DESIGNING FOR AN ACTIVE COMMUNITY FOCUS

BY

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ABSTRACT

This research dissertation set out to determine what form the design and integration of a suburban community centre as a catalyst for moving towards a sustainable built environment might take. The literature of theoretical arguments and built precedents were investigated to identify potential design parameters. A viable site for the project was also investigated.

As a result, the Sustainability Drop-in Centre was created in the heart of Karori. Its design was based on international case studies that emphasized green urbanism and TOD design initiatives, whilst also looking at Calthorpe's arguments for TOD design and Lynch's concept of place legibility as a set of inhabitable paths, edges, districts, nodes and landmarks. The integration of these crucial design parameters required a design intervention at multiple scales, from a new traffic design for the suburb to a detailed ramp design aimed at achieving energy efficient building design, thus limiting the need for lifts and escalators.

As a result the final chapter illustrates the new design proposal in the form of representational renders of the pedestrian experience. These renditions, informed by the construction drawings referred to throughout the study, determine that the integration of a community centre as a catalyst for moving towards a sustainable built environment would create many improved quality of life opportunities, including, but not limited to, chances for social interaction, spaces and occasions for local bartering, and an opportunity for education in regard to sustainable practices.

The design intervention has generated a stronger walkable suburb that gives importance to public sustainable forms of transportation and the needs of pedestrians, resulting in a suburb that will function well into a post-oil future.

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Chapter 1: Designing for an Active Community Focus

IN THIS SECTION:

- 1.1 Introduction
- 1.2 The Problem Statement
 - 1.2.1 Research Question
- 1.3 Purpose
- 1.4 Case studies
- 1.5 Restrictions

1. Designing for an Active Community Focus

1.1 Introduction

By the turn of the 21st century environmental issues have become a growing concern in the consciousness of the global community (Rabel, 2002), in parallel with evidence the effect of mankind on the environment has become increasingly extensive and complex (Shiva, 2009). These concerns have led to consideration of possible sustainable practices and architectural advances designers could make to achieve more sustainable suburban initiatives (Ewing and Moore, 2010), since the majority of energy consumption originates in the homes and suburban lifestyles of the citizens of developed countries. This has caused the architectural profession to rethink design principals and parameters and some new 'sustainable' communities (see section 3.2) have been the result.

Research into sustainable communities is concerned with networked intelligence in fabrication and construction, urban mobility, building design, and public space. Authors, such as Brundtland (1987), Walker (2006) and Vale, B., & Vale, R. (2009) look at creating innovative ways to change living in urban areas through, in part, the application of appropriate technologies that enable urban energy efficiency and sustainability, and enhance opportunity, equity, and cultural creativity. These authors explore the new forms and functions of cities and suburbs and suggest design and planning directions for a post-oil future where sustainability centres and teaching facilities could become prerequisites for a new way of living. The work in this thesis aims to encompass urban design as well as building design skills. In respect of the residential sector, and its largely suburban space, both of these aspects are paramount matters of concern.

This study will be investigating a community building, concentrating on ideas of how the overall suburb will regenerate and function in a coming world without oil. As a result the design intervention will be centred on an active community focus. This will entail;

- education about sustainable practices;
- a chance for social interaction;
- local barter;
- local markets.

The driving force behind the design will be directed by these attributes, thus the built programme can be best defined as a Sustainability Drop-in Centre.¹ Markets today tend to be put in car parks and the craft market at Frank Kitts Park is a good example of how these spaces do not work well for the market function. Today such activities are pushed to peripheries and are not well integrated into the suburban community, so why not design places for these activities to happen?

A recent master's thesis (Field, 2011, Pg. 35 to 50) conducted a study of living in Wellington suburbs to investigate environmental impact in comparison with quality of life. It did this by looking at ecological footprint and living conditions in 1956 and 2006. Field found that the more sustainable community of the 1950s (nearly half the footprint of today) was almost equal in quality of life if not superior to today's living conditions.

Thus the question is, as people could live a lower footprint lifestyle in the 1950s, what might doing the same thing look like today? In the 1950s people walked, they used public transport, and there were a lot more communal practices. Because having a community

¹ The Sustainability Drop-in Centre is the thesis design project, based on this research undertaking. This design aims to assess the initial research question: What would the design and integration of a community centre as a catalyst for moving towards a sustainable built environment be like?

focus and shared transport were more important, perhaps one of the routes to making a more sustainable environment today could be to incorporate better community facilities into existing suburbs.

1.2 The Problem Statement

The quality of life in today's developed countries can be considered problematic compared with a more sustainable lifestyle, found as far back as the 1950s. Thus the implementation of sustainable design solutions in the suburban community has become a matter of necessity.

Biocapacity, frequently referred to as the new wealth of nations (Ewing and Moore, 2010), is the ability of ecosystems to provide the resources people need whilst absorbing the wastes they create. The Global Footprint Network use biocapacity as another way to calculate national and global assets, expressing the measure in the form of global hectares. At 58.2 million global hectares, New Zealand has one of the world's largest biocapacities, and currently only uses 39.4 per cent of this (Ewing and Moore, 2010). While this seems very good, this data only indicates that the amount New Zealand uses is well below a biocapacity that is far beyond the world average. Herein is the fundamental problem, as New Zealand is responsible for one of the world's largest ecological footprints, enough to award the country the title of the world's seventh largest ecological liability, as shown in figure 1.1.

Figure 1.1: Today's top ten ecological liability countries. Sourced from: <http://rankingamerica.wordpress.com>. (Accessed October 15th 2012).

1.2.1 Research Question

Based on the above discussion, the following research question was framed:

What would the design and integration of a community centre as a catalyst for moving towards a sustainable built environment be like?

1.3 Purpose

Demonstration buildings have been seen as significant tools that change values by way of depicting what is possible (sustainablecitiesnet.com, 2012). The role of the sustainability drop-in centre will be to promote education, social interaction and well-being, in effect becoming a demonstration building for Karori. The purpose of the first part of this thesis is to provide a critical approach to the notion of sustainable design in today's suburban areas and introduce the inter-relationships between site-specific spatial design and sustainable practices. As a result this study aims to concentrate on three key design attributes;

- demonstrating sustainable design as a point of concord between facilities offered and the design of the building;
- producing a developed design, with attention to form and composition of the building;
- considering the site to provide a purpose-built space with attention to context.

The research question will be addressed by first looking at theoretical arguments surrounding well designed communal spaces, and then looking at international case study

examples of urban developments that apply these theories and that are considered to have achieved significant sustainable design.

1.4 Case studies

This thesis will address precedents in two sections. The first section will look at theories of urban space and sustainable space. In this body of work, the theoretical argument will include five areas of discussion;

- design theories of disconnected space by Trancik (1986), Koolhaas (2001), Lynch (1960) and Sitte (1980);
- Kevin Lynch's protocols for designing space;
- defining disconnected space according to Sitte and Lynch;
- comparing these theorists to New Urbanism theory;
- looking at sustainable theories that address disconnected space.

The second section will look at case studies of suburbs, cities and neighbourhoods and then compare them to Karori's old suburban centre during the early 1950s. Specifically the case studies will be;

- Vauban district of Freiburg, Germany - an example of TOD approach to green urbanism;
- The community drop in centre at BedZED sustainable eco-habitat in London.

1.5 Restrictions

This study involves the study of green urbanism eco-communities and Transit Oriented developments (TODs); as such the conclusions are, therefore, restricted to these development types. As the aim of this study is to attempt to achieve best practice, the case studies selected represent the most celebrated international developments, based on claims of sustainability. Conclusions will be based on looking at case study examples that best apply the theory based arguments in conjunction with discussing how each case study functions.

Chapter 2: Site selection and Site Challenges

IN THIS SECTION:

- 2.1 Investigation of three potential suburbs;
 - 2.1.1 Karori
 - 2.1.2 Johnsonville
 - 2.1.3 Newtown

Studies based on aerial mapping and current uses, paying attention to;

- Infrastructure and public space analysis
 - Current uses of space
 - Future design proposals
- 2.2 Justification for the selected site
- 2.3 Karori
 - Aerial maps identifying site
 - Brief description of current site uses
- 2.4 In-depth site analysis and site challenges;
 - Walkability
 - Building typologies
 - Road hierarchies
 - Green space
- 2.5 Summary

2.1 Investigation of three possible sites

Based on the need to find a thriving Wellington suburb that has scope for sustainable evolution, Newtown, Johnsonville and Karori were proposed as potential sites. All three suburbs have strong public transport links into Wellington city. Currently Wellington City's terrain dictates a radial transport system, emanating from a long route through the city that links to its retail and office activity, in a linear configuration following the shore line. Both Newtown and Karori are linked to this main public transport artery and as a result both suburbs are prime transport veins, which is an important aspect for any sustainable proposal, as appropriate traffic management can often increase sustainable practices and limit emissions (Carter, 2001).

Figure: 2.1. Johnsonville public transport vein. Author Owned image created using data from Ko-ordinates, refer to appendix A for larger image.

Figure: 2.2. Newtown Author Owned image created using data from Ko-ordinates, refer to appendix A for larger image.

Figure: 2.3. Karori public transport vein.. Author Owned image created using data from Ko-ordinates, refer to appendix A for larger image.

2.1.1 Karori

Karori is a suburb located at the western edge of the urban area of Wellington. It is significantly larger than most other Wellington suburbs, having a population of over 14,000 at the time of the 2006 census (Statistics NZ, 2012). The centre of Karori contains a shopping mall, new public library and café, and other amenities. There are three state primary schools in Karori: St Teresa's School, which is an integrated school, serving the Catholic population of the suburb; Karori Normal School in Donald Street, which serves the eastern and central part of the suburb; and Karori West Normal School in Allington Road, which serves the western end. While Karori remains a mainly residential area there are restaurants, cafes, supermarkets, good schools, real estate agents, and it is very well served by dental and medical professionals.

The suburb has been fortunate, however, in that despite its size, there is little heavy industry. Currently there are no future initiatives proposed for the greater Karori area, other than a few private enterprises and volunteer groups that aim to preserve, regenerate and protect wildlife as well as park areas in and around Karori (Wellington City Council, 2012a). This highlights the importance any proposal would need to give to green space.

2.1.2 Johnsonville

Johnsonville, on the other hand, is considered both a residential and commercial suburb. Unlike Karori this suburb does have a current design initiative, the Northern Growth Management Plan developed by Wellington City Council. Following this scheme a proposal to redevelop Johnsonville's main precinct into the "Johnsonville Town Centre" (Wellington City Council, 2012b), is being put in effect, as shown in figure 2.4. This plan recognizes

Johnsonville as Wellington's most economically important commercial and population hub outside the city centre.

Figure 2.4 Proposed plans for Johnsonville. Northern growth Johnsonville proposal 2007, Retrieved from wellington.govt.nz/projects. (Accessed 16th October 2012)

The plan recommends the creation of a unique and identifiable Johnsonville culture around the triangular precinct bordered by Johnsonville Road to the east, Broderick Road to the south and Moorefield Road to the west. Like many suburbs in Wellington, economic and commercial interests are the driving force behind the suburb's redevelopment. In the case of Johnsonville it could be argued this is the

most sustainable route to take as Johnsonville, unlike Karori or Newtown, already has significant infrastructure and is more economically self-sufficient; it has its own comprehensive shopping mall as opposed to the more limited facilities in Karori.

2.1.3 Newtown

Newtown lies in the southern part of Wellington. The population according to the 2006 census (Statistics NZ, 2012), was 8,409. The suburb lies east of Vogeltown, between Mount Cook and Berhampore. The main thoroughfares of Newtown are Riddiford St., leading from Mount Cook to Berhampore and Melrose, and Constable St., leading from Newtown to Kilbirnie. Originally a working-class suburb, Newtown has followed gentrification trends in recent years, attracting large numbers of immigrants, students and young professionals,

resulting in an ethnically diverse population. The Wellington City Council District Plan identifies Newtown as a suburb with an "identifiable or distinct character" (Wellington City Council, 2012c). Because of Newtown's special character only single household units are allowed in certain areas. Resource consent is needed to put two or more household units on a single site (Wellington City Council, 2012c). This is a very important aspect as any sustainable proposal must consider such local policies, even where they inhibit consolidation of multiple sites or their division. A future design initiative currently proposed for Newtown is the Adelaide road intensification project. As outlined in the summary notes of the 2005 community design workshop, this project entails incorporating two of the nine proposals discussed with local residents and business owners. Option 8, a short term plan would entail;

- parking provision – important to keeping life normal (so people can do business) and provide a useful buffer for pedestrians from traffic;
- green coloured lanes on roads as bus areas;
- permanent bus lanes and one lane for traffic in each direction. (Wellington City Council, 2012c).

A more gradually integrated long term plan is option 5 which encompasses a new traffic management plan that would allow traffic to move with more ease during peak traffic times, currently one of the major issues. This option, however, is not concerned with sustainable traffic planning at all, which might entail more use of public transport and less use of cars, but rather discusses ideas to relieve peak time congestion for existing mostly car traffic.

The key aspects of the new traffic management plan as outlined in the summary notes of the 2005 community design workshop entail;

- a longer-term bus or tram option;
 - a 25.3m corridor that could handle both this long term option (option 5) and the short term option (option 8);
 - changes to intersections and road widening in places to relieve traffic congestion.
- (Wellington City Council, 2012c).

2.2 Site selection summary

Careful consideration of the infrastructure of all three sites indicates there are four major aspects that must be considered for the proposed site. These are current uses of the space, scope for intensification if this is deemed useful, a current strong reliance on private vehicular transport, and a strong link to the central city transport services. Though Johnsonville and Newtown both have potential for this proposal, both of these sites already have future design initiatives and proposals, evident in the new design of Johnsonville's mall and the Adelaide road intensification project.

Whilst this alone is not enough to discount these two suburbs, Karori shows far greater potential due to its size, and massive dependence on the main Karori Road for private vehicular access, making it a suburb that would suffer greatly post-oil. Newtown's proximity accommodates multiple routes for access to the eastern suburbs and the central city but Karori is far enough away to be considered segregated and unlike Johnsonville this suburb cannot be designated a transport hub. Johnsonville is considered so, due to its multiple public transport links to the central city area and the outer suburbs, as it is served by two

bus companies and a railway line. Newtown's distance from the city and location allow the site to be completely integrated into the planning of Wellington, rather than it being a separate entity that could be considered detached like Karori and Johnsonville.

2.3 Karori - the proposed site

The proposed area of work is located in the centre of Karori, which currently accommodates the Karori mall, a medical centre, community hall, recreation centre, library, petrol station and various smaller retail stores. The proposed site (figure 2.5) will constitute the scope of work for phase two of this thesis. This existing central core of Karori is suffering from inaccessibility for pedestrians, underuse of space, and lack of cohesion due to the large traffic vein running right through the centre of the suburb. Connectivity on an urban scale is a vital part in the preservation of communities. Communities in the 21st century are declining due to urban sprawl, transportation needs and the ever growing population. The question posed about this specific site is, what are the contributing factors causing this sprawl and how can this be mitigated? Mixed usage, walkability and eliminating unnecessary vehicle dependence are the primary attributes associated with connectivity that can introduce a more defined community (Trancik, 1986, pp 3-4). This study aims to identify what defines a well-connected network of both pedestrian and traffic orientated travel, while acknowledging the permeability that each network needs to function efficiently. It also aims to create a greater interaction within the identified site, which is segregated from one half of the suburb due to the heavy traffic spine (figure 2.8).

Figure: 2.5. The Proposed Site.
 Author Owned image created using data from Ko-ordinates

The aim of mixed usage is to replace the sprawling, placeless, privatization of current trends with a denser, more integrated network, of pedestrian orientated uses. The current trends are, in almost all cases, virtually eradicating urbanism. Following Evans and Ford (2007, pp 3), there is a need for urban design to allow for the portrayal of the aesthetic values of the community through high density mixed use development. A representational example of diverse usage, in a local context, is Cuba Street. Its versatility of building usages from residential, retail, and commercial allows synergistic meetings between people to occur. Where the reliance on motor vehicles and public transportation is limited, occupants of these areas are able to live, work and socialize on a local scale rather than looking out of the site for their day-to-day needs (Ministry of the Environment, 2002). As stated by Jane Jacobs (1961, pp 273); “a city sidewalk by itself is nothing. It is an abstraction. It means something

only in conjunction with the buildings and other uses that border it or border other sidewalks very near it.” It can thus be argued that permeability is a critical part of mixed use in a neighbourhood, along with an appropriate street frontage, something the current central area of Karori does not incorporate well, as shown in figure 2.6

Figure: 2.6. Street frontage in central area of the proposed site. Author owned image shot on site 2nd September 2012

When considering transportation integration, like many places in Wellington, Karori already has streets that cater for pedestrians, but the connections between such streets are fragmented by the traffic orientated roads, the best example of which is Karori Road that runs right through the suburb, as shown in figure 2.8. Roads in the current climate are designed by road engineers, with their manuals and codes. The aim is to enforce passive safety while illuminating essential intersections to reduce all physical conditions that could produce a car crash (Chater, 2001, pp 47). This rationale is having adverse effects on the pedestrian experience within Karori and hinders walkability. Walkable neighbourhoods are created through well-connected thoroughfares; this is about the connectivity of the

community, the connection “from building to building, from lot to lot, and from block to block” (Chater, 2001, pp 14). Currently there is a lack of connection between the parks and recreation facilities on one side of the main road and the mall and medical facilities on the other.

The existing central heart of Karori is suffering from inaccessibility for pedestrians, over dependence on vehicular transport, and lack of cohesion due to Karori Road. Any new scheme will have to address both redevelopment of the existing relationship of the suburb to the road and permeability, whilst accommodating public transport. The current site needs to increase density at the heart, and increase the number of intersections, permeability, mixed-use, and connectivity to create a scheme that will lower private vehicle needs and dependence and also improve the overall dynamics of the community.

2.4 In-depth site analysis and site challenges

In order to consider how the site functions in its current configuration, the analyses undertaken for the designated area include:

- Walkability
- Building typologies
- Road hierarchies
- Green space

Figure 2.7 shows the different building typologies in the area. It reveals that the site is dominated by large commercial buildings which are isolated from each other. These buildings are all related to trading activities and are also separate from public facilities such

as the library and the medical centre. Recently a number of new buildings have been constructed such as the new library and park area where the town light house once stood². The removal of the old light house building, often utilized for club events and local community activities, like an after school teaching facility, has removed another important public space from this area.

Figure: 2.7. Building typologies.
Author Owned image created using data from Ko-ordinates

Any new design framework will need to look at integrating a number of building typologies or space typologies on this site. Incorporating a mix of typologies will foster growth and development in the area.

The second diagram, figure 2.8 shows the road hierarchies in the area. It reveals that a major connectivity barrier in the site is Karori Road. This road is a direct feed to the Karori Tunnel (the quickest link to the city). As a result it is a well-used road with traffic speeds of up to 50kph. Currently the road supports the primary bus service in Karori and it is dominated by traffic most of the day, a situation made worse during peak hours. This makes

² The Karori lighthouse, also referred to as the Lighthouse community centre, was a public community services building that was often used as a meeting space for group such as clubs and after school tutorial classes.

it an unpleasant environment for pedestrians and a November 2005 upgrade of the site meant this road no longer operates with pedestrian crossings. As shown in figure 2.9 the result was a series of multiple traffic lights, implemented along Karori Road, to accommodate pedestrians wanting to cross the road.

Figure: 2.8. Road Hierarchies.
Author Owned image created using data from Ko-ordinates

A new design framework should attempt to link the two sides of this road together whilst maintaining good access to public transport. Doing so will ensure that the link to the city is not lost, especially as the Karori bus services mostly use efficient electric buses. The existing site has public spaces that are fragmented from one another. The diagram below portrays the average distance a person would have to walk to get to and from the public locations. The selected areas are considered to be the most utilized public spaces. These are the inbound bus stop at the post office (PO), the medical centre (MC), the retirement village (RV), the smaller retail stores (SR), and the main church on Karori Road (CH). Also included is the average walking distance from a local bus stop to a secondary residential street (RS).

Figure: 2.9. Proposed traffic signal layout.
Image extracted from the Safer Roads Proposal, sourced from
www.wellington.govt.nz/projects/ongoing/saferroads

Figure: 2.10. Walkability on site. inbound bus stop at the post office (PO), the medical centre (MC), the retirement village (RV), smaller retail stores (SR), church (CH). Also included is the average walking distance from a local bus stop to a secondary residential street (RS)

This study shows that there is a lack of intersecting spaces occurring on site and thus any intervention would need to link the most utilized nodes to further enhance walkability.

Green space is space which has ecological and vegetation properties. These are primarily pedestrian orientated areas. Figure 2.11 shows the lack of green space. The only areas are

Figure: 2.11. Green space.

Author Owned image created using data from Ko-ordinates

at extreme ends of the site and are situated on either private land or school grounds. As the school grounds cannot be used by the general public this leaves practically no green space other than a small green patch behind

the petrol station. Green space is a crucial aspect for the suburban realm as it provides space for public recreation, reinforcing quality of life (Mendler, Odell and Lazarus, 2006).

This lack of green space indicates that any new proposal will need to address this issue to promote outdoor recreation in an attempt to increase social interaction and quality of life.

2.5 Summary of Chapter two

The outcome of this chapter determines that of the four aspects discussed walkability must be addressed to improve movement for pedestrians. Green space also needs to be accommodated in this area, in order to house more communal gathering and external

Figure: 2.12. The Proposed Site.
Author Owned image created using data from
Ko-ordinates

recreation spaces within the allocated site.

The main issue with permeability and road hierarchy is the heavily used road that cuts through the heart of the site. A new design framework will need to link the two sides of this road together whilst maintaining good access to public transport. This is a very important design feature that must be considered in phase two as the proposal must accommodate the trolleybus

service that runs through Karori, ensuring the link back to the central city area. With the recent

renovations and re-building of the library and removal of the old light house building, the site has lost vital spaces which were often utilized for club events and local community activities. Any new design proposal will need to integrate a number of building and space typologies on this site, and attempt to accommodate many varying uses. Incorporating a mix of typologies will foster growth and development in the area. Such growth can be introduced by incorporating space for farmers' markets, restaurant and café space, civic spaces and green space in order to increase external gathering spaces and recreation facilities.

In order to envisage how the design can accommodate the elements discussed in this chapter, a suburban design concept must be developed that satisfies the program outlined. The proposal will need to resolve the foremost land use problems. This will mean incorporating major axial connections, entry points, sculptural spaces, and maintaining the important connection of Karori to the city centre. At present these axial connections are by the current over dependence on vehicles. Nearly all of the key places are located directly along the Karori Road channel but this has also created a division in the suburb. The design strategy will focus on creating civic spaces that have room for movement of public transport but also facilitate pedestrian movement perpendicular to Karori Road. The initial conceptual scheme will attempt to house the proposed program in a large built form with both indoor and outdoor facilities, and with public transport dominating the main road running through the suburban centre. Though these notions are speculations on the result of the analysis conducted in phase one, the design strategy will follow the initial design directives. The design intervention will be centred on an active community focus, which will encompass;

- education about sustainable practices;
- a chance for social interaction;
- local barter;
- local markets;

The driving force behind the design will be directed by these attributes, thus the built program can be best defined as a Sustainability Drop-in Centre.

Chapter 3: Precedents and their analysis - Site challenges and theoretical arguments

IN THIS SECTION:

- 3.1 Theories of urban space
 - Design theories of disconnected space
 - Kevin Lynch's protocols for designing space
 - Defining disconnected space
 - Comparing previous discussion to New Urbanism Theory
 - Sustainable theories that address disconnected space
- 3.2 Case studies: suburbs, cities and neighbourhoods
 - 3.2.1 Community drop in centre at BedZED in London
 - 3.2.2 Vauban district of Freiburg, Germany
- 3.3 "Superordinate TOD" - Going beyond Green urbanism and TODs
- 3.4 Karori the old suburban centre.
- 3.5 The case for applying TOD principles
- 3.6 Building Program.

3.1 Theories of urban space

As with many older suburbs in Wellington, development of the Karori district was governed by primary access ways and road hierarchies. These routes and paths into the suburb often defined the manner in which the urban layout of the suburb was established. This trend of pathways and roads governing, and often dominating, the suburban structure is abundantly clear in the heart of Karori. Today the centre of Karori is flourishing with many amenities and facilities available for the public, but this site is also dominated by vehicular traffic. Karori Road, the main road in and out of the suburb, links directly to the Karori tunnel and is the path for public transport and private vehicles going to central Wellington. The 15 metre wide road literally divides the suburb and its centre in half, making connectivity from one side of the road to the other a challenging prospect.

Such defining edges and disconnected sites have often been labelled by Roger Trancik as lost or empty space, but before beginning to resolve issues in Karori, the first step is to determine how to mitigate empty space and understand attributes of urban design theories that pertain to such disconnected places. Terminology such as disconnected space can be misconstrued as a matter of urban design. While it is a significant design aspect, this study is concerned more with the manner in which the evolving suburban layout is affected. The evolution of the site indicates that the disconnected space is the result of urban expansion in which the original urban design no longer functions. Many theorists today have recognised the issue of disconnected space. In his book Roger Trancik (1986) talks about disconnected lost spaces and how the lack of definition of site and connectivity often segregates spaces completely, much like the road bisecting Karori.

Generally speaking lost spaces are undesirable urban areas that are in need of redesign...anti spaces making no positive contribution to the surroundings and its users. They are... ill defined without measurable boundaries and fail to connect elements in a coherent way. (Trancik, 1986, pp3-4)

This theory indicates that the disconnected space itself is not an area that is isolated or unusable, instead it points out that the urban space itself is the cause of the lack of site cohesion. Elements such as highways and roads can often create conflicting converging edges that have no apparent transition or connectivity. Practitioner, and theorist, Rem Koolhaas (2001) identifies such sites as 'Junkspace'. He considers such spaces the result of urban development over time, and their occurrence is simply due to the modern age.

If space-junk is the human debris that litters the universe, Junk-Space is the residue mankind leaves on the planet. The built product of modernization is not modern architecture but Junkspace. Junkspace is what remains after modernization has run its course, or, more precisely, what coagulates while modernization is in progress, its fallout. Junkspace is its apotheosis, or meltdown. (Koolhaas, 2001, pp.176-190)

Disconnected space, junkspace, and lost sites all have a common character: they identify a missing component that fails to connect the surrounding spaces. Disconnected space in essence is an inconsistency of converging spaces that become isolated due to urban functions such as roads and highways. As the population increases and the reliability of public transport declines, previous views and urban designs no longer function, and void spaces, such as Karori Road, become an opportunity to create connectivity on site. This connectivity could even exceed that of the original urban plan. This original plan was based on the tram and few cars and the increase in volume of private transport has resulted in

increasing disconnection. This site itself shows that simply following the historic layout of the site, which is dominated by the initial transportation scheme, has inadvertently resulted in disconnected space.

In order to grasp the new dimensions of the suburb, the public needs to perceive its changing boundaries as well as the conflicting edges on either side of the Karori Road. The intrinsic properties of urban space and the modes of perceiving it are subject to historical change. Spaces and buildings from different times co-exist in a city, but they are perceived with a contemporary mind. The image of a city, therefore, results from the interplay between its intrinsic properties and the modes of perception which are peculiar to a given time, but which may change over time. This is one layer of conflict that has given rise to disconnected space; a space still yearning to respond to the historic significance of the original urban layout surrounding it.

In his 1889 book, *The Art of Building Cities*, Camillo Sitte (1980) offers another mode of perceiving urban space, which is no longer static but dynamic. For Sitte, urban space is a substance loaded with an energy which flows between the masses of buildings and monuments. The plans of the squares that Sitte analyses in his book echo the dynamic relationship between form and space. Building blocks are hatched, suggesting that urban

Figure 3.1: Urban space drawing from *The Art of Building Cities* by Camillo Sitte

space is the result of the layout of the building mass. Singular buildings, like churches, which have an influence on the perception of space, are drawn in black. Streets and squares are portrayed as a continuous abstract surface, where only singular elements affecting the flow of space, like monuments,

are shown as abstract signs. Also, the idea of space as fluid energy can be read in the plans: the arrows are not directions for traffic, but signs indicating the flow of "spatial energy" (Sitte, 1980, pg. 322).

Sitte criticised the cities of his time because they lacked any relationship between built form and public space and because their spaces had neither function nor meaning. He claims that:

It is true that we now use the term [public space] to indicate any parcel of land bounded by four streets on which all construction has been renounced. That can satisfy the public health officer and the technician, but for the artist these few acres of ground are not yet a public square. (Sitte, 1980, pp.475)

Sitte believes the city should be seen as a work of art and not just a technical problem, which was how it was often considered by nineteenth-century engineers. Rather, a city should speak to the beholder because of the harmonic relationships between form and space, as would any work of art. However, Sitte was not so much concerned with the city as a whole but more so with those parts of it that could be contemplated as art works, like squares and streets: *"artistic worth can be expected only in that which we can see, like a single street or plaza."* (Sitte, 1980, pp.469)

In *The Image of the City*, Kevin Lynch (1960) was concerned with the intelligibility of the city's overall form. For Lynch, the pleasure that a city produces is directly related to its legibility and structure. This structure, according to Lynch, is made up of five elements: paths, edges, districts, nodes, and landmarks. The image of the city is collectively created and according to Lynch:

Each individual creates and bears his own image, but there seems to be substantial agreement among members of the same group. It is these group images, exhibiting consensus among significant numbers, that interest city planners who aspire to model an environment that will be used by many people. (Lynch, 1960, pp. 7)

Lynch is not concerned with the individual beholder but with the collective mind. Moreover, this underlying structure, which he calls image, must be shared by the inhabitants of the city and by city planners. Therefore, the “best” city would be one in which the image that inhabitants can build for it would fit the image planners had in mind as they designed it. While Sitte was concerned with pleasing views of specific city spots, Lynch is more concerned with the intelligible form of the overall city. If for Sitte the images of the city have an aesthetic meaning, for Lynch the image of the city has an emotional value.

Both theorists, Sitte and Lynch, envisage the city as an abstract work of art, not considering the notion of economic gains which have resulted in cities developing in the best way for individual developers to make the most profit. While both theorists mention the historic relevance of the site, and how older urban design inadvertently affects the current configuration, neither looks at how a suburb could be designed to facilitate future proofing or for a more sustainable way for the site to function. Some contemporary New Urbanism theorists have begun to consider both disconnected space and urban design that facilitates a more sustainable response. One such theorist is Peter Calthorpe.

With the world's population increasing, dependency on private vehicles has put a great strain on both quality of the liveable environment and quality of life in general. The ‘bigger, faster, better, more’ philosophy of the United States, as well as many other industrialized nations, has led to increased health risks, traffic congestion, and stress in general (Calthorpe

and Fulton, 2001). The Urban Network Concept designed by Peter Calthorpe (Calthorpe and Fulton, 2001) is one sustainable response for a site like Karori, where dependence on the automobile has created a disconnected space. The Network is one theory of Transit Oriented Development (TOD), or development that is centered on decreasing traffic congestion and improving pedestrian walkability through the use and support of a centrally located public transit centre.

Whilst considering disconnected space and the obvious sustainability advantages of independence from the private vehicle, Calthorpe also provides a greater appreciation of some of the economic implications of transit-oriented development (TOD). In his book, *The Regional City*, Calthorpe (Calthorpe and Fulton, 2001) drew on case studies from a cross-section of American cities to illustrate how TODs create a premium for developments (both commercial and residential) within an area, and attract capital investment.

Calthorpe argues that to initiate TOD most places require a catalytic infrastructure investment, which usually comes from the public sector. Various solutions are being found to funding challenges. For example, Denver City in Colorado funded infrastructure investment for TOD in the old Stapleton International Airport area through a bond from the expected tax and rating revenues of future residents and businesses. TOD projects are shown to deliver a return on investment by attracting capital investment on an on-going basis. Once infrastructure investment starts to happen, one or two developments that see the potential for gain become early initiators with capital projects. Then others catch on in increasing numbers. The figures below show capital investment in some TOD areas:

- Charlotte South Corridor (Sth Carolina) - \$400 million since planning started in 2000;

- Boston Silver Line - \$450 million since planning started late 1990s;
- Dallas Dart - \$1 billion since 1996;
- Portland MAX, - \$3 billion since the late 1970s. (Calthorpe, 1995, pp. 116).

Calthorpe believes that TOD needs to be the framework of the next wave of development, and that fixed infrastructure is an essential ingredient. He emphasizes the importance of developing layers of infrastructure to provide people with choices. He says simply building more roads to relieve congestion is not the answer.

It has been shown over and over again - when you expand road networks you don't relieve congestion. You either generate enough sprawl to consume that resource and/or you just immediately release the delayed or deferred trips. Once the capacity is there it would be absolutely filled up. (Calthorpe and Fulton, 2001, pp. 52)

TOD can contribute to significant reductions in car use, for example around 60 percent of trips to downtown San Francisco are by single occupant vehicles (Calthorpe and Fulton, 2001). While it may not be possible to ever overcome congestion altogether, Calthorpe says the best approach is to provide people with choices of transport modes and choices of living near transit. Calthorpe's very realist response to disconnected sites and over dependence on cars takes Lynch's and Sitte's arguments one step further, by attempting to find a more sustainable solution to the disconnected site.

3.2 Case studies: neighbourhoods, suburbs and cities

3.2.1 Case study 1: BedZED eco-habitat in London (Green Urbanism)

The Beddington Zero Energy Development in Wallington, London, is the result of a design concept driven by the desire to create a zero fossil energy development that will produce as much energy from renewable resources as it consumes. This mixed residence, mixed use development of 16,544 square metres with an approximate density of 50 dwellings per hectare on a former sewage works site provides 82 new homes, commercial workspace (1,695 square metres), and 18 live/work units. Other on-site facilities include a cafe/bar, sports pitch (4,336 square metres), medical centre, nursery and clubhouse (536 square metres). Each building unit, consisting of a three storey redbrick block, is arranged on a grid of shared streets. This scheme incorporates a 'pedestrian first' policy that includes good lighting and an overall layout constricting both vehicle speeds and parking spaces, the latter occupying a total of 986 square metres. Workspace roofs form gardens for neighbouring housing accessible by bridges, furnishing every home with a private garden. Through careful consideration of the urban layout at the design stage, the offices are shaded by housing to reduce solar gain. The residential dwellings are designed to maximize passive solar gain and are fitted with photovoltaic (PV) panels, which, along with superinsulation, wind-driven ventilation systems, the CHP plant and water conservation systems, "reduce energy demand to 25% of a conventional home of similar size" (Desai, 2002, pg 24). PV panels are used for solar shading, electricity generation and also as the building's skin. A heat exchange system, fed by the highly visible wind-driven ventilation cowls on the building rooftops, recovers around "70% of the warmth from the outgoing air" (Desai, 2002, pg 27). Each building incorporates low allergen construction, avoiding substances such as formaldehyde that are

associated with 'sick building syndrome'. In an attempt to confer proper consideration to the ecological environment, the roads and pavements are drained towards a ditch designed as a water feature to attract wildlife, while a planted bed system is incorporated in the greenhouse to treat the scheme's sewage.

The claim of sustainable excellence is made by the BioRegional committee (United Kingdom office), who define this scheme as "UK's largest mixed use sustainable community" (BioRegional 2012). The Beddington Zero Energy Development was a scheme originally initiated by the BioRegional committee and ZEDfactory (Zero energy development factory), and further developed by the Peabody Trust. The BioRegional committee is a world-wide group that aims to find solutions for sustainability, and has listed this scheme as one of its most successful projects to date in the United Kingdom. The BioRegional committee was initially founded as a charity and proposed many projects that were intended to be taken into the mainstream economy, either through the establishment of new companies, as in the case of BioRegional Charcoal and BioRegional MiniMills, or by working in partnership with existing companies, as in the case of BedZED. Due to the fact that this scheme has integrated principles based on these project proposals, the United Kingdom BioRegional committee claims the Beddington Zero Energy Development is sustainable.

The principles on which this project was constructed were meant to produce a zero energy design, as the project is intended to rely only on energy from renewable sources generated on site. This scheme is designed to incorporate various techniques that will utilize resources sustainably. This was not as successful as originally intended. After its evaluation in 2003 by the BioRegional committee, the following results were found.

- Space-heating requirements were 88% lower than UK average

- Hot-water consumption was 57% lower than UK average
- The electrical power used, at 3 kWh per person per day, was 25% less than the UK average; 11 % of this was produced by solar panels (Corbey, 2005).
- Mains-water consumption has been reduced by 50% or 67% compared to a power-shower household.
- The residents' car mileage is 65% less than average (Desai and Riddlestone, 2002, pp. 58).

There are 777 square metres of solar panels. Tree waste fuels the development's cogeneration plant to provide district heating and electricity, although there have been problems with this and currently it is not working and electricity is bought from the grid. In terms of energy efficiency, all of the dwellings face south to take advantage of solar gain, incorporate triple glazing, and have high thermal insulation. Rain water is collected and reused. Appliances are chosen to be water-efficient and use recycled water. Low impact materials were specified and these come from renewable or recycled sources within 35 miles of the site, to minimize embodied transport energy. The scheme incorporates collection facilities designed to support waste recycling. To encourage eco-friendly transport, electric and liquefied petroleum gas cars have priority over cars that burn petrol and diesel, and electricity is provided in parking spaces for charging electric cars. All of these various design considerations have meant people living in this scheme perform normal daily tasks with a smaller (in some areas below average) ecological footprint and thus these attributes define this project as a sustainable scheme. Green urbanism aspects that define this project as sustainable design are as follows.

- Passive solar design.

- Waste water recycling and onsite sewage treatment (although this also failed and is currently not working).
- Roof gardens.
- CHP system (Combined Heat and power plant) integrated to hot water supply (also not working at present).
- Energy efficient appliances.
- Renewable source of energy onsite.
- Low energy lighting.

BedZED has not managed to live up to its zero-carbon goals. The key element in the low energy strategy is this scheme's solar passive design that incorporates a sunspace: a small, south-facing conservatory running the full height of each home. The idea is that solar gain from the sunspace is stored in the concrete structure of the homes so they stay at a constant, comfortable temperature. The only heating in the homes comes from a towel rail in the bathroom and the heat that escapes from a large hot water tank. The towel rail is on the same hot water circuit as the tank. According to a report published by BioRegional, "42% of residents use their own electric heaters in winter" (BioRegional 2012). Overheating is more of a problem. According to the BioRegional report, "only 10% of residents are happy with internal temperatures in the summer, a problem aggravated by the towel rails" (BioRegional 2012). The report also says residents are reluctant to open some of the sunspace windows because of security concerns. Also, 18 of the original 20 live-work units, which face north and do not benefit as much from solar gain, have been converted into homes. Low-energy lighting and appliances, coupled with high levels of natural light mean BedZed homes use 45% less electricity than the Sutton average. This power is not produced from locally sourced wood chips in the CHP unit. The CHP unit was to function in a manner

Figure 3.2 Aerial view of Beddington Zero Energy Development, shortly after opening. Image sourced from www.bedzdhouse.co.uk

Figure 3.3 how BedZED works, diagram sourced from www.sd-commision.org.uk. Depicts waste management solutions, passive solar design, rainwater collection units and PV panels.

that would automatically load the chips into a dryer, and then move them into a chamber where they would be heated in the absence of oxygen to produce a gas; this would be used to power an internal combustion engine, which turned a generator. There were problems with the automatic loader for the woodchips. In 2005, the system was abandoned and conventional gas boilers were used to provide hot water to the district heating system. Though the CHP unit was abandoned, BedZed's PV panels produce 20% of the scheme's electricity without any need for maintenance. The wastewater treatment system, called the Living Machine, was almost as complex as the CHP plant. The water was run through a series of tubs containing reeds located in a conservatory. The idea was that bacteria on the roots of the reeds would purify the water. Like the CHP plant this required a lot of maintenance. As a result the Living Machine actually used more energy than a conventional sewage treatment plant (Bioregional 2012).

GREEN URBANISM	
Energy	Open Space, water and stormwater
<ul style="list-style-type: none"> • Energy efficient appliances Contributes to a 45% decrease in energy consumption • Wood-chip fired Combined Heat and Power Station Not sustainable as this system no longer works • Renewable energy on site Achieved by use of Solar PV systems • Passive solar design A sunspace heats and lights homes but creates conditions that are too hot in summer and give no control during winter • Low energy lighting Contributes to a 45% decrease in energy consumption 	<ul style="list-style-type: none"> • Waste water recycling Requires energy to maintain but supplies more than the required amount. • Roof garden spaces Gardens provided are very small but do promote social interaction • Filtration of rainwater • Maintain existing tree coverage

Table: 3.4. BedZED Green urbanism attributes

The advantage of this system is that the plant produces more water than BedZed needs for flushing toilets and garden irrigation. Because of this, the rainwater harvesting system has been disconnected and a supplementary unit has been connected to the living machine to maintain a viable water recycling system.

3.2.2 Case study 2: Vauban district of Freiburg, Germany (TOD)

Sitting on 40 hectares of land formerly used as a military barracks and inhabited by 5,000 residents, Vauban is arguably one of the sustainable locations of the developed world. The community is a product of a highly participatory grassroots process. A number of activists, feeling that the mobility and energy standards applied in Reiselfeld (a local suburb) were insufficient, demanded that a car-free, ultra-low-energy district be built. Soon thereafter Vauban was realized.

The first residents formed a collective and occupied the former military barracks. The district features one of Germany's largest passive house developments and a zero-energy solar village (energy cities 2012³). Vauban's cogeneration plant is fuelled by a renewable source of refuse wood-chips. There are also 89 photovoltaic systems throughout the development. Due to its ambitious energy standards, the district performs 90% better than conventional construction in terms of energy use (Siegl, 2010). The combined heat and power plant runs at 90% efficiency compared to a conventional power plant. Additionally, all houses meet and many exceed Freiberg's energy standard of 65 kWh/m²/year (including Vauban's numerous zero-energy houses and passive houses with solar, which actually produce more energy than they use).

³ Vauban exceeds Freiburg's low energy standard with a voluntary low-energy building standard of 55 kWh/m²/year and a passive house standard of 15 kWh/m²/year. (Energy cities 2012)

In addition to its ecological design, Vauban is widely known for its car-restricted living (in contrast to Rieselfeld which averages 1.1 parking spaces per dwelling unit). Most of Vauban's streets ban cars, and most housing units have no driveway or garage (Nobis and Welsch, 2003). Cars on the main street are restricted to 30 kph and all other streets are designed for very low-speed travel (5 kph). Vauban was laid out so that all residents live within two minutes of a covered bike-sharing kiosk and five minutes of a tram. With the district organized around a tramway spine that is settled into the streetscape and has 7-minute peak movements, public transport has constant omnipresence in Vauban. Vauban's planners made sure that the parking environmental footprint was limited. All parking is not included in the price of units, and fees to purchase a space are quite high at €17,500/space (energy cities 2012⁴). Seventy per cent of dwelling units are "parking-free," and what little parking does exist is sited in two shared garages on the suburb's periphery; both garages carry solar panels on the roof.

The environmental pay-off of the pro-transit and bike and pedestrian friendly policies of Vauban are reflected in statistics. This district has very low car use and ownership. Because residents' travel was last surveyed in 2003 before the tramway had opened, it is difficult to provide an up-to-date account of experiences in Vauban. However, other indicators suggest that Vauban has very low car use. Only 2.2 of every 10 Vauban residents own a car compared to 4.3 for Freiburg as a whole and 3.4 for Reiselfeld (energy cities 2012). Also, 57% of Vauban's adult residents sold a car upon moving to the district (Sustainability Office, City of Freiburg, 2009). It is notable that low car ownership was recorded in Vauban before

⁴ The planners of Vauban had to work with the City of Freiburg to develop a special waiver from the German National parking standard of one space per dwelling unit. A lot had to be reserved in one corner of the development for a future garage if the need should arise; car-free residents have to reserve a theoretical space in this yet-to-be-built garage at a much lower price of around 3,000€ compared to 17,500€ for an actual parking space.

its tram line opened. This probably reflected the influences of “self selection” – i.e., the car-free ethic of new residents. However other factors have weight, including the pro-active promotion of other modes, the provision of a free universal transit pass to some households, and the availability of conveniently located car-sharing. Although recent modal split data are not available, the consensus view is that transit use has replaced many bike and walk trips (Siegl, 2010). Most of Vauban’s residents buy a monthly transit pass and half buy a German National Rail Pass. Moreover, 75% of car-free households buy the national rail pass, compared to 10% of Germans nationwide (Nobis and Welsch, 2003).

SUSTAINABLE TRANSPORTATION		GREEN URBANISM	
Infrastructure	Programs and policies	Energy	Open Space, water & stormwater
<ul style="list-style-type: none"> • TOD: District Organized around tram spine • Tram: 3 stops • 7-min peak headway • Regional rail stop (Future) • 2 buses • 10-15 minutes to City Centre by tram/bus/ bike • Extensive Bike and Pedestrian paths; access to City Centre via separated bike paths • Network of off-street bike and pedestrian path provides access to all parts of project 	<ul style="list-style-type: none"> • Parking restricted: <ul style="list-style-type: none"> - High parking fees - Unbundled parking - 70% of units are “parking-free” - Access to parking in 2 shared garages on periphery • Auto restraints: <ul style="list-style-type: none"> - 30kph on main street - Limited access with very low speeds 5kph - Street layout allows for very little car circulation • Bike Priority: <ul style="list-style-type: none"> - covered secure bike parking within 2 minutes of every residence • Car-sharing 	<ul style="list-style-type: none"> • Low-energy building 65 kWh/m²/year standard, Voluntary; 55 kWh/m²/year; Passive house: 15 kWh/m²/year • District Heating • Wood-chip fired Combined Heat and Power Station provides all energy • Solar- 89 PV systems • Zero-energy Solar Village • One of largest passive house developments in Germany 	<ul style="list-style-type: none"> • Bioswales: open-channel-trough system • Rainwater collection • Ample Open Space permeable surfaces • Filtration of rainwater • Maintain existing tree coverage • Adjacent to creek Biotope • Green roofs

Table: 3.7. Attributes of Vauban district

3.3 "Superordinate TOD"- Going beyond Green urbanism and TODs

Transit Oriented Developments (TODs) shrink environmental footprints by reducing Vehicle Kilometres Travelled (VKT) and incorporating green urbanism and architecture in community designs. Synergies from combining TOD and green urbanism derive from: increased densities, which promote transit usage and reduce heating/cooling costs; mixed land uses which promote non-motorized transportation and limited-range electric vehicles; reducing impervious parking services matched by increased open space and community gardens; and opportunities for generating solar power from PV systems above public transport-stop canopies.

TOD has gained popularity worldwide as a sustainable form of urbanism (Cervero, 2008; Renne, 2009). It typically features compact and mixed-use activities configured around light or heavy rail stations, interlaced with pedestrian amenities. TODs are one of the more promising tools for breaking the vicious cycle of sprawl and car dependence feeding off each other, replacing it with a virtuous cycle: one where increased transit usage reduces traffic congestion and compact station-area development helps to curb sprawl.

A new, more environmentally friendly, version of TOD – in this study named “Superordinate TOD” - is taking form in several European cities. Superordinate TOD is an amalgamation of TOD and Green Urbanism. This combination creates collaborations that produce environmental benefits far beyond the sum of what they offer independently. TOD works on the Vehicle Kilometres Travelled (VKT) reduction side of shrinking a city’s environmental footprint, a direct correlate of energy consumption and emissions. VKT drops not just from increased rail travel by those living and working in TODs but also by changing trips that would be by car to off-site destinations to on-site walking and cycling. Green Urbanism

reduces emissions and waste from stationary sources in the form of green architecture and sustainable community designs (Beatley, 2000; Newman et al., 2009).

These two aspects working together inadvertently create stronger links across roads and spaces that would otherwise be dominated by private transport and segregated spaces suffering from a lack of connectivity, as in the case of Karori. With Green Urbanism, pocket parks and community gardens replace surface parking. Renewable energy can be sourced from solar and wind as well as bio-fuels created from organic waste and wastewater sludge. Recycling and reuse of materials, insulation, triple-glazed windows, bioswales, and low-impact building materials further shrink the footprint of a Superordinate TOD. In combination, the shared benefits of TOD and Green Urbanism can provide energy self-sufficiency, zero-waste living, and sustainable mobility.

Synergies that amass from joining TOD and Green Urbanism have the potential to occur in various ways:

1. **Incorporating Higher Densities.** The higher community densities required to fill the trains and buses that service TODs also shrink heating and cooling energy use from the embedded energy savings of shared-wall construction. The financial savings from lower energy bills and reduced transportation costs can produce a higher market demand for dense living in Superordinate TOD buildings.
2. **Mixed Land Uses.** The mixed association of housing, shops, restaurants, workplaces, libraries, Drop-in centres, and other activities, locate many destinations close together, thus encouraging more walking and cycling, not only to access public transport but also for neighbourhood shopping and socializing.

3. Reduced surface parking and impervious surfaces. Surface parking, which can consume half the land of many suburban multi-family dwelling complexes (Diasa, 2004) is substituted for by more green space for play, social activities, and interacting with neighbours. Lessening the footprint of parking decreases heat-island effects and water pollution from oil-stained run-off into streams. Less impervious surfaces of concrete and asphalt aid in recharging groundwater and replenishing urban aquifers, creating healthier gardens. While the common perception is that TODs appeal to non-traditional households (e.g., singles; young, childless professional couples; empty-nesters; and retirees) (Centre for TOD, 2008), Superordinate TODs can be child-friendly. The interiors of projects are given over to communal gardens, playgrounds, and appealing open space rather than parked cars. Reducing the car's domination not only creates more pedestrian controlled roads but can also lower accident rates, noise levels, and air pollution, thus creating much more enjoyable environments for children to play in. Having safe and secure spaces for children's play becomes a form of defensible space (Newman, 1996), allowing the kind of natural surveillance described in the writings of Jane Jacobs (1961).
4. Solar energy production at stations. With TODs, station areas are often community hubs, becoming places not only to get on and off of trains and buses but also in which to congregate, socialize, and take in community life (Cervero, 1998; Bertolini, 1996). Surface train and bus depots often feature overhead canopies that provide shade and weather protection. Photovoltaic panels can be placed on top of such canopies to generate electricity that is fed into surrounding homes through a smart

grid. Solar energy can also power light-rail cars, and recharge the batteries of plug-in hybrids at car-sharing depots and electric buses at stops during low demand periods.

3.4 Karori the old suburban centre

Remarkably the older urban layout of Karori was essentially a closer response to a Superordinate TOD than the current configuration of the central suburb. As little as two decades ago, Karori Road was considered a suburban thoroughfare right down to the heart

of the suburb where the bus services terminated. This bus route was influenced by the historic tram route that used to service Karori prior to the introduction of the electric buses. Configured around a massive roundabout, the central part of Karori housed a large supermarket, a community hall, a primary school, a church, sports club, and a large public park. The space was an efficient traffic distributor and the site was dominated by public transport and pedestrian traffic. Whilst the site did not incorporate some of the Green Urbanism parameters, such as on-site renewable energy and waste recycling, the entire public transport system was low emission due to the trolleybus services. This meant that the old suburban centre was located well within a recognized bus terminus making a good

location for pedestrian friendly shops, events and schools. Though the underlying issues of Karori Road forming a bisection of the community were not resolved, especially further away from the hub, the location of the suburban centre was well separated from the heavy traffic on this road and the main public transport stop was a perfect point for the traffic from Karori Road to disperse out into the smaller neighbourhood streets. While this initial design is not the ideal solution for the current suburban centre, it begins to encompass urban design layouts similar to the concepts characteristic of the TOD case studies discussed in this paper.

3.5 The case for applying TOD principles

Superordinate TODs offer a form of urbanism and mobility that could confer appreciable environmental benefits. They emphasize pedestrians, cycling, and transit infrastructure over car mobility. They mix land uses which not only brings destinations closer but also creates an active, vibrant street life and interior spaces, instilling a sense of safety and security. Through building designs and resource management systems, they embrace minimal waste, low emissions, and to the degree possible, energy self-sufficiency.

The case studies reviewed in this section highlight the potential benefits of Superordinate TOD. While other places such as BedZED have made strides in advancing green urbanism techniques, places like Vauban have successfully integrated many elements in their community designs. Superordinate TOD is spreading with perhaps the most ambitious version now taking shape in the deserts of the United Arab Emirates – Masdar City, outside Abu Dhabi (Spilsbury, 2012). Besides being car-free and served by rail and personal rapid transit (PRT) at ground level and freight-rapid-transit (FRT) below ground, Masdar City is to be fully energy self-sufficient using a massive solar farm on the project's edge. Additionally,

all organic waste is to be converted into biomass, all construction materials are being recycled, and over the long term the project is to become completely carbon neutral. Other communities should not necessarily seek to replicate the specific practices of these places but rather adapt principles of TOD and green urbanism to local circumstances and constraints.

Moving beyond the rhetoric to the reality of Superordinate TODs will take money, time, and political leadership. The built-in forces that work against designing safe, resource-conserving, and pedestrian-friendly districts around transit stations are immense, particularly in countries like New Zealand. Barriers are most likely to be eliminated through learning from real-world examples, such as those reviewed in this paper.

Superordinate TODs will be most effective when planned and designed at a regional level (Cervero, 1998). The Scandinavian model of TODs as “a necklace of pearls” (Newman, Beatley and Boyer. 2009) offers high environmental benefits by providing an interconnected system of walkable, transit-friendly communities. However, not every rail-transit station should become a Superordinate TOD, or even a plain TOD. Some transport interchanges could function best as busy terminal/transfer points and logistical nodes, with little if any housing, which is a fundamental feature of TOD. Others with poor pedestrian connections, such as stops in the middle of freeway medians, might best be surrounded by parking. However for communities like Karori, through pushing the envelope of sustainable urbanism with a physical and social environment conducive to transit-supportive growth, the Superordinate TOD model has much to offer.

Critics are apt to label Superordinate TOD as “social engineering” (Cervero, 1998). In truth, many of those living in the suburbs of the United States are “engineered” by being forced to

drive to get anywhere and everywhere, a result of segregated and low-density land-use patterns. Superordinate TODs provide consumers with more choices of where to live and how to travel. An increased choice with diversity is a good thing, especially given the progressively diverse make-up of households in New Zealand and other multicultural societies. This study indicates that given the opportunity, some households will select to live in a Superordinate TOD for lifestyle reasons.

3.6 Building Program

Based on the existing site studies in the previous chapter and the case studies and architectural theories analysed in this chapter, the following spaces were determined as crucial design elements for the proposed Sustainability Drop-in Centre. After review of the HOK Guidebook to Sustainable Design by Mendler, Odell and Lazarus (2006), and in conjunction with Rawlinson's New Zealand (2007), the number of spaces and areas were determined to facilitate good intensification of the site use. *Neufert Architect's Data* (Neufert and Neufert, 2012) was the main source used to determine the design considerations for each space.

ENTRY / SUSTAINABILITY INFORMATION CENTRE/ RECEPTION AREA /				
Space	No	Area	Total	Considerations
Main Atrium	1	Dimensions will follow the design concept		This hall aims give a wide impression of the interior, and is an opportunity to provide an architectural experience to visitors. This space will be multipurpose and used for exhibitions and in-door markets. Generally, a generous space that will use the maximum height, with potential to incorporate vertical movement.
SIC/Reception/Meeting rooms Administration and reception area with meeting rooms nearby	1	600	600	
Café & service Café/Performance area, all with same stud height and similar services requirements	1		500	

Organic produce market				
Open access to outdoor market area	1	400	400	
Main theatre space				
Strong link into atrium, used as crush space	1	3000	3000	
Stage/ Back stage area				
Private access to outside space	1	800	800	
Organic produce market				
Open access to outdoor market area	1	400	400	
Toilets (in each floor)				
Male and Female	1 each	15	30	
Possible retail space on ground floor				

RESTURANT SPACE

Space	No	Area	Total	Considerations
Main restaurant space				
Flat with high stud and private access to ramps and exterior of site	1	3000	3000	This space will need to link strongly with the multi-level site allowing easy movement from both interior and exterior ramps. Multi-level spaces between interior restaurant space and exterior sitting areas can be used as an opportunity.
Smaller outdoor space with ramp				
Flat with high stud	1	2000	2000	
Separate Bar				
Flat with high stud and access to ramps and outdoor seating	1	800	800	
Storage	Various		200	

ROOF TOP GARDEN

Space	No	Area	Total	Considerations
Rooftop Garden				
Opportunity to link this space with any neighbouring residential block(s)	Roof top			This block should be based on built dimensions and how the building will access any neighbouring schemes

SHARED OFFICE SPACES

Space	No	Area	Total	
Shared office facilities				
Conference room(s), reception, toilets, staff room(s) and meeting space(s)	various			
Rented offices	4	900	3600	

EXTERNAL SPACE

Space	No	Area	Total	Considerations
Green space Link to external recreation activity spaces both formal and informal.			600	
Bus service locations Maintain linear link to bus stops and access to building				
Vehicular access ways This space should not dominate the site and allow public transport and pedestrians to govern movement				
Civic space Access to any proposed parks and new building and current community centre.	1		2000	
Market square Must provide good access to building as well as neighbouring buildings, Aim here is to create a public space for battering.	1		900	
Carpark areas For storage, service access etc	1		600	

This program is open to expansion pending further research during the design phase.

Chapter 4: The Design intervention – A story at different scales

IN THIS SECTION:

- 4.1 Traffic design – private and public
 - Central public transport route
 - Alternative private vehicle route
 - Treatment of street edge
- 4.2 Pedestrian spaces
 - Green Space
 - Civic links
 - Links between residential block and sustainability centre
- 4.3 The Sustainability Drop-in Centre program;
 - Ground floor atrium - and attached spaces
 - Second floor restaurant
 - Roof top green space
- 4.4 Residential block - a TOD design initiative
- 4.5 Summary

4.1 Traffic design – private and public

4.1.1 Central public transport route

As determined earlier in chapter two, any new design framework will need to link the two sides of Karori Road, which currently serves both private transport and the public bus service. This has resulted in a very segregated street front on either side of Karori Road which is not pedestrian friendly. In order to mitigate this lack of connectivity and make the site more pedestrian friendly, the design proposal involves eliminating private vehicles from the immediate site. As shown in figure 4.2, the proposed public transport route maintains its original place through the heart of the suburb. This is an intentional design decision as the route maintains a strong link into the city, reflected in the suburb's historic tram service layout, as identified in chapter three.

Figure 4.1: Newly located bus stops, parallel to each other, located at key locations along the public transport route.

Based on the findings of the initial site study, lack of walkability was one of the fundamental problems.

While the excessive presence of private vehicles on the main road was a contributing factor to the lack of walkability, this alone was not the main cause. Based on the analysis of the key "nodes and places," (Lynch 1960), the walkability study identified that the various bus stops are not well connected with the activities occurring on site. The proposed plan of central Karori, now a bus only zone, also proposes a new bus stop and traffic signal layout. As shown in figure 4.1, the newly located bus stops attempt to facilitate strong links to the existing places on site, such as the Karori mall, post office and church, and also respond

Figure 4.3: New Walkability study of the proposed site. Each node starts at the new bus stop locations as well as the medical centre (MC), church (CH) and a nearby residential street (RS).

to the location of the new Sustainability Drop-in Centre. The result, as shown in figure 4.3, is a stronger walkability model which is now better connected, ensuring the site will be more pedestrian friendly. Another aspect of walkability, specific to the public transport route, is the connectivity from one side of the road to the other. To facilitate easier and more pedestrian friendly links, the new road layout proposes new crossing junctions located by the bus stops, and in order to integrate these crossings with both the buildings on site as

well as the bus services, both inbound and outbound bus stops are located opposite each other as depicted in figure 4.4.

Figure 4.4: New configuration of inbound and outbound bus stops, making crossing the roads and accessing public transport easier for pedestrians.

4.1.2 Alternative private vehicle route

The task of laying out a new private vehicle route is viable due to the gridded urban plan of Karori. The main requirement to be addressed is the management of the large traffic volumes that would now be commuting through neighbourhoods, with 7096 privately owned vehicles in the Karori region at the time of the 2006 census (Statistics NZ, 2012). In order to meet this requirement, the proposed alternative private vehicle route is divided into two parts either side of the main road, both of which have a slow zone speed limit of 40kph. The first route starts at the Hatton Street and Karori Road intersection, and connects back to Karori Road at the Eagle Street intersection and the second route starts at the Donald Street and Karori Road intersection reconnecting back to Karori Road at the

Managhan Avenue intersection, as shown in figure 4.2. Both of these alternative routes allow for two way traffic and each intersection branching off Karori Road is controlled by traffic signals. By pushing traffic out to the fringes of the suburban centre, Karori Road now only serves public transport, eliminating the need for any traffic signals in the heart of the mall region. This also means more pedestrian controlled crossings in the central area, which will further improve walkability and connectivity across Karori Road. By locating a set of traffic signals at the four intersections where the private vehicle routes connect back into Karori Road as seen in figure 4.2, these junctions are better controlled during peak hours.

4.1.3 Treatment of street edge

This new proposed traffic management plan highlights several key intersections that need to be redesigned to allow the segregation of public and private transport to work effectively. These intersections occur at the various streets that branch off Karori Road, specifically the intersections with;

- Beauchamp Street,
- Campbell Street,
- Reading Street,
- Raine Street,
- Parkvale Road,
- Chamberlain Road.

Chapter two identified permeability and pedestrian walkability as key issues, however, the close proximity of dwellings to local facilities was one of the good aspects of the linear

configuration of the urban plan. Treatment of these street intersections was designed taking these fundamental issues into account. The aim was to create a street end that would not hinder connections to the nearby residential areas by promoting good walkability and permeability to Karori Road. As shown in figure 4.5, these intersections close off vehicular access to Karori Road whilst maintaining open pedestrian access. These intersections also provided an opportunity to incorporate more green space along Karori Road. As shown in

Figure 4.5: Street end treated as an opportunity to create grass and garden areas for pedestrians.

figure 4.5 these green spaces use elevated grass areas to privatise the ends of the streets in a subtle way, as a result creating a space for pedestrian seating and/or bicycle racks. While the design does take into account private vehicles, the aim of enhancing the walkability and permeability is the post-oil design intention. The public transport plan, private vehicle plan and treatment of street intersections are based on creating a suburb that can be transformed into a walking-based suburban centre that will function and flourish post-oil. By segregating the private vehicle route and designing a new suburban centre that is for

pedestrians and electric public transport, this proposal can ensure a future proof design for Karori.

4.2 Pedestrian spaces

4.2.1 Green Space

Green space also needs to be accommodated in this area. Although chapter two specifically identified problems of permeability and road hierarchy resulting in a heavily used road that cuts through the heart of the site, another key issue is the lack of green space. In order to house more communal gathering and external recreation spaces within the allocated site, three new substantial green spaces are proposed, each specifically designed and located to

Figure 4.6: Proposed Green spaces site view.

create strong links between the proposed sustainability centre and the adjacent civic space.

The three green spaces are:

- a street level children's playground and recreation area;

- the second level roof top green space linking to the new residential block;
- a green roof above the third storey offices.

Figure 4.6 identifies each of these green spaces, all occurring at varying levels. Located on the south-east end of the site, the children's playground and recreation area is linked to

Figure 4.7: This early sun study conducted during first site analysis shows sun angles in late evenings above the Mall area

appropriate activities in the new building, as shown in figure 4.8. Located in an open space at the fringe of the immediate site, this area is exposed to the east-west sunpath, and is only overshadowed by neighbouring buildings during the late evening (figure

4.7). As a result this sunny area best functions as a green space that can accommodate children and other people throughout the day. This park also incorporates a moderately large open field as a good communal gathering space, a design intention of integrating more green space into the site.

Figure 4.8: Depicts internal layout of day care centre and toy library linking with children's playground in the civic square

Base Analysis of Wind loads

Wind rose for Karori road Wellington showing the number of hours each year wind that speeds of 3, 10, 13, 16 and 20 km/hr occur for different wind directions

This wind rose diagram on the left depicts the prevailing winds occurring in the simulated model for the central shopping mall area of Karori, the primary consideration for any design will need to address wind shelter from Northwesterly winds which occur two times more than the North-easterly winds. Occurring 800 hours in the wind-year, these prevailing winds will be a major issue when address habitation of the corner streets which at the moment attempt to mitigate wind loads by incorporating green space. The number of hours each wind load is felt is imperative to determine comfort levels this windrose shows the number of hours that uncomfortable (i.e. equal or exceed 15 km/hr) wind conditions and dangerous (i.e. equal or exceed 30 km/hr) wind conditions occur in the central Karori district of Karori.

As the existing building heights are relatively low overall, the average wind conditions in the area will be close to those illustrated in this windrose. The total hours each year that winds are likely to be uncomfortable amount to 3540 hours, or 40% of the year. The total hours each year during which wind speeds are likely to be dangerous amount to 330 hours, or 4% of the year.

Figure 4.9 Base findings of wind study. This windrose diagram illustrates prevailing wind occurring onsite, refer to appendix A for site study findings for wind conditions onsite and specific areas wind is an issue onsite. This study has been a major design factor and height establishing method.

Figure 4.10: Rendered roof plan of roof top garden linked to residential block and Sustainability Drop-in Centre atrium.

The second public access green space is located directly above the main stage/cinema space in the eastern block of the Sustainability Drop-in Centre. This second storey outdoor space is well sheltered from prevailing winds (figure 4.9) and the rooftop architecture incorporates varying levels to provide security for this elevated park, as shown in figure 4.10. Accessible through the main atrium of the building as well as from the core of the residential block, this space plays a vital role in creating a strong community area in which local residents and Drop-in Centre users can congregate. While this space is not designed to house particular recreation facilities, it could be an outdoor play area for children from the residential block as well as a place for relaxing for those who work in and visit the Drop-in Centre.

The third proposed green space is the green roof above the third storey offices. This is located on the highest level of the proposed building and is exposed to a lot of wind consequently this space is designed without public access. This space will promote urban biodiversity and form the integrated rainwater collection system for the Drop-in Centre. While these are the three main proposed green spaces they are not the only new green

areas. As shown earlier in figure 4.5, how the streets edges are treated will also introduce smaller green spaces to the centre of Karori.

4.2.2 Civic links

This design proposal also incorporates two distinct civic spaces linking the Drop-in Centre to the existing facilities of central Karori (figure 4.11). The first outdoor civic space is a square located between the main entrances of the library and the Drop-in Centre atrium. Designed as a large 30 by 20 metre square the intention was it would house an outdoor market that would act as a communal space for people to meet and barter on site. Closely linked to the main road this site acts as a transition space between the Drop-in Centre and the library. The link to the atrium was a crucial design factor in order to create a strong pedestrian route into the building so this space can be used for exhibitions or as a market space during bad weather. In order to create a strong link across the site the square is connected to the second civic space using a paved ramp that provides access to the existing recreation centre as well as the second storey restaurant in the Drop-in Centre. In order to create a space that echoed the feeling of the Spanish Steps in Rome, the current ramp to the Karori recreation centre was increased in width with planting boxes that double as seating to create a semi-sheltered space for people to inhabit. The larger civic space between the Drop-in Centre and the existing Karori community centre was another opportunity to create a space which occupants of all the surrounding buildings could use. Strongly connected to the recreation centre, Drop-in Centre and the community centre this civic space aims to reconnect the currently disconnected space in this area of Karori. Rather than using this space for parking as currently, the site only has limited access for emergency vehicles and any private vehicles on Beauchamp Street that need to make a U-turn. This civic space is to be made attractive

Figure 4.11: The Proposed site plan illustrates the new civic spaces created, the street front market square linking into the L-shaped atrium; the habitable ramp; and the new civic square between the community centre and the Drop-in Centre. Refer to appendix B.

for people working on site as well as the new consumers attracted to the retail spaces along the southern end of the drop in centre.

4.2.3 Links between residential block and sustainability centre

Both the programme and the layout of the Sustainability Drop-in Centre were conceived considering the links to both outside spaces and the proposed neighbouring residential block. The main atrium of the building wraps around and between the two blocks to create a strong internal link between the square and street front to the civic space outside the community centre. The movement through the building is also celebrated on the exterior between the recreation centre and the Drop-in Centre with the habitable ramp as shown in figure 4.11. As shown in the building sections, figure 4.12, the main link between the Drop-in Centre and the residential block is through the rooftop garden on level two that links into the residential block communal core. There is also public access to this rooftop garden through the building atrium promoting good use of the multi-use atrium exhibition space as well as providing a strong link to the neighbouring buildings. The resulting hierarchy of movement would allow occupants of the Drop-in Centre to access the rooftop garden but not the residential block, as this route is controlled with private access gates.

4.3 The Sustainability Drop-in Centre programme

4.3.1 Ground floor atrium and attached spaces

The ground floor interior floor plan has been designed to follow the existing movements through the site. In order to link up these spaces whilst promoting use of the building by pedestrians, the main atrium space, and ground floor exhibition and market space, wraps around the built form linking the market square and the civic square by the community

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General Notes

CONSTRUCTION DESIGN

In order to meet the primary design objectives of the proposed Sustainability Drop-in Centre, the construction design, entails specifying building materials and methods that are low energy, sustainable and from local resources. As a result the building incorporates a post and beam structure that is laterally braced using the Pyralis long span timber floor trusses. The large ramps and transverse bracing is achieved using double fish plate beams. With a flexibility for larger spans, the rafter level of each block of the building can be expressed in the large atrium, designed to house the layered ramps and walkways increasing the architectural aesthetic.

WIND PRESSURE MOVEMENT

The Trespa T135 series panels are designed for wind pressures specified by AS/NZS 1170.2 - beyond very high and high wind zones, the current site is designated as a high wind zone.

COMPONENT DESIGN

Design the system and its components to meet the loads of the design zone in accordance with NZS 1170.5 section 8 Requirements for parts and components. This detail designates each fixed bolt to incorporate an expansion rubber joint or a friction bolt that allows movement of up to 15mm at each exposed joint.

TRESPA FACADE CLADDING

Trespa Facade Cladding, 10mm thick panel, based on thermally treated, kiln-dried, plantation-grown wood fibres, manufactured under high pressure and high temperature. The cladding panels have an integral decorative surface using Electron Beam Cured technology. UV resistance and color stability complies with ISO 105 A02. As such the weathering and ageing characteristics of the cladding system as the cladding system ensures an 80 year life.

Fire classified to EN 13501-1, F sds0

Cladding system to be tested to AS/NZS 4254.

ROOF AIR BARRIERS

Refer to appropriate rigid air barrier section, Pyralis Air Barrier System, 7mm or 9mm.

No.	Revision/Issue	Date

Figure 4.12: Drop-in Centre
Partial section, Roof-top
garden links to atrium and
residential block

Project Name

Sustainability Drop-in Centre
Designing for an active community focus

Project	Sheet
Arch 501 Master's (7m2)	
Date	28th September 2012
Scale	1:100 @ A3

B18

centre, as shown in figure 4.13. Acting as a large crush space, the atrium is linked to a double storey café next to the auditorium space for live performances and cinema. Directly opposite the entrance to this auditorium is the Sustainability Drop-in Centre information offices, and the public toilets. The ground floor plan also houses two meeting rooms for hire. As determined by the initial site study, the accommodation is on multiple levels, meaning the south end of the site is elevated five metres above the street front. As a result the incorporation of ramps and platforms became a fundamental part of the design. While this is best depicted in figure 4.14, the longitudinal section, this is also well expressed in the

Figure 4.14: Longitudinal Section of Drop-in Centre linking into atrium space and residential block, refer to appendix B drawing B18

manner in which the small stairs and accessible ramps were designed at ground floor level. A fundamental intention was to create links from the street front to the south end of the new Sustainability Drop-in Centre. The atrium was designed to move people from the proposed market areas to the southern end of the site, either through it or via the new external ramp. As a result the smaller ramps had to be incorporated into the ground floor plan acknowledging this desired flow of pedestrian traffic. The solution was a cross-ramping

stairway as shown in figure 4.15. Once up the ramps and onto the elevated level, pedestrians have level access to the south end of the site, the toy library and children's day-care centre (figure 4.13) which share a sheltered outdoor crush space providing direct access to the children play ground as shown in figure 4.8. Finally, the ground floor plan also incorporates some retail space at the south end of the building to attract more people to this space.

Figure 4.15: Ramping stairs integrated into the concrete foundations, design maintains desired atrium pedestrian flow

4.3.2 Second floor restaurant

The second floor level of the western block is designed considering both internal movements from the accessible ramps and the varied exterior levels. The southern end of this block contains three retail spaces, all opening out onto the revised civic space. The main restaurant space is elevated two metres above this level, which is already 1.5 metres above Karori Road. Internally this level is accessed via the atrium ramps which link into a crush space providing access to both restaurant and the separate bar. Located directly next to the restaurant eating area is the outdoor bar and restaurant seating, as shown in figure 4.16.

General Notes

CONSTRUCTION DESIGN
In order to meet the primary design objectives of the project, the Sustainability Design Centre, the construction design, includes specifying building materials and methods that are low energy, sustainable and from local sources. As a result the building incorporates a precast and post-tensioned concrete frame. The building is located in a high wind zone. The large spans and long spans between the large spans and long spans are achieved using double skin panels. With a flexibility to large spans, the value of each block of the building can be expressed in the large spans, designed to house the large spans and always expressing the architectural aesthetic.

WIND PRESSURE MOVEMENT
The Trespa T425 series panels are designed for wind pressures specified by AS/NZS 1170.2 - beyond very high and high wind zones, the current site is designated as a high wind zone.

COMPONENT DESIGN - SPECIFIC DESIGN
Design the system and its anchorage to resist the loads of the seismic zone in accordance with NZS 1170.3, section 8 requirements for joints and components. This detail designates each fixed joint to incorporate an expansion rubber joint or a friction joint that allows movement of up to 15mm at each imposed joint.

TRESPA FACADE CLADDING
Trespa Facade Cladding, 10mm thick, is a precast, based on the moulding system, homogeneously reinforced with wood fibres, manufactured under high pressure and high temperatures. The cladding panels have an integral decorative surface using Electron Beam Curing technology. UV resistance and durability are achieved with ISO 9001:2015. As a result, the panels are not an immediate issue as the cladding system ensures an 80 year life.

Fire classified to EN 13501-1. Facade Cladding system to be tested to AS/NZS 4294.

RIGID AIR BARRIERS
Refer to appropriate rigid air barrier section. Pyralis Air Barrier System, 7mm or 8mm.

No.	Particulars/Notes	Date

Figure 4.16: Drop-in Centre First Floor Plan

Project Name
Sustainability Drop in Centre
Designing for an active community house

Project	Sheet
Arch 551 Master's (Plan)	
Date	27th October 2011
Scale	1:200 @ A3
	B08

This space consists of two levels with ramp and stairway access incorporated around a planted area. The lower level in this outdoor seating area is flush with the elevated ground level at the end of the external ramp. The aim of this deliberate configuration was to create a stronger link with the external walkway that would integrate the internal layout of the building more convincingly with the pedestrian movement through the site.

4.3.3 Rooftop Parks

The second level of the eastern block is an open rooftop garden. As shown earlier in figure 4.9, the plan of this garden has many green spaces at varying levels. This provides shelter and allows the rooftop garden to accommodate areas for promoting urban biodiversity and to house the rainwater collection services. As shown in figure 4.17, the design of the rooftop garden allows public access without the need for an aesthetically unappealing balustrade,

Figure 4.17 Architectural rendition of Roof-top Garden space

only allowing people into the centre of the garden, where a sense of shelter and security is evoked. As mentioned earlier, this green space is deliberately designed to allow access from both the Sustainability Drop-in Centre and the residential block.

General Notes		
<p>CONSTRUCTION DESIGN In order to meet the primary design objectives of the proposed Sustainability Drop-in Centre, the construction design entails specifying building materials and methods that are low energy, sustainable and from local resources. As a result the building incorporates a post and beam structure that is entirely braced using the Pyralis long span timber floor trusses. The large spans and beamwork bracing is achieved using double fish plate beams. With a flexibility for larger spans, the varied level of each block of the building can be expressed in the large atrium, designed to house the layered ramps and walkways expressing the architecture aesthetically.</p> <p>WIND PRESSURE MOVEMENT The Treppa T435 series panels are designed for wind pressures specified by AS/NZS 1170.2 - beyond very high and high wind zones, the current site is designated as a high wind zone.</p> <p>COMPONENT SEISMIC DESIGN Design the system and its components in accordance with the NZS 1170.3, section 3 Requirements for parts and components. This detail designates each fast fast to incorporate an expansion rubber joint or a friction bolt that allows movement of up to 15mm at each exposed joint.</p> <p>TREPPA, FACADE CLADDING Treppa Facade Cladding, 10mm thick flat panel, based on thermosetting resin, is a lightweight, translucent, weather resistant, manufactured under high pressures and high temperatures. The cladding panels have an integral decorative surface using Electron Beam Cured technology. UV resistance and color stability complies with ISO 102 A02. As such the wear abating and color retention of the translucent facade as the cladding system extends an 80 year life.</p> <p>Fire classified to EN 13501-1, Facade Cladding system to be tested to AS/NZS 4204.</p> <p>FLUID AIR BARRIERS Refer to appropriate rigid air barrier section, Pyralis Air Barrier System, from up sheet.</p>		
No.	Revision/Issue	Date

Figure 4.18: Drop-in Centre
Second Floor Plan

<p>Project Name Sustainability Drop-in Centre Designing for an active community house</p>		
Project And SHI Master's (Yr1)	Sheet	<div>B09</div>
Date 20th September 2012		
Scale 1:200 @ A3		

CONSTRUCTION DESIGN
 to call in to meet the primary design objectives of the proposed residential development. The Sustainable Design in Centre and the Sustainable Building, the construction details, articles specifying building materials and methods that are low energy, sustainable and from local sources. As a result the building incorporates a post and beam structure, the roof is literally braced using the Pyrite long span timber floor trusses. The trusses and the transverse trussing is braced using double rich plate joints. With a flexibility for larger spans, the varied level of each block of the building can be expressed in the height, designed to house the varied rooms and walkways between the architectural elements.

WIND PRESSURE MOVEMENT
The Tropic T-205 series panels are designed for wind pressures specified by ASCE 7-91 170.2 - beyond very high and high wind zones. The current site is designated as a high wind zone.

design the system and its anchorage. Things to resist the loads of the seismic zone in accordance with UDS 1170.5, section 8 Requirements for joints and components. This detail designates each fixed joint to incorporate an expansion rubber joint or friction bolt that allows movement of 1 to 1.5-in. each exposed joint.

PRESPA FACADE CLADDING is a new type of facade cladding, 10mm thick, made of polypropylene, based on flame-retarding, homogeneously reinforced with glass fibers, manufactured under high pressure and high temperatures. The cladding panels have an integral decorative surface using Electron Beam Laser technology, UV resistance and color stability, comply with ISO 10012 and ISO 9001 standards. The color change is not an irreversible process as in the cladding system ensures 30 years life.

It is classified to EN 13501-1, Facade
cladding system to be tested to

RIGID AIR BARRIERS
Refer to appropriate rigid air barrier section. Physical Air Barrier System, 1/2" or 3/4".

Mo.	Revisions/Issues	Debit

Figure 4.19: Residential Block Ground Floor Plan

Project Name	Sustainability Drop in Centre	Designed for an active community focus

Project	Exam
Year 10/11 Master's (Print)	B11
Date	
20th September 2012	
Score	1200 @ A3

GROUND FLOOR PLAN

4.4 Residential block - a TOD design initiative

As determined earlier, one of the fundamental characteristics of making a TOD is to increase residential density at the TOD hub. In order to integrate the proposed Sustainability Drop-in Centre into the urban layout of Karori with TOD principles in mind, a new low rise residential apartment building is proposed for the neighbouring vacant plot. Designed with two blocks around an external courtyard this residential development attempts to retain a strong link with the Sustainability Drop-in Centre and the proposed civic space and park at the southern end of the site. As shown in figure 4.19 the floor plan is divided into three sections. The first section closest to Karori Road, comprises two family dwellings and is divided from the central section by an internal core that contains the access stair. The section furthest from Karori Road is linked to the central unit via an external bridge on the third floor of the residential block. This last section also comprises two family units on each floor, again separated by the smaller central core housing the second stairway for egress. The courtyard space functions as a private green space for the residents of the building and the over-bridge on the third floor (figure 4.20) connects to the rooftop garden in the Sustainability Drop-in Centre.

4.5 Summary

The aim of this thesis was to integrate urban design and building design skills for the suburban residential sector, and to do this considering sustainable design practices, particularly for a post-oil future. As such the focus of the design was on achieving active community activities including;

- education about sustainable practices;

General Notes

CONSTRUCTION DESIGN
In order to meet the primary design objectives of this project, the Sustainability Design Centre and the Residential Block, the construction design, enables specifying building materials and methods that are low energy, sustainable and low cost resources. As a result the building incorporates a joint and beam structure that is entirely braced using the Pyralis long beam timber floor trusses. The large spans and facades allowing a achieved using double skin panels. With a flexibility for larger spans, the varied floor of each block of the building can be integrated in the large atrium, designed to house the layered atrium and walkways expressing the architectural aesthetic.

WIND PRESSURE MOVEMENT
The Trespa T405 series panels are designed for wind pressures stipulated by AS/NZS 1170.2 - beyond very high and high wind zones, the current site is designated as a high wind zone.

COMPONENT DESIGN
SPECIFIC DESIGN
Design the system and its components to resist the loads of the seismic zone in accordance with NZS 1171.5, section 5 Requirements for joints and components. This detail designates each fastener to incorporate an expansion rubber joint or a friction bolt that allows expansion of up to 10mm at each separate joint.

TRESPA FACADE CLADDING
Trespa Facade Cladding, 10mm thick flat panel, based on thermosetting resin, homogeneously reinforced with wood fibres, manufactured under high pressure and high temperatures. The cladding panels have an integral decorative surface using Electron Beam Coated technology. UV resistant and non-yellowing, with a choice of 100 AGS. As such the wear, staining and color changes are not an immediate issue as this cladding system ensures an 80 year life.

Fire classified to Eln 1200-1.5. Facade Cladding system to be tested to AS/NZS 4254.

ROD AIR EXHAUSTERS
Plaster to incorporate rigid air tanker sections. Pyralis Air Blower System. Item to item.

No.	Revision/Phase	Date

Drawing Title

Residential Block
Floor Plan 3
with living over bridge

Figure 4.20: Residential Block Floor 3 plan. With linking over-bridge .

Project	Sheet
Acad 5811 Masters (7/10)	B13
Date	20th September 2012
Scale	1:200 @ A3

TYPICAL PLAN FLOOR 3

- a chance for social interaction;
- local barter;
- and local markets.

These attributes formed the driving force behind the proposed design. Segregating private traffic from the central area of Kaori opens up this space to be far more pedestrian friendly and allow for more connectivity. As a result the proposed traffic plan creates a central public transport route and an alternate private vehicle route. The result has been a re-evaluation of the street end configuration for the smaller roads branching off Karori Road. Such an intervention aims to accommodate pedestrian movement and walkability, whilst limiting the presence of private vehicles on Karori Road. However, limiting private vehicles in the central area of Karori is not enough to create a thriving, walkable suburban centre. As such the design proposal has reconfigured the site to incorporate more green spaces such as the children's park, rooftop gardens and also the street end turning bays; stronger civic spaces and links, such as the market square and the civic space at the southern end of the site; and finally a walkable link between the residential blocks and the Sustainability Drop-in Centre. Promoting good walkability was also considered in the design of the building. The building program and layout was designed to facilitate ease of movement through the atrium and vertically through the building without using lifts. This detailed circulation design is discussed in the next chapter. The layout of the ground floor and second floors were governed by the site study and proposed site changes. As a result the building houses three key entry and exit points from the ground level into the main atrium space. These are located by the surrounding spaces created around the outside of the building, such as the

market square, the cafe space facing Karori road and the south end entry and exit in the atrium linking into the civic square. The aim was to create a building that could encompass the four attributes discussed earlier and do so in a manner that allowed the internal building program to function with the larger site proposal, which in turn would link into the new traffic management plans. The result is a building design that allows strong walkability, and a site layout in which the central road is no longer dominated by traffic. As theorized by Lynch, this creates better walkability because of interacting nodes, paths landmarks and edges. The new design layout of both the larger traffic plan, the building layout itself as well as the new residential block is in line with the theory of Transit Oriented Developments. By integrating this theoretical design strategy Karori road is far more walkable and no longer creates a disconnected space that offers little pedestrian interaction across the road. The new layout also uses the building atrium and inhabitable ramp to create links from the street front to the new civic square and park.

Chapter 5: Ramps – detailed design

IN THIS SECTION:

- 5.1 Chapter overview
- 5.2 Research into trade literature and alternatives to standard construction techniques
- 5.3 Discussion of principles of ramp design and configuration;
 - Circulation space and layout
 - Ramp size and gradients

5.1 Chapter Overview

Chapter 5 explains how vertical movement was considered in the Sustainability Drop-in Centre, namely through providing reasons for the systems implemented and the design strategies that, wholly or in part, support the ramp-only access strategy discussed earlier. The aim is a building that consumes less energy which will operate in a post-oil future. This chapter builds on Chapter 4, which focused on the implementation of accessible design and a layout which would best function within the heart of Karori. It does this by addressing specific issues around the design and detailing of the ramps to ensure ease of access. This information will help develop a comprehensive understanding of construction systems and strategies for a low energy building with a strong focus on ease of accessibility.

Once the internal design decisions were made about including ramps, the allowable space for these, and related access routes, the project could move past concept development into detailed design. The detailed design involves trade literature research and decisions on appropriate construction systems.

The second step in this detailed design phase involves applying the best practice for designing and building accessible ramps. As opposed to simply following minimum requirement standards for accessibility, the aim was to identify optimum design techniques that would create an accessible route that is both easy to access and manoeuvre through and also provides a seamless path that could be enjoyed by the building occupants as a celebrated part of the building architecture.

The research into trade literature identifies alternatives to standard construction techniques that could be used for the ramps. As part of the design process, possible materials and types

of details are reviewed. These not only concern the detailed connection and construction design but also the location of the ramps and how they fit into the building layout. Here the idea of compartmentalising the ramp egress was pursued. This chapter then discusses the implications of the specified construction techniques. Finally, it ends with a discussion on principles of ramp design and configuration, looking specifically at circulation space, doorway manoeuvres, ramp gradients and necessary special design decisions such as distance to landing, turning points and aesthetic relevance to the built form.

5.2 Research into trade literature and alternatives to standard construction techniques

In order to create a safe building environment two aspects of code compliance fundamentally influence the design of ramps. These are NZBC compliance documents C - fire safety and D1 - Access routes (Department of Building and Housing New Zealand). Essentially the aim of both compliance documents is to ensure a safe egress route or routes in any proposed building design and based on building occupancy and scale. When reviewing the design and layout of the proposed Sustainability Drop-in Centre, based on these two compliance documents the building requires two safe paths of egress for building occupants to use in case of emergencies. Both of these egress routes need to be fire safe and must be integrated into the building as separate fire cells. This essentially means that the routes must be housed in a compartmentalised zone within the building that is segregated from possible fires occurring in any other part of the building. These two routes are shown in figure 5.1. These factors alone do not ensure safe egress as another major consideration is the materials used for these safe paths or accessible ramps. Any materials specified would need to be fire rated and structurally sound during emergencies so that the

Figure 5.1 The two separate fire-cells are shown making each block of the building (Red) and the central compartmentalised atrium a completely segregated fire-cell (Blue). The green path identified is the safe path that provides two separate points of egress, the first through to the street front and the other via the level two outdoor seating area. This plan is a hybrid drawing edited using the ground floor and first floor plans, refer to appendix B.

ramps can be utilised during fires as safe paths of egress. As a result the selection of materials for this egress route has to comply with three design directives, these being;

- structurally sound construction,
- fire rated for longer fire resistance,
- sustainable materials that meet initial sustainable design directives.

In New Zealand the two most commonly used materials for fire rated safe path structures are concrete or steel coated with an intumescent fire retardant layer. This is often seen as a cheaper and easier alternative to timber construction which, in comparison, is much more flammable than steel and concrete. The main problem with using steel or concrete is the question of the sustainability of these materials; secondary to this is the fact that timber is a locally sourced material and a trade service that would involve far less embodied energy in both construction and supply of materials. An alternative solution to using steel or concrete must be found to satisfy all three of the detailed design directives. As a result there are two alternative solutions that use timber as the primary material. The first is deeper structurally strengthened timber such as LVL beams or Glulam beams, and the second is timber flitch beams. The main issue with using LVL or Glulam beams is the amount of toxic chemicals and glues that are used in the manufacturing of these timber members. The process requires more embodied energy in the construction of the strengthened beams and is a questionable sustainable material choice. Flitch beams appear a far more sustainable solution that meet all three detailed design directives, and the beam specified for the construction details of the ramps is the Better Header double plate flitch beam system, depicted in figure 5.2. The maximum allowable span for each of these strengthened beams is up to 18 metres before engineering design is required. Constructed using flush plates and gang-nails, these beams

are a cleaner greener option, with no use of toxic glues and with a maximum span requirement of 16 metres these beams satisfy both the structural and sustainable design directives. By specifying the deeper 300mm beams

Figure 5.2: Better Header flitch beams, image sourced from www.betterheader.co.nz

with two flitch steel plates, the size of the beam also provides a suitable fire rating as the kiln dried timber will create a char layer that will protect the timber beam during fires whilst maintaining a structurally acceptable residual section size of 200 millimetres, as shown in figure 5.3.

Figure 5.3: Char layer for timber section, timber size specified to ensure residual section of 200mm during fires

With the primary structural material specified the sequence of construction can now be identified. The following figures 5.4, 5.5, 5.6, 5.7 and 5.8 depict the construction sequence of each floor level. The main floor framing structure of the Sustainability Drop-in Centre

uses Pryda long span timber trusses. Each of these trusses can span a maximum of 10 metres as per trade specifications.

Figure 5.4: Construction sequence 1 - concrete floor.

Figure 5.5: Construction sequence 2 .

Figure 5.6: Construction sequence 3.

Figure 5.7: Construction sequence 4.

Figure 5.8: Construction sequence 5.

Due to the need for a sustainable timber size but more significantly the need for deeper beams to achieve the desired fire rating, these trusses span a total of 8 metres between

300x300 millimetre column supports as shown in the construction sequence images and figure 5.8. The floor plans in chapter 4 show the locations of the columns. The deeper truss floor framing systems allows for the large floor spans required with plenty of space for services (in this case electrics and water as the building is naturally ventilated) to be integrated into the floor framing system as shown in figure 5.9.

Figure 5.9: Gravity only column junction, at 8 meter spans

Figure 5.10: integrated services such as electrical, plumbing, and energy services. Image sourced from www.pryda.com.au

The Better Header Flitch beams are directly bolted to this floor framing system which cantilevers out into the atrium space 900 millimetres to create the floating ramps as shown in 5.10. These flitch beams are the primary structural system used for the ramps and continue down to the concrete foundation as shown in figure 5.11.

Figure 5.11: 900mm cantilever frames direct fixed to gravity columns or floor framing system.

Figure 5.12: double flitch plate beams used for ramp framing to transfer load down to foundation level. These are supported at every landing.

5.3 Principles of ramp design and configuration

The underlying aim of the detailed design phase is to incorporate best practice for designing and building accessible ramps in the Sustainability Drop-in Centre. Thus, the detailed design could not just be governed by minimum requirement standards. As such the ramp design and configuration is directed by two design and functional aspects;

- circulation space and layout;
- ramp size and gradients.

While these three aspects play a fundamental role in the detailed design phase, they also had to be considered very early in the design process as the implications of accessible movement meant consideration could not just be limited to the accessibility ramps in the atrium. This reflects a philosophy best defined by Robert Dale Lynch in his article, *Designing for Accessibility*;

A design philosophy that places the users' characteristics and needs at the center of the planning process will lead eventually to the creation of an environment that is accessible to handicapped people as well as to the able-bodied. Lynch (1979, Pg 66)

5.3.1 Circulation space and layout

There are many ways to ramp the circulation through a building. What is important at the entrance of the building is to ensure the wheelchair user enters at the 'front'. The layouts in Figures 5.13 to 5.16 show alternative entrances to the building. Figure 5.13 illustrates a straight ramp entrance to the building that separates the entrance for wheelchair users from that of ambulant people. This design, while entering at the front of the building, is not

preferred as it limits the egress and entry points for varying users, and because this access should be designed for all the occupants it is essential that the ramp access facilitates a universal entry threshold. This is especially crucial when reviewing the design strategy discussed in chapter 4, which outlines the significance of the three main entrances to the building and the connections made between internal movement and the external urban layout. Figure 5.14 shows an alternative entrance which starts the entrance to the ramp closer to the entry point to the building. Figure 5.15 also brings the entrance to the front, but makes poorer use of the space as it requires an extra platform and therefore more space. Figure 5.16 shows the preferred layout where the user enters from the 'front' of the building through the shortest route. It is always worth testing these alternatives for their architectural significance. As shown in the section of the internal ramp, figure 5.17, the configuration of the ramp matches the sketch design of figure 5.16, in which the two way ramp folds back on itself creating two access points. Doing so allows access to the building from the two main Karori Road entrances providing wheelchair access from both areas of the front of the building. This was also a crucial design aspect for fire safety egress.

Another crucial aspect of an accessible ramp is its level landings. Level landings occur at both the bottom and top of each ramp, where there is a change in direction of the ramp, after every 10.0 m length of a 1:15 ramp (after every 5.0 m length of a 1:12 ramp), and where there are doors located along the ramp. These landings are used as resting points for people using it, or to rest and allow other people to pass. Landings were made as wide as the full width of the ramp leading to them and approximately 1.8m long. These are fundamental design features that had to be employed in the Sustainability Drop-in Centre

Figure 5.13

Figure 5.14

Figure 5.15

Figure 5.16

to provide ease of manoeuvrability at these key junctions. Additional landing space is provided for top and bottom landings to account for doors or gates opening onto the landings. Where a door opens out onto a landing, the total length of the landing is 1500 mm plus the length of the door swing.

5.3.2 Ramp size and gradients

Ramps are considered an essential method for assisting wheeled traffic to cope with changes in level that are traditionally overcome by using stairs. Whilst accommodating the need for disability access, this is not the sole reason for the dominant role ramps play in the Sustainability Drop-in Centre. The aim of the ramp design for this building was to create a vertical pedestrian progression in the building that did not need to rely on energy consuming alternatives like lifts and escalators and, perhaps more significantly, created a comfortable and aesthetically pleasing route that would celebrate the varied levels of the building and the site.

As a result, going beyond the minimum accessibility requirements was a fundamental part of the ramp design. When considering the New Zealand Building Code's minimum requirements, both the 1.5m clear width and the size of ramp gradients at a ratio of 1:12 fall well short of what wheelchair users would define as comfortable. This is a fact best emphasized by Selwyn Goldsmith's analysis of 284 wheelchair users in Norwich, the findings of which were published in Julia Tarrant's and Alice Subiotto's book "Planning for disabled people in the urban environment". Goldsmith's analysis found that while travelling up a 1:12 ramp was possible, it was very strenuous and difficult over long distances even with intermediate landings. The study determined that a slope of 1:15 to 1:20 was much more comfortable and in fact, when asked, 43 per cent of the

respondents said that the need for landings was less necessary given the lesser slope (Goldsmith (1967) as cited by Tarrant and Subiotto (1969)). This study also emphasized the importance of larger widths of at least 1.8m for the ramp as well as the landings at the top and bottom of each ramp, because the minimum width, whilst working for linear progression up a ramp, was not very accommodating at turning points.

As a result of these findings, the ramps designed in the central atrium of the Sustainability Drop-in Centre were configured as 1:15 sloping ramps with a total width of 2.0m and a clear width of 1.8m. The critical design reason for using this slope was that a design that gave comfortable vertical movement for disability access would create spaces and access routes that would also benefit able-bodied users and occupants.

Chapter 6: Conclusion

IN THIS SECTION:

- 6.1 Conclusion
 - The objective and research question
 - The new pedestrian realm
 - Did the design meet the proposed design motivations?
 - Sustainability lessons, project strengths and weaknesses
 - Further research

6.1 Conclusion

6.1.1 The objective and research question.

The objective of this thesis was to provide a critical approach to the notion of sustainable design in today's suburban areas and introduce the inter-relationships between site specific spatial design and sustainable practices. In order to realise this objective the thesis question posed was:

“What would the design and integration of a community centre as a catalyst for moving towards a sustainable built environment be like?”

After an analysis of the current site and its strengths and weaknesses in chapters 2 and 3, the fundamental outcome was that any new design framework would need to link the two sides of Karori Road together whilst maintaining good access to public transport. As a result the first aspect identified in the proposed design is that the building alone is not a catalyst – it has to be accompanied by structural changes in the suburb, particularly in creating an environment that favours pedestrians rather than cars (as identified in the case analysis at Vauban, one of the precedents). However, what the structural layout analysis of the suburb shows is that a modern New Zealand suburb based on the car can, even now, easily be made much more pedestrian friendly, and hence more ready for a post-oil future.

Chapter 3 also looked at site specific challenges based on theoretical arguments of urban space and compared these to the two international precedents reviewed. Section 3.3 noted the Vauban District's success in incorporating principles of both Green urbanism and transit oriented design, which allowed for better walkability more communal engagement and the development of a community.

6.1.2 The new pedestrian realm.

The purpose behind the following renders is to show the new pedestrianized heart of Karori, achieved in part by the insertion of the Sustainability Drop-in Centre. These images act as a 2d simulation of the new walkable route.

6.1 A view of the street front café, the new atrium and bus route

6.2 New Market square shared between the main entrance and the existing library. Space integrated for local bartering and to promote social interaction.

6.3 Main entrance from the shared market square, one of three entry points allowing ease of access through the site.

6.4 View from the first multi-level accessible ramp, integrated to achieve ease of access and create an energy efficient building without lifts, limiting excess energy use.

6.5 A view from the central atrium walkway looking through to the existing community centre, depicting the progression through the building on both the ground, second and third floors.

6.6 Ground floor atrium, looking at the theatre area to the left and entry to the children's day care centre at the end of the atrium next to the community centre.

6.7 Main stage of new theatre space

6.8 Seating area near the proposed children's playground, looking back at the atrium entry and adjacent civic space

6.9 A view into the new civic space looking back to the children's play area

6.10 Walking back to Karori Road through the inhabitable ramp between the recreation centre and the Drop-in Centre

6.1.3 Did the design meet the proposed design motivations?

The emphasis of the of this study, promoted further by the case studies reviewed, was on creating strong communal links to local bartering, local businesses, close density living and strong links to public transport that was not hindered by private transportation. This echoed the following four community activities that were already seen as crucial for the proposed Sustainability Drop-in Centre.

- education about sustainable practices;
- a chance for social interaction;
- local barter;
- local markets.

The proposed design is based on these four design motivations and does realize each of these goals. In order to incorporate a sense of community and local bartering, the building's access and location of exhibition and market space are integrated into both an open public square, which links with the outdoor space of the existing recreation centre and Karori Library, and the large internal atrium space. This atrium space is a strong design feature that aims to emphasise the varying vertical levels of the building but more importantly the multi-use nature of this large public space.

In order to promote good chances for social interaction the building layout and programme aimed to incorporate both office space and public facilities whilst accommodating a large demographic of potential building occupants. Whilst the building does aim for building resilience, another simple way social interaction is facilitated is through the new links to the

local green spaces and neighbouring residential and civic spaces. The L-shaped atrium links the front of the building with the children's park and civic space behind the Sustainability Drop-in Centre, and the second floor green space is designed to link with the proposed residential building creating another communal space for local residents and the building occupants to share.

Finally education for sustainable practices is achieved in two ways. The first is simply through the manner in which the Sustainability Drop-in Centre operates as a demonstration building. Demonstration buildings are significant tools that change values by way of depicting what can be possible. This is precisely how the Sustainability Drop-in Centre works: it depicts how a building footprint can be occupied to promote more sustainable use and emphasises shared space and multi-use space. The second emphasis on achieving education for sustainable practices is a very literal one. The building is orientated around a sustainability information centre that is housed on its ground floor. This space is designed to open up to the large atrium space that can be used for exhibitions based on how to live, build and design in a much more sustainable fashion. As a result the design intentions of the Sustainability Drop-in Centre are achieved through a building that promotes education, social interaction and communal well-being.

6.1.4 Sustainability lessons, strengths and weaknesses and future research.

The resulting design proposal in this thesis has strengths but also some weaknesses. Fundamentally the strongest part of the building design is its low energy fit out, that uses alternative construction methods to create a comfortable building which requires no lifts or escalators. For a building aiming for sustainable low energy design such simple considerations early in the design can create a configured space that works for a very wide

demographic of building users, without the extra energy requirements. Another strong aspect of the design is the newly configured urban layout that successfully gives dominance to the pedestrian users of the site. While the aim was to create a more resilient suburb for a post oil future, regardless of when that future arrives, this new suburban layout ensures that the central township area will be a strongly connected space that is safe and walkable. One key weakness of the design is that this entire building as well as the suburban layout is work conducted by a single person. As a result the entire design has been achieved without input from consulting designers from crucial fields such as engineers, and landscape architects.

These low density areas have very good potential for change for a TOD type use. The more complex problem will be achieving a similar design evolution in the CBD. This is a good area for further research that could branch out from this work.

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Appendices

IN THIS SECTION:

- Appendix A
 - Site Study Diagrams and wind study
- Appendix B
 - Building construction drawings
- Appendix C
 - Detailed design trade literature specification sources.

Appendix A

Site Study Diagrams and wind study

Central Heart of Karori

The proposed site

This area constitutes the scope of work for phase two

Karori Mall _____

Medical centre _____

Library _____

Recreation centre _____

Petrol station _____

Community hall _____

Varying building typologies on site

Road Hierarchies on site

- Heavy traffic high density
difficult thoroughfare.
- Residential routes - inner suburb
easy thoroughfare
- Private low density

Walkability on site

Area in which an average person will
Walk 3 minutes (in radius) and 6 minutes
(in diameter).

Area in which an average person will
Walk 1 minute (in radius) and 2 minutes
(in diameter).

Base Analysis of Wind loads

Wind rose for Karori road Wellington showing the number of hours each year wind that speeds of 3, 10, 13, 16 and 20 km/hr occur for different wind directions

This wind rose diagram on the left depicts the prevailing winds occurring in the simulated model for the central shopping mall area of Karori. the primary consideration for any design will need to address wind shelter from Northwesterly winds which occur two times more than the North-easterly winds. Occurring 800 hours in the wind-year, these prevailing winds will be a major issue when address habitation of the corner streets which at the moment attempt to mitigate wind loads by incorporating green space. The number of hours each wind load is felt is imperative to determine comfort levels this windrose shows the number of hours that uncomfortable (i.e. equal or exceed 15 km/hr) wind conditions and dangerous (i.e. equal or exceed 30 km/hr) wind conditions occur in the central Karori district of Karori.

As the existing building heights are relatively low overall, the average wind conditions in the area will be close to those illustrated in this windrose. The total hours each year that winds are likely to be uncomfortable amount to 3540 hours, or 40% of the year. The total hours each year during which wind speeds are likely to be dangerous amount to 330 hours, or 4% of the year.

Base Analysis For Height Consideration Identifying wind loads.

Existing wind conditions on Karori road in Wellington have been determined using computer simulated data from WINDstation and validated using meteorological data recorded at Wellington Airport, provided by NIWA. The data, recorded at 10m above the ground, has been converted to pedestrian level wind speeds at 2m above the ground using terrain/height multipliers given in the New Zealand wind loading standard. No topographic or terrain corrections have been applied for central Karori as the immediate surrounding land is essentially flat.

The wind rose diagram shows that winds in the central area of Karori blow predominantly from the northeast, northwest and southwest. The lighter winds, corresponding to the red line (3 km/hr), occur from a relatively large number of directions within the northeast, northwest and southwest sectors. The stronger winds, corresponding to the blue line (20 km/hr), occur over a narrower range of wind directions, centred on the directions 70°, 200° and 300°. It is apparent from this diagram that winds occur most frequently from the northeast direction although the very high winds (not visible in this figure) occur most often from the southwest direction, but only for a very small number of hours each year; the architectural significance and implications are listed below.

Wind Description	Wind Speed (km/hr)	Effects
Calm, light air	0-2	Calm, no noticeable wind
Light breeze	3-5	Wind felt on face
Gentle breeze	6-8	Wind extends light flag; hair is disturbed; clothing flaps
Moderate breeze	9-11	Raises dust, dry soil and loose paper; hair disarranged
Fresh breeze	12-15	Force of wind felt on body; drifting snow becomes airborne; limit of agreeable wind
Strong breeze	16-20	Difficult to walk steadily; hair blown straight; umbrellas used with difficulty
Near gale	21-25	Walking difficult to control; wind noise unpleasant; body begins into wind
Gale	26-30	Great difficulty with balance in gusts; body blown sideways; dangerous for elderly people
Strong gale	31-35	People blown over by gusts
Storm	36+	Impossible to stand up; necessary to crouch and hold onto a support

Wind Load effects - Eddy

New buildings can have both beneficial and detrimental effects on the pedestrian level wind conditions. Sheltered areas can be created downwind of a building, or group of buildings, while windy areas typically occur around the sides and near the windward face of a building. Buildings generally only affect wind conditions when they are directly exposed to the wind. This means that larger buildings tend to affect wind conditions more than small buildings as they typically protrude above neighbouring buildings, creating a greater exposure to the wind. However, this is not always the case as a well designed large building can have less impact on wind than a poorly designed small building.

Ground level winds can be accelerated around the corners of the building creating windy regions as illustrated. The problem areas effected by such "wind eddies" are highlighted

Wind Load effects

Deflecting down winds

New buildings can have both beneficial and detrimental effects on the pedestrian level wind conditions. Sheltered areas can be created downwind of a building, or group of buildings, while windy areas typically occur around the sides and near the windward face of a building. Buildings generally only affect wind conditions when they are directly exposed to the wind. This means that larger buildings tend to affect wind conditions more than small buildings as they typically protrude above neighbouring buildings, creating a greater exposure to the wind. However, this is not always the case as a well designed large building can have less impact on wind than a poorly designed small building.

Buildings can deflect wind down to ground level, a mitigation technique employed in the past has been Veranda Extensions above pedestrian routes.

Wind Load effects - channels

New buildings can have both beneficial and detrimental effects on the pedestrian level wind conditions. Sheltered areas can be created downwind of a building, or group of buildings, while windy areas typically occur around the sides and near the windward face of a building. Buildings generally only affect wind conditions when they are directly exposed to the wind. This means that larger buildings tend to affect wind conditions more than small buildings as they typically protrude above neighbouring buildings, creating a greater exposure to the wind. However, this is not always the case as a well designed large building can have less impact on wind than a poorly designed small building.

Wind at ground level can be channelled between adjacent buildings.

Wind Load effects

Vicarious load transfer

New buildings can have both beneficial and detrimental effects on the pedestrian level wind conditions. Sheltered areas can be created downwind of a building, or group of buildings, while windy areas typically occur around the sides and near the windward face of a building. Buildings generally only affect wind conditions when they are directly exposed to the wind. This means that larger buildings tend to affect wind conditions more than small buildings as they typically protrude above neighbouring buildings, creating a greater exposure to the wind. However, this is not always the case as a well designed large building can have less impact on wind than a poorly designed small building.

Different sized buildings can interact to create windy conditions.

Base Analysis For Height Consideration

Case study comparison of wind loads and district plans of Wellington.

	Increase in wind speeds	Number of hours when winds are uncomfortable	Number of hours when winds are dangerous	Distance downwind of sheltered area
Open ground	-	3540 hrs/yr	330 hrs/yr	
11m high buildings	11%	3860 hrs/yr	460 hrs/yr	11 m
20m high buildings	19%	4220 hrs/yr	650 hrs/yr	20 m
30m high buildings	23%	4420 hrs/yr	790 hrs/yr	30 m
45m high buildings	29%	4640 hrs/yr	930 hrs/yr	45 m

Wind speeds will increase in localised areas near exposed buildings. These increases are estimated in the table above, along with estimates of the number of hours of uncomfortable and dangerous winds in these localised areas, and the sheltered areas downwind of the buildings.

The Wellington City District Plan for the central business district has wind rules in place that control the wind effects of new buildings over 4 stories in height (defined as 18.6 m). Three wind speeds are specified, that control the comfort, safety and change in wind conditions around a proposed development. The rules are performance based. In that a new building only needs to be modified if it has a significant adverse effect on the wind environment. The effects of the building are established by wind tunnel modelling and by expert assessment. The planning rules have gradually improved the wind environment in Wellington City since their introduction in the 1980s.

The need for wind controls in Karori will depend to a degree on the height of buildings allowed for in the planning rules, and on the level of amenity that is desired by the public. A comparison of the wind climates of the more localized effect on the Karori road area and Wellington City is shown in the Windrose Diagram on the left. This shows that Wellington City is almost twice as windy. Thus the determination of Height restrictions (limited to this study of the Wind Design only, not considering Seismic design) Can be atleast 6 stories in Height.

Appendix B

Building construction drawings

General Notes

CONSTRUCTION DESIGN
In order to meet the primary design objectives of the proposed Sustainability Drop in Centre, the construction design, entails specifying building materials and methods that are low energy, sustainable and from local resources. As a result the building incorporates a post and beam structure, that is laterally braced using the Pyda long span timber floor trusses. The large ramps and transverse bracing is achieved using double flitch plate beams. With a flexibility for larger spans, the varied level of each block of the building can be expressed in the large atrium, designed to house the layered ramps and walkways expressing the architectural aesthetic.

WIND PRESSURE MOVEMENT
The Trespa TS35 selfs panels are designed for wind pressures specified by AS/NZS 1170.2 - beyond very high and high wind zones, the current site is designated as a high wind zone.

COMPONENT SEISMIC DESIGN - SPECIFIC DESIGN

Design the system and its anchorage details to resist the loads of the system. The design shall comply with NZS 1170.5, section 8 Requirements for parts and components. The detail designates each flood bolt to incorporate an expansion rubber joint or a friction bolt that allows movement of up to 15mm at each exposed joint.

TRESPA FACADE CLADDING
Trespa Facade Cladding, 10mm thick flat panel based on thermosetting resin impregnated glass fibre with wood fibres, manufactured under high pressure and high temperature. The cladding panels have an integral decorative surface using Electron Beam Cured technology, UV resistance and color stability complies with ISO 105 A02. As such the wear staining and discoloration is minimal. No maintenance issue as the cladding system ensures an 80 year life.

The cladding is classified to EN 13501-1, Facade Cladding system to be tested to AS/NZS 4284.

RIGID AIR BARRIERS
Refer to appropriate rigid air barrier section, Physad Air Barrier System, 7mm or 10mm.

No.	Revision/Issue	Date

Drawing Title

Proposed Site Plan

Project Name

Sustainability Drop in Centre
Designing for an active community focus

Project	Sheet
A01 591 Masters (Prof)	
Date	
20th September 2012	B01
Scale	
1:500 @ A3

General Notes

CONSTRUCTION DESIGN

In order to meet the primary design objectives of the proposed Sustainability Drop-In Centre, the construction design, entails specifying building materials and methods that are low energy, sustainable and from local resources. As a result the building incorporates a post and beam structure, that is laterally braced using the Pyda long span timber floor trusses. The large ramps and transverse bracing is achieved using double flitch plate beams. With a flexibility for larger spans, the varied level of each block of the building can be expressed in the large atrium, designed to house the layered ramps and walkways expressing the architectural aesthetic.

WIND PRESSURE MOVEMENT
The Trespa TS35 series panels are designed for wind pressures specified by AS/NZS 1170.2 - beyond very high and high wind zones, the current site is designated as a high wind zone.

COMPONENT SEISMIC DESIGN - SPECIFIC DESIGN

Design the system and its anchorage details to resist the loads of the system. The system shall comply with NZS 1170.5, section 8 Requirements for parts and components. The detail designates each fixed bolt to incorporate an expansion rubber joint or a friction bolt that allows movement of up to 15mm at each exposed joint.

TRESPA FACADE CLADDING

Trespa Facade Cladding, 10mm thick flat panel based on thermosetting resin, is designed to be used with wood fibres, manufactured under high pressure and high temperature. The cladding panels have an integral decorative surface using Electron Beam Cured technology, UV resistance and color stability complies with ISO 105 A02. As such the wear staining and discoloration is not a design issue as the cladding system ensures an 80 year life.

Fire classified to EN 13501-1, Facade Cladding system to be tested to AS/NZS 4284.

RIGID AIR BARRIERS

Refer to appropriate rigid air barrier section, Physad Air Barrier System, 7mm or 10mm.

No.	Revision/Issue	Date

Drawing Title

Site Plan Zoom at
Beauchamp Street

Project Name

Sustainability Drop In Centre
Designing for an active community focus

Project	Sheet
Act 591 Masters (Prof)	
Date	
20th September 2012	B02
Scale	
1:200 @ A3

General notes

CONSTRUCTION DESIGN

In order to meet the primary design objectives of the proposed Sustainability Drop-In Centre, the construction design, entails specifying building materials and methods that are low energy, sustainable and from local resources. As a result the building incorporates a post and beam structure, that is laterally braced using the Pyda long span timber floor trusses. The large ramps and transverse bracing is achieved using double flitch plate beams. With a flexibility for larger spans, the varied level of each block of the building can be expressed in the large atrium, designed to house the layered ramps and walkways expressing the architectural aesthetic.

WIND PRESSURE MOVEMENT

The Trespa TS35 series panels are designed for wind pressures specified by AS/NZS 1170.2 - beyond very high and high wind zones, the current site is designated as a high wind zone.

COMPONENT SEISMIC DESIGN -

SPECIFIC DESIGN

Design the system and its anchorage/ramps to resist the loads of the Trespa TS35 series panels in accordance with NZS 1170.5, section 8 Requirements for parts and components. The detail designates each fixed bolt to incorporate an expansion rubber joint or a friction bolt that allows movement of up to 15mm at each exposed joint.

TRESPA FACADE CLADDING

Trespa Facade Cladding, 10mm thick flat panel based on thermosetting resin, is a high performance cladding with wood fibres manufactured under high pressure and high temperature. The decorative surface using Electron Beam Cured technology, UV resistance and color stability complies with ISO 105 A02. As such the wear, staining and discoloration of the cladding is not an issue as the cladding system ensures an 80 year life.

Fire classified to EN 13501-1, Facade Cladding system to be tested to AS/NZS 4284.

RIGID AIR BARRIERS

Refer to appropriate rigid air barrier section, Physad Air Barrier System, 7mm or 10mm.

No.	Revision/Issue	Date

Drawing Title
Site Plan Zoom to
Civic space by
Community Centre

Project Name

Sustainability Drop in Centre
Designing for an active community focus

Project Aci 591 Masters (Prof)	Sheet
Date 20th September 2012	B03
Scale 1:200 @ A3

General Notes

CONSTRUCTION DESIGN

In order to meet the primary design objectives of the proposed Sustainability Drop-In Centre, the construction design, enables specifying building materials and methods that are low energy, sustainable and from local resources. As a result the building incorporates a post and beam structure, that is laterally braced using the Pyda long span timber floor trusses. The large ramps and transverse bracing is achieved using double flitch plate beams. With a maximum of eight spans, the vertical level of each block of the building can be expressed in the large atrium, designed to house the layered ramps and walkways expressing the architectural method.

WIND PRESSURE MOVEMENT

The three F500 soffits panels are designed for wind pressures specified by AS/NZS 1170.2 - beyond very high and high wind zones, the current site is designated as a high wind zone.

COMPONENT SEISMIC DESIGN - SPECIFIC DESIGN

Design the system and its components to resist the loads of NZS 1170.3 seismic requirements for parts and components. The detail design shall be based on the design loads and seismicity of the site.

DESIGN - FLOORING

Design the flooring system to resist the loads of NZS 1170.3 seismic requirements for parts and components. The detail design shall be based on the design loads and seismicity of the site.

DESIGN - CLADDING

Design the cladding system to resist the loads of NZS 1170.3 seismic requirements for parts and components. The detail design shall be based on the design loads and seismicity of the site.

DESIGN - ROOF

Design the roof system to resist the loads of NZS 1170.3 seismic requirements for parts and components. The detail design shall be based on the design loads and seismicity of the site.

DESIGN - LIGHTING

Design the lighting system to resist the loads of NZS 1170.3 seismic requirements for parts and components. The detail design shall be based on the design loads and seismicity of the site.

DESIGN - MECHANICAL

Design the mechanical system to resist the loads of NZS 1170.3 seismic requirements for parts and components. The detail design shall be based on the design loads and seismicity of the site.

DESIGN - ELECTRICAL

Design the electrical system to resist the loads of NZS 1170.3 seismic requirements for parts and components. The detail design shall be based on the design loads and seismicity of the site.

Community Centre

Project Name	Sustainability Drop-In Centre
Project	And 591 Masters (Prof)
Date	20th September 2012
Scale	1:200 @ A3

Sheet	B04
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General Notes

CONSTRUCTION DESIGN

In order to meet the primary design objectives of the proposed Sustainability Drop-In Centre and the residential block, the construction design, entails specifying building materials and methods that are low energy/ sustainable and from local resources. As a result the building incorporates a post and beam structure, that is laterally braced using the Pyda long span timber floor trusses. The large ramps and transverse bracing is achieved using double flitch plate beams. With a flexibility for larger spans, the varied level of each block of the building can be expressed in the large atrium, designed to house the layered ramps and walkways expressing the architectural aesthetic.

WIND PRESSURE MOVEMENT

The Trespa TS35 series panels are designed for wind pressures specified by AS/NZS 1170.2 - beyond very high and high wind zones, the current site is designated as a high wind zone.

COMPONENT SEISMIC DESIGN - SPECIFIC DESIGN

Design the system and its anchorage details to resist the loads of the Trespa TS35 series panels for parts and components. The detail designates each fixed bolt to incorporate an expansion rubber joint or a friction bolt that allows movement of up to 15mm at each exposed joint.

TRESPA FACADE CLADDING

Trespa Facade Cladding, 10mm thick flat panel, based on thermosetting resin, is designed to be used with wood fibres, manufactured under high pressure and high temperature. The cladding panels have an integral decorative surface using Electron Beam Cured technology, UV resistance and color stability complies with ISO 105 A02. As such the wear staining and discoloration is minimal. The issue as the cladding system ensures an 80 year life.

Fire classified to EN 13501-1, Facade Cladding system to be tested to AS/NZS 4284.

RIGID AIR BARRIERS

Refer to appropriate rigid air barrier section, Physad Air Barrier System, 7mm or 10mm.

No.	Revision/Issue	Date

Drawing Title

Site Plan Zoom to Street Front

Project Name

Sustainability Drop In Centre
Designing for an active community focus

Project	Sheet
Ard 591 Master's (Prof)	
Date	
20th September 2012	B05
Scale	
1:250 @ A3

General Notes

CONSTRUCTION DESIGN

In order to meet the primary design objectives of the proposed Sustainability Drop-In Centre, the construction design, entails specifying building materials and methods that are low energy, sustainable and from local resources. As a result the building incorporates a post and beam structure, that is laterally braced using the Pyda long span timber floor trusses. The large ramps and transverse bracing is achieved using double flitch plate beams. With a flexibility for larger spans, the varied level of each block of the building can be expressed in the large atrium, designed to house the layered ramps and walkways expressing the architectural aesthetic.

WIND PRESSURE MOVEMENT

The Trespa TS35 series panels are designed for wind pressures specified by AS/NZS 1170.2 - beyond very high and high wind zones, the current site is designated as a high wind zone.

COMPONENT SEISMIC DESIGN -

SPECIFIC DESIGN

Design the system and its articulated details to resist the loads of the Trespa TS35 series panels in accordance with NZS 1170.5, section 8 Requirements for parts and components. The detail designates each fixed bolt to incorporate an expansion rubber joint or a friction bolt that allows movement of up to 15mm at each exposed joint.

TRESPA FACADE CLADDING

Trespa Facade Cladding, 10mm thick flat panel based on thermosetting high performance resin bonded with wood fibres, manufactured under high pressure and high temperature. The cladding panels have an integral decorative surface using Electron Beam Cured technology, UV resistance and color stability complies with ISO 105 A02. As such the wear staining and discoloration is minimal. The cladding issue as the cladding system ensures an 80 year life.

Fire classified to EN 13501-1, Facade Cladding system to be tested to AS/NZS 4294.

RIGID AIR BARRIERS

Refer to appropriate rigid air barrier section, Physad Air Barrier System, 7mm or 10mm.

No.	Revision/Issue	Date

Site Plan Zoom to Market Square

Drawing Title

Project Name Sustainability Drop-In Centre
Designing for an active community focus

Project	Sheet
Act 591 Masters (Prof)	
Date	
20th September 2012	
Scale	
1:200 @ A3	

B06

General Notes

CONSTRUCTION DESIGN
In order to meet the primary design objectives of the proposed Sustainability/ Drop-in Centre, the construction design, entails specifying building materials and methods that are low energy, sustainable and from local resources. As a result the building incorporates a post and beam structure, that is laterally braced using the Pyda long span timber floor trusses. The large ramps and transverse bracing is achieved using double flitch plate beams. With a flexibility for larger spans, the varied level of each block of the building can be expressed in the large atrium, designed to house the layered ramps and walkways expressing the architectural aesthetic.

WIND PRESSURE MOVEMENT
The Trespa TS35 series panels are designed for wind pressures specified by AS/NZS 1170.2 - beyond very high and high wind zones, the current site is designated as a high wind zone.

COMPONENT SEISMIC DESIGN - SPECIFIC DESIGN

Design the system and its subcomponents to resist the loads of NZS 1170.5, section 8 Requirements for parts and components. The detail designates each fixed bolt to incorporate an expansion rubber joint or a friction bolt that allows movement of up to 15mm at each exposed joint.

TRESPA FACADE CLADDING
Trespa Facade Cladding, 10mm thick flat panel, based on thermosetting resin impregnated glass fibre reinforced with wood fibres, manufactured under high pressure and high temperature. The cladding panels have an integral decorative surface using Electron Beam Cured technology. UV resistance and color stability complies with ISO 105 A02. As such the wear staining and discoloration issues associated with this issue as the cladding system ensures an 80 year life.

Fire classified to EN 13501-1, Facade Cladding system to be tested to AS/NZS 4284.

RIGID AIR BARRIERS
Refer to appropriate rigid air barrier section, Physal AF Barrier System, 7mm or 10mm.

No.	Revision/Issue	Date

Drawing Title
**Drop-in Centre
Ground Floor Plan**

Project Name
Sustainability Drop in Centre
Designing for an active community focus

Project Aci 591 Masters (Prof)	Sheet
Date 20th September 2012	B07
Scale 1:200 @ A3

General Notes

CONSTRUCTION DESIGN

In order to meet the primary design objectives of the proposed Sustainability/ Drop-in Centre, the construction design, entails specifying building materials and methods that are low energy, sustainable and from local resources. As a result the building incorporates a post and beam structure, that is laterally braced using the Pyda long span timber floor trusses. The large ramps and transverse bracing is achieved using double flitch plate beams. With a flexibility for larger spans, the varied level of each block of the building can be expressed in the large atrium, designed to house the layered ramps and walkways expressing the architectural aesthetic.

WIND PRESSURE MOVEMENT

The Trespa TS35 series panels are designed for wind pressures specified by AS/NZS 1170.2 - beyond very high and high wind zones, the current site is designated as a high wind zone.

COMPONENT SEISMIC DESIGN - SPECIFIC DESIGN

Design the system and its anchorage details to resist the loads of the Trespa TS35 series panels in NZS 1170.5, section 8 Requirements for parts and components. The detail designates each flitch bolt to incorporate an expansion rubber joint or a friction bolt that allows movement of up to 15mm at each exposed joint.

TRESPA FACADE CLADDING

Trespa Facade Cladding, 10mm thick flat panel based on thermosetting resin impregnated glass fibre with wood fibres, manufactured under high pressure and high temperature. The cladding panels have an integral decorative surface using Electron Beam Cured technology, UV resistance and color stability complies with ISO 105 A02, as such the wear staining and color change over time is negligible issue as the cladding system ensures an 80 year life.

Fire classified to EN 13501-1, Facade Cladding system to be tested to AS/NZS 4284.

RIGID AIR BARRIERS

Refer to appropriate rigid air barrier section, Physad Air Barrier System, 7mm or 10mm.

No.	Revision/Issue	Date

Drop-in Centre First Floor Plan

Project Name
Sustainability Drop in Centre
Designing for an active community focus

Project Act 591 Masters (Pro)	Sheet
Date 27th October 2011	B08
Scale 1:200 @ A3	

General Notes

CONSTRUCTION DESIGN
In order to meet the primary design objectives of the proposed Sustainability/ Drop-in Centre, the construction design, entails specifying building materials and methods that are low energy, sustainable and from local resources. As a result the building incorporates a post and beam structure, that is laterally braced using the Pyda long span timber floor trusses. The large ramps and transverse bracing is achieved using double flitch plate beams. With a flexibility for larger spans, the varied level of each block of the building can be expressed in the large atrium, designed to house the layered ramps and walkways expressing the architectural aesthetic.

WIND PRESSURE MOVEMENT
The Trespa TS35 series panels are designed for wind pressures specified by AS/NZS 1170.2 - beyond very high and high wind zones, the current site is designated as a high wind zone.

COMPONENT SEISMIC DESIGN - SPECIFIC DESIGN
Design the system and its articulated details to resist the loads of the seismic event in accordance with NZS 1170.5, section 8 Requirements for parts and components. The detail designates each fixed bolt to incorporate an expansion rubber joint or a friction bolt that allows movement of up to 15mm at each exposed joint.

TRESPA FACADE CLADDING
Trespa Facade Cladding, 10mm thick flat panel based on thermosetting resin impregnated glass fibre with wood fibres, manufactured under high pressure and high temperature. The decorative surface using Electron Beam Cured technology, UV resistance and color stability complies with ISO 105 A02, as such the wear staining and fading is minimal. The cladding system issue as the cladding system ensures an 80 year life.

Fire classified to EN 13501-1, Facade Cladding system to be tested to AS/NZS 4284.

RIGID AIR BARRIERS
Refer to appropriate rigid air barrier section, Physad Air Barrier System, 7mm or 10mm.

No.	Revision/Issue	Date

Drawing Title
Drop-in Centre
Second Floor Plan

Project Name
Sustainability Drop in Centre
Designing for an active community focus

Project And 591 Masters (Pvt)	Sheet
Date 20th September 2012	B09
Scale 1:200 @ A3

General Notes

CONSTRUCTION DESIGN

In order to meet the primary design objectives of the proposed Sustainability Drop in Centre and the residential block, the construction design, entails specifying building materials and methods that are low energy, sustainable and from local resources. As a result the building incorporates a post and beam structure, that is laterally braced using the Pyda long span timber floor trusses. The large ramps and transverse bracing is achieved using double flitch plate beams. With a flexibility for larger spans, the varied level of each block of the building can be expressed in the large atrium, designed to house the layered ramps and walkways expressing the architectural aesthetic.

WIND PRESSURE MOVEMENT

The Trespa TS35 series panels are designed for wind pressures specified by AS/NZS 1170.2 - beyond very high and high wind zones, the current site is designated as a high wind zone.

COMPONENT SEISMIC DESIGN -

SPECIFIC DESIGN

Design the system and its anchorage details to resist the loads of the building and its contents. Refer to NZS 1170.5, section 8 Requirements for parts and components. The detail designates each fixed bolt to incorporate an expansion rubber joint or a friction bolt that allows movement of up to 15mm at each exposed joint.

TRESPA FACADE CLADDING

Trespa Facade Cladding, 10mm thick flat panel, based on thermosetting resin, is a high performance material with wood fibres, manufactured under high pressure and high temperature. The cladding panels have an integral decorative surface using Electron Beam Cured technology, UV resistance and color stability complies with ISO 105 A02. As such the wear staining and discoloration is minimal. The issue as the cladding system ensures an 80 year life.

Fire classified to EN 13501-1, Facade Cladding system to be tested to AS/NZS 4284.

RIGID AIR BARRIERS

Refer to appropriate rigid air barrier section, Physal Air Barrier System, 7mm or 10mm.

No.	Revision/Issue	Date

Drawing Title
Site Plan
Residential Block

Project Name
Sustainability Drop in Centre
Designing for an active community focus

Project Aci 591 Master's (Prof)	Sheet
Date 20th September 2012	B10
Scale 1:200 @ A3

GROUND FLOOR PLAN

General Notes

CONSTRUCTION DESIGN

In order to meet the primary design objectives of the proposed Sustainability Drop-In Centre and the residential block, the construction design, entails specifying building materials and methods that are low energy, sustainable and from local resources. As a result the building incorporates a post and beam structure, that is laterally braced using the Pyda long span timber floor trusses. The large ramps and transverse bracing is achieved using double flitch plate beams. With a flexibility for larger spans, the varied level of each block of the building can be expressed in the large atrium, designed to house the layered ramps and walkways expressing the architectural aesthetic.

WIND PRESSURE MOVEMENT

The Trespa TS35 series panels are designed for wind pressures specified by AS/NZS 1170.2 - beyond very high and high wind zones, the current site is designated as a high wind zone.

COMPONENT SEISMIC DESIGN - SPECIFIC DESIGN

Design the system and its anchorage details to resist the loads of NZS 1170.5, section 8 Requirements for parts and components. The detail designates each fixed bolt to incorporate an expansion rubber part or a friction bolt that allows movement of up to 15mm at each exposed joint.

TRESPA FACADE CLADDING

Trespa Facade Cladding, 10mm thick flat panel, based on thermosetting resin, is designed to be used with wood fibres, manufactured under high pressure and high temperature. The cladding panels have an integral decorative surface using Electron Beam Cured technology, UV resistance and color stability, complies with ISO 105 A02. As such the wear staining and fading is minimal. The cladding system as the cladding system ensures an 80 year life.

Fire classified to EN 13501-1, Facade Cladding system to be tested to AS/NZS 4284.

RIGID AIR BARRIERS

Refer to appropriate rigid air barrier section, Physed Air Barrier System, 7mm or 10mm.

No.	Revision/Issue	Date

Drawing Title
Residential Block
Ground Floor Plan

Project Name	Sustainability Drop-In Centre Designing for an active community focus
Project	And 591 Masters (Prof)
Date	20th September 2012
Scale	1:200 @ A3

General Notes

CONSTRUCTION DESIGN

In order to meet the primary design objectives of the proposed Sustainability, DooH-Centre and the residential block, the construction design, entails specifying building materials and methods that are low embodied, sustainable and from local resources. As a result the building incorporates a post and beam structure that is laterally braced using the Pyralis long span timber floor trusses. The large spans and transverse bracing is achieved using double pitch plate beams, with a flexibility for larger spans, the varied level of each block of the building can be expressed in the large atrium, designed to house the layered ramps and walkways expressing the architectural aesthetic.

WIND PRESSURE MOVEMENT

The Trespa Ts35 series panels are designed for wind pressures specified by AS/NZS 1170.2 - beyond very high and high wind zones, the current site is designated as a high wind zone.

COMPONENT SEISMIC DESIGN - SPECIFIC DESIGN

Design the system and its anchorages/brings to resist the loads of the seismic zone in accordance with NZS 1170.5, section 8 Requirements for parts and components. This detail designates each fixed bolt to incorporate an expansion rubber joint on a friction bolt that allows movement of up to 15mm at each exposed joint.

TRESPA FACADE CLADDING

Trespasacacade Cladding, 10mm thick
 full panel, based on thermosetting
 resins, homogeneously reinforced with
 carbon fibers, manufactured under high
 pressure and high temperature, the
 cladding panels have an Integral
 Curved technology, UV resistance and
 color stability complies with ISO 105
 color changes are not an immediate
 issue as this cladding system ensures
 80 year life.

Fire classified to EN 13501-1. Fire Cladding system to be tested to AS/NZS 4284.

RIGID AIR BARRIERS

Refer to appropriate rigid air barrier section. Physéal Air Barrier System, 7mm or 9mm.

No.	Revision/Issue	Date

Drawing Title

Residential Block Floor Plan 2 & 4

Project Name

Sustainability Drop In Centre

Designing for an active community focus

Project	Sheet
Avcl 591 Master's (Prof)	
Date	
20th September 2012	
Scale	
1:200 @ A3	

CONSTRUCTION DESIGN

In order to meet the primary design objectives of the proposed Sustainability/ Drop-In Centre and the residential block, the construction design, entails specifying building materials and methods that are low energy/ sustainable and from local resources. As a result the building incorporates a post and beam structure, that is laterally braced using the Pyda long span timber floor trusses. The large ramps and transverse bracing is achieved using double flitch plate beams. With a flexibility for larger spans, the varied level of each block of the building can be expressed in the large atrium, designed to house the layered ramps and walkways expressing the architectural aesthetic.

WIND PRESSURE MOVEMENT

The Trespa TS35 series panels are designed for wind pressures specified by AS/NZS 1170.2 - beyond very high and high wind zones, the current site is designated as a high wind zone.

COMPONENT SEISMIC DESIGN - SPECIFIC DESIGN

Design the system and its anchored bracing to resist the loads of NZS 1170.5, section 8 Requirements for parts and components. The detail designates each fixed bolt to incorporate an expansion rubber joint or a friction bolt that allows movement of up to 15mm at each exposed joint.

TRESPA FACADE CLADDING

Trespa Facade Cladding, 10mm thick flat panel based on thermosetting resin impregnated glass fibre with wood fibres, manufactured under high pressure and high temperature. The cladding panels have an integral decorative surface using Electron Beam Cured technology, UV resistance and color stability complies with ISO 105 A02. As such the wear staining and fading is minimal. The cladding system issue as the cladding system ensures an 80 year life.

Fire classified to EN 13501-1, Facade Cladding system to be tested to AS/NZS 4284.

RIGID AIR BARRIERS

Refer to appropriate rigid air barrier section, Physal Air Barrier System, 7mm or 9mm.

No.	Revision/Issue	Date

Drawing Title
Residential Block
Floor Plan 3
with linking overbridge

Project Name

Sustainability Drop in Centre
Designing for an active community focus

Project	Sheet
Acl 591 Masters (Prof)	
Date	
20th September 2012	B13
Scale	
1:200 @ A3

TYPICAL PLAN FLOOR 3

General Notes

CONSTRUCTION DESIGN

In order to meet the primary design objectives of the proposed Sustainability Drop-In Centre residential block, the construction design, entails specifying building materials and methods that are low energy/ sustainable and from local resources. As a result the building incorporates a post and beam structure, that is laterally braced using the Pyda long span timber floor trusses. The large ramps and transverse bracing is achieved using double flitch plate beams. With a flexibility for larger spans, the varied level of each block of the building can be expressed in the large atrium, designed to house the layered ramps and walkways expressing the architectural aesthetic.

WIND PRESSURE MOVEMENT
The Trespa TS35 series panels are designed for wind pressures specified by AS/NZS 1170.2 - beyond very high and high wind zones, the current site is designated as a high wind zone.

COMPONENT SEISMIC DESIGN - SPECIFIC DESIGN

Design the system and its anchorage bracing to resist the loads of the structure and its components, NZS 1170.5, section 8 Requirements for parts and components. The detail designates each fixed bolt to incorporate an expansion rubber joint or a friction bolt that allows movement of up to 15mm at each exposed joint.

TRESPA FACADE CLADDING

Trespa Facade Cladding, 10mm thick flat panel based on thermosetting resin impregnated glass fibre with wood fibres, manufactured under high pressure and high temperature. The cladding panels have an integral decorative surface using Electron Beam Cured technology. UV resistance and color stability complies with ISO 105 A02. As such the wear staining and discoloration is minimal. The warranty issue on the cladding system ensures an 80 year life.

Fire classified to EN 13501-1, Facade Cladding system to be tested to AS/NZS 4284.

RIGID AIR BARRIERS

Refer to appropriate rigid air barrier section, Physal Air Barrier System, 7mm or 10mm.

No.	Revision/Issue	Date

Drawing Title

Residential Block
Roof Plan

Project Name

Sustainability Drop-In Centre
Designing for an active community focus

Project	Sheet
Act 591 Masters (Prof)	
Date	
20th September 2012	B14
Scale	
1:200 @ A3

Roof Plan

CONSTRUCTION DESIGN

In order to meet the primary design objectives of the proposed Sustainability Drop-In Centre residential block, the construction design, entails specifying building materials and methods that are low energy/ sustainable and from local resources. As a result the building incorporates a post and beam structure, that is laterally braced using the Pyda long span timber floor trusses. The large ramps and transverse bracing is achieved using double flitch plate beams. With a flexibility for larger spans, the varied level of each block of the building can be expressed in the large atrium, designed to house the layered ramps and walkways expressing the architectural aesthetic.

WIND PRESSURE MOVEMENT

The Trespa TS35 series panels are designed for wind pressures specified by AS/NZS 1170.2 - beyond very high and high wind zones, the current site is designated as a high wind zone.

COMPONENT SEISMIC DESIGN - SPECIFIC DESIGN

Design the system and its anchorage details to resist the loads of the building as specified in NZS 1170.5, section 8 Requirements for parts and components. The detail designates each fixed bolt to incorporate an expansion rubber joint or a friction bolt that allows movement of up to 15mm at each exposed joint.

TRESPA FACADE CLADDING

Trespa Facade Cladding, 10mm thick flat panel, based on thermosetting resin impregnated glass fibre with wood fibres, manufactured under high pressure and high temperature. The cladding panels have an integral decorative surface using Electron Beam Cured technology. UV resistance and color stability complies with ISO 105 A02. As such the wear staining and fading resistance is excellent. The issue as the cladding system ensures an 80 year life.

Fire classified to EN 13501-1, Facade Cladding system to be tested to AS/NZS 4284.

RIGID AIR BARRIERS

Refer to appropriate rigid air barrier section, Physal Air Barrier System, 7mm or 9mm.

No.	Revision/Issue	Date

Drawing Title

Residential Block
Longitudinal Section

Project Name

Sustainability Drop-In Centre
Designing for an active community focus

Project	Sheet
And 591 Masters (Prof)	
Date	
20th September 2012	B15
Scale	
1:200 @ A3	

SECTION C-C

General Notes

CONSTRUCTION DESIGN

In order to meet the primary design objectives of the proposed Sustainability Drop-In Centre and the residential block, the construction design, entails specifying building materials and methods that are low energy/ sustainable and from local resources. As a result the building incorporates a post and beam structure, that is laterally braced using the Pyda long span timber floor trusses. The large ramps and transverse bracing is achieved using double flitch plate beams. With a flexibility for larger spans, the varied level of each block of the building can be expressed in the large atrium, designed to house the layered ramps and walkways expressing the architectural aesthetic.

WIND PRESSURE MOVEMENT

The Trespa TS35 series panels are designed for wind pressures specified by AS/NZS 1170.2 - beyond very high and high wind zones, the current site is designated as a high wind zone.

COMPONENT SEISMIC DESIGN - SPECIFIC DESIGN

Design the system and its anchorage details to resist the loads of the Trespa TS35 series panels for parts and components. The detail designates each flitch bolt to incorporate an expansion rubber joint or a friction bolt that allows movement of up to 15mm at each exposed joint.

TRESPA FACADE CLADDING

Trespa Facade Cladding, 10mm thick flat panel, based on thermosetting wood fibres, manufactured under high pressure and high temperature. The cladding panels have an integral decorative surface using Electron Beam Cured technology. UV resistance and color stability complies with ISO 105 A02. As such the wear staining and discoloration of the cladding system issue as the cladding system ensures an 80 year life.

Fire classified to EN 13501-1, Facade Cladding system to be tested to AS/NZS 4284.

RIGID AIR BARRIERS

Refer to appropriate rigid air barrier section, Physal Air Barrier System, 7mm or 9mm.

No.	Revision/Issue	Date

Drawing Title

Residential Block
Transverse Section

Link to Drop-In Centre Rooftop Garden

Project Name

Sustainability Drop-In Centre
Designing for an active community focus

Project	Sheet
Acl 591 Masters (Prof)	
Date	
20th September 2012	B16
Scale	
1:100 @ A3

SECTION A-A

CONSTRUCTION DESIGN

In order to meet the primary design objectives of the proposed Sustainability Drop-In Centre and the residential block, the construction design, entails specifying building materials and methods that are low energy/ sustainable and from local resources. As a result the building incorporates a post and beam structure, that is laterally braced using the Pyda long span timber floor trusses. The large ramps and transverse bracing is achieved using double flitch plate beams. With a flexibility for larger spans, the varied level of each block of the building can be expressed in the large atrium, designed to house the layered ramps and walkways expressing the architectural aesthetic.

WIND PRESSURE MOVEMENT

The Trespa TS35 series panels are designed for wind pressures specified by AS/NZS 1170.2 - beyond very high and high wind zones, the current site is designated as a high wind zone.

COMPONENT SEISMIC DESIGN - SPECIFIC DESIGN

Design the system and its articulated bracing to resist the loads of the building and its contents. Refer to NZS 1170.5, section 8 Requirements for parts and components. The detail designates each fixed bolt to incorporate an expansion rubber joint or a friction bolt that allows movement of up to 15mm at each exposed joint.

TRESPA FACADE CLADDING

Trespa Facade Cladding, 10mm thick flat panel, based on thermosetting resin impregnated glass fibre with wood fibres, manufactured under high pressure and high temperature. The cladding panels have an integral decorative surface using Electron Beam Cured technology. UV resistance and color stability complies with ISO 105 A02, as such the wear staining and fading is not a concern. The cladding issue as the cladding system ensures an 80 year life.

Fire classified to EN 13501-1, Facade Cladding system to be tested to AS/NZS 4294.

RIGID AIR BARRIERS

Refer to appropriate rigid air barrier section, Physad Air Barrier System, 7mm or 9mm.

No.	Revision/Issue	Date

Drawing Title

Proposed Site Section

Project Name

Sustainability Drop-In Centre
Designing for an active community focus

Project	Sheet
Act 591 Masters (Prof)	
Date	
20th September 2012	B17
Scale	
1:200 @ A3

SECTION A-A

General Notes

CONSTRUCTION DESIGN
In order to meet the primary design objectives of the proposed Sustainability/ Drop-in Centre and the residential block, the construction design, entails specifying building materials and methods that are low energy/ sustainable and from local resources. As a result the building incorporates a post and beam structure, that is laterally braced using the Pyda long span timber floor trusses. The large ramps and transverse bracing is achieved using double flitch plate beams. With a flexibility for larger spans, the varied level of each block of the building can be expressed in the large atrium, designed to house the layered ramps and walkways expressing the architectural aesthetic.

WIND PRESSURE MOVEMENT
The Trespa TS35 series panels are designed for wind pressures specified by AS/NZS 1170.2 - beyond very high and high wind zones, the current site is designated as a high wind zone.

COMPONENT SEISMIC DESIGN - SPECIFIC DESIGN
Design the system and its anchorage details to resist the loads of the Trespa TS35 series panels in accordance with NZS 1170.5, section 8 Requirements for parts and components. The detail designates each fixed bolt to incorporate an expansion rubber joint or a friction bolt that allows movement of up to 15mm at each exposed joint.

TRESPA FACADE CLADDING
Trespa Facade Cladding, 10mm thick flat panel, based on thermosetting resin impregnated glass fibre with wood fibres, manufactured under high pressure and high temperature. The cladding panels have an integral decorative surface using Electron Beam Cured technology. UV resistance and color stability complies with ISO 105 A02. As such the wear staining and fading is minimal. The warranty issue on the cladding system ensures an 80 year life.

Fire classified to EN 13501-1, Facade Cladding system to be tested to AS/NZS 4284.

RIGID AIR BARRIERS
Refer to appropriate rigid air barrier section, Physal Air Barrier System, 7mm or 9mm.

No.	Revision/Issue	Date

Drawing Title
Drop-in Centre Atrium
Partial Section
Lines to varying levels on either side of atrium.

Project Name
Sustainability Drop in Centre
Designing for an active community focus

Project Aci 591 Masters (Pro)	Sheet
Date 20th September 2012	B19
Scale 1:50 @ A3	

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3

Appendix C

Trade Specification Literature