

Architecture with Lightweight Structures

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1. INTRODUCTION

I suppose the major part of my career has been devoted to the development of Lightweight Structures, culminating with what might almost be considered as fantasy in the *Tent House*.

It has been an exciting and illuminating experience, and has now brought me to the point where we are preparing to launch a series of light weight houses onto the market under the name of the Four–Seasons Collection.

To begin at the beginning. In 1972 I built two lightweight steel timber and fibre cement houses at Burderin in Queensland, overlooking Mooloolaba and the ocean. With hindsight it is obvious that these two small houses were the beginning of my quest for the light and beautiful which floated elegantly over the landscape rather than destroying it with bulldozers.

These were followed in 1973 by the timber structured *Shubert House* at Yandina, which was really just an update of the wide verandahed Queenslander.

For some years after this I pretty well lost sight of my objective and became engaged in the building of heavy duty home units and concrete block houses.

I finally got back to my light weight ideals in 1982 in the middle of one of this country's familiar recessions. On consideration, it would probably be found that most of my most thoughtful and productive periods have been in the financially depressed periods of my life.

2. LEWIS HOUSE

It was during this period when I had no money and very little work that I sat down to design myself a simple lightweight steel and timber house. As it turned out I never built it for myself. A real estate agent saw the drawings and had me put it together for him. It was constructed on a steep sloping site overlooking Noosa Heads and followed the principle of erecting a light tubular steel frame and constructing a platform on it.

The external wall frames were then assembled on the floor with factory fabricated Oregon Pine joinery components, following very much the exposed stud and rail systems of the early Queensland house. These frames were cross braced with steel tension rods and fitted with tubular eaves struts. The frames were pre-painted and lifted into position with a mobile crane. The system was designed to secure the frames and then build the house from the inside with pre-finished materials, thus dispensing with the need for scaffolding. The system worked well and the house was completed for a very modest budget.

3. 1ST QUADORPOD HOUSE

I was then commissioned by a friend of mine who owned a wheel barrow, rubbish bin and nail factory to design for his company a lightweight, basically steel house which could be easily transported into remote tropical areas and be built without the necessity for heavy lifting or earth moving equipment.

This small structure was to become known as the *Noosa Valley House*. To construct it, I invented and patented the *Quadropod System* for the house under the floor structure. I had always considered that in the many hundreds of pre-fabricated systems I had seen, none to my knowledge, had ever addressed, in any satisfactory manner, the area between ground and floor.

My approach was that the buildings would often be constructed in rough country by pretty much unskilled labour, and as such, the floor perimeter frame should be square and rigid and that the supporting structure under it should be capable of being raised and lowered so that heights and levels of the platform could be adjusted to the millimetre.

To achieve this, I designed lightweight steel towers on four legs and perimeter top rails braced with steel tension rods, to the top of each leg I attached four arms bolted to lightweight steel 'C' section floor bearers. Each set of four arms and floor bearers created a 3m x 3m square, the whole tower finally supporting 6m x 6m of under floor structure. The guts of the system was the provision of a threaded adjustment at the end of each arm. This allowed for positive and simple aligning and levelling of the floor structure which could be achieved even if the tower itself were slightly out of square and level. The system has been used by me on 8–10 houses since. The houses themselves have been widely recognised and acclaimed. The *Quadropod* could, I believe, have been mass produced and on such basis would have provided a logical and economic floor system on which to construct lightweight buildings.

The rest of the structure above floor basically followed exposed stud and rail structure of the early Queensland House but was fabricated in steel RHS tube and galvanised steel 'C' beams. It was lined once again from the inside with single skin custom orb 'cool clad' sheeting and the walls were then protected by 1.8m wide 'cool clad' eaves, supported on RHS outriggers. The main roof was flat and set below the top of the eaves to provide an air gap – the objective being that the flat roof, on heating up, would create an air flow under the eaves and induce movement of air through the house.

The system was economical and certainly could have been developed into an excellent package. In the meantime the client headed off in a different direction and the kit was never put into production.

4. THE HASTINGS

My firm won the commission to design and construct the 25 units on land in Hasting Street, Noosa (of which the Mortgagee had taken possession) with the objective of putting them on the market at a price below \$100,000. They started selling at \$96,000 and because of the strong demand, the client was able to obtain prices for the bulk of the units at up to \$110,000.

I designed lightweight steel bases and floor frames, plywood floors and walls with all windows factory installed. Roofs were fabricated beside each unit of timber gang–nail trusses, sheeted with 'custom orb', fitted with gutters and vent pipes and lined on gables. The unit was then assembled by crane and once we got the hang of it we were putting a basic unit together within one working day.

5. THE TENT HOUSE

My next venture in this direction was the now, pretty much acclaimed *Tent House*. This really did bring me close to disaster.

It developed from the desire to construct a lightweight and economical structure which would replace the tent we used to camp in on our property, provide us with a greater sense of security and at the same time retain the lightness and sense of freedom generated by tent living. It was obvious from the start, that it would be an ideal system for pre-fabrication on a modular basis.

I selected the standard floor ply sheet as the basic module and the house was designed on a 2.4m module along its length by 4 x 1.2m sheets wide. The frame was lightweight steel RHS constructed as a portal with the objective of bolting them together on the ground and lifting them into position with ropes, they were then bolted at the lower level to 'C' section floor frames and secured at the roof with steel CHS purlins. The frame was then braced through roof and wall structures with steel tension rods and turnbuckles.

The fly on the roof was fabricated of PVC and tensioned over the purlins and framing. The inner roof followed the precise principles of a tent. It was secured to a steel ring beam and tensioned with a ridge pole which wound up or down on threaded rods at 2.4m centres. Walls were designed and fabricated of canvas and clear vinyl, all of which fitted to spring rollers so that the entire house could be used as an open pavilion.

Access walls were framed of steel angle, glazed with clear-vinyl and set to slide on floor tracks. Selected bays were sheeted on external walls with 'custom orb' for security, and a central module was constructed of timber framed sheeted with plywood to provide a kitchen and cyclone-proof bathroom.

Quite by mistake, it achieved world wide acclaim and won the 1991 Robin Boyd award for domestic Architecture in Australia. From the *tent house* I have had somewhere near 3000 enquiries for really *a method of living which enriched the soul* and got away from the mostly very dull and boring edifices which comprise the bulk of Australian Housing.

6. THE 4 SEASONS HOUSES

My challenge has been taken up by David Smith and his company *Infiniti Australia P/L*. We have now developed a series of 7 variations on a theme which, we believe, will cater to an important and badly neglected section of our society.

These houses are developed from the basic *Tent House* translated into slightly more solid and secure structures while at the same time, we believe, retaining the exciting qualities of the tent. The structure is an adaption of the simple *Tent House* portal, the roof is now steel for required security but the eaves are available in either PVC or 'custom orb'. Ceilings are available in canvas as for the *Tent House* or sprung vaulted plywood. Walls are polystyrene steel faced sandwich panels or single skin plywood, windows are more conventional with wide use made of timber louvres and shutters and the development of our own *Monsoon Wall* which can be opened and shut with a series of sliding slats or pushed out as an awning.

The houses are now capable of being used in any climate, from the tropics of Cairns, through the deserts of central Australia, to the south end of Tasmania.

The first of these houses is presently under construction on Lamb-Island in Moreton Bay.

We believe this system is a break through in terms of Australian housing and it brings to me the fulfillment of a dream which I have held for the greater part of my Architectural career.



The Lewis House – Details



1st Quadropod House – Noosa Valley House



Lightweight Houses blend into environment – Noble House



105 Valley Drive



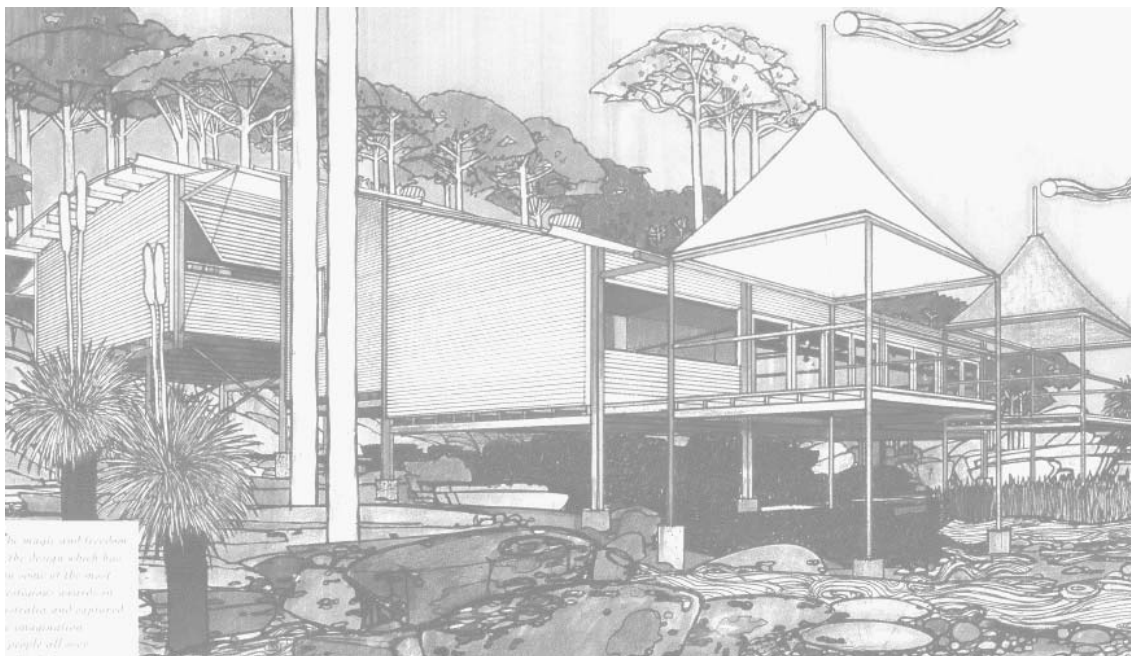
The Hastings House



Tent House



Walker and Towers House



*The image and text are
the design which has
in view of the most
effective search in
Australia and beyond
a common people all over*

The 4 Seasons Houses (Infiniti Australia P/L)