claremont, continues this tradition with a beautifully detailed exposed roof structure of glue laminated Jarrah trusses spanning almost 20 metres across the chapel.

The brief required a flexible space, able to accommodate one or 400 worshippers, but in an atmosphere that each group, regardless of size, felt comfortable in. The rich colours of the Jarrah timber structure and linings, combined with the modern interpretation of a traditional ecclesiastical form in the roof, provided the desired warmth and intimacy to the space.

top right
chapel in the context of the college campus
photo - courtesy of the architects

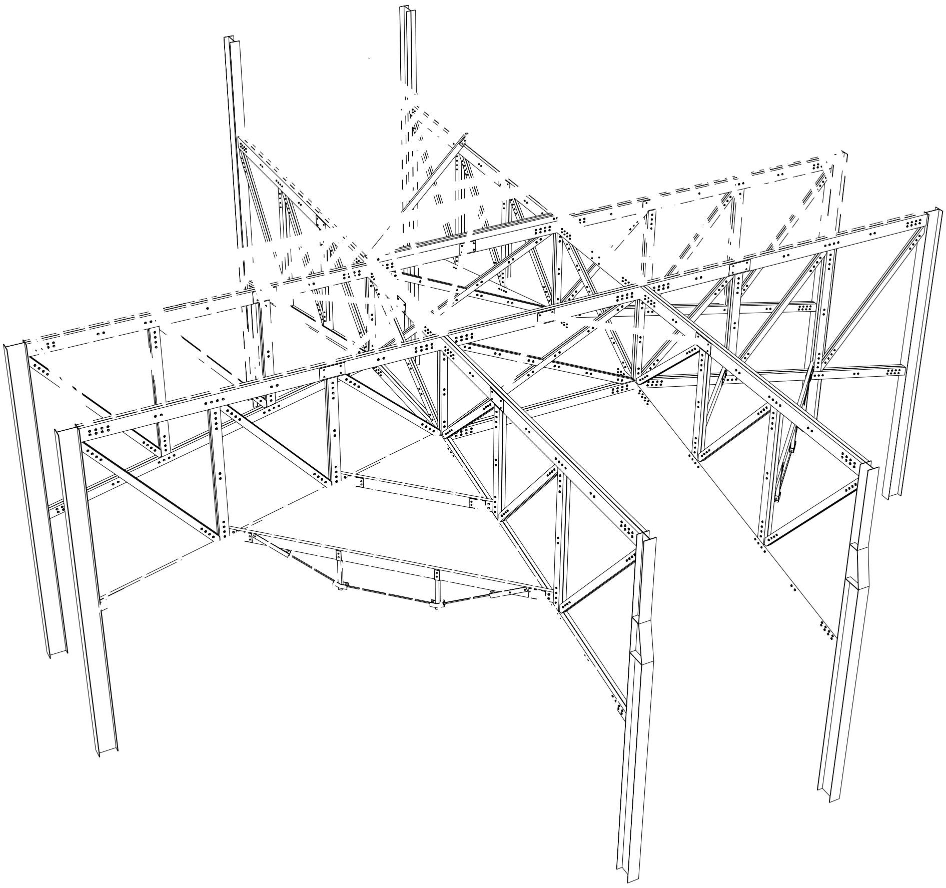
main image
the mostly masonry exterior of the chapel belies its exquisite jarrah interior

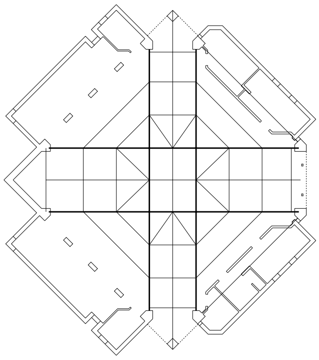
•**Description** - The John XXIII chapel is not a traditional ecclesiastical form, with a nave, two rows of columns and aisles running down each side. The flexibility required by the brief ruled this out. However the clients wanted to capture the intimacy this form gave a space. The architects reinterpreted the traditional nave and transept by representing only the top half of it through the timber trusses and roof. This left the floor free of obstructions, allowing for the easy movement in and out of large groups of students. Such a large spanning structure is not a part of traditional churches, and was made possible using the modern technology of **glue laminated timber** trusses.

The chapel is basically square in plan with the roof trusses spanning diagonally across the space in pairs, forming a **cruciform** overhead. Each of the corners is faceted. Three corners are entrances while the fourth houses the altar of the chapel. To improve lines of sight the floor follows the diagonal geometry of the roof structure and steps down to the altar. For flexibility in use, none of the seating inside the chapel is fixed. The supporting functions of the chapel such as the sacristy, storage, change rooms and a smaller chapel are placed around the outside of the chapel, in between the entrances.

The strong Western Australian light is carefully controlled, entering through glazing up high in the gable ends of the pitched roofs and through small windows near the top chord of each truss.

Like the timber interiors of the Sydney Opera House [#02], the rich dark hues of Jarrah timber, native to Western Australia, form a dramatic contrast with the concrete masonry of the exterior of the chapel. The trusses in particular dominate the interior, breaking up the space and creating a visually exciting element. Jarrah was also used to line the ceilings and walls and for joinery throughout the chapel.





top right
the cloistered courtyard of the college

middle right
plan of the chapel showing the nave form created by the truss and roof structure overlaid on the more modern and flexible floor plan

bottom right
diagram of traditional cruciform church layout

left
structure of the chapel

•**Structural description** - The structure of the ceiling consists of four intersecting trusses, in a cruciform arrangement. Together they form an interlocking **beam grid**, acting as one structural and bracing element. Each truss is constructed from paired, glue laminated Jarrah timber members, joined by steel connector plates. The steel plates are sandwiched between the two pieces of timber being connected and are concealed from view, with only the studded lines of bolt heads and washers exposed. Each truss is supported at the ends by steel columns, concealed within, and tied to, thick reinforced concrete block walls.

A gable roof pitches off the top chord of each pair of trusses with solid Jarrah rafters supporting a glulam ridge plate. Every five rafters there are a pair of solid Jarrah chord ties to stop the outward splay of the pitched roof.

Outside the cruciform of the trusses, below the punctured **clerestory** walls, the roof drops down to a triangular **skillion**. This is supported by beams spanning diagonally between the bottom chords of adjacent trusses and laminated Jarrah rafters. Where the beams of this roof are large in span, they are trussed with steel rods and tension struts. The whole roof of the chapel is clad with masonry tiles in keeping with the rest of the campus.

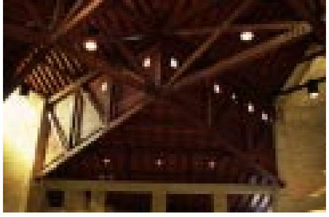
The ceiling, the outside of the trusses and internal timber walls, are lined with solid Jarrah battens spaced 12 mm apart. Behind the battens is black sound absorbing fabric and insulation. The spaced battens not only create an interesting visual effect but also act acoustically to absorb sound and reduce echoing. This is important given that there are large surface areas inside the chapel made up of concrete block.

top left and right
interior of the chapel showing the cross made by the timber trusses and the high level glazing

bottom left
view towards the nave

bottom centre
bell tower

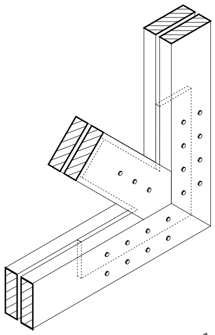
bottom right
looking up through the intersection of the trusses to the batten lined underside of the roof structure
photos - courtesy of the architect

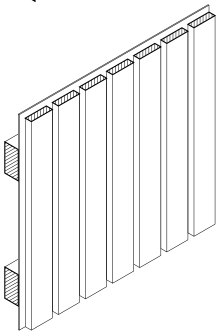


far left
detail of the truss intersection. steel connections are concealed with the exposed bolt plates providing a decorative element

left
details of the timber trusses and lining

below (top to bottom)
- truss plate connectors
- timber wall lining with backing
photos - courtesy of the architects





A Strategy for Design in Timber

• **Glue laminated Structures** - Glue laminated timber, or glulam, is a structural material created by gluing small sections of timber together to create large size elements that can be either curved or straight. Each section of timber is kiln dried then dressed to a uniform thickness and finger jointed into a long piece. The individual pieces of timber are then glued together to make simple structural elements which can then be processed further to make attractive appearance grade members.

Glulam timber offers many advantages over solid timber. Large pieces of solid timber can be difficult to get and hard to season. If a large piece of timber has a knot or other strength reducing characteristic in it, the whole piece is structurally effected. With glue laminated timber, because it is made from smaller pieces, any structurally suspect piece is removed before assembly. As each small piece of timber is already seasoned and dressed, glulam also has a high degree of dimensional stability.

Glue laminated timber is also beneficial from an ecological point of view. Because it uses small sections of timber, plantation timber can be harvested early in its growth and reassembled to create structural elements of any size.

• **Beam grid structures** - Most timber structures only work in two dimensions. Elements such as joists, trusses and rafters, work in isolation relative to each other and span in one direction, transmitting any load placed upon them to the two end supports. They need to be braced by other elements to stop them buckling. But for applications such as large spans, a much more efficient solution is a three dimensional structure like a **space frame** or the beam grid of trusses in John XXIII Chapel. In the chapel, all the elements of the roof are working together as one framework, and any load falling on one particular point of the roof is transmitted throughout the whole structure and down through all eight posts supporting the roof. The efficiency of this means that the timber elements that make up the structure can be smaller in size, reducing its overall weight and increasing its ability to span. It also produces a visually exciting element to the building. The disadvantages with such structures are their relatively high cost due to the complexity of the connections and increased labour time in fabrication and installation. Due to these factors, three dimensional structures are usually restricted to large spanning roof structures.

• references

Construction Review 1987, Vol 60, Nº 1, Feb, pp 38-45

Wood World 1988, 'Timber trusses combine strength and sensitivity', Feb

• glossary

beam grid/space frame: a three dimensional framework for enclosing spaces in which all members interconnect and act as a single entity

clerestory: a window, or row of windows, in the upper part of a room where it can admit light from above an adjacent roof

cruciform: in the shape of a cross

glue laminated timber: laminated timber where the laminations are joined with adhesive

skillion roof: a monoslope (single pitched) roof without a ridge or peak, providing the main roof or part of a roof

trussed beam/barrup truss: a timber beam reinforced with a trussed metal tension rod

• on the internet

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