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## Peer Reviewed Papers

<table>
<thead>
<tr>
<th>Authors</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iman Alsumsam</td>
<td>1</td>
</tr>
<tr>
<td>Beau Beza &amp; Frank Hanson</td>
<td>16</td>
</tr>
<tr>
<td>Martin Bryant &amp; Penny Allan</td>
<td>34</td>
</tr>
<tr>
<td>Rohan Dickson &amp; Marc Lane</td>
<td>54</td>
</tr>
<tr>
<td>Ryan Falconer</td>
<td>66</td>
</tr>
<tr>
<td>Steven Fleming</td>
<td>80</td>
</tr>
<tr>
<td>Gordon Holden</td>
<td>88</td>
</tr>
<tr>
<td>Magdalena Kowalik</td>
<td>102</td>
</tr>
<tr>
<td>Murray Lane</td>
<td>114</td>
</tr>
<tr>
<td>Alan March</td>
<td>122</td>
</tr>
<tr>
<td>Caroline McCaw</td>
<td>139</td>
</tr>
<tr>
<td>Nick McGowan &amp; Kathi Holt-Damant</td>
<td>147</td>
</tr>
<tr>
<td>David Mepham</td>
<td>159</td>
</tr>
<tr>
<td>Paul Osmond</td>
<td>169</td>
</tr>
<tr>
<td>Rob Roggema</td>
<td>178</td>
</tr>
<tr>
<td>Phillip Roöös</td>
<td>193</td>
</tr>
<tr>
<td>Lind Too &amp; Bhisna Bajracharya</td>
<td>202</td>
</tr>
<tr>
<td>Ned Wales</td>
<td>210</td>
</tr>
<tr>
<td>Stephanie Wyeth &amp; Laurel Johnson</td>
<td>218</td>
</tr>
</tbody>
</table>
Improving the Quality of Urban Public Spaces in Hama City, Syria: Investigating the Social Spatial Approach

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Abstract: Public space is of great importance to people’s quality of life. This is particularly true in Syria, where public spaces play a crucial role in the urban structure of its cities and in its inhabitants’ daily life. The research studies the opportunities to improve people’s quality of life in Hama, Syria by assessing the quality of its public spaces. The social and spatial qualities of its public places were explored by investigating the relationships between people and particular spaces. People’s perceptions of and behaviour in public space were investigated in three case studies from which social data was obtained. The spatial data was collected by conducting space syntax analyses. The outcomes illustrate that people’s perceptions of, and behaviour in, public space are similar, relatively, while unexpected results were obtained when they were compared to the spatial integration maps.

Keywords: public space, social and spatial aspects, human needs

Introduction: Public spaces play a significant role in the life of our cities; the literature, therefore, on public spaces is now of the utmost importance and is highly developed relative to urban design (Francis, 2009). Many researchers, such as Whyte (1980), Gehl (1987, 2010) and Carr et al. (1992) have focused their research on highlighting the principles that underpin the creation of resilient public space that is, spaces which will attract a wide variety of people through their flexibility of use, diversity of building type and accessibility. Public spaces, if within walkable cities or supported by energy efficient transport, would provide opportunities for social interactions, such as all kinds of personal, cultural and economic exchanges, and would provide liveable places that would play a significant role in community identity. In other words, they are making places for people (Carmona, 2003). Despite the intensive research on public spaces, there is still a gap in the literature on the meaning that people attach to public spaces. Francis (2009) argues that understanding cultural diversity and publicness could guide the design and management of public spaces. He points out that the research on public space should be more comprehensive in order to understand fully the meaning that public spaces have for people and the role of urban design in shaping their future (Francis, 2009), therefore, the focus should be to create diverse and flexible public spaces which are based on socially inclusive designs.

In this paper, the aim is to focus on exploring people’s perception of public spaces in Hama city and how they behave in, and use them. At the same time, the intention is to investigate their relationship with the physical environment, thereby, improving the quality of public spaces and in turn, creating successful and attractive public spaces which will attract and accommodate the different groups in the city. The investigative context for this research is Hama city, Syria, a historic city with a special identity which is situated on the Orontes River which passes through its very heart (Figure 1). The city
is the fourth largest city in the country, has a population of 562,763 and a population growth rate of 2.8% in 2010. This issue highlights the need to design and lay out public space flexibly. The city is famous for its ancient waterwheels, the ‘Norias’. Most of its public spaces are situated along and around the riverside and the main public park is the site of an historic castle, ‘Al-Qala Park’, which has an incredible view of the Orontes River and the ‘Norias’ (Figure 2). Hama city has a moderate climate; the average summer daytime temperature is 32°C, at night it is slightly lower, and in winter, the average daytime temperature is 10°C. Hama’s moderate climate encourages people to enjoy outdoor activities and engage in public life in the city. The research has been prompted by the fact that public space in Hama is extremely valuable in terms of accommodating culture, social life and it brings a liveliness and vitality to the city. People in Hama have their own culture as they have a strong relationship with the Orontes River and the ‘Norias’ alongside it.

**Methodology:** The research methodology relies on multiple evidentiary sources as a means to respond to the objectives of investigating the social and spatial aspects of urban public space in Hama city. A case-study research method, that involved taking a qualitative, investigative, mixed-method approach, underpins the research. The approach attempts to understand the investigative context as: (a) a social space, by exploring the perceptions and behaviours of the users of space, (b) a spatial space, by exploring the spatial structure of Hama. Two methods were used to collect the social data: a questionnaire survey, and observation and behavioural mapping, while the space syntax method was applied to reveal the spatial data. The three case studies were classified in terms of their location, character and historic importance to the coherence of the city. The three public parks chosen were: Al-Qala Park, the site of Hama castle, Um Al-Hassan Park, and Al-Andalous Park (Figure 3). Um Al-Hassan Park, situated in the city centre and on the banks of the Orontes River, would predict data for public spaces in the city centre; Al-Andalous Park, situated outside the city centre and away from the banks of the Orontes River, would predict information for public spaces at the edge of the city, while Al-Qala Park, situated in the historic city centre, was a special case due to its historic and archaeological importance. Observation and Behavioural Mapping were methods used in all three case studies. The data collection on the parks’ use was undertaken in January 2010 (winter) and August 2010 (summer). The survey was conducted on weekdays and at weekends, four times a day: morning (10:00-12:00), midday (12:00-14:00), afternoon (14:00-18:00), and evening (19:00-22:00). The data collection, made by the author, acting as
observer, involved using a set of symbols on a map, to record any specific activity seen in each of the three case-study locations (Figure 4). People were categorized by their age and gender. The questionnaire survey, which comprised open-ended questions, provided detailed information on how the users of the public parks interpreted the environment around them, what they thought about these spaces and what kind of activities and facilities they expected to find there. The questionnaire survey involved a variety of people, grouped according to their age, gender, occupation and knowledge. A snow-balling technique was used to select the group sample; that is, the author sent the questionnaire to friends and friends of friends, and so on. The targeted sample involved all inhabitants in the city, regardless of their place of residence and whether they used the public spaces or not, and they should only have knowledge about the public spaces in the city. Sixty-five participants responded to the questionnaire, 35 male and 30 female (the participants were between the ages of 16–65+ years).

The two aforementioned methods were used to collect the social data. However, the spatial structure of Hama and its integration values were explored by space syntax, a method developed by Hillier and Hanson (1984). This method provides an understanding of both the global integration of the city and the local integration around the selected spaces. Hillier highlights the importance of the integration of public spaces. He argues that integrated spaces, with high accessibility, have greater social life, and therefore, less crime. The integration values can be offered at two levels; a global level, whereby each street is integrated with all the other streets of the city, and a local level (connectivity), in which each street is integrated with the directly connected streets. Depthmap software (Turner, A. & A. Penn, 1999) was then used involving the preparation and analysis of axial maps.

**Users’ perceptions of public space: the findings**

The main findings from the questionnaire survey support Carmona’s ideas (2003), in that the respondents perceived Hama’s public spaces not only as physical entities but as spaces with which, individually, they had complex relationships and likewise, that a relationship existed between people and their surrounding environment. (Carmona et. al., 2003) The public spaces were perceived as green spaces to visit but also as places for social and cultural communication. Users particularly appreciated several attributes of these spaces in terms of: public health, natural aesthetics, psychological comfort, and protection from climate. Al-Qala Park was cited by respondents as their favourite and most important place. People were attached to it because of its historical
and archaeological significance and its location at the heart of the city, with a vista of the whole city, the Orontes River and the Norias. The second most frequently cited place was Um Al-Hassan Park, mainly because it is situated on the bank of the river in the city centre, with the two famous Norias, ‘Al-Jesria’ and ‘Al-Mamoria’, that users feel give the park a sentimental meaning and identity. The third place that the respondents mentioned was the old museum, ‘Al-Azim Palace’, which is of historical and archaeological importance, and has an identity and meaning for people.

The questionnaire survey concentrated on users’ needs and the qualities they expect to find in civic public spaces. The respondents’ answers indicate that the most important quality they seek relates to safety and security, an essential stage in Maslow’s hierarchy of human needs. (Maslow, 1954) The other important qualities they expect are related to comfort and relaxation, which match those cited by Carr et.al. (1992). Safety and security needs in public spaces can be achieved by ensuring that personal safety, health and wellbeing needs are met, and that security from threats and social problems are minimised. The need for hygienic public spaces is essential as 80% of the respondents reported that they hoped to enjoy pleasant and healthy spaces, of a high standard, and in a comfortable environment. A further 80% of the respondents referred to the need for convenient public services such as public toilets, adequate seating places, sufficient lighting, and safe playgrounds for children. The most frequently mentioned concern was feeling unsafe in public spaces because of anti-social behaviour. Child safety was another important aspect. Sixty per cent of the respondents stated that they do not feel comfortable allowing their children to play in public playgrounds. They cited poor maintenance of these areas as their main concern and that the materials used there were unsuitable and unsafe. In relation to comfort and relaxation, the questionnaire survey revealed that people required convenient seating places that were safe and sheltered from the sun, and safe and pleasant playgrounds for their children. In addition, they sought psychological comfort, expressed through their citing enjoying fresh air and pleasant views.

Users' behaviour in public spaces (parks): the findings

According to the survey’s findings, respondents’ use of public spaces is different in winter and summer due to the change in climate. In August 2010, the largest group of people was observed in the evening, the second largest group, in the morning, with the least number of people observed at midday and in the afternoon, as this is the hottest time of the day in the summer. There was no significant difference between weekdays
and weekends as it was the summer holidays. People visited Al-Qala and Um Al-Hassan Parks more than Al-Andalous Park. The people observed in Al-Qala Park were mainly sitting in groups at the edge of the park and walking along by the archaeological remains in the middle of the park. This finding echoes the work of Gehl (1987) in terms of what he called the ‘edge effect’. The most visited part of the park faces the Orontes River, with a view of the ancient Norias. Some of the user groups that were sitting facing the river had a barbeque, while others, who wanted to smoke the traditional hubba-bubba, gathered in the area near the park entrance. Families with children usually prefer to sit on the available seating places in the playground so they can watch their children playing safely. Some people were observed just walking around, standing in groups, chatting together or hanging around. In Um Al-Hassan Park, people were mainly standing at the entrance, viewing and photographing ‘Al-Jesria’ Noria then walking along the path running adjacent to the river (Figure 5). Families with children spent most of their time at the playground. Some people were simply sitting on the grass, walking along, chatting or passing through. The people in Al-Andalous Park were mainly sitting on chairs or on the grass and some of them were with their children in the playground. When the January 2010 survey was undertaken, the weather was cold with some rain. The largest group of people was observed at midday. The second largest group was observed in the morning and afternoon, with the least observed in the evening as this is the coldest and darkest time of the day in winter in Hama. The number of people visiting Al-Qala and Um Al-Hassan Parks was much greater than the number in Al-Andalous Park. The activities observed in Al-Qala Park were almost the same as in summer time, although the number of participants was significantly smaller; while in Um Al-Hassan Park, the main activity was passing through. In Al-Andalous Park, there was almost no activity; just a few people passing through.

Integration values in Hama and its public spaces (parks): the findings

The best globally integrated roads are mostly those that connect the city from the north to the south, along with the streets in the city centre, while the least well integrated are those in the east district of the city, as it is an industrial estate (Figure 6). Um Al-Hassan Park is situated on the most globally integrated roads, according to the global integration map of Hama, whereas Al-Andalous Park is located on medium integrated roads in the Al-Andalous area off the city centre. Although located in the heart of the city, Al-Qala Park was less globally integrated, compared to both Um Al-Hassan and Al-Andalous Parks. With regard to the interior paths of the three aforementioned parks,
again, the paths in Um Al-Hassan Park were the most globally integrated paths compared to the Al-Andalous ones, which were ranked in second place. The paths through Al-Qala Park were obviously the lowest integrated ones; this is due to the nature of its location, since it was the site of Hama castle and it has only one access route connecting it to the adjacent roads network. The results showed some obvious similarities and differences between the global and local integration maps (Figure 7). The main difference was that the integration values of the streets around Um Al-Hassan and Al-Andalous Parks were similar and could be classed as medium, locally integrated streets.

Discussion and conclusion

By focusing on the social and spatial aspects of public space in Hama, Syria, this study attempts to explore two sets of issues. The first concern is how space is perceived and used since, in Hama, there is no record of any previous studies examining this phenomenon. Secondly, the investigation looks at the relationship between the perceptions of users of the spaces and the way they behave in the space, along with the spatial structure of these spaces. A qualitative approach, using questionnaires with the users, observing user behaviour in the three case study locations, and a space syntax model of the physical structure of the city helped to achieve an in-depth assessment of both issues. By understanding these issues, it can help designers to improve the social and spatial quality of public space in Hama and change them, therefore, into responsive, resilient and inclusive spaces.

Three key issues emerged in relation to user behaviour. From observation, it can be concluded that the use of the three parks is not dissimilar to the use of space in other similar cities with similar climatic conditions. People stand, walk, sit and eat in them at various times of the day, weather permitting. What distinguishes Al-Qala and Um Al-Hassan Parks is that standing tends to be an activity associated mainly with tourists and local inhabitants as they view and photograph the river and the ancient Norias (Figure 5). In the case of Al-Andalous Park, users’ perceptions were confirmed by the number of people visiting the park. The questionnaire findings revealed that this space is viewed as extremely unimportant (only 6 of the 65 respondents mentioned it) and the observation revealed few people using the space. In contrast, Al-Qala and Al-Hassan Parks (25 and 27 respondents, respectively, out of 65) were both mentioned by almost 50% of the respondents; a fact confirmed by the number of people using them. A further confirmation of the relationship between perception and behaviour is illustrated
in terms of respondents’ views of safety. The questionnaire results show that they were very concerned about safety issues and this was confirmed by their behaviour in terms of sitting close to and watching their children while they were playing. Arguably, both Al-Qala and Um Al-Hassan Parks, with their natural (Orontes River) and historic (the Norias) features, are significant places in people’s minds because they define the identity of Hama. In Al-Andalous Park, this could be achieved by creating an identity and image for it.

The relationship between the social and the spatial findings shows an interesting result: surprisingly, Al-Andalous Park emerges as one of the medium integrated areas in Hama, both globally and locally. While according to people’s responses in the questionnaire survey, their view of it was that it is an inaccessible place, therefore, people do not use it properly. In contrast, Al-Qala Park appears to be a well integrated space in the city, according to people’s responses and in terms of the way they use it. However, in the spatial analysis, the results for this park show it to be a medium to low integrated area in Hama, both locally and globally. On the other hand, the findings relative to Um Al-Hassan Park showed results, as expected: it was a well integrated space in the city, locally and globally. At the same time, people referred to it as one of the most important public spaces in the city.

The above findings illustrate that improving the quality of public spaces in Hama will require a process which involves the users of these spaces, along with the spaces. Any improvement should adapt and be responsive to the different variables that may appear in the future urban growth of Hama such as population growth. Hama residents appear to have strong relationship with natural elements (the Orontes River); and historical and archeological features (such as the castle and Norias). Preservation of these cultural, historical and natural elements in Hama will promote further the city’s sense of place identity. These elements should be considered when qualitative improvement is made to public spaces in Hama.

In addition, people in Hama are keenly aware of the qualities and needs they expect of their city spaces, such as safety and security. Places where these needs are unmet usually results in spaces that are used infrequently by people. The best used spaces, therefore, are those which allow diverse social interaction to occur by providing a safe environment for people to engage in. These qualities of public space and people’s needs should be taken into consideration in the future development of Hama city.
References


Figure 1 View of the wooden waterwheels “Norias” on the Orontes River, Hama city

Figure 2 Hama City Site, Syria
Figure 3 Hama Map with Case Study Park Locations
Figure 4 some symbols used for manual mapping (Top right) and an example of behavioural map as recorded during observation, Al-Qala Park, Hama (lift)
Figure 5 People at Um Al-Hassan Park entrance viewing and photographing the river and the Norias
Figure 6 Hama City- Global Integration Map and the Case study Park Locations
Figure 7 Hama City- Local integration Map and Case Study Park Locations
Creating engaging places for young people: Beyond skateboards and playgrounds

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Abstract  
In the next 20 – 30 years the City of Whittlesea is expected to grow in population from 162,000 to, potentially, over 300,000: effectively doubling its population in a fraction of the time it took to reach current levels. Creating a sense of place in the city’s vast urban hinterland will be vital to the health, well-being and feeling of worth for its future residents. Apart from the typical challenges of providing physical infrastructure such as public transport, roads and utilities is the significant challenge of providing an appropriate social infrastructure for its community members. More specifically, the City of Whittlesea is asking itself how it will provide „appropriate” places in which its young people can live, work and play. The aim of this research is to identify and develop an understanding of the range of activities in which young people, in the „middle years” of 8 – 12, are engaged in the City of Whittlesea. Focusing on one of many of the city”s envisioned community facilities (e.g. a Community Activity Centre or other similar facility), contemplated to accommodate Whittlesea’s future population growth, the data generated from this research will be used in development of an urban design guide to realising the built environment for young people.

Introduction 
Design guidelines have been used to inform design and development efforts for years in many countries around the world. Many of these guidelines, however, provide generic and purposely vague text so that flexibility in application allows for a range of interpretations. Importantly, guidelines have evolved to allow developers, investors and others to design and build facilities that are targeted at a such a range of groups of people that in effect realise spaces for „no one in particular”.

In recent years academics, municipalities and government agencies, such as the NSW Department of Urban Affairs and Planning and Youth Action & Policy Association, have developed urban design guidelines, public space management plans and renewal strategies (e.g. place making) that are focused on the inclusion and realisation of facilities for specific members of their population (e.g. Sharpe & Tranter, 2011). Particularly, „young people” aged 11 – 25 have been targeted by
these municipalities and agencies. However, this range in age is quite large, incorporating some of life’s important milestones: at about 12 years of age one enters high school; at age 13 one becomes a teenager and is (technically) allowed to have a presence on Facebook; learn to drive at age 16; and at age 18 legally purchase and consume alcohol, vote, go to war, be elected to parliament, marry and, importantly, become an adult. The utilisation of this range in ages for the realisation of places and spaces for young people is seemingly ludicrous. This paper reviews literature revolving around the City of Whittlesea’s development of public places and spaces for younger people to provide focused information on „middle year” kids (i.e. aged 8 - 12). This is being done to assist this municipality’s development of an urban design guide to realising the built environment for its „forgotten” young people.

City of Whittlesea
As a part of this literature assessment, The City of Whittlesea is asking itself what activities do these „tweens” (i.e. in between child and teen) get up to in the municipality, what do they need (e.g. programs/services) to help them become a part of the community and how can the City best accommodate their needs? Extremely valid questions as children, adolescents, teenagers and young adults (i.e. people) learn about civic life and their participation in it from many settings in the community (Malone, 2006a; Sharpe & Tranter, 2011). These questions are particularly important for the City of Whittlesea to ask, since 9,210 „middle year” kids live in the municipality (ABS, 2011a): a 104% increase from the City’s 2001 „middle year” population (ABS, 2011b). Additionally, when employing the previously described age group (i.e. ages 10 – 25), 28,000 or 21% of young people make up the City’s population and this age group is projected to increase „by 40% over the next 15 years and reach almost 40,000 by 2021 (SAP, 2007, p. 3).

Whittlesea is Victoria’s third largest multicultural municipality (SAP, 2007) with 33% of its residents born overseas and approximately 43% of its community members speak multiple languages (ABS, 2011a). Sixteen percent of immigrants and refugees arriving during 2003 – 2004 in the City of Whittlesea were made up of 10 – 19 year olds (New Start, 2005). The municipality has the second highest indigenous population living in the North Western metropolitan region of Melbourne and its indigenous young people have been identified as being socio-economically disadvantaged. Additionally, „more than 5000 young people with a disability live in
the City of Whittlesea” along with more of its residents receiving the disability pension fund, a figure greater "than the Melbourne average" (SAP, 2007, p. 21).

Young people in age of 12 - 24 represented approximately 35% (or a population of 1,201) of homeless community members living in the Northern Department of Human Services Region (Victoria) (SAP, 2007), which includes Whittlesea. Nineteen percent of the municipality’s young people (aged 15 – 19) are, themselves, having children: this percentage is increasing in the City of Whittlesea despite the State’s decline in teen pregnancy (WYPAS, 2008). Additionally, 15% of the City’s male population were reported in the City of Whittlesea Youth Plan 2030 as being unemployed along with 12% of females of that same age (SAP, 2007). This youth unemployment average increased to total 15.1% in 2010 (HWLLEN, 2010); a figure that the City has reacted to by investing $25,000+ towards youth employment initiatives over the 2010/11 and current fiscal years (Budget 2010/11, 2011; Budget 2011/12, 2011).

What these figures, statistics and general information suggests is that substantial populations of young people, in the City of Whittlesea, are facing real life issues: issues that may disenfranchise and disconnect them from the wider community. However, when one engages with the young people of Whittlesea and interprets the literature revolving around their community concerns (i.e. public spaces and places) the “middle year” kids (and young people) provide a wealth of advice that can help shape as well as positively contribute to the their municipality and community. This research field, of young people and their inclusion in municipal and/or community development, can focus on many aspects of civic life, such as: Children”s Perception of Space and Place (see Chawla, 2002; Spencer & Blades, 2006); Learning and Teaching (see Malone, 2006a, 2006b); Needs of Children (see Gleeson & Sipe, 2006); and Transportation (see Tranter, 2010; Wyver, Tranter, et al., 2010).

The irony of the current situation in Whittlesea was summed up, rather cynically, in a 2010 planning meeting for a new Community Activity Centre where it was observed by one member of the City’s Community Facilities team that: „…we provide facilities for the very young (kindergartens) and the very old (planned activity groups) but there”s not much in between…which may explain why after the age of six the only contact some kids have with Council is in vandalising its facilities”.
In terms of the original direction of this paper (identifying activities of "tweens") a more robust data set has come to light and resulted in the establishment of five themes that can be used to direct the development of urban design guidelines for "middle year" kids (and young people) in Whittlesea. These themes will be explained in detail below and are: safety/health & well-being, services, programmes & activities, and facilities. Please note that these themes are discussed individually so that a message is conveyed. The material contained within each theme, however, is not restricted to that particular topic and in situations content may easily find a place under a related theme. Hence, the following discussion is not absolute or "set in stone" as other councils or professionals may find that according to their "site conditions" material is best repositioned.

**Themes for Urban Design Guidelines**

**Safety/health & well-being**
Safety/health & well-being is a highly important theme amongst "middle year" kids (along with young people) and appears to help "set the stage" for positive or negative interaction between kids and the community. This theme has been divided into four sub-topics (i.e. Perception of Kids (in the Public Realm), Public Spaces/Places and Mental Health, Social Issues and Transportation, to help better inform decision makers and illustrate concerns "middle year" kids have about their safety/health & well-being in the Whittlesea community. Please note that many themes and sub-topics cross over to issues related to the wider young people age group (i.e. 10 - 25) that was previously criticised in this paper. The literature (and its revealing lack of age specificity) tended to position discussion around this wide reaching age group. In the following discussion themes and sub-topics reflect this wider age group. Where "middle year" specific data is forthcoming this has been highlighted in the discussion.

*Perception of Kids (in the Public Realm)*
Middle year kids (and young people) understand that they may be perceived as threatening and delinquents by members of the wider community (SAP, 2007). In the City of Whittlesea the municipality’s public spaces were highlighted by young people as an example of where they did not feel safe. Unfortunately, kids can also be victims of anti-social behaviour and crime perpetrated by a range of community members. In particular, at shopping centres or public venues in Australia where
security guards are employed to “watch over” sites, children have reported being singled out and targeted by people of authority (PSYP, 2002). To counter this, the best results where kids (and young people) have been made to feel safe and welcomed, at shopping centres or similar establishments, is when management has trained personnel to develop an understanding of when to approach kids/young people and when they should call for a council youth worker to help with a given situation (PSYP, 2002).

Public Spaces/Places and Mental Health
What kids also describe under the Safety/health & well-being theme is that (youth service) personnel need to be available in public spaces. This request is not interpreted as a call for someone to run to if pursued by, for example, a security guard but rather someone they can turn to in times of trouble. If we reflect upon the City’s mental health data, Whittlesea can detail high incidents of depression amongst its young people and a reported increase in clients 10 – 24 years of age: the latter is expected to rise over the next 15 years (WYPAS, 2008). The suggested personnel, by the young people, are also in response to the need of having someone else to talk to other than friends and family. All of which revolve around trained personnel that can accommodate topics such as sexual health and the transitions particular to one’s stage of life (e.g. leaving primary school and entering into high school).

In particular, times of trouble can happen at all hours of the day and night. As a result, support (other than phone centres) is needed 24 hours a day and on an informal basis. Furthermore, kids and young people of the Whittlesea community reported in „What young people are saying 2008” (see WYPAS, 2008) and „Youth Plan 2030 Summary & Action Plan” (see SAP, 2007) that there are long waiting lists to meet with councillors: high demand and the cost for accessing this help is prohibitive.

Yet, to take a step back, for a public space/place to even begin to be attractive to young people they suggest that the environment needs to be inclusive and engaging, promote visibility/surveillance and social/peer interaction and have the capacity to encourage physical activity. Inferred here is community or, at the very least, some positive connection with the realised space and that „place making” does not simply relate to the provision of physical spaces for young people (Freeman, 2006). The
space must also cater to the different life and development stages of young people (SAP, 2007). The later is a big ask, as there appears to be conflict with this concept of space. Particularly, if we reflect on the different milestones presented in the introduction, which encompasses young people, we need to ask ourselves how this can be adequately or appropriately achieved. If one thinks about this, the municipality would be realising a space that caters to everyone and no one.

**Social Issues**
The most common challenges faced by „middle year“ kids and young people in the City of Whittlesea are: drug and alcohol issues, fitting in at school, fitting in at a new school, family issues, peer pressure, bullying and making friends/maintaining relationships (WYPAS, 2008). As well as being concerned with the above (mental health) related issues they also report being concerned with racism, violence, harassment, suicide, and discrimination. In particular, if we partition the different age groups that comprise „young people“ we see that the top challenges faced by 10 -12 year olds is the transition into high school and fitting in at a new school; for 13 -15 year olds it is fitting in at a new school; career and study is of concern for 16 – 18 year olds; and for young people aged 19 – 25 it is joining the workforce.

**Transportation**
A way to assist with the accommodation of these different stages in the life of young people and allow them to access the above suggested support is to reflect upon transportation in the community. The young people report that „public transportation is considered the most prevalent barrier to [their] accessing support when they need it“ (WYPAS, 2008, p. 29). Its costs are prohibitive, it is infrequent and its routes do not service the destinations of the young. Furthermore, they are concerned for their safety on public transport and would like to see personnel (e.g. security personnel) on the routes.

Aside from public transportation, to improve the walking and cycling capacity of the young people they request that footpaths and bike paths be improved as well as the street lighting that accompanies this infrastructure. In particular, the young people draw a link with mental health and the larger theme of safety/health & well-being in so fare as they describe that physical activity (e.g. walking, cycling) and/or sport is a good way to stay active and maintain good mental health. The new South Morang
Rail Extension which will link Epping to South Morang with rail services will be interesting to observe in terms of its usefulness in connecting facilities for young people in the municipality and to the broader metropolitan region.

**Services**
The sub-topic transportation begins to reveal the connection with “services and mental-health” and young people in the community. The theme Services has been broken into three sub-topics with each revealing considered thought and insight by the young people, in terms of what they need to develop and be part of the community.

**Local Council**
The “middle year” kids and young people highlight that the municipality is key to the success and development of youth services. Barriers to accessing these services (e.g. mental health) provided by council are mostly related to transport and costs. In the paragraph above, public transport is problematic for young people but they also explain that transportation can assist with their transition from dependence to independence: a key principle to take note of in the development of young people. Furthermore, council needs to locate services locally and not have them “centralised” where large distances separate young people from the assistance. In particular, the young people infer that council should take a “McDonalds approach” to service development and locate services in all suburban areas (i.e. catchments) to maximise access and use. This type of approach should also be widened to incorporate the design of services (and facilities) that are friendly and inviting to young people. An approach supported by Malone’s (2000) research as she asked “why McDonalds was such an attractive place”: the young people responded that “it was bright, clean and safe” (especially for females who used its toilets) (p. 143).

**Education**
Continuing with the “McDonalds approach” to service development (and use) a media campaign jointly run through schools, the community and parents to raise awareness should be implemented. Please note that implied within the “McDonalds approach” to a media campaign would be market applicability. That is, regular updating and re-packaging of information to consistently make young people aware of council services.
Another approach to educating young people about youth services is to employ social media such as Facebook, MSN, Yahoo and My Space to get the word out. Things like “what a youth worker does” and “how to access one”, education material on smoking, drug and alcohol use, mental health information and services and sexuality can be provided on-line. However, there must also be a soft copy (e.g. a PDF) of this and other youth related information that they can down-load and print out (if desired). Particularly, a “youth-bible” which presents all youth related services, facilities, programmes and so on was suggested to be developed by the young people of Whittlesea.

Counselling
A continuing theme throughout the young peoples” commentary is counselling services. The young people, however, extend their desire for counselling to be widened to include support for family and adulthood related issues. In terms of counselling, 10 – 12 year olds say they want other young people to talk with and to hear the counsellor’s (similar) experiences. Thirteen to 15 year olds would like this too but also look towards friends and (music) events where they can be around other people for help. The latter implies social exposure and not necessarily direct contact/communication with community members.

Lastly, the young people have been critical with youth councillors that they have had contact with in the municipality. Of concern is the young peoples” perception that counsellors jump to conclusions and are not confidential with clients” identities. The kids and young people want and expect 100% confidentiality when dealing with counsellors. Additionally, the young people would like counsellors and youth workers to focus on the strengths of the kids rather than their deficiencies.

Programmes & Activities
The next themes identified in the review of Whittlesea youth-specific literature are Programmes and Activities. Four sub-topics emerge from the „middle year” kids and young people”s suggestions revolving around programmes and are: Training/Education, Housing, Employment and Youth Events. In particular, Training/Education is an inferred topic from the previous discussion of counselling and commences the discussion under this theme.
Training/Education

More training of professionals was requested by the youth: particularly to develop and/or install community tolerance for young people. This topic has arisen a few times in this work and is directed towards those individuals who deal with young people. The list of individuals dealing with young people can be quite extensive but is focused on: security guards, counsellors and youth workers along with those that manage youth venues and/or donate their services for kids” activities (e.g. youth centre managers and sport coaches, respectively).

The young people also discussed the development of educational programmes and have identified four topics they would like addressed: population (addressing population pressure); sustainability (improving the sustainability of our cities); climate change; and water issues (like saving water). As well as these four topics, young people would like educational programmes that: focus on highlighting the indigenous contribution to society; integrate the varied community members living in Whittlesea (e.g. refugees and individuals with a criminal history); promote equity in health, education and employment between genders, people of different races and/or from different socio-economic backgrounds.

Employment and Housing

Pay for youth workers is a key ingredient to employing appropriately trained personnel and to retain their expertise at the City of Whittlesea, say the young people. This is rather good insight especially as the municipality has reported that there is one youth worker for every 3000 people and that the City is deficient by three workers (SAP, 2007). Furthermore, the young people are requesting more employment opportunities be developed in the City. The municipality is accommodating this request by increasing the funding to the Whittlesea youth employment initiatives highlighted under their „Grow our economy“ section of the web published budget (see Budget 2010/11; Budget 2011/12).

Housing is another important „programme” related sub-topic. Young people are suggesting a number of initiatives that revolve around providing safe and affordable housing for young people living in the urban fringe of Melbourne. They highlight that this is important because „housing services are generally located close to the Melbourne CBD and are difficult for young people in interface local government
areas to access" (WYPAS, 2008, p. 30). Another consideration of housing is that young people desire a rental assistance programme. Interpreting this later statement reveals that it is not necessarily financial assistance they are requesting but rather providing references/vouching for the young people as some find it difficult to secure accommodation with little or no rental history. The young people are also very keen to assist with the design of houses and have taken this concept a step further by entering into the world of social or urban planning: suggesting that caravan parks, or a component of them, should be dedicated to the City”s homeless population.

Youth Events
The above suggested programs may be regarded as items that can benefit the wider community of Whittlesea. In fact, one may regard all these themes and suggestions ultimately benefiting the community at large (see Malone, 2000). Yet, some events have been suggested to cater to the specific needs and desires of young people.

In this light, an attitude that continues to emerge amongst young people is that events, programs and services must focus on their positive attributes and strengths rather than addressing their deficiencies. Particularly, the young artists in the community need opportunities (and venues) to exhibit their talents. They also request youth specific events/programs where young people can develop a sense of belonging within the community and opportunities for the youth of Whittlesea to find or establish common ground with the wider community.

A suggestion, by young people, to achieve this connection is to establish a youth awareness week. Young people and members of the wider community can come together to plan a series of activities that, once again, draw attention to their positive attributes and present these to the wider community. It was also suggested by young people that council provide funding to FReeZA (a state wide youth related group) so that they can realise events for the City”s youth.

Surprisingly, the activities of „middle year” kids sought in this review of literature are few. Rather the insight provided by these kids (and young people) reveals a deep understanding of community needs and desires that goes well beyond self interest. Yet, 10 – 12 year olds desire activities where they can meet other people at their school, particularly to assist newly arrived young people that may be feeling isolated. Unfortunately, in the Whittlesea-specific literature, activities for kids aged 8 – 9 could
not be located and more research is needed. In terms of the wider age group of young people, 10 – 25 years old, they desire music, sport and game related activities. The location of these activities is suggested to be in a number of different facilities throughout the City.

**Facilities**

Facilities that „middle year“ kids (and young people) describe can be divided into three sub-topics for discussion. Each sub-topic, again, reveals a deep understanding of community needs and the possible contribution young people can have in the wider community. These sub-topics are: Public Places and Spaces, Youth Centres and the Realisation of Spaces/Places.

**Public Places and Spaces**

When asked what spaces young people would like in the City of Whittlesea they describe settings where they can relax, socialise, enjoy music, do activities, have fun, share interests and hang out. What these items reveal are that spaces for programmed and un-programmed activities are needed.

They also provide information and distinguish between needs of the youth and priorities for improving the community of Whittlesea at large. In terms of need, the young people suggest the development of facilities that provide a safe place to hang out and socialise, an environment where they can have fun and a place where services (e.g. counselling, mentoring and tutoring) can be accessed. The priorities for the community, as also described by young people, should be the development of a leisure centre or centres, improving public transportation and roads, bettering the walk and bike paths and multi-purpose centres as well as youth-specific facilities.

**Youth Centre**

Turning to the priority of youth-specific facilities, a youth centre (or more appropriately youth centres) emerged as a sub-topic from the literature. Yet, for a youth centre to be appropriate for the young people, and specifically the „middle year“ kids who want a place to hang out and talk with people, the facility should offer fun things to do, provide a safe place to hang out and socialise, offer games and sport activities, help young people in need and provide tutoring and homework help. Youth centre-specific activities (in rank order) as suggested by the young people are:
1) sports, 2) games and arcade games, 3) computers, internet and computer games, 4) movies, TV and DVD player, and 5) band/music facilities for music events. In addition, to the „roof overhead“ venue, open space for un-programmed activities must be included in this environment. The open/public space component is rather important as these spaces provide a stage for young people to „display, exhibit, try on and employ new identities“ (Malone, 2000, p. 137).

**Realisation of Spaces/Places**

The „middle year“ kids and young people highlight that in the realisation of, for example, these youth centres they do not need to be purpose-built (i.e. a new building). Rather, existing facilities, like unrented places in shopping centres or schools (utilised after hours and on weekends), are identified as potential spaces that could be used. They also suggest that they themselves and/or non-council related organisations (e.g. FReeZa) can assist in the planning and redevelopment of the existing facilities. Of great importance, is that in the realisation of these facilities, the services described, throughout this discussion, are integrated into this facility.

**Urban Design Guidelines for ‘middle year’ kids (and young people) in Whittlesea**

To assist with the realisation of these themes and, importantly, integrate „middle year“ kids and young people into the community development process, urban design guidelines for realising spaces and places, specifically with youth participation in mind, must be developed. Fortunately, much information and design guidelines that are directly applicable to this last task are available. Hence, there is no need to „re-invent the wheel“: the tools and material already exist; we just need to use them. Below is a „cut and paste“ and reworking of the „Urban Design Guidelines with Young People in Mind“ document developed by the NSW Department of Urban Affairs and Planning (see DUAP, 1998). These have been included here to illustrate one approach to the development of guidelines. Please note that they have been modified to reflect the information presented in this paper and, thus, are City of Whittlesea-specific (Table 1). One new section has been added to these guidelines and this revolves around the mental health theme in this paper.
### Table 1: Urban Design Guidelines for ‘middle year’ kids (and young people) in Whittlesea

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| **To allow young people to get to activities, meeting places, services and facilities. Public transport is preferred, but where this is irregular or not available, lifts are often sought from friends or family members. Alternative means of transport such as cycling and walking should be provided for in the city.** | • Maximise public transport such as rail, buses and taxis. Ride sharing activities amongst the public should be encouraged.  
• Locate pick-up and drop-off points for public transport, taxi ranks and ride share as close as possible to public spaces and young people’s activities.  
• Locate short stay (ten minute) parking areas within or as close as possible to meeting places as pick-up and drop-off points for lifts.  
• Pick up and drop-off points should be well-lit and include seating as well as a roofed facility. They should be positioned in active locations where the promotion of visibility can be maximised.  
• Increasing the area of public space around school bus stops will help accommodate active young people and their school equipment and back packs.  
• Provide and/or improve walking and cycle paths to youth destinations. These routes should be well lit and located along public infrastructure (e.g. roads) so that visibility opportunities exist.  
• Sometimes people have to move through a busy public area to get to a specially designed youth facility such as sport venues. Safe, easy to use, connecting routes need to be provided. |
| **To integrate rather than segregate young people from the wider community. Young people usually enjoy the liveliness of busy places and they shouldn’t be seen as problematic. In other situations passive participation in places is sought by the young people. An inclusive design process enables designers to be better informed of young people’s needs. Involvement in design and implementation encourages young people to take ownership of and responsibility for public spaces and features that they have assisted in creating.** | • Design public spaces which are flexible and can accommodate a wide range of users and their abilities.  
• Public space should be designed to accommodate programmed and un-programmed events/activities.  
• Youth specific settings should have space available for youth service personnel and their related service/programmes.  
• Larger spaces and wider paths offer more opportunities for a range of activities. A path four metres wide for example can accommodate three people walking abreast as well as a wheeled item such as a stroller, wheelchair, cycle or skateboard.  
• Provide seating in public for young people to gather as well as for other user groups. The provision of seating areas helps legitimise “hanging out” as an activity rather than an obstruction.  
• In public streets, seating is ideally positioned at the edge of footpaths where through movement is not blocked, seats can be easily observed and there are opportunities for viewing passers by while shop windows remain visible.  
• In pedestrian malls and arcades, seating should be positioned centrally so as not to obstruct shoppers or obscure shop windows, but still providing opportunities for observing passing activity.  
• Where facilities specific to young people are provided, such as youth centres, these should be integrated into the urban fabric and positioned where there is passing life and activity, for example in street level shopfronts.  
• Involve young people in planning initiatives for public space.  
• A formal point of contact (e.g. youth worker) with the local council is helpful. The process outlined below indicates when to include consultation. |
| **To encourage a range of uses in order to ensure diversity, liveliness and a choice of activities, particularly in public areas such as Epping Shopping Centre. The range of uses should also include youth “magnets”.** | • Consider the widest possible range of uses in the City and promote the vitality of existing centres. Encourage a mix of retail, commercial and entertainment activities as well as Government agencies and community services.  
• Encourage residential uses within or in close proximity to town centres to facilitate activity at a range of times. Residential uses within the centre should aim to include active, non-residential uses at the ground floor such as shopfronts.  
• Enhance the accessibility of the City by improving public transport, walking and bicycle paths and providing limited but well-designed integrated parking facilities at youth magnets.  
• Links between uses are important as young people will move between different magnets.  
• “Active edges” such as glazed shopfronts are preferable and provide visibility opportunities.  
• Maximise the number of entries to buildings from the street to assist in activating the public domain.  
• Rear lanes offer convenient short cuts and pedestrian routes. Lighting of such lanes is essential. Overlooking and visibility opportunities should also be maximised.  
• Landscaping of public spaces should not obscure pedestrian eye-level sight lines or sterilise large areas of space.  
• Facilities which attract people, such as youth services, should be maximised in public spaces to reinforce levels of activity. |
| **To improve the perception of safety in public spaces. Spaces should be well lit with** | • Dedicate blank wall spaces for young artists.  
• “Active edges” such as glazed shopfronts are encouraged and provide visibility opportunities.  
• Maximise the number of entries to buildings from the street to assist in activating the public.  
|
opportunities of visibility to discourage negative activity by community members.

domain:
• Provide discrete entry and exit points for young people accessing services where confidentiality is of concern.
• Rear lanes offer convenient short cuts and pedestrian routes. Lighting of such lanes is essential. Overlooking and casual observation opportunities should be maximised.
• Landscaping of public spaces should not obscure pedestrian eye-level sight lines or sterilise large areas of space.

The Public Stage:
Public entertainment, expression and communication

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| To assist young people seeking outlets for self-expression, there should be venues for public entertainment and opportunities for public communication. | • Design formal and informal spaces for public entertainment such as music, artistic and sport events. These spaces should provide meeting points, a focus for activity and an outlet for expression.  
• Design street furniture to be multi-functional – for example a flat bench may become an informal stage for performance artists. Street furniture should also be easy to maintain and long lasting.  
• Design programmed and un-programmed spaces which are large enough to accommodate a range of users – they can then also accommodate public performances, markets and other communal activities.  
• Online and physical „public” notice boards are a forum for young people to communicate to each other and the wider community. These should be used to promote youth activities.  
• Public art created by young people offers a medium for self expression. Such art works may be sculptural (three dimensional) or two dimensional (walls, murals, paving).  
• The public stage should be designed to cater to the young peoples’ different types of expression. |

Keeping Public Space Public: Privatisation and public issues

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| To ensure that spaces remain accessible to the public. That is, they are free to enter, are open at all times, not governed by security guards or surveyed by CCTV. | • Provide for spaces in the public realm in addition to those provided privately, such as malls.  
• Avoid over-management of public spaces by security patrols or through the use of CCTV.  
• Avoid cluttering public spaces - keep them simple and flexible. Prevent cars parking in public spaces.  
• Provide youth specific training to individuals that may come into contact and assist young people.  
• Provide spaces that allow for programmed and un-programmed activities. |

Separate but Visible: Activities which should be segregated

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| To ensure that potentially conflict-generating activities are physically separated from other uses, but remain visible. Such visibility reinforces the spectator value of exhibition activities and also provides informal observation opportunities. | • Provide „active” facilities in public areas and in locations that are visible to other public space users, but separate from main paths of movement.  
• Consider designing such facilities as stages for the display of achievements. |

Basic Services: Public Phones, Public Toilets and Sanitary Dispensers

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| To provide services such as public phones, toilets and sanitary dispensers in locations that are discreet but accessible to young people. | • Provide services such as public phones and public toilets where they are easy to find and where visibility opportunities exist. These facilities must also be well lit and clean.  
• Provide appropriate sanitary facilities in discreet, but public locations.  
• Consider co-locating these basic service items. |

Mental Health/Well-being

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| To provide space for youth worker/counsellors where young people are active. | • Where youth facilities, programs and/or services are provided walled space should be available for youth workers/counsellors.  
• These facilities should accommodate groups of two people to a family.  
• Discrete entry and exits into this facility should be provided to promote confidentiality of clients. |
Conclusion
The activities “middle year” kids (and young people) are involved in is not the “youth”-specific agenda item to focus on when developing strategies that cater for their needs and involvement in the wider community. This review of literature, specific to the City of Whittlesea’s young people, reveals a number of themes that underpin their thoughts of community engagement. Of great importance is that their thoughts and suggestions for improving Whittlesea reveals considered thought and an overall aspiration to improve many different features of this municipality. These “middle year” kids and youth specific themes are: Safety/Health & Well-Being, Services, Programmes & Activities, and Facilities. Importantly, mental health is of great concern and a large component of their potential positive contribution to the City. They have gone so far as to link improving and providing more bike/walking paths as a means to improve their physical and mental well-being: as well as provide an accessible, cost effective and independent means of travel within the community.

The “middle year” kids (and young people) are not asking for new facilities in the realisation of space/places for them. They understand that Whittlesea is positioned to take advantage of what currently exists (e.g. unrented shops) and are willing to help in the design and renovation of these facilities. Hence, the underpinning theme throughout this paper and that identified by the young people is to understand that information, material, facilities and so on already exist. Councils and municipalities just need to utilise what already exists and, importantly, they need to focus on the positive attributes of these community members when designing anything that attempts to address their participation in the community.

The information in this paper suggests that it is not urban design guidelines alone that are going to help the “middle year” kids and young people of Whittlesea become contributing members of the community. Rather, positive gains are going to be made through a committed and sustained effort by all those involved in the community: including the young people. This “effort” (e.g. in community development), however, revolves around a series of programs, services and activities that come together to (hopefully) improve relationships between the young people and wider community of Whittlesea. Furthermore, what the information in this paper also begins to suggest is that the “middle year” kids and young people are leading us adults down a path of “place making”: where bricks and mortar (i.e. facilities) are identified as one
component of a community. This then prompts the next step in this research: to investigate the relationship between urban design and place making from the point of view Whittlesea”s „middle year” kids and its young people.

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References


Resilience as a framework for urban design

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Abstract

Disturbances test urban resilience. After major disturbances, such as earthquakes or floods, recovery often relies on the adaptability of the community and the capacity of the urban environment to support it. Urban design should thus be able to assist in recovery. But normative theories in urban design champion everyday amenity and compactness in a drive for more livable and sustainable cities, while recovery planners often seek dispersal and de-intensification to minimise loss. How do we reconcile these goals? In an analysis of the recovery period after earthquakes in cities such as Christchurch, Concepción and San Francisco, we have mapped communities’ adaptive uses of the city so as to assess the resilience attributes of the urban morphology. From this we suggest a guide to how designers might intervene in spatial fabric to enhance urban resilience. We have concluded that diversity and modularity, both attributes of resilience systems and both spatially oriented, are embedded in the urban morphology of cities and, to varying degrees, have increased the capacity for communities to adapt and learn to live with their vulnerabilities. The attributes are qualitative, site-specific and interdependent rather than quantitative and absolute: the conclusions are therefore abstractions rather than formulae for urbanism. Nonetheless, resilience attributes can be important tools for assessing urban form and providing an approach to design both for the everyday and for the disaster.
Introduction

One of the best ways to understand a system is to disturb it (Descombes 1999: 80). And you don’t know whether a system has resilience until you have disturbed it to see what degree it can undergo change and still retain the same controls on function and structure, whether it is capable of self-organization, and whether it can build and increase the capacity for learning and adaptation (Folke 2006: 259-260). This definition of resilience originates in the science of ecological systems. Theories in urbanism discuss the city also as a system, so the ecological systems definition is apt. The components of urban systems and the urban system itself can be considered, when they get disturbed, in terms of resilience. But resilience now gets applied to urban theory with an alarming alacrity, and because it is a qualitative descriptor, an intangible that spans a number of disciplines, it has the potential to be abstracted beyond usefulness. So how useful might it be in urbanism if its conceptual underpinning turns into an all-encompassing, globalizing snake-oil with little value for the specificity of place? In fact, how do we know when we have got it?

One response is to see how cities respond to disaster: apocalyptic disturbances, such as hurricanes, floods and earthquakes. In the past some cities have been abandoned or changed so irrevocably after disasters (Tobriner 2006, Diamond 1995). Nowadays, translocation is not an option because people become attached to place and their real estate. In a more recent past, recovery planners have suggested that we should spread settlement and its components far enough apart because there is less chance of a tornado or an earthquake affecting things when they are so dispersed, and there’s more room to undergo repair. Tangshan in China is a product of such thought, where wide streets, low rise buildings and lack of an identifiable centre of a post earthquake reconstruction have left it somewhat lacking in what some have called ‘urbane refinements’ (Mitchell 2004: 8). Dispersed-ness is not really palatable in modern urban theory as humanity faces environmental issues of potential resource depletion (Mostafavi 2010) and inexorable population growth (United Nations 1999). And dispersed-ness or compactness is not necessarily a trait of resilience. Ecological systems’ resilience don’t rely on them. For example, a forest's resilience to a fire is often
embedded in the potential of the individual tree species' DNA to adapt. So what are the agents of resilience in a city? What's hidden in our cities' DNA that can help us regain function, reorganize, learn from, and adapt when the next disturbance comes along? And can we design make urban form out of resilience traits, so that it is integrated with the everyday function of a city?

This paper discusses the attributes of resilience and how applicable they are to urban theory. The methodology that we have used entails reviewing the way people adapt their activities in a city when the city changes. We have looked for the relationship between peoples' adaptations and urban morphology. Urban morphology is a good tool for looking at resilience: it operates on a number of scales and embraces human habitat, built form and open space in an interrelational landscape (Moudon 1997: 2). This multi-scalar contextual application is also a hallmark of resilience (Walker and Salt 2006).

Three case studies have been used. We looked at earthquakes in San Francisco, Concepción and Christchurch and their urban morphology. We have retraced the activities of people after the disasters and then looked at the urban morphological qualities at various physical scales to determine what physical features assist in amplifying the resilience of the whole system or its parts.

We have used resilience attributes suggested by Walker and Salt to analyse each city and each event, but we focus on the spatially oriented attributes of diversity and modularity. The concept of diversity pervade the theories of resilience, ecology, urban design and civic justice. Walker and Salt (2003) describe it as the source of future options. Jane Jacobs' (1993) seminal book attributed good urban life to good urban form, and good urban form to diversity. Richard Weller (2009:389) equates diversity (sic) with resilience and innovation. Susan Fainstein (2010) considers diversity paramount to social justice in cities, achievable not so much by spreading rich and poor evenly, but by making concentrations with porous boundaries. Lefebvre (1968) called this porosity the 'right to the city', analogizing the 'right to nature'. Porosity is a characteristic of modularity, and is interdependent of diversity. A modular urban system is composed of smaller, clearly identified units that are connected to each other so the system can operate at the scale of the module and the scale of the collective (Bolker 2000). 'A degree of modularity allows individual modules to keep functioning
when loosely linked modules fail, and the system as a whole has a chance to self-organise and therefore a greater capacity to absorb shocks’ (Walker 2006: 121). Resilience in a modular system is based on the shifting relationship between scales, and between autonomy on one hand and connectivity or porosity on the other.

In the course of this essay we will reflect on these two attributes but are mindful that they can be catalysed by other attributes of resilience, such as social capital, tight feedbacks, innovation, allowing variability and overlapping governance (Walker and Salt 2006). We suggest that these attributes give us a generic idea of what might generate resilience, but by looking at case studies we are able to match community adaptation with urban morphology and create a basis for evaluation of resilience. The evaluation is a starting point for designers.

Georges Descombes suggests that one of the best ways to understand a system is to disturb it. His ‘laconic interventions’ (Descombes 1999: 80) are small disturbances, which encourage the intensification of a site’s singular qualities. Having established a method for recognizing the prevalence of resilience characteristics in a city, we propose some interventions that designers may explore in cities both pre and post disasters, to see how we as designers can have a role in disturbing systems to expose and enhance their resilience.

Three disturbances

The 1906 San Francisco earthquake

The genesis of San Francisco’s urban structure dates from the mid-nineteenth century when massive immigration associated with the gold rush transformed the only harbour port on the west coast of America into a bustling metropolis. Its exponential urban development led to some expedient urban planning which laid out a small-block, wide street grid over the hilly, and sometimes very steep, terrain. Despite the inexorable and universalizing grid, the troughs in the topography established a series of neighbourhood centres. The grid was ‘designed’ with a flattish hierarchy of streets: only 2 or 3 main streets were wider than the rest. The first public spaces were initially centrally located, but as the city expanded the only room for parks was on the least developable land at the tops of hills, beside reservoirs. By 1870 the 1000 acre Golden Gate Park was
established on the lagoons and flattish sand dunes beside the ocean. Despite numerous fires and earthquakes, this urban structure persists and continues to define the essence of the city.

The 7.7 magnitude earthquake in 1906 was followed by a fire which, exacerbated by the earthquake’s rupture of the city’s water mains, razed much of the city’s building stock. During and after these catastrophes we have traced, through first hand accounts, people’s functional adaptations to the loss of services, communication and shelter:

- During the fire, people flocked to the hill top parks, not only because they were refuges from unstable building, but also because they were places to see and understand the threats, and communicate their experiences with others. (Greely, 1906) ( Fig. 1)

- Even though the earthquake created hazards on some streets, the grid provided options for people to get around the city with ease. It was easy to take one’s belongings to the nearest park and settle. (Morrow (19--) ( Fig. 2)

- Soon after, people gathered and camped in local parks, partly because it allowed people access back to their homes easily, partly because of the supply of water from reservoirs, and partly because it placed people in the company of neighbours. The parks became the defacto centres in the crisis and became the locus of commerce soon after. (Greely, 1906: 88) ( Fig. 3)

- People were unable to cook indoors due to the loss of or threat from fractured utility services, so they set up temporary kitchens in the streets. (Keeler 1906: 47) The width of the local streets made them suitable for such multi-purpose activities. (Fig. 4)

- Authorities were able to reestablish infrastructure relatively easily in the streets because they were long and straight: railways, trams and services were easily deployed. ( Fig. 5)

- After a while, people moved their encampments to Golden Gate Park, where there was a surety of water supply and sanitary drainage as they waited for reconstruction to finish.

- Commerce was quickly reestablished in the main streets by temporary carapaces built over the sidewalk. ( Fig. 6)
The groundswell of activity had a political effect. Although the government entertained the possibility of reorganizing the street structure according to a plan of the then illuminant Daniel Burnham based on his City Beautiful principles, the politics of the community and property owners’ will resisted such a change. (Fig. 7)

Each of these adaptations clearly has a relation to the city’s urban morphology which we can interpret in terms of its resilient attributes. At a local scale the breadth and unspecific programme of the network of hilltop parks and wide streets provided spatial diversity from the intensely programmed and developed private land, and thus provided a venue for the ad hoc functional diversity of the city’s activities. Spatial diversity also occurs at the broad scale of the city: Golden Gate Park and its divergent spatial typology, flat topography and low relief provided a resourced and ordered locus for longer term recovery that the smaller hill top parks could not have offered. The diversity of the city’s open space structure was important because it provided concentrations of spatial type. The legibility created by porosity of the gridded access network linked the divergencies of type.

The grid and the topography of San Francisco had a positive influence on the modularity of the city: the flat hierarchy of streets allowed some streets to ‘fail’ as access routes without affecting the system, while the hilly topography defined neighbourhoods that during the recovery period were centred on the hill top parks. The matrix of streets provided redundancies which allowed the modular neighbourhoods to operate both on a local scale and as part of the city’s system. But the lack of redundancy in water reticulation became a serious threat to the city during the fire. The shortage of water was resolved in the recovery period by the diversity of park types that included lagoons and the ease with which services could be laid out on gridded streets. Since 1906 San Francisco has implemented an auxiliary water system that cultivates redundancies in its water reticulation system.

While diversity and modularity played important roles in the city’s recovery, social capital was also a strong influence. San Francisco revoked overtones for a grand scheme, and we may speculate that the resilience of the extant urban form may in
part be due to the camaraderie of the camps and the desire to retain the same controls on structure and identity that were prevalent before the earthquake.

**The 2010 Concepción earthquake**

Concepción, with 1 million population, is now the second largest city in Chile, and in 2010 experienced one of the largest earthquakes ever recorded. The city is laid out around an isthmus of land between the mouth of the River Bio Bio and the Bay of Concepción, and in areas south of the river. It has experienced a number of tsunamis in its 300 year history: at some point in the 18th century the centre moved from Penco beside the Bay to La Mocha on the river’s edge. The metropolis is predominantly a low lying marshy area, punctuated by some steep granitic protrusions. *(Fig. 8)* Previously laid out as a number of villages between the marshes and the hills, it is now one large conurbation known as the City of Lagoons. Some remnant marsh lands remains, and some of the steeper hills are undeveloped. There is a variety of settlement patterns and built form across the city which includes medium rise apartment blocks and low density suburbia. The geomorphology provides the basis for a polycentric layout of form, but the city does not function polycentrically. There are large areas of centre-less low-density suburbia, and services are unevenly distributed across the city’s nodes, leaving a high reliance on a few important connections.

After the 2010 earthquake and ensuing tsunami, we collected people’s adaptive responses from the schools in Concepcion and the Ministry of Housing in Santiago:

- Looting proliferated in the initial aftermath when there was little communication.
- The collapse of two of the three bridges connecting the CBD to the southern part of the city disrupted the flow of people, goods and services essential for recovery for months. *(Fig. 9)*
- Many people who lived on the lowlands sought refuge on high ground to escape the impact of tsunamis. Unfortunately most high ground is either hard to access or privately owned, so there was much conflict.
- In the few days following the disasters many people gathered in communities and barricaded themselves in. They set up road blocks to prevent ingress of strangers. They gathered around the local park to communicate on specific needs such as medical supplies. (Fig. 10)
- Many people turned front yards adjoining streets into public space, and left back yards for private use, such as camping. (Fig. 11)
- Many people set up camp around the lagoons where there was access to fresh water. (Fig. 12)
- The government developed multiple schemes to appropriate private land and create natural barriers against future tsunami, but people quickly moved back into their tsunami affected land and erected temporary shelter. (Fig. 13)

Spatial diversity in types of open space in the lowlands facilitated a number of responses, but the lack of flat public space on high ground generated conflict amongst citizens. But perhaps one of the most dramatic and spontaneous adaptive responses to the earthquake was the construction of barricades to create small neighbourhoods with distinct boundaries. This adaptive behaviour suggests that under pressure, communities will instinctively establish the modular conditions necessary to generate or enhance *social capital* to ensure survival. First-hand accounts give evidence of the strong bonds that developed between members of these small communities and the way they adapted space to facilitate recovery.

At the city scale, one of Concepción’s greatest vulnerabilities is its ‘thin’ polycentricism (*Kloosterman, Musterd 2001*) which over-relies on port activities at risk from tsunami, the central business district (CBD) north of the river for governance and major services, and connections to the dormitory suburbs south of the river. The city appears modular, but it is not modular enough. Both the sub-centre and the metropolitan city as a whole rely for their viability on the connections between them and because of their interdependencies, it is not safe for either the sub-centres, or the connections between them, to fail.

AS in San Francisco, there appears to be unprecedented opportunities for *innovation* and experimentation after an earthquake, especially given the more sophisticated
undersanding of earthquakes that is now available. In reality, such sweeping changes after an earthquake are rare (McDonald: 2004). When it has happened, such as in Sri Lanka after its 2004 tsunami, it led to widespread dissatisfaction as fishing communities were translocated from the beaches that connected them to their livelihoods. Most people want life to return to normal as soon as possible and it is difficult to make lasting changes in such a short space of time. Two of the biggest hindrances to innovative change are land use issues and the reluctance of property owners to shift boundaries or give up land. In the Bio Bio region, the pressure to build back quickly and comprehensively, despite a healthy base of goodwill and optimism, might seriously affect the long term success of such a venture, encouraging shortcuts, particularly with consultation and environmental investigations and in the process, alienating stakeholders and communities.

The 2010 / 2011 Christchurch earthquakes

Christchurch is the country’s second largest city with 400,000 people and, like Concepción, also suffered a massive earthquake in 2010. Although New Zealand has an inferior GDP to that of Chile, it has much less disparity between rich and poor (UNDP 2009).

The earliest occupants, the Maori of Ngai Tahoe, had farmed the abundant land without significantly disturbing its ecological patterns which were dominated by a complex braided network of streams flowing in a matrix across the plains. In the 1850s the Canterbury Association channelized the hydrology into one open, though still modest, stream and laid out a grid of large blocks and wide streets across the city centre in a distinctively ordered pattern, from which their descendents subsequently sprawled late 20C suburbia across the Canterbury plains. In the process, the Avon River, the only surface remnant of the earlier hydrology was bridged in numerous places, and wetlands were reclaimed for low density economical housing. Open space is abundant, both in suburbia’s private gardens and in the width of its streets and in the acres of parkland that fill the landscape of the City of Gardens.

In 2010 it suffered the start of an ongoing nightmare: a series of earthquakes that experts say will continue to happen for at least another 3 years. The February 2011
The aftershock alone had over 150 casualties. Physically the main problem was liquefaction: the gravelly sandy geology liquefied, causing irreparable fractures in thousands of residences that were built near the river. Details of the recovery period have been the subject of a number of workshops in Christchurch. The relevant points are noted here:

- The city centre has been evacuated because of the danger of damaged buildings. Thousands of offices have relocated outside the centre and defacto centres are springing up in the ‘safer’ (i.e. non liquefaction-prone) areas to the west of the city centre. Businesses are taking medium term leases as they await decisions regarding the reconstruction of the city centre.
- Retail land owners in the city centre and the City Council are rapidly putting together plans for reopening the city centre.
- There has been intense public consultation by the City Council, particularly about the future of the city centre. The response from the community is overwhelming. In one open day 10,000 people attended, and so far 106,000 ideas have been posted on the City’s website. The main innovations canvassed were for more transport choice, a mixed use low-rise urban centre, and a more ecologically responsible ‘21C Garden City’. But fulfillment of these ideas may take some time – New Zealanders are notoriously reluctant to inhabit inner cities (ref…), and Christchurch is a conservative place for one to contemplate a reinvention of swamps in lieu of the extant grand avenues of deciduous trees.
- Out in the suburbs the response is somewhat mixed. Some areas, have generated strong community action groups. But many of the housing areas on the wetland areas around the river have less active communities. They lack local facilities such as schools and neighbourhood centres. The streets are now the location for port-a-loos (which contrasts poorly with San Francisco where they were the location for gutter kitchens that tied the community together). In the last month since writing the government has declared many of the suburban areas on the river ‘red zones’: where they intend to buy back land and hopefully appease the residents who have been wondering who let them build on these swamps. The future land use of the red zones is unclear, but it will probably be more parkland, perhaps unnecessary in a city that has an abundance of it already. The buy-back
will be an enormous burden on the tax payers of New Zealand, and the re-
housing options look like further sprawl to the west of the city, and the abandoned land being used as even more park land.

- One of the good stories to emerge out of the community attachment to Christchurch is that of ‘Gapfiller’: a creative group of individuals who, in the spirit of Richard Florida’s creative class, are intent on building from the bottom up by filling in the vacant lots with temporary activities where there is low rent.

It is interesting that the urban structure of Christchurch facilitated this reaction. What people are now asking for: a low rise city centre with a 21st-century garden approach recognizes the weaknesses in the centre’s lack of modularity and diversity. The social capital associated with Christchurch’s rebuild is clearly the most potent aspect of its resilience. It has a creative and innovative people who are keen to develop infill, who are looking at temporary solutions as a medium term option and who are using the resources of a large number of experts and competitions to explore the latency of the City of Gardens. The people of Christchurch have recognised the shortcomings of the way the city centre has been built over its waterways, erasing the variability that is fundamental to its ecological resilience. They recognize its lack of vibrancy and are now intent on adapting the city centre into a more spatially diverse and self-dependent place.

The current thinking that suggests new laneways to fragment the large blocks is an important initiative that will introduce a spatially diverse typology for the city.

The government’s newly released zoning plan, indicating which suburbs will be abandoned implies that the city sprawled in a rather homogenous fashion over a swampy plain and might be built in the wrong place. It looks like the kind of city Christchurch should be is one that relates more closely to the ground conditions underneath; a more modular city perhaps, dense where the ground can support it and defined and circumscribed by a complementary landscape of swampy ecologies.

**Analysis**

How do we use this data as designers to refine our role in city planning? It is apparent from each of the case studies that access, security and safety, communication and
temporary shelter are fundamental to recovery. They form a schedule of outcomes that need to be provided in an emergency in a quantity that is commensurate with the scale of the disaster. But they do not necessarily provide resilience. They do not tell us how the spaces of cities help communities to adapt, how they could reorganize or how they are able to learn. It is clear that we need to use attributes of resilience as a tool in assessing resilience and, in so doing, how one involved in the design of cities can respond.

One of the issues with the attributes is that they are not parametric: they are qualitative and interdependent. To this end we need to rely on case studies and comparative analyses rather than any explicit checklist of criteria. The attributes provide us with a framework for design that we can use in a number of ways.

Firstly they provide a mechanism for evaluation for a part of a city: a district; a neighbourhood; or a site. At a focal scale the attributes are general and contextual, and because they are already, to some extent, embedded in urban design discourse, they can be universally applied to any urban situation in any city. It is rarely a case of whether or not attributes of resilience are present, more that they exist at varying levels of intensity. In the chaos that exists after a disaster, they are a useful way of quickly assessing the shifting relationships between people’s adaptations and urban structure, function, and identity. For example, San Francisco’s urban structure, notwithstanding its intensity of use, had a city-wide typological diversity of open space, so people had options for a diverse range of different functions. And a modular grid that provided a redundancy of connections. As designers, we are able to ensure that these qualities are enhanced, especially on a site by site basis where the cumulative effects can be gradually assessed: in San Francisco, say, by amplifying typological diversity, preserving the modularity, and making good the deficiencies, such as the lack of redundancy in its water supply.

Based on this evaluation, we might suggest urban resilience is linked to specific spatial morphologies that encourage adaptation, such as a diversity of open space, redundancies in connectivity, self sufficiency (food from urban gardens, multiple sources of water) and local urban spaces that can quickly be adapted to encourage
communication and response. But the real power of the framework as a design tool lies in its capacity to suggest *place-specific* design interventions at a range of different scales. To be effective, design interventions must be *calibrated* to a city’s particular structure and function, identity and feedbacks and the multiplicity of social, political, economic and environmental forces that drive it. And they should recognize that cities, like all open systems, operate as a series of nested, interconnected scales, such as the plot, the block, the neighbourhood, the city, and the region. When we have this information, the resilience attributes operate as tools that can suggest how, where and at what scale to intervene to achieve maximum benefit for minimum input.

To influence urban resilience, design interventions in a modular or polycentric city need to target both modularity and connectivity, but the emphasis from city to city might be different. In Concepción, for example it may be more effective to enhance the autonomy of the district’s dispersed centres than to multiply the connections between them. In Christchurch, where connections are good, the polycentricism could be amplified by concentrating on the diversity of the city: creating functional diversity and spatial diversity (through urban design) will enhance a polycentric nature. Both interventions will influence resilience and the capacity of the cities to recover. But multiplying connections will only influence resilience at the regional scale. Reinforcing local autonomy will not only enhance regional resilience, it will also enhance local identity, which in turn will influence social capital, which affects resilience at every scale. In this way one type of intervention has a multiplicity of resilience benefits that continue in space and time way beyond the initial intervention.

The evaluation of resilience is a clear stepping stone for designers, and while three case studies are not enough they are a starting point to build up a body of knowledge on how disturbances, whether they are large disasters or small design interventions can change urban morphology and enhance resilience.

Our second conclusion is about timing and the nature of the design process. While designers can assist recovery by imagining new futures after an earthquake, it is often difficult for visionary master plans to achieve traction, and discouraging if there is inaction. Opportunities abound, but competition is fierce. Concepción’s centralized
master planning is suffering due to lack of consultation. Christchurch's citizens, having expressed what they want are still waiting for an integrated solution to housing, community consultation and urban renewal so they can start rebuilding. Christchurch experience also suggests another way designers can make a difference. Preempting or excluding community involvement in the recovery process can actually make communities more vulnerable (Comfort 1999). In order to engage the community at a local level, the designer needs to play a strategic role, negotiating between community and government to help find the best and most cost effective way to achieve outcomes for the community, and assisting the community with design interventions that are tactical and responsive. The resilience approach is a good model here, because it suggests that interventions should be targeted and relatively minimal, generated from the 'bottom-up', with whatever is at hand. This kind of design is about adjusting, encouraging redundancies, making 'space', and creating opportunities and it relies on the capacity of a system to self-organise, in its own way, over time. The first step in the process of community engagement might be to record a neighbourhood's 'geography of risk'. First hand accounts of the days and weeks after the earthquake will suggest how the recovery process was influenced by its geomorphology and physical structure. The next step might be to use this knowledge to develop strategies based on local knowledge, which responds to new opportunities as they arise, rather than imposing an all-encompassing master plan that may not recognize the vulnerabilities and opportunities that characterize the specifics of place.

With this knowledge of resilience it may be effective for designers to focus on other cities not in the throes of disaster recovery. Wellington, for example, where the only main road out of the city is sited right over a major faultline, as is the main shipping terminal and 80% of its water supply is in need of a stocktake on its resilience. The city centre is tightly wedged between a steep cliff and a waterfront built on shaky ground. As everyone is on high alert about earthquakes, now might be a good time to integrate resilience through its attributes as the city embarks on an assessment of its structure plan. In a pre-earthquake environment, the stakes are not so high, the competition is not so fierce, the advantages of collaboration can be seen more clearly, and recovery
considerations can be seen, not as a constraint, but as an opportunity to create a rich and vibrant and resilient city.

**Conclusion**

The resilience framework helps us understand not only when and where but also how to intervene. Recovery clearly has a spatial dimension and resilience theory suggests how we might design form and space as well as process, to influence recovery. As a tool for design the framework is qualitative and relative, rather than quantitative and absolute, and interventions need to be calibrated with the specifics of place over time and across a range of scales. This unequivocally lays down an important challenge for designers working in the field of recovery. If, as we have suggested, top down strategies can increase vulnerability, and bottom up strategies prevaricate, how should we design? Is the grand vision really appropriate today? Or should we, after an earthquake, engage in tactical design, small interventions and disturbances aimed at helping communities help themselves to adapt and recover? The answer may be a bit of both.
Bibliography


TOWARDS A NEW URBAN PRAXIS

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ABSTRACT
The central proposition of this paper is that the production of traditional master plans for places is an outdated and fraught urban design project which is steeped in architectural determinism. The authors outline how planning for the (re)development of places is a complex and multi-faceted project which is appropriately conceptualised as a ‘wicked problem’. Wicked problems possess a number of distinctive properties including: being difficult to define so all stakeholders agree on the problem to solve; have better or worse solutions, no right and wrong ones; and have no objective measures of success. Accordingly, the master plan emphasis around production of a physical design outcome is problematic in light of the intersection of social, economic and environmental parameters that relate to places and change through time. The authors outline how and why the ‘Design by Charette’ process may often end up producing a design which equally speaks to a predetermined set of objectives. An alternative process for design consensus is proposed which revolves around the production of an intelligent urban design framework, which is constructed as a flexible matrix with which to assess against relevant criteria. Alternatively, a return to bottom-up (consensus led) design, or incremental design, may be warranted. The authors conclude by asserting that the era of the master plan is waning, and the urban design profession ought to advance the concept of urban strategies as a new praxis.

A Brief History
There are two meanings implicit in the compound phrase ‘master plan’. One, a key top-down view drawing (ie layout, plan view). The other, a strategic vision (i.e. mastermind, prepare). Both meanings are intended, and the cleverness of the phrase has made it a byword for urbanism. Yet, this creates a false impression, that a layout in plan is equivalent to a strategic vision.

Certainly, some of the greatest urban schemes were primarily described in plan. Haussmann, concerned primarily with the width of streets to avoid barricades, marked up his plan of Paris in now-famous red line. Equally, the expansions (Plan Castro in Madrid/Eixample in Barcelona) were decided on the basis of large rational master plans. These plans mark a tangible transition from the ‘mean brutish and short’ mediaeval cities that preceded them, and the elegant, clean and stylish trappings of the modern world. This is not even particular to the 19th century – beginning in the 18th century with Lisbon (The Baixa Pombalina of 1755) and continuing to the 20th with Chicago (The Burnham Plan of 1909). This makes for an apparently constant cycle of urban renewal, through well-tempered master plans. Such that, in the same breath are mentioned as disparate plans as the Laws of the Indies (1512-1542), the plan of Savannah (1733) and the Commissioners Plan of New York (1811) – as beacons of the master plan, shining through the ages.
However, there are equally well known excesses of mid-century master planning that should give us cause for pause – Albert Speer in Berlin, Ceausescu in Bucharest, Robert Moses in New York. Their projects (both realised and unrealised) are the most clear and brutal examples of crude mono-dimensional ‘city planning from above’. Yet, in each case, blame is mostly laid on the person,
rather than the product. There arises, from literature of the 1960s\(^1\), a consciousness of a systemic failure in top-down planning, yet the dominance of the idea of the (designed) master plan prevails.

**External Challenges**

A root cause may be that ‘hero-designer’ is itself part of an important architectural tradition, starting with the decline of the beaux arts movement, and a reinvention of architecture as a fundamentally creative process. Thus architecture was, and remains, a struggle between the backward-looking Featurist\(^2\) and the forward-thinking visionary\(^3\).

In the 1970s, the first challenges to architectural determinism emerged. Faced with monolithic designs, failed experiments and the bowling over of complex and vibrant parts of their cities, a series of counter-movements, ranging from the 1971 *Battle for Kelly's Bush* in Hunters Hill, Sydney (green bans), to the 1972 Pruitt-Igoe demolition in St Louis, Missouri (the death of Modern architecture\(^4\)) reshaped popular attitudes towards large scale ‘projects’. Conservation, social planning and urban design are all movements that can be traced to these origins, now entrenched in their own right. Each can be understood as an attempt to inject specialist expertise in a rapidly expanding movement of urban renewal, to avoid the disastrous results of post-war experimentation and to control the unfettered vainglory of the individual designer. A desire for an inclusive design process, a recognition of what should be kept as much as what might be built anew.

This layering of the master planning process began to address what has long been recognised – that the successful design of an urban realm is a ‘wicked’ problem – with multiple open-ended facets, and no one ‘solution’. Yet, no matter how many opinions are garnered at its creation, in slow-moving implementation cycles, often the problems being solved by a master plan may no longer reflect the problems being experienced. Indeed, Jane Jacobs once identified the greatest challenge to a successful urban neighbourhood was its own success – such as the migration of middle class professionals to upcoming ‘unslummed’ creative districts, pushing up rents to heights the creatives could no longer afford\(^5\).

This indicates that complex problems are not just multi-dimensional and open ended, but that they may require change over time, even where the original solution was valid and successful. An iterative process (that recognises the wicked nature of urbanism) would not seek strict adherence as much as advancement of a particular urban strategy. Thus, instead of the current process of approvals, a merit-based approach may achieve more desirable ends (for example, adopting a purposive, rather than numerical, appraisal of development applications that follow master plans).

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4 Charles Jencks, The Language of Post-Modern Architecture, Rizzoli, 1984
5 *Death and Life of Great American Cities*, ob cit.
For a broader example, consider the issue of housing affordability. Sydney, in its range of attempts to ease supply pressures might equally kill its golden goose – the vibrant, heterogeneous harbour city attractor that drives demand. In the preparation of master plans for growth, Sydney ought not ignore the qualitative loss of its urban fabric, nor forget the likelihood that a future period of stability (or depopulation) in any long-term cycle may require today’s decisions to be undone. Thus in a complex solution, urban strategies that preserve well-loved urban fabric (whether or not heritage, or intact), and which limit the size of super-stratas, might sit alongside strategies to achieve short term growth. Whatever the solutions to such wicked problems – one should expect conflicts, and judgment calls. Cities are inherently complex organisms.

Internal Challenges

Yet what has changed, since designers ruled the roost? After all, some of the foremost urbanists remain architects, perhaps rightly so. Landscape Architecture, Planning and Urban Design all began as specialisations within architecture, and planners, landscape and urban designers are often architects. In the authors’ view, several factors that may have been to blame in the failure of architectural master planning bear a common thread through to the present.

These factors are Agency, Ego and Scale. First, we are our client’s agent, which in the case of architecture, means operating within a narrow brief (the delivery of program) on a particular site. Natural capitalist motivators such as the yield maximisation and highest-and-best use predominate. This is the tragedy of the commons – while each site may benefit from a plurality of ideas, subordinate uses, the “field” of background buildings, or the provision of public benefits, this will rarely be in the best interests of an individual site6. So we see a preponderance of poor public domain treatments in large architecturally designed sites. Indeed, some of the best resolved schemes are those that are constrained – an unbought block, a heritage item – that force the designer to take into account different criteria.

Secondly, egos (fed by the same master-architect tradition) make designers seek out statements, eroding the harmony of the city in a cacophony of different voices7. While most architects may agree that in the round, some buildings should project while others recede, it is rare to find a project where the voice is a recessive one. The blame may not lie with individual architects, but with the nature of the profession itself, that awards individual buildings for their merit, and rewards iconic architects with praise. Unless operating in niche fields, such

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6 “Architects are pretty much high-class whores. We can turn down projects the way they can turn down some clients, but we’ve both got to say yes to someone if we want to stay in business.” Philip Johnson

7 For example, Louis Kahn The Room, The Street and Human Agreement, 1971: “The street is a room of agreement. The street is dedicated by each house owners to the city in exchange for common services. Dead-end streets in cities today still retain this room character. Through-streets, since the advent of the automobile, have entirely lost their room quality. I believe that city planning can start with realization of this loss...”
as conservation, a demure project is at best passed over, at worst derided for mimicry. Thus what is celebrated is Modernist Featurism (to paraphrase Boyd), and not the sublime, unconscious, humble and coherent form of architecture.

An interesting exception to the rule against emulation are buildings belonging to other architects, particularly forerunners, or an architect’s own ‘body of work’. We praise consistency in architects building on the legacies of their heroes, or their own early works, before consistency in building on urban form, no matter how intact or well regarded that context may be. A symphony of form in coffee table books. Civic concerns - such as flexibility, change over time, diversity of form and end-user affordances - are also marginalised by a movement that privileges this brief, for this client at this point in time as paramount. Thus the profession, that rewards individual members, fails in its stated aim of championing good design.

Lastly, and perhaps most insidiously, all designers (except Frank Gehry) currently operate at a scale that is reproducible on standard sheets – A0 / B0 at most, A1 or B1 more usually. Scale is determined by the construction method – a single sheet layout that informs the manufacturer of the overall concept, supplemented by details. For the joiner, the object may be contained on A1 at 1:20. For the road contractor, the works might be contained on A1 at 1:2000. For the joiner, a details might be at 1:1. For the road contractor, at best a curb detail at 1:10. This results in a translation loss, whereby master plans become an arrangement of buildings and roads on vast tracts of land, with all the associated repetition of form8.

**Potential Futures**

As the transformative power of the digital age takes hold, this tyranny of scale may abate. However, equally, we see a new form emerging from digital architecture, a fluidity of form that arises from the aspatial nature of ‘model space’. In a weightless, planeless, virtual world, the entire paradigm of plan, section and elevation, dating back to Vitruvius, is now being broken down. These virtual buildings are translated into built form through complex engineering algorithms, such that they are physically realisable. Yet where does this leave the other translations that might be required to ground these concepts – the social, the civic, the contextual? Where the design returns to the hands of the individual, what happens to the wicked problem, the pluralist point of view? This has been the greatest challenge – where parametric design degenerates into ‘blobitecture’9.

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8 "Architecture is the art of how to waste space" Philip Johnson
9 “Although blob architecture “lacks the elegance, rigor and beauty that comes from modules, proportions and symmetry,” Lynn says, “in due time, the blob architects will discover a new form of beauty and elegance in the voluptuous, rhythmic and undulating forms of the differential calculus.” The envelope-pushing architect has seen his term shortened to blobitecture. Those planar types who prefer traditional forms like cubes and spheres -- and who look askance at the seeming shapelessness of what developed into a new style...“ Safire, The Way We
Yet, the parallel movements in planning (both statutory and social) and urban design that have characterised the same period from the 1960s to the present have been to address these wicked problems through regulation. There has been an explosion of regulation of the built environment. As each experiment is undertaken, each mistake is made, a new set of rules emerges to ‘preserve’ the social, civic or contextual values that are made manifest by those experiments. We have elaborate codes, books of rules, all of which have come into existence in recent times. These rules stand in opposition to the design process – controlling and corralling it. While the planning system (like many other uniform codes) has its genesis in the law, nowhere has it become more legalistic than in the urban space – perhaps because land is not fungible, so remedies must take the form of intervention – injunction or specific performance. Thus, while traditional legal battlefields (like commercial contracts) involving vast sums of money are now conciliated and arbitrated, urban issues (often quite straightforward) have taken on the worst qualities of black letter law – Byzantine complexity, inflexible rigidity, the rewarding of loopholes, and absurd technical solutions.

Nowhere is this more visible than in the New Urbanist movement in the USA and its Neo-Traditional counterpart in the UK. The movements can be characterised by their rules, codes and charters, and attempt to reduce all architectural expression to a series of established and regulated rules. Invariably, these rules are also derived from pre-modern architecture, “timeless” meaning “before modern times”, a denial of the transformation in building and thought wrought by the post-industrial age. These rules are also concerned primarily with the measurable – lengths, percentages, proportions – because these are easy to assert, repeat and enforce. Far less often do we find the qualitative, the room for exception, the ‘wiggly line’, that may allow designers to move forward.

This is not to say that New Urbanism and Neo-Traditionalism lack design, or designers. On the contrary, they are design-based movements. However, this design occurs only in plan – the master plan – handed down from on-high by the New Urbanist and Town Father (their client). Urban designers of this tradition aspire to an art of design garnered by years of practice, that reaches its highest expression in the Charette, an intensive design process that seeks to reduce the complexities of multiple agencies into a single irreducible plan, produced simultaneously by the master-designer while the Charette is being undertaken. In doing so, they break a commonly-held principle of design (function in plan, and beauty in elevation). This is, instead, design as spectacle – that one plan to describe all others can be produced - perfect and unalterable – and within the pressure-cooker environment of a workshop over a few short days. Yet we know that this model of decision making is highly flawed – from Harvard University’s


10 “It demands of us, what is the chief characteristic of the tall office building? And at once we answer, it is lofty.” Sullivan *The Tall Office Building Artistically Considered*, Lippincotts Magazine, 1896. Considering this argument is now 115 years old, one might have expected an equally forward-looking rebuttal by now.
famous case study of President Kennedy’s *Bay of Pigs vs Cuban Missile Crisis* processes\(^\text{11}\). Why would we expect it to be any different in this case, particularly given creative skills are rarely summoned ‘on tap’?

Of course, part of the answer comes from our earlier description of architectural determinism. The same processes that confound architectural master planning are innate in the *Charette* process – the primacy of the client’s brief, the designer’s own ego and predisposition to style, and the tyranny of scale. Designs (‘practice runs’) are often prepared in advance of the forum, based on limited information supplied by the client and key co-consultants. They follow the rules and preferences of the designer, particularly stylistic ‘signatures’ that characterise their plans – turbine squares, bifurcated streets. Thirdly, they are designed at a level where only the schematic impression may be garnered of the project – a pretty picture – rather than a fully resolved scheme. Whether the scheme is buildable, conforms to engineering or traffic models, or will result in a good urban place, cannot be evaluated in the context of a *Charette*. Only the viewer’s response to the pictographic, and the expert’s gut feeling. Nevertheless, by presenting a design at the end of the process, and making it visible to all stakeholders, the hallmark of consensus-based decision making is operative – the inability for agents in the process to critique it after the fact.

Expert designers may well produce gems in a *Charette*. Certainly, some beautiful plans are drawn, and many pretty places have been built. But, to paraphrase Mao Tse Tung, it is ‘too early to tell’ if these places are better. In fact, a variety of factors including predisposition and the Hawthorne effect\(^\text{12}\) mediate against any empirical evidence of success\(^\text{13}\). Conversely, the continuing reliance on single individuals to ‘design’ the perfect community, the lack of transparency of the design process, the rigidity of the controls placed on building design and the antithetical relationship with contemporary architecture are all cause for concern.

**Digital Futures**

So, to bring the two together, what lies at the collision point of the resurgent master-architect of the digital age, and the counter-movement of *Design by Charette*? Can we expect further clashes and polarisation, more experiments and rules to stop them? There may be another way. Just as we wish our places to be sustainable, so too should we aspire for our processes to be sustaining.

What of the original concept of the master plan as strategic design? Let us return to the adage that plan is function and beauty is section. Perhaps the cue lies in


\(^{12}\) The Hawthorne Effect (1950) relates to subjects’ tendency to modify behaviour in response to experiment conditions. In the case of New Urbanism, reported transport modality and general satisfaction may be skewed by post-purchase anxiety of subjects, seeking to rationalise their purchase.

the digital arts themselves – particularly gaming. While urbanists have been concerning themselves with imagined futures, software designers have been facing the very real challenge of how to invent realistic and complex urban topographies, for the simple task of providing persuasive and challenging gaming environments for their ‘shoot-em-ups’.

Algorithm-based design, already on the uptake in digital architecture to generate plastic form, is equally being used in gaming to generate complex urban environments – elegant plans of fractured grids with complex intersections. Plans which are ever complexified and built upon – not by art – but by the overlayering of other rules – collision rules (for multi-player mode), gravity rules (for falling masonry) – all the potential attendant rules of, say, traffic and civil engineering, simultaneous with all the rules of thumb of the seasoned urban designer. These algorithms operate differently in elevation. There is a clear taxonomy – generic built form typologies (‘primitives’) and generic articulation methods (‘sprites’), yet applied with deliberate permutations, variations, and randomness to achieve complexity of form within an overall harmony. Creativity, in this world, can be found in two components – rule generation on the one hand, and the creation of exceptions on the other.

So, to take this back into the ‘real world’, what might we learn? That master plans are already being generated procedurally, better than they can be drawn? Perhaps it is time for the design and redesign of urban spaces to be taken out of the manual world, and subjected to more rigorous rules-based algorithms. Not rules in the legal sense, but a series of operations, with a degree of flexibility and freedom. Rules that experts – not just designers, but engineers, social planners, architects, retail economists – all the many faceted aspects of the public domain – might contribute to. Rules that might be knowable to many, and not just a term of art for the few. Rules that might be interrogated through permutation and iteration, rather than a single answer asserted through deterministic design.

But procedural design can only go so far – it creates a base line, a playing field that is known to work across a complex web of matrices. A master plan produced through the bringing together of many agents to ensure that the constituent elements work. Conversely, what of beauty? This is perhaps the realm where the architect not only operates best, and is most sorely needed. Once the base model is set, the ever-improving creative power of humans – that works best at small scale – can and should be allowed to turn the crude building blocks of planning into the fine and elegant products of design. Not only this, but by operating in the virtual space, the fine manipulations on each individual building may be fed back into the whole – a continuous feedback loop – or continuous improvement process – by which all actors may support and enhance each other.

We are, perhaps, only on the threshold of this transformational change. First, to extend the computer analogy, we must develop our “low level programming language” – the logic rules that might underpin urban frameworks, and transform these algorithms from pretty gaming toys into serious design tools. This is the realm of urban strategies. So, to conclude, in the spirit of ‘who watches the watchers’, we offer three observations as to the manner in which they may be formulated:
1. Empirical Evidence

The rules ought to be based on evidence of what works. In our current design-led paradigm, empiricism sits uncomfortably, because creative acts are by their nature concerned with the new. The new praxis, allows the establishment of a common base line, the algorithm, forming the datum against which the occasional experiments at design-phase can be measured.

Equally, the rules underpinning a given place should not be mysterious or obtuse, they should be plain and discoverable. Anyone has the right to know why one permutation is considered to be more pedestrian friendly, or vibrant, or efficient, not take it at face value. Over time, as our understanding changes, so too should rules adapt.

2. Less is More

We are fundamentally concerned with the performance of urban spaces. In a manual design-based approach, performance is difficult to measure, particularly at an urban scale which may take years to realise. Therefore, our planning controls are a patchwork of solutions to a variety of problems, many now remote to the current situation. We do not innovate controls, we aggregate, because we lack the tools by which to discern the effect of removing a solution to a known former problem. In this manner, urban places might be called ‘wicked’ problems. It is difficult to say what an element contributes in isolation, given the complex web of multi-dimensional criteria.

Yet, by the synthesis of many experts, a series of urban strategies can be both developed and analysed in real-time, against a virtually limitless set of parallel criteria. Permutations expose any defects of logic automatically, having removed the tendency for the designer to draw the result in their mind’s eye. Additionally, by ‘turning off’ controls, we can understand more readily the degree to which the accretion of rules might be genuinely improving places, with a level of complexity that the determinist process rarely permits. Less rules, like law reform, also allows an variegated urban realm to work smarter and harder.

3. Letting Go

We are not (yet) machines. Yet, in the design of urban places, we struggle to retain the variety, innovation and delight we find in unplanned or slowly planned places. Architects’ gift of playfulness, experimentation, challenge and creativity have a valuable and important place in urban design. If we can get the ‘big’ moves right – the urban datum – through a good empirical rules-based system, and avoid the multiplication of controls that might suffocate change, then we should equally recognise the art by which the outcomes might be
improved and enhanced by design. We should ensure that a system of urban strategies recognises and accommodates better outcomes – whether through design review panel, standards for excellence, or merely ‘holding the line loosely’.

Analogue Futures

Of course, the ‘New Technocracy’ may not be everyone’s dream, and with expert dominance, might come to resemble Pornosec\(^{14}\), to use Newspeak. Remember that the concept of capital ‘P’ Planning itself dates back only to the turn of the twentieth century, and Harland Bartholomew. His seminal ideas for the creation of a planning discipline include separation of land use, design for the automobile and, of course, the creation of a plethora of ‘comprehensive plans’. Perhaps ironically, Pruitt-Igoe was built in his native St Louis. Our current thinking continues to bear the indelible marks of his ideas – particularly that plans ought to be handed down by experts – a top-down system. And, to use the oft-quoted Einstein aphorism, ”You cannot solve a problem from the same consciousness that created it. You must learn to see the world anew.”

So, an alternative to rethinking the “master” is to rethink the “plan”. A key emerging movement is grass-roots urbanism, in separate initiatives in Victoria\(^{15}\), the United Kingdom\(^{16}\), Lebanon\(^{17}\) and elsewhere. This movement propounds (quoting from the current UK Localism Bill):

“devolv[ing] more powers to councils and neighbourhoods and gives local communities greater control over local decisions like housing and planning ... to provide for community empowerment with powers to enable people to instigate local referendums on any issue ... and to provide local community groups with an opportunity to bid to buy assets of community value ... abolish regional strategies, provide for neighbourhood plans, make pre-application consultation compulsory, make changes to planning enforcement...”\(^{18}\)

If this movement gains currency, perhaps the master plan will not be replaced by a more sophisticated form of planning, but a less invasive one. One that may not be ‘planning’ in the traditional sense, so much as custodianship of neighbourhoods. A process which celebrates the local, piecemeal and popular, rather than the universal, strategic and necessary. Japan is no stranger to this system. All urban renewal is private (albeit at the direction of senior government), and requires the consent (and financial risk sharing) of all

\(^{14}\) ‘What are these books like?’ said Winston curiously. ‘Oh, ghastly rubbish. They’re boring, really. They only have six plots, but they swap them round a bit.’, Orwell, Nineteen Eighty Four, Part 2, Chapter 3.
\(^{15}\) Melbourne Place-Making Series, UFDQ92 Dec 2010, Urban Design Forum
\(^{16}\) Localism Bill 2010 – 2011 (in House of Lords committee at the time of writing this paper - http://services.parliament.uk/bills/2010-11/localism.html)
\(^{17}\) Khayat, Workshop offers Tyre proposals for growth, The Daily Star, 21 Sep 2004
\(^{18}\) Emphasis added
landholders. Arguably, while slow, they eventually achieve some of the best urban interventions in the process. Then again, cultural forces (harmony, consensus) may also be at work\(^{19}\). Nevertheless, in rapidly growing cities, the model may be inappropriate, and strong leadership and strategic direction is highly desirable\(^{20}\).

A variation on this theme, that leaves a place for designers, while addressing the issues of agency, ego and scale, would be collaborative planning of smaller, incremental design projects. This builds on the principle of ideation – expanding the range of ideas to expand the probability of [at least] one good idea\(^{21}\). This approach to design, seen in projects such as Battery Park City in New York, approaches the level of complexity required of a true urban place, through parcelisation and 'holding the line loosely'\(^{22}\). Clearly, Battery Park City remains a master planned project - yet within the process of implementation lies the germ of the process envisaged here.

### A Plurality of Urban Strategies

Ordinarily, a paper such as this might wind up with a pithy conclusion, the answer to the sum of questions raised. In this respect, we beg to differ. In the nature of a wicked problem, each and all of the solutions may have merit, they may work partly or wholly, independently or in unison. In all likelihood, each will raise new challenges, requiring further refinement to the process of urban renewal (itself a concept likely to become fixed in time). By the adoption of a flexible approach to urban strategies – one which incorporates change – the existing 'tyranny of the Master Plan', or any subsequent strategy, may be alleviated by the balancing of other viewpoints, and the necessity for compromise and consensus. The authors suggest that it may be in the exploration of this plurality of urban strategies that the new urban praxis lies.

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\(^{19}\) Law, Chan, Chui, Wong, Lee and Chau, *Urban Renewal Policies in Asian Cities for the Urban Renewal Strategy Review*, March 2009, University of Hong Kong

\(^{20}\) ibid.


\(^{22}\) “The plan 'took a very pragmatic, New York City attitude toward the site,' says Jonathan Barnett. 'Let's have blocks. Let's have a park. No megaliths.' Cooper and Eckstut wrote the design guidelines for various segments of Battery Park City in stages between 1980 and 1985. And, while the guidelines didn’t specify what the buildings would look like, they did specify the buildings’ placement, bulk, and materials. Cooper’s only rule of thumb at Battery Park City was: 30% open space, 20% streets, 50% development.” *Planning Magazine* Aug 1996, Vol 62 No 8, p10
Active Reform: improving opportunities for cycling in Perth, Western Australia

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Many Australian cities are pursuing policies and strategies to increase rates of cycling. These reflect a transport reform agenda, which in part signposts a growing understanding that increased rates of cycling could significantly improve public health through being a form of preventative treatment. Nevertheless, there is inertia in actually delivering 'cycleable' environments. This paper presents the basic - and well-appreciated - case for increasing rates of cycling. It overviews the role of the built environment in this as understanding these variables is critical to increasing rates of cycling.

Thereafter, it sets out the policy, funding and cultural context in Western Australia to help demonstrate the significant challenges that need to be overcome to achieve this objective. Recommendations are then posited to make cycling competitive as a mode choice for a range of trips.

Keywords: cycling, integrated network planning, cultural shift

1. Introduction
Cycling sells itself. It requires the use of major muscle groups, burns calories and can undertaken regularly and with enough exertion, offers cardiovascular benefits (Cavill, 2003; Wooldridge, 2005). The public health benefits of cycling as an urban treatment regime cannot be understated given data shows about 60% of Australian adults and 25% of children are overweight or obese (Rees, 2003) and these conditions increase risks of many other health conditions including cancer, diabetes, high blood pressure, heart disease, hypertension, osteoarthritis and stroke (Calle et al. 2003; Hu et al. 2001; Mokdad et al. 2003).

Healthy persons aged from 18 to 65 years are recommended to engage in five 30-minute sessions of moderate-intensity physical activity per week, three 20-minute sessions of vigorous physical activity or a combination of the two types: i.e. two 30-minute sessions and two 20-minute sessions (Haskell et al. 2007). Regular cycling for either leisure or utilitarian purposes can meet these needs.

Public health campaigns lead by organisations including the National Heart Foundation of Australia have long encouraged more physical activity through facilitation of healthier lifestyles and provision of guidance to governments and developers for the design of more activity friendly environments (National Heart Foundation of Australia, 2004, 2009a, 2009b; National Heart Foundation of Australia and Queensland Government, 2010). In the US, the Centers for Disease Control and Prevention (2009) is on the health/ cycling bandwagon, advocating for land use patterns that are more conducive to cycling.
Why then, do the data show worsening public health on many indicators, which have so many social and economic implications? Moreover, why do rates of cycling remain so low and people continue to rely on private transport for so many trips even though there is now strong understanding of how environments conducive to active transport can be delivered?

This paper discusses current practices regarding planning for better cycling infrastructure in a bid to increase the cycling mode share. The role of urban design is considered, as a lack of activity intensity is a major barrier to increasing rates of cycling as is a failure to provide safe cycling facilities such as Copenhagen-style paths along busy roads. Next, the policy context in Perth is considered and current rates of cycling are compared to national and international data. These data are thereafter considered in reflection of transport culture in Perth, which remains very auto-centric.

Following presentation of a case study of integrated cycle planning in Perth, the paper posits that to be truly effective, cycle planning has to reflect the following four tenets:

1) Leadership by Federal and State government in cycle planning including allocating a consistent funding stream and assisting local governments with developing cycling plans that form part of a regional network.

2) Provide accessible destinations (notwithstanding that secure end of trip facilities are necessary at destinations).

3) Provide safe, coherent routes to get to and from destinations, which includes treating intersections so they are not major barriers to cycling and providing routes in parallel (e.g. alternative routes for different types of cyclists).

3) Facilitate cultural shift so cyclists are not marginalised.

2. Designing the built environment for cyclists

There are two characteristics of the built environment that have a critical effect on the attractiveness of cycling. These are:

1) Distances between origins and destinations (e.g. where people live and work); and

2) Infrastructure provisions between origins and destinations (e.g. is cycling safe?)

The literature shows that distance plays a significant role in determining whether people cycle. In urban environments, distance is a product of activity intensity and to a somewhat lesser (but still important) extent, how connected cycle networks are (Krizek, et al. 2010; Pucher et al. 2011; Vandenbulcke et al. 2009). Research shows that a realistic cycle shed, or distance that people are prepared to cycle (all else being equal), is 3-5 kilometres, which accords with a 10-20 minute trip at 20 kilometres per hour.
Urban areas that deliver activity intensity present more opportunities for people to cycle 'acceptable' distances, given more destinations are within reach. This is particularly helpful for delivering incidental physical activity and associated public health benefits, as people can more easily choose to cycle for utilitarian trips.

In Perth, almost uniformly low activity intensity outside of the central business district helps explain continually low rates of cycling. State planning is yet to properly respond to the explicit relationship between activity intensity and increased rates of cycling by virtue of the low urban densities and poor mix of uses that continue characterise most suburbs (Falconer and Newman, 2010; Falconer et al. 2010).

However, proximity alone does not guarantee higher rates of cycling in isolation from the quality of infrastructure between origins and destinations. Issues regarding what infrastructure is appropriate for different types of cyclists and how roads can be designed to not sever origins from destinations are subject of much current debate by researchers. Nevertheless, all else being equal, greater exposure to high volume, high speed traffic, intersection controls and geometry that favour motor vehicles contribute to a reduced sense of cycling safety and are strong disincentives to cycling (Baker, 2009; McClintock and Cleary, 1996; Pucher et al. 2010; Parkin et al. 2007).

3. Understanding current cycling trends
3.1 The policy and planning context

Denmark, Germany and The Netherlands all have some form of Federal Cycling Plan or Strategy, which leads to direct funding for cycling projects. In the US, general increases in cycling trips reflect significant growth in Federal funding of and support for cycling programmes and new infrastructure (Handy et al. 2009). Increases in rates of cycling are occurring in cities with well-resourced cycling plans and in parts of these cities where there is both cycle-friendly infrastructure and sufficient activity intensity to support cycling trips (Pucher et al. 2011). Portland provides a leading example of growth in cycling trips, with a rise in the mode share of cycling for commute trips from 3% in 2000 to 8% in 2008 (City of Portland, 2008).

Australia now has a National Cycling Strategy, published through AustRoads (Australian Bicycle Council, 2010). However, the Strategy neither sets specific key performance indicators for States and cities, nor partners a committed, consistent funding stream for cycling projects. Policy and funding for cycling projects is principally the responsibility of State and local government (Pucher et al. 2010).
At the State level, responsibility for coordinating cycling initiatives has previously resided with Bikewest, which is part of the Department of Transport. Currently, the Department is reviewing the role of Bikewest and it is likely cycle policy and planning will become part of a new group called Moving People.

Bikewest is an advisory rather than regulatory body, which has limited its remit. Aside from Bikewest, there are myriad agencies with an interest in and/ or advocacy role in relation to cycling (see Attachment A). Many of the groups are tackling cycling from a different perspective and this can be cause for conflict. However, all should be considered partners in pursuing a common interest: cycling is a good thing! Overall leadership in planning, policy and funding is the variable that is lacking.

The State has produced the Perth Bicycle Network (PBN) Plan, which is a snapshot of current cycling provisions and potential routes for cyclists in Perth. The PBN is based on a ‘saddle survey’ and is as good as the latest data collected. In many cases, routes follow the path of least resistance (e.g. local streets parallel to main streets), given a dearth of formal cycling infrastructure along major roads in established areas of the city. In this respect, the routes neither always demonstrate where people would actually want to cycle nor are the safest for riders.

If more activity intense development is generated in activity centres to support transit access and increase walkability, which is anticipated by State Planning Policy 4.2: Activity Centres for Perth and Peel (August, 2010), there may be more opportunities for cycling. However, there is no guarantee that cycling infrastructure will facilitate safe, coherent journeys between origins and destinations.

Outside of Bikewest’s advocacy, and Main Roads WA and the Public Transport Authority’s strategic Principal Shared Path (PSP) projects, there is no existing committed State funding stream for cycling or requirement that cycling is addressed by Councils as part of their planning for streets under their own care and control (approximately 82% of streets in Western Australia). Thus, it is currently left to local government to develop Local Cycling Plans and apply for the grants that are available through the Department of Transport.

In July 2011, the State Premier announced that a Cycling Plan is being developed as part of the forthcoming Moving People Plan, which the Department of Transport intends
to unveil in 2012. Time will tell whether these forthcoming commitments will redress the current prevalent deficiencies in cycle network planning.

3.2 The cultural context

The way in which people (especially drivers), treat cyclists is interdependent with the type of cycling network that is provided on the ground. Despite some rhetoric to the contrary, cycling still tends to sit at the bottom of the mode use hierarchy, although there is hope this will be addressed through the release of the cycling component of the Moving People Plan next year. Evidence that cyclists are not sufficiently visible within the urban transport environment (a product of relatively low rates of cycling) and treated with due respect by motorists is the extraordinarily high percentage of vehicle-cyclist crashes involving cyclists being struck from behind (Australian Transport Safety Bureau, 2006).

International research corroborates some issues in Perth with cycling being perceived as being for ‘others’ rather than a normal activity (Gatersleben and Haddad, 2010; Moudon et al. 2005; Pucher et al. 1999). Many European countries – Holland and Denmark particularly – have developed transport and land use systems, and cultural proclivities that overcome these issues. This demonstrates that cycling can be mainstream but, realistically, not without a quantum shift in Australian cycling policy.

3.3 What the statistics say

Based on statistics published by the Australian Bureau of Statistics, the mode share of cycling for work and education trips in Western Australia dropped from 1.8% in 2000 to 1.2% in 2009. Census data for 2006 also indicates that the mode share of cycling for work trips was 1.2% not including trips taken using cycle as a secondary mode (i.e. taking the train and finishing or beginning a journey on a cycle). According to Perth and Regions Travel Survey (PARTS) data for 2003-2006, for all trip purposes, the overall mode share for cycling in Perth and Peel was 1.6%.

Census data for different areas of Perth helps demonstrate a relationship between cycling for work trips and the accessibility of workplaces. Perth retains a high degree of central city primacy, meaning that suburbs that are located towards the fringe of the city (particularly away from metropolitan train stations) and away from the Principal Shared Path network facilitate less utilitarian cycling because of reduced accessibility.
In 2006, the cycling mode share for work trips among residents of South Perth was 2.9% while the newer, more remote suburbs like Canning Vale and Ellenbrook had 0.4% and 0.2% cyclists, respectively. Research has found that rates of cycling in outlying residential neighbourhoods such as Canning Vale and Ellenbrook may have overall rates of cycling between 2 and 3%, but the majority of trips are for leisure purposes (Falconer, 2008; Falconer et al. 2010).

4. Case study: network planning in Alkimos Eglinton

Land use and transport planning in Alkimos Eglinton (AE) is unfolding as part of the broader trend of growth in Perth’s northwest corridor. AE is located north of Butler and south of Yanchep, and encompasses coastal hinterland. It covers around 2,600 hectares and has a forecast population of 57,000 by 2031. The District Structure Plan (DSP) for AE was lodged in 2006 and has subsequently been approved by both the State and local government. Since this time, proponents have prepared and lodged Local Structure Plans (LSPs), for individual landholdings within the DSP area.

Given there is a strong focus in transport planning for AE on non-car modes, some individual landowners are identifying the need for walking and cycling infrastructure to be of a high quality, to provide residents and visitors with realistic alternatives to the car for short trips. Clearly, this also requires appropriate land development patterns, which means delivering targeted, higher density, mixed use development parcels throughout their landholding.

This land development approach is consistent with delivering a strong case for well-patronised public transport. However, to support local trips by cycling and walking, easily accessible schools, coastal nodes and neighbourhood centres must be planned for along with larger centres/transit oriented development. This is not necessarily something that is done well in Perth and undoubtedly, this is a significant reason why cycling (and walking) mode shares are low.

The proponents of the Eglinton LSP are aiming to deliver such a pattern of land development while still being cognisant of market expectations on the fringe of the city. Critically, they are aiming to achieve cycling mode shares akin to those in inner suburbs for a mix of leisure and utilitarian trip purposes. The LSP demonstrates strong commitments to provision of a dense web of cycling infrastructure. These provisions
include a mix of on-street lanes, shared paths and Copenhagen-style lanes, in recognition that specific infrastructure for cyclists is highly favoured over mixing with general traffic, particularly on higher order roads. People will even cycle further to feel safer (Krizek, et al. 2007; Tilahun et al. 2007) and these sorts of facilities tend to improve actual safety – through reduced incidences of intermodal accidents – and encourage added cycling trips (Kelly, 2010; McClintock and Cleary, 1996).

Moreover, with the full support of the City of Wanneroo (the local government authority), many residential streets are being planned as 5.5m wide yield streets with a posted speed limit of 40 kilometres per hour: treatments that are only usually found in older suburbs in inner Perth. These should function as safe road riding environments.

The objective in delivering a mix of infrastructure is to provide ‘routes in parallel’, meaning more confident cyclists who favour road riding are not disadvantaged through no on-street provisions while less confident cyclists travel between development nodes on off-street infrastructure. The planned provision of a number of Copenhagen lanes represents the true first suburban example of dedicated off-street cycling infrastructure in Perth.

There are challenges to overcome like how Copenhagen lanes are treated at intersections. However, the Eglinton LSP provides an excellent example of leading transport planning for Perth and provides the City of Wanneroo with a template for how adjacent developers should tie into the cycling network that is being created.

6. Conclusions and recommendations
Lessons from locations such as Copenhagen and Portland are that sustained, holistic cycle investment strategies are required in unison with increased activity intensities and a cultural shift in attitudes about cycling (Pucher et al. 2011). We need to move away from proving the case for taking action to taking the action that we tend to talk about. Tokenistic investment in shared paths and some on-street cycle lanes in the suburbs and as a retrofit in established areas needs to be replaced by proper efforts at developing an integrated network. This network has to be safe, flexible (e.g. people of all abilities have routes they can use), and part of a land use and transport environment where people do not have unrealistic distances to travel.
European research has found that the ‘mass effect’ can occur whereby the presence of commuter cyclists encourages others to cycle for work purposes (Vandenbulcke et al. 2011). All else being equal, the more people who are cycling, the safer cycling tends to become (Krizek et al. 2010).

However, a self-reinforcing ‘critical mass’ can only be achieved when:

- There is strong governmental leadership in relation to cycling, characterised by a consistent funding stream and regional coordination of infrastructure provision
- There are real changes away from sprawl patterns of development towards activity intense land use supportive of cycling trips;
- Safe and connected infrastructure provides people with a viable choice for their trips; and
- A real step change in driver behaviour towards cyclists.

In relation to route design for cyclists, a ‘best for context’ approach appears to be best. This proposes that a combination of Copenhagen-style paths, shared paths, on-street lanes and shared streets is most appropriate, based on the types of origins and destinations that are linked.

I posit a ‘routes in parallel’ network is required in Perth, which gives people options for their trips. Thus, not every street has commuter cycle lanes on streets but a commuter can move a street or two along and find the infrastructure they like to use. Similarly, a moderately skilled cyclists can find segregated facilities or low-speed, narrow streets to use without too much effort. This approach requires that we temper our habits of overdesigning streets and shift towards delivering the multimodal transport environment that often features in planning rhetoric.

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Attachment A – State agencies and organisations with a regulatory role or interest in cycling and cycling promotion

- Bikewest;
- Main Roads WA;
- Public Transport Authority;
- National Heart Foundation;
- Road Safety Council;
- Cycling WA;
- Bicycle WA;
- Western Australian Local Government Association;
- Royal Automobile Club of WA (RAC WA);
- Physical Activity Taskforce;
- Bicycle Transport Alliance;
- PedBikeTrans;
- Cycling and Pedestrian Advisory Group;
- Cyclists Action Group;
- Over 55s;
- Department of Sport and Recreation;
- Department of Planning
- Department of Health; and
- Sustainable Transport Coalition.
The Bicycle Oriented Development (BOD): A New Tool in Urban Resilience

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*The University of Newcastle*
ABSTRACT (maximum 120 words)

In the wake of the global financial crisis, the urban renewal of large brownfield tracts has been put on hold. Since many of these sites flank the same waterfronts and rail easements, that have given bicycle transit a foothold in car dominated cities, there is case for seeing them as bicycle oriented developments. Peak oil, congestion, awareness of preventative health, and emissions reductions goals are seeing cities set bike mode share targets as high as 50%. 8-House by BIG is the architectural offspring of planning focused mainly on cycling, permitting residents to ride home to 10 floor apartments, via a bike ramp. It provides us a glimpse of alternative urban solutions we might look forward to as cycling becomes a key mode of transport.

Keywords: urban renewal, sustainable infrastructure & transport, ecocities, bicycle transit

37% of trips in Copenhagen are taken by bicycle, and authorities there aim to increase that to 50%. In that context, a Transit Oriented Development (TOD) is not one where most people walk a few hundred meters to the nearest metro station; most use bikes to get there, potentially over distances many times greater than they could comfortably walk. On large brown-field sites in Copenhagen, particularly Ørestad, we are seeing the rise of what might be called the BOD, or “Bicycling Oriented Development”. The temptation though, is to skip the modal change altogether, and cycle from home to work, school or the shops.

8-House, designed by architects Bjarke Ingels Group (BIG) is the architectural offspring of planning focused mainly on bicycle transit. It is an enormous 61,000sqm mixed use development—the largest and most recent in Ørestad—with apartments arrayed in such a way as to make them accessible from sloping balconies, zigzagging their way from the ground to the roof. Why? Because ramped balconies allow residents to ride their bicycles all the way home, to their apartments, even if they live in a 10th storey penthouse. 8-House is a glimpse to a future when buildings do more to accommodate cycling, than they have done for driving.
Seldom would an architect celebrate cars now, the way Le Corbusier did with the Villa Savoye (with its ground floor tailored to allow cars to enter the volume of the house, park, and then leave). Now, car parks are camouflaged. The trend instead is to celebrate bicycle parking. The bicycle parking station that was recently built outside Union Station, in Washington D.C., despite its modest (80 bike) capacity, cost in excess of $3,000,000\(^{ii}\). That was the price of an architectural statement underlining governmental endorsement for this mode of transport. Other architecturally conspicuous bicycle transit facilities include the McDonalds Bicycle Parking Station in Chicago’s Millennium Park, (beside Frank Gehry’s band shell), the Bikestation in Long Beach CA, the RBWH Cycle Centre in Brisbane, and the colossal Bike Flat beside Amsterdam’s central train station. The walls of MVRDV’s competition winning proposal for a House of Culture and Movement in Frederiksberg, Denmark, will double as frames to suspend and that way put visitors’ bikes on display. The Danish Pavilion at Expo 2000 in Shanghai, was in the form of a spiral that cyclists could ride through to the roof. As part of the landscape proposal, Governor’s Island in New York harbour will include 3000 wooden bikes, designed by the architects, West-8 in Holland, for free use by park users.

Bicycles emblemise values architects are eager to have conferred on their works: frugality, irreducibility; health; ecological sustainability, etc.. Governments enjoy their symbolism too, but more so the tangible contribution bicycle transit makes to the public health burden, urban mobility, emissions reductions, and the economy. The latest figures from England point to a £2.9b annual contribution to the nation’s economy, through increased worker performance, reduced costs of treating obesity, and job creation\(^{iii}\).

Starting from base rates of 1 or 2% of all trips, governments throughout the developed world are setting bike modal share targets of 5 to 10% of all trips, primarily through the provision of on-road and segregated bike routes. Unfortunately, in countries where bicycling has not been a mainstream mode of transportation in living memory, voters are finding the idea of
reducing parking space, and road lanes, to make way for bicycles, totally alien. Given the political toing and froing around the car/bicycle contest for Main Street, it could be decades before the Dutch model of universal bike access extends to the rest of the world. A recent report by Victoria's Auditor General concluded that recent attempts to make cycling mainstream, had patently failed\textsuperscript{v}.

Where we are seeing headway, is in cities with former industrial waterfronts, and disused rail routes, that have been converted into non-vehicular promenades and rail trails. Two standout cities are Portland OR, and Minneapolis MN, in the U.S.. The drawback of networks like these, is they do not match the Dutch ideal of segregated bike paths along shopping streets and to established institutions. People whose primary concern is getting from A to B, will more likely opt to drive, than cycle via a circuitous network of rail trails. However, we shouldn't discount the behaviour of cyclists motivated by fitness, or who would incorporate leisure rides into days filled with errands, or who would organise their lives around bicycle trails.

For people who might take access to bike routes into consideration when deciding where to buy or rent houses, or who might even think about bike routes when deciding where they would most like to work, or send their children to school, it could prove a happy coincidence that former rail routes, and post-industrial waterfronts, also connect many of the large brown field sites that are currently earmarked for urban renewal. If those sites are developed with housing, public institutions and places of work, cycling enthusiasts could find themselves occupying new, parallel cities, where once there were networks of rail lines, factories and wharves.

At the moment, designing urban renewal projects (outside Holland or Denmark), in the belief that keen cyclists will be the main users, might seem skewed, or futuristic. By even the most generous estimates, 9 out 10 trips in America’s most bike friendly major city, Portland Oregon, are made using public transport or cars\textsuperscript{v}. Given those numbers, it seems fitting that Portland’s largest new brown-field development, the South Waterfront project, only makes modest provisions for cycling: on-road routes in the dangerous door-zone; and a proposed waterfront promenade, with no definite date for completion.

Planners have been in the habit of looking at urban renewal projects on brownfield tracts, first and foremost in terms of public transport (even though riding on busses and trains does not increase health). Their order of priorities has them next giving consideration to organising and hiding roadways and parking (even though driving negatively impacts urban
mobility and the environment). Ample attention is usually given to enhancing the pedestrian experience, or, moreover, mitigating the body’s deficiencies, in the city, without a bike. To mitigate against the slowness of walking, streetscapes are contrived to be as interesting as big buildings permit. Pedestrians’ vulnerability—due, again, to their being slow—is compensated for by planning to increase passive surveillance.

The bicycling experience comes as afterthought. Urban designers have it in their power though, to impact the bike modal share, by moving the cycling experience to the top of their list of priorities. Their volition is limited in established areas, where drivers are using their votes to jealously guard lane space and parking rights. On the brown-fields though—where rail trails and waterfront promenades happen to be appearing as well—planners have a blank slate, and could realise a hitherto unimagined new kind of city, that is principally invested in bicycle transit.

Some cyclists, if they have left-wing or counter-cultural leanings, would see only developer architecture being built on these sites. And some developers, if they assume cyclists are poor or outside of mainstream society, might not recognise this as a group of potential keen buyers of properties on former industrial land. The special appeal of those developments is they flank the rail-trails and waterfronts that give safe, all-weather cycling, a foothold, in cities with road networks that are not safe for cycling in poor conditions.

If the significance of brownfields to cycling was understood in these terms, urban renewal agencies like The Portland Development Commission, would see it as a mater of urgency to tie promenades like the one on Portland’s South Waterfront, to existing waterfront/rail-trail networks of bike paths. If that involved works on city-owned land, it would benefit cities like Portland to fund their completion. We know cyclists are two and half times more likely to use protected routes, such as waterfront trails, than on-road routes, no matter how well they are marked. Completing such links would release flows of cyclists from densely populated new development areas, into segregated bike networks, raising a city’s overall bike share, while at the same time making new developments of greater appeal to that segment of the market who are keen cyclists.

Ascertaining the size of that market is problematic, given the way bike share data is gathered. Parts of Portland have bike modal shares as high as 10%. Does that mean one half of all people cycle, but for only one fifth of all trips? Though it would be impossible to accurately predict the impact Dutch standard bicycle infrastructure would have, if delivered
to Portland, we could conservatively imagine half of those living in progressive
neighbourhoods, using bikes for one half of their trips, pushing the bike share to 25%.

Now imagine if The Portland Development Commission eclipsed even Holland’s best efforts,
and spent more to please cyclists in the South Waterfront area than they have spent to
please drivers. They could do that by providing covered and back-drafted bike routes.
Ground planes could be undulating to help cyclists start and stop using gravity. Rather than
conceiving streetscapes from the slow moving view point of a pedestrian, in the manner
Gordon Cullen, for example, proposed, urban environments could be designed to look good
from the arcing, leaning, fluid point of view of a cyclist. As energy prices invariably rise, we
can imagine hyper bike friendly developments, incorporating new strategies like the ones
just proposed, inspiring almost everyone living there to use bikes for almost all trips. A 90%
bike share is not inconceivable, in areas designed to attract cyclists.

As mentioned earlier, 8-House in Copenhagen gives us a glimpse into a possible future,
when ever-increasing numbers of cyclists have caused us to change the way that we build.
The most immediately apparent possibility 8-House foretells, is for the replacement of other
forms of vertical circulation, with bicycle ramps. It is generally held that Elisha Otis’s
plummet-proof elevator of 1852, opened the way for high rise construction. There are other
means though, of lifting people up through the levels of high-rise towers.

The first 16 levels of The Marina City towers in Chicago, by architect Bertrand Goldberg, can
be ascended by driving a car. The only disappointment is that drivers can only experience
the spiralling car park this way, not the habitable parts of the building.

Cars are too space hungry to have caught on as machines for lifting people through
buildings. Bicycles though, require ramps hardly wider than those for pedestrians. If access
balconies are open to the outside, like those of 8-House, they can eliminate the need for fire
stairs, while even lifts could be elided. With his fanciful proposal for London, \textit{The Cloud},
Carlo Ratti proposed towers with no means of vertical circulation other than ramps, that most
users would ascend using bicycles.

With its bicycle ramp, 8-House also foretells the possible return of an idea left on the scrap
heap from Modernism, that of the street in the sky. Announced by Le Corbusier, it never
quite gelled, because “streets” like the one in the Unite d’Habitation in Marseilles (1946 to
1952), with offices, shops and a hotel, were disconnected from streets on the ground. As
streets go, Le Corbusier’s streets in the sky worked about as well as the streets of
Manhattan would work, if the avenues were all taken away, and the only way of moving from one street to the next, was via the subway. The mere suggestion is maddening, yet precisely what Le Corbusier was promoting when he said an access corridor, reached via the dark vortex of a passenger lift, would somehow be an aerial street. The experiment—repeated with every new lift-access condo—seems poised every time to collapse into chaos, of the kind J.G Ballard imagined in *High Rise*, his distopian novel\(^\text{vii}\).

The access balcony in 8-House, by contrast, is more like a mountain pass than separate streets scattered across an archipelago of little islands. Admittedly, cyclists don't have an express route, or "avenue", via which to move vertically, in the quick manner one moves North and South in Manhattan. Cyclists in 8-House have to crisscross their way to the top. As they do, their experience is of an access balcony that is far more like a street, with the opportunities a continuous street affords to interact with anyone in a building, not just those who happen to live on your floor.

The possible ramifications of a bicycle borne populace extend beyond the design of particular buildings, to duties buildings have to their urban contexts. If far more people rode bikes, making cities safe and liveable would not be nearly as hard as it has been where most people walk or use cars. To start with, activating public space by encouraging cycling, is not the uphill battle that activating space with pedestrians has proven to be. Pedestrians move slowly. They bunch up. Planners can't spread them around, so at best call on them to enliven main shopping streets, and strips of cafés. But let's imagine a city where three quarters of trips were by bicycle, one quarter on foot, and cars were an oddity. Shops and cafes could be littered evenly across the whole city, just one at the base of each building. The Jane Jacobs ideal\(^\text{viii}\), of throwing away zoning maps and encouraging a tossed-salad of functions, might actually have some chance of succeeding.

On the old streets of Amsterdam and Copenhagen, with streets and building stock dating to the era of horse drawn transportation, the bike modal share has plateaued at just over one third. Urban renewal sites offer an opportunity to develop ground planes, urban morphologies, and building typologies, for an age when many among us (the health conscious, the green and the busy) would rather live, work, shop and recreate in those parallel cities that are coming into focus as industry fades, because they offer safe cycling. Protecting these areas from cars, and investing in cycling as generously as we would otherwise invest in car parking and transit—because these are, after all, BODs—will greatly increase the resilience of the post industrial city.
The final two images show the potential of this theory if it were applied in Newcastle, Australia. Black represents bike paths (existing and potential) beside waterways and along working and former rail lines, plus under-utilized industrial sites and open green space. If it were densely developed, as a BOD running parallel to the car-centric city, the highlighted area could absorb population growth that would otherwise contribute to sprawl. The area shown could crossed in 20 minutes by a cyclist riding at the average speed of someone in Copenhagen, ie, 20km p/h. Occupants of the BOD could enjoy hyper friendly buildings and bike routes, that would be the envy of, and a beacon to, those living in parts of the city overran by vehicular traffic.

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1 City of Cyclists—Copenhagen Bicycle Life, City of Copenhagen, The Technical and Environmental Administration, 2009.
3 Alexander Grous, Gross Cycling Product [Report], London School of Economics, August 2011
5 In a lecture at The University of Melbourne, Roger Geller, Bicycle Coordinator for the City of Portland, said 10% of trips there are by bike.
6 Anne C Lusk, Peter G Furth, Patrick Morency, Luis F Miranda-Moreno, Walter C Willett, Jack T Dennerlein, “Risk of injury for bicycling on cycle tracks versus in the street,” in Injury Prevention, 0.1136/ip.2010.028696
COMPREHENSIVE RESILIENCE IN URBAN DESIGN

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ABSTRACT: This paper engages with resilience in urban design by discussing knowledge that can be derived from case studies as being important contributions to innovation and hope, the core of resilience.

The purpose of urban design is to sustainably add cultural, environmental and economic value to human settlements. In order to achieve this urban design must cover a broad scope of concerns, it must be comprehensive. Urban design knowledge cannot stultify but must advance through expansion, continual testing and refinement. Resilience in urban design knowledge springs from constant engagement with and adaptation of national and international ideas and examples disseminated through conferences, visits, study and reflection. In an attempt at comprehensiveness, current urban design examples from small scale to whole cities, all relevant to sustainable cities, are discussed under the five headings of - smart containment, smart growth, re-birth, building performance, and ecological urbanism. If a city expects to evolve sustainably and with resilience, urban design requires a comprehensive approach across the full scale from individual houses to the city as a whole, all of which is locally relevant. This can embrace the adaptation and transfer of ideas and knowledge that is widely available from other places. The challenge is to experiment and innovate and to strike the appropriate balance for application between place uniqueness and globalised culture.

Keywords: Urban Design Knowledge; Urban Design Examples; Architecture Examples; Urban Design Sustainability and Resilience

INTRODUCTION

The urban design discipline, which predominantly encompasses planning, landscape architecture, architecture, social sciences, urban economics and engineering, is the overarching field that can comprehensively and sustainably add cultural, environmental and economic value to human settlements. In order to achieve this urban design knowledge must not stultify, but must continually expand. Maintaining an active awareness of and willingness to adapt visionary trends, ideas and examples across a wide „comprehensive” spectrum, is a key in achieving this.

In the book „The Art of City Making” (2006) Charles Landry establishes seven city-making principles which emphasise the need for a creative approach to interpreting sense of place and making the particular place work best for residents. In explaining this he highlights that a city must be aware of what other cities are doing “go with the grain of local cultures and their distinctiveness, yet be open to outside influences. Balance local and global” and further, “learn from what others have done, but don’t copy them thoughtlessly” (p1).

Further reinforcing the necessity of awareness of trends, Newman and Jennings link the need for a city to be connected to the world of experience and ideas in their 2008 book „Cities as Sustainable Ecosystems” “…visions are placed within a context that is more tangible than the global arena but that provides a basis for global concerns. Moreover the diversity of approaches enhances resilience” (p24)

In their book „Resilient Cities” (2009) Newman, Beatley and Boyer point to several authors including Peter Hall, Robert Friedel, Lewis Mumford and Tim Gorringe who write in similar ways about cities successfully adapting to change by concluding “whatever it is called, the ability to experiment and innovate is the tissue of hope and the core of resilience” (p5).
This paper sets out to contribute to the process of learning from others by updating and expanding our stock of examples across a wide scope to feed our knowledge bank. It highlights what are considered to be important current trends and examples from which transferable lessons, each contributing to greater sustainability, may be gleaned thereby contributing to city resilience.

Five trends are identified that relate to city sustainability. Each is developed further with case studies, discussed at the level of principles rather than attempting deep explanations. All of these trends are seen to potentially contribute to sustainable resilience. Using the word „potentially” implies that the examples may be adapted or adopted in a range of locations and to varying degrees. The paper does not provide specific applications, seeing this as the task of others who may gain awareness from the paper and be provoked into searching wider than otherwise for solutions. The final heading „sense of place” reminds us, as Landry (2006) does, to connect current knowledge about exemplars to the local scene:

- 1. SMART CONTAINMENT
- 2. SMART GROWTH
- 3. RE-BIRTH
- 4. BUILDING PERFORMANCE
- 5. ECOLOGICAL URBANISM
- 6. SENSE OF PLACE

The examples fall within Newman et al.’s (2009) „Ten strategic steps towards a resilient city” items: 3 – Target public buildings, parking and road structures as green icons; 4 – Build transit-oriented, pedestrian-oriented and green-oriented developments together; and, 8 – Regenerate households and neighbourhoods. The paper is structured to highlight examples and its style is notational, to accompany the power-point conference presentation.

1. 1 SMART CONTAINMENT - INFILL

Many communities have vacant parcels of land within existing neighbourhoods that lend themselves to residential development. Housing development on these infill lots not only increases the affordable housing supply, but also revitalizes declining neighbourhoods and expands a community’s property tax base. Providing financial and regulatory incentives to offset the costs of development can help encourage construction of affordable housing within these parcels. A benchmark example in Toronto is by architect Lawrence Dodd (see below).

Investigations into barriers to infill development are underway in Australia which show that the following topics need revision: Construction Costs; Tax Reform; Land Supply; Development Approval Timeframes.

1.2 SMART CONTAINMENT - DESIGNED SUBURBAN INTENSIFICATION

Australian architect John Gray at Victoria University Wellington, New Zealand, conducted research into suburban intensification for a case-study area of 2.3ha which houses about 41 people/ha at 2.1 people per dwelling unit resulting in 75 people and 36 dwelling units (Gray and Hoare, 2010).

Under Wellington’s existing „containment“ regulations the area could support 48 dwelling units, which at 2.1 people/household equals 101 people, an increase of 35%.

If the example was carefully designed to achieve habitable-code standards, accounting for topography, existing building, privacy etc. the capacity of the area could be 78 dwelling units, which at 2.1 people/household equals 164 people, an occupancy increase of approximately 120%.

About 1600m2 could be given to gardens for food production.

The Wellington example would require planning and building code relaxations, a unique design approach and neighbourhood cooperation.

Image credit – John Gray

1.3 SMART CONTAINMENT – MELBOURNE’S VISION

The „Melbourne 2030 Strategy: Planning for Sustainable Growth“ shows that the city can accommodate the projected large growth of an additional million people sustainably without extending its boundaries. It can do this through intensifying habitation along transport corridors and by upgrading the suburbs to be more self-sufficient and sustainable.

Approximately 6% of Melbourne is given to urban corridors (3%) and activity centres (3%) [retail/service/cultural including city centre]. The projected growth is targeted in these areas to avoid loss of sense of place of the suburbs.

Illustrated is a corridor as it is currently and it’s possible future….showing the potential of corridor-intensification and infill. Five-story mixed use buildings with sub-centres spaced along corridors provide a solution.

Six ingredients are needed: A Mix of Uses; Higher Density; Strong Connectivity-Good transport; High Quality Public Realm; Distinctive Local Character.

Compared with incremental growth on the edge of the city the economic saving of this contained intensification could approach 110 $Billion over the next 50 years.
2.1 SMART GROWTH

Towns and cities are at a crossroad. Down one path is urban sprawl. This leads to endless roads, long commutes and traffic jams, high social and infrastructure costs and loss of farm-lands and open space.

Urban sprawl is widely spread-out development outside city centres, usually on previously undeveloped or farm land. It is characterized by having few people per hectare, homes that are separate from retail, commercial and industrial areas.

The spread-out nature of urban sprawl does not support public transportation. Urban sprawl homes are separate from places of work, shops and services, meaning that residents usually drive for all their travel. Continued sprawl threatens the health of our families, our communities, and ecosystems.

In the other direction is „smart growth” which creates compact, higher-density communities supported by public transit, bike and walking paths, surrounded by productive farmland and green spaces, forests and wetlands.

Smart growth promotes exercise and cardiovascular health. It includes a mix of housing, commercial, and shopping uses. It is development that provides business opportunities and jobs, balances development and environmental protection, and encourages strong neighbourhoods.

2.2 SMART GROWTH - TRANSPORT ORIENTED NEW DEVELOPMENT

Varsity Lakes” on the Gold Coast is a 343-hectare green-field site in Gold Coast City. The project’s mixed-use precinct is synergistically situated next to Bond University.

A modified-grid system of residential streets creates walkable linked neighbourhoods that share institutional recreation spaces and which are train-station accessible.

The layout encourages optimum solar orientation of houses and passive surveillance of public areas.
2.3 SMART GROWTH - MIXED-USE URBAN INTENSIFICATION

„South-Bank“ Brisbane supports a rich mix of uses (culture, park-lands, recreation, restaurants, entertainment, exhibitions, retail, residential, education…..but is missing household food shopping. There are clear visual links with the park and river. There are also strong physical links into adjoining neighbourhoods and across the river. The rehabilitated Grey Street adds to overall coherence. South-Bank has excellent accessibility across all modes including train, bus, ferry, pedestrians, bicycles, vehicles.

3.1 RE-BIRTH - THROUGH RETRO-FIT and UPGRADING

It is significant that 95% of Australia’s existing buildings were constructed without sustainability considerations. Keeping our existing buildings for as long as possible adds markedly to their life-cycle efficiency. But where possible, upgrading should be undertaken through retro-fitting that achieve sustainability goals. Office buildings are already being re-fitted to comparatively higher performance standards, but more innovative solutions are possible including the „Evolo“ competition entry which clips
prefabricated modules onto the exterior of existing buildings, adding a layer of green space for gardening, wind turbines or social uses.

3.2 RE-BIRTH THROUGH REDEVELOPMENT

The mixed-use Mizner Park, Florida, town centre demonstrates how suburban communities can create vital downtowns by redeveloping low functioning shopping centres. Mizner Park was a „dead“ internalised shopping centre surrounded by parked cars until its re-birth as a „Town Centre“ with regular streets and a wider range of mixed uses including apartments.

3.3 RE-BIRTH - THROUGH INFRASTRUCTURE TRANSFORMATION

Obsolete railway viaducts in Paris and New Your have been re-borne to enhance liveability of those cities. Paris has transformed the 1.5k, 70 arch „Viaduct des Arts“ to house arts and crafts workshops, galleries, showrooms, restaurants and café. On top is the „Promenade Plantée“ which extends beyond the viaduct for 4.5k, sometimes through buildings, providing a green pathway connecting districts.
The 2.3k „High-Line Park” in New York is a disused freight train line in the lower West side. Walkway, seating and native planting provide an urban outdoor experience that has contributed greatly to a renaissance of the neighbourhood.

3.4 RE-BIRTH THROUGH ECO-CITY GREENING

In an eco-city, people and organisations adapt to a changing climate and act to build a sustainable future. Such a city is compact, with high density of housing, business and cultural uses that sustain an effective public transport system, and walking and cycling above car use. With excellent air quality and generous public open space and landscaping, biodiversity is supported and people enjoy the benefits of health and happiness. City infrastructure and buildings generate and use renewable energy and feed into the metropolitan electricity grid. Food is grown locally and creatively, using horizontal and vertical spaces on buildings and in private and public gardens.

3.5 RE-BIRTH THROUGH BUILDING ON TOP

By comparison with building anew, constructing on top of existing buildings contributes significantly to sustainability by providing:
* low energy costs in demolition & disposal;
* low building material waste;
* materials savings - no need for footings - what can be built is limited by height & carrying capacity of the existing building;
* Light-weight construction (steel frame with plantation timber frame) OVERALL 35% building cost saving.
* increased number of city residents = fewer vehicle trips & less pollution for work trips;
* increased pedestrian journeys gives greater community health at less public cost;
* by limiting urban sprawl, overall journeys are shorter and the existing urban fabric is used more effectively – counter to decreasing household occupancy rate. OVERALL 33% increased city residency.

![Image](image_url)

Image credits – [www.e-architect.co.uk/architecture_competitions](http://www.e-architect.co.uk/architecture_competitions) – Graham Meltzer

### 4.1 BUILDING PERFORMANCE - ENERGY AUTONOMY

*First Light* is the name given by four Architecture Students at Victoria University in Wellington, New Zealand, for their finalist entry to US Dpt. Energy Sponsored „Solar Decathlon” (Farrow, et al, 2009).

Solar Decathlon is a competition that short-lists twenty house designs by university teams internationally every two years. The designs are built and exhibited on „The Mall” in Washington DC, educating a new generation of professionals & the public.

The designs must be liveable, completely solar-powered but must also blend aesthetics and modern conveniences with maximum energy production and optimal efficiency.

*First Light* includes electronic management of smart-systems including re-cycling, water collection, security, air-conditioning, ventilation, thermal performance and communications. It generates power for its own operation; it can re-charge an electric car and export power.

![Image](image_url)

Image credit – [firstlighthouse.ac.nz/featured/the-house/](http://firstlighthouse.ac.nz/featured/the-house/)

### 4.2 BUILDING PERFORMANCE - GREEN OFFICES

Nearing completion is the 310m high „Pearl River Tower” in Guangzhou, China, by SOM.

The sculptural façade directs wind to the pair of funnel-like openings at its mechanical floors at one-third and two-thirds the height.

Wind power in even mild conditions from different directions drive turbines to generate electricity for heating and ventilation.

The tower has a double-skin curtain wall for insulation as well as trapping heat for hot water.
Integrated solar collectors generate AC current for lighting & other needs. Daylight is "harvested" for lighting.

4.3 BUILDING PERFORMANCE - SUPER GREEN OFFICE

In 2006 Australia’s first 6-star rated building „Council-House 2“ in Melbourne successfully set out to establish new performance standards for office buildings. It gave reductions of: CO2 emissions by 82%; Electricity use by 82%; Gas usage by 87%; and Water use by 72%. Productivity improved 10% compared with the previously occupied council administration building. Four years later was Australia’s 250th 6-star or better building. The world’s first carbon-neutral better than a „perfect-score“ office building „Pixel“ in Melbourne.

4.4 BUILDING PERFORMANCE - PIXEL

Pixel by architects studio 505 and Grocon is self-sufficient for water and will generate surplus energy to neutralise its embodied energy. Innovations include carbon neutrality, a vacuum toilet system, the anaerobic digestion system and reduced car parking. The water initiatives in the project mean the building could be self sufficient for water – in this context, the project is water balanced as well as carbon neutral.
The building features a new type of concrete which halves the carbon in the mix. Melbourne University designed the „living roof“ which re-introduces Victorian grassland species to the Melbourne area, and includes tracking photovoltaic roof panels. The multi-coloured sun shade system on the exterior of the building will provide the maximum amount of daylight into the office space, protecting it from glare and heat in the summer. While smart window technology ensures windows will open automatically on cool nights to enable air flow into the building. Electricity is generated by roof-mounted wind turbines.

Image credit – www.australiandesignreview.com/news/17810-Pix...

4.5 BUILDING PERFORMANCE - DELTA

Another project by studio 5050 under design development, is the proposal for DELTA a 50-unit residential tower designed to stand 10-12 stories atop a heritage bluestone building in Melbourne. The tower will be composed of prefabricated laminated timbers that will be locally sourced. The project’s carbon neutral design goes well beyond the materials used as it is seeking Passive House certification, it the most efficient building in the country. The super-efficient shell is highly insulated, meticulously airtight, and features super high-efficiency windows. This sharply reduces the size of the equipment needed to heat and cool the building. The prefabricated componentized system will make the building simpler to assemble on-site.

Image credit – inhabitat.com/.../

4.6 BUILDING PERFORMANCE - QUEENSLAND GOVERNMENT

Queensland Government Architects office „Project Services“ have recently completed the State’s first 6+ green star rated building „Dandiri Contact Centre“ at Zillmere. Innovations in this building include significant passive design aspects – orientation, shading, mass and insulation, natural lighting and ventilation (selected areas), high ceilings as well as sealing against leakage. Other achievements derive from solar energy collection, recycled
timbers, avoidance of noxious gases from materials, and water collection for internal use and recycling. Construction materials were carefully selected to reduce CO2 impacts (eg: 40% of cement was replaced with blast furnace slag). External works include native plants and water management.

![Image credit - www.gbca.org.au/newsletter_preview.asp?id=794...]

5.1 ECOLOGICAL URBANISM – FIRST SUSTAINABLE CITY

*Masdar* (Arabic „the Source”) in Abu Dhabi, a new city of 50,000 residents under construction will run entirely on renewable energy when completed in 2015. Designed by Lord Foster in 2007 the compact, high-density low-rise city of 6 sq k will be completely free of conventional cars and their emissions. A fully automated electric Personal Rapid Transit System will provide a flexible alternative to private cars. Light rail links the city to nearby developments. Compared to conventional cities there will be 75% less fossil fuel consumed, 300% less water, 400% less waste. No resident will be more than 200m from essential facilities including shops selling locally grown produce. The Masdar Institute of Science and Technology (in partnership with MIT) will use the city for research in advanced energy and sustainability. Passive systems are incorporated: orientation to capture cooling sea breezes; perimeter walls to protect from desert winds. Courtyards and wind towers draw cooling breezes into narrow streets shaded from harsh sunlight…conjuring images of ancient bazaars.

![Image credit - www.bustler.net/.../]

*Page 99*
5.2 ECOLOGICAL URBANISM – MANY MORE CITIES TO COME

Dongtan Eco City, China (top image) will increase bio-diversity and will create a city that runs entirely on renewable energy for its buildings, its infrastructure and its transport needs. The city will recover, recycle and reuse 90% of all waste in the city, with the eventual aim of becoming a zero waste city. 

Dockside Green, Victoria BC Canada. Plans to become North America's first carbon neutral community, achieved through a combination of green solutions for buildings, transportation, energy and waste treatment. 

The Eco-City Longrono Montecorvo in Spain (bottom image) foresees the construction of 3,000 social homes and complementary services program. The new neighbourhood achieves a CO2 neutral footprint by producing renewable energy on site.
6. SENSE OF PLACE

What can we learn from these examples? Many things but unless we transfer knowledge gained from case studies in ways that are relevant to our own place then we potentially contribute to deterioration of our sense of place....even by contributing to placelessness (after Relph, 1976) as discussed further with regard to the Gold Coast by Holden (Holden, 2011).

The importance for a city’s resilience of developing place specific solutions was identified in reference to Landry (2006) and Newman and Jennings (2008). We know from examples such as the art museum and subway stations of Bilbao in Spain that innovatively designed buildings and services have resulted in strengthening sense of place and resilience notwithstanding the international origin of ideas and forms (Gospondi, 2004).

From this we may conclude that by seeking high quality design for small and large scale private and public elements then the city can potentially gain greater resilience through improved sustainability from selective transfer of ideas from elsewhere.

CONCLUSION

It is argued that if a city expects to evolve sustainably and with resilience, urban design requires a comprehensive approach, which is locally relevant. This can embrace the adaptation and transfer of ideas and knowledge that is widely available as demonstrated across the case studies shown. The challenge is to strike the appropriate balance for application between place uniqueness and globalised culture and technologies.

The paper selectively engages with physical, technological and visionary-policy driven examples of architecture and urban design across a wide range of scales from an individual autonomous house to entire cities. These are organised under sub-headings that are relevant to city sustainability. Many more examples are available and many of the ideas discussed may be adapted or transferred to other cities provided there is willingness, as Newman et al say (2009), to experiment and innovate, which is at the core of resilience.

BIBLIOGRAPHY

MAPPING RESILIENCE: A FRAMEWORK FOR CHANGING CITIES

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Abstract

Urban centres base their resilience on the ability to evolve and adapt as needed throughout their life. Although constantly developing, changing and subsuming nature for its needs, the current age of environmental awareness requires that cities progress in a more conscious and considered way. While they have become the dominant form of human habitation, there now exists a need to integrate 'green' solutions into urban centres to address social, physical and environmental well-being. The means of implementing the vast array of possible solutions without negative impacts is not clear; cities are complex systems, layering meaning, history and cultural memory - they are a manifestation of shared cultural values, and as such, they do not allow a tabula rasa approach of 'blanket' solutions.

All around us, cities are continuing to develop and change, and although their form is varied - sprawling cities with density and sustainability problems; or collapsing cities with 'dead' centres and dilapidated districts – a common issue is the resilience of the local identity. The strength or resilience of cities lies in the elements which have become fixed points in the urban structure, giving character and identity to a shared urban experience. These elements need to be identified and either maintained or revitalised. Similarly, the identification of urban elements which can most viably be modified without compromising character and identity of place, will assist in making concrete contributions to increasing both the sustainability and experience of cities, making them more resilient.

Through an examination of case studies, this paper suggests a framework to inform urban renewal assessing the widespread elements which generate an urban identity, beyond the traditional approach of heritage conservation for cultural or tourist purposes. The rapid contemporary alteration of urban structures requires an innovative methodology which satisfies on one side the need of new sustainable performances and, on the other, the resilience of the local character.
Theoretical background

Cities are resilient. Very few cities in history have really been lost and the ones which were, usually owe their death to catastrophic natural, social or environmental events which have also erased entire cultures (Mumford, 1989). Even after such devastation urban culture is able to resurrect, often in the same location, sometime just nearby. Cities are the highest product of mankind but, at the same time, man is the most dangerous threat to urban identity (Leonardo Benevolo, 1980). Without taking into consideration the devastation of war, technology itself has played a major part in changing on one hand the structure of the city, and on the other the lifestyle of its inhabitants (Kostof, 1991). The sanitation and social reforms in the 19th Century, the introduction of cars and zoning in the 20th Century have both fuelled the expansion of urban centres, sometime in an uncontrolled way and required mass demolition in consolidated cities in order to upgrade the urban fabric (Leonardo Benevolo, 1980). The resilience of cities dwells in their capacity to change and evolve, but when the perturbations are rapid, the social milieu is not as quick in assimilating the modification in the physical environment. Massive migrations, rushed modification of city forms and their extent have always created social tensions and, generally, weakened the character of urban centres (Mumford, 1989).

The 21st Century now poses a new challenge for cities. Our growing awareness of the environmental costs of Western lifestyles has given rise to a broad range of concerns. Amongst them is the knowledge that cities are absolute consumers - of resources, of energy and of technology (Girardet, 2008). With the majority of the world’s population now residing in cities, the challenge of implementing sustainability measures and solutions has become of key importance. Housing, transportation and food have all become strained due to the influx of people to urban centres, but the new green agenda poses a new threat for urban identity (Girardet, 2008). In the 20th Century, Le Corbusier was proposing to getting rid of the historical city of Paris, preserving just some major buildings, today the proposal for the futuristic sustainable city offer appealing images, but at the same time ones which are generalised and not considerate of the local identity of place (Solomon, 2003). In order to produce this sustainable city, the current industrial urban fabric should be demolished or heavily modified.

The need for cities to become sustainable is clear. As mass consumers of resources which are rapidly running out, it seems obvious that the city itself will need to be re-imagined, re-conceptualised and re-defined. Strategies to not only halt but reverse resource scarcity, pollution and environmental degradation need to be implemented on a massive scale (Birkeland, 2008). While destructive practices may be a hallmark of the modern city, their result - the built environment, certainly is. Yet is not possible to implement traditional methodologies to bring about these required changes - the very idea of widespread demolition of the urban fabric to create newer, better, more sustainable buildings and cities is counter-productive. Sustainable solutions invariably reference the reuse and recycling of existing objects so as to not waste the resources, labour and embodied energy within them. Keeping in mind the very small percentage of new buildings commissioned and/or built each year, and the even smaller number of new cities, it is clear that we need to alter and update both the existing building stock and the existing urban model in order to achieve sustainable goals (Birkeland, 2008).
It is important to note that implementing sustainable urban solutions and creating ‘green’ or sustainable cities is feasible and within the reach of contemporary society. We already possess the knowledge, skills and technology required to make our cities if not sustainable in the full sense of the word, then able to go a long way towards achieving those goals (Birkeland, 2008). There are numerous technologies (i.e. photo-voltaic films and paints; air purifying concrete; urban water purification means) and strategies (such as densification; better and integrated public transportation; walkable precincts), which can be employed; and countless theories and approaches (Eco-design by Ken Yeang (2006) and Cities for People by Jan Gehl (2010) are two examples) which can be applied. What appears to be the stumbling block is how to go about implementing them without losing urban identity in the process.

In order to face this new challenge, a reflection on how cities have evolved in the last two centuries to cope with technological and social innovations can provide guidance to managing future changes, sustainable not only in terms of performances but also from the perspective of culture and identity. Morpho-typolocial studies have informed urban analysis in recent years; the works of Caniggia, Muratori, Aymonino and Rossi have all based the investigations on urban resilience not on the presence of major landmarks, but mainly on the character of the recurrent typologies. Every city owns its character to a diffuse vibe generated by unwritten rules (Zukin, 1988). Benevolo (1993) discusses the idea of being a good neighbour when implementing either changes or commissioning buildings. By this he is referring to the careful consideration, understanding and maintenance of the urban fabric whenever a new addition or alteration was being made. In other words, ensuring that the new contribution to the city was in character with the buildings it was joining; that frontages were the same, that the detail of fenestration matched and that although individual, the building did not upset or challenge the whole, but rather ‘fit in’ to its surroundings. Repetition of elements, details and typologies is a key factor in determining the character of a place (Caniggia, 1987), but, as the New Urbanism experience or the suburban developments all over the world have demonstrated, they are not enough to generate place and identity, and may, in fact result in pastiche and kitsch.

In order to investigate the resilience of the city as resilience of its identity, case studies are investigated taking into consideration the following indicators:

- Approach to the consolidated urban fabric;
- Use /role of landmarks and monuments;
- Role of building typologies/urban morphologies
- The feasibility of each approach to meet the sustainable agenda

The examples investigated compare 19th, 20th and 21st Century cities in order to profile approaches to urban modifications and these have been subdivided in three main groups.

The Arabic Phoenix

In order to upgrade the existing urban fabric to accommodate the needs of a technological, social or economical revolution, elements or entire portions of a city are demolished. The new city literally takes the place of the old one preserving just the main features as heritage. This is the approach proposed by Le Corbusier for Paris, and it is also the way that city was redesign by Baron Haussmann.
in 1852 (Leonardo Benevolo, 1980). The idea of producing a modern city, with large avenues and boulevards to maximise commercial exposure and, at the same time, provide an effective control on the urban population drove the systematic erasing of the old Paris. The adopted city pattern is based on a system of triangles, to increase the more profitable corner positions, opening perspectives on major landmarks and monuments. A system of views across the city has been designed to navigate the city; the remnant of the old city, judged to be worth keeping, are isolated and find themselves at the centre of a network of radial avenues. Where old buildings are not present to inform the design, new monuments are provided, functional but also to celebrate the rising bourgeois society. The archetype used to design Paris was the Champs Élysées, a baroque perspective centred on the Palais du Louvre; the new city has been developed using as templates the experiences of Place Des Vosges, Place Vendome and Rue de Rivoli where the repetition of a simple building typology has been used as a device to design the urban space. Arcades and commercial activities at the ground floor where coupled with dwellings at the upper levels providing a mixture of social strata and not only of activities. The approach to redesign Paris was based on the systematic destruction of the pre-existing town, with the exception of elements recognised as unique, and the design of a new environment using a typology already experimented with in the local context.

A similar approach is evident in the 21st Century Beijing, where traditional courtyard houses are demolished to provide ground for Westernised high-rise development (Wu, 2000). Again, in this case the idea is to design the new city, sacrificing the old one and imposing a new image to the urban environment, with a consequential new cultural and social structure. Also in this case old monuments and new landmarks are devoted the role of preserving the local character. However, the new recurrent typology is not derived from the local context but imported from a more global and Westernised repertoire.

A more local example of this approach can be seen in the current town planning fascination with Transit Oriented Developments (TODs) which, in Brisbane at least, appear to focus exclusively on massively increasing building heights in order to cram as many people into as small a building footprint as possible (Charles & Hale, 2010). While it is possible to suggest that the fundamental drivers of these types of developments are well intentioned, invariably, due to the current urban morphology, these TODs form islands of high rise development amongst a sea of predominantly low density, low rise urban fabric, adding to existing transport and infrastructure woes. There appears to be little consideration for uniformity of building heights and the possibilities of meeting density requirements through consistent medium density development; and none at all for a culturally relevant typology.

In all these cases the social milieu of the city has been or could be devastated by this operation and in the 19th as well as 21st Century there are several critiques of this kind of approach. The resilience of the urban memory has been devoted to few elements, and a new identity, a new society has been provided to the city. In the case of Paris, in time the recurrent form of the urban block, with a typical and regimented building section, has become the most characteristic feature of the city centre. However Beijing has imported a typology foreign to its culture and one that fails to respect cultural and social structures embodied in the traditional building types and embedded within Chinese society. In the case of Brisbane the new typologies are delivered in a fragmented way and without an overall strategy for neighbourhood character.
Although this approach is theoretically feasible, in terms of sustainability, it is clearly unsuitable. Wanton and widespread destruction of the city cannot be supported as a responsible solution to the environmental agenda – the sheer amount of money and resources needing to be committed to the endeavour, for both the demolition and the rebuilding, as well as the blatant contradiction of sustainability goals makes this approach impossible. To paraphrase the Vales (1991), the earth does not have the required resources to re-build the city anew for each generation, or to meet each new urban aim. It is doubtful that this approach, regardless of how wondrous and sustainable the new city would be, could ever compensate for the destruction of not only cultural memory and collective identity but also the resources, labour and value of the ‘old’ city.

Pyramus and Thisbe

A different approach to the development of the city is the juxtaposition of appending new quarters to the existing ones; Ferrara is one of the early examples of a medieval city with a new Renaissance extension where the character of the two different parts is clearly identifiable. This approach has been widely used to manage the urban growth in the 19th Century when new quarters have been designed beyond the old city’s walls (Watkin, 2005).

In the case of Barcelona a simple gridiron has been laid down on the Northern side of the consolidated city. The urban pattern resembles the templates used in the Spanish Empire after the introduction of the Law of the Indies. Cerdá’s invention is the truncated corner which transforms every intersection into a small square (Rykwert, 2004). The few pre-existing artefacts outside the medieval walls of Barcelona are incorporated in the new city, but they do not become features of the new environment. Urban facilities, within the grid, are designed as landmarks, but the character of the environment is based on the typical form of the block and in the use of a recurrent building typology. In the case of Barcelona the blocks are not really meant to be of mixed use, with commercial activities allocated to predetermined areas. As in the case of Paris, the form of the block is what can be recognised as the element which constitutes the identity of Barcelona. As in Paris the transition space between public and private realms is mediated by arcades, in Cataluña this relationship is resolved with an enclosed building form opposed to wide pavements lined with trees.

This approach has been widely adopted in different parts of the world. In central Asia the former USSR has opposed the new efficient and modern socialist town with the old cities of the Silk Road. Bukhara still has a well preserved medieval core which the new city surrounds. This contraposition has ideological justification, but the use of a less characteristic urban form has generated a centre with strong identity and an anonymous peri-urban environment (Chuvin & Degeorge, 2001).

In this approach the urban extension is a modern and technologically updated environment; the core is preserved but seldom updated and in some cases this becomes a sort of open air museum, with plenty of cultural activities, but lacking dwellings or a mixture of uses.

This type of approach may be more sustainable than the previous one due to the absence of widespread demolition of existing buildings and infrastructure but it is hardly feasible to build a new city, with the immense consumption of resources and energy to construct new infrastructure, an
urban centre and dwellings. As tempting as it may be to ‘start again’ on a greenfield site, the logistics involved in this approach make it a massive and costly undertaking.

Jonah and the Whale

An approach which lies between ‘the Arabic Phoenix’ and ‘Pyramus and Thisbe’ is the one which tries to update and change the consolidated city by taking advantages of existing elements inside it. The evolution of technology and society not only requires new facilities, but often makes existing infrastructures obsolete (Trancik, 1986). The reuses of these in several cases have provided the chance to create exciting new urban spaces (Groth & Corijn, 2005).

The change in warfare in the middle of the 19th Century has allowed Vienna to demolish its inner city wall ring and insert between the medieval city and the modern one a ring of new urban functions and a network of wide roads to support the tram networks and contemporary mobility (L Benevolo, 1993). New landmarks have lined this part of the city and the fabric has been built in with mixed-use, low rise buildings. Commercial activities at the ground floor are faced with wide pedestrian pathways shaded by trees. More recent examples of this approach are the High Line in New York (Diller Scofidio & Friends of the High, 2008) or the Cheonggyecheon Canal in Seoul (CHO, 2010).

In the New York example a dilapidated railway has been transformed into a linear park. This case is one of the most recognisable application of Landscape Urbanism ideologies and an attempt to introduce a green element into a dense and complex city. The built environment has been maintained and reused preserving the character of this part of town; the actual industrial typologies have been adapted to accommodate contemporary functions often in close relationship with the new hanging garden (Diller Scofidio & Friends of the High, 2008).

The Korean experience is more drastic; in this case an urban motorway has been dismissed and demolished to re-create a historic stream. The new environment is an urban sanctuary where people can reconnect with the history of the city and element typical of the Korean culture. This project does not directly affect the surrounding fabric, it introduces a new social and symbolical space to regenerate the city and its character, not its form (CHO, 2010).

This infill approach is also one of the pillars for the new Milan urban plan. The development of the city towards a more sustainable future is not through proposing a new city on the side of the existing one, or on the site of the actual. The new urban environment is proposed by creating a network of spaces taking advantages of dilapidated industrial areas and abandoned infrastructure. Pedestrian networks, parks and new facilities are built within the consolidated town, taking advantages of its identity, its character and at the same time upgrading it in terms of liveability and infrastructure. The new plan for Milan starts with a mapping of opportunities for change; these opportunities are then reconceptualised in order to enhance the local neighbourhood character and provide new integrated systems of open spaces. In perspective of a more equitable, democratic and sustainable city, Milan is promoted as the anti-Dubai where punctual icons are sacrificed for uniform ideas and identity (Francini & Boschetti, 2011).
This approach, in respect of the two previously discussed, requires a detailed mapping of opportunities in the built environment. More than a generalised approach, it proposes a dynamic design strategy which solves macro problem with detail interventions. New landmarks are introduced, the urban form is partially modified but the general character of the environment is preserved as well as improved.

This approach appears to be both feasible and sustainable. The piecemeal strategy of opportunistic infill development offers retention of urban identity while simultaneously offering ways of changing and updating both building stock and the nature of the city. It takes into consideration the long lasting nature of architecture; with current construction having an expected lifespan of 50 years, a significant period of time and one which will see numerous changes to the urban environment. However, the majority of buildings will, over time, be demolished and replaced with new ones, and as that process occurs, it makes both economic and social sense for that change to be driven by environmental concerns. Collectively, we have an understanding and expectation that a number of urban buildings will, in our lifetime, be demolished and replaced through ‘natural’ attrition. This understanding makes the introduction of new urban elements both easier and socially, more readily acceptable.

Another facet of this urban progression is the much faster rate of retrofitting of urban buildings (Miller & Buys, 2008). Offering another feasible way of increasing both the sustainability and resilience of cities, retrofits can take advantage of leaps in terms of technology and urban image, allowing existing urban building stock to adapt to changing needs and circumstances. Local examples of successful retrofits (though not necessarily sustainable ones) include the State Law Building in Brisbane (colloquially known as the Batman Building or Gotham City) and the current upgrade of the Wintergarden in Brisbane’s Queen Street Mall. The City of Melbourne has gone further with a clear statement of sustainability and it could be suggested, a new typological prototype of urban buildings with its Council House 2 (Crist, 2006). This building, well publicised and promoted, has achieved iconic status not through its size or through fashion, but through the clever and considered use of contextually sensitive, sustainable measures in its fundamental design. Through this building it is possible to garner an inkling of the future sustainable city where each subsequent addition to the urban fabric builds upon the existing conditions and furthers environmental goals and achievements. This building offers a way of focusing not on the negative impacts of cities but on the improvements or gains that are possible with each iteration.

Discussion

Examining these urban exempla suggests a framework for implementing large scale urban sustainability changes, while maintaining and enhancing sense of place and urban identity. There is an implication in the above exemplars that the combination of urban typology and density of the urban fabric has led to the successful creation of a clear sense of place identity, able to be understood, accepted and supported through numerous generations of urban inhabitants. From this proposition it is possible to extrapolate an initial framework which addresses identity and resilience:

- A concrete, unified strategy for the overall urban development of a city – ‘the bigger picture’ which provides an overall vision for the future direction of urban maturity and which
subsequent individual site developments meet and enforce. This vision needs to address current urban concerns of transportation, density requirements and urban amenities as well as having a clear direction in terms of sustainability goals and agenda. An understanding of cities as manmade (artificial) ecosystems, and the need to meld the natural within urban systems should be the fundamental driver of this plan.

- Due to the need to respect and work with the existing urban fabric for sustainability reasons, and the infeasibility of widespread urban reconstruction, urban resilience can be created through the piecemeal upgrades and changes to both the building stock and the urban fabric.
- Infill development and the redevelopment of disused former industrial sites offer the best opportunities for rapid large scale changes.
- The opportunity provided by retrofitting buildings is also included into this category. The number and frequency of upgrades and changes to existing buildings easily forms part of the sustainable agenda as prolonging the useful life of any artefact while introducing green solutions will help to retain the understood and accepted urban character and fabric, therefore helping to achieve resilience while rapidly increasing the sustainability of cities.
- Favouring medium density mixed-use development, which respects, maintains or provides a culturally and contextually relevant consistent typology which is able to be employed to embody the existing character of the urban settlement.
- Numerous reasons support the argument for medium density development as a part of urban densification although it can be suggested that the current focus on Transit Oriented Development is too concerned with raising height restrictions and increasing density than on developing a consistent typology.
- Similarly, numerous reasons for mixed-use developments abound but for the purposes of this paper, its ability to create active streets is the main driver. As Leach (2002) suggests, it is the constant interaction between people and place that help to foster place attachment and identity, and giving citizens reasons for coming, going and interacting with both other people and urban districts promotes urban resilience.
- Maintaining or introducing a fine grained, dense urban fabric through the introduction of alleyways, lanes and arcades to reduce the scale of city blocks to a denser, more pedestrian one. The introduction of pedestrian streets, walkable neighbourhoods and the ongoing work of Jan Gehl (1987; 2010; 2004) are the cornerstones of this category, which again is aimed at increasing activity in urban centres. This strategy is supported by the introduction of an integrated and extensive public transport network, which reduces the need for private vehicle ownership and use, as well as supporting the use of bikeways and car sharing schemes to address both car dependence and spatial requirements and costs of providing parking.
- Developing a relevant and sensitive building typology able to offer, express or maintain the existing urban character and identity, at pre-determined densities. To ensure resilience and urban identity, this typology must embody the existing local character and be materially, contextually and culturally appropriate. However, this typology does not need to be strictly adhered to on a city wide scale – allowing for neighbourhood variations helps to add to the
'imageability' (Lynch, 1960) of the city and to offer distinct quarters or city districts, although an overall continuity of form is advantageous.

- Where the current typology is one of scattered single-family dwellings, a sensitive means of increasing density needs to be found. This may take the form of 'top hat' developments (where the original building fabric is maintained with a new extension added on top); retaining façades while building or retrofitting the building fabric; or keeping ‘pockets’ of heritage typologies and sensitively introducing the new typology around it.

- Each future development needs to exemplify both the (new, denser) typology and build upon sustainability goals. As our understanding of green urban living increases, there will be a simultaneous development of sustainable technology and solutions. These need to be required and incorporated into all new construction with an understanding of how each subsequent addition can build upon the existing systems provided by previous building stock. Focusing on the positive impacts of incorporating sustainable technology and systems, whether it be power generation, air or water purification, ecosystem regeneration or habitat restoration; will shift our understanding of cities from generating environmentally and ecologically negative impacts towards improvements and gains being made through the built environment (Birkeland, 2008). These technologies clearly need to be site specific and culturally and contextually relevant, yet fit within an overall framework of long term, large scale sustainable advancement.

- In larger scale developments, particularly when re-purposing former industrial sites, it may be worthwhile to investigate a communal approach to sustainability where individual buildings contribute a different environmental function, rather than having each building replicate every sustainable solutions. Respecting and following passive architectural design methods would clearly indicate that certain positions on an urban block may be more suitable to certain technologies than to others and block sized developments can take advantage of this situation.

Conclusions

Meeting sustainability aims and changing cities from unsustainable pollution and waste generators is one way that urban decline can be countered and urban resilience fostered. Turning the ‘function’ of cities away from economic drivers towards environmental ones will ensure that cities will continue to prosper, grown and survive. It is important that these changes are not seen as a negative but understood as yet another metamorphosis in the continuing evolution of the metropolis. Cities always have and always will, continue to morph; much like anything, they grown and change, or they die. The current environmental agenda is simply another stage in the process. Granted, very few of the previous changes have been on the scale of the one now required, or of the same pace. Typically, these changes were introduced and progressed slowly, allowing time for citizens to become used to the idea and to understand the thinking behind them. This new change may seem much more radical in both scale and scope, although if sensitively implemented, it too will quickly become accepted. One way in which this can be encouraged is by following the example of the past in the means through which changes were carried out. Due to the rapid nature of the required sustainability changes our urban centres need, it is even more important that they be carried out in
such a way as to minimise disruptions to the urban fabric and character. Consideration of context is a basic requirement of good architecture. Extending that contextual consideration to the scale of the city helps to create distinct districts and quarters within our urban centres, leading to the formation of urban character and place identity, as well as helping to form an identity and understanding of the whole city.

While changing cities at large is beyond us in terms of resources and agenda, incremental change of the kind we’ve grown used to can, piece by piece, help to build the sustainable cities of tomorrow. If every building we construct or retrofit serves some environmental function, be it power generation, production of clean air or water, then ultimately the sum of the whole will be greater than its parts. An interconnected urban 'green' grid which enriches not just our collective understanding of the role of cities, but that of the natural environment as well can be established through a clear understanding of the city as a system. Making these changes piecemeal as one building after another is due for upgrades or rebuilding will help to ensure that the character of the street, district and the city, remains resilient and intact.
References


Assessing population limits: A carrying capacity approach to planning

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ABSTRACT
While purporting to enhance Australia’s sustainability, the federal government’s Population Strategy rejects the assessment of the limiting factors to future population growth, thus avoiding urgent threshold issues such as resource depletion and environmental destruction. A more forward-thinking and whole-system perspective would assess and incorporate critical biophysical limits into governance processes with suitable prioritisation. It would encourage communities to examine their individual and collective responsibilities in the context of these limits in order to most equitably optimise outcomes; and it would employ both a resource-based examination of minimum population requirements, and an impact-based assessment of maximum thresholds. This carrying capacity approach to planning could help guide society towards a more sustainable future.

Keywords: carrying capacity, population, limits, sustainability, planning, resilience

Biography
Murray Lane (Bachelor Arts, Bachelor Built Environment, Masters Architecture) has a background in Architecture, having previously worked for Allen Jack + Cottier and Delfin Lend Lease. He currently teaches architecture at QUT while completing his PhD based on carrying capacity modelling.
In May 2011, the federal environment minister, Tony Burke, released the government’s strategy for a sustainable population, “Sustainable Australia - Sustainable Communities” (Australian Government). Prior to the report’s release, minister Burke seemed to court the possibility of incorporating population limits into government policy, stating that, “we have to also take into account, do some sections of Australia have what - with my agriculture hat on - gets referred to as a carrying capacity?” (Sales, 2010). However, once the document was released any aim towards carrying capacity targets was rejected, and instead, the introduction of socio-environmental monitoring was endorsed. In so doing, the government seems to discount the possibility that as a society, we are pushing up against biophysical limits that potentially threaten modern society and that population levels are the multiplier in this challenging equation.

Rather than setting population targets, the government’s population strategy purports to aim for a more sustainable Australia by managing impacts on the current population, monitoring migration and projecting population trends (Australian Government, 2011, p.25) but these measures lack any meaningful traction without the process of identifying population limits. For instance, how is sustainability measured, if not against a certain level of certain activities performed by a certain number of people over a certain amount of time? How does merely monitoring migration contribute to sustainability? How do we know that past population trends will continue on similar paths in the future if barriers to future growth are not identified?

Despite the report’s title, neither sustainable communities nor a sustainable nation can actually be ascertained, let alone achieved, without acknowledging firstly that limits to growth do exist and secondly that there is an inherent hierarchy contained within these limits. The hierarchy adopted by the Report gives equal weighting to economic, societal and environmental interests (Figure 1). This diagram fundamentally illustrates the disconnect between the laws of nature and unrealistic expectations for unlimited, continued growth, be it economic or societal. In this diagram of overlapping interests, each sphere is discrete, implying that the economy can sometimes operate outside of society and the environment. In reality, however, the environment actually forms the biophysical context to all other aspects: all resources come from the

![Figure 1](https://example.com/figure1.png)
physical environment, all societal endeavours occur in a physical setting and all economic activity is ultimately dependant on physical components. Likewise, the economy is but one subsection of the whole society, so should be represented not as an overlapping sphere, but one that is nested. An alternative model was included in the 1996 National State of the Environment Report (p. 10-12) and has been recommended to the Sunshine Coast Regional Council by its Sustainability Advisory Panel in 2009. This committee, perhaps the local government equivalent of Tony Burke’s federal department, provide a more realistic representation of these interests with the economy encapsulated by society, which in turn, is enclosed by the environmental sphere (figure 2). This systems-based perspective recognizes that there are limits inherent in our way of life and that aspects of the economy are limited by society, be it cultural norms, ethical responsibilities or population dynamics. Additionally, society and each of its component parts including the economy are all limited by their biophysical context.

The acknowledgement of societal thresholds is reflected in the Sunshine Coast Sustainability Advisory Panel’s recommendation for subsequent constraints mapping, an aspect mirrored by other local councils such as Port Macquarie-Hastings (Hopkins et al., 2009) but omitted from the federal government’s approach. Instead, the government’s report proposes the development of sustainability indicators in a strategy that potentially places government merely in the role of passive observer rather active planner. A more responsible planning position would attempt to build the resilience of a society within its biophysical context. This approach would see government anticipating potential future systemic impacts such as finite fuel depletion and increasing harsh weather events in order to determine safe tolerance limits in human activity.

In the absence of inherent threshold limits, the federal government’s proposed sustainability indicators will most likely measure socio-environmental performance rather than sustainability because sustainability by definition relies on the establishment of limits. To measure the sustainability of any activity is to measure how long it will endure, or literally, its ability to be sustained. Therefore, in order to ascertain sustainability, firstly thresholds to un-sustainability need to be established. For instance, in order to establish the sustainability of current rates of petroleum usage, first we would need to estimate the point at which demand exceeds supply. If this point was deemed to be five years away
then it could be said that the current rate of oil usage is sustainable for only five years. As such, sustainability is the measurement of time before which a given activity at a given rate becomes unviable. Without first establishing these biophysical thresholds, the federal government will not be able to actually measure sustainability.

There is growing evidence to support the view that we are now beginning to push up against the biophysical limits that our landscapes can support. Peak oil (McNamara, 2007), climate change (Garnaut, 2008), water shortage (Connell, 2007) and population pressure (Cohen, 1995) all provide stark examples of this trend and in our complex world any one of these factors could exacerbate others. Consequently, the identification and management of these limits is one of the most pressing imperatives of our time.

Despite the federal government rejecting the validity of carrying capacity analysis, this is actually the ultimate measure by which the limits in the relationship between society and the environment can be ascertained. Planning based on carrying capacity assessment poses the question, “how many people can this land support?” This question has largely assumed to have been made redundant in industrial society as increasing resource usage and economic growth have seemingly ushered in an era of limitless plenty. In this era the spectre of biological limits has been pushed off into the distant horizon by way of expansive resource exploitation, globalised just-in-time supply chains and economically efficient technological advancement. However, the seemingly infinite capacity of the earth to support society is no longer a narrative believed by all (Lane, 2010, p.1038), as our lifestyle is being squeezed from three sides: diminishing resources, increasing population and expanding environmental impacts. These limiting factors define the carrying capacity equation.

In estimating carrying capacities, the identification of potential environmental impacts is relatively straightforward. However, the quantification of acceptable limits is challenging and the apportioning of these limits to a certain population size is even more difficult. Climate change, environmental degradation and species extinction are all likely to expand with a growing population and consumptive lifestyle but determining direct correlations in each of these examples between the amount of impact and the number of people has not yet been determined with much accuracy. The problem in quantification lies in the fact that our complex tapestry of existence is not easily able to be unwoven to determine which threads were responsible for which impacts. While difficult at the global scale, some impact-based carrying capacity estimates have been initiated at a smaller scale (Graymore et al., 2010). For instance, it may be possible to determine thresholds for unacceptable clearing of remnant vegetation or unacceptable sewage waste at a
regional or community level. In order to define limits as population carrying capacity thresholds, analysis would need to estimate the per person waste generation, determine the point at which too much waste consistently exceeds the assimilative capacity of the natural environment, and divide the later by the former. This measurement of impact per person is not a new initiative (Summers, 2004). In fact, the development of new water supplies, sewerage networks and garbage collection services already often operates in this manner. However, gaining consensus on appropriate maximum acceptable thresholds is more problematic. Hence, approaching this modelling from a small geographic scale where degrees of impact may be more plainly obvious is likely to generate more widely accepted outcomes. On this point, the Population Strategy seems to at least concur, in recommending that their sustainability indicators be applied at a regional scale (Australian Government, 2011, p.75).

Whereas environmental impact analyses present difficulties in the correlation of population thresholds with land availability, a resource-based approach to carrying capacity assessment and planning, offers far more clarity in this regard. Given that society and individuals require certain measurable inputs such as food, energy and water, the calculation of population and land requirements is more readily achievable. While limits derived from impact analysis are based on maximums thresholds, resource-based approaches are principally concerned with providing basic inputs so minimum thresholds are required. Notably, minimum resource requirements are barely mentioned in the government’s Population Strategy, and, rather than aiming to measure their availability over time, the report merely assumes that any energy, food or water shortages in the future will be dealt with by efficiency gains and technological fixes seemingly without determining their viability (p.25). The Population Report also rejects carrying capacity-based population targets as arbitrary (p.25) which misrepresents the nature of this type of modelling. Carrying capacity estimates may seem arbitrary if viewed in isolation, but this should be avoided (Lane, 2010, p.1042). For instance, it may be quite meaningless to merely state that Australia has a carrying capacity of, say, 25 million people, if the presuppositions and limiting factors are not also given at the same time. These factors might include the degree of acceptable impacts as well as the resource requirements of the population, such as their anticipated diet and consumption patterns. Once these aspects are considered, a carrying capacity estimate will be conditional but certainly not arbitrary.

The processes involved in assessing a landscape’s resource-based carrying capacity have been refined in recent years, particularly in the area of food-supply modelling. For
instance researchers from Cornell University (Peters et al., 2007) conducted a study of New York State in 2007 which tested numerous dietary choices such as meat and fat consumption against a population’s land capability. One of the aims of this study was to influence societal behaviour in its food consumption patterns in order to reduce agriculture’s environmental footprint. They found a fivefold difference in per capita land requirements across various diets. Similarly, Simon Fairlie tested the ability of the UK to feed itself (2007) and then went a step further in calculating other basic necessities such as locally produced fibre and fuel. This process involves the consideration of key societal needs, apportions land requirements on a per person basis and then estimates how many people the landscape can support. It is proposed that adding the element of interactivity to this approach could provide valuable real-time feedback in land use decision making (Lane, 2010, p.1043). Such a model would allow the user to test a population’s consumption choices and its resource production systems against the environmental assimilation mechanisms and natural constraint parameters of the local landscape. This process not only provides estimates of population thresholds but is also a scenario-based educational and decision-making tool for communities, governments, planners and individuals to test and take responsibility for possible changes in behaviour and policy before embarking on a particular course of action. For instance, carrying capacity tools could be used to estimate the degree to which urban farming could feed our cities under a range of different assumptions; it could guide us in how much food is required for a frequently flooded township; it could discern dietary choices to plan for and maximise land usage; and it could assist in our choice of future energy sources, their location and distribution networks.

Another attribute of the resource-based carrying capacity assessment process is to increase local resilience. One way to improve resilience in the face of problems such as resource depletion and climate change is to produce and account for resources much closer to where people actually live. This re-localised future reduces the demand on fossil fuels for long-haul transport, more easily facilitates recycling of materials and nutrients back to the land and helps to engender greater environmental and ethical responsibility in local populations because impacts are often more immediately obvious and behavioural correctives more willingly undertaken (Vail, 2006). The simple idea of communities aiming to live largely within the carrying capacity of their regional environment would completely transform current trends in urban design. Rather than continued densification of populations into city centres, it would facilitate a regionally-based urban settlement pattern with self sufficient rurbans (Mochelle, 2010) dotted throughout the landscape. It would demand a decision-making process where society’s population strategy, its diet, built form,
energy systems and its entire urban framework would be based primarily on the ability of
the local physical environment to supply the population’s resources and assimilate its
waste. Long-term, a carrying capacity based approach to planning implies dramatic and
far reaching consequences to where and how we live.

The biophysical limits to our societal systems will not be avoided or postponed through
either ignorance or avoidance so the ethical path is to address these issues publicly,
respectibly and with the best data and modelling resources available. If community
consensus is required in deciding how to handle the implications arising from the
population question, perhaps decision-making at a smaller scale offers the best chance
of success. In the absence of guidance from federal or state governments, it is therefore
incumbent on local government to formulate their own carrying capacity strategies to
assess their own sustainability and resilience in a post-carbon future world. Currently,
two Southeast Queensland councils, Redlands and the Sunshine Coast, have made
generalised commitments to carrying capacity ideals. When each of these organisations
release specific details in the near future, unlike the federal government in its recent
report, it is hoped that they will not sidestep the issue of discussing population limits.

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Towards Fire Resilience in Suburban Morphology

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Towards Fire Resilience in Suburban Morphology

ABSTRACT
Australian settlements have a long history of interactions with the natural but potentially destructive processes of bushfire. However, fires are highly variable in terms of their direction, intensity and impacts due to variations in weather, vegetation, terrain and other local circumstances such as active defence. Further, the nature of fires’ interactions with human settlements are influenced significantly by the nature of settlements themselves. Accordingly, it is not surprising that core principles of urban morphology relating to bushfire attack have not been developed. This paper reports the results of analysis into selected urban morphology factors relating to the impacts of fire in a suburban edge setting.

INTRODUCTION
Australia has been exposed to a range of disasters in recent times, bringing to the fore the importance of managing risks associated with the range of natural hazards that could impact upon our settlements. Recently, to name but a few instances in our own region, we have seen the 2004 Aceh Tsunami, the 2009 Victorian bushfires, the 2011 Queensland floods and the 2011 Japanese earthquake and tsunami. In such circumstances, the concept of resilience has, intuitively at least, considerable relevance to the ways that hazards are dealt with in relation to human settlements. Recent adoption of resilience principles by various tiers of government in Australia has also strengthened the case for designing and managing human our settlements in ways that can withstand a range of setbacks. Despite heightened interest, however, it is not always clear how resilience is to be achieved in meaningful and long term ways.

This paper considers resilience in relation to one hazard type only, bushfire. It aims to establish some starting principles that can provide a basis for moving to more resilient settlement patterns. In this domain of bushfire disasters there are well established research traditions in understanding bushfire behaviour and the links between topography, vegetation, and weather. Similarly, considerable investment has been made in investigating the ways that individual structures can better withstand fires. However, when an urban design approach is used to consider bushfire, it becomes apparent that the closely related concept of resistance, explained below, should also be considered. It is argued that the features of settlements that contribute to bushfire resistance require careful consideration so as to improve planning and design for overall resilience.

To consider resilience and resistance more carefully, this paper sets out understandings of relevance to suburban development and management in bushfire prone areas. The paper then goes on to highlight key elements of urban morphology relevant to bushfire. A method allowing analysis of built
form elements relating to bushfire is established, referring to key urban design principles in Australia and overseas. A brief overview of the Bendigo 2009 fire is then provided to illustrate the broader features of the ways fire commonly interacts with the urban edges. Based on case study and statistical analysis of key urban form features, results are then set out, arguing that density and site coverage have influenced house loss rates. This is used to suggest that further work is required to understand the ways that particular forms of settlement may increase the risks associated with exposure to wildfire interface areas.

FIRES, RESILIENCE & RESISTANCE

Bushfires, or wildfires, are simply „unplanned fires” in vegetation (Ellis, Kanowski, & Whelan, 2004). The impacts of bushfires upon human values are felt most keenly when they have effects upon human life and property, typically in the geographical areas where settlements are within, or adjacent to, fire prone areas. In bushland or grassland interface areas, bushfires pose a periodic and seasonal threat that represents an ongoing tension. On the one hand, fire is a normal feature of many Australian landscapes. On the other hand, potentially catastrophic results can occur when households seeking the benefits of natural landscape values are periodically exposed to highly variable and sporadic risks levels. Bushfires pose particular types of risks, whereby events are usually of low yearly incidence and predictability; yet have a high likelihood of occurrence in the long term. Since many Australians appear willing to live near areas where bushfire risks are present (Cortner, 2008, p. 3) it falls to the built environment and related professions to find ways to manage these risks appropriately.

Resilience is a concept with traditional disciplinary spheres of use: physics and engineering; ecology; and, psychology. In physics, its oldest use, the term has a very clear definition as a property of a material: its ability or capacity to “bounce back” to original shape or form after a stressor (eg see Gordon, 1978). As noted by Norris et al (2008), however, the idea of resilience has also provided inspiration in other spheres. Of considerable importance and enduring influence is Holling’s 1972 paper examining the ecological resilience of species in particular environmental contexts. Broadly speaking, psychology uses resilience to describe individuals” and communities” abilities to return to normalcy after a stressor (Bonanno, 2004; Sonn & Fisher 1998).

Key issues arise when the concept of resilience is applied to the substantive problems of urban design and planning. Most notably, the closely related concept of resistance needs to be considered alongside resilience. Resistance is the ability of a material, person or community to withstand an initial shock without significant damage or effect (Norris 2008). This is an important distinction – it draws attention to the nature of resilience as a temporal process and an ability for recovery and restoration. Fundamental to this is the recognition that some aspects of a system will have resistive properties and will not have been affected by the stressor in the first instance.
Appreciating resistance as a parallel component of overall resilience processes highlights the importance of determining which elements of a system are likely to be durable, or to use a term familiar to urban design, “robust”. This identification is premised on the process of resilience following three main stages, following Norris et al (2008: 130).

1 Pre-Event Functioning
2 Stressor Event
3 Resistance to Stressor versus Disaster
4a Resilience if disaster affected elements improve and adapt as “bounce-back”
4b Dysfunction if vulnerability persists in disaster affected elements

This research seeks to examine only one aspect of the complexity underlying disaster resilience, the characteristics of resistance or robustness. In particular, it is concerned with the elements of suburban form that demonstrate resistance to bushfire. This understanding is considered a necessary first step to the process of recovery and adaption to improve resilience over time. To begin doing this, the next section examines the features of urban morphology that can provide descriptive criteria for assessment.

MORPHOLOGY AND THE URBAN EDGE

As metropolitan and major regional areas grow quickly in Australia, proportionally greater areas have developed as fragmented, low density peri-urban settlements (Low Choy, Sutherland, B Gleeson, & Sipe, 2008). Accordingly, in combination with the greater propensity for extreme weather resulting from climate change, ever greater numbers of persons are exposed to bushfire threats (Buxton, Haynes, Mercer, & Butt, 2011). Making sure that Australian settlements can manage bushfire hazards is core to long-term resilience (Lucas, Hennessy, Mills, & Bathols, 2007).

This study assumes that urban planning and design, in combination with a range of other disciplines and agencies, can improve bushfire performance of settlements in urban edge settings (March & Henry, 2007). To do this, evidence is required to establish which features of urban design will impact upon the risks associated with settlements interfacing with bushfires. Patterns of urban settlement in fire risk areas vary by density, site coverage, road pattern, degree of isolation, and so forth. In parallel, topography, weather, vegetation and many other factors vary considerably between sites. This wide variation results in considerable spatial difference in levels and type of bushfire risk.

The study of urban morphology seeks to describe and understand the features of urban areas. Schluter (1899) divided towns into three elements: ground plans or street fabric; buildings; and building utilisation (now best described as land use). While these categories were initially directed towards
historical description and analysis (Whitehand 2001), the urban morphology
tradition is a rich one. Many more recent models and approaches now exist
such those oriented to climate, to transport, to legibility and so forth.

This initial study is concerned with only two features of urban morphology as
they relate to fire impacts: lot (or plat) size"; and, site coverage. The first, lot
size, is concerned with the size of individual land components into which
ownership has been divided. The second, site coverage, is closely related to
the first, and is concerned with the proportion of land taken by structures on a
given lot.

THE BENDIGO 2009 FIRE

Given that South-eastern Australia is in one of the most fire prone areas
internationally (Buxton et al., 2011; March & Henry, 2007), the importance of
promoting resilience to bushfire was again highlighted by the Black Saturday
Fires of February 2009. They showed the potential for extreme losses
resulting from bushfires, and demonstrated how vulnerable Australian
settlements can be (Teague, McLeod, & Pascoe, 2010). The estimated cost
in dollar terms was approximately $4 billion, including response and damage
(Teague et al., 2010). This south eastern Australian area of high bushfire
incidence and intensity includes many country settlements, but also
encompasses the sprawling edges of Greater Melbourne. Until 2010, the
climate was characterised by a decade-long year drought. Combined with the
particular topography and vegetation of Victoria, periodic bushfire is a normal
summer component of many of these bushland ecosystems (Hughes &
Mercer, 2009; Emergency Management Australia, 2004; Ramsay and
Rudolph, 2003; The Bushfire Planning Group, 2005).

The particular circumstances of Saturday 7th February 2009 are important to
understand as the context to these devastating fires. Ten years of drought
combined with a month of record-breaking summer temperatures in late
January. In the days leading up to the 7th February fires, maximum daytime
temperatures reached over 40 degrees Celcius on a number of occasions ,
culminating in a maximum of 45 degrees on the 7th itself. In association with
this were unstable overall meteorological conditions including gusty hot winds
and low humidity (Bushfire CRC 2009). In total, over 2000 homes and 61
commercial premises were destroyed, with many more damaged. Some
430,000 hectares of land were burnt, and 173 lives were lost (Victorian

The empirical section of the work reported in the following sections involved
analysis of the fire perimeters using aerial photography, reviews of
submissions to the Royal Bushfire Commission, morphological mapping of the
urban form, and on-site photography. Fieldwork was undertaken in July 2010
with some follow up visits in August and November 2010.

Figure 1 shows the fire"s progression over time. Driven by north westerly
winds of 41km/h, it moved along a south westerly axis, developing quickly into
the crowns of trees near to the point of origin while also progressing quickly
across grassland at various speeds. Spotting also occurred approximately two kilometres beyond the main fire front. The fire progressed to near the intersection of Loddon Valley and Calder Highways by 6:30pm, a total linear distance 4.7 kilometres from the point of origin (Teague et al., 2010). Importantly, this is only 2 kilometres from the centre of the regional city of Bendigo, population 105,000.

![Figure 1 – Fire Progression by Time](Image)

At approximately 6:30pm, a wind change to the south west at 35km/h drove the fire towards the northeast. The result was a long fire front (approximately 4.0 kilometres). The fire progressed unevenly in a north easterly direction making its greatest overall “width” in this direction approximately 2.1 kilometres, until approximately 7:30pm, when it was largely contained. After 6:30pm ember spotting occurred due to the gusty south westerly wind change and a number of small fires started to the northwest. One such fire resulting from ember attack began beyond the fire front at Long Gully Reserve.

The fire resulted in one fatality, 41 injuries, and 341 hectares burned. A total of 58 houses were destroyed, with many more homes and properties damaged (Teague et al., 2010).
DATA COLLECTION & ANALYSIS

To explore lot size and site coverage and their relationship to fire impacts, statistical analysis was undertaken of the Bendigo 2009 Bushfire. Three case studies were selected from portions of the fire front and flanks, within a 200m distance, being urban interface areas under threat.

![Figure 2 – Case Study Sites](image)

Four classes of fire damage were established; „dwelling destroyed“, „property damage“, „undeveloped land damaged“ and „unburnt“. „Dwellings destroyed“ were dwellings with more than 50% of the floor area destroyed and were usually not habitable as a result (Blanchi et al, 2006). Property damaged was classified as a whole value, defined as any developed property which experienced a form of fire damage, rather than a scaled percentage value of fire damage. Such a scale was outside the scope of this research. „Undeveloped land damaged“ was identified as any vacant lot that displayed any effects of fire damage. Unburnt was determined as lots showing 0% of fire effects damage.

Lot size was categorised into three subclasses; Semi-rural, Large plot size and Residential. Semi-rural was defined as lots larger than 4000m². Large plot size was defined as within the area range of 800m²-3999m². Residential
was defined as lots less than 799m². These size ranges were formulated as they were indicative of the surrounding Bendigo region.

The analysis of density and its relationship with house loss was undertaken by way of Chi-square tests. Percentage tables and grouped bar charts were developed for cases A, B & C as well as the combined data set. This was used to graphically and numerically represent the trends in a simple form. Comparisons were then made between the percentage tables and the trends contrasted between the case studies and the previous Chi-square statistics.

Site coverage was calculated by dividing the total lot coverage of a particular lot by the total lot area. Total lot coverage included dwelling, sheds and any concrete or paved surfaces such as driveways. However, water tanks, swimming pools and gravel paths were not included in the total lot coverage value.

\[
\text{Site coverage} = \frac{\text{total lot area}}{\text{total lot coverage}}
\]

The analysis of site coverage and its relationship with fire impacts was undertaken by way of one-way ANOVA tests. Stacked box-plots displaying key data points were used to visually represent the relationship between the data found for Cases A, B & C. The One-way ANOVA test was used to determine whether the three populations’ means: dwelling destroyed; property damage; and, unburnt were equal. Put simply, it tested the two variations between the categories and determined if the groups are “significantly” different.

**SITE COVERAGE**

To understand the relationship between site coverage and fire penetration, average site coverage was calculated and presented for the combined case studies. One-way ANOVA tests were applied to the combined data to test the hypothesis that site coverage has a significant relationship with fire impact.
Figure 3: A comparison of site coverage mean values and inter-quartile range for cases A, B & C.

Figure 3 shows a box-plot representing the data set for cases A, B & C. The box-plot represents the mean percentage for site coverage. The above figure highlights that an increase in average "site coverage" was seen when moving from "dwelling destroyed" to "property damage" and then onto those properties which were "unburnt". This visual representation lends support to the theory that an increase in site coverage played an important role in decreasing risk to property in a fire event, at least in the case studied.

The combined data set is important in testing propositions formulated in this paper. As it incorporates all data from each of the case studies, it has the largest sample set which may reduce errors occurred in the analysis. For this combined data set, a one-way ANOVA is calculated by Minitab and produces a p-value of 0.000. While the output is 0.000, it should be reported instead as p<0.001. Hence as it is smaller than 0.05 it may be concluded that the test is significant at the 5% level and that the null hypothesis should be rejected. The conclusion from the output is that at least one of the fire impacts" categories" means is not similar for case A, B & C.

The calculation of Fisher Method grouping displayed the grouped information as follows; the category "unburnt" is awarded grouping I, both "property damage" and "dwelling destroyed" are grouping II and "undeveloped land damaged" is classified as category III. Means which do not share the same numeral are statistically significant. The two categories classified as within group II have two different mean scores for "site coverage"; however they are not significantly different. Again this may be a result of the underlying variance in the scope of damage within the category of "property damage". Although there are two categories which share a grouping, the conclusions and results to be drawn from the output are strong. It can be concluded that there is a statistically significant difference between the site coverage for the properties which were unburnt compared to those which were damaged and destroyed. From the results of the combined data it can be concluded that a property with
increased site coverage has a decreased likelihood of being effected by wildfire.

Key findings for Site Coverage show that for lots that were unaffected by fire penetration within cases A, B and C had an average site coverage of 37.2%. Of the lots within the three case studies that experienced property damage, 23.8% was the average site coverage. Lots within case A, B and C that had „dwellings destroyed“ showed average site coverage of 18.9%. Finally using one-way ANOVA testing on the combined data it can be shown that there is a statistically significant difference between site coverage for lots „unburnt“ compared to lots „destroyed“.

The results show that the unburnt, „residential“ lots in case A, contained an average site coverage of 55.03%, 8.8% greater than all lots unburnt within case A (46.2%). Similarly unburnt, „residential“ lots in case C reported average site coverage of 36.09%, 2.08% greater than all unburnt lots within case C (34.01%). These site coverage percentages are relatively high for the area. Further, these average site coverage percentages are greater than that of the lots affected by fire, through either; „dwelling destroyed“ and „property damage“. These results strengthen the idea that a greater site coverage percentage may reduce the likelihood of fire penetration. It also may be inferred that this decreased propensity for fire penetration, is a results of the lots acting as a barrier due to their greater site coverage. Possible reasoning may include reduced vegetative fuel loads across these lots of greater site coverage.

Statistically it can be concluded that there was a significant difference between site coverage of lots for properties unburnt and those of which were damaged or had dwellings destroyed.
To understand the relationship between density and fire impact, density and burn penetration has been displayed in cross tabulations. The distribution of data has been displayed on a grouped bar chart of density type and burn penetration level, summarised at Figure 4. One-way chi-squared tests have been undertaken for each case study in order to evaluate how „close“ these observed values are to those which would be expected from a hypothetically fitted model.

Results were calculated for the combined cases; A, B & C, which is presented below in Figure 5 to provide a more complete view of the effects of density.

<table>
<thead>
<tr>
<th>Density</th>
<th>Dwelling destroyed</th>
<th>Property damage</th>
<th>Undev Land Damaged</th>
<th>Unburnt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Semi-rural</td>
<td>35.38%</td>
<td>9.23%</td>
<td>15.38%</td>
<td>4.62%</td>
</tr>
<tr>
<td>Large plot size</td>
<td>23.45%</td>
<td>19.31%</td>
<td>4.14%</td>
<td>53.10%</td>
</tr>
<tr>
<td>Residential</td>
<td>4.46%</td>
<td>9.38%</td>
<td>1.79%</td>
<td>84.38%</td>
</tr>
</tbody>
</table>

*Figure 4: Cross tabulation of fire penetration vs. density for cases A, B & C.*

Figure 5: Grouped bar chart for density and fire penetration of cases A, B & C.

Once again residential properties were most predominantly „unburnt“. Furthermore the density category of „semi-rural“ had a proportionally significant percentage of which remained unburnt.

The combined chi-squared analysis uses the combined data and Minitab produced the following output for similar categories: Chi-Sq = 194.802, DF = 6, P-Value = 0.000. For the results the P-Value of 0.000 will be interpreted as P < 0.001.
The Chi-squared test statistic is 194.802 with an associated $p < 0.001$. The null hypothesis is also rejected, since $p < 0.001$. The conclusion may be made that "density" is associated with "fire penetration". It is observed that in the category of "dwelling destroyed", as the density increased from "semi-rural" to "residential" the observed damaged or destroyed values decreased.

Key findings for density show that for lots classified as "semi-rural" (larger than 4000m$^2$), there is an increased propensity to be subject to fire penetration. Tests observed that 89.29% of "semi-rural" lots within cases A, B and C displayed effects of fire penetration, with 32.14% of those with "dwellings destroyed". The inverse result was also found with properties classified as "residential" (>800m2) having a decreased propensity to be subjected to fire penetration. Furthermore 84.3% of lots within cases A, B and C, classified as "residential" were unaffected by fire penetration, compared with "large plot size" and "semi-rural" lots which remained 53.10% and 10.71% unaffected respectively. Finally, results of lots classed as "large plot size" were situated in between "residential" and "semi-rural" in terms of fire penetration. "Large plot size" lots experienced 46.9% burn penetration through either "dwelling destroyed", "property damage" or "undeveloped land damaged". These results show that in the case of the 2009 Bendigo Black Saturday Bushfire, that density had a highly significant association with fire penetration.

From the key findings, it is evident that lower density lots with lower site coverage percentage had a greater propensity to fire penetration. With a deeper look into the specific case studies it became apparent that these lots, classified as "semi-rural", appear to act as receiving lots, assisting the fire’s progression.

The results established that of lots classified as "semi-rural"; 100% in case A, 95% in case B and 82% in case C, demonstrated fire penetration through either "dwelling destroyed", "undeveloped land damage" or "property damage". The results for the three case studies combined found that 92.3% of "semi-rural" lots demonstrated fire penetration through either "dwelling destroyed", "undeveloped land damage" or "property damage". Although results from the chi-square test from case A and B were inconclusive, tests from case C and cases A, B and C combined proved that statistically that there was a strong association between density and fire penetration.

Case C, which contains a number of varying urban densities, demonstrates the effects of "low density" lots. As shown in figure 6, the fire body travelled in a south easterly direction, penetrating many of the "semi-rural" lots within the case study boundary.
The effects of larger plots as fuel islands and fire conductors also seem consistent for many lots classified in this study as “large plot size”. “Large plot size” lots displayed substantially less propensity to fire penetration when compared with “semi-rural” plots, with; 47% in case a, 100% in case B, 44% in case C, penetrated through either “dwelling destroyed”, “undeveloped land damage” or “property damage”. Case B appears to be an extreme case, which contains predominately “semi-rural” lots.

However, Case A shown in Figure 7 which includes lots with a wide spread of densities, provides an example of “large plot size” lots appearing to encourage the fire’s penetration, similarly to “low-density” lots. As shown in figure 7, it is apparent that “large plot size” lots appear to encourage the fire deeper into the built up area.
Lots most at risk from fire appear to be situated in isolation from dense „residential“ type housing, or were situated in loosely scattered pockets. Further it appears that lots of „large plot size“ are more susceptible to fire penetration when situated next to or surrounded by a lot of „low-density“. It is also apparent that in this scenario, „large plot size“ lots which were penetrated often did not have the protection of the higher density „residential“ lots which will be discussed later. This again suggests that in the case of the 2009 Bendigo Black Saturday Bushfire, low density lots appear to have acted as receiving lots or fuel islands, encouraging the penetration of the fire.

As an inverse result to „semi-rural“ lots, lots with a relatively high density for the region, classified as „residential“ appeared in many cases to have acted as a barrier to fire penetration. The results established that of lots classified as „residential“; 63% in case A, 100% of case B and 92% of case C remained unburnt. Furthermore with reference to figure 8, case study C exhibits the effects of „residential“ lots, in both the original fire body and the secondary fire to the north east, created through the effects of spotting.
From this figure, it may be presumed that the “residential” density lots on the eastern side of the main fire body acted as a buffer after the south west wind change. This buffering appears to have limited the penetration of fire into the built up area of residential lots. Again, the reasoning behind this occurrence can only be speculative, with many possible variables.

**CONCLUSIONS**

The analysis outlined and tested two independent variables: density; and, site coverage, which have proven to have statistically significant relationships with the effects of fire penetration. In terms of **site coverage**, key findings can be summarised as follows.

- Lots unaffected by fire penetration had an average site coverage of 37.2%, while those with property damage were 23.8% average site coverage, and “Dwellings destroyed” lots were an average site coverage of 18.9%.
• There is a statistically significant difference between site coverage for lots "unburnt" compared to lots "damage" and "destroyed".

In terms of density, key findings are that:

• Lots larger than 4000m² have an increased propensity to be subject to fire penetration, with 89.29% of "semi-rural" lots displaying some negative effects of fire penetration, with 32.14% of those having dwellings destroyed.

• "Residential" properties (<800m²) had a decreased propensity to be subjected to fire penetration, with 84.3% unaffected by fire penetration, compared with "large lot size" and "semi-rural" lots which were 53% and 11% unaffected respectively.

Care must be taken to ensure that it is understood that the results do not suggest that density or site coverage are causal variables to fire penetration. However, the results do indicate that in the case of the 2009 Black Saturday Bushfire in Bendigo statistically significant relationships exist between fire penetration, density and site coverage. These findings suggest that further research is necessary into the features of fire affected communities that are resistant to fire to inform future policy making.
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Networking offline: social histories and connectivity across time and urban spaces

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ABSTRACT
This paper outlines collaborative processes used by Design School staff and students working with local communities, and the local council urban planning team in Dunedin, New Zealand. Research, concept and scenario development stages are described, along with design concept solutions, to encourage community participation in a suburban development project. Solutions are proposed and considered in light of Shedroff et al’s Experience Design, and two contemporary museological ideas, namely Mike Wallace’s (1995) claim regarding a Museum’s potential role in forging a community of public discourse, and Christina Krep’s (2008) model of ‘Appropriate Museology’. Discussion considers the role of embodied local experience, along with experience design methods as a way of enacting or practicing theory, realized through the creative process of designing.

Keywords: Responsive & inclusive public spaces & built environment

This paper outlines a design student project that interfaced with a suburb and its communities using inclusive research and design practices. With the aim of telling social and cultural histories of and through the built environment, the resulting design concepts reflect and respond to local values and communities. Research (both historic and ethnographic) and design concepts were able to connect people with their local environment and draw historical narratives into present urban spaces in personal ways.

Project Introduction and Background

Interaction Design is a subject taught to year three Bachelor of Design (Communication) students at Otago Polytechnic. The degree programme emphasizes both literacy with a wide creative skill range and the application of these creative skills through client-based projects.

The Dunedin City Council urban planning team provided the brief for Interaction Design students in 2011, with the broad aim of enabling business and community development in the main retail centre of South Dunedin, a once industry-focused and now economically depressed suburb in this small city. The student results were so successful that students were encouraged to develop and deploy some of these concepts, through internships with the Otago Institute of Design and in partnership with community organisations. This paper addresses the theme of responsive and inclusive public spaces, as it is incorporated into the research and community development processes undertaken by design students, and the highly creative, interactive and playful concept solutions that have evolved through these ongoing collaborations. It goes on to consider the solutions in light of Shedroff et al’s Experience Design, and two contemporary museological ideas, namely Mike Wallace’s (1995) claim regarding a Museum’s potential role in forging a community of public discourse, and Christina Krep’s (2008) model of ‘Appropriate Museology’. Further discussion considers the role of embodied local experience and its relevance in an increasingly networked world, considering the socially inclusive nature of urban place-based design intervention.
1. The Design Brief

Dunedin is a small city in the far south of New Zealand, once the largest city in New Zealand by population (until about 1900). Its early beginnings saw rapid growth from 1865 with the regional discovery of gold. Following the gold rush, the city experienced an ambitious architectural boom, with many remaining Edwardian heritage buildings, in various states of repair. The finest and most celebrated examples are found in either the centre city, or on the campus of Otago University, the country’s first university. Less celebrated is the industrial history of the city, despite the numerous large industrial and manufacturing companies established in Dunedin. South Dunedin is a major inner city suburb located, as its name suggests, located south of the city centre on part of a large plain, including reclaimed coastal swamp. Few trees remain however, as the suburb is a mix of industrial, retail, and predominantly small and densely packed residential properties. In February 2011 South Dunedin promoted its first Heritage Open Day, including the celebration of the suburb’s industrial heritage.

“People often don’t realise the interesting history of South Dunedin and the hidden gems in the suburb. The open day offers a great chance to go and explore,” says Glen Hazelton, DCC Policy Planner (Heritage).

The South Dunedin Heritage Open Day was one indication that there were efforts afoot to help to develop a profile and regenerate South Dunedin, for its residents and visitors alike. It began with an invitation to local residents to explore historic areas, providing an opportunity for people consider themselves as participants in history. This is the point at which students were introduced, through a site visit, to the Council’s development plans. The planners in their introduction to students, made it clear that the project did not involve gentrification, but aimed through minor street modifications and through the brief given to design students, to highlight the rich working class histories of the area for the benefit of the mainly working class residents of the suburb today. In short, the design brief promoted community inclusivity in a way that reached beyond street scaping. The planners articulated the need for all design solutions to be relevant, and respond to the local community; to recapture an historic local identity and reflect their aim to attract further visitors to the area in order to support local business owners.

2. Methods

Students began their project by identifying appropriate and inclusive methods for research and project design. Here the work of Tim Brown (Design Thinking) and Nathan Shedroff informed the students of their need to understand their audience or community from a user-centred perspective.
Shedroff et al’s model of Experience Design considers all design to propose experience. His definition of experience is one that encompasses change as well as personal involvement. “To experience something requires that we recognize an alteration to our environment, our bodies, our minds, our spirits, or any other aspect of ourselves that can sense change” (Diller, Shedroff and Rhea 2005). At the core of the Shedroff’s ideas of research-informed Experience Design, is the ability to connect with people in terms of significance and meaning. “Meaning is an attribute of experience that describes how people understand the world around them” 

Student designers engaged in three types of research: field research through User Observations, social history research through the University’s Hocken Collection: Archive and Manuscripts, and community engagement through conversations at an open day held in an empty shop, as well as subsequent relationships with individuals and community organisations.

24 student designers each conducted numerous site visits, creating observations and visualizations of visitor use of the area. Informal conversations with residents and shopkeepers broadened the student’s research and allowed the observed community to respond through personal opinion and anecdote. They visited at different times of the day, night and week to gain a collective picture of urban use. Their research method encouraged a strong emphasis on observing how people experienced their urban environment and not basing assumptions on observed demographics. Some students undertook further research into historic traces of the suburb, through the University’s Hocken Archive, reading letters, newspapers, maps and documents rich in historical minutiae.

Through this engaged, inclusive and collaborative approach, students went on to produce many (literally hundreds) of design concepts for new experiences in public spaces, based on the rich industrial, social and environmental histories of the area, and designed for frequented but poorly utilized areas of the main road and shopping area.

3. Student Design Solutions

Of the many hundred ideas, 14 concepts were developed for presentation (through concept board and oral methods) to the Urban Planning team. Three concepts were selected by the team for further development. These concepts are briefly outlined:

1. The South Dunedin Bird Hunt: This concept represents the natural history of the suburb, and enlisted the re-use of alleyway walls and empty shop windows for graphics depicting facts about the native flora and fauna of the area. Supplementing the graphics is the design of a simple game, the South Dunedin Bird Hunt, which required players to find the “fun facts” included in wall and window graphics, and complete a game board, available from many of the participating shops in the area. The game concept is designed to appeal to younger community members and visitors to the area, with successful completion of the game resulting in membership to the “fully fledged bird rangers”
The online club encourages recorded sightings of these original residents of the area, and replanting of native grasses and sedges. This concept encourages responsiveness in the contemporary built environment, by reflecting on a lost natural environment, with several options for engagement.

Figure 1: The South Dunedin Bird Hunt, student design concept

2. Suburban branding: Place-based branding formed the direction for this concept, in order to develop, and celebrate the suburb’s unique identity. The brand story celebrates the industrial heritage of the area, incorporating the casting process to create a metal “brand”, suitable for burning into wood and surfaces. Taking its inspiration from the local Gasworks Museum, this brand makes connections between local industry and social histories, in particular the contribution of articulated gas to urban dwellers. Black was chosen for the logo colour, as many of the large chain stores threatening the local retailers in the area, have distinctively bright-coloured identities. The brand story was developed into four types of visitor experiences: The Gasworks Museum; the Mayfair theatre; the area’s ethnically diverse range of food outlets; and second-hand shopping. The brand story offered to “transport people through time”, as a way of accessing a wealth of authentic local experience. A package was developed for retailers and community groups to display their membership to the brand, including window stickers, a rubber stamp, and free postcards. Of the surveyed retailers, 80% were prepared to purchase the packages, encouraging the students to develop more business ideas around the brand, such as T-shirts. This design solution provided a script for member inclusion.

Figure 2: South Dunedin brand package, student design concept
3. Oversized Objects: street furniture – Taking cues from South Dunedin’s industrial heritage, this concept developed a range of street furniture concepts, reflecting on objects that are produced locally in factories, and then scaled for human anthropometrics. Rope, bathroom fittings and railway bogies, all became inspiration for seating and tables. This concept lifts items from traditional ‘work’ environments and replaces them in public spaces, creating a both a visibility for these industries, and a reflective place for community to gather, rest and talk. The usually industrial items create a responsive public amenity, both on a personal and community scale.

![Urban Street Furniture](image)

Figure 3: Urban Street Furniture, based on oversized objects produced in local factories, student design concept

4. Experience Design as Praxis: local and connected

Through design processes and concept solutions the student designers developed their understanding through this project, of the important role of embodied and local experience. Through onsite research processes, and their many and varied social experiences in the suburb, the students abandoned their digital devices, and engaged in embodied social networking in inclusive and responsive ways. The project required personal involvement, with a particular location and with particular people.

Beyond and extending this people-centred design method, the site and community were conceived in partnership, tied in with the student’s historic research of the area, and became conceived as a museological theatre. In the words of Mike Wallace (1995) regarding the role of a Museum’s potential role in forging a community of public discourse “I urge museums to seek not simply customers but constituents, ...and to become partners with communities in effecting change; to continue to think imaginatively about new ways of saying things, and boldly about new things that are worth saying.”
Christina F. Kreps’ (2008) term Appropriate Museology considers an approach to museum development that similarly adapts museum practices and strategies for cultural heritage preservation to local cultural contexts and socioeconomic conditions. This “bottom-up, community-based approach” that combines local knowledge and resources, was adopted by the students as a method that was able to better meet the needs and interests of this particular community.

In line with these arguments, student designers included a museological approach, curating historic moments and using a story-telling approach to connect with the people and places of South Dunedin. They began to form (offline) social networks with people who shared their user experiences. In the process students and staff became users of this suburb. A network of people with interest and opinions began to form, and this was key to both the design engagement and concept solutions. This is an inclusive and responsive approach to design. Don Norman (2004) suggests that “Experience design, perhaps more than other forms of design, is transactive and transformative: every experience designer is an experiencer; and every experiencer, via his or her reactions, a designer of experience in turn.” The student designers seek a particular kind of understanding, with which to form a praxis, an active process through which a theory is enacted, practiced, embodied, or realized through the creative process of designing. In this case the understanding surrounding a particular place, its social histories, and communities, is transformed. This supports Tim Brown’s claim (2009) that “Design Thinking requires bridging the Knowing-Doing gap”.

And while still in the development phase, the projects described have become nodes in a network of time and place. This paper, while not derived from an urban planning process, has engaged with urban planning problems, from an experience design perspective. Responses to these design concepts suggest that at times, different theoretical approaches may be useful for challenging and engaging in community development, with urban planning teams and objectives. Designers are able to include people (designers and publics alike) in their research processes as well as create responsive scenarios in potential design solutions. Through design research and concept development processes, a further similarity of concerns was identified in contemporary museological thinking.
Acknowledgements:

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Heterotopias of Production
Conceptualising Productive Spaces in Post-Modern Cities

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ABSTRACT
It is widely agreed that cities need to find more efficient and sustainable ways to feed themselves and that they can no longer wholly rely on resource intensive, globally dispersed food systems. Urban actors have faced significant difficulties attempting to establish food production spaces in post-modern cities, where such spaces have effectively been excised over the last 100-200 years, and where primary production contrasts with the underlying principles of these technologically-dependent, consumption-driven societies. In order to better integrate urban food spaces into post-modern cities, there is a need to better understand the relationship of such spaces to the broader urban environment. This paper proposes that, in post-modern cities, food production spaces are heterotopic in nature. It then considers the implications of conceptualising such spaces in this way, particularly with regard to urban resilience.

Keywords: heterotopia, post-modern, urban agriculture, resilience, production

PAPER TEXT
Most cities, particularly post-modern cities, rely primarily on dispersed global food systems which consume significant amounts of resources (modern food systems require 10 calories of fossil-fuel energy to produce a single calorie of supermarket food (Pollan 2006)), and result in significant amounts of emissions (the typical Australian basket of food has travelled in the order of 70,000km to get to our stores (Gaballa and Abraham 2007)). As well as being highly unsustainable, in many cities food systems fall well short of providing an affordable, consistent, and equitable supply of healthy food to the city’s inhabitants. In an attempt to address these problems, inhabitants of many cities are turning to urban agriculture. However, the broad-scale re-integration of food systems into cities has proved to be a slow process, particularly it would seem, in post-modern cities.
The Post-modern City
Post-modern cities are defined by urban environments which, motivated by globalisation and capitalism, favour consumption over production, portray the privatisation of public space by international capital (Murphet 2004); encourage virtual rather than social engagement; are characterised by cultural diversity and social pluralism; are reflected through facades, fantasy, illusion, and simulacrum rather than spatial substance (Murphet 2004); and ultimately promote individual autonomy, often at the cost of social altruism (Murphet 2004).

The functions and spaces of post-modern cities are usually highly despatialised (Sorkin 1992), decentralised, fragmented, and dispersed, as opposed to the amalgamated and orderly spatial arrangements of the pre-modern or modern cities. This fragmentation is exacerbated by: the structure of authority in post-modern cities, which is more decentralised (Connor 2004); the organisation of post-modern economies, which are often driven by activity at the periphery to the detriment of the centre (Connor 2004), by a greater range of global actors; and by social interactions and surveillance (Hannigan 1995), which occur within multiple, rhizomic global networks via ever evolving technologies.

Food Production in the Post-modern City
Taking into consideration the characteristics summarised above, one can see that urban food production (whether in the form of community gardens, city farms, productive landscapes, rooftop gardens, or other public/semi-public gardens) contrasts with the inherent values and attributes of the post-modern city. In the first instance, as a form of production, it contrasts with the predominating culture of consumption of the post-modern city. As an inherently localised activity – relying on local investment, labour, and conditions, and resulting in local produce – urban food production contrasts with the global trade and distribution processes which enable, and result from, the post-modern city.

Furthermore, in contrast to the capitalistic foundations of the post-modern city, urban food production activities, especially community gardens, are often altruistic and socialistic in nature – whether in terms of enacting a sustainable ethic, or providing opportunities for community betterment (training, food donations, etc). The provision of such spaces also often contravenes economic rationalisation principles with regard to land values.
Also, urban food production does not rely on or favour privatisation or commercialisation of space, as is common in the post-modern city, and production is dependent on spatial substance (the qualities of space) and physicality, as opposed to illusion and simulacrum.

Finally, urban food production necessitates and encourages physical and social interaction and involvement, in ways that can not be substituted by virtual means. This attribute often results in various types of community building, in contrast to the individual autonomy which prevails in the post-modern city.

These observations illustrate that urban food production is in many ways at odds with the inherent qualities of the post-modern city. But that is not to say it is incompatible with the post-modern city. To a limited degree, various urban actors have proved successful in developing urban food production programs which recognise, respond to, and even capitalise on certain qualities of the despatialised and fragmented post-modern city. An example would be BK Farmyards– a decentralised farming network in Brooklyn, USA.

The fact that urban food production typically brings together small, diverse groups of urban actors who are often motivated by outcomes beyond (or instead of) economic returns, means urban food production concerns can adapt to and work within the frameworks established in the post-modern city. Such food concerns do not rely on centralised authority systems (in fact they typically function as grass-roots, self governing entities), they can work with multiple and dispersed economic actors (for example they can trade with individual residents, local markets, and global supermarkets groups, or not trade at all), they are often benefited by, or reliant on virtual communication networks (for communication, knowledge development, trade, and organisation), and often employ digital surveillance and monitoring processes (such as waste tracking, or resource mapping).

So it can be seen that urban food production in post-modern cities often fundamentally contrasts with the inherent characteristics of post-modern cities, yet can effectively form part of those cities. In order to understand, and work with this unique scenario, urban designers of the post-modern city could benefit from considering urban food production in post-modern cities as heterotopic. Doing so may enable urban designers to better conceptualise the role of food production so as to better design such spaces into post-modern cities, to better understand the impact of such spaces in post-modern cities, and better realise the opportunities presented by such spaces. Should such
outcomes be realised, it may mean that urban food production in post-modern cities is adopted and implemented at a more significant and meaningful scale than it currently is.

**Heterotopias**

French Philosopher Michael Foucault introduced the concept of heterotopia to describe a certain type of space, or “other space” in the urban environment. Foucault first introduced his application of the concept in his preface to Les Mots et les choses (The Order of Things) (Foucault 1966a) published in 1966, then again in a radio broadcast (Foucault 1966b) also presented in 1966, and then finally, and in more detail, at a lecture given in 1967.

When introducing his concept of heterotopias, Foucault, talking about different emplacements or spaces, explains

> I am interested in certain ones that have the curious property of being in relation with all the other sites, but in such a way as to suspend, neutralize, or invert the set of relations that they happen to designate, mirror, or reflect.

. . . (Foucault 1998, 24)

Foucault explained that these spaces are of two main types: utopias (sites with no real place), and heterotopias (real places). He explained:

> There are... probably in every culture, in every civilization, real places - places that do exist and that are formed in the very founding of society - which are something like counter-sites, a kind of effectively enacted utopia in which the real sites, all the other real sites that can be found within the culture, are simultaneously represented, contested, and inverted. Places of this kind are outside of all places, even though it may be possible to indicate their location in reality. Because these places are absolutely different from all the sites that they reflect and speak about, I shall call them, by way of contrast to utopias, heterotopias. (Foucault 1986, 24)

Commentators explain that heterotopias present a “simultaneous state of spatial and morphological anomaly” (Faubion 2008, 42), which “have an essentially disturbing function: they are meant to overturn established orders, to subvert language and signification, to contrast sameness, and to reflect the inverse or reverse side of society” (Sohn 2008, 44). They are counter spaces which underline the normality of the quotidian, yet are anomalous in terms of their social and temporal organization, as well
as visually “in the formal and monumental character of their physical spaces” (Cenzatti 2008, 77).

Shane (2011, 15) explains

the heterotopia is a specialised urban element, an enclave that has multiple interior subdivisions that can hold conflicting urban activities in the same place at the same time (often in section). It is an important place of urban experimentation and change, handling nonconforming urban activities and contributing to the overall stability of the city through its capacity to host change.

Shane went on to reiterate two of the fundamental characteristics of heterotopias:

i. they are spaces within which actors reversed significant codes to invert the space beyond – if the city was chaotic for instance, then actors sought order and calm within the heterotopia;

ii. they are places that accommodate multiple actors within the same perimeter, each with their own space and codes.

He explained that these characteristics enabled urban actors to try new combinations and experiment, without disturbing the broader „urban ecology”.

In his article Foucault explicitly identified two categories of heterotopias: Crisis Heterotopias and Deviation Heterotopias. He then alluded to another two types which have been picked up and explained further others (such as Shane (2005) and Johnson (2006): Heterotopias of Illusion and Heterotopias of Compensation. A brief description of each type of heterotopia is provided below:

• Heterotopias of Crisis

Foucault describes these as privileged, sacred, or forbidden places, reserved for individuals who are in a state of crisis, in relation to society or the human environment in which they live. Examples of such heterotopias include: the traditional honeymoon trip, boarding schools (in its nineteenth century form), and military service.

• Heterotopias of Deviation

Foucault describes these as heterotopias in which individuals whose behaviour is deviant to the required norm are placed. Examples include: rest homes, psychiatric hospitals, prisons, and retirement homes.

• Heterotopias of Illusion
Shane explains that in Heterotopias of Illusion change is concentrated and accelerated. The rules governing the local system's organization can change quickly and arbitrarily. He argues that in such spaces, the primary values are pleasure and leisure, consumption and display, not work. Examples include: theatres, museums, libraries, cinemas, shopping centres.

**Heterotopias of Compensation**

Foucault explains that these spaces are sites which are "perfect, meticulous, as well arranged as ours is messy, ill constructed and jumbled" (1986, 27). An example cited by Foucault were the Jesuit colonies founded in South America which were laid out according to a rigorous plan and where the daily life of individuals was regulated and regimented.

**Heterotopias of Production?**

It can be seen that food production spaces in post-modern cities meet the general definition of heterotopology and comply with Foucault’s six principles of heterotopia:

iii. They are, or can be, common to all post-modern cultures.

iv. They have a precise and determined function in society which has evolved and will continue to evolve as society evolves.

v. They are capable of juxtposing, in a single real place, several spaces that in themselves may be incompatible – for example: co-location of incompatible forms of production; different types of productive space (such as a Greek vegetable garden adjacent to a tropical fruit garden); or synergies between waste and production.

vi. They are linked to slices of time in that they are: places were people go to escape normal time regimes; and where activity is dictated by diurnal and seasonal temporal regimes.

vii. They presuppose a system of opening and closing that both isolates them and makes them penetrable. Even though they are typically semi-public spaces, they are often open to a broader public, but all are subjected to access requirements, which may include: seeking permission, dressing in a certain manner, observing certain protocols, or accessing through a physical barrier.

viii. They have a function in relation to all the space that remains and this function unfolds between two extreme poles: either to create a space of illusion that exposes every real space; or to create a space that is other.

This is true of urban productive spaces in a number of ways. For example, they reflect the illusion that cities can sustain their inhabitants, or they represent a space which observes regulation, routines, and spatial order which opposes normal spatial arrangements.
As well as reflecting the above principles, food production spaces can be seen to be heterotopic as they are: “other spaces” which are morphologically and visually anomalous, and which have contrasting social and temporal organisations; they are contained, multicellular spaces which accommodate numerous actors and activities and which reflect and contrast with the normal and the quotidian in which they exist; the value of these space lies outside of the economical rationales typically associated with the city’s economy; and they function outside of the usual political processes (the two latter qualities are both characteristics of heterotopias according to Cauter and Dehaene (2008)).

In his article, Foucault concludes that the most essential aspect of the heterotopia is the fact that they are contestations of all other spaces. “…they are real spaces that show reality to be the illusion, or they are perfected spaces, more rational and ordered than normal spaces.” (Boyer 2008, 54). Urban food spaces fulfil both of these criteria as they contest the illusion of the city as a place that can equitably and sustainably sustain its inhabitants, and they create a space that is ordered and regimented in a way that exposes the apparent chaos and irregularity of its context.

However, although food production spaces may reflect some qualities of the different types of heterotopia listed above (for example, they depend on strict spatial arrangements and temporal regimes (as for Heterotopias of Compensation), and they comprise logical and orderly codes (as for Heterotopias of Deviation)), they do not wholly or significantly fit within the definitions of the heterotopia types identified above, for the following reasons.

Firstly, food production spaces do not accord with the different temporal structures of other heterotopias. Temporal organisation is a defining characteristic of heterotopias – as Faubion (2008, 31) explains “they engage temporalities distinct from those engaged in the places that surround them”. Cenzatti (2008) explains that the different types of heterotopias reflect different periodisations, and different temporal structures. He explains that Heterotopias of Crisis are the predominant form in „so-called” primitive societies and that these are places where individuals temporarily retire from society until they are ready to re-enter society in a new stable position. By comparison, Heterotopias of Deviance, which Foucault associates more with modern societies (Shane 2005), are occupied by individuals on a more permanent basis, by individuals “who are not expected to return to productive and accepted roles within dominant society” (Cenzatti 2008). It could be argued that Heterotopias of Illusion, which Shane
(2005) associates with post-modern societies, have much more fleeting, and dynamic temporal structures. Food production spaces have temporal structures similar to other heterotopias (for example they are visited frequently and for relatively short periods of time, as is the case with some Heterotopias of Crisis or Illusion), but also have overlying temporal structures different to all other heterotopias, these are the temporal structures dictated by natural cycles and processes (particularly seasons and weather).

Secondly, the spatial situations of urban food production spaces are different to those of other heterotopias. Heterotopias of Crisis (such as the holiday) are either non-spatial (in that they happen outside of an individual's quotidian realm) or “hide agents of change within the standard building types of the city, masking their catalytic activity” (Shane 2005, 15) and can occur in any and all other spaces. Heterotopias of Deviance (such as prisons) are often found as spatially detached pockets located where they can be „out-of-site, out-of-mind“. Heterotopias of Illusion (such as museums) are located in fixed spaces where there are significant concentrations of individuals and usually in relation to other spaces (such as city squares or cultural precincts). Heterotopias of Compensation seem to be represented by colonies, as settlements in their own right. Urban food production spaces by comparison to all of these can exist in a great range of locations (from suburbs to city centres), taking on a great range of spatial formats (from rooftops spaces, to continuous productive landscapes), without any specific or implied relationship to other spaces, but with rigid relationships to resources. They also tend to be more open and visible than other heterotopias.

It could therefore be argued that such spaces, in post-modern cities, represent a new type of heterotopia. These spaces would accommodate notions of both discipline and illusion, the dual codes of heterotopias identified by Shane (2005), but simultaneously would be defined by codes of production, whereby a physical resource would result from the functioning of the heterotopia – this is a characteristic not exhibited by any other type of heterotopia. In addition, they would reflect, and invert normal producer/consumer relationships, and in so doing would contest and subvert normal power structures relating to globalised systems - this is a role not exhibited by any other type of heterotopia.

The Implications on Urban Resilience
Heterotopias are important and central places and institutions in the city. In fact Shane (2005) argues that in the modern networked city (Cedric Price’s Tele Citta, or Lynch’s Ecological City), the heterotopia is the dominant urban element. Exploring the concept of heterotopias enables a reading and understanding of those spaces which defy other
By considering urban food production spaces in post-modern cities as heterotopic we are provided with a more complete understanding of how they affect and are affected by the urban environment. This alone may assist with better integration of such spaces in urban areas.

Returning to the theme of the conference, urban resilience, the following begins a discussion on the implications of conceptualising productive spaces in post-modern cities as heterotopic, particularly with regard to urban resilience.

Firstly, heterotopias in general exhibit a number of inherent characteristics which are consistent with qualities of resilient systems (as described by Walker & Salt (2006) and others): they are modular systems in that they are well defined and multicellular; they bring together diverse actors, facilitate diverse activities, and can be adapted to a range of diverse situations; and they comprise strong internal feedbacks mechanisms (Shane 2005, 233).

Secondly food production spaces in urban environments can significantly improve the resilience of urban food systems, and have a range of secondary benefits to urban resilience (such as promoting improved health, enhancing social connections and interaction, encouraging innovation, providing eco-services, and so on).

Couple these qualities with other inherent characteristics of heterotopias – their role as places for controlled experimentation (Shane 2005), and as mechanisms to subvert established order (Sohn 2008) and to challenge hegemony (Allweil and Kallus 2008) – and it becomes clear that food production spaces in post-modern cities can exist as potent spaces to catalyse change towards more resilient urban environments. The more visible nature of urban food production spaces elevates their visibility and thus their potential to effect change.

There are numerous examples of urban food production spaces fulfilling these roles in post-modern cities. A prime example is the City Farmer Demonstration Garden in Vancouver. It is a suburban garden open to the public, run by a number of volunteers and workers, as well as visiting researchers. It is managed by Michael Levenston, regarded by many as one of the Fathers of Urban Agriculture. Michael is also the Executive Director of City Farmer News, a blog site that has been serving as an
educational tool to an international community (including professional, amateur, and budding urban farmers) for 33 years. As an experimental, teaching, and demonstration garden, the space perfectly realises the potential of these types of "other spaces" to provoke the norms of society and catalyse change, and in so doing to positively impact on the resilience of the urban systems within which it exists.
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Heterotopias of Production
Conceptualising Productive Spaces in Post-Modern Cities

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Transit Mode and Route Decisions Enabling Transit Oriented Development

Abstract
The contemporary approach to realising integrated land use and transit oriented development has focussed on the role of the land use planner and urban designer but the key enabling activities for integrated land use and transit oriented development can be seen as being realised in the transit planning process. The key enabling factors of interest here are the mode and system characteristics and the route and station locations.

This paper is focussed on the transit mode and system characteristics and their impact on integrated land use and transit oriented development outcomes. Flexibility versus permanency, transit corridor permeability versus segregation, open versus closed systems, urban penetration, short term transport versus longer term land use benefits and the project vision and image are explored as notable mode impacts on the urban environment.

The research is based on a review of policy and planning documents and a series of semi structured interviews with Council and GCRT staff involved in the planning and design of the Gold Coast Rapid Transit project between 1998 and 2008. This paper is based on a sub set of the authors PhD research which addresses how integrated land use and transit oriented development objectives shape the urban transit planning structure and process.

Acknowledgements
I would like to acknowledge the support of management and officers of Gold Coast City Council and the Gold Coast Rapid Transit project for their generous time and support for interviews, Bond University and Associate Professor Daniel O’Hare, GB Arrington and Gordon Price for their advice and support.

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Introduction
Delivering integrated land use (ILU) and transit oriented development (TOD) outcomes has primarily been the responsibility of land use planners and urban designers yet the critical enabling decisions are made in the transit planning process, mainly by civil engineers. The two key enabling factors in this process are the Mode and System Characteristics (MASC) and the Route and Station Location (RASL) decisions.

Decisions about MASC highlight the way in which the issues of vehicle capacity, frequency, speed and associated levels of corridor permeability/segregation have consequences for the RASL. Decisions about the RASL determine where the transit is going and where stations can be located. The route connects the stations which may be on the urban edge; in old rail corridors or adjoining other edges, rivers, arterial roads or freeways. Alternatively the route may be integrated into local road corridors enabling the positioning of transit stations where people work, live, shop or play and where a dense, mixed use urban environment or future urban renewal supports accessibility and future patronage for the transit system.

The decisions about MASC and the RASL are key transit planning decisions but they have important consequences for city building and ILU/TOD outcomes. In the Gold Coast Rapid Transit (GCRT) it can be seen that the MASC and RASL decisions are influenced strongly by the ILU/TOD objective and the related land development benefits in the corridor. This research is based on the planning and design experience of the GCRT project, a light rail project which was an initiative of Gold Coast City Council in the 1998 City Transport Plan (CTP). This one billion dollar, thirteen kilometre transit project will operate along the dense Gold Coast lineal corridor and is planned to be operational in 2014.

This paper forms one component of the authors PhD which examines the way in which integrated land use and transit oriented development objectives influence the transit planning process. The research is based on semi structured interviews with people involved in the design and planning of the Gold Coast Rapid Transit project between 1998 and 2008. The research is intended to highlight the way in which the urban transit planning process has important consequences for ILU/TOD outcomes.

Concept Design and Mode and System Characteristics (MASC)
The Terms of Reference developed in the initial planning stages of the project set the criteria to be met by the GCRT to ensure that it would provide a service that was fast, frequent and reliable and could meet initial and projected demand. The criteria included capacity, operational ability, vehicle design and characteristics, reliability, safety, sustainability and environmental impacts. The GCRT vehicles were required to satisfy standards of patronage, passenger comfort and accessibility and be economically viable in capital and operating costs (GCRT 2009c: 46). Mode options were investigated based on system capacity, proven technology, future demand, city building, value for money, level of service and community preference (GCRT 2009c: 51). Both Bus Rapid and Light Rail Transit met the criteria but light rail was able to realise the criteria with significantly less risk.

There is strong international evidence of the relationship between light rail and city building benefits such as a positive urban image and higher quality development at key nodes (TCRP Synthesis Report 20, TCRP Report 102) but when these benefits were assessed as part of the Business Case they were invalidated due to inconclusive data (GCRT 2009c: 56).
1998 – 2008 The Answer is Light Rail

The light rail concept on the Gold Coast can be traced back to the planning aspirations of the Albert Shire Council who, in the mid 1990’s, invited light rail and TOD experts, including GB Arrington, from Portland Oregon to discuss the light rail potential for their rapidly growing centres (Power: 4.1). Following an amalgamation of councils in 1995 the idea carried over into the new Gold Coast City Council.

At that time the light rail was also being considered for the inner Brisbane area and was a mode option flagged in both the 1995 Regional Framework for Growth Management and the 1997 Integrated Regional Transport Plan. The Gold Coast Line Haul Foundation and Feasibility Study in 1998 determined mode and route options for the city and in September 1998 the Gold Coast City Council release the CTP which outlines the light rail project attracting national attention. Council and the State commence the “Gold Coast Light Rail Feasibility Study” in 2004 and this informs the formal investigation for the GCRT from 2006.

The advocacy for the light rail project is a consistent theme through the commentary of senior Council land use and transport planning officers. The Director of Planning Environment and Transport, Warren Rowe notes that from the beginning “… the answer was always light rail, and very early in the piece we adopted the, whenever anyone asked, whatever the question was, it was always light rail” (Rowe: 7.18). The first manager for transport planning and architect of the CTP, Ken Deutscher (1997/98), explains that the light rail concept had a practical and symbolic function, “… to send a message that things were going to be different it [CTP] was launched always as a light rail project because transport planning knowledge was pretty clear that this was the appropriate mode” (Deutscher: 3.2).

The second manager for transport planning, Rod Grose (1998/2010), establishes the project financial case and funding framework demonstrating Council’s serious bid for the project. Council’s proactive role on the light rail can be contrasted with that of the State, where the light rail was being ‘pushed from the Gold Coast end and ignored at the Brisbane end’ (Grose: 1.14). The State’s position is shaped by their experience in Brisbane where there had been success with the busways whilst a series of light rail proposals for the city had failed.

The State’s position was reflected in the Concept Design and Impact Management Plan (CDIMP) and Business Case process which required a detailed evaluation of both Bus Rapid Transit (BRT) and Light Rail Transit (LRT). Earlier investigations had established that in principle both BRT and LRT met the transport needs of the corridor. Other modes such as monorail were evaluated and eliminated as was the option of tunnelling.

Connecting the mode to a higher level vision

Whilst the CDIMP and Business Case tend to deal with the mode as a transport issue the commentary reflects a wider range of factors in the mode decision (Deutscher: 3.15, Case: 12.15, Kozlowski: 10.10). Council has tied the light rail, from its conception to a bigger, wider ‘city building’ vision for the city (Grose: 1.3, Deutscher: 3.9). The light rail is a vehicle for change and was always about realising a range of policy objectives (Rowe: 7.2) and it is these City Building objectives that become a key feature of the successful bid for $365 million of Infrastructure Australia funding from the Federal Government (Boersma: 9.6).

Council’s advocacy for light rail in the urban environment is well supported by international research such as the TCRP Synthesis Report 20 which highlights the symbiotic relationship
between rail transit and positive land use outcomes (TCRP 1997). The shaping of the project from the mid to late 1990’s is also a time when the ideas of New Urbanism, Smart Growth and Transit Oriented Development are developing and it is evident that these ideas are influential in the thinking of leading Gold Coast planners. This is also reflected in Council’s significant contribution to regional land use and transport policy at this time (Power: 4.8, Rowe: 7.8, Papageorgiou: 6.10).

GCRT Project Director, Tim Poole notes the way in which the mode characteristics came into play with the land use objective and the economic costs and benefits associated with the permanency of the system (Poole: 13.6). The issue of residual land value comes into this equation in an unprecedented way when Treasury count the residual land value in the business case (Grennan: 13.4).

The evolving theme around the mode and system characteristics is the growing focus on a higher level vision to enhance the corridor environment and to realise the significant, albeit longer term redevelopment opportunities. In this respect the design approach may be more aptly described as “Development Oriented Transit” (DOT) with the active focus on the mode as a catalyst for development and urban renewal. This is in contrast to the TOD approach which is by definition development oriented to transit.

The corridor was seen as “good territory to put the transit in” (Deutscher: 3.10), the power of the beach as a real estate anchor is important (Bitzios: 2.49) and there is already “heaps of development” (Grose: 1.18) and it is the right type of development (Papageorgiou: 6.18). Sections such as Southport are seen as sites for urban renewal and the light rail capacity for redevelopment in Southport is an important political driver for the project (Baildon: 5.11). The faith in light rail as a catalyst for change in this environment is highlighted by the support of the development industry (Power: 4.14).

The distinction between DOT and TOD clarifies the particular approach to the design of the light rail transit in the Gold Coast urban environment, one where the development is not subordinated to transit; rather, it shapes the transit design.

The project can be seen to evolve in response to its unique urban environment and the unusually strong planning and urban design values. However this underpins a view that those outside the project space were not understanding the higher level vision, that they were not ‘getting it’ (Bitzios: 2.39, Brooke: 2.40, Power: 4.4, Rowe: 7.9, Carroll: 8.7, Chang: 11.9, Molhoek: 14.10). People did not understand the light rail because they had not seen it (Bitzios: 2.39, Brooke: 2.40, Chang: 11.9) or they were not looking to the future (Molhoek: 14.4) they were uninformed about the problem (Carroll: 8.7) or they do not understand the scale of change in the city associated with the project impacts (Rowe: 7.19).

The views of those involved in the planning and design of the project develop over time and Council’s advocacy for the land use objectives becomes an evolving theme as the project develops but it is evident that many outside the project space do not “get it” reflecting the growing realisation that the GCRT was going to be more than just a transport project.
Image of the Mode
The higher level vision for the project, that is a vision of transit beyond its pure transport function, poses a challenge with people ‘getting it’, alternatively the public attention is focused more on the visual imagery of the mode in the urban environment.

The consultation results show community support for the light rail (GCRT 2009d). As the CDIMP and the mode debate progress firstly Queensland Transport and then the bus lobby respond to the image issue with visuals of the BRT looking very similar to the LRT, “almost building a light rail system with a motor and tyres” (Brooke: 2.25),

In the imagery of the project they looked similar, the vehicles looked similar the stations looked similar. The other day there was an article about the extensions of the light rail and the vehicle in it was the bus... (Chang: 11.11)

On the whole the imagery associated with the system is not a major driver within the project but it is seen as an important issue for the community and the project can be seen to have responded to this. The issue of light rail over bus is also seen as symbolic for the city, its meaning in terms of the value of the city, what the city deserves (Molhoek: 14.16).

GCRT Communications Manager, Anna Carroll notes how the ‘sophisticated’ and ‘sexy’ transit image is considered very important to the wider community (Carroll: 8.12). The light rail is seen as fitting with a desirable image for the city and this resonates with politicians and in the community (Poole: 13.10, Molhoek: 14.15, Power: 4: 16, Papageorgiou: 6.30).

The light rail capacity is associated positively with improved traffic impacts and a better pedestrian experience in Surfers Paradise (Gross: 1.10) although this can be contrasted with the scenario being promoted by opponents to the light rail which focussed on the older tram systems where trams congest the road space (Power: 4.6, Seymour Smith: 16: 10).

The overall image and perception of the light rail resonates with the wider community and shapes the project over and above its transport task as part of a desirable vision for the city, even if the project and the community have different understandings of what that actually is. The light rail image is seen as a good fit with the desirable image of the city, one supporting transport and tourism and the wider city building objectives for the city.

Mode Cost, Flexibility and Permanency in the Urban Environment
The mode debate was substantially shaped in the early days of the CDIMP process by two leading Australian transport academics, Professor Peter Newman and Professor Graham Currie who were each invited to address Councillors on the benefits of LRT and BRT options respectively. In April 2007 Newman spoke on the light rail transit benefits emphasising its permanency and positive impact on land use and the urban environment (Newman: 2007). In May 2007 Professor Graham Currie spoke of the benefits of Bus Rapid Transit noting that it was cheaper at one fifth of the LRT construction cost and cheaper to operate, as an open system would require no forced transfers and had flexibility benefits with the ability for on street running compared to the permanency of light rail (Currie: 2007). In these two key presentations the mode debate was significantly defined.

The issues of cost, flexibility and permanency are consistent themes in the debate but it is apparent that the respective strength of the bus/BRT option as cheaper and flexible is viewed negatively in the context of Council’s vision for urban change, “one of the
advantages of the bus, also one of its key disadvantages, is in its flexibility” (Bitzios: 2.29). Alternatively it is the permanency of light rail that supports the longer term land investment objective (Case: 12.12, Molhoek: 14.11, Power: 4.15). GCRT Project Director, Tim Poole, notes that light rail permanency underpinned the confidence about the business and land use planning benefits in the mode evaluation process (Poole 13.6). After the mode evaluation is complete the LRT and land use relationship is then a key element in the projects funding submission to Infrastructure Australia (Carroll: 8.6, Boersma: 9.6).

The advocacy for the BRT as a cheaper and flexible transport alternative to the LRT can be seen as out of alignment with the objectives of Council, and later the Federal Government, to realise the project not only as a transport project but to also realise wider city building and urban transformation outcomes.

### Transit Corridor Permeability as a TOD enabler

The permeability of the transit corridor is a feature of the MASC impacting on route and station locations (RASL). Transit Corridor Permeability (TCP) refers to the way in which the transit corridor integrates into an active urban environment and the ability for people to move through and over the corridor space so that the transit is not a barrier to other activities. TCP can be seen as a key factor in the RASL on the edge versus the urban centre.

TCP is related to MASC through capacity and frequency characteristics. The normal light rail capacity of 250 to 300 plus people compared to a traditional bus carrying 50 to 70 people, or a larger BRT carrying 100 to 150 people result in different capacity outcomes and different frequencies. Low capacities require higher vehicle frequencies hence a higher degree of segregation (Gross: 1.22, Chang: 11.13, Seymour Smith: 16.9). The frequency and speed of vehicles and the importance of time efficiency and reliability in the system can be a consequence of the system being open or closed, i.e. does the system cater for a set number of vehicle movements or can all vehicles access the system? In the GCRT the BRT system was proposed to be closed however the thinking about BRT design options is influenced by the open Brisbane and Adelaide BRT systems and international BRT where the transport objective has been efficiently realised in highly segregated corridors.

A fully segregated system is associated with greater system capacity (Seymour Smith: 16.10) and there are “far greater efficiencies” associated with the open bus system to the point that “it is very difficult to see how it would stack up as a closed system’ (Bitzios: 2.31).

The idea of a permeable transit system was embraced as one of the key objectives within the project from an early stage: “…we had already got rid of the overhead monorail concept, we had got rid of any notion of tunnelling and got rid of the idea of creating any strong barriers” (Poole: 13.11). This is a response to the vision of a transit system running substantially in a dense and active urban environment (Deutscher: 3.16, Seymour Smith: 16.13) and to provide access to the centre so that city building and land development objectives can be realised (Seymour Smith: 16.14).

Looking at international case studies there are many light rail systems that run into dense urban centres but the project found it difficult to find BRT systems that achieved the same level of urban penetration (Chang: 11.14). The Brisbane bus experience is an international best practice transit system but its efficiency is a consequence of its segregation and was not seen as unsuitable for the Gold Coast project (Poole: 13.11). GCRT Engineering Design
Leader, Leon Seymour Smith notes the problems of segregating the system, and the need “to support active modes and look at more sustainable travel patterns by integrating it at ground level” (Seymour Smith: 16.18). Corridor permeability is also associated with the capacity to have other social and economic activities adjoining the system:

... the important thing is that station is permeable and the station itself is a public space... There are a few examples in Strasbourg and Amsterdam. I saw tram station that was absolutely adjacent to a vegetable shop the guy had the stalls outside and you stepped of the tram right into that shop and I thought oh my god this is fantastic... it is critical not to segregate and to make it a public space with active frontages and people congregating, sitting (Kozlowski: 10.17).

The importance of the transit integrating into and enhancing the social and economic life of the city ties into the European imagery that was important in the community support for the project. The commentary shows the land use objective evolving through the course of the project development with civil engineering objectives aligning with the preferred urban design outcomes. The city building objective is realised in the commitment to the permeability of the system to recognise complementary activities that can occur in close proximity to the system (Bitzios: 2.24, Seymour Smith: 16.13, 16.14).

Centre versus the Edge
A key issue in the discussion following the TCP and MASC discussion is the importance of mode penetration into the centre of the urban environment. The urban design objective was a significant factor in ensuring that transit would run in the urban centre, not the edge.

Council realised this objective partly through the shaping of the urban design framework for the CDIMP which emphasised three key objectives: Transit Oriented Community, Placemaking and Green Boulevard. Chapter Five of the CDIMP drives the urban vision for the project. GCCC Urban Design Team Leader, Dr Marek Kozlowski, notes the significance of the mode in this vision: “Trams are a mode that integrate much better than bus. You have heaps of good examples of trams in Europe, and they have very good integration with pedestrians, with the surrounding uses, you cannot picture that with a bus...” (Kozlowski: 10.7)

The issue of mode integration in the urban centre is tied to walkability, accessibility and lifestyle objectives (Brooke: 2.36, Deutscher: 3.15, Case: 12.13). The walkability defines the development catchment (Baildon: 5.11, Papageorgiou: 6.19) and the qualities of the light rail: fixed track, manoeuvrability and amenity, are qualities cited as factors in achieving urban penetration and accessibility (Grose: 1.27, Brooke: 2.36).

The issue of mode penetration into urban centres was a key design issue for the project but it is in Southport, the business hub for the Gold Coast, that the mode and route issues came to a point for the project and the community. One route option, Marine Parade, ran on the outer edge of the centre with fewer impacts, costs but provided low accessibility and development potential. The second route option, Scarborough Street, was the main street of the centre with significant costs, risks and impacts but higher accessibility and significant development potential. GCRT Project Director, Tim Poole, highlights the significance of this decision and the relationship between the mode and route:
Our first real test of the design of the system, the integration with light rail, was making the tough decision about going through the centre of Southport rather than on the edge and that is where we introduced the notion to the community that this is about taking people to where they want to go, and Council’s planning in the heart of Southport around very dense land use, and this was a way of activating that. That is when, certainly within the project team and to a lesser extent within the community, we started to understand that this was being designed as part of the future of the city and then when it came to justifying why light rail instead of BRT it started to become easier (Poole: 13.7).

The commitment to light rail as a vehicle for land use change becomes very clear within the project at this stage but communicating this to the wider community runs up against vested interests and genuine concerns. The Southport Chamber of Commerce campaigned strongly for bus/BRT and they wanted the route to run around or even under the centre: “Some of them [Southport] thought that transport is better at the back of the city, rather than the centre of the city... If it was a BRT maybe there could be an argument behind that but with a light rail it should go in the central part of the city” (Kozlowski: 10.13). PET Director, Warren Rowe, asked if he could see BRT running down Scarborough Street, states: “I can, but it is the lesser by a long way to get the sort of land use outcomes” (Rowe: 7.20). The determination to run to in centre is also associated with an appropriate level of accessibility: “It’s about putting the transit where people want to be and where people want to use it. There is no sense putting a system that stops ten or fifteen minute walk out of Southport, because people just will not walk the ten or fifteen minutes” (Gross: 1.29).

To resolve the route decision for the project the community were invited to participate in consultations on the options and to vote on the two route options. The matter was decided in favour of Scarborough Street but this raised an interesting problem as the mode issue had not then been resolved and the vision was for LRT to run in that constrained corridor to realise the accessibility and the land development potential in that space and to ensure an appropriate level of permeability (Chang: 11.14).

In the Southport debate it becomes clear that the mode, route and land use objectives are inextricably linked for those shaping the planning and design of the project. For Council the permeable light rail running in a “Main Street” urban environment is the key to the bigger vision of urban renewal, supporting an accessible transit oriented, walkable lifestyle.

**Mode and System Characteristics Conclusion**

This research finds that Council has a firm view in favour of light rail underpinned by the need to realise integrated land use and transit oriented development outcomes and this shapes the transit project from its conception. The integrated land use objective can be seen to evolve and shape the project in its mode and system characteristics and route and station locations.

The modes are promoted differently, BRT as cheaper and flexible, LRT as more expensive but higher capacity, fixed and permanent. Within the project the issue of permanency underpins the confidence that the light rail is able to be a catalyst for land use change and is considered more favourably than the flexibility of the bus. The ‘city building’ vision is not perceived to be well understood but the positive LRT image with its European look and feel aligns with the desirable image for the city and supports the urban nature of the project.
References


Personal interviews conducted between February and June 2011: Arrington, GB; Baildon, G; Bitzios, A; Boersma, A; Brooke, S; Carroll, A; Case, B; Chang. M; Deutscher, K; Grennan, P; Grose, R; Kozlowski, M; Molhoek, R; Papageorgiou, M; Poole, T; Power, D; Price, G; Rowe, W; Seymour Smith, L.
Towards a sustainability indicator set for Australian cities

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ABSTRACT
The Australian Sustainable Built Environment Council (ASBEC) established the “Cities for the Future” project in 2009 to set out in practical terms what impact changes to urban form, land use and transport will have on greenhouse gas emissions, economic outcomes and liveability in Australian cities. It is anticipated that the outcomes of this project will help identify the benefits of various urban scenarios and potential optimal urban forms to inform public policy and government decision making. This paper discusses the process of developing a set of urban sustainability indicators, with the ultimate objective of deriving an indicator-driven “dashboard” to enable testing of contrasting policy scenarios, planning strategies and design models to support Australia’s resilient “Cities for the Future”.

Keywords:
Sustainability indicators; urban form; land use; public policy

1. Introduction
In 2009 the Australian Sustainable Built Environment Council (ASBEC) initiated the “Cities for the Future” project, which aims to set out in practical terms what impact changes to urban form, land use and transport will have on greenhouse gas emissions, economic outcomes and liveability in Australian cities. ASBEC is the peak body of industry and professional associations and NGOs committed to the sustainable planning, design, delivery and operation of the built environment. The Task Group formed to oversee the project comprises representatives from the Green Building Council Australia, Australian Institute of Architects, Australian Conservation Foundation, Property Council of Australia, Planning Institute of Australia and Association of Consulting Engineers Australia. The goal is to “identify the costs and benefits of various urban scenarios and potential optimal urban forms to inform public policy and government decision making” (ASBEC, 2010).

The first stage of the project focused on urban transport and greenhouse emissions, based on findings from independent research conducted by the Allen Consulting Group, Veitch Lister Consulting (VLC) and the Urban Research Program (URP) at Griffith University. The present author was subsequently engaged to provide a critical overview of key Australian and international research findings to identify common variables within the domain of “quadruple bottom line” (environmental, social, economic and governance) urban sustainability, and to review the current state of the art of urban sustainability indicators to define a set of 20-30 potential metrics in the context of the above domain.

An indicator can be defined as a measurable parameter which not only signifies the state of a phenomenon as a snapshot in time, but viewed longitudinally reveals the direction that phenomenon is heading and how far it is from a given start- or end-point. As the principal objective of a sustainability indicator is to inform public policy-making, its
usefulness typically relies on a three-way trade-off between scientific rigour, political effectiveness and democratic legitimacy.

2. Development of a draft indicator set

Work on urban environmental indicators goes back more than 30 years. Projects aimed at assessing city performance against a wider range of “triple bottom line” sustainability metrics were initiated in the 1980s and 90s by the World Health Organisation, the UN Environment Program and UN Centre for Human Settlements, and by many individual cities under the aegis of the Agenda 21 process advanced at the 1992 Rio Earth Summit.

The term “triple bottom line” captures three key, interconnected domains of sustainability – environmental, social and economic. The rationale for including a fourth bottom line of governance – defined as the statutory, regulatory, business, administrative and political processes which determine or influence decision-making and actions – is reinforced when the objective is policy, planning and design intervention rather than mere observation. It is also consistent with the Australian Bureau of Statistics framework where progress across these four domains is measured against the outcomes of societal aspirations (ABS, 2010). Sustainability is not a static end-state, but an evolving attribute of the dynamic environment/economy/society complex. Governance in this context implies a philosophy of adaptive management, an iterative approach which involves learning from the outcomes of a previous application of policies and plans to inform and improve the following round of implementation.

The development of an indicator set typically proceeds from the general to the particular: from the overall concepts (in this case the four sustainability domains of environment, society, economics and governance), to the key dimensions, to the specific, measurable indicators. The dimensions serve to organise and contextualise the indicators. In this case, review of recent literature (for example Blair et al, 2004; Kenworthy, 2006; UN, 2007; ABS, 2010; Kelly, 2010; Major Cities Unit, 2010; Roux and Stanley, 2010; Stiglitz et al, 2010) enabled a synthesis of seven distinct dimensions: Population dynamics; Environmental integrity; Energy and climate change; Access and amenity; Wellbeing; Economic prosperity; and Governance and citizenship. Resilience, or the ability to maintain system function in the face of external perturbation, was identified as an overarching system property pertinent to all dimensions.

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1 That is, which relate to “development which meets the needs of the present without compromising the ability of future generations to meet their own needs” (WCED, 1987).
Six Australian and four international sustainability indicator sets were then reviewed to derive a “master set” of 300 discrete indicators, excluding those which pertain to phenomena inapplicable to urban areas or which relate specifically to developing countries. This master list was assessed qualitatively against the criteria of feasibility, consistency, validity, openness, responsiveness, robustness, simplicity, relevance and holism, derived from the literature (Newton et al, 1998; Von Schirnding, 2002; OECD, 2003; Ehling and Körner, 2007), and reduced to a set of 30 core indicators of sustainable urban development. Particular consideration was given to the Bellagio Principles concerning selection of sustainability indicators (Hardi and Zdan, 1997).

This draft indicator set and supporting material formed the basis for discussion and further development at a workshop conducted by ASBEC in Sydney in late 2010. Invited stakeholders comprised some 40 representatives of built environment professional and industry associations, Commonwealth and State (NSW, Victoria and Queensland) agencies, NGOs and the private sector. Workshop participants decided that the indicator framework should align with the Council of Australian Governments (COAG) Reform Council’s National Objective and Criteria for Future Strategic Planning of Capital Cities – “To ensure Australian cities are globally competitive, productive, sustainable, liveable and socially inclusive and are well placed to meet future challenges and growth.” (Department of Infrastructure and Transport, 2011). This is also in broad alignment with the quadruple bottom line perspective discussed above. Accordingly the seven top level dimensions for the second draft of the indicator framework were revised to read:

- Economic prosperity (“globally competitive, productive”)
- Land use and transport
- Natural resources
- Biodiversity and ecosystem services
- Wellbeing (“liveable”)
- Equity and affordability (“socially inclusive”)*
- Governance (assumed rather than explicitly stated in the COAG objective)

The workshop also identified a series of separate themes under each dimension, for example “Equity and affordability” incorporates cost of living, housing and population themes. In addition, the initial set of 30 indicators was extensively revised and expanded to 76. The framework arising from the workshop may thus be summarised as follows: Dimensions (x 7) → Themes (x 32) → Indicators (x 76).

3. Refining the indicators – multi-criteria analysis
Clearly the above structure is too unwieldy to implement in practice. Multi-criteria analysis (MCA) was identified as a means to reduce the indicator set to the specified 20-30 practical metrics. MCA is a mathematical tool for comparative assessment of options, which can account for several criteria simultaneously (Mendoza et al, 1999).

MCA visualises an optimal indicator set in terms of several desirable characteristics or categories. These categories tend to be multi-dimensional, therefore each is best described in terms of a number of specific criteria which together provide a full explanation of the given category. The categories are not necessarily equally important; hence each is given a percentage weight to indicate its relative importance. The combined category weights must add up to 100%. Next, each indicator is scored against the individual criteria associated with each category. This involves the application of a numerical rating (e.g. 1 to 5) where the higher the score, the more closely the indicator aligns with the given criterion. The MCA method used for this project was a simplified additive model which assigns a numerical value to each indicator based on multiplying the category weights by the sum of the scores for each of the criteria. The weighted category values are then summed to give a final numerical value for the indicator:

\[ V(q) = \sum_i W_i(q) \sum_j S_{ij}(q) \]

where \( V(q) \) is the numerical value for indicator \( q \), \( W(q) \) is the category weight and \( S(q) \) is the criterion score for each indicator.

When these calculations are completed for all indicators, the final stage of the process is to rank the indicators from highest to lowest according to their numerical values. A cut-off point may then be applied, with indicators falling below this point being discarded. The categories and criteria illustrated in Table 1 below are derived from a synthesis of the SMART\(^2\) criteria and the Bellagio Principles (Hardi and Zdan, 1997).

**Table 1: Categories, weights and criteria employed in the multicriteria analysis**

<table>
<thead>
<tr>
<th>Category</th>
<th>Weight (%)</th>
<th>Criteria which qualify and explain the categories</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purposefulness</td>
<td>25%</td>
<td>Focused</td>
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<tr>
<td></td>
<td></td>
<td>Implementable</td>
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<td></td>
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<td>Meaningful</td>
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<tr>
<td>Efficiency</td>
<td>15%</td>
<td>Simple</td>
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<td></td>
<td></td>
<td>Accessible</td>
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</table>

\(^2\) Simple, measurable, accessible, relevant and timely.
<table>
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<tr>
<th>Effectiveness</th>
<th>30%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Practical</td>
<td>Measurement is standardised to facilitate comparison</td>
</tr>
<tr>
<td>Measureable</td>
<td>Statistically verifiable, reproducible and shows trends</td>
</tr>
<tr>
<td>Relevant</td>
<td>Directly addresses agreed issues of concern</td>
</tr>
<tr>
<td>Timely</td>
<td>Able to capture change at the relevant timescale to determine trends</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Communicability</th>
<th>20%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clear</td>
<td>The information conveyed can be understood by a wide range of users</td>
</tr>
<tr>
<td>Transparent</td>
<td>Data collection and analysis methods are readily comprehensible</td>
</tr>
<tr>
<td>Explicit</td>
<td>Uncertainties in data and interpretation can be made apparent and minimised</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Responsiveness</th>
<th>10%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adaptable</td>
<td>Responds to change and uncertainty</td>
</tr>
<tr>
<td>Scalable</td>
<td>Aggregated city scale data are valid at State and national scale</td>
</tr>
<tr>
<td>Replicable</td>
<td>Data collection and analysis methods can be repeated across different urban jurisdictions</td>
</tr>
</tbody>
</table>

Application of a cut-off point of 70 reduced the workshop indicator set to 54 (see Appendix); as a result two themes also dropped off the list – Happiness, and Participation (with respect to Governance) – because the associated indicators were considered unmeasurable. While 54 still exceeds ASBEC’s nominated figure of 20-30, MCA ranking offers a rigorous way to prioritise indicators in terms of scope (i.e. dimensions or themes). For example selecting the three most highly ranked indicators for each dimension gives a set of 21, and selecting the top indicator for each theme gives a set of 29. The ASBEC Cities for the Future Task Group will meet in August to finalise the indicator set, based on the relative MCA rankings and consensus around the importance of the various themes.

4. Conclusions

A project such as this begins with a shared image of a city transitioning towards sustainability. This in turn enables definition of the key conceptual dimensions of sustainable urbanism, which are reflected in the real, measurable dimensions of urban form – spatial, material, energetic and informational. The sustainable city is acknowledged as a dynamic and complex eco-socio-physical system, planned and managed with the objective of optimising the efficiency of resource inputs, minimising waste and pollution outputs and maximising closed loop cycles of materials. Urban spaces are robust – able to be used for a variety of purposes – and resilient – able to be modified to respond to the risks of climate change and natural hazards as well as the evolving needs of their users. Urban governance demonstrates both the ability to rapidly deal with the unexpected, and a capacity for gradual, organic change which regulates demand for large-scale redevelopment and its concomitant environmental and social impacts. The destination thus informs the tools needed to measure – and define – the parameters of the journey.
Acknowledgement: this project was funded through the Australian Sustainable Built Environment Council.

References


APPENDIX

The ASBEC draft urban sustainability indicator set ranked via multi-criteria analysis. The cut-off point is set at 70; 22 indicators (and two themes) fall below this point and have been discarded, leaving 29 themes and 54 indicators under seven dimensions.

<table>
<thead>
<tr>
<th>DIMENSION</th>
<th>THEME</th>
<th>INDICATOR</th>
<th>RANK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wellbeing</td>
<td>Health</td>
<td>Number of hospital beds per 10,000 population</td>
<td>95.67</td>
</tr>
<tr>
<td>Natural resources</td>
<td>Carbon/energy</td>
<td>Greenhouse gas emissions by industry sector</td>
<td>95.33</td>
</tr>
<tr>
<td>Economic prosperity</td>
<td>Employment</td>
<td>Employment participation rate</td>
<td>94.33</td>
</tr>
<tr>
<td>Wellbeing</td>
<td>Security</td>
<td>Road traffic accident fatalities and Injuries</td>
<td>93.33</td>
</tr>
<tr>
<td></td>
<td>Health</td>
<td>Number of doctors per 10,000 population</td>
<td></td>
</tr>
<tr>
<td>Natural resources</td>
<td>Air quality</td>
<td>Exceedences of fine particle (PM$_{10}$) health standards</td>
<td>92.67</td>
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<tr>
<td>Land use and transport</td>
<td>Land utilisation</td>
<td>Proportion of land allocated to different land use zones</td>
<td></td>
</tr>
<tr>
<td>Natural resources</td>
<td>Materials and waste</td>
<td>Solid waste to landfill by source, (municipal, C&amp;I and C&amp;D) per capita</td>
<td>91.00</td>
</tr>
<tr>
<td>Wellbeing</td>
<td>Security</td>
<td>Homicide rates per 100,000 population</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Health</td>
<td>Life expectancy at birth</td>
<td></td>
</tr>
<tr>
<td>Governance</td>
<td>Transparency and reporting</td>
<td>Publication of annual sustainability report</td>
<td>90.67</td>
</tr>
<tr>
<td>Natural resources</td>
<td>Carbon/energy</td>
<td>Residential electricity consumption</td>
<td>90.00</td>
</tr>
<tr>
<td></td>
<td>Water resources</td>
<td>Potable water consumption by sector</td>
<td>89.67</td>
</tr>
<tr>
<td>Wellbeing</td>
<td>Security</td>
<td>Rates of assault and break and enter per 100,000 population</td>
<td>89.33</td>
</tr>
<tr>
<td>Governance</td>
<td>Corporate governance</td>
<td>Number of organisations with a certified environmental management system</td>
<td>88.33</td>
</tr>
<tr>
<td>Governance</td>
<td>Transparency and reporting</td>
<td>Publication of financial information</td>
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</tr>
<tr>
<td>Economic prosperity</td>
<td>Household income</td>
<td>Weekly household income</td>
<td></td>
</tr>
<tr>
<td>Natural resources</td>
<td>Water resources</td>
<td>Potable water quality – exceedences of Australian Drinking Water Guidelines</td>
<td>87.67</td>
</tr>
<tr>
<td></td>
<td>Materials and waste</td>
<td>Percentage recovery of municipal, C&amp;I and C&amp;D waste</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Carbon/energy</td>
<td>Residential gas consumption</td>
<td></td>
</tr>
<tr>
<td>Biodiversity and ecosystem services</td>
<td>Inland water bodies</td>
<td>Exceedences of surface water quality guidelines</td>
<td>86.33</td>
</tr>
<tr>
<td>Economic prosperity</td>
<td>Education and training</td>
<td>Proportion of adult population with vocational or higher education qualification</td>
<td>86.00</td>
</tr>
<tr>
<td>Biodiversity and ecosystem services</td>
<td>Green infrastructure</td>
<td>Percentage tree cover</td>
<td></td>
</tr>
<tr>
<td>Equity and affordability</td>
<td>Cost of living</td>
<td>Consumer Price Index</td>
<td>85.67</td>
</tr>
<tr>
<td>Economic prosperity</td>
<td>Household income</td>
<td>Net household savings</td>
<td></td>
</tr>
<tr>
<td>Wellbeing</td>
<td>Health</td>
<td>Residential aged care places per 1000 population</td>
<td>84.67</td>
</tr>
<tr>
<td>Equity and affordability</td>
<td>Housing</td>
<td>Rental vacancy rate</td>
<td>84.33</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Homelessness rate</td>
<td>84.00</td>
</tr>
<tr>
<td>Land use and transport</td>
<td>Density</td>
<td>Population density</td>
<td>83.67</td>
</tr>
<tr>
<td>Equity and affordability</td>
<td>Housing</td>
<td>Proportion of household income spent on rent or mortgage payments</td>
<td>83.00</td>
</tr>
<tr>
<td>Land use and transport</td>
<td>Transport mode share</td>
<td>Trip to work modal split, number of journeys</td>
<td></td>
</tr>
<tr>
<td>DIMENSION</td>
<td>THEME</td>
<td>INDICATOR</td>
<td>RANK</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
<td>----------------------------</td>
<td>---------------------------------------------------------------------------</td>
<td>-------</td>
</tr>
<tr>
<td>Biodiversity and ecosystem services</td>
<td>Green infrastructure</td>
<td>Ratio of pervious to impervious surfaces</td>
<td>82.00</td>
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<tr>
<td></td>
<td>Habitat quality</td>
<td>Percentage of vegetated land cleared for development</td>
<td>81.33</td>
</tr>
<tr>
<td>Economic prosperity</td>
<td>Employment</td>
<td>Numbers and percentages employed, by industry</td>
<td>80.33</td>
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<td>Equity and affordability</td>
<td>Housing</td>
<td>House price index</td>
<td>80.00</td>
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<tr>
<td>Biodiversity and ecosystem services</td>
<td>Green infrastructure</td>
<td>Area of contaminated sites remediated as proportion of urban area</td>
<td></td>
</tr>
<tr>
<td>Wellbeing</td>
<td>Local amenity</td>
<td>Proportion of households within 400 metres of public open space</td>
<td>77.00</td>
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<tr>
<td>Equity and affordability</td>
<td>Population</td>
<td>Non-compliances with Disability Discrimination Act</td>
<td></td>
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<tr>
<td>Land use and transport</td>
<td>Freight efficiency</td>
<td>Freight transport modal split, tonne-kilometres</td>
<td>76.00</td>
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<tr>
<td>Wellbeing</td>
<td>Public participation</td>
<td>Participation rate in sport/physical recreation</td>
<td>75.67</td>
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<tr>
<td>Land use and transport</td>
<td>Accessibility</td>
<td>Proportion of households within 400 metres of public transport access</td>
<td></td>
</tr>
<tr>
<td>Wellbeing</td>
<td>Health</td>
<td>Proportion of people aged 16–85 diagnosed with a mental disorder in the 12 months prior to the survey</td>
<td>75.33</td>
</tr>
<tr>
<td></td>
<td>Public participation</td>
<td>Number of community gardens per 100,000 population</td>
<td></td>
</tr>
<tr>
<td>Land use and transport</td>
<td>Congestion</td>
<td>Cost of road congestion</td>
<td>74.33</td>
</tr>
<tr>
<td>Biodiversity and ecosystem services</td>
<td>Green infrastructure</td>
<td>Leaf area index</td>
<td></td>
</tr>
<tr>
<td>Governance</td>
<td>Accountability and responsibility for delivery</td>
<td>Existence of published performance delivery standards</td>
<td>74.00</td>
</tr>
<tr>
<td>Biodiversity and ecosystem services</td>
<td>Coastal processes</td>
<td>Proportion of urban wastewater treated to primary, secondary and tertiary levels</td>
<td>73.67</td>
</tr>
<tr>
<td>Natural resources</td>
<td>Productive land</td>
<td>Area of land utilised for agricultural production</td>
<td>73.33</td>
</tr>
<tr>
<td>Wellbeing</td>
<td>Health</td>
<td>Proportion of population overweight or obese</td>
<td>73.00</td>
</tr>
<tr>
<td>Economic prosperity</td>
<td>Economic structure and productivity</td>
<td>Estimated city GDP per capita</td>
<td>72.33</td>
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<td>Land use and transport</td>
<td>Density</td>
<td>Housing density</td>
<td>72.00</td>
</tr>
<tr>
<td>Equity and affordability</td>
<td>Cost of living</td>
<td>Index of Relative Socio-economic Disadvantage</td>
<td>70.67</td>
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<tr>
<td>Natural resources</td>
<td>Carbon/energy</td>
<td>Percentage of energy derived from renewable sources</td>
<td>70.33</td>
</tr>
<tr>
<td>Governance</td>
<td>Accountability and responsibility for delivery</td>
<td>Annual consumer satisfaction survey</td>
<td></td>
</tr>
</tbody>
</table>
Swarming landscapes, new pathways for resilient cities

Rob Roggema
Abstract

Current spatial planning and design practice regards urban and rural spatial systems as simple systems. The proposed design strategies are often one-dimensional, one-problem and one-solution oriented. As a consequence, they often decrease the flexibility of urban systems to cope with uncertainty and the occurrence of weather extremes. Spatial systems need to be looked at as complex adaptive systems, in order to improve their capability to deal with these circumstances. Translating the properties of Complex Adaptive Systems to spatial planning results in a new approach: Swarm Planning. Swarm Planning uses the concepts of self-organisation, emergence and adaptive capacity as the basic principles of design, thus increasing flexibility, diversity and resilience in urban and rural systems. Swarm Planning has proven to be successful in pilot designs at dealing with uncertainties and has led to future spatial visions that are capable of dealing with unknown changes and surprises in weather and climate. These Swarming Landscapes not only increase the resilience of cities and landscapes, they also provide society with an attractive and imaginable spatial future.

Keywords: swarm planning, uncertainty, complex adaptive systems, floodable landscape

Introduction

Spatial planning and climate change science are part of a complex and uncertain context. The general response to this, and this can be seen throughout both the spatial planning and the climate change community, is to try to reduce uncertainty by introducing more procedures, developing more detailed models and increasing control of processes. However, gaining more detailed knowledge does not always increase certainty, or as Kevin Trenberth [2010] puts it: 'More knowledge less certainty'. Both spatial planning and climate change, even more so if the two are linked, could gain from introducing self-organising principles. In order to be able to do so, the spatial system needs to be understood as a complex adaptive system, in which processes of self-organisation and emergence create ever changing spatial patterns, which, when used purposefully, will increase the system’s capability to respond effectively to unexpected change and uncertainty, for instance as a result of climate change. Providing the individual spatial elements in the landscape with a surplus of ‘technical skills’ will enable these spatial entities to self-organise and adapt more easily, thereby collaboratively increasing the adaptive capacity of the system. In order to create the conditions, which allow these self-organising processes to take place, current spatial planning practice needs to let go of its preference to regard spatial systems as being simple and problems as being tame. Complex Adaptive problems, such as climate change, cannot be dealt with within the current spatial planning framework. They require fundamental rethinking of the models underpinning spatial planning and introducing a new planning methodology. Swarm Planning claims to offer this methodology, using the dynamics of swarms as a metaphor. The behavioural patterns of swarms in nature are governed by the principles of self-organisation and emergence, rather than being planned and controlled by an outside authority. When these principles are built into a complex spatial system, the system can start displaying the properties of a swarm: responding to interventions and impulses it will change its shape, but not its content. The elements that make up the system will still be the same, yet they will interact in way that is more responsive to changing and uncertain circumstances, thereby increasing its adaptive capacity. The purpose of this paper is to develop Swarm Planning as a planning methodology, which is better equipped to deal with uncertainties and to effectively plan for the complex problem of climate change. This new methodology looks at spatial systems as complex adaptive systems and uses...
the properties of these systems spatially to increase the resilience and adaptive capacity of the
system. The paper will first examine different views on dealing with uncertainty, it will then
describe the properties of swarms and complex adaptive systems and their applicability to a
Swarm Planning method and the paper will conclude with describing a Swarm Planning design,
illuminating the potential benefits.

Dealing with uncertainty
Climate change and climate adaptation are often linked with uncertainty. As cited by the Global
Commons Institute [2011], WGI of the IPCC states: “Climate change, the greatest threat to
mankind, is resistant to reliable methodological quantification. In many cases it is not possible
to "ascertain the probability of outcomes and their consequences through well-established
theories with reliable and complete data. Both the risk and uncertainty of climate change
require a very large degree of subjective judgement, erring on the side of precaution”. People
are generally averse to uncertainty and vagueness and are accordingly reluctant to take action
in response. However, when uncertainty is framed positively, people have stronger intentions
to act [Morton et al., 2011]. Researchers describe several definitions of uncertainty [Solomon et
al., 2007; Dessai and Van der Sluijs, 2007]. Recognised ignorance, which is different from value
and structural uncertainty, addresses unpredictable uncertainties, which are related to
unprecedented (climate) events, which are too few to define a probabilistic distribution
[Garnaut, 2008] and arise in systems that are either chaotic or not fully deterministic in nature
and limits our ability to project all aspects of climate change [Solomon et al., 2007]. The
strategy to cope with this type of uncertainty is, instead of giving priority to reduce, both
technical and in policy [Mearns, 2010; Meyer, 2011], uncertainty to develop resilience and
flexibility to endure effects of unpredicted events [Engau and Hoffmann, 2011], accept
uncertainty and expect unanticipated surprises [Dessai and Van der Sluijs, 2007].
In the light of this, limits to or unavailability of climate predictions should not limit adaptation.
Instead, climate adaptation strategies [Dessai and Hulme, 2004; Hulme and Dessai, 2008;
Dessai et al., 2009], decisions [Dessai and Hulme, 2007] and robust measures [Hallegatte, 2009;
Wilby and Dessai, 2010] can be effective, even in the face of deep uncertainty¹ [Kabat, 2008]. It
may even prove cost ineffective to wait for more precise knowledge, especially if catastrophic
events, the likelihood of which is little known, are taken into consideration [Pindyck, 2006].
The lack of attention to uncertainties in major adaptation research works [Adger et al., 2007;
2009] therefore does not need to worry us as the resilience approach [Dessai and Van der
Sluijs, 2007] offers a positive framing of uncertainty and opens the opportunity to lessen the
impact of uncertainty, complexity and change, e.g. increase the resilience, through designing
our cities and landscapes learning from the way swarms work together in smart groups [Miller,
2010, pp 226].

Swarms
Swarms in nature have been extensively studied and the behaviour of bees, ants, birds and
termites is used as an example for human interactions in organisations and society [Fisher,
2009; Miller, 2010]. Core of these theories is that swarms function according to a couple of very
simple rules² and perform as highly resilient systems, due to, according to Van Ginneken [2009],

¹ Deep uncertainty is defined as the condition where analysts do not know or the parties to a decision cannot agree upon (1) the
appropriate models to describe interactions among a system’s variables, (2) the probability distributions to represent uncertainty
about key parameters in the models, or (3) how to value the desirability of alternative outcomes [Lempert et al., 2003; 2006]
² As an example, the very simple rules in nature (for birds and fish) are (1) Stay as close as possible to the middle, (2) Move in
same direction and with same speed as the others and (3) Stay 2-3 body-lengths away from neighbours
(1) the interactions taking place between a large number of similar and free moving ‘agents’, which (2) react autonomous and quick towards one another and their surrounding, resulting in (3) the development of a collective new entity and a coherent larger unity of higher order: the system is self-organising in preparing and responding to changing circumstances. It develops emerging patterns and structures, which lessen the impact of uncertainties, complexity and change. Miller [2010] defines four principles of a smart swarm: self-organisation, diversity of knowledge, indirect collaboration and adaptive mimicking (coordinate, communicate, copy). In the current timeframe of connectivity, networks and the World Wide Web these swarm characteristics are becoming more important and will increasingly shape the way we live in the future. As Bonabeau, Dorigo and Theraulaz [1999] have demonstrated that autonomous, emerging patterns and ‘parallel distributed’ co-evolution will empower collective self-organisation and enhance synchronicity. These will take the place of the controlled, pre-programmed and hierarchical centralised processes as we know them to date and will give space to self-organising innovation through an interchanging occurrence of correcting and stimulating feedback loops.

In the design of our built environment swarm theories and features are very rarely used. Oosterhuis applies swarm behaviour to buildings [Oosterhuis, 2006; 2011]. The programming and programmatic labelling and tagging of building components enables customising buildings to temporary desires or changing demands. The fluidity of the designs represents the constant adjustability of the individual elements in the building. The use of swarm characteristics on the regional landscape scale has been subject of several publications [Roggema, 2005; 2008a; 2008b; 2009; Roggema and Van den Dobbelsteen 2007; 2008; Roggema w. De Plaa, 2009]. However, the spatial translation of swarm characteristics has been identified as a research gap.

**Complex adaptive spatial systems**

As swarms are capable of self-organisation and can develop emergent patterns in order to maintain existence or deal with changes in their environments, they can be seen as complex adaptive systems. The features of this type of systems influence their resilience and adaptive capacity. Applying these features to the spatial systems in a region therefore can be useful to increase adaptive capacity and resilience of the spatial system and can make the region better equipped to deal with the potential disturbance of climatic events. However, even though cities are regarded as complex systems [Batty, 2005; Allen, 1996; Portugali, 2000], research rarely uses the knowledge about complex adaptive systems as input for design or future thinking. As a result of this most characteristics of complex adaptive systems are not extensively defined in a spatial manner. Research on this topic has started only recently [Roggema et al., 2011; 2012] and will be elaborated on in this paper. As a start the works of Johnson [2001] (eco-biological), Homan [2005] (organisational), De Roo [2006] (planning), Miller and Page [2007] (computational/social) and Miller [2010] (societal/decision-making) are taken. They all describe the properties of complex adaptive systems. When these properties are combined the key features of complex adaptive systems can be distilled: a complex adaptive system is able to self-organise, is diverse, contains indirect collaboration and adaptive mimicry, has the capacity to adapt (through diversity, flexibility, heterogeneity, reconfiguring, balance, and learning and storing), shows emergence in developing collective patterns, consists of a large number of individual elements, contains many interactions and is able to undergo change while retaining its basic features. In order to undergo such a change the system needs to receive a certain incentive, a tipping point [Gladwell, 2002], allowing the system to jump to a different state.
When these properties are translated into spatial dimensions (table 1), the following spatial elements arise: a mix of functions, a mosaic (different spatial sizes and entities) in the city and the landscape, space for natural resources, space that has not been allocated (free space), dense and connected networks, focal points (nodes) and changing land use.


<table>
<thead>
<tr>
<th>Properties of complex adaptive systems</th>
<th>Spatial dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adaptive capacity</td>
<td>Diversity</td>
</tr>
<tr>
<td></td>
<td>Mix of functions</td>
</tr>
<tr>
<td></td>
<td>Flexibility</td>
</tr>
<tr>
<td></td>
<td>Mosaic in city and landscape</td>
</tr>
<tr>
<td></td>
<td>Heterogeneity</td>
</tr>
<tr>
<td></td>
<td>Space for natural resources</td>
</tr>
<tr>
<td></td>
<td>Reconfiguring</td>
</tr>
<tr>
<td></td>
<td>Learning/storing</td>
</tr>
<tr>
<td>Adaptive mimicry</td>
<td>Reproduction</td>
</tr>
<tr>
<td>Self organisation</td>
<td>Collective patterns</td>
</tr>
<tr>
<td>Emergence</td>
<td></td>
</tr>
<tr>
<td>Indirect collaboration</td>
<td>Quality and quantity of connections</td>
</tr>
<tr>
<td>Large number of individual elements</td>
<td></td>
</tr>
<tr>
<td>Interactions</td>
<td>Starting points, focal points</td>
</tr>
<tr>
<td></td>
<td>Jumps</td>
</tr>
<tr>
<td></td>
<td>Jets patronising</td>
</tr>
<tr>
<td>Undergo change and retain basic features</td>
<td>Change in land-use, functions, human activities</td>
</tr>
</tbody>
</table>

The following section will examine each of the spatial dimensions on (1) how they are found, (2) what/how they contribute to the properties of complex adaptive systems, (3) what they mean in a spatial context and (4) how they can generate resilience.

- **The mix of functions** is based on the ‘diversity’ property of adaptive capacity. A more diverse city or landscape contributes to a higher adaptive capacity of the system. In spatial terms this means that when several different functions, such as living, agriculture, nature, water or industry are combined within a certain space, the diversity will be larger. In general, this also leads to intensive use of space, because functions are combined in close vicinity. When functions are combined, the configuration, mix and layout of the area can be more easily adjusted when an external ‘shock’ occurs, in other words the resilience of the area increases;

- **Mosaic in the city and landscape** has been derived from the properties flexibility and heterogeneity, which, once enhanced, increase the adaptive capacity of systems. When a ‘mosaic’ of spaces exists in the landscape or in the city, temporary and rapid adjustments are possible. In contrast, when large areas consist of mono-dimensional spaces, such as wide and open agricultural landscapes or extensive urban sprawl, adjustments at the edges of these spaces are possible, but it is hard to change the entire space. The mosaic in the landscape may consist of spaces ranging from large to small-scale and everything in between. Examples are meadows, mid-size agricultural complexes, nature areas alongside rivers, forests including open spaces, etcetera. In the
city a mosaic of spaces may consist of public space of different sizes, living areas in
different densities, compact neighbourhoods of the same spatial typology, parks of
different sizes and so on. When it is necessary to change the spatial layout due to an
external factor, a differentiated spatial area offers much more opportunities for
adjustment than a large space of a single type, hence the resilience of a differentiated
area is higher;

- The space for natural resources focuses on creating balance between the demand for
  and supply of water, food and energy resources. When this supply, combined with
  improved ways to store resources within the area, can be permanently reconfigured,
  demand can be met, even if there would be sudden changes in it. If climate changes and
  causes unexpected new circumstances, shifts between the supply of energy, food and
  water may be required, so when the landscape is capable of enabling these kinds of
  changes, the adaptive capacity is greater, hence the resilience is larger;

- The rationale behind the creation of free space is to increase the space for development
  and reproduction of collective patterns. When new patterns and functions can be
  developed without being hindered by existing occupying functions, processes of self-
  organisation and adaptive mimicry can freely take place. Spatially, this means that parts
  of an area must be kept free of allocating specific land use. New collective patterns
  emerge in the city where no concrete function is foreseen. For instance, in many older
cities, such as Amsterdam, Hamburg, Liverpool, London, Melbourne, to name a few, old
harbour quays and docks became outdated and were not rezoned for a long period.
During these periods of ‘unuse’ artists, small companies and new ways of living
emerged, gentrifying and transforming those areas into hip and popular
neighbourhoods. Eventually, these new collective patterns formed the basis for a
structural redevelopment of the ‘Docklands’. In this example, the ‘free space’ was
available to accommodate new demands. When the future would demand extra space
for flooding, sea level rise or energy supply, the availability of free space allows for these
new demands to be accommodated. This potential increases the resilience of the area,
compared with an area where new demands are impossible to fit in;

- The number and importance of networks is directly linked with the quality and quantity
  of connections. The networks of transport, water, energy and communication are taken
  into account. When there are more connections of better quality (faster, higher
  connectedness, more links, more intense) indirect collaboration between existing
  elements in the network/in the area will facilitate emergent patterns and
  functionalities. This type of highly connected networks keeps on functioning in
  uncertain circumstances and when unprecedented (weather) events occur. When
  required, these intense networks will develop emergent structures that start dealing
  with the event. By contrast, in single structured networks, without many connections,
  alternatives are difficultly developed. A good example of the latter is a neighbourhood
located in the bush with only one road to and from the area. In case of a bushfire the
access and evacuation to/from the neighbourhood is difficult and dangerous. It is
obvious that a multiple connected neighbourhood has better chances to survive the
event, hence represents a higher resilience;

- Within the networks crucial points, the focal, or starting, points are determined. These
  points form the most intense nodes, where networks are connected. Where a large
number of network connections come together it is more likely that changes happen,
new developments start and changes can be incorporated. Here, jumps or tipping points
are most likely to occur, because the chance of interaction between elements is much larger than in less intense or not connected areas and nodes. Spatial examples of these nodes are crossroads, intersections, bridges, dams, river deltas, public squares, energy distribution hubs, communication hubs, airports, shopping centres etcetera. These nodes occupy the crucial and strategic places in the urban network and landscape. From here the rest of the area and networks are ‘patronised’, e.g. influenced and developed in a directive way. For instance, these nodes are the points where water is distributed in case of a flood, where the energy is distributed and exchanged in case of high or low demand or the places where the mode of transport is chosen and then occupied through the rest of the network. When these nodes can function as the ‘tipping points’ where developments can start when external ‘shocks’ occur, and redistribute the water, traffic or energy according to the available capacity in the network, these points contribute to an increased resilience in the area;

- A potential change in land-use, functions and human activities is fundamental in allowing change to happen. In many current spatial designs functions and activities are predetermined by the design and don’t in allow the flexibility for changes to take place or, even stronger, to be stimulated. The property of a complex adaptive system to retain its basic features, whilst developing change, improves resilience. The adaptive system, in order to prevent itself from getting ‘locked in’, needs ‘anticipating’ tipping points to enhance change. The system needs to be triggered to change its land-use, human activities and functions, whenever external factors ask for it. For instance, if an area is flood prone the tipping point is defined as the moment at which the system ‘breaks’, e.g. is no longer capable of dealing with an overshoot of water. The anticipative tipping point already incorporates this in the precautionary changes the system undergoes. In other words, changed land-use, functions and activities are already in place, even before the external pressure on the system becomes too large. In this way, incorporated resilience becomes part of the system at a very early stage.

These spatial dimensions need to be seen as mutually complementary and form an integrated part of each particular area. Each of the dimensions is strongly related to the other ones and when used in a planning process can never be looked at from a separated perspective.

The other major aspect to discuss is the time factor. The pace at which a weather event occurs determines the way these spatial dimensions are capable of dealing with such an external ‘shock’. If the hazard occurs suddenly, rapidly and by surprise, a resilient system already functions in a way that it can take up the impacts of the event. Given the fact that many weather events are unprecedented it is even more important to prepare ahead and have system properties in place that are anticipative.

Swarm Planning

When the spatially translated properties of complex adaptive systems are used in spatial design a new design paradigm emerges, which increases the resilience of areas, allowing the spatial system to jump to higher levels of complexity when necessary. This design paradigm is called Swarm Planning [Roggema, 2005; 2008a; 2008b; 2009; Roggema and Van den Dobbelsteen 2007; 2008; Roggema w. De Plaa, 2009] Swarm Planning of those areas, i.e. spatial systems with increased adaptive capacity and resilience, requires three activities:

1. Increase the collective capacity to manage resilience [Walker et al., 2004]. This requires a collective future view on what a resilient equilibrium, under threat of climate change
and hazards, looks like. In this step the simple rules are defined that govern the behaviour of the swarm;

2. Define the spatial elements, as described in the previous paragraph, to be able to use the properties of complex adaptive systems in design and spatial processes. In this step the design parameters to work with (or the spatial elements the swarm consists of) are defined;

3. Start the process of increasing resilience. The jump to a higher level of resilience or complexity often requires an impulse. In this step the crucial intervention, which will start developments is defined. The swarm (the collective of spatial elements) responds to, prepares for or anticipates external changes and reshapes accordingly.

Swarm planning, implemented following these three steps is capable of increasing the adaptive capacity and resilience in spatial systems, and improving the capacity of regions and areas to anticipate (extreme) climate events. Swarm Planning is experimentally applied to design for floods in the Eemsdelta case study.

Swarm Planning example: floodable landscape

In the current discourse about coastal defences for sea level rise and storm surges, the safety level is increased through the strengthening and heightening of protecting structures, such as levees and dikes. Fast and accelerated sea level rise as predicted by Hansen and others [Hansen 2007; Hansen et al, 2007; 2008; Hamilton and Kaiser 2009; Lenton et al, 2008; Rahmstorf et al, 2007; Tin, 2008] raise concern about the capability of defences to withstand extreme circumstances at all times. Eventually, even the strongest dike will breach. The consequence of this belief in defending assets with an increasingly stronger dike is that once it breaches the impact is enormous, since the value of these assets is very high. A huge disaster will destroy assets of high value, such as properties, productive land and human life.

Eemsdelta case study

The Eemsdelta area is located in the North Eastern part of the Netherlands. The topography of the area is not very dramatic, but shows slight differences between the southern and northern parts. Surprisingly, the areas closer to the sea are around 1.5 meter higher than the inland parts. The majority of the area is in agricultural use and most of the villages have historical value. The area faces the sea to the North and a large river, the Eems, to the East. This location makes the area vulnerable to the impacts of sea level rise. The coastal defence is formed by a strong dike, which has its weakest point at the eastern boundary of the case study area. Should the dike breach here the flooding would reach the major city, Groningen, within 36 hours. Moreover, the area is the main supplier of natural gas, the extraction of which is under threat when such a flood would occur. Major economic development takes place in and near the Eems harbour, where energy supply, innovative and sustainable industries and main energy networks form a major asset. The area is one of the special attention and development areas for the regional government and one of the so-called hotspots for a climate adaptive spatial development. Planning for the area is under way and focuses on economic development, conservation of heritage sites and a sustainable and climate proof future.

Sea level rise in combination with storm surge, as the major threats from a climate change perspective, are taken as the starting point for the pilot-design. Given the uncertain pace of sea level rise and the specific moment the dike eventually will breach, it is worth exploring whether alternative designs may potentially be better equipped for decreasing the risk. The three stages
of Swarm Planning, as outlined above, are used to increase preparedness and to anticipate future changes.

Firstly, a collective view has been developed. This view emphasises that: under accelerated sea level rise, even the strongest dike will eventually breach and alternative coastal defence solutions need to be investigated. The key drivers for this alternative are (1) water will flow to the lowest points, topography determines where those are, (2) sea level rise determines the level of the water and (3) a north western storm surge determines the moment sea water will eventually flow behind the defence.

Secondly, once this alternative view has been conceived, a design strategy was developed. This strategy, represented in figure 1, was based on the spatial dimensions of complex adaptive systems, as demonstrated previously. Core idea in the design strategy is to move along with expected change rather than fighting and withstanding it. Water is allowed to enter the hinterland from the beginning, giving people, institutions and all functions the chance to anticipate the future by acting as if this future is already real. This was done by creating an inlet at the most vulnerable point in the coastal defence and allowing water to inundate at a slow pace. Only when the sea level rises with respectively 0.3m, 0.6m, 0.9m and 1.2m a larger area will be impacted by intruding sea water. The urban developments are directed by this expected change over time. Houses and other functions are adjusted to these future circumstances, e.g. are built floating, amphibious or water proof. Resilience of the area is increased through the following design interventions:

1. The functional mix in the design is extended through the combination of new forms of living and building, natural water-rich areas and new forms of infrastructure, which are combined with the existing agriculture and cultural heritage landscape. The richness of the functional intensities allow for the configuration, mix and layout of the area to be adjusted more easily when an external ‘shock’ occurs hence increasing the resilience of the area;

2. The mosaic in the landscape is enriched through the introduction of temporary spaces, which are prepared for flooding, but in normal circumstances function as agricultural open spaces, natural wetlands or juvenile brook-forests. This differentiated spatial area offers more opportunities to adjust it to unforeseen external factors;

3. Space for natural resources, such as water, food and energy is provided and these resources are stored in the potentially flooded area. The temporary character of the design allows for permanent reconfiguration of the supply. Demand can be met, even if sudden changes occur. When climate change causes unexpected new circumstances, shifts between the supply of energy, food and water may be required, so when the landscape is capable of enabling these kinds of changes, resilience is improved;

4. The design accommodates for free space for expected but undetermined ‘extra’ flooding, sea level rise or energy supply. This increases the resilience of the area when compared to an area where new demands are impossible to fit in;

5. The crucial focal point in the network in this area is the location of the weak point in the coastal defence. The design determines this node in the network and defines it as a tipping point for change. From this node development start to emerge, forming new patterns of where the water may flow, meanwhile determining new qualities of living, water management and nature;

6. This node, the first place where pressure on the system will enforce change can be seen as the ‘anticipating’ tipping point for change. Here, the system is triggered to change its land-use, human activities and functions, because the external pressure asks for it. The
landscape is prepared for receiving water and the buildings are prepared for water in their environments. In other words, the changes in land-use, functions and activities are already in place, even before the external pressure on the system becomes too large. In this way, incorporated resilience becomes part of the system at a very early stage.

Figure 1. Swarm planning for a floodable landscape at 0.3, 0.6, 0.9 and 1.2 m sea level rise [Roggema, 2009]
Finally, as the third phase of Swarm Planning, the process of resilience starts: instead of keeping strengthening the coastal defences, the design proposes to create a hole in the dike in an early stage. This will start the process of adaptation to future circumstances, even when it is not known what those will be exactly. This hole in the dike leads to a slow transformation of the area, ‘hosting’ more water as sea level is rising.

An advantage of this design approach is that it prevents damaging impacts of a large disaster, because the water has already been allowed to enter the hinterland and is treated as an ally rather than as an enemy. Because it is possible to accurately predict where the water will flow, people, buildings and organisations are capable of adapting in an early stage. The water will bring gradual changes and benefits. At first, brackish conditions will emerge in the unplanned areas, allowing enrichment of ecological conditions. Secondly and in a later stage all new buildings face water in their environment, a real estate asset of great value. The biggest advantage will probably be the fact that due to the slow pace of entering seawater a disaster never actually happens, but it is tamed to a gradually changing wet environment, which makes the area inherently safe.

Despite the fact that this paper does not focus on political or community processes, which facilitate the realisation of spatial design, a design, and especially an innovative one, is worthless without support from decision makers and citizens. In this specific case study the iconic image of a landscape that disappears under water makes the role of politicians and the community even more important.

The political context in this area is complex, but driven by urgency. The fact that several municipalities, a province and two waterboards, all being democratically chosen, govern the area makes decision making complex. However, the fact that climate change may have huge impacts and economically valuable assets, such as the National gas extraction fields and the harbours, are at stake, combined with the fact that the population in this area is shrinking, gives politics every reason to be interested. This was the reason that the regional government, in collaboration with the other responsible governments, developed a structure vision for the area in which climate adaptation plays an important role. There was also awareness amongst responsible mayors, councillors and regional ministers that innovative ideas are essential to find a strategy to increase resilience. The somewhat out-of-the-box design proposals were welcomed as valuable suggestions, but were not immediately embraced as the one-and-only overarching solution.

The community, despite the fact that population is shrinking and inhabitation densities are fairly low, was involved in the design process. The design ideas were shared in an early stage and were communicated carefully. The fact that the proposed strategy could prevent an unexpected disaster with large impact created support. Two elements were crucial in gaining support amongst communities. The first element is time. The pace of proposed changes is slow, which allows individuals to adjust step-by-step and determine their moment of leaving the area or to stay and accept changes. These kinds of decisions are not easily made and require time. The pace of change will be so slow that it matches the decision making process. The second factor of importance was the potential increase in property value. The new landscape is a landscape in which water plays a dominant role and existing houses are repositioned in the midst of a water-rich environment and in the middle of nature. These are assets that increase average real estate value. Only farmers voiced a negative reflection on the ideas. They faced the choice of either leaving their generation-long owned land or adjusting crops and farming techniques to the new, more saline circumstances.
Conclusion and discussion

As discussed in this paper climate adaptation faces uncertainty because changes in climate are difficult to predict. This causes a dilemma in a spatial planning and design context, because failure to include adaptation in spatial plans may lead to non-adaptation, which leads to a bad or no preparation for future changes. On the other hand, taking action now incorporates the risk of mal-adaptation, making wrong choices and preparing society in a bad way for the future. The cause of this lies in the complex character of uncertain and long-term climate adaptation, while spatial planning and design is oriented on the relatively short-term and consists of pretty straightforward (tame) activities.

This paper has described a potential way out of this dilemma, namely through the usage of properties well known in complex adaptive systems theory to describe spatial systems. However, complex adaptive systems are studied in a limited number of fields, such as ecology, sociology, computation and organisational theory. Therefore it is necessary to translate the properties of complex adaptive systems to spatially relevant entities, such as typologies, numbers and amounts of these entities, in order to use them to design regions that are more resilient and have a larger adaptive capacity. The paper demonstrates the possible use of these entities in spatial planning and design practice and to our knowledge this is the first attempt to achieve this. The spatial characteristics, derived from these properties form the second step of the Swarm Planning methodology, which consists furthermore of the first, development of a collective view, and the third step, start the ignition and emergence of the increase of resilience.

The case study shows how this methodology can be used in the development of a spatial design and how the complex adaptive entities can be applied. The results of the case study emphasise that resilience can be enhanced when these properties are used to conceive the design, but the case study does not ‘proof’ an improved resilience, hence this requires further elaboration. The results of the case study need to be quantified and compared with other case studies, which need to be developed.

Finally, when spatial systems are seen as complex adaptive systems, which behave like swarms, the resilience and adaptive capacity of regions can be increased. However, endless trust in engineering spatial solutions withstands widespread implementation of these principles in practice. Continuing on this pathway of engineering our way out of problems the solutions may appear robust, but lack resilience and, in dealing with extreme weather events, this will lead to more disasters. In the alternative design that incorporates potential effects of severe weather events in designs and the spatial layout of an area as demonstrated in this paper, future hazards are no longer a surprise, but will have become part of the ‘existing’: the area has already adapted before it is confronted with disasters.

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Integrated Approach of Sustainability and Climate Change Adaptation in a Metro Project

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ABSTRACT
The new Melbourne Metro underground rail project will leave a legacy long into the future, with an estimated design life which will extend beyond 100 years. As such it is extremely important to consider the mitigation of any environmental impacts, providing a sustainable outcome. It is also essential to pre-empt required adaptation of buildings and infrastructure in the future against the impact of changes in the local climate. Designing a metro system in the age of climate change provides the opportunity to go beyond standard specifications and compliance requirements, creating innovative sustainable and climate resilient design outcomes. On the contrary, constructing an underground metro project presents various design challenges fuelled by complex constraints, many uncertainties and risks. This paper will review the methodology used to integrate environmentally sustainable principles and resilient design for climate change adaptation, within the concept development phase of the Melbourne Metro Underground Rail Project.

Keywords: Sustainability, Climate Change, Resilient Design, Transport Infrastructure, Urban Design, Built Environment

Introduction
The population of Melbourne is set to grow more than one million by 2030\(^1\). Latest statistics indicate that an estimated 4.08 million people residing in Melbourne\(^2\), and if the population increase continues with the same rate as per the average rate of population increase in Melbourne’s growth areas recorded between 2001 and 2006 of 4.1 per cent\(^3\), Melbourne will have an estimated population of 5.8 million in 2030.

An additional 600,000 dwellings will need to be accommodated over the next 20 years of which almost 316,000 dwellings are anticipated to be in Melbourne’s established areas. Higher population growth will occur in identified growth areas, with expected increase of dwellings by 284,000 over the next 20 years. The growth centres are located in North Melbourne, West Melbourne and South East Melbourne. This growth will require a change in the overall urban footprint of Melbourne city changing from a monocentric city with one major CBD centre, to a polycentric city with multiple CBD-like centres.

It is vital in the shaping of the city to include supported, interconnected and improved public transport services, that recognise the strong commuter function to CBD and inner-suburbs and allow services that serve city growth. Within the last decade public transport patronage has grown at a record rate as a result of Melbourne’s population boom, coupled with higher

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\(^1\) Victorian Government, Dept of Planning and Community Development (2002). Melbourne 2030 - Planning for Sustainable Growth


\(^3\) Victorian Government, Department of Planning and Community Development (2008), Melbourne 2030; a planning update – Melbourne @ 5 million
petrol prices and recognition that the use of public transport will lessen the potential for climate change\textsuperscript{4}. In response to these developments, the report „Investing in Transport, East West Link Needs Assessment“, by Sir Rod Eddington; recommended that planning commence on the staged construction of a new Melbourne Metro (MM) rail tunnel, linking Melbourne’s booming western and south-eastern suburbs, and providing a major increase in the capacity of the rail network. A subsequent submission to Infrastructure Australia resulted in Australian Government funding being provided to commence pre-construction work for the Melbourne Metro project.

The MM project comprises of an underground rail network joining the existing Sunbury line in the vicinity of South Kensington in Melbourne’s west, passing beneath Parkville, Swanston Street in the heart of the CBD, and ending at Domain as a first stage, culminating in approximately 8 km of underground works, five underground stations at key locations throughout Melbourne and the provision for stabling yards and wider network improvements.

Figure 1: Alignment of the proposed Melbourne Metro Underground Rail (Source: Department of Transport Victoria)

**Project Brief**
The initial brief requested that all aspects of work should give consideration to the minimization of environmental and social impacts of construction, operation and maintenance, and that the design needs to consider future impacts of climate change. This requirement is supporting the Victorian Government Department of Transport’s aspiration to integrate environmental sustainability consideration into the design, construction and operation of all new projects\textsuperscript{5}. The Victorian Government clearly indicated in its vision statement as part of the Transport Integration Act that Victoria aspires to have an integrated


\textsuperscript{5} Department of Transport Victoria (2009). Towards an Integrated and Sustainable Future: New legislative framework for transport in Victoria
and sustainable transport system that contributes to an inclusive, prosperous and environmentally sustainable state.

The key challenges facing the New Melbourne Metro Underground Rail Project were the complex integration with the existing network, the planning of underground stations in congested urban areas whilst ensuring ease of connectivity with other modes of public transport, and at the same time considering the broader impact on communities, cityscape, social activities, economy and urban development, businesses prosperity and the quality of ambient environment space around stations. Supporting sustainable development, sustainable outcomes will be paramount, leaving a positive legacy 100 years hence for future generations.

Sustainability in Context
Sustainability is improving the quality of human life, while living within the carrying capacity of supporting eco-systems of the earth. For humans, sustainability is the potential for long-term maintenance of well-being, which has environmental, economic, and social dimensions. This is known as the triple bottom line principle. In 1994, John Elkington coined the phrase “The Triple Bottom Line” (TBL) to describe a foundational approach to sustainability. The Triple Bottom Line has since become a widely accepted principle for sustainability around the world. It says that success is measured not only by financial performance (the traditional bottom line), but by balanced achievements in environmental stewardship, economic growth and social responsibility.

Sustainable Development
Ecologically Sustainable Development represents one of the greatest challenges facing Australia’s governments, industry, business and community in the coming years. The Australian Government acknowledges the need for a sustainable future, and endorses the definition of Ecologically Sustainable Development to be “development which aims to meet the needs of Australians today, while conserving ecosystems for the benefit of future generations”. To do this, we need to develop ways of using those environmental resources that form the basis of the economy in a way which maintains, and where possible, improves their range, variety and quality.

Environmentally sustainable design transforms these principles of sustainable development into tangible outcomes for specific projects. Environmentally Sustainable Design is the philosophy of designing physical objects in the built environment with consideration for the related infrastructure in order to comply with the principles of ecological, social, and economic sustainability. For the Melbourne Metro rail project, a specific methodology has been used to embed environmental sustainability in the design.

Methodology
Complex processes and challenges are involved in the design of a transport infrastructure project, especially where existing urban development needs to be considered. This provides the opportunity to demonstrate an integrated design approach. The following process has been used during the initial project evaluation and concept development phase, and needs to be revisited throughout each phase of the project:

1. Establish environmental sustainability goals and performance requirements for the project at the earliest stage possible by engaging members of the project design and delivery team as well as interested stakeholders;

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Identify specific planning, design and construction strategies and communicate these practices to the design team and stakeholders and include these strategies in the project plans and specifications;

Balance the environmental sustainability goals and strategies with planning, design and construction requirements to find integrated solutions, not tradeoffs or compromises, and to identify conflicts that may arise;

Resolve competing interests, address schedules and budget concerns both within the project and with other stakeholders relating to environmental sustainability.

Figure 2: Process of implementing the ESiD Framework

Integration Frameworks
In order to support the methodology of integrated sustainable design, guidance frameworks have been developed for both Environmental Sustainability in Design (ESiD) and Design for Climate Change (DfCC). The frameworks provide guidance for the fundamental principles to be considered to achieve sustainable outcomes during the initial concept design, and consequently throughout the life cycle of the project.

Environmental Sustainability in Design Framework
The ESiD Framework performance goals are based on the fundamental principles of the triple bottom line. The framework strives to promote outcomes beyond a standard “green project”. A green project focuses solely on the environmental stewardship component of the triple bottom line approach, such as reducing waste, minimizing carbon and water footprints, preventing pollution and conserving natural resources. An integrated sustainable design approach moves beyond this and not only includes green components, but also integrates those of economic growth, social responsibility, maintainability, durability and operational efficiency. This includes taking into account the broader impacts of sustainability on the urban environment around the metro system.

The following definition has been developed for demonstrating integrated sustainable design within the project:

“Environmental Sustainability in Design is an integrated approach, embedding its principles within the design, construction, operation, and reuse/removal of the built environment in an ecologically and energy efficient manner. This includes efficient use of natural resources and reduction of waste, and also translates into better building and infrastructure performance, supporting economical growth, improving operational efficiency by extending life and minimising maintenance requirements, saving in whole-of-life cost and providing a healthy and safe environment for patronage.”

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The Environmental Sustainability in Design Framework uses six fundamental environmental sustainability categories to inform and guide the project planning, design and construction:

- Ambient environmental quality
- Community, biodiversity and heritage
- Energy end use efficiency
- Materials and waste
- Pollution control/localised impacts
- Water conservation

**Figure 3: ESiD Categories, work elements and aspects**

These categories summarize the principles integrated within each section of the project, applicable to each work element and the aspect of that category, for example rain water harvesting under the category of water.

**Climate Change**

Added to the complexity of sustainable development is the impact of climate change. The impacts of climate change if unchecked have potentially enormous economic, environmental and social implications for all Australians. Many changes in climate and extreme weather conditions are already being observed in Australia. Confronting a global shift in climatic conditions, Melbourne faces the impact of changes in temperature, rainfall, sea level rising and an increase in the number and severity of extreme weather events\(^9\). Even with long term plans in action to influence the climate, such as measures to implement considerable cuts in greenhouse gas emissions, the lag in the climatic system means that in the short term the impacts are unavoidable and measures need to be implemented to build resilience and reduce vulnerability.

The Australian Government recognises that mitigation measures must be put in place to stabilising greenhouse gases at 450 ppm CO2e or lower is in Australia’s national interest, consistent with limiting global warming to around 2°C\(^10\). However, the Government needs to consider what preparations it might need to take against the possibility that global agreements are less effective, and in the case of long-lived infrastructure, such as the Melbourne Metro Underground Rail, it is necessary to consider the possibility that temperatures may increase by 3-4°C, and that adaptation measures need to be put in place to be able to provide the continued and uninterrupted functioning of these major infrastructure systems. Acknowledging the need for adaptation, the Council of Australian Governments (COAG) developed a National Climate Change Adaptation Framework, which recognises that risks should be managed by, and implemented across sectors of

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10 Department of Climate Change (2010). Adapting to Climate Change in Australia: An Australian Government Position paper, DCC, Canberra
Design for Climate Change Framework
The Design for Climate Change methodology considers resilient design decisions which address measures of adaptation to impacts of a changing climate, where on the other hand mitigation measures are dealt with under the ESiD framework. The DfCC framework identifies possible risks caused by climate change and ensures that these are addressed during design. The DfCC methodology bases its principles on an integrated approach, which will ensure that the appropriate requirements are incorporated into the project.

Sustainability and climate change adaptation include requirements that normally do not go hand in hand. Considering sustainable outcomes on one hand and on the other integrating resilient design for climate change adaptation can be seen as competing interests. Base this framework’s methodology on the same principles as the ESiD, assisted in integrating and aligning the requirements from both sustainability and climate change adaptation.

Specific design parameters are defined within the Design for Climate Change framework, and are listed under the following categories:

- **Heat**: Increased temperature and more frequent heat waves
- **Dry**: Drought and less soil moisture
- **Weather**: Extreme rainfall, flooding and wind storm events
- **Sea**: Sea level rise and storm tides

These categories summarize the applicable climate change impacts taken into account within each section of the project, each work element affected and the risk identified. Key to the consideration of climate change impacts was to categorize the potential impacts in Melbourne, identifying adaption measures for increased temperatures and more frequent heat waves, extreme rainfall, flooding and wind storm events, extended periods of drought and less soil moisture, and sea level rise and storm surge tides. Melbourne is one of Australia’s major cities located at the coast. Almost a quarter of Australia’s population resides in Victoria, and a significant proportion lives along the urban coast of metropolitan Melbourne. The impact of sea level rise and tidal storm surges was thus considered as one of the risks for the project, caused by climate change impacts.

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12 Department of Climate Change (2009). Climate Change Risks to Australia’s Coasts: A first pass national assessment, DCC, Canberra
The DfCC framework reflects similar processes used in the UK for adapting to climate change impacts\textsuperscript{13}. Identifying possible design options for climate change adaptation follows the process of risk management in accordance with the Australian and New Zealand Standard for Risk Management AS/NZS 4360. A similar process of risk management relating to climate change has previously been used by the City of Melbourne\textsuperscript{14}.

![Risk Management Process adapted for Climate Change](image)

**Figure 5: Risk Management Process adapted for Climate Change (Source: Adapted from AS/NZ 4360:2004)**

**Project Outcomes**

The ESiD process and benchmarks were established to target an equivalent design outcome to a 6 Star environmental performance rating standard. During the concept development design phase, the ESiD framework recorded 79 sustainable initiative outcomes that have been included in the concept design, with a further 216 having been identified as potential initiatives to be included in subsequent design stages. Each outcome and initiative has a specific role in the reduction of the environmental impact of the MM infrastructure, stations and stabling yards. The key initiatives included in the concept design have been estimated to reduce emissions of 6,500 tonnes of CO2-E per annum, not including the significant savings anticipated from regenerative braking that is estimated to provide energy savings up to 30%.

Additional estimated environmental and energy savings through the introduction of the ESiD process include:

- Twin bored tunnels in place of the original plan for a single bored tunnel that will reduce waste by 50% and concrete usage by 50%;
- Cooling and heating energy demands from underground stations reduced from 100 MW to 8 MW and 3 MW respectively, resulting in annual savings of approximately 92 MW / annum;
- The use of alternative water sources and end use efficiencies on the underground stations saving the equivalent of 36 Olympic size swimming pools each year, a reduction in potable water use savings of 90,000 KL per year;

\textsuperscript{13} UK Climate Impacts Program (2003). Climate Adaptation: Risk, Uncertainty and Decision-making, London

\textsuperscript{14} Lorenz D, City of Melbourne (2008). Risk Management for Climate Change
Potential alternative energy sources identified to be considered in the next phases of the project, such as the provision of approximately 100 kW of Photovoltaic cells at the Stabling Yards delivering a 150 tonne annual reduction in CO2 emissions;

- Spatial allowance identified at the stations for potential installation of trigeneration systems which can act as district energy centres for the surrounding precincts, up to 5 MW of electricity generation per station. If realised in the future these trigeneration initiatives will potentially deliver $3.7 million in annual combined running cost savings (incorporating savings for wider precinct participating in the utilisation of trigeneration) with an environmental benefit of a 50,000 tonne annual reduction in CO2 emissions.

Conclusion
The development of sustainable communities and the delivery of sustainable transport infrastructures, which are resilient against climate change impacts, have been identified by the Australian Government as a key issue to the sustainable future of all Australians living in our growing cities. The integrated approach of sustainability and climate change adaptation in the Melbourne Metro underground rail project demonstrate that it is possible for project teams to address this key issue, and to consider all the complex decisions and design constraints in realizing a sustainable future in city growth along with its related infrastructure.

The Melbourne Metro project is a flagship contemporary development for the Melbourne region, which will also leave behind a legacy long into the future. This is similar for any transport infrastructure project in the city space, where modern conventional buildings generally have a 50-year lifespan, the infrastructure and interconnectivity of the urban environment will function significantly beyond this timeframe. As such, it is extremely important to consider the mitigation of any environmental impacts on the built environment and its related infrastructure, especially ongoing impacts. It is also essential to pre-empt the required adaptation of buildings and infrastructure in the future against possible impacts of changes in climate.
A Governance Framework for Eco-Centric Behaviour in Communities

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ABSTRACT
Climate change and its impacts have taken centre-stage in the media as well as academic research in recent years. This has led to better awareness of the sustainability issue among the general public. However, knowledge about sustainability is not necessarily matched by actual sustainable practices. The community plays an important role to effect lasting changes towards a more eco-centric behaviour. While various disciples such as marketing, psychology and urban design have undertaken research on this topic, these have often been done in isolation. The purpose of this paper is to draw together the knowledge from these well-established disciplines and develop a governance framework for eco-centric behaviour and community resilience. The Six–P governance framework includes psychological needs, physical facilities, personal motivations, public perception, price mechanisms and policies for community resilience. To illustrate the application of this governance framework, strategies adopted by green campus communities that reflect the Six-P framework are presented.

Keywords: Governance, Communities, Eco-Centric, Behaviour, Campus, Green, Resilience,

1.0 Introduction
Over the past decades, climate change scientists have warned of global warming and its catastrophic impact on planet earth and its inhabitants. The mounting evidence led to the start of the global climate change negotiations under the UN Framework Convention on Climate Change (UNFCCC) in 1990 and eventually the adoption of the Kyoto Protocol in 1997. Sustainable development is today a cornerstone of many political agendas.

To date, much of the effort in this direction has been top-down driven and understandably so given that the world is now one big global village. Eventually, the policies and programmes developed hope to change the consumption patterns of businesses and the communities. However, consider these findings published in DEFRA (2005): a) 30% of people claim to care about companies’ environmental and social record; but only 3% reflect this in their purchases; b) Whilst 90% of people know that drink cans may be recycled, only 50% say they have actually done so.

While a survey showed that 60% of people think that global warming would be best tackled on a global level (www.dft.gov.uk), the role of the community in effecting eco-centric behaviour changes cannot be under-estimated. Professor Tim Jackson from the University of Surrey noted that ‘negotiating change is best pursued at the level of groups and communities. Social support is particularly vital in breaking habits, and in devising social norms and more sustainable patterns of consumption’ (DEFRA, 2005).

However, attitude and behaviour change is a difficult and complex subject. To this end, this topic has been widely researched in many disciplines, including psychology, marketing,
sociology, environmental studies, built environment, etc. However, the rich knowledge in this topic has been accumulating in silos. The purpose of this paper is therefore to draw together the findings from these disciplines and develop a framework for nurturing eco-centric behaviour at the community level. Eco-centric behaviour is defined as sustained actions centred on minimising harm to the ecological system. The framework represents a working platform on which a robust governance model can be built to nurture eco-centric behaviour and therefore contributes to greater environmental resilience at the community level.

The paper is divided into four sections. The first section provides the backdrop for this study. Following this, the paper identifies the barriers and motivations to sustainable practices and through this, a framework for nurturing eco-centric behaviours is developed. Next, examples of strategies adopted by green campus communities that reflect the Six-P Eco-centric Behaviour Framework are given before the concluding remarks at the end.

2.0 Research Method
A combination of research methods is employed for this paper. First, desk literature research is vital to distil the knowledge generated from the different disciplines in relation to encouraging environmentally sensitive behaviour. This culminates in a framework that conceptualises the key factors for nurturing eco-centric behaviour. To illustrate the applicability of this model, case studies were undertaken. Case studies are a useful research tool for a better understanding of a set of relationships through in-depth analysis of a single group, incident or community. They are empirical inquiries that explore a phenomenon within its real-life context, and are capable of generating and testing hypotheses (Yin, 2002).

3.0 Barriers and Motivations to Nurturing Eco-Centric Behaviour
Pearce (1993) defined motivation as a set of forces; either weak or strong that initiates, directs and sustains a particular behaviour. If motivation can be seen as a positive force pushing an individual towards certain behaviour, barriers can be conceived as negative forces that cause one to hold back or move away from engaging in a specific activity.

According to McKenzie-Mohr (2000), barriers can be categorised as structural or non-structural. Structural barriers are external to the consumer and can refer to societal barriers such as absence of a convenient public transportation system. On the other hand, non-structural barriers are internal to an individual (e.g., lack of knowledge of how to participate in backyard composting). Where the barrier is non-structural (internal), McKenzie-Mohr (2000) noted that commitment and prompts are two useful methods to foster behaviour change. Nurturing eco-centric behaviour becomes more complex when the barriers are
structural or when multiple barriers (a combination of both structural and non-structural barriers) exist. Elmuheim et al. (2010) undertook a survey of facilities managers and found that time constraints, lack of knowledge and lack of senior management commitment are the main barriers for the implementation of consistent and comprehensive sustainable facilities management policy and practice.

In regard to motivators of eco-centric behaviour, the green marketing literature is useful in informing what drives consumer towards purchasing or adopting a more environmentally sensitive behaviour. Ottman et al. (2006) argued that ‘green products and services must satisfy two objectives: improved environmental quality and customer satisfaction. Misjudging either or overemphasising the former at the expense of the latter can be termed green marketing myopia’. Ottman et al. (2006) in their study reviewed successful green products and concluded that there are at least five desirable benefits: efficiency and cost effectiveness, health and safety, performance, symbolism and status as well as convenience.

3.1 A Six-P Framework for Nurturing Eco-centric Behaviour

The preceding discussion identified barriers and motivators to foster more sustainable practice. While these conceptual and empirical studies yielded rich insights into nurturing eco-centric behaviours, a closer examination suggests that there are clear areas of overlap. Synthesising these findings, a Six-P framework is developed. The framework identifies the key factors arising from the current body of knowledge that are important for engaging the community in eco-centric behaviours. Figure 1 below explains this framework diagrammatically.

![Six-P framework for nurturing eco-centric behaviours](image)

Figure 1 Six-P framework for nurturing eco-centric behaviours
4.0 Application of the Six-P Framework within University Communities

Having developed a holistic framework for nurturing eco-centric behaviour, the paper now applies the Six-P framework to university campuses by looking at sustainability initiatives within Australian and overseas universities.

a) Psychological

Current literature has shown that eco-centric behaviour is influenced by the psychological attitude towards the environment. Positive/negative attitude in turn is shaped by the knowledge of the consequences of environmentally irresponsible behaviour. In this regard, one of the ways to positively change the attitude and behaviour of campus community could be to integrate sustainability into teaching and research. A growing number of universities have given emphasis on integrating sustainability into the degree program coursework and research. For example, University of California, Berkeley conducts innovative research on sustainable technology and practices and emphasises the importance of increasing awareness of these values through instruction and example. Likewise, Australian National University has integrated sustainability into the degree programs by offering courses ranging from Greenhouse Science to Corporate Sustainability to Human Ecology.

b) Physical

The motivation for eco-centric behaviour can also be influenced by the availability of green facilities within the campus. For example, at Bond University, the Institute of Sustainable Development and Architecture building is the first six-star green educational building in Australia. Some of the sustainability features in the building are the extensive use of natural lighting and ventilation, energy efficient appliances/devices, ecologically designed storm water and waste water treatment and building management system to monitor usage of energy, water and wastewater. The amount of water being used, the CO\textsubscript{2} emissions and the amount of power self-generated are monitored and benchmarked against outputs for normal buildings as a measure of operational performance. Consequently, energy and water savings are made more visible leading to a greater sensitivity to the conservation of natural resources.

Strategic masterplanning of campuses with provision of green open spaces, active transport (promoting public transport, cycling and walking) and energy efficient buildings can also play a positive role in motivating econ-centric behaviour within campuses. There is a need to
examine current campus masterplans of universities to see how they can contribute to sustainability.

c) Personal
Personal gains are important considerations when engaging the community in eco-centric activities. This can take the form of convenience, time saving as well as health benefits. An integral part of becoming a sustainable campus is the development of specific plans to promote sustainable modes of transport. Departments in ANU use Timely Tredlies bicycles for transport around campus (ANU, 2008). With over 60 bikes covering more than 50,000 km per year, Timely Tredlies is the largest bike fleet of its kind in Australia. Timely Tredlies have been promoted as a fast way to travel that not only reduces environmental impacts but also improve physical wellbeing. University of Florida’s campus sustainability committee raised parking charges to discourage car use and promote public transport. Cornell University’s action plan for Transport gives all new students free transit for the first year to encourage public transit use and change their behaviour from early on.

d) Public Perception
Public perception can act as motivator to eco-centric behaviour in campus. At Bond University, the Institute of Sustainable Development and Architecture has won many local and international awards. To this end, the institute has received many requests to tour the building by many professional and educational groups. In this regard, this facility is an educational tool in driving home the message the importance of sustainable development to students and visitors alike. It allows high school students and visitors to experience first-hand the sustainable features of the building and how it can advance the goal of sustainability. The public perception generated from these visits can create the pressure to ‘live up to expectations’ among its occupants. To this end, greater eco-centricity is achieved albeit through an indirect way.

e) Price
This factor relates to the cost of choosing green. It is important to highlight potential economic gains if the community is to be convinced in making eco-centric choices. For many universities, the commitment to sustainability has meant changes in the procurement process. The emphasis here is on buying local, recycling, healthy living and life cycle costs. The impact on environment is minimised through identifying local green products and suppliers and procuring these services and products for the University. Additionally, consumers and suppliers both gain in getting a better price for the products and services. University of Oxford has a policy of sustainable purchasing by increased use of sustainable
products and products that can be recycled after use. University of California Berkeley has a policy of purchasing environmentally preferable products, minimising use of toxic substances and handling wastes responsibly.

f) Policies
In order to nurture eco-centric behaviour in campuses, it is important that the universities have a strong commitment to sustainability through strong management support. For example, the University of California, Berkeley (UCB) has an Office of Sustainability to regularly measure and report overall progress towards its aim of a sustainable campus. Additionally, there is also a Chancellor’s Advisory Committee on Sustainability to give strategic guidance to the Office of Sustainability. Locally, the Australian National University has a University’s environmental management office called ANUGreen which is part of the Facilities’ and Services Division. Through the ANUGreen office, ongoing collaboration on sustainability across departments is encouraged and supported through financial backing and long-term corporate commitments.

5.0 CONCLUSION
This paper has developed a Six-P framework for nurturing eco-centric behaviour and applied it to university communities. The framework is useful in that it would serve as the foundation upon which further research can be based to identify the dominant factors that drive or deter eco-centric behaviours in other communities. In practice, the framework can be used as a guide for developing a community engagement strategy. The factors identified serve as a useful checklist during the formulation of sustainability programs. The paper has also demonstrated the benefits of this multidisciplinary framework and argued for the need of both top-down commitment and bottom-up initiatives for sustainability. A community that is engaged in eco-centric behaviour is better prepared for an increasingly delicate natural environment.
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Talloires Declaration (http://www.ulsf.org/programs_talloires.html
Food in My Back Yard (FIMBY)
Implementing Urban Agriculture into
Australian Suburbs

Ned Wales
Nicole Webb

Bond University, Gold Coast, Australia
ABSTRACT

The recent climatic events, economic uncertainty and peak oil are leading to greater levels of awareness of our vulnerability for food supply and security. During the summer of 2010/11 much of the east coast of Australia was inundated with record rainfall and proceeding flooding, which impacted on food delivery from regional production areas to urban markets. Consequently many of our major food outlets in suburban neighbourhoods ran critically low in supply and price increases were significant. These events have lead to a wider dialog on where does our food come from and how can we ensure food supply as we enter into the dual challenges of rapidly increased energy cost and climatic shifts. Resourceful and progressive communities are taking action to address this issue with the implementation of urban agricultural in urban spaces that traditionally have been occupied by ornamental landscapes such as suburban back yards and parklands. This paper discusses what actions are taking place using various cases studies from local government, community groups and individuals across Australia.

Keywords: Urban Agriculture, green streets, green cities, sustainable cities, food security, local governments role in food production.

Introduction
Climate change, peak oil, and the effects these events will have on the availability of fresh food in the coming years is gaining broader awareness. Many community groups, environmental organisations, and government bodies are currently undertaking research and working on initiatives to ensure food supply in their local and regional areas during peak events such as extensive flooding and fuel shortages. This paper undertakes a brief review of current urban agriculture policies/initiatives undertaken locally and regionally to highlight urban agriculture practices currently occurring. The findings emphasise the role of grass roots, community networks and local food supply on both a neighbourhood and regional basis.

To gain an understanding of what other local governments are doing in the area of food security and local food supply, an investigation was undertaken of existing government policies, strategies, initiatives, at all levels of government. Within this limited research scope the work indicates that a diverse range of initiatives are currently being implemented by government; however, action is evident predominantly at the local government level as opposed to state and federal led policies and initiatives.

Gold Coast City Council has identified local food security as a priority matter in detailing with climate change and seeks to create awareness of, and change attitudes towards, the reliance on existing food importation and trade dependency. In 2010 a political mandate was sanctioned by City Councillors, through the approval of Action 33 of Council’s Climate Change Strategy where “developing a scoping study for local food production and purchase on the Gold Coast” was initiated.
The issue of vulnerability to the food network and supply chain became evident during the extensive flooding across the eastern seaboard of Australia in the 2010/11 wet season. People were broadly affected with delivery supply chains cut due to repeated flooding of highways and increased food cost such as tomatoes normally shipped from southern states and bananas from far northern Queensland witnessed price spikes due to severe crop damage.

In light of this and other climate change predictions, new initiatives for Gold Coast City’s local food production and supply are being investigated. Through this process it is intended to establish a more sustainable local food production and distribution network in an effort to move away from current dependence on national and international food production and sales networks and to clarify local food production capabilities and shortfalls.

**Local Government Climate Change Strategies**

In recent years a number of local governments have adopted climate change strategies. Brisbane City Council’s “Plan for Action on Climate Change and Energy 2007,” is a good example in how local agencies address local food initiatives. Of the plan’s eight (8) key Topic Areas, three (3) of the topic areas deal with urban food initiatives with identified actions detailing how the matter will be specifically addressed.

Brisbane City Council plan has a high focus on food security and ensuring its residents have access to fresh and affordable local food produce. This is further supported by provision to update the City Plan to provide for different forms of urban agriculture across the city including the establishment of interim amendments to the City Plan and related policy issues. Similar actions could be incorporated into the Gold Coast Planning Scheme to give statutory weight to the initiatives particularly through new and refurbished development across the city.

In comparison when looking at the Gold Coast City Council and its Climate Change Strategy 2010, the document deals with urban food supply under the banner of “locally grown food”. The below table was compiled from the strategy’s key actions and strategic outcomes to identify any urban food initiatives for the city.

<table>
<thead>
<tr>
<th>Urban Food Initiative</th>
<th>Key Action</th>
<th>Strategic Outcome</th>
<th>Performance Measure</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Locally grown food</td>
<td>Planning and Regulation</td>
<td>Strategic Outcome 7: Council has a planned climate change response that meets its statutory responsibilities.</td>
<td>Percentage of locally grown food available to the Gold Coast community</td>
<td>Action 33: Develop a scoping study for local food production and purchase on the Gold Coast.</td>
</tr>
</tbody>
</table>

*Source: Compiled from Gold Coast City Council’s Climate Change Strategy 2010*
Appendix B of the Strategy details a „climate change strategy risk response matrix“ for the city in dealing with climate change. Under „Social Sustainability“ identified risk, it was noted that „higher ground surface temperatures compromise food safety and increase food borne disease“, that its probability of happening is „likely“, which would be „catastrophic“ and is a „high“ priority.

Whilst the availability of urban food is dealt with broadly in this document, it is intended that further studies be undertaken for the city for land availability and soil quality. This action is important to scrutinise and validate land uses designations maximising potential crop yields. It is recommended that such strategies be evaluated frequently to ensure appropriate policy implementation via a planning scheme development code. It is possible that other urban food initiatives can be identified for implementation more broadly across the cities directorates. Political will on behalf of the local government to recognised this issue and give adequate support is of concern. Local politics is notorious for being motivated for short term gain where sustainable development policy can require long term funding for programs and implantations of effective measures.

Redland City Council‘s 2030 Community Plan was established with considerable community participation. The Community Plan details key themes and associated goals for the city in relation to urban food initiatives. Community gardens are a priority factor in the plan. Community building and cultural capital is seen as of major importance for the Redlands plan, where there is a strong emphasis on how urban agriculture initiatives are to be achieved; “We grow and share food in homes and community gardens, schools and edible streetscapes; small crops are harvested from working farms; and people support locally grown produce at growers” markets within the city and throughout the region.” (Source: Complied from Redland City Council’s 2030 Community Plan)

To assist in achieving policy objectives the plan included a „Green Lane Diary“ educational program for school children between the ages of 10-12; and „Growing Community Gardens“ whereby Council encourages groups to utilise Council grants as „seed money“ for their gardens.

Coffs Coast Draft Local Food Futures Framework 2010-2020 (NSW)
The aim of this framework is to support the „development of a sustainable local food economy for the region“ through capacity building with community groups, educational organizations, local industry, local business, and government agencies. Here, it is intended that a capacity building program will enhance awareness of the issues surrounding local food supply, create interest and enthusiasm in dealing with local food, identify a „road map“ for action, engage all levels of government, whilst also enhancing networks and partnerships with other agencies, organizations, and industry. Some of the key initiatives identified within the Coffs Coast framework include:

- **Community Supported Agriculture (CSA)** encourages landholders with small farms located close to cities or regional areas to become productive in the provision of fresh produce to these urban/regional locales on a regular (weekly) basis;
- **Micro Credit for Small Scale Farms** encourages the establishment of small scale farms by assisting in the initial food production setup costs through the provision of credit schemes such as low or no-interest loans;
- **Local Food Directory/Database** aims at raising the profile of local food producers with commercial and individual consumers to ensure a secure customer/trade base is available to local farmers (i.e., ensure economic stability);
- **Farm Gate Trail** encourages tourist activity through the hinterland region by visiting and purchasing local produce direct from the farm; similar in concept to the winery route tours;
- **Buy Local – Branding of Local Produce** creates awareness to consumers that they are buying fresh local produce and supporting the local food industry;
- **Seasonal Produce Guide** creates consumer awareness of which fruit and vegetables are in season and available in local markets; and
- **Food Processing** locally will support the production and availability of fresh fruit and vegetables whilst also supporting the local economy through the provision of employment and training. Dependence and usage of oil/petroleum will also lessen through reduced travel and production techniques.

This document provides a holistic framework for dealing with local food production and security within a regional setting which was ascertained from a public/private collaborative process. Invaluable information from this document could inform a similar framework for South East Queensland regions and should be noted accordingly. Community outreach is difficult in the best of situations. The failure to adequately engage community activism is often experienced in the public policy arena. There is a mechanism to overcome this tendency in the time poor condition commonly found in advanced economies.

**Northern Rivers Food Links (NSW)**

The Northern Rivers Food Links initiative was established through a cooperative process involving seven (7) Northern Rivers local government Councils and Rous Water in northern New South Wales to ensure a sustainable food future for the region. The Councils involved included Ballina Shire Council, Byron Shire Council, Clarence Valley Council, Kyogle Council, Lismore City Council, Richmond Valley Council, Tweed Shire Council, and Rous Water. This joint-partner project was made available by a $2 million grant from the NSW Environmental Trust. One of the main benefits to come out of the initiative was the „Village Showcase Project“. This project sought to encourage a collective village community approach to improving the food chain system across the Northern Rivers Region. The Village Showcase Project was designed to fund one larger project in each Local Government Area (LGA) to the value of $50,000 each LGA. Some of the projects envisaged by the scheme included: Community asset gardens (e.g., aged care facilities, Neighbourhood Centres) Community Food production maps and events (e.g., Community Jams) and Urban Agriculture Activity Hubs. A scheme similar to this could be offered on a regional scale in partnership with surrounding local governments to establish and strengthen a food supply chain for the South East Queensland region. Although broad scale regional approaches are highly valued in achieving sustainable development outcomes the coordination and longevity of such programs have been problematic in the past. Considerable resources can be required from cash strapped local governments. Federal and State funding is not always made available and limited longer term success is jeopardised.
Queensland Conservation Council
The Queensland Conservation Council (QCC) has been established for some 40 years. One of the key focuses QCC is currently working on is a strategy called the Local Food Consumption and Production SEQ Community Strategy. The strategy encompasses a geographic region of South East Queensland, northern New South Wales, and the Granite Belt and seeks to create a framework which facilitates the region to grow and consume fresh, local and ecologically grown food. Whilst the document is in its infancy, it has a clear set of strategies and actions to achieve its goal. The document also considers governance and the role of government at all levels in local food supply, production and security.

The document’s core strategies and actions include stakeholder engagement, capacity building through strong local food networks, identify the perceived benefits and barriers in local food production for the region, provide education and enhance awareness to the community in regard to their food choices, develop a planning framework to identifying the needs for local food production (eg regulatory requirements, infrastructure, etc), promote local food systems, and review government policies in regard to urban agriculture and local food production. Now is the ideal time for government (ie Gold Coast City Council) to start collaborating and working in partnership with the community and other organisations to produce strategies and frameworks that could actually facilitate local food production in urban areas. These types of documents and forward planning provide an avenue for steps to be undertaken in implementing urban agriculture within urban settings and providing fresh local produce for all to enjoy.

Transition Town Movement
The Transition Town Movement was originally founded in the United Kingdom in response to climate change, peak oil, and society’s industrialised and resource consumptive way of living. The movement is a community action at the local level, which essentially involves the process of, “…relocalising all essential elements that a community needs to sustain itself and thrive. It builds local resilience in the face of the potentially damaging effects of Peak Oil while dramatically reducing the community’s carbon footprint. In this way, it addresses both Peak Oil and Climate Change.” (Brangwyn and Hopkins). The movement has been well received across the UK and also internationally with Australia also having a number of transition cities being established. In fact, the Sunshine Coast was the first Transition Town in Australia and the first Transition Region outside of the UK (Conte, 2009).

Community Gardens
Through all of the research undertaken in regard to urban agriculture, community gardens appear to be the most common initiative implemented throughout Australia, with the most progressive across New South Wales. In most instances, the establishment of community gardens is community driven; however, they cannot occur without the support of local government. A number of local governments have established policies and guidelines for the establishment and running of community gardens, particularly in New South Wales. It is noted that whilst the Gold Coast has three (3) established community gardens across the city located in Varsity Lakes, Ormeau and Southport; with another two (2) gardens under construction at Tugun and Southport (GCCC, 2010); there is no policy or guideline in place for the city.

Brisbane’s Northey Street City Farm which is a not-for-profit organisation grows fresh produce on site to be on-sold to the community on market days (which is also on-site).
The city farm not only grows produce on site, but also conducts workshops and educates the community on gardening and farming within urban environments (i.e. permaculture). This facility would be an excellent case study to review with the intent of a similar facility/s being established by local governments.

**Conclusion**
Research indicates that from a government perspective, food security and urban agriculture is being driven at the local level through local government strategic and climate change documents. Whilst most local governments have identified food security as a priority item, most progressive governments are in the early scoping stages with no firm strategy in place to address the issue. The exception is northern New South Wales with frameworks currently in place for the Coffs Coast Region and Northern Rivers Region as discussed in this paper.

It is evident that community groups and organisations are very active and in some instances are promoting their own initiatives such as the transition town movement, establishment of community gardens, and Queensland Conservation Council’s Local Food Consumption and Production SEQ Community Strategy. Local government have the opportunity to work in partnership with these organisations to create a collaborative joint-venture policy framework for the city.

In terms of local food production, current focus is on an individualised micro-scale level where hobby gardens and veggie patches are being established mostly for self-consumption. Focus also needs to be placed on a larger scale food production within urban areas with the produce available to the general public through local outlets. This can be achieved by making underutilised areas productive such as incorporation of edible landscapes, streetscapes, rooftops and walls.

Currently from a convenience point of view, many people will purchase their produce from a large supermarket who imports much of its produce from international agricultural networks. If this matter is to be taken seriously, other options in terms of supply networks and convenient outlets are needed so that consumers have the option to purchase fresh, local, and affordable fruit and vegetables from a local outlet instead of purchasing from the major supermarkets. A marketing and educational campaign may be required to enhance community awareness in relation to local food initiatives and the importance of community support.

Local governments could include provision for this concept; however, establishment of a policy and design guidelines for a community would be required for inclusion within regulatory tools such as a Planning Scheme or via a Local Law. For example, positioning of edible streetscapes and verges could be located near community centres. There are many examples of successful initiatives in the urban agricultural movement where the organic permaculture model has been advanced. Places such as Cuba offer a number of lessons on how local food production becomes part of ones daily life and leads to healthier communities, reduced carbon out puts and urban resilience.
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Where will the children play?
Opportunities for inclusion in a resilient city.

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Abstract

A resilient environment is one that accommodates diversity, including a range of age groups. It offers robust public spaces and places that are welcoming to all community members— including children and young people. This paper reports on Redland City Council’s approach to achieving a child and youth friendly city. The Council supports its community’s vision for a child and youth friendly Redlands with a corporate policy, conscious child and youth friendly design practice, a commitment to engaging with children and young people and a concise suite of child and youth friendly indicators. These elements provide a favourable institutional environment for delivering a more resilient built environment—a child and youth friendly city.

Redland City Council through its long-term community plan identified community support for the promotion of Redlands as a ‘great place to grow up’—a city that provides for and welcomes its children and young people.

To operationalise this community value, Council committed to review its practices and focus on delivering a child and youth friendly built and natural environment. Council officers from Redland City in association with researchers from Griffith University’s Urban Research Program and a Children’s Play consultant produced a Child and Youth Friendly Redlands Policy, Child and Youth Friendly Redlands Indicators and a Child and Youth Friendly Redlands Design Guide. These three tools acknowledge Council’s roles in community leadership, advocacy, design, development, development assessment and monitoring and work together to position the Redlands as a child and youth friendly City.

Key Words

Child and youth friendly, policy, design, indicators

Introduction

Redland City Council is located on Moreton Bay, 25kms east of the Brisbane Central Business District in South-East Queensland. The local government area has rural, urban, suburban, and coastal and island communities, and a resident population of 141,856 residents in 2010. There are expected to be 188,878 residents by 2031 (an increase of 33%). Like the rest of Queensland, the Redlands population is ageing, though at a higher rate than the large neighbouring city of Brisbane. By 2026, nearly 25% of residents will be aged 65 years (an increase from 12.6% in 2006).

During the same period, the projected population of children and young people will slowly increase, however, as a proportion of the total resident population, children and young people will decline. While Council has focused on planning for an older population, there is an acknowledgement that
children and young people are an important component of the community and that without conscious attention to their needs, there is a risk of excluding these groups.

Council expanded the scope of the child friendly cities paradigm and aspires to a ‘child and youth friendly city’ including young residents (aged 15-17 years). This inclusion of young people coincided with considerable Council investment in the engagement of young people in a city-wide survey on their perceptions of personal safety and use of public space and the development of new facilities for young people.

**Child and Youth Friendly Redlands Research Methods**

The Child and Youth Friendly Redlands research project deliberately sought to impact existing Council practices and policies across program areas rather than develop new services. This differs from more common approaches to working with local governments on child friendly cities where the focus on achieving specific accreditation (through the UN Child Friendly Cities initiative) can stimulate a range of new activities and under-emphasise the necessity to review current practices and work with all parts of Council.

The research methods combined reflections on current practice with case study interrogation and engagement of children and young people. Table 1 outlines the methods, their purpose and broad outcomes.

**Table 1 Child and Youth Friendly Redlands Research Methods and Outcomes**

<table>
<thead>
<tr>
<th>Method</th>
<th>Purpose/Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Review of child friendly cities literature</td>
<td>The key findings were that:</td>
</tr>
<tr>
<td></td>
<td>To be effective, child friendly city initiatives require high level policy and leadership;</td>
</tr>
<tr>
<td></td>
<td>Engaging children and young people is central to child friendly cities;and</td>
</tr>
<tr>
<td></td>
<td>Safe and supportive environments are important for children of all ages.</td>
</tr>
<tr>
<td></td>
<td>These findings guided the development of the Child and Youth Friendly Redlands policy (expression of high level leadership), design guide (influences the design of the built and natural environment) and indicators.</td>
</tr>
<tr>
<td>Development of Redland child and youth friendly principles</td>
<td>The Draft Redlands Child and Youth Friendly principles were applied to the review of two contrasting sites (sensitive natural area and future regional park, and an established activity</td>
</tr>
<tr>
<td>Method</td>
<td>Purpose/Outcome</td>
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<td>-------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Audit of Council’s current and planned child and youth friendly policies, programs, activities, processes</td>
<td>The audit identified opportunities for enhancing current practice and confirmed the need for a Child and Youth Friendly Redlands policy, design guide and indicators.</td>
</tr>
<tr>
<td>Facilitated arts-based design workshops with children</td>
<td>The children’s workshops demonstrated the value of children’s perspectives in the design of the 2 case study sites.</td>
</tr>
<tr>
<td>Analysis of Redlands youth and public spaces survey results</td>
<td>Provided valuable insights into the perspective of over 2000 young Redlands residents on their use of public space, sense of belonging and perceptions of public safety.</td>
</tr>
<tr>
<td>Assessment of two case study sites</td>
<td>Demonstrated the value of child and youth friendly principles as a lens through which to analyse key built and natural sites. The assessment identified design and master planning process enhancements for both sites and another activity centre.</td>
</tr>
<tr>
<td>Preparation of a Child and Youth Friendly Redlands Policy</td>
<td>In response to the literature review finding that high level policy was necessary to deliver child and youth friendly practices, a policy was developed and endorsed by Council.</td>
</tr>
<tr>
<td>Preparation of a Child and Youth Friendly Redlands Design Guide</td>
<td>Informed by the above methods, the guide articulates the design issues and desirable environmental features relevant to a child and youth friendly Redlands. Provides guidance for Government, Council and private and institutional developers.</td>
</tr>
<tr>
<td>Preparation of Child and Youth Friendly Indicators</td>
<td>A set of measures that align with the Child and Youth Friendly Redlands policy to track outcomes for Redlands children and young residents in a range of important areas such as health and safety, sense of belonging, education, employment and training and others. The indicators will be incorporated into Council’s performance monitoring framework for the City.</td>
</tr>
</tbody>
</table>

The balance of this paper explores the products of the Child and Youth Friendly Redlands research project- the *Child and Youth Friendly Redlands Design Guide*, *Child and Youth Friendly Redlands Policy* and *Child and Youth Friendly Redlands Indicators*.

**Children and Youth Friendly Redlands Design Guide**

The Child and Youth Friendly Redlands Design Guide aims to create built and natural environments in the Redlands that integrate the needs and desires of children and young people. The guide is intended to inform the design of public and private sector developments. A key element of the guide is the promotion of processes that engage children and young people in design processes.
Diagram 1 is an excerpt from the guide that shares ideas for engaging children and young people in the design process.

**Diagram 1 Ideas for Engaging Children and Young People in Design**

- **Scope**
  - Review findings of consultations with children and young people to inform the project brief
  - Require consultation with children and young people as part of the project brief

- **Vision**
  - Consult children and young people about their priorities, vision, objectives for the project area
  - Involve children and young people in vision workshops
  - Utilise art, photography, film, focus groups, surveys with child care, playgroup and kindergarten children and parents, schools, youth organisations, informal gatherings, vacation care programs to elicit children and young people's visions and ideas

- **Data**
  - Consultations with children and young people (issues, local knowledge, use of the space/places, likes and dislikes) will provide rich data to the project
  - Information about children and young people (catchment statistics, other data sources etc) should also inform the project
  - Observe the presence/activities of children and young people in the project area

- **Analysis**
  - Use the vision, ideas, priorities, issues, knowledge of children and young people to inform data analysis and strategy development
  - Have children and young people assess the project area according to its 'child and youth friendliness' using agreed criteria and rating systems

- **Strategies**
  - Utilise the consultation findings to inform strategy development
  - Consult children and young people on draft Strategies

In addition to promoting engagement, the guide outlines a range of strategies for achieving a child and youth friendly built and natural environment. Table 2 is an excerpt from the design guide including strategy themes and a sample of strategies that are included in the design guide.
<table>
<thead>
<tr>
<th>Strategy Themes</th>
<th>Sample Strategies</th>
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</thead>
<tbody>
<tr>
<td>Sense of Place/Quality of Life</td>
<td>Way finding and orientation guides suitable for children and youth</td>
</tr>
<tr>
<td></td>
<td>Interpretative features provide opportunities for fun and learning</td>
</tr>
<tr>
<td>Getting There and Getting Around</td>
<td>Design that gives preference to pedestrians and cyclists of all abilities</td>
</tr>
<tr>
<td></td>
<td>Set-down areas</td>
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<tr>
<td>Designing for all ages and abilities</td>
<td>Playful elements encourage physical activity for all ages</td>
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<td></td>
<td>Residential accommodation (particularly medium and high rise) considers the needs of resident children for outdoor and indoor play</td>
</tr>
<tr>
<td>Playful Environs/Places</td>
<td>Play is integrated into the heart of new residential development and activity centres</td>
</tr>
<tr>
<td></td>
<td>Play opportunities encourage intergenerational play</td>
</tr>
<tr>
<td>Acknowledging/Acceptable Risk and Safety</td>
<td>Consolidate pedestrian connections in activity centres to the main spine</td>
</tr>
<tr>
<td></td>
<td>Ensure safe interaction between pedestrians and vehicles</td>
</tr>
<tr>
<td></td>
<td>Opportunities for safe exploration of natural areas</td>
</tr>
<tr>
<td>Public Space</td>
<td>Multi-functional, multi-use public spaces in activity centres</td>
</tr>
<tr>
<td></td>
<td>Variety of experiences</td>
</tr>
<tr>
<td></td>
<td>o Shady and contemplative space/quiet space, celebration and gathering spaces</td>
</tr>
<tr>
<td>Neighbourhood Living (school and home)</td>
<td>Activation of community use of schools (gardens, sports, community, culture)</td>
</tr>
<tr>
<td></td>
<td>Visual permeability from the street, Avoid blank walls and gated estates</td>
</tr>
<tr>
<td></td>
<td>Housing design to support family needs- storage (indoor/garage), living areas</td>
</tr>
<tr>
<td>Connection with Nature</td>
<td>Activity centres must integrate a variety of natural elements into their core (particularly elements that represent a ‘wild place’) with different textures, materials</td>
</tr>
<tr>
<td></td>
<td>Ensure easy access to natural areas</td>
</tr>
<tr>
<td></td>
<td>o Conservation areas, Local parks with nature based play, Waterways, creek, the bay</td>
</tr>
<tr>
<td></td>
<td>Green children’s environments (Child care centres, schools and others)</td>
</tr>
<tr>
<td>Get the Basics Right</td>
<td>Provision of Shade, Toilets, Water Points, Wireless/Broadband and other facilities</td>
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Child and Youth Friendly Redlands Policy

The Child and Youth Friendly Redlands Policy has been endorsed by Council. Among other things, the Policy commits Council to a city where:

- Children and young people are valued, supported, respected, provided for and feel included and connected to their communities. Children and young people are able to live well, feel safe and are protected from abuse, neglect and violence.

- Through inclusive planning and design, children and young people are able to live in quality urban, rural and island communities where public spaces are safe, fun and welcoming and circulation paths connect children and young people to a choice of education, transport options, open spaces and activity centres.

Child and Youth Friendly Redlands Indicators

The Child and Youth Friendly Redlands Indicators derive from the Child and Youth Friendly Redlands policy and include measures that are both within and outside of Council’s institutional responsibility.

The indicators provide Council with information on the comparative performance of Redlands children and young people and will highlight areas requiring attention through advocacy, intervention or program development.

A selection of the indicators is presented in Table 3 to provide an example of the type of child and youth friendly city indicators to be included in Council’s performance monitoring.

Table 3 Selected Child and Youth Friendly Redlands Indicators

<table>
<thead>
<tr>
<th>Child and Youth Friendly Redlands Policy Theme</th>
<th>Sample Indicator</th>
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<tbody>
<tr>
<td>Children and young people are valued, supported, respected, provided for and feel included and connected to their communities.</td>
<td>NAPLAN results for lower, medium and higher socio-economic Redlands schools</td>
</tr>
<tr>
<td>Children and young people will be supported to develop skills to become active citizens and be effective in influencing decisions about the city.</td>
<td>Children and young people’s involvement in community engagement programs (%/no of people and %/no events) No of Council-led and supported community engagement activities with children and young people’s voice considered</td>
</tr>
<tr>
<td>Children and young people’s creative and entrepreneurial abilities are supported by access</td>
<td>Level of youth unemployment and</td>
</tr>
<tr>
<td>Child and Youth Friendly Redlands Policy Theme</td>
<td>Sample Indicator</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
<td>------------------</td>
</tr>
<tr>
<td>to a choice of opportunities for learning, play, employment and creative expression.</td>
<td>underemployment (trend over time)</td>
</tr>
<tr>
<td>Through inclusive planning and design, children and young people are able to live in quality urban, rural and island communities, where public spaces are safe, fun and welcoming and circulation paths connect children and young people to a choice of education, transport options, open spaces and activity centres.</td>
<td>Number/% of young who report poor feelings of safety in the city (data gathered in bi-annual youth survey)</td>
</tr>
<tr>
<td></td>
<td>Number/% of young people who report poor community attitude to young people in public spaces (data gathered in bi-annual youth survey)</td>
</tr>
<tr>
<td></td>
<td>Reference to child and youth friendly policy and issues in key Council reports, strategies and plans</td>
</tr>
</tbody>
</table>

**Conclusion**

It is likely that none of the individual elements of Redlands child and youth friendly framework (policy, indicators, and design guide) would have emerged without the community’s vision and Council’s leadership for a child and youth friendly city. The package of tools seeks to influence the many spheres of Council’s responsibilities (governance, strategy and policy development, service delivery, development assessment and monitoring) to maximise the opportunity for Redlands to be ‘a great place to grow up’. A place where inclusive and welcoming public places and spaces create resilience.
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# 4th International Urban Design Conference

## ‘Non’ Peer Reviewed Papers

<table>
<thead>
<tr>
<th>Author</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lynne Armitage</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Meenakshi Arora &amp; Hector Malano</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>David Cox</td>
<td></td>
<td>15</td>
</tr>
<tr>
<td>Saeed Ebrahimbadi</td>
<td></td>
<td>25</td>
</tr>
<tr>
<td>Liam Filson &amp; Sue Little</td>
<td>36</td>
<td></td>
</tr>
<tr>
<td>Abu Hoque</td>
<td></td>
<td>52</td>
</tr>
<tr>
<td>Inji Kenawy</td>
<td></td>
<td>62</td>
</tr>
<tr>
<td>Stefan Kruczkowski</td>
<td></td>
<td>69</td>
</tr>
<tr>
<td>Todd Layt</td>
<td></td>
<td>80</td>
</tr>
<tr>
<td>Mohaddeseh Mahoodi &amp; Bushra Abbasi</td>
<td>91</td>
<td></td>
</tr>
<tr>
<td>Du Peijun</td>
<td></td>
<td>99</td>
</tr>
<tr>
<td>Colleen Rowe</td>
<td></td>
<td>105</td>
</tr>
<tr>
<td>John Troughton</td>
<td></td>
<td>113</td>
</tr>
</tbody>
</table>
Built heritage and sustainability: Perspectives on value

Lynne Armitage

Institute for Sustainable Development and Architecture
Bond University, Queensland
Abstract
The values associated with built heritage can be identified and defined in a number of different ways, often reflecting the perspective of the commentator. From the Australian perspective, the community’s commitment to heritage protection predates that of the formal legislature but has been slower to act than many other OECD nations. The National Trust of Australia, as a community organisation, championed the cause of built heritage more than two decades before the government responded by legislative action. It was not until the 1970’s that formal frameworks were established through statutory control mechanisms for the identification and protection of Australia’s rich stock of heritage places (Irons and Armitage 2011).

Currently the national conscience is becoming more aware of the need to reduce our carbon emissions. The potential opportunity cost savings achievable by the more effective use of the resources embodied in existing built structures has re-emerged as an area of interest and the imperative for policies and practices across the board to achieve reductions in carbon pollution is becoming normalised, albeit not yet fully mandated. Set within this context, this paper seeks to review the multifaceted elements which contribute to our perceptions of heritage which may be equated to a reflection of our values incorporating yet transcending the merely economic (Ashworth 2002) and also identifies responses being developed to deal with these concerns from a sustainability perspective.

The paper considers some of the many meanings of the relevant terminology and discusses concepts of cultural heritage, of place and of value providing a preface to a review of the value of heritage from a number of perspectives. It considers the benefits of heritage conservation including potential environmental benefits, and offers a contemporary commentary on some economic, social and professional concerns with particular reference to listed commercial office premises and the need to measure carbon footprint of such buildings. Reference is also made to the role of refurbishment and carbon profiling as techniques for reducing carbon emissions based on case study examples.

Keywords: Australia; built heritage; carbon footprint; heritage and environment; heritage value; property value.
Built heritage and sustainability: Perspectives on value

Placemaking has long been recognised as being as complex an activity as the places it seeks to manage. Healey commented quite recently (2010) that, in order to make places better for the stakeholders, there is a need for effective intervention. However, the complexities of urban place must recognise the plurality of purpose which placemaking needs to address as „systems better imagined as overlapping, loosely bounded and loosely coupled sets of relations” in preference to a hierarchical approach (op cit: 226). The stakeholder perspectives of urban placemaking which are focal to the approach adopted in this paper are fairly loose and overlapping and revolve around the value-to-user standpoint of built cultural heritage and its relationship to sustainability. The users may be the owners who occupy their own premises or their tenants and range from the community, financial institutions, public and private occupiers and investors and all are members of the broader society. The main property type under discussion is heritage listed commercial property assets, most specifically office property, but as little research exists in this area quite a lot of the material used has been sourced from studies of residential property where transferable.

Before discussing the main theme of the relationship between built heritage and value these terms will be considered individually. So, firstly what do stakeholders mean by „built heritage” and secondly what is „value”? The latter part of the paper looks at a case study of a commercial office development and the process of carbon profiling to measure, and thus limit, carbon emissions in the development and use of the property. The paper concludes with some issues of concern which have been identified by the Queensland Heritage Council (QHC).

Meanings of built heritage and heritage place

Given that there are four levels of statutory control over heritage – international, national, state and local – plus community based approaches such as the National Trust and the Burra Charter, defining built heritage can be problematic. However, to simplify matters the following Commonwealth definition gives a good indication of what is meant. Gazetted in 1975, the Australian Heritage Commission Act (AHC Act) initiated the heritage legislative system at the national level and whilst this statute has been superseded, subsequent legislation has reaffirmed the tenets of the Act. The Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act), for example, provides a more contemporary reinterpretation of the original definition offered by the AHC Act. Section 528 of the EPBC Act defines the heritage value of a place as including the „place”s natural and cultural environment having aesthetic, historic, scientific or social significance, or other significance, for current and future generations of Australians”. The EPBC Act also provides for a formal broadening in Australia”s heritage focus and offers a more appropriate and inclusive contemporary interpretation of heritage with Indigenous heritage value being specifically referenced and defined within the EPBC Act.

For the purposes of the EPBC Act, environment includes the „heritage values of places” (s. 528). As such, heritage, or more precisely heritage value is formally recognised as comprising a component part of the environment. A common misconception, rooted in the origins of heritage conservation practice, is that the terms heritage and historic are synonymous. This has the effect that „heritage means old” and results in a mistaken interpretation all too often adopted.
**Meanings of value and market value**

In the general community, the term *value* as indicated by the OED (1976:1285), has nine separate entries the first of which is *worth, desirability, utility* which is clearly recognised when heritage value is being considered as would another: *“one’s principles or standards, one’s judgement of what is valuable or important in life”*. Such definitions reflect the emotion which is often appropriately associated with heritage and may encompass diverse or conflicting emotions and value judgements (expanded by Ashworth 2002) which may cause disagreement when scarce resources (e.g. for conservation or acquisition) may need to be allocated.

The various definitions of *value* also include *purchasing power, worth as estimated* and *valuation* which is where the perspective offered by this paper is focussed. When an individual or other entity wishes to acquire a property in the market, they have to outbid other interested potential purchasers and so the eventual price reflects the new owner having valued the property more highly than others who were not prepared to match their offer price. This is an individual transaction price and whilst it reflects the purchaser’s opinion of value, a broader measure is required (in many cases) to establish value for, for example, balance sheet or other asset purposes or for establishing market value to support a mortgage. This broader measure is identified by the definition of market value as specified by the International Valuation Standards Council (IVSC), a not-for-profit organisation set up under United Nations’ auspices. The *market value* definition is:

> the estimated amount at which a property should exchange on the date of valuation between a willing buyer and a willing seller in an arm’s length transaction, after proper marketing wherein the parties both acted knowledgeably prudently and without compulsion.

**IVSC 2011**

This definition creates some issues when valuing a heritage property if there is no general market for such property but where a heritage listed property is well located from a market perspective, its refurbishment may result in a premium price over comparably located property, for example in the commercial office market, whilst also reducing the potential carbon footprint.

**Impact of heritage listing on commercial property value**

To consider the impact of heritage listing on property value as supported by empirical studies, there have been several in Australia, North America and Europe but most were undertaken in the 1990s and a comprehensive review of that literature may be found in Irons and Armitage (2011). Three of the more informative studies of commercial property are discussed below.

It is often asserted that heritage listing affects property value negatively for example with the constraint on a property’s redevelopment potential having been one of the prompts for the emergence of transferable development rights from listed commercial properties to other sites in the same ownership. A study of non-residential property in Victoria by the Urban Consulting Group (UCG 1995:132) found that the reduction in value may be short-lived and closely associated with the date of listing after which the property market absorbs the new status. Increases in value have been noted when an area/place is listed as this creates added value through the certainty that the local built character will be maintained as with the value of individual properties such as in a streetscape for example.
UCG (1995) concluded that there was a range of factors variously responsible for impact on the value of property with heritage listing including: “the nature of the building (building type); the condition of the building; the use of the building and the availability and feasibility of alternative uses; and the location of the building”. This led the authors to the very reasonable conclusion that “generalising conclusions regarding the impact of heritage listing on property value can be problematic”. (UCG 1995a)

Considering more specifically commercial property and heritage control in relation to development value, Dominy (2001) studied seven case studies in Sydney, Parramatta and Maitland. Both passive investment properties and properties that had been subject to adaptive re-use and/or redevelopment were considered. The focus for the former group of properties was on examining the impact of heritage controls on ongoing economic and financial performance and for the latter group of (refurbished) properties it was focussed on the financial feasibility of the individual development schemes on a cost/benefit basis, in light of the heritage controls imposed.

The principal finding from Dominy’s study include:

- The economic viability of property development is “first and foremost dependent on market related factors which are not generally related to heritage consideration. The identification of unmet market demand, the presence of favourable market conditions and timing in the market cycle are essential prerequisites for economic success, regardless of whether a chosen property is heritage listed or non heritage listed” (p. 174).
- In each redevelopment case study the individual nature of the heritage listing did not deter project commitment by a developer.
- Heritage listing, in the four redevelopment cases studied, did not affect negatively the projects’ direct financial feasibility.
- Project costs overall were increased in all of the four development case studies due to their heritage listing but the costs were not significant and were found to be recovered and, in fact, were exceeded by the commensurate increases in project value gained via the development incentives which were generated through transferable development rights or other heritage offset bonuses.

Dominy focused exclusively on non-residential property and, as with the UCG study, stressed the dominant role of market-related factors – which are not generally a heritage consideration – in determining the economic viability of development projects.

The third study was undertaken in 2006 by International Property Databank for English Heritage, the Investment Property Forum and the Royal Institution of Chartered Surveyors. (IPD 2006) It is a major study, noteworthy given the number of listed office properties sampled at 221 and their value – GBP 1.6 billion. Whilst the study was national, three fifths of the sample of offices owned by investors (mainly superannuation funds, property investment companies and insurance companies) were situated in the West End of London. The listed properties differed from the total stock of offices held in investment portfolios by being older and also by being smaller. Except for the City of London and London Mid-town, rental values were lower than on the newer, unlisted buildings and investment returns (equivalent yields) were in-line with those of unlisted properties except in the City and Mid-town where they were lower (stronger). The report considered that “the long-term performance of listed and unlisted offices appears to have been identical at the national level” and, even after the influence of the large stock of top-performing listed properties in the West End is discounted, the return on listed property shows only a 0.3%
weaker yield. When a longer term view is taken, from 1981 when IPD records began, a decline in the number of listed offices owned as a proportion of total office property held by the investors fell sharply: „Whereas the number of unlisted offices fell by 10% between 1981 and 2004, the number of listed offices halved.” (IPD 2006:6) Their contribution to total capital value also fell from 8.3% in 1981 to 4.3% 23 years later in 2004.

The reasons for the reduced attraction of listed office property to the institutional investor is attributed to the institutions’ increasing preference for large properties; the sale of smaller properties (which are more likely to be the listed ones) to private property companies and other investors who assets are not covered by IPD records; a policy to update the portfolio and concerns of obsolescence in older buildings. In addition, a trend to acquire office property outside Central London (where there are fewer listed office buildings) also contributes to the decrease in the representation in the portfolios. Three positive characteristics of the listed office sample were noted (IPD 2006:i): outside London, there were fewer vacancies in listed buildings; future rental income growth for listed property was greater than for non-listed property (though that may be a feature of that particular market structure) and, in the longer term, lower refurbishment costs have been recorded by investors of listed compared to non-listed property suggesting „investors in listed offices have not had to spend more on refurbishment in order to attract and retain tenants.”

**Sustainability and listed property performance**

Queensland Heritage Council (2009:6) proffers a number of reasons why heritage matters from a sustainability perspective. It recognises that conserving heritage places is a form of sustainable development which contributes to community identity but that the best way to protect historic places is to ensure their active use and good maintenance, often within a changing economic and/or social context. Direct economic benefits can accrue to both the community and to property owners through local area improvement and continuing use avoids the need in many cases for demolition as more gradual adaptation is more feasible and may be less costly than replacement by new construction.

When considering the value of heritage listed office property, it would be interesting to be able to identify the proportion of such property in use which is in public or private ownership as that in private ownership generally has to pay its own way without subsidy and if refurbishment and retrofitting can be found to be a viable economic outcome, the property can be well employed in the market, valuable resources can be retained and carbon footprints reduced. Asset valuations of buildings in public ownership can ensure effective operation of building services to contribute to a reduction in carbon dioxide emissions which can be reflected in the triple bottom line assessment. The increased value of productive heritage property can contribute to increased public income through the property rating system and indirectly contribute to subsidies for non-economic heritage property.

**Sustainability options for commercial property**

Although unique neither to heritage listed property nor to commercial property, the following examples of initiatives which are being promoted to support a reduction of carbon emission in buildings and the associated process of construction may be considered relevant to the current discussion.
1. RICS/BIS low carbon construction

Whilst Australia is working its way towards a legislated and then a traded carbon emissions system, there is as yet no national framework established for low carbon construction although compliance with a range of performance standards at the national and state levels is well advanced and the early adoption of green office leases by government has been a strong incentive to property owners to ensure their buildings are attractive to this major sector of the leasing market.

In June 2011, the UK government Department for Business Innovation and Skills (UK BIS 2011) responded to a report of the Low Carbon Construction inter governmental taskforce (LCC IGT) noting, inter alia, the need to „demonstrate the benefits of low carbon construction … in the public and private sector”, enable the industry to better understand future opportunity in this field and enable the market to flourish with appropriate „skills, research and innovation.” One industry contribution to the debate is from the RICS (2011) which nominated several opportunities to for the construction industry to contribute to government and industry programmes to promote low carbon construction. These include the need to consider: a standard method of carbon measurement for embodied carbon, low carbon procurement, appropriate use of „smart building” systems/building information modelling (BIM), research into energy performance of buildings and places held in the public estate, research into the impact of low carbon credentials on the market value of property, more rigorous requirements for the fit-out of buildings, the extension of green leases for commercial property, life cycle cost assessment and the extension of enhanced capital allowances to incentivise more spending to reduce emissions.

Australia is recognised as a world leader in several of these categories (RICS 2011) particularly in respect of the green lease requirement of the public sector and in carbon accounting. Considering more specifically the role of carbon measurement in construction, a recent analysis undertaken by quantity surveyors and building economists WT Partnership (2011) indicates that „the nett trade cost of construction on a cradle-to-gate basis of embodied carbon will rise by 0.35% to 0.70% as a result of carbon pricing.” Whilst this will be a substantial sum on a major construction project, compared to other areas of potential cost variability, it is not a large percentage of total costs of construction. If a cradle-to-grave approach is adopted, the carbon footprint of the building over its lifecycle increases and the durability of the building, such as with long lasting properties – many of which may be heritage listed – bears consideration. The longer economic life of the building results in a lower annualised carbon footprint and the deferment of the need to initiate a new structure with the highest incidence of carbon emissions occurring during construction is reduced.

2. Ropemaker Place case study

Ropemaker Place is the redevelopment by British Land Plc of a site in Ropemaker Street in the City of London/London Borough of Islington to provide some 80,000 square metres of office space over 20 floors. The building was completed in 2009. A study of the development was completed by Sturgis and Roberts (2010) using a carbon profiling methodology (fully detailed in the report) which demonstrated that by identifying the building components and choosing materials, designs and techniques to reduce carbon equivalents „the building is shown to be performing overall 63% less than its notional (control) equivalent. What is also apparent is that the majority of these improvements are focussed on the operational side of the Carbon Profile.” (Sturgis and Roberts 2010) Appendix 1 (op cit:43) of the report also makes recommendations for all buildings, stating „A few key areas exist that, if resolved at the design stages, can have a great
effect on a building’s durability, longevity, value and overall carbon performance.” Their study also highlights the role of the building’s occupants who, for 98% of the structure’s life between completion and redevelopment, are the source and control of a large part of the building’s operational carbon emissions.

It should be noted that Sturgis and Roberts’s comment that reduced carbon emissions „enhance value” needs to be viewed somewhat critically as there is no evidence in their study to support this assertion, particularly from a market perspective. The jury is still out on the effect on property value of enhanced green credentials and research from the USA (Eichholtz, Kok and Quigley 2010) found that, between their 2007 and 2010 studies, „the „green” premium decays over time: for every year of „label decay”, the rental premium decreases by 0.4 % and the transaction premium decreases by 1.7%.” This could be accounted for by the reduced impact of zealous early adopters being joined by more measured tenants and owners as well as from the impacts of a less buoyant American property and employment market during the study period.

Issues

Queensland Heritage Council’s 2009 Heritage Strategy (QHC 2009) provides a useful review of issues which remain to be addressed in order for the heritage which we value to be best managed. These include:
- Population pressure, development activity and a resources boom
- Local heritage is identified and protected in an inconsistent manner across the state
- Cultural heritage is not well recognised in the town planning process
- Economic data on the value of cultural heritage to the community is sparse
- Further incentives for owners of heritage property is needed
- The impact of cultural heritage on property values is not extensively researched
- The role of philanthropy from private and corporate donors is untapped
- The potential for heritage offsets to benefit heritage property and places needs strengthening
- Awareness of many aspects of cultural heritage management and contribution is limited in the community and government.

Conclusions

The paper has attempted to link the concept of value from both a built heritage and a sustainability perspective which is a path which appears not to have been trodden by many other researchers, possibly for reasons which are self-evident. The author is very aware that the paper has strayed from its original intention which was to focus on heritage and market value but the decision to look more thoroughly at the impact of sustainability on development practice has greater urgency and is an avenue which is leading to further case study research currently being undertaken on other heritage listed commercial property. These limitations are a consequence of the dearth of material which relates specifically to the nexus between listed property and sustainability. This imbalance will be reduced when next year’s conference paper will (hopefully) report on current research into listed buildings’ sustainability profiles and performance more directly.

References


Integrated Water-Energy-GHG Management for a Sustainable Future

Meenakshi Arora and Hector Malano

The University of Melbourne, Australia
Abstract
Water and Energy are the mutually reliant fundamental infrastructure sectors. Water is critical for electricity generation and electricity is critical for water provision. Water security is closely linked to energy security and therefore the Greenhouse gas (GHG emissions). With ever increasing population and industrialization, the available water resources are under extreme stress and there is a pressing need to look for alternative water sources, water reuse and recycling by adopting integrated urban water management and also looking at the energy intensities of the proposed solutions. The nexus between energy and water supply is increasingly important due to water scarcity facing many regions around the world and efforts to mitigate GHG emissions. Energy use and its associated GHG emissions form an integral part in every step of the urban water cycle and wastewater treatment. This paper will discuss strategies to achieve the long term water and energy sustainability.

Keywords: Sustainable, urban, development, Water, Energy
Introduction
Sustainable water supply and wastewater collection is one of the most significant services and needs careful planning and management, not only in terms of infrastructure development, but also to maintain the minimal standard and continuity of the service. Water scarcity facing many regions around the world is also critical to Australia. With rapid population growth and resulting urbanization, water demand is on rise, hard pressing the finite global water resources, with per capita water availability steadily decreasing. As most major cities of Australia expand and existing areas are redeveloped, energy consumption associated with water distribution will increase. Also, water shortage for electricity generation puts extra pressure on energy sector (Hightower and Pierce, 2008). Water security and decarbonisation of the economy are the key defining challenges of this century. Population growth, intensive agricultural development, urbanisation and industrial growth are all leading to increased demand for water at the same time as environmental impacts of current water systems are being increasingly scrutinised. There is an increased concern about climate change globally and an urgent need for GHG mitigation options reflected in the Australian Government’s Carbon Tax policy. As water industry is a big user of energy, it warrants for a paradigm shift in the way urban water services and energy services are managed, to prevent the demand exceeding the supply by considering both demand and supply options together. As many nations are now looking at alternative water supply options including rain water tanks, recycling and reuse, desalination etc. to provide future water security, it is critical to carefully assess the energy intensity, implications of associated GHG emissions and cost effectiveness of proposed strategies. This is, especially significant since most of these alternative water supply options have greater energy intensity than traditional sources (Cohen et al, 2004; Marsh and Sharma, 2007). Energy used to move water is estimated at 7% of total global energy use (James et al, 2002). Climate change adds further complexity in some regions by reducing water availability and it therefore increases the energy inputs and associated emissions to access and treat water (Kenway et al, 2008). Therefore, it is imperative to understand the water-energy nexus to enable the water sector to reduce its operational energy costs and reduce GHG emissions to facilitate the design of water and energy systems capable of realizing more synergistic benefits (Sattenspiel, 2009). This paper will discuss the integrated urban management along with energy and GHG emissions management.
Urban Water Cycle

Traditionally, the water supply, sewage disposal and stormwater drainage in Australian cities have been considered separately which inhibits the interactions between these phases of water cycle to be understood and utilized to better manage the urban water provision. Therefore, the water authorities need to re-evaluate the traditional approach and seek alternative ways to minimise the impact of urban planning on environment by understanding the energy intensity of water provision and vice versa along with associated GHG emissions. This would require a more holistic view allowing all three components of water cycle, energy usage & GHG emissions and their interactions to be considered together throughout the various stages of urban water cycle.

In most countries, the water is extracted from aquifer or surface water body, transported to a water treatment facility where it’s treated and purified to drinking water quality standard and distributed to consumers. The waste water produced by consumers is transported to wastewater treatment facility for treatment and disposal without or minimal recycling or reuse. The stormwater from individual household and public places is collected and transported by stormwater drainage system and released into the environment without any pre treatment. So it’s a single use approach, water is used only for one use and discarded and a very high quality drinking water is generally used for all the end uses including toilet flushing, irrigation etc. which does not need high quality drinking water. This presents an opportunity to provide fit for purpose water by reusing the rainwater and recycling the grey water. As water resource is limited and the ever increasing population and industrialization is putting significant stress on the aquifers & river systems and on the infrastructure network to transport water and wastewater, single use of water is not sustainable.

The stormwater drainage from urban regions to avoid flooding is very costly as well as puts enormous pressure on the receiving water ecosystems as it brings heavy loads of contaminants and sediments from the urban areas. Therefore, there is a need to adopt a system approach considering imported water, wastewater and rainwater as a system in which output of one subsystem feeds as input to another subsystem, called Integrated Urban Water Management (IUWM) and also to look at the energy intensity of each step. The main objective of Integrated Urban Water Management is to optimize the urban planning and management of water cycle by rainwater collection, stormwater harvesting and wastewater reuse, and is also called Water Sensitive Urban Design
(WSUD). It is based on the principle of diversifying water source options that connect with reinforcing sustainable water use for improved micro-climates benefits like healthy waterways while providing low carbon supply options, reduced imported water demand, reduced pressure on the water supply and wastewater collection infrastructure, enhancing community well-being and liveability (Mouritz, 2007)

The rainwater falling on the roof is quite clean and can be harvested and used on site to reduce the demand for imported water considerably. Coombes et al, [2000, 2002] reported that rainwater collected from roofs in an inner city area and stored in tanks was of acceptable quality for hot water, toilet and outdoor uses. Also, the quality of rainwater improved in rainwater tanks. The collection and use of rainwater can provide significant savings in amount of imported water required & distribution infrastructure and stormwater infrastructure requirements along with reduced flash flooding and improved stormwater quality. Stormwater harvesting reduces the pollution load considerably reaching the waterways. The other potential source is recycling the grey water. Mitchell et al [1997] and Troy [2004] reported that the use of treated wastewater for outdoor and toilet flushing can significantly reduce water demand and sewage discharges. Demand management is a significant tool aimed at increasing the system efficiency at utility level and end use level, promoting locally available resources and water efficient appliance use (White & Fane, 2002). This can be achieved by a mix of behavioural and technical changes.

**Water Energy Nexus**

In 2010, Melbourne Water supplied 361 GL of drinking water to the retail water businesses and treated a total of 271 GL of sewage at the eastern and western treatment plant. Melbourne Water is among the top 15 electricity users in Victoria and the top 150 in Australia and used 1.64 PJ of energy in 2009/10 (1.416 PJ in 2008/09) costing $20.2 million on energy compared with $17 million in 2008/09. Operational GHG emissions were 351,071 tonnes of carbon dioxide equivalent (Melbourne Water, 2010). Additionally, the recently constructed desalination plant with a capacity to deliver up to 150 GL a year, would consume 2,160 MWh/day of energy and produced 1.4 Mt of CO2 emissions during construction with additional estimated 1.2 Mt CO2/year. For most cities, new sources of water such as desalination, recycled water and rainwater tanks have greater energy intensity than the traditional sources (Hightower and Pierce, 2008).
Recently increased concern about climate change and the need for GHG mitigation options focused attention on water related energy use and its GHG implications. Therefore, having the capacity to quantify energy and carbon emissions associated with the entire water cycle is critical to assist in planning for the adoption of a strategic approach towards water supply and discharge. It’s important to ensure true energy neutrality of water supply strategies. In recent years, significant efforts have been made to reduce water consumption and GHG emissions. These efforts, however, have largely been carried out separately on water resource management and GHG emissions, and the coherence is generally not reflected while planning and managing the water and energy resource due to lack of tools capable of analyzing the nexus between water supply and energy/GHG in an integrated way. Wilkinson, 2007 studied the energy usage for urban water supply. But the study did not focus on GHG implications and possible solutions. Lundie et al., 2004 evaluated the water and wastewater services projected for 2021 in Sydney and concluded that demand management and energy efficiency provide the best opportunities in terms of water and energy savings. Kenway et al., 2008a, studied the energy usage in provision and consumption of urban water in Australian and New Zealand cities at the system level, object level and total urban energy use. The study provided a first estimate of energy use for water provision in Australia, but does not offer an in depth understanding of the interactions between the water and energy use and GHG emissions under various scenarios. Detailed assessment and understanding of the Water-Energy-GHG nexus is crucial to enable the water and energy systems to understand where gains can be made more effectively (Rocheta and Peirson, 2011) and to ensure that the adaptation strategies in urban water supply systems do not pose exacerbate climate change.

This understanding is crucial to facilitate the achievement of optimum climate change adaptation of water and energy systems through the selection and evaluation of alternative strategies by enabling the comparative analysis of various strategic options in terms of water availability, water quality, energy use and GHG emissions associated with water provision. This study recommends the development of the necessary evaluation tools needed to enable the implementation of such an assessment framework. The tool can become comprehensive industry standard with appropriate modelling capability for quantifying the energy consumption and its impact on GHG emissions of any proposed new urban water supply strategies.
Conclusions
Traditionally, the domestic water services have often failed to address the multiple water demand for multiple purposes like drinking, toilet flushing, cloth washing and irrigation. The water supply has typically focused on single-use services which is not sustainable with ever increasing demand for water. There is a need to utilize the huge potential nested in rainwater harvesting and wastewater reuse and recycling and to understand the energy intensity of each option to find the most suitable infrastructure option for water provision in decentralized manner. Therefore, there is a need to develop a comprehensive accounting framework for combined evaluation of water flows, energy use and GHG emissions to identify opportunities for cost effective efficiency gains in terms of water, energy and emissions savings.
References:
Urban planning and fire design. Should communities protect themselves against the spread of fire from neighbours?

Mr David Cox, B.Arch (UQ-Qld), M. Arch (Heriot Watt/ ECA-Edinburgh), FRAIA, RIBA

*Director, Cox Architects*
INTRODUCTION:

The theme of this conference is ‘Resilience’. Resilient Cities protect and enhance their urban resources while managing the impact of climate change and population growth.

One of the impacts of climate change is the increased prevalence of fires.

My paper deals with this ‘part’ of climate change and what impact this aspect has on the design of our cities.

My conclusion is that we are not dealing with this aspect very well, and it seems to be a forgotten subject when it comes to discussing and undertaking urban design. It’s time to take stock and deal with the problem.

Much of my research in recent years has dealt with the improvement fire design and the development of fire-safe buildings. There are significant ramifications of this work which relate to the design of our cities as well.

My paper will deal with new possibilities for both urban and rural areas in accommodating the damaging effects of bushfires. I will use a case study, being a display Fire Station, which demonstrates how we can design for these events and improve the sustainability and safety of our cities and rural infrastructure accordingly.

PART 1: COVENTRATED

The word ‘Coventrated’ is a buzzword of the English language. It did not exist on the 14th November 1940. It did, however, come into existence one day later.

On the evening of November 14th, 1940, the German Luftwaffe staged a bombing raid on the English city of Coventry. Coventry was an attractive target to the Germans, being the site of a number of key British munitions factories. They had bombed the city before but this time it was different. The following are recollections of the events of that evening:

- The moon began to rise over Coventry at 5.18 pm. Everyone would later recall its extraordinary brightness. It gleamed on the cobbles of the old city and the lead roof of the cathedral. The sight made people nervous. The citizens had come to fear a bomber’s moon.
  - At 7.10 pm the sirens sounded. This was early for a raid to be announced and the apprehension deepened. Ten minutes later the Germans were overhead and the bombardment began. It started with small incendiaries. They make a curious swishing noise as they fell. ....
- They came down in huge numbers and the emergency services and volunteer firewatchers were soon overwhelmed. At 9.31 p.m. the first high explosive (HE) bombs hit the ground. A firewatcher’s log recorded at 9.40 p.m. “Cathedral blazing fiercely.” ..........

By midnight, Coventry’s defences were overwhelmed, and the city was ablaze – German bombers who participated in the raid would later speak about the lake of fire they saw beneath them, while the city’s own fire fighters spoke in despair about how they simply could not control the inferno.
The all-clear sounded at 6.16 am (next day), eleven hours after the first warning. Few heard it.

To that date, the use of explosive devices by the Germans had not created widespread devastation. This time was different. They used fire.

Coventry had been hit by 503 tons of high explosive, 56 tons of incendiaries and 127 parachute mines. The combination of high explosives together with the incendiaries effectively scattered the incendiaries in all directions starting fires wherever they landed.

What happened that night in Coventry is understood to be the first example of a man-made fire storm. Technically it was a new invention. Many cities had been burned before by fire and many had been started by man, but this was the first time man had harnessed the power of fire storm to effectively destroy a city, and all in just 11 hours.

As well as widespread devastation of the commercial and industrial areas of Coventry, 42,904 houses, consisting of more than half of the city’s houses, were destroyed. It was not the explosions that caused this devastation, but the intense ferocity of the fires that spread through the city.

Of course, not all fires are man-made, but if the destruction of Coventry that night in 1940 teaches us anything, it’s that safe, sustainable and resilient urban planning is vital to mitigate the effects of such disasters.

Lessons that can be learned from this example are:

- The containment of fire from one property to another is vital to the survival of the whole of a city.
- The fire rating standards of each building has a direct relationship with the fire rating performance of the entire city.
- The material and construction of the roofs of most of the city effectively made the city vulnerable despite the predominent use of masonry wall construction for the walls.
- If the buildings were constructed of non combustible materials and design, the city would not have been devastated.

PART 2: DENIAL IS NOT A RIVER IN EGYPT

For many years Australians have ignored the effects of fires in urban planning and building design. Despite this, Australia’s worst three bush fire ‘disasters’ have occurred in the last ten years.

Despite the repeated warnings signs for many years we are still living in denial by continuously building cities which are vulnerable to devastation by fire. I suggest we may well be the ‘lucky country’ but we can’t trade on our luck for too long.

A definition of stupidity is doing the same thing and expecting a different result. For as many years as I can remember, people have been building houses in the Dandenong Ranges in Victoria, being burnt out, and rebuilding the same or similar buildings in the same place. There are a new building standards for these areas, but why has it taken a recent disaster to prompt people to act and why
historically have we ignored the repeated warnings in a country where fire is a natural and recurring event?

Some of Australia’s worst recorded fires have occurred in the last 10 years. These include:

- **2009** Black Saturday Fires, Victorian Bush Fires, 7th Feb, 2009: Australia’s worst bush fire in the nation’s history. 173 people killed, over 5000 people injured, 2,029 homes destroyed, and 4,500 sq.km forest burnt.

- **2003** The Canberra urban fires, Jan 8th 2003: Australia’s second most expensive fire. 4 people died, 470 homes destroyed, 2000 businesses damaged, and repair bill $450 million.

- **2011** Black Sunday Fires, Perth, 5th Feb 2011: no loss of life, 72 homes destroyed, 32 more damaged.

(Note: Prior to the last 10 years, The Ash Wednesday Fires of Victoria and South Australia, in 1983, caused the death of 75 people.)

If we include recent international fire reports in only the last 2 weeks, they include the following:

- **2011**-from the 6/9/2011, Texas Fires: 3.5 million acres of state forest destroyed, over 1000 homes destroyed, over 600 homes destroyed around one town, Bastrop. The fire was ‘whipped’ into an inferno by tropical storm Lee’s winds. Death toll 4 at least, and thousands of people evacuated.

- **2011**-Canberra Chemical Fires, Australia, 17/9/2011: Fire broke out in an Industrial Estate of Mitchell, suburb evacuations, Fire took 22 hours to bring under control.

From the above brief lists of fires referred, it is noted:

- Both the Canberra Fires, the Perth fire and the Texas fires damaged extensive urban areas and not just bushland areas
- The large proportions of homes destroyed in these fires were in urban areas.
- Extensive and devastating damage by ‘bush fires’ worldwide is not an uncommon event.

It can also be seen that Australia’s preparedness for these events should go beyond simply improving the standard of homes in bush land areas alone. We should be improving the standards of our urban areas as well.

Despite the recent history of devastating fires referred above, Australia is still largely unprepared to withstand these events occurring in our urban and rural areas. This is most likely because it is commercially cheaper to ‘insure’ the risk than it is to mitigate the risk by design.

The more worrying aspect of our dependence on ‘insurance’ is that it is not only individuals who are avoiding the problem by relying on insurance policies, it is governments as well.

These pieces of paper are of no tangible benefit when we have to face devastation by fire. Should one of our cities be ‘Coventrated’ by either a manmade or natural event, then it is unlikely the insurance companies will exist let alone be in a position to replace what has been lost. This is cold
comfort to governments and individuals who have relied on the ‘insurance panacea’ to solve the problem.

The value of ‘insurance’ is to spread the financial risk. Individually this is a useful feature available in our society but collectively (e.g. governments) we should be investing in practical ways of solving the problem in the first place rather than simply trying to mitigate the financial risk to others.

Our community needs to face up to these challenges or face the consequences of inaction. Managing Emergencies requires skill and commitment from many different parties. It requires input from urban planners as well. These principals are perhaps better and more fully described in Jackson’s “Managing Emergences - Guidelines for Emergency planning”. (Refer bibliography)

The reason for raising these issues in this section is because it is the urban planners who must take the key role in making this change. Architects may provide technical individual solutions but it requires a collective effort by the urban planners and town councils to effect this change and raise our preparedness for the extreme events. We should be focusing on ensuring that new buildings do not to permit the spread of fire to neighbours and that they are constructed in such a way that they will withstand fire attack from outside the building. There are also many benefits to ensure they are protected from inside exposure as well.

This requires a different approach to the design of buildings. It goes beyond simply meeting present building act requirements (ref BCA). It is also of little use unless collectively we all adopt this higher standard of design. The benefits, however, are far reaching. We will be going a long way towards ‘Future proofing’ our cities for the next generation whilst protecting our own.

With this theoretical background in mind, Cox Architects set out to design a practical construction system which would satisfy these requirements and hopefully lead the way to solving at least some of these problems.

PART 3: RESEARCH PROJECT- Xanthorrhoea 1-FIRE STATION.

‘Xanthorrhoea 1’ is a research project undertaken by Cox Architects to examine and develop primarily new construction systems suitable for building in bush fire prone areas. This project culminated in the construction of a full size prototype building.

The theoretical aspects of the study, which commenced in 2005, confirmed that it was not sustainable to continue to build in standard construction techniques in these areas because the buildings constantly failed. There was a vast waste of resources and a serious threat to life to continue to do so. It was also found there was not a construction system available which could withstand the full effects of bushfires. To overcome this problem, this new construction system was developed.

The system used in constructing the prototype building was patented prior to the Victorian Bush Fires of February 2009 and the prototype was largely completed by then. This research anticipated Australia’s vulnerability to such an event occurring.
The building is designed for the most hazardous category of bush fire attack. It has been independently assessed to meet this standard and has the potential to exceed the same. The construction system offers improvements in overcoming other broader effects of global change by providing a high resistance to cyclones and floods. Other benefits include low maintenance, high thermal insulation, high durability, and high security. The combined effect of some of these advantages reduces energy consumption.

A unique feature of the system is the integration of the roof and walls. Rather than fixing the insulation under the roof, this system forms a structural fire insulating shell over the building which is integral with the walls. This makes the roof far stronger than standard. The protective layer is like icing on a wedding cake in that it covers and protects the entire cake.

The windows are protected by patented fire resisting awnings which are part of the construction system. They offer a range of other benefits including reducing energy consumption. The building is solar powered and requires minimal energy consumption. The services are independent as necessary in remote rural locations. The construction system demonstrates that it is suitable for a range of different small building types such as Fire Stations, Police Stations, Schools and other civic buildings. In rural areas especially, these community buildings play a very important role by providing shelter and acting as communication centres in times of crisis.

By ‘Raising the bar’ in regards the durability and performance of our buildings, they will last longer, require far less maintenance, and provide better shelter against the increasingly unpredictable effects of climate change. In doing so, they will be more sustainable than current standard construction methods. This project tries to achieve this and to lead the industry towards building assets in the future, not liabilities. It also proves that you can build responsibly in bush fire prone areas.

PART 4: BUILDING ELEMENTS - ROOFS.

In the research project above, it was found necessary to invent many different items and methods of construction in order to produce a building envelope that would sustain the full effect of a bush fire attack. The reason that each of these individual items is so important is because should one item fail, then the whole of the protection system could fail. Essentially a chain is as strong as its weakest link.

There is not sufficient time to discuss the research into each element of the research project but if I was given the opportunity of improving only one item in the effort to improve the fire resistance of the average residential or small commercial Australian building, then it would be the roof. This is because it was found that it was the roof design inadequacies which caused the major breaches of the fires investigated.

It should be noted that for a single storied average Australian residence that:

- The majority of surface area of a building envelope is the roof.
- The roof has no fire rating protection at all.
- The junction with the walls is often the fire entry point of the building.
- With regard to fire resistance, the roof is the weak point of the building.
In consequence to the above, and the investigation of the effect of fires around buildings, it was clearly necessary to design new methods of protecting the roof element as this element was going to be critical to the whole project.

The final result was a system that achieved a very high fire resistance against external bushfire attack. One part of same alone achieved a rating of ‘3’ hours. The complete system should be considerably more than this. It is understood that this very high rating has not been achieved by a roofing system before. (For more detailed description of FLR’S refer appendix).

The relevance of this item is that should we raise the fire resistance performance of all roofs used in a city to this standard, then this change in itself would dramatically improve the preparedness of the whole city against fire and other extreme events. It is also reasonable to make the assumption that should this technology have been available and used in Coventry in 1940, then the word ‘Coventrated’ may not have existed.

PART 5: URBAN PLANNING- USES OF THIS TECHNOLOGY.

There is a myriad of ways this new technology can be used in urban planning to help protect our cities and urban infrastructure from the devastation by fire or fire storms themselves. This paper highlights to availability of this new technology in response to the need already discussed. The implementation of the same is another exercise.

However, to demonstrate applications of this technology in urban planning and different building uses, the following are three conceptual examples of the same:

A) Urban Planning- City -‘The Brisbane Line’:

I have called this planning concept of mine ‘The Brisbane Line’ which has historic connotations. The concept could be used in many cities around Australia and elsewhere.

It is obviously very difficult to implement these new standards of design into the whole of an existing urban fabric. For economic reasons the adoption of these new standards may not be feasible in very low density housing areas commonly described as ‘urban sprawl’.

However, new low and medium density housing and commercial buildings are well suited to the adoption of this technology. If these buildings are upgraded with this technology, then they could act as ‘walls’ of built form that could serve as buffers around the central business zones thereby providing additional protection to the latter. The ‘walls’ I have termed the ‘Brisbane Line’. (Refer to the attached sketch which describes the same).

B) Urban Planning- Rural:

There are many areas or rural land surrounding cities in Australia which have been deemed by local councils as being unsuitable for housing and other building uses because of the high fire danger
posed by bush fires. Using current building practices this restriction is quite understandable and responsible.

Using the technology described in this paper, however, it is feasible to build in these areas providing other infrastructure such as safe road access etc is provided. Obviously councils will need to engage with the local fire authorities in the formulation of the building control requirements.

C) Urban Planning- Building Uses:

There are many building types that could benefit from the use this technology. They include:

- Civic buildings in rural areas that can act as shelters in extreme weather events. (e.g. schools, local halls etc)
- Civic buildings in urban areas that require better protection against urban fires. (e.g. court houses, council chambers, schools, etc)
- Police stations, fire stations, railway stations and municipal service buildings
- Auditoriums and theatres of high public use.

PART 6: WHAT DO WE LEAVE BEHIND?

Whilst many believe that every new suburb developed and every new high rise apartment building constructed in our county is a sign of progress and prosperity, I raise the question that this may not be the case.

My concern is that if buildings are not sustainable, then building them is not making progress. We are more likely simply creating yet another liability for our future generations to endure. Hence I suggest by investing in making our cities more durable and sustainable and making them in a way which they will be able to sustain extreme climatic events including fire attack, we will be ‘future proofing’ our cities for the next generation. In this way we will be providing them with assets in the future and not liabilities. Also, with the reduction and resources and energy use, it looks like they are going to need whatever assets we can give them.

PART 7: APPENDIX

FIRE RESISTANCE LEVELS:

The Building Code of Australia (BCA) requires buildings to comply with a Fire Resistance Level (FRL).

The BCA defines a FRL as the grading period in minutes for three criteria: structural adequacy, integrity and insulation:

- Structural adequacy refers to the ability of a structure to maintain its stability and load bearing capacity
- Integrity means the ability of a structure to resist the passage of flames and hot gases
- Insulation is the ability of a structure to maintain a temperature below specified limits on the surface not exposed to fire.
An FRL requirement for a wall of 90/90/90 would mean that the wall must maintain structural adequacy for 90 minutes, integrity for 90 minutes and insulation for 90 minutes, as tested to Australian Standard 1530.4-1990: ‘Methods for fire tests on building materials, components and structures-Fire resistance tests of elements of building construction’.

Buildings that are required to have fire-rated components can use certified wall, floor and ceiling systems that have been tested to the above standard.

PART 8: BIBLIOGRAPHY

- COX ARCHITECTS [WWW.COXARCHITECTS.COM.AU](http://www.coxarchitects.com.au)
- BCA refer Appendix above.

PART 9: ABSTRACT

ABSTRACT: International Urban Design Conference- Resilience in Urban Design- 2011:

For many years Australians have ignored the effects of fires in urban planning and building design. Despite this, Australia’s worst three bush fire ‘disasters’ have occurred in the last ten years. It’s time to take stock and deal with the problem.

My talk will deal with new possibilities for both urban and rural areas in accommodating the damaging effects of bushfires. I will use a case study, being a display Fire Station, which demonstrates how we can design for these events and improve the sustainability and safety of our cities and rural infrastructure accordingly.

The Fire Station is the result of a research project undertaken by our firm to examine and develop new construction systems suitable for building in bush fire prone areas. The project culminated in the construction of this full size prototype.

The theoretical aspects of the study, which commenced in 2005, confirmed it was not sustainable to continue to build in standard construction techniques in these areas because the buildings constantly failed. To overcome this problem, this new construction system was developed.

The construction system demonstrates that it is suitable for a range of different small building types such as Fire Stations, Police Stations, schools, and other buildings including housing. Community...
buildings, especially in rural areas, play a very important role by providing shelter and acting as communication centres in times of crisis.

By ‘raising the bar’ in regards the durability and performance of our buildings, they will last longer and provide better shelter against the increasingly unpredictable effects of climate change. In doing so, they will be more sustainable than current standard construction methods. This project tries to achieve this and to lead the industry towards building assets in the future, not liabilities. It also proves that you can build responsibly in bush fire prone areas.
The Winter climate and non motorised travel modes – a case study in Kiruna, Sweden

Saeed Ebrahimabadi, Charlotta Johansson, Maria Öberg, Kristina Nilsson

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Abstract

The paper presents part of the results from a survey study, in Kiruna, Sweden’s northernmost town. The focus of the study was on travel pattern in towns with sub-arctic climate. The findings of the survey showed that inhabitants of Kiruna travelled more with car compared to other Swedish towns with similar population while public transport, walking and cycling held very small shares of the total travels. Regarding effect of the sub-arctic climate on transport mode, the majority of respondents considered slipperiness, wind and precipitation to have the most negative effect on both walking and cycling. The findings suggested the importance of climate factors to be emphasised in traffic planning in the sub-arctic regions.

Keywords: Sustainable transport,

Introduction

The aim of this paper is to explore the travel pattern and attitudes towards non motorised transport modes among the inhabitants of the town of Kiruna. Kiruna, located above the Arctic Circle in the Swedish Lapland is going through a profound urban transformation as a large part of the town including the centre has to be relocated and rebuilt. This is due to the land deformation caused by the iron ore mining in the immediate vicinity of the town. According to the last official decision, the new town centre including housing areas, commercial buildings and public services will be located 3 kilometres to the eastside of the present town centre (Kiruna kommun, 2011). Given this extraordinary situation, Luleå University of Technology, Sweden, has initiated number of research projects to support the ongoing planning process. One of the projects which is partially presented here, concerns about physical and traffic planning in harsh cold climate. As a part of problem identification, a survey was conducted to inquiry about the socioeconomic background, travel pattern and attitudes towards different travel modes in the sub-arctic context.

In regions with harsh climate, the seasonal climate factors have strong effect on every aspect of the urban life including transportation. Our review of the literature on climate and travel pattern met very few results, compared to the large body of the literature on urban travel pattern. On this basis, to carry out the travel survey in Kiruna, some sections were specifically tailored to scrutinize the effects of sub-arctic climate elements on non-motorized travel modes, namely, walking and cycling.

Background

Kiruna is Sweden’s northernmost town that inhabits nearly 18000 people. The identity of Kiruna is intertwined with the sub-arctic climate. This climate is characterized by long
winters that last 7 to 8 months. During the winter, the temperature remains constantly under zero degree Celsius between November and March. Number of days with snow cover exceeds 200 days per year. Such climatic conditions make Kiruna distinguished from many other Swedish towns.

One of the prime concerns for the future of Kiruna is to alter the current traffic pattern. Today, the public transport holds a very small share of total personal transport in the town. Car is the dominant transport mode both for work and non-work trips. Public transport in Kiruna is based on the bus system. (Kiruna Kummon, 2011a)

The objectives and questions of the study

The objective of conducting this questionnaire study has been to obtain an overall picture of the travel pattern in Kiruna as well as understanding what factors play significant role in preferring car over other transport modes. In addition, we aimed to measure the effects of local climate elements such as snow, ice and low temperature on walking and cycling. In line with the objectives of study, following questions are raised.

- What is the share of different travel modes for the trips made by Kiruna inhabitants?
- Do pedestrians and cyclists perceive local climate factors differently?
- What is the effect of different local climate factor on pedestrians and cyclists?
- How can non-motorized travel modes be supported in the future traffic strategy considering seasonal climate factors?

Data

The paper is based on the information obtained via a mail survey which was carried out in April and May 2011. The questionnaires involved circa 1500 of the inhabitants. The sample population was composed of 1250 of adults (20 to 74 years old) and 250 teenagers (15 to 19 years old). The questionnaire included two main sections. The first section comprised questions on socio-economic backgrounds, the respondent’s attitudes toward different travel modes and the impact of some of the climate factors on non motorized travel modes. The second section was a travel diary to be filled on certain dates. The dates for travel diary were equally distributed among the week days. The dates for filling in the travel diary were in April and May so as inhabitants would be able to experience winter weather conditions while completing the survey. We received totally 516 correctly answered questionnaires which corresponded to nearly 35 per cent of the whole sample population.
Descriptive analysis of the responses

Some of the socio-economic information resulted from the survey is presented in the table 1. The average age of the respondents is 48.35 which is one year older than the average age of the whole town population in age between 15 to 74. According to survey, there is 1.4 car per household in Kiruna while this number declines to approximately one car per household for the entire Sweden (SIKA, 2007).

Table 1. Some of the socio-economic factors resulted from the survey in Kiruna

<table>
<thead>
<tr>
<th>Number of respondents</th>
<th>Average House-hold size</th>
<th>Car per House-hold</th>
<th>Average Age</th>
<th>Respondents gender division (%)</th>
<th>Residence type (%)</th>
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<td></td>
<td></td>
<td></td>
<td>Women</td>
<td>50,4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>men</td>
<td>49,3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Detached house</td>
<td>44,2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Terraced house</td>
<td>9,1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Multi-family house</td>
<td>41,8</td>
</tr>
<tr>
<td>514</td>
<td>2,79</td>
<td>1,42</td>
<td>48,35</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The latest national travel survey in Sweden (RES 2005-2006) shows that travel pattern in the sparsely populated municipalities differs in various aspects from the large towns and cities (SIKA, 2007). To achieve a sensible comparison, the results from the survey in Kiruna are compared to the travel pattern information of the municipalities with the population between 12500 to 25000 obtained form RES 2005-2006. In all of these municipalities including Kiruna, the public transport is based on the bus system. Table 2 includes information on the shares of the five main travel modes of the aforementioned municipalities (labelled as “low populated municipalities”) and Kiruna on the day of survey.

Table 2. Travel pattern in Sweden (low populated municipalities) and Kiruna

<table>
<thead>
<tr>
<th>Percentage of each travel mode on day of the survey</th>
<th>Car as driver</th>
<th>Car as passenger</th>
<th>Bus</th>
<th>Bicycle</th>
<th>By foot</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low populated municipalities</td>
<td>47,14</td>
<td>14,81</td>
<td>4,22</td>
<td>9,51</td>
<td>24,32</td>
</tr>
<tr>
<td>Kiruna</td>
<td>65,93</td>
<td>12,30</td>
<td>1,04</td>
<td>1,35</td>
<td>18,13</td>
</tr>
</tbody>
</table>

Looking at the ratio of each travel mode, the ratio of the „car as driver“ trips includes 47 per cent of all trips in this group of municipalities. In Kiruna, the same trip mode accounts for nearly 67 per cent of the average weekdays travels. On the other hand, the shares of other travel modes are smaller in Kiruna. In particular, public transport (Bus) and bicycle hold a very small share of daily trips. We should somehow note that,
this survey was carried out during the winter time, while the information of the other municipalities is representative of the four quarters of year.

**Impact of climate factors on the choice of walking and cycling**

The respondents were asked to determine the extent to which the given climate factors (sun, low temperature, precipitation, slipperiness, wind and darkness) would influence their choice of travel mode if they had considered travelling by foot or bicycle during the winter season. They could rate between 1 (very negative) to 5 (very positive) in a five steps rating scale with the option to choose “unable to rate”. Table 3 includes a summary of the responses.

| Table 3. The perceived impact of winter climate factors on walking and cycling |
|---|---|---|---|---|---|
|  | 1: Very negative (%) | 2: Fairly negative (%) | 3: Neutral (%) | 4: Fairly positive (%) | 5: Very positive (%) | Median |
| Low temperature | By foot | 464 | 15.5 | 27.1 | 35.7 | 11.8 | 9.6 | 3 |
|  | Bicycle | 272 | 47.4 | 20.6 | 22.1 | 5.1 | 4.8 | 1 |
| Wind | By foot | 466 | 27.0 | 39.9 | 29.1 | 2.7 | 1.0 | 2 |
|  | Bicycle | 276 | 52.9 | 25.4 | 20.3 | 0.7 | 0.7 | 1 |
| Slipperiness | By foot | 474 | 34.6 | 36.5 | 26.4 | 1.9 | 0.6 | 2 |
|  | Bicycle | 279 | 68.8 | 17.6 | 11.8 | 0.7 | 1.1 | 1 |
| darkness | By foot | 461 | 9.5 | 16.6 | 64.4 | 6.7 | 2.8 | 3 |
|  | bicycle | 274 | 31.4 | 16.1 | 47.8 | 2.9 | 1.8 | 3 |
| Precipitation | By foot | 465 | 22.6 | 42.2 | 30.3 | 3.4 | 1.5 | 2 |
|  | bicycle | 276 | 60.5 | 23.2 | 14.9 | 0.4 | 1.1 | 2 |
| Sun | By foot | 474 | 0.8 | 0.4 | 10.3 | 17.7 | 70.7 | 5 |
|  | bicycle | 274 | 8.4 | 1.1 | 15.7 | 23.7 | 51.1 | 5 |

We noticed that the number of “unable to rate” answers and the non-response cases is much higher among the answers to the questions on cycling. For the questions on cycling, the ratio of “unable to rate” answers ranges between 34.6 to 36 per cent across the six factors and the ratio of the non-response answers varies between 10.7 to 12.3 per cent. When it comes to walking the highest percentages of “unable to answer” and non-response answers are respectively 3.7 and 5.8. In the table 3, the valid ratios of various answers are presented which are the share of each scale when the non-response answers and “unable to rate” ones were not included in the calculation. Unsurprisingly, among the 6 factors, the impact of sun showed an opposite trend to the others. In both cycling and walking, sun has received most positive responses. In particular, concerning walking, more than 70.7 per cent of the respondents, have
assessed effect of sun as „very positive” on the choice of walking. Between the five other factors, slipperiness has been assessed with the most „very negative” answers by 34.6 per cent for walking and 68.8 per cent for cycling. We notice that for the five factors, the percentage of very negative answers is remarkably higher for cycling than for walking. About walking, more respondents have chosen to answer fairly negative or neutral for the all factors except the sun. This tendency is also reflected on the median values associated with those factors. For both walking and cycling, darkness has been assessed as “neutral” by a large part of the respondents.

**Discussion**

Compared with the other Swedish municipalities with similar population, the study portrays Kiruna with larger share of car travels and smaller shares of public transport, cycling and walking. From the survey, we learned also that 64 per cent of respondents are employed which among them, 52 per cent lived in less than 3 km distance to their work place which highlights the potential of transferring part of the car trips to bicycle and walking. Regarding perceived effect of climate factors, respondents have ranked slipperiness, snow, rain and low temperature with most negative effect on the choice of walking and cycling. Not unexpected in the Swedish context, sun has been stated by majority of the respondents as having “very positive” effect both on choice to walk and cycle. We observed a clear response rate difference between cycling and walking. Not only that very few of respondents have use bicycle for daily transport (1.35 per cent of daily trips is by bicycle) but also on the effect of climate on the cycling, many answered with „unable to rate” choice or left the questions without any answer.

Interestingly, the effect of weather on walking is assumed to be smaller than previously understood. There is definitely an effect of extreme weather conditions such as high winds or rain, snow, thunder, heat, etc., but not on walking on an average day according to Sauter et.al. (2008). For leisure travel and sojourning at public places, the weather, however, is crucial. It is somehow not in disagreement with results of the survey which suggest that the harsh climate conditions are perceived to have important effect on walking and cycling.

Dealing with climatic factors is challenging though. Despite the expressed enthusiasm for climate sensitive design, urban climate knowledge has a low impact in planning in Sweden (Elliason 2000). Principals of climatic design are difficult to use for urban and traffic planners and they become often subordinated during the complex and long decision making processes.
**Conclusion – attention to climate factors**

The higher interest in walking than cycling as indicated in travel pattern and attitude questions, underscore the potential of walking in the future traffic strategy of Kiruna. The results show also that winter climate factors have larger negative impact on choice of cycling. Nevertheless, cycling should not be neglected in the future traffic strategy as its share in overall travel pattern changes during different periods of the year. Therefore, we will conduct another travel survey in Kiruna in September 2011 in order to achieve a broader picture of the relation between seasonal climate factors and travel pattern. Findings of the opinion survey highlight the following issues that can serve as baselines for climate consideration in transport planning for harsh cold climate.

- In the context of sub-arctic climate, a clear strategy prioritizes climate principals at different planning stages.
- Sun access for sidewalks and pedestrian routes should be considered under various planning phases.
- With the negative attitude about slipperiness it is of great importance that winter road maintenance for sidewalks and bicycle routes is prioritized.
- Wind and snow drift: Simulation of wind and snowdrift can support planning at macro and micro scale with the aim to more efficient use of out door public spaces as well as easier maintenance of roads and sidewalks.

However, structural aspects and socio-economic factors should be further analysed to ensure the results.

**Acknowledgements**

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**References**


Lines of Motion:
Scales of Architecture
Transcend the Divide between Design & Planning

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(Former Director, Environmental Systems and Compliance, Olympic Coordination Authority, Sydney 2000 Olympic Games)
Abstract
This paper explores the artificial border between design and planning. 20th century architects recognised this disciplinary obstruction and now second millennium designers need to consider this so they can build complex cities successfully. Design and planning professions need to reconcile their roles, if their practitioners intend to reform dysfunctional cities.

Sydney’s transport infrastructure is dysfunctional. Indecision within government and blurred roles among numerous professions have prevented metropolitan infrastructure from keeping pace with demand. At the heart of this issue is lack of perception across scales of space. With no overall master plan, indistinct professions and vested interests in public-private-partnerships - the vision is lost.

Lessons from Sydney’s 2000 Olympics provide one framework to reconcile design and planning disciplines. Throughout all Olympic preparations, Government coordinated both planning and design - so original visionaries remained in control of the vision. Olympic methodology was a top-down concept created by government, with implementation by the commercial sector as bottom-up effort. Government issued specifications while others (architects and planners) responded with innovative designs.

*Lines of Motion* is a concept that looks beyond an individual site or one viewpoint (design or planning) and envisages architecture for a whole city. For transport, *Lines of Motion* transverses all scales of the „Cities of Cities‟. The scales range from transport network scale, urban space scale, through to train-station scale. A scenario is Observatory Park Station. In 2010, the author studied the metropolitan transport network and realised the need for a second CBD interchange and a new train line to connect Barangaroo with Circular Quay along a Greater City Circle. Further study showed Observatory Park as the pivotal site at train-station scale. Iteration and inter-relationships across three scales of architecture combine planning and design. The resulting „architecture‟ of the interchange building encompasses design, location and city-wide need for transport itself.

Keywords
Scales of Architecture: A Vision
The first professional degree in urban design was established at Harvard University in 1956. (Harvard Library 2011). Jose Lluis Sert started a variety of innovations in the architecture curriculum because he was an architect who could perceive the void 'between the architecture of individual buildings and the architecture of the city (Peter 1994). His answer was to teach urban design as a new discipline.

Sert's course tried to fill a gap that had formed between the design of buildings (architecture) and the design of cities (urban planning). He tackled the neglected 'heterogeneous, interlocking, overlapping, sometimes-competing networks' of social engagement in urban spaces where happenstance encounters can cement a community and sometimes foster pluralism (Goldhage 2005). Sert believed that rationalist urbanism had neglected dimensions of urban life that were just as critical to cities as hygiene and efficiency. Modern cities were ignoring the way that people interact, use space and relate philosophically to space in their lives in the street, neighbourhood and monuments of a city (Goldhage 2005).

The essence of what Sert identified was a sensitivity - of lack of it - to human proportions in urban design and he understood the importance of scale in architecture. Sert said: “We design things that look very well as models, or blown down to magazine-page size, but very bad when blown up to full size.” (Zucker 1944)….. “At the time I began to talk about these matters . . . people were absolutely unconcerned. The architects thought it was none of their business. The planners were just not interested in that kind of physical world.” (Peter 1994)

In terms of modern history, this significant rebuff to rationalist urbanisation is a quite recent occurrence, within the lifetime of many current planners, architects and specialists. It was one reaction against technocratic planning and the emergence of sprawl in the 20th century. In retrospect, reasons why city planning around the world became progressively insensitive to the scale of human proportions are understandable. After 1945, cities expanded in area to cope with a bulging post-war population. An by 2008, cities were housing half the world's population, due to mass migration from the countryside.
Scales of Architecture: Sydney 2000 Olympic Games

Australia’s chance to showcase good urban design came in the middle of this unfolding turmoil of overpopulation and ad hoc planning when the NSW State Government, Australia, bid Sydney as the host city for the 2000 Olympic Games. Apart from usual motives such as civic pride and tourism, this bid was a chance to challenge the uncoordinated, rationalist way of approaching urban planning that had entrenched itself in most cities around the world. Also there was the impetus of wanting to leave a legacy to future planners, architects and the construction industry for a new millennium. The NSW Government realised that the legacy could be unique because for the first time, the International Olympic Committee (IOC) requested that its bidder cities deliver a green games at a summer Olympics. This was Sydney’s opportunity to combine architecture and city planning and showcase sustainability and integrated urban design.

Fortunately, due to the need for Sydney to capture votes to win the right to host the 2000 Olympic Games, officials and promoters were forced to work in a coordinated manner from the outset. Just as importantly, the bid was based on the principles of sustainable development. The idea of sustainability combined environmental–social–economic ideology and was relatively new at this time. Sustainability planted its concept in the public consciousness in 1983, when the Secretary-General of the United Nations established the World Commission on the Environment and Development - also known as the Brundtland Commission. So it was a mere ten years later, in 1993, that the Sydney Bid Committee developed the Environmental Guidelines for the Summer Olympic Games - based on sustainability - as part of its IOC application.

Then Sydney won the Games. The first step for the NSW Government was to build its legal framework and it established the agency, the Olympic Co-ordination Authority (OCA) in June 1995 with the Olympic Co-ordination Authority Act 1995. This was supported with the State Environmental Planning Policy No 38 - Olympic Games and related projects. A Master Plan soon followed and the promise of sustainability got under way. The Master Plan foreshadowed an integrated design across both urban space and landscaped space to create a sporting precinct around a new railway station at Homebush. The main element was an ‘Olympic Boulevard' cutting an axis through the Olympic precinct from north to south. This spine provided a focus for public circulation and public transport. By incorporating the existing Bicentennial Park into a network of parklands around the core site, a major new park of 450 hectares became possible. This promised to be, for western Sydney, what Centennial Park is to the eastern suburbs. The Master Plan was the basis for a shift from the pragmatic to the interpretative and facilitated new overlays of public art and enhanced public space. It provided a robust basis for the future of a site that might serve multiple agendas (Maher 2000).

As a location, Homebush had a head-start because it already had the ambiance of Bicentennial Park. However there was a challenging constraint. Sydney's 2000 Olympic Games were intended to concentrate the largest number of purpose-built stadia ever built for an Olympics, and 90 percent were within one area at the geographic centre of metropolitan Sydney (Bingham-Hall 1999). Ironically this convenient supply of vacant space in such a central location was only possible because of past planning mistakes. The location had been a dump site for more than thirty years and contained pockets of contaminated landfill around the precinct which had blighted previously attempted projects. So implementation of a successful Olympics necessitated...
very high quality conceptualisation and planning across nearly every discipline of design, engineering and science.

OCA worked with the Government's waste agency - WasteNSW - to clean-up the soil contamination at the Olympic precinct and made the space ready for an Olympic grade sports hub. From the government's viewpoint, this remediation effort, while expensive, transformed a wasteland from a liability to an asset and provided a building site that was safe and suitable for Olympic construction to begin.

However the extent of the green games could not be confined to projects on the precinct. Sustainable development includes the way people travel to and from buildings and venues. So OCA committed to make the Olympic venues accessible by public transport - including from the international airport. The step to achieve this ambition was establishment of a new agency, the Olympic Rail Transport Authority (ORTA). This new, specific-purpose agency completed the Olympic Park Railway Station and its rail loop in 1997. A 'test run' was trialled during the inaugural Homebush Royal Easter Show held on the precinct in 1997. More than one million visitors arrived by public transport during show-time. When put to the 'real test' during September 2000, the ORTA-designed transport system carried up to 50,000 people per hour during the Olympic Games.

While the environmental aspect was obvious, OCA also realised it needed to include the social aspect of sustainability in its urban design and planning from the beginning. It worked with other sectors of industry and conducted community liaison to ensure that delivery of innovative facilities and services had the inclusion and support of relevant parties. Although OCA had a small staff which usually numbered about 300 officials, its functions were: Developer; Coordinator; Asset Manager; and Budget Monitor.

Such a grand scope of work was feasible because the NSW Government did not expect OCA to manage the staging of the Olympic Games itself. OCA was an urban design agency of government and in the words of (then) Minister for the Olympics, Michael Knight: “.... OCA builds the theatre, SOCOG puts on the show”.

So OCA kept its focus on land clean-up, design, construction and expected maintenance of the sporting arenas and other venues needed to accommodate the Games. With sustainability as its guiding principle, OCA established several specific sustainability plans, including: Technical Guidelines; the Environmental Tender Specification; an Environmental Management System; numerous Environmental Management Plans; and community consultation. Guidelines and specifications required tenderers to provide evidence of their company's environmental policy, management systems, due diligence with environmental legislation, and past environmental performance. This detailed level of control and planning was conducted before the tendering process, so it enabled most of the on-the-ground work to be specified and contracted to the commercial sector. OCA's planning and comprehensive procurement management system gave the Government confidence that sundry companies – big and small – could align their efforts to the Government's objectives.
So the goals and concept design for the Olympic precinct was a top-down process by a
government agency that used a bottom-up implementation by and with industry practitioners. In
a coherent manner, Government set the criteria and challenged the commercial sector to build all
the Olympics as sustainable development. The commercial sector rose to this challenge with
innovative responses to Government tenders that was unprecedented. OCA used a process of
continuous iteration in the specifications, design reviews, and coordination of the resulting
contracts across design, engineering, construction, commissioning and operation. While close
supervision had been done by Government before, this was a much more systematic process and
it produced more sustainable architecture, urban design and innovative infrastructure than in the
past. The most influential factor in architects and other professionals designing Sydney’s
Olympic venues and infrastructure in accordance with sustainability, was the brief that requested
them to do it from the start. Furthermore the approach had endorsement of those in Government
who controlled the budget.

The main implication arising from this Olympic case study for urban designers is that visionaries
can remain in control of their original vision by actively coordinating and supervising the
implementation. This does not imply that the founding fathers of a grand design have to build it
– instead it says that they need to coordinate it. By starting from one team or one agenda, urban
planning and architecture can be implemented across all scales of a project. Sydney's Olympics
was awarded the slogan of 'best games ever' but its most profound legacy was a demonstration
case for a new approach to constructing a sustainable urban space - through the integration of
design and planning.

Nonetheless, eleven years later, after achieving a world show case of sustainable development -
Sydney’s urban design is uncoordinated and its plans for transport infrastructure are
dysfunctional. Indecision within successive governments and blurred roles among numerous
professions have prevented metropolitan infrastructure from keeping pace with demand. What
happened to the Olympic legacy of perceiving integration across scales of space and
architecture? With no single master plan that can stand the test of time, with vested interests in
public-private-partnerships and with overlapping professional roles among the disciplines,
Sydney has not implemented a design vision. Instead vision itself seems to be what is lost.

**Scales of Architecture: The Lines of Motion Concept**

It is feasible for a concept to look beyond an individual site, viewpoint, or single profession -
whether it is called urban design or planning. In this paper, the author is envisaging an
architecture that applies across the whole city. In particular, for transport, Lines of Motion is a
concept that transverses all scales of the „Cities of Cities”. The architectural scales range from
the largest - transport network scale, through urban space scale, and through to the smallest -
train station scale.

The author designed a scenario to illustrate Lines of Motion in a Master degree project in 2010.
He called it Observatory Park Station. The feature that makes Observatory Park Station
different from the design of any other station is that it is a railway station generated from a wider
study of Sydney’s transport network. The transport study was conducted first, and reviewed the
general transport network of Sydney to identify the missing links at the urban space scale. This was conducted to determine the transport requirements of the urban area, before proceeding to selection of a suitable site for a proposed new train station. A large scale was used to decide where to locate the next smallest scale of design and construction. Observatory Park Station is a result of applying design to all scales, from transport planning for the metropolis, through urban design of areas, to finally the architecture of a train station building. These scales work together and furthermore the outcome would not be as effective without each one of these scales. In this manner, design goes across scales of architecture in a similar way to the intent of Sert’s teachings at Harvard University.

**Planning Scale: The Vision**

At the Sydney metropolitan transport network scale, Sydney can be regarded as a place where local communities and nodes come together to create a much greater identity than each of the individual cities from which Sydney is composed. Some nodes are not critical to greater Sydney, and other nodes are self-sufficient. Nevertheless, some nodes are key to the whole metropolis. The concept of *Lines of Motion* accepts these levels of critically and gives priority to the preferred ways that commuters want to move around. So the concept tries to connect nodes in a transport design that provides city-wide transport routes for the needs of Sydney-wide travellers. *Lines of Motion* does not try to change the paths already created by travellers, unless there is a clearer path that becomes apparent during the process of iterative review and re-design.

This is the rationale for a *Lines of Motion* approach to first look at the large scale before considering the next scale - to find a site for a train station (Observatory Park). The aim is to take advantage of existing transport routes to find potential sites and opportunities for improvement. Improvement can be in a physical form of the choice of mode of transport. For example train, light rail, T-Way, bus or ferry are possibilities. If a new pathway is needed, the concept can cut and re-tie existing pathways into more streamlined combination of routes. *Lines of Motion* takes a set of criteria into account in the design of transport:

- simplification of the transport system to an intuitive level so that a tourist would understand it easily, with one map;
- simplification of patronage along the same pathway;
- satisfaction of commuters’ needs in getting from A to B either by enhancing an existing route or creating a quicker alternative;
- variation in usage of a specific transport mode, such that when one group of commuters depart, another group takes its place and the train / ferry / bus route continues;
- provision of pathway capacity (number) of train tracks or bus lanes which can support two-way journeys (eg: one line per pair of tracks or bus lanes);
- provision of express services by duplication of lines running side by side (where needed) to operate one of the lines as a fast line;
- distributing commuters so that they are not funnelled into the same path.
By adopting these criteria as the basis for transport design and applying them to Sydney, the author designed a metropolitan transport system along the *Lines of Motion* concept and developed a new transport map for Sydney. The map is an outcome of using these criteria and other rules to create a network that allows flexibility as the city’s needs change. The map is set out with an over-all grid of four main lines and other lines assist these main lines.

This layout is shown in Graphic #1.
Planning Scale: The Concept

Graphic #2 shows Observatory Park Rail Station as a critical link in the *Lines of Motion* concept. However in the design, the train station’s role as a link evolved not from its location or any specifics of its local area - but from another transport concept generated at another scale - the *City Ring*.

![Graphic #2 Lines of Motion – City Ring Graphic](image)

For Sydney, the author’s (proposed) *City Ring* would address the poor rail connection that currently exists around the „City or Cities“*. City Ring* would connect Epping to Blacktown and create a continuous circuit line to link across the city. The *City Ring* Line is a line type that is used commonly around the world, however it can only be used in particular parts of a network for an overall unifying purpose. These lines are very important as they link other lines together and give distinction to a city as a metropolitan area. Examples are the London and the Moscow Circle lines (Moscow Metro 2011) (Transport for London 2011).

The *City Ring* would create a heavy rail line to link most CBDs and major business parks of Sydney. It would use 76 percent of existing train track and connect: City CBD - Chatswood - Epping - Blacktown - Parramatta - Liverpool - Airport - City CBD. This would create a train line that connects Epping to Blacktown. The rationale fits with the *Norwest Rail Line* and *Parramatta-Epping Rail Line* (PRL 2003) (Department of Transport 2011). It would allow Sydney’s transport system to change from its current spokes-in-a-wheel shape to an orbital
pattern, so that commuters do not have to all go via the city’s CBD. This forms the pivotal piece in the four main lines of the concept, as shown in Graphic #2.

At this point it is worth giving a description of the author’s proposed City Ring. It starts at Central Station and travels through to Wynyard via the current City Circle Line (which is reused in a proposed Greater City Circle below). It crosses the Sydney Harbour Bridge using the Independent Public Inquiry proposal of hanging trains under the deck of the bridge (Independent Public Inquiry 2010). Then City Ring follows a similar tunnel route to the Metropolitan Rail Expansion Programme, CBD Rail Link (2005) to St Leonards via Victoria Cross (Miller Street and Pacific Highway) in North Sydney and Crows Nest (Department of Transport 2011). From there it uses the current track to Epping and travels via the proposed Northwest Stage One section to the Norwest Business Park (Department of Transport 2011). From there the Line of Motion concept proposes that the rail line continue via Parklea Markets and follow the State-owned land within the current T-Way on Sunnyholt Road to Blacktown (Transitway 2011). The route would run along existing track to Parramatta and through to Liverpool. A bend would need to be constructed to continue the line on to the East Hills track and connect with Sydney Airport. From here it would return to Central Station.

In general, the advantage of a transport ring is that it defines a city. It integrates the city into a whole from a traveller’s viewpoint and allows locals and tourists to understand the layout of the city easily, from a “bird’s eye” perspective. This enables a traveller to understand the public transport system better and offers encouragement to utilise an alternative to the private car.

Urban Design Scale: The Vision

At the urban scale, the Lines of Motion concept identifies the Sydney CBD as a transport issue. In the scenario, Observatory Park Station does not need to be considered at this scale because urban requirements determine need, location and design of transport.

The author’s study of the local area determined that the current separation of the city’s CBD into East and West is the cause of many CBD transport issues. The separation is an artefact resulting from topography, the original placement of the City Circle rail line and subsequent growth on the western side of the city’s CBD.
Urban Design Scale: The Concept

*Lines of Motion* proposes a new *Greater City Circle* railway line that would travel around the western edge of the city’s CBD to incorporate areas like Barangaroo. It would link back into the existing *City Circle* railway at Circular Quay Station. This is only part of a much larger Line 6 which would connect to the city (shown in Graphic #1, the city wide map). The rationale fits with the Western Relief Line, Pitt Alignment and Second Harbour Crossing because the Central-Wynyard track would be re-used as a through-line and create a new railway interchange at the northern end of the CBD (Department of Transport 2011) (Public Transport User Association 2009).

A proposed *Greater City Circle* railway line would:
- substantially address Barangaroo’s transport needs;
- connect Circular Quay and Barangaroo directly as the future East-West city wharfs;
- offer the existing *City Circle* as a quicker alternative to cross-town walking, due to its greater passenger catchment width.
Architectural Scale: The Vision
Subsequently, the author considered the small architectural scale to design Observatory Park Railway Station. Through an iterative process, the ideal site was ill-defined during the author’s study of other scales of architecture. As the design developed and only after the concepts became clearer could a site be determined. Observatory Park is the site that evolved from consideration at several scales.

The proposed rail station at Observatory Park is located at the (now) disused toll gates that are still on the Sydney Harbour Bridge. The *Lines of Motion* concept generated a greater understanding about the ideal location for a transport interchange. Observatory Park Station was a result of the transport needs at larger scales before it emerged as a suitable catalyst for a more streamlined public transport system in Sydney’s CBD. Its location and architecture encapsulates consideration of both planning and urban design studies.

Architectural Scale: The Concept
A strong endorsement for the proposed Observatory Park Rail Station is that it would recreate Bradfield’s original “Gateway to the North” (J.J.C. Bradfield 1915). The interchange concept is an adaptive reuse of the Cahill Expressway and former bridge toll gates. There are three key elements that define the station’s architectural design:

- **The Tactile Wall** is a single High-line like element to connect East with West from Circular Quay to Barangaroo (High line 2010);
- **The Chasm** is a sunken space located in the former toll gate area which reveals an underground city at this location. It creates an inclined park that allows continuous uninterrupted flow between platforms;
- **The Obelisk Array** is a unifying grid that symbolically projects out from the Obelisk in Macquarie’s Park to connect with the city’s history.

Graphic #5  Lines of Motion – Observatory Park Elements Graphic, © Liam Filson
The station’s architecture creates a layered and dynamic form via interaction of these three key elements in the context of Sydney’s history and geography. By removing the barrier formed by the current Cahill Expressway across the quay and by resolving the visual resistance that the expressway causes currently, the design would flow more easily. It would give an approachability to the harbour and Opera House which is so iconic in the architecture of Sydney itself.

Further details are available at the website: https://sites.google.com/site/observatorypark/

Conclusion
This paper has endeavoured to show the benefits of accepting inter-relationships across three scales of architecture in methods used for planning and designing urban space. The Lines of Motion concept is such an approach, by first looking at the large scale before considering the next scale. The proposed Observatory Park transport interchange is a building that encompasses design, location and city-wide requirements for transport. It utilises conscious iteration in design and was selected as a site within an overall architecture, instead of being an independent idea or separate process. The outcome is architecture that arises on the site and can give back to the whole city because it fits into its larger metropolis.

The silo divisions that obstruct the perspectives of different professional practitioners have developed - unfortunately - in the culture of the planning and design disciplines. This has lowered trust and coordination among these professions. It has created division between planning and design that has been continued on for generations of practitioners. Urban design attempts to break through these barriers but the reality is that while ever professionals do not trust one another, or decline to work together, the architecture of cities suffer. Instead, it is interdisciplinary collaboration among a city’s designers and planners that gives a city its individuality. Without this, a city loses its unique distinction and sense of place.
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The Application of Sustainable Neighbourhood Design in Creating a Resilient Neighbourhood in the Face of Natural Disasters

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ABSTRACT

Exposure to natural disasters creates significant risks in urban areas where human and economic resources are located in large numbers. The built and natural environment of these resources are constantly changing through new development projects. This continuous urbanisation brings new challenges to reducing the risks of natural disasters, particularly given that the number of natural disasters affecting urban populations has risen four-fold since 1975. The recent natural disasters in New Orleans, Haiti, Christchurch and Brisbane showed that community resilience at the neighbourhood level played a critical role in managing the after effects of the disasters.

Community resilience is the capacity of a community to absorb shocks and stresses either by adaptation or resistance, to maintain certain basic functions and structures during disastrous events, and to recover and bounce back after these events. Unfortunately this community resilience is not evident in every neighbourhood. Neighbourhoods which are based on an urban livelihood comprising the capabilities, assets and activities required for a means of living both now and in the future typically offer such community resilience.

In this context, the purpose of this paper is to identify how sustainable neighbourhood design can be utilised to generate a livelihood at the neighbourhood level which ensures a resilient neighbourhood, and ultimately reduces the vulnerability of the community to natural disasters.

KEYWORDS: Natural disaster, community resilience, urban livelihood, sustainable neighbourhood design.

1. INTRODUCTION

Exposure to natural disasters creates significant risks in urban areas where human and economic resources are located in large numbers. The built and natural environment of these resources are constantly changing through new development projects. The motivation for these projects is based upon the opportunity to create new socio-economic portfolios for city dwellers and also to generate economic benefits to investors, developers and various types of commercial entities. This city development process brings almost every year new roads, new residential neighbourhoods, new business parks, new shopping centres, new schools/colleges and new network of utilities and services.

At the same time, continuous urbanisation brings new challenges to reducing the risks of natural disasters. A report by UN-Habitat, an agency responsible for human settlements, says the number of natural disasters affecting urban populations has risen four-fold since 1975. During the last few years the world witnessed terrible human loss and material destruction by natural disasters. In this year already six large scale events, which include the Brisbane floods, the Victoria storms and Cyclone Yasi that hit Australia in January and February respectively, the Christchurch earthquake in New Zealand in late February, the March earthquake and tsunami in Japan, and the tropical storm Irene in the USA in August, have taken place.
We have seen through stunning images provided by the global news media how established urban areas in Australia, New Zealand, Japan and the USA have been affected by these natural disasters. These events reminded us about the importance of a disaster risk reduction system not only for the traditionally vulnerable communities in low socio-economic rural areas, but also for the communities in economically strong urban areas. The Indian Ocean tsunami of 2004, which killed at least 230,000 people, would have been a tragedy whatever the level of preparedness; but even when disaster strikes on a titanic scale, there are many factors within human control—a knowledgeable population, a good early-warning system and settlements built with disasters in mind—that can help to minimise the number of casualties (The Economist, 2007). At the same time, the recent natural disasters in New Orleans, Haiti, Christchurch, Brisbane and Japan showed that community resilience at the neighbourhood level played a critical role in managing the after effects of the disasters.

However, a fully effective disaster risk reduction system is not that easy to develop and implement, as it needs to consider a number of factors and involves a number of issues, experts and disciplines. At the same time, the system needs to cover both pre and post disaster periods. In this context, this paper concentrates only on one of the components of the system, and identifies how sustainable neighbourhood design can be utilised to generate a livelihood at the neighbourhood level which ensures a resilient community, and ultimately reduces the vulnerability to natural disasters.

2. THE CONCEPT OF A RESILIENT NEIGHBOURHOOD

Community resilience is the capacity of a community to absorb shocks and stresses either by adaptation or resistance, to maintain certain basic functions and structures during disastrous events, and to recover and bounce back after these events. Unfortunately this community resilience is not evident in every neighbourhood.

A neighbourhood is based on a network of physical systems and communities. The physical systems include neighbourhood’s roads, buildings, infrastructure, open spaces, water courses, and vegetation, and ultimately these form the built and natural environment of the neighbourhood. Communities form the social and institutional components of the neighbourhood, which are various forms of organisations, institutions, authorities and agencies, which operate in an urban area (Godschalk, 2002). During a disaster, the physical systems and communities must be able to survive and function under extreme stresses, otherwise the neighbourhood would be extremely vulnerable to disasters.

A recent study of state of Orissa in India demonstrated that some of the rural neighbourhoods in the state are the most highly resilient and the livelihoods in these neighbourhoods are advance in term of cultural, educational, infrastructure and industrial development. This year’s the near simultaneous floods in Brazil and Brisbane in Australia provided a contrast in
terms of their impact (and media coverage). Brisbane experienced huge property damage, but relatively little loss of life and the community coped relatively well with the recovery work and showed the appropriate level of community resilience to combat one of the worst natural disasters of the country's recent history. Brazil, however, experienced a large loss of life due to lack of resources in the affected area and vulnerability of its urban neighbourhoods to natural disasters.

These incidents have shown that a neighbourhood with livelihood that possesses a large stock of social and physical capital cannot be easily dislodged from its usual condition, but if dislodged by adverse shocks by natural disasters, its reservoir of social, economic, environmental and physical resources can assist it to return to its original condition. In the opposite case, a neighbourhood severely deprived of social and physical resources always struggles to return to its original condition after any form of natural disaster.

Therefore the concept of a resilient neighbourhood is based on the assets and capacities of neighbourhood's physical systems and the quality, skills and resources of the local communities. At the same time, the successful application of communities' skills and resources relies on empowering of the neighbourhood residents to build their own opportunities, supporting their access to assets, and developing an enabling policy and institutional environment.

In this context, it is noted that the purpose of sustainable neighbourhood design is to ensure a livelihood which comprises the capabilities, assets, quality and activities required for a means of living both now and in the future. It is therefore considered that sustainable neighbourhood design principles could be applicable in creating a resilient neighbourhood. In this respect, three specific design considerations, as shown in the following diagram, form the resilient neighbourhood development process. The specific design considerations, which are discussed in detail in the following three sections of this paper, are applicable for both neighbourhood re-building or retrofitting and greenfields development purposes.

![Diagram of Community Empowerment, Asset Mapping, and Resilient Neighbourhood Design](image)

3. ASSET MAPPING

The first consideration in the resilient neighbourhood design process is to identify necessary assets for the neighbourhood.

An "asset" is defined as any factor or resource which enhances the ability of individuals, communities and populations to maintain and sustain health and well-being. These assets can operate at the level of the individual, family or community as protective and promoting factors to buffer against life's stresses. (Foot and Hopkins, 2010). At the neighbourhood level physical assets and natural resources are the key elements to provide a physical shape and spatial identity to the neighbourhood, and also to foster community development, local governance and emergency preparedness. This should be the catalyst for any sustainable
neighbourhood development process to achieve community resilience.

Therefore, any neighbourhood re-building or any new neighbourhood development project must include a ‘neighbourhood asset assessment or mapping’ process. The purpose of this process would be, as identified by the Improvement and Development Agency of the UK, to define:

- The practical skills, capacity and knowledge of local residents.
- The passions and interests of local residents that give them energy for change.
- The networks and connections - known as "social capital" - in a community, including friendships and neighbourliness.
- The effectiveness of local community and voluntary associations.
- The resources of public, private and third sector organisations that are available to support a community.
- The physical and economic resources of a place that enhance well-being.

(Foot and Hopkins, 2010)

The neighbourhood design process usually starts with a site analysis, which needs to be combined with the neighbourhood asset assessment process to produce an asset map. This map would include the number, location, capacity and type of the following five categories of assets.

Category 1: Fixed Asset

This category of asset is related to physical structures and identity, such as built structures (including housing stock), plants, machineries and other infrastructure related to various services and utilities (eg. sewer pump station, electric sub-station or transformer, water tank etc.) and various types of roads and movement routes.

Category 2: Human Asset

This category includes neighbourhood assets to foster the skills and knowledge people hold, and also their personal health, such as schools, other educational and training centres, health and fitness centres, sports facilities, and health centres and health professionals.

Category 3: Environmental Asset

This category of asset is to provide neighbourhood amenity and to hold natural resources, such as parks, reserves, open spaces, mountains, forests and water bodies.

Category 4: Social and Cultural Asset

This category of asset enhances social norms and networks, cultural values and related infrastructure, such as religious institutions (ie. church, mosque, temple etc.), community halls, clubs, voluntary organisations, recreation centres, community and local authority organisations.
Category 5: Economic Asset

This category of asset is related to the economic growth of the neighbourhood and community’s specific employment skills, opportunities and infrastructure including commercial enterprises, shops and offices.

Once various types of assets are identified, these need to be included in the overall neighbourhood vision and incorporated physically in the neighbourhood setting. In this respect, the second consideration in the resilient neighbourhood design process is the tool to assemble assets together, which is described in the following section.

4. STITCHING ASSETS TOGETHER THROUGH SUSTAINABLE NEIGHBOURHOOD DESIGN

In the current age of globalization, world’s natural resources are continually shrinking, consumerist culture and hi-tech inventions are increasing, and peoples’ lifestyles are rapidly changing. Therefore, neighbourhoods should be able to provide agile environments that accommodate rapidly changing resources, needs, activities and technologies. The neighbourhoods must respond to communities’ sophisticated socio-cultural, economic, environmental and political demands and tailored solutions that closely reflect their values and needs. In this respect, the general intention of sustainable neighbourhood design is to ensure a sustainable community where residents are satisfied and in which they are happy to continue living now and in the future.

A UK study, which assessed the sustainability of eight former coal-mining neighbourhoods, found that social and environmental issues were more influential than the quality of housing on people’s sense of well-being and satisfaction with the neighbourhood (Green, Grimsley and Stafford, 2005). It is therefore considered that sustainable neighbourhood design, which is the preferred tool to stitch assets together, needs to provide attention not only to neighbourhood’s capital assets but also to community’s socio-cultural and environmental assets.

In this context, the design considerations in sustainable design process, which are particularly the catalysts in stitching assets together to achieve community resilience at the neighbourhood level are discussed below.

- Location to ensure safety and long term existence of all categories of assets

The neighbourhood layout needs to consider appropriate locations for various land uses, and neighbourhood facilities and assets so that they are not directly threatened by any likely natural disaster. The layout needs to accommodate emergency transport routes, infrastructure and facilities in order to ensure neighbourhood’s capacity to withstand sudden temporary shortages of water, food, energy and other critical services. The location of new neighbourhood facilities needs to be considered appropriately to avoid unnecessary dislocation of existing production facilities, businesses and services. The housing blocks need to be close to basic community services, places of employment, and amenities.
• **Distribution and capacity to ensure efficiency of all categories of assets**

Deficiencies and scarcities of various form of neighbourhood assets (as identified through the asset mapping) in one neighbourhood need to be specifically remedied during the design of various neighbourhood facilities including school, open spaces, communal facilities, neighbourhood centre etc. The neighbourhood design needs to ensure that various assets and community facilities are distributed appropriately throughout the neighbourhood so that these provide residents’ easy and direct access and meet the needs of the whole community. The design should encourage mixed-use and ensure a balanced distribution of various land uses throughout the neighbourhood through an appropriate roading, block and open space layout so that the neighbourhood can support the regional targets for infrastructure loading, ecological carrying capacity, economic growth and housing accommodation. The built structures, various neighbourhood facilities, movement routes and other infrastructure need to be climate sensitive to ensure the low operating costs of buildings and infrastructure which will contribute to the long term quality of life of residents, and the competitiveness of the local authorities and their businesses. At the same time, the resource demand by the neighbourhood needs to be consistent with the long term capacity of the city’s infrastructure and the region’s resource base.

• **Connectivity to ensure easy availability of all categories of assets**

An inter-connected street and pathway network needs to be considered to provide easy, safe and direct access to all communal facilities within the neighbourhood. The site layout of the neighbourhood should allow residents’ easy and direct access to natural landscapes and green spaces. The layout needs to encourage walking and cycling as attractive and alternative movement options. The movement options need to complement the requirements of youth, seniors, and people with disabilities so that they can live side by side in the same neighbourhood.

• **Diversity to ensure effectiveness of all categories of assets**

The mix of land uses needs to be considered to offer various opportunities for live, work and play in the same neighbourhood. The neighbourhood layout needs to accommodate a variety of housing which provides affordable and attractive choices for all the people who make up a community, including families, empty nesters, single parent families, childless couples, seniors on fixed income, and one-person households of various ages. The variety and flexibility in the block and lot layout needs to be considered so that residents can live in the same neighbourhood throughout their life and people of varying income levels can choose to live near their work, favourite schools, and other amenities. Multivalent spaces need to be considered for communal activities for effective and efficient land utilisation purposes. The neighbourhood layout and facilities need to accommodate various forms of convenient, comfortable and affordable transport modes so that residents can choose to walk, cycle or use public transport without any significant loss in time or convenience.
• **A sense of place to ensure the community’s cultural assets**

The sense of place needs to be reinforced in the design of the built environment, and the manner in which neighbourhoods are integrated into urban, rural and natural surroundings. The neighbourhood needs to accommodate and highlight the local identity which is rooted in the natural features and history of the area and local community’s pioneering traditions and culture. Gateways, focal points and other prominent features in the neighbourhood design need to be considered to reinforce the character of the community and the place. Design pallets for various built forms and landscape elements need to be considered in the overall design to assist building and landscape designers so that they can play with the key themes, and evolve an increasingly distinctive style appropriate to the place.

• **A socially interactive and flexible environment to ensure the community’s social assets**

The physical layout needs to enhance the day to day community interaction so that the residents and local businesses can know each other appropriately, and feel comfortable against likely risks and know how to respond and work together when disaster strikes. The neighbourhood design needs to be flexible enough, which is capable of adapting with ease to natural disasters and also to changes in climate, technology, demographics and economic conditions.

• **Preservation and enhancement of natural resources to ensure the neighbourhood's environmental assets and also to complement fixed infrastructural assets**

The neighbourhood layout needs to respect, maintain and restore the natural functioning of the landscape, especially rivers, streams and wetlands, and sensitive areas should be protected. The flow of water, waste and energy into and out of neighbourhoods needs to be reduced so that the efficient use of natural resources at the neighbourhood level reduces the overall city’s vulnerability to shortages in supply, sudden price hikes, and natural disasters. The neighbourhood landscaping needs to include multi-layered plantings that actually increase net habitat for many species, which will be relative to pre-development conditions. Trees, gardens and hedgerows need to be considered for cost-effective ‘green infrastructure’ contributing to a quieter and more pleasant micro-climate, shading buildings, cleaning and retaining storm water flows and improving air quality.

• **Safety and amenity to ensure the community’s socio-cultural assets**

Crime prevention through environmental design (CPTED) principles need to be considered in the layout design so that connections between buildings and open spaces encourage community members to watch out for each other. Public spaces (including public reserves and movement routes) need to be in prominent and directly visible places and tend to be alive day and evening. Buildings and facilities need to offer individuals the level of control they need to feel safe at all times. The layout needs to offer a safe access to all neighbourhood facilities by all groups of the community. The neighbourhood amenity needs to be considered through an appropriate built environment design and the necessary landscape elements.
5. COMMUNITY EMPOWERMENT – PUTTING THE COMMUNITY FIRST

As discussed, sustainable neighbourhoods are those that are able to sustain their development over time. These neighbourhoods have a stockpile of assets which can be used to fight against the changing circumstances. As described in Section 3 of this paper, more than just financial or physical, such assets are cultural (ways of thinking and acting) and social (connections with others) as well. By developing a critical mass of assets through an asset assessment and then subsequent physical design, neighbourhoods are able to meet their needs and aspirations on an ongoing basis. In this respect, residents’ participation through an appropriate neighbourhood governance structure is integral to both the process and outcome of the resilient neighbourhood concept. Such involvement is the very basis through which the neighbourhood itself builds the array of personal and community assets needed to ensure its long-term vitality (Leviten-Reid, 2006).

A “putting the community” first approach will ensure that the residents of the neighbourhood have a voice in directing community development and key stakeholders regularly collaborate on how to maintain existing neighbourhood assets and also how to develop new assets. To achieve this, community members need to be engaged early and continuously in the neighbourhood planning, design and development process. Local government’s role would be to facilitate a positive and active level of engagement. The local level governance structure should provide a platform where the governments, public agencies, businesses, utilities and community organisations would be able to come together on a regular basis to discuss long-term policy, and where consensus exists, would be able to align their plans, policies and programs. The neighbourhood design needs to put emphasis in creating the appropriate number and types of facilities, and communal physical assets which would ensure an ongoing involvement of the community members in the operation of these assets. A resident led and managed design guideline system could be considered to ensure community’s long term involvement in the design development and subsequent evolvement of design in the neighbourhood.

This type of community empowerment would assist to develop partnership among various parties and bring trust among them. When the local partners and community members have the access to information on local government plans, they have the capacity to challenge and lobby local government on disaster management and the allocation of appropriate resources.

5. CONCLUSION

As the number of devastating weather related and geo-physical disasters and processes increases, community risk in our continuously growing and densely populated urban areas rises too. In this context, this paper identifies that development of resilient neighbourhoods through sustainable design process could be one of the effective tools in the disaster risk reduction system. This particular tool could assist in creating strong and safer communities, and these communities would be based on the capacity and assets of people and place now and in the future.
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Effect of Gender on Thermal Comfort in Multicultural Public Places

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ABSTRACT
The city and the urban environment became extremely important in the daily lives of the increasing number of urban populations across the world. Urban research acknowledges that planning urban places should be responsive to the diversity of population. The aim of this paper is to analyse the results of thermal comfort study in the outdoor urban places. The location has been monitored regarding standard comfort variables: air temperature, humidity, wind speed, and globe temperature. The quantitative assessment of comfort conditions was combined with a questionnaire of pedestrians’ thermal comfort perception. In this paper, the analysis of observed thermal sensation with regard to gender and cultural background concerning the sensitivity of different groups to heat and cold is presented.

Keywords: Thermal Comfort, Outdoor Places, Cultural Diversity, Urban Climate

INTRODUCTION
Urban places are the common ground where people carry out the functional and ritual activities and play an important role of binding the community (Carr et al, 1992). In the last decades, the growing number of migration in global cities created a plurality of cultures as well as a new challenge for urban designers whose role is to manage the coexistence of different people in shared places (O'Byrne, 1997; Short and Kim, 1999; Hawkins, 2006). Especially in global cities, researchers recognised that public places should be designed in order to promote inclusion, inviting and accessible in order to attract large numbers of people and generate cultural diversity (Bloomfield & Bianchini, 2005; Janssens et al., 2009).

Amongst other factors, the acceptance and use of outdoor spaces are dependent on microclimatic conditions. Understanding the richness of environmental conditions in outdoor urban places and the users’ comfort implications open up new possibilities for the development and improvement of urban spaces (Panagopoulos, 2008). However, the satisfaction with the thermal environment of the space doesn’t only depend on the microclimate, but also on personal variables of the users. The individual differences in experiencing thermal environment are well studied. However, the differences between different cultural backgrounds and the male and female subjects are relatively small (Karjalainen, 2007). An awareness of these issues would be valuable to urban designers, not by the way of limiting possible solutions, rather by enriching the design possibilities. In this paper, we are concerned with these personal differences of the users. The study examines the influence of the cultural background and the gender on the thermal comfort of the outdoor places users.

STUDY AREA
“A home to people from many different countries, Australia is indeed a multicultural place.” (S. Thompson, 2003)
Since 1788, Australia has been received immigration when white colonists invaded a land already occupied for millennia by Aboriginal groups (Burnley, Murphy, & Pagan, 1997). This long history of migration in Australia has brought with it increasing population diversity.

Field survey is carried on in the City of Greater Geelong in the state of Victoria (44° 22’ S, 30° 0’ S, at an altitude of 23 m). To ensure the presence of users having different cultural background, the study took place on a multicultural festival parade on a typical summer day (the 26th of February 2011).

METHODS

To achieve the aim of the study, both the objective measurements and the subjective assessments are used in measuring the thermal comfort sensation of the users. Data collections included environmental measurements as well as human participation. The average microclimatic variables were measured at the site using a portable weather station set to record the measurements at 15 minutes interval from 10:00 to 14:00 at a height of 1.6 m above ground. The results of the microclimatic measurements are shown in figure 1.

![Figure 1: The microclimatic measurement from 10:00 am to 02:00 pm](image)

As stated by Honjo (2009) there remain problems in the assessment of outdoor comfort indices. However, SET*, PMV and PET have proven to be suitable for application at the current state of the art (Honjo, 2009; Pickup and de-Dear, 2000). In order to assess the thermal comfort, The PMV index were calculated as using Rayman program. The PMV values are shown in table 1.

<table>
<thead>
<tr>
<th>Time</th>
<th>10:00</th>
<th>11:00</th>
<th>12:00</th>
<th>13:00</th>
<th>14:00</th>
</tr>
</thead>
<tbody>
<tr>
<td>PMV</td>
<td>1.1</td>
<td>1.6</td>
<td>2.4</td>
<td>2.9</td>
<td>2.6</td>
</tr>
</tbody>
</table>

Table 1: The PMV values calculated by Rayman from 10:00 am to 02:00 pm

The human participation was examined through a questionnaire survey that took place during the field measurements. The questionnaire was divided into three parts. The first part was a demographic data collection (age, gender, and cultural background). Using the ASHRA 9 point thermal sensation vote scale, the overall thermal comfort’s perception of the users was investigated. The last part of the questionnaire was reviewing the perception
and preferences of individual microclimatic parameter. Furthermore, the activity level and the
clothing were observed.

RESULTS
According to the Australian bureau of statistics, Australian population is formed of 10
different cultural backgrounds. The number of responses of different genders from these
different backgrounds is shown in figure 2.

![Cultural Background Table]

<table>
<thead>
<tr>
<th>Cultural Background</th>
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<tbody>
<tr>
<td>1 Australia</td>
<td>15</td>
</tr>
<tr>
<td>2 North West Europe</td>
<td>17</td>
</tr>
<tr>
<td>3 Southern &amp; Eastern Europe</td>
<td>14</td>
</tr>
<tr>
<td>4 North Africa &amp; Middle East</td>
<td>12</td>
</tr>
<tr>
<td>5 South East Asia</td>
<td>10</td>
</tr>
<tr>
<td>6 North East Asia</td>
<td>9</td>
</tr>
<tr>
<td>7 Southern &amp; Central Asia</td>
<td>7</td>
</tr>
<tr>
<td>8 Americas</td>
<td>5</td>
</tr>
<tr>
<td>9 Sub-Saharan Africa</td>
<td>3</td>
</tr>
<tr>
<td>10 Oceania &amp; Antarctica</td>
<td>1</td>
</tr>
</tbody>
</table>

Figure 2: number of responses of different genders from the 8 cultural groups

The number of responses for the overall thermal comfort according to the gender is shown in
figure 3.

![Figure 3]

Figure 3: number of responses for overall thermal comfort according to their gender

Expressing the voted thermal sensation of the surveyed male and female subjects as a
function of the measured PMV value on the same graph show their relative sensitivity to heat
and cold as seen in figure 4.
The correlation between the female and male according to their thermal comfort votes is relatively weak (0.25). However, from the figure we can notice that under warm thermal conditions the responses of men and were about the same. However, under the coolest conditions, women feel more uncomfortably cold than men.

In order to examine the cultural background effect on sensitivity of gender to heat and cold, we distributed them according to the Australian Bureau of Statistics’ different cultural groups. To increase the accuracy of the results, four samples of different cultural backgrounds with highest number of responses has been chosen. These are Australian, Southern Eastern Europe, South East Asia and Southern Central Asia. The voted thermal sensation of four different cultural background groups of female subjects, as a function of the measured PMV values is shown in figure 5.

It is noticed from the figure that under extreme conditions (cold and hot), different ethnic groups show different sensitivity with subjects from group G1 being more comfortable and those from group G7 the less comfortable as seen from their deviation from the ideal condition PMV = 0. The difference between the groups is noticeable.
The voted thermal sensation of four different cultural background groups of male subjects, as a function of the measured PMV values is shown in figure 6.

![Figure 6: Cultural background effect of male subjects to heat and cold](image)

The same behaviour is repeated for male from different ethnic groups. Here also we see that the group G7 shows the biggest deviation from the ideal conditions while the other 3 groups show almost identical behaviour. Figures 5 and 6 suggest again that female subjects are more sensitive to uncomfortable conditions (higher deviation in all groups) as reported in previous studies (Kruger, 2010).

**CONCLUSION**

The analysis of observed thermal sensation with regard to gender and cultural background concerning the sensitivity of different groups to heat and cold was presented. We found that in general under extreme conditions, women feel more uncomfortably than men. Sensitivity is clearly different for different ethnic groups. For both female and male groups, subjects from group G1 show the most comfortable behaviour. This could be understood as this group represent the Australian people and are expected to be the more adjusted with the weather. More interviews are needed in order to ensure more data to cover the wide range of climatic variations.

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Consumer choice as a method of raising the
design quality of new homes and
neighbourhoods

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ABSTRACT

Issues relating to housing growth – how much, what and where – have often overshadowed issues relating to housing quality, in particular the type of places being created. The UK’s Commission for Architecture and the Built Environment (CABE) championed the design quality of new homes and neighbourhoods through its ‘Building for Life’ initiative.

How can design quality be improved alongside increasing pressure to build more homes - quickly? The new Conservative/Liberal coalition government’s drive to both reduce industry regulation and build the country out of recession provides an added dynamic and a challenge to those who promote design quality in residential-led developments. This research suggests that design quality could be improved by harnessing the potential power and influence of consumer decision making.

Keywords:

Housing design, CABE, Building for Life, Population Growth.

Introduction

The concepts and ideas presented have the potential to influence the Australian planning and development industry subject to a future Australian national framework for residential design quality being developed (akin to Building for Life – see www.buildingforlife.org). Such a framework would complement Australia’s growing focus on urban design and place making as demonstrated through documents such as the Charter for Queensland Places (Queensland Board for Urban Places, 2010) and the Australian Government’s forthcoming Urban Design Protocol. However, these concepts and ideas also have the potential for growth beyond the British and Australian planning systems, extending to a wider global audience.

Background

Since the publication of the UK’s Commission for Architecture and the Built Environment (CABE) housing quality audits (CABE, 2004, 2005b, 2007) and more recently the high profile and controversial press coverage of the former UK Labour government’s £1.06 billion „Kickstart“ housing programme, the quality of new homes and neighbourhoods has been the subject of increased scrutiny.
“Kickstart” was a fiscal stimulus package that is expected to deliver up to 22,398 new homes nationwide by 2012. Led by the government’s Homes and Communities Agency, Kickstart was controversial in that the programme was found to fund “poor” and “average” quality schemes when assessed against the criterion of a design audit called Building for Life (CABE, 2008a). This was also put in place at a time when the then government’s policies (e.g. HMSO, 2007) required the planning system to deliver well-designed homes and neighbourhoods.

CABE as a government quango (Quasi-Autonomous Non-Governmental Organisation) championed the creation of good, ordinary places. However CABE criticised the fact that many of these ordinary places largely comprised of anonymous and placeless residential suburbs, typified by developers’ own house styles. The places to which CABE referred had been largely developed by national house builders, employing standard portfolio products, with varying degrees of local variation and success from an urban design perspective. This has to be understood to be at a time when the government and many local authorities were under increasing pressure to help facilitate the delivery of more new homes to address the country’s ever increasing housing shortfall. The level of house building has recently been at its lowest level since 1945.

Over the past decade, it has become evident that the government’s aspirations for good design have been compromised by the pressure to build more homes and local authorities varying widely in the importance they place on urban design and place making. As a result, only 18% of new build homes and neighbourhoods met the national Building for Life standard when CABE conducted the country’s first nationwide design quality audit (CABE, 2007). CABE’s demise led to the abandonment of the proposed second national design quality audit. However, one of CABE’s final publications shed light on progress since 2007. In 2010, CABE released evidence from its Building for Life Accredited Assessor database. The database revealed that only 15% of schemes on its database met the standard – a fall of 3%. CABE stated,

“Data relating to formal assessments by local authorities gives a useful indication of the quality of 123 schemes from across England over the last year. The results show that the quality of housing has not improved.” (2010,p.7)

Despite CABE’s closure in March 2011, it is clear that the challenges associated with design quality remained to be resolved.
The case for better designed homes and neighbourhoods is supported by economic, social, cultural and environmental justifications. Since 2008, local authorities across England have been expected by government to gather data on the design quality of newly completed residential led developments; auditing the design standard of developments using Building for Life. This data was then reported back to government through „Annual Monitoring Reports‟.

The previous (Labour) government‟s ambitious design quality targets sat somewhat uneasily alongside the quality of schemes securing planning approval across the country. It was not unusual for schemes throughout the early 2000s to have either a weak or absent design led approach despite the introduction of Design and Access Statements in May 2006 (HMSO, 2006). Additional factors that also sat uneasily alongside the previous (Labour) government‟s design aspirations included:

- established home builder and local authority working practices, where below standard schemes routinely secured planning consent;
- a growing deficit in housing delivery particularly since the global „credit crunch‟ when industry output virtually ceased;
- consumer decision-making processes seemingly unaligned with the design quality agenda; local authorities facing challenging efficiency savings;
- Labour‟s Kickstart programme; and
- the new Conservative-led coalition government seeking to release state control in favour of free-market principles.

These factors both created and continue to create a challenging climate for urban designers employed in local authorities and for those home builders seeking to reinforce and develop best practice and yet achieve commercially viable developments. This climate is further aggravated by the current government‟s commitment to rolling back state control in planning in order to facilitate home building (that it considers a vital contributor to economic recovery) and the introduction of a „New Homes Bonus‟ where local authorities are financially rewarded for each new home built within its administrative area. This bonus has been introduced at a time when government is dramatically reducing other levels of financial support to local authorities placing them under severe financial strain. State-led aspirations for urban design and place making are therefore clearly under threat, with the effective financial paralysis of CABE in autumn 2010 a somewhat unsettling indication of what may lie
ahead. However, the current though very controversial, draft National Planning Policy Framework published in July 2011 makes clear its alleged commitment to „good design“ and development that is sustainable.

However, could a complementary and in some senses, radical new approach to improving the quality of new homes and neighbourhoods be introduced, that relies less on local and central government and instead, creates a climate whereby home builders more proactively design better conceived schemes at the outset, rather than being encouraged or pressured to by local authorities and/or other public agencies? This step change proposition might be brought about by simply helping home buyers to become better informed consumers where they might be more inclined to reject below standard design in terms of the individual buildings and the places in which they are placed.

Why do consumers buy a below standard product?

Research by the Joseph Rowntree Foundation (JRF) highlighted what it called the „expectation-offer gap“ (2002, p.48). This research discussed the concept of an expectation-offer gap in respect of workmanship, internal design, private amenity space and service provision. Whilst the research did not consider the expectation-offer gap beyond design of the home as a singular unit, to the qualities of the street and the neighbourhood, the research offers an interesting and thought-provoking area of debate relating to why people buy products (i.e. a home) that fall short of their expectations and aspirations. This is exemplified by CABE’s Housing Audits (2004, 2005b, 2007) and research undertaken by North West Leicestershire District Council which has identified the consumer having to accept a gap in design quality expectation and aspiration versus what products are available and offered on the market. This clearly assumes however, that the consumer is conscious of this gap and the subsequent sacrifices they may be making.

Hedges and Clements (1994 cited in JRF, 2002, p.103) argue within their research:

„…public attitudes are too conditioned by the characteristics of the actual housing market for people to stand back and separate out the intrinsic desirability of ownership as such from the desirability conferred on it by circumstances…“

Hedges and Clements continue to suggest that, „a change in the context might lead to a different balance of preferences“ (1994 cited in JRF, 2002, p.103) although they stop short of suggesting how this context should and could be changed. However, this pre-supposes that the consumer determines their preferences from market availability rather than their own lifestyle and aspiration expectations.
In selecting a new home, it is suggested that a consumer has a series of personal requirements and preferences relating to the home, its affordability and its location – though it is conceivable that these requirements may be limited to a basic mental checklist, rather than robustly testing the current and future performance of the product and the place in which it is located. However, with home moving comprising of more than just preference decisions but also financial, emotional and other logistical considerations (for example, buyer chains and school catchment areas), perhaps it is unreasonable to expect the consumer to draw more than basic conclusions about whether a home and place is right for them. Such a view is reinforced in Thaler and Sunstein’s (2009) international best-selling book entitled, “Nudge” where they discuss the idea that consumers could benefit from advice (or nudges) to help them make better decisions. Thaler and Sunstein argue that hard problems or choices become easier with practice though point out, “unfortunately, some of life’s most important decisions do not come with many opportunities to practice…Generally, the higher the stakes, the less often we are able to practice. Most of us buy houses and cars not more than once or twice a decade” (2009, p.81).

The Joseph Rowntree Foundation (2002) suggested that, „the aim must be to create an “intelligent client” not just a consumer of a product…[however] they are not well equipped to act as “intelligent clients”. Their vision needs to be expanded” (2002, p.99). Though the JRF also argues that better product choice needs to be complemented by a better informed consumer concluding, „it needs a rethink of both the industry and the attitudes of the house-buying consumer” (2002, p. 99). For instance, the consumer is now well accustomed to seeing energy efficiency rating bars on home appliances such as fridge freezers and washing machines with the intention of assisting consumers to make a more informed choice. Such ratings therefore „nudge” the consumer and offer them the opportunity to make a more informed choice. It is somewhat ironic that in some instances the consumer is afforded more advice on household products – those products that are placed or used within the home, rather than the home itself. Needless to say, these products cost considerably less than the home itself. It is worthwhile noting that the general public is becoming accustomed to Energy Performance Certificates relating to the environmental performance of new and second hand properties and therefore is potentially receptive to new sources of product information.

Hedges and Clements (1994 cited in JRF, 2002, p.104) highlighted during the post-war period that home ownership has been more than about securing a place to live; it is about securing a property that promises a healthy prospect of financial gain. This therefore raises the question whether the „expectation-offer gap” is overcome by the national preference for
home ownership, compensated by the prospect of both ownership and the promise of financial gain. It is interesting to note that a CABE commissioned Ipsos-MORI survey „Attitudes to the built environment” discovered that 26% of people are apparently not interested in the way places look and feel (CABE, 2010, p.12). It is therefore conceivable that the current situation of supply not meeting neither need nor demand has resulted in consumers purchasing homes that require compromise simply in order to secure a property to meet their immediate needs, or in the case of first time buyers, take a first step onto the housing ladder. The cycle of residential design quality is therefore repeated by the success of the home building industry – success determined not by quality of place but by units sold and business turnover. The challenge is therefore to secure change where demand exceeds supply and where product and brand differentiation is limited to sales promotions, such as those relating to internal upgrades or cash discounts.

Interestingly, there appears to be an absence of the recognition of the potentially transformational role of the consumer in raising the quality of design with the focus largely upon design control through planning and to some degree persuading the private sector to embrace good design for commercial if not social reasons. Indeed, over ten years ago Carmona (2001, p.4) alluded to the then „increasingly powerful effect” of the public on improving the quality of new homes. But it is Franklin’s observations that provide the most concise summary of the challenge, which this research seeks to address. Author and researcher Bridget Franklin (2006) commented that „the actions of private house builders are dominated not by regulators or designers but the pursuit of profit and appeal to the market” (2006, p.98). Franklin’s observations provide a stimulus for a new way of thinking and a fresh approach to securing good quality design in new residential led developments.

Creating a more informed consumer of new homes

A question is therefore asked - how can a step change in the design quality of new homes and neighbourhoods be achieved? And this question must be set within the context of current home builder/local authority working practices, and consumer behaviour; where:

- supply falls short of both need and demand,
- below standard design routinely secures planning consent and,
- below standard developments are not being rejected by the consumer.

Kruczkowski (2008) working for North West Leicestershire District Council developed a quality rating scheme and branded it as „ourplace™” for new homes based on the nationally based „Building for Life” set of design standards, developing a simple scoring regime (see figure 1). Under the scheme, home builders receive a rating certificate (with ratings
published on a web site) following planning consent (and where applicable, once again-any design related planning conditions have been discharged) for display in their Sales Office. It is expected that over time, consumers will be accustomed to seeing such ratings and expect to see rating certificates displayed in Sales Offices.

Developers who secure “A+” or “A” ratings are entitled to use the ourplace™ brand within on and off site marketing material as a method of brand differentiation. Such use of the brand is also intended to raise public awareness of the scheme and generate a source of income to support the costs associated with managing and developing the initiative. Income is generated through the sale of licence agreements to developers opting to use the brand identity and through a commission based revenue stream based on sales of ourplace™ branded merchandise purchased by home builders.

<table>
<thead>
<tr>
<th>Number of Building for Life criteria met (/20)</th>
<th>Building for Life tier</th>
<th>ourplace™ rating tier</th>
</tr>
</thead>
<tbody>
<tr>
<td>16+</td>
<td>Very good</td>
<td>A+</td>
</tr>
<tr>
<td>14 – 15</td>
<td>Good</td>
<td>A</td>
</tr>
<tr>
<td>10 – 13</td>
<td>Average</td>
<td>B</td>
</tr>
<tr>
<td>9 and under</td>
<td>Poor</td>
<td>C</td>
</tr>
</tbody>
</table>

Figure 1: Table illustrating how Building for Life performance relates to ourplace™ rating tiers

The rating scheme is similar in its ethos to Australia’s Green Building Council’s forthcoming Green Star Communities rating scheme, whereby consumers are encouraged to consider factors they might not otherwise have considered when considering potential places to move to. Whilst still a pilot scheme, ourplace™ has been adopted by another three other local authorities in England. The pilot authorities in England are North West Leicestershire, South Derbyshire, Charnwood and St. Helens.

**Early research findings**

Research and monitoring will continue into 2013. Emerging results suggest that planning approvals for below standard schemes reinforce the status quo. It therefore follows that if home builders can secure approvals for below standard schemes then there is no planning incentive for them to design better. As businesses seeking to maximise share holder value one way in which home builders can achieve this is to get the lowest quality (and often cheapest) scheme approved. It is widely accepted that good design generally costs a
developer more in both design development and production. However, it is worthwhile noting that despite the below standard nature of many schemes securing consent, most UK home builders can and have produced well designed schemes, though these remain the exception as opposed to the norm – and consumer exposure to schemes of quality is limited.

Further results suggest that home builders recognise the potential impact and value of a quality rating scheme on business performance if it were to become mainstream (ourplace™ is currently a peripheral scheme operating across four local authorities). The impact of this finding is significant. As with Australia’s Green Star programme, once private industry can see tangible benefits of responding positively to a particular agenda then industry chooses and wants to design better rather than being forced to by public agencies - the success of which is clearly questionable.

Finally, it is widely recognised that consumers are location and price sensitive. Some consumers will buy the cheapest they can (aim to buy below their maximum budget), others will buy the best they can afford (buying up to their maximum budget). However, the research conducted to date suggests that rating developments through such a scheme will raise consumer awareness and encourage comparison “shopping” between developments within a consumers’ price and location range.

Conclusions

Initial findings suggest that the home building industry will be more receptive to embracing design quality by embedding it within organisational culture and practice when a quality rating scheme is mainstreamed. This in turn should further stimulate competition, product development, innovation, creativity and brand differentiation (“direct positive” and “indirect negative”). Initial research also clearly demonstrates that home builders are more than capable of building well-designed (and commercially successful) homes and neighbourhoods, with numerous “prototype” schemes developed over the last decade, e.g. Ravenstone, Leicestershire, Anstey, Leicestershire, and Melbourne, Derbyshire. Whilst these represent only a small percentage of product output, it does raise questions as to why these successful “prototypes” are not impacting more generally on the bulk of product output, i.e. why are these not more widespread?

The industry has often defended its typical output, claiming that the consumer is not rejecting what some local authorities consider to be below standard designs. It is therefore possible to conclude that below standard design, whilst widely criticised by some local authorities and public agencies represents a viable and perhaps at times lauded business model. Research also demonstrates a gap in consumer expectation and product offer – a gap that could be
conceivably filled if the principles and lessons of „prototype” schemes were more readily understood, followed and applied.

It is perhaps inevitable that those advocating the principles of urban design will spend much of their time justifying its value to others, such as those commissioning developments, formulating policies and making decisions – or is it? Perhaps securing the future of urban design in the 21st century, which in the recent history of the UK has been at the mercy of political turmoil and the global economic climate, can be safeguarded by focusing on architecture. Not however on the architecture by which we would typically understand it, but the notion of a truly well designed architectural environment – whereby designers and crucially developers, focus their efforts on placing the value of urban design and place making within the consciousness of the consumer. Thus enlightened, the consumer becomes the main stimulus to which the development industry responds.
References


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Designing with Plants and Turf that survive environmental extremes.

Todd Layt
Floods, cyclones, drought and bush fires have tested our urban landscapes to the limit over recent years. Couple this together with regional regular weather extremes such as humidity, frost, and heat, and the result is one very harsh environment. What can be done in the design phase to help ensure urban planting success in these types of conditions? Firstly, it helps to get the site preparation right, and not make the mistakes that have led to failed projects in recent weather conditions in Queensland and elsewhere. Then it’s get the right plant for the right place. That is to match proven plants to survive the floods, the droughts, to resist fire and to best match the plants with the site soils, mulch type and maintenance levels. What do you do after these weather extremes to repair areas? Recent breeding, erosion control research work, and site observation of extreme weather affected sites in Queensland helps shed some light as to what practices perform the best. Some of the case studies listed lead to the conclusion that when done right the results are, green projects that have better survivability and more resilience in urban design.

Note; Where possible in this paper, research information has been placed on Ozbreed’s web site to make it easier for it to be found. Links will be displayed through the paper. Copyright issues for some research papers preclude this.

Todd Layt has a long history in horticulture, consultancy, research and the general nursery and turf industry. In the past he was a Director of the International Erosion Control Association (Australasia), and has presented a number of papers at those events in Australia, New Zealand, and the USA. Recently he was involved in writing papers including; quantifying the strengthening of soil by commonly used plants and turf, measuring drought tolerance of plants, and fire retardant plants. Todd has bred a number of successfully used landscape plants and turf types, now widely being planted around the world for commercial landscape and erosion control use, and recently bred the first and only general purpose Australian Native turf. His focus these days is to provide green life solutions for the harsh Australian Landscape.

Introduction

Urban green life is at the heart of our towns and cities. Places like parks, sporting fields, and urban walkways, are vital for an active healthy population. Just as important are passive green spaces around hospitals, housing, units, factories, offices, and even roadsides and railways. Research has often linked health benefits with natural living parks consisting of turf and plants. Patients who overlook parks in hospitals recover better, and residents of high rise housing with access to green open spaces are healthier. They have better mental health, immunity to disease, and work more productively. Even a child’s behaviour is improved by natural turf and plants. When people live and work next to nature, they are more relaxed and are less susceptible to high blood pressure, stress and depression. Couple human health benefits, with other positives of green life such as a reduction in the heat island effect, erosion control, better air quality, pollution and heavy metal remediation and you have vital reason to keep urban greenery not only safe but thriving. Did you know 5 square metres of turf provides enough oxygen for one person to breathe each day, or that turf takes in 4
times as much carbon as a modern lawn mower expels. Urban gardens are also an important mechanism for reducing carbon.

We usually only consider keeping our buildings, and people safe from natural disaster, but with all this in mind, should we not be planning to keep our urban greenery also safe, by designing and using it in such a way as to make it resilient to natural disaster. Should we not be taking full advantages of the resilience that green life has to natural disaster. Should we be considering how the use of appropriate plants and turf can mitigate and reduce the severity of some natural disasters? Floods, fire, and drought all hurt our green life, but designing smart urban green spaces can greatly reduce the damage, and the expense of clean up, and rectification. Using certain types of plants around buildings can help greatly reduce the damage from bush fire, or using certain turf types and plants can greatly reduce erosion from floods and massive downpours. Using drought tough plants can reduce dust and respiratory problems in times of drought, heat and severe winds.

Discussion

Green life and Bush fires.

Many organisations release lists of plants that are good to plant in bush fire prone zones, but few are based on research. Most are simply based on opinion, but by cross referencing a number of these lists, a more reliable list of plants can be gathered. Be careful however, as some just copy each other. Some lists however are based on plants farmers have used for well over a hundred years as fire breaks, or plantings that have actually helped save people’s homes in bush fires. One important study by the CSIRO tested the ignitibility of Australian plants. In recommending which plants are more suitable than others for fire prone areas, you need to take all this information into account. It must be noted that any plant can burn when exposed to enough flames and heat, it is just that some are less likely to ignite, or may take longer to ignite. For this reason you cannot rely on plant selection alone to stop bush fires, but it makes sense to use plants that generally delay in their ignition.

The CSIRO study is the only scientific test that tested how quickly both dry and moist leaves of certain Australian native plants take to ignite. In the tests, Lomandra longifolia took 38.53 seconds to ignite at 400 degrees using fresh leaves, and 11.13 seconds for oven dried specimens. Compare this to Eucalyptus elata that took 11.57 seconds to ignite when fresh, and 3.22 seconds when oven dried, and it is easy to extrapolate why Lomandra longifolia and other Lomandra types could be a good choice for fire prone areas. Listed below are results for some plants that took longer to ignite, with cultivars that work well in the landscape listed next to the information.

<table>
<thead>
<tr>
<th></th>
<th>Fresh leaves</th>
<th>Oven dried leaves</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lomandra longifolia</td>
<td>38.53</td>
<td>11.13</td>
</tr>
</tbody>
</table>

TANIKA Lomandra longifolia LM300 PBR Australia Wide except humid areas like Queensland
NYALLA Lomandra longifolia LM300 PBR Australia Wide except humid areas like Queensland
Lomandra longifolia Katrinus Deluxe PBR Australia Wide except humid areas like Queensland
KATIE BELLES Lomandra hystrix ‘LHBYF’ PBR Better for humid regions like Queensland
TROPIC BELLE Lomandra hystrix ‘LHCOM’ PBR Better for humid regions like Queensland
SHARA Lomandra fluviatilis ‘ABU7’ PBR Australia wide

Anigozanthus (Kangaroo Paw) 40.05 3.51

Based on this data, Kangaroo Paws if kept green, will work well. Avoid allowing there foliage to go dry. Avoid in humid regions. Use Landscape types like Gold Velvet, Regal Velvet, Amber Velvet, or Anigozanthus flavidus types. Avoid pot culture or smaller forms, as they are usually just annuals.

Casuarina glauca 43.02 10.53

Trees and ground cover form. Free Fall is the only ground cover form.


Agapanthus were not in the CSIRO trial as they are an exotic plant, but over one hundred years ago farmers around Australia planted Agapanthus as fire breaks. In the recent bushfires in Victoria, there are some farmers that claim these plants saved them. Agapanthus have been one of the most popular plants when it comes to fire breaks. Unfortunately many are concerned that high seed yielding Agapanthus could in certain wetter regions have weed potential. Even if this is the case, there are enough types that have very low seed set that are safe selections such as;

QUEEN MUM Agapanthus orientallis 'PMN06' PBR is a safe low seeding variety that has high water content in its leaves, ideal for using as an attractive fire break.
Well maintained lawns have been used as fire breaks on many occasions. At this fire at Warragamba near Sydney about 10 years ago, this well maintained lawn stoped a major fire in its tracks.

For more plant lists and literature links go to www.ozbreed.com.au and follow the links to the research section.

Drought

Drought can be one of the worst natural disasters, leading to fire, dust storms, lack of water resources, loss of crops, livestock, degradation of rivers, and the loss of urban green life. Using drought tough plants and turf on roadsides, in parks, and in any urban landscape is essential in Australia. Roads departments have been testing plants in extreme drought tolerant situations for years and years. In eastern Australia, most roadsides are not irrigated, and as such roads departments have learned which plants survive. Not surprisingly they generally use native plants that are well adapted to the drought cycles of Australia. Some of the mainstay plant types they use are Lomandra, Dianella, Callistemon, Grevillea, Westringia, Leptospermum, Casuarina, Eucalyptus, Acacia, and native grasses such as Themeda, Poa, Pennisetum, and Imperata. These choices have been developed over decades of trial and error, with the departments sticking to plants that have been successful in dry periods. Urban planners can learn from these landscapes, and use plants that live on natural rainfall. In the West with its dry summers and sandy soils, places like Perth do need to irrigate a little, but the amount can be reduced by using drought tolerant plants. Little quantitative study has been done into how much water is required for plants to survive on urban roadsides. One recent study was conducted based on a Californian water use formula, called Wucols. This report can be found at www.ozbreed.com.au under the research section. It basically studied actual roadside plantings in North Western Sydney, and analysed the rainfall in each area. It showed that even in the
recent drought, many native plants survived and performed well on these roadsides. This study was for one of the driest periods on record for the area. Lomandra stood out as a plant type that performed extremely well in this study. So even in drought, there are green life choices for roadsides and other urban landscapes that require no or little water. The study also found that Zoysia turf survived these really dry periods on roadsides very well. Empire, a type of Zoysia japonica, is now becoming very popular as a roadside turf, due to its ability to survive drought and its low maintenance characteristics. When choosing plant types it is also very important to use the right plant for the right place. For example Lomandra hystrix does far better in the Humidity of Queensland than Lomandra longifolia. Using greenlife that is very drought tolerant in the wrong humidity region, or cold region defeats the purpose of long term survivability. Another recent paper from the department of Primary Industries rated Zoysia macrantha, an Australian native Zoysia as more drought tolerant than Couch, Kikuyu and Buffalo. There is one commercial cultivar of Zoysia macrantha called Nara, and it has already been used successfully in no irrigation roadsides, and a large army base. A water authority study in the USA found Zoysia and Couch turf types to far better survive drought than Buffalo turf. Buffalo turf has become popular as a home lawn, particularly with all the recent TV advertising, but for urban resilience to drought it's lack of underground rhizomes, makes it more susceptible to drought damage.

USA water authority study showed Buffalo is not as drought tolerant as Zoysia and Couch.

These studies, and the experience of roadside landscapes, proves urban landscapes can survive periods of drought in Australia, and provided the right turf and plants are chosen, drought is one disaster urban green spaces can survive.
Flood and Erosion

The recent Brisbane floods hurt a lot people, damaged many buildings, but also devastated large areas of urban green space. But plants and turf are resilient, with many types surviving the flood, with some however doing better than others. Anything with underground rhizomes, for example, survived better than those without. Buffalo turf for instance fared poorly on some turf farms, and in some parks and private homes. Zoysia turf types performed the best in floods, which is interesting, as they also are rated so highly for drought. Couch turf after some clean-up also came back well. Many sporting facilities had to undergo major clean ups, particularly the removal of silt, and in some instances it was easier to replace the turf after all the earth works. At the University of Queensland, 6 of the universities 8 sporting fields went under. It took two weeks before they got onto the fields to start the clean-up. A couple of the fields were left unscathed, and were quickly back in use, whilst others just needed a quick clean up and basic rejuvenation, before the turf was ready again. Some areas needed major scarifying, but the turf could be saved, whilst two areas were total write offs, and needed returfing. With only two fields needing replacement turf, I think that shows how resilient turf can be to flood. It was silt that caused the damage not water. In returning these parks and fields the management had to be mindful of high levels of E. coli and faecal streptococci well in excess of EPA guidelines. Applications of Lime solved these problems. One of the biggest parts of the clean-up of parks, gardens and sporting fields in Brisbane was the removal of silt. For example the Brisbane River left behind over 10,000 tonnes of silt on the parks, and sporting fields at the University of Queensland. This all had to be removed.
Plants that could survive being buried by silt or left under water for a time, or those plants that could handle some damage from machinery fared best, and often survived the floods. Lomandra hystrix, Dianella and Liriope did well on many sites. If these get damaged, the rhizomes will reshoot from below the ground. In some instances though, there was just too much silt to save the plants, and replanting was required, but compared to buildings, the cities green life bounced back remarkably well.

Major storm events and floods can cause devastating erosion. Engineers often provide hard solutions for erosion, but this forgoes all the benefits of green life. Using hybrid engineering and green life solutions, like geotextiles, with turf and plants is one solution, but another solution is to use Australian native plants that have better soil strengthening capacity. A study published at the International Erosion Control Association (IECA) conference in Florida, showed many Australian, and some exotic plants have high soil strengthening capabilities. King Alfred, an Australian Dianella plant strengthened the soil 752% or 70 kPa, whilst Katie Belles a Queensland Lomandra rated 32.3 kPa. Common Loamandra only had a rating of 13.6 kPa. One turf variety, namely Empire Zoysia, had a rating of 97.9 kPa, which was far more than Couch and Kikuyu. As a result of this research, roadside trials a few years back, and the fact that Empire needs far less mowing, some roads departments around Australia have now switched from Couch to Empire Zoysia. Most urban RTA roadsides including slopes in NSW are now grassed with Empire, as well as many sites in Queensland. Using specialised erosion control plants developed through specialist breeding can greatly reduce erosion, and protect urban green space from natural disasters such as flood and major storm events. The full paper can be found at http://ozbreed.com.au/pdf/erosionpaper.pdf or ordered from the IECA. Nara
native turf is highly salt tolerant according to the department of Primary Industries of Qld, and can handle better the inundation of big seas, making it ideal for coastal erosion control. Better protection of our foreshores from natural disaster may become a bigger issue in the future. DPI Salt Study results for Nara are available at http://ozbreed.com.au/download/Zoysia_salinity_tolerance_comparison.pdf

Testing the soil strengthening capabilities of plants.

Conclusion

Green space is clearly an important aspect of urban design. Recent research, trials, and breeding of better plants and turf have showcased how green life can also help reduce the impact on these urban areas from natural disaster. The severity of bush fires can be reduced by choosing the right plants and turf. Certain plant and turf types have been shown by research to withstand drought far better than others, allowing well researched urban green life designs to better survive Australia’s all too common natural disaster of drought. Many types of plants and turf have been identified to better survive floods, and breeding of Australian native plants and new turf varieties has provided plants ideally suited to the reduction of urban erosion. When designing urban environments to better withstand natural disasters, it is not just engineering solutions that provide the answer to better resilience, but also more resilient plants and turf.
Research Bibliography, links to papers and Internet sites.

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http://www.saws.org/conservation/ordinance/turfgrass
Physical problems of Kuala Lumpur’s streetscape: Case study of Bukit Bintang Street

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² Second author
Abstract

In this paper, the current physical conditions of Kuala Lumpur’s streetscapes is examined based on a special look at Bukit Bintang Street - one of the most visited streets in the Kuala Lumpur. At the first step of this research, sixteen physical attributes of urban spaces have been revealed and then a qualitative evaluation and a quantitative survey have been accomplished afterwards, in order to examine the current conditions of the identified attributes in the case study area. Some physical problems such as disharmonious skyline, small scale of the roads, improper pavement and flooring, and etc were discovered and examined through a direct observation and photographing of Bukit Bintang Street. In addition, a questionnaire survey with the sample of fifty respondents was carried out to show the user’s point of view on the examined problems and the result of survey reveals that the traffic congestion and lack of parking space, in Bukit Bintang Street, were the major problems known by the respondents.

Keywords: Urban space, Physical attributes, physical problem, Kuala Lumpur’s streetscape, Bukit Bintang street

1. Introduction

Examinations on the physical conditions of current urban public spaces can be clearly described as an essential step toward having a responsive and inclusive environment. Therefore, this paper aims to identify the most common physical problems of Kuala Lumpur’s streetscape, especially within the old parts of the city, through evaluating the current conditions of physical attributes of the case study street. Bukit Bintang street - as one of the most visited streetscapes of Kuala Lumpur which is located in the Golden Triangle of this tourist city, and is considered to be one of the most important tourist attractions of Kuala Lumpur - was chosen as the case study for examination of its physical shell – façades and floors of this space – to identify its physical problems.

The importance of studying the physical attributes of urban spaces can be seen from the influences of physical spaces on the people’s daily activities. The findings can also become a feedback in the training process of designers in order to perceive the significance and effects of the physical attributes of urban spaces on the design of a sustainable city.

2. Literature review

Streetscape is one of the most important designed spaces in the city and considered as one of the two major elements of urban space. so, for examining the streetscape’s
features and problems, illustration of urban space implication and attributes is firstly essential.

To clarifying the meaning of urban space in this paper, reference is made to Krier’s (1979) theory of urban space as external space. He mentioned that “all types of space between building in towns and other localities are urban spaces.”

In order to figure out the physical problems of an urban space, it is first necessary to identify the physical attributes that can influence urban public spaces. Friedmann et al. (1978) was one of the earliest to study the evaluation of urban open space. Substantial resources have been devoted to improving urban open spaces as a result of a growing concern for the quality of the public environment of cities. Krier (1979) carried out a comprehensive research on “Typological and morphological elements of urban space.” Speiregen (1965) wrote on the “Proportions of space: Size, scale and enclosure of space.” Bently et al. (1985) examined “Visual appropriateness: The role of detailed appearance.” Kaplan (1982) contended that a city-dweller is more appreciative of ‘green’places. Lo et al. (2003) mentioned “other major literatures concerning the design attributes for urban open space include Pushkarev and Zupan (1975), Gehl (1987), Marcus and Francis (1990), Carr et al. (1992), Rubenstein (1992), Cherulnik (1993) and Tomalin (1998).”

2.1 Selected physical attributes
Since streetscape is a one of the two known kinds of urban space - street and square -, the urban space's attributes can adopt as streetscape's attributes. So from the review of the above-mentioned literatures on design attributes in urban space, and with regard to the characteristics of the old parts of Kuala Lumpur city, three groups of physical attributes were identified and selected for this study because of their compatibility in the environment of the Bukit Bintang street. Namely,

- **Design elements and street furniture**: Paving, seating, signs, planting, shelter and canopy.
- **Form characteristics**: Proportions of space, time, skyline and different architectural styles of buildings.
- **General factors**: Facilities for disabled people, parking space, traffic, maintenance and cleaning.
3. Methodology

This study is a kind of qualitative research which attempts to explore the most common physical problems of Kuala Lumpur’s streetscapes. So case study was selected as the main strategy of this research and Bukit Bintang street was chosen as the single case study to be examined through two different phases of data collection as follows;

3.1 Qualitative evaluations

For the visual appraisal, a deep observation and an accurate study of this area were followed by the taking of photographs of the above-mentioned physical attributes. The Bukit Bintang street was visited at different times of the day and during various events to examine all different conditions and the users’ behavior. The evaluation revealed the current conditions of these attributes and found which attributes were not at the satisfactory level and could be considered as physical problems.

3.2 Quantitative analyses

After the qualitative examination of Bukit Bintang street and the identification of the physical problems of the area from the urbanization point of view, a questionnaire survey was conducted to ascertain the users’ perspective on the identified physical problems. The sample of the study consisted of 50 questionnaire surveys on people who lived or worked in the Bukit Bintang street or knew of this area. The distribution of age, race, gender, the purpose of being at the area and the education level of the respondents is summarized in Fig 1. The response sample mainly consists of users aged above 18 and had attained tertiary education level. People were asked to what extent they thought that the Bukit Bintang street has those problems.
### Figure 1
Distribution of age, race, gender and the purpose of being at the area and the education level of the respondents.

<table>
<thead>
<tr>
<th>Gender</th>
<th>Number of respondent</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>23</td>
<td>46</td>
</tr>
<tr>
<td>Female</td>
<td>27</td>
<td>54</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Age</th>
<th>Number of respondent</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>18-35</td>
<td>39</td>
<td>78</td>
</tr>
<tr>
<td>35-50</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>50 or above</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Race</th>
<th>Number of respondent</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local</td>
<td>31</td>
<td>62</td>
</tr>
<tr>
<td>Foreigner</td>
<td>19</td>
<td>38</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Level of education</th>
<th>Number of respondent</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under diploma</td>
<td>9</td>
<td>18</td>
</tr>
<tr>
<td>Diploma-bachelor</td>
<td>26</td>
<td>52</td>
</tr>
<tr>
<td>Master-PHD</td>
<td>15</td>
<td>30</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Purpose of being in the area</th>
<th>Number of respondent</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Living-working</td>
<td>18</td>
<td>36</td>
</tr>
<tr>
<td>Shopping- visiting-others</td>
<td>32</td>
<td>64</td>
</tr>
</tbody>
</table>

### 4. Findings

The result of the two phases of data collection is mentioned as follows;

**4.1 Identified physical problems of the Bukit Bintang street**

Through the qualitative process of direct observation and examination of the three groups of physical attributes, some physical problems were identified as follows:

1) Improper walkway paving and flooring, 2) Not enough shelter and canopies to protect people from climate changes such as rain and wind, 3) The lack of suitable street furniture & seating, 4) Irregular signs try to dominate each other, 5) Inadequate pavement and pedestrian crossing, 6) Small scale of the roads, 7) The lack of renovation of the old building, 8) The architecture of new buildings contrasts stylistically with the traditional architecture of old buildings, 9) A disharmonious skyline has been created by a proliferation of buildings of random heights, bulk and spacing, 10) The lack of facilities for disabled people, 11) The lack of parking space, 12) Traffic congestion, 13) The lack of public services and maintenance, and 14) The lack of plaza for social events and street show.
4.2 Importance of identified physical problems from the users’ perspectives

In the questionnaire survey, people’s perceptions on the identified physical problems at three levels – low, average and high – were asked. Since the disharmonious skyline was not a familiar concept for people and it was created mainly through the contrast between the heights of the old and newer buildings, this problem was not mentioned in the questionnaire and only the contrast between the architectural style of old buildings and newer ones was asked. Hence the result of this item was generalized for the disharmonious skyline as well. Fig 2 presents the result of the whole survey. The result showed that traffic congestion with the 86% high rate were the major problem of this area which was followed by the small scale of the roads with 68%. Lack of parking space was the other important physical problems, which 62% of the users ranked highly. 54% of users mentioned that there was not enough shelter and canopies for the raining time and 52% stated about irregular signs on the facades of the buildings. Finally, the contrast between the architectural style of new buildings with old ones with the 20% high rate was of the least importance for the users.

<table>
<thead>
<tr>
<th>The physical problems of Bukit Bintang street</th>
<th>Low</th>
<th>Average</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Improper paving and flooring</td>
<td>30%</td>
<td>32%</td>
<td>38%</td>
</tr>
<tr>
<td>2 Not enough shelter and canopies</td>
<td>20%</td>
<td>28%</td>
<td>54%</td>
</tr>
<tr>
<td>3 Lack of suitable street furniture &amp; seating</td>
<td>38%</td>
<td>36%</td>
<td>26%</td>
</tr>
<tr>
<td>4 Irregular signs</td>
<td>10%</td>
<td>38%</td>
<td>52%</td>
</tr>
<tr>
<td>5 Inadequate pavement and pedestrian crossing</td>
<td>30%</td>
<td>26%</td>
<td>44%</td>
</tr>
<tr>
<td>6 Small scale of the roads</td>
<td>8%</td>
<td>24%</td>
<td>68%</td>
</tr>
<tr>
<td>7 Lack of renovation of the old building</td>
<td>30%</td>
<td>42%</td>
<td>28%</td>
</tr>
<tr>
<td>8 Architectural style of new buildings contrast stylistically with old ones</td>
<td>36%</td>
<td>40%</td>
<td>24%</td>
</tr>
<tr>
<td>9 Lack of facilities for disabled people</td>
<td>26%</td>
<td>30%</td>
<td>44%</td>
</tr>
<tr>
<td>10 Not enough parking space</td>
<td>14%</td>
<td>24%</td>
<td>62%</td>
</tr>
<tr>
<td>11 Traffic jams</td>
<td>2%</td>
<td>12%</td>
<td>86%</td>
</tr>
<tr>
<td>12 Lack of public services and maintenance</td>
<td>30%</td>
<td>38%</td>
<td>32%</td>
</tr>
<tr>
<td>13 Lack of plaza for social events or street shows</td>
<td>24%</td>
<td>38%</td>
<td>38%</td>
</tr>
</tbody>
</table>

Figure 2 shows the extent people think the Masjid Jamek area has the above-mentioned physical problems.

5. CONCLUSION

With regards to Rogers’ (1999) contention that good design of urban space rests upon the establishment of a direct relationship with people living and working around there, it is
argued that users’ opinions on the design of urban space cannot be neglected in order to achieve a high environmental quality.

It was found that people in an old part of the city such as Bukit Bintang street put much emphasis on the consideration for automobiles travel, scale of the roads and parking space in the design of urban open spaces. According to these major problems, It can be mentioned that people living and working in a high density and old part of the city would require better public transportation system which is probably the only solution for avoiding the traffic congestion, environmental pollution and improving the quality of the area.

Besides, the results reveals the importance of shelters and canopies that offer protection against climatic changes especially in the tropical weather of Malaysia, which is another important urban design attribute. Users’ opinions also reflect the necessity of setting rules to regulate installation of commercial signs on buildings of this street.

This research shows the importance of the physical problems of urban spaces from the users’ perspective. Further studies are required for finding design strategies to solve the identified problems and achieve a responsive environment, thereby making Kuala Lumpur's streetscape a inclusive and responsive urban space.

REFERENCES

Renewal of the Hangzhou part 
Grand Canal heritage

Du Peijun

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ABSTRACT

The Grand Canal in China connected Beijing and Hangzhou who plays an important role in the past years of China. Resident chose to live next to the canal before whose houses become heritage nowadays. Hangzhou, at the end point of the canal which flow through the centre of the city, faces many problems of the fusion of the modern city and old districts. There are three traditional blocks left next to the canal. This paper will discuss the different attitudes and problems toward the conservation, the methods during the renewal, the coordination considering of the overall image of the city in the future.

Keywords: Grand Canal  Renewal  Hangzhou  heritage

PAPER TEXT

The Grand Canal is the longest, biggest, oldest canal in the world, from Beijing to the north and Hangzhou to the south, cross Beijing, Tianjin, Hebei, Shandong and Zhejiang province. It is 1794 km length across Hai River, Yellow River, Huai River, Chang River and Qiantang River, which has almost 2,500 years history. The Grand Canal plays an important role in communicating economics and culture between north and south, especially for the agriculture and industry development and town evaluation.

Hangzhou part canal has a deep sense of history and human culture. The heritages still exist along the canal, including the old buildings and landscape. Nowadays, Hangzhou canal can be divided into three parts, traditional part, modern part and future part. The traditional part is in the north which reflects the old feature and life style most. There are three intensive old blocks in this part, named Qiaoxi Street, Xiaohe Street and Dadou Street. Each block have their own characteristic, and reserve some traditional buildings.
QUESTIONS

In the rapid development of modern China, there must be plenty of new buildings replace the old ones. The traditional blocks will face many problems during the renewal of city. As culture heritage, we prefer to keep these blocks in memorial of the old life and old culture, especially when the government decide to apply for World Cultural Heritage. We all need to keep the original form and use them in a right way. But there will be some problems.

1. Functions. Keep them in the original form by repairing the structures and redecorate the inside space. But all the facilities are not as good as the new buildings. Therefore, people will not choose to live here as before, this space may come to a deserted and lonely place.

2. Authenticity. Hangzhou part canal, applies for World Cultural Heritage, must show the integral traditional features. So the government decide to connect the three blocks together by constructing some fake buildings along the canal. It is just like the landscape gallery which is not the really heritage. Actually, we can recall the Shanghai history by the StoneGate, the Beijing history by the quadrangle courtyard, but nothing by the fake old buildings, besides it’s really a waste of place of only two storeys buildings in such a good place.

3. Harmony. Located along the canal across the centre of city, the three blocks are not isolate place, which must have some relation with the modern settlement. There are many differences between them, such as building mass, features, elements, colors. It is not easy to combine them together in a harmonious way. Usually, people consider the traditional blocks whose scale is close to human beings as the foreground and the modern skyscraper as the back ground, focus more on the old ones.

RENEWAL METHODS

Renewal of the traditional block, there are three idiomatic methods. First, genetic renewal, which means pick up the element and spatial composition that represent the characteristic of heritage, for example the quadrangle courtyard and try to maintain the
courtyard surrounded by four dimension buildings and the galleries which space flow through. This method is always used for duplicate or recovers important building features. Second, museum renewal, which change all the residential function to exhibition to show the old life style like antique museum, or use for some small bars and shops for people to sense, like Xintiandi in Shanghai. Many renewal projects use this way for commercial purpose. But this method cannot be used in a large amount of place. Third, organic renewal, which combine the former two way together. Make the old structure much stronger, redecorate the inside space and improve the facilities. Usually, people choose to make the first floor as stores selling some souvenir or snacks and the second floor as bedroom to live. Heritage along the Hangzhou canal use the second and the third method most.

<table>
<thead>
<tr>
<th>Type</th>
<th>Landmark buildings</th>
<th>Public buildings</th>
<th>Promote high-rise settlement</th>
<th>High-rise settlement facade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coordination</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coordination</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Analysis</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Suggestion</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Colors</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coordinate</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

**COORDINATION**

Between the traditional blocks and modern blocks, there must be a transition place which is considered as mid-shot. This place is used for connect two parts with different mass, style, and colors. Some is filled with large greenbelt which also creates some public leisure place. Some is filled with fake traditional buildings which also make some synthetic useful spaces. Others are filled with large industry factory which has its own features compare to the two different parts.

The traditional blocks are very similar to each other. We can do very few changes among them except improving the living quality and building facade. So the only thing
we can do is to find out the common features of the heritage and find out how to make the modern part next to them coordinate to the old ones.

1. Mass. Most of the old buildings are made of wood with two storeys. But consider of the requirement and intension of land, modern buildings are very large, both in plan and height. For this issue, it’s difficult to coordinate them in the same level. We can only try our best to make the skyline continuously limitedly.

2. Style. Traditional buildings always have some details such as slope crest, pediment, eave and wood column etc. For the modern buildings, we can use the detail element try to make them harmonious, which must have some influence to its own style. Therefore, we only can add few decorations on the old or new buildings to make them integrate but cannot change a lot.

3. Colors. This element is easy to control. Old buildings are always with dark grey roof and dark brown or white walls, some with stone basement. New building can have several colors and easy to change. And according to the color planning research, we find out the most appropriate way is color hue coordinate. That means to control the old and new in the same color system in hue, and use different color system in brightness and saturation according to the requirement. Because old buildings always have very dark and strong color, we can easily make the new ones coordinate by the same color tone but separate them by different brightness or saturation.

We find four different typical new building styles. First, important landmark buildings, we suggest use amount of glass facade to weaken its big mass, use a few materials of the old buildings foreground as ornament. Second, large public buildings like hospital which is not that tall, we suggest use high brightness low saturation colors with small ornament to compare. Third, proximate high-rise settlement, we prefer to use low saturation mid brightness colors with large greenbelt as cover. Fourth, high-rise settlement faraway which is better to be similar to old ones with high brightness and low saturation colors, like the background with less comparison.

PRINCIPLES

In general, we have to face the paradox in the development of city between preserve heritage and building modern ones. In order to create a unitary abundant vivid city image, we try to find a way not break the original environment and give some principles on the renewal along the Hangzhou Canal.
1. Globality. Consider the heritage as part of the city and try to make the whole zone in one style system.

2. Continuity. Connect all the point along the canal together and give a continuous color mode to join them.

3. Hierarchy. Attract people’s attention in foreground and leave the background to the environment. Divide them in different levels.

REFERENCE

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The Universal House – a multidisciplinary approach to designing responsive and inclusive housing.

Colleen Rowe

*Workable Living, Brisbane, Australia*
The Universal House – a multidisciplinary approach to designing responsive and inclusive housing.

Colleen Rowe

Workable Living, Brisbane, Australia

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ABSTRACT

What happens when you sit an architect, occupational therapist, town planner, engineer and builder at the same table with a blank slate for housing design?

This paper presents a design case study. By looking at how people from different walks of life use residential spaces over their lifespan, applying social and functional values to the original design brief, and integrating architectural features, construction processes, transporting constraints and siting requirements into the design process, we are able to produce homes that are flexible and changeable throughout the lifespan of the building and the people.

We provide a design solution to housing that is inclusive and responsive to the fragility, complexity and diversity of life.

PAPER TEXT

The Universal House™ is a collaboration of architects, an occupational therapist, town planner, engineer and builder to deliver fully universal, wheel-friendly, sustainable, flexible homes.

We first met during Easter 2009 to discuss housing for disabled and/or disenfranchised groups who have traditionally not been well serviced by the private market or the social housing sector. This happened within the context of the Economic Stimulus Package, the “national conversation about disability” leading towards developing a National Disability Strategy, government reports on homelessness and mental illness and media coverage of Indigenous housing. Indeed, it was our opinion that despite considerable
political will and unprecedented funding, appropriate housing – to meet the environmental, economic and social needs of individuals and the community as a whole – was still not being produced.

From the beginning it was a “meeting of minds”. As an occupational therapist I brought to the group the social context of disability and vulnerability – the issues/difficulties not widely known within the community about finding and maintaining appropriate housing; the residential context of the disability standards; the functional aspects of the built environment and how it can influence and impact on a person’s ability to perform their normal everyday tasks. Gabriel Poole (architect) is a genius with space. His ability to feel and “see” space, to pare things down to their simplest components while maintaining line and dimension is at the core of our ability to produce a building that has the breadth of flexibility and function of the Universal House. Malcolm Holz (town planner) brought the community context to our group - knowledge of planning schemes and regulations, relating the dwelling to the street, services and community. We each brought to the table a lifetime of experience and passion in challenging the status quo; recognising the need to provide a different type of housing and development. From each of our different sectors, we have seen innovative and worthwhile projects fail because one of the other sectors has faltered. Indeed with the value of hindsight, the strength of our collaboration and resulting designs lies in the integration of the architectural features, social and functional aspects, construction processes, transporting constraints and siting requirements.

The team targeted 4 specific groups of people who we believed were not serviced at all by the private market, and often not well serviced by the social housing sector. These 4 groups were:

- People with physical limitations - people with mobility difficulties, coordination problems, decreased sight, and well as people going through the normal aging process.
- People with disabilities and/or mental illness who need to live in close proximity in order to share support funding packages
- People with mental illness
- Indigenous Australians, especially in remote communities.

We looked specifically at their functional needs (in particular the health related literature), and the aspects of the physical environment that make it possible to do the normal everyday tasks that you or I might take for granted. In optimising the environment, we can maximize people’s ability to be independent, lead meaningful lives and contribute to their communities. We used the “person, environment and task”
model of occupational therapy practice combined with our collective experience of working in various housing, health, Indigenous and aged care organisations to develop functional briefs for each of these groups of people. We wanted to test the premise that if we designed homes for people at the “pointy end” of the spectrum of housing needs, we would come close to designing housing for everyone. In developing spaces that meet the needs of people with disabilities, we would also produce homes that make daily life easier and more comfortable for everyone who lives in them.

Our early discussions centred around “movement”: making it easy for everyone to move around – within the home, down the street, within the community - as life changes (sometimes dramatically and without warning, and at other times as our life stages evolve). We talked about moving people out of hospitals and freeing up beds so others can move in as early as possible; people with disabilities being able to move around in general without “special” (different) environments and entrances; having a home that makes it easier to manage with a temporary injury, such as a broken leg; homes to cater for our needs as we grow older, or if we have aging family or friends visit. We talked about the moving and growing population trends – the housing shortage generally as well as the changing demographics of housing needs.

Part of the brief was that the houses would not only suit people’s physical needs, but would also promote a sense of wellbeing. The World Health Organisation definition of health (that hasn’t changed since 1948) states: “Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity”. We briefly discussed some of the research on the built environment and its effect on wellbeing. Gabriel summed it up beautifully when he responded with: “I’ve always thought that if people lived in beautiful houses they’d be happier”.

With quick turnaround times in mind, we quickly realised the benefits of factory built homes for our project. We contacted builders Jim and Penny Margach who had been working with Gabriel in developing “breathable walls” in factory built modules for remote locations. We also worked with Rod Bligh (engineer) to develop light weight roofing systems to connect the modules and enclose the spaces between modules.

We recognised that sustainability would be a key factor in our project. Environmentally friendly housing has traditionally been the preserve of middle to high-income earners, and yet low-income earners need it most to offset the costs of living. People with disabilities, mental illness or high support needs have ongoing (and often high) costs associated with medications and health services, and are less likely to be in long-term employment. With limited resources at their disposal, and often with severe financial constraints, they are least able to provide for ongoing housing costs - including basic
services such as utilities, maintenance and repairs. From a daily living perspective, it was also important that the houses were easy to clean.

There was also a very strong focus on long term sustainability – to the individual in having certainty of housing that will cater to their changing needs over their lifespan, and to governments and the community in providing housing that does not require the enormous cost of retro-fitting accessible features and assistive equipment as peoples’ needs change, particularly as they age.

As we worked through the design process, we realised that the design brief items could be broadly divided into 2 categories – those relating to the building/module itself, and aspects or issues that related to how the modules were sited in relation to each other and/or to the street and community. And so, through paring down design to the essentials, taking into account life’s stages and evolutions and developing modules that have the flexibility to be individualised, we realised we could produce a home that suited all the groups of people in our initial brief. And so we have produced The Universal House™ - a home for the diversity of people, households and communities in Australia.

The Design Solution

Ans so, what does The Universal House™ look like? We have designed for modular construction to allow the flexibility required for “housing for life”. Each housing module is 3.6 metres wide and up to 15 metres long. The individual modules are structurally self-contained and can:

- Stand alone (be individually titled) on small lots
- Allow clusters of modules to be co-located and arranged according to the site characteristics
- Allow a home to be enlarged or reduced according to family needs and stages of the life span
- Connect in ways that allow the modules to have some shared facilities while maintaining privacy for individual residents
- Allow the relocation of buildings to areas of increasing demand from areas where demand has diminished. This results in efficient use of resources and minimizes the risk of vandalism to buildings that are unoccupied for long periods of time
- Allow modules/homes to be moved if geographic relocation is required (e.g. change in family circumstances or need to access services/support in a different location)
The simple curved roof that can span 4.8 metres with no interval structure can connect two modules, thus creating a spacious, insulated room that can be used alternately for indoor - outdoor living or secured, cosy activities.

We use factory construction to achieve quick turnaround times, minimize waste during the construction process and to deliver housing to areas where there are constraints on availability of local labour and materials. The building system can be delivered to site as flat packed building components or fully transportable buildings, whichever is most cost effective for the specific site and location. General low maintenance construction leads to fewer ongoing costs over the life of the building.

The patented wall system effectively acts as tubes of air pulling cool air into the wall cavities from under the house and expelling hot air into the specially designed roof ridge and expelled at the ends. This means there is no heat transference into the house. We have installed a number of houses in the tropics where, as a result of this wall system combined with cross ventilation, air conditioners are not required or their use is vastly reduced. In cooler climates the roof vent can be closed to trap hot air in the ceiling space during winter.

We use 19mm timber particle board for all internal wall linings – this is an extremely robust material and stands up to difficult treatment in challenging environments. It allows occupants to install heavy-duty fixings into walls where required. Importantly, grab rails can be installed on any wall at any angle without structural reinforcing.

The units have wheelchair accessible entries, rooms and car space. They are designed with circulation spaces that exceed AS1428.2 (enhanced design for access and mobility). The building system also allows us to design for the very small percentage of people who need extra large spaces for manoeuvring large wheelchairs and specialized equipment.

All the ceilings are engineered to accept ceiling hoist tracking up to 240kg; doors are designed for easy retro-fitting of automatic devices and grab rails can be installed on any wall at any angle without structural reinforcing. Our sliding doors can open and close where a ceiling track goes through the doorway. The bathroom design allows a bath with hoist space underneath to be fitted into the shower area without plumbing and installation costs.

Apart from the increased independence that ceiling hoists can give some people, health and safety concerns about the use of floor hoists in homes are likely to follow the trend of Australian hospitals and overseas support services where ceiling hoists are mandated. Currently the greatest cost in retro-fitting a ceiling hoist is in engineering and reinforcing existing ceiling structures.
We are working on a system of adjustable height kitchen benches with removable under bench cupboards. This is another feature that targets the changing needs of the building or the resident.

We have designed “accessible” door handles that allow sliding doors to fully recess into the wall cavity so that the full width of the door opening can be used. The handles can be used with all types of hand (dys)function, as well as using push/pull with arm, elbow or knee.

There is minimal disturbance to the land, particularly on sloping sites, with the house is sited above the ground. Homes can be fitted with solar panels, water tanks, and can be prepared for off-grid use.

**Where to from here:**

Finalising a design and having partners ready for construction only completes the first stage of this project. We need to test the usability of our designs from the perspective of people living in the homes and for housing organisations needing to use the flexibility we claim to offer. We need to collect data on the internal temperatures in the homes over time, on maintenance costs and on the use of alternative energy sources within the homes.

There is little research that correlates the physical housing environment with health measures such as visits to doctors, admissions to hospital, support hour funding and to life satisfaction measures. Some initial research in the fields of spinal injury and mental illness appear to show positive correlations. With the current trend towards vastly increasing applications for community support, this information will be critical for well-informed policy and decision-making in the housing and disability sectors. We would like to extend this type of investigation to include the benefits to all individuals - and to communities - of living in beautiful homes that have been designed to enhance wellbeing.

During our discussions we were often reminded of the fragility, complexity and diversity of life. We hope our designs provide a solution to the need to develop inclusive and responsive communities.

**Bibliography**


CREATIVE COMMONS AND THE FUTURE CITY – A LIFE HUB

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Resilience, Urban Design, Effective Governance, Leadership
ABSTRACT

There is an opportunity for Urban Designers to integrate the impending reality of scarce global food resources into a coherent plan for a “People Centric” sustainable resilient city. A Creative Commons (Life Hub) is a part of the continuum of food from farm to fork and space from flower boxes to fields. Creative Commons is a Planning Term used to designate Open Space in a City/Urban setting that focuses on the natural capital but especially food. The food focus includes education, production, preservation, preparation, presentation and promotion; the people (social) focus includes human senses, needs, behaviour, food security and social rules (governance); and the creative focus is as a “Life Hub” with multiple interacting educational and cultural activities and “Fiestas” to maximise the value of the open space. It is part of the city system to minimise the impact of climate change and food security

CONCEPT DEVELOPMENT

The reduction of land around houses in cities has restricted a families’ access to grass for playing and exercise, gardens for food and flowers, Hills Hoist and the backyard shed for creativity. Cities provide play areas and open spaces to compensate this loss. We propose a design to consolidate and maintain these areas as a shared and professionally managed asset, a “Creative Commons” with food security. We can build cities but can we build lives?

It is “compensation” for the loss of space but adds significant opportunities to develop individual and community relationships and entrepreneurship. It minimises a financial burden on the community by operating the Commons as a “Not-for-Profit” institution. It provides practical working space for financial sharing or exchanging skills and assets in production, retailing and cultural activities. It focuses and educates the community on the real natural environment and its products especially food and organises events that maximise the personal interaction with each other to develop community trust and culture.

The urgent need is for the disadvantaged to have easy economic and physical access to the space to enjoy and use it, to mix with the community and to have financial access to the programs. This is the central theme of the concept. The market will ensure rich people are fed, but Food Insecurity will need a solution, both in Australia and internationally and the Creative Commons is an approach. The food continuum has other urban design features such as Food Storage/Distribution Hubs, Community Gardens, Farmers Markets (Retail), Restaurants, Food Precincts, Profitrons and Open Fields to deliver food to all citizens.

CREATIVE COMMONS DEFINITION

Local open space that facilitates neighbourhood development and human evolutionary progress (measured as social capital) through inclusivity, creativity and entrepreneurship.

Inclusivity: Includes all cultures and the advantaged and disadvantaged (including financial). Creativity: Place for humans to meet share, dream, do, reflect and evolve. Entrepreneurship: Individuals taking responsibility and creating economic opportunities for themselves and others. Franchising the disenfranchised.
DESIGN FEATURES

The Design is for humans, with the eye of a “landscaper” and our philosophy (nature) of “fresh air, fresh water, fresh food, fresh sunshine, quietness and vistas”. The human centric approach includes the following 5 models of key areas impacting the human activity in cities.

It is based on knowledge of how people spend their time, their money and balance their lives and how this can be improved to enhance their individual and collective wellbeing.
The design generates and enhances social capital, with trust a basic parameter and includes social behaviour (Governance) in relation to 5 levels, individual, networks, business, community and biosphere. The design uniquely includes behaviour as part of the design to allow individuals freedom of action to maximise creativity and integrates it with responsibility for their actions with an action management system.

The approach integrates the food cycle (and 5 key areas) and includes knowledge of the health and environmental impacts of foods, the Food and Environmental Pyramids.

Four layers of organisation and management are recognised, modelled and managed; natural, social, physical and financial capital.
METHODOLOGY

The start is to define a space by both its physical boundaries and social boundaries. Best practice business techniques such as those of IBM are then used to build the Commons.

HOW??? How to build a Creative Community Commons

- Community Designers & Partners
- Community Relationships
- Knowledge
- Material Goods
- Finance
- Health
- Time Bank
- Community Forums
- Co-ordination

Focus Level 1: Individual

It is about Partnerships: It is recognised that many other partners will be involved in building the community, especially Councils, and the contribution of other parties will be matched with the Life Hub to provide the best mix, as shown here at the individual level. The natural, social, physical and financial value of the community is determined and goals are set to increase all capital values of the community, but especially financial ones and the cash flow. Age, culture, country (200 in Australia, all “out of Africa”) training, background or experience of the individuals is not a concern (an opportunity) with the result e.g. the Mamre Life Hub

The Creative Common is about Collaborative Consumption “Product-service systems that facilitate the sharing or renting of a product (i.e., land sharing); Redistribution markets, which
enable the re-ownership of a product (i.e., food); and Collaborative lifestyles in which assets and skills can be shared (i.e., co working the knowledge and space)

It is about **Events**: Outdoor Concerts: Open-Air Cinema: Dramatic Festivals: Cultural Festivals: Farmers Markets: Community Markets: Food Fairs: The Arts: Regional Promotions; Food Promotions.

A green field site is preferable as it provides the most efficient way to build a Life Hub.

The food continuum includes Food Storage/Distribution Hubs, Farmers Markets (Retail), Restaurants, Food Precincts, Profitron, (Carbon Forests) and Open Fields, outside the city.

It is about **Food**: Food Security issues are emerging as a majour global risk factor and our job as Urban Designers is showing policy makers how to reduce the impact of food security and climate change on supply. City towers 600m tall (Food Tower, sunlit or not) with a 3ha footprint, could produce basic food for 100,000 people, but it is not needed yet, try a Profitron. We have answers to most of the issues of land scarcity, water, nutrients, energy climate change, education and lagging technology for example in the Bennelong Profitron.

**ISSUES AND SOLUTIONS –TODAY, NOW, IMMEDIATELY**

- **Land scarcity**: Use “Profitron” (glasshouses) to boost productivity 10^4. Locate near consumers
- **Genetics**: Focus on vegetables and fruit. Use existing varieties, breed better ones, new species
- **Water crisis**: catch rain water, recycle water inside glasshouse, exploit evaporative cooling
- **Nutrient losses**: N2 fixation, P, S, recycle
- **Energy dilemma**: solar panels on site, minimise chemicals by disease and insect control, LED’s
- **Climate & Environment**: take climate out of equation, design sustainability in
- **Education/Communities**: Life Hub; Politicians - Information; (Speculators: Regulate)
- **Lagging technology**: Can’t wait for Science (10 years). Use what we have now and improve.
We recognise the nature of systems and new systems are needed for food and the Life Hub can impact many of the critical aspects of the Davos model of global risk. The need is to apply the proven ecological principles to all land, especially food lands; 800 years old, upgraded degraded land or virgin land. The Creative Commons extends it to urban land.

Plants also stimulate the visual senses in gardens, on streets or in roundabouts.

Or that the same open space has value for expressions of creativity that are mind boggling; “Impressions” on the Liang River or those of Christo and Jeanne-Claude in Central Park, NY.

A resilient city needs a legacy. Its assets improve people’s lives even when times get tough. Examples of this robust and lasting fabric include the urban park systems designed by Fredrick Law Olmstead in the U.S.A. and the marvelous architecture built during wealthier times. The Creative Commons is a dynamic substrate for urban agriculture. It challenges our imagination about how food and plant production, and associated activities, can be programmed and managed in many ways for generations to come. It is a source of plant and food knowledge available to all, but above all a community asset to generate trust.