NAWIC

International Women's Day Scholarship

"The Sustainability of Affordable Housing in Australia –Lessons Learnt from Studies in Brazil"

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Table of Contents

1. Foreword

In March 2009 I was jointly awarded the Inaugural International Women's Day Scholarship by the Australian National Association for Women in Construction (NAWIC). The annual scholarship is intended to provide female professionals with an opportunity to develop a white paper that would become a positive instrument of change in the Australian Construction Industry.

My submission proposed to look at affordable housing in Australia and investigate methods of improving its sustainability. Considering the economic downturn in early 2009 and accompanying predictions of rising unemployment, combined with the existing shortage of affordable housing in Australia, this topic struck me as one of great importance to our country at the present time.

The scholarship required an international component to broaden the source of ideas and information. My proposal included a trip to Brazil in mid April 2009, to meet with local architects and academics in Rio de Janiero and Sao Paulo, as well as attend a two week workshop in Salvador da Bahia. This workshop, entitled "Building Communities – strategies when building houses for the urban poor" was developed by Architecture Sans Frontieres - UK (ASF-UK) and brought together a group of 25 architects, engineers, planners and sociologists from 10 different countries. This workshop aimed to explore housing strategies for the urban poor in Salvador Da Bahia, Brazil and centred on two local case studies.

Based on this trip to Brazil and further research carried out here in Australia I have compiled this paper looking at the issues surrounding affordable housing in Australia by investigating both socially responsible and environmentally sustainable case studies. The paper is intended to assist the Australian Construction Industry with the sustainable design and delivery of affordable housing developments in our cities.

My professional background is in the field of Structural Engineering as well as experience in international development work. My proposal to research the topic of affordable housing in Australia stemmed from a personal interest in this subject which I see as a huge challenge to our country's sustainable development. As such, this paper describes my views, not the views of my employer.

I would like to gratefully acknowledge the immense support and encouragement I have received from NAWIC, in particular NAWIC NSW President Letitia Turnbull and Vice-President Davina Rooney. I would also like to thank my mentor Emma Synott for her guidance as well as Deborah Dearing for her invaluable feedback in reviewing this paper. I am also extremely grateful to the following people for assisting me in my research over the past year, Dr Alex Frediani, Melissa Kinnear, Peter Valilis, Ananda.Ganeshan, Vinicius Andrade and my employer Arup for supporting me through this process.

2. Executive Summary

In the context of the current shortage of affordable housing in Australian cities, this paper aims to generate ideas on how the Australian Construction Industry can improve both the physical and social sustainability of much needed new affordable housing developments. The paper draws on lessons learnt from studying urban housing developments in Brazil in April 2009.

The paper defines sustainable development as housing which meets the needs of current residents without adversely affecting the needs of future generations. Affordable housing is defined broadly as any housing which is affordable for low or even middle income earners which could be owner-occupied or rental housing owned by government, community groups, corporations or individuals.

The paper briefly outlines the challenges faced by both Brazil and Australia in providing appropriate low cost housing in urban environments. It details a brief history of housing issues followed by a description of the current state of affordable housing in each country.

The next section of the paper investigates two examples of affordable housing developments, one in Brazil and one in Australia, which highlight the importance of socially responsive design. The first project discussed is a government housing intervention in Salvador da Bahia. The paper recounts an assessment carried out to determine the aspirations of residents and how these were affected by housing features. This section details Amartyr Sen's Capability Approach which is an assessment method based on people and their aspirations. The second project detailed in this section is the Pemulwuy Project in Redfern, NSW which is a great example of participatory planning. The design process is described, showing how the Aboriginal Housing Company determined the aspirations of residents and how these were ultimately incorporated into the design of the proposed development.

The final section of the paper investigates two award winning examples of environmentally sustainable affordable housing projects in both Brazilian and Australian cities. The first project is the design of a commercial housing development in Recife, Brazil which was awarded the international "Living Steel Award". The paper finally investigates the K2 Apartments, a multi-award winning Victorian Government public housing project in Melbourne, Australia. The highly sustainable design features are described and assessed using post-occupancy data.

The exercise of investigating and assessing the design features of socially responsive and environmentally sustainable affordable housing projects in Brazil and Australia was carried out to highlight the importance of the people using them. The outcome of this study is a recommendation to the Australian Construction industry to be mindful of three major elements in any affordable housing design process. Firstly that the needs and aspirations of residents should be investigated in a participatory manner and documented at an early stage of the design, to act as a guide for the design team. Secondly that environmentally sustainable design features are most successful when linked to the aspirations of the residents. Thirdly if we cannot be certain of our target market, or the changing needs of future generations, we need to ensure that design features incorporate flexibility that will not hinder residents from achieving the things they themselves find important. By prioritising these elements of a design process we can improve both the social and physical sustainability of affordable housing developments in Australian cities.

3. Introduction

This paper investigates the sustainability of affordable housing in Australian cities. It will draw on lessons learnt from the study of urban housing developments in Brazil.

Australia's major cities are currently facing a keen shortage of affordable housing. Key worker groups including teachers, fire-fighters, nurses, police and ambulance officers are among those Australians struggling to find affordable housing in our cities. A recent study by Bank West [1] has shown that in 2007 "81% of local government areas in capital cities are unaffordable for key workers"- an increase of 28% from 2002. Current reports by the Australian Institute of Health and Welfare[2] have found that more than 170,000 Australian households are on waiting lists for public rental housing across the country.

According to a Homelessness White Paper written in December 2008[3] around 105,000 people are homeless on a given night in Australia. This shortage of housing, available to low income earners, is a problem which has developed due to various factors including gentrification of our cities, high land costs and taxes, land shortages and a surge in the Australian urban population. This paper will investigate government policy and social attitudes which may have contributed to this housing crisis.

In an attempt to address this housing shortage the current Federal Government included $6.6 billion in its 'economic stimulus package' for the construction of 20,000 new homes and the upgrade of a further 2500 vacant homes to be used as public housing. In the light of this push for new affordable housing in Australian cities, it is important for the Australian Construction Industry to ensure the new housing is sustainable as well as affordable.

The concept of 'sustainability' is a multi-dimensional one which is well used in many aspects of our current lives. In this paper, the notion of sustainable development is based on the Brundtland Commission's definition[4], namely "forms of progress that meet the needs of the present without compromising the ability of future generations to meet their needs." This definition contains two important parts. Firstly progress should meet the needs of the present. This paper will explore the idea that without meeting the needs of the individual end user, sustainability measures - however technically innovative - will not be successful. The second part of the definition requires that progress be mindful of not limiting the choices and opportunities of our future generations.

When applied to the topic of affordable housing, sustainable development has both a physical and a social component. Physically, it promotes the efficient use of materials and energy in order to limit the waste of our depleting global supply of resources. Currently residential housing contributes 9.1% to the total carbon emissions in Australia, having risen by 24.8% since 1990[5].Socially it inspires the development of productive communities which promote the aspirations of lower income earners and therefore enable them and their children to thrive.

The definition of affordable housing used in many Australian studies of 'housing stress' is housing that costs less than 30% of income for the bottom 40% of income earners[6]. This paper however applies a more general notion as defined by Julian

Disney of UNSW[7] which considers any housing which is affordable for low or even middle income earners. These housing developments could be owner-occupied or rental housing owned by government, community groups, corporations or individuals.

Brazilian Government housing schemes officially target citizens who earn 0 to 3 times the Government set minimum wage per month (approx AUD$300 as of Feb 2009), 'social' housing is for those who earn 3 to 5 times the minimum wage per month and 'affordable' housing is for those who earn 5 to10 times the minimum wage per month. These definitions were not applied in this study and the broader definition of affordable housing as described above was also applied to studies of urban housing in Brazil.

Compared to Australia, housing deficit has been a long-standing problem in Brazil due to historical and political events. Brazil has experienced rapid urbanisation over the past 70 years with 85% of the total population of almost 200 million people currently living in urban areas[8]. These large numbers combined with approximately 8% national unemployment[9] have resulted in more than 35% of the urban population living in slums known as 'favelas'[10]. The condition of these informal housing settlements vary from long-standing, consolidated sites to those lacking even basic infrastructure. The study of affordable housing developments in Brazil ranged from private industry driven projects, government housing interventions to illegal occupations.

This paper will investigate the design features of recent sustainable housing projects, two of which address the social sustainability of affordable housing and the importance of providing residents with an environment which will promote, not hinder their aspirations. The other two project studied are recent examples of award winning environmentally sustainable affordable housing designs. The success of these features, as well as the resultant benefits to the residents is assessed.

This paper aims to provoke thought on how the Australian Construction Industry, in designing and delivering affordable housing in Australian cities, can promote both social and physical sustainability.

4. Housing Challenges in Brazil

4.1 Brief History

Brazil has a rich history which extends long before the arrival of the Portuguese in the 1500's and the creation of Salvador da Bahia as the first capital in 1549. Prior to this the indigenous Indians of Brazil had inhabited the land for as many as 50,000 years. However, Portuguese colonisation particularly the trade and slavery accompanying it, did much to shape the demographic of modern day Brazil.

Slavery was officially abolished in 1888 at which point 800,000 freed African slaves who mostly worked on sugar, tobacco and coffee plantations in rural areas, flooded urban centres looking to set up new homes. There was limited infrastructure in place for this sudden influx of population and most were unemployed due to lack of education and literacy. Most joined the first informal housing settlements known as 'favelas'. The favelas continued to grow through the end of the 19th Century until today. Brazil's second largest city – Rio de Janiero – currently has an estimated 1million favela residents.

Politics, as in most countries, has had a huge impact on housing policy in Brazil. Unlike Australia, Brazil has experienced the extremes of government from a fascist dictator in the 1930's and a right wing Military government in the 1960's to the current left-wing government headed by President Lula who was part of the socialist workers' movement in the 1970's. Accompanying these changes in the rule of government were differing policies on housing and how to deal with the favelas.

4.2 Current Situation

The current population of Brazil is just less than 200 million, it is the third largest country by land mass with 8 different climate zones. The Brazilian Government's General-Co-ordinator of climate change, Jose Domingos Miguez stated that Brazil contributes to only 3% of global greenhouse gas emissions with three quarters of these emissions attributed to deforestation. Brazil runs primarily on hydro-power and 80-90% of its car fleet can run on ethanol.

A study in 2003[11] stated Brazil's housing deficit to be approximately 7 million units, mostly in the southeast and northeast regions and it has been identified that 84% of the housing deficit in Brazil is concentrated on families earning less than three times the government set minimum wage.

In a response to the Global Economic Crisis in late 2008 the current President Lula of Brazil announced a new housing program in early 2009 called "Minha casa Minha Vida" which translates as "My House, My Life". This program promises to provide 1million houses, 80% of which will be provided in the State of Bahia. The government has not committed to a timeframe for the completion of this housing program, however the first stage is set to be finished within 2 years and consultation with industry has already started. Under this program the government will provide low interest loans directly to the construction industry, who will in turn sell the housing

units to low income earners who are also eligible for low interest loans from the Government bank CAIXA.

The Government released a set of guidelines for these new houses, including minimum dimensions for different dwelling types and standard requirements similar to building code guidelines. There are unfortunately no sustainability features included in these guidelines. This can be seen as a missed opportunity to enforce sustainable design features such as improved passive thermal control achieved through dwelling orientation, cross ventilation and increased ceiling height.

Many Brazilians fall outside of the Government housing system due to the fact that their income comes from informal employment such as fishing or labouring. Many of these people find themselves living in the favelas in the major cities. The prevalence of these urban slums in Brazil, despite varying forms of government opposition and intervention since their creation, is a good indication of the priorities of low income earners.

In many cases the favelas have inadequate stormwater or sewage services and consist of only temporary dwellings. Physically, therefore they do not offer much security or opportunity. What the favelas do provide is an opportunity for individuals to pursue their aspirations of attaining work in the cities, being close to services and occupying a piece of land which they aspire to one day own. This will provide them with economic security and an asset which will provide them and their children with more choices in their lives. Despite often high crime levels, residents see the favelas as places of opportunity and choice, where they can take control of their housing needs, without having to rely on an inadequate government system to allocate them accommodation.

5. Housing Challenges in Australia

5.1 Brief History

The prominence of housing as an issue in Australian society has been influenced by changing political and historical events over the past hundred years. Government policy has reacted to changing needs over the years, driven not only by political agenda but also by economic climate and public opinion. Consequently, its form and emphasis has been one of the major factors which have shaped the current housing situation.

Governments in Australia provide a range of support and assistance for housing but the two main programs over the last century have been the Commonwealth-State Housing Agreement (CSHA) and Rent Assistance (RA).

In addition to the two main programs, the CSHA and RA, the Commonwealth Government has also provided other specific housing assistance programs for high need groups such as aged care, disabled care and housing for Aboriginal and Torres Strait Islanders.

Housing assistance has prioritised different aspects of affordable housing over the last century. Housing policy in the first half of the century was primarily focused on providing workers with basic housing to protect them from the elements. In the 1900's – slums had formed in Australian cities, particularly in seaside areas[12]. Politically, there was pressure to redevelop these central metropolitan areas to make way for profitable wharf space. Public opinion was also concerned by overcrowded areas with poor sanitation - particularly after the bubonic plague outbreak in the Rocks in Sydney in 1900. At the same time, trade unions saw potential new work for construction industry in the creation of new inner city housing. The Government therefore became involved in providing housing for workers in Australian cities.

During the early decades of the century, due to the Depression and the First and Second World Wars private house building slowed due to lack of funds, labour and materials. The Government focused on meeting the housing shortage of the time by quickly providing as much housing as possible. The answer to this strategy at the end of WWII was to import pre-fabricated dwellings from Europe[13]. Housing was concentrated in large estates on the outskirts of major cities. These developments initiated significant urban sprawl as well as creating the "Great Australian Dream" of owning a single dwelling on its own block of land.

The modest appearance of the dwellings was an important factor in the public housing process of the time since it ensured that tenants moved on from these houses as their financial prospects improved. This facilitated the 'revolving tenant scenario' and would take pressure off the erection of more public housing estates[14].

As time went by - although public rental housing was still important for low income households - the CSHA soon began to encourage more home ownership[15]. This was facilitated via the provision of low interest loans to home builders and the sale of houses on highly concessional terms. This can be seen as recognition of low income residents' needs for security of tenure as a base from which to build their future lives,

helping them to improve their economic status and resulting in a more sustainable outcome.

In the latter half of the century, housing needs shifted from primarily nuclear families to single parent households or people living alone such as the elderly. Affordable housing developments began to take different forms to the large estate developments of the past, with more unit blocks and attached houses being introduced to meet the new demographics. Soon after, Government policy began to recognise the importance of understanding the needs of residents and developed more partnerships with not-for-profit organisations to manage the housing stock as well as the residents[26].

5.2 Current Situation

House prices in urban areas have risen in the last decade due various factors. Firstly the varied demographic of the residents of our cities , which include from young professionals as well as retiring 'Baby Boomers' has created increased competition for inner-city housing. Gentrification of older residential and former industrial urban areas has further reduced the amount of affordable inner-city housing. The above-mentioned Commonwealth Government's emphasis on Rent Assistance and the subsequent reliance on the private housing market to provide accommodation for those in need, has also contributed to the urban housing shortage. Aspects of recent Government policy may also have constrained the private sector from generating a sufficient supply of affordable housing in our cities.

Urban populations have been consistently rising in Australia and are predicted to continue to do so. According to the United Nations Common Database, the percentage of urban population in Australia has risen from 75% in 1950 to almost 93% in 2005.There has been a consistent decrease in the supply of urban land available for new housing. The cost of land, as a proportion of an average house and land package has risen from 33% in 1973 to 78% in 2003[16].

The Property Council of Australia has criticised the Government for not better planning land releases to accommodate the construction of more urban housing[17]. They also claim that State Government property taxes and development charges, high revenue earners for the Government, have been a major constraint on the provision of affordable housing by the private sector. A report in early 2006 by the Residential Development Council[18] found that on average, a quarter of the money Australians paid for a new home or unit was spent on Government taxes and compliance costs, this was more than the cost of the land itself.

With rising property prices in our cities[19] the maximum rate of Commonwealth Rent Assistance is well below the level required to make private rents affordable for low-income people in most capital cities. There are also a large number of low to middle income earners "caught in the middle" i.e. those who earn too much to be eligible for public housing or rent assistance, yet who cannot afford to buy or rent privately in the city. This group has been forced to move to the outer suburbs to find cheaper housing, giving them less access to employment and other services.

In early 2009, the Government replaced the CSHA with the National Affordable Housing Agreement (NAHA). This joint agreement between Commonwealth Government, State Governments and Local Governments aims to "ensure all Australians have access to affordable, safe and sustainable housing that contributes to social and economic participation"[20]. The new funding arrangements will be measured on key outcomes set in the performance framework of the agreement. The agreement provides for various incentive schemes for private industry to construct affordable housing.

This puts the Australian Construction Industry (ACI) in a primary role to influence the form and success of Australia's solution to its affordable housing problem. In its endeavour to provide affordable housing, the ACI should aim to become a world leader in designing and delivering sustainable developments. With the changing economic and environmental climate it is vital that the ACI does not revert to methods of the past, but innovate to meet the needs of low income Australians so that they produce developments that are successful now and do not impact on the choices of future generations. Sustainable affordable housing is housing which is so successful it not only meets the immediate needs of the resident i.e. shelter, health, protection but provides opportunities for residents to achieve their aspirations and improve their lives.

6. Socially Responsive Design – Case Studies

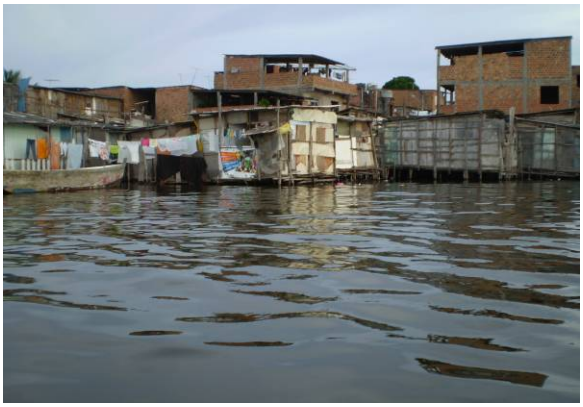
This section of the paper will document two different case studies of affordable housing projects which demonstrate how socially responsive designs can promote sustainability. The first project describes the process of investigating the aspirations of residents using Amartyr Sen's Capability Approach. The second project is an example of an affordable housing development which utilised a unique process to ensure the social sustainability of the ultimate design.

6.1 Novos Alagados, Salvador da Bahia

6.1.1 Introduction;

Salvador da Bahia - now Brazil's third largest city - was Brazil's first capital city under Portuguese rule and an important port for the export of sugar and tobacco. As the entry port for the majority of Brazil's African slaves, over 80% of Salvador's current population of 3 million has Black African ancestry.

The area of Alagados, whose name means 'flooded' in Portuguese, is in the northwest of Salvador. It was first settled in 1946 on swampy, unused land along the shore of Tanheiros Cove[21]. The initial settlement consisted of houses called 'palafitas' which were basically stilt houses. The houses were built from timber and supported on a forest of timber stakes which were bedded in the sea floor. The floor area of these houses ranged from 16m^2 to 100m^2 with, often precarious, narrow bridges linking the houses with the shore. There was no formal connection to water or electricity however this type of housing was attractive for various reasons, the major one being that the palafitas were under the jurisdiction of the navy who was not as vigilant in their policing of the sea as the army was of the land.



Despite some attempts by the government to destroy the settlement in Alagados, it continued to grow into the 1970's. It was mainly populated by inner-city migrants who saw the palafitas as an opportunity to acquire a permanent place to live close to employment, services and city life. The low lying, swampy land beneath the palafitas was gradually in-filled by residents and the municipal government with rubbish and waste. The land around the palafitas was eventually reclaimed and the houses consolidated, providing the residents with a much sought after asset which they could invest in and improve.

Novos Alagados was first settled in 1977, in the adjacent cove to Alagados. By 2000 there were approximately 15,000 people living in this settlement which covered approximately 18 hectares. There have been different interventions in areas of the settlement by both government and international Non Government Organisations (NGOs). Novos Alagados has been treated by many as a place to experiment with different types of affordable housing solutions.

This housing development was visited and studied as part of an Architecture Sans Frontieres - UK (ASF UK) Workshop. This part of the workshop was developed in conjunction Dr Alex Frediani of the Development Planning Unit (DPU) of University College London (UCL). The first week of workshop focused on a study of Amartyr Sen's Capability Approach and how it applied to the Novos Alagados housing settlement. This area had been studied by Dr Frediani as part of his doctorate paper in 2007 "Housing Freedom, The World Bank and Poverty Alleviation – Squatter Settlement Upgrading in Salvador da Bahia, Brazil"'.

Dr Frediani assessed the World Bank intervention in this area using Amartyr Sen's Capability Approach to Development as an appropriate method of determining the true success and impact of the World Bank intervention on the residents of Novos Alagados[22]. This analysis of the intervention highlighted issues raised by residents which had not been picked up in the World Bank's own assessment of the housing program[23]

6.1.2 Amartyr Sen's Capability Approach;

The capability approach was presented at the ASF UK workshop by Dr Alex Frediani. This section is a very brief introduction to the concepts of the Capability Approach and its origins.

Amartyr Sen is an Indian born, Nobel prize winning economist. His book "Development as Freedom" was published in 1999 and outlines what is known as the "Capabilities Approach". Sen had been working on this approach since the 1980's. In collaboration with other economists he helped to form an alternative to the traditional economic model for dealing with poverty and human development. "Over the last decade Amartyr Sen's Capability Approach has emerged as a leading economic framework for thinking about poverty, inequality and human development generally."[24]

This method of assessing welfare looks at what humans need to flourish[25]and advocates that people living in poverty be provided with the possibility to not only function but to have the capability and freedom to function in areas of life that are important to them.

The approach focuses on positive freedoms rather than negative freedoms. A negative freedom is the absence of undesirable conditions, for example - the freedom from cold, or exposure. A positive freedom is a person's ability to be or do something, for example - freedom to attain income and therefore improve their economic situation[26]. When applied to housing, this method means providing residents with capabilities through housing to achieve the things they most value, for example income, social networks or security.

"This approach is people centred and is concerned with what people value, their aspirations and their freedom to achieve them. While people are perceived as drivers of change, the Capability Approach aims at strengthening the enabling environment

for the realisation of people's aspirations."[27] The "Capability Approach" analyses not what things are, but rather what things do. A house for example, is not just a shelter from the weather but a home which can support a resident's need for safety, security or even pride.

6.1.2 Aspirations:

Through close interaction with residents, the ASF workshop group was able to asses the social as well as physical impact of the different interventions using the Capability Approach. My group was assigned a costal area known as Litoral to interview nine households. A government intervention had taken place here in the 1980's when the land around the palafitas was infilled and the residents given legal title of their land. The government provided infrastructure for the area in the form of water, sewage, stormwater, electricity and rubbish collection. They also offered to construct new brick homes for the residents. After the completion of two of these houses, the remaining residents declined the offer stating they preferred to build their own houses.

In order to explore the process of the Capability Approach, this section looks at the aspirations impacted by the construction of a solid brick house on the site of the old timber palafita homes. This analysis breaks down the reason *why* a brick house is something that is needed by the residents of Litoral. By looking at what things do, not what they are we can apply this process to other situations and may find that what is needed is actually contrary to our assumptions. In our interviews, the following aspirations surfaced as of primary importance;

Local individuals aspired to;
a) Attain Income/Prosper
b) Live in Safety
c) Be Healthy
d) Participate in a Social Network
e) Expand/Improve their Living Conditions (security of tenure)
f) Individualise

In the hot tropical climate of Salvador, there were certainly benefits to the timber palafitas homes. The structures had low thermal mass and good cross ventilation, improving air temperature and quality. However these reasons were strongly outweighed by more important aspirations of the local residents as described below;

a) Attain Income/Prosper

This aspiration was a strong one, which was evident in all conversations with residents. Most of the original residents living in Novos Alagados, had moved there with the intent to improve their access to employment and services provided in the city. The residents unanimously felt that the consolidation of the houses from timber palafitas to brick structures positively impacted their financial security and therefore prosperity for several reasons.

Many residents felt that they would only feel confident to invest in the structure of their homes if they had legal tenure of their land. Once the structures were constructed out of brick they no longer required as much maintenance and therefore were less of a burden on time and finances.

We visited one resident who lived in her original timber palafita structure, now on solid ground since land had been infilled around the timber piles. This was the only one remaining in the area. The resident very much aspired to having a 'solid' home made from bricks so that she would have less maintenance requirements and since her husband had recently died, it would reduce her reliance on others in the community to help her maintain the cladding on her home.

b) Live in Safety

The ability to live in safety is a major consideration for Brazilians, especially those living in the favelas. The favelas are notoriously influenced by drug gangs and can be dangerous places to live. The battles between drug gangs often take place in the streets of the favelas leaving law abiding residents of the areas vulnerable to this violence. The first family we interviewed had lost their husband/father to a stray bullet, not only devastating the family but leaving them without their main income earner. Although residents feel that the passive thermal conditions of the timber/palafita houses are more comfortable in the hot temperatures, one of the reasons residents aspire to a brick house with limited windows for the reason that they are solid and would stop a bullet from entering their house.

c) Be Healthy

This aspiration is linked with attaining income since if the main income earner in a family is sick, it affects the opportunity for the family to prosper. Although the palafitas provided a healthy, well ventilated internal environment, the houses perched over the shallow water into which waste was dumped, were not a healthy place to live. The open sewage in the lagoon resulted in disease for its inhabitants and the stagnant water was perfect breeding ground for mosquitos carrying diseases such as dengue and malaria.

d) Participate in a Social Network

Our interviews revealed that this aspiration was actually better served by the communal environment provided by the palafitas. Since the houses have been consolidated and more secure brick walls constructed, people were seen to be less interactive with neighbours. Due to the increased value of the brick homes - some of the residents have subsequently sold their houses and moved to other areas, resulting in the break-up of the old community.

e) Expand/Improve their Living Conditions

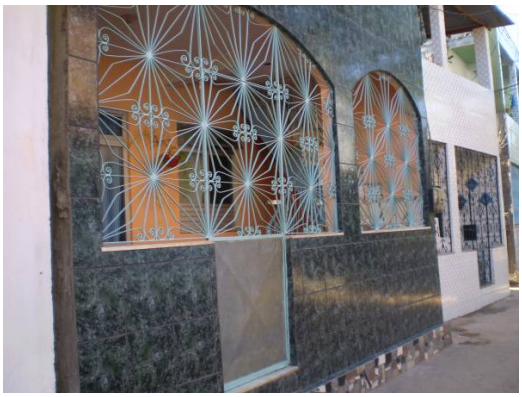
The residents of Litoral expressed a strong aspiration to expand and improve their homes. It is easy to see how a brick house offers much more possibility for expansion than the timber palafitas. The brick walls are much stronger and more easily accommodate an additional floor when residents save the required funds and

as the family grows. The brick houses built in Novos Alagados are very similar to many low cost houses in Brazil and are constructed from a minimal concrete frame with brick wall infill. The floors are a form of ribbed slab with tiles used to minimise the amount of concrete (Photo#). Columns starter bars can be seen in most of the brick houses, in anticipation of the next floor being built in the future.

The two brick houses built by the government in Litoral (Photo#) were intended to be small core houses, consisting of just one room and a bathroom with the expectation that they could be extended to accommodate growing family needs as funds became available. However, vertical expansion was not incorporated into the design of the roof which has a mono-sloped pitch supported by angled walls. This made an additional of an extra floor above complicated for the residents who are not trained builders. Horizontal expansion was also limited due to the location of underground septic tanks directly adjacent to the building - residents were wary of enclosing the space in case it became contaminated by tank overflow in high tides and rain.

f) Individualise

This aspiration was evident from the exterior of the houses in Novos Alagados . The different choices of external paint, tiling and even the security mesh on the windows revealed the residents' aspiration to individualise their homes.



6.1.3 Summary of Findings:

The study of the Novos Alagados housing intervention using Amartyr Sen's Capability Approach highlighted the less than obvious aspirations of residents and what a substantial impact housing design features can have on the lives of residents. It was only through discussion and consultation with the community that we fully understood their needs. Once these aspirations were identified, it was clearer to us as designers how certain design features – such as a timber or brick façade - could promote or hinder the residents' aspirations. Had the local Government or other NGO's involved in this housing intervention taken the time to investigate these needs prior to design and construction of the housing units, the current economic, social and even physical state of the residents might be quite different today.

6.2 Pemulwuy Project, The Block, Redfern NSW

6.2.1 Introduction and History of the Block

The Block is approximately 8000 square metres of land in Redfern, bordered by four streets of Everleigh, Caroline, Hugo and Hudson, rich in history and controversy, and recently described by Timeout Sydney as "Urban slum, Aboriginal icon or real-estate goldmine?".

As described on the AHC website, the Redfern area has long been home to Aboriginal people. The traditional owners of Redfern are the Gadigal people (also known as the Eora people) who had lived in Redfern and the surrounding areas of Sydney for more than 40,000 years before the landing of the British in 1788. The Gadigal population was virtually wiped out due to a small pox epidemic within the first three years of European settlement as well as violent clashes fighting against the invasion of their land. Their resistance was led by the Eora leader named Pemulwuy (meaning "Earth" in Bidjigal language) after whom the housing project is aptly named, symbolising the continuation of the struggle of the indigenous people of the area.

There was a large migration of Aboriginals to Redfern throughout the 1900s due to the possibility of regular work in the nearby railway yards and perceived education and housing opportunities. The Aboriginal population surged after the 1967 National Referendum which gave citizenship rights to Indigenous people for the first time along with the promise of better access to services in the cities. This migration continued to such a great extent that in the early 1970s a serious overcrowding and homelessness crisis had developed in Redfern.

There were large numbers of Aboriginal people in Redfern without permanent or adequate housing. As a consequence, a group of Aboriginals took up squatter residence in some of the empty terraces in Louis Street. These squatters organised themselves and ultimately formed the Aboriginal Housing Company (AHC) in 1973. Initially, with funds from a government grant, the AHC purchased and restored six terrace houses in the vicinity of the Block. The Aboriginal population of Redfern tripled between 1976 and 1981 primarily as a result of increased housing opportunities.

Having received varying levels of support and funding from changing governments throughout the 1980s and early 1990s, the AHC finally purchased the last house on The Block in 1994. However, in the early 1990s heroin had begun to infiltrate the community and the violence in and around the Block meant that very few people other than residents ventured into the area. This isolation meant that drug and criminal activities were more likely to occur due to the lack of public exposure. Many

of the terraces around the Block were empty and derelict, making them a perfect location for drug dealers to congregate and conduct their business. In an attempt to expel these criminals from the neighbourhood, in 1997 the AHC demolished some of these empty houses. There are currently only about 20 indigenous households left on the Block. AHC intends to build a new, more sustainable housing development on this significant site and have named it the Pemulwuy Project.

The AHC and the residents of The Block have encountered varying levels of opposition to their project over the past ten years. Public perception of the Block suffered from the media reports of a 2004 riot and negative reports of the violence in the area. In the same year, Cabinet papers were leaked to the Sydney Morning Herald which detailed the Government's ambitious plans for redeveloping the Redfern Waterloo Area. The report highlighted that the State Government owned approximately one third of the land in Redfern and Waterloo and valued it at up to $5 billion. The report also claimed that the value of the land would increase if Aboriginals were not living in Redfern

"There is no way that Redfern is going to be that commercial mini-centre with Aboriginal housing and The Block still in place," Ken Morrison, executive director of the NSW Property Council told the Australian Financial Review: "We need to sort that out."

Regardless of this varying support from the Government, the AHC continued their design process for the Pemulwuy Project and is now rightly proud of the design scheme which was finally given planning approval by the Government in July 2009.

6.2.2 The Design Process

The Design Process undertaken by the AHC for the Pemulwuy Project is an excellent example of a participatory planning process with the intent to fully understand the needs and aspirations of the residents. It has helped those involved in the project to fully understand the cultural and social values of the residents and how they relate to housing on the Block.

The initial step in the design process of the Pemulwuy project was to commission a Community Social Plan for the site. The Social Plan was intended to document the current social situation on the Block and the most appropriate ways to address existing social issues. It aimed to investigate the aspirations of the residents of The Block by identifying twelve principles[28] which were to be considered during any design and decision-making processes on the project;

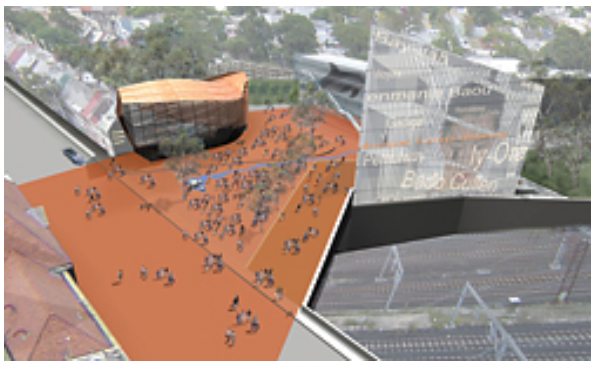
1. Reconciliation and Social Harmony
2. Appropriate and Affordable Housing
3. Culturally Appropriate Service and Facility Needs
4. Community Safety
5. Supporting Families, Women and Children
6. Aboriginal Health
7. Aboriginal Identity, Culture and Spirituality
8. Training, Skills Development and Employment
9. Ownership and Management
10. Aboriginal Enterprise
11. Ecological and Environmental Sustainability
12. Contact with Nature

These principles not only provided guidance for the design process, but also formed the basis of evaluation criteria. A scoring system[29] was developed to measure the performance of the design against various aspects of the twelve principles. This scoring could be used by planners, architects, landscape architects, engineers and builders in their work to ensure the final development reflects the expectations of the Aboriginal community on the Block.

The Social Plan won a National Award for Excellence in Community Housing in 2001. In 2004 the Social Plan received an international Crime Prevention Through Environmental Design (CPTED) Innovation Award from the International Security Management and Crime Prevention Institute and the International CPTED Association.

The next step of AHC's design process for the Pemulwuy Project was a series of consultation workshops run by the AHC's Planning Team. The purpose of the workshop was to help decide on the physical form of the new development. The workshops were an important way to involve as many experts and indigenous community leaders as possible. Topics discussed in the workshops ranged from urban planning to community and public domain safety to environmental sustainability.

Further to this process of consultation, the top twelve final year architect students at Sydney University participated in a design exercise called "Dreaming of the Block". The students each produced a prototype design for a new house on the Block and their models were displayed at the AHC offices. The community were encouraged to assess the different models and provide feedback. This demonstrated a very successful way of helping the residents understand the design issues. Instead of having to visualise design features described in reports or drawings the physical model of the house prototypes helped the residents to understand how certain design aspects might have positive or negative impacts on their lives. Feedback from this process was collated and a 'working model' produced which was used as a stimulus for more consultation and discussion.



In addition to the social plan, the AHC commissioned Merrima (Aboriginal Design Unit at the NSW Government Architect's Office) to create a Cultural Brief to establish the cultural identity of the project and which elements of the project could be used to express those cultural values. Four areas were identified as landscaping, public art, engagement of the community and RED Square – a large public space proposed as the main entrance to the development.

This planning process therefore resulted in a comprehensive set of guidelines on the aspirations of the local residents, which the design team used to complete the scheme design to submit for Development Approval. The Pemulwuy Project current design is a mixed-use development including 62 family homes, a business college, a

hostel, a sports centre, a spiritual elder's area, a civic square, a retail office building and Aboriginal artist markets.

6.2.3 Aspirations of Residents and the Subsequent Design Features

The aspirations of the residents of the Block, are well summed up by Mr Dick Blair, one of the 11 original directors of the AHC;
"The whole aim of the project is to bring Aboriginal people together so that we can live in the way we want to live and share what we have with one another. Many of us are now living in slums and pigsties because we cannot afford the high rents. It is difficult to get jobs because we have no skills and because white people don't want to employ us. We can't be proud to live in these conditions. But when we are living together we will be able to help each other to learn skills and to get jobs and, most importantly, we will be proud of our houses and proud of our community. Our children will be able to grow up with more opportunities than we had and they too will be proud of their community and proud of themselves. All we ask is that we be given a chance to prove that it can work".

The information provided in the social plan, particularly the twelve principles can be interpreted to represent the following aspirations of the present and future residents of the Block.

a) Community Pride
Redeveloping the Block with a new sustainable, mix-use, landmark development would help the Aboriginal residents of Redfern regain the respect of the wider community they feel they have lost through the degradation of the Block. Currently, the negative image of the Block as a hub of criminals and drug dealers has damaged the image of the Aboriginal people in Redfern in the eyes of the surrounding community. The indigenous community would like non-Aboriginals to be equally proud of the Block for its history and culture and recognise the many achievements of this Aboriginal community.

The fact that the local community is part of the decision making process allows them to ensure that the final development is something that they will be proud of, a development which will showcase values that they themselves consider to be the most important.

Aside from the perceptions of the surrounding non-Aboriginal community, the community on the Block see the land as one of spiritual significance. The significance is not only of the tradition Gadigal land and their fight which ended in the first urban Aboriginal land purchase but also in the fact that the Block in Redfern has become a meeting place "like a traditional Koori watering hole" (Mick Mundine, Chief Executive Officer of the AHC). The Block redevelopment will directly allow for this interaction of Indigenous people from other areas, since 42 of the new 62 houses will be filled by new residents to the Block. It is therefore important to the residents that the design of the Block achieves a 'Sense of Place' or connection to Aboriginal spirituality.

b) The Right to Choose *(Health and Amenity)*
The AHC felt that the previous design of housing in the area, consisting mainly of old terrace houses, was inappropriate for the local residents. The buildings were dark

and dingy, with high maintenance requirements. The interlacing laneways became places ideal for drug dealing and crime.

The Aboriginal community want to live in housing which is appropriate to their values, and only they can decide what this means. The new housing development aims to provide healthy, comfortable yet affordable homes with minimal maintenance. Due to the transient nature of traditional Aboriginal lifestyles, maintenance of housing has not traditionally been of high priority in the values of the indigenous people. The design consists of six three-storey multi-apartment units. The vertical transport design is such that 80% of the units can be accessed without the use of lifts, and the remainder rely on hydraulic lifts which have minimal maintenance requirements.

Outdoor living and interaction with nature is also an important value for the Aboriginal residents of the block. Thus the floorplates of the units are stepped, to ensure open, north facing, balconies on each floor. The external space of each unit is actually equal in size to the internal space thus providing an appropriate, urban response to this need.

c. Safety

The Block has become a place notorious for crime and in particular drug dealing. The local residents hope that the new development will eradicate these negative elements in the community and restore a healthy safe environment in which their children can live.

As mentioned previously, the project has won an international award for Crime Prevention Through Environmental Design (CPTED). CPTED is a method of assessing the relationship between crime prevention and physical design, and the management and planning of facilities and public areas.
"The design concept for the Pemulwuy project aims to remove areas of seclusion and emptiness, where crime and violence can occur un-noticed." [30] The openness of the site layout, minimising laneways or hidden corners aims to ensure openness and public surveillance which will assist in crime prevention.

d. Prosperity

Many of the previous aspirations link into the aspiration of prosperity and success of the residents and their families. The local residents believe that reduction in crime on the Block and the development of a cherished Aboriginal precinct in Redfern will help to minimise the racial discrimination of urban Indigenous Australians and thus improve their opportunities for education and employment. Employment and training is also a major goal of the actual construction of the project, where local labour is intended to be a priority. Aside for this the proposed development consists of equal areas of residential and commercial development, providing local job opportunities.

Being so close to university and Tafe campuses, the new rental housing on the block should provide housing for youths from other parts of the country, giving them the opportunity to improve their education and future employment potential.

6.2.4 Summary of Findings;

The Aboriginal Housing Company did an exemplary job at investigating the needs and values of the residents in designing the Pemulwuy housing project. They have come to appreciate the importance of appropriate housing, through the devastating impact of mistakes made in the past. The AHC has seen the Aboriginal community on the Block suffer from crime and unemployment and has remained determined to provide a housing development that will not only provide shelter but nurture a community back to health. The AHC has focused on the needs of the urban Indigenous community living in Redfern. This group, although varied, is more homogeneous than a typical inner city affordable housing project, either government or private, which could be home to residents of varying cultures and backgrounds. Nevertheless, it is important to take the time to investigate the potential resident of any housing development and help to promote their common needs and aspirations.

7. Environmentally Sustainable Design - Case Studies

This section of the paper will document two different case studies of affordable housing projects which have focused on environmentally sustainable design. Both projects have won international awards for these design features. These are described and assessed in terms of how they impact on a resident's needs and aspirations.

7.1 Recife Affordable Housing Design

7.1.1 Introduction

Geographically, Recife (the Portuguese word for Reef) is a coastal city located in a humid tropical climate zone which is characterised by intense solar radiation, high humidity and rainfall accompanied by high constant temperatures. The city's land is very low lying, intersected by waterways and prone to flooding. Recife city is home to just over 1.5million people and notable in that it has the highest murder rate of any Brazilian state capital. The city has vast socioeconomic inequalities with approximately 55% of the urban population living in favelas[31] which are interspersed throughout the city, often bordering affluent neighbourhoods characterised by luxury apartments.

This section of the paper will look at an affordable housing design created by Brazilian architects Andrade Morettin Arquitetos Associados Ltda (AMAA) based in Sao Paulo. The design was completed for a site in a city called Recife – the capital city of the State of Pernambuco in the North East of Brazil. This design was awarded the Living Steel award in the 2nd International Architecture Competition for Sustainable Housing. Living Steel is a campaign which was developed by the World Steel Association to help improve the quality of live for growing urban populations. It was designed to stimulate innovative and sustainable housing design and construction in steel.

In 2007, AMAA submitted and won this competition with their prefabricated steel, four-storey urban housing design for Recife. The architects focused on the essentials of comfortable living which they term "Essential Architecture". This "embraces basic minimalist construction with an economic use of materials for a light structure". The buildings incorporate elements which promote both physical and social sustainability relevant to the local context. As part of the design brief, the Client provided a report written by sociologists describing the local demographic and social environment to ensure that the design was appropriate.

The low-rise apartment building designed by AMAA, consists of no more than four storeys thus providing the required density without the need for motorized vertical transport. While the design aims to respond sustainability concerns through reduction

of materials and energy use, this chapter will look at how this impacts its performance in providing residents with a means to achieve the things they value.

This housing development will be analysed in the context of how the design meets the needs of residents in the area. The project has not progressed to construction; therefore no post-occupancy data is available. The paper will therefore consider how the design features have accommodated potential needs of residents.

7.1.2 Design Features;

a) Inner city location

The housing development was designed to be located in an Inner city location with good access to work and services, as opposed to fringes of city. The design therefore offers residents the opportunity to be close to employment and services. This not only reduces the need for private transport, for young residents or families this can provide the capability to attain income and prosper, while for elderly residents this provides peace of mind, knowing that good medical care and services are in close proximity to their homes.

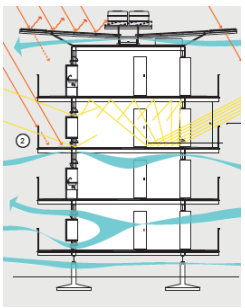
b) Steel construction

While steel is more expensive – the design was based on the assumption that prefabricated elements would be quicker to construct and the lightness of the structure meant less excavation and complex foundation engineering in a weak, sandy soil, making it more viable. Incidentally, this has not turned out to be the case as the cost of steel has risen so much that the client no longer considered the project to be feasible.

The cost of construction was important in this project, since any elevated costs in construction would be passed onto the resident. The system for providing affordable housing in Brazil is that the bank provides capital for developers at low interest rates to build the housing after which citizens purchase these units on the open market with money also borrowed from the same government banks at low interest rates. The low construction cost and subsequent low purchase price for good quality housing aligns with residents' aspirations to attain wealth and invest in their future. Money can be spent on education or enterprise, rather than housing costs. Steel construction in this coastal environment however would need to be highly corrosion resistant to ensure durability of the structure and subsequent low maintenance costs.

The opportunity to purchase a home at a reasonable cost as opposed to renting could also align with a resident's aspiration to attain an asset which can generate profit through sale and allow them the choice to expand or the choice move to other locations perhaps to be closer to family.

c) Passive thermal conditions



The design has some excellent features which allow for low-cost passive thermal control of the units. The design of the superstructure includes a large roof and balcony over-hangs which act like 'umbrellas' to ensure protection from the rain and direct sun. In line with the design philosophy of material reduction as well as this intent to enhance passive thermal performance, this design does not include heavy brick wall construction. This reduces the weight on the steel structure and provides a low thermal mass to avoid accumulation of heat in a climate where the

nights are as equally hot as the day. The reduction of heat build-up provides thermal comfort for residents who cannot afford the cost of mechanical cooling systems. The design was also conceived with bright colours to minimise absorption by solar radiation.

Excellent cross-ventilation is also a key design feature and contributes to the passive solution of the units. The unit buildings were located on the site so as to line up with prevailing winds and allow maximum airflow. For these same reasons, the balcony facades are designed without glass but consist of user controlled, openable light-weight shutters which block the intense sun, yet do not block ventilation. The façade facing the common walkway is polycarbonate cladding within lightweight steel frame.

These features are likely to align with a resident's aspiration to live in a healthy, comfortable internal environment without any particular changes in living habits. However, also to be considered is that Recife is one of the most dangerous cities in Brazil, more than twice as deadly as Rio de Janiero with an estimated 2617 people murdered in the metropolitan area in 2007 [32]. Safety is therefore a major issue in the lives of residents.

Affordable housing needs to provide residents with a secure environment therefore, considering the local context the lightweight façade is a potential clash with the resident's need to live in safety. There are considerable numbers of Brazilians killed by stray bullets passing through windows and lightweight construction. According to police figures there were 16 people killed by stray bullets and 220 were injured in Rio de Janiero throughout 2008[33]. This is therefore a highly sustainable feature which may end up hindering rather than promoting the residents aspirations for themselves and their families to live in safety.

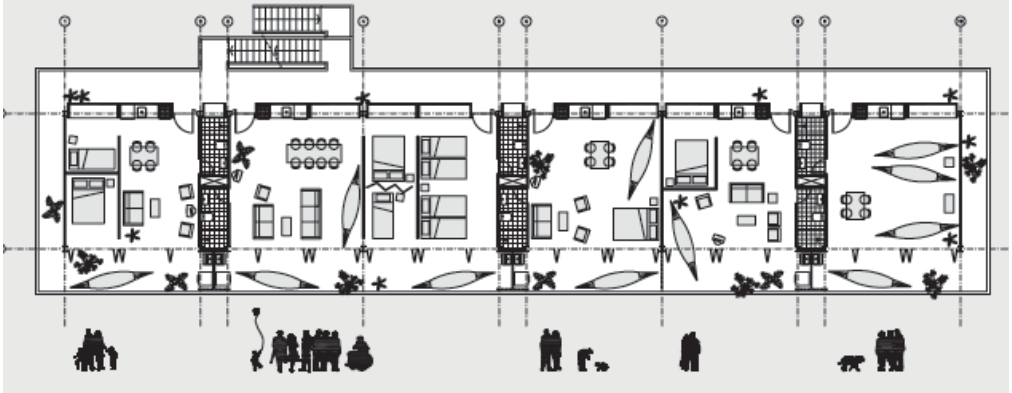
d) Minimal Energy Consumption and Reuse of Resources

The design of the multi-unit building includes several features which reduce the impact of the development on the environment. These include the possibility of including solar hot water heating or even photovoltaic panels on the roof of the structure and the collection and reuse of rainwater from a large gutter in the centre of the roof.

These features are not only beneficial to the environment but would reduce the on-going costs of the residents. If the building itself could contribute to the monthly requirement of power and water, there would be a reduction in bills and therefore generate savings for residents. This would obviously align with the aspiration of residents to attain wealth. Other aspirations to consider may be concerns over hygiene of recycled water, reliance and maintenance of technologies. Disruption of services or cause of illness can impact on the residents' ability to carry out their everyday lives including caring for others and attaining income.

e) Spatial Design and Layout

The internal layout of the units consists of either one or two large rooms which open onto the balcony, with ablutions along one wall. Kitchen facilities form part of the main room, also aligned with the front façade. The large space is not partitioned by fixed walls but is intended to be divided by lightweight partitions as required.



The large open space as well as the connected balcony allows for flexibility to suit the occupant's needs. For example it is common in the locality to sleep in hammocks rather than fixed beds. The space can be used as a sleeping quarters, with hammocks going up during the night and being removed in the morning to make space for daily activities. This flexibility means changes in the family can be easily accommodated, aligning with residents' potential aspirations to expand, as well as to individualise by being able to control the interior arrangement of space. "Intervention in space by user is not only allowed, but in fact encouraged: The participation in the definition of the space stimulates the feeling of belonging, which besides adding to the wellbeing of the community also improves the involvement and responsibility regarding the preservation of the place - a fundamental factor for the sustainability of the complex"[34].

This is an ideal design for locations where the residents may come from various cultural and social backgrounds where privacy can be viewed differently. For those residents who aspire to privacy in their home, partitions will allow them to achieve this separation, while those who do not value privacy as much have the freedom to disregard enclosed living quarters.

Balconies and horizontal circulation provide space for meetings and daily interaction with the community – "These common spaces are the spine of the building's dynamics and may become the backbone of the community as well[23]". Provided these areas are safe they may provide the resident with a chance to participate in a social network and feel part of a community thereby generating personal, social and economic benefits of the housing development.

6.2.2 Summary of Findings;

As members of the Construction Industry we often impose our own assumptions of a resident's needs, these assumptions may not be applicable to the circumstances of the individuals. Ideally, a study should commissioned as part of a housing development brief, which clearly identifies the target market and their needs and aspirations, as was the case in the Recife Affordable Housing project. In assessing the design features of this housing design, it became evident that putting time and effort into the investigation of resident's aspirations before we proceed with design is important in order to deliver an appropriate housing development which will be well used, long standing and therefore sustainable.

7.2 K2 Public Housing Windsor Vic

7.2.1 Introduction:

The K2 Housing development was commissioned in 2000 by the Victorian Government's Office of Housing (OoH) to be an "Environmentally sustainable and socially responsible design"[35]. K2 is a 96 unit, medium density apartment complex in the south east of Melbourne City. The OoH was not only the Client for this building development but also took on the role of project managers. Design Inc's winning architectural design was completed and residents began occupancy in March 2007. Since completion the K2 development has won many awards for sustainable and socially responsible design, including most recently the 2009 United Nations award for "Best Sustainable Residential Complex – World Environment Day Award".

Due to the innovative design of the residential units, OoH realised that tenant education would play a critical part in the success of the housing development. Occupants of this social housing complex are generally low income earners or those with illness or disability. The demographic mix at K2 consists of elderly residents, middle aged and young adults, some of whom are disabled or infirm and therfore benefit from the close proximity to hospital services. The development is not designed to cater for families with young children.

A Tenant's Education Kit was developed and handed out to residents upon their arrival and information boards remain on display in front of the entrance and in the common spaces of the development. There have been ongoing education sessions held for the tenants, to further educate them on how to most efficiently use the building.

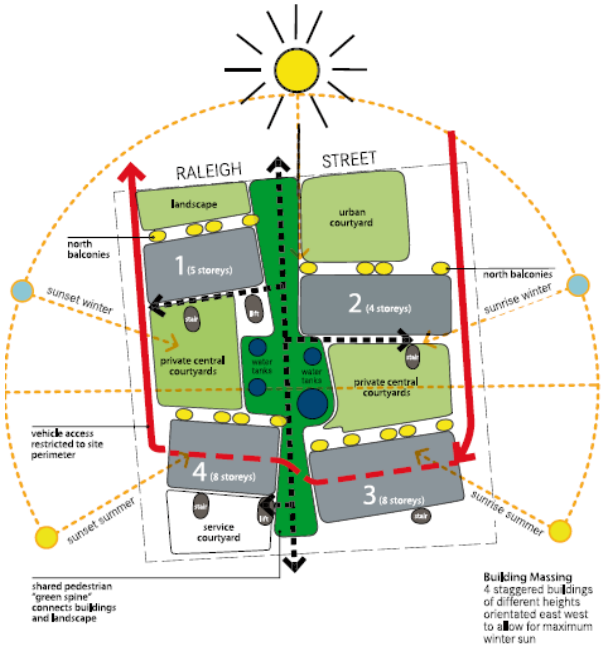
The final design aimed to reduce gas, electricity and water usage based on a typical development of this kind. OoH undertook to meter the usage carefully and carry out post-occupancy surveys to analyse the success of the features. The next section will look at the sustainable design features and their successes based on the post-occupancy metering and how this may be linked to aspirations of the residents. For the purpose of this assessment possible aspirations of residents are considered since no interviews have been carried out with occupants.

7.2.2 Features including post-occupancy assessment:

a) Site Plan including "Green" Spine

The 4800 square metre site consists of four connected buildings which are oriented on the east west axis. Two of the buildings are 8 storeys, with the remaining two 4 and 5 storey height. The buildings are staggered and spaced to allow maximum solar

access to each of the buildings north façade and to allow communal courtyard areas between the buildings.



Adjacent to the 'Green Spine' are shared, common landscaped areas. These areas are intended to promote social interaction as well as increase awareness of the sustainable functions of the building, containing water tanks and landscaping features.

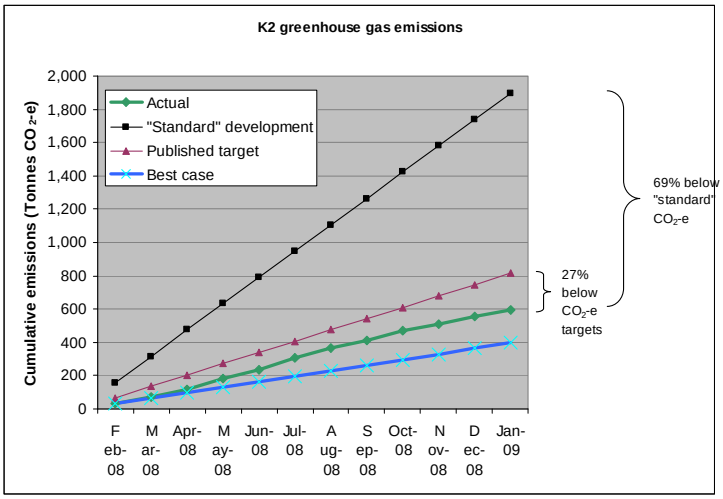
Approximately 20% of the site layout is dedicated to landscaping. The layout of the common courtyards consists predominantly of paving and 'water smart' gardens planted with durable species which can survive the dry local climate. The benches placed in this area seem appropriate for the elderly or infirm who can use this space for social interaction. This feature does therefore appear to align with the needs and aspirations of the intended demographic.

b) Passive Design

Various design features of the units contribute to the internal, passive thermal conditions. No electric heating was provided, in its place a central gas fired hydronic natural convector system was installed. Combined with passive design features and because gas has much lower green house gas emissions than typical electric heating systems, the emission of CO^2 generated by heating demands in the K2 apartments was predicted to be 88% less than a standard apartment development.

The results of the post-occupancy analysis of meter readings from February 2008 to January 2009 show a much greater use of energy for heating and hot water combined. The actual gas meter readings were consistently higher than the predicted targets, with a total excess for the year of 230%. The target values aimed at a 0MWh usage of gas for heating purposes from the months of October until the end of April. In these months the excess above the target was as much as 1000%. The post-

occupancy data does however show the success of the greenhouse gas emissions – dropping 27% below the target for the project, which is 69% below the predicted emissions of a standard apartment building.



It is interesting to consider the reasons for the larger than predicted energy usage for heating, especially in the summer, spring and autumn months. In order for the passive heating features to operate as designed, the residents must be mindful of when they should and shouldn't open windows or operate fans – as outlined in the Tenant Education Kit. Therefore, this discrepancy may be an issue of more education and learning on the part of the tenant. However, since this energy consumption is linked to the behaviour of the tenants, it may be that some of the residents' particular needs and aspirations are driving these figures.

Looking at the demographic of the housing development there is a large percentage of the residents who are elderly or infirm. It may be that this group of residents prefer a higher ambient temperature in their apartments, due to their poor physical state. The higher than normal needs of these residents would need to be taken into account in the design and predicted performance of the building. A way of determining if this is actually true would be to plot the demographic of each unit's occupants with their actual energy use to determine whether there is a common link. Depending on the priority, there are two ways of considering this relationship. It may either be that the building performs better under the occupancy of a different demographic of resident or it may be that due to the specific needs of the residents in this building, its performance will not be as good as a theoretical target could be.

c) Reduction in Water Usage

Water conservation is another important design feature of the K2 development. Rain water is collected from all the roofs and stored in water storage tanks in the central courtyard. This water is pumped to gas powered domestic hot water plants, reducing the use of mains water. The collection of rain water also reduces the amount of stormwater drainage entering the council system.

Grey-water is collected from sinks and showers in the two larger apartment buildings and is treated for re-use in toilet flushing and garden watering. The Tenant Education Kit advises residents what can and can't be put down their sinks to ensure the water is not contaminated. Currently, the amount of grey-water being collected is much less than predicted. The OoH believes this discrepancy is due to the reduction of resident's water usage further to the success of their tenant education campaigns.

The K2 design predicted a 53% reduction in water usage when compared with a standard apartment development. Water efficient fittings contributed 28%, 8% from rainwater collection and a further 17% from recycled grey water. Further to the results of the post-occupancy metering, this targeted amount of water use is being met, assuming that each unit is home to 1.5people. Even if this varies slightly, it is considerably less than a standard apartment building. The reduction is due to the inclusion of sustainable design features which do not impact the residents' use of the water but rather the treatment of it after use.

7.2.3 Summary of Findings:

The K2 apartments are an excellent example of an affordable housing project which has attempted ground-breaking reductions in energy and material usage. The OoH has been dedicated to the achievement of a housing development which could set standards for sustainable construction into the future. In researching this project, the emphasis on the building itself has become very evident. The designers recognised early on that the success of some of the sustainable design features such as recycling grey-water and passive thermal heating would require the collaboration of the residents. Therefore, there has been and continues to be a large amount of effort spent on educating the residents on the needs of the buildings instead of the other way around. Alternatively, the needs and aspirations of residents allocated by the public housing system to this inner city development, close to medical services could have been initially investigated and the building features designed to suit them.

From the assessment of the post-occupancy data, the building has been partially successful in its actual reductions of energy, but definitely successful in its aim to raise awareness of the issues and trial new design features which have the potential to reduce the environmental footprint of residential developments. If these design features could be linked to the needs and aspirations of the residents, they could be even more successful.

8 Conclusions

The exercise of assessing the impact of design features in various affordable housing projects in Brazil and Australia was carried out to highlight the importance of the people using them. Without consideration of the resident's values and aspirations, highly sustainable, technical features can be left redundant or not used to their full potential. By promoting this consideration the Australian Construction Industry can not only support physical environmental sustainability which can be achieved through building features, but also support social sustainability and the improvement of the lives of citizens struggling with housing needs.

In an ideal world, our aspirations would align with the needs of our physical environment. Unfortunately, this is not always the case and people's values are sometimes opposed to it. In order to introduce successful sustainability initiatives, we must work with these aspirations in order to succeed. Therefore, in designing affordable housing we should prioritise the investigation and understanding of the target market.

This ideas presented in study Amartyr Sen's Capability Approach can be extended to the broader question of what minimum standards should be provided for Australians in relation to housing. The Universal Declaration of Human Rights[36] states that the right to adequate housing is essential. The right to housing is also recognised and supported in Australia's National Action Plan on Human Rights which states that all Australians should have access to affordable, adequate and appropriate housing. Both of these documents however seem to be geared to providing capacities or negative freedoms as opposed to capabilities or positive freedoms to improve their lives.

Australia, being a prosperous, developed country is in a position to do better than just alleviating the negative freedoms of shelter for low income earners and should be aiming to provide affordable housing which promotes positive freedoms, enabling lower income earners to flourish and improve their lives.

To do this the Australian Construction Industry should focus on this research in the early stages of the design process and make the findings available to all members of the project team. It is essential that residents themselves participate in this process, so that false assumptions are not made. The design features then need to be selected and incorporated in accordance with these aspirations. This will ensure their success and therefore the social and physical sustainability of the housing development. Since residents can change as can values and aspirations of different generations, an amount of flexibility should be incorporated into the design and delivery of affordable housing developments to ensure that residents themselves are given some control in the use of their homes.

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