

POST-CONSTRUCTION REVIEW OF SUSTAINABLE HOUSING FOR INDIGENOUS PEOPLE IN THE REMOTE COMMUNITY OF NGUIU, AUSTRALIA

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Summary

The Homes on Indigenous Land (HOIL) housing programme is an Australian Government initiative to improve the levels of home ownership and living conditions of Indigenous people in remote areas. This paper reports a two-year post-construction review of the first four homes constructed under this programme, built in 2010 in the community of Nguiu in tropical northern Australia. The assessment included the performance and appropriateness of the design and construction of the houses, environmental performance, and cultural suitability. The review shows that the houses are performing to initial expectations in these aspects, and that modern sustainable housing design and traditional Indigenous cultural requirements can be successfully combined. The findings will provide feedback into the design and construction methods used for housing in remote Indigenous communities.

Keywords: sustainable housing, indigenous people, remote communities, culturally responsive design, environmental performance, Australia

1 Introduction and Background

The 2006 Australian census [1] shows that Indigenous households are only half as likely to own their own home as are non-Indigenous Australians. This contrast in home ownership rate is due to various social and economic disadvantages experienced by Indigenous people [2] [3], particularly in remote communities. The Australian government has initiated the Home Ownership on Indigenous Land (HOIL) programme to increase home ownership rates [4]. Under a HOIL housing project being run in the remote Indigenous community of Nguiu (pop. 1450) in northern Australia, four homes were built in 2010 by the government agency IBA (Indigenous Business Australia). The purpose of this paper is to report the results of a two-year post-construction review of the first four HOIL homes built in Nguiu. The findings of the report evaluate the suitability of the design, materials, and construction methods used, and should inform construction practices and strategies for improving aboriginal housing design and construction in Australia.

2 The sustainable indigenous housing project in Nguiu community

The goal of the housing project was to construct environmentally sustainable homes of good quality. After consultation with the Indigenous community, aspects of design and

construction that were considered included the key design features of the houses, building life cycle, embodied energy, climatic conditions, social impacts, environmental performance, the desired floor plan, occupant comfort in terms inside temperature; minimization of energy costs; minimization of environmental impact during the building life cycle; reduction of operational/maintenance requirements; and ease of construction.

Features of the houses constructed in Nguiu include: orientation of house axis according to solar factors; a compact thermal envelope; passive solar heating; natural cooling and ventilation; and solar hot water. Glazing is coated and most of the windows are on the north side and are sized for winter heating, with roof overhangs to reduce solar gain in summer. The windows are sized and located for ventilation cross-flows and stack effects. Insulation in tropical areas is aimed at reducing solar heat gain, particularly through the roof: ceiling insulation comprises 5R fibreglass batts, in external walls comprises 0.5R foil, and in some internal walls comprises foil and 5R batts. Timber was chosen as the main construction material on environmental and logistical grounds.

3 Methods used for the post-construction review

This two year post-construction review of various aspects of the performance of the houses was based mainly on a field inspection (in July 2012), which focused on the performance of materials and the design and operation of the houses with respect to original expectations. The items assessed included: final house design form and layout; structural integrity of the buildings; construction materials; interior and exterior finishes; mechanical systems and services; thermal characteristics and ventilation control; and environmental performance and technologies. Non-housing outcomes assessed included the cultural suitability of the homes and home-owner satisfaction. In addition, an examination was made of the pertinent literature, comprising a small number of studies regarding the modelled thermal performances of the houses and the procurement methodologies used in various recent Indigenous housing projects, including the IBA HOIL project.

4 Results

4.1 Fieldwork Results and Findings

The results of the review reveal that the houses are generally operating as expected, with many positive outcomes and some aspects that could be improved. The positive outcomes include: environmental design features including high sloping ceilings, natural ventilation, and passive solar elements; cyclone-rated building strength; simplicity and ease of construction; durable construction materials including termite- and moisture-resistant timber and steel roofing; culturally-appropriate layout and features; and building to the original budget. Owner satisfaction levels are high, including with regard to the culturally-responsive design elements, which provide visual privacy and respect the cultural relationships between occupants. Issues/problems since completion relate mainly to the need for education of home-owners about the features, maintenance, and use of their homes. Home maintenance is recognised as an issue in Indigenous housing [5].

4.2 Thermal Performance: Literature Findings

Using thermal modelling, Martel and Horne [6] investigated the internal thermal comfort performance of two of the IBA HOIL houses and six houses from the Strategic Indigenous Housing and Infrastructure Program (SIHIP), all built in Nguiu. The SIHIP houses are built using concrete panels for the walls and are insulated in the exterior walls and ceiling space.

The thermal performance modelling showed that the IBA houses have lower diurnal temperatures and higher nocturnal temperatures compared with the respective outside temperatures. The IBA houses were modelled to have lower energy star ratings compared with the SIHIP houses, and were therefore to have higher predicted energy use to maintain occupant temperature comfort by cooling or heating. However, the modelling for the IBA houses assumed no ceiling space insulation, and would have over-estimated the solar gain into the houses. Therefore, the thermal performance of the houses is probably substantially better than the modelling suggests and probably similar to the SIHIP houses.

The model results of Martel and Horne [6] suggest that improvements to the thermal performance of the IBA Nguiu homes may be found by reducing solar gain by changing the glazing from clear glass louvre panels to opaque panels. However, the modelling as a basis for decision-making would need to be verified by empirical testing before changes were made in the glazing for future homes.

4.3 Procurement Methodology: Literature Findings

A procurement methodology comprises the “operational systems and processes by which a [housing] project is implemented and delivered” ([7], p. 3). Complementing this is the procurement strategy, which refers to the plans and policies of an organisation that provide a means to deliver a project. Together, the strategy and methodology form the procurement system, which is the organisational structure that ensures projects are executed in a way consistent with the organisation’s goals and structure.

Martel et al. [7] reviewed and compared the procurement options available to government agencies when contracting for housing construction in remote Indigenous communities in Australia. The IBA project is characterised by an innovative procurement method that was devised to generate sustainable, affordable private-ownership housing for Indigenous people in remote communities. The project used a ‘design and construct’ methodology [7] whereby the tender process for the project was the result of prior research and development by IBA that informed the specifications for design and construction. This method differed from those adopted by other government programmes as the IBA HOIL project involved constructing houses for private ownership, rather than for social housing. Overall, this meant that the IBA project had more tightly defined goals, more tightly defined/controlled procurement method, clarity and tangibility, stakeholder participation, and closely-specified measures of success than did other housing programmes.

Favourable aspects of the procurement method used by IBA included: lowered risk due to well defined project goals and procurement/delivery method; design control rested with IBA rather than with contractors; an emphasis on cost given that the aim was to recover construction costs from the sale of the completed properties to owners with limited ability to service mortgage loans; a commitment to sustainability via design elements and construction materials used; a commitment to build durable houses to manage repairs and maintenance costs; Indigenous community consultation on design requirements; and the use of modular components for ease of construction and choice for home owners.

5 Conclusion

The innovative aspects to the sustainable housing built in Nguiu include culturally-responsive design, environmental efficiencies, life-cycle costing of projects and assets, and the construction and procurement systems used. These accord with the integrated elements of housing for remote Indigenous communities recommended in the proposed guidelines of AHURI [5]. Innovation in procurement and construction systems has been identified by AHURI [5] as a key element in successful Indigenous housing projects. The implementation of the particular procurement strategy and methodology used for housing delivery has been favourably reviewed by Martel et al. [7].

Inappropriate building design and construction for local conditions has often been the case for remote Indigenous communities [5]. However, this review of homes in Nguiu shows that not only can environmentally sustainable buildings be constructed cost-effectively, but that they meet the needs of Indigenous people. Seeking input from the community on the design and layout of the homes has been vindicated by high levels of homeowner satisfaction. The Nguiu case study highlights the construction materials and technologies required for sustainable, energy efficient, and affordable owner-occupier housing for remote Indigenous communities in Australia. This review of the design process, construction materials and methods, and procurement methodology used suggests that the HOIL programme should continue to aim for housing and non-housing outcomes, focusing on the quality of design, built form, and the cultural needs of Indigenous people.

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