

The Igneous house

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Abstract

The Igneous House is a modular system of construction constructed from pre-fabricated GRC panels for a robust house that will resist all natural catastrophes. The entire structure is factory-manufactured and delivered to site in containers. The components include floor panels, interior and exterior wall panels and free-spanning roof panels. Panels are solid or hollow.

All panels interlock as the tongues engage with matching grooves which are bolted and post-tensioned for structural continuity. Structural engineers have already certified the system in principle. Panels are provided with pre-cast sleeves to enable services such as water, electricity, gas and telecommunications to be easily installed. The floor panels encompass an integral footing, air conditioning duct and water storage; the latter being used for either fire-fighting or consumption or both. The external wall panel can be removed at any time for access to attend to the services within the cavity, or for drying after a flood. Roof panels are free spanning over the 7.5m internal width.

The system has provisions for sprinklers to spray water onto the roof and walls which self-activate when a bush fire is looming. Water is collected externally, flows back into the floor tanks for recirculating. This is called the "Waterwall System".

External awnings provide shade in the static state, but a portion is lowered over the openings to protect them during cyclones, hail or bushfire while the perimeter awning frame, made from GRC, remains in place. These are called "Tempest Awnings".

Keywords

Igneous House, Ferro-Cement, Durability, Bushfire-resistant, Cyclone-Resistant, Flooding, GRC, Tempest Awning, Demountable, Prefabricated, Modular, Resilient

INTRODUCTION

It can be said that the building industry (in Australia at least) and those associated with it are slow to react to change (ref 1) that "There has not been any great innovation in building over the past 50 years or so..." That is akin to "If you always do what you have always done, you will always get what you got."

Now consider the virtues and benefits of a house or building with its entire structure 'from footing to finish' erected solely using GRC.

This paper is in 3 sections, dealing with:

1. The history and introduction to a building system that the author believes is so resilient and robust that it can withstand bushfire, cyclone, hail damage and flooding and is therefore named the IGNEOUS HOUSE.
2. The components, assembly and typical plans and layouts.
3. The summary which will overview its virtues.

HISTORY AND INTRODUCTION

The author graduated at UWA as an architect in 1972. The Ingenious System effectively started in 1975 when Faigen built a 2.5m diameter ferro-cement dome in his back yard in Dianella, Western Australia, Figure 1. While lecturing at Curtin University of Technology (1990-2004) he 'found' GRC. The IGNEOUS SYSTEM has been gestating all the while. He has been quoted as being "...a restless experimenter...", nothing has changed since!

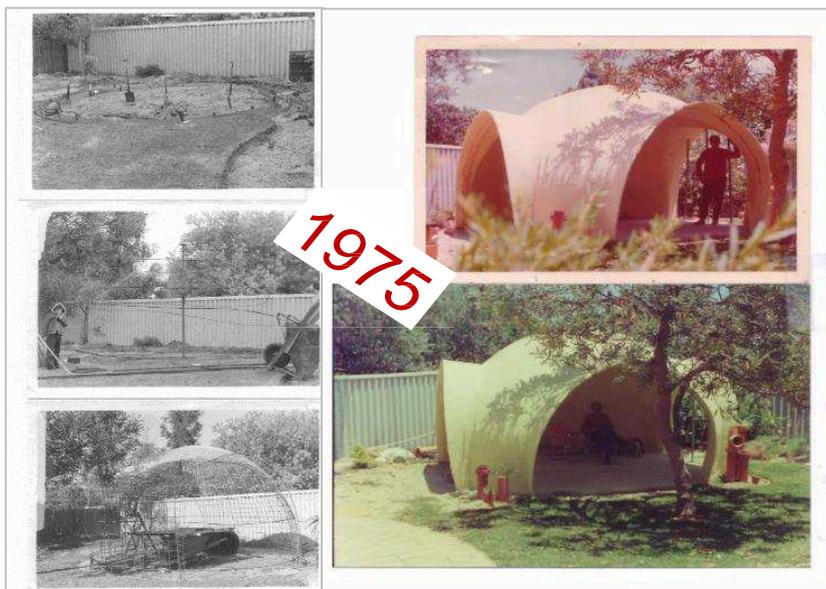


Figure 1. Ferro cement

In May 1976 a newspaper article appeared in a Western Australian Newspaper quoting the then Minister for housing: "Double Brick Irks Jones" wherein the Minister stated: "We have not advanced far from Ancient Egyptians who also took one small building unit and placed it on top of another". The Minister's subsequent letter to Faigen offering assistance did not result in any action, Figure 2.

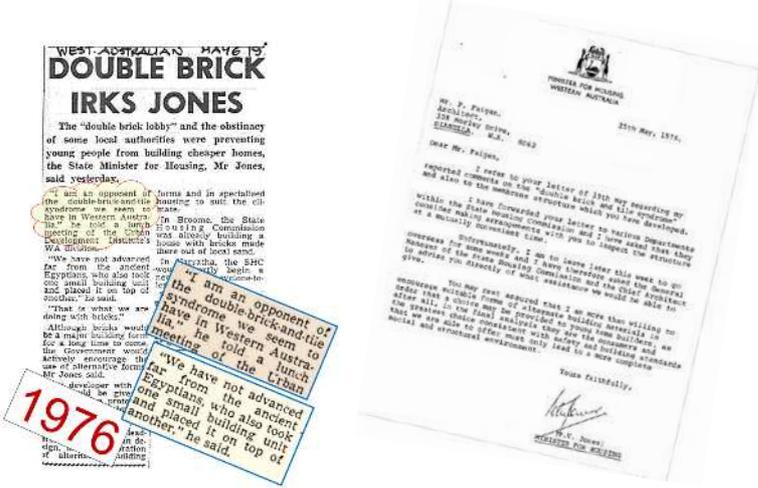


Figure 2. Correspondence

In April 2011, the Insurance Council of Australia announced the Annual Resilience Award for durable housing. The criteria were to provide a durable building that: "... could be useable post event and not require repairs for any 2 of the following key events..."

1. Sustain a 20 min. hailstorm of 80mm projectiles @125km/h
2. Water inundation above floor level (flooding)
3. External fire risk (bushfire) with radiant heat over 40kw/m2
4. Exposure to extreme rain for 1hr
5. Gusting winds to 279km/hr (cyclonic)

Faigen's 'brief' was to commission a built product that will satisfy all 5 key criteria.

In 2011 Faigen met with a manufacturer of GRC products in New South Wales and the Igneous House was created, see Figure 3.

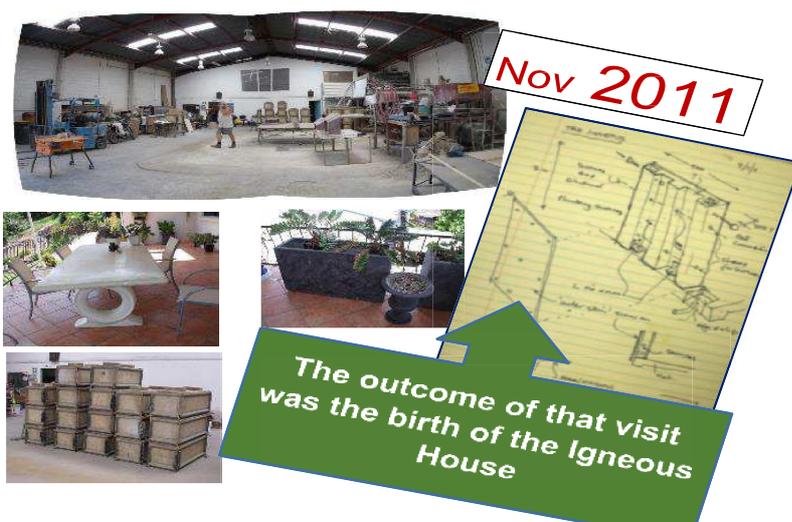


Figure 3. The visit

Because of its properties, design flexibility and robustness Faigen realized that GRC was the ideal material from which to manufacture an entire building that would satisfy this 'brief' such that the building structure can be manufactured and completed using only GRC products. It would probably be manufactured on an assembly line and transported to site in containers.

Faigen considered the following;

- a. FIRE: This can destroy a building by penetrating the 'external skin' and other openings leaving little in its wake, so there is a need;
 - for water to fight the fire, and plenty of it,
 - to prevent embers attacking the building,
 - to ensure windows and openings are protected,
 - to ensure the structural parts are not adversely affected by fire or weather.
- b. HIGH WINDS: High wind, either in a cyclonic or fire driven can lift the roof or smash windows, blowing out walls in the process, so there is a need:
 - for a roof shape that minimizes the uplift,
 - for the structure to be adequately tied down,
 - to protect windows and openings.
- c. FLOODS: Be able to readily return the building to its habitable state.
- d. RESISTANCE TO HAIL and other PHYSICAL ATTACK: The structural elements must be tough enough not to suffer serious damage by external attack by hail, seismic activity, or human action (vandalism etc)

The IGNEOUS SYSTEM solves all issues and more, see Figure 4.

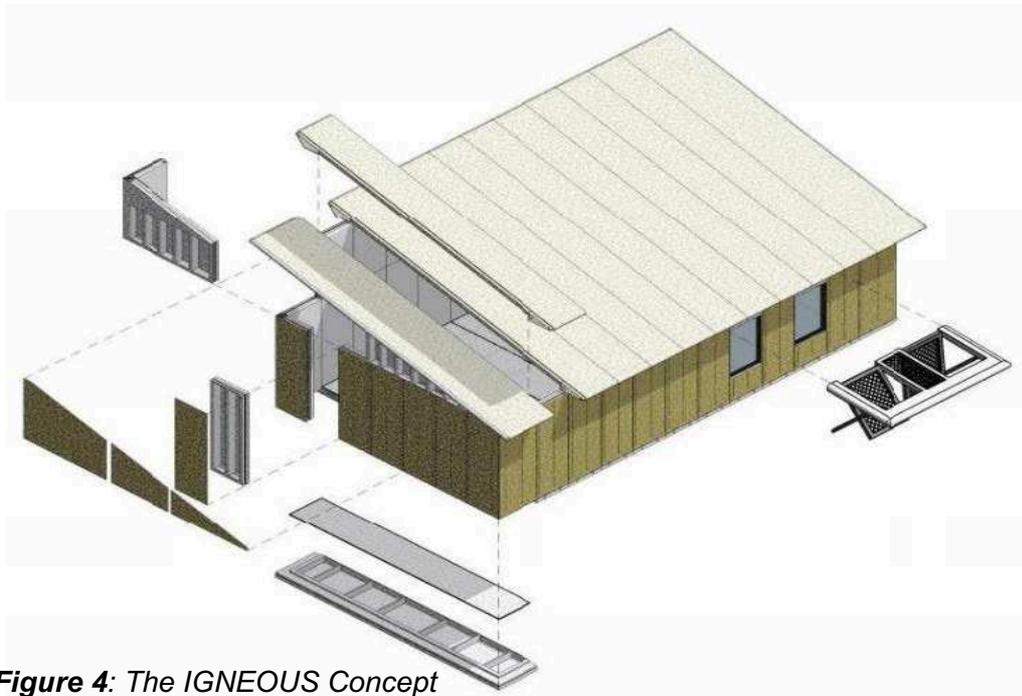


Figure 4: The IGNEOUS Concept

The components

The components are best described graphically; see to the following images and drawings:

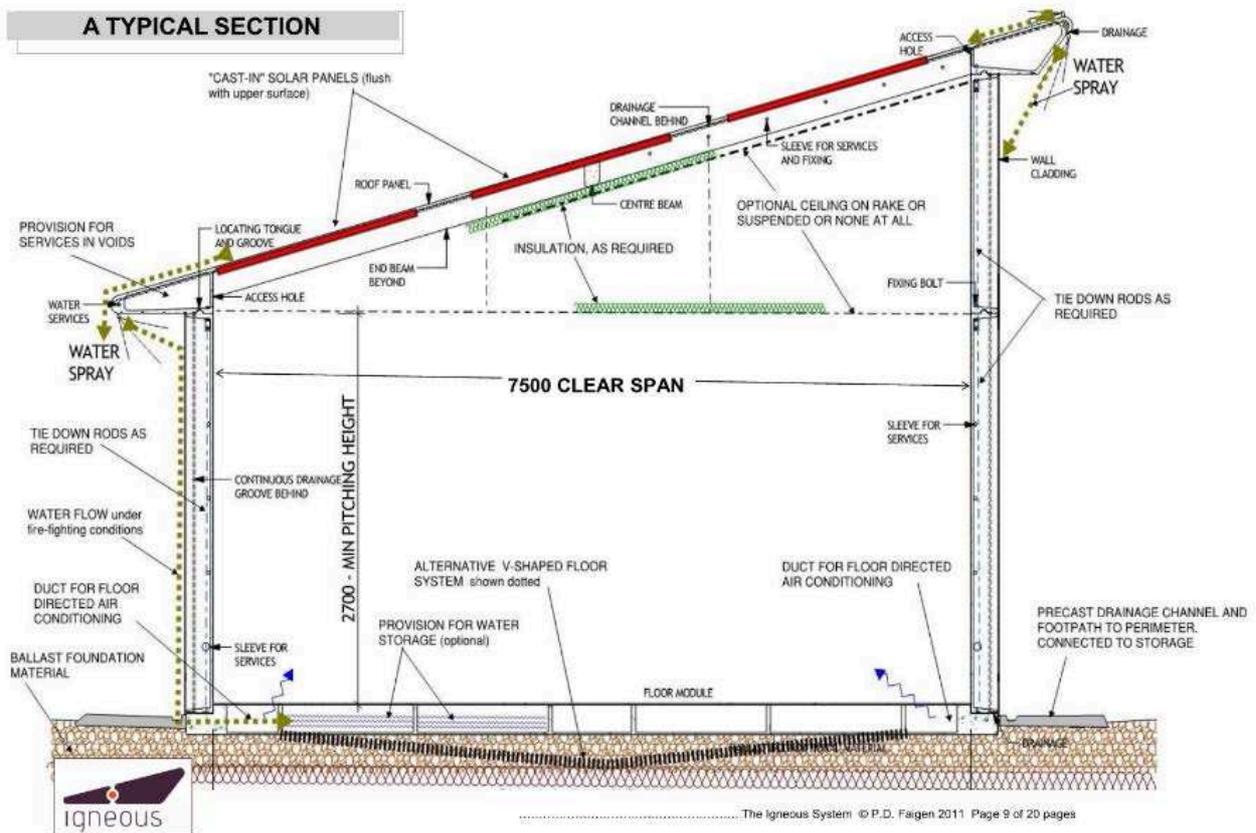


Figure 5: Typical section

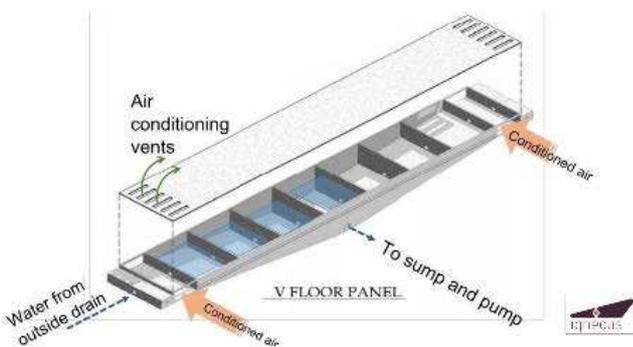


Figure 6: Floor panels which include the footings and water tank and air conditioning ducting

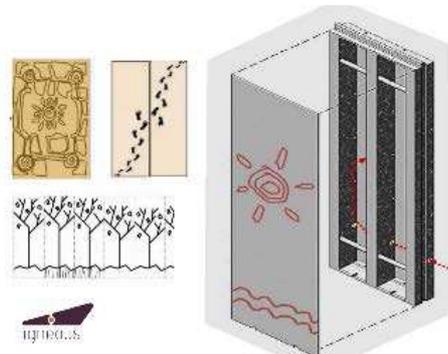


Figure 7: Wall panels that are load bearing together with a removable external skin

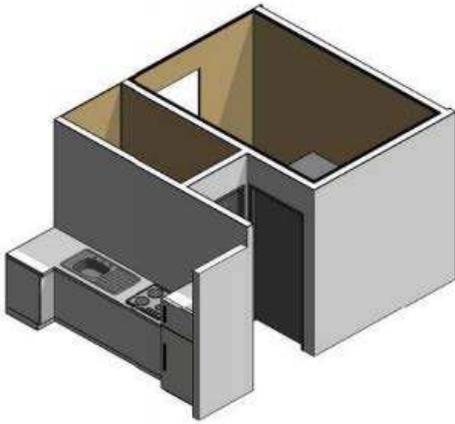


Figure 8: A prefabricated “wet area” pod that incorporates the bathroom, toilet, laundry and kitchen with all services having been installed prior to delivery to site. In some cases the same module has the mezzanine staircase installed.

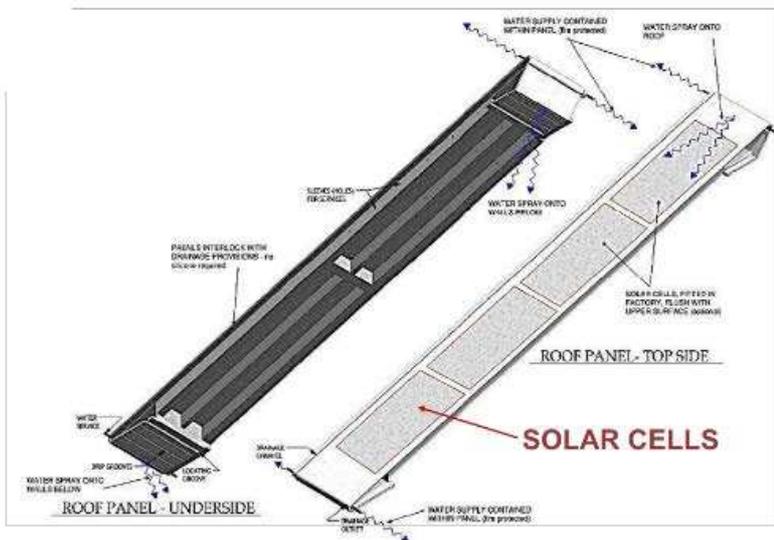


Figure 9: Roof panels capable of clear-spanning the building. Solar cells are installed prior to delivery

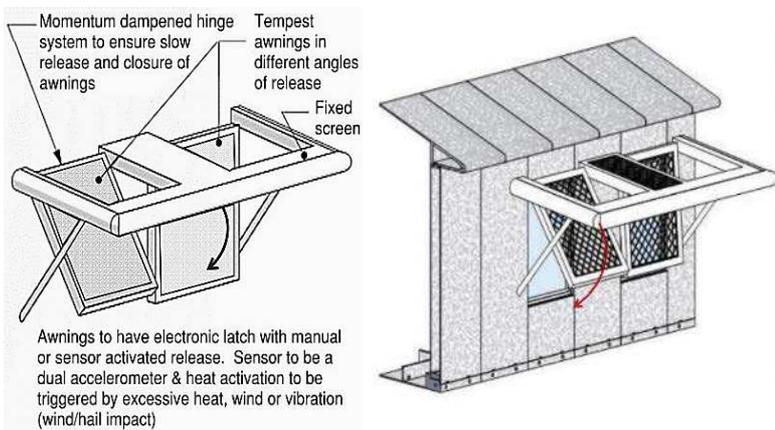


Figure 10. A Tempest Awning that automatically closes when the winds or temperature get to such a level that protection is needed for windows and openings.

... And why not multi storey using the same panels?

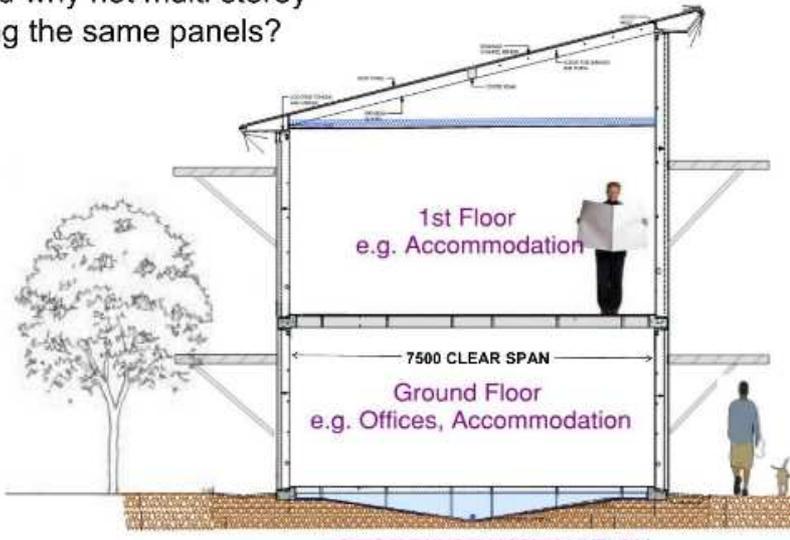


Figure 11: 2-storey. There is no reason structurally or otherwise to suggest that the same panels cannot be used as multi-storey construction.

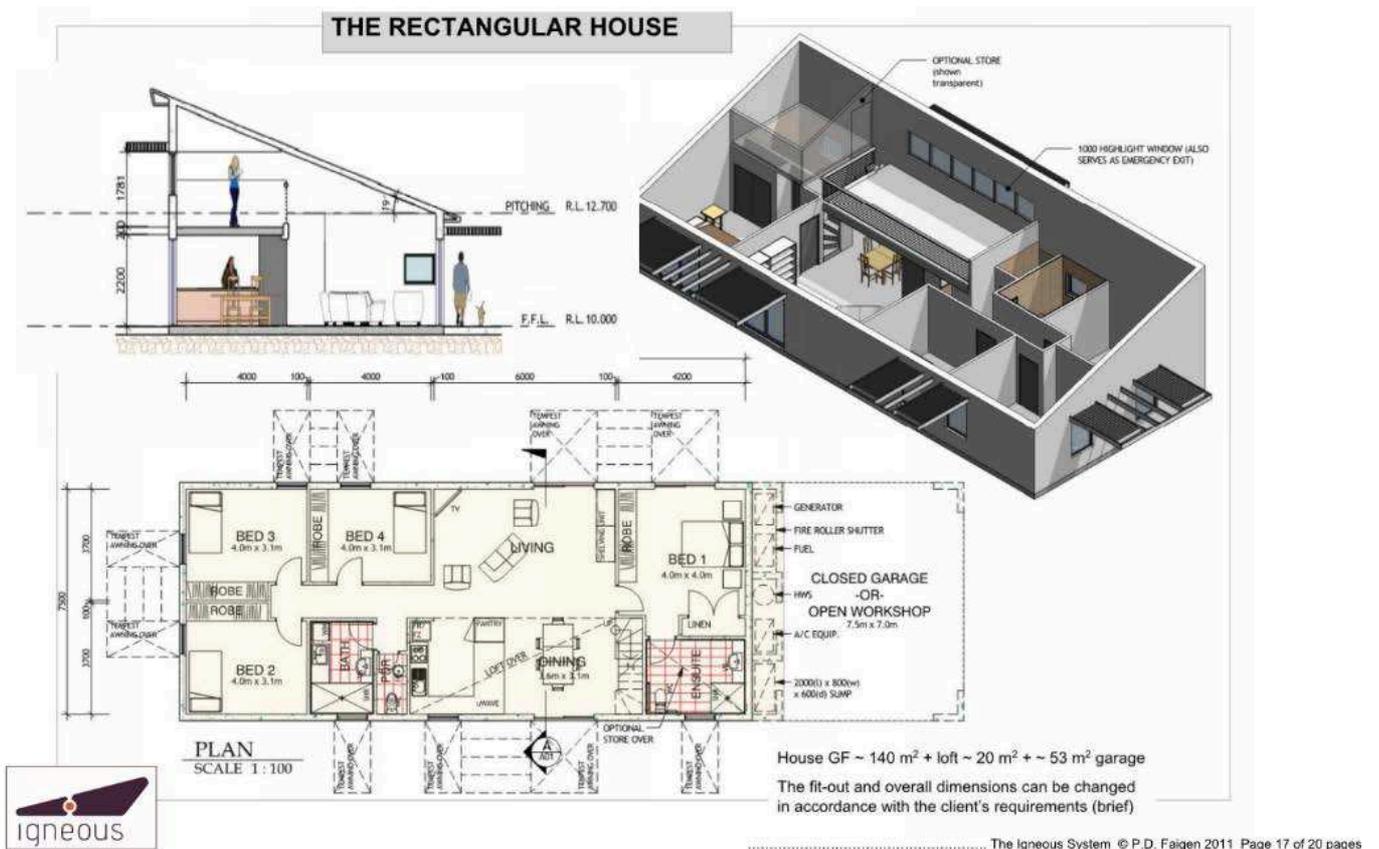


Figure 12. A typical layout



Figure 13: A country setting

SUMMARY AND BENEFITS

The Igneous System is;

- An innovative, resilient and sustainable prefabricated and modular system engineered for cyclonic, flooding and bushfire conditions. i.e. It is “all-tempest resistant”.
- Suitable for country, remote areas and overseas sites because it is fully transportable.
- Lock-up can be achieved in 7 working days using semi-skilled labour.
- There is literally no site wastage.
- Only minimal maintenance is required.
- Variety of layouts and external motifs are possible.
- Can be extended horizontally or vertically for multiple stories.
- Life cycle costing effective, sustainable.
- It is demountable and therefore can be relocated or recycled with ease.

Its design will have universal appeal being ideally suited for;

- Multiple uses e.g. residential, community, offices.
- Community living e.g. retirement villages, detention centers, military barracks etc.
- Mining Companies’ town sites or semi-permanent camps.
- Country Shires, remote areas whether forested or in exposed locations.
- Indigenous housing.
- Local and Overseas Relief Housing.

Why is it called 'Igneous'?

Faigen's "brief" was to commission a built product that will satisfy all 5 Key Criteria stated above. Thus far Faigen has completed the conceptual design and detailing. He is currently looking for someone who can help complete the mission.

REFERENCE

1. Quote: David Hodgett former MLA, Victoria, August 2014, PrefabAus conference, Melbourne Victoria.