KILLEN FALLS HOUSE

STEEL AWARDS 2012

WINNER CASE STUDY

AUSTRALIAN STEEL INSTITUTE

STEEL CLAD STRUCTURES AWARD 2012

EQUAL STATE WINNER (NSW + ACT)

ARCHITECTURAL MERIT

The Killen Falls house designed by owner / architects Peter and Stephanie Lane of Jackson Lane Pty Ltd sits on a secluded hill in the northern New South Wales hinterland near Byron Bay. The site is bounded on two sides by Emigrant Creek incorporating a significant waterfall and a buffer zone of remnant rain forest.

The main axis of the house is aligned to capture the sound of the waterfall. A major S-shaped spine wall emulates the contours of the site and the shape of the creek and forms the main connecting gallery providing access to all rooms. Each space is designed to maximise cross ventilation from prevailing breezes at the site and to take advantage of spectacular rainforest views.

It is the owner's intention to have a house that harms neither its inhabitants nor the environment and is a joy to live and work in. The design also incorporates innovative construction techniques and materials to reduce life cycle cost and utilise available local skills. The completed house satisfies all of the owners' expectations for comfort and amenity and was constructed within the budgeted cost and timeframe. Steel was used extensively as both a structural and cladding material.

INNOVATION IN THE USE OF STEEL

Weathering steel

The main S-shaped wall forming the dominant spine of the building is clad with specially pressed Lyten steel cladding panels (HR Lyten® Sheet - HW350). Because of the curved plan shape the long horizontal panels needed a very shallow shiplap profile to follow the curve without crimping and distortion. The special profile was pressed in standard 3m lengths for rapid site installation and to minimise offcuts. The result is a low maintenance low cost and attractive wall finish.

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Stainless steel gutters

The custom designed stainless steel eaves gutters serve multiple purposes. Apart from collecting copious amounts of rainwater in this sub-tropical location they also act as effective sun shades for the extensive glazed external wall areas. The gutters are self cleaning and require no on-going maintenance. Fabricated as simple draped flat sheets they are easy to install and adjustable for fall. Type 304 stainless steel was specified as the site is remote from the sea.

Stiffened steel plate roof

The main bathroom was intended to be a simple glass cube

with minimal exposed framing. This required a very low roof pitch to ensure that the roof form was not visible from ground level. The problem of effective weatherproofing and rainwater disposal was solved by the use of a fully welded stiffened steel plate roof deck. The roof panel was pre-fabricated off site and installed in one piece complete with insulation and protective coatings. An inorganic zinc silicate coating system was specified in lieu of hot dip galvanising to avoid distortion of the large flat panel.

The roof panel was a fully welded stiffened steel plate roof deck, pre-fabricated off site and installed in one piece complete with insulation and protective coatings applied.

Prefabricated steel clad roof panels

The radial plan form of the main gallery corridor and external covered walkway presented challenges in both the framing system and weatherproofing. The solution was to pre-fabricate roof panels in identical segments that were structurally independent and simple to install. The external walkway panels incorporate Colorbond® steel flat sheets laminated to both faces of a structural plywood core. Internal gallery panels incorporated similar Colorbond® finished top surfaces and decorative pre-finished plywood undersides. These techniques ensured a high standard of quality control in the factory environment and rapid site installation with no rework or applied finishes.

Longline roofing

The main pavilion roof features a soaring gable roof form with the subtle curved surface of a hyperbolic paraboloid. This complex form required a roofing material in long lengths with a narrow width, long spanning properties and concealed fixings. Lysaght® “Longline” 305 met all of these criteria.

EFFICIENT USE OF STEEL PRODUCTS

The design documentation was thorough and precise and there was very close collaboration with the builder in the development of final construction details. This resulted in a clear understanding of design objectives and close control of project cost.

The extensive use of steel in the design allowed the builder and architect to closely control costs by maximising off-site pre-fabrication of building elements. Steel components were procured well in advance under fixed price orders and careful detailing ensured minimum rework. Site installation was rapid and required minimum labour and relatively small cranes.

The use of steel framing for suspended floors on the sloping site with a minimum number of simple pad footings allowed the builder to get out of the ground rapidly and establish a clear working deck for the superstructure.

ENVIRONMENTAL PERFORMANCE

Sustainability was a key criterion in all design decisions. All materials used were non toxic and all finishes and adhesives are low VOC. All timber flooring is FSC certified and external decking is recycled composite material.

Rainwater harvesting provides 100% of all water requirements and a reed bed secondary filtration system is incorporated in the waste management system. The design provides for a 4 kW grid connected PV solar power system.

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Steel framing and cladding systems were selected for their low life cycle cost. All steel framing elements are either galvanised or inorganic zinc coated for long life and low maintenance. Similarly all external steel cladding is either Colorbond Ultra® or Lyten® 350 weathering steel.

A major maintenance problem in sub-tropical regions is the development of fungus and mould on external timber and masonry surfaces. This problem is avoided by the use of steel which does not support fungal growth and does not require continuous cleaning and repainting.

The use of steel allowed the project to avoid the mainenance problems associated with fungus and mould on external timber and masonry surfaces.

BUILDABILITY

A high degree of design collaboration was achieved between the architect and the structural engineer in the design phase and between the architect and structural steel detailer in the fabrication phase.

The design included simple forms that allowed a very high degree of off-site prefabrication to minimise site labour costs. All elements were critically reviewed by the design team to meet this objective. As a result the following items were identified for prefabrication:

- Primary structural framing
- Bathroom roof
- Gallery roof panels
- Walkway framing and roof panels
- Lyten wall cladding panels
- Stainless steel eaves gutters

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The design was developed as a Revit 3D model, with all connection details designed by the structural engineer, which could then be inserted into the model by the architect. An AutoCAD 3D model was extracted and exported to the steel detailer for preparation of the shop details.

The architect worked in close cooperation with the structural engineer and steel detailer in the fabrication phase to ensure the design intent was realised and that site installation work was simplified.

PROJECT TEAM

Client:	Peter + Stephanie Lane
Architect:	Jackson Lane Pty Ltd
Structural Engineer:	Peter Lucena + Associates
Head Building Contractor:	Jim Cameron
ASI Manufacturer:	OneSteel Metaland Lismore
Fabricator (Framing):	Koellner Steel
Fabricator (Cladding):	Readings Engineering Lismore
Steel Detailer:	Austek Detail Drafting
Coatings Supplier:	Industrial Galvanizers