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Future Christchurch: Towards an Efficient Economy

Che Wei (Jacky) Lee

Christchurch, like most cities around the world, has evolved from a walking city, to a transit city, and currently the automobile city. The advancement of each transportation technology permitted the further expansion of cities while complying to same duration of travel time. This has consequently steered Christchurch towards urban sprawl that suffers from numerous problems such as the ever-increasing burden of traffic. A significant part of the problem is the persisting preference of private cars which undermines environmental and public health impacts. Due to Christchurch’s low population density, initiatives for improving public transport was often deemed too risky. Therefore large investment funds into state highways and road widening has long been the short-term fix to resolve road congestions.

This thesis explores an alternative solution for overcoming auto-dependence. It takes advantage of Christchurch’s car culture, and applies emerging transport initiatives which underscore collaboration as a method of consuming. It also examined the applicability of such initiatives, its economical and social benefits, and the potential for it to act as a catalyst for the betterment of public transport. It envisions a future that questions the necessity of owning a car by providing multi-modal transportation. In doing so, Christchurch can evolve towards an efficient economy.
Acknowledgements
This thesis could not have been written without Camia Young, who not only served as the best advisor anyone could ask for, but also encouraged and challenged me throughout the year. Our shared outlooks towards personal vehicles and advocacy in bike commuting has kickstarted the research, aiming to find a possible transport solution for the future of Christchurch.

I also thank Chris Barton, Journalist of NZ Herald, who throughout the year, encouraged me to think critically about each decisions made, and motivated the group to pushing ourselves to be recognized outside the academic realm.

I would also like to acknowledge and extend my heartfelt gratitude to the rest of Future Christchurch studio: Zhi Jian (David) Wong, for his notable guidance and support over the years. Biran He, for his encouragement and virtuous critique on all of my university work. Praveen Karunasinghe, for his incredible public speaking mentorship. Alexander Haryowiseno, for his generous assistance in editing. Erica Austin, for her infectious passion and positivity for Christchurch. And our secret weapon Duy Khang Phuong, for his astounding knowledge in structural engineering.

Finally, I thank the people of Christchurch for their warmhearted support and feedback of Future Christchurch Initiative. This thesis shares and appreciates their optimistic and aspiring attitude towards the envisioned Christchurch in this thesis.
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The Collective Proposal for the Future Christchurch Initiative

Authors: A. Haryowiseno, CWJ. Lee, ZJD. Wong, P. Karunasinghe, B. He, E. Austin

A group of six thesis students from the University of Auckland’s School of Architecture pooled their individual thesis to engage in a collective design project for the future rebuild of Christchurch. Each student began by researching a unique economy in Christchurch with the aim to tease out possible catalysts for growth and stimulate investment in the city. There is a strong overlap between the individual projects, recognizing that economies are not independent from one another, rather they intimately coexist.

The brief for this project stemmed from two critiques on the Christchurch Central City Draft Plan, which was released in December 2011. During the consultation phase an International Speaker Series was held in Christchurch and the invited guests were asked to critique the plan. The general consensus was two fold, that the plan was limited in scope due to the mandate to look only at the CBD, and it lacked a financial strategy to realize the plan. It was from these critiques that the aim for this group’s project emerged, which is to consider the entire Christchurch legal boundary and any factors affecting it, i.e. regionally, nationally and globally. As well the group set out to research the local economies to find drivers for proposed urban strategies. The recently released Christchurch Central Development Unit’s Blueprint to rebuild the Central Business District underscores the importance of taking the economy into consideration; while the students offer different proposals the intention to foster a healthy economy is shared.

Further to these two critiques is the added ambition to develop an appropriate strategy for Christchurch, one that paves the way for its future. This requires understanding what makes Christchurch unique, while at the same time reflecting on 20th Century planning so as to learn from it and develop a 21st Century approach. Cities like nature evolve and adapt to changing trends, technologies and economies. In the late 20th Century it was common for large areas of cities to be developed as new financial centres, like Canary Wharf in London or La Défense in Paris, but once completed they lacked the character and qualities the older parts of these European cities offered. Such developments were 15-20 year long construction projects, and were conceived of as large-scale modern developments with a fixed end result. Because of the nature of how these projects were designed, they were unable to adapt to change, which involves a certain organic responsive quality found in older parts of European cities. Once completed these large developments often felt static and lacked character, which was certainly not the intention upon conception. Further, we live in an age where the future is unlikely to be like the present, and given the exponential rate of innovation the future is rather unpredictable. For these reasons, the student’s proposals aim to anticipate the inevitable nature of change and it’s inherent unpredictability. To do this they are approaching planning not from an end result but rather from a starting point.

The work was conducted across three stages, first the students each developed an in-depth research into a unique economy, from this they developed an urban strategy and then an architectural example. In the Innovation Economy, Alex Haryowiseno recognizes that Christchurch is undergoing a typical evolution where low value manufacturing is being replaced by high manufacturing. Alex is developing a strategy that promotes dynamic zoning, which aims to attract investors from various innovative research and development companies. Che Wei (Jacky) Lee has developed a proposal for the Transportation Economy that transitions Christchurch from a city congested with single occupant vehicles towards a multi-modal city that can efficiently move people and goods. In the Energy Economy, Zhi Jian (David) Wong is proposing a transition from a fossil fuel dependent economy towards a renewable energy based economy; to do this he has proposed a green energy precinct. Biran He has approached the Housing Economy by developing housing that can adapt to trends and transform over time to meet changing demographics. In the Creative Economy, Praveen Karunasinghe explains the value of providing a creative education vs. a productive education, and develops a strategy to distribute learning centers throughout the city in order to promote a mindful society and lifelong learning. While Erica Austin addresses how to shift from an event city (static venues) to an eventful city (transformational venues) in the Experience Economy by designing a centralized events hub with satellite structures that populate the city at different times of the year. Together, they form the ‘Future Christchurch Initiative’.
Since the United Nations publication of Our Common Future (Brundtland, 1987), sustainable development has become a prominent concept in creating a more economical, social and environmentally friendly world. It was also in the 19th Century that the zoned planning system was developed, which meant areas were developed with single uses. While the aim was to improve quality of life, this approach was successful in that it prevented social injustices such as industry being adjacent to housing, but it has had other costly consequences on city developments. The largest of which is the nature of urban sprawl, which depends on automobiles to obtain most services. This sort of city development was shaped by an era run by cheap oil. A system which seemed to run efficiently back then, is now problematic due to the growth of population and private vehicle ownership over the past few decades. Modern cities suffer an endless list of problems because of urban sprawl, including loss of productive land, traffic congestion and spiralling infrastructure cost among others (Duany, Plater-Zyberk, & Speck, 2000).

**Evolution of Christchurch**

Christchurch, like most cities, has been progressively shaped by the evolution of transport technologies from walking to transit and automobile. This enabled cities to form a new style of development, which resulted in a push outwards. This is coined by Newman as the “one hour wide city”, which meant that cities could easily spread up to fifty kilometres as long as the commute time stays within one hour (Newman & Jennings, 2008). This is a natural evolution of cities and is “understandable but not wholly beneficial”(Coupland, 1996). This change of city size via change in transport technology is noteworthy in that, each advancement allowed an expansion of the city, it also made the previous transport technology less effective (Dravitzki & Lester, 2007). For instance, The existing transport network in Christchurch favours people to drive cars. It is perceived as the easiest, most convenient way to travel. Thus the growth of the private vehicle has reached 0.8 vehicles per capita in 2008 (Ministry of Transport, 2012) while consequently the patronage on public transport is at a historic low.

**Public Transport in Christchurch**

Christchurch’s current urban sprawl condition has made its bus network inefficient and has consequently resulted in low patronage over the years. However in the wake of the recent earthquakes, now is the perfect time to rethink the transport network, at the same time future proof the impeding shortage of petroleum. The cordon off city centre further accentuates the demand of a new transport solution as roadways suffer from congestions, adding to drivers’ frustrations. What was a mono-centric city is now gradually transforming into a multi-nodal city as business begins to shift outside of the city centre. The recent draft plan proposed by the Christchurch City Council (CCC) in December 2011 addressed the need for an alternative transport by reintroducing light-rail, however there was a constant lack of evidence provided by the CCC to persuade the government to help fund the $1.8 billion package, especially knowing that mass rapid transit will only be effective when provided with sufficient population density, (Jhumm, 2012). Christchurch lacks the critical ingredient for making a successful transit solution: Density. Therefore the large investment funds into state highways and road widening from the government has made its bus network ineffect(Weisbrod & Reno, 2009). This thesis aims to dissect the current conditions of Christchurch’s transportation network and its effects on the economy.

It is recognised that as oil becomes increasingly scarce, transport and commodity prices will increase (Mitchell, 2008). The availability of cheap oil has a major contribution to Christchurch’s low density living as people are prepared to travel farther to engage in activities. The low travel costs have occurred simultaneously with societal changes such as increased household income, smaller families, more leisure time and the shift from shopping as necessity to shopping as recreation (Rotem-Mindali & Salomon, 2007). It is for the aforementioned social changes and shift to private transport that significantly changed New Zealand retail landscapes such as the domination by malls, big box retail centres and supermarkets (Abigail, 2009).

Public transportation services are pivotal to the wellbeing of a nation. They provide mobility, shape land use and development patterns, generate jobs and enable economic growth, and support public policies regarding energy use, air quality and carbon emissions (Weisbrod & Reno, 2009). This thesis aims to dissect the current conditions of Christchurch’s transportation network and its effects on the economy.

“Cities of fear make decisions based on short-term, even panicked, responses; cities of hope plan for the long term, with each decision building towards that vision, hopeful that some of the steps will be tipping points that lead to fundamental change. Cities of fear engage in competition as their only driving force, while cities of hope build consensus around cooperation and partnership. Cities of fear see threats everywhere while cities of hope see opportunities to improve in every crisis.” (Newman et al., 2009)
have taken advantage of commuting behaviours in land on the edges of cities where rents are cheaper. However as driving costs increase in the near future, this thesis believes that there will be a corresponding shift of ammenities to focus back to central places.

Pushing Past the 4th Wave
As previously mentioned, transportation technology has been the main driver that shapes the urban form. It was the five waves of innovation (Water power mechanisation, steam power rail, electricity, petroleum and digital networks) that contributed to societal changes for the last two centuries (Newman et al., 2009). While we are already entering the sixth wave of innovation, namely sustainable development, Christchurch’s urban form still lingers at the 4th wave, the automobile city. As innovation of digital networks created new ways of communicating over recent years, this thesis raises the question of how innovation of information technology could potentially change commuting behaviours to affect the future urban fabric of Christchurch.

Multi-modal City
Within the New Zealand context Christchurch has the highest vehicle ownership, with 0.8 cars per capita and 2.5 cars per household. Its car use pattern suggests that 95% of commute to work are occupied by only a single occupant, the driver (Ministry of Transport, 2012). The problem is not the number of cars we own, but how we travel that makes a significant difference to the community; the preference is not by choice, but forced due to the lack of choice. This thesis aims to propose innovative solutions that promotes car-sharing, while at the same time designing a more efficient transport system. The intention is to push Christchurch past its auto-dependent state, into a multi-modal city.

Carpark Reclamation
It is evident that the amount of abundant amount of spaces dedicated to car parking within the city center has had adverse effects on public transport patronage; minimum parking requirements has been the one planning rule that does more damage to public transport than any other. It has provided a substantial hidden subsidy for those who drive, compared to those who commute via public transport, or walk or cycle (Arbury, 2009). Cars can take up a substantial amount of space. A safe estimate suggests that 32% of the Cathedral Square area unit is covered with car parking spaces that could accommodate a minimum of 1,000 single detached homes or retail spaces. This thesis will address the adverse effects of the abundant amount of these single use spaces, and aims to find a solution to allow the reclamation of these wasted spaces. As the betterment of public transport progresses, such spaces can be utilized much more usefully to correspond the shift of ammenities to central places and the prevention of the aforementioned sprawl.

Adaptable Interchange
Innovative startups such as Better Place, Zip Car and NextBike, suggests a new trend of personal transport solution that demands spontaneous solutions. Thus this thesis aims to devise an architecture response that can be highly adaptable to accommodate the fast-changing transportation technology landscape that has emerged over the recent years. This thesis proposes to design a new type of transit oriented architecture that not only caters to various modes of transport, but are flexible enough to be implemented within the whole of Christchurch.
Economic Research
1.0 Urban Form & Mobility

Since the development of cities several thousand years ago, their form and patterns have changed significantly. The establishment of city economics has drawn in resources from across the globe, with consumption occurring far from the place of production. (Newman & Jennings, 2008) As the population of cities grow, decision making becomes invariably more complex. However, they are most often still shaped and structured by one fundamental driver: personal mobility.

1.1 Travel Time Budget

The average travel-time budget has always been around one hour per day. This is also known as the Marchetti constant throughout the urban history. This time-budget appears to be the principle for how people live in cities: the preference of traveling on average half an hour for their main journey to and from home (Newman & Jennings, 2008). Thus the Marchetti constant dictates that cities can be no more than “one hour wide.” This essentially meant that an average trip can be half an hour and a maximum trip can be one hour.

This understanding of an acceptable maximum travel time provides insight and planning priorities for cities, as a city tends to become dysfunctional beyond a particular size and spread. Cities with high density can grow larger in population because they cover less area, therefore various modes of transportation could still take people to most destinations under half an hour. On the other hand, cities with lower density will reach their size limits sooner because a city with an average transit will begin to be dysfunctional once its size spreads greater than “one hour wide” (Newman & Jennings, 2008).

The other limit to the size of a city is the overstretch of the cities’ bio-regional capacities. Cities can often exceed the capacity of their watersheds, food, energy, and materials to provide sustainable consumption, forcing the city to rely more on imports. It is therefore the human ecology and systems which leads to the shape and structure of cities.

For the argument of this thesis, I will begin by examining how cities have changed through history while keeping this major characteristic of the acceptable travel time. Understanding the way urban systems have historically been shaped by transport priorities will provide a better insight into how a more sustainable city could be shaped in the future.
1.2 Walking Cities

Initially cities embraced the necessity of walking as the main mode of transport, this determined the urban form of cities until the middle of nineteenth century. A highlighted feature of these walking cities is the high densities of between 100 and 200 people per hectare, mixed land use and narrow streets. Thus cities were usually small and compact, often no more than five to eight kilometers across. It also allowed agricultural land to be within close proximity, providing accessibility to all parts of the city with an average half-hour journey there and back.

The early settlement of Christchurch began in November 1847. The town was modeled after a traditional community back in England, with landowners, small farmers and workers, and with churches, shops and schools. The plan of Christchurch at the time consists of the characteristics of a walking city, with longest distance spanning 3 kilometers. Like most walking cities, it has a mono-centric form.

Figure 2: Map of 1874 Christchurch

Christchurch City Libraries, http://goo.gl/IFJS1
Due to invention of trams and trains in the mid 1800s and the pressure from population and industrial growth, the old walking city was slowly expanded into transit-based cities. These cities consisted of medium-density, mixed-use developments at the rail nodes and along the tram routes. Consistent with the travel-time budget, cities could now extend up to twenty to thirty kilometers. Walking villages based around train or tram routes were typically formed at various nodal points. Agricultural and natural areas still remained between the corridors of linear development.

Christchurch’s introduction to rail dates back to 1863, when the Ferrymead to Moorhouse Avenue railway opened as New Zealand’s first public steam railway in the next 20 years. Steam and horse trams transformed the once walking city of Christchurch to a transit city. This consequentially pushed the boundaries of the city further outwards, at approximately 10km wide.

Figure 3: Map of 1941 christchurch
Motorized transportation has begun to shape cities since the 1950s, particularly in North America and Australia. Car-dependent cities have the characteristics of low densities of between ten to twenty people per hectare. They are typically bigger in area than transit cities and much more spread out, given that automobiles can travel up to fifty kilometers within the travel time budget. Other than urban parks, there is generally little access to agricultural and natural lands because the areas between linear corridors of the transit city have been filled with car-dependent suburbs whenever roads are established.

This form of city gained great popularity among many developed cities. Coupled with motorway infrastructure, the car enabled cities to be traversed more quickly compared to public transport. However, the consequences of automobile cities are high ecological footprints and high economic costs. Automobile cities typically use more than 1,000 liters of gasoline per person per year on mobility; transit cities use around 300 to 500 liters; and walking cities use less than 100 liters per person per year. Car-dependent cities spend around 12 to 17 percent of their household expenditure on transportation costs, compared to 5 to 8 percent in transit and walking cities (Newman & Kenworthy, 1999). The high costs are due to the space requirements for cars and the expense of their purchase and use.

Car-dependent cities also create a number of social problems. The sense of community is undermined by precluding casual interaction that occur while walking and using public transport.

To sum up, the dramatic rate of urbanization takes up more land and increases the impact on ecosystem patterns. The demands of urban population exerts greater pressure on the ecosystems outside cities - all because of the need to accommodate people's average one-hour travel-time budget. The availability of cheap petroleum has fueled the automobile-dependent urban forms known as sprawling cities with high ecological footprints and multiple social issues.

Christchurch today has most characteristics described above. The uptake of private automobiles in the 1950s has had severe impact on existing trams, hence a dramatic fall of public transportation which is to be examined later in this section. Currently Christchurch is roughly 30km wide, which is in fact an ideal size for the transit city previously mentioned. However, despite having the advantage of a flat typography, the existing low density coupled with the transport network favours people who drive cars. This is seen as one of the many contributing factors to the lack of patronage for and public transportation and therefore a lack of advancement over the past years.
1.5 Comparing Walking, Transit and Automobile Cities

Most cities today have a combination of the discussed urban forms, often in rings around the center. For instance, Melbourne’s fringe areas has two to three times more car use and three times less public transport and walking than the wealthy core of the city. What is interesting is that when comparing cities, there is no correlation between car use and the average per capita wealth (Newman, 2000) (Figure 5). Moreover, the two opposing commuting (cars and public transport) patterns are more apparent in Figure 6.

Transit Speed
The key to these different cities, and the effectiveness of its public transport infrastructure, is the relative speed of transit to traffic. Most U.S. and Australian cities have much higher traffic speeds than transit speeds; thus with the constraints of the travel-time budget, people will tend to drive, allowing high speed trains to be the only competition. European cities and wealthy Asian cities usually have higher transit than traffic speeds, therefore a much better public transport patronage. However this only works if there is no high-speed freeway system. Developing countries such as Bangkok, Kuala Lumpur, Manila have not developed quality mass-transit systems, so buses are stuck in traffic, despite having a transit-based urban form. Hence, city streets are usually congested as people try to minimize their travel times. For instance, in Bangkok, where average speed for traffic is 13 kph, the transit speed is at a non competitive 9 kph due to the lack of trains or bus-lanes. These cities can overcome automobile dependency effectively if they obtain sustainable rail systems or bus rapid-transit schemes that travel faster than other traffic.

**Figure 5:** Cities wealth and car use

**Figure 6:** Workers using public transport vs private vehicle energy consumption per capita

Newman and Kenworthy, 1998
<table>
<thead>
<tr>
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<th>Traditional pre-modern walking city</th>
<th>Industrial transit city</th>
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<td>Larger industries, concentrated in parts of cities (national and regional economy)</td>
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<td>Cars (almost exclusively)</td>
<td>Walking and cycling (local), transit (across city), cars (supplementary), air (for global)</td>
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<td><strong>Urban Form</strong></td>
<td>Walking city; small, dense, mixed, organic</td>
<td>Transit city: medium-density suburbs, dense mixed centre, corridor with green wedges</td>
<td>Automobile city: high-rise CBD, low-density suburban sprawl zoned to further separate functions</td>
<td>Sustainable City: local urban villages (high density) linked across city by transit, medium and low density areas around villages, no more sprawl</td>
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<td>Medium</td>
<td>High</td>
<td>Low-medium</td>
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<tr>
<td><strong>- wastes</strong></td>
<td>Low</td>
<td>Medium</td>
<td>High</td>
<td>Low-medium</td>
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<tr>
<td><strong>- nature orientation</strong></td>
<td>Close to rural areas (dependent)</td>
<td>Some connection through green wedges</td>
<td>Little nature orientation (independent)</td>
<td>Close to nature</td>
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*Figure 7: Comparing Walking, Transit and Automobile Cities*  
Newman and Kenworthy, 1998
In 1984 American Public Transportation Association (APTA) carried out an analysis of the employment and business revenue impacts of investment in public transit. It demonstrated that public transit investment supports substantial amount of job creation and increase in business revenues at the national, state and local level, creating significant economic benefits in addition to the more obvious mobility benefits provided to riders and the traveling public (Cambridge Systematics Inc & Economic Development Research Group, 1999). The same analytical techniques have been applied in several major metropolitan areas and the analyses showed that the economic return was many times greater than the initial investment, and that the long-term negative economic impacts of under-investing were severe.

To understand the full scope of the economic impact from transportation investment, one needs to distinguish the difference between economic impact and benefit-cost analysis:

- **Economic Impact Analysis** focuses specifically on measurable changes in the flow of money (income) going to households and businesses, including both spending and productivity effects.

- **Benefit-Cost Analysis** includes social, environmental and quality of life impacts. Below are demonstrations of the economic impact of transportation:

**Direct Spending**
Direct spending refers to the capital investment in public transportation that supports the purchase of equipment and facilities. These will also support associate jobs such as drivers, maintenance workers and other transportation agency workers. Thus, investment in public transportation projects and services can directly support short-term construction jobs and longer term operations jobs (Weisbrod & Reno, 2009).

**Indirect and Induced Effects**
- **Indirect Effects:** The above direct spending can lead to sales and thus support jobs in supplier industries.

- **Induced Effects:** The wages of construction workers and public transportation operation workers, as well as growth in wages at suppliers, can all lead to further retail sales for businesses that provide consumer goods and services.

**Travel Improvement Impacts**
The long-term travel benefits are fundamental justifications for public transportation investment that can ultimately lead to greater and more lasting impacts on an area’s economy. The direct benefits for travellers falls into four categories:
- Travel time savings
- Travel cost savings
- Reliability improvements
- Safety improvements

These benefits can all provide monetary savings for passengers and travellers who keep using other transportation modes.

**Non-Monetary Impacts**
In addition to the transportation and economic benefits above, which can be quantified or expressed in dollar terms, it is also useful to recognize broader qualitative benefits. The value of having the a choice of transportation when typical mode of travel is unavailable is one of many impacts that should be included for decision making. This also creates resiliency for transportation under circumstances such as vehicle unavailability due to maintenance and repair, high gas prices or parking costs, or short term disability or financial constraints (Weisbrod & Reno, 2009).

The most often celebrated environmental benefits due to increased public transportation is the reduction of air pollution, noise and a wide variety of automobile related health problems. These impacts are illustrated below in Figure 8.

**Value of Choice**
The value of giving people a choice to commute can effectively reduce the amount of car use and reduce on road congestions.
Through the increasing transit services, it will consequently affect travel patterns in a variety of ways. This in turn, have consequences for the economy. Vehicles that are removed from traffic via transit use produces travel time savings for both transit and highway users. Although these savings may be hard to pinpoint through quantitative terms, it reflects real improvements in mobility and accessibility at a personal, neighborhood and community level.

The driving fact behind the understanding of economic impacts of transit investments are the fact that businesses and workers have a limited budget of time and dollars. A well-functioning transit system saves time and reduces travel related costs for the millions of transit and highway users daily. Business can benefit from allocating less resources to logistic costs and gaining a larger workforce. This offers businesses to develop competitive products and services in the long run in order to benefit themselves and supporting businesses. The ripple effect of transit investment are illustrated in Figure 9.
3.0 Rise and Decline of New Zealand Public Transport

The public transport in New Zealand has typically sought to resolve two major transport problems: traffic congestion in the major cities and generation of greenhouse gas emissions. In 2009, New Zealand’s total greenhouse gas emission were 70.6 million tones of carbon dioxide equivalent, which means it is 19.4% higher than the 1990 level. Ministry for the Environment states that this long-term trend is largely due to growth in energy emissions, particularly from road transport and electricity generation. As the demand for energy grows and prices rise, the energy consumption becomes increasingly tied to its economic viability. Cities with high urban energy metabolism will be at a competitive disadvantage in the future (Austin, 2012).

When compared with reports from Land Transport NZ (Figure 10.), Road transportation accounts for a vast majority of all transport CO2 emissions (Ministry for the Environment, 2011). This is the result of a high preference of commuting via personal automobiles over public transport. Statistics from the Travel Survey from 2008 - 2009 shows more than half of the sampled population did not use public transport at all. One may easily question the efficiency of New Zealand’s public transport today without knowing its evolution over time. It is important to understand the history of public transport in order to put into context the current circumstances.
3.1 Electric Trams

Most New Zealand early settlements in the late 1800 had already transformed to the previously mentioned ‘transit city’. Cities that spread at approximately ten to twenty kilometers, already had steam or horse powered public transit systems. However, in New Zealand, the period 1899 to 1916 was the start of a new era in electric tram systems introduced in various New Zealand cities and towns. This was the first time electricity was used as a significant source of transport energy.

The four main cities (Auckland, Wellington, Christchurch and Dunedin) had populations ranging from 50,000 to 180,000 whom supported the public transport system. Trams were the preferred mode of travel for the urban passenger until the early 1950s.

3.2 Buses and Trucks

The First World War exposed many soldiers to the uses of trucks, thus setting up small bus companies and trucking firms became popular amongst the post-war soldiers. This is noticeable in the time line below (Figure 12) where there is the initial decline of tram patronage (i).

Two factors significantly impacted the long-term tram patronage between 1930 to 1950: first, the 1930’s Depression reduced economic activity and decreased patronage (ii) and second, the Second World War restricted car use and petrol rationing, resulting in a steep boost in patronage (iii). As a result, Tramway patronage hit its peak in the war years (iv).

Figure 12: Tramway Patronage 1900 to 1955 in New Zealand
3.3 Entering the Automobile Era

The 1950s were, according to Peter Newman, known as the ‘automobile city’. It was a typical period where cities sprawled substantially due to the uptake of private automobiles. New Zealand was no different, and the restrictions that may have constrained private car uptake from previous two decades had disappeared. Encourage by increased wealth, New Zealand’s private car ownership surged in the 1950’s. By the end of the decade, the goal of many British and U.S. car makers for the western world was “a car for every household”, which they nearly achieved in New Zealand.

Cities began to expand as New Zealand’s population grew, but this time in the form governed by private cars rather than public transportation. Moreover, there were large changes to the public transport system. With the exception of Wellington, most trams were replaced by motor-based bus systems. Because of the growing car industry coupled with now 50 year old tram systems which needed substantial upgrading to meet the demands of the growing city, instead investment shifted towards bus-based systems, which was a more affordable approach. Compared with reinvestment in the tram systems, buses had lower operating cost and greater route flexibility for increased coverage, thus it appeared a better choice.

<table>
<thead>
<tr>
<th></th>
<th>Inner Suburb</th>
<th>Outer Suburb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auckland</td>
<td>0.71</td>
<td>0.85</td>
</tr>
<tr>
<td>Wellington</td>
<td>0.66</td>
<td>0.84</td>
</tr>
<tr>
<td>Christchurch</td>
<td>0.75</td>
<td>0.95</td>
</tr>
</tbody>
</table>

Figure 14: Cars Per Household in Three Major Suburbs

![Figure 13: New Zealand new cars registered from 1926 to 2010](image)
3.4 Decline

Throughout the 1960’s and 1970’s New Zealand settlements remained largely mono-centric and the CBD was the common central destination for both private cars and the buses. While trams operated along dedicated routes, buses shared the same road space with private cars, which lead to congestion and slower transit times relative to personal car travel. In later parts of the 1970s, petroleum prices rose steadily in price, so did the bus fare. Thus some of the advantages held previously for public transport eroded, furthering the decline of public transport’s appeal.

A key question this thesis aims to answer regarding public transport is why people left it when it was at its best and strongest in the 1950s? The public transport system then would have given people greater access to work, education and shopping. However, Figure 14 shows that car ownership in three major cities was at about 0.9 per household. Notably those in the outer suburbs were more car-dependent where public transport services performed poorly. Although that may be one of the many reasons responsible for the decline of public transport, the contention according to ‘Rise and Decline of the Public Transport in New Zealand’ suggests that the demand for social-recreational travel are perhaps the principle factors responsible due to the fact that once a car is owned it is used, and generally replaces the use of other modes of travel including public transport (Dravitzki & Lester, 2007).

The personal preference for personal car travel inevitably raised high demand on road widening thus putting extra stress on government funding. According to Parliament documents, 80% of total funds are allocated to road and state highways (NZ Parliamentary Library, 2006). This leaves only 14% of funds for public transport, which inevitably lead to poor services such as limited routes. The lack of patronage is further compounded by attitudes of public transport being for those who can’t afford a car. All of which contributed towards the loss of appeal to the general public and high preference of personal car travel (Figure 15).

Figure 15: The Vicious Circle Of Bus vs. Cars
**Figure 16:** Rise and Decline of New Zealand Public Transport"
Mono-centric urban form:
Heavy congestions at CBD destinations
Buses share the same congestions

Cars per Household:
Auckland: 0.85
Christchurch: 0.95

Petrol price rose steadily (600%)
Bus fare also rose, contribution to decline of patronage.
“Transport is Canterbury’s most significant area of infrastructure provision, given its large public and private costs, contribution to the economic performance of the region, influence on urban form, and other social and environmental effects. Transportation is fundamental to the quality of life in any city, and Christchurch is no different. It provides access to schools, jobs, services and recreation. How people travel to work and how often affects the physical environment through emissions, noise, congestion and community severance. It affects and is affected by where people live, work and the other places they spend their time. Our future ability to fund our transport methods and networks is, however, about making smart choices.” (UDS Partnership, 2009)

The Canterbury Regional Land Transport Strategy acknowledges the many challenges facing the region over the next thirty years, such as demographic, technological changes, oil supply security and fuel price volatility (Canterbury Regional Transport Committee, 2012). Rex Williams (Commissioner of Transport Committee) is certain that the Land Transport system needs to be able to adapt to meet our changing needs while supporting the region’s economy and improving access in an affordable way. This strategy seeks to transition over time towards a multi-modal transport system that gives people greater choices for commuting.

Figure 17: Canterbury Regional Land Transport Strategy 2012 - 2042
4.1 Household Travel Patterns

Examining various statistics from the Household Travel Survey will provide a better insight into how people travel.

Cars
As of late 1950s, Christchurch continues to behave like the “Automobile City”, (Newman & Jennings, 2008). Car travel is growing at about 2.5% per annum. Traffic volumes are also expected to have increased by 27% by 2026 (GCTDM, 2009). Thus cars will be the initial focus on this section.

The trends in car registration (Figure 18) illustrates the ‘car culture’ of the nation and consequently stimulated the existing transportation network.

Christchurch Car Travel Facts:
- Cars are used 85% of all daily trips in greater Christchurch area.
- NZ had the 5th highest rate of vehicle ownership amongst the OECD countries (700 cars per 1,000 persons)
- Christchurch in 2006: 709 cars per 1,000 persons.
- 60% of residents drive to work. (Auckland is 57%, Wellington is 40%)
- 96% of those cars driven to work by Christchurch residents have only a single occupant.

Figure 18: Population trend and new cars registered

(NZ Transport Agency, 2011)
(Statistics NZ)
4.2 Car Ownership

Car ownership is usually an appropriate indicator for assessing the auto-dominance of a city. After reviewing the latest household travel survey, it was evident that 85% of all trips are made in private cars and 19 out of 20 cars travelling to work have only a single occupant. Cars facilitate people's need to travel further, faster, and more frequently than ever before. Cars are now comparatively easy to buy with easier access to loans and low-priced imports. Compared with public transport, they are often perceived to be convenient, with increased freedom for most people and have lower operating costs. Free parking within walking distance of Christchurch’s central business districts or suburban employment areas contributes to this perception of low costs. Consequently, vehicle ownership has increased over the past years (Figure 19, Figure 20).

Figure 19: Vehicle Ownership Per Household
Source: Ministry of Transport - Transport Monitoring Indicator Framework

Figure 20: Vehicle Ownership Per Capita
Source: Ministry of Transport - Transport Monitoring Indicator Framework
4.3 Household Car Accessibility

Comparing with past New Zealand Census Data (1996, 2001 and 2006), a trend for all regions surfaces:

- Households with access to **zero vehicles** are **decreasing**

- Households with access to **one vehicle** remains **quite stagnant**

- Households with access to **two vehicles** are **growing**

- Households with access to **three or more vehicles** are **growing**

*Figure 21:* Number of households with access to nil, one, two or three motor vehicles by region

### 4.4 Analysis of GDP Trends

An analysis was undertaken to investigate the extent to which car ownership levels might be affected by changes in real income (GDP per person) and changes in real car prices (Conder, 2009):

- Figure 22. Shows the increasing trend in GDP per person
- Figure 23. Shows the generally decreasing trend in average real car prices.
- The coupling of the two is the major contribution to the increase in car ownership during this period.
There appears to be a relationship between growth rates in cars per person and in GDP per person. Times of increasing GDP per person and decreasing car prices tend to correspond to increasing cars per person. The cars per person growth rates are less volatile than those for GDP per person. There is no clear evidence that the car per person trend either leads or lags behind the GDP per person trend.

The substantial reduction in car prices in the period after 1988 appears to be a major factor in influencing the strong growth in car ownership over the 1988 - 1991 period, when GDP growth was very weak (or negative).
4.6 Travel Modes

The way we travel is affecting our quality of life, infrastructure costs, and the environment. It is reported from the survey that the private car is used 86% of all journey to work in Christchurch. This is an issue that needs to be addressed. To change the way people travel in Christchurch, time and strategy will be required. Improved information about sustainable travel choices and travel plans can de-incentivise commuting via personal vehicles. People need to know the benefits and costs in order to make well-informed decision about the way they travel. The design and location between work, education, health, leisure and community facilities can influence the way people travel. The further the distance, the greater the car dependency and energy consumption. Areas not in close proximity to transit corridors are associated with higher usage of personal vehicles. The availability of residential car park also affects the way people travel.

Figure 25: Mode Share of Travel Pattern
WEEKLY TIME SPENT TRAVELLING PER PERSON

<table>
<thead>
<tr>
<th>Cost</th>
<th>Auckland</th>
<th>Wellington</th>
<th>Canterbury</th>
</tr>
</thead>
<tbody>
<tr>
<td>$0</td>
<td>1,500,000</td>
<td>3,000,000</td>
<td>4,500,000</td>
</tr>
<tr>
<td>$750,000</td>
<td>150000</td>
<td>225000</td>
<td>300000</td>
</tr>
</tbody>
</table>

New Cars Registered Population Trend (Census)

<table>
<thead>
<tr>
<th>Year</th>
<th>Auckland</th>
<th>Wellington</th>
<th>Canterbury</th>
</tr>
</thead>
<tbody>
<tr>
<td>1858</td>
<td>1863</td>
<td>1868</td>
<td>1873</td>
</tr>
<tr>
<td>1878</td>
<td>1883</td>
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<td>1898</td>
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<td>1918</td>
<td>1923</td>
<td>1928</td>
<td>1933</td>
</tr>
<tr>
<td>1938</td>
<td>1943</td>
<td>1948</td>
<td>1953</td>
</tr>
</tbody>
</table>

Cars
- 85\% of all daily trips are by car
- New Zealand has the 5th highest rate of vehicle ownership amongst OECD countries
- 560 cars / 1000 persons in Christchurch
- 60\% of residents drive to work, 96\% of them have only a single occupant car

Car Passenger
- 709 cars / 1000 persons

Pedestrian
- 609 cars / 1000 persons

Cyclist
- 509 cars / 1000 persons

Public Transport
- 1.20 cars / 1000 persons
- 1.30 cars / 1000 persons
- 1.40 cars / 1000 persons
- 1.50 cars / 1000 persons
- 1.60 cars / 1000 persons
- 1.70 cars / 1000 persons

Motorcyclist
- 500 cars / 1000 persons

Other Household Travel
- 500 cars / 1000 persons

Household Travel Survey

DISTANCE TRAVELLED PER PERSON, PER YEAR, BY AGE GROUP (2004 - 2008)

- Personal
- Business
- Education
- Recreational
- Accompany Someone
- Shopping
- Social Holiday
- Work
- Sale

Car Passenger
- 0-4
- 5-14
- 15-24
- 35-44
- 45-54
- 55-64
- 65-74
- 75+

Motorcyclist
- 0-4
- 5-14
- 15-24
- 35-44
- 45-54
- 55-64
- 65-74
- 75+

Other Household Travel
- 0-4
- 5-14
- 15-24
- 35-44
- 45-54
- 55-64
- 65-74
- 75+

Cyclist
- 0-4
- 5-14
- 15-24
- 35-44
- 45-54
- 55-64
- 65-74
- 75+

Public Transport
- 0-4
- 5-14
- 15-24
- 35-44
- 45-54
- 55-64
- 65-74
- 75+

Other Household Travel

Motorcyclist
5.0 Economic Research Summary

It was concluded in section 1.0 that transport technology played a critical driver behind the evolution of cities. The expansion of Christchurch was an inevitable consequence of private vehicle uptake over the past fifty years. Although each advancement of transport technology allowed people to travel further, it also made the previous transport less effective.

Declining Car Usage
It is evident that petrol prices will only increase in the near future. With this forecast in mind, it is very hard to ignore the lack of efficient alternative transport solutions in Christchurch needed to future-proof the oil crisis. Recent statistics have begin to show declining trends towards new cars registered, suggesting that the demand for an alternative solution is needed to push Christchurch past its auto-dependent state.

Land Use
The zoned planning system with single land use has steered Christchurch toward urban sprawl that depends on automobiles to obtain most services. This was illustrated in the travel mode pattern diagrams in section 4.6. An intervention is needed to reduce the need for driving by shifting work and amenities within close proximity of where people live. Car parking space reclamation can be one of the many solutions for encouraging this movement, which will be further explained in section 6.2 of this thesis.

1845
Steam Power Railroad
2nd Wave
1900
Electricity Internal Combustion Engine
3rd Wave
1950
Petrol Chemicals Electronics
4th Wave
1874
Walking City 3.2 KM
1941
Transit City 10 KM

Figure 26: Mode Share of All Trips to Work in Christchurch
The Next Wave

As the past waves of innovation shaped Christchurch into an automobile city, this thesis further explores the implementation of 5th wave and 6th wave for shaping future urban forms; How can digital networks, software technology and sustainable renewable energy be used to shape the future Christchurch?
Collective Strategy
Previous literature on post-disaster population trends shows evidence that the occurrence of a natural disasters amplify existing population growth trends. (Tom Love, Saperes Research Group) Prior to the earthquakes Christchurch was experiencing positive growth towards the West, as identified by the 2006 census data. This trend was amplified following the earthquakes, where the city’s population growth and economic activity has shown a dramatic increase in the West. Conversely, the eastern suburbs were experiencing negative population growth, and again this trend was further exacerbated due to the earthquake.

Through our collective theses we have engaged in the debate about where Christchurch should be rebuilt, and given the existing population and growth trends, we believe that a poly-centric city would be a more resilient proposition as it would foster the emerging identities of the suburbs at the same time as supporting a city centre. The intent is to create a resilient Greater Christchurch with a primary central core surrounded by identifiable satellite centres.

This re-envisioning of the city’s future is dependent on the synergy between the city’s existing economies. Each of our theses examines an economy and seeks to highlight potential catalysts to foster a more sustainable regeneration of the city. While at the same time we recognize that economies do not work independently rather they intimately coexist, for this reason we draw on relationships between our theses.
Knowledge based industries will be one of the keys to regenerating the city’s economy. The recent decline in manufacturing based employment, which makes up the majority of the city’s workforce, provides Christchurch with an opportunity to think about how the city’s existing assets can be utilized to help the transition towards an economy based on knowledge and innovation.

The city’s existing rail corridor has dictated the way manufacturing facilities populate the city’s urban fabric. At the moment however, it acts as a barrier which severs the connection between the north-western and southern suburbs, which is where the educated workforce of Christchurch are mainly residing. Addressing this condition by allowing for the revitalization of this corridor could provide the opportunity for high value businesses to grow.

The current primary and secondary industry oriented economy of the city needs to change drastically to accommodate the change into an innovation based economy. A large part of this transformation will stem from a change in education, which Praveen has addressed in his thesis ‘Creating Creative Christchurch’. This paradigm shift in learning will prepare young students as well as adults for higher earning jobs. Moreover, these learners will become the innovative thinkers of the new innovation economy.

The provision of workspaces and the quality of life necessary in order to attract and retain educated workers will be one of the main factors that will determine the success of this shift. The EPIC initiative acts as a seed for this shift to occur, by attracting displaced high-value businesses under one roof. This initial investment has the potential to expand into the industrial corridor and create a synergy with the existing manufacturing facilities. As Mulder (2009) has discussed, the further attraction and retention of this critical mass should come from a consideration towards the business and lifestyle ecosystem. This aspect can come through the collaboration with other aspect of the economy such as the notion of achieving an eventful city through transitional events architecture (Erica) and the notion of lifelong learning through the provision of learning lounges (Praveen). The cooperation between initiatives involved within these respective economies (such as EPIC, Arts Circus and the Unlimited School) has the potential of creating the network synergy necessary for the attraction of local and international talents and businesses.
Towards an Efficient Economy
by Che Wei (Jacky) Lee

This thesis acknowledges the impacts of the transportation network in shaping the city's future regeneration, and builds up on current trend of the population's movement towards the west and the emerging potential to revitalize the declining industrial corridor, as outlined in the ‘Innovation Economy.’

The proposed transport network addresses four identified nodes of importance: the CBD, the Western growth towards Hornby, the Airport Link and the Lyttelton harbour. Layered into these key nodes is a system of multiple modes of transport that are seamlessly integrated through efficient use of modern technology. The strategy includes:

- High frequency rail for passengers will allow movement from west to east along the declining manufacturing corridor, this will connect the expected population growth areas in the West to the CBD via public rail transportation. This infrastructural line acts as a catalyst to attract investment and revitalize the current manufacturing oriented corridor.

- The airport plays a vital role to the future economic growth as it is a significant gateway for both people and high value commoditie.

- The high frequency bus corridor from the CBD to the Airport and from Hornby to the Airport creates a loop between three of the key activity centers.

On top of these fixed systems, emerging innovative transport solutions such as bike share and car share services will also be integrated together by a mobile application initiative called KiwiGo. KiwiGo will act as a “front-end” of the transport network, providing clear information about sustainable travel choices and travel plans to de-incentivise commuting via personal vehicles. The flexibility of KiwiGo in both its programme and usage ensures that it can adapt to the ever-changing transport landscape in the near future.
The Green Economy
by Zhi Jian (David) Wong

Capitalizing on the projected increase in population, a Green Zone is proposed in the West, creating a self-sustaining prototype district that demonstrates the principles of Zero-Carbon design. The aim for this Green Zone is to become a public demonstration of sustainable living and working through various scales of design; from green community living to generating businesses that make renewable energy technology.

The Green Zone is located in the West, and because of the population growth, key economic activity is expected to happen. The advantage of locating the Green Zone in the West also allows more room for future growth, which is possible should the manufacturing of renewable technologies be scaled up to supply the rest of Christchurch and other global destinations. The success of the Green Zone relies on a strong connection to the CBD and the seaport via rail and the airport via a transport corridor, as outlined in ‘Towards an Efficient Economy’. The area would act as a main hub for ongoing pedestrian flow towards the CBD from the nearby suburbs.

In order to create an attractive lifestyle, the integration into the Green Zone are areas for a range of events and learning facilities, as explained in ‘The Experience Economy’ and ‘Creating a Creative Economy.’ Working in conjunction with the notion of life-long learning, the precinct will act as a key education hub, which serves as a campus for “green-education”. By manifesting the knowledge and technology behind green living through multiple showcases within the city’s fabric, the Green Zone aims to be a demonstration site of how to live, work, play and learn in a more sustainable way.
Inner city living can be much more sustainable and economically viable when compared to developing fringe land for further suburban sprawl. This is especially true given the shift in demographics, which suggests there is an incongruent relationship between the housing stock and the population – two-thirds of the housing stock is comprised of three bedroom single detached houses, yet the population demographics show there is an increase in the demand for housing for singles and couples.

To address this changing demographics, Biran He has proposed a new flexible housing type that can be modified depending on the dweller’s needs. It is a modular system and can be deployed to suit different sites. The aim is to address the urgent housing crisis with an efficient modular system, that at once can address the influx of workers, but in the future could adapt to changing demands.

For case studies Biran He has chosen two sites, one the housing demonstration site proposed in the CCDU Blueprint, which is located in the CBD on the edge of the new Green Frame. The second site is adjacent to the Green Zone, outlined in ‘The Green Economy.’ In both case studies the housing typology could accommodate a range from young singles to small families to empty nesters, the aim is to encourage community living in close proximity to work and play. The housing typology is targeted at aspiring creative workers and demonstrates a new alternative option for housing that challenges conventional suburban sprawl.
Creating Creative Christchurch
by Praveen Karunasinghe

Praveen Karunasinghe’s thesis is about supporting the emerging creative class in Christchurch starting with education, which is a key component that greatly influences the future employment landscape of the city, as a knowledge-based industry is vital to shaping the city’s economic regeneration. Through analysis of census data Praveen learned that the Western and Eastern suburbs currently lack opportunities for high quality education as is shown in the low rates of higher level educated residents. As a consequence, many of these residents engage in low skill low value jobs and have low incomes. Given the West is predicted to grow, it is a prime opportunity to improve the quality of education, and by increasing the opportunities for students and adults to participate in creative education, we can reverse the growing reliance on low skill labour. Furthermore, we can begin to educate high skill inventive workers, which are needed to fuel the ‘Innovation Economy’.

The proposed architecture is modular and can be assembled to create different scales of learning facilities targeting a range of possible ages. The Learning Lounges are designed to target the younger generations, while the Media Techs are designed to target adults and can be tailored to suit specific high skilled learning.

Praveen’s thesis has developed two case studies, a Learning Lounge associated to the Green Zone and a Media Tech associated to the Innovation Precinct. In both instances the aim is to foster a new identity for the area by educating a workforce to support creative high skilled high earning jobs.
The Experience Economy
By Erica Austin

Erica Austin’s thesis is about creating an infrastructure to support an eventful economy which in turn can support the revitalization of Christchurch. Erica is borrowing from an emerging organization called The River of Arts, which has the aim to connect different arts initiatives and thread them through the city. Erica developed three case studies to illustrate the potential ways events can occupy and support the economy:

In the first case study, which was a live project, Erica was the teaching assistant to Uwe Rieger for LUXCity, which was the opening event of The Festival of Transitional Architecture (FESTA) 2012. For this event Erica helped to curate the site planning and facilitate the coordination required for 16 large scale architectural installations and associated business. The event was a huge success and attracted 20,000 people to the otherwise vacant city centre.

The second case study is for modular events facilities that can be assembled in different configurations to host a range of events. These transformational events facilities are housed in my third case study, which is for the Art Circus, a central hub for the arts. The transformational events architecture can be distributed throughout the city and can support such events as performances, markets, exhibitions, lectures and other community events.

Collaborations are formed between the Innovation Precinct and the Arts Circus, which also takes into account the creative industries and how they can play a role in the transitional city phase. The presence of events in the city lends to creating a quality of life which can act to attract and keep the workforce needed to contribute towards a knowledge based economy, which is vital to the future of Christchurch as outlined in both the ‘Innovation Economy’ and the ‘Creating Creative Christchurch’.
Conclusion for the Future
The polycentric model of growth shows great potential in addressing the current and emerging economic circumstances in Christchurch. By proposing this multi-nodal development, the design will be able to harness the inherent potential of growth in multiple key activity areas of the city. This includes the identified growth of the western suburbs, the initial investments in the CBD, as well as other infrastructural assets such as the rail corridor. A multi nodal development concentrating on these key areas will allow the opportunity for different identities to emerge across the city, which helps cultivate confidence and regain trust from future investors. This is critical for the success of the future reconstruction for the city of Christchurch.
Urban Strategy
7.0 CCDU Blueprint

The rebuild blueprint from CCDU (Christchurch Central Development Unit) was released on the 30th July, 2012. For the purpose of the argument, this thesis has also evaluated this document, hoping to find supporting evidence for the future of Christchurch transportation.

Although the plan was produced for economic recovery, the critique was its heavy emphasis on the central node. This overlooked the potential in growth outside the city center, which was accelerated after the earthquake.

There was also a lack of attention towards public transport in the wider context. The only solution being the central bus interchange, cycle and pedestrian friendly area within the city center. This has had issues where commuters needed to go into city centers first in order to be transferred somewhere else. Thus this thesis also proposes a more efficient transport network in later sections that takes into account the growing western suburbs.

Figure 27: CCDU blueprint, released 30th July 2012
7.1 Desperate Times

Early estimates from the Canterbury Employment and Skills Board states that the earthquake rebuild will require 24,000 carpenters, painters, labourers, concrete layers and other trades, plus a further 12,000 managers, accountants, engineers, shop staff and hospitality workers, to support them. (McCrone, 2012)

With this forecast in mind, it is hard to ignore the lack of efficient transportation when Christchurch faces impending population spike in the near future. Short term solutions are required that in the long-term are sustainable. This is an enormous and complex issue as it is determined by where people are housed, where and how they get to work, and what kind of effect this is likely to have on the long-term development of the city. Ideas and solutions, such as rail, that have been criticized for being too expensive and unrealistic, suddenly begins to make a lot more sense. (Jhumm, 2012)

Good public transport such as rail will not only mean that the city will operate more efficiently during the rebuild, but will also facilitate people making their move a permanent one, while attracting new businesses and skill migrants. Current demographic suggests a population shift towards the west, and was also accelerated after the earthquake. The potential for key growth areas such as Hornby, Riccarton and Papanui already indicates the formation of a network of suburbs. These suburbs are also conveniently located in close proximity to the rail, thus further validates the demand for a reliable inter-suburb transport solution.
7.2 Why Rail?

As the rebuild of Christchurch approaches, the demand for new land and new homes is expected to soar. The Press has illustrated many of the existing and emerging subdivisions in the region, which interestingly has significant number of developments strategically located near the increasingly critical north-south corridor. Developments located at Kaiapoi, Belfast, Papanui, Middleton, Hornby, Rolleston, Prebbleton, Heathcote Valley and Lyttelton are all conveniently located within 500 metres to a existing railway line.

This suggests that the role of railway lines in the future transportation system of Christchurch can not be ignored. Whether it’s a commuter rail system, or a tram-train system, the fact that the existing railway is there, gives Christchurch the opportunity to establish high quality rapid transit corridors to serve these key growth areas.

**Load Efficiency**

While solutions such as car sharing has the potential in increasing vehicle occupancy and efficiency in cars, the range can still be quite limited, it ranges from the lowest occupancy in Geneva and Vienna of 1.2, to the highest in Manilla at 2.5 (Newman et al., 2009).

Public transit, on the other hand, has a much higher range, from 3.4 in Manila (bus jitneys) to 129.3 in Mumbai (per carriage, often with many riders on the roof); so the potential for change in higher transit occupancy levels seems much more possible. Thus investing in trains are the simplest way for Christchurch to increase its transit ridership. (Newman et al., 2009)

**Density**

Christchurch lacks one critical ingredient of a successful rapid transit system: density. In high density cities such as Bangkok, there is no need to think about creating T.O.Ds around transit stops, as most of these cities only need to be retrofitted with transit after population and development exploded. However in many lower density urban regions, such as Christchurch, the communities in need of transit do not have the sufficient density to make it feasible. Transit needs densities over thirty-five people and jobs per hectare of urban land and domination of walking/cycling requires densities over one hundred people and jobs per hectare. Due to the nature of single land use, Christchurch residential suburbs have merely 30 to 40 people per hectare, 1 to 10 in outer suburbs, which poses problems for the feasibility of a rapid transit network (Statistics New Zealand, 2006). Densities in urban areas need to increase to support transit and allow more people to live and work where they can have alternative transport options. Of course it is a chicken and egg situation as often the transit system is needed to get the land-use process to densify and focus development around stations.

This thesis acknowledges the trend in population growth towards the west suburbs, thus aims to design interchange stations in the few aforementioned key growth areas, and aims to increase the density in those areas to support transit.
7.3 Proposed Rail Network

Figure 30: Proposed rail network
8.0 Frequent Bus Network

Our bus network is underused, less than 4% of all trips are made by bus. It's clear from the route map and the timetables that Christchurch’s bus network is intended as a community service – i.e. transport for those who cannot drive – and not as a credible alternative to driving a car.

This thesis proposes an overhaul of the bus system, where a selection of current corridors can potentially be changed from curb bus lanes into median bus lanes

**Curb Bus Lanes**
This is the current set up for most bus lanes in Christchurch. In which:
- Is more prone to delay due to left turning vehicles.
- Only operates during peak hours
- Makes transit service unreliable
- Raising arguments over bus lane infringement fines for drivers that are turning left

**Median Bus Lanes**
Median bus lanes can have many benefits, including:
- Providing dedicated route space for bypassing congestion
- Transit become much more reliable in keeping on time
- Needs careful intersection design and transit-priority signals.
- The dedicated space can be easily replace with light rail systems in the future when feasible.

Figure 31: Moorhouse Avenue Aerial Photo

Figure 32: Curb Bus Lane vs. Median Bus Lane
8.1 Key Routes

The current bus network covers Christchurch city quite thoroughly. However the pitfall for most bus routes are the amount of unnecessary loops and kinks that makes an inefficient bus network altogether. For instance, route 18 to Papanui seems to fail to serve a purpose as it runs parallel to the main key routes of Papnaui Road. It seems so that it is only trying to cater to the area in between Papanui Road and Cranford Street, which is no more than 500 meters of walking.

This thesis proposes more simple system focusing on high-quality and high-frequency lines (of any mode) that head into the CBD and across the city in straight lines. To make use of efficient bus network, I have chosen a few key routes to have:

- High frequency buses
- Real time information
- Increased stop spacing
- Priority measures

Figure 33: Proposed High Frequency Bus Corridors
9.0 Cycling

Cycle-friendly cities are currently one of the most sought after solutions for shaping auto-dependent cities into a resilient one. It has proven to be the most efficient mode of transport when ranked with miles per gallon. (Ghanta, 2010) When combined with multi-modal transit systems, it promotes healthier lifestyles as opposed to a mono-modal travel pattern Christchurch currently offers.

Drop the Helmets

Helmets are a significant disincentive to ride: They are inconvenient, uncomfortable, and unattractive, but most of all, helmets signal that cycling is dangerous – when it’s probably the most life extending habit you can take up. This has been a debatable topic in which this thesis believe helmet laws do more harms than benefits for its discouragement in cycling. Currently only Australia and New Zealand has mandatory all ages helmet laws. Most other countries afford their citizens the civil liberty to decide for themselves. Countries that have mandatory helmet laws actually have higher head accident rates than countries without them. (Cyclopolitan, 2012)

<table>
<thead>
<tr>
<th>Transport</th>
<th>Average PMPG Person-mile per gallon</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bicycle</td>
<td>984</td>
</tr>
<tr>
<td>Walking</td>
<td>700</td>
</tr>
<tr>
<td>Running</td>
<td>315</td>
</tr>
<tr>
<td>Plugin Hybrid</td>
<td>110.6</td>
</tr>
<tr>
<td>Motorcycle</td>
<td>71.8</td>
</tr>
<tr>
<td>Passenger Train</td>
<td>71.6</td>
</tr>
<tr>
<td>Airplane</td>
<td>42.6</td>
</tr>
<tr>
<td>Bus</td>
<td>38.3</td>
</tr>
<tr>
<td>Car</td>
<td>35.7</td>
</tr>
</tbody>
</table>

Figure 34: Transport Mode Efficiency (Ghanta, 2010)

Bike Share

Bike-share systems are sweeping the globe as they provide many benefits. They rely on spontaneity and ease of use. Countries with mandatory helmet laws has been facing difficulties for encouraging spontaneous bike sharing commute. Robert Henderson, managing director of BikeVentures are currently pushing bike sharing services locally. He describes the mandatory helmet law as something that bike sharing systems will need to work with, not against.

“All the bikes come with helmets, there is a security loop on the back of the helmets which is locked with the bike. Julian pioneered this in Auckland and to date it is the only cycle sharing scheme around the world which has properly integrated helmets. The helmets are then sanitized frequently. I admit its not ideal but this is the law we must work with.”

- Robert Henderson
  Managing Director
  Bicycle Ventures

Due to the bike-friendly topography of Christchurch, bike sharing stations will also be a part of the urban strategy. These will be part of the whole transportation network and scattered within the urban fabric.
9.1 Proposed Cycle Lanes
### 10.0 EV Cars

One of the key components in Zhi Jian (David) Wong’s thesis, *Future Christchurch: A Green Economy*, is to incorporate an Electric Vehicles Network. The reason being that the batteries within the Electric Vehicles will act as a backup source of energy in times of crisis.

“The housing unit becomes an autonomous system in which the solar panels generate electricity to charge the battery for the car and the battery can run significant appliances if needed.

*The Better Place organization is currently leading the change towards the electric vehicle era, as the electric car is 5.2 times more efficient than a standard car running on fossil fuel car.*

The downfalls such as long charge times are changed in which the batteries can be swapped at battery outlets; and you will be charged for how much you travel. Faster than pumping petrol at Shell. This significantly reduces the cost of an EV as the battery is the major cost in the final price.”

(Wong, 2012)

#### Energy Savings Calculations

7470 kWh per person spent on transport using an Internal Combustion Engine (ICE) vehicle.

Assumption of energy usage for an electric vehicle = 21 kWh/100km (energy usage for a Nissan Leaf)

Assumption of energy usage for a ICE vehicle = 110 kWh/100km

An electric vehicle is approximately 5.2 times more efficient than a vehicle running on a fossil fuel engine

(Wong, 2012)

#### Battery Swap Stations

Cost for One Battery Swap Station = USD $500,000


To install 100 Stations across Christchurch = NZD $63 Million

According to the Better Place organization this Battery Swap station is half the cost of a typical Petrol Station and would only take 2 days to install and construct a working battery swap station. A battery swap station installed with only 15 batteries is able to switch batteries for 2,500 EV. “Shai Agassi: A Better Model?”. (27m:02s): commonwealthclub.org.

(Wong, 2012)

#### Smart Grid

A “Smart Grid” is the modernization of the electricity grid in which the system is able to automatically optimize, protect and monitor operations between interconnected elements of the energy network. A “Smart Grid” is critical to the success of using decentralized renewable sources to feed the self-sustaining network and electrifying the transportation to Christchurch. This “Smart Grid” would be able to allocate energy where it is most needed and in the most efficient way. Christchurch is in a unique opportunity at the moment as a lot of its network infrastructure is damaged because of the earthquake and would is in need of replacing. This is the time to upgrade to the Smart Grid. (Electric Power Research Institute, 2011)

(Wong, 2012)
ELECTRIC CARS
They’re fast, fun, quiet and efficient. So what’s held them back? Four things, actually: high cost, limited range, long charging times and uncertainty about resale value. So, armed with clever ideas and modern technology, we set out to change all that. Introducing the switchable-battery Renault Fluence Z.E.

SWITCHABLE BATTERIES
This innovation makes the electric car downright practical. Switchable batteries offer unlimited range, dramatically reduce the cost of electric cars, eliminate charging time concerns and put resale values back in the money.

BATTERY SWITCH STATION
Problem solved. Simply drive in, stop, and let our automated station do the rest. In about the time it takes to fill up a gas tank, we can switch your low battery with a fully charged one. Now you’ve got unlimited range. Just drive. Switch. And go.

CHARGE SPOTS
Next, we looked for a way to let drivers charge at their convenience. Enter Better Place Charge Spots. Included in your membership, your Charge Spot lets you plug in at home and wake up to a full “tank.” Plus, you’ll have unlimited access to any Charge Spot in town.

Design proposals in chapter 13
The economic research in the previous section has addressed the dominance of personal private vehicles, followed by the proposal of a multi-modal transport network as part of the urban strategy. This section will demonstrate the alternative approach this thesis will begin to take to transition Christchurch past its car-dependency state.

The economic research concluded the adverse impacts of personal private vehicles exerts on Christchurch’s urban form, and this thesis aims to tackle that. However in order to intervene, an extensive research on the current road network is needed to fully understand the existing transport infrastructure of Christchurch. This section calculates the existing road areas in relation to the land area:

- Within the territorial authority border, road surface area takes up 10.2%.
- Within the urban boundary border, road surface area takes up 22%.
- Figure 41 is an extrusion map that shows the concentration of tarmac road infrastructure near city centers.

**Figure 41:** Road area percentage
Figure 42: Road area percentage extrusion map
11.2 Road Area | Building Footprint

1. Cathedral Square
   - Building Footprint: 40.2%
   - Road Area: 23.1%

2. Avonloop
   - Building Footprint: 25.6%
   - Road Area: 20.8%

3. Richmond South
   - Building Footprint: 19.2%
   - Road Area: 20.7%

4. Sydenham
   - Building Footprint: 26.2%
   - Road Area: 20.7%

5. Waltham
   - Building Footprint: 30.8%
   - Road Area: 20.2%

6. Riccarton South
   - Building Footprint: 19.5%
   - Road Area: 20.1%
7. Opawa

8. Belfast South

9. Papanui

10. Riccarton West

Figure 43: Road area percentage table
11.3 Car Parking Spaces

The current city centre is covered with abundant amount of car parking spaces. The image below is an aerial view of cathedral square area unit, 56% is open car parking spaces, wasted for only a single use. This is a clear indication that Christchurch is designed for cars, and not for the people. These spaces can be easily utilized much more usefully by other functions once reclaimed.

Figure 44: Aerial view of Cathedral Square

(Google Earth Image)
Figure 45: Indication of car parking spaces in cathedral square area unit.
11.4 Reclaiming the city

If car use can be controlled, or decreased, the need for road widening or demand for car park can be considerably diminished, allowing the spaces dedicated to cars to open up for other uses.

Below are a catalogue of the key activity centers. These area often consists of strip malls that have high demands on open car parking spaces. The following examines these car parks and the possibilities of reclaiming them back for other uses.

![Figure 46: Typical areas of different uses](image)

**Cathedral Square**

<table>
<thead>
<tr>
<th>Category</th>
<th>Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land Area:</td>
<td>2,196,000 m²</td>
</tr>
<tr>
<td>Road:</td>
<td>23.1%</td>
</tr>
<tr>
<td>Building Footprint:</td>
<td>40.2%</td>
</tr>
<tr>
<td>Non-Building:</td>
<td>59.8%</td>
</tr>
<tr>
<td>Social Recreational:</td>
<td>4.7%</td>
</tr>
<tr>
<td><strong>Car Park:</strong></td>
<td>32%</td>
</tr>
<tr>
<td></td>
<td>= 702,720 m²</td>
</tr>
</tbody>
</table>

**Avonloop**

<table>
<thead>
<tr>
<th>Category</th>
<th>Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land Area:</td>
<td>1,413,000 m²</td>
</tr>
<tr>
<td>Road:</td>
<td>20.8%</td>
</tr>
<tr>
<td>Building Footprint:</td>
<td>25.6%</td>
</tr>
<tr>
<td>Non-Building:</td>
<td>74.4%</td>
</tr>
<tr>
<td>Social Recreational:</td>
<td>7.3%</td>
</tr>
<tr>
<td><strong>Car Park:</strong></td>
<td>10%</td>
</tr>
<tr>
<td></td>
<td>= 361,728 m²</td>
</tr>
</tbody>
</table>

![Figure 47: Possible use after reclaimation](image)
Riccarton

- Land Area: 1,085,000 m²
- Road: 16.7%
- Building Footprint: 25.9%
- Non-Building: 74.1%
- Social Recreational: 14.7%
- Car Park: 8.5%
- 92,225 m²

Riccarton South

- Land Area: 793,500 m²
- Road: 20.1%
- Building Footprint: 19.5%
- Non-Building: 80.8%
- Social Recreational: 5.2%
- Car Park: 9.2%
- 73,002 m²

Spreydon

- Land Area: 1,193,850 m²
- Road: 16.9%
- Building Footprint: 19.2%
- Non-Building: 80.8%
- Social Recreational: 5.8%
- Car Park: 2.9%
- 34,621 m²
Linwood/Eastgate

Land Area: 1,750,000 m²
Road: 15.8%
Building Footprint: 18.9%
Non-Building: 81.1%

Car Park: 4.4%
77,000 m²

Papanui

Land Area: 1,484,300 m²
Road: 19.4%
Building Footprint: 22.3%
Non-Building: 87.7%

Car Park: 2.5%
37,110 m²

Hornby

Land Area: 2,939,340 m²
Road: 13.0%
Building Footprint: 23.4%
Non-Building: 76.6%

Car Park: 4.2%
123,450 m²
12.0 Overcoming Automobile Dominance

As significant as the need for better public transportation network proposed in the previous section, this thesis also acknowledges the reality of Christchurch’s current transportation network, which favours those that drives. This section will firstly analyze the target problems addressed in the economic research.

**Target Problem**
Christchurch is currently a car-dependent city. While cars are considered as a luxurious mode of travel in some cities around the world, it is a necessity in Christchurch. Alternative mode of transport are either inefficient (buses), deemed too dangerous (cycling) or simply not feasible for the distance (walking). One of the highlighted facts with travel pattern is that, 79% of work journey are conducted through personal vehicles, and more importantly, 95% have only a single occupant, this has presented to be highly inefficient, generating large amount of spaces on the road during peak times, thus traffic congestions.

![Figure 48: Car-dependent Vs. Public Transit oriented cities](image)

![Figure 49: Target Problems With the Current Transportation Network in Christchurch](image)
Solution
Rather than fighting the norm, this thesis aims to propose an alternative solution that takes advantage of single-occupant cars that currently dominates the road space. This section demonstrates the alternative approach to effectively push Christchurch past its auto-dependence state, into a multi-modal city: As previously mentioned from chapter 6.0, it is about shifting Christchurch’s urban form past the 4th wave of innovation (petrol chemicals), into the 5th (digital networks).

Over the past decade the innovation of digital networks has fundamentally changed the way people live, work and play, and it has often overturned conventional methods to obtaining the same goals. This thesis encourages this cultural, social and perceptual shift through digital networks, and to challenge individual’s perception on personal vehicle usage. For instance, through technology we can turn private vehicles into privately-run public transportation.

Mobile technology has greatly matured over recent years, and has provided us with boundless information and frictionless ways of communication with others from a day to day basis. The nature of transparent information is nothing but familiar with this generation of smartphone users, thus can be adopted for efficiently tying various modes of transport seamlessly.

Smartphone Adoption
According to Google’s “Our Mobile Planet”, New Zealand has proved to be one of the fastest nation in smartphone adoption, thus should encounter little problem for the implementation.
There is an emerging shift in patterns of consumption, where individuals are beginning to share resources rather than own privately. This concept is referred as ‘Collaborative Consumption’ (Botsman, 2010). For example, we all own a home power drill even though on average it is only used twelve to thirteen minutes in its entire lifetime. The question asked is whether there is any reason for owning if what we need is the thing it provides, in this case the hole, not the drill. What’s prefered is to instead, rent the drill, or rent out one’s own drill to others in exchange for money; This thesis encourages the practice of “collaborative consumption” with the three vacant seats in single occupants vehicle, namely car-sharing.

**Example Business Models**

**Car sharing**
- Zipcar, GoGet, WhizzCar, Autoshare, Stattauto, Autolibre, Denzeldrive, Cambiocar, Zazcar, City Car Club

**Peer-to-Peer Car Sharing**
- Whipcar, RelayRides, Drivemycar Rentals, Getaround, Tamycar, Buzzcar, Nachbarschaftsauto, autonetzer, SnappCar

**Bike sharing**
- Velib, Bixi, Barclays Cycle Hire, B-Cycle, Call-A-Bike, CyclOcity, Niceride, HZ Bike, Social Bicycles, Cycle Chalao, Spinlister

**Toy Rental**
- Dim Dom, BabyPlays, Rent-a-toy, ToyLib, Speelotheken, Brinquedoteca

**Neighborhood Rental**

“Collaborative Consumption describes the rapid explosion in traditional sharing, bartering, lending, trading, renting, gifting, and swapping reinvented through network technologies on a scale and in ways never possible before.”

“Collaborative Consumption is one of the 10 Ideas That Will Change The World.”

- Times Magazine
Figure 54: Hyper Consumption Vs. Collaborative Consumption
11.3 Car-sharing

Car-sharing proves to have a direct impact on the number of vehicles on the road, thus one of the simplest solutions in resolving traffic congestions during peak times.

However, the current car-sharing options are limiting, with mostly PC only interfaces. This often limits the useability of such services, and can be discouraging when car-sharing needs to be organised prior trips.

Recent innovation of mobile devices has arguably shifted consumers into a “Post-PC era”, where there presents a huge increase in demand for mobile applications for everyday tasks. Therefore this thesis is interested in also developing an easy-to-use mobile application to encourage drivers to actively rent out their empty seats on their mobile devices to riders going in similar directions.

Post-PC world represents a displacement of computing from the traditional, 30 year-old Intel architecture used on desktop to the Datacenter and the Cloud.

- Perlow, 2012

Figure 55: Current Car-sharing options
12.0 KiwiGo App

“KiwiGo” initiative is a mobile application that demonstrates how future Christchurch can adopt modern mobile technology and allow its users to navigate through the city seamlessly using multiple modes of transportation; to shift Christchurch from a car-centric to a multi-modal travelling city.

Car-Sharing
“KiwiGo” envisions to fundamentally change the way people perceive their personal vehicles. It is a smart car-sharing application that takes advantage of the sea of cars and allows drivers to actively rent out the aforementioned vacant seats to others heading in similar directions; allowing drivers to turn their personal vehicles into privately-run public transport. The following is a detailed walkthrough of the car-sharing interface.

“KiwiGo App will be the most affordable and sustainable system for the future of Christchurch.”
- Michael Blelyeven, CERA

Public Transport Integration
KiwiGo will also be integrated with existing public transport systems to ensure seamless transfer across all modes of transport.

Login Page
Users will be prompted to log into KiwiGo at this page. New users of this service can sign up easily via the app, PC free.

Sign Up Page
Users will need to be fully registered / verified to use KiwiGo.
Driver Interface
After the log in, users can navigate through different interfaces depending on their needs. To actively share your current ride, the driver interface will prompt drivers to input their destinations while KiwiGo identifies the fastest route of access ( ).

Real Time Match Making
To ensure minimal detour for drivers, KiwiGo will match other users asking for a ride along the drivers route ( ).

KiwiGo will also suggest alternative routes to maximise the amount of riders for pickup. ( )

Offer Rides
Drivers can tap the orange indicators to reveal the person asking for a ride in similar direction. The profile will show this person’s rating by the colour circle around the profile picture, his/her full name, current address, and the recommended fare for the ride.
Rider Interface
To catch a ride, users can input their destination while KiwiGo match nearby drivers heading in similar directions.

Driver Choices
Matched drivers will be shown on the screen, including their rank (color bands around profile picture), registered vehicle type, number of empty seats left (###), and the price tag for this ride.

Compare
KiwiGo provides a variety of drivers for riders to compare in order to find the suitable driver and vehicle type. For instance, one may need larger spacious vehicle types if they have luggage.
Ride Feedback
KiwiGo encourage users to make a comment after each ride experience, these comments will be made publicly on their respective profile pages. This way everyone will help contribute to a much better and safer community.

Activity Summary
User’s monthly activity summary will be shown in the profile page. The amount of seats and distance shared, amount of CO2 emission saved and amount of KiwiGo credit earned will be displayed to remind how everyone can make a little contribution to make a bigger impact on the betterment of our environment and community.

One App to Rule Them All
KiwiGo aims to be the mobile application that integrates all modes of transportation, this allows users to move throughout the city as easily as possible where detailed transport direction is just a few swipes away.
Public Transport Integration

Bike & Car Share
KiwiGo will also be integrated with existing bike & car share such as NextBike™ and Bicycle Ventures™. Users can easily locate shared bikes and cars in close proximity and rent them right from this application.

Multi-Modal Direction
To shift Christchurch into a multi-modal travelling city, KiwiGo can provide many different alternative commuting options for users to choose from. The estimated time will also be given.

12.1 Social Media Integration

By live updating the status on social media such as Facebook or Twitter, it adds more reliable security.

Figure 56: Social Integration for KiwiGo

KiwiGo will also create a weekly or monthly summary of how much money or carbon emission saved by using this service. Deep integration with social media gives KiwiGo the best marketing tools available.

Figure 57: Weekly Summary of KiwiGo
12.2 Why Mobile App?

Christchurch lacks a vital component which determines the success of most speed transits: Density. It was also this factor which contributed to the uncertainties of light-rail proposed by Christchurch City Council, which was then eventually ignored in the most recent rebuild blueprint released by CCDU.

Thus this thesis acknowledges the risk of the costly transportation investments ($1.8 billion) and suggests an alternative solution for overcoming single occupancy travel patterns.

“KiwiGo” can be economically viable due to the fact that, unlike other transportation, it requires no extra infrastructural investment. “KiwiGo” is an example for using current resources that we already have, but in a much more efficient way.

Catalyst for Change
Given the right procedures of implementation, this mobile application has the potential to spread virally amongst this car-cultured population and act as a catalyst to change the urban fabric of Christchurch. Not only can KiwiGo be seen as an experiment, but it can also begin to raise the public awareness of public transport.

It’s a Win-Win Situation
KiwiGo does not intend to directly compete with existing public transportation services, but rather provide benefits such as the efficiency and reliability of bus systems by cutting down the number of vehicles on the road.
Design Proposal
13.0 Design Brief

Previous chapters of the thesis laid the groundwork of the transportation system, this chapter aims to design the intersections of those proposed transportation network. This thesis is interested in the nature of these interchange stations when one change from one mode to the other.

Plug and Play Module

The aim is to design, in isolation, a series of interchange stations, ranging from various scales depending on the transport they serve. Each of these modules, S, M, L, XL, will accommodate different combinations of transportation modes. These interchanges in various scales could then be easily plugged into Christchurch’s urban fabric in their respective sites.

<table>
<thead>
<tr>
<th></th>
<th>Train</th>
<th>Bus</th>
<th>Bike Share</th>
<th>Car Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>S</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>L</td>
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<td></td>
</tr>
<tr>
<td>XL</td>
<td></td>
<td></td>
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</tbody>
</table>

Figure 59: The different scales of interchange

Towards an Efficient Economy | Design Proposal | Design Brief
13.1 Objectives

Transit Oriented Forms
As the approach of categorizing interchange stations continues, it was becoming clearer that these interchanges had to be dependent on the transportation it serves. Therefore the function will dictate the form of the structure.

Navigate with Ease
The objective of these interchanges is to encourage commuters to use public transport by making multi-modal obvious and transparent. Commuters will be able to quickly understand what modes of transportations are available at each interchange stations.

Weaving Architecture
Due to the nature of these interchanges, they will need to allow seamless exchange between multiple modes of transport. Thus the concept explores ways to spatially weave the modes of transport together efficiently. Study models through paper strips have been attempted to devise a system for the form to address these objectives.

Figure 62: The design proposals will serve clear navigation purposes.

Figure 63: Weaving study model
13.2 Form Concept

Process
The form needs to be modular, with adaptability to any site and transportation mode it serves, thus a basic 5x5 grid was chosen to develop this system. The four corners of the grid is lifted up to create spaces underneath to be used as shelters. The form also creates spaces for two axis movement.
**Modular System**

The modularity of this form provides adaptability for creating different movement axis. However this form was not flexible enough, thus cutting out just a strip will be used as the base module. Through different arrangements, it allows a hierarchy of movements. It also allows vertical circulation when arranged vertically.
13.3 Transit Construction

Box Girder Bridge Construction
The emphasis of the concept was to be transit oriented, thus I have taken the direction to look into the construction method used for highway fly overs and modern elevated structure of light-rail transport.

The focus is to re-use typical transit construction method in a more flexible way. The box girder construction section, is both structurally sound and easily fabricated. This allows the various scale designs of the interchanges to be easily populated within the urban fabric of Christchurch.

On-site Cast Concrete
This thesis will also use cast concrete to construct the “XL” scale of the interchange. This construction method allows the form to be freeform, thus offer greater flexibility.

Figure 64: Box Girder Construction
Source: Scoop
http://farm3.static.flickr.com/2287/2536145648_59a173e6ba.jpg
Source: structuremag
http://www.structuremag.org/images/1007-f2-5.jpg
Source: NZTA
http://www.structuremag.org/images/1007-f2-5.jpg
Figure 65: The Basento Viaduct, by Sergio Musmeci

http://thefunambulistdotnet.files.wordpress.com

Figure 67: Rotondo Stormpod

http://www.rotondo-es.com/StormPod.html

Figure 66: Reinforced Concrete Structure by Felix Candela


Figure 68: Delivery of Prefabricated modules

http://www.rotondo-es.com/StormPod.html
13.4 Small Module

Strip Module
The small module is used for one mode of transport, for instance a bus stop. I have used the same concept of the strip module in section 13.2, and raised the both ends.

Sheltered Space
This created spaces underneath the strip to be used as bus shelters.

Seat + Canopy
Due to the nature of precast concrete construction, the ledge can be easily moulded as one-piece for timber seats to be laid on.

Multi-directional
The arrangement of these bus stops can cater to both sides of the median bus lane, previously proposed in the urban strategy section 8.0.
Figure 69: 3D Section
This module will have a 700mm thick foundation that sits firmly in the ground.
Figure 70: Plan of “Small Module” on median bus strip.
Figure 71: Section AA’
Median Bus Stop

The image on the right is an example of how these “Small” modules can be arranged to be used as median bus stops that caters to both sides. This is a very minimalistic approach that is both functional and aesthetically pleasing.
Figure 72: Small module used a bus stop.
Train Stop
The image on the right is an example of how these “Small” modules can be arranged to be used as train stops.
Figure 73: Small module used as train stop.
Better Place Charge Spot
The image on the right is an example of how these “Small” modules can be arranged to be used as Better Place Charge Spot, where EV vehicles can quickly recharge their batteries.
Figure 74: Small module used as Better Place Charge Spot
90° Rotation
The “Medium” module is derived by rotating the previous “Small” module.

Separate Spaces
This rotation created separated spaces to accommodate for dedicated cycle lanes in the middle while the two outer spaces can still be used as bus stops on a median bus strip.

Bike Share + Fixtation Integration
By arranging the modules in this way, it created larger bus stop areas while the middle can be used for bike “Fixtation” services. Bike Sharing service such as “NextBike” can also be integrated.

If this structure were to be placed on a median bus strip, it will cater to both bus lanes and dedicated cycle lanes that runs in parallel with the key bus corridors.
Figure 75: Plan of “Medium Module” on median bus lane

Figure 76: Section AA’
**PREcast Seismic Structural System**

Also known as PRESSS, this seismic design solution was developed at the University of California in San Diego under the leadership of New Zealand structural engineer Nigel Priestly. This design system is based around concrete structural elements and has pushed earthquake engineering into new territory.

The key to PRESSS is its use of un-bonded post tensioning cables within a precast wall, beam and column structure, which along with specially designed ductile joints, allow for a controlled rocking mechanism that returns the building to upright without significant structural damage, even after a major seismic event.

PRESSS offers enhanced performance during a seismic event and in turn minimal repair requirements, as well as being efficient and economical to construct through the use of precast concrete.

*Figure 77: 3D Detail of PRESSS*
**Bike Share Services**
Bicycle Ventures is able to provide a fleet of fully maintained NextBikes with helmets, racks and locks. The bikes are provided with the NextBike rental management system which gives riders easy access to the bikes anytime of the day.

**Bike “Fixtation”**
public work stands, pumps, and vending machines for the bicycle infrastructure

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**Figure 78: Section BB’**
**Bus Stop + Bike Share**

The image on the right is an example of how these “Medium” modules can sit on a median bus strip to accommodate both bus stops and bike sharing stations. The dedicated cycle lane is safely separated that runs in the middle.
Figure 79: "Medium" module on a median bus strip.
This structure can accommodate for bus stops, bike share, bike fixtation and cycle lanes.
Dedicated Cycle Lane
Proposed from the urban strategy, dedicated cycle lanes will run in the middle of the median bus strip. This gives cyclists access to safe, and reliable dedicated cycle lanes down every key bus corridors.
Figure 80: Dedicated cycle lanes that runs in between the two bus stops. This image shows how bus and cycle services are woven together by this structure.
13.6 Large Module

Mirror
The “Large” module is derived by the previous “Medium” module by Mirroring the form along it's length axis.

Battery Switch Station
By mirroring previous form, it created at 6 meter wide tunnel to accommodate Better Place Battery Switch Station.

Battery Storage
The leftover spaces are used as storage spaces, ready to be swapped for EV cars.
Figure 81: Plan of “Large” Module

Figure 82: Section AA'
Multi-Modal Interchange
This image demonstrates how bus, cycling, and Better Place’s battery switch station are woven together by the structure of this design.
Figure 83: Street Perspective of “Large” module
Strip Module
The strip module is placed along the two sides of the railway track. With middle part raised.

Outer Edge Extract
The extracted edge were used to loft an overarching structure over the railway track.

Loft Bridge

Extend + Widen Ends
The ends of the structure was extended and widened to be used for the entrance.

Interchange entrance
Railway + Bike Lane
The railway and dedicated bike lane will run underneath this structure.

Accessible Roof
The roof will be accessible to pedestrians and cyclist. This connects the two sides of the railway track.

Rooftop Public Space
The middle strip, which is flat, will be public spaces.

Flexible System
This presented to be a modular system that can be multiplied to allow for expansion if necessary.

XL+L
These flexible modules can be configured to accommodate different modes of transport. By adding on a “Large” module, it adds bus and EV car services.
Figure 84: Plan of “XL” module
Figure 85: Section AA’

Figure 86: Section BB’
Invitation to Rooftop
The image on the right is a street perspective of the module. The ramps and building are in one piece that invites people to access the rooftop, which bridges the two sides of the railway track.

Figure 87: Street perspective of the “XL” module.
Rooftop Garden
The image on the right is an example of how the rooftop can be turned into lovely rooftop public places. The slight change of levels creates an interesting topography, similar to multiple mountain ridges.

Figure 88: Rooftop perspective.
Interior Perspective
The interior space of the structure is set out as straightforward as possible with clear indication for transparent information on multiple modes of transport. This way one should be able to easily navigate their way to their desired destination.
Urban Overview
The image on the right is a demonstration of how the various scale of the interchanges can co-exist to serve different purposes.
13.8 Case Study: Papanui

Why Papanui?
Although my design proposals aren’t designed for any specific site, the intention is to allow them to be easily populated on any site, depending on the transportation mode they serve. This thesis proposes to use Papanui as an example of how these small modules can be plugged into the urban fabric.

Reclamation of Car Parks
Papanui is listed as one of the key activity centers for Christchurch, thus has enough open car parking spaces outside the mall for reclamation.

Crossroad of multi-modal transport.
This site is also a crossroad of the multiple modes of transport I proposed as my urban strategy. Making this site perfect to demonstrate how the various scale interchanges can be plugged into this site.
**Plug n Play**

These modules are designed to be easily plugged into the site, depending on the transportation mode it will serve. These can also essentially be applied to other parts of the Christchurch.
Collaborations and Discussions
14.0 Public Collaboration

The notion of collaboration was evident from the very start of the Thesis. This was achieved through the formation of a body of work comprising of individual theses that could each stand on its own, whilst still being able to be read together as a whole. Being an Auckland based studio also enabled the group to assume a neutral position in analyzing the current problems and coming up with possible solutions.

This collaborative aspect was also extended outside the academic realm through engagement with both the public and private sector. In addition to just being a larger body of academic research work, the projects also situated themselves within the professional realm by engaging with people who were heavily involved with the future of Christchurch. The process of discussion and feedback with professionals from a range of industries helped gave strong practical groundings to the design projects. This lent to the development of innovative solutions to the problems at hand for the final proposals.

As a whole, the group has experienced the successes of the bottom-up approach for the greater community of Christchurch, through our collection of small initiatives. This was evident in the overwhelmingly positive reception received in the presentations to the Christchurch City Council and during the Festival of Transitional Architecture (FESTA) Public Presentation Event, which surpassed all expectations.

KiwiGo Development

The mobile application initiative, KiwiGo, is a vital component for transitioning Christchurch into a multi-modal city. In order to bring KiwiGo to fruition, I have approached several local initiatives that share my vision in creating a multi-modal Christchurch.

The first step I took was presenting in a public lecture, “Shac Micro Architecture” in Christchurch Polytechnic Institute of Technology. The overarching theme, “small idea, big impact” of the event was aimed at informing the public about innovative solutions for the future of Christchurch. Due to the public consensus of the desperate need for multi-modal transit, KiwiGo was very well received. This was further enhanced by introducing the community-driven car sharing service, because everyone can take part in the betterment of making commuting through Christchurch more efficiently.

After the public response from Shac Micro Architecture, Coralie Winn from Gap Filler pitched the idea to several local software developers. Subsequently, Kaila Colbin from Ministry of Awesome introduced me to Jurg Honger, programme manager at Tait Communications. They coincidently needed a transportation solution such as KiwiGo for their fast growing company. Jurg Honger has also kindly organized for me to present KiwiGo to their team of software engineers, which sparked great interest for further development. This also grabbed the attention of Robert Henderson from Bicycle Ventures, a local bike sharing initiative working closely together with Tait for their campus. The research has also further grasped the attention of Shaun Hardcastle from Aurecon, alongside Christchurch City Council and CERA.

Figure 95: Chain reaction of interest
Figure 96: Public Presentation at Shac Micro Architecture Workshop for KiwiGo

Figure 97: Public Presentation at Shac Micro Architecture Workshop for KiwiGo
14.1 Christchurch Collaboration

Public Engagement
To push the momentum of our collective proposals, Future Christchurch was invited to be a part of Festival of Transitional Architecture (FESTA). A public presentation was held to showcase the design proposals to everyone including city leaders who joined our previous conversations.

The feedback from both public and city leaders surpassed our expectations; The support and encouragement of our approach to planning proved to be successful in gaining their attention. Edward Wright from Environment Canterbury (Ecan) commended the case study of Papanui due to their recent office relocation to that site. Robert Henderson of Bicycle Ventures Ltd praised the integration of bike sharing in the proposed interchanges.

We also attended the TEDxEQCHCH during our stay in Christchurch, where we met Alexandros E. Washburn, chief urban designer for New York Highline. He was one of the many inspiring talks that brought Christchurch great energy, vision, and positivity towards the future of Christchurch.
Figure 99: Public Presentation at CPIT

Figure 100: Public presentation at CPIT

Figure 101: Future Christchurch Studio checking in at TEDxEQCHCH

Figure 102: Alexandros E. Washburn
14.2 Conversations

The collaboration between a diverse range of professions is also a prominent goal of this thesis. During the course, two conversations were organized in both Auckland and Christchurch, to discuss the real world implication of the proposed projects. (appendix 1.)

**Auckland Invites:**
- Dushko Bogunovich, Associate Professor, UNITEC
- Matthew Bradbury, Senior Lecturer, UNITEC
- Marianne Riley Architect, Associate at Jasmax Ltd.
- Aaron Sills, Architect, Partner at Sills van Bohemen Architects

**Christchurch invites:**
- David Falconer (Christchurch City Council)
- Michael Blyleven (CERA)
- Richard Carr (CDC)
- Robert Henderson (Bicycle Ventures)
- Malcolm Locke (Wholemeal)
- Jurg Honger (Tait)
- Shaun Hardcastel (Aurecon)

The aim of the conversations is to bring together a wide range of professions to the table. Ranging from government to business enterprise, it accentuated the strength of collaborative thinking through the critique from different perspectives.

These conversations have been invaluable for the progress of this thesis. Through real-world discussions with policy-makers, it has effectively forced critical levels of thinking into the decision making of our strategies.
The outcomes achieved were made possible through working collaboratively as a team of thesis students. Through setting up an office structure, a working and learning environment was created in which the sharing of knowledge is facilitated. This aspect required each team member to take on a unique role within the group based on their individual strengths and learn from each other.

Situating the projects within the public realm also yielded a number of opportunities for the team. In doing so, each member were able to engage and build up a network of connections with the people involved in the rebuild of Christchurch. This process of interaction with local organizations and initiatives such as the Arts Circus, Unlimited School, EPIC and many others, informed the direction of each respective projects. Not only did this help give the design a rooted foundation to develop on, but this process also helped open up future potentials to develop some of the proposals through the members’ prospective careers.

The successful outcome of this collaborative approach, both as a learning model and as a way of creating discussions within public realm, brings into consideration the opportunity of extending this method as a platform towards future projects. Therefore, this project will become a starting point for the Studio Christchurch as well as being documented through the third volume for the Future Christchurch publication. By continuing this collaborative approach, the design projects will carry on to facilitate open discussions and the sharing of valuable knowledge in academia across the country along with the community of Christchurch.

Figure 105: Studio collaboration
Figure 106: Studio collaboration through knowledge sharing
Figure 107: Future Christchurch Studio in beginning of research

Figure 108: Future Christchurch Studio after FESTA public presentation
14.4 The Exit Show
Conclusions
Transport Dictates Urban Form
This thesis acknowledges the past, present, and future potential of Christchurch City. It has been evident in the economic research that the advancement of transportation technology over the past centuries has been the main driver behind the expansion of cities; it has steered the evolution of Christchurch from a walking city to transit city and now the automobile city. Each advancement allowed people to travel further in distance while keeping within the same period of time. This “travel time budget” dictates that cities should only be “one hour wide” in order to retain travel efficiency. (Newman & Jennings, 2008)
Thus the critical understanding of this thesis is that transport technology is what dictates the urban form, not a result.

The Need for Alternative Transport
The extensive uptake of automobiles over the past decades was an inevitable consequence of the industrial society. The 19th century developed zoned planning systems which depended on automobile to obtain most services. This type of lifestyle and city development was pumped by the era of cheap oil, in which is absent today. However the prominent discovery was that people are still conducting 85% of all daily trips through their personal automobiles. After examining recent statistics and travel surveys, it has been evident that the automobile preference was not by choice, but forced due to the lack of alternative transport solutions.

This thesis acknowledged both the challenges and significance of implementing quality public transportation in Christchurch. The government is currently only interested in investing in tarmac roads with little consideration on the impending oil crisis. Further investment in public transport has always deemed too risky due to Christchurch’s low density and sprawled condition; The government proposes to spend $21 billion on roading infrastructure after 2012 but only $0.7 billion on other transport projects. This negligence towards public transport is what this thesis has strongly confronted with.

Small Idea, Big Impact
This thesis realizes the reality that the holdback of public transport investments are often due to various high risk factors. Auto-dependent cities are usually associated with low density and insufficient patronage to support its public transport. Thus instead of fighting the norm, the first solution taken was to use the dominant car culture as an advantage for transforming Christchurch towards auto-independency. The mobile application initiative, KiwiGo, will begin the intervention at resolving single occupant vehicles through active car sharing. By providing a user-friendly interface and reliable service, the hassles previously associated with car sharing can be easily resolved. The strategy takes advantage of the 5th wave of innovation: digital networks, software technology, to transition private car use to a more collaborative system. (Newman, Beatley, & Boyer, 2009) The practice of such initiative is both economically and socially beneficial; drivers can cut down travel costs while riders worry less about car parking. When combined with existing public transport services, people will begin to view personal cars as merely another mode of transport. The success of KiwiGo will further lead to immense contextual urban impacts, by incentivizing a change in car-use, substantial amount of funds for tarmac roads can be redirected to the betterment of public transport.

The basis of this approach is a reflection on the critique of most master planning methods, namely the top-down approach. These method often aims towards a one-off, final end result. The flexibility of KiwiGo in its programme and usage surpasses conventonal public transport solutions; it allows and welcomes the integration of emerging collaborative consumption initiatives such as Zip Car and NextBike. It also ensures that KiwiGo can continue to adapt to the ever-changing transport landscape in the near future. In comparison to the $21 billion roading projects, with just a fraction, KiwiGo initiative has the potential to spread virally amongst the car-cultured population. The more active users, the more drivers ready to share their rides, thus a more efficient car sharing network. Through this initiative, this thesis has demonstrated how a grassroot approach towards resolving congestion can be much more economically viable rather than the conventional top-down method.

Architecture Response
The focus of this thesis is not exclusive to the architecture itself, but the research methodology that informs the design process. The architecture response intends to aid commuters with one objective: navigation. This thesis envisions the architecture to operate as landmarks that can be easily identified as transit interchanges. Thus the architecture plays the “front end” of the entire transportation network. By categorizing the interchange into different scales, much like KiwiGo, it allowed the functions to be flexible. The modularity of the system not only allowed the design to be highly adaptable to accommodate the various transport modes, it also enabled the interchanges to be easily transported to different sites. Thus this strategy allows them to be easily populated within Christchurch’s urban fabric. Each interchange will serve a specific purpose, depending on the transport mode it accommodates. This approach of “plug and play”
strategy is a reflection on the critical finding of this thesis: transportation should dictate the urban form, not vice versa.

This basis of this thesis sits in the strong opinion that Christchurch should no longer linger in the state of automobile city. In the wake of the recent earthquakes, now is the perfect time to re-evaluate its current transport network, and future proof the impeding shortage of petroleum. Knowing that the fruition of conventional public transport in Christchurch has been, and will continue to be an uphill battle, this thesis has proposed a simple yet powerful solution that benefits both personal and public transport.

While the technology of yesterday drove the expansion of cities, the innovation of today should steer social behavioural changes towards collaborative consumption. Through this we can begin to push Christchurch into a multi-modal city, towards an efficient economy.
Auckland Conversation

This year we are testing a new approach to thesis by pooling individual thesis students and engaging as a collective to develop a strategic urban plan for Christchurch. Instead of coming up with an urban master plan or end vision we are starting with economic research and teasing out possible catalysts for growth. Each student has researched a unique economy in Christchurch, and from their investigations they have derived an urban strategy that could in some way stimulate investment into the city.

There is a strong overlap between the individual projects, recognizing that economies are not independent from one another, rather they intimately coexist.

Invited Guests:
Dushko Bogunovich, Associate Professor, UNITEC
Matthew Bradbury, Senior Lecturer, UNITEC
Marianne Riley Architect, Associate at Jasmax Ltd.
Aaron Sills, Architect, Partner at Sills van Bohemen Architects

Students:
Erica Austin (The Experience Economy)
Alex Haryowiseno (Innovation Economy)
Biran He (The Housing Economy)
Praveen Karunasinghe (The Creative Economy)
Jacky Lee (The Economics of Transportation)
David Wong (The Green Economy)

Advisors:
Chris Barton (New Zealand Herald Journalist)
Camia Young

The following is the transcript of the conversation.

Marianne: I have a broad question for all of you, what is the relationship between the CBD and the fringe? There is a huge opportunity within the CBD, it was a city that was already too big for its boots and now it has the opportunity to become more centralized.

Matthew: I think just the opposite is true, but that is ok.

Marianne: Maybe not, what I’m talking about is that there is a core and there is the city that has spread out into the landscape. What I’m interested in knowing is how each of your projects link to each other, for instance how do housing and transport link together?

Camia: That is what we have come together to discuss today, while certain overlaps have begun to emerge the students have developed their research so as to become familiar with an economy and the respective potentials. But your point about whether to centralize or decentralize is one the group has talked about and is beginning to take a position on. Alex, you have shown through your work an emerging urban strategy, can you tell us about this?

Alex: My approach has been to locate potential sites within Christchurch’s industrial zone, you can see in the aerial map the industrial zone is the part that is all white, and it runs east west and through the southern part of the CBD. If new IT centres are located in this area, it would create a demand for housing as well as possibly educational facilities and the need for improved transportation, all because these new centers will attract people to work in these zones.

Aaron: I think perhaps a major issue is about creating a sustainable city model, if that is an over arches idea, then probably transport and housing are the big drivers, especially transport. If you can intensify the central city, and you establish your a goal to make a certain percentage of the population capable of living and working in an area where they can get around by walking and cycling, then there is less car use. So in a way, creating a sustainable city model could guide the other projects.

Camia: Do you think there has to be a singular guiding principle? Or do you think that each project could work somehow in parallel?

Matthew: There seems to be an unspoken assumption that it is a good idea to go back to the city, to rebuild the city. Are all of you in agreement with that?

Jacky: Well, we don’t want to make it a centralized model, not like how it was before which was really monocentric.

Matthew: You don’t agree with that?

Jacky: We see it more as a network with satellite hubs.

Matthew: The CCC Draft plan was very much so about going back to the city center.

Aaron: I don’t know if it was, just because they wanted to create a decent center with people living in it does not mean they intend on taking the whole of Christchurch and moving it into the center.

Matthew: No, no but the intention is to rebuild the center and intensify it. So is that what you all believe should be done, rebuilding the city center?
Erica: I don’t believe it is about just rebuilding the city center, but it is a significant part. The CBD will still work as the center, but our proposals suggest other satellite centres connected to the CBD.

Biran: The greater Canterbury Development Strategy has identified four possible models for growth, with the two extremes being the “Business as Usual” model which follows the urban sprawl of the last 20 years, and the “Concentration” model which is mono-centric. But what we are proposing is an Unconsolidated form where we have small urban centers within the urban area with intensified development as well.

Dushko: So it is a bit of a compromise, an in-between model?

Aaron: It is not a compromise, that has a negative connotation.

Matthew: So have you looked at how other cities around the world are developing, and maybe compared different models?

Praveen: We looked at the cost efficiency of the city, for instance the Newman Kenworthy graph which shows the density of a city relative to oil consumption, this graph shows there is a clear trend where there is an inverse correlation and essentially you have a transport efficient city if it is dense, but if you have the mono-centric model everyone still needs to travel to the center if they live in the suburbs, which is less efficient.

Marianne: Auckland for instance has a workforce spread all over the city, for instance the CBD only has 15-20% of the work force or maybe even less, but what this means is that the public transport systems are forever failing because you don’t have a hub, the city center.

Camia: Is that a failure of the transport?

Marianne: It is a failure of the entire system, because your workforce is dotted all over the city and the busses are therefore always under patronized. It is all about the connection between where people are living and where people are working, that is the model you want to make work. And what is also really important is creating spaces close to where people live that have a mini-city feel, one that brings with it a sense of a high quality of life. Alex, your proposal shows industrialized hubs in certain areas and others of you are proposing other areas, and I am interested in when you guys sit around the table and start fighting for your patch, because you will start to have to do it at some point. Then there is a question around the use of cars, why would we use them if we have to park them in the city centre?

Jacky: As I see it, the current proposal for a light rail or other forms of public transport need big investment, and I think it is really risky, especially when you know that mass transit only works with a certain population density, and it won’t really work at all in a low density area. That is my main concern. So if it is risky why not invest in something small and something that is personal such a mobile application.

Marianne: But you are always going to have to park a car.

Matthew: Yes, but not so many cars.

Marianne: Yes ok.

Camia: And you don’t want to categorically say there is no choice any more.

Jacky: What I am proposing should runs in parallel with advancements in public transport; I definitely think there should be better public transport.

Marianne: Have you read Julian Genter, she is one of the Green MPs now, she talks all about parking being the limiting force.

Jacky: Yes, by limiting the amount of parking and increasing the cost it discourages people from driving, but it is kind of cruel if you don’t want people to drive and you don’t have good public transport then it does not work, so both parking and public transport have to be addressed.

Aaron: The discussion about driving is not an either or, I live 5 minutes from where I work which means I don’t use my car very much, but I still have one. It is not about getting rid of cars; it is about less time on the road.

Jacky: I am not too concerned about the number of cars we own, but rather what does concern me is that people drive predominantly alone.

Aaron: But it is also about how many total miles get traveled, apparently there has been less driving mileage in the last 5 years in New Zealand.

Chris: Just picking up on some of the comments so far, and having been involved in the project from the start, this point of where you have gotten to so far and now considering where it all goes is interesting. There is I think among you an inherent contradiction. I think there are two projects that operate on an economic model that
is very different to our current model, and that is David’s Sustainability strategy, and Jacky’s Collaborative Consumption model. Where as the other proposals are tied to economic growth in the conventional sense, all of you are talking about improving growth and GDP in the conventional sense. There are two that seem to be going in a different economic direction, while the others are quite conventional. Possibly yours too Praveen, but you are still trying to define where you are going with education, it could be tied to the sustainability model, but I think you are still talking about growth as improving GDP.

Camia: That does open up an interesting question, do we have to take economic growth as an accepted given?

Dushko: I think in the sake of Christchurch you have to because obviously the economy has suffered a massive drop, so it needs to recover. To argue in the case of Christchurch we should now invent this new no-growth economy does not make sense in a city that has been so badly hit. In this particular case I’d say growth is all right up to a certain stage, and I certainly don’t mind that all six of you have taken the economy as the main driver. But I am also looking for something in common, or a leader, the project that encapsulates it all. And I was hoping David’s green economy project would be the lead, but it isn’t because it is really about clean energy, so you might think about changing your title. The green economy is something bigger, it includes more then just the energy economy, many other things such as housing, manufacturing and so on. Maybe if all six of you would agree that there is this seventh entity, which is the green economy, then you could all fit in this overall concept, one that values nature.

David: What I presented way my urban strategy, prior to this I researched the Green Economy and this includes the range of issues you are talking about.

Dushko: Maybe all of you should go back to that research and ask how can I fit my work inside of this. How does each of the six of them actually get a green’ color? That might be the unifying strategy. And then sustainability is just in it, you don’t have to worry that sustainability is about what kind of heating people will use, or how they will drive, is it sort of minor.

I think we can safely assume way more expensive energy in the future, to me that is a given, double, triple energy of any kind, not just fossil fuels, but any kind, which will then reduce the urban metabolism overall, which means there will be less mobility. You should not take that as a kind of disaster, but you should see the good things in it. Why do we spend so much time in our cars, why do we shuffle so much around, just transporting from one place to another, why are we doing all that? There is a lot of stupid traffic going on everyday in every big city. So maybe expensive energy can have a positive spin, maybe everyone will calm down and maybe they will have more time and fun in life. This shift towards expensive energy is serious, and there is a huge body of literature to support this, very scientific, and this is very soon in fact 10-15 years down the road.

Marianne: When you talk about growth there is the whole social side of the city, when you think of growth maybe it is not just about the economy but about civic pride. I think it comes through all of your projects, for instance with respect to housing you think of economic growth and social growth in terms of 1-2 people living in a larger house, how do we create housing that creates a community, that creates an attractive society. If you can think of it not just in terms of putting a dollar value on it, but perhaps in terms of health benefits, mental and physical, then the social well being could be an overall sustainable principle. I think that would give you all a joint vision. It is not to say you are going to master plan everything down to the last detail, but how do you create a framework where people can then infill their own identity. And then what are the pilot projects, for instance, an innovative housing project with infrastructure connections to the industrialized area. What does that pilot project look like and how does it work within the city? That would start to prove your thesis. So you cast the overall vision and you drill down to a few seed projects.

Camia: You mean where is the start. In some respect that is being shown through Erica’s thesis and the notion of curating a festival, or Jacky’s transportation app as the starting point. So the returning question is what is the overarching concept that hangs these thesis together? And it is one way to say we need an overarching theme, but this becomes quite hierarchical. Perhaps another way to bring the projects together is to think of them more as a network of integrated economies.

Aaron: There are a couple of things about networks that I picked up on in two of the presentations, in the one about education there is the idea of clustering of lower decile schools in poorer neighborhoods, and the other one was the industrial innovation project and the kind of stitching through that area. I was wondering is it a problem, the clustering in that sort of scenario, it means things are uneven, which can create a kind of hierarchical network.

Praveen: Yes, by clustering the lower performing schools it means that the rich get richer and the
poor stay poor, which is a social hierarchy.

Aaron: It is the same issue that social housing providers have, should one pepper pot or cluster social housing, I think the former is better, it is better to create a sort of even spread of different types of people, different wealth, different school qualities. So when you talk about networks and non-hierarchical things is this what you mean?

Camia: Yes, but lets take education as the example, I have an idea for a non hierarchical approach. My thesis in colleague was a school system for LA, they had a problem due to the lack of space, and to temporarily solve the problem they were putting portables on campuses. At the time of my thesis in 2000, 25% of the high school students were attending class in portables, this meant facilities were way over capacity and the entire school system was suffering. What I proposed was to tap into online learning, which would free learning from being something you have to do in a classroom at a fixed time and place, making learning more accessible. By doing this you could open up a certain flexible in learning, which could completely transform education and the building typology to create hot spots in a city. If you distribute small classrooms throughout a city students can attend them on their own time frame, which completely changes education in a city as opposed to a person having to attend a single room they can access learning when and where they want through online learning. That is the kind of network I would suggest, it is not the network we currently have which has faults, it doesn’t quite take advantage of the resources we have available to us. I think we need to look at the current technological potential and seeing where it could go.

Dushko: So you are trying to save on brick and mortar, we don’t need so many new buildings. You are saying we can have teaching taking place in a virtual space?

Camia: Not necessarily, I think you still need a place for learning, I just don’t think it has to be in a larger institution, instead education can be distributed throughout the city, learning can be made more accessible and flexible.

Dushko: So we don’t need huge buildings?

Camia: Right, a classroom could be like a coffee shop, and people of all different ages could be learning in this space. Students could be online learning sometimes, or have one-on-one with tutors. This could change the dynamic of a teacher to student relationship, and instead a teacher could assist a student with learning by helping students through online exercises. Basically what I am saying is there is definitely room for innovation in education, because there is a massive shift where learning is no longer about memorization, it is about synthesizing information.

Aaron: Partly that is about teachers, there was a thing on the radio last night about British Nannies were being used to provide this infrastructure.

Camia: That is Sonata Mitra, he has two TED lectures, which are brilliant. In 2006 he went to inner India and left a touch screen monitor hooked up to the Internet, he came back a month later and observed what happened. He found the kids had improved their English were playing games and had figured out how to communicate through the Internet. He knew he was on to something rather obvious but interesting, that is kids learn through curiosity. He has gone on to develop his research to understand how learning can be transformed through curiosity driven learning, so we don’t have to have the one teacher that provides information and then tests a student’s learning, it changes the model. We are moving from what I would call a productive society or industrial society form of education, which is memorize, regurgitate, produce, and become a productive citizen, to a creative based education society where we are given an enormous amount of information which we have to somehow make sense of and learn to be critical of and then make something from it.

Aaron: There is a connection to the transportation app, it is a based on a network with relatively small players interfacing with each other. Another thing on the radio last night was talk about the industrial economies in Europe and the weaving factories that are still there. Two things, they said there is a resurgence of industry because China is becoming slightly more expensive and that was opening opportunities. But also that resurgence was a completely different type of industry one based on a vertical integration, these manufacturing businesses were having to create their own brands so they were both making things and selling things. I don’t think we can move away from industry by saying we are moving to a knowledge based economy, it is just that industry will change. And in fact my feeling is that New Zealanders need to focus more on manufacturing.

Dushko: That is the German model.

Matthew: This is the same beat in England 20 years ago, and Germany went the other way towards high manufacturing, and now look at who has the better economy. England moved towards the service economy, banking, insurance etc., and manufacturing in the north of England.
was forgotten, unfortunately it did not quite work out. But to come back to Christchurch, and this conversation. How are your proposals going to intersect with what is happening on the ground at the moment, and how are your projects framed within other situation like Christchurch and disaster cities. For instance the east side of Christchurch is where liquefaction occurred and as I understand it many of those people have left? If you compare Christchurch to New Orleans, many of the poor people left and most did not come back because basically there was not housing. This has changed the demographic of New Orleans, and now a lot of young people are moving there. Is that the kind of scenario that could be played out in Christchurch?

Camia: I don’t know if that is the case in Christchurch, I don’t know the demographics of the people that have left, but there are quite a few people that have not received their insurance money so they basically can’t afford to leave. I think it might be the opposite of New Orleans, where in Christchurch the people that had money and had the opportunity to leave, left.

Marianne: But then there are also a lot of business owners in the CBD that are taking their money and going to Brisbane or Auckland to set up a factory or business.

Matthew: That is the other driver, many western cities are decentralizing and people are moving out. That was definitely happening before the earthquake, everyone was emptying out of the city. People who own property there are making a big effort to protect property value, and that seems to be part of the drive of bringing people back to the city. Is that part of your thinking?

That is a big economic driver.

Chris: Just picking up on what you are saying there, Erica’s thesis for sure picks up this idea, her project zero’s in on the shrinking city more then the others, which is what you are talking about. And by acknowledging that we have these gaps all over the place, and asking the simple question, what are we going to do with them, she has developed a proposal based entirely on the shrinking city and the absence of the city. I think some of the others tie into that idea too, Alex’s identifies the shrinking manufacturing businesses and the areas within the city that are left vacant and tries to address the issue. That may be another theme that could bring all the project together and explored in more detail. It does seem that Erica’s stands out as the one that really address the fact that the city is shrinking.

Aaron: It seems to me that there is a move to residential coming back to the city, I think that is partly driven by the fact that creative communities tend to be in the center, at least for a city this size. So I presume there will be a rebuilding, and that will tie in with a general move to a central residential area, I don’t think it has to mean everyone will move in, but I do think it will help the rebuild now better then it would have 20-30 years ago.

Camia: In a way we have to look at what the phasing strategy might be, and understand which one is the catalyst for the next one, but then it becomes a chicken and egg question. Do you build an IT hub first or do you build housing, or something else?

Marianne: The danger is they need 26,000 houses, and where are they going to put all of them? And where are all the amenities if you put the housing on the fringe, the amenities are nowhere.

Aaron: Talking about phasing, one model to look at is Britomart, that developer has been very smart over the last 10 years. They started by building a big tent, then they rented it out to artists groups for very little rent just to bring the public in, I suspect they thought carefully about it and how to build it up over time and get people there. And of course you can’t put a whole lot on the market at once because the market is not big enough to absorb it.

Erica: My proposal is to do something similar, by bringing activity back to the city it will attract investors. There are quite a few precedents around the world where this has happened. In my proposal I want to provide artists studios and accommodation in conjunction with temporary or pop up places for events to happen, and then a second phase where the businesses, retail or hospitality would be attracted to the pop up events. This would allow for a kind of phasing to happen.

Camia: Something that is happening that is unique to Christchurch right now is this notion of the temporary project, which in itself is not so unique, but in this context it is allowing for experimentation. Gapfiller is testing ideas, like the Dance’O Mat, which was hugely successful while other Gapfiller events have not been so successful. What it does is allows for inexpensive experimentation to see what works, unconventional ideas can be tested. So it is not like, lets build a convention center, invest millions of tax payer dollars, and see if it works? There is also the idea that the event does not happen in the same place every time, and I think there are some urban principles that could be drawn
from this, so instead of looking at a fixed city we can actually come up with a type of architecture that can adapt and transform as a city changes, it could either grow or shrink. I think there in is a possible thread to join the projects.

Marianne: Yes, and then the architecture responds to the community.

Aaron: The city is like that anyways, I mean not a convention center, but again Britomart is a good example, many of the buildings there were warehouses, and now they are being re-used for restaurants, shops and events.

Erica: One of the projects the Gapfiller did was that they moved the giant chess board from Cathedral Square on to one of the empty sites, and as time went on a cafe was built around it. I think this is a good precedent, it shows that things start to emerge around small insertions. For my project, I don’t want to build event architecture and think that people will come, I want to allow for organic growth. I want it to be more about designing a system rather then designing a product. So there is not an end product, but a flexible system.

Camia: And that could be a thread for all of these projects.

Aaron: But then zoning becomes a problem.

Camia: Yes, zoning is a massive problem, a problem of the last century really. Don’t get me wrong I’m not suggesting heavy industry be placed next to residential or a school. But maybe there is another way to create flexibility and resilience.

Aaron: Well you don’t have to have a fixed rule, it could be on a case-by-case basis.

Camia: There is the entire industrial zone that Alex is looking at that could be rezoned for IT hubs and residential, instead of going out to the fringes you do infill instead.

Dushko: Yes, residential towers.

Biran: They are scared of towers down there.

Dushko: Safe towers.

Camia: Well, that brings up another issue. This does not have to be a tall city, nearly every tall building in Christchurch will eventually come down once the demolition is complete. They are currently in the third phase of demolition. The first phase was the building is not safe it has to come down, the second phase was the building failed safe, people could escape but it is no longer structurally sound, and it has to come down, and now there is the third phase, which is the insurance payout is more financially viable than saving the building. There has been this massive backlash due to the insurance payouts, which is why so much more is lost then say in San Francisco or Tokyo where they don’t have government insurance schemes, there people are fighting to save their buildings, and here it is a disposable city condition. And it is changing the landscape dramatically.

Marianne: That was a question I had, what about heritage? A friend of mine lives in Lyttelton, and when she goes into the centre she does not recognize where she is, she is completely lost in a city she once knew. Maybe you could just leave some of the landmark buildings even if they are in ruins, just put fences around them, and then one day we work out how to deal with them. Are we just erasing the wounds so we don’t have to think about it. If they are dangerous just pull them down to one or two stories, and put fences around them. That is a question for your projects, the heritage of the city is now lost, how do we recognize what was once there in these projects? Because the emotional continuity of the city does need to be there, and as architects we need to recognize this.

Dushko: I would like to say something about infrastructure, the word has been mentioned a few time this morning but never as the overall concept, some people have talked about energy and transport, so it is not that you have forgotten. But I would like to urge the group to think about infrastructure as the overall concept, as the overall idea that there is this magic underground system, and that you push the button and the lights come on, or you open the tap and the water comes out.

The overall idea that the city is well provided for, such as food, water, sanitation, mobility, and fuel, that idea is under a major threat, and personally I do not believe that the infrastructure as we have today will survive. I think there is a need for a radical reconceptualization of infrastructure. That means both of its typology- its geometric layout and the idea there is a power plant in the center and then reticulation goes to all the buildings in the city “C both the geometric layout and the technologies that power the whole system. I see the likelihood of great decentralization that many systems will not be reticulated anymore or at least will be backed up by the centralized systems so that most buildings will have to some degree their own power their, own water and their own sanitation. I urge you all to question the notion of urban infrastructure as a big heavy centralized system, because I believe Christchurch has a historic opportunity to create...
something different, highly decentralized and highly autonomous.

Matthew: So you are talking about Green Urbanism, almost a polycentric city, maybe these new mini hubs have their own power centers?

Dushko: Part of this new idea for infrastructure is includes harnessing nature and the ability to process some of our waste to produce energy for the city. A low density city which leaves large tracks of land undeveloped, can be very productive and sustainable, because it leaves a lot of horizontal space and land for harnessing solar energy, generating food and dealing with storm water. The whole concept of infrastructure is changing, and this could be another overall linking theme for all of your projects. You could agree on an overall philosophy of infrastructure, then it is more likely you will find common ground among your six economies.

Camia: One of our student last year catalogued all the infrastructures in Christchurch, and what he proved is that most, not all of the major infrastructures are centralized, which is as you suggest, and I agree, is a major problem because it is vulnerable to failure. The sewage system and its failure post earthquakes is the key example. What the student proposed, after cataloging how the infrastructures worked before the earthquakes, was a new method for working, which was a decentralized network system. He went on to propose two linear spines with branching systems off of it and connecting across.

Dushko: that is exactly what we proposed for Auckland! A linear city.

Aaron: I am just wondering if the overarching theme is a kind of non-hierarchical network. But I think there has to be a balance, because there is a lot of value in having a CBD. So you have this kind of network, but in fact there always has to be a centre in Christchurch.

Matthew: The center is over.

Aaron: Well you can explain the center as part of the next level up of network, in the same way that Auckland has a center and Hamilton has a center, so it is part of a network.

Camia: I see it as there are moments of intensity, and one intensity might be defined as central.

Dushko: Well of course there will be, I mean there will always be Cathedral Square and nobody is suggesting this should be bulldozed, but the centre won’t have the economic importance that it has had through the last century.

Matthew: The center is over.

Dushko: That is important, you all know that Christchurch was a planned city, it was designed with the cutting edge ideas in that time, which was the 19th Century grid city. Well now we are in the 21st century, and the turmoil and the challenges of the 21st century will be quite severe, and the 19th century model will not work. So here is an opportunity to radically redesign the whole idea of a city and infrastructure.

Dushko: That is exactly what we proposed for Auckland! A linear city.

Camia: I think there might be an egg in between?

Aaron: The omelet?

Dushko: That is important, you all know that Christchurch was a planned city, it was designed with the cutting edge ideas in that time, which was the 19th Century grid city. Well now we are in the 21st century, and the turmoil and the challenges of the 21st century will be quite severe, and the 19th century model will not work. So here is an opportunity to radically redesign the whole idea of a city and infrastructure.

Chris: Maybe to test out the idea that you are proposing something radically different, we could ask each of you if your project was real and you were going out to work with an architect and make it happen in a way you would want it to happen, who would your client be?

Alex: My client specifically would be the EPIC initiative, which is an IT hub currently proposed for the CBD to bring businesses displaced from the CBD back to the centre. They are a private initiative, by Will William, the CEO of a software company in Christchurch.

Erica: Mine would be the Art Circus people, what they want to do is relocate the current events village from Hagley Park and create an event hub within the CBD along Tuam Street. This is partially funded by the CCC, I think. And it is likely to be one of the anchor projects, depending on which way things go.

Biran: I would look at couples and singles, and I would go with developers as the client, a private client, and I would try to persuade them to build in the city boundary and not go out into the Towards an Efficient Economy | Appendix | Auckland Conversation Transcript
fringes.

David: I would choose the Christchurch Agency for Energy (CAfE). I would propose to transition towards a more sustainable energy scheme through changes in the infrastructure. They are a sub agency to the government council. I presented my solar ideas to them, but they were not so responsive. They said unfortunately while it makes sense the current market in Christchurch has no driver or any stimulus, and that solar is 4 times more expensive then oversees, and unfortunately there is no driver to bring these costs down. And then they explained the many obstacles in the way of transitioning toward energy efficiency, for instance there are thousands of homes being repaired through insurance claims, and while it logical to insulate the homes during the repair, the insurance policies only allow for rebuilding to preearthquake conditions, they do not allow for improving or upgrading, even at the owners expense.

Aaron: It depends on whom you are talking to, we share an office with solar city, and they have just signed a deal to supply solar for an entire development.

David: Yes, that is a good precedent. But the solar adoption rate in New Zealand is around 2% while in Australia it is like 50%.

Chris: So is your client a government agency or private market?

Aaron: Didn’t you mention using private car vehicles as well? Would you still be connected to the grid?

David: The problem with the electrical vehicle is that the battery is the most expensive part, so there is this group that basically says we will take the battery out of the car. It takes about 18 hours to charge, so you need to swap the battery at swap stations. It is faster then pumping gas, and you get charged by the amount of energy you use similar to fuel consumption, but electrical consumption. The idea would be to set up battery swapping stations, like gas stations, but instead they swap batteries.

Camia: It is hard to pin down your client, you could look at it as a government agency, or you could look at it as a series of energy producing business, solar, wind etc, but maybe it is both?

Aaron: Well if it is agency driven you are trying to convince the market, if it is market driven then it has to make more financial sense. You could look at Germany, they have subsidized the solar industry through their central government which has driven investment and adoption.

David: We are thinking about feed-in tariffs, the same as they did in the UK. They incentivized putting in solar, so people invested into solar, it used to be back when it first started that people where putting energy back and getting 4x the value for it, then people started having solar farms in their own homes, but as more people put in solar this changed the payback period. But again this is policy driving the market, for me it is about supporting the demand so the supply can be met.

Aaron: It is more then policy, it is government funded, so you are taking from some people through taxes and paying to get a change.

David: Actually the real idea is about taking the money from oil and putting it into something else.

Dushko: The change is basically a carbon tax, by taxing the dirty forms of energy and giving it to the clean forms of energy.

Aaron: I’m a great believer that the market will do that eventually. Oil will get expensive, as long as civilization does not end.

Jacky: For my client I am not coming from a top down approach but more a ground up, so I’m thinking more about this app. When I presented it down at CPIT people came up to me and asked me when this service would be launched.

Marianne: So you are your client?

Aaron: Are there precedents for this app already?

Jacky: Yes, but not in Christchurch. I have been working on finding a few software developers, but really now the problem is funding. And while there are apps that do this, I want it to be localized and more Christchurch specific, so in the future I guess my client might be Metro, the public transportation service in Christchurch. I would like to persuade them to support this app, then it is not about a tug of war between driving your car or taking the bus, instead it gives people a choice and ultimately reduces congestion, which increases efficiency, so it is a mutually beneficial.

Camia: Embedded in each of these thesis is the notion of a real application, an outlet to test an aspect of the thesis. Jacky’s app is doing that, as well as the Festival of Architecture that Erica will help to curate.

Praveen: My client would be Vicki Buck, she is the x-mayor of Christchurch and helped to start the Unlimited School; it is both primary and secondary, and it is based around creative and
innovative education. It would be exciting to see how this idea could be extended into other regions.

**Camia:** Interesting so we have a mix of private and public clients. Something to think about. We need to wrap up, are there perhaps some closing remarks?

**Aaron:** You all seem to have a huge amount of energy, and working as a team seems to be a good thing, that is really noticeable to me, keep feeding energy off each other.

**Marianne:** I agree, and I have really enjoyed hearing about all your projects, and I feel really optimistic about the future, I can see you could turn this into something special. It is great to hear you have been down there, and you will go down there again. They are hitting the hard yards there in terms of not having a city, so the hopes for the future is very important. The seed of an idea can often become a reality, you have to be passionate, but you will all get there, just keep on talking and find the right people to make things happen, so the question of the client is really important.

**Matthew:** You have a really interesting approach to urbanism, it is a great way to approach this kind of problem. As you start to look at the applications of these kind of ideas one of the important things is the landscape, Christchurch is a swamp, was a swamp. Do you have Di Lucas Black maps? These show were the streams were, so if you are doing something radical, say well the city should not have been there in the first place.

**Dushko:** I am very impressed by your presentations, you have structured them coherently, and you have spoken eloquently. You have done a good job conveying an enormous amount of information to us, who are seeing your projects for the first time. That is an important professional skill and will also help you in communicating in the practice. In terms of what the objective was for this meeting that is to find some common ground. I think we have indicated where it might be but we have not found it yet, but there is definitely some way to do it, and I think there should be some common ground, and I think it should be around the green economy as an overall idea, and urban infrastructure as a concept that needs radical reinvention.

**Chris:** I think we have some work ahead, but what has been good about this is that it has been able to highlight where the projects overlap and where they are different, there are some natural groupings that are beginning to work out, and whether there is an overarching theme or not I don’t know, but it may not be necessary, it may be that there is a contradiction between the sustainable projects vs. the more growth oriented projects, maybe they can sit alongside each other, they have so far so maybe that is alright. I think that is the discussion going forward, is to where the alliances are and where the differences are.
Bibliography


