Case Studies of the Structural Aspects of 7 Recent Aquatic Centres

Insert name
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General Timber Design

Laminated timber members

Purlins butted between rafters to provide lateral restraint.
Consider equilibrium moisture content which depends on the control of the internal space conditions. Typical economic conditions for indoor pool controlled atmosphere is 70%RH and 28ºC for which EMC approx 13%. But for uncontrolled conditions, for example a translucent covered pool you could get average 90%RH and 15ºC which would give EMC of about 21%. For this you need to interpolate between dry (16%) and green stresses (25%). (Ref. Timber Construction Manual, AITC). Consider heat effects. At 28ºC and 70%RH timber will lose about 7% of its strength.

Sawn timber members
The same effects will occur. Creep is more of an issue because the timber is likely to be fixed at much higher moisture content than the EMC it will finally reach in service. Laminated members are fabricated at low moisture content and are also larger sections and creep is less of an issue.

Durability

All timber treated H3.2 throughout the building. All nails hot-dip galvanised – not plated.
No galvanised brackets, straps, etc. especially in the roof spaces due to rusting in chlorine environment. Timber nailed cleats use to fix purlins etc. – consider end and edge distances.
Where metal fixings cannot be avoided use T316SS. Ensure good passivating.
Nail plates with 200 microns sprayed metallic aluminium plus an acrylic sealer perform well.
Ply gussets have also been used successfully for smaller spans (up to 24m clear).
Steel may be OK if hot dip galvanised and can be fully maintained (above water?) and/or replaced. Must be entirely within the vapour barrier envelope to avoid condensation. Splash can be an issue.
Rate of change of equilibrium moisture content is the major factor with creep deflections so use a good sealer on laminated members. There are single coat epoxy urethanes which can be re-coated. These are expensive but appropriate to swimming pools where it is difficult to maintain surfaces above water.

POOL CASE STUDIES

Franklin Indoor Pools, Pukekohe
Brief included 100year life.
Laminated timber beam and strut frames springing from concrete columns. Bolted stainless steel joint plates.
Steel alternative frames were 20% more expensive with expensive coating system – no solution provided for re-coating at 25-30year intervals. Steel would be above pools and therefore difficult to sand-blast or clean down and to re-paint. Buried sections, cleats etc unable to be re-coated without dismantling building.

Freyberg Community Pool, Palmerston North
Simple laminated timber portals with nailed on steel side plates sprayed with metallic aluminium and acrylic. T316SS base fixings.

Epsom Girls Grammar School, Auckland
Mono-pitch rafters on RHS steel legs entirely encased and within the vapour barrier. Cheaper than tension rods and lighter rafters.

Whakatane Aquatic Centre, Whakatane

Approximately 30m long 765 x 90 simply-supported curved mono-pitch laminated timber rafters with central king post and tension ties supported on pre-cast concrete cantilever columns. Mid-point dowelled joint designed for ease of transport but the laminator chose to make the beams in a single length.
Rafters designed to take all wind load uplift. Tension ties take gravity loads only.
Assemblies constructed at ground level and pairs of rafters with purlins lifted onto the pre-cast columns and bolted.

Lido Aquatic Leisure Centre, Palmerston North
Cantilever pre-cast concrete columns supporting tapered laminated timber rafters with epoxy dowelled connections. Heavy steel brackets bolted to the top of the columns with dowels welded on to take the rafters and provide the internal gutters and service access. The brackets are all hot-dip galvanised and completely encased in the construction and entirely within the vapour barrier.

AC Baths, Taupo
25m pool building structure is the same as Whakatane. End tubes supporting the tension rods were changed to suit contractor. Larger diameter therefore thinner wall for same bending strength – but local effects at rod caused buckling! Think small!
Leisure pool building similar structural form but supported partially on steel posts and in a high humidity/high temperature situation due to the geo-thermally heated indoor/outdoor pool. Allowance made in the sizing of the sections.

Queenstown Aquatic Centre
At concept stage. Raking cantilever pre-cast concrete columns with large ply box beam rafters proposed. Rafters to have full length laminated timber chords with force transfer by nailing to internal steel sections to facilitate joining and bolting to columns. Laminated timber secondary framing and purlins envisaged. Possible use of LVL but treatment issue to be solved. (LVL with LOSP treatment was used for Wairoa pool.)

INSERT POOL GRAPHICS FROM CD SUPPLIED