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Christchurch Central City Revitalisation Plan: Accommodating 30,000 Residents into Christchurch’s Four Avenues

A thesis
submitted in partial fulfilment
of the requirements for the Degree of
Master of Landscape Architecture

at
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by
Susan Anderson

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Christchurch Central City Revitalisation Plan: Accommodating 30,000 Residents into Christchurch’s Four Avenues
Abstract

Over the past few years Christchurch’s Central City has fallen into a decaying state. Many key retailers, commercial, industry and residential dwellers have moved to the outer suburbs. Creating multiple sub-centres and leaving Christchurch with a broken heart. The Christchurch City Council is committed to revitalising the Central City in order to create a world class city with a vibrant heart (Christchurch City Council, 2006). One of the key goals of the Central City revitalisation is to increase the residential population to 30,000 by 2026.

This dissertation takes a critical look at this goal and investigates whether this goal is achievable and if so, what the limitations or tradeoffs that need to be made to achieve it and demonstrates what the city may look like. The method of research through design has been used to investigate this research question and to test the 30,000 residents’ goal. This has been done though modelling, density testing and establishing three landscape focused scenarios to test this goal within the current Central City infrastructure.

Through testing the current and predicted densities of the Central City, it is apparent that the current density of the Central City is exceptionally low by international standards. It has also been established that the current zonings and development patterns are not suitable to encourage development and the residential population increase like that the City Council is aiming for.

The target goal of 30,000 is achievable. The challenge is, how this residential development is is going to be implemented, in order to create a central city that is an appealing and desirable place to visit and live. As well as keeping the current character and creating an identity that is unique to Christchurch.

This dissertation is not intended to be a final solution to the Central City revitalisation but more a stepping stone in the process of regenerating and establishing a vibrant city centre. The creation of a successful city centre is not solely through the introduction of more residential population but through may parallel projects and initiatives working towards the same goal.

Keywords: Central City, Density, Revitalisation, Modelling, Scenario Testing, Residential Population, Mixed use, Research Through Design, Spacemate, Four Avenues, Central City Revitalisation Plan (CCRP), Donut City, Character of Christchurch, Sustainable City
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Also thank you to everyone and anyone who helped me along the way through sharing their knowledge, views or opinions on this topic. This dissertation has sparked many long conversations regarding the central city and what is right or wrong, all of which has helped me in producing this final dissertation.

I would also like to thank my family and friends for supporting me through this study and all the help and guidance you have giving me over the past year of study has been very much appreciated.

Thank you
Susan
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Abstract

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Figure 1: Original Plan of Christchurch
1.1 – Introduction to Christchurch city

Christchurch officially became a city in 1856, making it New Zealand’s oldest city. Christchurch was built off a pre-drawn plan brought from England, which included Barbadoes Cemetery, Hagley Park and Cathedral, Latimer and Cranmer Squares. The original urban area of Christchurch was confined within four town belts, which were later re-named after four of the city’s first superintendents; Bealey, Rolleston, Moorhouse and Fitzgerald (see Figure 1). These four avenues formed a walking city core of around 450 Hectares. Christchurch City has now grown out to cover 45,240 Hectares (http://www.christchurch.org.nz/About/), but the Four Avenues still remain as the identifiable edge of the Central City, the Four Avenues are today used to define the scope of Christchurch City Council’s Central City Revitalisation Plan.

“The success of Christchurch is tied directly to the success of our Central City. The centre’s importance is borne out through its historical significance as the birthplace of our community, its current role as the commercial, cultural and social centre of the region and its importance in ensuring that Christchurch and Canterbury continues to grow as dynamic places to live and work” (Christchurch City Council [CCC], 2006, p 2). One of the main goals of the Central City Revitalisation Plan is to increase the population of the Central City to 30,000 by 2026. This project explores the implications of this intensification on the inner city but first it is important to set the scene of Christchurch’s Central City.
Figure 3: Current Christchurch City with Central City Highlighted
Population

The current population of Christchurch city is 348,435 (http://www.christchurch.org.nz/About/), around 8,000 of whom live within the Four Avenues.

![Population](image)

*Figure 4: Population Percentages*

Christchurch central city unlike that of Auckland and Wellington has a higher number of older (14% being 65 or older) residents. This suggests that the current accommodation within the Central City is more affordable and suitable for the older generation (Statistics New Zealand, 2009). Although normally central city living is most attractive to either young professionals with no children between 20-mid 30s and then older post-children age groups between 40-60 years old. Christchurch central city is at a paradox where there is not sufficient and affordable housing to attract these age ranges to central city living and currently not the demand for this type of housing. This has led to the higher percentage of 65+ living within the Four Avenues as they have the finances to pay for property. Whereas the current rental prices do not guarantee a return for a developer to develop property aimed at the 20-30s demand group, making the central city unfeasible for most of this group (J, McDouagh, personal communication, November 11, 2009).
Residential

- 8000 people live in the Central City.
- The Central City’s residential population is growing faster than any Christchurch suburb – between 1991-2001 there was a 28% increase in the Central City residential population.
- During the past 5-years, 38% of Central City residents had moved there from surrounding areas in Christchurch.
- 52% of people living in the Central City work in the Central City (see Figure 5)
- 37% of people living in the Central City walk or bicycle to work (see Figure 5)

The above statistics show that over recent years there has been an upturn in the appeal of central city living. Therefore the City Council’s goal of increasing the residential population may be achievable. The advantage of central city living is also the potential for a more sustainable city, where people are able to easily walk or bike to work. This is another goal of the revitalisation, through which the Council hopes to make Christchurch a more sustainable city.
One of the main challenges of the Central City revitalisation is going to be to achieve the increase of residential accommodation in such a way that it meets the ideals and expectations of how Christchurch people like to live. For example the proportion of separate houses in the Four Avenues decreased from 24% in 2001 to 17% in 2006. By comparison, the proportion of separate houses in Christchurch city has increased from 72% to 74% over the same period (Christchurch City Council [CCC], 2009), (see Figure 6), showing the demand for separate houses in the suburbs is higher than in the Central City. In the Central City the majority of the dwellings are ‘two or more flats/units joined together’, (see Figure 7). In 1996 they accounted for 74% of the dwellings in the Four Avenues, and in 2006 this was 72%. For Christchurch city, flat/units made up only 22% of all dwellings in 2006. Not surprising, the Central City is of a higher density and has more conjoined houses, rather than the lower density separate houses of the suburbs, as is the case with most central cities in New Zealand and internationally. Although in comparison with other cities the density of Christchurch Central City is still very low.

Central City employment

Traditionally the centres of cities house, commercial and business sectors comprising of the majority of the cities jobs and economy. Currently in Christchurch’s Central City there are 5,600 businesses that operate within the Four Avenues, these employ 52,000 people comprising of 30% of all jobs in Christchurch, (see Figure 8).

![Figure 8: Employment Numbers in the Central City](image)

Between 2000 and 2008, the number of employees working in the Central City increased by 13.8%. Whereas the number of employees in Christchurch City increased by 24.1%. During the same period the number of businesses located within the Central City increased by 9% and the number of business units in Christchurch City increased by 30%. The proportion of Christchurch’s businesses located within the Central City has decreased from 19.5% in 2000 to 16.3% in 2008(CCC, 2009), (see Figure 9).

![Figure 9: Proportion of Businesses in the Central City](image)

Although the Central City is considered the commercial hub of Christchurch and Canterbury there is a definite shift of businesses and industry out to the surrounding suburbs. This may be due to land or office space being cheaper and located closer to major arterial roads and residential subdivision. Christchurch has also over the years lost a lot of commercial head offices to Wellington or Auckland.
Retail/shopping

- There is approximately 260,000 m² of retail floor space in the Central City and 500,000 m² in the remainder of Christchurch, (see Figure 10).
- 40% of visitors to the Central City come to shop. (CCC, 2009)

The Central City contains around a third of the retail space of Christchurch city and has traditionally been the main shopping destination for the city, the same as other ‘High’ or ‘Main’ streets in other cities. Although the Central City still maintains a large portion of the retail space there has been a shift away from shopping in the Central City, to shopping at malls, which now service the outer suburbs, removing the need to travel into the Central City to shop. The malls are not only in a convenient location but also contain most of the major nationwide chain stores, free car parking and offer weather resistant shopping. Once upon a time High St and Cashel Mall contained many locally owned stores which could only be found in these locations, creating the desire for shoppers to shop in the Central City and support the local businesses. Many of these have now closed down due to financial pressure, rent prices and diminishing customers. Ballantynes department store is still attracting many shoppers into the Central City and seems to be the life line to many of the retail stores in the city mall. A lot depends on Ballantynes staying open and in its current location to feed the retail of the Central City.

Figure 10: Amount of Retail Space in the Central City in Comparison to Christchurch

Figure 11: Location of Major Shopping Areas
Tourism

- 4070 hotel beds, or 60% of Christchurch’s total nightly accommodation, are located in the Central City, (see Figure 12).

![Nightly Accommodation](image)

*Figure 12: Amount of Accommodation in the Central City*

- At any given time, 1 out of 5 people in the Central City is an out-of-town visitor, (see Figure 13).
- Average occupancy in the City’s hotels is 80%. (CCC, 2009)

![Visitors to Central City](image)

*Figure 13: Percentage of out of Town Visitors to the Central City*

Tourism is a key component to the Central City and is something that is not likely to be lost to the outer suburbs as many of the key tourist destinations eg, Cathedral, tram, Art Centre and Museum are all located in the Central City, as well as the majority of the accommodation. Tourism and tourists are a key element to the Central City and also to its revitalisation, as it is a large part of the economy and brings many people into the Central City at various times.

Tourism plays a key role in the economy with Greater Christchurch hosting more than 2.5 million visitors annually. Tourism is the largest export industry in Canterbury, with 12% of the Christchurch workforce employed in businesses dependent on tourism (Christchurch City Council [CCC], 2007, p.22). The tourism industry is in turn dependent on the unique natural, cultural and landscape values, therefore protection and enhancement of these are vital for the tourism industry and Christchurch’s economy.
In this study I have defined the Central City as shown on the plan. I have included a portion of Hagley Park, as this part of the park is an important public open space for residents on the west side of the Central City. It also makes up a large part of the neighbourhood parks network.
The current City Plan (1995) zones which currently control development.
Current public transport and cycle lanes within the Central City which establish the main routes and connections through the Central City.
According to the Christchurch Draft Open Space Strategy (2010) for every 1000 residents 1.1ha of neighbourhood parks is required. Therefore with 30,000 residents 33ha is required; currently there is 42.24ha of open space in the central city so there is more than enough for the current residents and will not need to be added to for the proposed increase in population.

Christchurch City Council public parks provision currently stands at around 1.1 ha / 1000 population for neighbourhood parks, 3.5 ha /1000 for sports parks 18.1 ha / 1000 population for regional parks. (Christchurch City Council [CCC], 2010)
Walking distances and times within the Central City.
Heritage Places Trust listed buildings.
The Special Amenity Areas within the Central City.
1.2 – Introduction to Project

The Central City Revitalisation Plan (CCRP) 2001 was developed by the Christchurch City Council to guide growth and development within the Central City. The CCRP states that one of its main goals is to increase the residential population in the Central City to 30,000 by 2026. This goal is a vital driver to all the other revitalisation projects, as these residents will shop and work locally as well as activate public spaces within the Central City.

There are currently 8000 residents in the Central City which means that in order to accommodate 30,000 residents, the residential infrastructure needs to be almost tripled. This dissertation focuses on exploring options and visualising a spatial plan for incorporating 30,000 residents in the Central City, while still maintaining the character of Christchurch and the ideals of living of Christchurch residents. Although there has been a Capacity Study undertaken for the Central City, this was not publically accessible until the very end of my project. The Capacity Study looks at just numbers and quantities of people in the Central City; it does not evaluate the spatial, qualitative or landscape elements, whereas this dissertation extends the investigation into an evaluative dimension. The Capacity Study was also based around the parameters of the current City Plan and was not able to incorporate mixed use developments or redevelopments of current underutilised and heritage buildings. These are things that are going to be key to developing a successful vibrant central city.

The Central City is the commercial, cultural and social centre of the region. The Central City is the hub of Christchurch and the South Island containing the largest concentration of business, with 1.7million m2 of commercial floor area and over 52,000 people employed in the Central City, along with a third of Christchurch’s retail space (CCC, 2006, p.10). Despite this there are concerns for the long-term vitality of the Central City including the potential ‘Donut Effect’ (Donut City) of an unhealthy core and the associated threats of business and residential growth going to the outer suburbs or to other cities (Christchurch City Council [CCC], 2001, p.3), (see figure 21).

As the introduction of these residents is key to the whole revitalisation project it is important to work out how, and even if, it will be possible to fit 22,000 more residents within the Four Avenues. According to the 2001 census the Central City was the fastest growing area by population in Christchurch, with 38% of the people living in the central city having moved from outer suburbs (Christchurch Downtown Dwellers – 2005 NZ Statistic Report). So there has been a desire for the current population of Christchurch to live in the Central City, and also a push from international trends for cities to be more walkable and for sustainable living.

With the Central City physically confined within the barriers of the Four Avenues, as well as around existing buildings and infrastructure, the introduction of around 22,000 more residents into this area needs to be carefully planned and executed to ensure the character of Christchurch city is kept and the Christchurch City Council’s goal of ‘a world class city’ is achieved. Although the Christchurch City Council and developers have extensive experience in green field development, the Central City revitalisation will be the first major infill development for the region and most probably the biggest and most influential to be undertaken in Christchurch city.
The Donut City created through the Donut Effect. A hole in the centre caused by key industry, commercial and residential moving to the outer suburbs.

Christchurch City is in danger of and is already starting to become a Donut City with a hole in the centre.
Christchurch city is expected to grow, through the UDS there has been a strategic plan put in place of how to manage this growth in the periphery of Christchurch city and in the current satellite towns. There is yet to be such a plan for the Central City and how it will cope with the growth that is predicted. The introduction of 22,000 more residents into the 420 Hectares of the Four Avenues will change the dynamics and urban infrastructure that we currently see and has been for many years.

Christchurch Central City currently has a much lower residential density compared to other major cities:

*Figure 23a: Christchurch*

Christchurch = 12 residents per hectare (4.72 hh/ha)

Jan Gehl’s study only focused on the inner city (bound between Kilmore, St Asaph, Rolleston and Madras Streets), which does not contain the majority of the residential population, as currently the Central City does not contain many mixed use development. With most of the commercial and retail within the central core and the residential around the outside. When the density is worked out over the whole of my study area of 450 hectares (8000/450 = 17.7 residents per hectare and 6.99 hh/ha)

*Figure 23b: Seattle*

Seattle = 27 residents per hectare (10.62 hh/ha)

*Figure 23c: Wellington*

Wellington = 42 residents per hectare (16.53 hh/ha)
Figure 23d: Perth
Perth = 8 residents per hectare (3.14 hh/ha)

(Gehl, 2009)

Figure 23e: Adelaide
Adelaide = 12 residents per hectare (4.72 hh/ha)

(Gehl, 2009)

Figure 23f: Copenhagen
Copenhagen = 66 residents per hectare (25.98 hh/ha)

(Gehl, 2009)

Figure 23g: Sydney
Sydney = 68 residents per hectare (26.77 hh/ha)

(Gehl, 2009)
In the Urban Design Strategy (UDS) 2007 the target density for the Central City is 50 hh/ha (CCC 2007, p.26), (see Figure 24) or 127 residents per hectare, which as a comparison is around the same density as Tokyo, Japan (see Table 1). This would create a vastly different Christchurch to what we have today. The UDS’s target density of 50hh/ha equals 22,500 households within the Central City (50 X 450) which works out as 57,150 residents (22,500 X 2.54*) which is almost double the 30,000 target. 30,000 residents in the Central City works out to be 66.66 residents per hectare (30,000/450) and 26.24 household per hectare (66.66/2.54). Surprisingly, this is the same density as Copenhagen.

* The amount of households per hectare was worked out at 2.54 which is according to the UDS the average amount of people living in a house hold. (CCC, 2007, p. 26)

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**Figure 24: UDS table of Predicted Densities. Source: (CCC, 2007, p. 44)**

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<th>2027-41</th>
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<td>✓</td>
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<td>✓</td>
<td>✓</td>
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<td>Prebbleton sewer and stormwater issues (TDB)</td>
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Table 1: International City Densities. Whole Urban Area Taken into Account not just the Central City Area.

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<th>City</th>
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<th>HHs (hh/ha)</th>
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<td>Roma, Italy</td>
<td>17.61</td>
<td>6.93</td>
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<td>Zurich, Switzerland</td>
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<td>Cardiff, UK</td>
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<td>Vancouver, Canada</td>
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<td>Rio de Janeiro, Brazil</td>
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<td>18.66</td>
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<td>75.77</td>
</tr>
<tr>
<td>Cairo, Egypt</td>
<td>317.36</td>
<td>124.94</td>
</tr>
</tbody>
</table>

(https://www.demographia.com/db-intlcitydens.htm)
Figure 26: Section 1 (see Figure 28)

Figure 27: Section 2 (see Figure 28)
In most traditional and current major cities the central city has a higher density of population in comparison to the other areas of the city. This is not the case in Christchurch city as can be seen from these density sections. Figure 26 and 27 show density sections take through Christchurch city.
2.1 – Density

Density is a way of measuring the compactness of an area. It provides an idea of the amount of buildings and people within a specific area for comparison with others. Most commonly density is measured through the number of households per hectare (hh/ha) or the number of people per hectare (pp/ha). The number of households per hectare gives more of an idea of the amount of buildings within that area, whereas the number of people per hectare gives more indication of the mass of residents and is useful when working out the facilities needed in an area. Density can either be used to determine the type of space wanted, or to evaluate an existing space.

There are many arguments about what the ideal density is. Unwin (1912) suggested that the upper density limit should be 12 houses per acre (29.64hh/ha) whereas Lloyd Wright (1932) suggested an ideal density is one house to an acre (4.94hh/ha) (Berghauser Pont & Haupt, 2002, p.22). One thing we do know is that the inner city should be a higher density to the outer suburbs and rural areas, as this allows for a more active and intense core to support the range of activities including commerce, tourism, retail and industry.

Through the desire for a more accurate reading of density, Britain, Europe and the United States are now using Floor Space Index (FSI), in the US it is known as Floor to Area Ratio (FAR). These both express the building size in relation to the lot size (Berghauser Pont & Haupt, 2002, p. 23). This gives a more comprehensive idea of the qualities of the space and the amount of built and non built area.

In relation to this project density has been looked at over a board scale from very low density separate houses through to high density pod/capsule living. This has become a phenomenon in Japan especially, through pod hotels which contain a series of units just big enough for a person to lie down in. Also in Europe, shipping containers or purpose built capsule houses have been built for student accommodation, providing all the conveniences of a full size house on a small compact scale.

2.2 – Mixed Use

Christchurch city, like many North American cities, does not have a lot of mixed use development especially within the central core. This is in contrast to most European cities which have traditionally had mixed uses within the central city. Many developers and financial institutions are resistant to mixed use, due mainly to the fact that the length for retail leases differs from commercial and residential, which inhibits opportunities for redevelopment long term.

The creation of industrial and commercial parks, along with the draw of cheaper rent prices outside the existing core, has led to the shift of major industries being located in the outer suburbs rather than the traditional location of the central city. This has in turn forced urban sprawl as residential, retail and recreation areas have followed the industries to be closer to people’s workplaces. This has not only contributed to sprawl, but also created single use low density areas.

2.3 – Heritage

Heritage is an important part of Christchurch and especially the Central City. Heritage and heritage buildings contribute significantly to Christchurch’s identity. They also provide a reference to the past and the development of the city.

Within the residential zones there are areas which have been labelled as Special Amenity Areas (SAMs), these are areas that have distinct character from that of the surrounding neighbourhoods, and are protected under the zoning.
2.4 – Open Space

Christchurch city has always provided ample green public open space, as well as access to the outdoors and rural areas with ease. These features add to the quality of life in Christchurch, as well as being a key draw card for people visiting the region and why people choose to live in Christchurch (Christchurch City Council [CCC], 2010).

The public open space in metropolitan Christchurch is located at regularly spaced intervals linked by the grid and radial pattern of the streets, making them easily accessible to residents within the city (CCC, 2010).

Currently the Christchurch City Council public parks provision is:
1.1 ha / 1000 population for neighbourhood parks,
3.5 ha /1000 for sports parks
18.1 ha / 1000 population for regional parks (CCC, 2010, p. 5)

The next challenge for the City Council in terms of public open space is going to be how to cope with higher household densities and urban intensification. This challenge is going to be to provide enough high quality public open space to compensate for less private space. As well as the potential loss of environmental quality, including opportunity for large trees, recreation and green space. This is going to be an important achievement in order to make higher density acceptable to Christchurch residents, who have the expectation of abundant private and public space (CCC, 2010).

Open space is not only important for recreation, health and social reasons but it is also important for protecting cultural and heritage values. Open space and particularly waterways and areas of natural and cultural value are important to Ngāi Tahu, as they provide links to places and practices of Ngāi Tahu tūpuna (ancestors) (CCC, 2010). Within the urban environment of Christchurch the existing public open space contains natural features and connections for Ngāi Tahu, as well as being important features to sustainable city living (CCC, 2010). Therefore are important to conserve and protect not only for heritage and cultural aspects but as key components to a vibrant successful city centre.

Christchurch is known as the ‘Garden City’ and has a long tradition of this which is evident in many private gardens and public parks. These features are a key element to the character and identity of urban Christchurch, combined with the characters of Lyttelton and Akaroa, as well as rural heritage places and plantings, all of which reflect the garden heritage of Christchurch City (CCC, 2010).

2.5 – Transport

Transport and transport modes can have a huge effect on a city and how well it functions especially from a pedestrian perspective. Conflict between vehicles and pedestrians is one of the major problems in cities today (Gehl, 2009). Christchurch and the Central City especially are dominated by private vehicles and for years a lot of the planning has been directed towards roads and accommodating cars. This has created a less than desirable condition for pedestrians and cyclists and a public transport system that does not work effectively due to road congestion. Limiting the through traffic, as well as the number of car parks and the speed cars can travel, while enhancing pedestrian and cycle ways, Jan Gehl believes will go a long way to improving the flow and liveability of the Central City and creating a more desirable location.
2.6 – Donut City

A ‘Donut City’ or the ‘Donut Effect’ is caused by the decline of the central city through a shift of commercial, industry, retail and residential to the outer suburbs. Traditionally cities were built with a fortified wall around their boundary, this confined the city to within these limits as well as providing protection for the city and its inhabitants. As the city grew the suburbs then spread out outside the walls. “Industrialisation and mechanised transport have created waves of urbanisation which in turn has led to an apparent inability to ‘contain’ the city” (Smyth 1996, p.101).

As a response to the Donut City there is the push for more compact cities and cores like those of the traditional cities. There are a number of reasons why the donut city effect is happening in cities including Christchurch, such as the draw of lower rents in the outer areas for commercial and industrial. Also people are moving out of the central city as it is not seen as an appropriate place to raise children, due to lack of space, safety and schools (Smyth 1996). Investment in school infrastructure may be an important social step to enhance the central city residential population.

A compact core of high density and mixed use will invoke diversity, except in social terms as a compact core has the danger of creating a social bias and exclusion, income potentially will be a big divider, as only the high income earners will be able to afford to live within the core and the lower income earners will be forced around the outside edges (Smyth 1996). Social issues need to be thought of in terms of mixed use as well as industries and building occupancy. For a successful central city there needs to be a mix of all types of people rather than concentrations of income levels.

In order to fix the problems of a donut city the city centre needs to be more compact but care needs to be given in order not to flip the city back in to a donut but in the opposite direction to the previous with a decaying ring around the outside. Finding this delicate balance is key to providing many cities with the revitalisation they require.

2.7 - Summary

Through the literature review it has been identified why Christchurch Central City has ended up in its current state, with the need to be regenerated and ways in which this can take place. It has identified the important areas that need to be addressed and maintained. A topic such as this, the revitalisation of a central city, has many different elements and areas that could and need to be investigated as to their requirements and ways of best practice. One of these elements or an important part is the social amenity of the city and how this affects the liveability of the city. The social amenity of a city affects all of the aspects mentioned above. This literature review has just focused on a broad context in order to gather an understanding for the topic and its associated literature; further studies will need to look into the details of these selected topics.

![Figure 29: Key Points from Literature Review](image-url)
3.0 – Methodology
The topics identified and discussed in the literature review are components that will be researched and tested using the method of research through design. In the process of research through design I will first establish a set of density/living models which I will test against each other to determine their spatial qualities and comparison to Christchurch city living ideals. I will then use these models as part of establishing three different scenarios of possible solutions for incorporating 30,000 residents in the Central City. From there, one scenario will be chosen to be investigated further in detail to establish its appropriateness in the existing infrastructure of the Central City, from a landscape focus – where the character of Christchurch is retained and enhanced, (see Figure 30).

*Figure 30: Methodology*
4.0 – Research Through Design
As the main method of research for this dissertation is research through design, most of the investigation has been undertaken through design experimentation. Firstly a set of density models have been established, which were then tested against each other. Then through the establishment of three scenarios, different characters and city forms were established and tested to find a final solution to fully test the goal of 30,000 residents within the Central City.

### 4.1 - Density

In order to investigate possible densities for the Central City a set of fifteen density models were developed. These models would be used to calculate and investigate how it would be possible to increase the residential population in the Central City to 30,000 as well as testing them against one another to investigate density and ideals of living.

For each model their lot size was based on those listed in the Christchurch City Plan 1995, therefore each model fits into the City Plan categories of Low Density, Medium Density, High Density (B) and High Density (A), (see Table 2).

<table>
<thead>
<tr>
<th>Density Level</th>
<th>Lot Size Range</th>
<th>Minimum Net Site Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Density (Models 1-2)</td>
<td>Not specified</td>
<td>800m²</td>
</tr>
<tr>
<td>Medium Density (Models 3-6)</td>
<td>600m² – 650m²</td>
<td>550m²</td>
</tr>
<tr>
<td>High Density (B) (Models 7-9)</td>
<td>450m² – 500m²</td>
<td>330m²</td>
</tr>
<tr>
<td>High Density (A) (Models 10-15)</td>
<td>275m² – 325m²</td>
<td>250m²</td>
</tr>
</tbody>
</table>

Low Density

Model One:
Single House, Low Density
Lot Size = 29 X 29m (841m²)
House Footprint = 15 X 10m (150m²)
Number of Levels = 1
Density = 9 households/Hectare

Model Two:
Two Houses per lot, Low Density
Lot Size = 29 X 29m (841m²)
House Footprint = 15 X 10m (150m²)
Number of Levels = 1
Density = 18 households/Hectare

Medium Density

Model Three:
Single House, Medium Density
Lot Size = 25 X 25m (625m²)
House Footprint = 15 X 10m (150m²)
Number of Levels = 1
Density = 16 households/Hectare

Model Four:
Two Houses per lot, Medium Density
Lot Size = 25 X 25m (625m²)
House Footprint = 15 X 10m (150m²)
Number of Levels = 1
Density = 32 households/Hectare

Model Five:
One times two town houses per lot, Medium Density
Lot Size = 25 X 25m (625m²)
House Footprint = 15 X 10m (150m²)
Number of Levels = 2
Density = 32 households/Hectare

Model Six:
Two times two town houses per lot, Medium Density
Lot Size = 25 X 25m (625m²)
House Footprint = 15 X 10m (150m²)
Number of Levels = 2
Density = 64 households/Hectare

*This is what the CCRP and City Council are aiming for with 26hh/ha
*This is what the UDS is aiming for with 50hh/ha
**High Density (B)**

**Model Seven:**
Apartment 100m², High B Density  
Lot Side = 21 X 21m (441m²)  
House Footprint = 10 X 10m (100m²)  
Number of Levels = 4  
Density = 64 households/Hectare

* This is what the UDS is aiming for with 50hh/ha

**Model Eight:**
Apartment 81m², High B Density  
Lot Side = 21 X 21m (441m²)  
House Footprint = 9 X 9m (81m²)  
Number of Levels = 4  
Density = 64 households/Hectare

**Model Nine:**
Apartment 81m² times two per lot, High B Density  
Lot Side = 21 X 21m (441m²)  
House Footprint = 9 X 9m (81m²)  
Number of Levels = 4  
Density = 256 households/Hectare

* This is what the UDS is aiming for with 50hh/ha
High Density (A)

**Model Ten:**
Apartment 64m², High A Density
Lot Side = 17 X 17m (289m²)
House Footprint = 8 X 8m (64m²)
Number of Levels = 8
Density = 200 households/Hectare

**Model Eleven:**
Apartment 64m² times two per lot, High A Density
Lot Side = 17 X 17m (289m²)
House Footprint = 8 X 8m (64m²)
Number of Levels = 8
Density = 800 households/Hectare

**Model Twelve:**
Apartment 25m², High A Density
Lot Side = 17 X 17m (289m²)
House Footprint = 5 X 5m (25m²)
Number of Levels = 10
Density = 250 households/Hectare

**Model Thirteen:**
Apartment 25m² times four per lot, High A Density
Lot Side = 17 X 17m (289m²)
House Footprint = 5 X 5m (25m²)
Number of Levels = 10
Density = 1000 households/Hectare

**Model Fourteen:**
Capsule/Pod Housing 9m², High A Density
Lot Side = 17 X 17m (289m²)
House Footprint = 3 X 3m (9m²)
Number of Capsules per row = 5
Number of Levels (per row) = 2
Rows per lot = 4
Density = 1000 households/Hectare

**Model Fifteen:**
Capsule/Pod Housing 9m² times two, High A Density
Lot Side = 17 X 17m (289m²)
House Footprint = 3 X 3m (9m²)
Number of Capsules per row = 16
Number of Levels (per row) = 5
Rows per lot = 1
Density = 2000 households/Hectare
Christchurch current residential population

Density in the Central city should be higher than that of the outer suburbs. The typical Christchurch suburban house has been used for Model One as that gives a more general view of Christchurch living. The average living sizes for the Central City are as follows:

Total building area in Central City = 1528,451.2m² (1380,040.2m² of buildings + 148,411m² heritage buildings). 13.38% ((204,520.2294/1528,451.2) X 100) of total buildings in Central City are currently being used as residential, (see Figure 31).

Figure 31: Total Amount of Residential Buildings Including Heritage

Key

- Total building area in central city (1528,451.2m²)
- Total residential buildings including heritage buildings (204,520.2294m²/13.38%)

Total residential buildings (including heritage buildings) = 204,520.2294m².

Figure 32: Total Amount of Heritage Buildings

Key

- Total building area in central city (1528,451.2m²)
- Total building area of heritage buildings (148,411m²/9.70%)
There are around 8000 residents in the Central City. Therefore currently each person in the Central City is living in an area of 25.565m² (204,520.2294/8000 = 25.565m²). To add an extra 22,000 residents at this density we would need to add an extra 562,430m² (25.565 X 22,000 = 562,430m²) to the residential building total. If we were only to keep the existing buildings in the central city and redevelop them into residential we would need to convert 36.80% ((562,430/1528,451.2) X 100 = 36.80%), therefore the total percentage in the central city would be 50.18% of residential (36.80 + 13.38 = 63.56%), (see Figure 33).

**Figure 33: Total Amount of Residential Buildings to Accommodate 30,000**

- Total building area in central city (1528,451.2m²)
- Increase in total residential building through redevelopment (562,430m²/50.18%)

On the other hand, if we were to build more buildings for the extra 22,000 residents but at the same density, keeping with the 25.265m² per resident, I have developed two models which have the floor space of 25m² (12 and 13) both require the addition of 22,000 single person occupancy apartment units. But both are worked out at different densities, model 12 includes more open space around the apartment buildings (needing a total of 880,000m² to accommodate 22,000 residents) whereas model 13 is a much more compact model (only needing 220,000m² to accommodate 22,000 residents).

**Figure 34: Total Buildings**

- Total building area in central city (1528,451.2m²)
- Total residential buildings including heritage buildings (204,520.2294m²/13.38%)
- Total building area of heritage buildings (148,411m²/9.70%)
- Increase in total residential building through redevelopment (562,430m²/50.18%)
4.2 - Spacemate

The house size of each model was defined from Model One being an average 3 bedroom Christchurch suburban house through to Model Fifteen which is a generous sized pod or capsule living. This is in order to achieve a wide variety of living styles and sizes to test against each other.

Each model was then put into a 100m x 100m (hectare) block in order for each model to be easily assessed against each other. By arranging each model into a hectare block it also made it possible to evaluate the density of each of the models against each other with a standardised measure of density (x households per hectare). Although it was felt this standard measure of density didn’t actually provide enough information about the quality of the space that each model creates; there is no indication as to how tall the buildings are or the amount of open space. Spacemate, a method of measuring density developed by Meta Berghauser Pont and Per Haupt as part of their doctorate at Delft University of Technology in the Netherlands, was then chosen to be used as a way to determine the densities further. Spacemate was developed not only to give a clearer understanding of densities but to also offer a quantitative and qualitative measure of space usage, Spacemate provides a linkage between densities on one hand and residential environments, building typologies and the degree of urbanisation on the other (Berghauser Pont & Haupt, 2002).

To determine a better understanding of the density of places Spacemate uses four variables, Floor Space Index (FSI), Ground Space Index (GSI), Open Space Ratio (OSR) and Layers (L), (see Figure 35). The Spacemate graph works by not only taking into account one variable at a time but together FSI, GSI, ORS and L are all introduced as equally important in describing spatial objectives and qualities (Berghauser Pont & Haupt, 2002, p. 69).

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**Figure 35: Spacemate Variables. (Source: Haupt & Pont, p. 26)**
All four variables are calculated using the same series of data – gross floor area, built area and plan area - so they are therefore mathematically related to each other. A change in the FSI automatically means a change in the GSI and/or the OSR. A consistent GSI indicates an unchanged ratio between built and non-built areas (Berghauser Pont & Haupt, 2002, p.26).

Once the FSI, GSI, OSR and L values have been calculated they are then put onto a graph (Spacemate) that shows the interrelationships between each variable, (see figure 36). The y-axis which measures FSI gives an indication of the intensity in an area; the x-axis which measures GSI reflects the compactness of the area. The OSR and L are gradients that fan out over the graph. OSR allows the pressure on the non-built space to be gauged and L shows the number of floors. The combination of all four variables gives each project a unique spatial ‘fingerprint’ (Berghauser Pont & Haupt, 2002, p.30).

Figure 36: Spacemate Graph. (Source: Haupt & Pont, p. 33)
To illustrate how the Spacemate graph works and also the change in density and building typologies as a result in changes of the value of FSI, GSI, OSR and L, the Spacemate book provides hypothetical transformation processes, (see Figure 37).

The first transformation (AB) begins with (A) being an L-shaped 5 storey development, and (B) being a closed 5 storey development. Both the FSI and the GSI rise along the floor line which remains a consistent 5 storeys and the OSR decreases because the floor area has increased and the non-built space decreased (therefore less open space for a larger amount of built space) (Berghauser Pont & Haupt, 2002).

The second transformation (AC) aims to create a low-rise typology without reducing the density (FSI). In this the FSI line remains consistent and the floor levels reduce from five to two. The GSI rises due to the floor area which was previously stacked up on top of each other is now spread out over the entire plan area. The OSR falls as the same amount of built space is now divided over less non-built space (Berghauser Pont & Haupt, 2002).

Figure 37: Spacemate Transformations. (Source: Haupt & Pont, p. 34)
Spacemate can also be used as a starting point in the planning or development process, to determine first the density and typology that you desire from the development, rather than being used as an afterthought to measure the densities. Spacemate can also be used to investigate various development strategies such as land development typologies, urbanisation, and typologies of non-built space, which provides a starting point to not only quantify built form but also relate this to the qualitative characteristics of urban areas (Berghauser Pont & Haupt, 2002).

**Land Development Typologies**

Similar areas of land development typologies appear in clusters on the Spacemate graph, these areas can also therefore be described in terms of FSI, GSI, OSR and L. When a desired intensity (FSI) is set out the diagram determines which typologies are possible. When compactness (GSI) is defined the possibilities regarding land development are limited further, (see Figure 38).

*Figure 38: Land Development Typologies. (Source: Haupt & Pont, p. 56)*
Urbanisation
In this instance urbanisation is determined by the pressure on the non-built space (OSR). In the rural cluster the GSI and FSI are low, therefore the OSR is high. In this situation there are few buildings and therefore a large amount of non-built space per square meter of gross floor area. The opposite is the case in the highly urban where there is only a small amount of non-built space per square meter of gross floor area, (see Figure 39).

Figure 39: Urbanisation. (Source: Haupt & Pont, p. 58)

Typologies of non-built space
From using both the land development typologies and the degree of urbanism, Figures 40 and 41 reflect the differences in non-built space and makes it possible to outline the degree of openness. In rural and suburban areas with low densities there tends to be more private open space, whereas in the more urbanised higher density areas there tends to be a higher level of public open space.

Figure 40: Typologies of Non-Built Space One. (Source: Haupt & Pont, p. 60)  
Figure 41: Typologies of Non-Built Space Two. (Source: Haupt & Pont, p. 60)
The three above categories can be collated and analysed and are grouped by Spacemate into three areas, Park City, Courtyard City and Garden City (Berghauser Pont & Haupt, 2002, p.63), (see Figure 42).

Park City consists of high-rise typologies and is characterised by the public nature of its open space consisting of grass-lands, landscaped parks and roof parks. Courtyard City consists of mid-rise development which contain courtyard open space which is open or closed, public or private. Garden City is low-rise privately owned country estates, gardens, patios and roof top gardens.

These three “Cities” can be used as a base for determining the outcomes of a development and the spatial elements desired, just as the FSI or the OSR can be pre-determined to create a specific density. Currently, wider Christchurch city could be described in the “Garden City” category, ringing true to Christchurch’s slogan. In order to revitalise and increase the residential population of the Central City, the Central City will need to fit into at least the ‘Courtyard City’ if not even the ‘Park City’.

After establishing how Spacemate worked as a qualitative and quantitative assessment of densities, it has then been used on each of the fifteen models in order to calculate their spatial elements and a more qualitative assessment against each other. By being able to view the models using different evaluations including the density, Spacemate calculations, lot and house size and the total number of people, gives a broad overview of the qualities of each model.
Figure 43: Spacemate Axis
4.3 – Density Models

Model One:

Low Density (Minimum net site area of 800 m²)
Single House,
Lot Size = 29 X 29m (841 m²)
House Footprint = 15 X 10m (150 m²)

Number needed for 22,000 people = 815 (Blocks) (10,000 houses needed)
Calculations based on average 3 person occupancy.

Density = 9 households/Hectare

Spacemate Calculations:
FSI = 0,178
GSI = 0,178
OSR = 4,606
L = 1
Model Two:

Low Density (Minimum net site area of 800m²)
Two Houses per lot,
Lot Size = 29 X 29m (841m²)
House Footprint = 15 X 10m (150m²)

Number needed for 22,000 people = 707 (Blocks) (10,000 houses needed)
Calculations based on average 3 person occupancy.

Density = 18 households/Hectare

Spacemate Calculations:
FSI = 0.356
GSI = 0.356
OSR = 1.803
L = 1
Model Three:

Medium Density (Minimum net site area of 550m²)
Single House,
Lot Size = 25 X 25m (625m²)
House Footprint = 15 X 10m (150m²)

Number needed for 22,000 people = 550 (Blocks) (12,000 houses needed)
Calculations based on average 2.5 person occupancy.

Density = 16 households/Hectare

Spacemate Calculations:
FSI = 0.24
GSI = 0.24
OSR = 3.166
L = 1
Model Four:

Medium Density (Minimum net site area of 550m2)
Two Houses per lot,
Lot Size = 25 X 25m (625m2)
House Footprint = 15 X 10m (150m2)

Number needed for 22,000 people = 275 (Blocks) (12,000 houses needed)
Calculations based on average 2.5 person occupancy.

Density = 32 households/Hectare

Spacemate Calculations:
FSI = 0.48
GSI = 0.48
OSR = 1.083
L = 1
Model Five:

Medium Density (Minimum net site area of 550m²)
One times two town houses per lot,
Lot Size = 25 X 25m (625m²)
House Footprint = 15 X 10m (150m²)

Number of Levels = 2
Number needed for 22,000 people = 275 (Blocks) (12,000 houses needed)
Calculations based on average 2.5 person occupancy.

Density = 32 households/Hectare

Spacemate Calculations:
FSI = 0.48
GSI = 0.24
OSR = 1.583
L = 2
Model Six:

Medium Density (Minimum net site area of 550m²)
Two times two town houses per lot, Lot Size = 25 X 25m (625m²)
House Footprint = 15 X 10m (150m²)

Number of Levels = 2
Number needed for 22,000 people = 137.5 (Blocks) (12,000 houses needed)
Calculations based on average 2.5 person occupancy.

Density = 64 households/Hectare

Spacemate Calculations:
FSI = 0.96
GSI = 0.48
OSR = 0.541
L = 2
Model Seven:
High B Density (Minimum net site area of 330m²)
Apartment 100m²,
Lot Side = 21 X 21m (441m²)
House Footprint = 10 X 10m (100m²)

Number of Levels = 4
Number needed for 22,000 people = 172 (Blocks) (15,000 houses needed)
Calculations based on average 2 person occupancy.

Density = 64 households/Hectare

Spacemate Calculations:
FSI = 0.907
GSI = 0.226
OSR = 0.852
L = 4
Model Eight:

High B Density (Minimum net site area of 330m²)
Apartment 81m²,
Lot Side = 21 X 21m (441m²)
House Footprint = 9 X 9m (81m²)

Number of Levels = 4
Number needed for 22,000 people = 172 (Blocks) (15,000 houses needed)
Calculations based on average 2 person occupancy.

Density = 64 households/Hectare

Spacemat Calculations:
FSI = 0.734
GSI = 0.183
OSR = 1.111
L = 4
Model Nine:

High B Density (Minimum net site area of 330m²)
Apartment 81m² times two per lot,
Lot Side = 21 X 21m (441m²)
House Footprint = 9 X 9m (81m²)

Number of Levels = 4
Number needed for 22,000 people = 86 (Blocks) (15,000 houses needed)
Calculations based on average 2 person occupancy.

Density = 256 households/Hectare

Spacemate Calculations:
FSI = 1,469
GSI = 0,367
OSR = 0,430
L = 4
Model Ten:

High A Density (Minimum net site area of 250m2)
Lot Side = 17 X 17m (289m2)
Apartment 64m2,
House Footprint = 8 X 8m (64m2)

Number of Levels = 8
Number needed for 22,000 people = 110 (Blocks) (30,000 houses needed)
Calculations based on average 1 person occupancy.

Density = 200 households/Hectare

Spacemate Calculations:
FSI = 1,771
GSI = 0,221
OSR = 0,439
L = 8
Model Eleven:

High A Density (Minimum net site area of 250m²)
Apartment 64m² times two per lot, Lot Side = 17 X 17m (289m²)
House Footprint = 8 X 8m (64m²)

Number of Levels = 8
Number needed for 22,000 people = 27.5 (Blocks) (30,000 houses needed)
Calculations based on average 1 person occupancy.

Density = 800 households/Hectare

Spacemate Calculations:
FSI = 3,543
GSI = 0,442
OSR = 0,157
L = 8
Model Twelve:

High A Density (Minimum net site area of 250m2)
Apartment 25m2,
Lot Side = 17 X 17m (289m2)
House Footprint = 5 X 5m (25m2)

Number of Levels = 10
Number needed for 22,000 people = 88 (Blocks) (30,000 houses needed)
Calculations based on average 1 person occupancy.

Density = 250 households/Hectare

Spacemate Calculations:
FSI = 0.865
GSI = 0.08
OSR = 1.056
L = 10
Model Thirteen:

High A Density (Minimum net site area of 250m²)
Apartment 25m² times four per lot,
Lot Side = 17 X 17m (289m²)
House Footprint = 5 X 5m (25m²)

Number of Levels = 10
Number needed for 22,000 people = 22 (Blocks) (30,000 houses needed)
Calculations based on average 1 person occupancy.

Density = 1000 households/Hectare

Spacemate Calculations:
FSI = 3.460
GSI = 0.345
OSR = 0.189
L = 10
Model Fourteen:

High A Density (Minimum net site area of 250m²)
Capsule/Pod Housing 9m²,
Lot Side = 17 X 17m (289m²)
House Footprint = 3 X 3m (9m²)

Number of Capsules per row = 5
Number of Levels (per row) = 2
Rows per lot = 4
Total per lot = 40
Number needed for 22,000 people = 22 (Blocks) (30,000 houses needed)
Calculations based on average 1 person occupancy.

Density = 1000 households/Hectare

Spacemate Calculations:
FSI = 1.245
GSI = 0.622
OSR = 0.302
L = 2
Model Fifteen:

High A Density (Minimum net site area of 250m²)
Capsule/Pod Housing 9m² times two,
Lot Side = 17 X 17m (289m²)
House Footprint = 3 X 3m (9m²)

Number of Capsules per row = 16
Number of Levels (per row) = 5
Rows per lot = 1
Total per lot = 80
Number needed for 22,000 people = 11 (Blocks) (30,000 houses needed)
Calculations based on average 1 person occupancy.

Density = 2000 households/Hectare

Spacemate Calculations:
FSI = 2,491
GSI = 0.498
OSR = 0.201
L = 5
Table 3 shows the collection of the Spacemate values for each model combined with the Christchurch City Council City Plan density of that model.

**Table 3: Spacemate Values and City Plan Densities**

<table>
<thead>
<tr>
<th>Model</th>
<th>Plan Area (m²)</th>
<th>Gross Floor Area (m²)</th>
<th>Built Area (m²)</th>
<th>FSI</th>
<th>GSI</th>
<th>OSR</th>
<th>L</th>
<th>CCC Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 1</td>
<td>841</td>
<td>150</td>
<td>150</td>
<td>0,178</td>
<td>0,178</td>
<td>4,606</td>
<td>1</td>
<td>Low</td>
</tr>
<tr>
<td>Model 2</td>
<td>841</td>
<td>300</td>
<td>300</td>
<td>0,356</td>
<td>0,356</td>
<td>1,803</td>
<td>1</td>
<td>Low</td>
</tr>
<tr>
<td>Model 3</td>
<td>625</td>
<td>150</td>
<td>150</td>
<td>0,24</td>
<td>0,24</td>
<td>3,166</td>
<td>1</td>
<td>Medium</td>
</tr>
<tr>
<td>Model 4</td>
<td>625</td>
<td>300</td>
<td>300</td>
<td>0,48</td>
<td>0,48</td>
<td>1,083</td>
<td>1</td>
<td>Medium</td>
</tr>
<tr>
<td>Model 5</td>
<td>625</td>
<td>300</td>
<td>150</td>
<td>0,48</td>
<td>0,24</td>
<td>1,583</td>
<td>2</td>
<td>Medium</td>
</tr>
<tr>
<td>Model 6</td>
<td>625</td>
<td>600</td>
<td>300</td>
<td>0,95</td>
<td>0,48</td>
<td>0,541</td>
<td>2</td>
<td>Medium</td>
</tr>
<tr>
<td>Model 7</td>
<td>441</td>
<td>400</td>
<td>100</td>
<td>0,907</td>
<td>0,226</td>
<td>0,852</td>
<td>4</td>
<td>High B</td>
</tr>
<tr>
<td>Model 8</td>
<td>441</td>
<td>324</td>
<td>81</td>
<td>0,734</td>
<td>0,183</td>
<td>1,111</td>
<td>4</td>
<td>High B</td>
</tr>
<tr>
<td>Model 9</td>
<td>441</td>
<td>648</td>
<td>162</td>
<td>1,469</td>
<td>0,367</td>
<td>0,430</td>
<td>4</td>
<td>High B</td>
</tr>
<tr>
<td>Model 10</td>
<td>289</td>
<td>512</td>
<td>64</td>
<td>1,771</td>
<td>0,221</td>
<td>0,439</td>
<td>8</td>
<td>High A</td>
</tr>
<tr>
<td>Model 11</td>
<td>289</td>
<td>1024</td>
<td>128</td>
<td>3,543</td>
<td>0,442</td>
<td>0,157</td>
<td>8</td>
<td>High A</td>
</tr>
<tr>
<td>Model 12</td>
<td>289</td>
<td>250</td>
<td>25</td>
<td>0,865</td>
<td>0,08</td>
<td>1,056</td>
<td>10</td>
<td>High A</td>
</tr>
<tr>
<td>Model 13</td>
<td>289</td>
<td>1000</td>
<td>100</td>
<td>3,460</td>
<td>0,345</td>
<td>0,189</td>
<td>10</td>
<td>High A</td>
</tr>
<tr>
<td>Model 14</td>
<td>289</td>
<td>360</td>
<td>180</td>
<td>1,245</td>
<td>0,622</td>
<td>0,302</td>
<td>2</td>
<td>High A</td>
</tr>
<tr>
<td>Model 15</td>
<td>289</td>
<td>720</td>
<td>144</td>
<td>2,491</td>
<td>0,498</td>
<td>0,201</td>
<td>5</td>
<td>High A</td>
</tr>
</tbody>
</table>
By grouping all the models together and graphing them on the Spacemate graph we are able to read and assess them against each other. Models with similarities in spatial qualities appear on the same area of the graph. The interaction between the four variables is more important than their singular absolute values: “a high rise area can have the same FSI as an area with closed building blocks, the high-rise area is in fact built in a much less compact manner and so has a lower GSI (Berghauser Pont & Haupt, p. 54).”

Figure 44: Models on Spacemate Graph
4.4 - Models vs Central City

In order to fully access the different models and their appropriateness in the Central City it needed to be established whether a certain model and density would fit within the current infrastructure. The total space of the Central City area was divided into Open Space, Existing Buildings, Heritage Buildings, Road Network and the left over space was deemed to be the ‘Potential Useable Space’ to infill with residential development.

This works out at:
- Total space of central city = 4,499,077.7m²
- Open Space = 422,421.9m² (9.39%)
- Existing Buildings = 1,380,040.2m² (30.68%)
- Historic Buildings = 148,411.1m² (3.30%)
- Road Network = 952,442.4m² (21.16%)
- Potential useable Space = 1,595,780.5m² (35.47%)

From here, the space each of the individual models would need (see Table 4), if they were to accommodate 22,000 people (raising the current population of 8,000 to 30,000) was calculated for comparison with the Central City area (see Figure 45), in order to establish whether the Central City had the capacity to accommodate 22,000 more residents using that particular model. It is quickly clear that Models 1, 2 and 3 are going to need more than the total current space of the Central City. Models 4 and 5 would need a about the same amount of space as the total current space of the Central City. This made it easy to quantify that most of the low and medium density models used individually would not be able to achieve the 30,000 target. These calculations also do not take into account the area for roads, parks and services that would also need to be added with a higher residential population, but just purely the space needed for the lot size of each house.

<table>
<thead>
<tr>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
<th>Model 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>9 x 3 = 27 (number of people per block)</td>
<td>18 x 3 = 54</td>
<td>16 x 2.5 = 40</td>
<td>32 x 2.5 = 80</td>
<td>32 x 2.5 = 80</td>
</tr>
<tr>
<td>22000/27</td>
<td>22000/54 = 707.4</td>
<td>22000/40 = 550</td>
<td>22000/80 = 275</td>
<td>22000/80 = 275</td>
</tr>
<tr>
<td>= 841.8 (how many lots needed for 22,000 more people)</td>
<td>(100 x 100) x 707.4</td>
<td>(100 x 100) x 550</td>
<td>(100 x 100) x 275</td>
<td>(100 x 100) x 275</td>
</tr>
<tr>
<td>= 8418000m²</td>
<td>v7074000m²</td>
<td>v5500000m²</td>
<td>v2750000m²</td>
<td>v2750000m²</td>
</tr>
<tr>
<td>= 2659.6992 x 2659.6992</td>
<td>= 2345.2078 x 2345.2078</td>
<td>= 1658.3123 x 1658.3123</td>
<td>= 1658.3123 x 1658.3123</td>
<td>= 1658.3123 x 1658.3123</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Model 6</th>
<th>Model 7</th>
<th>Model 8</th>
<th>Model 9</th>
<th>Model 10</th>
</tr>
</thead>
<tbody>
<tr>
<td>64 x 2.5 = 160</td>
<td>64 x 2 = 128</td>
<td>64 x 2 = 128</td>
<td>128 x 2 = 256</td>
<td>200 x 1 = 200</td>
</tr>
<tr>
<td>22000/160 = 137.5</td>
<td>22000/128 = 171.87</td>
<td>22000/128 = 171.87</td>
<td>22000/256 = 85.93</td>
<td>22000/200 = 110</td>
</tr>
<tr>
<td>= 1375000m²</td>
<td>= 1718700m²</td>
<td>= 1718700m²</td>
<td>= 859375m²</td>
<td>= 1100000m²</td>
</tr>
<tr>
<td>= 1172.6039 x 1172.6039</td>
<td>= 1310.991 x 1310.991</td>
<td>= 1310.991 x 1310.991</td>
<td>= 927.0248 x 927.0248</td>
<td>= 1048.8088 x 1048.8088</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Model 11</th>
<th>Model 12</th>
<th>Model 13</th>
<th>Model 14</th>
<th>Model 15</th>
</tr>
</thead>
<tbody>
<tr>
<td>800 x 1 = 800</td>
<td>250 x 1 = 250</td>
<td>1000 x 1 = 1000</td>
<td>1000 x 1 = 1000</td>
<td>2000 x 1 = 2000</td>
</tr>
<tr>
<td>22000/800 = 27.5</td>
<td>22000/250 = 88</td>
<td>22000/1000 = 22</td>
<td>22000/1000 = 22</td>
<td>22000/2000 = 11</td>
</tr>
<tr>
<td>= 27.5</td>
<td>(100 x 100) x 88</td>
<td>(100 x 100) x 22</td>
<td>(100 x 100) x 22</td>
<td>(100 x 100) x 11</td>
</tr>
<tr>
<td>= 275000m²</td>
<td>= 220000m²</td>
<td>= 220000m²</td>
<td>= 220000m²</td>
<td>= 1100000m²</td>
</tr>
<tr>
<td>v220000m²</td>
<td>= 469.0415 x 469.0415</td>
<td>v220000m²</td>
<td>= 469.0415 x 469.0415</td>
<td>v1100000m²</td>
</tr>
<tr>
<td>= 524.4044 x 524.4044</td>
<td>= 938.0831 x 938.0831</td>
<td>= 469.0415 x 469.0415</td>
<td>= 469.0415 x 469.0415</td>
<td>= 331.6624 x 331.6624</td>
</tr>
</tbody>
</table>
Figure 45: Models in Comparison to Current Space within the Central City

Total Space of central city = 4,499,077.7 m²
- Open Space = 422,421.9 m²
- Existing Buildings = 1,380,040.2 m²
- Potential useable space = 1,595,780.5 m²
- Road Network = 952,442.4 m²
- Historic Buildings = 148,411.1 m²
After calculating the total area of each model against the total area of the Central City, it then needed to be tested against the ‘Potential Usable Space’ area, so it could be identified further which models would and wouldn’t work in the existing context. Figure 46 shows each of the 15 models and the area needed, matched against the area of the ‘Potential Useable Space’. This gives a clearer understanding of how much space each model needs versus how much space is available. This showed that Models 1 through to 5 take up a much larger amount of space than is available and Models 6 to 8 require just slightly more than the available space. Models 9 through to 15 all fit within the available ‘Potential Useable Space’. It would also be possible to use a mixture of various models to create a mixed density plan that would fit into the space available.
4.5 - Scenarios

After working with the models to determine how much space they would require and how they could fit within the existing area, three scenarios were developed to test the models and the ideas driven from the literature review in the conditions of the existing Central City. This provided the chance to test ways of using different densities or combinations to achieve different goals and see how the city would look with the outcome of these goals.

The three scenarios developed are, Business as Usual (BAU), Intensification (INT) and Defying the ‘Norms’ (DTN). These three scenarios would give three distinct city forms that could be tested for appropriateness within existing Christchurch. To control the outcomes of each scenario eight assumptions were used to determine the specific priorities of that scenario:

**Density** – priority of either a high or a low density over the Central City area.

**Mixed Use Development** – whether it be high or low, just within the central core or all over the Central City. A high priority would be maximum mixed use development and low being singular use development only.

**Special Amenity Areas (SAMS)** – with the SAMs being important heritage or character areas under the current City Plan, these require stricter resource consents it was important to recognise them and their potential to have an effect on the overall city intensification and character. They have been scaled from high priority to keep, to low not to keep the current rules and guidelines.

**Heritage Buildings** – are again another important part of Christchurch heritage and streetscape. These offer potential to be re-developed into residential or commercial property where appropriate. For the scenarios this is scaled high priority to develop through to low priority where the heritage buildings will not be touched.

**Open Space** – open space is also an important part of a healthy and liveable central city. The incorporation of public open space into the Central City revitalisation can either be a high priority, with public open space being a major component and a large amount incorporated into the city, or it could be a low priority, with the majority of open space being incorporated into private individual’s sections.

**Public Transport** – a comprehensive efficient public transport system is a key element to a sustainable city, one of the goals of the City Council for Christchurch city. Public transport is also an important infrastructure of any world class city. For the scenarios public transport is scaled from high through to low priority, this generally relates to and reflects the priority of private vehicles.

**Pedestrian/Cycle Access** – the Four Avenues of Christchurch were first established to be a walkable distance, also Jan Gehl’s report for Christchurch city reflects on the priority and need to make the city walkable and safe for pedestrians and cyclists. Pedestrian/cycle access priority is also quite closely linked to priority for public transport, and is again evaluated from a high priority through to low priority.

**Private Car Access** – currently the Central City is dominated by private cars, roads and parking. This is common for Christchurch city as a whole. The Central City is a key thoroughfare between the outer suburbs, due to the one way system it is quick and easy to travel by private car from one side of the Central City to the other. There is also ample parking for shoppers and workers affecting the streetscape. As mentioned above, the priority of private car access and parking is also linked to that of public transport and pedestrian/cycle. A higher priority private car access will mean a lower priority on public transport is needed and vice versa. Again private car access is measured from a high to low priority.

<table>
<thead>
<tr>
<th>Density</th>
<th>Mixed Use Development</th>
<th>Special Amenity Areas</th>
<th>Heritage Building Development</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="High to Low Density" /></td>
<td><img src="image" alt="High to Low Priority Mixed Use" /></td>
<td><img src="image" alt="High to Low Priority Special Amenity" /></td>
<td><img src="image" alt="High to Low Priority Heritage Building" /></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Open Space</th>
<th>Public Transport</th>
<th>Pedestrian/Cycle</th>
<th>Private Car Access</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="High to Low Open Space" /></td>
<td><img src="image" alt="High to Low Priority Public Transport" /></td>
<td><img src="image" alt="High to Low Priority Pedestrian/Cycle" /></td>
<td><img src="image" alt="High to Low Priority Private Car Access" /></td>
</tr>
</tbody>
</table>

*Figure 47: Table of Assumptions*
Figure 48: Scenario Flow Chart

Scenario 1 'Business as Usual' (BAU)

Scenario 2 'Intensification' (INT)

Scenario 3 'Defying the Norms' (DTN)
Scenario 1 is ‘Business as Usual’ and will therefore look similar to the current Christchurch city. Although it will only get around 1500 more residents into the Central City.
Scenario 1 - BAU

- Business as usual
- Low density living (max height of new residential two storeys)
- ‘Human scale’ of Central City
- High priority of private open space
- Enhance ‘Garden City’ theme
- Maintain current development and urban patterns

Scenario 1 is ‘Business as usual’ which aims to maintain current development and urban patterns of Christchurch Central City, while infilling areas where there is a potential to develop residential population. The priorities for Scenario 1 are to firstly keep the low density of living which currently exists within the Four Avenues. The human scale of the Central City is something that Jan Gehl referenced in his report as being an important character for Christchurch (Gehl 2009). Scenario 1 also focuses on incorporating open space as a high priority; this would be through a combination of public open space as well as private, in order keep and enhance the ‘Garden City’ theme of Christchurch and link the Central City with outer suburbs. Private car access is also a high priority, whether it is parking and access for residential, work, shopping or leisure activities. Pedestrian and cycle access have a medium priority, but both come after private car access, the same with public transport. Mixed use development is only a medium priority and would be focused only within the direct inner city area. As far as heritage buildings and Special Amenity Areas these would both remain as they are and heritage buildings would not be looked at for re-development.

The lower density models (1-4) are to be used in this scenario with a maximum height of development at two storeys. The average space of these models needed to increase the residential population to 30,000 residents takes up more than four times the current potential space in the central city; therefore it is quickly apparent that Scenario 1 is not going to be the best solution for increasing the residential population. Therefore the ‘norms’ of current development and urban patterns will have to change and be revised in order for Christchurch Central City to reach a residential population of 30,000.

- More than four times the available space needed for this scenario
- Current development and urban patterns have not been successful at enhancing the Central City
- Will encourage more low density living and sprawl conditions
- Heavy reliance on private cars
Scenario 2 is ‘Intensified Business as Usual’ and will look similar to Copenhagen central city. Scenario 2 will accommodate around 8,000-10,000 more residents within new developments plus the new residential development in mixed use or redevelopments. This will meet the 30,000 target so long as development is strategically planned and implemented.
Scenario 2 – ‘INT’

- Intensified business as usual
- Keeping within the living desires of Christchurch residents
- High level of mixed use developments
- High density in the inner core, tapers off to a lower density at edges of Central City
- Large interest and investment in public transport and pedestrian/cycle over private vehicle

Scenario 2 is intensification of ‘Business as Usual’, while still trying to keep with the norms and expectations of living within Christchurch. But pushing these to create a higher density and more compact central city closer to those of other central cities in New Zealand and internationally. This scenario aims to have a high level of mixed development (retail/commercial and residential) as well as a higher density, especially within the direct centre of the city. The Inner City already contains many multi storey buildings; therefore the amenity values will not be adversely affected. The density and building heights would then slope off towards the edges of the Central City to meet and connect with the surrounding suburbs. Pedestrian/cycle access and public transport has a higher preference to private vehicle access, especially in the centre. Open space is of a lower priority to what it was in Scenario 1 but still an important feature. The focus is on public open space with limited private open space.

In this scenario pedestrian and cycle networks could also double as open space networks creating another layer of mixed use development and also maximising space for residential development. The SAMs will still be kept as protected areas, which will create pockets of lower densities within the Central City. Heritage buildings will be redeveloped where appropriate to accommodate residential population or mixed use development.

Medium density models (5-8) will be used in this scenario. The average space of these models fits just outside the potential space of the Central City.

- Medium density residential
- Space needed to fit 30,000 just over what is available
- Could potentially reach or get near to goal while keeping the ‘norms’ of living in Christchurch
- Protection of SAMs and heritage buildings will retain heritage value of Central City
- Reduction of private vehicles will improve pedestrian experience in the Central City
Scenario 3 ‘Defying the Norms’, will look similar to Singapore. This will accommodate on average around 49,000 people and could be even as many as 127,000 (depending on what combination of models are used).
Scenario 3 – ‘DTN’

- Intensification
- High density
- High mixed use development
- High public open space and little private open space
- Limited private vehicle access and high public transport

Scenario 3 aims to push the boundaries and defy the norms of how we think about central city living in Christchurch. In comparison to many central cities around the world this scenario is still relatively low density, but for Christchurch it is a complete extreme to what we are used to and the ideals of how we like to live.

There is a high priority consideration for high density, mixed use, public open space, pedestrian/cycle and public transport. Heritage buildings would be developed and the SAM zoning removed. There would also be little consideration for private car use in order to maximise the space for buildings or public open space.

Scenario 3 is similar to Le Corbusier’s Contemporary City model with high rise buildings and open space in-between. Public transport and pedestrian/cycle access and networks are a high priority and would be the main transport mode within the Central City as there is little priority or consideration for private cars, parking would be limited and minimal and even many streets removed or pedestrianised.

The average of the high density models (9-15) fits well within the potential space of the central city and also creates the potential for more than 30,000 residents, although it will not keep with the current character and ideals of Christchurch and even New Zealand cities.

- Scenario 3 will fit more than 30,000 people in the space available
- Multi storey apartment buildings with communal park type land
- Out of context of the current Central City and overall Christchurch
- Danger of losing the character of the Central City and the history
- Inconsistent with living ideals of Christchurch residents
Scenario 2 is the best solution of these three scenarios, as it gets very close to achieving the goal of accommodating 30,000 residents within the Four Avenues, while at the same time keeping the current character and ideals of Christchurch, and creating a desirable place for people to live.

There are two possible ways to ensure Scenario 2 will fit the 30,000 residents. One is to build up higher within the current Central City (incorporate some of the higher density models from Scenario 3). Or, alternatively, to extend the boundary of the Four Avenues to include connecting blocks of the surrounding suburbs where there is a large amount of space which could be developed into residential accommodation with still a close locality to the Central City facilities.

To keep Scenario 2 within the Four Avenues, which are the boundaries which this dissertation has been bound by, then the inner city needs to be of a higher density that what has been established in the Scenario 2 flow chart and plan. The inner city area will resemble more Scenario 3 with high density development, minimal private open space and private car allocation. There will also need to be a high level of mixed use between commercial, retail and residential. On the outer areas of the Central City the housing will be of a lower density then that of the inner city so that it bridges between the outer suburbs and the inner city. This area will be where the majority of the residential housing will also occur. Scenario 2 also allows the Central City to keep its small scale which has been recognised as an asset to the city, along with preserving the amenity of the Avon River, Hagley Park and other important open spaces such as Cranmer and Latimer Squares. With the increasing population these areas are going to become even more valuable to the Central City community especially as there will be lower amounts of private open space than in the suburbs.

Table 5: SWOT Analysis for Scenario 2

<table>
<thead>
<tr>
<th>Strengths</th>
<th>Weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Keeps ‘norms’ of living in Christchurch</td>
<td>• May not reach the 30,000 goal</td>
</tr>
<tr>
<td>• Will keep the current small scale of the central city</td>
<td>• Requires a lot of mixed use redevelopment and zone changes</td>
</tr>
<tr>
<td>• Gets close to the goal population</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Opportunities</th>
<th>Threats</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Chance to create a vibrant central city while keeping it within Christchurch’s character</td>
<td>• No desire for people to live in central city</td>
</tr>
<tr>
<td>• More reliance on public transport/pedestrian and cycle traffic</td>
<td>• House prices and general living costs too high for most people</td>
</tr>
<tr>
<td>• Create a new identity for Christchurch</td>
<td>• Lack of social amenities/schools etc</td>
</tr>
</tbody>
</table>

In order to test Scenario 2 more, the goals and objectives have been tested in a series of plans to establish the potential for Scenario 2 to work on the ground and be incorporated within the existing infrastructure and the Central City. This is not meant to be a final or a definite plan as there are many more issues that need to be addressed such as land ownership and zoning to name a few. The aim was instead to provide a snap shot of what could be possible and what the Central City would look like.
Figure 58: Density Scenario Two

Figure 59: Mixed Use Scenario Two
Figure 60: Amount of Models and Which Density Needed

Model 11
4 hectares = 3,200 households
3,200 people

Model 9
15 hectares = 3,840 households
7,680 people

Model 6
20 hectares = 1,280 households
3,200 people

Model 5
100 hectares = 3,200 households
8,000 people

Total = 11,520 households
22,080 people
Figure 61: Combination of Models with Total Space Axo

Figure 62: Combination of Models with Total Space Plan
Figure 63: Density and Other Features
Figure 64: Mixed Use and Other Features
5.0 – General Discussion and Conclusion
The challenge of investigating the incorporation of 30,000 residents into the Four Avenues was more complex than it seemed at first. It has also become apparent that increasing the population of the Central City is not going to be the golden solution to the problems Christchurch Central City is facing. Providing accommodation for 22,000 extra residents is not going to make people move to the Central City, there needs to be parallel projects to entice residents back into the Central City to drive the demand for living within the Four Avenues.

Christchurch Central City is a unique location filled with human scale buildings (Gehl, 2009), links to the city’s heritage, the amenity values of the Avon River cutting through the street grid, and views to the Port Hills. These are some of the many features that suggest the Central City would and should be an appealing place to live, work and play. Through the outcomes of the Jan Gehl report the Council is implementing some of Gehl’s recommendations; this will improve the quality of public space within the inner city and take a good step towards the overall revitalisation. Gehl’s recommendations focus on reducing the car dominance within the Central City and creating a high quality pedestrian space. This will ideally increase the appeal of the Central City as a shopping and entertainment destination for Christchurch residents.

Christchurch, unlike many other major cities in New Zealand and also internationally, has been spared the intense high rise development in the inner city. This has given Christchurch a smaller scale, different to other central cities such as in Wellington and Auckland. The combination of the gothic architecture and the ‘Garden City’ theme gives Christchurch an old English town feel. High density development within a Central City runs the danger of destroying this character and creating a central city like that of any other city in the world. This puts Christchurch in a unique position where development of the city can be carefully planned and controlled, ensuring the key elements that make Christchurch Christchurch are preserved and enhanced to create not only a ‘world class city’ but a city with a unique identity. Identity of what Christchurch is and where it is going is something that I personally feel Christchurch city is missing. It seems the idea of the ‘Garden City’ is being clung to without any recognition or thought. Development of an identity or enhancement of what the ‘Garden City’ theme is will go a long way to guide the revitalisation of the Central City and to people’s identity with it being the heart of the city and community.

Other aspects that need to be addressed to encourage residents back into the Central City include the lack of social amenities: there is only one public primary school within the Four Avenues and no public high schools, forcing children and parents to have to travel a distance from their home to attend school or pay for private education. This is a major reason why families chose to live out in the suburbs because of the close locality to a preferred school. The Central City does not provide high quality social amenities for its current residents unlike what the outer suburbs have managed to do. The introduction of schools and education infrastructure would go a long way to improving this.

The Central City also does not accommodate small children, with only a few play grounds. The current open space, although ample in terms of quantity for the number of residents, is underutilised and of poor quality. The Central City’s greatest natural asset, the Avon River and the river reserve, has poor accessibility, inadequate pedestrian connections and limited spaces to stop and enjoy the location. These are all things that have been recognised in the Gehl report and are being considered by the Council. Enhancement of the river and river reserve, along with Cranmer and Latimer Squares, to provide a high quality public space for all ages, individuals and groups will go a long way to creating a desirable neighbourhood for people to live and to visit the Central City, this is something that my landscape approach addressed.
Throughout this project my goal was to test the target of 30,000 and to get as close as possible to incorporating 30,000 residents while maintaining the character of Christchurch. Christchurch people have a very entrenched view of how they like to live and that is the suburban separate house on a reasonable sized fully fenced section. Although this low density is not appropriate within a central city context and is something most currently residents in the Central City have accepted, trading this in order to be closer to amenities such as work or social areas. For the Central City revitalisation to work there needs to be a medium reached between Christchurch suburban living (and the ideals of Christchurch residents) and ‘traditional’ inner city living. Through my scenario testing I have found that it is possible to get very close to the 30,000 target while only increasing the density of the Central City by a small amount. Most of the higher density would be located within the inner city where it would not have an adverse effect, as there are already larger scale buildings and highly urbanised areas. The outer blocks towards the edges of Four Avenues would be a medium density, but work and look similar to the surrounding suburbs; although lot sizes would be smaller than suburban lots, therefore high quality public open space is a must. This would provide a range of living types and densities. Giving people the option of living within a higher density CBD type environment similar to what is found in other cities central city. While also providing a smaller scale ‘suburban dream’ type living towards the edges of the Four Avenues, with the convenience of central city living. This diversity of densities, different house types and living styles across the Central City is going to be important to enticing a wide range of people, incomes and ages into the Central City, creating a rich diverse community. 

With this project there has been a wide range of possible factors to investigate. The introduction of 22,000 residents will help in revitalising the city but is not going to solely fix the current issues, there needs to be a variety of different studies and projects undertaken, focusing on different aspects which will all work together towards achieving the same goal. Things such as transport including public transport, private vehicles and parking, cycle and pedestrian ways, as well as an open space network, heritage, tourism, events and festivals, crime and safety, social amenity and sustainable solutions are all things that need to be incorporated into the regeneration of the Central City. These are areas for future studies to build on and be used in conjunction with the outcomes of this study. 

There have been many challenges with this study which have made it difficult. Not having access to the Capacity Study until the end of my study meant that there is some repetitiveness between the two, but since I knew the Capacity Study existed I attempted to undertake my study from more of a landscape focused and qualitative angle rather than just working with numbers of people. If I had access to the outcomes of the Capacity Study earlier, it may have meant I could have used that base data rather than producing my own data, this would have allowed the scope of this project to be widened. For example the study could have incorporate some of the other areas that I have suggested for further investigation or to take the issues of residential population further into detail. 

This study has been a step in the right direction towards solving the issues of the Central City and creating a vibrant heart of Christchurch city. Although the goal of a revitalised City Centre is still some distance off for Christchurch, my study contributes to the realisation that the bones of a world class city are already there, and just need enhancing. I hope that this dissertation can be seen and used as a good starting point of investigating and solving the problems of the Central City and creating an interesting and vibrant place for people to live.
6.0 - References


