08

Location: Barry St, Gracemere, Central Queensland

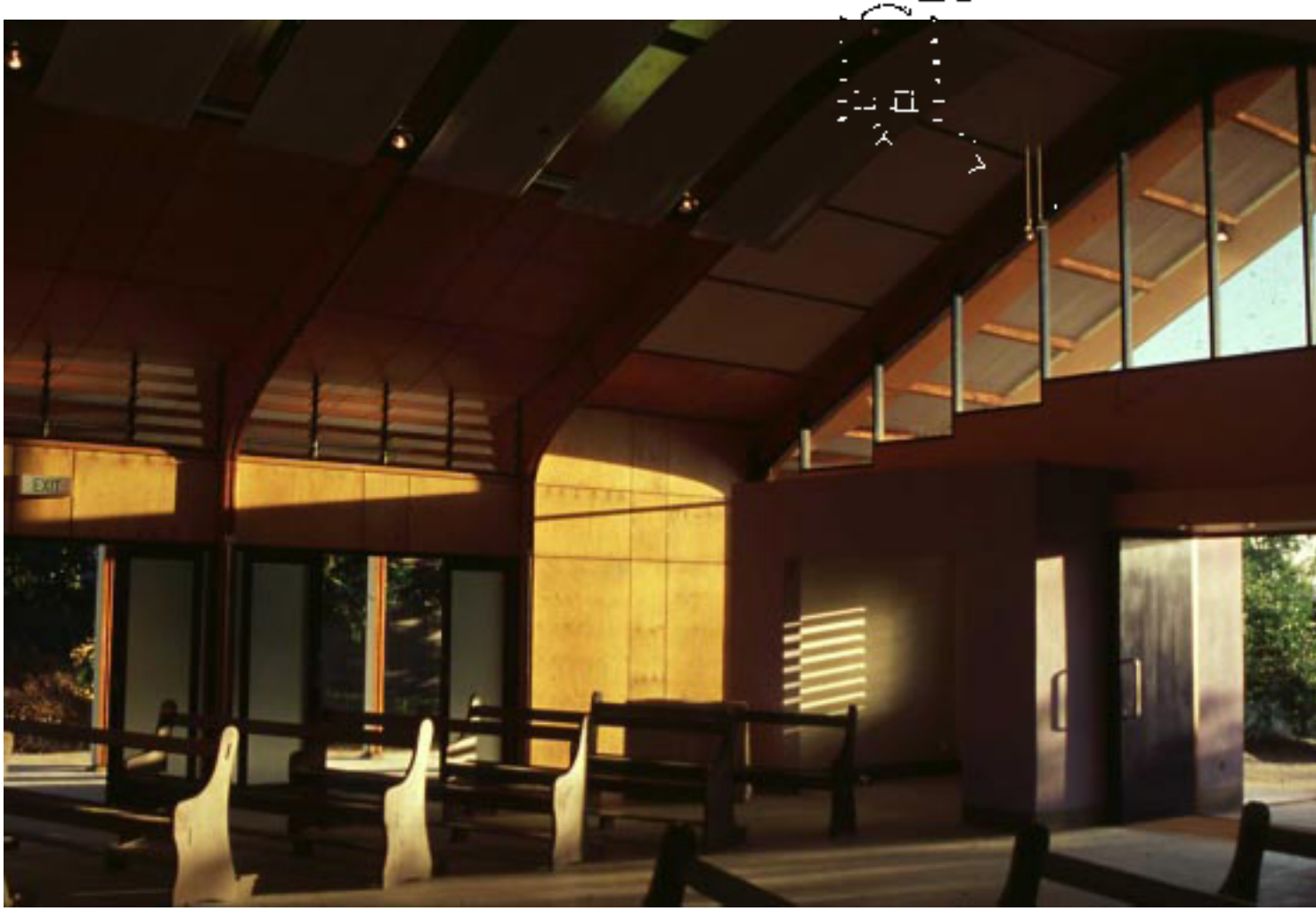
Owner: Anglican Church of Australia

Architect: Innovarchi Pty Ltd

Engineers: Timber structure: Timberbuilt Pty Ltd - 03 9543 3733
Remaining structure: Reinhold and Stanaway.

Builder: Close Construction

Date of Construction: 1995



written by: Susan Ferguson | design: Peter Walker

St Andrews Anglican Church

Gracemere - Central Queensland

St. Andrews Church is a crisply detailed, elegant building for a small congregation in the township of Gracemere, south of Rockhampton. The building began its life as a conversation about the design of Australian churches. Reverend Elliot of St. Andrews expressed a desire for departure from the steeply pitched roof form of the European church towards a new model, more suited to the Australian climate, and lifestyle.

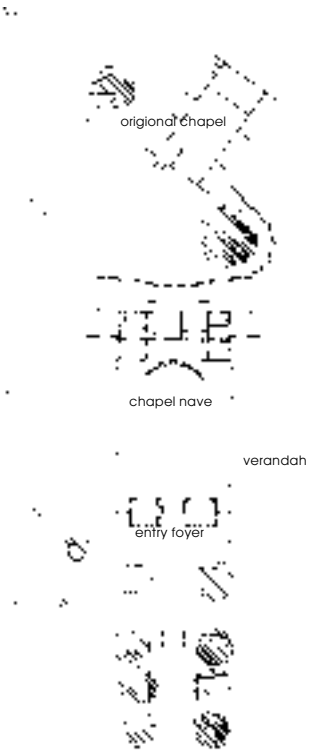
From that initial conversation, Ken McBryde and Stephanie Smith of Innovarchi developed the design for this church over a period of six and a half years as they experimented with ideas for a segmented portal system whilst working for Renzo Piano in Italy. While living in urban Genoa, the qualities of Australian light, flora and fauna were a strong memory for Smith and McBryde. St. Andrews was to be the first built result of their thoughts about Australian church design, and the portal system.

main image
interior of nave
all photos - courtesy of
the architects

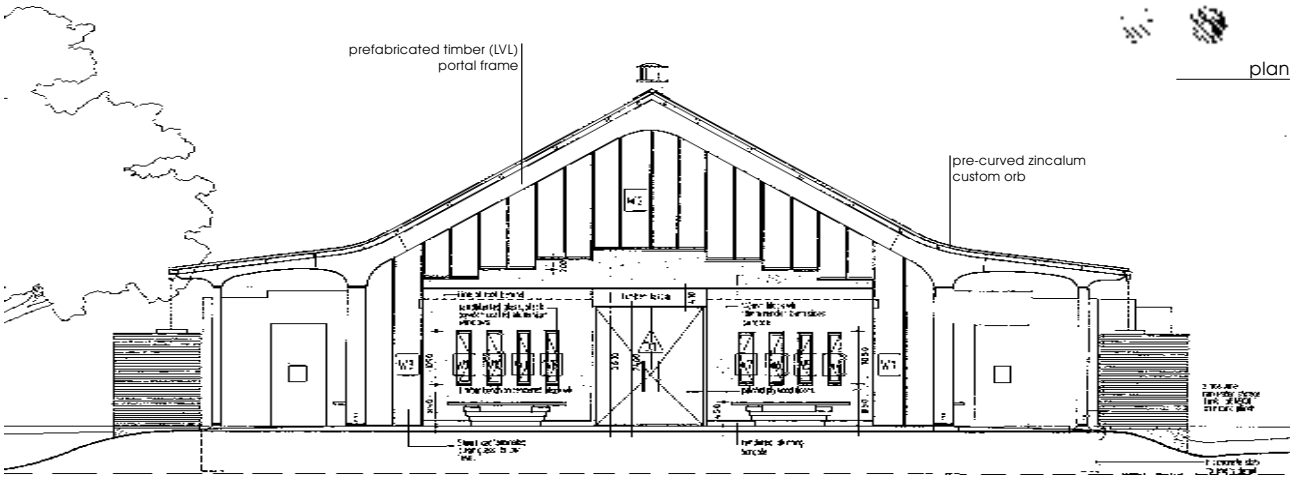
The existing single skinned, pitched roof, 'fibro' clad church on the site had outlived its usefulness for the congregation, as it was too small and inflexible. It also represented some of the characteristics of European churches that Reverend Elliot wanted to move away from. The congregation required a larger multipurpose space to accommodate church services, meetings and social events.

The site strategy employed by the architects involved relocating the older structure on an east/west axis at the rear of the site, and placing the new, multipurpose church building on a mound at the front. The siting created a private courtyard at the rear and developed constant visual connections between the two buildings. Upon entering the new building, the cross of the original church is viewed through the end window as a centrepiece above the altar.

• **Structural Description** - The St. Andrew's Church is constructed using an innovative segmented laminated veneer lumber (LVL) portal. This building is the first Australian construction of the system researched and developed by Innovarchi.



plan



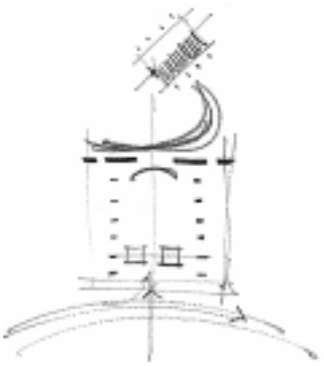
entry elevation

top left
external view of chapel

top right
view of portal frames prior to internal fit out

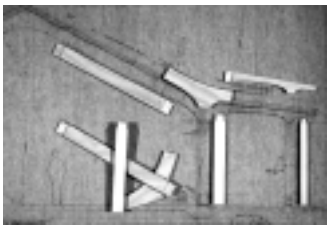
above right
floor plan of chapel

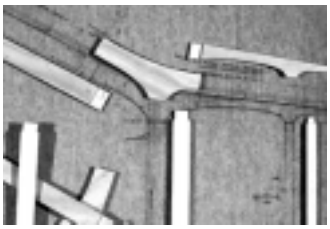
left
entry elevation
drawings - courtesy of the architects



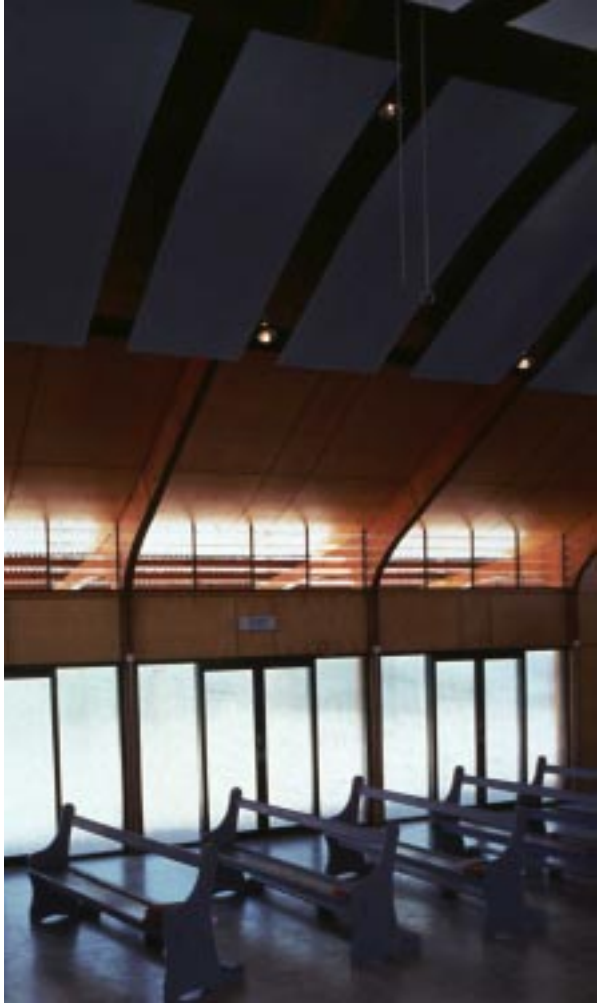
The softly draped three bay portal allows for a lofty worship space within, and a shady verandah on each side of the building. This portal arrangement required structural plywood bracing on the end bays but allowed greater freedom in the remaining openings, as non-structural infill could be used. The side walls are completed internally and externally with timber framing that supports a series of aluminium double doors and windows and a modular pattern of plywood sheets. The sheets are fixed with a 10mm shadow line gap between the plywood panels exposing the joints to create a visual rhythm within the building.

Louvred panels in the top section of the side walls provide cross ventilation and allow for a visual continuation of the portal structure as it continues outside. The ceiling is plywood supporting mineral wool acoustic panels and is fixed along the line of each purlin. Battens articulate the mineral wool sections. Mini-orb panels hover over the space as acoustic baffles. The modulated plywood lining in each bay flows cleanly from inside to outside, as ceiling becomes eaves soffit. Masonry boxes, clustered together in the shade of the portal and separated from the primary structure, provide the necessary service functions within the hall. The end walls are infilled with an off-the-shelf glazing system modified to accommodate the shape and potential movement of the portal.





The segmented timber portal system was applied to the Church due to a tight budget, and the restrictions of unskilled construction labour. The LVL portals arrived on site as a kit of parts ready to be assembled manually. Each of the pieces is composed of three laminates with the straight sections of the centre laminate accommodating the hidden joint, while the outer sections follow the curve. The segments were designed to be slid together (like model train track components), the hidden joints nail fixed by hand, and lifted into position by crane. This system allowed the roof to be constructed early, which eased pressure on the construction program and negated rain delays.



top left
preliminary design sketch

above
model layout of portal segments

top right
glazed doors of church interior open onto side verandah

middle right
junction between two segments of the portal frames

bottom right
entry foyer of the church

•The portal system - Portal framed building systems have been around for a long time, traditionally being constructed from a steel framework. Recent advances in timber engineering and construction however, have seen an increase in the number of timber portal framed buildings.

In a portal system the joints between the columns and rafters, and rafters at the ridge, are fixed and rigid, providing a structural stability that eliminates the need for bracing within the plane of each frame. These frames are then arranged in a series of bays, braced on the outside between each frame, and the lining and cladding applied. This type of framing, with columns and bracing restricted to the perimeter, creates a clear open space, free of structure, inside the building. The most common application of the portal frame is in industrial buildings where maximum span, height and width are required at minimum cost.

As Innovarchi have demonstrated, attention to aesthetics and the articulation of the skeletal nature of the portal, opens possibilities for its application beyond industrial building as an effective structure in civic, commercial, or domestic settings. The drawings to the right present some of Smith and McBryde's experimentation with the portal system in domestic construction.

•Why use timber portals when they could be steel? Timber portals are comparable to steel in terms of span and strength, at a lower weight and cost, both environmentally and economically. There are a number of other reasons why timber portals could be an equivalent, if not better solution than steel:

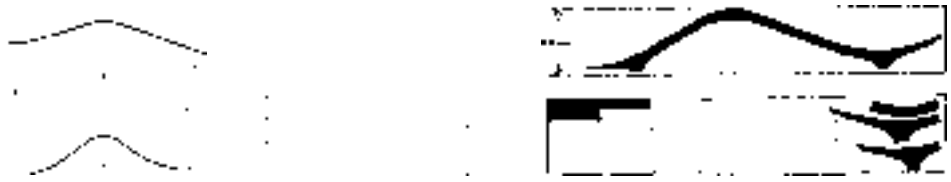
[1] While the Gracemere Church experiments with a new solution, most timber portals achieve rigid joints at the knee and ridge through nailed plywood gussets. The ply gusset is a simple, but highly effective solution that can be easily achieved on site with a nail gun and rudimentary carpentry skill. This reduces construction costs. [2] Timber structures of this type have similar or improved resistance to fire and corrosive environments. In fire, timber will char at a constant rate, while steel will deform and fail at a temperature common in building fires. [3] Dependent on the scale of the building, the portal itself could be constructed in pieces in a domestic scale workshop, or be constructed on site, without the requirement for industrial scale fabrication and lifting equipment common for steel fabrication. [4] The use of timber in this application allows greater freedom, as any infill framing and cladding can be easily fixed to timber, with conventional tools. [5] Flexibility with infill material and fixing requirements with timber portals allows change to occur more easily in the building throughout its life.

•A segmented LVL system - Laminated Veneer Lumber is manufactured from veneers which are rotary peeled, dried, and laminated together under heat and pressure with a phenolic adhesive. This provides an exterior grade glue bond identical to that used in structural and marine plywood. The grain direction of all veneers is oriented in the direction of the beam length, which makes maximum use of the inherent strength properties of timber fibres.

Developing a segmented LVL system has some distinct advantages, over and above those given for other timber portal framing:

Lightness: a large frame can be made of smaller pieces, which can be transported to site more easily, and lifted by hand. Weight minimisation can also reduce transportation costs.

Material economy: LVL can be manufactured in almost unrestricted lengths, but with a maximum width of 1.2 metres. As the diagram bellow suggests, large curved portals, can be segmented into long straight pieces and small "elbow" pieces, which can be cut economically from a sheet.



Ease of Transport: as a kit of parts the segmented portal could be more easily transported to any site, but it would be particularly valuable as a structure for remote sites (inaccessible by large trucks), steep sites or overseas destinations.

Ease of assembly: segments can be fitted together, and hand nail-fixed on site, with a crane required only upon erection.

bottom left
free-form portals economically derived from a limited variety of curved and straight segments

bottom middle
frames made from prefabricated segments

bottom right
comparative diagram demonstrating economy of segmented method over traditional approach
drawings - courtesy of the architects

below
-some of Smith and McBryde's experimentation with the portal system and modular arrangements in domestic construction

•references

Australian Timber Design 1997, "Laminated Veneer Lumber", Sep, p. 7

Norrie H. 1996, "St Andrews Church" Architectural Review Australia, Summer, pp. 46-53

•glossary

jig: a custom made, or commercially available device to set a dimension, angle or shape for fabrication

LVL (laminated veneer lumber): a structural lumber manufactured from veneers laminated into a panel with the grain of all the veneers running parallel to each other

portal frame: a planar frame where the lateral and bending forces are transferred by moment resisting connections from the portal rafters to the columns

•on the internet

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