

5th Healthy Cities: Working Together to Achieve Liveable Cities

Conference



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The Importance of Sense of Place in Achieving a Sustainable Community

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Abstract

Whangarei District in Northland, New Zealand experienced significant growth over the period 2001-2008. This growth created a number of challenges for the district. To address these challenges the Whangarei District Council developed a growth strategy - Sustainable Futures 30/50 - to guide long term strategic planning for the district. Whilst ensuring integration of future land use with infrastructure provision, the Strategy addressed all four well beings in the Local Government Act - economic, environmental, social and cultural - to better enable the sustainable development of the district over the next 30/50 years.

Background research, together with feedback from the public, highlighted the importance of “sense of place” in engendering a sustainable social economy. This includes an emphasis on good urban design to ensure high quality urban amenity to attract residents, professionals, businesses and tourists to the district. It identified the need for a range of community services including education, health, cultural, entertainment and recreational facilities. As a district Whangarei will compete not only in New Zealand but globally to attract the professionals (and families) that will be required to ensure a sustainable economy and community. To compete successfully sense of place was identified as an important attractor.

To support enhancement of sense of place a detailed tactical plan has been developed for the district. The plan identifies work streams in five outcome areas: safe community; great facilities; great environment – natural and built; community engagement; and supporting development. These initiatives will be implemented over time through two main planning documents produced by territorial authorities in New Zealand: the Long Term Plan (under the Local Government Act) and the District Plan (under the Resource Management Act). Each will play an essential part in implementing sense of place initiatives and thus contributing to sustainable communities and a sustainable economy.

Keywords: sense of place, sustainable development, growth strategy, tactical plan

Introduction

The Whangarei District in Northland, New Zealand experienced significant growth over the period 2001 to 2008. This resulted in widespread land development throughout the district including ribbon development along the coast and transport corridors, sporadic development on the urban fringe and scattered rural residential development throughout rural and coastal areas. The widely dispersed nature of this development created a number of challenges for the district, including the timely and cost effective provision of infrastructure, managing cumulative effects of development, and the fragmentation of productive farmland.

Although growth is slowing in line with global and national trends, future growth for the district is projected to continue and, in some parts of the district, has the potential to be substantial. To manage future growth sustainably, the Whangarei District Council formulated

a long term sub-regional growth strategy. This project, entitled Sustainable Futures 30/50, identified economic drivers of development, assessed future growth potential, determined existing and potential land use patterns, and assessed and planned for infrastructural requirements for the district over a 30-50 year time frame. Environmental, social and cultural constraints on, and consequences of, anticipated development were identified and assessed. This research and analysis enabled a long term, integrated, strategic planning programme to be developed, based upon sustainability principles, to assist the sustainable development of the district over the next 50 years (Whangarei District Council, 2010c).

Sustainable Development

The Growth Strategy was structured using a sustainable development approach. It integrated the four sustainability criteria contained within this concept – sustainable economy, sustainable environment, sustainable society and sustainable culture. A sustainable economy is based upon the recognition that if development is to be beneficial over the long term it must be founded upon enduring economic growth that is cognisant of its natural, social and cultural environment.

Economic development, to be environmentally sustainable, must be aware of, and in harmony with, the ecological systems within which it operates and upon which it depends. Water, air, coast, harbours, biodiversity, and soils all provide essential ecosystem services critical to our well being. The economic system and social/cultural welfare depend ultimately on the ecosystem services and resilience of our natural environment.

A sustainable society implies an ongoing improvement in social well being - for present and future generations. Social well being is comprised of a range of factors including health, education, employment, financial security, leisure, physical environment, social environment, and personal safety. A sustainable society is also resilient in the face of challenge and changing circumstances. Social infrastructure is critical to ensure a sustainable community.

A sustainable culture requires cultural and historic heritage to be recognised and provided for. The traditions and aspirations of tangata whenua are an integral component in New Zealand. A sustainable culture is one that embraces different cultures and respects and enhances freedom to retain, interpret, and express different arts, history, heritage and traditions, and encourages participation in recreation, creative, and cultural activities.

Preparation of the Growth Strategy identified the major role that developing a sense of place would play in creating a sustainable future for people of all ages and cultures in the district. It highlighted that our district must compete both nationally and internationally if it is going to attract the skilled people and their families needed to meet the needs of current and future

generations. Addressing sense of place is also important in helping to make our settlements attractive to new residents and visitors whilst retaining the attributes that attracted the present residents in the first place (Whangarei District Council, 2010b).

Sense of Place

Sense of place is an important, multifaceted concept that attracts, retains and enriches communities in relation to a particular locality. A sense of place emerges through knowledge of the history, geography and sociology of an area, its natural and cultural heritage, the stories and myths associated with a place, and the relationships of communities with the land. Sense of place comprises two essential elements: the 'community' or those people who feel attachment or a sense of belonging to a place; and the physical and intangible elements of a place that contribute to its special character or 'familiarity'.

A sense of place helps people identify with where they live and with each other. It can attract people and businesses to a place and help retain them there. It can also attract visitors and make them return to a particular place. It can assist in the promotion and 'branding' of a city or district. Sustainable tourism relies upon a continuing sense of place. A strong sense of place can lead to more sensitive stewardship of historic/cultural and natural heritage. And an enduring sense of place assists social cohesion and social engagement. Thus, sense of place contributes to environmental, economic, social and cultural well being.

A number of aspects contribute to a sense of place and can be improved to enhance that sense of place. These include historic and cultural heritage, natural heritage and landscape, land uses, gathering places and focal points, views and gateways, and the built environment encompassing such aspects as local character and amenity, neighbourhood identity, and urban design. All these elements contribute to sense of place and can be protected and improved to enhance a sense of place. This is referred to as 'place-making', and is increasingly recognised as an important part of environmental, social and economic planning (Whangarei District Council, 2010b).

Urban design describes the physical features that define the character or image of a street, neighbourhood, community, city, or the district as a whole. Urban design is the visual and sensory relationship between people and the built environment. The built environment includes not only buildings and streets, but also the natural environments which are incorporated into the urban framework. Good urban design can create a sense of place where there was none, and will build on the assets of an inherently well located site. Mixed use, higher density, walkable neighbourhoods encourage local services and community interaction, making safer, healthier, more attractive places to live, work, play and visit.

Developing a strong sense of place, through good urban design incorporating those values (both natural and historic/cultural) that currently exist, will enhance the district and its varied settlements as places to live, work and play. A sense of place also serves to attract visitors and tourists thereby contributing in economic terms to employment and social development. A strong sense of place contributes to economic well being, and economic prosperity contributes in turn to a positive sense of place. Both contribute to the sustainable development of the district over the long term.

Tactical Plan

Whilst sense of place was identified in the Growth Strategy as an important issue, and a range of implementation actions intended to enhance sense of place across the district are included in the Growth Strategy Implementation Plan, a Sense of Place Tactical Plan was developed to guide Council operations in enhancing sense of place over the shorter term. Generally these are priority actions identified in the Growth Strategy Implementation Plan.

The Sense of Place Tactical Plan is an internal document that will help guide Council operations and ensure that sense of place is incorporated into Council planning processes. The document explains why sense of place is an important consideration, and notes the general barriers to achieving a high quality (and positive) sense of place. Sense of place related projects can be seen as non-essential and may suffer funding cuts or deferrals should difficult financial circumstances arise (Whangarei District council, 2011).

However, the tactical plan illustrates how a sense of place is connected to a number of outcomes desirable in a community. The most desirable outcomes generally relate to safe communities, great facilities, great environment (natural and built), supporting development and good community engagement. These outcomes are then linked to specific outputs (projects) produced by Council through its operations or facilitated by Council in collaboration with government agencies, iwi, community and business groups, and the public.

Projects relating to a safe community include a CitySafe programme, closed circuit television (CCTV) coverage, crime prevention through environmental design (CPTED), community guardianship, Maori wardens, graffiti reduction, bylaw controls and enforcement, improved pedestrian and cycling connectivity, mixed use development, and cooperative engagement with the community, business groups and organisations such as the New Zealand Police.

The provision of great facilities is a critical element to creating and improving sense of place. Such facilities include provision for sport and recreation (passive and active), arts culture and civic amenities, entertainment and nightlife, natural and historic/cultural heritage, and

associated infrastructure such as transport, parking, etc. Specific outputs include implementing the Arts, Culture and Heritage Policy, continued support for Sport Northland and sports and recreational clubs, continued provision of high quality sports fields, parks, reserves, playgrounds, walking and cycling tracks, youth facilities, community halls, conference facilities, libraries, museums, cinemas, theatres and places for performing arts including dance and music. Council is producing a Night- time/Weekend Economy Strategy (encompassing an alfresco dining policy) to improve facilities for night time weekend activities to breath more life into the City centre (Whangarei District Council, 2010a).

Outputs in terms of great environments (natural and built) include the development and implementation of integrated catchment planning, the Whangarei Harbour Integrated Management Strategy, Biodiversity Strategy, Coastal Management Strategy, Rural and Urban Development Strategies, Urban Design Strategy, and Open Space Strategy, together with improved provisions in the District Plan to enhance protection of outstanding landscapes, natural character of the coast, indigenous biodiversity, water resources, historic and cultural heritage, urban and rural amenity, including better urban design. Enhancing blue/green networks along streams and harbours across the district, including urban Whangarei, will improve the district's naturally endowed sense of place.

Supporting development to improve sense of place includes providing appropriate infrastructure, undertaking research/analysis and providing advice from Council's economic development unit, working collaboratively with business groups, the private sector and Maori organisations to facilitate desirable developments, providing easily accessible information to developers and business interests, supplying urban design advice, and ensuring regulatory systems are efficient and decision making is timely and consistent.

Good community engagement includes working with communities, including Maori, to ensure they share Council's vision of the future, are well informed on sense of place initiatives, and are involved in place making, particularly in their own localities. Council can assist communities to develop their own plans for identifying/supporting community infrastructure and articulating community preferences for local place making. Council also provides grants for community projects and facilities and assists groups to access external funding. Engagement with the Disability Sector Reference Group, Positive Aging Advisory Group and the Youth Advisory Group can assist inclusiveness for those sectors.

A number of projects enhancing sense of place in Whangarei City have recently been completed. These include a number of harbour side developments, comprising a destination 'hub' housing the Whangarei Art Gallery, a visitor information centre, cafe, and inter-city coach terminal; an iconic canopy on Victoria Bridge to locate a weekly artisans market/fair;

an art walk and heritage trail celebrating the art, culture and history of Whangarei; and inner city improvements including entrance features, riparian plantings, street trees, pavement improvements, gardens, signage and flags/banners.

A number of other proposals have been initiated and budgeted for completion in the near and longer term. These include: a harbour side loop walkway/cycleway to link the Harbour Basin to a new reserve on Pohe Island using a new harbour bridge (when completed) and back via Victoria Bridge; an iconic Hundertwasser Art Centre at the Harbour Basin; a new harbour side park; and a number of CBD improvements including extending an existing inner city pedestrian mall, a new covered mall and street improvements in the CBD and improving pedestrian accessibility and connectivity, particularly between the CBD and Harbour Basin. A Maori cultural centre at the Harbour Basin has also been proposed over the longer term.

Implementation

A range of methods will be necessary to implement the Sense of Place Tactical Plan. Methods include statutory and non-statutory approaches. Two statutory documents are critical to the implementation of the Plan. These are the Whangarei District Plan produced under the Resource Management Act 1991 and the Whangarei District Council Long Term Plan produced under the Local Government Act 2002.

The District Plan is the key land use planning document prepared by territorial authorities. Its purpose is to promote the sustainable management of natural and physical resources, including the built environment. The District Plan can be used to improve sense of place in many ways, including protecting urban and rural amenity, important landscapes, natural and historic/cultural heritage, improved urban design, mixed use zoning, land use development controls, and managing adverse environmental effects (Whangarei District Council, 2007).

Of the available tools under the Local Government Act the most important is the Whangarei Long Term Plan. The Long Term Plan details council activities, community outcomes, and how council activities will progress the community outcomes. The future sequencing of infrastructure provision, maintenance and replacement (both hard and soft) over the following 10 years is outlined in the Long Term Plan and includes detail on activity/asset management and capital works programmes (Whangarei District Council, 2012).

As well as statutory tools, a variety of non-statutory methods are available to assist implementation of the Tactical Plan. These include: strategies and policies; structure plans and development plans; urban design guidelines; community projects and partnerships with community groups, education providers, health providers, iwi/hapu organisations, and private enterprise.

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Creating Relaxing and Enjoyable Landscapes

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Creating Relaxing and Enjoyable Landscapes

Abstract

A large number of urban health problems are related to stress. People are least stressed are when they are relaxed and happy. Unfortunately little of modern landscape design is dedicated to creating relaxing and enjoyable spaces. Often modern landscapes and open spaces are funky, stylish, or make a statement, but are really not conducive to relaxation and offering a moment of enjoyment during a busy day.

In order to reliably create relaxing environments, it is essential to first understand what features of the landscape enhance relaxation. Most people feel drawn to nature in order to relax. Many go to beaches, lakes and rivers, others to the country. It follows that there is a lot to learn from nature in creating relaxing and enjoyable landscapes. The straight lines and sharp angles that constitute so much of the hard geometry of modern landscape structures are not found in nature. In contrast, the natural landscape is a world of gentle, relaxed curves, rounded edges and softened lines. Rivers wind their way around large rocks and trees, Wind and water wear down sharp edges to facilitate their movement over them.

Humans also do not naturally move in straight lines and turn in sharp right angles. However, their movements are typically functional. Landscape designers are familiar with the power of desire lines and many failed landscapes find people trampling over walls and through gardens because the lines of movement in the area had not been considered. Similarly, the places where people feel drawn to sit are not always those places provided for in the design.

It is possible to design relaxing and enjoyable landscapes that still satisfy imposed constraints. It requires a new kind of analysis, considering the psychology of open spaces, lines of movement and creating enjoyable functionality.

Introduction

Stress is a major cause of health problems, especially in our overcrowded cities. Stress has both direct and indirect effects on health. Direct effects are caused by the resultant physical tension, characterised by: short, shallow and irregular breath; accelerated or irregular heartbeat; impaired gastro-intestinal function; tense, contracted or rigid posture; headaches; excessive muscular tension; and poor quality sleep. These effects are debilitating to the body and increase its susceptibility to disease.

Indirect effects are caused by emotional tension, leading to substance abuse, such as smoking, drinking, illicit drugs, over-the-counter and prescription drugs as well as excessive comfort eating. These behaviours lead to an even larger range of health problems.

Clearly, any factors that reduce tension and enhance relaxation can only be of benefit to the general level of health and well-being in cities. In order to identify these factors, it is important first to understand the characteristics of tension and relaxation. Based on this understanding, it becomes possible to identify factors that can help encourage and enhance relaxation. This knowledge can then be incorporated into the landscape design process to help create spaces that are relaxing and enjoyable.

Tension and Relaxation

Relaxation is best defined as the ability to move freely in all directions. Our minds become more open, positive and capable of creative and lateral thinking. We become more simple and direct. Emotionally we find ourselves more open, positive, responsive and compassionate. Our bodies become more supple. We breathe deeper and slower, our pulse rate slows and our movements become more free. We experience a wider field of view and become more aware of sounds, smells and physical sensations. We become more capable of responding to situations.

In contrast, tension finds us more or less constrained to one line of movement. Mentally we fall victim to fixed ideas, circuitous, obsessive and negative patterns of thought. Our foreheads become tense. Our emotions become guarded and negative. Our bodies become tense and our posture more fixed. Our field of view reduces and our senses become numbed. In this state we are capable only of reaction to stimuli.

Tension can be likened to a train running on tracks. We become stressed, depressed or angry, resentful, abusive, even violent because tension locks us into a state with very few apparent choices. Our scope of vision narrows, often to almost tunnel vision. We become fixated.

Relaxation and tension are relative. They are experienced in different degrees and by moments. In addition, we have a mutual influence on each other that is greater the closer we are to each other. If a person close to us is really tense, then this tends to increase the tension in surrounding people. If one in a group is positive and relaxed, this has a beneficial effect on those around.

Moments and Change

We live our life by moments. Some can leave a lasting influence in us. The more frequently we experience moments of relative relaxation, the more our overall level of relaxation increases.

It sometimes happens that we are faced with a seemingly insurmountable problem. Then something in us relaxes for a moment. Choices appear and a solution presents itself. This experience can be quite inspirational.

Emotion and body follow the mind. We may have a negative thought in reaction to something we see or hear. Negative emotions, such as resentment, anger or contempt, rapidly appear. Our body becomes more tense. Each repetition of these thoughts brings increased negative emotions and tension until circumstances (usually external) enable change. For example, your co-worker makes a comment. Your inner reaction and thoughts are that you think they are lazy, they are taking credit for your ideas etc etc. You reach the point where you simply can't stand them anymore. Then another person you have been secretly keen on happens to give you a big smile and a very encouraging look. Suddenly your poor old co-worker is of no consequence anymore.

Body and feeling can provide triggers for relaxation. Our mind can only perceive the world through senses and feelings. So, how can we use this to create conditions that are more conducive to relaxation?

What Helps Us Relax?

Relaxation is characterised by moments of a more positive and open attitude. This can be triggered by things that make us smile, feel happy or laugh. Our lives become so serious in all the wrong ways that we often forget the importance of having fun. Unexpected and pleasant surprises can make us pause, smile and become interested in our surroundings. Many of us feel drawn to nature in order to relax. In everyday life we may enjoy gardening, keeping pets or having indoor plants. Recreational activities, such as bushwalking, surfing, fishing, scuba diving, skiing, or sailing, all bring us closer to nature. In the backyard, park, bush or beach, we are surrounded by nature and are more likely to be nourished by its unexpected moments of beauty. Nature tends to awaken the senses with the sun, wind, sights, smells and sounds. Smell, so vital in childhood, is one of our first senses to numb. How often does a chance smell trigger a vivid childhood memory?

Learning from Nature

A large number of us spend our working days walking on hard surfaces, sitting indoors in air-conditioned offices with artificial lighting and staring at computer screens. Our built environment is typically composed of rectangular spaces with low ceilings.

The straight lines and sharp angles that constitute so much of the hard geometry of modern architecture and landscape design are not found in nature. In contrast, the natural landscape is a world of gentle, relaxed curves, rounded edges and softened lines. Rivers wind their way around large rocks and trees, Wind and water wear down sharp edges to facilitate their movement over them.

All living things have a mutual influence on each other. Our mental, emotional and physical state is influenced by and has an influence on others. Close proximity to plants and animals has an influence on us as well. It is hard to walk through a forest of she-oaks without feeling a little quieter with the soft cushion of fallen needles under foot and the hushed tones of wind through the trees. If we are lucky enough to see a platypus in the bush we tend to quieten and feel privileged. Sitting nestled in the buttress roots of a giant moreton bay fig gives another experience, or seeing rainbow lorikeets feeding on red gum flowers.

There is a sense of timelessness and continual movement and change. The seasons and weather have a dramatic influence on the landscape and all it's forms of life. There are no straight lines or vertical walls or any perfect geometric forms. The beauty of most objects in nature is in their imperfections. An almost perfect crystal is far more beautiful than a synthetic one that is engineered to geometric perfection.

The Japanese have a refined appreciation of nature and this is evidenced in their gardens and art. Their appreciation of rocks and the feeling expressed by their placement and attitude toward each other can clearly be seen in many of their traditional gardens. The Japanese aesthetic of wabi-sabi, which involves the intentional placement of imperfections in art, gives character and life to objects that would otherwise seem cold and lifeless. The concept of borrowed scenery helps lift the observer's attention beyond the confines of the garden they are in. Their use of changes in direction in paths helps jolt the attention and awaken the senses to the beauty around.



The same rocks, placed in different arrangements, can create quite different impressions.

Movement

We perceive the world as a construct of stationary objects and relative movement. We design and build with the concepts of vertical and horizontal lines, and reference our heights as elevations above sea level. All of these are gravity referenced measures, and gravity is a purely radial force. We orient buildings based on magnetic north, which is slowly moving and radially concentric. When we look at images of the earth from space it is quite apparent that the sea isn't level and parallel

lines facing north aren't parallel at all. But the errors are acceptable for the scale of our works.

In reality, everything in life is moving and filled with movement. Even seemingly inanimate objects such as rocks are in a state of continual movement. At the atomic level electrons orbit around nuclei. At the microscopic level rocks expand, contract, soften and harden as they warm, cool, wet and dry out. Even the surface of stone is in a constant flux as it weathers, oxidizes, erodes and forms hosts to lichens and mosses.

Although we are taught to perceive motion in straight lines and three dimensional vectors, the most fundamental and prevalent form of motion is rotation. From the subatomic to the astronomic scale everything rotates and orbits and we measure this in terms of cycles. We are composed of atoms that are in constant rotation. Our bodily functions consist of circulatory systems and cycles, we live on a planet that rotates on its own axis and around the sun, we see light and hear sounds that are both measured in terms of cycles per second.

Every form of life exists, is maintained and perpetuated through cycles. In humans, our respiratory and cardiovascular systems maintain all the cells in our body and their operation is measured in terms of cycles per minute. Plants and animals propagate thanks to reproductive cycles. In humans and most mammals the reproductive function is controlled by the menstrual cycle in the female. In plants, their dependency on the environment means that this function is controlled by the seasonal cycle.

Knowledge of the importance and significance of cycles is not new. The ancient Egyptians had the symbol of the ouroboros, depicted by a snake eating its tail. Native Americans have the medicine wheel. Hinduism and Buddhism use the mandala. Taoism uses the yin yang. Even stone henge is arguably a depiction of this same fundamental truth.

There needs to be circulation in our built landscapes as well. It's a lot more relaxing to follow paths that circulate through the landscape rather than reach stagnant, dead ends. It's never as enjoyable to have to turn around and head back the way you came.

Creating Relaxing and Enjoyable Landscapes

The more appropriate a landscape is to its function, the more relaxing a space we create.

The best landscapes are an expression of functional aesthetics. Too often we tend to satisfy the functional requirements first, and then try to "pretty-it-up" afterwards. A successful landscape satisfies all of its functional requirements intrinsically within a cohesive design. This entails design elements that are multifunctional. They should be an integral part of the overall design while satisfying function and hopefully having fun in the process.

When we come to designing landscapes in urban areas, scale is typically the biggest limiting factor. Density of housing in cities has steadily increased over the years and the Australian dream of a quarter acre block is becoming more of a luxury. Public open space has become increasingly important in medium to high density housing areas, as well as in central work areas. With this comes increased pressure to provide multi-functional spaces to accommodate differing user requirements dependent on the time of day and the days of week.

In light of these factors, it is impractical to create cameos of the natural bushland in cities. Instead, we need to incorporate those features of nature that we find appealing and relaxing into our built landscapes. These include: relaxed curves; softened edges; circulation; intentional imperfections; lots of life, colour, movement and change; pleasant surprises; unexpected details; and above all else, fun.

The groundwork of any landscape design is satisfying the functional requirements of the brief within the constraints provided. Once these are clear, analysing lines of movement through the landscape is a good place to start. Quite often this will provide sufficient information to rough out the design basics. This is really quite simple. We look at where users of the landscape may be coming from and where they may want to go. It is the designer's job to facilitate this progression, rather than obstruct and impede it. Users need to feel free to move in the direction they want, otherwise they create their own access out of frustration.

Once the lines of movement have been mapped out, the rest of the landscape can be developed based on the constraints and functional requirements of the brief. These lines of movement form the basis for paths, steps, paving and open space. Because every project is different, it is impractical to discuss overall design past this point. Instead we'll look at the common components of most landscapes.

Getting Curves Right

Curves are often poorly executed in landscapes. They vary from the fixed geometry of circles, ovals and arcs that are lifeless and lack movement to the inclusion of random wavy lines that seem to serve no function and lack fluency.



The curve at left seems disjointed and random, whereas the path gently winding past trees makes perfect sense

There are three important aspects of a curve: how it starts; how it finishes; and the curve itself. A curve should draw your eye along it. Each part should be equally weighted so that nothing catches your eye. This inherent sense of movement requires that the start and finish need to make sense. Curves need to appropriate to their function. There is no purpose in having a curved path if it isn't following the most comfortable access between one area and another.

On the practical side, 20mm grey electrical conduit provides a useful visual aid in resolving and marking out curves on-site. Its resistance to bending is fairly uniform along its length, ensuring curves remain fairly fluid. It is surprising how a few millimetres can be the difference between a fluid curve and a disjointed and random line.

Paths and Paving

Paths and paving reinforce the principal lines of movement through the landscape. They enable us to create circulation through the landscape, giving the user a sense of always moving forward. Humans do not naturally move in straight lines and turn in sharp right angles. We tend to follow economic, organic curves to change direction. We can see this clearly in areas where paths turn or meet in turf or planted areas and foot traffic tends to leave a curved path which cuts the corner.



Paths can also present an opportunity for a bit of fun while still satisfying function

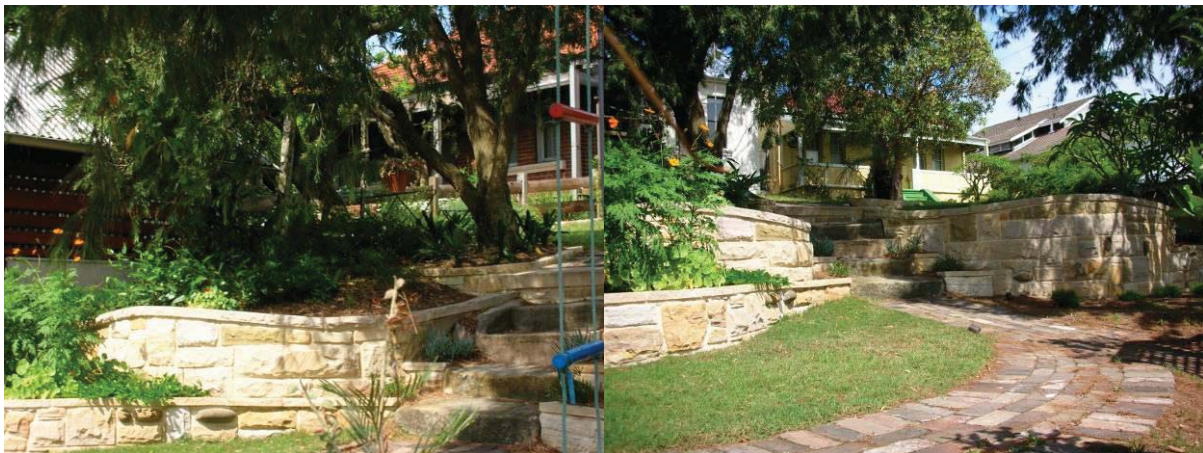
Rest Areas

Having somewhere to sit quietly, read, eat or talk with others is an important functional requirement on any landscape. Physical requirements of rest areas include: adequate space to accommodate anticipated user requirements; comfortable seating, including informal seating as well (seating walls, grassy slopes); shade in summer; and wind protection and sunny location in winter.

Equally important for an inviting and relaxing rest area are the psychological requirements. These include: planting, screen or walling behind our backs; seating placed on level ground or facing downhill; more than one entry and exit route to the area; slightly set apart from main access routes; enjoyable views or details;

Retaining Walls

Retaining walls can be multifunctional and useful elements. They enable terracing and levelling of sloped sites, can provide informal seating, raise soil levels to enhance plant growth and can be beautiful element in their own right. It's generally more relaxing not to have high walls adjacent to paths and a 10% slope or batter on the face of the wall tends to feel more comfortable and increases the structural stability of the wall. The top of retaining walls can also be curved to make them less serious and imposing.



Curving the top of these walls helps them seem less fixed and imposing

Planting

Plant selection is no doubt one of the hardest aspects of landscape design. We work with a palette of size, form, colour and texture to fulfil an intended role in the landscape. Then follows the daunting task of trying to find plants to satisfy these required parameters, both initially, and for the years that follow. Plants have an annoying habit of growing and changing, or even worse, not growing and dying. The best design is severely impaired by plants that fail to flourish. There is nothing relaxing about being in the company of plants that are sitting sadly in various stages of decline and death.

Nature has the upper hand here with the benefit of thousands of years of natural selection providing plants that seem just right for the space they occupy. Designers need to spend time understanding the plants they use better. How they behave, what climatic conditions and rainfall levels they need. What aspect and soil suits them best. A lot of this information can be gathered by observing where they tend to occur naturally and thrive. Specialist growers and experienced gardeners are also a useful resource in this area.

Change and Unexpected Details

It seems ingrained in humanity that the more familiar we become with something, the less we really see it. On holidays, surrounded by fresh impressions, we become more open, relax and observant. This highlights a need for change in the landscape to constantly trigger fresh impressions. This is difficult to accomplish with hard structures, but can be achieved with planting to show different features throughout the year. Our modern landscapes tend to be more formal and foliage based and less alive with flowers. Flowering deciduous fruit trees, bulbs and perennials can all make for dramatic changes in the landscape throughout the year. Water features that don't behave predictably can also keep interest alive. Lighting can give the landscape an entirely different appearance by accentuating features that don't predominate during the day. Lighting can also be programmed to give a different feel on different occasions.



The same small garden viewed from different sides gives totally different impressions thanks to slightly raising the ground level towards the middle of the yard. The timber bridge is tuned to sound the notes of the octave when walked on (bridge by Hugh Jones).

The inclusion of pleasant surprises and unexpected details helps waken a childlike curiosity and interest to see what else we can discover. For this reason it is also desirable that all of the garden should not be immediately apparent. Users feel encouraged to be more observant. Structures that appear different from different angles, timber bridges that resonate when you walk on them, alcoves that echo – designing these features can be a lot of fun which is shared vicariously with the subsequent users of the landscape.

Conclusion

The more appropriate a landscape is to its function, the more relaxing a space we create. The best landscapes are an expression of functional aesthetics. They satisfy all of the functional requirements intrinsically within a cohesive design. This entails design elements that are multifunctional. They should be an integral part of the overall design while satisfying function and hopefully having fun in the process.

We need to incorporate those features of nature that we find appealing and relaxing into our built landscapes. These include: relaxed curves; softened edges; circulation; intentional imperfections; lots of life, colour, movement and change; pleasant surprises; unexpected details; and above all else, fun.

Melbourne City Baths Project – Retrofitting for sustainability

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The Melbourne City Baths Project – Retrofitting for sustainability

A study for improved building performance and energy efficiency in the heritage context.

Abstract

Conservation of heritage and other buildings of architectural significance within our cities is not only vital a component in maintaining our cultural identity but also in developing healthy cities. Conservation of these buildings requires constant maintenance and restoration and ongoing improvements so the spaces within can be comfortably and sustainably occupied. Sustainable conservation reduces the risk of valuable buildings becoming redundant or being demolished and preserves the embodied energy in the building materials. This research aims to explore the possibilities and limitations of improving the environmental performance of a heritage building including environmental sustainability, heritage conservation and occupant satisfaction. This will be done through a case study of the Melbourne City Baths in collaboration with the City of Melbourne exploring the potential of a series of sustainable retrofitting initiatives. Success of these initiatives will be assessed through analysis of carbon emissions, utility consumption, heritage conservation and a cost/benefit analysis.

Keywords: *heritage, sustainability, conservation, retrofitting*

Introduction

The aim of this project was to investigate the possibility of combining sustainable design solutions into the built heritage context. The Melbourne City Baths is researched as a case study to identify, in collaboration with the City of Melbourne, sustainable design initiatives that can be retrofitted to improve the performance of the Melbourne City Baths within a heritage conservation context. Improving the performance of the building relies on finding a synergy between built heritage conservation, environmental sustainability and overall occupant satisfaction. This research aims to address these three components and provide evidence that may help to mitigate the future improvement of the City Baths and other heritage buildings.

Why Retrofit

The City of Melbourne has identified that the existing commercial building stock in the municipality of Melbourne produces up to 48% of the total greenhouse gas emissions across the city (1200 Buildings, The City of Melbourne). Retrofitting these existing buildings has the potential to improve energy performance and indoor environment quality, which reduces operating costs not only through system performance but also through the improved satisfaction and productivity of the people engaging in the spaces. The City of Melbourne has set a goal for achieving a carbon neutral city by 2020, therefore one of their strategies is to retrofit 1200 of these existing commercial buildings. The Melbourne City Baths was identified as a potential candidate for retrofitting as part of the 1200 buildings project.

The Melbourne City Baths is a National Trust listed heritage building, which means it is recognized to be a place of cultural significance and '*contribute to the understanding of Victoria's history*' (Heritage Victoria, Victorian Heritage Database). There are over 100 heritage buildings in the city of Melbourne and many other architecturally significant buildings which are used for commercial purposes and have the potential to be retrofitted as part of the 1200 buildings project. This research aims improve the understanding of the possibilities and constraints for improving the performance of these buildings whilst maintaining their architectural and cultural integrity.

In terms of sustainability, the retrofitting of these existing buildings is best justified by Maahsen-Milan (2011, p. 711) as '*the most sustainable building is one that is already built*', referring to the savings in demolition waste, construction costs and embodied energy when choosing to conserve an existing building rather than building a new one. Additionally, the preservation and conservation of heritage buildings is culturally sustainable, ensuring that '*places of cultural significance are conserved for present and future generations*' (Burra Charter, p.1) as is recommended by the Australian International Council of Monuments and Sites in the Australia ICOMOS Burra Charter, 1999.

Sustainability, with respect to this research, can be partially described by Australia's National Strategy for Ecologically Sustainable Development (1992) as *'using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased'*. In addition to ecological processes, the focus on cultural sustainability in this research requires that places of cultural significance are also maintained as they can also be considered as finite resources for the community. In this respect, community resources refer not only to the natural and urban ecosystem but also to the functional and cultural value of the existing building.

Sustainable design solutions will need to find a balance between improving and enhancing the ecological performance of the building and preserving its intrinsic architectural and historical character. This next section will outline some of the theory and background underpinning this research and outline the approach used to investigate the aim.

Heritage Conservation Requirements

Australia ICOMOS (Burra Charter, 1999, p. 1) defines heritage buildings as, *'historical records, that are important as tangible expressions of Australian identity and experience. Places of cultural significance that reflect the diversity of our communities, telling us about who we are and the past that has formed us and the Australian landscape. They are irreplaceable and precious.'*

Two significant issues have been identified when considering heritage buildings for retrofitting, these are the limitations placed on the modification of the structure and character of the building and the pressure placed on the indoor environment quality to improve the building to modern standards. Key issue is how to reduce the carbon emissions *'without damaging the intrinsic architectural or historic character and significance of a structure'* (Godwin 2011, p.13). The issue of adaptation for indoor environment quality will be considered further when exploring occupant satisfaction.

When considering building modification, it is important to find a balance between complete preservation and complete retrofitting. If it is decided that a building needs to be preserved in its entirety and the building 'as is' has unbearable management costs, then the building will most likely be left abandoned to decay. In contrast, an inconsiderate retrofit of a heritage building may result in *'adaptively reused buildings that are nothing more than keeping the external skin, they are empty space without the original setting and spirit of the place'* (Yung 2011, p. 8).

Heritage conservationists such as Australia ICOMOS (Burra Charter 1999, p. 1) advocate *'a cautious approach to change: do as much as necessary to care for the place and to make it usable, but otherwise change it as little as possible so that its cultural significance is retained.'* Within this approach it is important to find such a balance between new additions/ alterations and new work ensuring *'it does not distort or obscure the cultural significance of the place, or detract from its interpretation and appreciation'* (Burra Charter 1999, p. 7).

Heritage Sustainability

It has already been discussed that sustainability within the scope of this research covers not only the environmental impact of the building but also the sustainability of cultural heritage. Sustaining cultural heritage requires ongoing maintenance and repairs which according to the Department of Planning and Community Development *'will assist in ensuring the ongoing significance of the place and enhance its longevity. This contributes to improved energy efficiency and sustainability outcomes.'* (DPCD Heritage buildings and sustainability 2009, p. 2) Retrofitting of heritage buildings, goes beyond maintenance and repairs into ensuring *'the total quality of life, now and in the future, can be increased.'* (NSES, 1992)

Yung (2011) outlines four components to determine the viability of sustainable redevelopment of existing buildings these are social, economic, environmental and political. Not all of these components are relevant to this research but certain elements can be extracted to give a reasonable explanation of what makes a sustainable heritage retrofit. These are outlined below:

- **Economical Sustainability**

The building needs to be able to be adequately maintained and improved to avoid dilapidation and continue heritage conservation this is made possible through viable capital costs, maintenance costs and payback periods. As is the case with the Melbourne City Baths, the building is managed by an executive body (The City of Melbourne), whose first priority when choosing to retrofit is the cost/benefit analysis or payback period of the proposal.

- **Social Sustainability**

The building needs to be able to provide a functional internal environment suited to the required comfort levels. Ensuring the heritage building is fully occupiable and functional will be the best chance for ensuring it receives ongoing maintenance and preservation. This is discussed further in the next section on occupancy satisfaction. The cultural significance of the building also needs to be maintained, this is described by Maahsen-Milan (2011) as a Qualitative approach to sustainability. Tweed (2007, p.62) states that maintaining built heritage *'not only contributes to the state of health of the built environment but also crucially to community and cultural identity and helps to define the character of the place.'*

- **Environmental Sustainability**

The proposed retrofit needs to reduce impact on the environment through energy, gas and water initiatives, this is considered by Maahsen-Milan (2011, p. 712) as the Quantitative approach towards sustainability and is assessed through performance analysis using consumption data and complex energy modelling. This may include increased thermal efficiency, the use of sustainable energy resources and systems and the improvement of lifecycle and durability. Godwin (2011, p.13) highlights that it is important to understand the relationship between the embodied energy of a new building element and its corresponding energy savings after installation, *'for example, the replacement of a 200 year old window with a new double glazed window when the new one can only be*

expected to last 20-30 years is not sustainable.'

Through these improvements the building has the potential to become carbon neutral or contribute positively to the environment, this requires consideration of the way the building is integrated with the surrounding urban ecosystem. Proposals such as storm and grey water collection, water treatment and improving urban biodiversity help to improve building integration.

Occupancy Satisfaction

The most economic, culturally and environmentally efficient way to occupy an existing building is to adapt to the original building conditions. As described by Maahsen-Milan (2011, p.712), *'sustainable preservation relies upon an understanding of the original building matter and its relationship with the intended function.'* Three possible outcomes are proposed with regard to understanding the original building conditions:

- The first and most conservative method is to change the use of the spaces within a building to a use that is closest to the natural/ original functioning scope of the space. This requires an understanding of the original indoor environment quality of the building such as temperature, humidity and natural lighting.
- The second solution is to reduce the comfort expectations within a space to minimize the requirements for artificial lighting, heating and cooling. This recommendation is a solution that has been successful in retrofitting of commercial buildings throughout Melbourne drastically reducing energy consumption and providing passive solutions to compensate. One example is the Australian Conservation Foundation's building 60L, where the expectations of thermal comfort, which are commonly perceived as being best when least variable, were allowed to vary within a range of 19-26°C (60L detailed report 2002, p. 20). The 60L detailed report (2002 p. 20-26) claims that *'people can achieve comfort by adjusting windows and putting on, or taking off jackets and jumpers'*, the adjustment has allowed a reduction in heating and cooling energy loads of 41%.
- The third and least conservative method is to accept some changes to the original elements of the building in order to accommodate new Indoor Environment Quality requirements. This is the case with the Melbourne City Baths where, due to their competition for patrons with other nearby recreation centres, the baths has to provide certain operating conditions for clients placing limits on their flexibility. For the city baths, it is necessary to ensure that a compromise in comfort does not compromise the economic sustainability of the building.

Whilst understanding how the original building functioned can give foresight into allocation of new functions to spaces, in the case of the City Baths, the building is already fully occupied so the reorganization of the functions of specific spaces needs to be economically viable with regard to existing and required services and accessibility.

Overall synergy of solutions

Synergy refers to the ability of a series of sustainable retrofitting solutions to compliment or work together with the existing building and the surrounding ecosystem as a single sustainable and improved system. From the previous discussion this will require that proposed solutions not only ensure heritage conservation, economic, social and environmental sustainability and provide a fully functional and occupiable building but also work together to improve the overall performance of the building. One example of such synergy would be through a co- or tri-generation system which depends upon the harnessing of waste heat to improve the overall efficiency of the system. The efficiency of the system can not be achieved independently from the harnessing of this waste heat. In the same manner, the proposed solutions cannot work independently of the building, each other or the surrounding environment.

Methodology

The methodology for addressing the aim of this paper, to find sustainable design solutions that can be incorporated into the heritage conservation context, began with research into current literature, governmental building regulations/ recommendations and existing case studies that address the issue of combining heritage and sustainability.

Following this research, key issues and considerations were able to be outlined that form a guideline for assessing the viability of proposed sustainable design solutions. The performance of the Melbourne City Baths was studied through the use of current utility data, building plans, Integrated Environmental Solution (IES) VE-6.4 modelling and consultations with the management and engineers from the building and the City of Melbourne. Proposals for sustainable design solutions that could be retrofitted into the existing building were then researched, modelled and discussed with the City of Melbourne and refined based upon their viability in relation to the three factors identified previously of heritage conservation, sustainability and occupant satisfaction.

Limitations

Many limitations were found during this study of the Melbourne City Baths, which are most likely relevant to other heritage buildings. This included the lack of or poor condition of documentation detailing the existing building conditions mostly due to numerous changes in ownership and ongoing maintenance and repairs of the building which result in lost or redundant plans. Therefore, a number of assumptions have been made during the analysis of the current conditions and analysis of proposed conditions. These assumptions were mostly based upon consultations with the City of Melbourne and the building managers to ensure their viability and have been outlined in the paper.

Other limitations include both financial and social restrictions upon the ability to utilise some of the more innovative and unusual solutions. This mostly regarded the business case scenarios which may have placed the City Baths at a disadvantage to the competing recreational centers nearby.

The Melbourne City Baths - Background

The city baths are located on an isolated city block on the Northern side of the Melbourne CBD. It is a triangular site with facings on Swanston Street, Franklin Street and Victoria Street. It is a three storey building across a 3° slope with approximately 250m² usable floor area below ground level. First opened on 9th January 1860, the city baths provided a public wash house and one swimming pool for Melbourne in a time when few people had a fresh water supply in their own homes. Over its lifetime the baths have fallen into various states of disrepair. The first occasion, prompted demolition of the original building and the construction of what is primarily the current building completed in 1904.

The 1904 building was designed by JJ Clarke, a prominent Melbourne architect who also designed the treasury building. JJ Clarke's original design was carefully articulated to provide separate Men's and Women's bathing and separation between first and Second class bathing between what is the current Sports Medicine Clinic and the Main Pool entry. As Melbourne progressed it was more common for people to have bathing facilities in their own home, so the Baths became a recreational facility. In the period between 1904 and the 1980's the main pool gallery was added, heating was added to both pools, a chlorinated pool filter system was added, mixed bathing was introduced and the central wall and separate entrances for men and women were removed and a cafe, clothes lockers and dressing rooms added.

By 1981 the pool had once again fallen into disrepair, the Builders' Labourers' Federation provided the opportunity for a plan of restoration and development to be implemented. This restoration included the addition of 6 squash courts, a gymnasium, public spas and saunas, lounges, sun deck, eating facilities and a sports medicine clinic. In 1983 the newly restored baths were reopened comprising of what are predominantly the current conditions.

In 2011, a new boiler replaced the old one to provide hot water supply to the entire building and heat the two swimming pools. Currently, the Melbourne City Baths is a sports and recreation centre open to the public with a 30 meter swimming pool and a 16 meter swimming pool. It contains several group fitness rooms, two sets of change rooms for men and women, 2 squash courts, a gymnasium, weights room and spa/massage facilities. The lower level of the building contains a physiotherapy clinic and a retail outlet for footwear.



Figure 1. The Melbourne City Baths, view from Swanston St

The figures supplied by the Melbourne City Baths show that between beginning of July 2011 and the end of March 2012, 251,068 people used the facilities at the City Baths. This is equivalent to an average of 913 people per day or about 65 people per hour. Fluctuations in the occupancy rates throughout a typical day are shown in Figure 2, this is based upon the group fitness timetables and demonstrates that the use of the facility generally fluctuates with the beginning and end of the average work day. The participants in the mid morning classes are mostly elderly. The operating hours for the city baths are Monday to Thursday: 6am to 10pm, Friday: 6am to 8pm, Saturday and Sunday: 8am to 6pm (daylight saving 8am to 8pm).

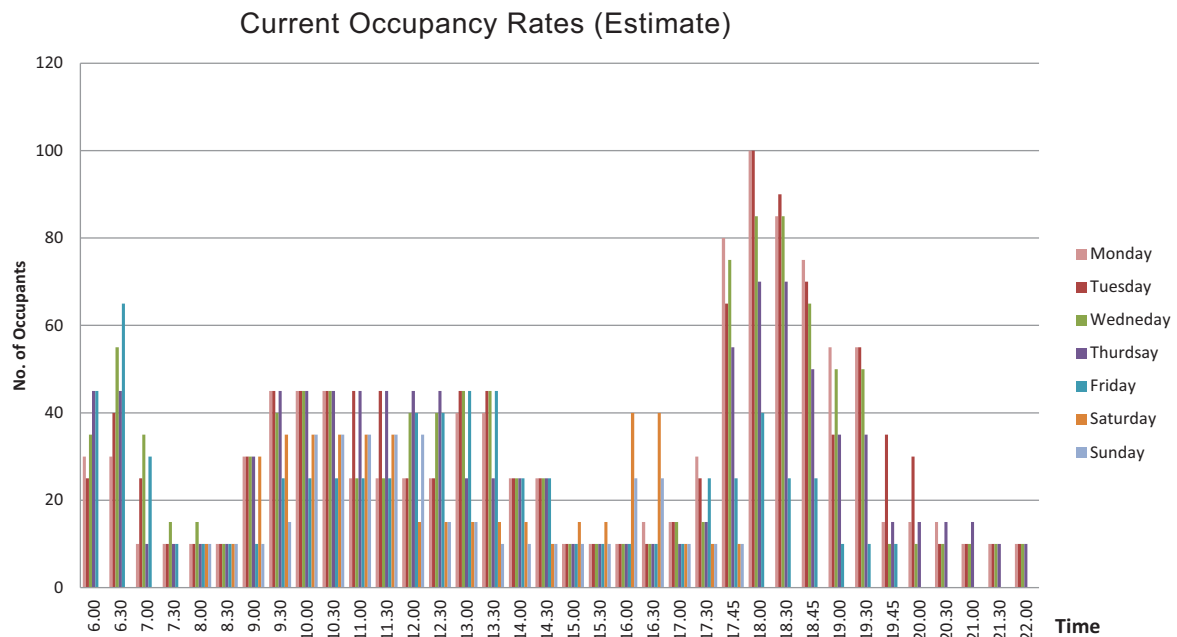


Figure 2. Patterns of Occupancy at the Melbourne City Baths derived from group fitness timetable

Existing Conditions - Current Performance assessment

Depending on the building type, Green Star and NABERS are performance rating tools that can help to assess the efficiency of the building systems and identify areas within the building where further initiatives can be taken. However, rating tools for Swimming Pool Facilities do not yet exist, therefore, the assessment of the current performance of the building relies upon feedback from staff and clients and an understanding of the current building systems, energy usage, maintenance and assessment using complex building modelling such as IES. Heritage buildings are required to meet minimum performance requirements outlined in the BCA, as described by the DPCD Heritage buildings and energy efficiency notes (2009, p. 1) this may *'require imaginative design solutions to retain their cultural significance, it is possible to develop alternative design strategies to the BCA prescriptive measures provided they meet the required level of performance.'*

Staff and client feed back:

- There are large expanses of roof glazing that allow heat to be transferred out of the pool areas in winter
- A lack of natural ventilation and inadequate thermal control throughout the Foyer and Personal Training Area, Gymnasium and weights areas, results in air conditioners running continuously and inefficiently. These areas also lack heating in winter, which is required for comfortable exercising.
- The Main and Minor Pool areas have too much air flow entering through poorly sealed and open windows and through the doorways from the foyer. The pool areas need to be maintained at approximately the same temperature as the pool temperature with a controlled air speed to reduce wind chill, but need a relatively high degree of air changes to reduce sense of stuffiness from warmth and humidity.

Analysis of Building Systems, Utility consumption and results from Complex Building Modelling:

- There are already some important thermal control systems in place at the City Baths, however, there is an obvious gap in the staff's understanding of how these systems would operate most efficiently and their current management of the building. For example, there is currently a heat wheel which converts heat energy from exhaust flue into warm air to heat the pool areas, however, the pool areas are continuously open to the external environments losing all of the heat gained in this process.
- High volumes of water and energy are consumed keeping the two swimming pools (600,000L of water) at 29 and 30°C as can be seen in table 1. Issues to be addressed are heat loss to evaporation, water loss to evaporation and systems for improving overall efficiency. The current boilers were replaced recently and claim to be 97% efficient therefore it is assumed that these boilers need not be changed.
- The overall thermal efficiency of the building requires upgrading including improving the thermal performance of the building fabric and efficiency of the HVAC operating system. This includes issues such as zoning, automation and a degree of natural ventilation. Essentially this is to address the issue of carbon emissions and energy consumption, but also the occupancy satisfaction.
- Large volumes of water are also used in the four change rooms for showers and toilets. There is an opportunity to improve the building's passive energy performance, specifically the domestic water consumption for showers and toilets and improving rainwater collection and utilizing the large expanse of roof for solar hot water.

Utility	Annual Consumption (2011)	Average Rate	Cost
Electricity	670,617 kWh	\$0.112/ kWh	\$75,129
Gas	4,785 GJ	\$6.30/ GJ	\$30,149
Water	7,272 kL	\$ 3.10/ kL	\$22,575

Table 1. Current Utility Consumption base year (Information sourced from City of Melbourne)

Retrofitting possibilities - Swimming Pools and Enclosures

Maintaining the temperature of the swimming pools and their enclosures was identified as one of the most energy intensive functions of the Melbourne City Baths. Under current conditions large volumes of water and energy are consumed maintaining the pool temperature and the thermal conditions in the pool enclosures.

Maximizing the efficiency of both the pool water heating and pool enclosure heating systems requires a degree of synergy between the two systems. Ideal conditions for the pool water are 29°C for the large pool and 30°C for the smaller pool. Ideal thermal conditions for the pool enclosure maintain the air temperature at or slightly above the pool water temperature. This minimizes heat loss due to evaporation from the pool water and ensures comfort for the swimmers. It is also necessary to ensure that fresh air is introduced into the pool area, specifically the larger pool area, where aerobic activity is more intense, however high velocity air movement should be avoided to reduce wind chill and evaporation. Ensuring that the required conditions are maintained and operate as efficiently as possible will ensure both environmental and economical sustainability, most importantly maintaining occupancy comfort and satisfaction allowing the facility to remain competitive.

Under current circumstances the pool is mostly left uncovered overnight, even though there is a cover for the small pool, this results in additional energy wastage due to unnecessary heat loss from the pool water. A pool cover has not been installed in the larger pool area due to issues of storage and preservation of the heritage gallery surrounding the pool. Maintaining the optimum levels of fresh air and temperature in the pool enclosure are often compromised by managerial decisions based on a perceived level of comfort and maintaining security. This includes leaving doors and windows open from the pool enclosure onto the adjacent foyer and external conditions. It has been observed that a major cause of inefficiency in the existing systems has been a lack of understanding of the optimum operating conditions by members of staff.

The existing mechanical systems for both pool heating and enclosure heating are relatively efficient. This includes a recently installed high efficiency condensing boiler which heats the water for both swimming pools and the domestic hot water supply. To heat the pool enclosures a thermal recovery heat exchange wheel extracts heat from the exhaust to heat fresh air which is transferred into the pool enclosures through ventilation under the windows. Unfortunately, the heat wheel is currently faulty and scheduled for refurbishment, assuming that the heat wheel will be restored to service the existing mechanical systems should be highly efficient.

Even with a highly efficient mechanical system, there are still a number of sustainable design solutions that can be implemented to supplement and improve the efficiency of the overall system. These include:

- Introducing the use of 'Thermal Shield' thermal pool blankets from to cover both of the pools when they're not in use.

This can save 1.5 Olympic swimming pools of water and almost 38 tonnes of Carbon Dioxide emissions a year. The installation and storage of the thermal blanket in the large pool must take into consideration the heritage gallery, seen in figure 3.



Figure 3. Main pool, taken from the heritage protected gallery

- Upgrading the existing building fabric to improve thermal performance of the roof and walls. This includes sealing the windows and insulating the roof. The building has significant heating requirements for the pool areas. These solutions provided substantial benefit to the comfort levels in the pool areas and could reduce carbon emissions by over 100 tonnes seen in figure 4.

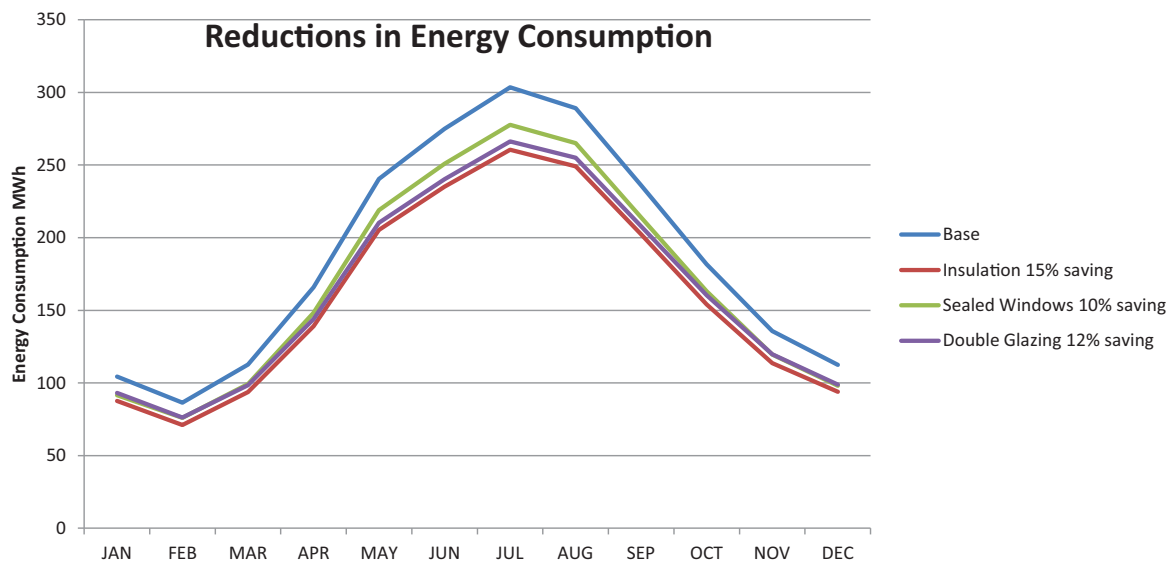


Figure 4. Comparison of reductions in energy consumption in the building for different building fabric upgrades.

- Exploring the potential for Cool Roofs. This requires painting the roof of the building with a highly reflective paint such as 'Thermoshield' in order to reduce the amount of heat gained through solar penetration in the building and reduce the urban heat island effect (significant at the City Baths due to large areas of bitumen). Results demonstrate that there was minimal gain from a cool roof at the city baths, this is mostly due to the heating requirements of the pool areas and did not include the benefits gained for the urban heat island effect.

- Reducing unwanted air infiltration by introducing separation between the pool enclosure and its adjacent zones. This will reduce fluctuations in the temperature in the pool enclosure and reduce heat loss from the pool water due to evaporation as well as improve comfort levels. This is explored further in the next section.

Retrofitting possibilities - Heating, Ventilation and Air Conditioning

Excluding the previously discussed swimming pool enclosures, most of the building requires some degree of cooling during warmer periods and heating in cooler periods. Two types of zones have been identified in these parts of the building they are the areas where high intensity physical exercise is performed and the transitional or circulation spaces throughout the building. In the zones where physical activity occurs, such as the personal training studio, gymnasium and group fitness rooms, space conditioning needs to provide precise thermal comfort conditions for high levels of activity. In contrast, the circulation and transitional zones, such as corridors, the lobby and reception, can provide a much more flexible level of space conditioning as less time is spent in these zones. These two types of zones have different thermal requirements yet they are poorly zoned and separated from each other resulting in an inefficient system and occupant dissatisfaction. The heating and cooling systems in these areas compete with each other, the adjacent spaces and the external conditions reducing their ability to operate efficiently.

Physical activity zones

Under current conditions areas such as the personal training studio, cardio and weights areas and the group fitness areas have a variety of different HVAC systems to control thermal conditions. These areas are spread throughout different parts of the building and each have different building fabric conditions. The areas of main concern are those which require continuous thermal control during opening hours such as the personal training studio and the cardio and weights areas. These areas are continuously occupied although they have varying degrees of occupancy throughout the day. They are poorly zoned areas which are generally connected to the circulation areas of the building and in some parts to external conditions. The cardio and weights areas have a particularly poor building fabric reducing the HVAC efficiency and comfort levels. The group fitness areas are generally better zoned and have individually controlled units for cooling. The following solutions are proposed for the physical activity zones:

- Reassessment of the appropriate thermal conditions to suit indoor physical activity zones. This is explored in the VIS apparent temperature study and may allow the cooling requirements to be reduced in relation to relative humidity in the personal training area. This could minimise the loading on the existing system by broadening the acceptable temperature range. The study suggests that controlling the humidity is key to broadening the temperature demand on the cooling system, this could be controlled by the coolerado system discussed below.

- Installation of a more efficient cooling unit such as a 'Coolerado' cooling system. This system could replace or supplement an existing cooling system to reduce energy consumption by up to 90% saving up to 26 tonnes of CO₂ emissions annually. The system can provide cooled air without adding humidity, but it does not remove humidity from the outside air, so in the hotter and more humid months it may not be a suitable solution for areas of high physical activity.
- Introduce new zoning or provide management strategies for the closure of existing doors to improve efficiency of the existing systems. This is explored further below.

Retrofitting possibilities - Circulation and Transitional Spaces

The original design of the entrance, reception and lobby areas of the building was quite different from the present conditions. The reception and entrance area was originally divided into two with two entrances one each for Men and Women and the lobby and personal training area between the two pools was an open air courtyard with an arcaded perimeter. The alterations to form the present conditions occurred between 1908 and the 1980's and remain in the heritage listed part of the building. These areas of the building, excepting the personal training area, have perhaps the most potential for reinstating the original functioning scope of the building. They are areas where the occupants would place less value upon comfort and may therefore have a greater potential for reducing the comfort expectations.

As with the Entrance Foyer and reception areas, the circulation spaces throughout the building are not key areas for thermal control. These areas therefore have the most scope for minimizing or in some cases eliminating the need for a HVAC system. By separating these areas from the more important areas of the building they can act as air locks or insulating barriers between the highly controlled environments and external conditions. The following solution proposes new zoning as mentioned in the previous two sections.

- More efficient use of zoning such as closing doors, such as the entrance seen in figure 5, would make a significant difference to the running costs of the building and could save up to \$20,000 annually. Additionally, installation of some internal partitions would ensure greater control over these running costs, as well as improved thermal comfort. The construction of air locks and zoning reduces the amount of cooling required by up to 80% as seen in Figure 6.



Figure 5. Entrance to the Main Pool from the foyer with doors open

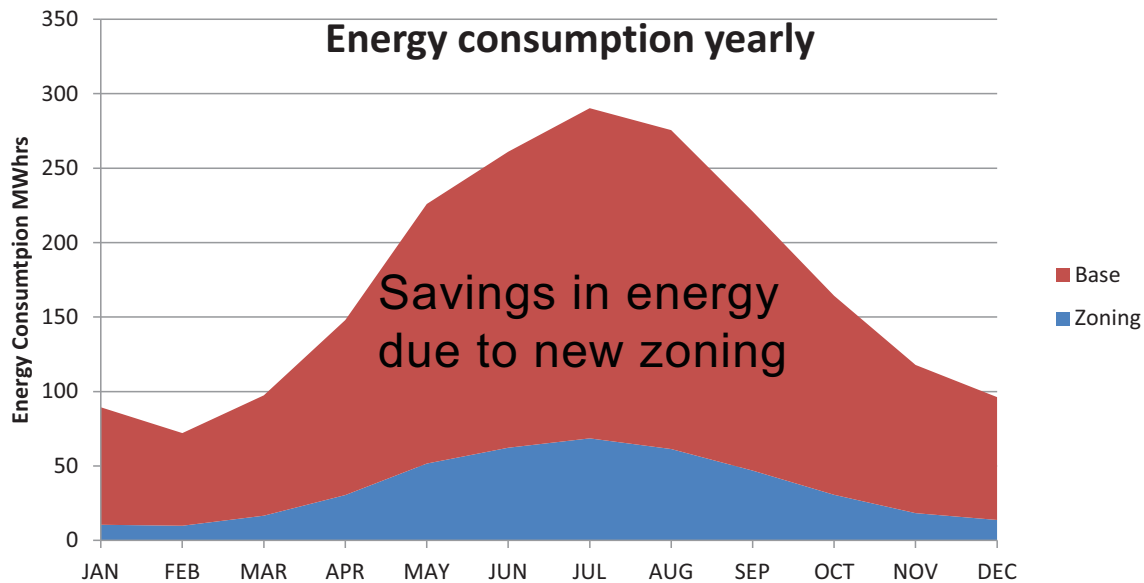


Figure 6. Energy consumption before and after the rezoning.

Retrofitting possibilities - Roof space - solar and water

There is a significant area of inefficiently used roof space above the building including North facing roof area. The roof area provides an opportunity for the building to become better integrated with its surrounding ecosystem as well as increase the potential for creating a carbon neutral environment. Under current conditions, the facility provides toilet and shower amenities for an average of 915 people per day. The water for this is sourced entirely from the mains system and hot water provided by the gas boiler.

The roof currently consists of a number of structural systems, varying from the very visible red corrugated iron to less visible flat roofs above the newer parts of the building. The red corrugated iron above the heritage listed part of the building could create limitations when altering its appearance. The roof space has great potential to improve the amenities in the building, the sustainable design solutions explored were:

- The installation of a solar hot water system, such as an endless solar evacuated tube system, to supplement the current boilers and provide hot water for the changing facilities. Unfortunately, the installation of solar hot water even if it is only to provide domestic hot water is not a sustainable option for this building. The benefits of a solar hot water system would most likely be appreciated better if the building had an inefficient existing boiler and used a smaller volume of hot water.
- The installation of rainwater collection tanks to provide water for toilet flushing or watering new green spaces and reduce the amount of storm water runoff into the surrounding ecosystem. Unfortunately, the amount of rainwater that can be harvested from the roof area only covers 18% of the water required for toilet flushing and tank installation is expensive. However, smaller tanks could be installed around the site to irrigate small green spaces improving the interaction of the site within the ecosystem and having the potential to improve thermal control in parts of the building through shading.

Summary Retrofitting Solutions

The following table summarizes the retrofitting possibilities considered in this report. The City of Melbourne currently desires a 6 year payback period, therefore solutions that will take longer than 6 years are likely to be considered unsuitable.

	Tonnes of Carbon saved annually	Payback Period	Other annual Benefits & Savings
Pool Cover	37.8	3.75 Years	333,277L water
Roof Insulation	60	3.2 Years	13 Cars off the road
Sealing windows	39	10 Months	9 Cars off the road
Double Glazing	48	7 Years	11 Cars off the road
Cool Roof	39	9-13 Years	8.5 Cars off the road
New zoning	226	1 Year	107 Cars off the road
Solar Hot water	19	41 Years	4 Cars off the road
Rainwater Harvesting	-	14 Years	280,150L water
Coolerado	14.8-26.6	2-3 Years	3-6 Cars off the road

Table 2. Summary retrofitting possibilities

*Cost of Materials and installation were estimated using Rawlinsons, Australian Construction handbook.

Discussion

The Melbourne city baths has a unique situation for a heritage building in terms of the function and comfort levels required from the building. As previously discussed one of the most energy intensive areas of the building revolves around the two swimming pools. This is a particularly unusual situation as the comfort of the people using the pool relies on high temperature and humidity which directly contrasts with the comfort requirements in the adjacent areas. The results show that one of the most dramatic improvements in reducing the energy consumption at the City Baths is to rezone the building, ensuring adequate separation between the areas with different comfort requirements. This reveals a lot about upgrading heritage buildings for sustainability because simple improvements in the management of the building could make large differences in the performance and comfort levels throughout the building.

An improved management strategy for the city baths would include:

- Educating the staff so that they understand the most efficient way for the building to run, including an understanding of the desired levels of humidity and temperature in the pool area for comfort and reduced heat loss to evaporation.
- Utilization of the existing pool blanket and installing one for the main pool
- Ensuring doors between all zones are kept closed and closing windows when necessary
- Ensuring regular inspections and maintenance are carried out on vital mechanical systems, such as the Heat wheel to maximise the efficiency and synergy of systems.

In addition to understanding the importance of managing the existing conditions in the building, it is also important to understand the value of the existing systems in the building. For example, the existing boiler runs at almost 100% efficiency, this meant that the cost of installation and volume of water that can be supplied by a solar hot water system did not prove to be economically sustainable. In contrast, the existing split system in the foyer is old and inefficient so replacing it with a coolerado system is both environmentally and economically sustainable. So while the initial urge is to replace all systems with an environmentally sustainable alternative, the most sustainable choice was to maintain some of the current systems.

The Melbourne City Baths, like many heritage buildings, is built with its own degree of '*passive survivability*' (Carroon and Moe 2010, p.10) this refers to the passive features of the building that were built in before buildings relied upon electricity to control them. To a degree these help the performance of the building such as the thick brick cavity walls, high ceilings and timber window frames, however, the function of the building has evolved over time. Initially, the swimming pools would not have been used during the winter months and the current issues of reducing heat loss through the building fabric would have been less of an issue. The foyer and lobby area would have been open to cross ventilation with an internal courtyard reducing the cooling load in summer. Unfortunately, this change in function means that there are some retrofitting solutions that will require alteration of the building fabric. There are significant benefits gained from installing insulation and improving the windows as discussed previously sustainable retrofitting it is about finding a balance between complete preservation and complete retrofit. It is essential that the building can maintain a competitive service for economical sustainability, therefore the decision to upgrade the building fabric should be based upon the improvements in occupancy comfort and the ability of the building to maintain a high standard of facility.

The business case scenario, that is the payback, maintenance requirements and disruption to the facilities that come with each proposed solution, was a driving factor for the City Baths which is highly dependable on customer satisfaction. This perhaps differs from other heritage retrofits where a building is used as office facilities or other purposes that the tenants are willing to sacrifice a degree of comfort to reduce carbon emissions and maximise the passive qualities of a heritage building. As a result the potential for installing innovative technologies which are generally more expensive is reduced. Discussions with the City of Melbourne narrowed down the scope of this research and there were some sustainable retrofitting possibilities that were considered economically unsustainable prior to this study, but may have been suitable in another situation, these included:

- Natural ventilation utilizing an existing void as a thermal chimney.
- Installation of a natural pool - also unsuitable due to lack of space.
- Automated window opening.
- Installation of hydronic floor heating in the pool areas to utilize the return heat from the pool water.
- Installation of people powered gym equipment such as treadmills to power

televisions.

- Installation of a grey water treatment system, also an issue due to lack of space.

Conclusion

The aim of this project was to investigate the possibility of combining sustainable design solutions into the built heritage context. This research has revealed that there is scope for improving the occupancy satisfaction of heritage buildings whilst maintaining heritage sustainability and improving the building systems synergy. Whilst, the study of the current performance of the Melbourne City Baths demonstrated a wide range of areas where innovative green technologies and strategies could be implemented, this study has shown that heritage sustainability is as much about reducing carbon emissions as it is about maintaining revenue and sustaining building image. The Melbourne City Baths is an iconic heritage building and maintaining economic sustainability through more conservative retrofitting solutions will ensure longevity of the building and its appreciation by future generations.

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Images

Figure 1. Photograph, The Melbourne City Baths, view from Swanston St, Annie Harrison, 2012

Figure 3. Photograph, Main pool, taken from the heritage protected gallery.
Source: <http://sydneyearlydailyphot.blogspot.com.au/2008/05/melbourne-city-baths.html>

Figure 5. Photograph, Entrance to the Main Pool from the foyer with doors open, Annie Harrison, 2012

Healthy cities, climate change and the role of high albedo surfaces and green infrastructure

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Healthy cities, climate change and the role of high albedo surfaces and green infrastructure

Abstract

The Urban Heat Island (UHI) is the city area which microclimate is warmer than the surrounding country areas. In Melbourne this difference has been recorded at around 3-4 degrees Celsius. The situation is exacerbated during extreme summer heatwaves, when vulnerable sections of society may be exposed to heat stress or heat stroke conditions. In Europe in 2003, over 26,000 deaths were attributed to that summer's heat wave. During Melbourne's heatwave of February 2009 there were 374 'excess deaths' reported.

Recent research at the University of Melbourne Burnley campus has shown that a combination of urban trees, green roofs and high albedo (reflective) roofs can both directly reduce the contribution to the UHI effect of our buildings and indirectly mitigate climate change by reducing building energy use. If these results are also seen through the latest biophilic research, which links mental and physical health to access to nature, it becomes clear that implementing an urban green infrastructure not only helps to reduce human exposure to heat stress but also supports a healthier city.

Keywords: *urban heat island, biophilia, green walls, green roofs, high albedo treatment*

INTRODUCTION

The Urban Heat Island (UHI) is the city area which microclimate is warmer than the surrounding country areas. In Melbourne this difference has been recorded at around 3-4 degrees Celsius (Coutts *et al.*, 2008). The situation is exacerbated during extreme summer heatwaves when vulnerable sections of society may be exposed to heat stress or heat stroke conditions. In Europe in 2003, over 26,000 deaths were attributed to that summer's heat wave. During Melbourne's heatwave of February 2009 there were 374 'excess deaths' reported (QUT, 2010).

Recent research at the University of Melbourne Burnley campus has shown that a combination of urban trees, green roofs and high albedo (reflective) roofs can both directly reduce the contribution to the UHI effect of our buildings and indirectly mitigate climate change by reducing building energy use. If these results are also seen through the latest biophilic research, which links mental and physical health to access to nature, it becomes clear that implementing an urban green infrastructure not only helps to reduce human exposure to heat stress but also supports a healthier city.

This paper presents the benefits of the initial shading research (Livesley *et al.* 2011), the green roof research (Chen and Williams 2009) and the high albedo roof research. The 'connection to nature' benefits have not been reported here, but are mentioned as part of the context of potential benefits.

BACKGROUND

The Urban Heat Island (UHI) effect refers to the phenomenon of a metropolitan or built up area that is significantly warmer than its surrounding areas. Apart from the health impact from individual events there are long term effects, for example today's downtown Los Angeles has been measured to be 2.5°C warmer than in the 1930's, which equates to 1 – 1.5 GW of electricity. As we use more electricity to cool in summer, this equates to an extra \$100 Million per year (Akbari 2008).

The UHI effect can be detected throughout the year, but it is of particular public policy concern during the summer. The higher surface and air temperature is associated with increases in electricity demand for air conditioning, air pollution, and heat stress-related mortality and illness (Rosenfeld *et al.* 1995; Nowak *et al.* 2000; Sailor *et al.* 2002; Hoggrefe *et al.* 2004). According to the U.S. Centre for Disease Control and Prevention, over the past 20 years, more Americans were killed by heat than by the combined impact of hurricanes, lightning, tornadoes, floods, and earthquakes. Within a five-day period, the 1995 Chicago heat wave killed between 525 and 726 people (Akbari 2008). As such, the UHI effect is a very real and serious problem facing developed areas.

In areas that suffer from the UHI effect, the temperature difference is usually larger at night than during the day and is most apparent when there is little wind. The UHI occurs because some of the materials that cities are built of hold onto the heat of the day, specifically bitumen roads, concrete, bricks and other construction materials. These materials often have a low albedo, being a dark colour, and therefore absorb more solar energy to add to this thermal lag. In relation to pollution, the UHI effect decreases air quality by increasing the production of air pollutants such as ozone (Taha *et al.* 1994). Further, the UHI effect has been linked to changes to local weather patterns including rainfall and pressure systems, resulting in a reduced removal of these air pollutants. For example, rainfall is greater downwind of cities, partially due to the UHI effect.

Mitigation of the UHI effect can be accomplished through the use of trees, green roofs and the use of high albedo or lighter surfaces in urban areas. The vegetated options absorb solar energy and evapotranspire while the high albedo surfaces reflect more of the solar energy and absorb less heat. Comparing mitigation options such as increased vegetation, higher albedo surfaces and higher albedo pavements (Rosenzweig *et al.* 2009), the influence of vegetation on urban climate is more important than the influence of the albedo of built surfaces. That is, for a similar effect on the UHI, we only need to plant trees in 7% of the city's area, as compared to raising the albedo of 48% of all the city's surfaces. Yet both are solutions to be applied as they are cumulative and vegetation cannot be used in every situation.

Previous high albedo studies

There have been several studies using both field measurement and computer simulations that document the energy savings from increasing the solar reflectance properties of building surfaces, combined with an increased thermal emittance. These show that the higher the solar reflectivity a roof colour is, the lower the solar radiation is absorbed, and therefore the lower surface temperature will be (Kiehl and Trenberth 2010). In summary they have shown cooling energy savings between 5-

25% depending on building type (Akbari and Konopacki 2005). The same researchers in 2001 found an average decrease of 24°C in surface temperature, an 11% decrease in aggregate air conditioning energy consumption, and a corresponding 14% drop in peak electricity demand. Other relevant field studies in California and Florida have demonstrated direct cooling-energy savings in excess of 20% upon raising the solar reflectance of a roof to 0.6 from a prior value of between 0.1 and 0.2. Energy savings are particularly pronounced in older houses that have little or no attic insulation, especially if the attic contains air distribution ducts for ducted heating and cooling. Further, Akbari *et al.* (1997) observed cooling-energy savings of 46% and peak power savings of 20% achieved by increasing the roof reflectance of two identical portable classrooms in Sacramento, California.

Previous urban trees studies

There have been several key studies investigating the cooling energy savings achieved through tree shade (Simpson and McPherson, 1996; Akbari *et al.* 1997; Donovan and Butry, 2009; Pandit and Laband, 2009). These studies document the impact of tree shade on the cooling energy demand through small-scale empirical data collection, large-scale modelling and large-scale surveys. Akbari and fellow researchers (1997) measured seasonal cooling of two full-scale residential buildings provided energy savings of up to 30% (4 kWh per day) and estimated peak power demand savings of 0.7 kW for each of the houses. Simpson and McPherson (1996) reported that shading on the west side of houses showed the highest reduction in cooling energy demand and that adding two shade trees on the west would reduced annual cooling costs for the house by between 10-50%. Pandit and Laband (2009) through a broad survey of 160 households in Auburn Alabama and economic analysis of behavioural energy use estimated that 50% shade could reduce power use by almost 20% in a “typical” residential house. Similarly, Donald and Butry (2009) used energy bills from 460 households in Sacramento, California alongside their levels of tree shade to estimate that tree shade was reducing electricity use by 5.2%.

Previous green roof studies

Green roofs are defined as roofs which support planted vegetation. Demonstrated benefits include reduced peak runoff of roof water, aesthetically pleasing cityscapes, longer roof life, provision of biodiversity habitat, reduced building energy use and a reduction of the urban heat island effect (Banting 2005, Oberndorfer 2007, Dunnett and Kingsbury 2004). For example, a Canadian study found that a green roof reduced daily energy use during summer by 75-90% compared to a reference roof (Bass and Baskaran 2003).

Biophilia

Biophilia is a concept first written about by Harvard biologist Edward O. Wilson in his book by the same name (1984). He argued that human beings have an innate and evolutionarily based affinity for nature. This has been taken up by three key academics, Stephen Kellert an architect, Esther Sternberg a MD and Judith Heerwagen a psychologist. Between them they have developed the medical and psychological evidence that underpins biophilia and the design strategies for its application.

A summary of some of these benefits was provided by who identified 16 international case studies linking access to the natural environment to improved health outcomes, including reductions in headaches, colds, Sick Building Syndrome (SBS), and patient length of stay (Loftness 2006). Beyond the health benefits, ten international case studies demonstrate that access to the natural environment increases individual productivity between 3-18% and reduce absenteeism between 9-71%, while eight studies indicate over 50% (each) lighting and HVAC energy savings. From an environmental standpoint, biophilic features foster an appreciation of nature, which, in turn, should lead to greater protection of natural areas, eliminate pollution, and maintain a clean environment.

METHODS

The Burnley campus of The University of Melbourne is located in eastern metropolitan Melbourne on the southern bank of the Yarra river (Figure 1). Mean annual rainfall is 681 mm, mean minimum temperature 8.9°C and mean maximum temperature is 19.9°C. Three air-conditioned ('thermostat set to achieve 21°C ±1°C in summer and winter using Midea 2.5kW splitplplit heat pump system) single-room dwellings (3.2 x 3.7 x 3.3 m) were instrumented with heat flux sensors (HFS4, Omega Pty Ltd, USA; thermal resistance = 0.004°C W⁻¹ m⁻²) on all walls, ceiling and floors to directly and continuously measure heat transfer rates (buildings A, B and C shown in Figure 1). The white roofs (buildings D and F) and the Green Roof (building E) do not have air-conditioning.

The test buildings are of a lightweight construction typical of Australian housing, and insulation levels are indicative of the 1991 minimum building standards (approx R1.0 walls and R0.82 ceilings). The un-insulated timber floors and the absence of weather strips to doors resulted in an assumed infiltration rate of approximately 2 air changes per hour (ACH). The doors and windows were always closed with the exception of those times when access was required for installation and maintenance of equipment. Blinds were installed to North facing windows in order to mitigate direct solar radiation on sensors which produces misleading sensor output. The new buildings (G, J and H) were built to the BCA code 2010, with R3.5 in the ceiling and R2 in the walls with weather stripping.

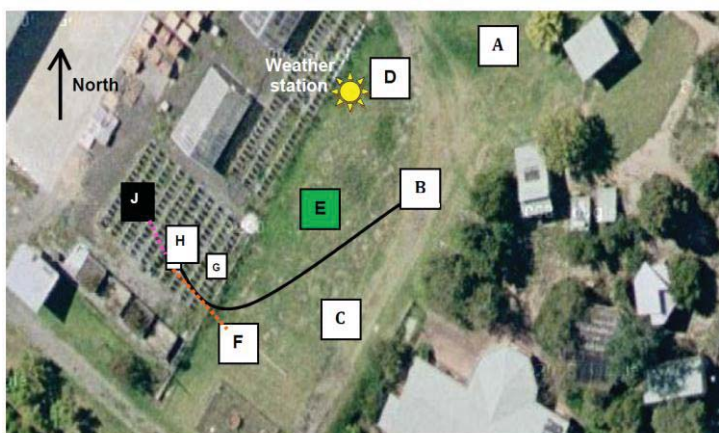


Figure 1 – The site; A-F: full scale buildings 11m², G: 1/3 scale building and J & H: ½ scale buildings

The buildings were placed so as to not shade each other between 9 am and 3 pm in winter and are placed on turfed ground. On the western wall of all three buildings, an infrared thermocouple (OS36, K type, Omega Pty Ltd, USA) was installed 0.8 m from the wall at a height of 1.5 m. Heat flux sensors were attached to the inner wall (within the wall cavity between the insulation batts and the plasterboard) using epoxy resin. The infrared thermocouples and heat flux sensors were logged continuously at 20 second intervals using a Datataker DT85 (Datataker Pty Ltd, Australia) linked to the internet and an 80 W laptop computer. Supporting climate data (total solar radiation on horizontal plane, wind speed & direction, ambient air temperature, ambient air relative humidity, rainfall) was collected from a weather station (Hobo Pty Ltd, USA) mounted to Building B (later moved). The air conditioner was manually switched from heating to cooling in early Spring 2010, and from cooling to heating in early Autumn. Building lights are always off, windows always closed and internal blinds fully drawn. Door use is minimised, and shut when researchers are inside.

High albedo and green roof study (buildings D, E, F, G, H and J)

This component of the study was based on two concurrent testing methodologies. The first was installation of full-scale three single room buildings (and one 1/3 scale building) at the University of Melbourne's Burnley campus in Melbourne, Australia. Two of the full scale buildings and the 1/3 scale building are painted with proprietary reflective white cool roof paints (CRP), and the third building is left unpainted as a control and later converted to a green roof.

The second method was a computer simulation of the physical experiment using TRNSYS software package. While these methods ran concurrently, precedents set by Akbrai *et al.* (1997) suggested that simulated and measured data tend not to be the same but are rather implicit of trends. To make the computer model more realistic the measured data was used to calibrate the input data to the model to ensure better correlation and more liable prediction and sensitivity analysis.

Shading trees study (buildings A, B and C)

Two buildings were flanked on the north and west walls by trees, i) nine 3.5 m tall evergreen Eucalyptus sideroxylon trees in 75 L pots (building A) ii) nine 4.0 m deciduous Fraxinus excelsior trees (building C). The third building (B) was the control and had no tree shade. Tree water use was measured continuously for one of both species using two lysimeter balances (300 ± 0.05 kg capacity). It was expected that the trees would provide small, but significant, reductions in north/west wall thermal loads and heat transfer, but not shade the roof. Trees were automatically irrigated for 2 minutes every Tuesday and Friday at midnight. Pots were kept weed free and covered with coarse porous gravel to minimise surface evaporation. All pots were placed on paving slabs to prevent root exproation outside of the pot.

RESULTS

The data from the green roof in this study is still being collected and analysed, but preliminary results show that there was very little reflected solar radiation measured from the green roof, while internally the room was up to 4°C cooler in summer. In winter the internal temperature also stayed a little warmer. Also there was significant less variation in temperature in the building with the green roof than the white and control roofs. This was not as marked as expected dues to the small size of the

building and therefore the large comparative wall surface area. This is in line with earlier research carried out by Chen and Williams (2009), showing a decrease in internal temperature due to the green roof leading to potential energy savings of 48% if the space under the green roof is air-conditioned to 24°C.

The white roofs decreased internal temperature by up to 4°C, but more prominently the roof temperature could be up to 40°C cooler while the radiation off the white roof up to a factor of 3 greater. That is up to 500 W per m² of heat reflected from the roof on a mid thirties degrees Celsius day.

The shading trees research showed that on a warm, high solar radiation day the shaded wall can have a reduction in thermal load of up to 36%, from even this thin *Fraxinus* canopy in comparison to no tree shade. In the 10 days of data analysed for December 2010, the temperature reductions from *F. excelsior* shade ranged from 4 to 36%, whereas the reductions from *E. sideroxylon* shade ranged from 2 to 22%, in comparison to no tree shade. Internal wall heat flux closely mirrors the general patterns seen in external wall surface temperatures. In December, there is large inward heat transfer rate on high solar radiation days, when surface wall temperatures exceed 40°C. Inward daytime heat transfer rate is approximately halved by the *F. excelsior* shade.

This study also demonstrated that this cooling load reduction and potential energy saving benefit also comes at a small water cost. It showed that the water cost were met through rainfall inputs with a little summer irrigation support. At the rates of tree water use observed over 10 days in December 2010, three months of irrigation at 3.8 L per day would require 357 L. Assuming a kilolitre (1000 L) water cost of approximately \$1.00, this is no cost at all, unless of course potable water reserves are perilously low.

CONCLUSIONS

This study has shown that even moderate tree shade can provide considerable cooling load reductions at the time when they are most needed. It has shown that green roofs and white roofs reduce contribution to the UHI effect and reduce cooling energy requirements. All of this will result in a reduced impact on climate change. Finally, there are also potential psychological and physical benefits to people if the green options are used, through biophilia, though this needs further research.

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The Caboolture Hub
Case Study - Building Social Infrastructure



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Abstract:**Case Study – The Caboolture Hub – Building Social Infrastructure**

The Caboolture Hub project developed a significantly expanded and improved council Library, Regional Art Gallery and new Learning and Business Centre. The combination of all three elements under one roof in the heart of Caboolture aspired to increase community participation in learning and cultural contact. Since opening, attendance and bookings indicate that the building is being welcomed by the community and promises to deliver social outcomes beyond the expectation of the community.

The design team embraced the desire to deliver a building beyond the ordinary with a commitment to delivery of quality spaces and contemporary design. This reflected the design team's belief and confidence in the resurgent Caboolture community. In addition, the project was designed to reinvigorate a tired and lifeless civic heart via major urban design initiatives. The challenges faced by the team to exceed client and community expectations are discussed along with the design and programme initiatives.

Keywords: *Caboolture, Learning, Library, Gallery, Social, Infrastructure.*

Introduction

The Caboolture Hub is a project jointly designed between Peddle Thorp and James Cubitt Architects. The building of over 5000m² in the Caboolture city center was constructed by the local council to not only meet the growing spatial needs for a public library, but also provide additional facilities for the creative arts and for community education. The outcomes, we believe, have exceeded the local community's expectations and hopefully will achieve longer term outcomes that will deliver improvements in a region facing development challenges.

Caboolture is a regional city north of Brisbane undergoing rapid growth both commercially and residentially. The region is widely characterised as having a lower socio-economic profile with many social, health, employment and education issues. Three years ago the Moreton Bay Regional Council decided to invest in a major piece of social infrastructure in the heart of Caboolture. This was the first major development in the city center precinct in fifteen years.

Before initiating the project, the Council researched the strategic steps required to deliver a 'Learning Community' in Caboolture. It was identified that community will participate in learning opportunities offered in accessible and non-threatening environments and that informal training builds self-confidence and assists in job readiness and general life skills. Community based learning was viewed very positively and participants appreciated the opportunity to interact with their community locally. It was found that informal, accessible, and non-threatening environments with a strong local and community focus that responds to community needs is highly valued. In addition, it was recognised that public libraries play a vital role in the life of a community. It has the power to inspire, educate, inform and entertain people. Good information resources, reliable equipment, skilled staff, attractive and efficient 'people-orientated' buildings are essential elements in providing effective library services to the community.ⁱ

Civic buildings are a cultural focus for the entire community and a library is pivotal to the pursuit of lifelong learning, the exchange of knowledge and ideas and the productive use of leisure time. To this end, it was anticipated that the design should engender community pride, be aspirational in nature and deliver qualities defined as "anchors" of community life, which facilitate and foster broader and more creative interaction. As a result, the combination of a community library, a gallery and a community learning centre creates a venue that increases visitations by cross-pollination and attracts participants into learning programmes.

The challenge for this project was to create facilities that could offer an undefined but wide-range of council programmes as well as attracting external education providers whose requirements would be varied. Key to meeting these aspirations was consideration that the building needed to be flexible, bold, timeless, respectful, and equitable and be of quality that would be valued by the community. The building has delivered on all these aspects.

This paper reflects on what the architectural team regards as important aspects of the project as indicators to its community acceptance as evidenced by the significant increase in patronage. It is hoped that lessons learnt can be translated to other initiatives in similar communities.

About Caboolture

Caboolture is an urban centre approximately 44 kilometres north of Brisbane and is considered to be part of the greater Brisbane metropolitan region within South East Queensland, and it marks the end of the Brisbane suburban commuter railway service. As at 30 June 2010, the city had an estimated population of 46,882 and its growth exceeds that of Brisbane.

The city is representative of many of the issues facing non-metropolitan areas and in particular urban areas on the outer edges of capital cities. The central business district, modern in many ways, lacks the urbanity and vibrancy of more contemporary places and wider development is trending to the air-conditioned retail precincts and strip shopping, fast food centres servicing low density residential suburbs that make up the majority of housing in the region.

The annual population growth rate in the 2009-10 period for the Moreton Bay Region was at 3.0%, twice that of Brisbane at 1.4% and with Queensland as a whole at 2.0%. As identified by Queensland Government statistics, the council region is over twice the rate of disadvantage socio-economic conditions than the directly neighbouring region of Brisbane. The measure of most disadvantaged for the region is at 22.9 with Brisbane at 7.2.ⁱⁱ

As is often written, residential based communities lack much of the investment in community infrastructure with a reliance on commercial development to create places for people to socialise. Unfortunately the contemporary commercial replacement for place making are no substitute for creating genuinely civic places for people to communicate, interact and potentially have positive outcomes such as learning or creative expression.

Background to the Project

In 2007/2008 the Caboolture Central Project (CCP) was officially withdrawn. The CCP incorporated a Performing Arts Auditorium, Library, Art Gallery and a Learning Centre. The effort and resources expended on the development of this project progressed to detailed design and specification stage. This effort was halted as the Queensland State government enacted amalgamations of Local Governments across QLD, in which the Caboolture Shire Council, Pine Rivers Shire Council and Redcliffe City Council and became Moreton Bay Regional Council (MBRC).

One of the drivers behind this development was the inadequate size of the council library in the centre of Caboolture which at the time was only 900m². Future planning and population projections informed the floor space requirements for the facility needing to be around over 2,500m².

Despite its State Government designation as the principle activity centre of the region, Caboolture did not have adequate arts and cultural infrastructure to fulfill its role. The lack of a public art gallery was recognised in the 1998 regional planning forum and identified as the number one priority in arts cultural forums. Caboolture and surrounding areas has an active arts community and this was a key driver for the inclusion of an art gallery and creative studio space. Specifications developed by council and associated community consultation included a gallery conforming to the high end of comparable regional standards.

In the budget for 2009/10, the MBRC approved three signature infrastructure projects within the region of which the Caboolture Project was one.

Project Description

The Caboolture Hub provides a 3000m² modern Library, 1000m² Regional Art Gallery, 1000m² Learning & Business Centre and soon to be established cafe alongside the Caboolture Town Square. The building was sited in an unselfish manner to complete the enclosure of the town square as well as maintain and enhance access to the Memorial Hall used by community groups and was the temporary home of the library during construction. The building also allows the opportunity for the potential of a future Performing Arts building to be sited on King Street. The siting maximised connections to the existing carpark and adjacent streets and activates back-road areas and in turn creating a legible series of disparate, unconnected spaces.

A new integrated colonnade links the Hub to the main streets enticing visitors and providing a level of connectivity essential to stimulating the town square. Significantly this provides the community opportunities beyond those defined by the brief providing the site of festivals, cultural displays, entertainment and learning.

The buildings form reflects a philosophy of simplicity. Materials have been selected to capture the public nature of a city centre. Folding zinc, coloured concrete and bare fibre cement walls, provide an architectural statement reflective of the strength of the nearby Glasshouse Mountains and the region as a whole.

The library is simple in form and detailing with an emphasis on natural light. Specific functional spaces are scattered around the perimeter with noisier spaces transitioning to quiet spaces. Special zones are identified by purpose-designed suspended lights that incorporate colour and texture symbolic of the carpet snake pattern developed in collaboration with a local artist and reflective of the traditional landowners meaning of the word "Caboolture".

The gallery has several display spaces as well as storage and curatorial support facilities. Tubes of natural light provide a subtle background illumination that can be controlled in conjunction with the track lighting system to the main gallery. A grid of mobile walls allows for easy reconfiguration of the space to suit the changing exhibition programme. A smaller blackout room for multi-media displays is linked back to the entry vestibule to create a circular journey with an additional gallery off the foyer for display of community artists. Support activities including studios and workshop spaces provided on the lower level. The spaces are connected through a stepped theatre space linking both the lower ground and ground floors and that can open onto a landscaped plaza.

The learning centre provides a series of flexible seminar rooms, business centre and multi-media training labs positioned to overlook key spaces within the Hub. The Hub has been achieved through a coordinated and collaborative process of engagement with users, the community, consultant team, project managers and the contractor. This approach of working as a holistic team was based on the shared ambition of those involved seeking to provide the community of Caboolture with a significant new cultural facility.

Medellin Comparison

During the design phase of the Caboolture Hub, the architectural team undertook research into successful projects around the world to gain insight and knowledge into successful Learning Centre projects. Of particular resonance to the team were the series of social infrastructure initiatives undertaken in Colombia.ⁱⁱⁱ Whilst a more extreme example of social problems compared to the Australian setting, this city presents a strong case for conscious development of social infrastructure to address community issues.

Medellin is Colombia's second largest city with a population of 3.5 million that has been transformed from a dangerous, crime ridden city with large disadvantaged communities into a thriving metropolis. Its civic pride was buoyed by new public buildings and squares, and the creation of an efficient and well maintained public metro rail and cable car system to serve densely populated communities in its hillside precincts. Public transport links rich with poor neighborhoods and has stimulated private development.

The transformation of the city was initiated by thoughtful planning, crime prevention programs, sponsored community initiatives and a national policy directing architectural projects as a means to reduce poverty and crime. Regional governor from 2004 to 2007, Sergio Fajardo, initiated an agenda linking education and community development with infrastructure and major architecture interventions. These major investments in public infrastructure include several library developments in low socio-economic communities, community arts projects, sports facility, a quality science centre and Botanic Gardens improvements which converted a dangerous and neglected area into safe and well utilised community space.

In a further commitment to maintain consistent development in social infrastructure, E.P.M., the government entity which supplies public utilities including electricity, water, communications is mandated to allocate profits (around US\$450 million a year) to go directly to building new schools, public spaces and transport system. The consistency of funding and the commitment to equitable allocation of funds between rich and poor are important aspects of the Medellin social agenda.

The España library visited earlier this year comprises three linked black boulder shaped block perched over the Medellin valley. Designed by Bogotá architect Giancarlo Mazzanti and the building has become a symbol of the community's civic pride and success in positive change. Whilst impressive from the outside and curiously planned on the inside with difficult circulation and poor construction, the positive effect in the community is obvious. Visitor to the community are often met by children on the journey from the cable car station to the library by local school children eager to earn a few dollars to tell the story of how the previously gang-run community has changed as result of this and related projects. It is clear the community has been empowered from education and delivered major social benefits.

Community representatives have stressed that successful outcomes of social infrastructure are not just about building or renovating schools.^{iv} Social and economic benefits that public buildings and new public spaces need to marry with longer-term, community-based policies of urban renewal and programmes such as providing both rich and poor with the same quality education, transportation and public architecture. In this equitable sensibility of social infrastructure investment, Medellin acknowledges the increase in the sense of ownership and positive community spirit amongst the whole population.

Place Making

Urban quality or the sense of place can fall into two definitions, one emphasising the built form and the other the psychology of place. The physical nature of place revolves around design decisions in relation to the way buildings connect to spaces, views, landmarks and the like. The psychology of place focuses on a person's senses telling them whether a place feels safe, comfortable and vibrant. Combining these definitions then suggests that that urban quality can be considered in much wider terms than the physicality of architectural form, scale and material and also relate with aspects of urban quality connected with social, psychological and cultural dimensions of place. Thus positive memory equates to the quality of place.^v

Urban design therefore is not just a space making but all the activities and events which activate places and make urban life. Successful urban places are based predominantly on street life, and the various ways in which activity occurs in and through buildings and spaces.

Investing in new and improved community facilities is very important as such facilities help build communities, keep people healthy and happy, and provide opportunities for individuals to improve learn and prosper. However new buildings are not the only way to build or develop communities. The life or activity of a place has as much importance and therefore places need to be matched with creative programmes.

Whilst it is possible to develop communities from building new facilities, this is very dependent on the commitment of the client and community, the client's brief, the overall vision for community and place development and the skill of the architect in creating a design concept. However not all communities welcome change. In addition, new buildings have to be designed in relation not only to its primary purpose and site, but also its wider urban environmental setting. The need is for good urban design alongside good architecture matched with a process that is inclusive and community.

The Caboolture Hub sought to establish a venue that would go beyond its immediate surrounds and connect into the wider civic area. The venue addresses the town square with no street front door. The colonnade between streets is the civic scaled connection from two main street frontages and creates a major identity and signpost to the precinct but also acts to encourage street life and an external venue for things like markets and performance. The notion that a building has an impact within its precinct is a important consideration in the design process.

Community Development and Learning

Community development seeks to empower individuals and groups with the knowledge and skills needed to improve and change their own communities and own lives.^{vi} The objective is to break the cycle of poverty by providing education, access to technology and economic opportunities as a vehicle to development of a community and improve an individual's life.

Urban development with a focus on physical infrastructure has traditionally been viewed as the main means to enact community development. However, the development of connected communities via online communications has enabled communities to expand their footprint. Local communities that cannot connect and participate in the larger

context are becoming increasingly marginalised. Thus it is important to consider the connectivity of a community beyond its region.

The Caboolture Hub project has enabled the council to provide a range of education programmes beyond that traditionally offered by council libraries. This has come about by the mix of facilities under one roof and the cooperative approach between the library, gallery and learning centre entities to operate collectively with compatible and complementary education programmes that target the needs of the local community.

Successful development and innovation of learning spaces has come about by conversations between designers and educators exploring and negotiating ideas. Lecture theatres, seminar spaces and classrooms are the traditional core of learning spaces. Structured classrooms have been so universally accepted that educators have, until recently, tended to ignore the influence that space can have on learning outcomes. In addition, students have become adept at gathering web-based information; the role of educators is shifting from that of information provider to that of learning facilitator and education shifting from individual learning to collaborative problem solving experience.

As seen in university development, briefs are increasingly emphasising the spaces between more traditional teaching areas and developing collaborative study lounges that support informal learning. In addition, the development of 'learning commons' referring to interdisciplinary location for several student services inside the library such as a resource centres and IT assistance and the like, creates a functional and dynamic experience for students in one central location.

The Caboolture Hub offers programmes to the local community that is empowering people with new skills who would otherwise have limited access to learning. These programmes are run by the council library, the learning centre and creative arts components within the venue and mix traditional classes such as beginner computer tuition, to learning how to develop start-up a business to creative art classes.

In addition, external providers such as the Queensland University of Technology (QUT), TAFE Queensland use the venue due to insufficient and inadequate facilities in the area. This inclusion of tertiary level students, educators and education providers within the community venue is activating the building and creating vibrancy between the interconnected spaces.

Traditional seminar/conference/teaching spaces are complemented with various computer teaching rooms and meeting spaces. Whilst most of the facilities available are fairly conservative in planning, key design ideas include openness, transparency and connectivity that allow visibility of facilities for all visitors to see education programmes in action. Emphasis on the visibility of social spaces that connect rooms creates vibrancy to the building which filters through the venue.

In parallel with the education side of the venue, a business centre for local business and community organisations to have quality venues for meetings, collaboration and socialisation. The visibility of the business centre was a conscious initiative and the business lounge overlooks the entry foyer and directly across from the seminar centre break-out space thus continuing the theme of connectivity and openness. The quality and range of these spaces is enabling local businesses and community groups to meet and collaborate in ways not readily available before this project. Reports from the venue indicate an enthusiasm evidenced by the forward bookings.

The arts community in the region has had a major uplift in facilities not only as a result of the Regional Gallery component but also the creation of a venue for display of community artists and significantly the inclusions of studio spaces as an incubator for new creative art businesses. Operating like an artist-in-residence programme, these businesses not only have their own facilities but artists can also engage with the community with education programmes and exhibitions. This strong visibility of the arts in a public venue and the commitment to encourage development of the regions' arts community will likely have ongoing positive outcomes for a previously unappreciated community.

Measure of Success

The success of public infrastructure projects is ultimately judged by how the community for which they are built, welcome and utilises them. The Caboolture Hub project, whilst enthusiastically supported by the local council, had mixed support in the community during its development.

Evidence of the successful marriage of building design with the programmes on offer is illustrated by the fact that during the first four months of operation the Library had over 73,000 visitors and Library membership increased by six percent and Library loans increased significantly beyond that rate. The Caboolture Regional Art Gallery has recorded some of the highest visitation figures of any regional gallery in Queensland. The Learning and Business Centre has been warmly received by the local business community with March bookings indicating over more than 140 meetings by local community and commercial organisations. The size and scope of the Caboolture Hub is allowing council to offer the community a wider range of workshops, programs and activities with an increase in bookings and participation. Tertiary and commercial educators can now offer city centered programmes with long-standing forward bookings now in place.

Since opening the library has recorded a jump in visitors and loans, a measure that the client has expressed delight with. Sample data shows that before construction (2008/09) the library has door counts averaged around 15,000 visits per month. Since opening this has risen to around 20,000, an increase of 60%. Similarly, book issues in 2008 averaged around 31,000 and have risen since opening to over 35,000 with March being close to 40,000 book issues.

Visitors & Loans	2008 Pre-construction			2009 Pre-construction			2011 During Construction Temporary location			2012 After Opening		
	Aug	Sep	Oct	Jan	Feb	Mar	Aug	Sep	Oct	Jan	Feb	Mar
Door Count	14352	15111	15117	11462	13778	15071	12727	12710	12088	19970	19250	22352
Book loans	30145	31055	32055	30613	29548	31594	26895	26119	25592	37221	35211	39641
Source – Moreton Bay Regional Council												

Of an equally significant note are the education programs offered by the library component of the venue. Data gathered last year and since opening has shown a significant increase in programs on offer and community participation of these activities. As shown in the following table, participation has increased on average of 350%.

Programs & Participation	2011 During Construction Temporary location			2012 After Opening		
	Aug	Sep	Oct	Jan	Feb	Mar
Programs	40	24	31	47	70	81
Participation	266	656	352	1586	1646	1658
Source – Moreton Bay Regional Council						

In a different measure, community reaction to creating major building projects was mixed before and during construction and significantly positive since opening. The project team maintained a casual watch on local media reports which presented updates on project announcements issued by council and various construction milestones and the opening. It was with interest to observe the commentary (albeit few in number) on local new websites to gauge community's thoughts of the project. As with most public building projects, a significant proportion of the population often criticise government agencies spending money. A significant change in sentiment was observed after opening with negative comments disappearing and the public welcoming the major investment by the council.

A sample of these comments from local new websites follows (names withheld).

Caboolture Shire Herald

Posted on 11 May 11 at 07:27am Caboolture Shire Herald website

To the bleeding hearts upset about how the money is spent do you not realize why Caboolture has so many social problems? The answer is this- Caboolture was a small rural town up until about 2 decades ago. It as a town has grown enormously commercially and residentially but has had not kept up with the growth in the key areas of infrastructure and cultural profile, hence becoming a lower class socio-economic wasteland for junkies and bludgers. The only way to prevent this happening is to invest money in schools libraries sporting facilities knocking old buildings down and building new state of the art facilities that attract a better class of people to the area. (spelling corrected)

Posted on 12 Mar 10 at 01:47pm Caboolture Shire Herald website

I think it is a wonderful idea... I understand there are many other issues that need considerable help, however, 'the hub'(which some have already condemned) is going to set up many jobs for people in our district, from construction to administration and much, much more... On completion and in turn, 'the hub' will generate higher revenue which is essential for our rapid growth. With this in mind, 'the hub' will allow a better position for other issues to be addressed efficiently. I have lived in Caboolture for 25 years and it is no the longer the small town I was nurtured with in. It is now a growing city which I expect will sufficiently provide my family the best resources possible. Is that not a building block of which every mother wants for their children? Be proud of Caboolture and understand that this will be a turning point for our community. Growth is what betters us as human beings. As a community, we are forever growing, don't fight it, just let it be!

Posted at 10:05 AM November 23, 2011 Quest News website

HUB = Huge Ugly Building. I cannot believe that our Council has wasted \$25 million of ratepayers' money on this hideously ugly building. It is just a scaled down and less functional version of the building that the former Caboolture Shire Council was to have built for our community before we were amalgamated. It contains no auditorium for performances and has a tiny little art gallery that has not much more floor space than the average house has these days. It is really just a big ugly overpriced library with a few token add-ons.

Posted at 11:54 AM November 25, 2011 Quest News website

Just what Caboolture needs - an art gallery. Honestly how many locals will go to it? More chance of people seeing art if it was put in the Morayfield tavern!

Posted at 9:51 AM November 23, 2011 Quest News website

Another white elephant for King Street somewhere that is going to be vandalised and that will encourage a criminal element at night!

Positive and negative media however is offset by anecdotal accounts communicated to the team. The public who have not had an avenue to access even basic contemporary learning opportunities have, for instance, emotionally expressed thanks for first time being shown how to create a personal CV to apply for jobs and how to access social media sites which before they had no knowledge of how to engage with these contemporary communication tools. The ability for the often disadvantaged public now has significantly improved access to computers and education programmes often offered for free. Whilst this is not particularly unusual within similar facilities, what has resonated with the design team is that often the comments include reference to the quality space and facilities within which these programmes are offered – the public like being there. It was the intent of the design team to create a venue that gave due respect to a struggling community with quality design, quality facilities and quality programmes

Peer recognition

In the recent 2012 Sunshine Coast Regional Architecture Awards, the building received a Regional Commendation and shared the Building of the Year for the region. This peer recognition being an impartial external review has recognised aspects of the design that were consciously created to respond to the challenging brief.

The jury citation wrote:

The Caboolture Hub is appropriately civic in scale and responsive to its prominent location adjacent the town square. Building massing resolves difficult existing site constraints and the building's form is enhanced by well scaled and detailed external treatments. A light filled central atrium connects the primary spaces which include a public library, art gallery and learning centre. Moving through the building, there is delight in the transition between spaces, which, through careful design and selection of materials and furnishings, each offer their own character and experience. This exemplary building demonstrates a high level of public accessibility and engagement and represents an optimistic and commendable investment of public resources by the regional Council.

Conclusions

It was the design team's intent to create a building that the community could embrace as a place to: collaborate; research; communicate; reflect; learn and enjoy.

As shown by comparator projects such as in Medellin, Colombia, investment in quality buildings with a commitment to provide programs tailored to community needs can deliver long term community benefits. The Caboolture Hub is showing signs of change in community development by the enthusiastic support achieved so far and hopefully an indicator to longer term social improvement. However, as expressed by leaders in Medellin, a one off project is not enough and community development is a series of initiatives in multiple facilities and programmes.

The process by which the venue is created needs to be collaborative and enthusiastic. All those involved need to understand the underlying goals and long-term outcomes that the project will create for the community. A significant element of the success of this project was the decision by council to create a multi-use venue that combined the library, gallery

and learning centre. This merging of activity has been embraced by the venue management by mixing and melding of programs that complement each other.

Successful projects are not just about the architecture. Boldness and confidence in the design is important but also so too is longevity in the architectural design and therefore avoiding gimmicks and fashionable aesthetics so a building has a civic response and responsibility to its surrounds to last the test of time. Good design is a mechanism to firstly get people in the door and then provide facilities and spaces that will encourage the public to engage with the programmes that curators and educators offer.

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PIE Discussion Paper 2 – MAKING LEARNING CITY DEVELOPMENT CREATIVE AND INNOVATIVE

***Sea Changes*: the role of public art and the expression of creativity,
identity and sense of place in a healthy city**

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Paper presented at

The 5th Healthy Cities: Working Together to Achieve Liveable Cities Conference

Geelong – 6 – 8, June 2012

***Sea Changes*: the role of public art and the expression of creativity, identity
and sense of place in a healthy city**

Abstract

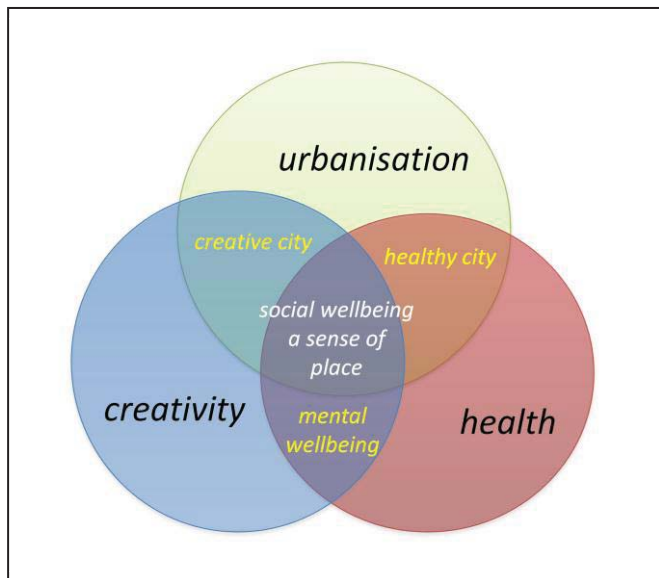
This paper will explore the role of public art within urban renewal projects and its capacity to achieve the expression of a sense of place, local identity and creative community. It will question and consider the inter-relationship between health and creativity and between a sense of wellbeing and a sense of place, for both individuals and communities.

The paper will provide a case study of the curation and delivery of a public art program as part of the Redcliffe Seaside Village Rejuvenation project in South East Queensland from 2010-2011. The project has delivered an attractive and unique destination experience for locals and visitors alike with the public art program playing a key role. While the major improvement works to streetscaping and landscaping comprised this outcome, it is the shift in social perception which achieves the real sea change and sense of urban renewal. Public art can not only value-add to the public space asset and amenity but can catalyse these perceptual shifts, evoking cultural and creative significance.

Keywords: *public art, creativity, social wellbeing, placemaking*

Many understandings and policy frameworks for A Healthy City focus on physical wellbeing, aspects such as walkability, active transport and recreational facilities. I would like instead to focus on mental wellbeing, to try to understand how a city might display and communicate a healthy mental condition.

As a public art curator, I am interested in the links between creativity, mental health, and the urban environment.



The link between creativity and better mental and physical health is well established by research. Creating helps make people happier, less anxious, more resilient and better equipped to problem-solve in the face of hardship. But a healthy city is not necessarily a creative city – parks, playgrounds, bikeways, access to educational and medical resources and so on will certainly make for a healthy city without necessarily generating creativity. And the creative city is not necessarily a healthy one. In fact one might argue that while the industrial city was an unhealthy city, its melting pot formula was pivotal in generating rich cultural and intellectual avant-gardes. It's fair to say that the bars and bordellos, the cafes and laneways of modernity may not have been the healthiest urban environment but they were often the most creative. However that connection may have as much to do with our understanding of and attitudes to notions of both health and creativity as much as with the lived conditions of those environments.

Our traditional understanding of creativity has focused on what is now often termed eminent creativity – the gifted talents of rare individuals. According to this definition of creativity, most of us aren't. The artist is thus a marginal social figure. Conversely, our traditional understanding of mental health was that of innate normality – that most of us have it. Mental health was a taken-for-granted common condition and mental illness was a rare and deviant one.

The connections between the artist and 'the mad' and 'the bad', between creativity and 'craziness' was underscored by a politics of deviancy and practices of social marginalisation. Even now the unhealthy and dysfunctional city provides fertile ground for site-specific creative commentary – as Melbourne Laneways Public Art Program so aptly demonstrates:

a dead-end lane filled with a soundscape
of ringing from discarded telephones
that can't be answered

Artists: Martine Corompt and Phillip Brophy



a bricked wall, a dead barrier,
that should live and breathe

Artists: Beth Arnold and Sary Zananiri



a vacant lot for carparking instead
of a site for housing the poor

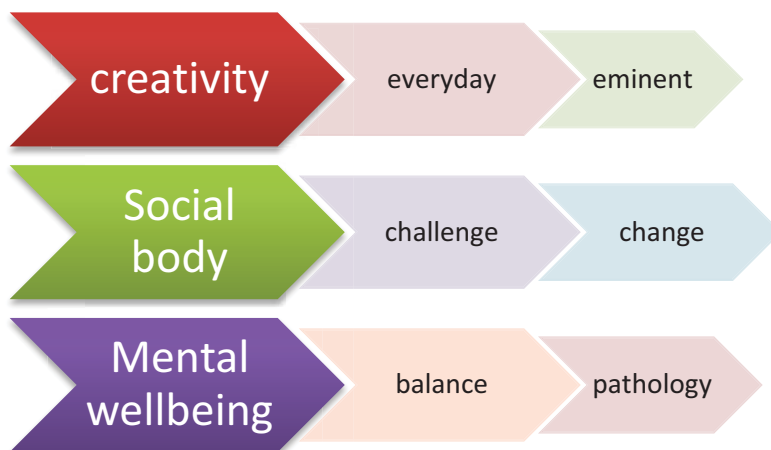
Artist: Samuel Indratma



These temporary artworks are the perfect urban interventions, testimony to the artist's creative capacity to find meaning in contradiction and conflict, literally comments in the margins of the city, or even the city having some kind of behavioural episode. The artist, as eccentric outsider, can take creative risks that seem beyond the reach of the majority, employing eminent creativity.

A lot of the writing about creative cities has focused, and perhaps quite rightly, on eminent creativity – building cultural capital, attracting a creative class and competing globally for this talent. While this is certainly linked to the shift between the industrial and the post-industrial city, it has only some overlap with notions of a healthy city and the generation of social wellbeing.

And while there is some clinical evidence which can connect eminent creativity and mental illness, particularly bipolar disorder, there is far stronger evidence to suggest that creativity favours the development of resistance to psychopathology.



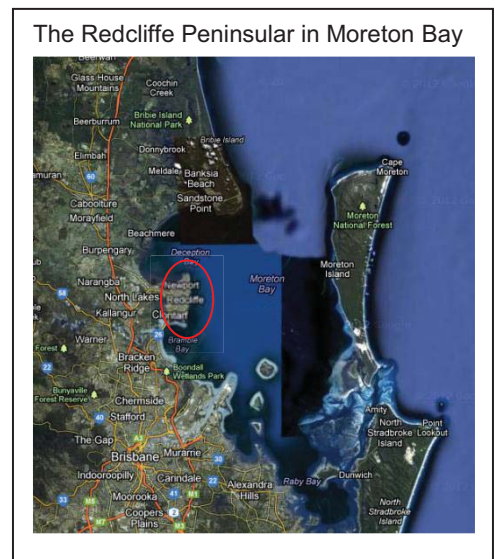
The notion of a healthy creative city involves, in my opinion, a shift in emphasis from eminent creativity to everyday creativity – that creativity is not unusual or rare but is a qualitative aspect of mental functioning. It's something we all use when we don't just re-apply what is already learned and known, often when we are faced with challenges. Everyday creativity may be analytic and problem-solving, it may be intuitive and risk-taking, it may be playful and spontaneous. Sounding normal? It probably is.

Making public art is about taking artists out of their rarefied white box galleries which privilege their idiosyncratic and personalised expressions into a creative contribution to a public conversation about a place that is shared, used, and lived in. I think this relational aspect of public art can only be successful if we appreciate everyday creativity and understand the relationship between eminent and everyday creativity.

I also believe that a similar argument holds true for mental health. The traditional approach to mental health focuses on the pathology of disorder and dysfunction, marginalizing the mentally ill as a rare minority. However contemporary approaches to mental health recognise that many mental illness conditions are common and that very few of us will not experience social and emotional challenges which negatively affect our mental wellbeing. Mental health, like physical health, needs to be maintained through proper care, exercise and nutrition – social and emotional exercises, interesting food for thought. Public art – its curating and commissioning, its making and integrating, and its audience interaction and experience – provides

such social and emotional exercise and nutritious food.

In 2010 Brecknock Consulting was engaged by Moreton Bay Regional Council to curate, manage and deliver a program of permanent public art as part of the Redcliffe Seaside Village Rejuvenation Project. The Council described this area to be “one of the most significant strips of land within the Moreton Bay region” and one deserving of a high standard of contemporary, attractive public amenity. And therein lay a challenge – delivering something that was contemporary, relevant to this time and even the future, and that would also communicate the historic and environmental significance of this place.



To my mind, this project was timely. I grew up in Redcliffe and so my relationship with this place is long and whenever I go there, and I guess this is same for most people when they go to places of their childhood or even when we meet with childhood friends, I’m filled with that uncanny feeling that nothing has changed but everything has. In the case of Redcliffe, it’s not so much the changes to the physical environment that affect my sense of place but rather it’s the shift in perceptions that I can sense – a changing and evolving sense of place. So the curatorial rationale that I developed for this urban renewal project was “Sea Changes” as a way of giving metaphoric expression to these perceptual shifts.

Redcliffe is a city of around 50,000 people that lies immediately to the north of Brisbane, occupying a peninsular of land jutting out into Moreton Bay. Redcliffe had a heyday period, well before my time, as a popular holiday spot, a seaside village & get away place from Brisbane – there was even a seaside fun park called Luna Park from the mid 1940s to the mid 60s which was located close to the project site. In my childhood, this phase had passed and Redcliffe had become more of a retirement place and business was in decline. It felt cut-off, a bit sad, depressed and neglected. Tourists, visitors and Brisbanites were now focussed on the Gold and Sunshine coasts with their sparkling sandy beaches and surf cultures.

Today there is a renewed interest in and real appreciation for Redcliffe and for the environment of Moreton Bay. People are enjoying the beaches and foreshores of the Peninsula precisely because they are not the surf and sand tourism centres, because they have a different and quite unique atmosphere and offer a distinctive lifestyle and coastal experience. Lots of people are choosing to come and live there, lots of young families.



Public art can play a vital role in communicating site significance, expressing identity and helping to forge an authentic sense of place. The artworks commissioned as an integrated part of this revitalisation project are not temporary interventions, creative comments from the margins, but are the result of a considered invitation to an artist to speak from the centre as it were, to make something appropriate, sensitive, thoughtful, subtle and generous for a highly visible, highly used public realm environment. Their creative manifestation to my mind marks a transition from a depressed and isolated place to a place with a renewed sense of identity and purpose.

Phil Price *OPTO*



Opto is an iconic wind-driven kinetic artwork by New Zealand artist Phil Price. It is a landmark work, located at an important apex within the site and generating a sense of arrival and destination for Redcliffe. Its vertical form celebrates the sky, cleverly and playfully expressing the coastal breezes and currents, balancing the historical and iconic jetty whose horizontal form celebrates the sea. This is an aspirational, inspirational and innovative artwork. It alludes to a sustainable energy future but also playfully evokes the memorable fun of the erstwhile seaside carnival.

Hew Chee Fong & LM Noonan *Vessels*



Vessels by Hew Chee Fong and Loretta Noonan is a pair of granite boat forms positioned close to the shoreline. Redcliffe was the site of Queensland's first convict settlement and this foreshore is the site of the first convict ship landing, the *Amity*, in 1824. There is a significant memorial wall within the adjacent parkland, commemorating this landing event. *Vessels* is an intimate human-scaled work. It has a somber tone to complement the landing memorial, and the work's simplified design evokes the vessel as an archetype, inviting people to rest, reflect and dream. The work's

gentle poetry also calls to mind wider stories of boating and fishing, including the whaling industry which was based in Moreton Bay, and indeed even the local sea-creatures themselves which include dolphins, turtles and dugong.

A memorable thing that happened in my Redcliffe childhood was a school excursion to the local library to meet Kath Walker (Oodgeroo Noonuccal) and to hear her read her poetry to us. This was something quite different, strange even, and quite unforgettable. Poetry was the vehicle that allowed this woman, her culture, her sense of place to enter into my life. Moreton Bay, and Stradbroke Island especially, felt different to me after that. It somehow meant more to me – I'm sure it strengthened my sense of belonging to this area even though, of course, I am not Aboriginal – this is what I would call a sense of belonging with difference – a creative inclusion perhaps.

So it was very wonderful, with this project, to be able to invite Indigenous artists Bianca Beetson and Megan Cope to have that conversation again about a local Indigenous cultural perspective, its relationship to others and to place in a lasting and tangible way.

Bianca Beetson *Story Poles*



Story Poles by Bianca Beetson features ancient designs in contemporary translation, located along a pathway with internal lighting for brilliant evening effect. Bianca lives locally and her family ran a restaurant in Redcliffe called Beetsons and her uncle Arty Beetson, who recently passed away was a local, national and international football legend.

Megan Cope *After the flood*



Within the pathway adjacent to Bianca's *Story Poles* are three ceramic tableaux by Megan Cope featuring maps of Moreton Bay with a mixture of Indigenous and non-Indigenous place names and references. Megan's Indigenous family are the Quandamooka people from Stradbroke Island. Military maps echoing the myth of terra nullius and depicting the land devoid of Aboriginal occupation have been appropriated and filled with names & places significant to local Indigenous groups. The result manifests a dual history and a quest to re-inscribe the historical cultural significance of our surrounding landscapes. Together these artworks sponsor an inclusive sense of gathering and cultural exchange for family and community in a spirit of reconciliation.

Russell Anderson *ANTBV*



Above the southern parkland and located on Redcliffe Parade is Russell Anderson's artwork, entitled *Apparatus for non-destructive transmission of biological visualisation*. The work is an interactive sculptural device, presenting as a popular street-side amusement. Russell, a long term Redcliffe local, has created a fictional nautical legend of a 19th century explorer who was shipwrecked in Moreton Bay. This device, salvaged from the wreck, contains the captive essence of a sea creature. Viewers are invited to turn a handle, generating power to view the sea-creature essence contained within and its projected image.

Brad Nunn
Cenotaph of Remembrance



Finally, as part of the public art program, an artist was invited to be involved in designing a new Anzac Memorial for the area. The annual Redcliffe Anzac Day parade and dawn service is one of largest and most popular in South East Queensland, as it is a beautiful experience to watch the sunrise over Moreton Bay. The new memorial design by artist Brad Nunn achieves an iconic scale and presence and the work becomes a termination point and destination for the promenade experience. Brad Nunn consulted closely with local retired servicemen and the Redcliffe RSL. Inscribed on the cenotaph form are the names of all the conflicts Australian troops have served in as well as a series of single words which resonate with the personal experience of war. The hollow form has internal lighting which rises and falls in intensity as an expression of the eternal sleep of the fallen.

As a curator I worked closely with AECOM, the landscape design team, to identify a suite of artwork opportunities that not only enhanced the design scheme but also expressed thematic aspects of the site as place stories. I also considered how the story unique to each artwork would contribute to telling a bigger story of place. That bigger place story, "Sea Changes", is the deep and evolving relationship between Redcliffe and Moreton Bay. Public artworks, as visible and tangible inscriptions of this creative dialogue, make manifest the creative and cultural dimensions of everyday life and of the built and natural environment. These artworks, I would argue, provide a demonstrable connection between people and place, generating a sense of social wellbeing for a healthier city.

Finally I would like to show another example of a temporary artwork which featured in last year's Art&About festival in Sydney. British artist Michael Landy created a 13-metre installation in lower Martin Place, mapping the Sydney CBD and indicating where 200 stories of kindness were placed throughout the city streets. The stories were selected from over 600 contributions describing everyday acts of kindness as fleeting social exchanges between strangers. The stories were made available online but when you happened to discover one within the actual city streets and laneways there was a small surge of excitement (for me anyway!) as you occupied what you supposed might be *the* public place where the act of kindness had happened. Michael Landy somehow made tangible what a secret pleasure the contemporary practice of kindness has become.

Michael Landy *Acts of Kindness*



Adam Phillips and Barbara Taylor in their co-authored text "On Kindness" (2009) state "an image of the self has been created that is utterly lacking in natural generosity. Most people appear to believe that deep down they (and other people) are mad, bad and dangerous to know; that as a species – apparently unlike other species of animal – we are deeply and fundamentally antagonistic to each other, that our motives are utterly self-seeking and that our sympathies are forms of self-protectiveness." Kindness, Phillips and Taylor argue has become our forbidden pleasure. Michael Landy's work makes a further connection between this conception of the self and our urban environment. Cities, like the people within them, are also mad, bad and dangerous to know. The way to behave in the city is to keep to oneself, to go about your business, not to loiter or linger. Landy's work as a geography of ephemeral anecdotes maps another impulse within the social body – an impulse repressed but one that is, I would argue, fundamentally essential to our wellbeing.

In a world of escalating problems, it seems essential to encourage greater engagement in creativity. A groundswell in the practice of everyday creativity, in the originality of day-to-day life, might not only enhance individual health and social wellbeing, but create a more accepting and supportive climate for the major innovations and social sea changes we so badly need.

References

Arthur J. Cropley, *Creativity and Mental Health in Everyday Life*, Creativity Research Journal, Vol 3, 167-178, 1990.

Adam Phillips & Barbara Taylor, *On Kindness*, Penguin, 2010.

Ruth Richards, *Everyday Creativity, Eminent Creativity ,and Health*, Creativity Research Journal, Vol 3, 300-326, 1990.

Guidelines for Enhanced Natural Light and Ventilation in Apartments

(Steve Moller, Sustainable Built Environments Pty, Ltd.)

SBE has produced Guidelines for Natural Light and Ventilation in multi storey residential buildings for the City of Moreland. This guide will assist council and developers to identify ways to improve performance in these key areas through better building design. The guidelines set performance requirements and provide deemed-to-satisfy provisions based on rules of thumb and accepted best practice. The guidelines identify how to predict borrowed daylight and ventilation in internal bedrooms and identify requirements for glazing, light wells, openable area and lengths of breeze paths.

Aim: Clear and numerate guidelines to promote and evaluate levels of daylight and natural ventilation for resident amenity above that required by the minimum building code.

Daylight

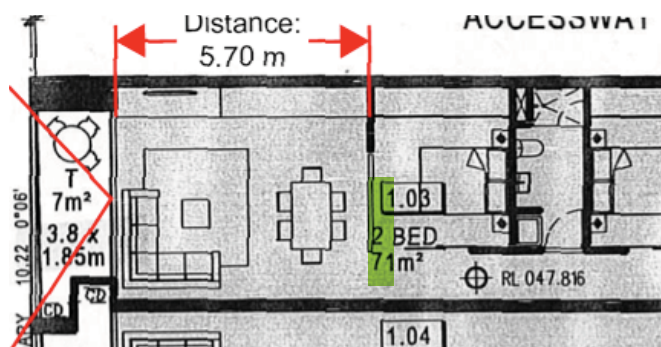


Lightwells

A simple table is used to assess:

- ▶ Light well Dimensions
- ▶ Windows size
- ▶ Glazing properties

Required to provide adequate daylight in adjoining bedrooms. ($DF > 0.5$)



Apartment Depth

A spreadsheet calculator is provided to assess:

- ▶ Apartment depth
- ▶ Obstruction by adjacent buildings, balconies etc.
- ▶ Window size and glazing type

Required to provide adequate daylight at the rear of the apartment. ($DF > 1.0$)



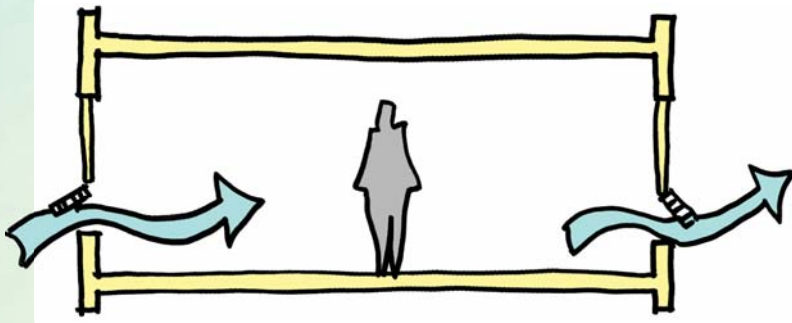
Borrowed Light

The borrowed light calculator builds on the apartment depth calculator:

- ▶ Extent of glazing and type
- ▶ Room dimensions

To provide adequate daylight to the inner room ($DF > 0.5$)

Natural Ventilation



Cross Flow Ventilation

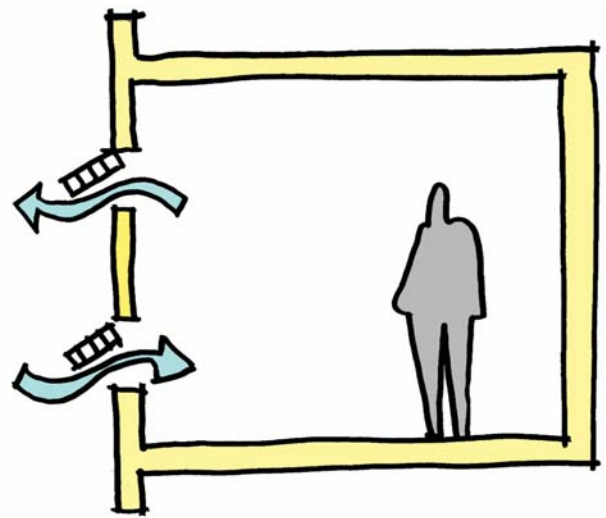
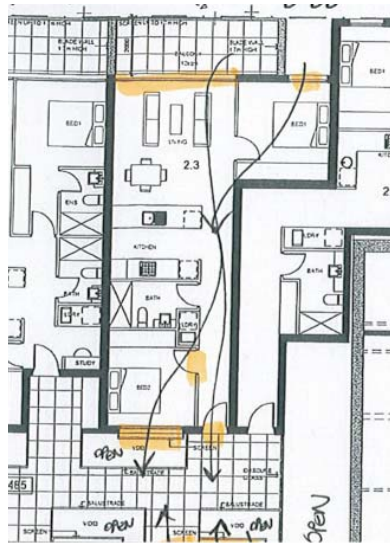
The guidelines specify aspects of the “Breeze path” to ensure good cross flow ventilation:

- ▶ Length of the breeze path **MUST** be <15m
- ▶ Ventilation openings **MUST** be located either in opposite or adjacent external walls
- ▶ If on adjacent walls, ventilation openings must be at least 3m apart at their closest point.
- ▶ Size of ventilation openings **MUST** be > 2% of total floor area or 1m²
- ▶ No more than 1 doorway or opening <2m² along breeze path

Single Sided Ventilation

The guidelines specify aspects to ensure adequate single-sided ventilation:

- ▶ Maximum permissible depth of room: 5m.
- ▶ Ventilation openings must be separated high and low or split across the width of the room/facade
- ▶ Minimum free openable area: inlet and outlet each 5% of the floor area.



Borrowed Ventilation

Ventilation may be borrowed by an adjacent room provided that:

- ▶ The openable area provided in the wall of the adjacent room matches the openable area in the façade
- ▶ The openings must be in line and the breeze path direct.
- ▶ The room borrowing the ventilation must be no more than 3.5m deep.

Moreland are using these guidelines to assess designs submitted for Town Planning approval.

NEXT STEPS:

Moreland are working on incorporating these guidelines into the Moreland Draft Planning Guide.

Moreland plan to test the guidelines against measured results in completed apartments.



WAITING AT THE STATION:

Positioning organisational health promotion to support sustainable capacity for whole-school sexuality education

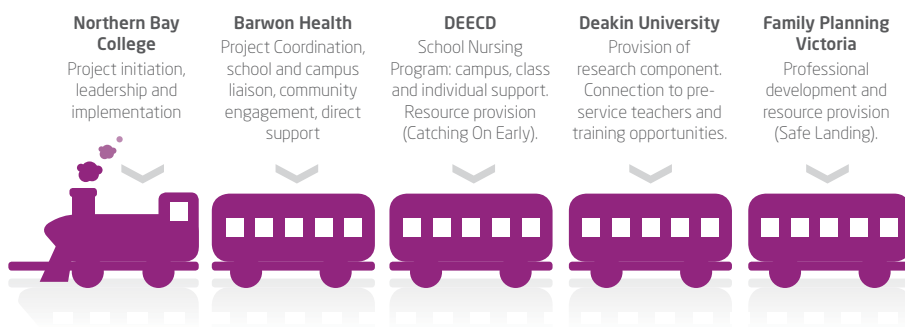
Susan Parker, Health Promotion Officer, Barwon Health



S.E.C.S: The Sexuality Education & Community Support project

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Significant achievement

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SAMPLE BASELINE DATA

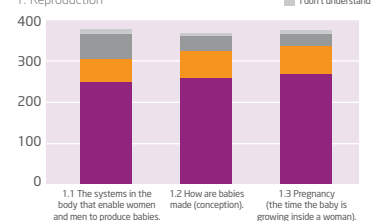
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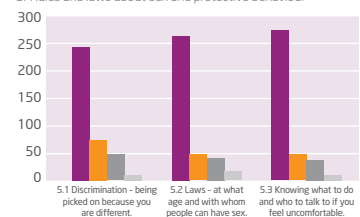
Sample questions to year 5/6 students

Should the following topics be included:

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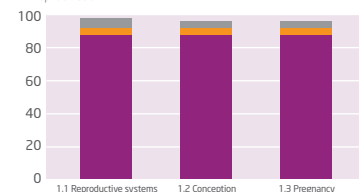
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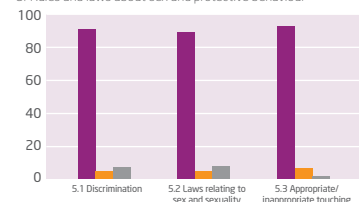
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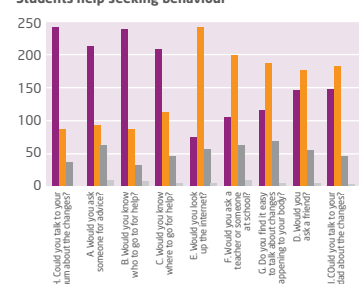
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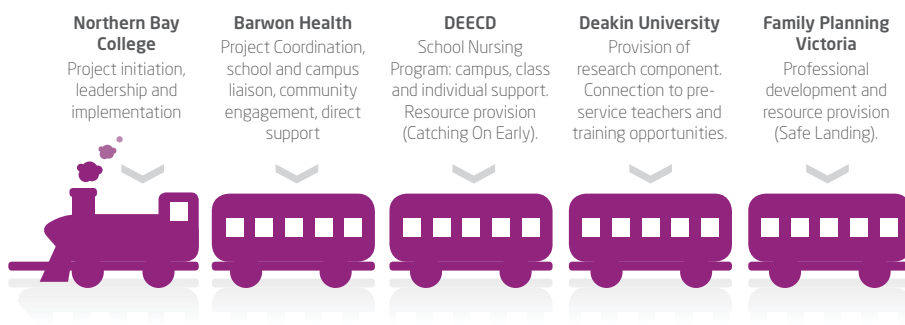
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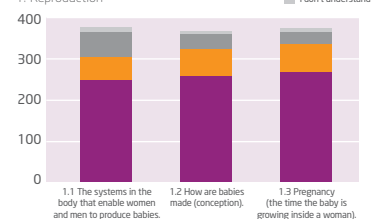
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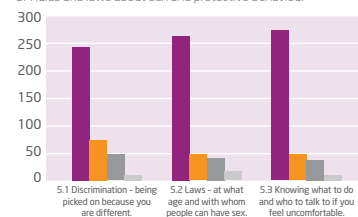
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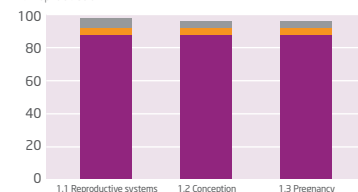
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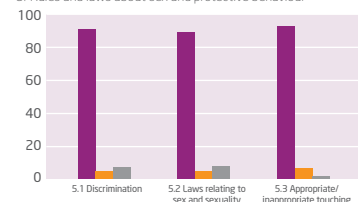
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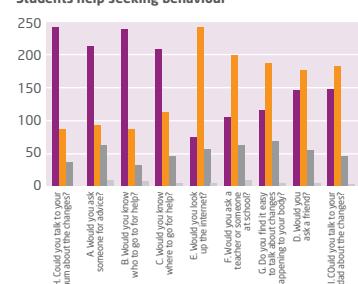
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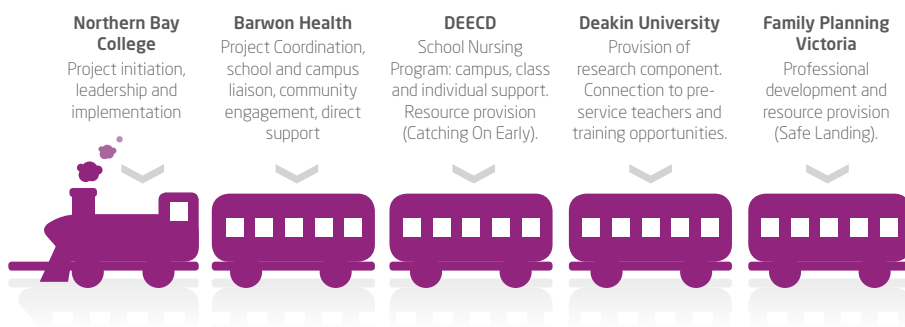
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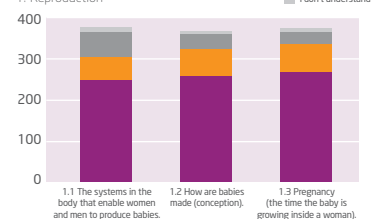
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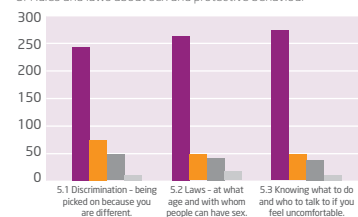
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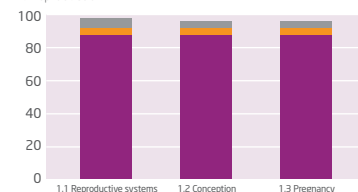
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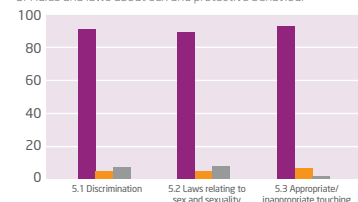
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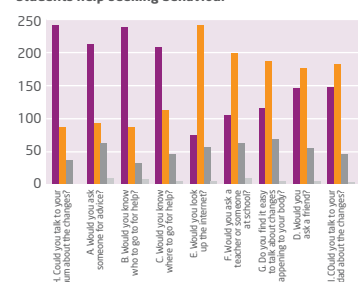
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Engaging Designers in the discussion on Indoor Environment Quality

Name: Philippa Soccio
Position: PhD Student
Organisation: Faculty of Architecture, Building & Planning,
The University of Melbourne

Paper presented at
The 5th Healthy Cities: Working Together to Achieve Liveable Cities Conference
Geelong – 6 – 8, June 2012

Engaging Designers in the discussion on Indoor Environment Quality

Abstract

An International Ideas Competition held by the Future Proofing Schools team at The University of Melbourne, asked designers *to realise the future potential of prefabricated classrooms*. A total of 119 entries were received that presented a range of ideas relating to sustainability, landscaping, prefabrication and pedagogy. Under ‘sustainability’, entrants were asked to address indoor environment quality (IEQ) because of the “very real and negative impact” it has on health and effective teaching and learning (Lyons, 2001:2). However less than a quarter of the entries addressed IEQ. This was surprising and concerning. IEQ should be addressed during the design phase of a building. At this stage it can be holistically integrated, reducing energy requirements while improving the well-being of occupants. Where IEQ is not addressed early, there can be expensive repercussions. This paper is a discussion on IEQ and health in the learning environment. It raises two important questions: *Are designers currently engaged in the conversation on IEQ? If not, how do we engage designers in the conversation on IEQ?*

Keywords: *Indoor environment quality, design, learning environments*

Introduction

This paper will discuss, in the context of an International Ideas Competition, the current level of engagement amongst building designers with issues of indoor environment quality (IEQ). This topic was chosen for discussion following the analysis of 119 competition entries submitted into *The Future Proofing Schools Ideas Competition*, on the design of future prefabricated classrooms. Competition entrants were given four detailed briefs, written by a multidisciplinary team, and were asked to respond to each with equal consideration. The importance of IEQ was emphasised in the ‘Sustainable School Environments (SSE)’ brief where 44% of the advice provided was specific to IEQ. However, the analysis has revealed that less than a quarter of 119 competition entries addressed issues of IEQ and this has raised questions about *why?*

This paper is written in four parts. The first section introduces what IEQ is and how it relates to sustainability, health and productivity. As a starting point, the discussion will relate IEQ to commercial buildings where the quality of the indoor environment was first acknowledged as being important (Fisk et al., 2011). In the second part, IEQ is discussed in relation to the design of educational facilities. The focus is on ‘small buildings’. It is in small buildings where there often isn’t the budget to thoroughly investigate design solutions for IEQ. The approaches for addressing IEQ will be discussed using outcomes of the *Future Proofing Schools Ideas Competition* and current research on the IEQ performance of eight existing prefabricated classrooms, as case studies. The third part will speculate about whether IEQ was overlooked by designers who entered the competition. The final section discusses what may need to happen next, by way of education and/or change, to encourage designers to facilitate good IEQ in their buildings, during the design phase. This will be particularly important *if the results of the competition are indicative of an industry wide trend.*

1. IEQ = health + sustainability + productivity

Buildings that are designed to address technical function, mechanical stability and basic safety are not automatically healthy buildings. Achieving a healthy building is multi-factorial. In the context of this paper ‘health’ will be discussed in relation to IEQ factors

and not human factors such as cooking, cleaning, furniture layout, appliances, ergonomics, etc.

IEQ is an assessment of the combined impact of air quality, light, acoustics and thermal comfort on a space. IEQ is closely related to health and sustainability. IEQ is one attribute of sustainable design. It impacts on the well-being of building occupants in terms of both their physical and mental health (Jacobs et al., 2007). However unlike other attributes of sustainability, such as resource conservation, land-use, material selection or transportation, the IEQ cannot be readily seen or easily measured. This combined with decision makers whose priorities are in conserving energy (Loftness et al., 2006a) and/or costs, can result in the quality of the indoor environment being degraded (Bearg, 2009). Other challenges in providing good IEQ include site variability, climate, projected versus actual performance, material selection, construction quality, detailing, operational and maintenance issues (Loftness et al., 2007; Vittori, 2002).

Enhanced productivity by the workforce is the number one reason for employers and companies to invest in healthy buildings with good IEQ. Work places are complex and productivity can fluctuate for a range of building and non-building related reasons, such as task, level of support, amount of compensation, etc (WBDG, 2011). However research into productivity inhibitors and enhancers, shows a general trend that when the productivity inhibitor is non-building related, (such as an organizational restructure), a building with good IEQ will continue to be more productive than a neutral building (Paevere & Brown 2007).

Productivity, along with well-being, is difficult to quantify. The two most readily available indices for evaluating investment into healthy buildings is absenteeism rates and the self-assessment of productivity (Loftness et al., 2006b). National and International studies into workplace productivity have tried to assign figures to what the financial benefits of IEQ are. In Australia, investment in IEQ that improves productivity by 1% is estimated to translate into an annual saving equivalent to the whole energy cost of a building or, nationally \$2 billion (Waterhouse, 2009). What this means for buildings of the future is summarised by the General Services Administration in their publication *The Integrated Workplace*, that "since people are the most important resource and greatest expense of any organization, the long-term cost benefits of a properly designed, user-friendly work environment should be factored into any initial cost considerations" (WBDG, 2011).

Part 2: IEQ and learning spaces

The importance of design choices that favour IEQ is not limited to commercial spaces. A child spends 15,000 compulsory hours in the school environment during their formative years (Rutter, 1979) and of this, 85 to 90 percent of their time indoors (Johnson, 2010), making the need for appropriately designed school facilities an important issue. A fundamental requirement in the design of educational facilities is to provide an environment that encourages effective learning, teaching and personal development without any adverse health effects (Ali et al., 2009).

Poor IEQ in the classroom can result in reduced attendance and impaired performance. *Reduced attendance* is defined as the time a student spends outside their classroom, away from the contact of teachers and peers. *Impaired performance* is defined as a student's reduced ability to concentrate and process and/or retain information (Mendell & Heath, 2005). These things combined can impact on student test scores, which is the current method used to measure educational productivity (OECD, 2009). However educational productivity, like workplace productivity, is determined by many modifiable

factors of which the learning setting is only one (Sammons et al., 1995; Stoll & Fink, 1996; and Walberg 1981).

The Future Proofing Schools (FPS) team at The University of Melbourne is a multidisciplinary team that won an 'Australian Research Council' (ARC) grant in 2010, to investigate how to improve the quality of Australian prefabricated classrooms. Prefabricated classrooms, which are also referred to as: prefabs, transportables, portables, demountables, relocatables or modular, are an important part of school infrastructure in Australia. In some states they accommodate up to 30% of school children (Australasian Educational Managers' Conference, 2008) and are used primarily for four reasons (Smith, 2010):

- 1) During emergencies such as after fire and floods,
- 2) With changing demographics and enrolments
- 3) With remoteness, where there is a skills shortage; and
- 4) During capital works programs at the schools.

However despite the value placed on prefabricated classrooms by Departments of Education around Australia, the users and general public are very critical of them for a range of reasons, of which IEQ is one. Other reasons include; their undesirable sense of "temporariness" (Shelton, 2003:23), their "bounciness" as a result of the flexible floor (Shelton, 2003:23) and the general feeling of isolation occupants may have depending on where the buildings are positioned on the site. Prefabricated classrooms can be used as both permanent and temporary accommodation. The research of the FPS team has focused on 'temporary' prefabricated classrooms. This is because while these spaces are intended to be 'semi-permanent', many temporary 'relocatable' prefabricated classrooms become 'permanent' as they are used continuously on the same site for 5, 10 or 15 or more years.

With the intention of improving the quality of 'relocatable' prefabricated classrooms, a first phase of research conducted by the FPS team focused on documenting the problems and the opportunities of these spaces, as they related to 'sustainability, pedagogy, landscaping and prefabrication. This research is documented in the FPS Phase 1 (2011) publication. These four areas (referred to as briefs) formed the four criteria which entries entered into the *Future Proofing Schools Ideas Competition*, were judged against. The Ideas Competition was the second phase of the research and its purpose was to disseminate the FPS team's findings and encourage designers and manufacturers to consider a range of new and exciting possibilities. The third and final phase of the research, the FPS Phase 3 (2012) publication has just been completed and involved a period of analysis and reflection on all the issues and opportunities.

Drawing from the works of Soccio & Hes (2012) in the FPS Phase 1 & 3 Publications; the Sustainable School Environments (SSE) brief made 260 recommendations across nine areas of sustainability. 44% of this advice related specifically to IEQ. The advice was both informed and implied. The prescriptive nature of informed advice such as watts per meter square, lux levels, air change rates and so forth, was targeted at less experienced designers. Informed advice helps designers to place boundaries around the problem and find a solution (Lawson, 2006). The implied advice was embedded in the general discussion, a quote or image of a precedent and was intended to allow more experienced designers to use their own judgement for more creative and innovative solutions.

The analysis of 119 competition entries revealed that 22% addressed issues of IEQ (Backhouse, 2012). Of these, the general approach was to investigate each parameter

in isolation and not address how the overall IEQ would be impacted, especially with regards to the flow-on effects of one decision influencing other outcomes.

We understand what these flow-on effects are, through data collected on the IEQ performance of eight existing prefabricated classrooms in five Australian climate zones. For example, a decision to orient a prefabricated classroom located in the Western Australian desert, so that its single entry point faced towards other buildings on the site, impacted significantly on the heat gain. This orientation meant that two walls of glass now faced east and west, drawing into the space the morning and afternoon sunlight. The large areas of glass, while perhaps intended to illuminate the space with daylight, became a major source of glare and heat.

Data collected on the ambient air temperature inside this classroom over December 2010, recorded a maximum temperature of 54°C. A building on the same site with correct orientation recorded a maximum temperature of 41°C. While these temperatures are particularly extreme over summer, when the buildings are not occupied, the Heating Ventilation Air Conditioning (HVAC) system in the first classroom is still under significant load, even in milder conditions. To increase the well-being of the occupants, the energy efficient evaporated air-conditioning system, which in an arid climate should be mostly sufficient when combined with shading and other systems, was replaced in mid 2011 with a refrigerated air-conditioning system, which requires more energy (FPS Phase 1, 2011).

There is an interesting contrast between how the competition entries proposed addressing IEQ compared with the methods *actually used* in existing prefabricated classrooms. In a sample of 60 competition entries the emerging trend was to propose passive solutions. However results from the data collected inside eight existing prefabricated classrooms, suggests that IEQ is being maintained using active solutions, rather than mixed mode or passive solutions.

Passive solutions do not require energy, often compliment natural systems and are associated with good design and integrated practice. Examples of the type of passive solutions proposed in the competition entries include illuminating the space using daylight, controlling thermal comfort using thermal mass and stack ventilation and maintaining air quality by opening the windows to allow for cross ventilation, preventing a build up of CO₂. Alternatively, active solutions require energy. They are often engineered systems that are used to either compliment passive systems or improve a building where IEQ may not have been considered during the design process.

Passive design has an important role for improving energy efficiency. As given in the example of the classroom located in the Western Australian desert, had orientation been considered and appropriate window shading provided, then the school may have been able to continue using the 'active' evaporated cooling. However in a learning environment it is not possible to only address IEQ using passive systems, because of the very specific requirements for air quality, light, acoustics and thermal comfort. The solution is well summarised in the work by Loftness, *et al.*, (2007) who want design that "merges the natural, minimum resource-conditioning solutions of the past (daylight, solar heat, natural ventilation) with the innovative technologies of the present into an integrated "intelligent" system that supports individual control to achieve environmental quality with resource consciousness".

3. Has IEQ been overlooked by designers?

Looking at the results of the *Future Proofing Schools Ideas Competition*, it appears on the surface that the importance of IEQ has been overlooked. However, there are a

number of factors that should be discussed. For instance the SSE brief contained 260 recommendations relating to nine areas of sustainability. There were also three other briefs that outlined specific requirements for pedagogy, landscaping and prefabrication. All of this information combined culminates into a significant and diverse amount of detail. While one competition entrant (Anonymous, 2012) described this amount of detail as being “great because it showed that the problem had ‘meat’ to it” it is possible that other competition entrants were overwhelmed. Especially as the competition guidelines asked entrants to consider the requirements of all four briefs equally, but then limited entrants to just two A1 pages for communicate *how* they would do this.

Designers may not have overlooked IEQ issues, but instead overlooked *how* to communicate in their competition entry that they were addressing IEQ. As referenced in the first section of this paper, IEQ is an experience of space and cannot be readily seen. This may have made it difficult to communicate graphically. The emerging trend, in a sample of 60 competition entries, was to address one of the *other* areas of sustainability (such as resource conservation). By doing this competition entries could focus on ideas that could be successfully communicated graphically, such as PV cells, water tanks, window shading and position of windows for cross ventilation.

However, the ability to rationalise why designers may have overlooked explicitly showcasing their ideas for addressing IEQ, doesn’t automatically mean that they *are* engaged in the conversation on IEQ. There is growing momentum in an argument put forward in international research on sustainable environments, that “the challenges and inspiration that can be sparked by commitments to a full suite of environmental performance variables have been missing in both education and practice” (Loftness, et al., 2005: 52). This was reinforced by the reaction of an acoustics service provider who was *impressed* that 22% of competition entries had addressed IEQ in the design phase of their building. This suggests that the results of the *Future Proofing Schools Ideas Competition* may be indicative of a bigger problem, which is that addressing IEQ performance is not regarded as being the *responsibility* of building designers.

4. What needs to happen next?

For IEQ issues to be successfully addressed in a resource conscious way there needs to be a greater focus in design education on each of the performance areas. The work by Loftness et al (2007) argues for specific building science foundation courses that address thermal and air quality, acoustic and spatial quality, visual quality and building integrity. These should then be followed by studios that combine building performance expertise with innovation and collaborative design processes. This will combine technical knowledge with the creative process nurtured in the studio environment for future designers to take a more proactive interest in systems engineering and design detailing.

There also needs to be changes within the Industry. There is criticism by design profession of Section J of the Building Code of Australia (BCA) which relates to energy requirements. Section J is an example where efforts to conserve energy can negatively impact on IEQ. For example in demonstrating compliance with provisions set out in the BCA, a designer can either follow a series of rules that are deemed-to-comply to the BCA, or can use an alternative solution provided they can demonstrate that it is *equivalent* to the performance requirements. However demonstrating this requires computer modelling, which is currently expensive and may be outside the budget of a small building. Therefore the budget forces designers to use the ‘deemed-to-comply’ rules set out in BCA, which are active systems. In the case of lighting, this means

taking the 'design by energy limit' approach, which equates to uniformly lighting the space with highly efficient fluorescent fittings (McLean, 2006). This approach can be problematic for IEQ because it doesn't take into account overall illuminance and can result in complaints of excessive light (SSE brief, 2011). There are other concerns with how Section J of the BCA impacts on IEQ, however there is not the scope in this paper to discuss these further.

Conclusion

IEQ is an important issue that has a significant impact on the health of a building through the well-being of its occupants. Looking into the future, healthy buildings will continue to maintain their current level of importance, while the need for energy efficiency will grow. We need to ensure that we are engaging designers in conversations about IEQ, so that decisions can be made during the design phase of a building, that positively impact on IEQ. Enabling these conversations to take place may require better education, at a tertiary level, so that designers feel more confident about their ability to address IEQ. However even with the confidence to make decisions during the design phase of a building, which positively impact on IEQ, current regulatory documents like the BCA makes proving that these 'alternative solutions' meet the performance requirements, expensive. In summary, there is unquantifiable value in healthy buildings with good IEQ. Achieving good IEQ, through good design, isn't a luxury that should be reserved for big buildings with big budgets. It should also be extended to smaller building such as relocatable, prefabricated classrooms.

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City of Layers - Reconfiguring the Built Environment for Sustainability

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Title: City of Layers - Reconfiguring the Built Environment for Sustainability

Abstract

This paper presents an architect's point of view into how the built form and urban life could be enhanced by using planning and architecture to reach a more equitable balance with nature.

With our knowledge and technology we should be progressively and creatively enhancing the urban form so a new built reality emerges, one that can possibly enrich people and enable a sustainable future. This alternate path requires the courage to break from traditions and necessitates the mergence of the seemingly disparate disciplines of urban planning, architecture, engineering, art, sciences and business so these can more effectively integrate the many disparate parts that exist within the built environment to produce a more vibrant, viable composition, one that could possibly transform the built environment into an entity that can replicate and function as a natural sustainable system.

Keywords: *city, layers, sustainability, architecture, configuration, composition*

Introduction

This paper provides an outline as to how change can be directed within the urban form to enable a more sustainable future. Inevitably, within the urban form, every decision is important. How we choose to plan, design, place, structure, configure and interface the urban form with built elements, are all important decisions and therefore, it is essential that right decisions are made.

This paper is also a response to the increasing complexity involved with today's systems and processes, where often these overwhelm us and we lose sight of the possible. Simply by knowing the possible, we have the opportunity to direct change and influence what architecture is to eventuate and thereby also the overall 'appropriateness' of the resulting outcome.

City of Layers

The City of Layers concept is a reductionist approach that first distils the most important aspects and strategies and then uses these to envision the possible cities

of the future; cities that can be more social, liveable and configured to accommodate more of us. Cities are after all our lifeblood. These can offer large economic, investment, social and political opportunities but when we make mistakes, these can commit us to long-term resource use, the production of more waste, emissions and to ongoing environmental degradation

Within the urban form, we are already feeling a 'big squeeze'. The Geelong population is forecasted to rise from 290,000 to 500,000 by 2050 and in Melbourne from 3.9 to 5 million by 2030. Similarly, worldwide, the numbers of people moving to cities is also staggering. This week alone, it is estimated that 1 million people will move into the world's cities, adding some 20 Melbourne sized cities to the planet each year. Countries with an already large population base like India face even greater challenges, where within the next 10 years it is estimated that an additional 500 million people will need to be housed.

The traditional response to population increases is to expand the urban form, often with developments driven with financial imperatives. And in an effort to make the built form more efficient and affordable, it are often rationalised, designed with fewer materials, reduced amenities and with smaller spaces.

With such solutions, our view on how to achieve 'liveability' and 'sustainability' seems to be out of focus. As the built form expands with its infrastructure of roads and housing developments these not only create social problems but also ecological stress. This is evident in Geelong, where urban expansion is preferred to the alternative; the enhancement of the existing urban form. And not having the adequate infrastructure or the necessary amenities both compromises the liveability aspects and does not enable the transformation required to achieve sustainability.

*'The region is constrained by a lack of infrastructure – including centres of activity around entertainment or leisure sites to create attractive scenes – and pales in comparison to other key regional cities, it found.'*¹

An alternative to urban expansion is to densify and diversify the existing urban form. Melbourne is an example of a city that adopted this strategy, transforming itself from being a 'dead at night' in 1980 into an 'open all hours' city by 2002. And, by 2006,

¹Shane Fowles, Geelong's Field of Dreams, Geelong Advertiser Saturday, 7 April 2012

Melbourne was rated one of the most 'liveable' cities in the world.² Today however, the challenge remains for the strategies adopted in the Melbourne inner city to be replicated throughout its outer suburbs.

*'In inner Melbourne . . . you've got everything there. It's a pedestrian city, it's a cycling city, public transport wherever you look.....The problem is how do you make that real for Melbourne as a whole. That's a huge challenge.'*³

Both the liveability and sustainability aspects can be similarly rated. Both have the common elements of 'work', 'health', 'community', 'connection', 'education' and 'amenity' (see Figure 1). Each criterion however, has a different emphasis, as achieving liveability does not necessarily result in a sustainable outcome. For instance Melbourne may rank highly with the liveability criteria but ranks lowly in terms of sustainability, placed 7th from the 20th largest Australian Cities⁴. Therefore, both these aspects are equally important and both must be considered when strategising how to improve the urban form.

Liveability Criteria (Five broad categories with over 30 qualitative and quantitative factors across	Sustainability Criteria	Common Factors for Future Cities
Stability	Employment Household debt	Work
Healthcare	Health Well-being	Health
Culture & Environment	Public participation Air quality Ecological footprint Green buildings Water Biodiversity Climate change readiness	Community Connection
Education	Education	Education
Infrastructure	Density Transport Food production	Equitable" access to services. Amenity

Figure 1 – Liveability and Sustainability Criteria Comparison and Common Factors

The Green Building Council (GBC) organisations such as the GBCA and US-GBC have established frameworks that address these very aspects, with the Green Star Communities and LEED Neighbourhood Development (ND) tools. Both these tools

² As rated by The Economist Intelligence Unit Limited Liveability Criteria

³ Professor Howe, the ex-senior Minister for the Hawke government and ex-deputy prime minister to Paul Keating, as quoted in The Age Monday, April 02, 2012 in the article titled 'Sprawl 'threat' to Melbourne's title Expert warns relentless growth puts liveability in doubt'

⁴ As rated by the Australian Conservation Foundation's Sustainable Cities' Ranking.

have similar criteria and both place an emphasis on the design and configuration of the built elements (see figure 2). However, as these tools are voluntary, these are most often applied in a piecemeal fashion and thereby do not necessarily achieve the desired liveability standard or enable the transformation required to achieve sustainability.

GBCA - Greenstar Communities	USGBC - LEED Neighbourhood Development	Common factors
Create Opportunities for Economic Prosperity	Regional Priority	Work
Foster Environmental Responsibility	Green Infrastructure and Buildings	Health
Enhanced Liveability	Smart Location and Linkage	Community Connection
Embrace Design Excellence	Neighbourhood Pattern and Design	Amenity
Demonstrate Visionary Leadership and Strong Governance	Innovation and Design Process	Design and Configuration

Figure 2 – GBC Green Star Communities and LEED ND Criteria Comparison and Common Factors

One necessary change to achieve the desired standard and transformation is how the urban form is planned. Today's urban planning policies and processes have not fundamental changed for more than 100 years, these were developed in a time when there was no resource scarcity and no one expected cities to have millions of inhabitants. The in-place centralised initiatives are ideas proposed from people who thought they knew what everyone needed, but did not really understand how to create communities, vitality or enable sustainability.

Alternatives to the present urban planning policies and processes exist with the use of performance measures or performance based zoning, with innovation, value and benefit creation. These would inevitably place greater pressure on planners, architects and developers, who would need to use all their skills to manoeuvre through politics, policies, stakeholders interests, delivery methods, financial efficiencies, public and private sector involvement, all to effectively integrate and configure built elements with infrastructure into new reality for the social good. Rather than adopting restrictive zoned based processes, each new development proposal would be assessed on how it proposes not only reconcile the foreseeable

risks but also by how it would benefit society and reduce the massive burden we have placed on the natural environment. This would give the community the assurance of what will be developed will enhance the built environment along with our wellbeing (see Figure 3).

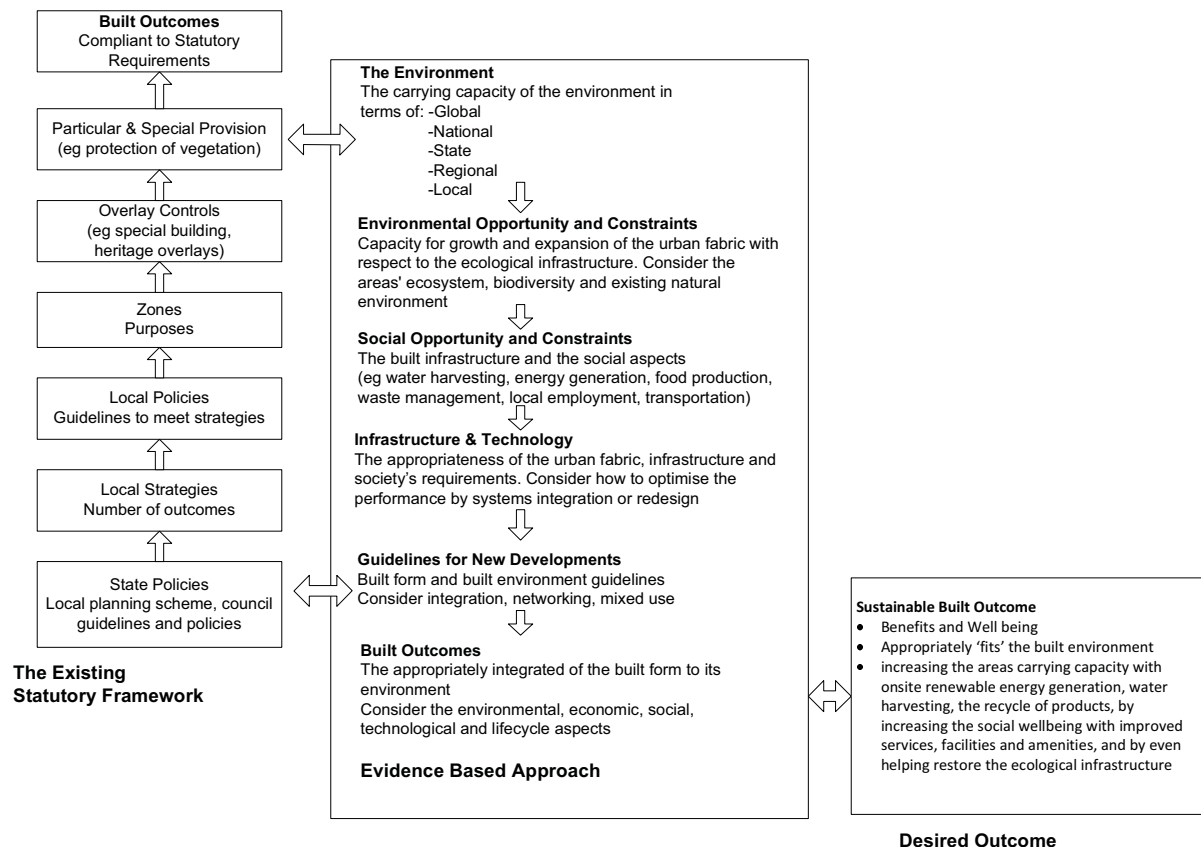


Figure 3 – The Traditional Planning Process Compared to an Evidence Base Approach

With our knowhow and ability, we should be transcending traditions and self imposed constraints, to produce what is most appropriate for our time. Furthermore, the solutions we provide should not lie between adaptive or mitigative measures, but rather, these should be derived from today's technology and knowledge. With these, we could be rethinking the urban environment, so cities can both enhance life and reach a more equitable balance with nature.

The key tool we have is design. Design is that powerful tool that provides us with the means to choose how we structure, compose and configure built elements. Design should however not be limited to designing efficient buildings or developments, but also used to replan and reconfiguration of the built environment - as a whole, so each part and element can be appropriately integrated, interfaced, is in support to

the other parts and when combined, are able to produce an enhanced the whole. With design we can contemplate and determine what is to eventuate, from single compositions to complex functioning systems such as cities.

Masdar City, United Arab Emirates is an example of a new urban form that was purposefully planned and designed to sustainably accommodate 50,000 people and rate highly in terms of liveability. Innovative design measures enabled this city to 'close its loop' on waste and water, and generate all its energy from renewable sources such as solar and wind. This is also a city that has replaced the personal vehicle with an integrated underground public transport system, within everyone's reach.

But is building new cities the answer? We already have a built form, which can more easily be upgraded than reconstructed. By changing our focus from new built to enhancement projects and with appropriate choices, both our self sufficiency and quality of life within cities could be purposefully and progressively improved. With what we have, we should not be starting again, and nor should we continually seek to expands the urban form.

The progressive transformation of the urban form could commence with the enhancement of the existing individual built elements. Smart facades with photovoltaic cells and panels could be placed throughout the built form, on all sun-facing vertical and horizontal surfaces, including roofs, and paving. New connections could also be added between buildings, at multiple levels. Roof top planting could be placed to treat and recycle water, reduce the heat island effect and provide public meeting spaces. Underground and elevated public transport could be added and thereby reduce the requirement for private vehicles.

Unseen, the internal processes could be progressively restructured to close the loop on water and waste, allowing everything to be recycled, without causing any ecological harm. Sensor and feedback technology could also be used to provide performance information on how the built environment is faring – which would then also initiate further improvements. And as technology is progressively embedded within the built environment it could begin to harvest all its necessary resources to function, which would in turn support, enrich, and nourish its inhabitant (see Figure 4).

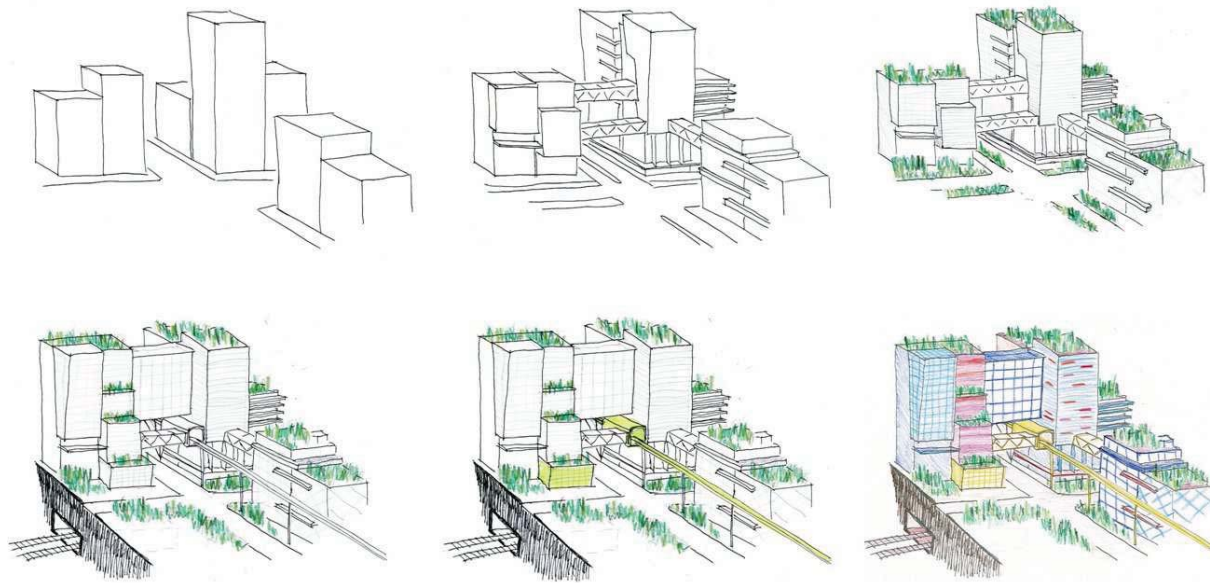


Figure 4 – The progressive densification and diversification of the urban form, in layers

As the built environment evolves, a more fertile architecture could eventuate, possibly one that has self reviewing measures, one that seeks refreshment and has living qualities. This ‘new’ architecture would be based on strategies of dissipation, having a diffusive built form that maximises its involvement and interaction with its inhabitants, and has interactive systems that would create a dynamic environment based on inclusiveness, connections, and responsiveness. The resultant whole would be turbulent yet resilient, possibly with the extensive reticulation of the trivial, all stratified in layers of forms and materials with social spaces and inspiring architecture.

By restricting urban expansion, virtually every aspect of the urban form would need to be changed, possibly into a form that is more compact with an enhanced infrastructure, amenities and serviced with effective public transport. This would enable the community to become engaged and connected,⁵ whilst also providing the means to protect the surrounding ecology located at the city’s fringes. The emergent multi centric built environment would be allowed to continually evolve as an integrated design process is applied with solutions that further integrate art with landscape, place appropriately scale structures and incorporate new technologies that would improve the quality of life and provide long term benefits.

⁵ The number of intersections, the streets and walkways that exists define the connectiveness of the place. According to US-GBC LEED ND 55 intersections per square kilometre are required to make a functioning urban form and 155 is regarded as best practice

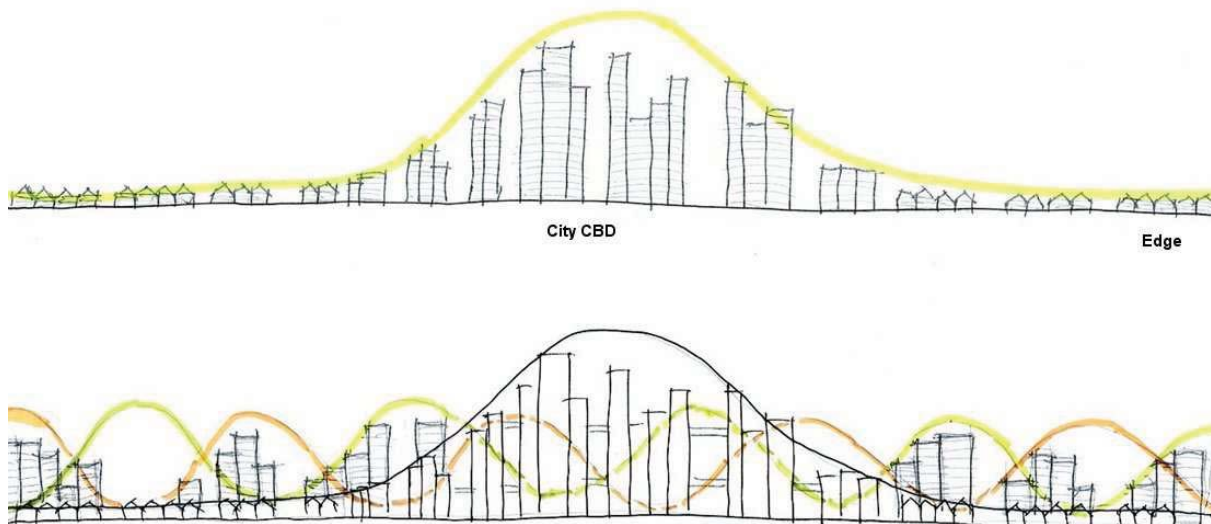


Figure 5 - The Traditional City with its Core and Edge compared to Multi Centric Urban Form

As the necessary key elements, the component parts and the required technology are identified to make this transformation possible; these could then be planned, combined, and configured, in layers upfront, for verification and to ensure the desired architecture and composition eventuates (see Figure 6). One possible layer could be the 'art and social interactions' layer. This layer would ensure boundaries were blurred between the private and social spaces, made more permeable, whilst also making art more accessible and the whole more interesting.

Another layer could be how the 'green bits' are embedded both vertically and horizontally and intertwined into the built form, so these become vital parts of the urban environment. Landscaping could be placed on roofs, walls and used to absorb CO₂, provide further shading, reduce glare, absorb heat, improve the air quality, provide food and collect and treat rainwater, thereby making clean water readily available for everyone. Green spaces could also be placed and configured as attractive transition zones where people and fauna can interact, where the local ecology could thrive, and possibly extended to the built form, arranged to allow urban farming whilst providing shade and cooling to the immediate environment.

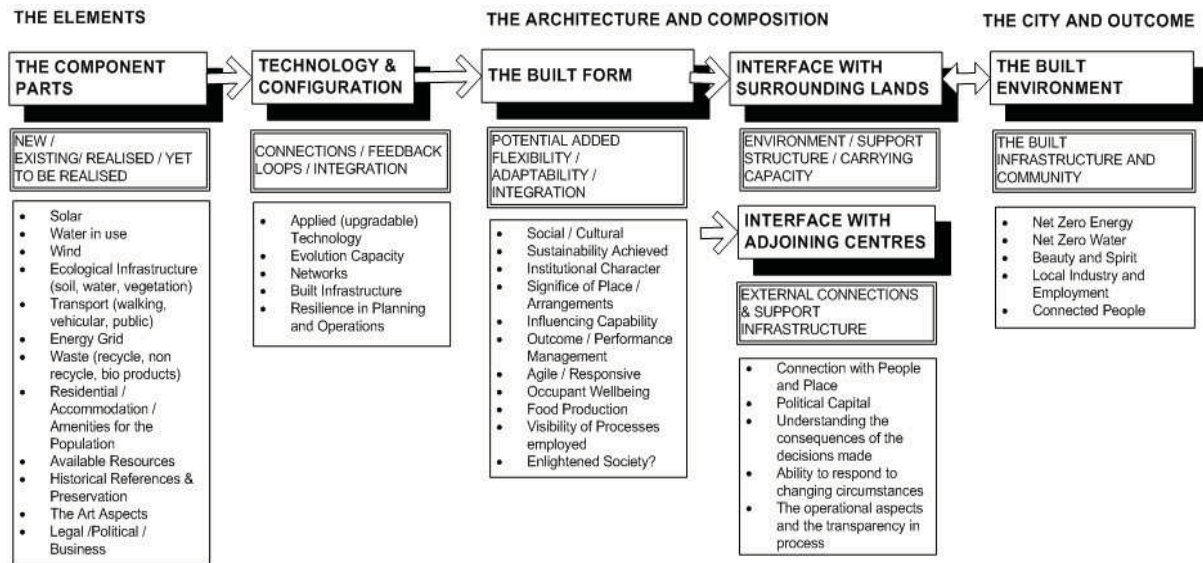


Figure 6 - Key Architecture and Composition Elements and Outcomes

As the reconfiguration of the built environment is contemplated, reference to the new urbanism movement's concept of the city, the neighbourhood and the blocks could be used to redefine the urban form and envision the transformation required, possibly through a series of networks, nodes, connections and links. Architecture is after all a social art that requires social collaboration, participation and needs some guidance as to the possible. Through collaboration and community participation, we could be establishing liveable, fully serviced and connected communities, possibly with neighbourhoods configured so homes are all within walking distance to shops, schools, recreational parks, workplaces or to public transport, all within 5 to 10 minutes.

Similarly, the many disparate parts within the urban form could be more effectively linked and connected when these are considered as part of a network. Simply by adding random links both the distance and time of travel could be reduced. It after all the many small links and connections that allow networks⁶ to achieve efficiencies in movement, makes the whole resilient,⁷ and allows the many parts to mutually support each other, collaborate and function as a self evolving whole.

'Form based' zoning could be used to enhance the appearance of the block, the neighbourhood and the city as places and by creating walkable precincts and by possibly encourage urban regeneration. Similarly, architecture, as a mediator

⁶ Networks are essentially structured to effectively and efficiently move resources in a few steps

⁷ The internet is an inherent resilience network which has the ability to easily reroute data when some links fail, without affecting the whole

between the natural and the artificial, could be used to renew and create new relationships and connections within communities and with the natural environment. And instead of enabling intimacy within the built environment, we could be striving for its opposite 'extimacy,' as we seek to better link living spaces to their surroundings.

As the built form and its component parts are manipulated, either consciously or deliberate, we could do so possibly by disfiguring rather than organising or rationalising, with deliberate choices, and not necessarily by controlling the forms or outcomes. Architecture can be given the ability to carry and generate itself, by fostering exchanges and by possibly providing the scaffolding and infrastructure that would support a stratified response that can lead to further enhancements.

Similarly, the processes within the urban form could also be progressively restructured until these begin to mirror nature and become organic and self-reliant. And as the open loops with the urban processes are closed and the whole is allowed to grow and evolve, then these could start to progressively enrich society with its industries, until eventually the built form would reach a new level of self reliance and possibly become sustainable.

Many opportunities are created as the population increases. The proportional costs per person drop, making higher cost upgradable technologies more affordable, viable and desirable, especially when considered in terms and lifecycle costs and benefits. Similarly, with the location efficiencies created, a new high densified mixed use development could result, possibly with increased business, local participation, enhanced public transport and thereby also with a reduced carbon footprint. After all, we don't built cities to build infrastructure. We make infrastructure to support us and our cities.

With such solutions, an alternate type of growth could emerge; a restorative and regenerative growth that would progressively improve the liveability aspects within the urban form. Each new services, work and connection added would enhance the whole and possibly allow it to reach a sustainable balance with its natural environment.

This is the city of layers concept, a concept that does not necessitate the reconstruction of the built form but rather its enhancement. Each new addition would further enhance and renew the urban form, not by expanding or reconstructing it, but

by establishing new connections, adding diversity, density, and new businesses. Not necessarily by repeating elements but customising the built spaces, by creating a variety of spaces for both vertical and horizontal living, possibly filled with narrow streets, overhanging buildings, distinct communities, with many connections and amenities, and with local work opportunities. With these a diffused rather than centralised built form would emerge, one that would be scattered yet organised, structured yet complex, with diversity and technology driven communities, and a form that is supported with multiple micro grids of services that source and provide all the necessary resources for it to function sustainably.

At the community level, as layers of enhancement and complexity are added, these would progressively increase the diversity and density, increase local industries and employment opportunities, and better connect the community. The in-place infrastructure would similarly be enhanced, so it starts to harvest the required resources; the energy, water, and food, and ensures that waste is recycled and the overall impact on the natural environment is reduced, possibly reaching a point of net zero resource use and where beauty and spirit prevails. In time, cities could be similarly progressively transformed from their largely static state into dynamic complex social organisms, possibly into virtual living forms.

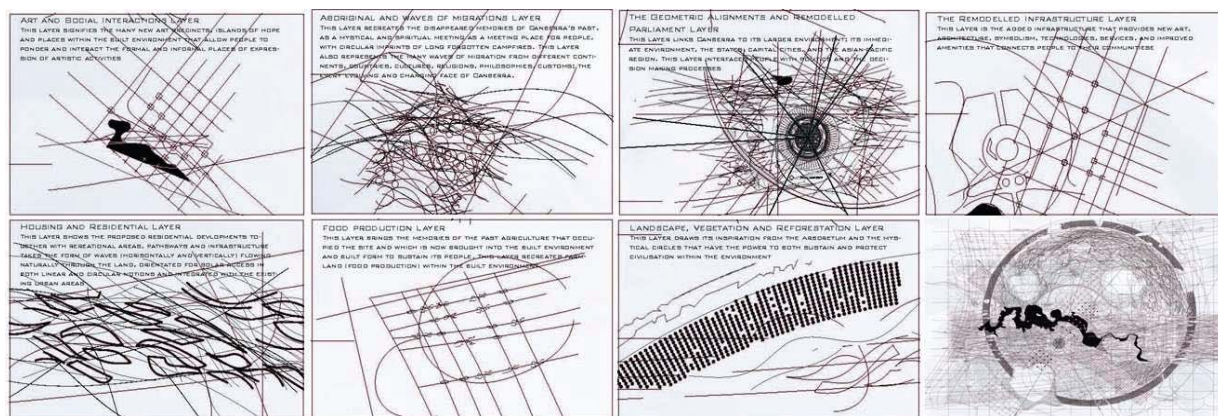


Figure 6 – The City of Layers concept applied to re-envision Canberra

Conclusion

As we design, we recreate ourselves. Once form is created, it becomes a virtual extension of us. The building envelop is likened to our external skin, the motor vehicles that transport us to our feet and the technology we use to our voices. And as we further extend ourselves into the environment with built form, we could be endeavouring to create more social and sustainable outcomes, where possibly the

whole becomes a dynamic complex social living organism. Then someday, as
Pigmalion once breathed life into a statue, so would we be able to breathe life into
architecture and the built environment.

A City's Disaster Recovery: The role of a Healthy City Initiative



*A CDHB led intersectoral partnership
with 200+ signatory organisations*

Compiled for the Healthy Cities Conference, Melbourne 2012.
Updated August 2012. healthychristchurch@cdhb.health.nz

A City's Disaster Recovery: The role of Healthy Christchurch

1 Introduction

This report describes the response of a healthy cities initiative to the first two years of disaster recovery. In 2010 and 2011 Christchurch, New Zealand, experienced five major seismic events, two of which resulted in widespread destruction. While this report focuses on Christchurch the events affected the wider Canterbury region and many of the initiatives identified have a wider reach.

Following the first event in September 2010, Healthy Christchurch (HC) recognised that it had a role to play in assisting community organisations to subsequently support their communities in the recovery.

Healthy Christchurch is a Canterbury District Health Board (CDHB) led collaboration of groups from a variety of sectors who are committed to working together to promote the health of the people of Christchurch. The focus of our current work programme is on the recovery of Christchurch. This involves wide collaborative efforts providing support and advice to policy and planning processes, supporting community resilience initiatives, and ensuring a sustainable, accessible information portal for recovery practice and strategies.

The focus of this report is on the contributions made by HC to the maintenance of community resilience in the city. This work was informed by a review of the literature around community recovery initiatives carried out by the CDHB in 2010¹ which concluded that recovery happens best when it is community owned and driven.

The report touches on a range of initiatives under the following headings:

(Note some initiatives impact on more than one area)

- **Needs Assessment**
 - Community Wellbeing & Resilience Meetings & Report
 - Commemoration of the February 2011 event
 - Christchurch City Health and Wellbeing Profile
 - Literature Review – The Social Integration of construction workers into a recovery setting
- **Communication**
 - Community Wellbeing & Resilience Meetings & Report
 - One Stop Shock
 - The Healthy Christchurch Website
 - Warmer Canterbury
- **Psycho-social Recovery**
 - The Wellbeing Game
 - The Wellbeing Campaign
 - Take Time to Smell the Roses
 - River of Flowers
 - Wellbeing & Resilience Hui
 - Places of Tranquillity
 - Community Dinners

¹ Review of Community Recovery Initiatives, Community & Public Health, CDHB, 2010. http://www.healthychristchurch.org.nz/media/42273/eq_reviewofcommunityrecoveryinitiatives101008.pdf

- **Recovery Tools**
 - The Wellbeing Game
 - Integrated Recovery Planning Guide

2 An Earth Quaking Christchurch

For those out of town and more so out of New Zealand it is difficult to understand the impact of the multiple events and continual aftershocks occurring in Christchurch since the first in September 2010. The loss of lives and injuries is life changing, the impact to the buildings and infrastructure significant and the psychological effect to community wellbeing is enormous and on-going.

On September 4th 2010 the first earthquake hit at 4.35am striking the Canterbury region in New Zealand's South Island. This 7.1 earthquake was centered near rural Darfield just outside of Christchurch and caused damage to buildings, injuries and loss of power and sewer lines for many across Canterbury. The earthquake was reported to be felt across the South Island and the lower and central North Island. The fact that it occurred in the night time which contributed to no fatalities.

On Boxing Day 26th December 2010 a 4.9 hit the central city and was one of many largely felt shallow aftershocks that day damaging some buildings and closing streets in the central city.

The most damaging earthquake, a magnitude 6.3 earthquake hit at 12:51 pm on Tuesday, 22 February 2011. The intensity felt in Christchurch was Mercalli 8. The peak ground acceleration (PGA) in central Christchurch exceeded 1.8g times the acceleration of gravity and a shaking intensity equivalent to Mercalli 10+. This is the highest PGA ever recorded in New Zealand, is also one of the greatest ever ground accelerations recorded in the world and the highest in a vertical direction.

The government immediately declared a state of national emergency, which stayed in force until the 30 April 2011. There were 185 fatalities including nationalities from more than 20 countries. 133 people were lost when two modern buildings collapsed, eight were killed when masonry fell on a bus in a central city street and an additional 28 people were killed in various places across the city centre. 12 were killed in suburban Christchurch. Between 6,600 and 6,800 people were treated for injuries. The earthquakes downed phone lines, triggered wide spread power and water outages for days and left many without sewerage for months. While the final figures are not yet completed it is likely that at least 10,000 houses will need to be demolished, and well over 100,000 have some level of damage. Significant liquefaction occurred in saturated soil areas across eastern suburbs causing the ground to behave like liquid. The silt pouring out of the ground like mini volcanoes produced around 400,000 tonnes of silt, flooded suburbs, opened sink holes and caused massive damage to roading, infrastructure and limited access to areas by vehicle. Liquefaction damage and potential future aftershocks mean that some parts of Christchurch cannot be rebuilt on.

The next major event following February 22nd was a large aftershock on 13 June which caused considerable additional damage including significant liquefaction. The earthquake caused power outages, which left around 54,000 households without power. Forty-six people suffered injuries, and one elderly man died after being knocked unconscious. The fifth main event occurred on 23 December 2011 where many hard hit suburbs were impacted again with liquefaction.

In total since September 2010 a total of 10, 569² aftershocks have hit Canterbury with those over magnitude 3.0 (easily felt) totaling 3398. The aftershocks continue with 1063 since the last major event in December³.

The total cost to insurers of rebuilding has been estimated at NZ\$20–30 billion, making it by far New Zealand's costliest natural disaster, and the third-costliest earthquake (nominally) worldwide.⁴

3 Needs Assessment

3.1 Community Wellbeing & Resilience Meetings and Report

Following the September 2010 earthquake, the Ministry of Social Development (MSD) convened a series of meetings for the community and voluntary sector in Christchurch. The purpose was to identify the needs of the sector so they could contribute effectively to both the recovery and maintenance of community resilience. At the first of those meetings it was recognised that small, locally-based groups and agencies had a key role in supporting the recovery of their local communities.

A subsequent meeting requested that the Council of Social Services in Christchurch (CoSS) take responsibility for finding out about the needs of groups and their communities and to capture what was happening. The project was developed by CoSS and HC, with support as requested from Christchurch City Council (CCC), Mental Health Foundation(MHF) and the Department of Internal Affairs (DIA). A number of other agencies contributed to the meetings, including Community & Public Health (CPH), Civil Defence Emergency Management, MSD and Earthquake Support Coordinators.

The seven meetings held from December to February 2011 had two purposes. The first was to provide groups with information about building personal and community resilience, recovery management and recognising potential times of higher community stress. Secondly to support attendees in small groups to describe how their communities and their group or organisation had been affected by the earthquake and what they had done to respond to community need. They then identified the support their community was still seeking and what capacity they had to meet that need.

The majority of those who attended were representatives of community groups and NGO service providers. These included social service providers, community development groups, churches, schools, pre-schools, and neighbourhood groups. Other attendees included individuals from affected communities, city councillors and community board members, and central or local government staff.

The total number of participants at the meetings was approximately 119, representing 74 individual non-governmental organisations. Feedback from the participants was positive with a high number expressing that they appreciated the opportunity to share their stories and experience. They also highly valued the recovery information provided.

² <http://www.christchurchquakemap.co.nz/> Accessed 7th August 2012

³ <http://www.geonet.org.nz/canterbury-quakes/aftershocks/> Updated August 7th 2012

⁴ Facts are still being collected for these ongoing events but this report has used information from online media releases as well as a collection of facts on Wikipedia http://en.wikipedia.org/wiki/2011_Christchurch_earthquake . Other useful sites are www.eqc.govt.nz and www.cera.govt.nz

A report was written about the needs of community agencies in supporting community wellbeing and recovery⁵.

3.2 Commemoration of the February 2011 event

The first anniversary of the February 22nd earthquake that took 185 lives, injured many and would leave thousands with broken homes required a sensitive approach. In order to better understand the communities needs the Canterbury Earthquake Recovery Authority (CERA)⁶, who has established strong links with and signed up to Healthy Christchurch, requested an online poll.

The Healthy Christchurch website provided the tool and the poll was promoted through the network and by CERA through its website and Facebook. The poll covered topics such as whether people were wanting to go to the large community event, have a day off work, a local event or stay at home.

A TradeMe (online auction site) message board was also started by the community and the comments made were considered along with the poll. The poll showed that many Cantabrians expected an event in Hagley Park (the major city park) similar to a memorial service held in 2011. A significant number of respondents however supported having local events that allowed communities to be together to commemorate and to look to the future (see River of Flowers below).

3.3 Christchurch City Health and Wellbeing Profile

The Christchurch City Health and Wellbeing Profile has two parts to it. The first is a snapshot capturing information about Christchurch's population and the factors that influence their health and wellbeing. The data collection for this was largely undertaken prior to the earthquakes (from September 2009-2010) but now provides an even more timely snapshot of what people valued about life in Christchurch. The Profile was developed through the Healthy Christchurch interagency network and included a survey and public consultations.

The second part is producing up a number of key issues papers based on the things that were raised in developing the profile. These issues were identified as factors which influence people's health and well-being in the city. Health begins where we live, work, learn and play. The Profile is a reminder that everyone has some role to play promoting Christchurch as a good place to live. A wide range of data about what influences health and wellbeing in Christchurch has been gathered and as such is a useful tool for planners, government and other agencies, communities and individuals to identify priorities. The conversation started in the consultations will continue as people respond to the Profile. The key issues summaries will be updated regularly as new data becomes available to provide a reliable source of information of over 40 key issues identified.

⁵Supporting community resilience in post-quake Christchurch, Council of Social Services and Healthy Christchurch, July 2011. <http://ccoss.org.nz/wordpress/wp-content/uploads/Supporting-Community-Recovery-Final-Report-July-2011.pdf>

⁶Christchurch Earthquake Recovery Authority. <http://cera.govt.nz/>

The profile and all key issues papers are available from the HC website⁷. As Christchurch rebuilds both socially and structurally from the devastation of the September 2010 and February 2011 events this body of work will offer insights and evidence which can help shape a recovery that prioritises health and wellbeing of Christchurch citizens as the measure of success.

3.4 Literature Review – Social Integration of workers

As part of the rebuild of wider Canterbury there will be a large workforce arriving in the city. Social integration of workers during rebuild is a priority for CERA. Healthy Christchurch is working alongside CERA to provide support. The first stage is for a literature review that will both inform the planning process and assist in designing integration strategies.

4 Communication

4.1 One Stop Shock

The provision of information at the community wellbeing and resilience meetings was highly valued. However many commented there was a plethora of information around but many people and agencies were not in a state to wade through it to find what they needed. There was also some criticism of many information sources suggesting to go to a web address for more information, when thousands were without power.

In this context HC created a printable one page two sided flyer with an essential list of key contacts, services, funding and financial support and free counselling. This was updated weekly over the first few months then monthly. It was downloadable via the Healthy Christchurch website for community organisations to hand out and distributed at many public meetings.

After a year with multiple earthquake events a One Stop Shock Flyer was created for the Refugee & Migrant background communities⁸. This was undertaken in collaboration with the Culturally & Linguistically Diverse Communities inter-agency committee.

4.2 Healthy Christchurch Website

With many communities and community organisations reiterating the lack of effective communication and information, HC identified a clear role in distributing information through its website and weekly news posts which are sent to around 200 signatory organisations and over 400 key contact people.

Website information included links to resources such as the literature review of 'best practice literature and other significant international recovery documents'⁹. While web

⁷The Christchurch City Health Profile, Canterbury District Health Board, 2011 <http://www.healthychristchurch.org.nz/city-health-profile.aspx>

⁸One Stop Shock, Earthquake Recovery Information sheet http://www.healthychristchurch.org.nz/media/45847/onestopshock_111208cald.pdf

⁹Long Term Planning after Disasters. Community and Public Health, CDHB, 2011 http://www.healthychristchurch.org.nz/media/42276/eq_ltplanningafterdisastersfull.pdf

access was still an issue for some members of the public most agencies were able to access this information.

Weekly news posts were already a key aspect of HC communication strategy however the system was overhauled to be more effective and became a core component of the website. Approximately 20 relevant items covering recovery and earthquake information, services, links, events and funding were posted each week and available immediately on the website. They were also emailed weekly directly to HC signatories to distribute throughout their organisations and networks.

4.3 Warmer Canterbury

Keeping warm and well for this winter (2012) is the current focus for many Canterbury organisations and individuals. Christchurch traditionally has a hard winter but on top of this many people are still living in damaged houses and temporary accommodation.

Healthy Christchurch wanted to support this by acting as a portal to share information and planning activities. One aspect involved facilitating a collaborative working group of key agencies to ensure they were able to support each other's initiatives thereby increasing reach and reducing any potential duplication. This project also involved agreeing key messages for distribution and CERA and HC co-ordinated the production and distribution of a range of winter warmth resources¹⁰.

When thinking about warmth and wellness during winter, it is about more than just warm homes. Other things to consider and plan for include: fuel security, social isolation, mental well-being, immunisations, and effective transport.

The HC website aims to provide accessible and relevant information so that agencies and individuals have a way of knowing what winter-related services are available within the community. It is also a place to share existing or upcoming winter-focussed programmes that can assist individuals and communities to manage during the cold months.

5 Psycho-social Recovery

5.1 The Wellbeing Game

The inaugural Wellbeing Game began during Mental Health Awareness Week (10th - 16th October 2011) and went for four weeks. It was pretty easy. People joined as an individual or formed a team of up to ten people; they logged their hours and activities, under the 5 strategies below, onto the website and watched the hours grow. Together we logged **7,410** happiness/wellbeing hours for Christchurch!

The 5 strategies for wellbeing are based on international evidence researched by The Foresight Project in the UK¹¹. Applying these five easy things to your life will improve your wellbeing and help you on the way to happiness.

¹⁰Winter Warmth brochures <http://www.healthychristchurch.org.nz/winter-warmth-and-wellbeing.aspx>

¹¹The Foresight Project, UK <http://www.neweconomics.org/projects/five-ways-well-being>



In 2012 the Wellbeing Game is getting an overhaul so it can be the best online game ever. We are also piloting the game in two settings – a school and a workplace over June/July to further input into the development of the game, ready for October's Mental Health Awareness Week. We have interest from several large government organisations to be involved this year as well as many smaller NGOs.

5.2 Five Winning Ways to Wellbeing Campaign

This is a Public Health social marketing wellbeing campaign. The key partners are the MHF, CPH, and CERA and it is funded by MSD and the Ministry of Health. The campaign aims to increase wellbeing in the wider Christchurch population during the recovery. Multi sector planning and advisory groups have both been established and a market research company has been contracted to undertake the research which the groups have identified is required in order to shape appropriate social marketing of the 5 ways to wellbeing in the Canterbury context. The aim is to launch this in early December 2012.

5.3 Take Time to Smell the Roses

In May 2011, HC hosted an afternoon tea for volunteers, community leaders and community based managers to give a little time out and some much needed inspiration and laughs. Two signatories CoSS and MHF got together with HC to make this happen.

These are the wonderful people who are looking after our communities, neighbourhoods, streets, neighbours, friends and family. Many of these people had been working evenings and weekends since September. Over 8 months! Recovery is going to be a long haul and we do not want these people to get exhausted and burn out.

There were opportunities to share stories of resilience and to celebrate successes with peers. The MHF presented some practical strategies for building flourishing communities and looking after your wellbeing.

Peter Fitzsimons, a high calibre International Speaker gave his time and had the nearly seventy guests in hysterics in about 1 minute of starting to talk. He gave it his all giving line after line of hilarity and finishing off with some inspirational words told to him by Sir Edmund Hilary.

5.4 River of Flowers

The River of Flowers was initiated and led by HC in collaboration with the Avon-Otakaro Network (AvON)¹². The project was a direct response to the Commemoration day poll (see above).

The Prime Ministers Office and the Christchurch City Council were in the midst of planning a memorial event at the largest central city park, Hagley Park. However, a significant number of respondents had requested local events that allowed communities to be together to commemorate, and to look to the future.

The River of Flowers was our collaborative attempt to provide these opportunities for people to commemorate the day in their own way and with their community. Fifteen sites were hosted by local community groups along the Avon, the cities major river which flows through the central city and out to the eastern side of Christchurch where the most devastation occurred.

At any time during the day of the 22 February 2012, people brought flowers to drop in the River and wrote messages on a Tree of Hope. From 12.30 to 1.30pm, local community groups hosted the sites and included speeches, singing, silence and connectedness. At 12:51 two minutes silence was held, followed by the release of red helium-filled biodegradable balloons.

The River of Flowers¹³ was an opportunity to:

- come together as a city through a river of flowers
- let go through dropping flowers into the river
- hold two minutes of silence to remember those who have died, been injured, or who have lost their homes
- write notes of hope and post them on a tree of hope
- acknowledge the importance of the river(s) in the life and heritage of the city
- give a token of respect back to the river(s)
- show the connections between communities - particularly those most affected
- celebrate our strength - resilience and supporting one another.

5.5 Wellbeing & Resilience Hui

Six months after the national emergency finished and the disaster response phase had moved forward into recovery, HC hosted a collaborative Hui (meeting) with the MHF, CoSS and CPH. This was an opportunity for community organisations and sectors working with communities to get together and network while also learning about four effective recovery tools. Three of these were HC initiatives included in this paper : The Wellbeing Game, Community Wellbeing and Resilience Project and the Integrated Recovery Planning Guide. Another resource The 'Before, During & After' – Emergency preparedness resource was presented by CPH.

Workers appreciated some time out, real tools helpful and relevant to their work and a lovely lunch.

¹²Avon-Otakaro Network.<http://www.avonotakaronetwork.co.nz/index.html>

¹³<http://www.healthychristchurch.org.nz/focus-areas/wellbeing/river-of-flowers.aspx>

5.6 Places of Tranquillity

Imagine the tranquillity of a Japanese garden, a Buddhist fountain meditation area, a walking meditation circle or a Korean undulating park and playground. Or perhaps a green maze leading to an area of contemplation, a place of tranquillity and stillness amidst the chaos and impact of the disaster that has occurred in Christchurch.

Healthy Christchurch led this innovative collaboration which will create six gardens of beauty and peace to fill in some of the gray demolition sites across Christchurch.

This has been undertaken in partnership with Maori, Pacific and the ethnic minority communities and as such incorporates important traditions, cultures and spiritual philosophies. This will ensure that these communities' voices and presence is more visible in the rebuild of our city.

Lincoln University landscape architecture students created 40 beautiful designs as entries for the Places of Tranquillity¹⁴. The competition concluded with awards being presented to the successful students at the HC Hui on May 31 2012. Six winning designs were chosen through voting via the HC website or in person at two venues in the city. In total 990 votes were cast. Over winter the students will be allocated to two mentors. One will be an established landscape architect to support the students taking the drawings to practical designs. The other will be a community development mentor to ensure that the Maori, Pacific and cultural diverse communities are engaged with appropriately and effectively as the end users. They will also be supported by Greening the Rubble¹⁵ who have expertise in temporary site development. The intersectoral project team will confirm sites and access sponsorship ready for a spring start.

5.7 Community Lunches

Mid-winter 2012 community lunches are being provided as a treat to ten NGOs who regularly provide community lunches to those in the hardest hit in the east of the City. Richard Till a celebrity chef, the Volunteer Student Army¹⁶ along with the HC team are giving the staff a day off and a treat to the community who come along. So far the response has been tremendous with numbers requiring extra ovens, plates and cutlery being brought in. Numbers are averaging 80 coming for the community lunches.

Opportunities like these offer many resiliency outcomes. Community workers are acknowledged and get some respite, the community feels valued and for the mostly older community there is some intergenerational connection with young student volunteers. Volunteers also get the opportunity to give and earn a ticket to a volunteering concert¹⁷. Everyone has a wonderful time and leaves with a happy heart and warm tummy. Photos available on the HC website¹⁸.

¹⁴ <http://www.healthychristchurch.org.nz/focus-areas/places-of-tranquillity.aspx>

¹⁵ <http://greeningtherubble.org.nz/wp/>

¹⁶ www.sva.org.nz This is a student led recovery initiative following September 4th earthquake

¹⁷ www.theconcert.co.nz

¹⁸ www.healthychristchurch.org.nz

6 Recovery Tools

6.1 Integrated Recovery Planning Guide

Integrated planning involves taking an holistic approach to addressing needs of communities to determine the most appropriate course of action. The earthquake recovery process, although complex, presents a unique opportunity to work towards improving the health and well-being of the community.

The Integrated Planning Recovery Guide¹⁹ builds on existing work of the Canterbury District Health Board and the Christchurch City Council. Targeted questions aim to enhance constructive thinking and encourage innovation. It is designed to help us:

- plan in ways that build stronger more sustainable social, environmental and economic outcomes
- promote the health of all, and
- keep sight of the shared vision for stronger, healthier and more resilient communities.

Essential components of the guide are Health Promotion and Maori Health (Te Pae Mahutonga) frameworks. Free training in use of the Guide is available and able to be targeted for individual organisations.

8th August 2012.

Michelle Whitaker, Healthy Christchurch Co-ordinator



¹⁹<http://www.cph.co.nz/Files/IntegratedRecoveryGuideV2-Jun11.pdf>

Planning for Pets in the Face of Increasing Urban Density

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Paper Presented at
The 5th Healthy Cities: Working Together to Achieve Liveable Cities Conference
Geelong – 6 – 8, June 2012
Planning for Pets in the Face of Increasing Urban Density

Abstract

It is easy to take for granted the role of pets in our society. Eight in ten Australians have at some stage owned a pet. Every second home in Australia currently houses a pet dog or cat. Quite simply, pets are a part of life. But urban consolidation, changing lifestyles and government legislation are compromising our ability to own pets.

Research shows that pets deliver a host of community health benefits. Pet owners are happier and healthier than non-pet owners; pets help connect people with nature and each other, they make people feel secure, and help overcome increasingly sedentary habits and isolating lifestyles. It is not surprising that pet ownership is so highly valued, with the majority of owners regarding their pet as “one of the family”.

Cities need to be liveable not only for people but also for their animal companions. As we live in smaller spaces it is important to ensure that pets are not squeezed out. Healthy urban design can account for pet permissibility and accessibility.

The built environment can be readily designed to account for pets and their owners. Along with thoughtful design, policies should permit pets in all types of housing - particularly rental and strata – on public transport and in public open space.

Other countries, more familiar with urban consolidation, have for years successfully integrated pets into highly urbanised environments. Australia could follow in these international footsteps, and actively plan for pet ownership.

The needs of pets, pet owners and non-pet owners are legitimate and need to be appreciated. It makes sense to have integrated strategies in place to ensure that people and pets live harmoniously.

Research undertaken by Petcare Information and Advisory Service (PIAS) has identified key issues and opportunities relating to pet ownership and changing lifestyles. New resources are available to help us plan for a future that supports the responsible care and management of pets.

Key words: dogs, cats, pets, health, permissibility, urban density

Introduction

Australia is facing rapid change that will potentially compromise the nation's health and wellbeing. Our increasingly crowded cities are making it harder for people to maintain a connection with nature. Our busy yet sedentary lives are creating an overweight and unhealthy population. Our rapidly aging society and growth of single person households predispose many people to loneliness and social isolation. It would be wonderful to find a remedy for these issues. Something readily available to help people connect with nature and each other, to exercise more, to improve health and reduce loneliness.

Pets can do all this and more, and they are right here under our noses. In fact, they are so much a part of everyday life that we tend to take them for granted. But pets are an easy, available means of improving quality of life and wellbeing for the current and future residents of our cities.

Unfortunately pets are at risk of being squeezed out of our increasingly cramped and hectic lifestyles. People with pets need to be acknowledged and planned for. It is not difficult to integrate and manage pets in a way that enhances their value to individuals and communities. But without intervention, the push for urban consolidation will result in the communities of our future missing out on the physical, emotional and social benefits that responsible pet ownership can provide.

Popularity of pet ownership

Pet ownership is a normal part of life for the vast majority of Australians. The figures speak for themselves; two thirds of households include pets, almost half of households include dogs and catsⁱ and 85% of our population have owned a pet at some time in their lives.ⁱⁱ

The enormous popularity of pets is reflected in the way owners feel about them - 92% report that they feel very close to their pet.ⁱⁱⁱ And for most people nowadays, it seems that pets are seen as important members of the family.

Pets are clearly a significant part of Australian communities, but more than that, they should be seen as an important part of *healthy* Australian communities.

Why are pets important?

There has been a strong interest in research into the human-animal bond for many years. The research findings clearly demonstrate that pet keeping can actually improve our lives:

Pets are good for your general health:

- Pet owners are at lower risk of cardiovascular disease than non-pet owners^{iv}
- Pet owners visit the doctor less often and use fewer medications than non-pet owners^v
- Pet owners are much less likely to die in the 12 months following a heart attack than non-pet owners^{vi}
- A study of widows found non-pet owners reported a deterioration in their health after the death of a spouse, whereas pet owners did not^{vii}

Pets help prevent loneliness:

- Research from the University of Western Australia shows that 70.5% of pet owners reported rarely or never feeling lonely, compared to 58.3% of non-pet owners^{viii}
- 74.5% of pet owners reported finding it easy to get to know people compared with 62.6% of non-pet owners^{ix}
- People love their pets and frequently regard them as members of the family; a recent survey showed that 93% of owners reported feeling very satisfied with their pet and 86% of people say when things go wrong it's comforting to be with their pet^x

Dogs encourage exercise:

- The likelihood of achieving the recommended level of physical activity per week was seven times higher for dog owners who walked with their dog five or more times per week, compared with non-dog owners^{xi}
- Dog owners reported 55 more minutes of total physical activity per week than non-owners^{xii}

Pets are good for the community:

- Pets encourage social interaction and improve perceptions of neighbourhood friendliness^{xiii}
- People walking with a dog are more likely to have conversations with other people^{xiv}
- Pets help facilitate social interactions for people with disabilities^{xv}

Pets are good for children:

- Pets help children to develop nurturing and social skills^{xvi}
- Children with pets are more popular with their peers and demonstrate greater empathy^{xvii}
- Children with pets have higher self-esteem^{xviii}
- Young children with pets exercise more and are less likely to be overweight^{xix}
- Pet ownership in early childhood helps prevent sensitivity to allergens in later life^{xx}

Pets are good for the elderly:

- Pets in nursing homes are one of the few interventions capable of permanently lifting the mood of hospices and nursing homes^{xxi}
- Pets boost activity levels in older people, helping to improve overall health in the elderly^{xxii}

Pets offer a fantastic antidote to many of the problems associated with modern lifestyles. If a new drug provided the same benefits that pets provide it would be hailed a medical miracle. Holistically, cities of our future need to include pets if they want to embrace genuine health outcomes.

Note: a fully referenced research summary 'Pets and Community Health – how do companion animals help improve the lives of people?' is available at www.petnet.com.au/pets-and-community-health

It is getting harder to own pets

In recent years, social and demographic changes have led to smaller households. Fewer group households, declining marriage rates, an increasing number of divorces and an ageing population have all contributed to a growth in the number of smaller households. In fact the fastest growing type of household in Australia, particularly in Sydney and Melbourne, is the lone person household.^{xxiii}

Household structure is contributing to a clear trend away from the detached home on a quarter acre block in suburbia, to higher density - often high rise - living. The great Australian dream of owning your own home with a large backyard, a BBQ, a Hills Hoist and a Blue Heeler has changed. An estimated 22% of Australian households are now living in homes that are covered by a strata plan, meaning there are nearly 2 million strata properties nationally.^{xxiv} These trends are set to continue, so in the future we can expect to have even more people living closer together and in smaller groups or alone.

Numerous studies have provided a comparison of the incidence of pet ownership in city and rural areas. The 2006 National People and Pets Report indicated that dog and cat ownership is significantly less prevalent in metropolitan areas (45%) and significantly more prevalent in country areas (55%).^{xxv} This is consistent with ABS data identifying that dwelling type and available space affects the likelihood of owning a dog or cat. The ABS statistics indicate that while 38% of Australian households had a dog and 27% a cat, this increased to 43% of households living in a separate house owning a dog and 30% owning a cat.^{xxvi} Other research further reveals that people living in medium density housing (semi-detached, row, terrace or town houses) are more likely to own dogs and cats than those living in high density housing (flats, units or apartments).^{xxvii} So basically the smaller the backyard or apartment, the less likely people are to own a dog or a cat.

Pet ownership is being compromised by these housing and demographic changes; older people, those who live alone and people living in medium to high-density housing, are all less likely to own pets than the general population. But these are not the only factors impacting pet ownership, other issues that will also influence our ability to own pets in the future include busy lifestyles, access to open space and policies that are not pet-friendly.

Put simply, it is getting harder to own pets. But it does not have to be that way. In many countries, where high-density living has been the norm for a longer period of time, pets have been successfully integrated. Australia now has an opportunity to embrace urban design and policy initiatives that support pet ownership.

Permissibility

Unfortunately there are many Australians who would like to own a pet but are simply not permitted to do so. A recent Australian survey of medium to high density

dwellers revealed that the key reason for the 67% of respondents who didn't own a pet, was due to housing limitations.^{xxviii}

Before any person decides to get a pet they need to be absolutely certain they are permitted to keep the pet where they live. For people who live in strata and/or rental accommodation, this can involve seeking approval from an owners corporation, a landlord or a managing agent (or all three). Pets are banned in many rental and strata premises, so this can be a difficult process resulting in stress for pet owners and serious welfare implications for animals. Animal welfare agencies indicate that as many as 30% of dogs and cats are surrendered by owners who are unable to locate adequate accommodation.^{xxix}

The lack of pet-friendly strata and rental accommodation is a serious issue and one that would seem somewhat misguided. New Australian research by Dr Emma Power from the University of Western Sydney reveals that dogs help their owners to get to know others within an apartment building and local neighbourhood, and can be valuable in creating a strong apartment community. Pet owners were keen to ensure their pets fitted in well with others in the community, and regularly helped one another with advice on training and caring for pets.

Strata developments can be planned to sustainably support a variety of lifestyles, including pet ownership. This should incorporate both the physical building design and policies/by-laws. At present, residential tenancy and strata legislation around Australia is quite varied; in many states it is possible to have blanket bans restricting pet ownership. The ACT has implemented sensible strata legislation whereby pet owners are able to apply to keep a pet and cannot be unreasonably refused, while blanket bans on pets are simply not permitted. Ideally this type of legislation should exist nationally, and for residential tenancies as well as strata.

Petcare Information and Advisory Service (PIAS) in conjunction with Strata Community Australia have developed resources to help manage the issues of pets in strata (<http://www.stratacommunity.org.au/strata-living/pets>). Pet Application and Agreement forms provide a clear application process that allows pet owners and owners corporations to understand and agree on the conditions pertaining to owning a pet in a strata property. Similar resources are currently being developed for pets in rental accommodation.

Older people and pets

People over the age of 65 are the least likely group in the community to own a pet.^{xxx} Yet in many ways, this age bracket has the most to gain from pet ownership. Key reasons older people do not own pets include lack of permission to keep a pet where they live, fear of having to move somewhere that does not permit pets, fear that the pet will outlive them and lack of support to help them care for pets.

Older people in their own homes may need help with simple tasks such as washing and walking a dog, or taking a pet to the vet. Support for these activities can make a huge difference to older people's ability to continue to enjoy the benefits of pet ownership. Programs that support pet ownership amongst our older population do exist, but they tend to be small scale and are generally isolated to specific communities. 'Petlinks', 'Pets of Older Persons', 'Bow Meow' and 'Pets are

Wonderful Support' are examples of existing and successful volunteer based programs. There is further potential to graft care of pets onto existing services such as the Home and Community Care program.

For older people who are making the move into an aged care facility, the ability to take their pet with them can help prevent unnecessary trauma. Residential care should ideally feel less institutionalised and more like 'home'; pets can help to achieve this. There is a somewhat false perception that pets in aged care facilities can pose health risks, yet experience in Australia and overseas clearly demonstrates that barriers such as this can be overcome – nothing is impossible – and the benefits far outweigh the perceived difficulties and risks. Nursing homes in the Netherlands not only permit pets, they are prioritised and viewed as being integral and valuable.

As the Australian population ages, Governments and the community need to actively support older people to own or have access to pets.

Support and practical advice

Well informed pet owners results in better, more responsible care of pets, fewer council/neighbour complaints and greater lifestyle enjoyment. Despite widespread beliefs that pets need access to a lot of outdoor space, the reality is it is possible to keep dogs and cats very successfully in apartments and inner-urban areas with the correct selection, care and management. In fact, inner-urban pet owners report very little difficulty and high levels of satisfaction with dog and cat ownership (94% and 93% respectively), with just 1% of dog owners and 2% of cat owners expressing dissatisfaction.^{xxxii} Informed decision making, combined with sensible management can go a long way to ensuring long term success.

Free resources to help pet owners are readily available and should be promoted. Information such as the free Selectapet service run by PIAS can help prospective pet owners choose an appropriate breed of dog or cat to suit their lifestyle. Another PIAS resource, Pets in the City, provides specific, practical information and tips to help owners responsibly manage pets in smaller spaces (www.petnet.com.au/selectapet-choose-a-pet and www.petsinthecity.net.au).

When people and pets share smaller, indoor living environments, the way that an owner approaches the care of their pet can make a big difference in their ability to enjoy their life together.

- All pets need basic care including food, water and health care. In addition, dogs in particular have social needs; they need companionship. It is also imperative that dogs are trained and socialised from a young age.
- While there is a wide choice of pet species and breeds available, this can actually cause confusion for would-be pet owners. Of primary concern is that a prospective owner chooses a pet that suits their lifestyle. Dogs and cats in particular have very different care requirements and can exhibit a huge range of behavioural variations amongst breeds. Pets need to be chosen on their suitability rather than their looks or breed popularity.

- Cats can make excellent pets for busy people living in small spaces. They don't have the same exercise requirements as a dog and they are very quiet and clean. They are low maintenance and generally happy to be left alone and indoors. Cats really are the perfect pet for the 21st Century, yet it is interesting to note that the Australian cat population has declined significantly in the last couple of decades. This is in contrast to the majority of Western nations where cat ownership has been increasing.^{xxxii}
- Working pet owners need assistance from time to time to help ensure their pet's needs are met. Research shows that neighbours, friends and family frequently provide help in an informal way, but being able to obtain professional services can also help to reduce the burden for busy pet owners.

Access to public space

Leaving a dog indoors constantly without companionship is not a reasonable option. The benefits of being out and about with dogs are multiple; healthy exercise for both owner and dog, increased social interaction, enhanced neighbourhood security and less nuisance behaviour from bored pets. This requires planning for walkable neighbourhoods and access to public open space. The principles of healthy urban design apply equally to dog owners as to the overall population, with the addition of pet-friendly council policies to provide good access for pets.

Access to off-leash areas is also vital, especially when outdoor space is limited at home and it is impossible to let a dog run around, play and interact. Being able to sit at an outdoor cafe enables dog owners to provide the companionship that their pet needs while creating social opportunities for both owners and their pets. Being able to walk your dog along a shopping strip and secure him to a suitable post while running an errand is enormously helpful.

All too often pets are banned from public spaces. In the Sydney metropolitan area, despite miles of coastline, there are no dog-friendly ocean beaches, not even for dogs on a leash, not even in winter. In some states and cities pets are not permitted in outdoor dining areas or where food is consumed. Dogs are often not permitted in many urban parks, sometimes even on a lead. There are many benefits in providing access to public open space for dogs and their owners. Smart planning policies will account for pets and their owners, ensuring that their needs are integrated into open space planning.

Design guidelines such as 'Public Open Space and Dogs', are available to help open space professionals assess their requirements and consider options for integrating dogs and their owners in open space planning (<http://petnet.com.au/publications-information>).

Public transport

Inner suburban residents have long been encouraged to forgo car ownership and use public transport instead. Unfortunately for pet owners, dogs are rarely permitted in taxis or on public transport anywhere in Australia. In some instances small dogs and cats can be taken on public transport as long as they are secured in a pet carrier, but this isn't always a practical solution. Pet owners need to be able to

transport their pets to vets and groomers. Dog owners should also be able to take their companions on outings away from their local area.

In some countries it is not unusual to see pets in the cabins of aeroplanes. Policies need to change to enable pet owners to access public transport with pets. There is no reason why a well behaved, trained, friendly dog on a lead or a cat in a carry cage should not be permitted on any Australian bus, tram, train or ferry.

Managing the downsides

It is true that having pets in the community can also create problems. Managing and resolving pet related issues will become increasingly important as our cities become more heavily urbanised. Education and resources will be the key to creating an environment where pet nuisance is minimised whilst community pet benefit is still maximised.

Australian research proves that pet owners can manage pets in smaller spaces with few problems. Survey respondents identified that the most common problems are minor and the major issues are experienced by only a few. The most commonly mentioned problems were hair shedding and vet bills. These were followed by barking dogs, difficulty in providing enough exercise and no regular access to a secure outdoor area. For almost one third of pet owners there were no problems at all.^{xxxiii} The research also revealed that most pet owners put strategies in place to manage potential issues.

Public open space access brings problems such as dog waste, dog aggression and nuisance behaviour. The provision of bags to collect dog waste and bins to deposit it in certainly helps to resolve dog waste issues, peer group pressure amongst park users also seems to regularly assist. Encouraging owners to train and socialise dogs results in more harmonious park usage for all. The City of Sydney has over 40 off-leash dog areas and keeps issues to a minimum by offering free dog training plus discounted desexing and microchipping.

Conclusion

Pets may be just one part of the larger healthy, livable cities picture, but they are an intrinsic part. It is not difficult to integrate and manage pets in a way that enhances their value to individuals and communities.

Pet owners are the majority of our population. Pets provide valuable opportunities to lower stress, reduce loneliness and improve health. Yet pet ownership is being compromised by lifestyle and demographic changes at the very time that it can be most beneficial. Planning for healthy urban environments must account for the place of pets in private and public spaces channelled through sensible pet-friendly policy decisions.

Information is available to help pet owners manage pets successfully and responsibly. Resources are available to help decision makers understand how to better integrate pets into the built environment and our lives.

As Australian lifestyles change, we must ensure that pets are not forgotten.

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Retrofitting the edge cities – Macquarie Park Case Study

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ABSTRACT

This paper investigates the health and urban impacts of alternative strategies to retrofit edge cities, including one that incorporates a Personal Rapid Transit network as a feeder for the existing transit nodes. Macquarie Park has been identified as a typical “edge city” within an emerging Australian multi-centred city form. The health impact is evaluated based on the outcomes for air pollution, accidents and physical activity due to active travel. The avoided public health costs total \$25 million per annum when weighed against a continuation of the existing transportation trends. A positive urban impact occurs from the smaller amount of land required for parking spaces with a potential capital cost saving of more than one billion from building car parks.

Keywords: Personal Rapid Transit, edge cities, active travel, health, urban space

INTRODUCTION

Planning policies for sustainable development are inherently complex not only for the low-density residential suburbs but also for the emerging polycentric urban forms which require complex regulatory instruments. Changing the land use is difficult in any settled urban form (Lachapelle and Franks 2009) and even more difficult in ‘edge cities’ – urban sub-centres emerging at major traffic nodes, around airports, shopping malls or business parks, which include higher concentrations of employment than housing and are often poorly integrated into the larger regional context, and thus highly car-dependent.

Redeveloping existing buildings to accommodate higher densities and mixed land use, and especially to provide an alternative to car dependence is difficult. The main constraints to transforming edge cities into more dense and pedestrian-oriented urban environments are physical: size and infrastructure (Scheer and Petkov 1998). Scheer and Petkov (1998) argue that increasing density and providing a fine grained network of streets is not possible without restricting the size of development parcels and controlling street layout; these policies would disrupt the traditional planning practice and market-based development processes. As many

planners have done, Scheer and Petkov have failed to consider infrastructure and transport options to support increased urban density, other than those to accommodate cars.

This paper is concerned with analysing the potential of a non-conventional transport solution – the Personal Rapid Transit (PRT) system to bridge the gap between the existing car-oriented urban form and the transit-oriented urban future that is essential for sustainable development. PRT's potential effectiveness in retrofitting the 'edge cities' is analysed with specific application to an Australian case study.

MACQUARIE PARK – THE EMERGING EDGE CITY

In Australia, the concept of 'edge city' has not been thoroughly investigated. Garreau identified North Sydney as an example of an Australian edge city (Garreau 1991). Freestone (1997) argues that North Sydney is not a good example, being more an extension of the CBD. He chose North Ryde as a case study of an Australian edge city and concluded that "the essential pre-conditions" for the evolution of edge cities in Australia are missing (p. 256). He argues that the major Australian cities are less freeway-dependent than the North American metropolis and "the Australian CBD remains the single most important employment and activity node in every major city" (Freestone 1997, p. 255).

However, in recent years, metropolitan planning strategies for Sydney have encouraged the growth of major sub-centres in addition to the traditional CBD. Specialised centres are clusters of high employment concentrations around major airports, universities, large commercial precincts and business parks (NSW Government 2010) – similar to edge cities' development pattern. The investigation contained in this paper suggests that this urban form can be recognised in Sydney too, identifying Macquarie Park as a typical 'edge city'.

Macquarie Park is a major highly skilled employment centre, combining commercial, business, research and educational activities and it has all the characteristics of a typical 'edge city' defined in 1991 by the father of the concept, Joel Garreau (see Table 1).

In 2006, the total employment number in Macquarie Park was approximately 32,000 compared to only 5,599 residents (Australian Bureau of Statistics 2006). The City of Ryde (2009) estimates an employment growth to 78,000 jobs based on projected build-out of available floor space, an increase in the residential population of 5098 and an additional 28,000 university enrolments by 2031, making the Macquarie Park Centre a potential generator of 278,000 daily trips to and from the centre within two decades.

Macquarie Park displays one of the highest car dependency rates for work trips compared to other similar centres. In 2006, 87% of the journey to work was either as vehicle driver or car passenger, 4% by train, 5.7% by bus and only 2.5% walking and cycling (TDC 2009). Since the opening of the Epping-Chatswood rail link in 2009, with three new rail stations within the area, an increase of rail mode share is expected.

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Table 1 - 'Edge city' characteristics of Macquarie Park

Garreau's five functions of edge cities	Macquarie Park	Checklist Y/N
More than 5 million square feet (465.000 square meters) of office space	800,000 square meters commercial/office space	Y
More than 600,000 square feet (56.000 square meters) of retail space	73,000 square meters (Macquarie Shopping Centre only)	Y
More jobs than bedroom	32,000 jobs + 30,000 students (2006) 5599 residents (2006)	Y
Has grown and changed completely in the past thirty years	Has changed rapidly over the last 30 years from a bushland, market gardens and paddocks area to a major centre housing a well-known university, multinational corporations, and a continuously growing research and innovative hi-technology sector	Y
Is a regional end destination being perceived as an "has it all" place	Macquarie University Macquarie Shopping Centre The Riverside Corporate Park Macquarie Business Park	Y

However, the physical scale of Macquarie Park (7 square kilometres) implies that many of the existing and potential destinations are not within walking distance of the rail stations. Thus, even though higher density land uses are to be clustered around the stations, there is a need to increase accessibility to peripheral parts of the area, including parts of the University campus.

PERSONAL RAPID TRANSIT SYSTEM

The PRT concept and its potentially low environmental impacts and high levels of comfort, safety and convenience for individual passengers, have been investigated by scholars, planners, and local governments. In the US, the most recent PRT studies have taken place in San Jose, Portland, New Jersey, and Tyson Corner (ULTra Global PRT 2011). In Europe, several national agencies and local authorities commissioned extensive PRT studies between 2000 and 2010 and the majority of studies concluded that PRT systems would have positive outcomes and would be technologically feasible in the selected locations, at least hypothetically (Carnegie et al 2007; Karlsson 2011; Konradsson 2011; Nelstrand 2011). Two studies of PRT feasibility in Melbourne and Canberra concluded that the system is worth considering (Wyatt 2006; Jones 2009). Wyatt (2006) reported that by implementing a PRT system in Melbourne, pollution in peak hours would decrease by 16%, the amount of petrol used by car users previously commuting to the PRT serviced area would decrease by 23% and the system would significantly reduce traffic congestion during peak hours. Jones (2009) concluded that a PRT system could have a greater level of penetration for the layout of Canberra and would be more cost-effective compared to the existing bus system.

Currently, two systems are fully operational for public use (ULTra PRT at Heathrow, London and Masdar PRT in Masdar, Abu Dhabi), with another one due to commence construction in 2012 (Suncheon Wetland in Suncheon, South Korea).

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We developed a concept design for a PRT network as a feeder for the existing major transit nodes in Macquarie Park (see Appendix 1). The proposed network has a track length of 17.8 kilometres, twenty simple stations with two to five berths, most of them off-line. For this project we used an expert version of the ACT City Mobil software provided by its developers (Lowson and Lees-Miller 2011, pers. comm., 14 August). Although the software is not peer-reviewed, it is a limited version of the real, fully operational system from Heathrow, London (ULTra Global PRT, 2011). Simulations were used to estimate passenger waiting time, travel time, and vehicle kilometres travelled, for high capacity demand during peak hours, and low capacity demand during off-peak hours (Table 2). The aim of this exercise was to determine whether a PRT system could deliver adequate passenger service performance at different levels of demand, and to evaluate what sort of stock investment would be needed to offer the proposed level of service. The results showed that the overall performance of PRT is very effective, which will make transit easier and might increase the attractiveness of conventional public transport.

Table 2 – Simulation results for peak and off-peak hours

Indicator	AM peak	Inter peak	PM peak	10-hour SIM
Mean waiting time(seconds)	16 s	16 s	72 s	20 s
Maximum waiting time(sec)	75 s	62 sec	187 s	79 s
Waiting time less than 60 sec (%)	90%	91%	50%	88%
Passenger groups per hour	1635	903	1524	16,707
Average distance travelled (km)	1.94 km	1.81 km	1.84 km	1.84 km
Average trip time (sec)	194 s	181 s	184 s	183 s
Maximum trip time (sec)	937 s	937 sec	937 s	937 s
Fleet required	204	110	197	219
Average occupancy rate	2.34	1.45	2.40	2.34

The outcomes from the PRT simulations were used to compare the likely health and urban impacts of a scenario based on increasing local access by PRT (LAPRT scenario) to those of other two scenarios: a projection of current transport trends by 2031 (business-as-usual or BAU scenario) and the current local strategy for the area (the ‘planned’ targets scenario).

HEALTH AND URBAN IMPACT

The health focus in transport and land-use policies is important if urban systems are to change. Strategies combining active travel and reducing emissions from motor vehicles would give the largest health benefits (Marshal, Brauer and Frank 2009; Woodcock et al 2009). Recent research indicates that 2.3% of mortality in Australia is caused by air pollution (NSW Ministry of Health 2012). Health costs associated with air pollution are around AU\$4.7 billion per year in New South Wales (NSW Ministry of Health 2012).

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Obesity is also associated with the built environment seen as a result of diet, physical activity and urban form (Papas et al 2007). Evidence from the literature review showed that thirty minutes of physical activity per day is associated with health benefits, reducing the risk of major diseases such as cardiovascular diseases, diabetes, dementia, depression and obesity (Cerin et al 2007; Lachapelle and Frank 2009; Woodcock et al 2009; Trubka et al 2010; Matan et al 2012).

A study based on the US National Household Travel Survey found that 29% of transit users achieved more than 30 minutes of physical activity per day (Besser and Dannenberg 2005 cited in Lachapelle and Frank 2009). The minimum physical activity level recommended by the National Physical Guidelines for Australians is 30 minutes per day for at least five days per week (Trubka et al 2010).

For this study, the health impact of the three scenarios in Macquarie Park has been evaluated based on emissions of the most dangerous pollutants for human health (carbon monoxide, oxides of nitrogen, particulate matters PM2.5 and PM10, and sulphur dioxide), accidents and physical activity level due to active travel for each scenario. The avoided public costs are presented in Table 3.

Table 3 - Avoided costs due to air pollution, accidents and lack of physical activity

Health impact	LAPRT vs. BAU		LAPRT vs. Planned	
Air pollution impact				
Saving on Pollution (tonnes pollutants)	778	33%	285	15%
Annual benefits ¹ (\$ million)	7		3	
Impact on passengers safety				
Savings on Accidents	109	33%	40	15%
Annual benefits ² (\$ million)	14		5	
Increased physical activity impact				
Increased Physical activity (active travel hours)	1,248,676	73%	624,676	27%
Annual benefits ³ (\$ million)	3.88		1.97	
Total savings on Health (\$ million)	25		10	

Notes: 1. The human health effect costs due to air pollution have been estimated by different studies at between 0.7 and 2.7 cents per VKT with a midpoint around 2 cents in 2001 prices (Austroads, 2003) and 3 cents in 2006 prices (Glazebrook, 2009). For this study, the cost used was \$0.04 per VKT in 2011 prices assuming an annual inflation index of 3%.

2. In this study, an average cost of 0.076 \$/VKT of road accidents has been assumed based on the total cost of 5.1 billion dollars for 42,299 road crashes and 66,581 mil VKT (RTA 2011). This average cost of 0.076 \$/VKT is very close to the cost assumed by Glazebrook (2009) in his calculation of the external transport costs (0.09 \$/VKT in 2006 prices).

3. Trubka et al (2010) reported the value of 1 hour health benefit as \$3.02 in 2007 prices. This value has been indexed to 2011 prices at the average annual inflation rate of 3%, obtaining a value of \$3.11 per hour, which has been used in this study.

By implementing the PRT system within Macquarie Park, the avoided cost due to air pollution, accidents and lack of physical activity totals approximately AU\$25million per year compared to a continuation of present trends. Furthermore, considering the projected targets and transport improvements under the “Planned” scenario being achieved by 2031, the PRT could still save more AU\$10 million per year.

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The indicator we used to compare urban impact is based on the gross floor space (GFS) for the new structured car parks required for each scenario. The amount of future car parking spaces based on trip forecast under each scenario is presented in Table 4.

Table 4 - GFS required for building new parking spaces by 2031

	BAU	PLANNED	LAPRT	Local access by car	Local access by PRT ¹	LAPRT vs BAU	LAPRT vs Planned
Trips by car only (driver)	183,906	145,122	120,150	22,206	3,402		
2031 Parking Demand							
Total car parks	91,953	72,561	60,075	11,103	1,701	-30,177	-10,785
Existing car parks	37,700	37,700	37,700	0	0	0	0
Future car parks required	54,253	34,861	22,375	11,103	2,091 ²	-29,787	-10,395
Cost of multistorey/underground car parking							
Floor space required for new car parks(sqm) ³	1,627,590	1,045,830	671,250	333,083	62,721	-893,619	-311,859
Costs (\$ Million) ⁴	2,170	1,394	895	444	84	-1,191	-416

Notes: 1. 1701 'park and ride a pod' spaces considered for trips by car + PRT;

2. Space required for PRT depots to store 390 pods was considered similar to the space required for car parking

3. The minimum floor space required for cars, including manoeuvring lanes, blind aisles and columns is 28.67 sqm (Ryde DCP 2010); for disabled parking spaces a bigger space is required; for this study an average of 30 sqm per parking space was considered. Similar space was assumed to store 390 pods

4. Cost for a basement car space ranges between \$27,000 and \$40,000 per bay (City of Ryde Parking Study 2009; Newman and Scheurer 2010); for the 2031 estimates, a minimum cost of \$40,000 has been considered; if we apply the inflation index of 3% per year, the cost per bay would range between \$48,765 and \$72,244 by 2031 so the cost of \$40,000 is at the very low end of price range; same cost per berth was considered

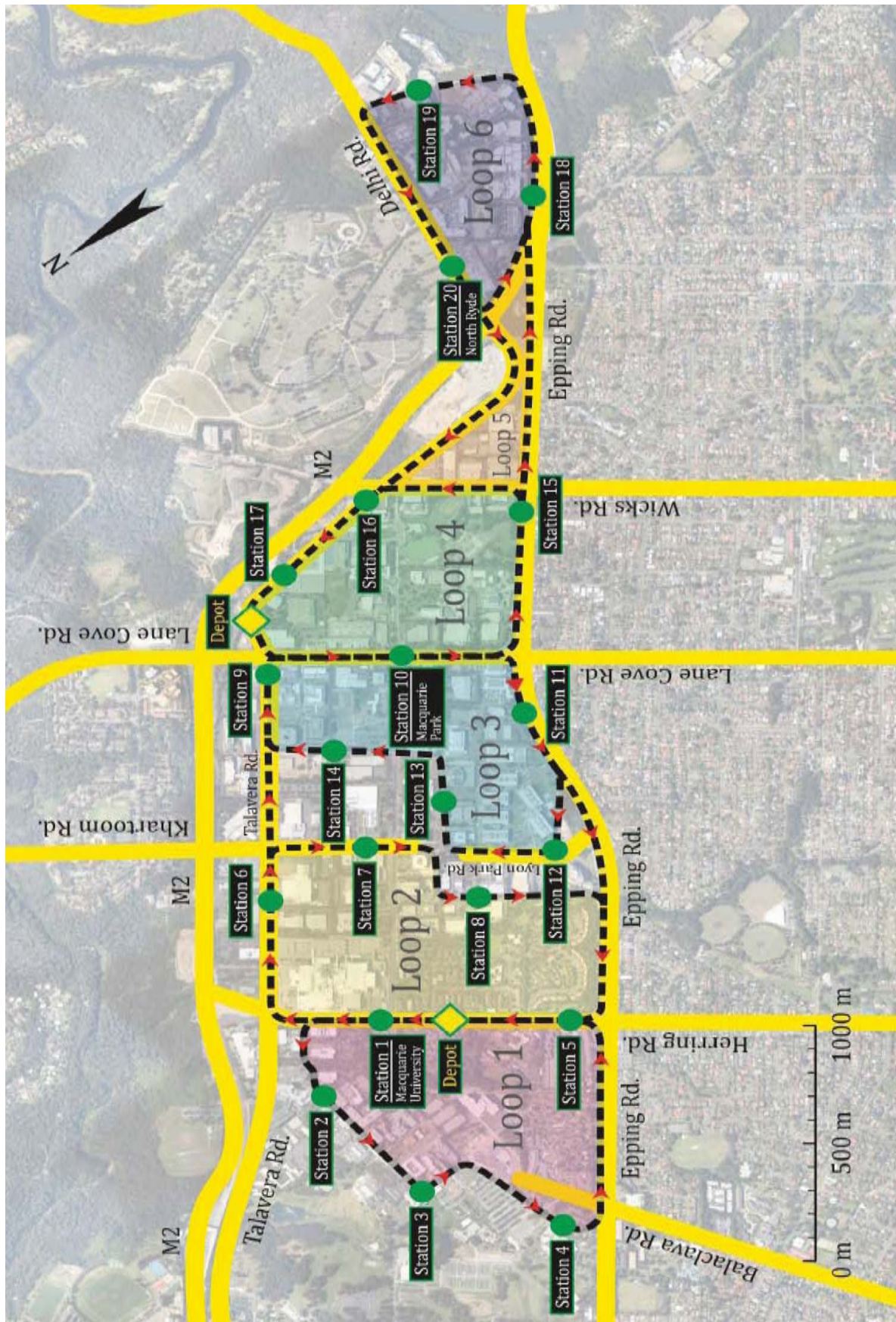
The urban impact analysis investigated the effect of the PRT network on the land used for parking spaces. The benefit of implementing a PRT system in Macquarie Park compared to a business-as-usual projection by 2031 is of AU\$1.19 billion savings from building parking spaces only. The huge benefit which might not be seemingly encountered by the policy makers is the amount of land saved: more than 890,000 square metres of floor space which might produce a better return in a development than car parks.

CONCLUSIONS

If we are to re-invent cities, particularly multi-centred cities designed around cars, we need new visions of sustainable transport futures (Kenworthy 2006). However, new visions also need specificity. Future strategies to address the sustainability needs of edge cities should solve specific local problems but must also be integrated within regional strategies.

Potentially, the urban space released by retrofitting edge cities with a PRT system well integrated within conventional transport systems could be redesigned to encourage greater physical activity and social interaction. The high theoretical performance and the positive health and urban impacts draw the conclusion that PRT may be worth considering in future strategies.

Appendix 1 – Schematic graphic of the PRT network and stations proposed for Macquarie Park



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